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HATCH EXPERIMENT STATION

—OF THE—

MASSACHUSETTS AGRICULTURAL COLLEGE.

BULLETIN NO. 96.

FUNGICIDES, INSECTICIDES, SPRAYING CALENDAR.

MAY, 1904.

The regular Bulletins of this Station will be sent free to all newspapers in the State and to such individuals interested in farming as may request the same. Technical Bulletins are sent only to those persons interested in the subject treated of in each case.

AMHERST, MASS.:
PRESS OF CARPENTER & MOREHOUSE
1904.

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HATCH EXPERIMENT STATION

OF THE

Massachusetts Agricultural College,

AMHERST, MASS.

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HATCH EXPERIMENT STATION, Amherst, Mass.

Fungicides, Insecticides, and Spraying Calendar.

George E. Stone, Henry T. Fernald, F. A. Waugh.

This bulletin contains a compilation of formulas for fungicides and insecticides taken from various sources, and the usual spraying calendar. Many of these mixtures can be bought already prepared from reliable dealers, which saves much time and trouble in mixing them. The following precautions should be taken into consideration:

1. Care should be taken to keep all substances employed in spraying where they cannot be used by mistake. All substances should be correctly labeled.

2. Solutions and mixtures containing copper sulfate, corrosive sublimate, and arsenate of lead should be made in wood, glass or earthern vessels.

3. Arsenical solutions should not be applied to fruits, etc, within two weeks of the time they are to be used as food.

4. Trees should not be sprayed when they are in blossom as the bees which are necessary to fertilize the flowers may be destroyed.

FUNGICIDES.

1. BORDEAUX MIXTURE.

4 pounds copper sulfate (blue vitriol).
4 pounds lime (unslaked).
25 to 50 gallons water.

Dissolve the copper in hot or cold water, using a wood or earthern vessel. Slake the lime in a tub, adding the water cautiously and only in sufficient amount to insure thorough slaking. After thoroughly slaking, more water can be added and stirred in until it has the consistency of thick cream. When both are cold, dilute each to the required strength and pour both together in a separate receptacle and thoroughly mix. Before using, strain through a fine mesh sieve or a gunny cloth.

The mixture is then ready for use. Considerable trouble has frequently been experienced in preparing the Bordeaux Mixture. Care should be taken that the lime is of good quality and well burned and has not been air slaked. Lumps are far superior to the fine lime and such are selected by masons for preparing finishing coats. Where small amounts of lime are slaked it is advisable to use hot water. The lime should not be allowed to become dry in slaking, neither should it become entirely submerged in water. Lime slakes best when supplied with just enough water to develop a large amount of heat which renders the process active. If the amount of lime in the Bordeaux Mixture is insufficient, there is danger of burning tender foliage. In order to obviate this the mixture can be tested with a knife blade or with ferro-cyanide of potassium (1 oz. to 5 or 6 oz. of water). If the amount of lime is insufficient, copper will be deposited on the knife blade, while a deep brownish-red color will be imparted to the mixture when ferro-cyanide of potassium is added. Lime should be added until neither reaction occurs. A slight excess of lime, however, is desirable and it is seldom one has to apply these tests.

The standard mixtures are :

(a). 25 gallons (full strength mixture, or 4—4—25 formula), that is 4 lbs. copper sulfate, 4 lbs. lime and 25 gallons water.

(b). 50 gallons, (half strength mixture, or 4—4—50 formula).
(c). 6—4—50 formula.
(d). 3—6—50 "
(e). 2—2—50 "
(f). 3—9—50 "
(g). Resin Bordeaux Mixture: in preparing take 2 gallons of the resin stock solution (No. 14) and add to it 10 gallons of water. Mix this with 40 gallons of Bordeaux Mixture.

d, e and f are suitable for peach foliage and for Japanese plums. The only insects against which Bordeaux Mixture appears to be of any value are Flea Beetles.

2. COPPER SULFATE SOLUTION.

(Strong Solution.)

1 pound copper sulfate.
25 gallons water.

Applied only on trees without foliage.

3. COPPER SULFATE SOLUTION.

(Weak Solution.)

2 to 4 ounces copper sulfate.
50 gallons water.

For trees in foliage.

4. POTASSIUM SULFID.

3 ounces potassium sulfid.
10 gallons water.

Valuable for gooseberry mildews, etc.

5. CORROSIVE SUBLIMATE.

(For Potato Scab.)

2 ounces corrosive sublimate.
15 gallons water.

Dissolve the corrosive sublimate in 2 gallons of hot water, then dilute to 15 gallons, allowing the same to stand 5 or 6 hours, during which time thoroughly agitate the solution several times. Place the seed potatoes in a sack and immerse in the solution for 1½ hours.

Corrosive sublimate is very poisonous, consequently care should be taken in handling it, and the treated potatoes should not be eaten by stock. The solution should not be made in metallic vessels.

6. FORMALIN.

(For Potato Scab.)

8 ounces formalin (40 per cent solution).
15 gallons water.

Used for the same purpose as corrosive sublimate, but not poisonous. Immerse the seed potatoes for 2 hours and spread out to dry before planting.

INSECTICIDES.

7. PARIS GREEN.—DRY.

1 pound Paris green.
20 to 50 pounds flour.

Mix thoroughly and apply evenly; preferably when dew is on the plants.

8. PARIS GREEN.—WET.

1 pound Paris green.
1 to 2 pounds quick lime.
200 gallons water.

Slake the lime in part of the water, sprinkling in the Paris green gradually, then add the rest of the water. For the peach and other tender leaved plants use 300 gallons of water. Keep well stirred while spraying.

9. ARSENITE OF LIME.

1 pound white arsenic.
2 pounds fresh burned lime.
1 gallon water.

Boil together for 45 minutes and keep in a tight vessel. Add one quart of this to a barrel (50 gallons) of water for use.

10. ARSENATE OF LEAD.

4 ounces arsenate of soda (50% strength).
11 ounces acetate of lead.
150 gallons water.

Put the arsenate of soda in 2 quarts of water in a wooden pail, and the acetate of lead in four quarts of water in another wooden pail. When both are dissolved, mix with the rest of the water. Warm water in the pails will hasten the process. For the Elm-leaf Beetle use 25 instead of 150 gallons of water.

11. WHALE OIL SOAP.

2 pounds potash whale oil soap.
1 gallon hot water.

For winter use only.

12. KEROSENE EMULSION.

½ pound hard soap, shaved fine.
1 gallon water.
2 gallons kerosene.

Dissolve the soap in the water which should be boiling ; remove from the fire and pour it into the kerosene while hot. Churn this with a spray pump till it changes to a creamy, then to a soft butter-like mass. Keep this as a stock, using one part in nine of water for soft bodied insects such as plant lice, or stronger in certain cases.

13. MECHANICAL EMULSION.

A substitute for the last. Made entirely by the pump, which draws water and kerosene from separate tanks and mixes them in the desired proportion by a mechanical device. Several pumps for this purpose are now on the market, but none seem to be entirely reliable.

14. RESIN-LIME MIXTURE.

5 pounds pulverized resin.
1 pound concentrated lye.
1 pint fish or other animal oil.
5 gallons water.

Place the oil, resin and 1 gallon of hot water in an iron kettle and heat till the resin softens: then add the lye and stir thoroughly; now add 4 gallons of hot water and boil till a little will mix with cold water and give a clear, amber colored liquid: add water to make up 5 gallons. Keep this as a stock solution. For use, take

1 gallon stock solution.
16 gallons water.
3 gallons milk of lime.
$\frac{1}{4}$ pound Paris green.

The object of this preparation is to obtain an adhesive material which will cause the poison to adhere to smooth leaves. It has been highly recommended by the New York State (Geneva) Experiment Station.

15. LIME, SALT AND SULFUR.

New Jersey Bulletin No. 162.

50 pounds stone lime.
50 pounds flowers of sulfur.
50 pounds stock salt.
150 gallons water.

Slake the lime with hot water, enough to do it thoroughly, add the sulfur, stir well, and boil for at least an hour, adding water as necessary. Then add the salt, boil at least fifteen minutes more, and dilute to make the 150 gallons. In boiling use no more water than necessary to make a fluid mass. Strain through burlap and apply hot.

16. LIME AND SULFUR MIXTURE.

Good results are obtained by leaving out the salt from the formula given above and preparing the mixture as follows: Slake the lime in a little hot water, slowly adding the sulfur and stirring vigorously; then boil one hour. Strain through burlap, dilute with water to make up the 150 gallons and apply to the tree.

Lime, Sulfur and Salt, or the Lime and Sulfur Mixture should only be applied to the trees after the leaves have fallen and before the buds open in spring.

17. CARBOLIC ACID EMULSION.

1 pound hard soap shaved fine.
1 gallon water.
1 pint crude carbolic acid.

Dissolve the soap in the water, boiling; add the carbolic acid and churn as for kerosene emulsion. Use one part of this with 30 parts of water.

18. HELLEBORE.

1 ounce hellebore.
1 to 2 gallons water.

Steep the hellebore in a pint of water and gradually add the rest of the water. Hellebore may also be dusted over the plants, either pure or mixed with flour or plaster.

19. INSECT POWDER. PYRETHRUM.

Mix with half its bulk of flour and keep in a tight can for 24 hours; then dust over the plants. Or,

100 grains insect powder.
2 gallons water.

Mix together and spray.

COMBINED FUNGICIDES AND INSECTICIDES.

20. BORDEAUX MIXTURE AND PARIS GREEN.

4 ounces Paris green.
50 gallons Bordeaux Mixture.

21. BORDEAUX MIXTURE AND ARSENATE OF LEAD.

Prepare the arsenate of lead as above (Formula No. 10), but instead of adding the arsenate of soda and acetate of lead, when dissolved, to the water, mix the two together well, then add one-third of this to 50 gallons of Bordeaux Mixture.

22. BORDEAUX MIXTURE AND ARSENITE OF LIME.

1½ quarts Arsenite of Lime (made by formula No. 9.)
50 gallons Bordeaux Mixture.

23. IVORY SOAP.

1 bar Ivory soap (10 cent size).
15 gallons water.

Apply warm as it thickens on cooling.
Recommended for rose mildew, red spider, plant lice, etc.

FUMIGANTS.

24. CARBON BISULFID.

Evaporate one pound of Carbon bisulfid to every thousand cubic feet of space. This is done by pouring the bisulfid into shallow dishes placed in the upper part of the place to be fumigated, and closing everything tightly and leaving 24 hours. Then open, air for ten minutes before entering or using anything which has been fumigated. This treatment is effective for infested grain, weevily seed, clothes moths, carpet beetles, etc., in closets, trunks, tight boxes or wherever these substances are kept or in which they may be placed for treatment. Caution: Do not use Carbon bisulfid near a fire, or where there is much heat, as it takes fire easily, even from a lighted pipe or cigar.

25. HYDROCYANIC ACID.

For Nursery Stock.

Potassic cyanid (98 or 99%) .2 or .25 gram per cu. ft.
Sulfuric acid (1.83 sp.gr.commercial) ½ more by measure.
Water ½ more than sulfuric acid.

Multiply the number of cubic feet to be fumigated by .2 or .25, giving the number of grams of cyanid; divide the answer by 28.35, giving the weight of the cyanid in ounces. Take 1½ times as many fluid ounces of acid and $2\frac{1}{2}$ times as many fluid ounces of water as ounces by weight of cyanid. Mix water and acid in an earthern or granite ware jar, then by loose bag and string drop in the cyanid after closing tightly the place to be fumigated. Leave closed 40 minutes, then open from the outside and air for at least ten minutes before entering.

26. SULFUR.

For Empty Houses.

Close the house tight and burn 200 grams (about 6 oz.) to 1000 cu. ft. of space. Keep the house closed at least twelve hours.

27. SULFUR.

For Houses with Growing Plants.

Evaporate a small quantity in a kettle over a kerosene stove, taking care that it does not catch fire. Or, paint some of the heating pipes occasionally with a mixture of sulfur and oil.

TREATMENT OF GREENHOUSE PLANTS.

On general principles the practice of spraying greenhouse plants cannot be recommended, since the control of the diseases of greenhouse plants consists to a large extent in maintaining favorable or hygienic conditions.

When greenhouses are about to be emptied, or before replanting, systematic fumigation can be practiced to good advantage with Nos. 25 or 26.

Red Spiders and Mites.

Flowers of Sulfur one ounce.
Water one gallon.

Mix well and spray over infested plants. Soapsuds may be used instead of the water with good results. Formula No. 23 has also been recommended for these insects.

Plant Lice: Aphides.

Burn tobacco stems; when the house is empty, fumigate by any fumigant, such as Nos. 25 or 26.

Thrips.

Nikoteen 4 cc. (1/8 oz.) }
Water 150 cc. (5 fl. oz.) } Per 1000 cubic feet.

Mix and vaporize in the house at night: will kill most of the Thrips.

White Fly.

Fumigate as for Nursery Stock above, No. 25, except that instead of using .2 or .25 gram of cyanid per cubic foot, use .007 to .01 gram according to how tight the house is. Use the corresponding proportions of Sulfuric acid and water, fumigate at night for three hours, and then ventilate. Repeat the fumigation two weeks later. This treatment must be used with caution, as tender plants may under exceptional conditions be somewhat injured.

Eel Worms.

For eel worms on cucumbers, melons, violets, tomatoes, roses, etc., change the soil or freeze or sterilize it.

Mildews and Leaf Spots.

Powdery and Downy Mildew and Anthracnose on cucumbers and melons. Leaf blight of tomatoes (scab) can be controlled by maintaining proper moisture conditions of the air, giving sufficient light and ventilation and keeping water off the foliage as much as possible. For Rose Mildew, evaporate sulfur or paint the pipes occasionally with a mixture of sulfur and oil.

Stem Rots.

For chrysanthemum stem rot prevent over-crowding, give sufficient light and air. Carnation dry rot, select healthy cuttings; avoid planting in infected soil, extreme forcing and adverse conditions. For Lettuce Drop and Rhizoctonia, sterilize the soil.

Rust.

For chrysanthemum rust, select healthy stalk; pick off all rusted leaves; avoid exposure to dews and excess of moisture on the foliage. Carnation rust can be avoided by selecting rust-free, rugged stalk and keeping moisture from the foliage as much as possible.

Burns and Wilts.

For Lettuce Top Burn, maintain low temperature during damp, cloudy weather. For cucumber wilt and burning of leaf edges, avoid excessive use of nitrate and secure good texture of the foliage by means of sufficient light and ventilation.

GENERAL OUTLINE OF TREATMENT.

Apple. First treatment before buds swell, formula 1a or 2. Second treatment just before blossoms open, 1b or 20 or 21. After the blossoms fall treat again with 20 or 21. If the weather is wet and scab fungus is severe, treat at intervals of two weeks with 1b. For canker worm and curculio treat just before the blossoms open with 20 or 21, as recommended above. For scale use 15.

Apricot. Same as for peach or plum, which see.

Asparagus (rust, summer stage). Spraying thoroughly during July and August a few times with 1b or 1g constitutes a partial preventive. In planting new beds avoid too dry soil. For asparagus beetle, spray summer growth with No. 10.

Bean. When third leaf expands use 1b for rust or anthracnose, followed 10 days later by a second application of the same. Repeat later as necessary.

Blackberry. Use 1b or 2 before buds open. Just before the blossoms open use 20, 21 or 22. Repeat every ten days or two weeks if required.

Cabbage. Lime at the rate of 35 to 50 bushels an acre is recommended for club root, but is not always successful.

Celery. For rust and blight, spray seed beds with 1b every two weeks. The same solution may be sprayed on the plants after setting out, at intervals of two weeks.

Cherry. Treatment practically the same as for plum, which see.

Currant. Use 1b before leaves start. At first appearance of worms use 18, and as often afterward as the worms reappear.

Dewberry. Same as blackberry.

Elm. Spray the first week in June with 10. A second application later is sometimes worth while.

Gooseberry. Same as currant, which see.

Grape. As soon as buds swell use 1a or 2. Just before the flowers open 20 or 21. When fruit has set 1b, or, if insects are feeding on the foliage, 20 or 21. Two to four weeks later use 1b, if rot, mildew or anthracnose appear.

Nectarine. Same as for peach, which see.

Nursery Stock. When leaves first appear, No. 20 or 21. If leaf-eating insects appear use 20, 21 or 8, 9 or 10. If fungus troubles appear, use No. 1b.

Peach. Treat like plum. It should be specially noted, however, that peach foliage is tender and may be injured by Paris green or strong Bordeaux mixture. The former should always be used with caution, enough good lime being added in all cases to neutralize the effect of the soluble arsenic in the Paris green. Disparene or arsenate of lead, No. 10, is always safer and to be preferred. Bordeaux mixture should never be used on peach foliage stronger than formula 1e or 1d.

Plum. Black knot should be removed with the pruning shears as soon as discovered, and should be burned. Trees should be examined for knots about the middle of June. In case of bad infection several examinations may be necessary, but usually one is enough. Spraying before buds open with 1a or 2 will assist materially in checking the spread of the knots. Brown rot is also checked by this same early spraying. It can be further prevented to some extent by thinning the fruit. With certain varieties it is practicable to pick the fruit before quite ripe, allowing it to mature in a cool storage room. For leaf blight or shot-hole fungus use 1d or 1e. 1b can be used on plums of the old European varieties. The foliage of the Japanese varieties is much more tender, like that of the peach, and the weaker solutions, carefully made with plenty of lime, are requisite. For curculio, spray with 8, 9 or 10 just before the blossoms open and again soon after they fall. In place of 8, 9 or 10, No. 20, 21 or 22 may be used to advantage in most cases, thus checking fungus and insect pests at the same time. The curculio can also be combated by jarring the trees in the early morning and catching the insects as they fall off. For this purpose a regular curculio catcher is desirable. For scale, treat same as on apple.

Quince. When the blossom buds appear use 1 b. If any leaf-feeding insects are present substitute 20, 21 or 22. After blossoms fall use 1 b. Use same solution every ten days or two weeks thereafter as long as leaf or fruit spot are threatening. For scale, treat as on apple.

Pear. Blight should be treated with the pruning knife, removing all blighted portions, and cutting about 4 to 6 inches into fresh, sound wood. For scab and other fungus diseases treat same as apple. For psylla use 12 when leaves open. Use 12 again once or twice later as needed. For scale, treat as on apple.

Potato. For scab use 5 or 6. For blight and rot, spray *thoroughly* with 1 b when plants are half grown, and again every ten days to two weeks till tubers are well formed. In case beetles are troublesome substitute 20, 21 or 22 for 1 b.

Raspberry. Treat same as blackberry, which see.

Strawberry. For rust or leaf spot use 1 b as soon as fresh leaves appear in spring. Just as blossoms begin to open spray with 20, 21 or 22. Use 1 b on new plantations during summer and fall as required. One or two sprayings should nearly always be given.

Tomato. To check rot, blight and flea beetle, use 1 b soon after planting out and again after fruit is formed.

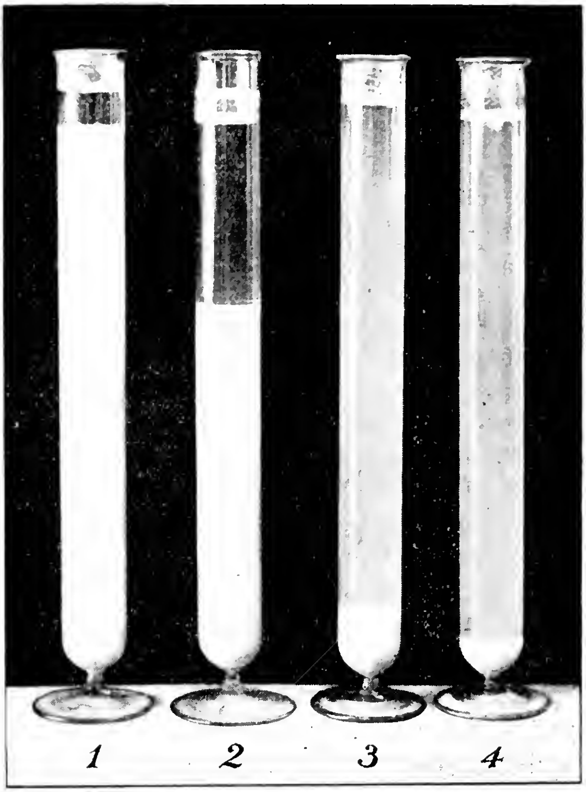

Fig. 1 : showing the degree of settling in properly and improperly made Bordeaux Mixture.

(1). Bordeaux Mixture properly made by mixing diluted lime and copper sulfate together in a separate vessel 24 hours after the copper and lime have been prepared.

(2). Mixture made by combining freshly made copper sulfate and lime solutions.

(3). Dissolved copper solution poured into lime water while warm.

(4.) Freshly prepared lime water poured into the copper solution while warm.

(1) and (2) photographed 3½ hours after mixture was placed in cylinders and shaken.

(3) and (4) photographed 15 minutes after being placed in cylinders and shaken.

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A FARM WOODLOT.

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A FARM WOODLOT

FRANK A. WAUGH.

There is at present a widespread interest in forestry, though this interest is nowhere greater than the imminent importance of the subject justifies. On the other hand it is quite plain that many of our resources, public and private, state and national, are being shamefully wasted because of the ignorance or carelessness of the principles of forestry. It becomes a public duty, therefore, for anyone who has even an elementary knowledge of the subject, or who possesses even a modicum of practical information, to spread this knowledge or information for the general welfare.

One thing greatly needed in current forestry discussions is concrete knowledge of forest facts and of forestry operations. Too much of the common talk on the subject stops with general principles, (which are mostly unintelligible when they are unconnected with concrete examples), or even contents itself with the fervent assertion that forestry is a good thing and ought to be encouraged.

It is the purpose of this bulletin to set forth a single definite concrete example of practical forestry under conditions typical of nearly the whole State of Massachusetts and of large areas in neighboring States. The problem in hand is that of the ordinary farm woodlot, and the conditions are those prevalent on a majority of New England farms.

The woodlot in question belongs to the Department of Horticulture of the Massachusetts Agricultural College, and has been for many years subjected to the same conditions, the same demands, and, for the most part, to the same unsystematic management as any farm woodlot. It has been called upon for stove-wood, fencing, rough lumber, etc., and has not been made the theater of any general experiment in scientific systems of forestry. There have been some plantings of forest trees, however, in which particular the conditions are not typical of the common farm woodlot. The tract contains 12½ acres of good land. In respect to the quality of the land the situation is not exactly typical; for the farm woodlot ought to occupy waste land, while this tract, if cleared, would be prime orchard or garden land. It occupies the top and north and west slopes of a small hill or drumlin.

Products required.—The woodlot in question is expected to produce stove-wood, fence posts, and dimension lumber. Recently there have been some calls upon it for box lumber. These requirements are practically the same as will be found on any other farm. The stove-wood is easily secured from necessary thinnings, the removal of dead trees, etc., and may be looked upon as entirely a waste product. According to our experience the removal of stovewood does not any more than pay for the work required—sometimes less than that. It is altogether probable that there is very little land in the State where stove-wood can be grown and harvested at a profit. If a woodlot yields nothing better than this, its owner can make money by giving it away.

Fence posts and stakes are always in demand on a farm. On this farm they are largely used for making grape trellises, staking up bush fruits, etc. They are worth considerably more than fire wood, and are a trifle harder to produce, yet may be taken in quantity from any fairly well managed woodlot. In our own case we find American larch one of the best species for producing this class of material. Several of the photographs show the larch trees, which of course were planted in this situation.

Dimension lumber can be secured from any straight, clear, forest-grown trees of reasonable sizes. In our wood we find chestnut and hemlock the most productive, with oak and maple standing second. We have no large white pine, which might easily be one of the best. In the production of good dimension lumber, real forest conditions are required and some length of time is necessary. The trees must stand close enough together to make clean, straight trunks. They should be culled out as fast as they reach maturity, and frequently certain trees have to be cut before absolutely mature in order to favor other trees or to improve the forest composition.

Box lumber is required on our farm in making boxes for marketing fruit and vegetables, and for making greenhouse flats. Any fairly clear soft wood will answer. Hemlock does well and even poplar is good. The harder and more valuable kinds of lumber may well be saved for more honorable uses.

Species of Trees.—The varied requirements of almost any farm make it desirable to have several different kinds of trees growing in the woodlot. In this respect our own lot is a model. We have more than mere samples of the following species: chestnut, white oak, red oak, hard maple, yellow birch, white birch, larch (often known as tamarack), Scotch pine, and hemlock. There are small quantities of other species. For example there is considerable small growth of white pine, a few black cherry, sassafras, etc. This mixture of species is encouraged, both because it is easier to manage (under farm conditions) and because it furnishes a variety of forest products.

Mixture of Species.—We have just said that the mixture of species is easier to manage than any one species alone. This is probably untrue as a general principle applied to large forest areas, and there are undoubtedly some exceptions even in the conduct of farm woodlots. Nevertheless the growth, exploitation and reproduction ot pure woods—that is areas covered with one species only—does not seem to meet the conditions existing on the ordinary farm.

If several species are to be mixed, however, it is obvious that great care should be taken in making up or in controlling the mixture. Some species are much more valuable than others and the most valuable ones should be given the preference ; and some species will thrive in company while others will not. With respect to the former principle it is to be noted that ordinary farm management (or mismanagement, in this case) often secures a result exactly the opposite of that desired. The careless man cuts always the trees best suited to his immediate needs,—that is the best trees in the forest,—leaving the poorer ones to survive and perpetuate themselves. With respect to the second principle it may be remarked that to make the best theoretical mixture of species requires a considerable knowledge of forest species and technical forest principles. This is a matter which space now forbids us to enter upon.

Reproduction and succession.—One of the commonest shortcomings in farm management of woodlots is that the trees are cut without regard to their reproduction. Constant foresight should be had to the future composition of the woodlot. The valuable species should be encouraged. Pines and hemlocks should be allowed to bear seed. Young oak seedlings should be favored. A good growth of oak can sometimes be secured from sprouts coming up from stumps (coppice reproduction). Chestnut reproduces itself vigorously in this way, especially where young trees are cut close to the ground.

It will be noticed also that some species follow each other in a definite succession. On waste land, recently cut over areas, or abandoned farm fields, birch and poplar are usually the first to appear. As soon as these trees have formed a forest cover, have begun to shade the ground, other species come in. Pines, oaks, and hemlocks belong to this second crop. Comparatively worthless species may thus be taken advantage of to secure the establishment of better ones.

Improvement cuttings.—As already hinted, cuttings are to be made not with sole regard to the wants to be immediately supplied. The trees selected for removal should be chosen largely with reference to the trees which remain. The stand of timber should be kept fairly uniform, not so thick as to kill out good-sized trees, and not so thin as to allow heavy side branches to grow. Where two good trees are unduly crowding each other, one of them should be removed. In deciding which tree shall go and which shall stay the question is not so much which will make the best lumber now as which will make the best growth in the next ten or twenty years. If the future is kept thus consistently in mind it will seldom be necessary to make any extensive "improvement cuttings" just for the sake of helping the woodlot. Every tree taken out will represent an improvement cutting.

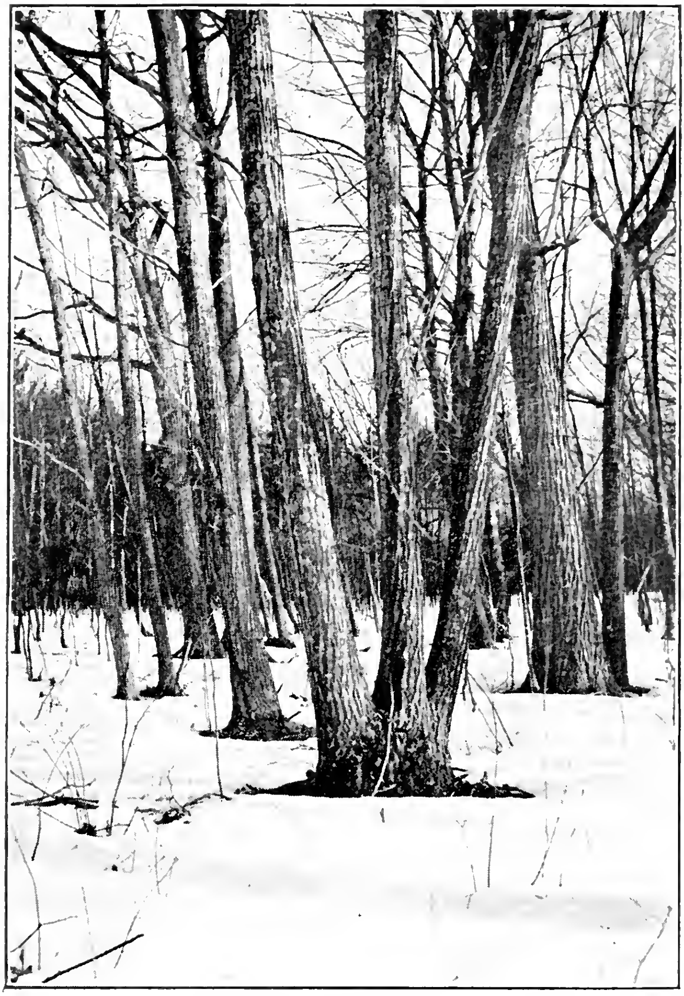
Plantings.—The typical woodlot, and the sort by far the most common in New England, consists of a natural forest. If it is properly managed it will reproduce itself indefinitely. No tree planting is necessary. In many places, however, even in Massachusetts, tree-planting is necessary, practicable and profitable. Our own woodlot contains both natural woods and planted areas. There is one lot of planted white birch fifteen years old. See plate 12. There is another area planted with Scotch pines and larch mixture twenty-five years old. See plate 9. One of the best artificial plantations is of pure larch twenty-four years old. Another smaller plantation of larch is seventeen years old. These trees were set in rows 4 feet apart, with trees about 2 feet apart in the rows. They have done very well indeed and are already producing valuable timber. See plates 10 and 11. It is entirely plain that forest plantations of larch and pine can be successfully made on our soil.

In conclusion we invite special attention to the photographs which really show more of the actual forest conditions than can be told in words. Each one is a lesson in itself. Yet, as for that, thoughtful observation of growing forests anywhere will always bring important facts to light; and if this brief bulletin shall arouse the reader to such interest and observation, its principal object shall have been fully served.

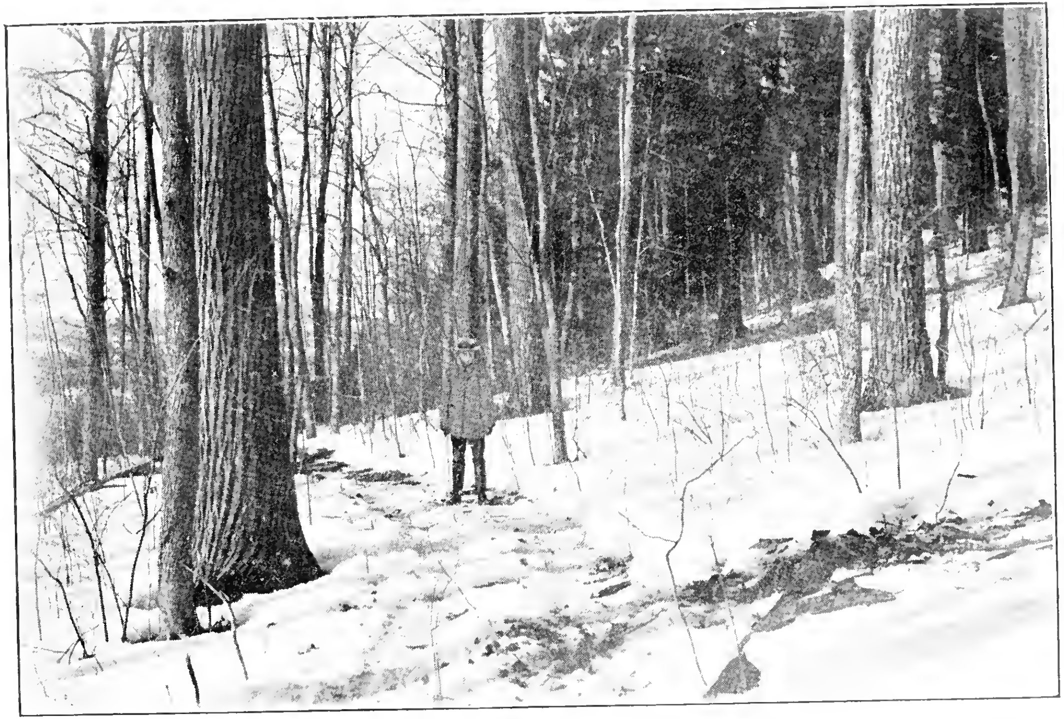
1. **Mature Forest.** Old Hemlocks and Chestnuts, crowding. The three Chestnuts in the middle should be taken out. They are mature, and will make good sawlogs.

2. **Chestnut, Second Growth.** Mostly sprouts from stumps. These should be thinned. There are a few sawlogs and several railroad ties here.

3. **Old Sugar Tree.** From the standpoint of the forest, this tree should have come out several years ago. It is quite proper, however, that the farm woodlot should produce syrup or sugar, and with such a purpose in view old sugar trees would be retained.



4. **Young Chestnut.** Mostly coppice growth, showing the vigorous reproduction when young chestnut is properly cut. A little thinning would be in order here. A few telephone poles could be cut.

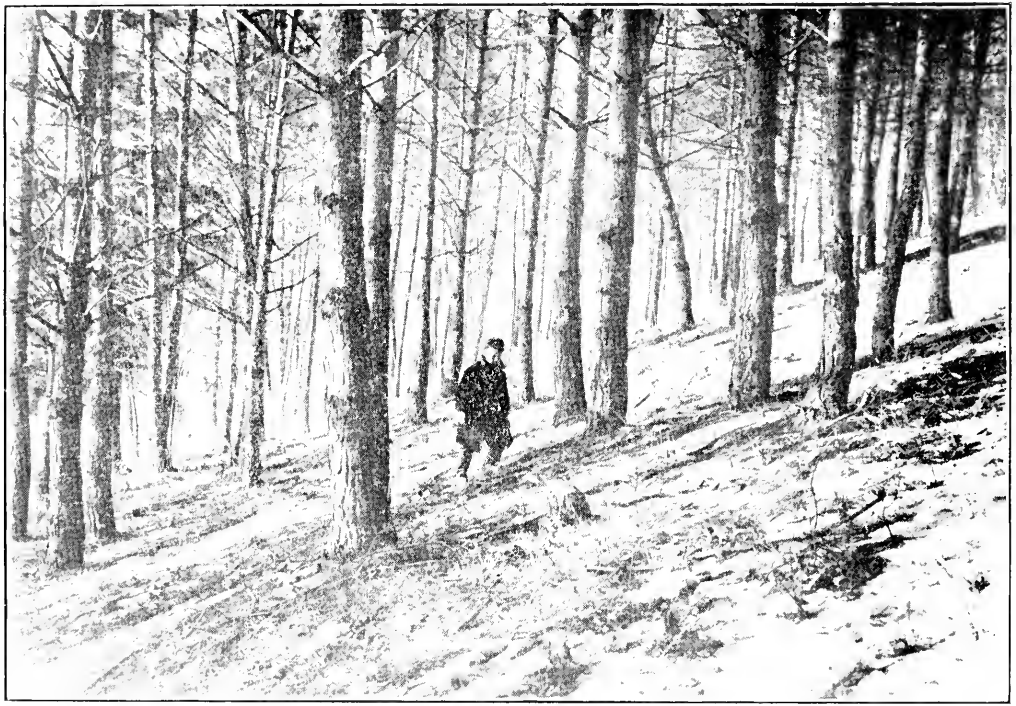


5. **Mixed Forest.** The large Chestnuts near the left and right sides of the picture should be removed. They are practically mature, and should make room for the younger trees beside them.

6. **Natural Reproduction.** Hemlock coming in under the shade of young birch. Showing the vigorous natural reproduction of forest under suitable conditions.

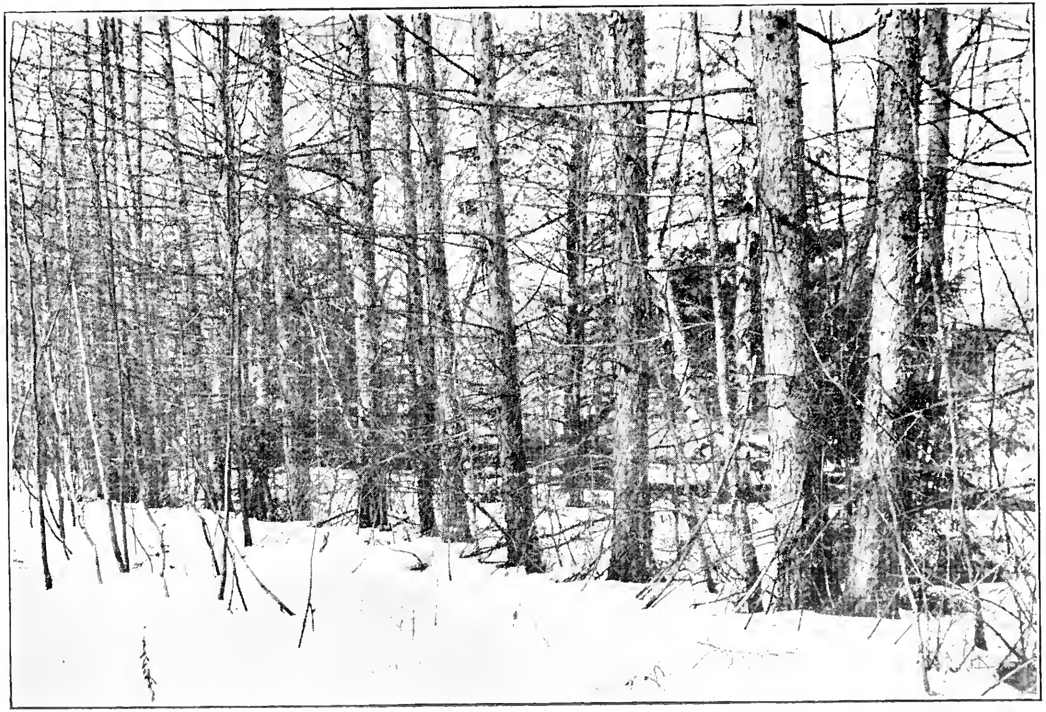
7. **Yellow Birch and White Pine.** The pine is coming in from natural seeding under the birch. The birch can be gradually thinned to make room for the pine.

8. **Young Second Growth Forest.** Chestnut, oak and maple mixed. The large stump shows how chestnut ought NOT to be cut.



9. **Scotch Pine and American Larch.** These trees were planted out 25 years ago, and have been pruned and thinned. White pine would doubtless have been better than Scotch pine.

10. **American Larch.** A thick plantation about 17 years old. Now ready for thinning. Will furnish fence posts, grape stakes, etc. In a few years the larger trees would make telephone poles.



11. **American Larch.** Trees planted about 25 years ago. Some thinning would now be in order. The trees to be taken out will make good fence posts.

12. **Plantation of White Birch.** These trees, now about 15 years old, are not valuable except as nurse trees for other species. Underplantings of pine or hemlock would probably be successful here.

13. **Thinning Larch.** Showing the poles taken from a plantation of American Larch 25 years planted. The poles are about 20 feet long and average 5 inches in diameter at the butts.

THE FOLLOWING BULLETINS ARE AVAILABLE FOR DISTRIBUTION TO THOSE WHO MAY DESIRE THEM.

No. 27. Tuberculosis in college herd: tuberculin in diagnosis: bovine rabies: poisoning by nitrate of soda.
No. 33. Glossary of fodder terms.
No. 35. Agricultural value of bone meal
No. 41. On the use of tuberculin (translated from Dr. Bang).
No. 54. Fertilizer analyses.
No. 57. Fertilizer analyses.
No. 64. Analyses of concentrated feed stuffs.
No. 67. Grass thrips: treatment for thrips in greenhouses.
No. 68. Fertilizer analyses.
No. 70. Fertilizer analyses.
No. 72. Summer forage crops.
No. 75. Fertilizer analyses.
No. 76. The imported elm-leaf beetle.
No. 77. Fertilizer analyses.
No. 78. Concentrated feed stuffs.
No. 79. Growing China asters.
No. 81. Analyses of fertilizers and manurial substances, instructions to manufacturers, agents, etc.: discussion of trade values: treatment of barnyard manure with absorbents.
No. 82. Orchard management: cover crops in orchards; pruning orchards: report on fruits.
No. 83. Fertilizer analyses.
No. 84. Fertilizer analyses.
No. 85. Concentrated feeds.
No. 86. Orchard treatment for the San José scale. One year's experiments in Massachusetts.
No. 87. Cucumbers under glass.
No. 89. Fertilizer analyses.
No. 90. Fertilizer analyses.
No. 91. Injuries to shade trees from electricity.
No. 92. Fertilizer analyses.
No. 93. Concentrated feeds.
No. 94. Distillery and brewery by-products.
No. 95. Fertilizer analyses; notes on barnyard manure; trade values.
No. 96. Fungicides, insecticides, spraying calendar.
No. 97. A farm woodlot.
Technical. No. 1. Greenhouse aleyrodes; strawberry aleyrodes.
Special bulletin,—The brown-tail moth.
Special bulletin,—The coccid genera Chionaspis and Hemichionaspis.
Index, 1888-95.
Annual Reports,—1898, 1899, 1900, 1901, 1902, 1903, 1904.

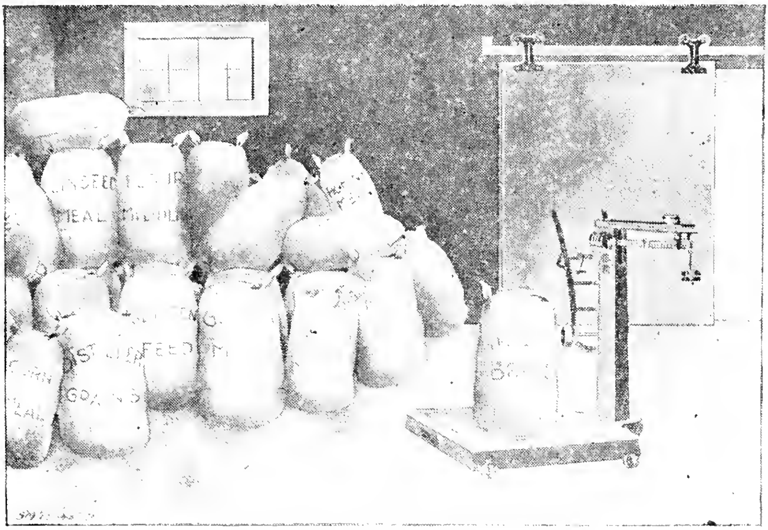
HATCH EXPERIMENT STATION

OF THE

MASSACHUSETTS AGRICULTURAL COLLEGE.

BULLETIN NO. 98.

INSPECTION OF CONCENTRATES.



JULY, 1904.

The regular Bulletins of this Station will be sent free to all newspapers in the State and to such individuals interested in farming as may request the same. Technical Bulletins are sent only to those persons interested in the subject treated of in each case.

AMHERST, MASS.:
PRESS OF CARPENTER & MOREHOUSE
1904.

HATCH EXPERIMENT STATION

OF THE

Massachusetts Agricultural College,

AMHERST, MASS.

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GEORGE W. PATCH,	*Observer.*

The co-operation and assistance of farmers, fruit-growers, horticulturists, and all interested, directly or indirectly, in agriculture, are earnestly requested. The Bulletins will be sent free to all newspapers in the State and to such individuals interested in farming as may request the same. General bulletins, fertilizer analyses, analyses of feed-stuffs, and annual reports are published. Kindly indicate in application which of these are desired. Communications may be addressed to the

HATCH EXPERIMENT STATION, Amherst, Mass.

DEPARTMENT OF FOODS AND FEEDING.

INSPECTION OF CONCENTRATES.

JOSEPH B. LINDSEY.*

CONTENTS.

A. TO MANUFACTURERS, JOBBERS AND RETAILERS.

Pleasant relations between Station, Manufacturers and Retailers.

This is the second bulletin issued since the passage of the new feed law. The full text of the law, together with a number of interpretations were published in bulletin No. 93. The large majority of manufacturers, jobbers and retail dealers have fully conformed to its requirements, and a friendly spirit, as well as a mutually satisfactory understanding, is believed to exist between these parties and the experiment station.

A Few Violators.

A few dealers on the other hand, seem disposed to make light of the law, and have repeatedly offered their goods for sale unbranded and unguaranteed. The station has endeavored to be extremely patient in the matter and has repeatedly sent the offenders marked copies of the law, together with written notifications in accordance with sec-

*With the co-operation of E. B. Holland, P. H. Smith, W. E. Tottingham and A. Parsons.

tion 7. Letters of inquiry have been carefully considered and full information given.

Offenders to be Prosecuted. It is now believed that everyone is, or ought to be, fully informed concerning the several requirements of the law, and should willful violations be met with in the future, it will be absolutely necessary for the station to prosecute the violators in acccordance with sections 4 and 7.

Form of Guarantee. In response to numerous inquiries as to the proper form of guarantee necessary to meet the requirements of section 1, the following is suggested which should be printed on the package, or on the tags to be attached to the package:

100 LBS.

COTTONSEED MEAL,

MANUFACTURED BY

JOHN BROWN & CO.,

MEMPHIS, TENN.

Guaranteed Analysis.

Protein 43 per cent.
Fat 9 per cent.

B. A FEW WORDS WITH THE CONSUMER.

Consumer Protected.

The new feed law makes possible the employment of a regular inspector, who visits all sections of the state a number of times each year, collects samples and notes whether the several statute requirements are complied with. The consumer has, as it were, a special agent constantly at work in his interests, protecting him against any possible fraud or misrepresentation.

Bulk of Feed Free from Adulteration.

In general it may be said that the bulk of the feed now offered is free from serious adulteration and is as represented. The large majority of local dealers are desirous of securing and selling only standard feeds of recognized worth, and are frequently addressing letters of inquiry to the station concerning the character of questionable or unknown articles. A few dealers seem disposed to carry an inferior line of feeds and appear desirous of pushing the sale of those,—irrespective of quality—on which there is the largest margin of profit.

Consumer Must Help Himself.

The consumer owes it to himself to see that the feeds he purchases are properly tagged, are not damp, mouldy or wormy, are free from foreign admixtures that can be detected with the unaided eye, (weed seeds, hulls, and the like) and are of a satisfactory mechanical condition. He should further carefully scrutinize the guarantee, in order to ascertain its true meaning. The mere fact that a feed stuff bears a guarantee, does not certify that it is unadulterated or of a satisfactory character.

The station has established definite standards for all regular brands (see page 6) and the attached guarantee should conform to the standard. The consumer has only himself to blame if he is not sufficiently posted to discriminate between the true and the false. The materials analyzed and reported on pages 8 to 26 were collected during the late winter and early spring by our regular inspector, who thoroughly canvassed all sections of the state. In many cases it was not thought necessary to take samples. The 378 samples collected, were obtained of 186 grain dealers, located in 120 different towns.

C. FEED STANDARDS.

A standard for comparison is always necessary in passing accurate judgment on the quality of concentrated feed stuffs. The percentages of protein and fat serve as an index of the character of such feeds in the majority of cases. To be of *standard quality*, the various concentrates should maintain the following percentages of protein and fat in addition to a good physical and mechanical condition.

	FEED STUFF.	PROTEIN.	FAT.
Protein Feeds.	*Blood meal.*	85	0.2
	Cottonseed meal.	43	9
	N. P. linseed meal.	38	2
	O. P. linseed meal.	32	6
	Gluten meal.	35	1
	Gluten feed.	25	3
	Germ oil meal.	25	10
	Distillers' dried grains.	32	10
	Malt sprouts.	25	1
	Brewers' dried grains.	22	5
	Wheat middlings (flour).	18–20	5
	Wheat middlings (standard).	17–19	5
	Mixed feed.	16–18	4.5
	Wheat bran.	15–17	4.5
	Dairy feeds.	17–19	4–5
	Oat middlings.	16	6
	Rye feed.	15	3
Starchy (Carbohydrate) Feeds.	*Ground oats.*	11	4
	Ground wheat.	11	2
	Barley meal.	11	1.5
	Rye meal.	10	1.5
	Corn meal.	9	3
	Hominy meal.	10.5	7.5
	Provender.	10	3.5
	Corn and oat feed.	8–10	3–5
	Fortified oat feed.	12–14	3–5
	Oat feed.	5–8	2
	Corn bran.	9	5
	Dried molasses-beet-pulp.	9	0.3
Poultry Feeds.	*Meat scraps.*	50	12–15
	Meat and bone meal.	35	10
	Bone.	25	—
	Poultry mash and meal.	13–16	4–5
	Chick and scratching grains.	9–11	2–3
	Clover meal.	12	2

D. CLASSIFICATION OF CONCENTRATED FEEDS.

Protein Feeds.

CLASS I.

30 to 45% protein.
50 to 60% carbohydrates.*
75 to 92% digestible.

- *Cottonseed meal.*
- *N. P. and O. P. linseed meals.*
- *Atlantic, Chicago and Cream gluten meals.*
- *Ajax Flakes, Biles Fourex and Blue Ribbon distillers' grains.*

CLASS II.

20 to 30% protein.
60 to 70% carbohydrates.*
65 to 85% digestible.

- *Buffalo, Globe, Pekin, Queen and Warner's gluten feeds.*
- *Germ oil meal.*
- *Malt sprouts and brewers' dried grains.*

CLASS III.

15 to 20% protein.
70 to 75% carbohydrates.*
60 to 75% digestible.

- *Flour and standard wheat middlings, mixed feed and wheat bran.*
- *Buffalo creamery and H-O dairy feeds.*
- *Oat middlings and rye feed.*

Starchy (Carbohydrate) Feeds.

CLASS IV.

8 to 14% protein.
75 to 85% carbohydrates.*
80 to 95% digestible.

- *Oat, wheat, barley, rye, corn and hominy meals.*
- *Provender and corn and cob meal.*
- *Corn and oat and fortified oat feeds.*
- *Corn bran and dried molasses-beet-pulp.*

CLASS V.

8% and less protein.
85% carbohydrates.
35 to 60% digestible.

- *Oat feed.*
- *Peanut feed.*
- *Corn cobs.*

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* Including fat reduced to carbohydrates.

E. RESULTS OF THE INSPECTION.

I. Protein Feeds.

BLOOD MEAL.

Manufacturer or Jobber, Brand and Retailer.	Sampled at:	Water.	Protein.		Fat.		Fiber.
			Found.	Guar.	Found.	Guar.	
		%	%	%	%	%	%
Armour Fertilizer Works, Chicago, Ill.							
Howe Bros.	Gardner	11.19	86.43	85-87	0.24	0.2-0.3	—
Seymour & McDonald	S. Lancaster	11.19	86.30	85-87	0.31	0.2-0.3	—
Cyphers Incubator Co., Buffalo, N. Y.							
Howard & Smith	Hatfield	5.58	91.70	86.00	0.25	1.00	—
Average		9.32	88.14	—	0.27	—	—

COTTONSEED MEAL.

Manufacturer or Jobber, Brand and Retailer.	Sampled at:	Water.	Protein Found.	Protein Guar.	Fat Found.	Fat Guar.	Fiber.
American Cereal Co., Chicago, Ill.							
Sunflower... H. C. Puffer Co	Springfield	5.24	47.03	43.00	8.23	9.00	—
Sunflower... H. C. Puffer Co	Springfield	6.10	45.33	43.00	8.47	9.00	—
E. F. Wheeler	Stow	6.40	44.75	43.00	9.79	9.00	—
American Cotton Oil Co., New York, N.Y							
W. N. Potter & Sons	Greenfield	5.56	43.31	43.00	10.81	9.00	—
W. N. Potter's Sons & Co.	Hadley	6.91	44.31	43.00	9.61	9.00	—
W. N. Potter's Sons & Co.	Hadley	4.97	44.45	43.00	9.83	9.00	—
W. N. Potter's Sons & Co.	Hadley	7.43	42.46	43.00	9.73	9.00	—
W. N. Potter's Sons & Co.	Northampton	7.29	47.17	43.00	8.47	9.00	—
Weld & Beck	Southbridge	7.53	45.58	43.00	8.55	9.00	—
Prentiss, Brooks & Co	Westfield	6.40	42.20	43.00	8.37	9.00	—
Augusta Brokerage Co., Augusta, Ga.							
A. B. C.... Pierce & Winn	Arlington	7.45	44.05	43.00	8.72	9.00	—
W. P. Battle & Co., Memphis, Tenn.							
Battle...... F. M. Keefe	Waltham	6.05	45.98	43.00	9.81	9-10	—
R. W. Biggs & Co., Memphis, Tenn.							
Canary..... H. C. Puffer Co.	Springfield	7.40	44.62	43.00	7.92	9.00	—
H. E. Bridges & Co., Memphis, Tenn.							
J. B. Garland & Son	Worcester	7.22	44.27	43.00	9.57	9-10	—
F. W. Brode & Co., Memphis, Tenn.							
Owl........ C. G. Burnham	Holyoke	5.27	44.62	43.00	13.27	9.00	—
Owl........ Bryant & Soule	Middleboro	6.05	47.78	43.00	8.84	9.00	—
Owl........ Sprague & Williams	S. Framing'm	8.77	45.45	43.00	9.01	9.00	—
T. H. Bunch, Little Rock, Ark.							
Old Gold, .. W. N. Potter & Sons	Greenfield	6.58	44.40	43.00	10.51	9.00	—
Old Gold, .. S. P. Puffer	N. Amherst	6.68	43.22	43.00	9.65	9.00	—
Old Gold, .. Cutler Co.	N. Wilbraham	5.85	44.75	43.00	8.88	9.00	—
Old Gold, .. Taft Bros	Whitinsville	7.47	43.92	43.00	10.07	9.00	—

COTTONSEED MEAL —(CONTINUED.)

Manufacturer or Jobber, Brand and Retailer.	Sampled at	Water.	Protein. Found.	Protein. Guar.	Fat. Found.	Fat. Guar.	Fiber.
		%	%	%	%	%	%
Chapin & Co., St. Louis, Mo.							
Green Diamond, Marlboro Grain Co.	Marlboro	6.89	46.50	43.00	8.04	9.00	—
Green Diamond, Dennison Plummer Co	New Bedford	7.52	44.31	43.00	8.11	9.00	—
Green Diamond, H. C. Puffer Co.	Springfield	6.66	42.46	43.00	7.45	9.00	—
G. D. Meserve	Easthampton	8.19	45.89	43.00	8.80	9.00	—
Chas. M. Cox Co., Boston, Mass.							
Magnolia, ..Frank E. Smith	Amherst	6.96	43.87	43.00	9.77	9.00	—
Magnolia, ..E. H. Smith	Northboro	7.80	42.78	43.00	7.41	9.00	—
Elberton Oil Mills, Elberton, Ga.							
J. L. Brown	Fitchburg	6.38	43.61	43.00*	8.47	9.00*	—
Hayley & Hoskins, Memphis, Tenn.							
H. & H.....C. B. Sawin & Son	Southboro	6.95	46.33	43.00	9.91	9–10	—
H. & H.....Seymour & McDonald	S. Lancaster	5.73	44.22	43.00	8.71	9–10	—
Hunter Bros. Milling Co., St. Louis, Mo.							
Seth J. Reed	Amherst	6.25	42.55	43.00	10.26	9.00	—
E. A. Briggs & Co.	Attleboro	5.94	46.82	43.00	8.98	9.00	—
Miner & Edgerton	Chicopee	7.10	44.49	43.00	7.96	9.00	—
City Mills Co.	Holyoke	7.61	44.53	43.00	8.26	9.00	—
J. E. Dodge	Lowell	7.21	44.40	43.00	9.13	9.00	—
J. W. Wilder	Springfield	7.22	43.43	43.00	9.02	9.00	—
D. L. Marshall & Co., Boston, Mass.							
Phœnix.....Edward C. Paull	Taunton	7.91	44.45	43.00	9.01	9.00	—
Oliver Refining Co., Portsmouth, Va.							
Prentiss, Brooks & Co.	Easthampton	6.88	43.00	43.00	8.02	9.00	—
Prentiss, Brooks & Co.	Holyoke	7.30	42.25	43.00	8.26	9.00	—
H. W. Kimball	Westboro	8.07	42.78	43.00	8.68	9.00	—
Hugh Petit, Memphis, Tenn.							
Horseshoe. T. H. Emerson	E. Weymouth	6.22	43.05	43.00	11.74	9.00	—
Sledge & Wells Co., Memphis, Tenn.							
Star........George A. Stevens	Worcester	7.02	42.07	43.00	9.55	9–10	—
J. E. Soper & Co., Boston, Mass.							
J. Cushing & Co.	Hudson	7.74	45.72	43.00	8.92	9–10	—
W. H. Smith	Northampton	7.47	42.25	43.00	8.82	9–10	—
J. B. Bridges & Co.	S. Deerfield	6.41	44.53	43.00	11.07	9–10	—
Vilas E. Moore	Springfield	7.05	43.00	43.00	9.33	9–10	—
Below Standard.							
Augusta Brokerage Co., Augusta, Ga.							
A. B. C.....Prentice & Son	Milford	7.92	40.32	43.00	8.56	9.00	—
Chapin & Co., St. Louis, Mo.							
Green Diamond, W. W. McIntyre	Marlboro	5.81	39.97	43.00	9.77	9.00	—
Humphreys, Godwin & Co., Memphis, Tenn.							
Dixie.......C. D. Holbrook Co	Palmer	7.39	34.71	43.00	7.74	9.00	—

* Guaranteed by Chas. M. Cox Co., Boston, Mass.

COTTONSEED MEAL.—CONTINUED.

Manufacturer or Jobber, Brand and Retailer.	Sampled at:	Water.	Protein. Found.	Protein. Guar.	Fat. Found.	Fat. Guar.	Fiber.
		%	%	%	%	%	%
D. L. Marshall & Co., Boston, Mass.							
Phœnix..... Lummus & Parker........	Danversport..	7.21	41.94	43.00	9.02	9.00	—
Norton-Chapman Co., Boston, Mass.							
A. F. Sanctuary	Amherst.....	7.26	41.73	43.00	9.00	9.00	—
Oliver Refining Co., Portsmouth, Va.							
Jacob Burkhardt..........	Beverly	7.04	39.62	43.00	8.47	9.00	—
Highest................	....	8.77	47.78	—	13.27	—	—
Lowest................	....	4.97	34.71	—	7.41	—	—
Average................	....	6.89	43.79	—	9.12	—	—

LINSEED MEAL.

Manufacturer or Jobber, Brand and Retailer.	Sampled at:	Water.	Protein. Found.	Protein. Guar.	Fat. Found.	Fat. Guar.	Fiber.
1. New Process.							
American Linseed Co., Chicago, Ill.							
Cleveland Flax, S. A. Eastman........	Milford.......	8.72	36.95	38-40	3.61	1-3	—
Elmer C. Packard	Brockton	9.34	36.82	38-40	4.16	1-3	—
C. G. Burnham.......	Holyoke......	8.30	38.04	38-40	2.89	1-3	—
Average..........................	....	8.79	37.27	—	3.55	—	—
2. Old Process.							
American Linseed Co., Chicago, Ill.							
G. B. Pope & Co..........	Waltham.....	8.76	33.21	32-36	7.67	5-7	—
A. L. Clements & Co., New York, N. Y.							
W. W. Hosmer...........	Westfield	7.65	32.03	32-37.5	7.09	5.5-8.5	—
Mann Bros. Co., Buffalo, N. Y.							
D. W. Manvell............	Ashley Falls..	8.86	35.97	34.15	7.82	6.05	—
Metzger Seed & Oil Co., Toledo, Ohio.							
Prentice & Son	Milford	8.88	31.86	30-36	7.44	5-7	—
W. N. Potter & Sons, Greenfield, Mass.							
Amsterdam, W. N. Potter & Sons	Greenfield....	9.43	34.22	33-37	10.09	7-8	—
D. W. Ranlet, Boston, Mass.							
Square, ...J. E. Dodge	Lowell.......	6.52	33.48	32-37.5	9.57	5.5-8.5	—
Below Standard.							
Flint Mill Co., Milwaukee, Wis.							
Green Oval, Bedford Coal & Grain Co.	Bedford	9.97	30.54	32-36	7.13	5-7	—
Average..........................	....	8.58	33.04	—	8.24	—	—

GLUTEN MEAL.

Manufacturer or Jobber, Brand and Retailer.	Sampled at:	Water.	Protein.		Fat.		Fiber.
			Found.	Guar.	Found.	Guar.	
		%	%	%	%	%	%
Glucose Sugar Refining Co., Chicago, Ill.							
Chicago, ... J. O. Ellison	Haverhill	12.42	39.80	38.00	1.86	3.00	—
Chicago, ... Briggs & Co	Taunton	9.31	38.79	38.00	1.01	3.00	—
Illinois Sugar Refining Co., Chicago, Ill.							
Cream, ... City Grist Mills	Newburyport	7.02	42.11	35.50	0.91	3.00	—
Cream, ... Cutler Co.	W. Brookfield	9.59	36.42	35.50	1.75	3.00	—
Cream, ... A. N. Whittemore & Co.	Worcester	7.60	44.62	35.50	0.88	3.00	—
Chas. Pope Glucose Co., Chicago, Ill.							
Cream, ... City Grist Mills	Newburyport	9.29	36.86	34.12	2.17	3.20	—
Average		9.21	39.77	—	1.43	—	—

GLUTEN FEED.

Manufacturer or Jobber, Brand and Retailer.	Sampled at:	Water.	Protein Found.	Protein Guar.	Fat Found.	Fat Guar.	Fiber.
Flint Mill Co., Milwaukee, Wis.							
Flint, ... H. I. Gould & Co	Charlton Dep.	6.00	26.29	28.50	1.78	3.00	—
Glucose Sugar Refining Co., Chicago, Ill.							
Buffalo, ... F. F. Woodward & Co	Ayer	8.01	26.59	28.00	2.96	3.00	—
Buffalo, ... Seymour & McDonald	S. Lancaster	8.05	25.45	28.00	3.09	3.00	—
Buffalo, ... C. H. Mead & Co.	West Acton	8.35	24.70	28.00	3.15	3.00	—
Buffalo, ... J. E. Merrick	S. Amherst	5.91	24.88	27.50	2.47	2.50	—
Illinois Sugar Refining Co., Chicago, Ill.							
Pekin, ... Jacob Burkhardt	Beverly	8.23	24.97	28.00	5.76	3.00	—
Pekin, ... Marlboro Grain Co	Marlboro	7.66	28.04	28.00	3.29	3.00	—
New York Glucose Co., New York, N.Y.							
Globe, ... C. D. Holbrook Co	Palmer	4.96	26.94	27.00	2.56	3.38	—
Globe, ... Sprague & Williams	S. Framingh'm	8.62	25.85	27.00	2.06	3.38	—
Warner Sugar Refining Co., Chicago, Ill.							
Warner's, .. Sweetzer & Day	Chelmsford	7.46	25.01	28.00	3.81	3.50	—
Below Standard.							
Flint Mill Co., Milwaukee, Wis.							
Flint, ... S. P. Puffer	N. Amherst	7.67	21.76	28.50	3.24	3.00	—
Glucose Sugar Refining Co., Chicago, Ill.							
Buffalo, ... Conant & Co	Littleton	8.72	22.86	27.50	3.29	2.50	—
Buffalo, ... Conant & Co	Littleton	7.21	23.26	27.50	3.79	2.50	—
Illinois Sugar Refining Co., Chicago, Ill.							
Pekin, ... J. E. Dodge	Lowell	7.91	23.87	27.50	2.58	2.50	—
National Starch Co., New York, N. Y.							
Queen, ... Lincoln Mill	N. Scituate	8.04	20.14	27.10	1.45	3.20	6.42
Average		7.52	24.71	—	3.02	—	—

DISTILLERS' DRIED GRAINS.

Manufacturer or Jobber, Brand and Retailer.	Sampled at :	Water.	Protein. Found.	Protein. Guar.	Fat. Found.	Fat. Guar.	Fiber.
		%	%	%	%	%	%
J. W. Biles Co., Cincinnati, Ohio.							
Fourex, ... D. F. Howard	Ware	6.75	33.39	33.00	11.71	11.00	—
Chapin & Co., Boston, Mass.							
Ajax Flakes. A. F. Sanctuary	Amherst	5.85	36.33	33.35	10.91	12.00	—
Manhattan, . R. M. Gould	W. Brookfield.	5.84	34.45	34.00	16.90	12.00	—
Charles A. Krause Grain Co., Milwaukee.							
Blue Ribbon. John Shea	Lawrence	7.05	33.30	33.00	13.55	11.00	—
Blue Ribbon. Cutler Co.	Warren	7.15	34.97	33.00	15.04	11.00	—
Below Standard.							
J. W. Biles Co., Cincinnati, Ohio.							
Fourex. .... Briggs & Co.	Taunton	6.22	30.06	33.00	9.35	11.00	—
Charles A. Krause Grain Co., Milwaukee.							
Blue Ribbon. J. M. Johnson	Medfield	6.28	29.00	33.00	13.04	11.00	—
Average		6.45	33.08	—	12.93	—	—

MALT SPROUTS.

Manufacturer or Jobber, Brand and Retailer.	Sampled at :	Water.	Protein. Found.	Protein. Guar.	Fat. Found.	Fat. Guar.	Fiber.
American Malting Co., Syracuse, N. Y.							
B. W. Brown	Concord	5.59	28.87	25.00	1.33	2.00	—
Sprague & Williams	S. Framingh'm	6.97	29.66	25.00	1.12	2.00	—
Chas. M. Cox Co., Boston, Mass.							
B. W. Brown	Concord	7.62	28.13	25-26	1.38	1.91	—
Hottelet & Co., Milwaukee, Wis.							
C. O. Parmenter & Co.	S. Sudbury	5.70	25.80	24.00	1.44	2.00	—
E. P. Mueller, Milwaukee, Wis.							
Prentice & Son	Milford	12.51	25.80	26.25	1.28	1.91	—
Average		7.68	27.65	—	1.31	—	—

WHEAT MIDDLINGS.

Manufacturer or Jobber, Brand and Retailer.	Sampled at :	Water.	Protein. Found.	Protein. Guar.	Fat. Found.	Fat. Guar.	Fiber.
1. Flour.							
Bay State Milling Co., Winona, Minn.							
Red Dog, W. N. Potter's Sons & Co.	Northampton.	10.42	19.13	—	4.34	—	—
Northwest Consol. Mill. Co., Minneapolis.							
XXX Comet, H. P. Howland	Spencer	10.69	19.92	—	5.81	—	—
Washburn-Crosby Co., Minneapolis, Minn							
Adrian, ... A. F. Sanctuary	Amherst	9.40	21.20	—	6.03	—	—

WHEAT MIDDLINGS.—(CONTINUED.)

Manufacturer or Jobber, Brand and Retailer.	Sampled at	Water.	Protein. Found.	Protein. Guar.	Fat Found.	Fat Guar.	Fibre.
		%	%	%	%	%	%
Below Standard.							
Moses Dorr, Boston, Mass.							
H..........G. M. Foster..............	Lowell........	10.97	14.39		2.43		6.56
Average.... :............		10.30	18.66	—	4.65	—	—
2. Standard.							
Hunter Bros. Milling Co., St. Louis, Mo.							
Shorts......J. B. Garland & Son	Worcester ...	9.28	18.83		4.12	—	
Mystic Milling Co., Sioux City, Iowa.							
F. A. Walker.............	No. Adams...	10.89	17.60	—	4.38	—	—
New Prague F. M. Co., New Prague, Minn.							
H. E. Noyes & Son.....	Lowell	10.43	17.34	—	5.09	—	—
Geo. Tileston Milling Co., St. Cloud, Minn.							
Fancy, ...Field & Field	Leverett......	10.91	17.91	—	5.77	—	—
S. D. Viets Co., Springfield, Mass.							
P. W. Eaton & Co........	Williamst'wn .	10.61	17.00	—	5.20	—	—
Washburn-Crosby Co., Minneapolis, Minn							
Flour.......A. F. Sanctuary	Amherst	10.14	19.09	—	5.83	—	—
A. F. Sanctuary	Amherst	9.92	17.20	—	5.30	—	—
Below Standard.							
James Gorsline Est., Rochester, N. Y.							
S. Gannett................	Milton...	11.09	15.14	—	5.77	—	4.80
Average................................		10.41	17.64	—	5.18	—	—

MIXED FEED.

Manufacturer or Jobber, Brand and Retailer.	Sampled at	Water.	Protein. Found.	Protein. Guar.	Fat Found.	Fat Guar.	Fibre.
Annan, Burg & Co., St. Louis, Mo.							
Carter's ....S. D. Viets Co............	Springfield ...	9.18	17.03	—	4.73	—	—
Brooks Elevator Co., Minneapolis, Minn.							
Royal,......Jacob Burkhardt	Beverly	7.74	16.85	16.61	4.89	5.48	—
Royal.......C. O. Parmenter & Co....	S. Sudbury...	9.26	15.58	16.61	4.47	5.48	—
Royal.......Edward C. Paull..........	Taunton	11.13	15.67	—	4.44	—	—
Royal ......J. Loring & Co...........	Watertown ..	8.90	16.72		4.35	—	—
Chapin & Co., Boston, Mass.							
Vermont....Geo. P. Rogers	Worcester....	7.78	17.07	—	4.64	—	—
Chas. M. Cox Co., Boston, Mass.							
Wirthmore, Whitman Grain & Coal Co.	Whitman.....	10.03	16.81	17-19	4.72	4-5	—
J. H. Cressey & Co., Boston, Mass.							
Peerless. ...Horvitz Bros	New Bedford.	8.01	15.71	—	4.67	—	—

MIXED FEED.—(CONTINUED.)

Manufacturer or Jobber. Brand and Retailer.	Sampled at:	Water.	Protein. Found.	Protein. Guar.	Fat. Found.	Fat. Guar.	Fiber.
		%	%	%	%	%	%
E. Crosby & Co., Brattleboro, Vt.							
Crosby's Fancy. J. E. Lamb	Greenfield....	9.99	17.95	17.53	4.99	5.37	--
Flint Mill Co., Milwaukee, Wis.							
Vermont,...C. T. Wyman	Hubbardston .	10.05	17.29	—	4.76	—	—
Hunter Bros. Milling Co., St. Louis, Mo.							
Matchless,..Geo. P. Rogers..........	Worcester	7.75	17.34	—	4.35	—	—
Imperial Mill Co., Duluth, Minn.							
Boston, ...Fisher, Churchill Co..	Dedham......	10.25	17.11	—	4.91	—	—
J. E. M. Milling Co., Frankfort, Ky.							
Kyome, ...H. E. Noyes & Son.......	Lowell	10.06	16.32	—	4.20	—	—
Lake Superior Mills, Superior, Wis.							
Superior, ..J. W. Raymond..........	Concord......	10.88	16.99	—	5.01	—	—
Lawrenceburg Mills, Lawrenceburg, Ind.							
Golden Bull, Oscar Shumway	Webster......	10.85	16.85	—	4.45	—	—
C. R. Lull, Milwaukee, Wis.							
D.,.........D. F. Howard...........	Ware	11.78	17.72	—	4.95	—	—
National Milling Co., Toledo, Ohio.							
National, ...Briggs & Co.	Taunton......	10.10	15.58	—	4.08	—	—
Potter Grain Co...........	Shelburne F'ls	10.13	17.95	—	4.44	—	—
New Prague F.M.Co., New Prague, Minn.							
Equality....City Grist Mills	Newburyport .	10.09	17.20	—	5.08	—	—
Pillsbury-Washburn Co., Minneapolis.							
Dandy,.....J. F. Robinson...........	Mansfield.....	8.16	15.67	—	4.64	—	—
Russell-Miller Milling Co., Minneapolis.							
Occident,...A. E. Lawrence & Son....	Ayer	9.13	17.72	—	5.88	—	—
Occident,...J. W. Doon & Son........	Natick	9.20	16.99	—	5.35	—	—
Schultz, Banjan & Co., Beardstown, Ill.							
Duchess, ...F. F. Woodward & Co....	Ayer	10.14	15.79	—	4.48	—	—
Sheffield-King Milling Co., Minneapolis.							
Gold Mine, J. H. Nye	Brockton	9.92	17.81	—	4.54	—	—
St. Albans Grain Co., St. Albans, Vt.							
Hygrade, ..C. W. Lane	Townse'd Har.	9.07	17.60	17.19	5.01	4.6	—
David Stott, Detroit, Mich.							
Honest, ...Ogden & Thompson	Brighton.	9.38	15.49	—	4.84	—	—
Waggoner-Gates Milling Co., Independence, Ind.							
J. O. Ellison.............	Haverhill	9.43	16.81	—	4.38	—	—
Washington Flour Mill, Washington, Mo.							
A. D. Thomas...........	Palmer	7.47	16.99	—	4.95	—	—

MIXED FEED.—(CONTINUED.)

Manufacturer or Jobber, Brand and Retailer.	Sampled at:	Water.	Protein.		Fat.		Fiber.
			Found.	Guar.	Found.	Guar.	
		%	%	%	%	%	%
H. K. Webster & Co., Lawrence, Mass.							
High Grade, H. K. Webster & Co.	Lawrence	9.77	17.68	—	4.80	—	—
Unknown.							
Cream, ... John Enwright & Son.....	Fall River....	10.10	15.53	—	4.67	—	—
Below Standard.							
Stratton & Co., Concord, N. H.							
M. F. Wilbur.............	Lexington	9.94	14.88	—	4.57	—	—
Wheat Feed with Admixtures.							
J. Altman, New Bedford, Mass.							
Mascot, ... J. F. Kirk	New Bedford.	8.80	10.49	12.59	2.97	3.19	16.93
Frank Dunham, Sheffield, Mass.							
—,* Frank Dunham...........	Sheffield. ...	8.29	14.00	—	3.82	—	—
A. Waller & Co., Henderson, Ky.							
Blue Grass, A. J. Richards & Son......	Quincy.......	8.95	9.48	12.59	2.45	3.19	17.73
Highest	....	11.78	17.95	—	5.88	—	—
Lowest........	....	7.47	9.48	—	2.45	—	—
Average†........	....	9.54	16.73	—	4.72	—	—

WHEAT BRAN.

Manufacturer or Jobber, Brand and Retailer.	Sampled at:	Water.	Protein Found.	Protein Guar.	Fat Found.	Fat Guar.	Fiber.
Blue Earth City Mill Co., Blue Earth City, Minn.							
W. H. Dewhirst	Groveland....	8.97	17.03	—	5.21	—	—
Chapin & Co., Boston, Mass.							
Gilt Edge Flakes, E. A. Cowee.........	Worcester....	7.63	18.42	—	5.00	—	—
Glen Mills Cereal Co., Rowley, Mass.							
Glen Mills Cereal Co....	Rowley.......	9.21	14.97	—	3.98	—	—
H. L. Halliday Milling Co., Cairo, Ill.							
H.......... O. B. Burnham............	Beverly	9.63	16.76	—	4.41	—	—
O. D. Wilder.............	Lowell	9.45	16.19	—	4.66	—	—
H. R. Kearny & Co., Minneapolis, Minn.							
Kearny's.... Bryant & Soule....	Middleboro...	8.46	16.28	—	4.55	—	—
Ogilvie Flour Mills Co., Montreal, Can.							
Ogilvie's.... G. B. Pope & Co.	Waltham.....	8.89	15.58	—	5.07	—	—
Unknown.							
L. K., ... Torrence, Vary & Co......	Lynn	8.63	16.19	—	5.17	—	—
St. Louis winter, J. E. Dodge..........	Lowell	9.04	16.10	—	4.69	—	—
Average..................	....	8.88	16.39	—	4.76	—	—

* Vim oat feed added.
† Wheat feed with admixtures excluded from the average.

DAIRY FEEDS.

Manufacturer or Jobber, Brand and Retailer.	Sampled at:	Water.	Protein. Found.	Protein. Guar.	Fat. Found.	Fat. Guar.	Fiber.
		%	%	%	%	%	%
J. W. Biles Co., Cincinnati, Ohio.							
Union Grains, J. H. Nye	Brockton	7.05	24.18	24.00	6.68	7.00	—
Union Grains,* A. H. Wood & Co.....	Framingham .	7.67	23.74	24.00	8.31	7.00	—
Buffalo Cereal Co., Buffalo, N. Y.							
Creamery Feed. Tyler Grain & Coal Co.	Hyde Park ..	7.69	18.42	20.00	4.68	5.00	—
H-O Co., Buffalo, N. Y.							
H-O............N. Bedford Team'g Co.	New Bedford.	7.40	18.34	18.00	4.52	4.50	—

FEEDS CONTAINING MOLASSES.

Manufacturer or Jobber, Brand and Retailer.	Sampled at:	Water.	Protein. Found.	Protein. Guar.	Fat. Found.	Fat. Guar.	Fiber.
American Milling Co., Chicago, Ill.							
Sucrene Dairy, A. F. Butler..........	Adams	12.45	15.01	16.50	1.92	3.50	—
Sucrene Dairy, City Mills Co.........	Holyoke	12.30	14.66	16.50	3.89	3.50	—
Sucrene Horse, C. B. Benedict........	Gt. Barrington	12.83	14.57	13.50	2.00	4.50	—
J. W. Barwell, Waukegan, Ill.							
Blatchford's.† ... Bosworth & Wood....	Leominster...	10.08	26.90	28.25	10.80	11.25	—
Blatchford's.† ... F. M. Keefe..........	Waltham.....	10.99	27.56	28.25	10.06	11.25	—
J. Bibby & Sons, Liverpool, England.							
Bibby's cake.... G. B. Pope & Co.	Waltham.....	10.27	20.49	20-22	8.31	5-7	—
Blomo Mfg. Co., New York, N. Y.							
Blomo..........F. W. Aldrich	Chicopee	24.10	10.44	15.00	1.08	1.19	—
Blomo..........A. W. Charter	Springfield ...	27.20	12.38	15.00	1.01	1.19	—
E. P. Mueller, Milwaukee, Wis.							
Molasses Grains, C. G. Burnham	Holyoke.	14.94	11.80	21.81	2.03	2.73	—
Molasses Grains, Prentice & Son	Milford	15.27	18.12	21.81	1.78	2.73	—

OAT MIDDLINGS.

Manufacturer or Jobber, Brand and Retailer.	Sampled at:	Water.	Protein. Found.	Protein. Guar.	Fat. Found.	Fat. Guar.	Fiber.
William S. Hill & Co., Boston, Mass.							
——,‡ F. Diehl & Son.......	Wellesley	6.20	18.47	—	7.39	—	—

RYE FEED.

Manufacturer or Jobber, Brand and Retailer.	Sampled at:	Water.	Protein. Found.	Protein. Guar.	Fat. Found.	Fat. Guar.	Fiber.
Cutler Co., North Wilbraham, Mass.							
W. W. Hosmer.......	Westfield.....	11.97	14.39	15.00	2.74	3.00	—
Oneonta Milling Co., Oneonta, N. Y.							
A. D. Potter..........	Orange.......	11.25	15.27	14.75	3.16	3.50	—
Average.......... ...	....	11.61	14.83	—	2.95	—	—

* Biles' Ready Ration.
† Sugar and Flaxseed.
‡ Withdrawn from the market.

II. Starchy (Carbohydrate) Feeds.

OATS.

Manufacturer or Jobber, Brand and Retailer.	Sampled at.	Water.	Protein. Found.	Protein. Guar.	Fat. Found.	Fat. Guar.	Fiber.
		%	%	%	%	%	%
William Baylies	New Bedford	6.58	11.80		4.37		—
R. C. Snow	Ware	9.56	12.20	—	3.04	—	—
C. L. Beals & Co	Winchendon	6.71	12.55	—	4.17	—	—
Average		7.62	12.24	—	4.06	—	—

CORN MEAL.

Manufacturer or Jobber, Brand and Retailer.	Sampled at.	Water.	Protein. Found.	Protein. Guar.	Fat. Found.	Fat. Guar.	Fiber.
Chandler Gr. & Mill. Co., Lawrence, Mass.							
Pierce & Winn	Arlington	17.41	8.21	—	2.59	—	—
A. .... G. M. Foster	Lowell	15.28	8.43	—	2.85	—	—
B. .... G. M. Foster	Lowell	9.50	9.65	—	3.30	—	—
Husted Mill. & Elev. Co., Buffalo, N. Y,							
J. S. Place & Co	Dighton	14.20	8.43	—	2.71	—	—
Mackenzie & Winslow, Fall River, Mass.							
John Enwright & Son	Fall River	11.37	9.30	—	3.20	—	—
Narragansett Mill. Co., E. Providence, R.I.							
R. Macomber & Son	Myricks	14.20	8.65	—	2.85	—	—
Irving Powers & Co., Charlestown, Mass.							
Pierce & Winn	Arlington	15.54	8.43	—	2.92	—	—
Benjamin Andrews	Hingham	15.32	8.56	—	3.39	—	—
Eastern Grain Co	Bridgewater	16.09	8.65	—	3.32	—	—
S. Gannet	Milton	12.15	8.30	—	3.56	—	—
Lincoln Mill	N. Scituate	16.04	7.63	—	2.59	—	1.16
I. Morton	Plymouth	16.15	8.34	—	3.27	—	—
C.W. & G.W. Nigh'gale	Quincy Adams	12.55	8.43	—	3.41	—	—
Average		14.29	8.46	—	3.08	—	—

HOMINY MEAL.

Manufacturer or Jobber, Brand and Retailer.	Sampled at.	Water.	Protein. Found.	Protein. Guar.	Fat. Found.	Fat. Guar.	Fiber.
American Cereal Co., Chicago, Ill.							
E. A. Cowee	Worcester	8.91	10.40	11.00	9.22	8.00	—
American Hominy Co., Indianapolis, Ind.							
C. F. Rice	Brookfield	5.91	10.67	10.24	6.08	7.72	—
Buffalo Cereal Co., Buffalo, N. Y.							
Howard's, ... J. M. Johnson	Medfield	7.60	10.27	10.50	8.57	8.50	—
Chapin & Co., Boston, Mass.							
Niagara White, Geo. A. Stevens	Worcester	10.38	9.61	10-11	5.07	7-8	—
Chas. M. Cox Co., Boston, Mass.							
Wirthmore, ... W. C. Bliss	Coldbrook	7.05	10.32	10.5-12	7.66	7.5-9	—
Fisher, Churchill Co	Dedham	11.66	9.56	10.5-12	6.00	7.5-9	—
Cutler Co	W. Brookfield	7.94	10.27	10.5-12	7.48	7.5-9	—

HOMINY MEAL.—(CONTINUED.)

Manufacturer or Jobber, Brand and Retailer.	Sampled at:	Water.	Protein. Found.	Protein. Guar.	Fat. Found.	Fat. Guar.	Fiber.
		%	%	%	%	%	%
F. L. Kidder & Co., Paris, Ill.							
Kidder's, ...H. P. Howland	Spencer	10.44	9.65	11.00	6.67	8.05	—
Miner-Hillard Mill. Co. Wilkes-Barre, Pa.							
Steam cooked,..Jacob Burkhardt......	Beverly.... ..	9.36	9.92	12.00	6.79	9.00	—
Steam cooked,..J. B. Bridges & Co....	S. Deerfield ..	7.18	9.61	12.00	6.63	9.00	—
Steam cooked,..Edward C. Paull......	Taunton	9.48	9.56	12.00	5.80	9.00	—
Patent Cereals Co., Geneva, N. Y.							
A. N. Whittemore & Co.	Worcester....	10.85	10.01	11.46	6.96	9.30	—
J. E. Soper & Co., Boston, Mass.							
Blue Ribbon,...M. F. Wilbur.........	Lexington ...	9.35	10.27	11.00	7.89	8.00	—
Blue Ribbon,...A. N. Whittemore & Co.	Worcester....	9.96	10.14	11.00	7.06	8.00	—
Suffern, Hunt & Co., Decatur, Ill.							
E. A. Hillman	Furnace......	10.65	9.65	11.02	6.53	7.70	—
Cutler Co	N. Wilbraham	10.85	9.83	11.02	7.36	7.70	—
D. F. Howard	Ware	9.88	9.92	11.02	7.39	7.70	—
Below Standard.							
Chapin & Co., Boston, Mass.							
Niagara White, C. O. Parmenter......	S. Sudbury...	7.11	9.26	11.00	6.79	8.00	—
Chas. M. Cox Co., Boston, Mass.							
B. W. Brown.	Concord	8.49	9.35	10.5-12	7.91	7.5-9	—
Toledo Elevator Co., Toledo, Ohio.							
Charlemont Co-op. Asso.	Charlemont...	10.70	9.09	12.60	7.05	8.57	—
Highest....	....	11.66	10.67	—	9.22	—	—
Lowest	....	5.91	9.09	—	5.67	—	—
Average.......... ...	....	9.19	9.87	—	7.23	—	—

CORN AND OAT FEED—PROVENDER.

Manufacturer or Jobber, Brand and Retailer.	Sampled at:	Water.	Protein. Found.	Protein. Guar.	Fat. Found.	Fat. Guar.	Fiber.
American Cereal Co., Chicago, Ill.							
Victor, ...Torrence, Vary & Co.	Lynn.........	11.12	7.81	9.00	2.53	4.00	—
Buffalo Cereal Co., Buffalo, N. Y.							
XXX. .... Tyler Grain & Coal Co.	Hyde Park ..	9.13	9.26	9.50	4.26	4.50	—
Chop. ....H. E. Noyes & Son...	Lowell	8.21	8.34	7.50	3.94	3.50	—
F. G. Cover & Co., Lowell, Mass.							
Horse feed, ...Hood Farm	Lowell	11.52	10.67	—	2.65	—	—
Diamond Elev. & Mill. Co., Minneapolis.							
O. O. Yellow,...J. L. Brown..........	Fitchburg	11.33	10.44	10.51	5.51	5.75	—
O. O. White.... J. L. Brown..........	Fitchburg	8.39	10.58	10.51	5.72	5.75	—
F. Diehl & Son, Wellesley, Mass.							
Provender. .....F. Diehl & Son.......	Wellesley	9.15	7.68	8.00	3.63	3.00	—
A. Dodge & Son, Beverly, Mass.							
Colonial,* ......A. Dodge & Son......	Beverly..	10.86	14.00	—	4.12	—	—

* Withdrawn from the market.

CORN AND OAT FEED—PROVENDER.—(CONTINUED.)

Manufacturer or Jobber, Brand and Retailer.	Sampled at:	Water.	Protein. Found.	Protein. Guar.	Fat. Found.	Fat. Guar.	Fiber
		%	%	%	%	%	%
Edward Ellsworth & Co., Buffalo, N. Y.							
De-Fi. ....J. Cushing & Co.......	Winchendon .	9.55	9.79	8.30	3.31	3.00	—
Empire Mills, Olean, N. Y.							
Empire.........Seth J. Reed..........	Amherst.	13.28	7.37	7.63	2.12	2.97	—
Great Western Cereal Co., Chicago, Ill.							
Boss............Dexter Root Co.......	Springfield. ..	9.10	8.95	9.00	4.29	4.00	—
Durham, ...Taft Bros	Whitinsville..	10.17	8.78	8.27	4.68	3.64	—
W. H. Haskell & Co., Toledo, Ohio.							
Haskell's Stock, Hathaway&Mackenzie	New Bedford.	9.15	9.00	10.00	6.44	6.25	—
Haskell's Stock, Briggs & Co.	Taunton	7.18	8.91	10.00	5.75	6.25	—
C. D. Holbrook Co., Palmer, Mass.							
C. D. Holbrook Co....	Palmer.......	11.58	7.90	2.50*	2.82	2.50*	—
Narragansett Mill.Co., E.Providence,R.I.							
Provender. E. E. C. Swift	Falmouth	12.41	9.88	9.00	3.67	3.80	—
Niagara Mill. and Elev. Co., Buffalo, N.Y.							
Niagara Special, J. A. Bouvier.........	New Bedford.	11.11	11.06	8.31	4.50	3.83	—
Oneonta Milling Co., Oneonta, N. Y,							
Provender, ...Atkins & Cartland....	East Lynn....	10 49	7.95	8.75	2.83	3.50	—
Potter Bros. & Co., North Adams, Mass.							
Potter Bros. & Co.......	North Adams.	9.34	8.78	8.05	4.23	3.05	—
M. C. Richmond, Adams, Mass.							
Richmond's Horse, M. C. Richmond...	Adams	9.91	10.09	10.00	5.17	5.50	—
Strong-Lefferts Co., New York, N. Y.							
Lenox, ...C. G. Burnham	Holyoke. ...	12.17	8.39	9.88	4.41	3.27	—
Valley City Mills, Grand Rapids, Mich.							
Purity. ....City Grist Mills.......	Newburyport .	14.99	8.91	—	3.60	—	—
Highest		14.99	14.00	—	6.44	—	—
Lowest....		7.18	7.68	—	2.12	—	—
Average....		10.46	9.30	—	4.10	—	—

FORTIFIED OAT FEED.

Manufacturer or Jobber, Brand and Retailer.	Sampled at:	Water.	Protein. Found.	Protein. Guar.	Fat. Found.	Fat. Guar.	Fiber
American Cereal Co., Chicago, Ill.							
Quaker Dairy...D. B. Hodgkins' Sons.	Gloucester....	7.96	13.38	14.00	4.03	3.50	—
Quaker Dairy...Robinson & Jones	Natick	7.83	13.10	14.00	3.56	3 50	—
Schumachers, ..Fisher, Churchill & Co.	Dedham......	8.06	12.07	13 00	5.49	5 00	—
Schumachers, ..John Enwright & Son.	Fall River....	8.12	11.80	13.00	4.92	5.00	—
Schumachers, ..Geo. P. Rogers.......	Worcester....	8.76	10.49	13.00	4.06	5.00	—

* Improperly guaranteed

FORTIFIED OAT FEED.—(CONTINUED.)

Manufacturer or Jobber, Brand and Retailer.	Sampled at:	Water.	Protein. Found.	Protein. Guar.	Fat. Found.	Fat. Guar.	Fiber.
		%	%	%	%	%	%
H. C. Black & Son, Greenfield, Mass.							
O. K. Horse....H. C. Black & Son....	Greenfield....	13.03	11.58	12.00	4.37	4.25	—
Buffalo Cereal Co., Buffalo, N. Y.							
Horse..........Tyler Grain & Coal Co.	Hyde Park...	9.67	11.70	12.00	4.33	4.50	—
J. B. Garland & Son, Worcester, Mass.							
A. Red Tag. ..J. B. Garland & Son ..	Worcester....	8.12	12.55	12.75	3.50	3.50	—
B. Red Tag. ..H. W. Kimball........	Westboro	9.46	10.71	10.50	2.89	3.25	—
B. Red Tag. ..J. B. Garland & Son ..	Worcester....	7.07	11.19	10.50	2.07	3.25	—
H-O Co., Buffalo, N. Y.							
H-O Horse. ....W. P. Whittemore....	Mt. Hope	9.33	12.86	12.00	4.76	4.50	—
Average.............	....	9.02	11.96	—	4.08	—	—

OAT FEED.

Manufacturer or Jobber, Brand and Retailer.	Sampled at:	Water.	Protein. Found.	Protein. Guar.	Fat. Found.	Fat. Guar.	Fiber.
American Cereal Co., Chicago, Ill.							
Vim. ....Pierce & Winn	Arlington	5.57	4.17	6.50	1.86	2.75	—
Vim. ....G. S. Whitney........	Concord Jct..	4.95	5.84	6.50	2.53	2.75	—
Chas. M. Cox Co., Boston, Mass.							
G. B. Pope & Co......	Waltham. ...	5.17	6.76	6.50	2.01	3.50	—
Great Western Cereal Co., Chicago, Ill.							
Royal. ....Edwin C. Paull.......	Taunton.	5.06	5.79	7.60	1.95	2.80	—
Albert A. Keene, Boston, Mass.							
Jaquith & Co.........	Woburn......	4.61	6.19	8.30	2.57	2.38	—
Inferior.							
H. C. Puffer Co., Springfield, Mass.							
Hulls. ....H. C. Puffer Co.......	Springfield ...	5.80	2.63	—	0.57	—	—
Average.............	....	5.19	5.23	—	1.92	—	—

MISCELLANEOUS STARCHY FEEDS.

Manufacturer or Jobber, Brand and Retailer.	Sampled at:	Water.	Protein. Found.	Protein. Guar.	Fat. Found.	Fat. Guar.	Fiber.
A. H. Brown & Bros., Boston, Mass.							
Dried Grains. ..H. A. Crossman	Needham	6.07	14.00	14.00	3.81	3.50	—
Pratt Cereal Oil Co., Decatur, Ill.							
Germaline. .....City Grist Mills.......	Newburyport .	9.89	12.81	12.90	2.37	1.29	—
Germaline. .....E. A. Cowee	Worcester....	8.70	13.42	11.64	2.72	2.34	4.70
Germaline......Geo. P. Rogers........	Worcester....	8.03	12.77	16.27	2.05	1.92	—
Natural Food Co., Niagara Falls, N. Y.							
Shredded wheat waste. J. F. Kirk......	New Bedford.	9.05	10.49	10-12	2.14	2.00	—
Shredded wheat waste. C. G. Jordan...	Weymouth ..	9.12	11.41	10-12	1.87	2.00	—

* Withdrawn from the market.

MISCELLANEOUS STARCHY FEEDS.—CONTINUED.

Manufacturer or Jobber, Brand and Retailer.	Sampled at:	Water.	Protein Found.	Protein Guar.	Fat Found.	Fat Guar.	Fiber.
		%	%	%	%	%	%
Glen Mills Cereal Co., Rowley, Mass.							
Corn Middlings, Glen Mills Cereal Co.	Rowley	11.51	10.44	12-13	9.42	12-13	
Chandler Gr. & Mill.Co., Lawrence, Mass.							
Smuttings,* Chandler Grain & Mill. Co.	Lawrence	7.80	11.93	—	5.60		—
Glen Mills Cereal Co., Rowley, Mass.							
Coarse corn bran, Glen Mills Cereal Co.	Rowley	10.48	8.56	9-10	4.61	4.5	—
Fine corn bran, Glen Mills Cereal Co.	Rowley	7.73	9.48	9-10	7.15	4.5	
Alma Sugar Co., Alma, Mich.							
Dried mol.-beet-pulp, Wallace Lord.......	Athol	4.52	9.83	9.00	0.31	0.48	—
Dried mol.-beet-pulp, A. A. Prentiss & Co.	Athol	4.28	10.01	9.00	0.25	0.48	—
Dried mol.-beet-pulp, F. W. Aldrich	Chicopee	6.41	10.05	9.00	0.61	0.48	—

* Largely corn bran.

III. Poultry Feeds.

MEAT SCRAPS.

Manufacturer or Jobber. Brand and Retailer.	Sampled at:	Water.	Protein.		Fat.		Ash.
			Found.	Guar.	Found.	Guar.	
		%	%	%	%	%	%
1. Beef.							
American Agricultural Chemical Co., N.Y.							
Phillips, Bates & Co.	Hanover	7.58	46.77	40.00	14.36	15.00	29.22
S. D. Andrew's Son, Providence, R. I.							
Hathaway & Mackenzie.	New Bedford.	8.03	46.50	—	15.28	—	28.30
Armour Fertilizer Works, Chicago, Ill.							
Wallace Bros.	Clinton	8.79	52.39	50-52	30.48	10-12	5.81
Howe Bros.	Gardner	9.63	52.35	50-52	26.57	10-12	7.87
Beach Soap Co., Lawrence, Mass.							
H. Bruckman	Lawrence	8.86	48.00	60.00	23.85	20.00	17.96
L. B. Darling Fert. Co., Pawtucket, R. I.							
J. S. Place & Co.	Dighton	6.84	47.26	50.00	16.94	16.00	27.14
John C. Dow Co., Boston, Mass.							
Dennison Plummer Co.	New Bedford.	8.91	47.03	50-55	20.06	15-17	21.53
George E. Marsh Co., Lynn, Mass.							
Seymour & McDonald.	S. Lancaster	10.82	49.27	45-55	15.21	10-15	22.80
Mason Manufact. Co., Woonsocket, R. I.							
Prentice & Son	Milford	5.93	46.24	45.00	21.44	18.58	23.11
Cutler Grain Co	S. Framing'am	6.07	48.09	45.00	19.10	18.58	25.47
N. E. Dressed Meat & Wool Co., Boston.							
Albert Culver Co.	Rockland	7.95	65.46	58-62	16.94	10-19	9.05
Joseph Spellman & Co., Providence, R. I.							
T. E. Borden	N. Westport	9.62	57.08	55.00	13.87	12.00	17.97
Chicopee Rend'g Co., Springfield, Mass.							
O. K. L. E. Moore	Millington	14.32	33.96	27-30	16.78	12-15	30.57
E. A. Cowee, Worcester, Mass.							
E. A. Cowee	Worcester	14.67	37.25	—	22.35	—	22.56
Hinckley Rend'g Co., Somerville, Mass.							
City Grist Mills	Newburyport.	7.50	43.17	39.63	15.01	15.34	31.15
A. Lord & Co., Chelsea, Mass.							
H. A. Crossman	Needham	10.31	37.82	40-50	19.02	19.00	29.91
Mackenzie & Winslow, Fall River, Mass.							
William J. Meek	Fall River	11.07	35.76	40-50	14.65	19.00	34.81
J. E. Woodill, Natick, Mass.							
Sprague & Williams	S. Framing'am	9.27	34.89	20-25	16.70	10-16	34.29
Young & Halstead, Troy, N. Y.							
Lamb Bros. & Co.	Orange	7.85	42.11	50.00	25.62	9.00	21.78

MEAT SCRAPS.—(CONTINUED.)

Manufacturer or Jobber, Brand and Retailer.	Sampled at:	Water.	Protein. Found.	Protein. Guar.	Fat. Found.	Fat. Guar.	Ash.
		%	%	%	%	%	%
2. Mutton.							
N. E. Dressed Meat & Wool Co., Boston.							
Jaquith & Co	Woburn	6.89	36.59	38-41	11.82	10-17	33.87
3. Steamed Meat and Bone.							
N. Roy & Sons, South Attleboro, Mass.							
E. A. Briggs & Co.	Attleboro	5.88	55.85	45-50	9.72	8-10	21.48
Highest		14.67	65.46	—	30.48	—	34.81
Lowest		5.88	33.96	—	9.72	—	5.81
Average		8.89	45.90	—	18.38	—	23.65

MEAT AND BONE MEAL.

Manufacturer or Jobber, Brand and Retailer.	Sampled at:	Water.	Protein. Found.	Protein. Guar.	Fat. Found.	Fat. Guar.	Ash.
Armour Fertilizer Works, Chicago, Ill.							
F. W. Davis	Ashburnham	7.18	51.69	50-52	10.40	10-12	28.97
Bowker Co., Boston, Mass.							
Robinson & Jones	Natick	7.49	34.05	30.00	8.95	5.00	12.12
Lavery Fertilizer Co., Merrimac, Mass.							
City Grist Mills	Newburyport	6.34	29.71	—	12.88	—	47.11
Lowell Fertilizer Co., Boston, Mass.							
Swift's, City Mills Co.	Holyoke	9.88	33.52	40-50	11.20	8-15	40.43
George E. Marsh Co., Lynn, Mass.							
Seymour & McDonald	S. Lancaster	7.90	33.87	36-46	9.38	8-12	43.67
D. W. Romaine, New York, N. Y.							
A. H. Wood & Co.	Framingham	4.73	39.49	45.00	16.48	15.00	26.84
Whitman & Pratt Ren. Co., Lowell, Mass.							
A. H. Wood & Co.	Framingham	5.71	41.15	32-35	14.87	10-15	32.83
O. D. Wilder	Lowell	3.68	42.87	32-35	15.58	10-15	33.00
Average		6.61	38.29	—	12.47	—	33.12

FISH.

Manufacturer or Jobber, Brand and Retailer.	Sampled at:	Water.	Protein. Found.	Protein. Guar.	Fat. Found.	Fat. Guar.	Ash.
International Glue Co., Boston, Mass.							
E. H. Doble & Co.	West Quincy	12.70	42.83	40.86	2.27	2.44	39.56

BONE.

Manufacturer or Jobber, Brand and Retailer.	Sampled at:	Water.	Protein. Found.	Protein. Guar.	Fat. Found.	Fat. Guar.	Ash.
Armour Fertilizer Works, Chicago, Ill.							
Granulated, Howe Bros.	Gardner	6.89	24.18	24-26	3.66	5-6	62.31
Beach Soap Co., Lawrence, Mass.							
Cracked, John Shea	Lawrence	5.88	26.55	25.00	4.39	5.00	60.55
Granulated, Lowell Coal Co.	Lowell	7.19	22.11	25.00	13.73	5.00	49.00
Bowker Co., Boston, Mass.							
Cracked, W. T. McLaughlin Co.	Highland Sta.	6.18	26.76	20.00	0.87	—	64.33
Meal, W. T. McLaughlin Co.	Highland Sta.	7.50	25.98	20.00	1.89	—	61.12

BONE.—(CONTINUED.)

Manufacturer or Jobber, Brand and Retailer.	Sampled at:	Water.	Protein Found.	Protein Guar.	Fat. Found.	Fat. Guar.	Ash.
		%	%	%	%	%	%
M. L. Shoemaker & Co., Philadelphia, Pa.							
H. A. Wilder	N. Hatfield	7.27	26.94	25-30	1.62	1-3	61.71
A. L. Warren, Northboro, Mass.							
Cracked. W. W. McIntyre	Marlboro	4.34	29.39	26.00	6.87	3.00	56.35
Meal. W. W. McIntyre	Marlboro	6.02	27.03	26.00	13.03	6.00	48.65
Whitman & Pratt Ren. Co., Lowell, Mass.							
Green cut. J. B. Cover & Co.	Lowell	7.82	28.08	25-30	2.07	8-10	58.42
Beach Soap Co., Lawrence, Mass.							
Meal. John Shea	Lawrence	4.47	10.88	10.00	4.02	8.00	76.36
George E. Marsh Co., Lynn, Mass.							
Meal. Seymour & McDonald	S. Lancaster	3.33	15.88	—	4.81	—	70.19
Average		6.08	23.98	—	5.18	—	60.82

POULTRY MASH AND MEAL.

Manufacturer or Jobber, Brand and Retailer.	Sampled at:	Water.	Protein Found.	Protein Guar.	Fat. Found.	Fat. Guar.	Ash.
Buffalo Cereal Co., Buffalo, N. Y.							
Tyler Gr. and Coal Co.	Hyde Park	9.37	16.99	17.00	5.26	5.00	3.71
Cyphers Incubator Co., Buffalo, N. Y.							
Laying Food. Howard & Smith	Hatfield	10.94	15.84	15.26	2.83	5.50	6.76
J. W. Day & Co., Lynn, Mass.							
Meat Mash. J. W. Day & Co.	Lynn	9.84	13.95	11.50	4.87	3.50	7.64
E. H. Doble & Co., West Quincy, Mass.							
Goldthwaite's Contin'l, E. H. Doble & Co.	West Quincy	11.35	15.27	14-15	4.25	3.5-4.5	5.87
A. Dodge, Hyde Park, Mass.							
Soft Feed. A. Dodge	Hyde Park	7.46	17.86	—	5.09	—	5.24
Eastern Grain Co., Bridgewater, Mass.							
Eastern Grain Co.	Bridgewater	9.73	12.73	—	3.43	—	3.48
C. H. Felker & Co., Brockton, Mass.							
O. K. C. H. Felker & Co	Brockton	12.18	14.09	15.67	3.03	3.03	6.00
O. K. C. H. Felker & Co	Brockton	11.76	15.67	15.67	4.18	3.03	5.53
H-O Co., Buffalo, N. Y.							
H-O. Eastern Grain Co.	Bridgewater	10.41	15.27	17.00	6.01	5.50	2.37
Midland Poul. Food Co., Kansas City, Mo.							
Nursery Chick. City Grist Mills	Newburyport	7.15	15.67	14.50	3.89	4.00	17.04
Growing Chick. City Grist Mills	Newburyport	8.66	21.15	20.50	2.92	3.70	16.57
Egg-Feather Producing. City Grist Mills	Newburyport	8.63	22.42	20.00	2.86	3.50	15.68
Grenadier. D. H. Craig	Plymouth	9.14	14.74	16.00	3.36	6.50	14.97
Puritan Poul. Farms & Mfg. Co., New York.							
Puritan Chick. Robinson & Jones	Natick	8.71	11.08	12.50	6.28	7.50	6.30
Puritan Lay. Stock. F. M. Keefe	Waltham	10.06	11.06	12.00	5.04	5.50	6.55
Puritan Lay. Stock. Cummings, Chute & Co.	Woburn	9.17	12.42	12.00	6.11	5.50	6.29
Ropes Bros., Salem, Mass.							
Mash. Ropes Bros.	Salem	8.16	15.32	18.00	4.74	4.00	6.09

POULTRY MASH AND MEAL. (CONTINUED.)

Manufacturer or Jobber, Brand and Retailer.	Sampled at:	Water.	Protein. Found.	Protein. Guar.	Fat. Found.	Fat. Guar.	Ash.
		%	%	%	%	%	%
G. T. Savage, Boston, Mass.							
Meat Cereal, ...Wallace Bros.	Clinton	7.78	13.16	11.50	4.72	3.50	8.42
Meat Cereal, ...Wallace Bros.	Clinton	10.10	18.38	11.50	5.48	3.50	4.75
Spratt's Patent, America, Newark, N. J.							
Chick Meal,* ...Bryant & Soule.......	Middleboro ..	7.78	22.02	20.00	4.03	4.50	9.20
Poultry Food,* .Bryant & Soule.......	Middleboro ..	5.81	19.04	20.00	3.31	4.50	16.52
Torrence, Vary & Co., Lynn, Mass.							
Mash,........Torrence, Vary & Co..	Lynn.........	11.53	14.66	6.00	4.44	0.50	5.80
Tyler Gr. and Coal Co., Hyde Park, Mass.							
Soft Food, ...Tyler Gr. and Coal Co.	Hyde Park...	12.01	11.32	11.32	3.47	3.47	3.81
Highest........................		12.91	22.42	—	6.28	—	17.04
Lowest		5.81	11.06	—	2.83	—	2.37
Average........................		9.83	15.70	—	4.33	—	8.03

CHICK AND SCRATCHING GRAINS.

Manufacturer or Jobber, Brand and Retailer.	Sampled at:	Water.	Protein. Found.	Protein. Guar.	Fat. Found.	Fat. Guar.	Ash.
Blake, Sampson & Co., Worcester, Mass.							
Chicken, ...Blake, Sampson & Co.	Worcester....	9.90	10.14	8.5-9.5	4.31	2-3	12.38
Bosworth & Wood, Leominster, Mass.							
B. & W. Chicken, Bosworth & Wood ..	Leominster...	10.18	9.88	9.97	2.71	2.89	12.02
Chamberlain, Kirkwood, Mo.							
Perfect Chick,..A. A. Prentiss & Co ..	Athol	8.56	10.84	14.06	2.47	2.93	24.09
E. A. Cowee, Worcester, Mass.							
Climax Chick, ..E. A. Cowee..........	Worcester....	11.44	10.49	8.50	2.90	2.50	15.01
J. Cushing & Co., Fitchburg, Mass.							
Gilt Edge Chick, Merriam & Rolph....	Fitchburg	10.15	8.39	8.00	3.68	3.00	16.05
Cyphers Incubator Co., Buffalo, N. Y.							
Cyphers Chick, Albert Culver Co......	Rockland	8.04	10.84	10.47	2.83	3.31	13.19
J. B. Cover & Co	Lowell	10.49	12.34	11.34	4.01	3.17	2.04
J. W. Day & Co., Lynn, Mass.							
Climax Chicken, J. W. Day & Co.	Lynn	11.87	11.72	10-11	2.91	2-3	3.41
Albert Dickinson Co., Chicago, Ill.							
Crescent Chick, H. C. Puffer Co.	Springfield ...	8.36	10.62	9.50	3.00	3.00	13.37
T. W. Emerson Co., Boston, Mass.							
Chick...........Griffin Bros	Fall River....	11.04	12.81	9.50	5.72	4.50	2.07
Chick...........Torrence, Vary & Co .	Lynn.........	11.51	12.25	9.50	4.78	4.50	2.28
C. H. Felker & Co., Brockton, Mass.							
Blended Grain, C. H. Felker & Co....	Brockton.....	11.13	10.67	10.00	3.29	3.00	1.87
Chicken, ... C. H. Felker & Co. ..	Brockton.....	11.04	10.84	10.00	3.99	3.00	3.65
Greene Ch'k'n F'd Co., Marblehead, Mass.							
Greene's Chicken, G. F. Greene Coal Co.	Campello	10.29	11.37	14.00	4.01	3.00	2.03

* Cracked biscuit.

CHICK AND SCRATCHING GRAINS.—(CONTINUED.)

Manufacturer or Jobber, Brand and Retailer.	Sampled at:	Water.	Protein. Found.	Protein. Guar.	Fat. Found.	Fat. Guar.	Ash.
		%	%	%	%	%	%
George S. Harding, Binghamton, N. Y.							
Unexcelled Baby Chick, Lawrence Bros.	Falmouth	8.75	12.29	15.00	4.04	7.75	12.20
H-O Co., Buffalo, N. Y.							
H-O Pigeon,.... G. D. Meserve........	Easthampton .	7.88	11.19	—	3.22	—	1.71
Thomas Loham, Marblehead, Mass.							
Chicken,. ......Thomas Loham.......	Marblehead ..	13.88	11.63	10.5-11.5	6.02	5-6	2.19
Moses H. Rolfe, Newburyport, Mass.							
Choice Chicken, Moses H. Rolfe......	Newburyport .	11.96	13.25	12.50	4.34	4.00	2.82
Ropes Bros., Salem, Mass.							
Chick, ...Ropes Bros...........	Salem........	8.79	10.53	12.00	3.88	2.00	16.13
Mixed Grain,...Ropes Bros...........	Salem........	9.37	11.06	10.00	2.58	2.00	10.75
Ross Bros., Worcester, Mass.							
Wyandotte Chicken, F. W. Sawtelle & Co.	Readville.....	9.44	8.60	8.25	2.67	2.25	18.34
W. H. Small, Evansville, Ind.							
Mix. gr'ns and oys. shells,* J. A. Sullivan	Northampton.	10.02	13.30	11-12	1.93	2-3	15.13
Stanley Grain Co., Lawrence, Mass.							
Stanley Grain Co.	Lawrence	11.03	13.25	—	3.46	—	6.90
Tyler Gr. and Coal Co., Hyde Park, Mass.							
Tyler Gr. and Coal Co.	Hyde Park...	10.98	10.06	—	2.97	—	1.69
H. K. Webster & Co., Lawrence, Mass.							
Chicks,.........H. K. Webster & Co..	Lawrence	10.74	12.16	10-12	3.33	2-3	2.42
Chicks,.........H. K. Webster & Co..	Lawrence	11.62	12.29	10-12	2.88	2-3	1.94
Poultry,........H. K. Webster & Co..	Lawrence	10.92	12.16	9-11	3.37	2-3	1.73
Young & Halstead, Troy, N. Y.							
Lamb Bros. & Co.....	Orange.......	9.27	11.06	—	3.36	—	8.35
Highest	....	13.88	13.30	—	6.02	—	24.69
Lowest............	....	7.88	8.39	—	2.47	—	1.69
Average............	....	10.34	11.29	—	3.52	—	8.09

CLOVER MEAL.

Manufacturer or Jobber, Brand and Retailer.	Sampled at:	Water.	Protein. Found.	Protein. Guar.	Fat. Found.	Fat. Guar.	Ash.
Bennett & Millett Co., Gouverneur, N. Y.							
Pioneer,........Frank E. Smith.......	Amherst	9.17	11.37	—	2.55	—	—
Cyphers Incubator Co., Buffalo, N. Y.							
Mealed,.... ....C. H. Felker & Co....	Brockton	8.60	20.32	13.70	4.97	1.90	—
Prentiss, Brooks & Co.	Holyoke.	9.21	17.25	13.70	3.83	1.90	—
Short cut hay,..F. W. Sawtelle & Co..	Readville	7.23	15.06	10.70	2.81	3.90	—
Average..........................		8.55	16.00	—	3.54	—	—

* Guaranteed by retailer.

F. THE RESULTS DISCUSSED.

I. Protein Feeds.

Blood Meal.
Page 8.

An attempt is being made to introduce this material into Massachusetts markets as a food product. It is the highest grade concentrate offered, containing over 86 per cent protein and only traces of fat. The remainder of the product consists of water and ash. The samples taken, were clean, of good mechanical condition, and almost free from odor. Present sales will probably not warrant any definite retail price, the figures mentioned varying from two and one-half to six dollars a hundred. An experiment recently completed with milch cows, indicates that pound for pound the protein in blood meal is equivalent to that contained in cottonseed meal.

Cottonseed and Linseed Meals.
Pages 8–10.

Cottonseed meal: The quality of the meal found was very satisfactory, and the various lots with a few exceptions were tagged in conformity with the statute. The color was bright yellow, and the average protein content of the 52 samples collected was 43.79 per cent The manufacturers of late years have succeeded in more thoroughly removing the oil, only three samples in the present collection show-over 11 per cent of fat. A slight excess of linters (cotton) and hulls were noticeable in some instances. While a few samples were somewhat inferior, there was no indication of intentional adulteration. One to three pounds of cottonseed meal daily forms one of the cheapest sources of protein for dairy animals.

Linseed meal: Of the ten samples collected, three were new and the remainder old process. They were free from adulteration and as a whole of fair quality. The percentage of fat was slightly higher than a few years ago, especially in the old process meals, and in this latter case, resulted in lowering the percentage of protein.

Gluten Products.
Page 11.

Gluten meal: Chicago gluten is again on the market and Cream gluten meal bears the name of another firm and a higher guarantee. The six samples of meal collected were of excellent quality, containing on the average 39.77 per cent of protein and 1.43 per cent of fat. The fat content has steadily decreased and the minimum guarantee should be reduced to about 1 per cent.

Gluten feed: The quality proved similar to last season. The 15 samples taken averaged in protein 24.71 per cent and in fat 3.02 per cent. The protein guarantees, however, ranged from 27 to 28.5 per cent and the fat from 2.50 to 3.38 per cent, a deficiency of over 3 per cent in protein. The excuse of a temporary falling off due to inferior corn can no longer be considered. The feed must substantially maintain its guarantee or lower figures must be adopted. It is believed that a guarantee of 25 per cent would more nearly express the average amount of protein likely to be contained in this feed. There was no intentional adulteration, except possibly an excess of hulls in some cases.

Distillers' By-Products. **Page 12.**

Distillers' dried grains: The seven samples collected were free from adulteration and of satisfactory quality, averaging in protein 33.08 per cent and in fat 12.93 per cent.

Malt sprouts: The five lots sampled were of good quality with a protein content of 27.65 per cent.

Wheat By-Products. **Pages 12–15.**

Four samples of flour middlings and eight of standard middlings were collected. The flour middlings are usually the more valuable. A sample of inferior flour, testing only 14.30 per cent in protein, was misbranded "red dog", whereas, red dog should contain 18 to 20 per cent. Millers are cautioned against such misrepresentations.

Standard middlings, or middlings as the term is employed by various shippers, has no definite limitations. Some samples contained a considerable proportion of red dog, while others, both in appearance and analysis, closely resemble finely ground bran or mixed feed. One sample was inferior containing but 15.14 per cent of protein.

Mixed feed: This is a mixture of varying proportions of bran and middlings. Of the 34 samples taken, one was below standard and three others contained foreign admixtures. Several were guaranteed, which is certainly commendable. The practice of running the screenings, ground or unground, into the mixed feed is well known, and while it may not be very detrimental in some instances, still the amount and character of the screenings should determine whether it is permissable or otherwise. Many samples contained straw, hulls and weed seeds. The latter are especially objectionable.

An appreciable number of samples were wormy. *Local dealers are again cautioned against offering wheat feed with foreign admixtures, unless tagged in conformity with both section 1 and section 6 of the feed law.* Three samples were collected, none of which were properly tagged.

Wheat bran: The nine samples taken were of good quality. As a whole, bran has averaged cleaner, freer from adulteration and more uniform than mixed feed.

Buyers are advised to examine wheat offal, *and not to purchase any mixed wheat feed or bran that contains a noticeable quantity of screenings, weed seeds, cut straw or grain hulls.* Manufacturers are cautioned against such accidental or intentional adulteration, and are encouraged to brand their sacks with name, trade mark, weight and guarantee. It is believed that such an action would gradually inspire confidence on the part of the buyer, and direct his attention towards the articles thus branded.

Miscellaneous Protein Feeds. **Page 16.**

Biles Union Grains, relatively a new feed, was composed principally of distillers' dried grains, malt sprouts, wheat feed, hominy meal and salt. The manufacturers claim that it has the necessary bulk and protein percentage for a complete grain ration for dairy animals. Judging from its appearance and composition, it would appear that such claims are well founded.

Molasses feeds, so called, are likely to be offered quite freely in the near future. Molasses itself when fed to dairy cows in reasonable quantities (3—4 pounds daily) has proved itself to be a satisfactory carbohydrate, and a combination of molasses with feeds rich in protein should certainly be productive of good results, providing the mechanical condition is satisfactory and the price is not excessive. The keeping quality of such feeds is yet to be fully demonstrated.

Sucrene dairy, composed principally of malt sprouts, light oats and granulated molasses, together with a small amount of high grade protein feeds, fell slightly below its guarantee. Its nutritive effect has not yet been tested.

Blatchford's sugar and flaxseed, evidently a mixture of flaxseed and linseed meals, carob bean and fenugreek, was offered at \$3.50 a hundred pounds. Its use, other than as a partial milk substitute for young calves, would be questionable economy.

Bibby's dairy cake and Blomo feed are being tested at the present time, and the results will be reported in a subsequent bulletin. The latter contained an excessive amount of water and fell decidedly below its guarantee. These feeds have been referred to more at length in Bulletin No. 93, pages 41 and 46.

Mueller's molasses grain, a mixture of dried brewers' grains, malt sprouts and molasses—did not maintain its guarantee. In one case the protein discrepancy was practically 100 per cent. Such a variation is the very best advertisement against its use.

Gee's oil cake compound, one sample of which was collected, is not linseed meal, but consists largely according to the Connecticut station, of wheat and weed seeds.

Note: Most proprietary mixed feeds are likely to prove expensive and not as satisfactory for dairy purposes, as combinations of one-third cottonseed or gluten meal, one-third flour middlings and one-third wheat bran, or as a mixture of half and half by weight of gluten feed and wheat bran. See Bulletin No. 93, pages 47-51.

II. Starchy Feeds.

Oats, Corn and Hominy Meals. Pages 17 18.

Oats: Because of the cold, wet season of 1903, oats in many instances became infected with smut or later with mould, and the resulting grain was so inferior that horses often refused them. Bleaching or sulfuring was tried and while it may have improved the appearance, it is doubtful if it improved the quality. Such oats it would be better to grind and feed to swine or dairy animals than to use as a horse feed.

Corn meal: As corn last season did not all mature and cured very imperfectly, the percentage of water was exceedingly high (about 20 per cent) and the protein and fat contents low. This corn, unless mixed with old, was difficult to grind and soon heated. The only remedy would be to kiln dry as soon as possible after harvesting.

Hominy meal: The hard part of the corn kernel, known as hominy, or hominy grits, is used for human food. The residue or soft part of the kernel, sometimes called white meal is sold as a cattle feed and consists of the hull, germ, and more or less of the protein and starch. It is quite widely distributed, is kiln dried and has a feeding value similar to dry corn meal. The twenty samples collected, averaged 9.87 per cent of protein and 7.23 per cent of fat. Three samples were inferior, though apparently free from adulteration. One sample sent by a local dealer was adulterated, accidentally or other wise, with a noticeable quantity of ground corn cobs. Several shippers recognizing their inability to maintain former guarantees have adopted new figures and others have been cautioned in the matter.

Corn and Oat Feeds.
Pages 18–19.

Corn and oat feed: — These feeds consisted largely of corn meal or hominy and oat feed with occasionally some wheat feed or barley, and in one case buckwheat. They averaged in protein 9.30 per cent and in fat 4.10 per cent, and practically all met their guarantees. These mixtures are intended mostly for horses and are prepared primarily to make use of the residue from the oat meal mills. The tendency has been in many cases to utilize a low grade of corn. If free from mould and of good appearance, they are probably worth from 10 to 20 per cent less than corn meal. The prices asked for many of these feeds were frequently in excess of their value.

Fortified Oat Feeds.
Pages 19–20.

Most of these mixtures are composed chiefly of oat feed, or corn and oat feed, fortified with wheat middlings or red dog. A small amount of linseed meal was noted in two samples. At the prices asked, they cannot be regarded as very expensive for horse feeding, although the writer would prefer a mixture of one-half corn, one-fourth oats and one-fourth bran. Combinations of cottonseed meal flour middlings and bran, distillers' grains and middlings, or gluten feed and bran, are held to be decidedly more economical and satisfactory for dairy animals than fortified oat feeds.

Miscellaneous Starchy Feeds.
Pages 20–21.

The several samples of oat feed taken were of poorer quality than usual, containing a very high percentage of hulls. *Shredded wheat waste*, as its name implies, is the residue from the manufacture of shredded wheat biscuit. The price asked, $1.75 a hundred, was excessive, excepting when purchased as a food for chickens. For ordinary feeding purposes, it could hardly be considered more valuable than corn meal.

Corn bran, has probably about two-thirds of the feeding value of corn meal.

Corn middlings is a valuable carbohydrate. It contained rather more protein than corn meal and was particularly rich in fat. Its feeding value would probably be slightly in excess of corn meal.

Dried molasses-beet-pulp, fully maintained its guarantee. Its value is discussed at length in Bulletin No. 99.

Germaline, said to be made from the germs of corn, from which the oil has been extracted, probably has about the same feeding value as hominy.

III. Poultry Feeds.

Meat Scraps. Pages 22-23. Scraps are compounded chiefly of flesh (protein) with varying amounts of fat and bone, and from 7 to 10 per cent of water. The twenty-one samples taken, averaged 45.90 per cent protein and 18.39 per cent fat. The proportion of bone differed widely as shown by the percentage of ash. There was no product on the market which varied more in feeding value, some samples having nearly twice the value of others. In purchasing *preference should be given to fine ground brands of high protein content, small to medium amounts of bone and relatively low percentage of fat, under 20 per cent rather than over.*

The material should be free from taint. There is a tendency to mark all scraps "beef" irrespective of the source. Shippers should guard against this. The usual retail price was $2.50 a hundred for the best grades, containing about 50 per cent protein.

Meat and Bone Meals. Page 23. These were finely ground animal products; averaging lower in both protein and fat and decidedly higher in ash (bone) than meat scraps. The best grades should contain 35 to 40 of protein. The retail price of $2.00 a hundred may be considered a fair one in proportion to the highest grades of meat scraps at $2.50 a hundred. A sample of fish, of good average quality was collected.

Bone. Pages 23-24. Nine of the eleven samples of bone had been lightly steamed or kettle rendered, while two samples because of their low protein content, had evidently been subjected to high steam pressure. The former are to be preferred for poultry feeding. The nine samples tested slightly over 25 per cent of protein. Adulteration was not observed.

Poultry Meals. Pages 24-25. The twenty-three samples collected were composed chiefly of corn, oats and wheat or wheat offal together with scraps or meat and bone meal and charcoal. Grit or shells were occasionally present.

The number of brands has multiplied rapidly of late, many dealers now preparing their own mixtures. The average composition was protein 15.70 per cent and fat 4.33 per cent. Some brands were marked for special purposes, such as "growing," "feathering and producing," yet failed to show any material diffeience in composition. The retail price of these mixtures varied from $1.60 to $2.50 a hundred pounds, which in the majority of cases was too high. For growing poultry a mixture of 4½ parts of corn meal, 4½ parts ground hulled oats, and one part of finely ground scraps or meat and bone meal, ought to prove satisfactory. A desirable meal for laying hens may be made by mixing by weight one-third bran, one-third corn meal, one-sixth ground oats and one-sixth gluten feed. Such combinations ought not to cost over $1.30 to $1.50 a hundred pounds.

Spratt's patent chick meal and poultry food consisted of cereals, a nitrogenous by-product, and considerable ashy matter, made into the form of a biscuit and baked.

Chick and Scratching Grains. Pages 25–26.

The prominent components of these mixtures were the cereals wheat, corn, oats, millet, Kaffir corn, barley, and buckwheat together with charcoal, grit and shells. Small amounts of linseed meal were occasionally observed. The various seeds were whole, cracked or fine cracked, depending on their original size and the purpose for which the mixture was intended. For chicks millet was a favorite ingredient with the other grains fine cracked. The 28 samples averaged 11.29 per cent in protein and 3.52 per cent in fat and were far more uniform in composition than the meals and mashes. The price asked ranged from $1.50 to $3.00 a hundred. Feeds of a high ash content should be avoided, as no one can afford to pay two cents or more a pound for grit. It is believed that equally satisfactory combinations can be prepared by the average poultrymen at a cost of from $1.40 to $2.00 a hundred.

Clover Meals. Page 26.

The four samples collected varied widely in composition as well as in appearance, one sample being largely seeds. The price, $1.75 to $2.00 a hundred, was excessive. It is doubtful economy to feed material having such an uncertain value.

G. MARKET VALUE OF CONCENTRATES.

FEED STUFFS.	Monthly Wholesale Prices. January.	February.	March.	April.	May.	June.	Average Wholesale Price.	Average Retail Price.
Cottonseed meal,	$26.80	$27.15	$26.95	$26.25	$26.45	$25.90	$26.58	$29.00
Lindseed meal,	24.00	23.90	25.05	24.50	25.10	24.70	24.51	28.15
Gluten meal,	—	—	—	—	28.10	28.35		32.35
Gluten feed,	25.45*	25.50	23.90	22.95	23.90	23.00	24.27	27.10
Gluten feed, bulk,	24.05*	24.00*	23.10*	21.10*	22.40*	22.40*	22.84	27.10
Distillers' dried grains,	24.75**	24.75**	24.75**	23.25**	24.00**	23.50**	24.15	27.35
Malt sprouts,	18.00†	18.25†	18.60†	18.95†	17.75†	18.50†	18.34	19.20
Red Dog,	24.15	25.00	23.45	24.50	26.20	25.15	24.74	27.75
Wheat middlings,	24.30	25.50	24.30	23.65	26.25	25.50	24.92	25.15
Mixed feed,	23.35	24.15	24.20	23.65	25.50	25.30	24.36	25.65
Bran, Spring,	21.00	21.95	20.80	20.50	22.50	20.55	21.22	24.55
Bran, Winter,	21.80	22.88	21.90	21.85	24.05	22.70	22.53	24.55
Hominy meal,	24.55*	23.68*	21.30	20.75	21.40	22.55	22.37	23.90
Oat feed,	—	16.00†	18.00†	16.35†		19.50†	17.46	17.00
Provender,	—	—	22.15†	21.60†	23.00†	23.88†	22.66	25.50
Corn meal,	21.60	22.00	23.00	23.20	24.20	24.20	23.00	23.65
Oats, No. 2, clipped white,	29.37	36.25	33.75	30.94	31.56	31.25	32.20	35.95
Feed barley,	—	—	—	—	—	—	22.52	—

*Northwestern Miller.
**Chapin & Co.
†New England Homestead.

Unless otherwise specified, the above wholesale quotations were taken from the weekly report of the Boston Chamber of Commerce. The average retail prices were obtained by the representative of this station from local dealers during the first four months of the current year, and therefore are not strictly comparable with the average wholesale figures which are brought up to the first of July.

Prices of all concentrates have ruled high. The cost of cottonseed meal has risen steadily since 1899, when it could be bought for about $24 a ton. In spite of this fact, it may be considered at present one of the cheapest sources of protein for feeding purposes, as well as an economic source of organic nitrogen. Linseed meal has been offered at lower figures than formerly. The retail advance appears to be greater than for most feeds, probably because of the comparatively small amount sold.

But little gluten meal was on the market and it was held at a high figure. Gluten feed was found to be quite generally distributed, and for the last four months wholesale quotations have not shown wide variations. This feed has proved itself very satisfactory for milk production. Distillers' dried grains, comparatively speaking, have been offered at reasonable prices, and may be regarded as a satisfactory and economical source of protein.

The prices of mill feeds,—middlings, "mixed feed" and bran,—have been very firm. During May they were practically prohibitive. It is believed from the standpoint of economy that the majority of feeders use too much bran and not enough cottonseed, linseed, gluten, distillers' grains and flour middlings. One third bran in the average grain ration is generally sufficient; many feeders endeavor to do with less, depending on distillers' and brewers' grains and malt sprouts to give the grain ration the necessary bulk. Hominy and corn meals showed no marked difference in price. Their nutritive values are quite similar. The term "provender" does not mean a mixture of corn and ground oats, but varying proportions of corn and oat offal. The difference in the quality of such mixtures renders them of uncertain value. Oats have been uniformly high in price during the last six months. On the ton basis the average retail price was practically $36. Feeders naturally look for oat substitutes and are inclined to reduce the oat ration to a minimum and substitute hominy chop, dried brewers' and distillers' grain and wheat bran.

HOW MUCH DOES IT COST

TO PRODUCE A QUART OF MILK, AND HOW MUCH OUGHT YOU TO GET FOR IT?

That depends upon:

1. The kind of a farmer you are.

2. How many tons of hay you obtain from an acre, and how large a quantity of corn each acre produces.

3. How much it costs you to grow and harvest this raw material.

4. Whether you grow peas and oats. clover, millet, soy beans and fodder corn to keep up the milk flow during a dry spell.

5. The kind of concentrates you buy, your method of purchasing, and the prices you pay for them.

6. The kind of cows you keep and the care they get.

7. The quality of the milk produced, the way it is cared for, and your skill in marketing it.

8. Your method of keeping accounts.

Possibly a quart of milk costs you 2 1-2 cents, possibly 5 cents. Would it not be well to find out? Perhaps you are getting 12 cents a gallon for your milk; can't you obtain 14, 16, or 18 cents? Try it, and if you do not succeed at once, try again.

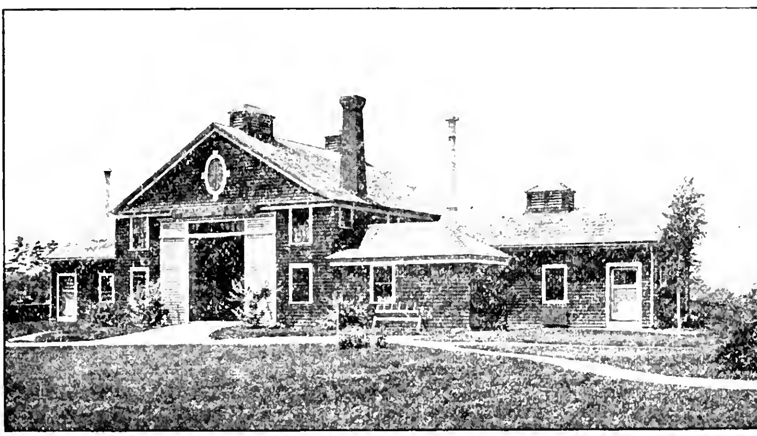
HATCH EXPERIMENT STATION

OF THE

MASSACHUSETTS AGRICULTURAL COLLEGE.

BULLETIN NO. 99.

I. DRIED MOLASSES-BEET-PULP.
II. THE NUTRITION OF HORSES.



FEEDING BARN.

JULY, 1904.

The regular Bulletins of this Station will be sent free to all newspapers in the State and to such individuals interested in farming as may request the same. Technical Bulletins are sent only to those persons interested in the subject treated of in each case.

AMHERST, MASS.:
PRESS OF CARPENTER & MOREHOUSE
1904.

HATCH EXPERIMENT STATION

OF THE

Massachusetts Agricultural College,

AMHERST, MASS.

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The co-operation and assistance of farmers, fruit-growers, horticulturists, and all interested, directly or indirectly, in agriculture, are earnestly requested. The Bulletins will be sent free to all newspapers in the State and to such individuals interested in farming as may request the same. General bulletins, fertilizer analyses, analyses of feed-stuffs, and annual reports are published. Kindly indicate in application which of these are desired. Communications may be addressed to the

HATCH EXPERIMENT STATION, Amherst, Mass.

DEPARTMENT OF FOODS AND FEEDING.

I. DRIED MOLASSES-BEET-PULP.

JOSEPH B. LINDSEY*

A. Method of Manufacture.
B. Character of the Product.
C. Composition of the Product.
D. Digestibility of Molasses-Beet-Pulp.
E. Feeding Experiment with Cows.
F. Method of Feeding Molasses-Beet-Pulp.
G. Is it Economy for Farmers to Use the Product?

A. METHOD OF MANUFACTURE.

The Alma Sugar Co., (Alma, Mich.) describes the process of manufacture as follows:

"In the sugar factory the beets are thoroughly washed, then shredded and placed in large cylinders. Pure water is admitted and the sugar soaked out by the diffusion process. This liquor is drawn off and the pulp, containing 92 per cent moisture and ¼ per cent sugar, is conveyed at once to the drier where it is first run through presses reducing the moisture to 82 per cent. Residuum molasses from the sugar factory containing 50 per cent sugar is next mixed with the pressed pulp. This mixture is then put into the kilns where it is thoroughly dried by direct heat. The drying process lasts 35 minutes. Immediately upon coming from the kilns the pulp is sacked and ready for shipment. One hour from the time the sugar is extracted from the beets the Dried Molasses-Beet-Pulp is in sacks ready for use."

*With E. B. Holland, P. H. Smith and L. G. Cook.

B. CHARACTER OF THE PRODUCT.

The product prepared by the above described process is quite dry, coarse, and resembles in appearance ordinary black tea. It was found in the market in sacks containing 80 pounds each, was properly guaranteed, and was offered at retail during the winter of 1903-1904 at about $22.00 a ton.

C. COMPOSITION OF THE PRODUCT.

	Sample used. %	Corn Meal. (For comparison.) %
Water,	8.58	13.47
Ash,	5.23	1.23
Protein,	9.91	8.71
Fiber,	15.67	1.92
Extract matter,	60.11	71.02
Fat,	0.50	3.65

The molasses-beet-pulp was characterized by its low percentage of protein and its high ash and fiber content, the latter being the principal constituent of the cell walls of the beet. The crude protein was found to consist of 7.01 per cent of true albuminoids and 2.90 per cent of amids. The extract matter contained 13.80 per cent of cane sugar and 1.83 per cent of glucose. The pentosans (18.40 per cent) were in all probability largely in the form of a hemi-cellulose and would also be included in the extract matter. The pulp contained only traces of fat. Both molasses-beet-pulp and corn meal are carbohydrate feeds. The carbohydrates in the meal consist principally of starch, while those in the molasses-beet-pulp exist chiefly in the form of fiber, pentosans, and sugar.

PRINCIPAL ASH CONSTITUENTS.

	Molasses-Beet-Pulp.		Corn Meal. (For Comparison.)	
	Percentage.	Pounds in a Ton.	Percentage.	Pounds in a Ton.
Moisture,	8.58	—	13.47	—
Total ash,	5.23	—	1.23	—
Phosphoric acid,	0.16	3.2	0.70	14.00
Potassium oxide,	1.46	29.2	0.40	8.00
Calcium oxide, (Lime)	0.95	19.0	0.03	0.60
Approximate value per ton,		$2.56		$0.85

The total ash in molasses-beet-pulp is noticeably higher than in most carbohydrate concentrates. It is characterized by a relatively large amount of potash and lime, and a small amount of phosphoric acid. Including the nitrogen, the total fertilizer constituents contained in the beet pulp would be approximately 20 per cent more valuable than those contained in the corn meal.*

D. DIGESTIBILITY OF MOLASSES-BEET-PULP.

	Sample used. Average 3 trials.	Corn Meal. (For comparison.)
Dry matter,	85	89
Protein,	64	70
Fiber,	84	—
Extract matter,	91	94
Fat,	—	91

The experiment, the results only of which are presented, was conducted with three sheep and proved the pulp to have a high average digestibility. The sheep appeared to have found little trouble in digesting the fiber, which is not surprising in view of the fact that the cell walls of the beet are soft and comparatively free from incrusting substances (lignin). Judging from the composition and digestibility of molasses-beet-pulp and corn meal, one would feel justified in assuming that there would be no marked differences in their comparative nutritive value.

E. FEEDING EXPERIMENT WITH COWS.

MOLASSES-BEET-PULP VS. CORN MEAL.

Object of the Experiment: The object of the trial was to note whether the animals ate the pulp freely and its effect upon their general condition; the comparative yield of milk, milk solids and milk fat with the two rations, and the consequent economy of the dried pulp as a dairy feed.

Plan of the Experiment: Two cows, one of which, (Pearl) had been in milk for about a year and the other (Red 11) for two months, being the only ones available at the time, were employed and fed by the alternate method.

* Because of the relatively small amount of fertilizing ingredients as compared with the nutritive ingredients in the two feeds, this difference is of minor importance.

During the first four weeks both cows received the beet pulp ration; during the second four weeks, the corn meal ration, and during the third four weeks the beet pulp ration. The first week in each period was preliminary and the results are not included. The average results of the first and third periods are compared with those of the second period.

DURATION OF THE EXPERIMENT.

Periods.	Character of Ration.	Dates.	Cows.
I.	Molasses-beet-pulp	Jan. 30 through Feb. 19.	Red II and Pearl.
II.	Corn meal.	Feb. 27 through Mar. 18.	Red II and Pearl.
III.	Molasses-beet-pulp.	Mar. 26 through April 15.	Red II and Pearl.

The method of caring for, feeding and weighing the animals, and of sampling the feeds and milk was the same as in previously reported experiments. (See Bulletin 94, pages 6 and 7.)

Character of the Feeds. The silage consisted of Pride of the North corn and medium green soy beans, grown together in the same row. Owing to the cool summer of 1903, the yield was light, 8 tons to the acre, and both plants were immature when harvested, and the beans unevenly distributed. The silage was fairly good and showed a relatively high protein percentage (2.13) which might be expected from immature plants. The rowen analyzed well, but had been somewhat injured by wetting. The Ajax Flakes (a brand of distillers' grains) were a little low in protein (29.07 per cent) but bulky and generally satisfactory. The character of the molasses-beet-pulp has been already described. It was bulky and eagerly eaten. The corn meal, though a trifle below the average in protein, was free from mould and of good quality.

AVERAGE DAILY RATION CONSUMED BY EACH COW.
(Pounds.)

Period.	Silage.	Rowen.	Distillers' Grains.	Molasses Beet-Pulp.	Corn Meal.
Molasses-Beet-Pulp.	32.5	14.5	2.5	5	—
Corn Meal.	32.5	14.5	2.5	—	5

The daily rations were eaten clean and were considered sufficient for each cow. The quantity needed was based upon the size of the animal, milk yield, and ability to consume and utilize food. Red II. received daily 5 pounds more silage, 1 pound more rowen and 1 pound more Ajax Flakes than Pearl. The 5 pounds of molasses-beet-pulp daily were fed dry mixed with the Ajax Flakes, and had a slightly laxative effect, caused noticeably dark colored faeces, and seemed to have a favorable effect upon the general condition of the animal.

AVERAGE DRY AND DIGESTIBLE NUTRIENTS IN DAILY RATIONS.
(Pounds.)

Character of Ration.	Dry Matter.	Digestible Organic Nutrients. Protein.	Carbohydrates.	Fat.	Total.	Nutritive Ratio
Molasses-Beet-Pulp.	25.01	2.67	13.68	0.72	17.07	1:5.8
Corn Meal.	25.37	2.65	13.62	0.89	17.16	1:5.9

The quantity of daily nutrients in the two rations was nearly identical.

HERD GAIN IN LIVE WEIGHT.

Character of Ration.	Pounds.
Molasses-Beet-Pulp.	7+.
Corn Meal.	8—.

The variations in weight were unimportant. During the two beet pulp periods, there appeared to be a slight gain and during the corn meal period a slight loss.

HERD YIELD OF MILK AND MILK INGREDIENTS.
(Pounds.)

Character of Ration.	Total Milk.	Daily per Cow.	Total Milk Solids.	Total Milk Fat.	Butter Equivalent 85%.
Molasses-Beet-Pulp.	1164.7	27.7	155.9	54.1	63.6
Corn Meal.	1222.9	29.1	162.6	56.0	65.9

The corn meal ration appeared to have yielded 5 per cent more milk, 4.3 per cent more milk solids and 3.5 per cent more milk fat, than did the beet pulp ration. Because of the small number of cows in the experiment and the margin for experimental error, which must always be allowed, too much importance should not be given this increase.

AVERAGE COMPOSITION OF THE HERD MILK.

Character of Ration.	Total Solids.	Fat.
Molasses-Beet-Pulp.	13.38	4.64
Corn Meal.	13.30	4.58

* Calculated.

The composition of the milk produced by the two rations was nearly identical.

FOOD COST OF MILK PRODUCTS.

Character of Ration.	Total Cost of Milk.	Cost of 100 lbs. Milk.	Cost of 1 lb. Butter. Cents.
Molasses-Beet-Pulp.	$10.75	0.92	16.9
Corn Meal.	$11.05	0.90	16.8

The difference in the cost of the milk products produced by the two rations was slight.

DRY MATTER AND DIGESTIBLE MATTER REQUIRED TO PRODUCE MILK AND BUTTER.

(Pounds).

	Dry Matter.			Digestible Matter.		
	100 lbs. Milk.	One lb. Solids.	One lb. Fat.	100 lbs. Milk.	One lb. Solids.	One lb. Fat.
With Molasses-Beet-Pulp.	92.35	6.90	19.88	61.48	4.59	13.24
With Corn Meal.	87.13	6.55	19.03	58.87	4.43	12.86

The above calculations show that it required from 3 to 6 per cent more digestible and dry matter to make milk and milk ingredients with the molasses-beet-pulp ration than with the corn meal ration.

F. METHOD OF FEEDING MOLASSES-BEET-PULP.

(*a*) *Dairy Cows.*

Naturally one of the principal uses of this product will be as a food for dairy stock. It is a carbohydrate similar to corn meal, and should be mixed with one or more protein concentrates. It is bulky and will serve to dilute the heavier grains. It is believed that from three to five pounds daily of the pulp are sufficient for cows producing an average quantity of milk. A few rations are suggested :

1.

150 lbs. distillers' grains.
200 lbs. molasses-beet-pulp.
Mix and feed 7 lbs. (9 qts.) daily.

2.

75 lbs. cottonseed meal.
75 lbs. gluten feed.
200 lbs. molasses-beet-pulp.
Mix and feed 7 lbs. (8 qts.) daily.

3.	4.
100 lbs. gluten meal.	100 lbs. wheat bran.
100 lbs. flour middlings.	100 lbs. cottonseed meal.
150 lbs. molasses-beet-pulp.	150 lbs. molasses-beet-pulp.
Mix and feed 7 lbs. (7 qts.) daily.	Mix and feed 7 lbs. (9-10 qts.) daily.

The above rations are intended for average sized cows, producing 10 to 12 quarts of milk daily. The quantity fed can be increased or decreased according to the capacity of the animal to utilize it. Heavy milking Holsteins will profitably utilize from one-half as much again to double the quantity. The usual roughage ration for the above mixtures will consist of what hay the animals will eat clean (20 to 24 pounds)* or one bushel corn silage and 12 to 16 pounds hay daily.

Pasturage: A number of pounds of the above grain rations may be used to supplement pasturage, although they are rather rich in protein for such a purpose. Mixtures by weight of half and half gluten feed and molasses-beet-pulp, or one-third wheat bran, one-third gluten feed and one-third beet pulp, or of one-third distillers' grains and two-thirds beet pulp would be considered preferable.

(*b*) *Other Stock.*

Fattening: It should prove satisfactory for fattening beef animals, in the proportion of two-thirds beet pulp, to one-third cottonseed or gluten meal.

Swine: The station was not successful in feeding it to pigs, the animals uniformly refusing it. It is possible that they might be taught to eat it, though it is doubtful if it would prove as satisfactory as corn or hominy meals, because of its high fiber content.

Horses: The station has not yet fed it to horses, although it is believed it may be used with good results. A ration by weight of one-third oats, one-third bran, and one-third molasses-beet-pulp is suggested. The manufacturers advise that it be thoroughly moistened before being fed to horses.

G. IS IT ECONOMY FOR FARMERS TO USE THE PRODUCT?

Farmers who are in position to produce their own feed cannot, as a rule, afford to purchase starchy concentrates; they should be pro-

*Ten pounds of corn stover may be used in place of 8 to 9 pounds of hay.

duced on the farm in the form of corn and oats. For milk production especially, it is decidedly more economical to *purchase grains rich in protein*, such as cotton-seed and gluten meals, distillers' dried grains and flour middlings. When the supply of home grown corn is exhausted or limited, molasses-beet-pulp may be substituted for fattening stock and possibly for horses, and occasionally as one-third of the grain ration for dairy purposes. Milk producers who *purchase all of their grain* will find the pulp a satisfactory component of the daily grain ration.

CONCLUSIONS.

1. Molasses-beet-pulp—a kiln dried residue of beet pulp and molasses—is low in protein and very high in carbohydrates. It differs chemically from corn meal in having more ash, a much larger amount of fiber and only traces of fat. The carbohydrates of corn meal consist principally of starch, while those of molasses beet-pulp are composed largely of sugar, pentosans and fiber. It is slightly less digestible than corn meal.

2. It keeps well, will absorb large quantities of added water, has a slightly laxative effect, has proved a palatable and healthful food for dairy stock and satisfactory as a component of a grain ration for the production of milk. It can also probably be used with good results for fattening, and as a partial grain feed for horses.

3. Because of its coarse mechanical condition, it will serve as a diluter for the heavier concentrates.

4. It is rather inferior in nutritive effect to corn meal (probably 10 per cent).

5. It was offered at $22 to $23 a ton at retail in Massachusetts during the winter of 1903-1904 as compared with corn meal at $25 to $26 a ton, and these figures express approximately the relative commercial values of the two feeds, based upon the nutritive material contained in them.

6. The above opinions concerning the character and quality of the molasses-beet-pulp are based upon the supposition that the quality of the manufactured product remains unchanged.

II. THE NUTRITION OF HORSES.

J. B. LINDSEY AND P. H. SMITH.

A relatively large number of experiments upon the scientific feeding of horses have been undertaken at different times, chiefly by European investigators, in order to ascertain not only the most economical and satisfactory feed stuffs, but also to determine the amount, kind and proportions of the several nutrients needed to produce a given amount of work under a variety of conditions. Of late a number of American experiment stations have devoted considerable attention to the problem, more particularly with reference to the most satisfactory and economical combinations of different coarse fodders and concentrated feeds for farm horses.

Feeds Suitable for Horses.

A. *Concentrates.* Oats may be considered par excellence the most satisfactory concentrate for horses and are largely fed in the North; their relatively high cost is the only objection to their use. Corn is very generally used in the South and West, either shelled or on the ear, while barley is a staple food for horses on the Pacific slope. Considerable so called feed barley is offered in New England at about $20 a ton at wholesale, and if free from mould, it can be used satisfactorily as an oat substitute. Half of the grain may consist of crushed or coarsely ground barley, fed in connection with oats, corn and oats, or corn and wheat bran. Although experiments with coarse hominy chop (white meal) are not on record, it is believed that this feed may constitute one-half of the daily grain ration in place of corn, or possibly as an oat substitute.

Wheat, chiefly because of its cost, has never come into general use as a horse feed. The North Dakota station fed it ground and mixed with wheat bran with satisfactory results. Wheat bran has been quite generally fed by American experimenters, as a portion of the daily grain ration. The New Hampshire station states that a mixture of bran and corn, half and half by weight, is a satisfactory substitute for oats for working horses.

Cottonseed meal of first quality, although not particularly relished by horses, has been productive of good results when fed in small quantities (one to two pounds daily) mixed with other grains. Experiments with linseed meal have demonstrated its value as a source of protein for hard worked horses, and the same may be said of both gluten meal and gluten feed. Experiments with brewers' dried grains of good quality have shown them to be fully equal to oats and to be decidedly more economical; not being particularly palatable, they should be mixed with other grains, such as bran and corn. Distillers' dried grains have been but little used. The Massachusetts agricultural college has fed its farm horses a ration containing one-fourth distillers' grains, with excellent results.

Molasses from the sugar beet has been used in Europe for many years. In the South, sugar cane molasses is fed freely to horses and mules. After reviewing all available data, Langworthy concludes that "molasses may be safely fed to horses when its cost in comparison with other feed stuffs warrants its use; a quart night and morning diluted with water being apparently a reasonable amount." The writers believe that molasses, although rather disagreeable to handle, is likely to prove an economical and satisfactory feed for horses and also for fattening purposes. The present price of 14 cents a gallon (12 pounds) renders it an economical carbohydrate feed.

"Molasses feeds" and "blood and molasses feeds" are being used quite extensively in Europe and are beginning to appear in our northern markets. The molasses feeds usually consist of some absorbent such as cut straw, chaff, oat clippings and malt sprouts, to which has been added molasses and more or less corn and hominy meals, together with a little cottonseed or other feed stuff rich in pretein. Such combinations are likely to prove expensive. Mixtures of brewers' grains, malt sprouts and molasses are also on the market, but their uneven composition and poor mechanical condition render them of uncertain value. Blood and molasses (Blomo feed) offered as an oat substitute, consists of ground corn stalks, or similar material, as a basis, mixed with fresh dried blood and molasses. Its exact feeding value has not yet been demonstrated. It is believed that from one-half to one pound daily of blood meal, now offered by the packing houses, will prove quite satisfactory as a component of a grain ration for hard worked horses.

B. *Coarse Feeds.* Timothy, although the least digestible and nutritious of the several grasses, appears from experience to be well suited to the needs of the horse. This may possibly be explained on the ground that it is likely to be free from noxious plants and also that it best serves as a diluter or distributer for the more concentrated feeds. Experiments have demonstrated that alfalfa, clover hay, corn stover, Kafir corn stover, straw and small quantities of corn silage may also be fed with satisfaction. It has been claimed that alfalfa and clover hays produce colic in horses. This condition can be avoided if only one-half of the hay ration consists of these feeds. In fact, the Utah station has used alfalfa hay as the only coarse fodder (20 pounds daily) with excellent results. Investigations with millet hay, as an exclusive coarse fodder, for horses, tend to furnish evidence that it is the cause of an increased action of the kidneys as well as lameness and swelling of the joints. There are but few experiments on record relative to the value of roots and tubers as a food for horses and their use is not general in this country. A small daily feed of carrots is esteemed by many, and a recent German writer suggested the use of 12 pounds of cut potatoes daily, per thousand pounds of live weight, with the proviso that horses should not be watered immediately after receiving the potatoes.

Preparation of Feeds. Watering.

There is no particular advantage in cutting hay for horses. When horses are worked hard, when the hay is very dusty, or when it appears necessary to dilute or lighten the grain ration, it may be wise to cut and moisten the hay and mix in the grain.

Generally speaking not anything is gained by cooking or soaking ordinary feed stuffs. Experiments have made clear that it is not necessary to grind grain for healthy horses having good teeth. When animals are worked hard and have only a short time in the middle of the day to feed, ground grain will doubtless prove advantageous.

The amount of water consumed by the horse daily will naturally depend upon the temperature of the atmosphere, the amount and kind of work performed, and the character of the food consumed. The extremes may be placed at 30 and 100 pounds; with 60 to 70 pounds as an average for farm horses of 1200 to 1300 pounds live weight.

Many opinions have been expressed and a number of experiments are on record relative to the proper time of watering. The consensus of opinion seems to be that it really makes no particular difference, providing reasonable judgment is used. After prolonged muscular exertion, horses should naturally receive water before being fed. It is not wise to change suddenly from one system of watering to another.

Digestibility of Foods by Horses.

A food is valuable as a source of nutrition, only in proportion as its various nutrients can be digested and assimilated. Experiments have shown that horses digest their food less thoroughly than ruminants. The difference is especially marked in case of the crude or woody fiber, and is explained on the ground that the food consumed by horses is less thoroughly chewed, and is retained for a shorter period in the digestive tract. The results of all American digestion experiments are found in Lindsey's Compilation. (11th Report of the Hatch experiment station p. 214).

Digestible Nutrients Needed Daily.

The results of the numerous experiments made by various investigators, as well as extensive compilations of the rations fed by cab and express companies are stated in the following table* and show the quantity of the several nutrients required by horses under a variety of conditions.

Kind of Work.	Nutrients per 1000 lbs. live wt. Protein.	Fat.	Carbohydrates.	Total.	Nutritive Ratio.	Energy in Nutrients. Calories.
European Experiments.						
Light. Wolff-German.	1.5	.4	9.5	11.4	1:7.0	22150
Medium. Wolff-German.	2.0	.6	11.0	13.6	1:6.2	26700
Heavy. Wolff-German.	2.5	.8	13.3	16.6	1:6.0	32750
Moderate. Grandeau-French.	1.9	.4	10.0	12.3	1:5.7	23050
Paris Bus Co.'s horses.	1.6	.4	12.1	14.1	1:8.1	27200
Ordinary. Lavalard-French.	1.1	—	11.0†	12.1	1:10.0	22510
Severe. Lavalard-French.	1.3	—	11.0†	12.3	1:8.4	23180
American Experiments.						
Light, driving horses.	1.6	.2	6.4	8.2	1:4.3	15895
Light, general average.	1.0	.3	6.3	7.6	1:7.0	14800
Moderate, express and cab.	1.1	.5	9.0	10.6	1:9.2	20860
Moderate, farm.	1.6	.4	8.1	10.1	1:5.6	22760
Moderate, general average.	1.5	.4	9.7	11.6	1:7.0	22710

* Taken from Bulletin 125, Office of Experiment Stations, U. S. Department of Agriculture. The authors have drawn freely from this excellent publication in the preparation of this paper.

† Includes fat multiplied by 2.25.

It is probable that the horses receiving the different rations containing the above groups of nutrients were all properly nourished and produced a maximum amount of work in return for the food supplied. On the other hand it is evident that the inexperienced person would gain very little positive information concerning definite feeding standards from a study of the above figures, and, in fact, it is very difficult to establish any standard to suit all cases, for the reason that the *character* of the work performed, governs very largely the amount of food required. It is believed that the so called moderate ration suggested by Grandeau should furnish a sufficient quantity of available nutrients for horses doing an average amount of farm work. In general it may be said, that a good understanding of the principles of animal nutrition, coupled with close powers of observation and practical experience should enable the feeder to keep his horses in a high degree of effective service at a minimum cost.

A few points should be kept in mind:

1. The amount of food required is proportional to the amount of work performed.

2. The amount of food required is also proportional to the speed with which the work is done.

3. More energy and consequently more food are required by a horse when drawing a load at a trot, than at a walk.

4. Worry, confusion, fast driving and much stopping, sudden, short and severe labor, all consume much energy and require extra food.

5. Generally speaking it is believed that truck horses drawing heavy loads slowly over good roads, require less food than express and cab horses.

6. Horses doing severe work require more protein than those engaged in light work.

7. The proportion of protein to carbohydrates (nutritive ratio) required by horses doing moderate work should be about 1 to 7 or 8, and for horses doing heavy work as 1 to 5 or 6.

Rations for Horses.

The following rations have been fed to horses at experiment stations, and by practical men having large stables, and are here presented to show the wide diversity of feeds that can be fed with satisfactory results. The wise feeder will keep constantly in mind that no radical or sudden change should be made in the ration of the horse, especially when the animal is doing hard work. Changes should be brought about gradually, and any apparent ill effects noted.

1.

Weight of horses 1050 lbs.
Oats 12 lbs. (12 qts.)
Hay 15 lbs.

2.

Weight of horses 1200 lbs.
Oats 7 lbs. (7 qts.)
Corn 7 lbs. (4½ qts.)
Corn stover 12 lbs.

3.

Weight of horses 1000 lbs.
Bran 3 lbs. (6 qts.)
Corn 6 lbs. (4 qts.)
Hay 12 lbs.

4.

Weight of horses 1200 lbs.
Bran 2 lbs. (4 qts.)
Corn 6 lbs. (4 qts.)
Gluten feed 6 lbs. (5 qts.)
Corn stover 12 lbs.

5.

Weight of horses 1200 lbs.
Corn 8 lbs. (5 qts.)
Bran 7 lbs. (14 qts.)
Hay 10 lbs.

6.

Weight of horses 1200 lbs.
Corn 8 lbs. (5 qts.)
Linseed meal 4 lbs. (4 qts.)
Hay 10 lbs.

7.*

Weight of horses 1200 lbs.
Bran 2 lbs. (4 qts.)
Hominy meal 6 lbs. (5½ qts.)
Oats 4 lbs. (4 qts.)
Hay 15 lbs.

8.†

Weight of horses 1100 lbs.
Bran 3 lbs. (6 qts.)
Provender 6 lbs. (5 qts.)
Hay 15 lbs.

9.

Weight of horses 1200 lbs.
Corn 10 lbs. (6½ qts.)
Hay 15 lbs.
Silage 15 lbs.

10.‡

Weight of horses 1200-1400 lbs.
Oats 4 lbs. (4 qts.)
Cracked corn 10 lbs. (6½ qts.)
Hay 15 lbs.

Generally speaking, 12 to 15 pounds each of hay and grain daily are sufficient for horses of 1200-1300 pounds weight doing moderately hard work. Should a portion of the grain consist of cottonseed, or gluten meal, it would be wise to reduce the grain ration somewhat and increase the quantity of hay. Farmers will naturally prefer to feed a maximum amount of hay and as small a quantity of grain as possible. In view of the high prices usually prevailing for oats, the feeder should aim to provide partial or entire substitutes for this grain. Mixtures of corn and bran, or corn, brewers' grains and bran ought to prove quite satisfactory.

* Suggested by Lindsey.

† Fed at Massachusetts State station previous to 1894. Corn was crushed and mixed with oats in proportion of 400 lbs. of corn and 15 bushels of oats.

‡ Hatch Experiment station horses. Heavy farm work.

HATCH EXPERIMENT STATION

—OF THE—

MASSACHUSETTS AGRICULTURAL COLLEGE.

BULLETIN NO. 100.

I. ANALYSES OF MANURIAL SUBSTANCES FORWARDED FOR EXAMINATION.

II. ANALYSES OF LICENSED FERTILIZERS COLLECTED IN THE GENERAL MARKETS.

III. MARKET VALUES OF FERTILIZING INGREDIENTS.

JULY, 1904.

The regular Bulletins of this Station will be sent free to all newspapers in the State and to such individuals interested in farming as may request the same. Technical Bulletins are sent only to those persons interested in the subject treated of in each case.

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1904.

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OF THE

Massachusetts Agricultural College,

AMHERST, MASS.

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Albert Parsons, B. Sc.,	*Inspector* (Foods and Feeding).
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George O. Greene, M. S.,	*Assistant Horticulturist.*
George W. Patch,	*Observer.*

The co-operation and assistance of farmers, fruit-growers, horticulturists, and all interested, directly or indirectly, in agriculture, are earnestly requested. The Bulletins will be sent free to all newspapers in the State and to such individuals interested in farming as may request the same. General bulletins, fertilizer analyses, analyses of feed-stuffs, and annual reports are published. Kindly indicate in application which of these are desired. Communications may be addressed to the

Hatch Experiment Station, Amherst, Mass.

DIVISION OF CHEMISTRY.

C. A. GOESSMANN.

ANALYSES OF FERTILIZING SUBSTANCES SENT ON FOR FREE EXAMINATION.

WOOD ASHES.

1450-1454. I. Received from North Hatfield, Mass.
II. Received from Colrain, Mass.
III. Received from North Amherst, Mass.
IV. Received from Sunderland, Mass.
V. Received from Shelburne Falls, Mass.

	Per Cent.				
	I.	II.	III.	IV.	V.
Moisture at 100° C.,	21.27	13.90	15.10	8.82	.44
Potassium oxide,	4.72	5.58	5.92	5.60	11.04
Phosphoric acid,	1.66	1.54	1.40	1.22	2.82
Calcium oxide,	27.43	32.95	27.68	39.54	42.86
Insoluble matter,	14.64	13.13	15.22	10.50	9.67

1455-1459. I. Received from Osterville, Mass.
II. Received from Hadley, Mass.
III. Received from North Amherst, Mass.
IV & V. Received from Newburyport, Mass.

	Per Cent.				
	I.	II.	III.	IV.	V.
Moisture at 100° C.,	25.78	22.11	19.72	2.47	2.95
Potassium oxide,	4.44	6.04	4.24	5.56	6.20
Phosphoric acid,	1.66	1.28	.90	1.54	2.04
Calcium oxide,	28.16	28.00	33.12	32.79	34.52
Insoluble matter,	13.35	13.43	9.81	20.62	16.63

1460-1464. I & II. Received from Holyoke, Mass.
III. Received from Hinsdale, Mass.
IV. Received from Fall River, Mass.
V. Received from Marblehead, Mass.

	Per Cent.				
	I.	II.	III.	IV.	V.
Moisture at 100° C.,	1.17	29.69	12.20	14.22	5.85
Potassium oxide,	3.28	3.64	5.80	4.44	3.44
Phosphoric acid,	1.20	.74	1.40	1.28	1.16
Calcium oxide,	30.90	22.31	27.60	32.78	24.06
Insoluble matter,	32.55	24.19	23.30	14.35	36.39

1465-1469. I & II. Received from Sunderland, Mass.
III. Received from Bernardston, Mass.
IV. Received from North Amherst, Mass.
V. Received from Sunderland, Mass.

	Per Cent.				
	I.	II.	III.	IV.	V.
Moisture at 100° C.,	31.70	25.15	6.82	19.87	33.29
Potassium oxide,	2.20	4.32	8.24	3.00	.89
Phosphoric acid,	1.62	1.34	1.66	1.16	.46
Calcium oxide,	28.51	27.43	33.28	25.38	33.23
Insoluble matter,	10.18	11.91	18.72	27.11	4.56

1470-1474. I & II. Received from Easthampton, Mass.
III & IV. Received from Cushman, Mass.
V. Received from North Amherst, Mass.

	Per Cent.				
	I.	II.	III.	IV.	V.
Moisture at 100° C.,	1.32	15.36	29.04	37.85	17.99
Potassium oxide,	3.04	4.64	2.40	1.07	3.90
Phosphoric acid,	.51	.54	.88	.28	.84
Calcium oxide,	18.74	25.62	20.39	31.66	28.05
Insoluble matter,	47.21	22.97	42.25	6.93	15.67

1475-1478. I. Received from North Amherst, Mass.
II. Received from Hadley, Mass.
III. Received from Springfield, Mass.
IV. Received from Sunderland, Mass.

	Per Cent I.	II.	III.	IV.
Moisture at 100° C.,	19.40	19.68	1.65	19.52
Potassium oxide,	3.74	3.32	6.20	3.22
Phosphoric acid,	.86	.60	.82	1.42
Calcium oxide,	26.90	35.71	19.73	29.75
Insoluble matter,	13.23	12.52	34.09	15.99

LIME ASHES.

1479-1483. I. Received from South Deerfield, Mass.
II. Received from North Hatfield, Mass.
III. Received from East Leverett, Mass.
IV. Received from Hadley, Mass.
V. Received from North Amherst, Mass.

	Per Cent. I.	II.	III.	IV.	V.
Moisture at 100° C.,	1.58	11.20	28.62	36.62	26.32
Potassium oxide,	2.46	2.36	.74	.92	.80
Phosphoric acid,	1.48	1.16	.52	.64	1.08
Calcium oxide,	49.59	49.52	36.82	33.76	36.16
Insoluble matter,	3.54	2.76	5.68	3.73	5.79

1484-1487. I & II. Received from North Amherst, Mass.
III & IV. Received from Sunderland, Mass.

	Per Cent. I.	II.	III.	IV.
Moisture at 100° C.,	8.50	4.32	.34	1.46
Potassium oxide,	1.68	1.64	2.74	1.82
Phosphoric acid,	.64	.35	.92	.97
Calcium oxide,	44.57	40.74	48.69	47.49
Insoluble matter,	7.36	25.47	4.22	7.37

NITRATE OF SODA.

1488-1491. I. Received from North Hatfield.
II & III. Received from West Millbury, Mass.
IV. Received from Sutton, Mass.

	Per Cent. I.	II.	III.	IV.
Moisture at 100° C.,	.82	1.87	.47	2.12
Nitrogen,	15.39	15.45	16.16	15.56

COTTON-SEED MEAL AND DRIED BLOOD.

1492-1494. I. Cotton-seed meal, received from Amherst, Mass.
II. Cotton-seed meal, received from Southwick, Mass.
III. Dried blood, received from West Newbury, Mass.

	Per Cent.		
	I.	II.	III.
Moisture at 100° C.,	6.47	6.15	9.27
Nitrogen,	6.73	7.19	12.05
Phosphoric acid,	*	*	.03

POTASH COMPOUNDS.

1495-1498. I & II. High grade sulphate of potash, received from North Hatfield, Mass.
III. Carbonate of potash, sampled at Amherst, Mass.
IV. Sulphate of potash-magnesia, sampled at Amherst, Mass.

	Per Cent.			
	I.	II.	III.	IV.
Moisture at 100° C.,	.77	.20	.75	4.57
Potassium oxide,	50.40	51.64	60.48	23.40
Sulphuric acid (So_3),	*	*	.65	*
Chlorine,	*	*	1.45	*

PHOSPHATES.

1499-1502. I. Dissolved bone black, received from North Hatfield, Mass.
II. Burned bone, received from Boston, Mass.
III. Burned bone received from Springfield, Mass.
IV. Phosphatic slag, received from Amherst, Mass.

	Per Cent.			
	I.	II.	III.	IV.
Moisture at 100° C.,	8.65	.17	.80	.15
Total phosphoric acid,	18.80	39.66	38.26	18.61
Soluble phosphoric acid,	15.36	*	*	*
Reverted phosphoric acid,	2.10	*	*	*
Insoluble phosphoric acid,	1.34	*	*	*
Calcium oxide,	*	52.12	*	50.58
Organic and volatile matter,	*	.79	*	*
Insoluble matter,	*	.96	*	*

*Not determined.

TANKAGE.

1503-1505. I. Received from West Millbury, Mass.
II. Received from Westport, Mass.
III. Received from Amherst, Mass.

	Per Cent. I.	II.	III.
Moisture at 100° C.,	5.95	5.55	3.80
Total phosphoric acid,	17.14	13.04	12.66
Available phosphoric acid,	7.80	7.54	7.04
Insoluble phosphoric acid,	9.34	5.50	5.62
Nitrogen,	5.17	6.27	7.16

GROUND BONE AND DRY GROUND FISH.

1506-1508. I. Ground bone, received from Brockton, Mass.
II. Ground bone, received from West Newbury, Mass.
III. Dry ground fish, received from North Hatfield, Mass.

	Per Cent. I.	II.	III.
Moisture at 100° C.,	5.05	6.84	13.35
Total phosphoric acid,	21.10	19.27	9.04
Available phosphoric acid,	7.42	5.71	6.54
Insoluble phosphoric acid,	13.68	13.56	2.50
Nitrogen,	3.73	3.07	8.16

MISCELLANEOUS BY-PRODUCTS.

1509-1512. I. Wool waste, received from Spencer, Mass.
II. Wool waste, received from Amherst, Mass.
III. Mill waste, received from East Walpole, Mass.
IV. Factory waste, received from Littleton, Mass.

	Per Cent. I.	II.	III.	IV.
Moisture at 100° C.,	5.75	5.75	5.65	1.60
Potassium oxide,	5.92	.84	.38	4.96
Phosphoric acid,	.77	.38	.42	.90
Nitrogen,	2.69	3.31	1.34	2.95
Calcium oxide,	2.54	2.96	1.45	31.28
Insoluble matter,	22.35	29.05	12.24	*

*Not determined.

SHEEP MANURE AND LIQUID MANURE.

1513-1514. I. Sheep manure, received from Natick, Mass.
II. Liquid manure, received from Fitchburg, Mass.

	Per Cent.	
	I.	II.
Moisture at 100° C.,	2.35	96.56
Potassium oxide,	3.16	.018
Phosphoric acid,	.32	.006
Nitrogen,	.92	.56
Calcium oxide,	1.80	*
Insoluble matter,	56.62	*

COMPOUND FERTILIZERS.

1515-1519. I. Received from Methuen, Mass.
II. Received from Sunderland, Mass.
III. Received from Andover, Mass.
IV. Received from South Attleboro, Mass.
V. Received from South Amherst, Mass.

	Per Cent.				
	I.	II.	III.	IV.	V.
Moisture at 100° C.,	9.41	6.45	1.92	5.55	11.95
Total phosphoric acid,	8.14	6.26	13.30	18.68	9.86
Soluble phosphoric acid,	2.61	4.98	—	—	5.12
Reverted phosphoric acid,	4.52	.76	5.76	6.40	2.70
Insoluble phosphoric acid,	1.02	.52	7.54	12.28	2.04
Potassium oxide,	11.36	9.54	10.26	6.16	7.58
Nitrogen,	4.98	5.67	4.35	3.85	3.71

1520-1524. I. Received from Methuen, Mass.
II. Received from Bedford, Mass.
III. Received from West Brookfield, Mass.
IV. Received from Littleton, Mass.
V. Received from Hadley, Mass.

*Not determined.

	Per Cent.				
	I.	II.	III.	IV.	V.
Moisture at 100° C.,	3.60	6.45	1.11	6.73	9.45
Total phosphoric acid,	11.52	10.41	2.38	8.70	13.43
Soluble phosphoric acid,	2.04	2.37	—	.08	1.42
Reverted phosphoric acid,	5.14	2.97	.61	2.25	5.46
Insoluble phosphoric acid,	4.34	5.07	1.77	6.37	6.55
Potassium oxide,	9.96	8.20	5.68	2.06	8.98
Nitrogen,	5.00	5.45	.81	3.64	3.82
Calcium oxide,	*	*	36.83	*	*

SOILS.

1525-1528. I. Received from Rutland, Mass.
II. Received from Brookfield, Mass.
III & IV. Received from Newton, Mass.

	Per Cent.			
	I.	II.	III.	IV.
Moisture at 100° C.,	30.63	2.40	21.78	31.33
Potassium oxide,	.17	.29	.18	.09
Phosphoric acid,	.11	.35	.007	.05
Nitrogen,	.14	.46	.14	.16
Calcium oxide,	.06	.20	.46	.53

1529-1532. I. Received from Newton, Mass.
II. Received from North Adams, Mass.
III & IV. Received from Brookline, Mass.

	Per Cent.			
	II.	II.	III.	IV.
Moisture at 100° C.,	26.30	38.73	56.99	34.99
Potassium oxide,	.10	.55	.09	.16
Phosphoric acid,	.007	.22	.10	.05
Nitrogen,	.16	.37	.40	.33
Calcium oxide,	.30	1.48	.61	.96

1533-1536. I. Received from Lenox, Mass.
II, III & IV. Received from East Whately, Mass.

	Per Cent.			
	I.	II.	III.	IV.
Moisture at 100° C.,	4.71	20.04	20.93	32.60
Potassium oxide,	.27	.18	.14	.12
Phosphoric acid,	.37	.19	.27	.06
Nitrogen,	.07	.11	.09	.13
Calcium oxide,	1.34	.12	.15	.07

*Not determined.

II. ANALYSES OF COMMERCIAL FERTILIZERS COLLECTED DURING 1904, IN THE GENERAL MARKETS BY THE AGENT OF THE HATCH EXPERIMENT STATION OF THE MASSACHUSETTS AGRICULTURAL COLLEGE.

Laboratory No.	Name of Brand.	Name of Manufacturer.	Sampled at
	Compound Fertilizers.		
1	Grass and Lawn Top Dressing	American Agricultural Chemical Co., Boston.	Seekonk.
37	Grass and Lawn Top Dressing	American Agricultural Chemical Co., Boston.	Weir.
161	Grass and Lawn Top Dressing	American Agricultural Chemical Co., Boston.	Hatfield.
180	Grass and Lawn Top Dressing	American Agricultural Chemical Co., Boston.	Brockton.
81	Tobacco Starter and Grower	American Agricultural Chemical Co., Boston.	N. Amherst.
560	Tobacco Starter and Grower	American Agricultural Chemical Co., Boston.	Greenfield.
232	High Grade Fertilizer with 10% Potash	American Agricultural Chemical Co., Boston.	Amesbury.
10	Bradley's Potato Manure	Amer. Agric. Chem. Co., Bradley Fertilizer Co. Branch.	Fall River
199	Bradley's Potato Manure	Amer. Agric. Chem. Co., Bradley Fertilizer Co. Branch.	New Bedford.
234	Bradley's Potato Manure	Amer. Agric. Chem. Co., Bradley Fertilizer Co. Branch.	Haverhill.
320	Bradley's Potato Manure	Amer. Agric. Chem. Co., Bradley Fertilizer Co. Branch.	Lowell.
32	Bradley's Comp. Manure for Potatoes and Vegetables	Amer. Agric. Chem. Co., Bradley Fertilizer Co. Branch.	Weir.
45	Bradley's Comp. Manure for Potatoes and Vegetables	Amer. Agric. Chem. Co., Bradley Fertilizer Co. Branch.	Fall River.
213	Bradley's Comp. Manure for Potatoes and Vegetables	Amer. Agric. Chem. Co., Bradley Fertilizer Co. Branch.	Haverhill.
46	Bradley's Potato Fertilizer	Amer. Agric. Chem. Co., Bradley Fertilizer Co. Branch.	Weir.
265	Bradley's Potato Fertilizer	Amer. Agric. Chem. Co., Bradley Fertilizer Co. Branch.	Boston.
355	Bradley's Potato Fertilizer	Amer. Agric. Chem. Co., Bradley Fertilizer Co. Branch.	Waltham.
51	Bradley's Eclipse Phosphate	Amer. Agric. Chem. Co., Bradley Fertilizer Co. Branch.	Weir.
219	Bradley's Eclipse Phosphate	Amer. Agric. Chem. Co., Bradley Fertilizer Co. Branch.	Amesbury.
295	Bradley's Eclipse Phosphate	Amer. Agric. Chem. Co., Bradley Fertilizer Co. Branch.	Lowell.

Laboratory Number.	Name of Brand.	Moisture.	Nitrogen in 100 lbs.		Phosphoric Acid in 100 lbs.							Potassium Oxide in 100 lbs.	
								Total.		Available.			
			Found.	Guaranteed.	Soluble.	Reverted.	Insoluble.	Found.	Guaranteed.	Found.	Guaranteed.	Found.	Guaranteed.
	Compound Fertilizers.												
1-37-161-180	Grass and Lawn Top Dressing	5.08	4.89	3.91-4.73	1.28	4.22	1.46	6.95	6-9	5.50	5-7	2.74	2-3
81-560	Tobacco Starter and Grower	10.99	3.31	3.3-4.13	4.71	3.97	1.89	10.57	10-13	8.68	8-10	4.02	4-5*
232	High Grade Fertilizer with 10% Potash	12.45	3.52	2.4-3	2.05	4.17	2.30	8.52	7-10	6.22	7-8	9.06	10-12
10-199-234-320	Bradley's Potato Manure	12.75	2.50	2.5-3.25	2.47	5.23	1.97	9.67	8-11	7.70	6-8	5.48	5-6
32-45-213	Bradley's Comp. Manure Pot. and Veg.	8.89	4.06	3.29-4.12	3.43	4.37	2.56	10.36	9-13	7.80	8-11	6.92	7-8
46-265-355	Bradley's Potato Fertilizer	15.45	2.36	2.06-2.88	3.65	4.34	2.07	10.06	10-13	7.99	8-10	3.42	3-4
51-219-295	Bradley's Eclipse Phosphate	14.87	1.58	1.03-2.5	5.18	3.30	2.70	11.18	10-15	8.48	8-12	2.02	2-3

*Suphate of potash, the source of potash.

II. ANALYSES OF COMMERCIAL FERTILIZERS COLLECTED DURING 1904, IN THE GENERAL MARKETS BY THE AGENT OF THE HATCH EXPERIMENT STATION OF THE MASSACHUSETTS AGRICULTURAL COLLEGE.

Laboratory No.	Name of Brand.	Name of Manufacturer	Sampled at
	Compound Fertilizers.		
212	Bradley's English Lawn Fertilizer,	Amer. Agric. Chem. Co., Bradley Fert. Co. Branch,	Amesbury.
312	Bradley's English Lawn Fertilizer,	Amer. Agric. Chem. Co., Bradley Fert. Co. Branch,	Lowell.
217	Bradley's Complete Manure Top-Dressing,	Amer. Agric. Chem. Co., Bradley Fert. Co. Branch,	Amesbury.
255	Bradley's Complete Manure Top-Dressing,	Amer. Agric. Chem. Co., Bradley Fert. Co. Branch,	Boston.
302	Bradley's Complete Manure Top-Dressing,	Amer. Agric. Chem. Co., Bradley Fert. Co. Branch,	Boston.
369	Bradley's Complete Manure Top-Dressing,	Amer. Agric. Chem. Co., Bradley Fert. Co. Branch,	Bridgewater.
242	Bradley's Corn Phosphate,	Amer. Agric. Chem. Co., Bradley Fert. Co. Branch,	Amesbury.
315	Bradley's Corn Phosphate,	Amer. Agric. Chem. Co., Bradley Fert. Co. Branch,	Lowell.
322	Bradley's Corn Phosphate,	Amer. Agric. Chem. Co., Bradley Fert. Co. Branch,	Newburyport.
3	Church's Fish and Potash,	Amer. Agric. Chem. Co., Bradley Fert. Co. Branch,	Seekonk.
61	Church's Fish and Potash,	Amer. Agric. Chem. Co., Bradley Fert. Co. Branch,	Weir.
413	Church's Fish and Potash,	Amer. Agric. Chem. Co., Bradley Fert. Co. Branch,	Springfield.
557	Church's Fish and Potash,	Amer. Agric. Chem. Co., Bradley Fert. Co. Branch,	Greenfield.
343	Clark's Cove Bay State Fertilizer G. G.,	Amer. Agric. Chem. Co., Clark's Cove Fert. Co. Branch,	Hudson.
344	Clark's Cove Potato Fertilizer,	Amer. Agric. Chem. Co., Clark's Cove Fert. Co. Branch,	Hudson.
414	Clark's Cove Potato Fertilizer,	Amer. Agric. Chem. Co., Clark's Cove Fert. Co. Branch,	Springfield.
358	Clark's Cove King Philip Guano,	Amer. Agric. Chem. Co., Clark's Cove Fert. Co. Branch,	Hudson.
411	Clark's Cove Great Planet Manure,	Amer. Agric. Chem. Co., Clark's Cove Fert. Co. Branch,	E. Longm'dow.
226	Crocker's Potato, Hop and Tobacco Phosphate,	Am. Ag. Chem. Co., Crocker Fert. & Chem. Co. Branch,	Haverhill.
432	Cumberland Potato Fertilizer,	Am. Ag. Chem. Co., Cumberland Bone Phos. Co. Branch,	Southwick.

Laboratory Number.	Name of Brand.	Moisture.	Nitrogen in 100 lbs. Found.	Nitrogen in 100 lbs. Guaranteed.	Phosphoric Acid in 100 lbs. Soluble.	Reverted.	Insoluble.	Total. Found.	Total. Guaranteed.	Available. Found.	Available. Guaranteed.	Potassium Oxide in 100 lbs. Found.	Potassium Oxide in 100 lbs. Guaranteed.
	Compound Fertilizers.												
212-312	Bradley's English Lawn Fertilizer, ...	5.40	4.71	4.08-5.23	1.32	4.51	1.23	7.06	6-8	5.83	5-7	2.68	2.5-3.5
217-255-302-369	Bradley's Comp. Man. for Top Dressing..	6.63	4.67	4.95-5.78	1.54	3.98	1.23	6.75	6-8	5.52	5-7	2.72	2.5-3.5
242-315-322	Bradley's Corn Phosphate, ...	13.12	2.12	2.06-2.80	4.03	4.31	3.17	11.51	10-12	8.34	8-10	1.54	1.5-2.5
3-61-413-557	Church's Fish and Potash, ...	12.03	2.18	2.07-2.9	3.71	3.43	3.43	10.57	7.5-10.5	7.14	6-8	3.86	2-3
343	Clark's Cove Bay State Fertilizer G. G., ..	15.50	2.24	2.06-2.88	4.41	3.21	2.69	10.31	10-13	7.62	8-10	1.58	1.5-2.5
341-414	Clark's Cove Potato Fertilizer, ...	10.24	2.11	2.06-2.88	5.12	3.66	3.76	12.54	10-13	8.78	8-10	3.00	3-4
358	Clark's Cove King Philip Guano,..........	16.45	1.39	1.03-2.5	5.86	2.50	2.46	10.82	10-15	8.36	8-12	2.02	2-3
411	Clark's Cove Great Planet Manure,.......	11.35	2.99	3.3-4.12	3.22	3.87	2.43	9.52	9-13	7.09	8-11	6.62	7-8
226	Crocker's Potato, Hop and Tobacco Phos.,	11.83	2.14	2.06-2.88	4.99	3.06	2.64	10.69	10-13	8.05	8-10	3.06	3-4
432	Cumberland Potato Fertilizer,............	14.62	2.07	2.06-2.88	5.82	2.57	3.25	11.64	10-13	8.39	8-10	3.06	3-4

*Sulphate of potash, the source of potash.

II. ANALYSES OF COMMERCIAL FERTILIZERS COLLECTED DURING 1904, IN THE GENERAL MARKETS BY THE AGENT OF THE HATCH EXPERIMENT STATION OF THE MASSACHUSETTS AGRICULTURAL COLLEGE.

Laboratory No.	Name of Brand.	Name of Manufacturer.	Sampled at
	Compound Fertilizers.		
82	Darling's Potato Manure,	Am. Agric. Chem. Co., L. B. Darling Fert. Co. Branch,	N. Amherst.
463	Darling's Potato Manure,	Am. Agric. Chem. Co., L. B. Darling Fert. Co. Branch,	Worcester.
89	Darling's Potato and Root Crop Manure,	Am. Agric. Chem. Co., L. B. Darling Fert. Co. Branch,	N. Amherst.
92	Darling's Tobacco Grower,	Am. Agric. Chem. Co., L. B. Darling Fert. Co. Branch,	N. Amherst.
105	Darling's Farm Favorite,	Am. Agric. Chem. Co., L. B. Darling Fert. Co. Branch,	N. Amherst.
365	Darling's Farm Favorite,	Am. Agric. Chem. Co., L. B. Darling Fert. Co. Branch,	Bridgewater.
441	Darling's Blood, Bone and Potash,	Am. Agric. Chem. Co., L. B. Darling Fert. Co. Branch,	Worcester.
486	Darling's Blood, Bone and Potash,	Am. Agric. Chem. Co., L. B. Darling Fert. Co. Branch,	Harvard.
198	Baker's "AA" Ammoniated Superphosphate,	Am. Agric. Chem. Co., H. J. Baker & Bro. Branch,	New Bedford.
144	Baker's "AA" Ammoniated Superphosphate,	Am. Agric. Chem. Co., H. J. Baker & Bro. Branch,	Worcester.
428	Baker's Complete Potato Manure,	Am. Agric. Chem. Co., H. J. Baker & Bro. Branch,	Springfield.
434	Baker's Complete Potato Manure,	Am. Agric. Chem. Co., H. J. Baker & Bro. Branch,	Worcester.
135	Great Eastern Garden Special,	Am. Agric. Chem. Co., Great Eastern Fert. Co. Branch,	Sunderland.
396	Great Eastern Garden Special,	Am. Agric. Chem. Co., Great Eastern Fert. Co. Branch,	E. Longm'dow.
171	Great Eastern Vegetable, Vine and Tobacco,	Am. Agric. Chem. Co., Great Eastern Fert. Co. Branch,	Sunderland.
406	Great Eastern Vegetable, Vine and Tobacco,	Am. Agric. Chem. Co., Great Eastern Fert. Co. Branch,	Westfield.
450	Great Eastern Vegetable, Vine and Tobacco,	Am. Agric. Chem. Co., Great Eastern Fert. Co. Branch,	Agawam.
399	Great Eastern Northern Corn Special,	Am. Agric. Chem. Co., Great Eastern Fert. Co. Branch,	Westfield.
417	Great Eastern Northern Corn Special,	Am. Agric. Chem. Co., Great Eastern Fert. Co. Branch,	E. Longm'dow.
221	Pacific Potato Special,	Am. Agric. Chem. Co., Great Eastern Fert. Co. Branch,	Amesbury.
261	Pacific Potato Special,	Am. Agric. Chem. Co., Great Eastern Fert. Co. Branch,	Newburyport.

Laboratory Number.	Name of Brand.	Moisture.	Nitrogen in 100 lbs.		Phosphoric Acid in 100 lbs.							Potassium Oxide in 100 lbs.	
			Found.	Guaranteed.	Soluble.	Reverted.	Insoluble.	Total. Found.	Total. Guaranteed.	Available. Found.	Available. Guaranteed.	Found.	Guaranteed.
	Compound Fertilizers.												
82-463	Darling's Potato Manure,	11.77	2.68	2.5-3.25	4.09	2.69	3.22	10.00	8-11	6.78	6-8	6.06	5-6
89	Darling's Potato and Root Crop Manure,	10.56	3.84	3.3-4.12	4.71	3.68	2.87	11.26	9-13	8.39	8-11	6.62	7-8
92	Darling's Tobacco Grower	7.23	4.22	4.54-5.37	5.03	3.08	2.30	10.41	5-8	8.11	4-6	8.20	10-11
105-365	Darling's Farm Favorite,	15.60	2.06	2.06-2.88	5.69	2.68	2.25	10.62	10-13	8.37	8-10	3.18	3-4
441-486	Darling's Blood, Bone and Potash	9.94	3.64	4-10.5	3.24	4.03	2.61	9.88	8-12	7.27	8-10	6.56	7-8
198-444	Baker's "A. A." Ammo. Superphosphate	13.94	2.58	2.5-3.25	5.56	3.78	2.79	12.13	11-14	9.34	9-11	2.02	2-3
428-434	Baker's Complete Potato Manure	10.07	3.41	3.3-4.13	2.60	3.20	2.46	8.26	7-10	5.80	6-10	10.08	10-12
135-390	Great Eastern Garden Special,	9.54	3.14	3.3-4.12	4.07	3.50	2.74	10.31	9-13	7.57	8-11	7.08	7-8
171-406-450	Great Eastern Veg., Vine and Tobacco,	11.52	2.19	2.56-2.88	5.44	2.59	2.51	10.54	10-13	8.02	8-10	7.09	6-7
399-417	Great Eastern Northern Corn Special,	14.57	2.56	2.5-3.25	5.22	3.58	2.46	11.26	11-14	8.80	9-11	2.36	2-3
221-261	Pacific Potato Special,	11.76	2.11	2.06-2.88	5.28	3.14	2.79	11.21	10-13	8.42	8-10	3.00	3-4

II. ANALYSES OF COMMERCIAL FERTILIZERS COLLECTED DURING 1904, IN THE GENERAL MARKETS BY THE AGENT OF THE HATCH EXPERIMENT STATION OF THE MASSACHUSETTS AGRICULTURAL COLLEGE.

Laboratory No.	Name of Brand.	Name of Manufacturer.	Sampled at
	Compound Fertilizers.		
273	Pacific Nobsque Guano.	Amer. Agric. Chem. Co., Pacific Guano Co. Branch.	Newburyport.
270	Soluble Pacific Guano.	Amer. Agric. Chem. Co., Pacific Guano Co. Branch.	Newburyport
108	Packers' Union Potato Manure.	Am. Agric. Chem. Co., Packers' Union Fert. Co. Branch.	Amherst.
116	Packers' Union Gardeners' Complete Manure.	Am. Agric. Chem. Co., Packers' Union Fert. Co. Branch.	Amherst.
366	Packers' Union Gardeners' Complete Manure.	Am. Agric. Chem. Co., Packers' Union Fert. Co. Branch,	Concord.
548	Packers' Union Gardeners' Complete Manure.	Am. Agric. Chem. Co., Packers' Union Fert. Co. Branch,	Greenfield.
127	Packers' Union Animal Corn Fertilizer.	Am. Agric. Chem. Co., Packers' Union Fert. Co. Branch.	Amherst.
8	Quinnipiac Phosphate.	Amer. Agric. Chem. Co., Quinnipiac Co. Branch.	Seekonk.
163	Quinnipiac Phosphate,	Amer. Agric. Chem. Co., Quinnipiac Co. Branch.	Hatfield.
532	Quinnipiac Phosphate,	Amer. Agric. Chem. Co., Quinnipiac Co. Branch.	Pittsfield.
30	Quinnipiac Potato Phosphate,	Amer. Agric. Chem. Co., Quinnipiac Co. Branch.	Fall River.
533	Quinnipiac Potato Phosphate.	Amer. Agric. Chem. Co., Quinnipiac Co. Branch,	Pittsfield.
561	Quinnipiac Potato Phosphate.	Amer. Agric. Chem. Co., Quinnipiac Co. Branch.	Williamstown.
66	Quinnipiac Potato Manure,	Amer. Agric. Chem. Co., Quinnipiac Co. Branch.	Seekonk.
88	Quinnipiac Potato Manure,	Amer. Agric. Chem. Co., Quinnipiac Co. Branch.	N. Amherst.
461	Quinnipiac Potato Manure.	Amer. Agric. Chem. Co., Quinnipiac Co. Branch.	Worcester.
83	Quinnipiac Market Garden Manure.	Amer. Agric. Chem. Co., Quinnipiac Co. Branch.	N. Amherst.
425	Quinnipiac Market Garden Manure.	Amer. Agric. Chem. Co., Quinnipiac Co. Branch.	Springfield.
464	Quinnipiac Market Garden Manure.	Amer. Agric. Chem. Co., Quinnipiac Co. Branch.	Worcester.
451	Read's Vegetable and Vine.	Amer. Agric. Chem. Co., Read Fert. Co. Branch.	Worcester.
466	Read's Farmers' Friend Superphosphate.	Amer. Agric. Chem. Co., Read Fert. Co. Branch.	Worcester.

Laboratory Number.	Name of Brand.	Moisture.	Nitrogen in 100 lbs.		Phosphoric Acid in 100 lbs.							Potassium Oxide in 100 lbs.	
								Total.		Available.			
			Found.	Guaranteed.	Soluble.	Reverted.	Insoluble.	Found.	Guaranteed.	Found.	Guaranteed.	Found.	Guaranteed.
	Compound Fertilizers.												
273	Pacific Nobsque Guano,	14.66	1.23	1.03-2.5	5.54	2.80	1.87	10.21	10-15	8.34	8-12	2.10	2-3
270	Soluble Pacific Guano,	4.44	2.44	2.06-2.86	2.49	5.52	3.20	11.21	10-13	8.01	8-10	1.54	1.5-2.5
108	Packers' Union Potato Manure,	14.84	2.05	2.05-2.88	6.12	1.09	2.66	10.77	10-13	8.11	8-10	6.16	6-7
116-360-548	Packers' Union Gardeners' Com. Manure.	13.68	2.42	2.4-3.	3.43	3.48	1.74	8.65	7-10	6.91	6-8	10.10	10-12
127	Packers' Union Animal Corn Fertilizer.	13.32	2.50	2.5-3.25	7.13	2.87	2.38	12.38	11-14	10.00	9-11	2.06	2-3
8-163-532	Quinnipiac Phosphate.	13.58	2.66	2.5-3.35	5.60	2.97	2.43	11.00	11-14	8.57	9-11	2.38	2-3
30-533-561	Quinnipiac Potato Phosphate,	14.34	2.15	2.06-2.88	5.16	2.03	2.71	10.80	10-13	8.09	8-10	3.28	3-4
66-88-461	Quinnipiac Potato Manure,	12.97	2.42	2.5-3.25	4.77	2.37	2.71	9.85	8-11	7.14	6-8	6.36	5-6
83-425-464	Quinnipiac Market Garden Manure,	11.53	3.40	3.3-4.12	4.58	3.86	2.10	10.54	9-13	8.44	8-11	6.56	7-8
451	Read's Vegetable and Vine Fertilizer.	12.04	2.08	2.06-2.88	6.56	1.50	2.48	10.54	10-13	8.66	8-10	6.24	6-7
466	Read's Farmers' Friend Superphosphate.	12.31	2.06	2.06-2.88	4.71	3.78	2.41	10.90	10-12	8.49	8-10	3.5[illegible]	3-4

II. ANALYSES OF COMMERCIAL FERTILIZERS COLLECTED DURING 1904, IN THE GENERAL MARKETS BY THE AGENT OF THE HATCH EXPERIMENT STATION OF THE MASSACHUSETTS AGRICULTURAL COLLEGE.

Laboratory No.	Name of Brand.	Name of Manufacturer.	Sampled at
	Compound Fertilizers.		
405	Tucker's Special Potato Fertilizer	Amer. Agric. Chem. Co., H. F. Tucker, Branch	Westfield.
507	Wheeler's Corn Fertilizer	Amer. Agric. Chem. Co., M. E. Wheeler & Co. Branch	Pittsfield.
517	Wheeler's Corn Fertilizer	Amer. Agric. Chem. Co., M. E. Wheeler & Co. Branch	Gt. Barrington.
513	Wheeler's Potato Manure	Amer. Agric. Chem. Co., M. E. Wheeler & Co. Branch	Gt. Barrington.
540	Wheeler's Potato Manure	Amer. Agric. Chem. Co., M. E. Wheeler & Co. Branch	Pittsfield.
240	Williams & Clark's Royal Bone Phosphate	Am. Ag. Chem. Co., Williams & Clark Fert. Co. Branch	Haverhill.
166	Abbott's Animal Fertilizer	W. H. Abbott, Holyoke, Mass.	Sunderland.
339	Abbott's Animal Fertilizer	W. H. Abbott, Holyoke, Mass.	Holyoke.
111	Armour's All Soluble	Armour Fertilizer Works, Baltimore, Md.	Amherst.
269	Armour's All Soluble	Armour Fertilizer Works, Baltimore, Md.	Danvers.
126	Armour's High Grade Potato	Armour Fertilizer Works, Baltimore, Md.	Amherst.
284	Armour's High Grade Potato	Armour Fertilizer Works, Baltimore, Md.	Danvers.
387	Armour's High Grade Potato	Armour Fertilizer Works, Baltimore, Md.	S. Framingh'm
330	Beach Universal Brand Fertilizer	Beach Soap Co., No. Lawrence, Mass.	Lawrence.
144	Berkshire Complete Fertilizer	Berkshire Fertilizer Co., Bridgeport, Conn.	No. Hadley.
373	Berkshire Complete Fertilizer	Berkshire Fertilizer Co., Bridgeport, Conn.	W. Bridg'wat'r
25	Stockbridge Potato and Vegetable	Bowker Fertilizer Co., Boston, Mass.	Fall River.
26	Stockbridge Potato and Vegetable	Bowker Fertilizer Co., Boston, Mass.	Dighton.
96	Stockbridge Potato and Vegetable	Bowker Fertilizer Co., Boston, Mass.	Northampton.
18	Bowker's High Grade Fertilizer	Bowker Fertilizer Co., Boston, Mass.	Dighton.
353	Bowker's High Grade Fertilizer	Bowker Fertilizer Co., Boston, Mass.	Waltham.
375	Bowker's High Grade Fertilizer	Bowker Fertilizer Co., Boston, Mass.	Marlboro.

Laboratory Number.	Name of Brand.	Moisture.	Nitrogen in 100 lbs.		Phosphoric Acid in 100 lbs.							Potassium Oxide in 100 lbs.	
								Total.		Available.			
			Found.	Guaranteed.	Soluble.	Reverted.	Insoluble.	Found.	Guaranteed.	Found.	Guaranteed.	Found.	Guaranteed.
	Compound Fertilizers.												
405	Tucker's Special Potato Fertilizer.	14.37	2.30	2.06-2.88	3.39	3.77	2.61	9.77	10-13	7.16	8-10	3.26	3-4
507 517	Wheeler's Corn Fertilizer,................	14.05	1.76	1.65-2.47	3.84	4.12	2.81	10.77	10-14	7.06	8-11	2.16	2-3
513-540	Wheeler's Potato Manure.	13.00	2.06	2.05-2.86	4.86	3.14	2.23	10.23	10-13	8.00	8-10	3.06	3-4
240	Williams & Clark's Royal Bone Phosphate.	14.42	1.54	1.03-2.5	4.39	3.75	2.81	10.95	10-15	8.14	8-12	2.18	2-3
166-339	Abbott's Animal Fertilizer.	9.11	3.58	3-4	1.73	9.25	7.42	18.40	17-19	10.98	15-17	—	—
111-269	Armour's All Soluble,....................	9.23	3.21	2.51-3.34	7.20	1.73	.77	9.70		8.93	8-10	4.18	4-5
126-284 387	Armour's High Grade Potato,............	8.71	1.76	1.65-2.47	6.40	2.48	1.30	10.18	—	8.88	8-10	9.82	10-11
330	Beach Universal Brand Fertilizer.	3.33	1.98	1.65-2.10	2.98	4.65	4.14	11.77	10-13	7.63	8-12	3.00	2-3
141 373	Berkshire Complete Fertilizer,............	7.49	2.87	2.47-3.29	6.12	2.27	1.59	9.98	10-12	8.39	8-10	6.26	6-8
25-26-96	Stockbridge Potato and Vegetable.	8.87	3.29	3.29-4.12	4.35	2.13	2.17	8.65	7-10	6.48	6-8	10.12	10-12
18-353-375	Bowker's High Grade Fertilizer,..........	10.65	2.54	2.25-3.25	4.71	3.56	2.71	10.98	10-13	8.27	6-9	4.00	4-6

II. ANALYSES OF COMMERCIAL FERTILIZERS COLLECTED DURING 1904, IN THE GENERAL MARKETS BY THE AGENT OF THE HATCH EXPERIMENT STATION OF THE MASSACHUSETTS AGRICULTURAL COLLEGE.

Laboratory No.	Name of Brand.	Name of Manufacturer.	Sampled at
	Compound Fertilizers.		
182	Bowker's Hill and Drill Phosphate	Bowker Fertilizer Co., Boston, Mass.	Bridgewater.
244	Bowker's Hill and Drill Phosphate	Bowker Fertilizer Co., Boston, Mass.,	Haverhill.
267	Bowker's Hill and Drill Phosphate,	Bowker Fertilizer Co., Boston, Mass.	Boston.
316	Bowker's Hill and Drill Phosphate	Bowker Fertilizer Co., Boston, Mass.	Boston.
207	Bowker's Farm and Garden Phosphate,	Bowker Fertilizer Co., Boston, Mass.,	Bridgewater.
235	Bowker's Farm and Garden Phosphate	Bowker Fertilizer Co., Boston, Mass.	Haverhill.
408	Bowker's Farm and Garden Phosphate	Bowker Fertilizer Co., Boston, Mass.	Springfield.
467	Bowker's Farm and Garden Phosphate	Bowker Fertilizer Co., Boston, Mass.,	Worcester.
547	Bowker's Farm and Garden Phosphate,	Bowker Fertilizer Co., Boston, Mass.	North Adams.
282	Breck's Market Garden Manure,	Joseph Breck & Sons, Boston, Mass.,	Boston.
299	Farquhar's Vegetable and Potato Fertilizer	Chicopee Rendering Co., Springfield, Mass.,	Boston.
304	Farquhar's Vegetable and Potato Fertilizer,	Chicopee Rendering Co., Springfield, Mass.,	Boston.
13	E. Frank Coe's Red Brand Excelsior Guano,	E. Frank Coe Co., New York City,	Dighton.
38	E. Frank Coe's Gold Brand Excelsior Guano	E. Frank Coe Co., New York City,	Dighton.
426	Columbian Corn Fertilizer,	E. Frank Coe Co., New York City,	Westfield.
536	Columbian Corn Fertilizer,	E. Frank Coe Co., New York City,	Greenfield.
551	Columbian Corn Fertilizer	E. Frank Coe Co., New York City,	S. Williamst'n.
305	Thompson's Improved Vine, Plant and Veg'ble Manure,	R. & J. Farquhar & Co., Boston, Mass. (Importers),	Boston.
504	Thompson's Improved Vine, Plant and Veg'ble Manure,	R. & J. Farquhar & Co., Boston, Mass. (Importers),	Boston.
190	Lister's Special Corn Fertilizer,	Lister's Agricultural Chemical Works, Newark, N. J.,	Rochester.
253	Lister's Special Corn Fertilizer,	Lister's Agricultural Chemical Works, Newark, N. J.,	Newburyport.

Laboratory Number.	Name of Brand.	Moisture.	Nitrogen in 100 lbs. Found.	Nitrogen in 100 lbs. Guaranteed.	Phosphoric Acid in 100 lbs. Soluble.	Reverted.	Insoluble.	Total. Found.	Total. Guaranteed.	Available. Found.	Available. Guaranteed.	Potassium Oxide in 100 lbs. Found.	Potassium Oxide in 100 lbs. Guaranteed.
	Compound Fertilizers.												
182-244-267-316	Bowker's Hill and Drill Phosphate,	12.96	2.53	2.47-3.29	5.86	3.15	2.12	11.13	10-13	9.01	9-11	2.02	2-3
207-235-408-467-547	Bowker's Farm and Garden Phosphate,	10.82	1.73	1.65-2.47	5.44	3.08	2.23	10.75	9-11	8.52	8-10	2.16	2-3
282	Breck's Market Garden Manure,	15.53	2.67	2.5-3.25	5.41	3.68	2.45	11.54	11-14	9.09	9-11	2.08	2-3
299-304	Farquhar's Vegetable and Potato Fertilizer,	7.38	4.54	3-4	.61	6.15	5.88	12.64	7-8	6.76	—	6.72	7-8
13	Red Brand Excelsior Guano,	6.97	3.15	3.5-4	7.27	1.17	1.13	9.57	10-12	8.44	9-12	9.88	6-8*
38	Gold Brand Excelsior Guano,	8.38	2.86	2.4-3.3	8.03	1.25	1.13	10.41	9-10	9.28	7.5-9	6.04	6-7*
426-536-551	Columbian Corn Fertilizer,	9.14	1.94	1.2-1.5	8.25	1.50	1.25	11.00	10-11	9.75	8.5-10	2.68	2.5-3*
305-504	Thompson's Imp. Vine, Plant & Veg. Man.	8.16	3.86	3.5-4	6.40	2.86	3.76	13.02	12-13	9.26	8-9	6.88	6-7
190-253	Lister's Special Corn Fertilizer,	13.03	2.99	1.5-2.4	5.28	3.22	2.43	10.93	9-11	8.50	8-11	3.02	3-4

*Sulphate of potash, the source of potash.

II. ANALYSES OF COMMERCIAL FERTILIZERS COLLECTED DURING 1904, IN THE GENERAL MARKETS BY THE AGENT OF THE HATCH EXPERIMENT STATION OF THE MASSACHUSETTS AGRICULTURAL COLLEGE.

Laboratory No.	Name of Brand.	Name of Manufacturer.	Sampled at
	Compound Fertilizers.		
14	Swift's Lowell Potato Manure,	Lowell Fertilizer Co., Boston, Mass.,	Fall River.
321	Swift's Lowell Potato Manure,	Lowell Fertilizer Co., Boston, Mass.,	Lowell.
474	Swift's Lowell Potato Manure,	Lowell Fertilizer Co., Boston, Mass.,	Ayer.
542	Swift's Lowell Potato Manure,	Lowell Fertilizer Co., Boston, Mass.,	Williamstown.
36	Swift's Lowell Animal Brand,	Lowell Fertilizer Co., Boston, Mass.,	Fall River.
139	Swift's Lowell Animal Brand,	Lowell Fertilizer Co., Boston, Mass.,	Sunderland.
205	Swift's Lowell Animal Brand,	Lowell Fertilizer Co., Boston, Mass.,	New Bedford.
233	Swift's Lowell Animal Brand,	Lowell Fertilizer Co., Boston, Mass.,	Amesbury.
307	Swift's Lowell Animal Brand,	Lowell Fertilizer Co., Boston, Mass.,	Boston.
313	Swift's Lowell Animal Brand,	Lowell Fertilizer Co., Boston, Mass.,	Lowell.
145	Swift's Lowell Potato Phosphate,	Lowell Fertilizer Co., Boston, Mass.,	Sunderland.
298	Swift's Lowell Potato Phosphate,	Lowell Fertilizer Co., Boston, Mass.,	Boston.
340	Swift's Lowell Potato Phosphate,	Lowell Fertilizer Co., Boston, Mass.,	Lexington.
309	Swift's Lowell Bone Fertilizer,	Lowell Fertilizer Co., Boston, Mass.,	Boston.
357	Swift's Lowell Bone Fertilizer,	Lowell Fertilizer Co., Boston, Mass.,	Hudson.
394	Swift's Lowell Bone Fertilizer,	Lowell Fertilizer Co., Boston, Mass.,	Lexington.
497	Swift's Lowell Bone Fertilizer,	Lowell Fertilizer Co., Boston, Mass.,	Ayer.
500	Swift's Lowell Bone Fertilizer,	Lowell Fertilizer Co., Boston, Mass.,	Harvard.
39	Mapes' Economical Potato Manure,	Mapes Formula and Peruvian Guano Co., N. Y. City,	Taunton.
250	Mapes' Economical Potato Manure,	Mapes Formula and Peruvian Guano Co., N. Y. City,	Sunderland.
370	Mapes' Economical Potato Manure,	Mapes Formula and Peruvian Guano Co., N. Y. City,	S.Framingh'm
491	Mapes' Economical Potato Manure,	Mapes Formula and Peruvian Guano Co., N. Y. City,	Leominster.

Laboratory Number.	Name of Brand.	Moisture.	Nitrogen in 100 lbs. Found.	Nitrogen in 100 lbs. Guaranteed.	Phosphoric Acid in 100 lbs. Soluble.	Reverted.	Insoluble.	Total. Found.	Total. Guaranteed.	Available. Found.	Available. Guaranteed.	Potassium Oxide in 100 lbs. Found.	Potassium Oxide in 100 lbs. Guaranteed.
	Compound Fertilizers.												
14-321-474-542	Swift's Lowell Potato Manure, ...	6.75	2.82	1.64-2.46	4.86	2.18	1.02	8.06	8-11	7.04	7-9	4.14	4-5*
30-139-205-233-307-313	Swift's Lowell Animal Brand, ...	9.24	2.56	2.47-3.3	6.82	2.19	1.66	10.07	10-13	9.01	9-11	4.08	4-5
145-298-340	Swift's Lowell Potato Phosphate,.........	13.53	2.61	2.47-3.3	6.18	2.65	1.30	10.13	9-11	8.83	8-10	6.08	9-7
309-357-494-497-500	Swift's Lowell Bone Fertilizer, ...	10.44	1.85	1.64-2.48	6.10	2.02	1.32	9.44	9-12	8.12	8-10	3.10	3-4
39-250-370-491	Mapes Economical Potato Manure, ...	7.65	3.31	3.29-4.12	1.54	2.58	2.81	6.93	6-8	4.12	4-5	8.70	8-10*

*Sulphate of potash, the source of potash.

II. ANALYSES OF COMMERCIAL FERTILIZERS COLLECTED DURING 1904, IN THE GENERAL MARKETS BY THE AGENT OF THE HATCH EXPERIMENT STATION OF THE MASSACHUSETTS AGRICULTURAL COLLEGE.

Laboratory No.	Name of Brand.	Name of Manufacturer.	Sampled at
	Compound Fertilizers.		
43	Mapes Corn Manure,	Mapes Formula and Peruvian Guano Co., New York	Taunton.
393	Mapes Corn Manure,	Mapes Formula and Peruvian Guano Co., New York	S. Framing'am
7	Chittenden's Complete Root Fertilizer,	National Fertilizer Co., Bridgeport, Conn.,	Seekonk.
106	Chittenden's Complete Root Fertilizer,	National Fertilizer Co., Bridgeport, Conn.,	N. Hatfield.
137	Chittenden's Complete Root Fertilizer,	National Fertilizer Co., Bridgeport, Conn.,	Sunderland.
142	Chittenden's Complete Root Fertilizer,	National Fertilizer Co., Bridgeport, Conn.,	N. Amherst.
397	Chittenden's High Grade Special Tobacco,	National Fertilizer Co., Bridgeport, Conn.,	Southwick.
423	Chittenden's High Grade Special Tobacco,	National Fertilizer Co., Bridgeport, Conn.,	Westfield.
347	New England Corn Phosphate,	New England Fertilizer Co., Boston, Mass.,	Marlboro.
174	Olds & Whipple Complete Tobacco,	Olds & Whipple, Hartford, Conn.,	Sunderland.
421	Olds & Whipple Complete Tobacco,	Olds & Whipple, Hartford, Conn.,	Southwick.
256	Special Potato Fertilizer,	Parmenter & Polsey Fertilizer Co., Peabody, Mass.,	Peabody.
259	Plymouth Rock,	Parmenter & Polsey Fertilizer Co., Peabody, Mass.,	Peabody.
76	Hubbard's Soluble Tobacco Manure,	Rogers & Hubbard Co., Middletown, Conn.,	Sunderland.
452	Hubbard's Soluble Tobacco Manure,	Rogers & Hubbard Co., Middletown, Conn.,	Agawam.
140	Hubbard's Soluble Potato Manure,	Rogers & Hubbard Co., Middletown, Conn.,	Sunderland.
447	Hubbard's Soluble Potato Manure,	Rogers & Hubbard Co., Middletown, Conn.,	Agawam.
141	Hubbard's Oats and Top Dressing,	Rogers & Hubbard Co., Middletown, Conn.,	Sunderland.
346	Hubbard's Oats and Top Dressing,	Rogers & Hubbard Co., Middletown, Conn.,	Bedford.
351	Hubbard's Corn Phosphate,	Rogers & Hubbard Co., Middletown, Conn.,	Bedford.
549	Hubbard's Corn Phosphate,	Rogers & Hubbard Co., Middletown, Conn.,	Leyden.

Laboratory Number.	NAME OF BRAND.	Moisture.	Nitrogen in 100 lbs.		Phosphoric Acid in 100 lbs.							Potassium Oxide in 100 lbs.	
								Total.		Available.			
			Found.	Guaranteed.	Soluble.	Reverted.	Insoluble.	Found.	Guaranteed.	Found.	Guaranteed.	Found.	Guaranteed.
	Compound Fertilizers.												
43-393	Mapes' Corn Manure	10.10	2.47	2.47-2.88	3.01	3.52	4.63	11.16	10-12	6.53	8-10	6.60	6-7
7, 106, 137, 142	Chittenden's Comp. Root Fertilizer	10.09	3.87	3.3-4.0	6.08	1.57	.84	8.49	10-12	7.65	8-10	6.54	6-7
397-423	Chittenden's High Grade Spec. Tobacco	5.37	5.97	5.7-6.5	5.12	.79	.33	6.24	7-9	5.91	5-7	10.00	10-11*
347	New England Corn Phosphate	11.20	1.69	1.64-2.46	5.50	2.43	.79	8.72	9-12	7.93	8-10	3.00	3-4
174-421	Olds & Whipple Complete Tobacco	8.08	5.09	4.53-5.35	.38	3.25	1.87	5.50	—	3.63	3-4	5.60	5.5-6.5†
256	Special Potato Fertilizer	9.51	3.39	3.29-4.12	1.26	3.42	2.17	9.85	9-13	7.68	8-11	7.40	7-9
259	Plymouth Rock	8.80	2.47	2.47-3.29	3.88	3.03	2.02	9.83	9-13	6.91	8-11	4.74	4-4.25
76-452	Hubbard's Soluble Tobacco Manure	9.45	5.00	5-6	.45	7.13	4.55	12.13	10-12	7.58	7-8.5	10.02	10-11
140-447	Hubbard's Soluble Potato Manure	9.72	4.68	5-6	.81	6.00	5.45	12.26	10-12	6.81	7-8.5	6.30	5-6
141-346	Hubbard's Oats and Top Dressing	5.06	7.81	8.8-9.5		4.37	5.22	9.59	7.85-9	4.37	3.94-4.35	10.04	8.35-9.5
351-549	Hubbard's Corn Phosphate	13.81	1.12	1-1.5	5.82	3.97	.90	10.69	10-12	9.79	8-10	4.58	3.5-4

*Sulphate of potash, the source of potash.
†Carbonate of potash, the source of potash.

II. ANALYSES OF COMMERCIAL FERTILIZERS COLLECTED DURING 1904, IN THE GENERAL MARKETS BY THE AGENT OF THE HATCH EXPERIMENT STATION OF THE MASSACHUSETTS AGRICULTURAL COLLEGE.

Laboratory No.	Name of Brand.	Name of Manufacturer.	Sampled at
	Compound Fertilizers.		
90	High Grade Soluble Tobacco Manure	Rogers Manufacturing Co., Rockfall, Conn.	No. Amherst.
502	High Grade Soluble Tobacco Manure	Rogers Manufacturing Co., Rockfall, Conn.	Leominster.
102	Complete Potato and Vegetable Fertilizer	Rogers Manufacturing Co., Rockfall, Conn.	Amherst.
544	Complete Potato and Vegetable Fertilizer	Rogers Manufacturing Co., Rockfall, Conn.	Pittsfield.
112	High Grade Complete Corn and Onion Manure	Rogers Manufacturing Co., Rockfall, Conn.	Amherst.
179	High Grade Complete Corn and Onion Manure	Rogers Manufacturing Co., Rockfall, Conn.	Leominster.
443	Lawn and Garden Fertilizer	Ross Brothers, Worcester, Mass.	Worcester.
563	Complete Animal Fertilizer	N. Roy & Son, South Attleboro, Mass.	S. Attleboro.
41	Essex Rhode Island Special	Russia Cement Co., Gloucester, Mass.	Dighton.
58	Essex XXX Fish and Potash	Russia Cement Co., Gloucester, Mass.	Dighton.
101	Essex XXX Fish and Potash	Russia Cement Co., Gloucester, Mass.	Hadley.
140	Essex XXX Fish and Potash	Russia Cement Co., Gloucester, Mass.	Worcester.
59	Essex Com. Manure for Potatoes, Roots and Vegetables	Russia Cement Co., Gloucester, Mass.	Taunton.
65	Essex Com. Manure for Potatoes, Roots and Vegetables	Russia Cement Co., Gloucester, Mass.	Gloucester.
435	Essex Com. Manure for Potatoes, Roots and Vegetables	Russia Cement Co., Gloucester, Mass.	Worcester.
62	Essex Odorless Lawn Dressing	Russia Cement Co., Gloucester, Mass.	Taunton.
239	Essex Odorless Lawn Dressing	Russia Cement Co., Gloucester, Mass.	Haverhill.
72	Sanderson's Tobacco Formula "B."	Sanderson's Fertilizer & Chemical Co., New Haven, Ct.	Sunderland.
84	Sanderson's Tobacco Formula "B."	Sanderson's Fertilizer & Chemical Co., New Haven, Ct.	No. Hatfield.
167	Sanderson's Tobacco Formula "B."	Sanderson's Fertilizer & Chemical Co., New Haven, Ct.	Sunderland.

Laboratory Number.	NAME OF BRAND.	Moisture.	Nitrogen in 100 lbs.		Phosphoric Acid in 100 lbs.								Potassium Oxide in 100 lbs.	
								Total.		Available.				
			Found.	Guaranteed.	Soluble.	Reverted.	Insoluble.	Found.	Guaranteed.	Found.	Guaranteed.		Found.	Guaranteed.
	Compound Fertilizers.													
90 502	High Grade Soluble Tobacco Manure,....	6.96	4.86	5-6	1.37	5.23	4.04	10.64	8-10	6.60	6-8		11.42	11-12
102-544	Complete Potato and Veg. Fertilizer, ...	9.55	2.40	2.25-3.25	2.04	4.81	2.71	10.40	10-12	7.75	8-10		6.64	5-6
112 479	High Grade Com. Corn and Onion Manure,	7.73	3.75	3.60	2.62	3.65	4.07	10.34	8	6.27	6		7.39	7
413	Lawn and Garden Fertilizer, ...	14.70	2.39	2.5-3	4.58	3.40	2.61	10.59	6-8	7.98			1.78	5.5-6
563	Complete Animal Fertilizer,............	5.55	3.85	3-4	—	6.40	12.28	18.68	18-19	6.40	6-8		6.16	6-7
41	Essex Rhode Island Special,...........	10.61	3.35	3-3.5	3.88	4.02	3.51	11.41	9-11	7.90	8-9		6.72	6.5-7
58 101 440	Essex XXX Fish and Potash, ...	10.93	2.30	2.1-3	3.84	4.68	4.84	13.36	12-14	8.52	9-11		2.62	2.25-3.25
59 65-435	Essex Com. Man. for Pot., Roots and Veg.,	7.78	3.79	3.7-4.5	6.01	2.82	3.40	12.23	9-11	8.83	7-8		8.70	8.5-10*
62-239	Essex Odorless Lawn Dressing, ...	4.59	1.35	3.7-4.5	2.41	4.32	3.91	10.64	8-10	6.73	6-7		7.58	7-8
72 84-167	Sanderson's Tobacco Formula "B,"	8.73	2.60	3.33-4	.68	6.13	5.42	12.23	10-12	6.81	6-8		8.68	6-8*

*Sulphate of potash, the source of potash.

II. ANALYSES OF COMMERCIAL FERTILIZERS COLLECTED DURING 1904, IN THE GENERAL MARKETS BY THE AGENT OF THE HATCH EXPERIMENT STATION OF THE MASSACHUSETTS AGRICULTURAL COLLEGE.

Laboratory No.	Name of Brand.	Name of Manufacturer.	Sampled at
	Compound Fertilizers.		
85	Sanderson's Formula "A."	Sanderson's Fertilizer and Chemical Co., New Haven, Ct.	No. Hatfield.
168	Sanderson's Formula "A."	Sanderson's Fertilizer and Chemical Co., New Haven, Ct.	Sunderland.
160	Swift, Sure Superphosphate.	M. L. Shoemaker & Co., Philadelphia, Pa.,	No. Hatfield.
248	Swift, Sure Superphosphate.	M. L. Shoemaker & Co., Philadelphia, Pa.,	Sunderland.
9	Wilcox Potato, Vegetable and Onion Manure,	Wilcox Fertilizer Works, Mystic, Conn.,	Seekonk.
27	Wilcox Potato, Vegetable and Onion Manure,	Wilcox Fertilizer Works, Mystic, Conn	Dighton.
150	Wilcox Potato, Vegetable and Onion Manure,	Wilcox Fertilizer Works, Mystic, Conn.,	Amherst.
64	Wilcox Potato Fertilizer,	Wilcox Fertilizer Works, Mystic, Conn.,	Dighton.
109	Wilcox Potato Fertilizer,	Wilcox Fertilizer Works, Mystic, Conn.,	Amherst.
110	Wilcox Fish and Potash,	Wilcox Fertilizer Works, Mystic, Conn.,	Amherst.
147	Wilcox Fish and Potash,	Wilcox Fertilizer Works, Mystic, Conn.,	N. Hadley.
328	Potato Plowman,	Whitcomb & Pratt Rend. Co., Lowell, Mass.,	Reading.
378	Potato Plowman,	Whitcomb & Pratt Rend. Co., Lowell, Mass.,	N. Chelmsford
348	Corn Success,	Whitcomb & Pratt Rend. Co., Lowell, Mass.,	N. Chelmsford
364	Corn Success,	Whitcomb & Pratt Rend. Co., Lowell, Mass.,	Reading.
374	Corn Success,	Whitcomb & Pratt Rend. Co., Lowell, Mass.,	Concord.
527	Special Fertilizer "B. B." Brand,	A. H. Wood & Co., Framingham, Mass.,	Framingham.
527	Special Fertilizer "C. C." Brand,	A. H. Wood & Co., Framingham, Mass.,	Framingham.

Laboratory Number.	Name of Brand.	Moisture.	Nitrogen in 100 lbs.		Phosphoric Acid in 100 lbs.							Potassium Oxide in 100 lbs.	
								Total.		Available.			
			Found.	Guaranteed.	Soluble.	Reverted.	Insoluble.	Found.	Guaranteed.	Found.	Guaranteed.	Found.	Guaranteed.
	Compound Fertilizers.												
85-168	Sanderson's Formula "A,"	9.57	3.50	3.33-4	2.54	4.42	4.71	11.67	9-10	6.96	6-8	6.38	6-8
160-248	Swift, Sure Superphosphate,	8.18	3.09	2.88-4.13	8.10	2.85	2.84	13.79	9-11	10.95	-	4.60	4.5-6
9-27-150	Wilcox Potato, Veg. and Onion Manure,	14.82	3.61	3.3-4.3	6.05	2.10	2.25	10.40	8-10	8.24	7-9	6.62	6-8
64-109	Wilcox Potato Fertilizer,	14.20	2.61	2.05-2.88	2.47	4.26	3.99	10.72	7-8	6.73	6-8	4.98	4.5-5.5
110-147	Wilcox Fish and Potash,	18.24	3.10	2.49-3.29	1.64	3.63	2.69	7.96	6-8	5.27	5-7	3.84	3-5
328-378	Potato Plowman,	5.15	3.29	3.29-4.11	3.04	4.76	2.15	9.95	10-13	7.80	8-10	7.30	7-[illegible]
348-364-374	Corn Success,	6.85	1.89	1.65-2.47	3.15	4.92	2.12	10.40	10-13	8.37	8-10	3.26	3-4
527	Special Fertilizer "B.B." Brand,	12.85	2.19	2.06-2.47	5.28	1.76	.97	8.01	10-12	7.04	7-9	4.75	5-6
528	Special Fertilizer "C.C." Brand,	9.41	3.06	3.30-4.12	7.29	1.77	1.61	10.67	11-13	9.06	9-11	5.18	5-6*

*Sulphate of potash, the source of potash.

TRADE VALUES OF FERTILIZING INGREDIENTS IN RAW MATERIALS AND CHEMICALS FOR 1903 AND 1904.

	1903	1904
	CENTS PER POUND	
Nitrogen in ammonia salts,	17.5	17.5
" nitrates,	15.0	16.0
Organic nitrogen in dry and fine ground fish, meat, blood, and in high-grade mixed fertilizers,	17.5	17.5
" " " fine bone and tankage,	16.5	17.0
" " " coarse bone and tankage,	12.0	12.5
Phosphoric acid soluble in water,	4.5	4.5
" " soluble in ammonium citrate,	4.0	4.0
" " in fine ground fish, bone and tankage,	4.0	4.0
" " in cottonseed meal, castor pomace and wood ashes,	4.0	4.0
" " in coarse fish, bone and tankage,	3.0	3.0
" " insoluble (in water and in neutral citrate of ammonia) in mixed fertilizers,	2.0	2.0
Potash as Sulphate, free from Chlorides,	5.0	5.0
" " Muriate (chloride),	4.25	4.25

The above schedule of trade values was adopted by representatives of the Massachusetts, Connecticut, Rhode Island, Maine, Vermont and New Jersey Experiment Stations at a conference held during the month of March, 1904, and is based upon the condition of the fertilizer market in centers of distribution in New England, New York and New Jersey during the six months preceding March, 1904, and refers to the current market prices, in ton lots, of the leading standard raw materials, which furnish nitrogen, phosphoric acid and potash, and which enter largely into the manufacture of our commercial fertilizers.

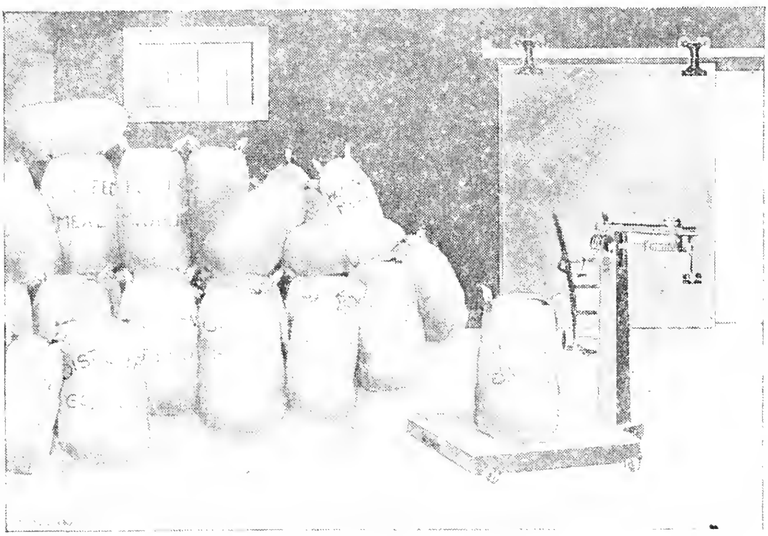
HATCH EXPERIMENT STATION

—OF THE—

MASSACHUSETTS AGRICULTURAL COLLEGE.

BULLETIN NO. 101.

INSPECTION OF CONCENTRATES.



DECEMBER, 1904.

The regular Bulletins of this Station will be sent free to all newspapers in the State and to such individuals interested in farming as may request the same. Technical Bulletins are sent only to those persons interested in the subject treated of in each case.

AMHERST, MASS.:
PRESS OF CARPENTER & MOREHOUSE
1904.

HATCH EXPERIMENT STATION

OF THE

Massachusetts Agricultural College,

AMHERST, MASS.

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William P. Brooks, Ph. D.,	*Agriculturist.*
George E. Stone, Ph. D.,	*Botanist.*
Charles A. Goessmann, Ph. D., LL. D.,	*Chemist* (Fertilizers).
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Edward G. Proulx, B. Sc.,	*Third Assis't Chemist* (Fertilizers).
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Philip H. Smith, B. Sc.,	*Ass't Chemist* (Foods and Feeding).
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Joseph G. Cook, B. Sc.,	*Assistant in Foods and Feeding.*
George O. Greene, M. S.,	*Assistant Horticulturist.*
George W. Patch,	*Observer.*

The co-operation and assistance of farmers, fruit-growers, horticulturists, and all interested, directly or indirectly, in agriculture, are earnestly requested. The Bulletins will be sent free to all newspapers in the State and to such individuals interested in farming as may request the same. General bulletins, fertilizer analyses, analyses of feed-stuffs, and annual reports are published. Kindly indicate in application which of these are desired. Communications may be addressed to the

Hatch Experiment Station, Amherst, Mass.

DEPARTMENT OF FOODS AND FEEDING.

INSPECTION OF CONCENTRATES.

JOSEPH B. LINDSEY.*

CONTENTS.

A. SUMMARY OF THE FEED LAW.

The Massachusetts feed law was published in Bulletin 93, and also as a circular. Copies may be had on application. The following are its chief requirements :

Section 1 defines explicitly the form of guarantee to be attached to all packages of feed stuffs, to wit: Name, brand or trade mark, name and address of manufacturer, importer or dealer, net weight, and percentage of crude protein and crude fat.

Section 2 specifies feed stuffs included in the law.

Section 3 defines feed stuffs exempt from the law.

* With the co-operation of E. B. Holland, P. H. Smith, E. S. Fulton and A. Parsons.

Section 4 states the penalty for violation of the previous sections.

Section 5 mentions the duties of director or deputy with reference to collecting and analyzing samples, and states penalty for interfering with the deputy while engaged in the inspection.

Section 6 declares against the adulteration of whole or ground grain or standard by-products, and fixes penalty.

Section 7 requires the director to prosecute violators of the act.

Sections 8, 9 and 10 define the term importer, state sum to be allowed for carrying out the provisions of the act, etc.

B. DUTIES OF PARTIES CONCERNED.

Duties of Shippers and Retailers.

In the first place, it is the duty of all manufacturers or jobbers shipping into the State to tag or brand their products as required by law. Secondly, the retailers are *responsible* for the proper tagging or branding of feeds they offer. During the past summer and autumn many articles were found entirely unguaranteed, some incompletely guaranteed, and others bearing too high a protein figure. All parties were legally notified, and in case of a subsequent violation are liable to prompt prosecution without further notification. Dealers in purchasing should order goods subject to the requirements of the Massachusetts law.

Business of the Consumer.

At the present time there is a large variety of feeds offered in Massachusetts, and prices have reached a high level. The consumer should note whether the feed he considers purchasing is guaranteed, and if the guarantee corresponds to the feed standard published by the Station. He should examine the material carefully and refuse to accept anything that is mouldy, wormy or appears adulterated. He should be very cautious concerning new feeds, and should ascertain their feeding value before purchasing. The addition of a cheap filler to standard feeds is getting to be altogether too common a practice. Furthermore, it is the business of the consumer to keep his eyes open and his mental faculties on the alert, otherwise he is likely to pay twenty-five dollars for twenty dollars' worth of nutrients, and have only himself to blame for his bad investment.

Duties of the Station.

It is the duty of the Station, so far as the resources permit, to see that all feeds are properly marked, to collect and examine them, in order to note whether they are as represented, and to publish the results for the benefit of all interested parties. The Station stands ready, through correspondence and through the personal services of its regular inspector, to furnish whatever information it may possess concerning the character and nutritive value of all feed stuffs. It desires to promote the best interests of all parties: consumers, local dealers, jobbers and manufacturers. It believes in mutual good will and honest co-operation. The Station aims to be conservative, and to in no way interfere with legitimate trade.

C. RESULTS OF THE PRESENT INSPECTION.

JULY 26 — OCTOBER 15.

I. PROTEIN FEEDS.

Cottonseed, Linseed and Gluten Products. Pages 13-15.

Cottonseed meal. The samples collected were of good color, contained the usual amount of linters and hulls, and while there was no indication of adulteration, several were inferior.

Linseed meal. The various lots of new and old process meal sampled were of fair quality, being free from adulteration and of normal composition, with the exception of one sample of old process meal, which contained an excess of fat (11.04 per cent.).

Gluten meal. There are only two brands of this product offered. The protein content was high, though showing a noticeable variation. There is occasionally a complaint because of the dull color of some shipments or because of a slight rancid odor. The manufacturers assure us that the color depends largely upon the brightness of the corn. Neither of the objections should weigh seriously against the feed.

Gluten feed. As a whole, gluten feed was decidedly lower in protein than at any previous inspection. The protein content of the 22 samples ranged from 19.44 to 26.99, and averaged 23.48 per cent, while the guarantees were from 25.00 to 28.50 per cent. The manufacturers claim this deficiency was due to the incomplete recovery of the partially developed starch granules in the immature corn of the past two seasons. Even if such is the case, it does not excuse a guarantee several per cent. in excess of the actual content. According to present indications, the crop of 1904 will be of better quality. There were no signs of adulteration, unless possibly an excess of hulls in some instances. The dull color of certain lots caused many to look upon the feed with suspicion, though color is not a true index of value. There was no germ oil meal offered.

Distillers' and Brewers' By-Products. Pages 15-16.

Distillers' grains. The samples taken were free from adulteration and of good quality, with the exception of one new brand, which only tested 24.00 per cent. protein. The finer particles contain considerably the more protein. The smoky odor from the kiln drying almost invariably predominated over the acid from the fermentation.

Malt sprouts. The several samples collected had a good protein content, but were not in every case as clean as could be desired. Malt sprouts consist of a mixture in varying proportions of sprouts, barley, barley hulls, weed seeds and ashes. The smaller the amount of the last three constituents, the better the feed.

Brewers' grains were not on the market.

Pure Wheat By-Products. Pages 16-20.

Wheat offal is very generally distributed, and its sale in Massachusetts is probably greater than that of any other feed stuff. The classification of the several flour mill by-products by the various manufacturers and shippers is extremely variable, and evidently not based on any definite standard.

The term *flour middlings* may indicate any material, from the best red dog containing 20 per cent. or more of protein, through the finer and lighter colored of the brown middlings to low grade flours testing less than 13 per cent. of protein. The latter contain an excess of starch, and are not true middlings.

In a similar manner the so-called *standard middlings*, or shorts, have no definite limitations. The best grades following flour middlings contain a considerable proportion of red dog, while the poorer class, in both appearance and analysis, closely resemble finely ground mixed feed or bran.

The samples of unadulterated *mixed feed* collected, showed the usual variations in the proportions of bran and middlings. Generally speaking, the larger the proportion of flour middlings, the higher the percentage of protein and the more valuable the feed. Farmers should examine mixed feed before purchasing, and note if it contains a noticeable quantity of fine material.

It is customary, in many mills at least, to run the screenings, ground or unground, into the mixed feed, and while the practice may not be very objectionable in some instances, still the amount and character of the screenings should determine whether it is permissible or otherwise. *Screenings* consist largely of light wheat, hulls, pieces of straw, oats and weed seeds. The latter constitute a rather large percentage, and are especially objectionable from the possibility of introducing a pest on the farm.

Bran, as a whole, averages cleaner and more uniform than mixed feed, though more or less screenings are occasionally noted, especially chaff and grain hulls. Farmers should refuse an article containing any noticeable amount of such material. Light colored, flaky, so-called Canada bran, contains rather more starch and less protein than the American product.

All wormy, caked and mouldy wheat feeds should be avoided. Purchasers are advised to give preference to those articles that bear the name of a reputable manufacturer or jobber, which are bright and clean, and which have shown a high protein content by previous analyses.

Wheat Feed with Admixtures. **Pages 19-20.**

For a number of years the Station has found more or less wheat mixed feed adulterated with ground corn cobs. During the present season feeds of this character were quite well distributed. They were sold under the special brand names of Blue Grass, Jersey, Dairy, Indiana and Mascot. Other brands are likely to appear at any time. While some were not guaranteed, the larger portion bore a tag stating that the material contained 12.05 per cent. of protein and 3.20 per cent. of fat,* and that it consisted of winter wheat bran, winter wheat shipstuff or middlings, and corn and cob meal. A careful chemical and microscopical examination showed it to consist approximately of

* Genuine mixed feed should contain 16 to 18 per cent of protein and 4.50 per cent fat.

1500 pounds of wheat by-products,—chiefly bran,—and 500 pounds of ground corn cobs. It contained practically no corn. The particular attention of the jobbers was called to this incorrect statement of composition, and they promised a speedy correction in that they would substitute the words *corncob meal* for corn and cob meal. The term corncob meal seemed to be preferred to ground corn cobs, though it is supposed to convey the same meaning. A statement of wheat bran, wheat middlings and corn cob meal, is held by the writer to represent the character of this material, and to be within the letter of section 6 of the Massachusetts feed law. The manufacturers were the Brooks Elevator Co. of Minneapolis; Indiana Milling Co. of Terre Haute, Ind., and A. Waller & Co. of Henderson, Ky. It is believed that this material is now correctly guaranteed.

Another product known as *Peerless mixed feed* was also found, and was guaranteed to consist of spring bran, middlings, red dog flour and re-cleaned ground wheat screenings. An examination showed it to be composed *largely of ground wheat screenings*, with relatively small amounts of corn cobs, oat clippings, wheat bran and middlings. *The consumer can form his own opinion as to its feeding value.* The jobbers have now prepared another guarantee, stating its constituents to be spring bran, middlings, red dog flour, corncob meal, oat clippings and ground wheat screenings. This feed was made by the Brooks Elevator Co. of Minneapolis.

These feeds, *when properly marked*, are perfectly legitimate articles of trade. If the farmer and dairymen desire to buy *ground corn cobs, wheat screenings and oat clippings* at the rate of *$24* to *$26 per ton*, they should certainly be granted the privilege. To sell such mixtures for genuine wheat "mixed feed" is a downright fraud, and parties doing so will be subject to the *full* penalty of the law. The consumer simply asks manufacturers, jobbers and local dealers to "state what they sell and sell what they state." The presence of cobs and like substances can usually be detected by the hard, woody character of the material when chewed.

"Mixed feed" containing white corn, hominy meal, finely ground oats, oat feed or buckwheat flour, are occasionally noted. There is also a tendency this season to add more or less of the inferior shrunken wheat resulting from the ravages of rust. Consumers are cautioned to be on their guard against such deceptions.

Miscellaneous Protein Feeds. Pages 21-22.

Molasses feeds are bulky, and are generally intended to constitute the entire grain ration. Such feeds should be dry, otherwise they will mould and deteriorate rapidly. Moist, sticky feeds are also unpleasant to handle.

Sucrene dairy feed, composed of granulated cane or beet molasses, light oats, malt sprouts and a small quantity of cottonseed and gluten meals, maintained its guarantee and was in good mechanical condition.

Sucrene horse feed is said to be composed of light oats, barley, corn, linseed meal and molasses. The two samples collected exceeded their protein guarantee.

Holstein sugar feed, said to contain 20 per cent. of cane molasses and 10 per cent. of cottonseed meal, was slightly below its protein guarantee.

Blomo feed is composed of ground corn stalks, oat clippings or similar material as a basis, together with blood and molasses. It showed a much lower water content than formerly, which should result in a decided improvement in its keeping quality. Several lots have been found to contain an excess of water, which caused it to spoil rapidly during the summer months. It has been fed satisfactorily at this Station, but the writer can see no economy in its use, otherwise than furnishing a variation from the regular corn and oat diet.

Blatchford's sugar and flaxseed consisted of ground flaxseed and linseed meal, carob bean, cottonseed meal and cereals or cereal by-products. Because of its cost, its use must be quite restricted.

Molasses grains are a sticky feed of a relatively high moisture content and are composed of malt sprouts, beet pulp and molasses. The samples collected were deficient in both protein and fat, and incorrectly guaranteed in one instance.

Oat middlings and the *several rye feeds* were of average quality.

Biles' union grains are a mixture of distillers' grains, malt sprouts, wheat feed, hominy, linseed meal and salt.

H-O dairy feed is composed of oat offal, corn, and wheat feed, fortified with cottonseed meal.

II. Starchy (Carbohydrate) Feeds.

Corn and Hominy Meals.
Pages 32-24.

Corn meal. A noticeable quantity of inferior corn meal has been in the market during the past year, due to the imperfect development of the 1903 crop. This meal frequently contained as high as 20 per cent. of water, which caused it to become rapidly mouldy and dark colored. Corn is purchased for its starchy matter, and slight variations in its protein content—providing it is sweet and of good color—is of minor importance. The new crop, which will soon be on the market (December first) will probably show a decided improvement.

Hominy meal. This feed, in keeping with corn, was rather inferior to that produced in previous years. Positive adulteration was not noticed.

Corn and Oat Feeds. Provender.
Pages 24-25.

There was comparatively little true provender offered. Only four samples, composed of ground oats and corn meal, are reported. The various brands of corn and oat feed collected were of the usual quality, and consisted of oat refuse, corn or hominy meal, and generally slightly fortified with flour middlings. A high fat content is indicative of hominy. Ground peanut waste was found in a number of the mixtures.

Fortified Oat Feeds.
Page 26.

Most of these mixtures consisted largely of oat offal, more or less corn in some instances, with a nitrogenous by-product. Quaker dairy contained cottonseed meal, and Buffalo horse, linseed meal. These feeds show from 2 to 3 per cent. more protein than the corn and oat feeds.

Both corn and oat feeds and fortified oat feeds contain from 800 to 1200 pounds or more of oat offal to the ton. The manufacturers evidently find it more profitable to thus dispose of this material than to attempt to sell it unmixed with other grains. It is very difficult to attempt to express a correct opinion concerning the relative value of these feeds as compared with a good quality of corn or oats, for the reason they are likely to vary considerably from time to time, both in quality of material, as well as in composition. If for any reason they are preferred to the clear grains, the purchaser should select those that seem to have the fewest oat hulls.

Such foods as *zest, force* and *shredded wheat waste* are quite different from oat offal. These materials have evidently been slightly injured by overheating, etc., thus preventing their use as a human food. They are usually free from fiber, and if dry and free from mould, are equal in feeding value to clear corn meal. As a food for chickens these materials probably have even a greater feeding value.

III. Poultry Feeds.

Meat By-Products.
Pages 27-28.

Meat scraps. Scraps are mixtures in varying proportions of flesh, fat and bone. Preference should be given to the more finely ground brands of high protein content (45-50 per cent.), small amounts of bone (ash) and relatively low percentage of fat. Manufacturers are cautioned against misbranding their scraps. Mutton are of light grey color, beef a brown, and horse scraps nearly black. Avoid meat scraps that are tainted. The several samples reported averaged 48 per cent. of protein, 17 per cent. fat and 24 per cent. ash, and were of good average quality. The retail price was about $2.50 a hundred pounds.

Meat and bone meals. These were finely ground animal refuse, averaging lower in both protein and fat, and decidedly higher in ash (bone) than meat scraps. A good grade of this material should contain 35 to 40 per cent of protein. The quality may be regarded as generally satisfactory. The average retail price of $2.00 a hundred may be considered a fair one, in proportion to meat scraps at $2.50 a hundred.

Bone. The protein content of the several samples varied with the method of rendering. The more thorough the steaming, the more complete the removal of the animal matter, and the higher the ash percentage. Lightly steamed or kettle rendered bone is preferable for poultry.

Poultry Meals.
Page 29.

The various samples collected were composed largely of corn, oats, wheat or wheat by-products, buckwheat, and occasionally charcoal and oyster shells. Most of them were slightly fortified with meat and bone meal, dried blood, cottonseed or linseed meals, to increase the protein matter. Among the other products noted in one or two instances, were peanut waste, corn bran and cobs, shredded wheat waste, weed seeds and finely cut hay. The price asked was about $1.75 a hundred pounds. It is believed that poultrymen can prepare equally satisfactory mixtures at a cost not exceeding $1.50 a hundred. Combinations have been suggested in bulletins 93 and 98.

Chick and Scratching Grains.
Pages 29-30.

The chick feeds were composed largely of wheat, corn and millet seed, with more or less Kaffir corn, flaxseed, charcoal and grit. The various coarser mixtures intended for mature fowls contained wheat, corn, oats, buckwheat, Kaffir corn, sunflower seeds, peas, flaxseed, shells, grit and charcoal. The larger the amount of grit present (as expressed in the percentage of determined ash), the less valuable the mixture. Several of these brands contained from 20 to 25 per cent grit and cost $2.50 a hundred. Practically all of these mixtures were of a satisfactory character. Poultrymen ought to be able to make equally as good combinations at a cost of from $1.50 to $2.00 a hundred.

D. ANALYTICAL DATA OF THE INSPECTION.

I. Protein Feeds.

COTTONSEED MEAL.

Manufacturer or Jobber, Brand and Retailer.	Sampled at	Water	Protein. Found	Protein. Guar.	Fat. Found	Fat. Guar.	Fiber.
		%	%	%	%	%	%
American Cotton Oil Co., New York, N. Y.							
A. F. Sanctuary	Amherst	8.38	43.43	43.00	8.95	9.00	—
C. H. Cox	Haverhill	8.40	43.35	43.00	9.41	9.00	—
F. W. Brode & Co., Memphis, Tenn.							
Owl, W. G. Davis Co.	Westfield	8.46	43.96	43.00	8.50	9.00	—
Chas. M. Cox Co., Boston, Mass.							
Magnolia, J. Cushing & Co.	Fitchburg	9.27	43.96	43.00	7.45	9.00	—
Hunter Bros. Milling Co., St. Louis, Mo.							
Morse Bros.	Southbridge	8.48	45.63	43.00	8.83	9.00	—
D. L. Marshall & Co., Boston, Mass.							
Phoenix, F. F. Woodward & Co.	Fitchburg	7.94	42.29	43.00	9.47	9.00	—
Slightly Below Standard.							
Chapin & Co., St. Louis, Mo.							
Green Diamond, E. A. Kellogg & Sons.	Feeding Hills	8.33	41.42	43.00	7.85	9.00	—
Chas. M. Cox Co., Boston, Mass.							
Magnolia, S. A. Eastman	Milford	9.29	38.87	43.00	9.81	9.00	—
Magnolia, W. P. Whittemore	Mt. Hope	9.03	40.01	43.00	9.56	9.00	—
Nat. Cot'nseed Prod. Co., Memphis, Tenn.							
Indian, Geo. B. Pope & Co.	Waltham	9.23	39.80	40-45	7.81	8.5-10	
Average		8.68	42.27	—	8.76	—	

LINSEED MEAL.

Manufacturer or Jobber, Brand and Retailer.	Sampled at	Water	Protein. Found	Protein. Guar.	Fat. Found	Fat. Guar.	Fiber.
1. New Process.							
American Linseed Co., Chicago, Ill.							
Cleveland Flax, C. G. Burnham	Holyoke	10.30	37.51	38-40	3.32	1-3	—
Cleveland Flax, H. A. Crossman	Needham	10.78	38.21	38-40	3.04	1-3	—
D. H. Howard	Ware	10.41	37.60	38-40	3.83	1-3	—
Below Standard.							
American Linseed Co., Chicago, Ill,							
Millbury Grain Co.	Millbury	10.64	36.33	38-40	3.24	1-3	—
Average		10.53	37.41	—	3.36	—	—

LINSEED MEAL — (CONTINUED.)

Manufacturer (Jobber, Broker and Retailer).	Sampled at.	Water.	Protein. Found.	Protein. Guar.	Fat. Found.	Fat. Guar.	Fiber.
2. Old Process.		%	%	%	%	%	%
American Linseed Co., Chicago, Ill.							
C. A. Pierce	Hinsdale	10.60	36.06	32-36	7.07	5-7	—
A. L. Clements & Co., New York, N. Y.							
W. F. Filmore	Three Rivers.	9.41	31.28	32-37.5	6.91	5.5-8.5	9.66
Flint Mill Co., Milwaukee, Wis.							
Green Oval. G. H. Huckins	N. Grafton	10.72	32.38	32-36	7.59	5-7	—
Mann Bros. Co., Buffalo, N. Y.							
D. W. Manvel	Ashley Falls	9.67	34.80	34.15	11.04	6.05	—
Metzger Seed & Oil Co., Toledo, Ohio.							
Cutler Co.	N. Wilbraham	10.83	33.08	30-36	7.28	5-7	—
H. C. Puffer Co.	Springfield	9.62	31.90	32-36	7.87	5-7	—
Wright & Hills Lins'd Oil Co., Chicago, Ill.							
J. S. Nason & Co.	Westboro	10.23	35.62	32-36	7.14	5-7	—
Below Standard.							
Hunter Bros. Milling Co., St. Louis, Mo.							
H. Bruckman	Lawrence	10.32	30.41	34.00	7.26	6.50	—
Average		10.18	33.19	—	7.77	—	—

GLUTEN MEAL.

Glucose Sugar Refining Co., Chicago, Ill.							
Chicago. Potter & Co.	Athol	9.09	41.15	38.00	1.50	3.00	—
Chicago. Hathaway & Mackenzie	New Bedford.	8.96	35.80	38.00	2.05	3.00	—
Chicago. H. P. Howland	Spencer	12.88	36.50	38.00	3.59	3.00	—
Illinois Sugar Refining Co., Chicago, Ill.							
Cream. Bedford Coal & Grain Co.	Bedford	10.41	42.69	35.50	0.92	3.00	—
Cream. Henry Houghton	Wilkinsonville	10.02	39.45	35.50	0.95	3.00	—
Average		10.27	39.12	—	1.98	—	—

GLUTEN FEED.

Glucose Sugar Refining Co., Chicago, Ill.							
Buffalo. W. C. Bliss	Coldbrook	9.36	25.50	27.50	2.63	2.50	—
Buffalo. W. C. Bliss	Coldbrook	10.12	24.04	27.50	2.75	2.50	—
Buffalo. Lummus & Parker	Danversport	9.64	25.71	27.50	2.82	2.50	—
Buffalo. Lummus & Parker	Danversport	10.86	24.35	27.50	3.15	2.50	—
Buffalo. MacKenzie & Winslow	Fall River	10.92	24.13	28.00	3.80	3.00	—
Buffalo. W. H. Smith	Northampton.	10.29	24.92	28.00	3.05	3.00	—
Flint Mill Co., Milwaukee, Wis.							
Flint. A. L. Clark	Leominster	7.90	20.02	27.00	3.44	3.00	—
Flint. G. H. Huckins	N. Grafton	9.73	24.79	27.00	6.10	3.00	—

GLUTEN FEED—(CONTINUED.)

Manufacturer or Jobber, Brand and Retailer.		Sampled at	Water	Protein Found	Protein Guar.	Fat Found	Fat Guar.	Price
			%	%	%	%	%	
Illinois Sugar Refining Co., Chicago, Ill.								
Pekin	G. M. Foster	Lowell	7.07	25.41	28.00	2.70	3.00	—
New York Glucose Co., Edgewater, N. J.								
Globe	Mitchell & Sawyer	Sterling	8.17	26.09	26.00	3.28	2.50	—
Norton-Chapman Co., Boston, Mass.								
Golden Rod	J. Burkhardt	Beverly	10.77	24.13	27.00	5.03	4.00	
St. Louis Syrup & Pres. Co., St. Louis.								
	H. C. Bowen & Son	Cheshire	9.11	25.80	27.50	3.50	2.50	
Below Standard.								
Glucose Sugar Refining Co., Chicago, Ill.								
Buffalo	L. H. Dyer	Belchertown	10.33	23.02	27.50	3.17	2.50	
Buffalo	Haverhill Milling Co.	Haverhill	9.07	22.60	28.00	3.35	3.00	—
Buffalo	W. H. Smith	Northampton	10.86	21.20	28.00	2.03	3.00	—
Buffalo	Albert Culver Co.	Rockland	8.70	20.01	28.00	2.16	3.00	—
Flint Mill Co., Milwaukee, Wis.								
Flint	Geo. B. Pope & Co.	Waltham	10.13	22.64	28.50	2.91	3.00	—
Illinois Sugar Refining Co., Chicago, Ill.								
Chicago	F. J. Hastings & Co.	S. Acton	10.17	22.29	28.00	3.34	3.00	—
National Starch Co., Chicago, Ill.								
Queen	Mackenzie & Winslow	Fall River	10.53	20.49	27.10	1.26	3.20	—
Queen	Mackenzie & Winslow	Fall River	10.55	19.97	25.00	2.11	2.90	—
Queen	F. F. Woodward & Co.	Fitchburg	9.66	22.29	25.00	2.16	2.90	—
Queen	Van Deusen & Foley	Springfield	9.34	19.44	—	2.26	—	—
	Highest		10.92	26.99		6.10	—	—
	Lowest		7.00	19.44	—	1.26	—	—
	Average		9.74	23.48	—	3.05	—	—

DISTILLERS' DRIED GRAINS.

Atlas Feed & Milling Co., Peoria, Ill.								
Atlas	W. A. Haynes Co.	Maynard	7.38	34.40	36.00	14.03	11.50	
J. W. Biles Co., Cincinnati, Ohio.								
Fourex	Potter & Co.	Athol	6.89	31.50	33.00	10.02	11.00	—
Fourex	S. L. Davenport	N. Grafton	7.70	32.73	33.00	11.45	11.00	—
Fourex	Weld & Beck	Southbridge	7.72	34.89	33.00	13.25	11.00	—
Colonial Distillery Co., Trebeins, Ohio.								
	Cutler Co.	Warren	8.92	33.25	33.50	12.17	11.50	—
Chas. A. Krause Grain Co., Milwaukee.								
Blue Ribbon	D. W. Foskett	Brimfield	9.81	34.66	33.00	14.43	11.00	—

DISTILLERS' DRIED GRAINS—(CONTINUED.)

Manufacturer	Jobber, Brand and Retailer.	Sampled at	Water	Protein. Found.	Protein. Guar.	Fat. Found.	Fat. Guar.	Fiber.
			%	%	%	%	%	%
Below Standard.								
Chas. A. Krause Grain Co., Milwaukee.								
Eagle	L. E. Moore	Millington	8.52	24.00	29.00	9.82	11.00	—
J. D. Page & Co., Syracuse, N. Y.								
Empire State	Seth J. Reed	Amherst	7.15	29.48	36.22	11.54	11.76	—
Average			8.01	31.86	—	12.09	—	—

MALT SPROUTS.

Manufacturer	Jobber, Brand and Retailer.	Sampled at	Water	Protein. Found.	Protein. Guar.	Fat. Found.	Fat. Guar.	Fiber.
Chas. M. Cox Co., Boston, Mass.								
	E. F. Wheeler	Stow	13.82	25.89	25-27	1.05	1.5-3	—
Cutler Co., N. Wilbraham, Mass.								
	Marlboro Grain Co.	Marlboro	12.27	26.06	26.00	1.02	1.50	—
D. W. Ranlet, Boston, Mass.								
	Geo. A. Stevens	Worcester	12.32	24.57	23-25	1.12	1-1.5	—
Average			12.80	25.51	—	1.06	—	—

WHEAT MIDDLINGS.

Manufacturer	Jobber, Brand and Retailer.	Sampled at	Water	Protein. Found.	Protein. Guar.	Fat. Found.	Fat. Guar.	Fiber.
1. Flour.								
Bay State Milling Co., Winona, Minn.								
	Arthur D. Potter	Orange	10.15	20.01	—	4.73	—	—
Berger Chittenden Mill. Co., Milwaukee.								
Red Dog	E. D. Smith	Westfield	12.03	17.68	—	3.55	—	—
Hecker-Jones-Jewell Mill. Co., New York								
Fancy	A. M. Reed	N. Westport	11.35	18.42	—	4.32	—	—
Pillsbury-Washburn Co., Minneapolis.								
XX Daisy	G. C. Turner & Co.	Chester	12.28	19.04	—	5.36	—	—
Washburn-Crosby Co., Minneapolis.								
Adrian	J. B. Garland & Son	Worcester	11.57	18.51	—	4.97	—	—
Average			11.48	18.73	—	4.59	—	—
Low Grade Flour.								
Geo. Tileston Milling Co., St. Cloud, Minn.								
Fancy	C. F. Cole	Huntington	12.44	14.66	—	2.76	—	—

WHEAT MIDDLINGS —(CONTINUED.)

Manufacturer or Jobber, Brand and Retailer.	Sampled at	Water	Protein Found.	Protein Guar.	Fat Found.	Fat Guar.	Fiber.
		%	%	%	%	%	%
2. Standard.							
Banner Milling Co., Buffalo, N. Y.							
Banner. .... Frank Dunham..	Sheffield	12.38	16.85		4.58	—	- -
J. G. Davis Co., Rochester, N. Y.							
Clark Bros..	Lenoxdale....	10.09	18.74	—	5.31	—	-
Hecker-Jones-Jewell Mill. Co., New York							
H. B. Chase & Son ...	Hyannis	12.57	18.51	—	4.83	--	--
Morris City Mills, Morris, Minn.							
J. Cushing & Co.......	Fitchburg	11.51	17.99	--	5.21	—	--
New Prague F. M. Co., New Prague, Minn.							
C. S. Barber..........	Bernardston .	11.24	18.07	--	5.39	—	—
Cutler Co.............	N. Wilbraham	10.21	17.29	--	5.69	—	—
Pillsbury-Washburn Co., Minneapolis.							
B............... William Baylies	New Bedford.	11.72	16.32	--	4.84	—	—
Valley City Mill. Co., Grand Rapids, Mich.							
C. A. Pierce	Hinsdale	11.18	17.64	—	4.91	—	—
Washburn-Crosby Co., Minneapolis.							
Flour........... G. C. Turner & Co. ..	Chester	11.88	18.87	-	4.99	—	--
Unknown.							
H. K. Webster Co. ...	Lawrence	12.22	18.21	—	5.89	—	—
Marlboro Grain Co....	Marlboro.....	11.04	18.60	—	5.05	—	—
Canada.......... Arthur D. Potter	Orange........	10.83	18.38	—	6.00	—	--
Below Standard.							
Northwest Consol. Mill Co., Minneapolis.							
Ham & Co..	Woburn.	11.01	15.71	—	4.94	—	—
Valley City Mill. Co., Grand Rapids, Mich.							
F. F. Woodward & Co.	Fitchburg .. .	11.59	15.84	—	4.61	—	--
Highest	....	12.57	18.87	—	6.00	—	--
Lowest	....	10.21	15.71	—	4.58	—	—
Average..............	....	11.52	17.64	—	5.22	—	—
Adulterated.							
Chandler Grain & Milling Co., Lawrence.							
—.* C. A. Ketchum & Co..	Salem	12.79	11.58	-	3.81	--	5.21
Unknown.							
1.*...... Chandler Grain & Milling Co.	Lawrence	12.41	12.69	—	4.10	—	7.67
2.*...... Chandler Grain & Milling Co.	Lawrence	12.79	11.19	—	3.94	—	6.02

*Nearly one-half corn and weed seeds.

MIXED FEED.

Manufacturer or Jobber, Brand or Retailer.		Sampled at	Water	Protein.		Fat.		Fiber.
				Found.	Guar.	Found.	Guar.	
			%	%	%	%	%	%
Acme Milling Co., Indianapolis, Ind.								
Acme	W. C. Bliss	Coldbrook	11.32	16.23	—	4.61	—	—
Acme	A. E. Gilbert	W. Brookfield	10.28	15.62	—	4.30	—	—
American Cereal Co., Chicago, Ill.								
Bluebell	J. Cushing & Co.	Fitchburg	10.21	16.14	—	4.45		—
Buckeye	Thorne Bros.	Millis	10.89	16.19	17.75	4.56	4.70	—
Ansted & Burk Co., Springfield, Ohio.								
	Hale Knight	Newburyport	10.70	15.18	—	4.03	-	—
Charles Broeker & Co., Owensboro, Ky.								
—[1]	E. A. Cowee	Worcester	10.90	16.32	—	4.54	—	—
Chapin & Co., Boston, Mass.								
Edison	F. A. Dodge	Saundersville	10.03	15.97	—	4.62	—	—
Green Diamond	G. F. Green Coal Co.	Campello	10.67	16.10	—	4.83	—	—
	E. C. Packard	Brockton	9.68	15.97	—	3.71	-	—
Chas. M. Cox Co., Boston, Mass.								
Wirthmore	Prentiss, Brooks & Co.	Westfield	10.04	16.14	17.19	4.68	4.5	—
J. Cushing & Co., Fitchburg, Mass.								
—[2]	J. Cushing & Co.	Fitchburg	11.36	15.58	—	4.35	—	—
Geo. T. Evans, Indianapolis, Ind.								
Hoosier	Green River Grain Co.	Greenfield	9.86	15.62	-	4.17	—	—
Flint Mill Co., Milwaukee, Wis.								
Vermont	E. H. Smith	Northboro	10.83	17.60	17.50	4.83	4.70	—
Garland Milling Co., Greensburg, Ind.								
Garland	Edward C. Paull	Taunton	10.65	16.55	—	4.27	—	—
Hunter Bros. Milling Co., St. Louis, Mo.								
Sunshine	C. H. Felker & Co.	Brockton	10.79	15.01		4.22	—	—
Sunshine	Bosworth & Wood	Leominster	11.19	15.23	—	4.40	—	—
Sunshine[3]	C. W. Gifford	New Bedford	9.77	15.32	—	5.89	—	—
Imperial Mill Co., Duluth, Minn.								
Boston	F. E. Brooks	S. Framingham	11.09	16.90	—	4.77	—	—
Lawrenceburg Mills, Lawrenceburg, Ind.								
Snowflake	W. N. Potter's Sons & Co.	Northampton	10.73	17.16		4.72	—	
Lexington Roller Mills Co., Lexington, Ky								
	Eastern Grain Co.	Bridgewater	11.00	15.27	—	4.52	—	—
Louisville Milling Co., Louisville, Ky.								
Eatmore	John Enwright & Son	Fall River	10.56	18.16	-	4.44	—	—
Mackenzie & Winslow, Fall River, Mass.								
Grey Eagle	Mackenzie & Winslow	Fall River	10.50	15.32		4.19	-	-
John F. Meyers & Sons, Springfield, Mo.								
Model	Weld & Beck	Southbridge	9.94	16.06	—	4.80	—	—

[1] A considerable amount of oats and some corn present. [2] Largely bran and screenings. [3] Not a straight wheat feed.

MIXED FEED—(CONTINUED.)

Manufacturer or Jobber, Brand and Retailer.	Sampled at	Water	Protein. Found	Protein. Guar	Fat. Found	Fat. Guar	Fiber.
		%	%	%	%	%	%
R. P. Moore Milling Co., Princeton, Ind.							
King. . . . . James Lally, Jr.	Milford . .	10.90	15.93		4.41		—
Pillsbury-Washburn Co., Minneapolis.							
Fancy. . . . . . Norton & Warren. . .	Warren	10.86	17.99		5.41		—
Rex Mills, Kansas City, Mo.							
Rex. . . . . . . M. C. Richmond, . . .	Adams	10.73	17.16		4.65		
Rex. . . . . . Marlboro Grain Co. .	Marlboro. . . .	11.26	16.28		4.50	—	
Henry Russell, Albany, N. Y.							
Choice. . . . . . J. M. Johnson	Medfield	11.39	17.42	—	4.83	—	—
M. T. Huntington. . . .	Pittsfield	10.59	16.50	—	4.28	—	—
Russell-Miller Milling Co., Minneapolis.							
Occident. . . . . B. W. Brown.	Concord . .	11.67	18.03		5.48		—
Sparks Milling Co., Alton, Ill.							
Try Me. . . . . E. H. Dyer . .	Belchertown	12.46	17.38		4.27	—	—
Star & Crescent Milling Co., Chicago, Ill.							
Eastern Grain Co.	Bridgewater .	10.80	17.20		4.87	—	—
David Stott, Detroit, Mich.							
Honest. . . . . Warner Bros.	Sunderland. . .	10.31	16.72	—	4.73	—	—
Valier & Spies Milling Co., Marine, Ill.							
Valiers'. . . . . Briggs & Co.	Taunton . . .	11.95	16.10		4.79	—	—
Valley City Mill. Co., Grand Rapids, Mich.							
Farmers' Favorite. F. I. Woodward & Co.	Fitchburg	11.45	15.71	—	4.20		—
Webster Mill Co., Webster, S. Dak.							
Dennison Plummer Co.	New Bedford.	11.01	17.55		3.85		—
Below Standard.							
Unknown.							
Royal. . . . . . . J. Wadsworth & Co. . .	Northboro . . .	11.44	14.60	—	3.94	—	—
G. D. Meserve.	Easthampton	11.43	14.57		4.06		—
Highest		12.46	18.16	—	5.89	—	—
Lowest.		9.68	14.57	—	3.71	—	—
Average.		10.84	16.29		4.54		—

WHEAT FEED WITH ADMIXTURES.

Manufacturer or Jobber, Brand and Retailer.	Sampled at	Water	Protein. Found	Protein. Guar	Fat. Found	Fat. Guar	Fiber.
Brooks Elevator Co., Minneapolis, Minn.							
Peerless. . . Chandler Grain & Mill. Co.	Lawrence . . .	11.67	12.25		3.77	—	6.76
Peerless. . . . . Taft Bros.	Uxbridge. . . .	11.89	14.70	15.22	4.41	5.47	12.38
Royal. . . . . E. C. Paull.	Taunton	11.78	10.58	10.01	4.18	5.48	9.14
J. H. Cressey & Co., Boston, Mass.							
Indiana. . . . . Dennison Plummer Co.	New Bedford	9.83	11.63	12.05	2.98	3.20	15.11
Mascot. . . . . Dennison Plummer Co.	New Bedford.	9.33	10.79	12.59	2.93	3.19	16.42

WHEAT FEED WITH ADMIXTURES—(CONTINUED.)

Manufacturer or Jobber, Brand and Retailer.	Sampled at	Water	Protein. Found.	Protein. Guar.	Fat. Found.	Fat. Guar.	Fiber.
		%	%	%	%	%	%
Indiana Milling Co., Terre Haute, Ind.							
Jersey, ...E. J. Adams..........	Gt. Barrington	12.70	14.04	12.05	3.96	3.20	13.24
Jersey, ...J. P. Seabury.........	N. Dartmouth	12.39	10.62	12.05	3.12	3.20	16.62
Jersey, ...Jaquith & Co.	Woburn......	10.01	11.32	12.05	3.59	3.20	14.82
Jersey. ....A. M. Thompson.....	Worcester....	8.78	10.93	12.05	3.04	3.20	16.93
Jennings & Fulton, Boston, Mass.							
Dairy,..........C. H. Cox............	Haverhill.....	10.69	12.25	12.05	3.41	3.20	14.78
Dairy...........C. H. Cox............	Haverhill.....	10.53	15.71	12.05	4.41	3.20	8.10
Dairy,..........E. A. Cowee..........	Worcester....	8.51	11.67	12.05	3.23	3.20	16.59
Dairy,..........E. A. Cowee..........	Worcester....	10.91	11.28	—	3.10	—	15.69
Norton-Chapman Co., Boston, Mass.							
J. W. Doon & Son....	Natick	10.65	11.54	—	3.39	—	15.24
J. H. Nye, Brockton, Mass.							
—.[1] J. H. Nye	Brockton.....	10.38	14.53	—	5.72	—	7.41
Schultz & Baujan, Beardstown, Ill.							
Eagle.[2] ....Briggs & Co..........	Taunton......	9.74	12.40	—	3.63	—	10.82
Eagle.[2] ....G. B. Pope & Co.....	Waltham	9.78	11.98	—	3.71	—	11.37
A. Waller & Co., Henderson, Ky.							
Blue Grass,.....T. J. McDonald	Lowell	9.78	11.45	12.59	2.96	3.19	15.35
Blue Grass,.....Goding Bros..........	N. Easton....	10.33	10.67	12.59	2.72	3.10	15.88
Blue Grass......A. E. Gilbert	W. Brookfield	10.02	10.71	12.59	3.01	3.10	14.96
H. K. Webster Co., Lawrence, Mass.							
Sample,[3] . .... .H. K. Webster Co. ...	Lawrence	12.20	13.95	15.00	4.47	4.00	6.58
Unknown.							
W. W. Thatcher	N. Dartmouth	10.45	11.02	—	2.89	—	16.72

WHEAT BRAN.

Manufacturer or Jobber, Brand and Retailer.	Sampled at	Water	Protein. Found.	Protein. Guar.	Fat. Found.	Fat. Guar.	Fiber.
Glen Mills Cereal Co., Rowley, Mass.							
Glen Mills Cereal Co..	Rowley	11.10	15.14	—	3.49	—	—
Hunter Bros. Milling Co., St. Louis, Mo.							
T. H. Emerson	E. Braintree..	11.23	15.01	—	3.73	—	7.63
H. C. Puffer Co.......	Springfield ...	9.60	14.48	—	3.93	—	—
Pillsbury-Washburn Co., Minneapolis.							
Squire & Co.	Monson	10.92	15.97	—	3.29	—	—
Sparks Milling Co., Alton, Ill.							
Try Me,...... ..E. H. Dyer..........	Belchertown..	12.57	17.25		4.43	—	—
George Urban Milling Co., Buffalo, N. Y.							
C. D. Holbrook Co...	Palmer.......	12.23	15.75	—	4.84	—	—
Average		11.28	15.60	—	3.95	—	—

[1] About one-half hominy meal. [2] Buckwheat flour and corn present. [3] Considerable corn present.

DAIRY FEEDS.

Manufacturer or Jobber, Brand and Retailer	Sampled at	Water	Protein Found.	Protein Guar.	Fat Found.	Fat Guar.	Fiber
		%	%	%	%	%	%
J. W. Biles Co., Cincinnati, Ohio.							
Union Grains. . .S. L. Davenport. . . .	N. Grafton. . .	9.33	24.00	24.00	7.60	7.00	-
H-O Co., Buffalo, N. Y.							
H-O. . . . . .C. P. Washburn.	Middleboro. . .	8.21	18.16	18.00	5.38	4.50	
H-O. . . . . .G. R. Drake.	W. Bridgew'er	8.75	18.47	18.00	4.80	4.50	-

FEEDS CONTAINING MOLASSES.

Manufacturer or Jobber, Brand and Retailer	Sampled at	Water	Protein Found.	Protein Guar.	Fat Found.	Fat Guar.	Fiber
American Milling Co., Chicago, Ill.							
Sucrene Dairy. .City Mills Co..	Holyoke.	12.18	16.19	16.50	3.62	3.50	-
Sucrene Dairy. .Noble Milling Co. . . .	N. Dana	10.50	18.42	16.50	3.28	3.50	
Sucrene Horse. .H. A. Crossman	Needham	11.44	15.88	13.50	2.91	4.50	
Sucrene Horse. .Noble Milling Co. . . .	N. Dana	10.43	17.81	13.50	3.61	4.50	
J. W. Barwell, Waukegan, Ill.							
Blatchford's.[1] . . .Millbury Grain Co . .	Millbury	9.70	27.52	28.25	10.23	11.25	-
J. Bibby & Sons, Liverpool, England.							
Bibby's Cake. . .M. F. Wilbur.	Lexington . . .	10.70	19.00	18.20	7.61	6.8	
Blomo Mfg. Co., New York, N. Y.							
Blomo. . . . . . .B. F. Mills.	Pittsfield . . .	9.84	15.36	15.00	1.27	1.19	-
F. W. Goeke & Co., St. Louis, Mo.							
Holstein. . . . . .B. W. Brown	Concord	10.61	12.99	15.23	2.30	3.27	
E. P. Mueller, Milwaukee, Wis.							
Molasses Grains. Prentice & Son. . . .	Milford	13.43	17.20	21.81	1.70	2.73	-
Molasses Grains. Warner Bros.	Sunderland. . .	17.04	10.13		1.14	-[2]	

OAT MIDDLINGS.

Manufacturer or Jobber, Brand and Retailer	Sampled at	Water	Protein Found.	Protein Guar.	Fat Found.	Fat Guar.	Fiber
Jennings & Fulton, Boston, Mass.							
F. J. Hastings & Co. .	S. Acton	9.46	16.81	17.00	7.23	7.00	
Norton-Chapman Co., Boston, Mass.							
A. H. Wood & Co. . .	Framingham . .	8.79	15.78	--	7.10	-	-
Unknown.							
J. B. Garland & Son .	Worcester. . . .	8.13	15.27		7.45	-	
Average.		8.79	15.95	—	7.26		

[1]Sugar and flaxseed.

[2]Protein and fat 23 per cent.

RYE FEED.

Manufacturer or Jobber, Brand and Retailer.	Sampled at	Water	Protein. Found	Protein. Guar.	Fat. Found	Fat. Guar.	Fiber.
		%	%	%	%	%	%
Bosworth & Wood, Leominster, Mass.							
Bosworth & Wood. . .	Leominster	11.79	15.84	15.00	2.87	3.00	—
Geo. Callanan, Castleton, N. Y.							
G. C. Turner & Co..	Chester .	12.13	14.35	12.00	2.61	2.00	—
Close Bros., Schenectady, N. Y.							
Middlings. . . . . H. K. Webster Co.	. Lawrence	11.10	16.10	15.37	3.09	3.10	—
Cutler Co., N. Wilbraham, Mass.							
Ham & Miller. . . .	. Thorndike .	13.14	14.74	15.00	2.94	3.00	—
Oneonta Milling Co., Oneonta, N. Y.							
Arthur D. Potter .	. Orange. . .	11.30	16.67	14.75	3.33	3.59	—
Average.		11.89	15.54	—	2.97	—	—

CALF MEAL.

J. W. Barwell, Waukegan, Ill.							
Blatchford's. . . . Squire & Co.	. Monson . . .	9.58	24.09	25.00	4.62	5.00	—

II. Starchy (Carbohydrate) Feeds.

OATS.

Manufacturer or Jobber, Brand and Retailer.		Sampled at.	Water	Protein. Found.	Protein. Guar.	Fat. Found.	Fat. Guar.	Fiber.
			%	%	%	%	%	%
Montana	Blake, Sampson & Co.	Worcester	10.23	8.80		5.18	-	9.60
	E. A. Cowee	Hudson	10.00	12.20	-	3.08	--	-
	E. A. Cowee	Hudson	10.66	12.60	-	3.35	-	-
	E. D. Smith	Westfield	9.75	11.80	-	4.43	-	
	Average		10.41	11.39	-	4.01	-	

GROUND BARLEY.

	C. G. Burnham	Holyoke	12.71	9.04	-	1.90	--	

CORN MEAL.

Buffalo Cereal Co., Buffalo, N. Y.								
	G. M. Foster	Lowell	14.05	8.21		3.20	-	
Chandler Grain & Milling Co., Lawrence.								
B.[1]	G. M. Foster	Lowell	12.54	8.86	---	3.20	-	[illegible]
Narragansett Mill Co., E. Providence, R. I.								
	A. M. Reed	N. Westport	13.90	8.47	—	3.18		-
	Henry Houghton	Wilkinsonville	13.77	8.43	-	3.10	—	
White Corn	H. K. Webster Co.	Lawrence	13.83	8.39	--	3.65	-	
	M. G. Williams	Taunton	12.73	8.86	- -	4.00		-
	Average		13.47	8.54		3.30		—

HOMINY MEAL.

American Hominy Co., Indianapolis, Ind.								
	F. E. Smith	Amherst	7.13	10.71	10.24	8.87	7.72	
	Lummus & Parker	Danversport	8.89	10.50	10.24	8.02	7.72	
Buffalo Cereal Co., Buffalo, N. Y.								
Howard's	Briggs & Co.	Taunton	9.55	10.58	10.50	7.23	8.50	
	G. M. Foster	Lowell	9.51	10.23	10.50	7.40	8.50	
Chapin & Co., Boston, Mass.								
Green Diamond	Norton & Warren	Warren	11.13	9.97	10-11	7.23	7-9	
Niagara White	F. A. Dodge	Saundersville	9.39	10.14	10-11	7.10	7-8	
Chas. M. Cox Co., Boston, Mass.								
Wirthmore	F. A. Fales & Co.	Norwood	9.30	10.67	10.5-12	8.53	7.5-9	
Yellow	A. S. Gurney & Co.	Wareham	11.35	10.23	9.5-12	6.84	7.5-9	

[1] Dark colored, musty and of inferior quality.

HOMINY MEAL—(CONTINUED.)

Manufacturer or Jobber, Brand and Retailer.	Sampled at	Water	Protein. Found.	Protein. Guar.	Fat. Found.	Fat. Guar.	Fiber.
		%	%	%	%	%	%
Evans Milling Co., Indianapolis, Ind.							
Evans. ....Cutler Co.....	N. Wilbraham	9.12	11.02	10-12	9.28	7.5-9	—
R. J. Hardy & Sons, Boston, Mass.							
White. ....J. Cushing & Co.	Fitchburg	9.87	10.58	10-12	8.61	7.5-9	—
Hunter Bros. Milling Co., St. Louis, Mo.							
Yellow..........Morse Bros...	Southbridge .	9.12	11.02	10.50	8.90	7.50	—
H. C. Puffer Co........	Springfield ...	5.90	9.52	11.02	6.95	7.70	—
Patent Cereals Co., Geneva, N. Y.							
S. K. Carter....	W. Berlin	9.34	9.79	11.00	7.47	8.00	—
J. E. Soper & Co., Boston, Mass.							
Blue Ribbon. ...M. F. Wilbur.........	Lexington ..	8.10	10.40	11.00	7.72	8.00	—
Suffern, Hunt & Co., Decatur, Ill.							
Clark Bros............	Lenoxdale....	8.81	10.93	11.02	8.74	7.70	—
Toledo Elevator Co., Toledo, Ohio.							
G. H. Huckins,........	N. Grafton. .	9.38	9.83	12.60	7.21	8.57	—
U. S. Furmentum Co., Detroit, Mich.							
Furmentum. ....H. C. Bowen & Son ..	Cheshire	9.91	10.27	10.05	8.17	8.48	—
Below Standard.							
Hunter Bros. Milling Co., St. Louis, Mo.							
D. F. Howard	Ware	9.56	8.91	11.02	6.39	7.70	—
Toledo Elevator Co., Toledo, Ohio.							
Lummus & Parker....	Danversport .	7.53	9.30	12.60	7.48	8.57	—
Highest		11.35	11.02	—	9.28	—	—
Lowest..............................		5.90	8.91	—	6.39	—	—
Average..............................		9.10	10.22	—	7.85	—	—

PROVENDER.

Manufacturer or Jobber, Brand and Retailer.	Sampled at	Water	Protein. Found.	Protein. Guar.	Fat. Found.	Fat. Guar.	Fiber.
Narragansett Mill Co., E.Providence, R.I.							
W. C. S. Wood	E. Norton....	11.26	9.70	9.00	3.51	3.80	—
J. S. Nason & Co., Westboro, Mass.							
J. S. Nason & Co.. ..	Westboro	12.40	10.05		4.02	-	—
E. D. Smith, Westfield, Mass.							
E. D. Smith	Westfield.....	10.68	9.52	—	3.82	—	—
Smith & Northam, Hartford, Conn.							
E. N. Jencks	E. Douglas...	11.12	9.74	9.00	3.72	4.00	—
Average............................		11.37	9.75	—	3.78	—	—

CORN AND OAT FEED.

Manufacturer or Jobber, Brand and Retailer.	Sampled at.	Water.	Protein. Found.	Protein. Guar.	Fat. Found.	Fat. Guar.	Fiber.
		%	%	%	%	%	%
American Cereal Co., Chicago, Ill.							
C. . . . . R. W. Renfrew & Son	Pittsfield	10.73	8.08	—	2.50	—	—
Victor, ... W. N. Potter & Sons	Greenfield	9.22	8.34	9.00	3.24	4.00	—
Victor, ... A. B. Bacon	Spencer	9.12	7.77	9.00	2.93	4.00	—
Schumacher's, . . G. R. Hastings & Son	Boylston	11.25	10.23	13.00	2.75	5.00	10.72
Schumacher's, . . S. D. Viets Co.	Springfield	10.06	10.70	13.00	3.23	5.00	—
A. B. Bacon, Spencer, Mass.							
Blue Ribbon, . . . A. B. Bacon	Spencer	9.98	10.32	11.60	3.64	4.60	—
Buffalo Cereal Co., Buffalo, N. Y.							
XXX . . . . Tyler Grain & Coal Co.	Hyde Park	8.24	10.32	9.00	4.43	4.00	—
J. Burkhardt, Beverly, Mass.							
Horse feed, ... J. Burkhardt	Beverly	9.36	9.30	8.00	5.81	4.12	
W. G. Davis Co., Westfield, Mass.							
Mixed feed, ... W. G. Davis Co.	Westfield	11.44	9.09	—[1]	3.81	—[1]	
F. Diehl & Son, Wellesley, Mass.							
Provender, ... F. Diehl & Son	Wellesley	8.87	7.95	8.00	3.59	3.00	
Edward Ellsworth Co., Buffalo, N. Y.							
De Fi, ... A. B. Bacon	Spencer	7.82	8.65	8.30	3.51	3.00	—
Great Western Cereal Co., Chicago, Ill.							
Boss, ... Van Deusen & Foley	Springfield	8.20	8.82	9.00	5.23	4.00	—
Durham, ... Taft Bros.	Uxbridge	9.80	8.86	7.94	3.03	3.92	—
W. H. Haskell & Co., Toledo, Ohio.							
Haskell's Stock, . Frank Knight	Charlton Depot	8.37	10.14	10.00	7.30	6.25	—
H O Co., Buffalo, N. Y.							
N. E. Stock, . . . G. F. Green Coal Co.	Campello	9.57	10.36	10.00	5.58	4.00	—
N. E. Stock, . . . Jaquith & Co.	Woburn	9.02	10.01	10.00	4.35	4.00	—
C. D. Holbrook Co., Palmer, Mass.							
C. D. Holbrook Co.	Palmer	8.01	9.13	2.50[2]	6.43	2.50[2]	
Husted Milling & Elevator Co., Buffalo.							
Monarch Chop, . F. A. Sherwin	Groton	9.68	8.51	8.09	4.50	4.16	—
Monarch Chop, . Sprague & Williams	S. Framingham	10.09	8.56	8.09	4.54	4.16	—
Strong-Lefferts Co., New York, N. Y.							
Lenox, ... City Mills Co.	Holyoke	10.34	7.81	9.88	3.57	3.27	—
Highest		11.44	10.79	—	7.30	—	—
Lowest		7.82	7.77	—	2.50	—	—
Average		9.46	9.15	—	4.24		

[1]Custom mixed.

[2]Improperly guaranteed.

FORTIFIED OAT FEED.

Manufacturer or Jobber, Brand and Retailer.	Sampled at.	Water.	Protein. Found.	Protein. Guar.	Fat. Found.	Fat. Guar.	Fiber.
		%	%	%	%	%	%
American Cereal Co., Chicago, Ill.							
Quaker Dairy.... M. T. Huntington ...	Pittsfield	7.28	13.77	14.00	4.30	3.50	—
Quaker Dairy.... Seymour & McDonald	S. Lancaster ..	9.47	10.44	14.00	2.69	3.50	20.10
Buffalo Cereal Co., Buffalo, N. Y.							
Horse.......... E. A. Briggs & Co. ...	Attleboro	8.91	12.46	12.00	4.22	4.50	—
Horse.......... E. A. Cowee	Worcester....	8.65	11.67	12.00	5.03	4.50	—
Green River Grain Co., Greenfield, Mass.							
O. K. Horse..... Green River Grain Co.	Greenfield....	9.93	12.46	12.00	5.35	4.25	—
H-O Co., Buffalo, N. Y.							
H-O Horse...... Evans & Bowker	Baldwinsville	9.00	11.67	12.00	4.71	4.50	—
H-O Horse...... S. D. Viets Co........	Springfield ...	9.77	12.73	12.00	5.19	4.50	—
H-O Horse...... F. A. Lincoln & Co ..	Worcester....	9.93	12.42	12.00	4.06	4.50	—
J. B. Garland & Son, Worcester, Mass.							
A. Red Tag. .. H. P. Howland	Spencer	8.15	11.41	12.75	3.82	3.50	—
B. Red Tag. .. J. B. Garland & Son ..	Worcester	8.55	9.79	10.50	3.94	3.25	—
Average.............................		8.96	11.88	—	4.34	—	—

OAT FEED.

Great Western Cereal Co., Chicago., Ill.							
Friends. .... G. H. Wilbur.........	E. Wareham .	8.53	7.15	8.00	3.00	3.00	—
Below Standard.							
Unknown.							
J. B. Garland & Son ..	Worcester....	6.23	3.56	—	1.45	—	—

MISCELLANEOUS STARCHY FEEDS.

American Cereal Co., Chicago, Ill.							
Zest waste...... W. W. McIntyre ...	Marlboro.....	11.61	9.97	—	1.57	—	—
Jennings & Fulton, Boston, Mass.							
Force waste. ... F. J. Hastings & Co...	S. Acton	8.49	13.04	11-12	3.65	1-2	—
Natural Food Co., Niagara Falls, N. Y.							
Shredded wheat waste, Thorne Bros. ..	Millis	10.08	12.46	10-12	1.88	2.00	—
Pratt Cereal Oil Co., Decatur, Ill.							
Germaline...... Albert Culver Co.	Rockland	11.41	12.81	12.90	2.36	1.29	—
Alma Sugar Co., Alma, Mich.							
Dried mol.-beet pulp. A. N. Whittemore..	Worcester....	9.68	9.65	9.00	0.63	0.48	—
A. H. Brown & Bros., Boston, Mass.							
Dried Grains.... F. J. Hastings & Co...	S. Acton	9.31	12.29	14.00	3.58	3.50	—

III. Poultry Feeds.

MEAT SCRAPS.

Manufacturer or Jobber, Brand and Retailer	Sampled at	Water	Protein Found	Protein Guar.	Fat Found	Fat Guar.	Ash
1. Beef.			%	%	%		%
American Agricultural Chemical Co., N.Y.							
G. F. Green Coal Co.	Campello	9.48	55.46	40.00	14.80	15.00	18.05
Howe Bros.	Gardner	8.82	49.31	40.00	12.77	15.00	26.48
City Mills Co.	Holyoke	11.91	54.58	30.00	14.31	8.00	17.88
Beach Soap Co., Lawrence, Mass.							
Haverhill Milling Co.	Haverhill	7.69	49.22	60.00	17.96	20.00	21.49
L. B. Darling Fert. Co., Pawtucket R. I.							
Melvin Parker	W. Barnstable	7.76	50.80	50.00	10.50	16.00	24.63
John C. Dow Co., Boston, Mass.							
Hawes & Pierce	Foxboro	10.24	44.42	50.55	15.13	15-17	27.49
G. E. Fassett, Beverly, Mass.							
G. E. Fassett	Beverly	10.87	64.10	58.62	17.56	10-19	7.38
Hinckley Rend'g Co., Somerville, Mass.							
A. H. Wood & Co.	Framingham	5.62	46.46	30-35	12.73	10-15	29.73
Lowell Fertilizer Co., Boston, Mass.							
Swift's. J. M. Johnson	Medfield	8.22	45.10	40-50	15.14	15-20	27.22
Geo. E. Marsh Co., Lynn, Mass.							
C. A. Ketchum & Co.	Salem	8.48	52.04	45-55	14.18	10-15	22.21
Mason Mfg. Co., Woonsocket, R. I.							
Cutler Co.	S.Framingham	5.33	46.24	45.00	20.76	18.58	16.46
Joseph Spellman & Co., Providence, R. I.							
Griffin Bros.	Fall River	9.48	59.80	55.00	13.15	12.00	18.36
J. A. Torrey, Rockland, Mass.							
1. J. A. Torrey	Rockland	10.75	48.39	45.00	19.88	22.00	24.87
2. J. A. Torrey	Rockland	8.25	44.62	—	19.09	—	24.63
H. K. Webster Co., Lawrence, Mass.							
H. K. Webster Co.	Lawrence	8.02	52.73	55.00	18.94	12.00	17.40
Whitman & Pratt Ren. Co., Lowell, Mass.							
J. Cushing & Co.	Hudson	6.35	38.13	30-35	24.53	10-15	29.51
Sanford Winter, Brockton, Mass.							
Sanford Winter	Brockton	5.20	37.29	33-38	25.45	23-26	21.15
2. Mutton.							
G. E. Fassett, Beverly, Mass.							
G. E. Fassett	Beverly	7.46	37.34	35.40	14.78	10-15	36.38
N. E. Dressed Meat and Wool Co., Boston							
Cummings, Chute & Co.	Woburn	7.14	37.64	35-41	14.80	10-17	36.88
Highest		11.91	64.10	—	25.45	—	36.88
Lowest		5.20	37.29	—	12.73	—	7.38
Average		8.27	48.09	—	17.01	—	24.16

MEAT AND BONE MEAL.

Manufacturer or Jobber, Brand and Retailer.	Sampled at	Water	Protein. Found.	Protein. Guar.	Fat. Found.	Fat. Guar.	Ash.
		%	%	%	%	%	%
American Agricultural Chemical Co. N. Y.							
Bradley's. ...... Potter & Co.	Athol	6.40	37.78	30.00	10.44	8.00	43.24
Beach Soap Co., Lawrence, Mass.							
John Shea............	Lawrence	4.13	24.27	26.00	10.03	10.00	55.92
Joseph Breck & Sons, Boston, Mass.							
Wallace Bros.........	Clinton.......	7.01	28.17	32-35	9.09	10-12	44.70
Chicopee Rend'g Co., Springfield, Mass.							
O. K........... L. E. Moore..........	Millington ...	14.46	36.06	27-30	15.52	12-15	31.34
Lowell Fertilizer Co., Boston, Mass.							
Swift's.......... City Mills Co..........	Holyoke......	6.49	44.49	40-50	12.34	8-15	31.73
Swift's.......... J. B. Cover & Co......	Lowell.	6.51	46.90	40-50	12.39	8-15	29.31
Swift's.......... Prentice & Son.........	Milford	7.21	46.07	40-50	12.13	8-15	30.92
Worcester Rend'g Co., Auburn, Mass.							
H. P. Howland.......	Spencer	6.17	36.42	5.7[1]	12.29	—	41.02
Average.............	....	7.30	37.52	—	11.78	—	38.52

FISH.

Russia Cement Co., Gloucester, Mass.							
Essex....... Chandler Grain & Mill. Co.	Lawrence	8.05	43.57	8-10[2]	1.71	—	43.68

BONE.

C. A. Bartlett, Worcester, Mass.							
Raw, ... E. H. Smith..........	Northboro ...	8.81	24.04	20-25	0.34	4-4	65.15
Beach Soap Co., Lawrence, Mass.							
Meal, ... John Shea............	Lawrence	2.76	10.88	10.00	5.87	8.00	76.75
Lowell Fertilizer Co., Boston, Mass.							
Swift's.......... J. B. Cover & Co......	Lowell	6.42	22.42	10-15	5.84	5-10	62.54
J. A. Torrey, Rockland, Mass.							
J. A. Torrey..........	Rockland	7.25	17.72	—	2.34	—	67.99
Average.............	....	6.31	18.77	—	3.60	—	68.11

[1] As ammonia equivalent to 25.71 to 35.07 per cent protein.
[2] As nitrogen equivalent to 50.02 to 62.50 per cent protein.

POULTRY MASH AND MEAL.

Manufacturer or Jobber, Brand and Retailer.	Sampled at	Water	Protein. Found.	Protein. Guar.	Fat. Found.	Fat. Guar.	Ash.
		%	%	%	%	%	%
American Cereal Co., Chicago, Ill.							
Cyrus Jones	W. Lynn	10.85	13.77	14.00	6.13	4.50	3.12
J. W. Barwell, Waukegan, Ill.							
Blatchfords.[1] ... C. P. McClanathan ...	Barre Plains..	7.58	32.00	33.00	6.85	10.00	24.74
J. W. Day & Co., Lynn, Mass.							
Meat Mash, ... Butman & Cressey	Lynn	10.43	16.32	11.50	4.44	3.50	6.94
Meat Mash, ... J. W. Day & Co.	Lynn	10.47	14.26	11.50	3.94	3.50	6.01
C. H. Felker & Co., Brockton, Mass.							
O. K. .... Burbeck & Brett	N. Abington ..	11.62	14.17	15.67	4.44	3.03	3.95
Greene Chicken Feed Co., Marbleh'd, Ms.							
Greene's Mash, .Curley Bros.	Wakefield ...	10.34	10.02	12.00	6.13	2.00	2.84
H-O Co., Buffalo, N. Y.							
H-O .... Lawrence Bros.	Falmouth	11.38	16.76	17.00	5.00	5.50	2.39
William Parry, Lynn, Mass.							
William Parry	Lynn	11.80	15.27	—	1.62	—	2.77
Puritan Poultry Farms & Mfg. Co., N. Y.							
Puritan Lay. Stock, W. A. Haynes Co.	Maynard	10.08	11.63	12.00	4.83	5.50	6.04
Ropes Bros., Salem, Mass.							
Hash, ... Ropes Bros.	Danvers	9.75	18.60	18.00	3.42	4.00	5.17
Tyler Grain & Coal Co., Hyde Park, Mass.							
Soft Food, ... Tyler Grain & Coal Co.	Hyde Park ...	9.32	12.64	11.32	6.35	3.47	4.04
Average		10.33	16.06	—	4.83	—	6.18

CHICK AND SCRATCHING GRAINS.

Manufacturer or Jobber, Brand and Retailer.	Sampled at	Water	Protein. Found.	Protein. Guar.	Fat. Found.	Fat. Guar.	Ash.
Bryant & Soule, Middleboro, Mass.							
Chicken, ... Bryant & Soule	Middleboro ...	10.96	9.04	7.00	3.59	2.00	13.70
Bryant & Soule	Middleboro ...	12.54	11.41	9.00	3.03	2.00	1.83
O. B. Burnham, Beverly, Mass.							
O. B. Burnham	Beverly	11.26	10.58	—	2.87	—	9.28
W. F. Chamberlain, St. Louis, Mo.							
Perfect Chick... F. E. Cousins & Co. ..	Lincoln	10.12	11.89	14.06	2.79	2.93	23.10
Daniels Mill Co., Hartford, Conn.							
Chick .... Dresser Hull Co.	Lee	10.19	8.16	11.00	2.05	3.10	18.90
A. B. Miner	Chicopee ...	12.34	11.67	—	3.17	—	1.74
T. W. Emerson Co., Boston, Mass.							
Chick .... M. H. Cushing & Co. .	Middleboro ...	8.85	11.58	9.50	4.19	4.50	5.23
M. H. Cushing & Co. .	Middleboro ...	12.45	12.90	12.50	3.20	2.50	2.70

[1] Poultry meats.

CHICK AND SCRATCHING GRAINS—(CONTINUED.)

Manufacturer or Jobber, Brand and Retailer.	Sampled at	Water	Protein. Found.	Protein. Guar.	Fat. Found.	Fat. Guar.	Ash.
		%	%	%	%	%	%
G. E. Fassett, Beverly, Mass.							
Chicken. ....G. E. Fassett.........	Beverly	13.01	12.55	12.00	3.66	4.00	3.60
Greene Chicken Feed Co., Marblehead.							
Chicken..........C. A. Ketchum & Co..	Salem	12.49	11.06	14.00	4.16	3.00	2.10
H-O Co., Buffalo, N. Y.							
Lawrence Bros.........	Falmouth ...	11.82	11.76	12.00	4.44	3.00	1.78
Mackenzie & Winslow, Fall River, Mass.							
R. I. Chick,.....John Notter..........	New Bedford.	11.91	9.88	8-10	2.29	2-3	11.75
W. W. McIntyre, Marlboro, Mass.							
W. W. McIntyre......	Marlboro	12.01	9.48	—	2.58	—	12.09
Puritan Poultry Farms & Mfg. Co., N. Y.							
Laying Stock. ..John Shea	Lawrence	9.75	9.44	8.50	3.50	2.50	21.42
A. M. Thompson, Worcester, Mass.							
Chicken,.. ......A. M. Thompson.....	Worcester....	10.48	8.86	—	3.75	—	18.47
Highest	....	13.01	12.99	—	4.44	—	23.10
Lowest	....	8.85	8.16	—	2.05	—	1.74
Average.............	....	11.35	10.69	—	3.28	—	9.85

CLOVER MEAL.

Manufacturer or Jobber, Brand and Retailer.	Sampled at	Water	Protein. Found.	Protein. Guar.	Fat. Found.	Fat. Guar.	Ash.
Joseph Breck & Sons, Boston, Mass.							
—,[1]...............M. F. Wilbur.........	Lexington ...	9.23	10.58	11.00	1.75	1.50	—
Jordan Milling Co., Jordan, N. Y.							
Hale Knight	Newburyport	9.15	10.67	11.00	1.88	2.00	—

[1] Alfalfa and white cut clover.

E. AVERAGE COMPOSITION OF CONCENTRATES.

The following analyses are of samples collected during the past few years, and may be held to represent the present average composition of these feeds.

FEED STUFF.	No. of Samples.	Composition.					
		Water.	Ash.	Protein.	Fiber.	Nitrogen-free extract.	Fat.
		%	%	%	%	%	%
I. PROTEIN FEEDS.							
Cottonseed meal	285	7.0	6.6	45.5	6.3	24.3	10.3
N. P. linseed meal	46	9.0	5.4	37.5	8.9	36.5	2.7
O. P. linseed meal	96	8.5	5.2	34.4	8.6	36.6	6.7
Gluten meal	99	9.0	1.0	35.8	2.2	49.9	2.1
Gluten feed	110	8.5	1.7	26.5	7.2	53.1	3.0
Germ oil meal	24	9.0	2.9	22.1	9.3	46.5	10.2
Distillers' dried grains	19	8.0	1.7	33.0	13.1	32.4	11.8
Malt sprouts	7	11.0	5.8	27.1	11.9	42.6	1.6
Brewers' dried grains	5	8.0	3.8	23.1	10.8	49.4	4.9
Wheat middlings (flour)	90	10.0	3.2	19.4	3.1	59.5	4.8
Wheat middlings (standard)	279	10.0	4.3	18.0	7.0	55.7	5.0
Mixed feed	670	10.0	5.3	17.1	8.2	54.9	4.5
Wheat bran	359	10.0	6.1	16.3	10.0	53.2	4.4
H-O dairy feed	17	8.0	3.6	18.3	12.7	53.4	4.0
II. STARCHY FEEDS.							
Ground oats	3	12.0	3.3	11.4	8.7	60.8	3.8
Ground wheat	1	12.0	1.9	12.1	2.9	69.2	1.9
Barley meal	5	13.0	2.3	11.3	5.7	65.8	1.9
Corn meal	56	14.0	1.4	9.5	1.9	69.9	3.3
Corn and cob meal	37	11.0	1.4	8.9	6.7	68.4	3.6
Hominy meal	75	9.0	2.5	10.7	4.0	65.8	8.0
Corn and oat feed	95	10.0	3.2	8.9	10.5	63.9	3.5
H-O horse feed	16	9.0	3.2	12.5	9.8	62.1	3.4
Quaker dairy feed	41	8.0	4.6	13.2	16.8	54.3	3.1
Schumacher's stock feed	29	8.0	4.1	11.5	11.4	60.4	4.6
Oat feed	124	7.0	5.4	7.7	22.0	55.1	2.8

F. DIGESTIBILITY OF CONCENTRATES.

The figures in the following table are percentages or pounds in a hundred. Moving the decimal point two places to the left gives the nutrients in *one pound* of the feed.

FEED STUFF.	Digestibility. Dry Matter.	Protein.	Fiber.	Nitrogen—free extract	Fat.
	%	%	%	%	%
I. PROTEIN FEEDS.					
Cottonseed meal	70.7	40.0	2.0	15.6	9.6
N. P. linseed meal	71.0	32.0	7.0	31.6	2.4
O. P. linseed meal	72.3	30.8	4.9	28.7	5.6
Gluten meal	79.2	31.5	—	44.9	2.0
Gluten feed	77.8	23.0	5.5	47.2	2.5
Germ oil meal	69.2	16.2	8.8	35.4	9.9
Distillers' dried grains	74.5	22.4	8.0	26.0	10.3
Malt sprouts	59.6	21.7	10.0	29.0	1.6
Brewers' dried grains	55.7	18.2	15.7	28.7	4.5
Wheat middlings (flour)	74.7	16.5	1.1	52.8	4.1
Wheat middlings (standard)	—	14.5	2.3	45.0	4.3
Wheat bran	55.8	12.7	2.9	36.6	3.0
H-O dairy feed	59.8	14.3	5.2	37.4	3.4
Rye feed	73.0	10.5	--	9.3	2.3
II. STARCHY FEEDS.					
Ground oats	61.6	8.9	2.3	46.8	3.2
Barley meal	—	7.9	—	60.5	1.7
Corn meal	83.2	6.5	—	66.4	3.0
Corn and cob meal	75.1	5.0	3.1	60.2	3.0
Hominy meal	73.7	7.1	2.2	55.5	7.6
Corn and oat feed	67.5	6.3	5.0	53.0	3.0
H-O horse feed	67.3	9.3	3.4	49.1	2.9
Quaker dairy feed	57.0	9.5	9.2	29.5	2.4
Oat feed	43.7	5.3	7.3	28.0	2.5

A feed is valuable as a source of nutrition, only in so far as its various parts can be digested and assimilated. For example, the analyses of 285 samples of cottonseed meal showed an average of 45.5 per cent. of protein, of which a cow is capable of digesting 88 per cent., equivalent to 40 per cent. of the meal. In like manner the animal can digest 64 per cent. of the 24.3 of starchy matter present, equivalent to 15.6 per cent. of the meal. The digestibility of all the important concentrates has been determined by many carefully conducted and oft repeated experiments, and the above table gives a condensed summary of the results.

The dairyman, in making an intelligent and economical selection of the relatively expensive concentrates, should not only know the amount of protein, fat and carbohydrates which such feeds contain, but likewise the percentages actually digestible, and consequently available for the production of milk and flesh. In general, it may be said that the cereals and the standard by-products have an even composition and a high digestibility. Feed mixtures of uncertain make-up are likely to contain considerable fiber and smaller amounts of digestible matter.

G. CONCENTRATED "POINTERS" ON CONCENTRATED FEEDS.

Protein Feeds.

Cottonseed meal, even at present prices—$30 a ton—is the cheapest form in which protein can be obtained. Two pounds are a safe daily allowance for dairy animals, mixed with some bulky feed, such as bran, malt sprouts or dried molasses-beet-pulp. It is also rich in phosphoric acid (2.50 per cent.) and potash (1.80 per cent.), which means a better quality of manure.

Linseed meal (30 per cent. digestible protein) acts as a gentle laxative, and is safe for all kinds of stock. It is usually too expensive to be used for ordinary purposes. It is very satisfactory for sheep and growing lambs. Its nutritive value is some 10 per cent. less than cottonseed. The old and new process meals do not vary much in feeding value.

Gluten meal, likewise a very digestible protein concentrate (31.5 per cent. digestible protein) ranks with linseed meal in nutritive value. Two to three pounds daily is the usual amount to be fed, mixed with more bulky feeds containing less protein.

Distillers' dried grains, the kiln dried residue from the manufacture of alcohol, spirits and whiskey from the several cereals, is also an economical protein feed. It has the advantage of being bulky, and ranks quite closely in feeding value to gluten feed.

Gluten feed is a mixture of gluten meal, corn hulls and broken corn germs. The feed has a high digestibility, and contains 22 per cent. of digestible protein. It is considered one of the very best feeds for milk production, and at the market prices usually prevailing, is almost always an economical concentrate. Three to four pounds (2½ to 3½ quarts) can be fed daily mixed with bran, malt sprouts or other bulky feeds.

Malt sprouts are not palatable, and when used should always be in a grain mixture. They are quite bulky, and will serve as a satisfactory diluter of the heavier concentrates. They may be fed dry as one-quarter of the daily grain ration, and at ordinary market prices may be regarded as an economical feed. They absorb large quantities of water, and should always be thoroughly moistened if over two pounds are fed daily.

Wheat by-products—middlings, mixed feed and bran—are among the most popular feeds offered.

Fine or flour middlings possess about 25 per cent. greater feeding value than bran. They are quite desirable for swine and young stock, and as a constituent of grain mixtures for milk production. The Station has had good results by feeding milch cows equal parts by weight of flour middlings and distillers' dried grains.

Mixed feed—bran and middlings—varies noticeably in both feeding and commercial value. The larger the quantity of fine middlings present, the more valuable the feed. Some so-called mixed feed contains scarcely any middlings. The best grades are probably worth about one dollar a ton more than bran. If such a feed is preferred, the dairyman may often find it to his advantage to purchase the bran and flour middlings separately and mix by weight three parts of bran and one part of middlings.

Wheat bran is only 62 per cent. digestible, has 12.5 per cent. of digestible protein, and from the standpoint of nutrition cannot otherwise be regarded than as an expensive feed. It is, however, palatable, slightly laxative, and forms a most excellent feed with which to mix the heavier concentrates. Many large milk producers prefer to use one-third and even one-half bran in their grain mixtures. It is quite possible to dispense with bran by making combinations of distillers' grains, malt sprouts, flour middlings and corn meal. Small producers, who presumably can look after the feeding of their stock, may use silage or cut hay as a distributer in place of bran. Mixtures of cottonseed, fine middlings and corn meal may thus be fed without injurious effect.

Rye feed, a mixture of rye bran and rye middlings, is at least equivalent to standard wheat middlings in feeding value.

Oat middlings are a valuable feed stuff, and worth probably as much as the best grades of wheat flour middlings.

Proprietary or *prepared protein feeds* are fairly well distributed. They frequently consist of oat offal as a basis, fortified with cottonseed meal, red dog flour and the like. Most of these feeds are expensive.

Molasses feeds are frequently met with, and are likely to be quite freely offered in the future. Those thus far examined consist of oat offal, light oats, malt sprouts and molasses, brought into a merchantable condition. The Station is making a study of these feeds, but is hardly prepared, as yet, to express any positive opinion as to their relative values.

Carbohydrate Feeds.

Corn meal is 89 per cent. digestible, and is unquestionably the standard starchy feed. Its market price is largely determined by the size and condition of the Western corn crop.

Feed barley is likewise a valuable and economical starchy feed stuff. It is considered the best grain for horses, oats only excepted. It can also be used satisfactorily for swine and dairy stock.

Hominy meal or *chop*, sometimes called white meal, is a kiln dried by-product from the manufacture of hominy, and consists of the hull, germ and the softer starchy parts of the corn kernel. In common with many other by-products, different lots vary more or less in feeding value. It is more bulky than corn meal, and can be used with excellent satisfaction for dairy stock, swine and horses. Recent investigation at this Station tends to show that ton for ton it is likely to prove about equal in nutritive value to well-cured corn meal. Because of its dry condition it will not heat as does the latter feed stuff.

Oats, also a carbohydrate feed, have rather more protein, noticeably more fiber, and some 20 per cent. less digestible starchy matter than corn. Experience has proved them to be the most satisfactory horse feed. They can hardly be regarded as valuable a starchy feed as corn meal.

Corn and oat feeds and *fortified oat feeds*. In most cases the writer believes the consumer will get more for his money by purchasing straight corn, hominy and barley meals, or good oats, in preference to these mixtures.

H. THE COST OF DIGESTIBLE PROTEIN.

The wise dairyman will make the farm produce the greater part, if not all, of his starchy feeds, and as much as possible of the protein needed. He will supplement his home grown fodders by purchasing feeds rich in protein. The following table is intended to show the cost of a pound of digestible protein in the more prominent concentrates. The ton prices given are average wholesale quotations for the month of October. To obtain retail figures, add 10 to 20 per cent.

FEED STUFF.	Ton Price.	Cost of Protein, allowing for Carbohydrates. (cts. a lb.)	Cost of Protein, not allowing for Carbohydrates. (cts. a lb.)
Cottonseed meal	26.70	2.37	3.35
Linseed meal	26.75	2.92	4.34
Gluten meal	28.25	2.76	4.48
Gluten feed	24.95	3.00	5.42
Distillers' dried grains	25.25	3.22	5.64
Malt sprouts	20.00	3.00	4.61
Flour middlings (red dog)	25.70	4.00	7.80
Standard middlings	23.00	4.08	7.93
Wheat bran	21.00	4.74	8.27
Oats	24.00	7.69	13.48
Corn meal	24.25	7.40	18.65
Hominy meal	24.00	6.56	17.00

In the first case, ½ cent was allowed for a pound of digestible fiber, 1 cent for a pound of extract matter and 2¼ cents for a pound of fat. In the second case, no credit was given for these ingredients, because it is argued that the farmer purchases the feeds for the protein contained in them.

The teaching is the same whichever method is employed, namely, that protein can be *purchased most economically* in the highest grade of concentrates, and conversely, the lower the percentage of protein the feed contains, the higher its cost a pound.* Therefore, Mr. Dairyman, when you need protein, get it in the most concentrated form—in the cottonseed, linseeds, glutens, distillers' grains and malt sprouts,†—and leave the low grade feeds for your neighbor, who doesn't know or doesn't care anything about the cost of a quart of milk.

I. SOMETHING ABOUT GRAIN RATIONS.

Concentrated feeds differ from roughage in two important particulars. First, all concentrates contain more true starch and less woody fiber, and consequently are more digestible; secondly, most of them contain more protein. The object, therefore, of feeding concentrates is to increase both the total digestible matter and the amount of protein in the daily ration.

It is better to use two or three grains in making a ration than to feed one concentrate exclusively, and the feeder should aim to prepare palatable grain mixtures. Rations should be bulky to avoid digestive disturbances. Many feeders use from one-third to one-half wheat bran in order to obtain the necessary bulk. Distillers' and brewers' dried grains and malt sprouts likewise serve as economical bulky feeds. It is also possible to use corn silage and chopped hay as diluters or distributers of the heavy concentrates.

If bran is used as a base, a very good type of ration may consist by weight of:

(1) ⅓ bran, ½ gluten feed and ⅙ cottonseed meal.
(2) ⅓ bran, ⅓ cottonseed meal and ⅓ corn meal.

* Corn meal, hominy meal and occasionally oats, are economical starchy feeds, but not economical sources of protein.

† The market cost of these several feeds will determine which is the most economical for you to purchase. See pages 34 and 35 for special remarks on wheat by-products.

(3) $\frac{1}{3}$ bran, $\frac{1}{3}$ gluten meal, $\frac{1}{3}$ flour middlings.

(4) $\frac{1}{2}$ bran, $\frac{1}{2}$ gluten feed.*

One may use dried distillers' grains for bulk and also as a source of protein, mixing by weight:

(1) $\frac{1}{2}$ distillers' grains, $\frac{1}{4}$ flour middlings, $\frac{1}{4}$ corn meal.

(2) $\frac{1}{2}$ distillers' grains, $\frac{1}{6}$ cottonseed meal and $\frac{1}{3}$ corn meal.

Malt sprouts, also a bulky feed, can be used mixed with other grains by weight as follows:

(1) $\frac{1}{4}$ malt sprouts, $\frac{1}{4}$ mixed feed, $\frac{1}{2}$ gluten feed.

(2) $\frac{1}{5}$ malt sprouts, $\frac{2}{5}$ corn meal, $\frac{2}{5}$ gluten feed.

It is better to prepare a considerable amount of the above mixtures at one time, and then feed a definite quantity each day.

In case corn silage is used as a distributer, the mixture may consist by weight of:

(1) $\frac{1}{3}$ cottonseed meal, $\frac{1}{3}$ flour middlings and $\frac{1}{3}$ corn meal.

(2) $\frac{1}{2}$ corn meal, $\frac{1}{4}$ cottonseed meal and $\frac{1}{4}$ oat middlings or rye feed.**

Care must be taken to see that such combinations are well mixed with the silage.

Seven pounds is the usual quantity to be fed daily to cows producing 10–12 quarts of milk. The richer the milk, the more food needed. Because of the high prices of concentrates, and in localities where there is not a quick demand for milk, many feeders may find it economy to use but 5 pounds of grain daily, and feed maximum amounts of roughage.† Heavy milking Holsteins generally require from 10 to 14 pounds of grain daily, depending upon the milk yield.

It is hardly possible to advise dairymen which ration would prove the most economical, as prices are likely to change so quickly. The price of wheat by-products will probably be relatively high the present season, while corn, oats and their by-products ought to be rather less than last season. If the consumer will take advantage of the general suggestions made in this bulletin and put his own mental powers into operation, he ought to arrive at a satisfactory solution of the problem.

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* This ration, although a trifle wide, has proved quite satisfactory with many feeders.

** Many other grain rations may be found by consulting Bulletins 93-94-98-99.

† Early cut hay, hay of peas and oats cut when in blossom, clover rowen and corn silage all help to keep down the grain bill.

J. MARKET VALUE OF CONCENTRATES.

FEED STUFFS.	Monthly Wholesale Prices. July.	Aug.	Sept.	Oct.	Nov.	Average.	Average Jan. Nov.
Cottonseed meal	26.05	26.50	26.40	26.70	26.55	26.44	26.52
Linseed meal	24.95	25.75	26.30	26.75	25.90	25.93	25.17
Gluten meal	28.10	27.00	28.00	28.25	28.40	27.95	—
Gluten feed	24.25	22.75	23.85	24.95	25.25	24.21	24.24
Gluten feed, bulk	22.50*	21.63*	22.85*	23.90*	24.00*	22.98*	22.90
Distillers' grains	23.75**	23.75**	24.25**	25.25**	24.50**	24.50	24.31
Malt sprouts	17.90†	17.50†	18.40†	20.00†	—	18.45	18.38
Red dog	25.05	27.45	27.00	25.70	24.55	25.95	25.29
Wheat middlings	24.50	27.00	26.40	25.50	24.35	25.55	25.20
Mixed feed	24.00	24.95	24.60	24.40	23.85	24.36	24.36
Bran, spring	19.40	20.69	20.50	20.65	21.00	20.45	20.87
Bran, winter	20.95	21.70	21.30	21.20	21.75	21.38	22.00
Hominy meal	22.45	24.50	25.05	24.00	24.05	24.01	23.12
Oat feed	20.00†	19.00†	17.85†	18.00†	—	18.64	18.05
Corn meal	23.30	24.00	24.40	24.20	26.60	24.50	23.68
Corn, No. 2, Yellow	21.25	23.20	23.20	23.20	25.70	23.31	—
Oats, No. 2, Clipped white	31.25	30.65	24.70	24.05	24.40	27.01	29.84
Feed barley	20.00	20.85	21.05	19.40	19.80	20.22	22.14
Rye, No. 2	28.90	28.20	29.80	32.50	32.50	30.38	—

* Northwestern Miller. ** Chapin & Co. † New England Homestead.

K. WEIGHT OF CONCENTRATES.

This table has been prepared by weighing a carefully measured quantity of the several feeds.

FEED STUFF.	One Quart Weighs.	One Pound Measures.
Protein Feeds.		
Cottonseed meal	1.5 lbs.	0.7 qts.
N. P. linseed meal	0.9 "	1.1 "
O. P. linseed meal	1.1 "	0.9 "
Gluten meal	1.7 "	0.6 "
Gluten feed	1.3 "	0.8 "
Germ oil meal	1.4 "	0.7 "
Distillers' dried grains	0.5-0.7 "	1.0-1.4 "
Malt sprouts	0.6 "	1.7 "
Brewers' dried grains	0.6 "	1.7 "
Wheat middlings (flour)	1.2 "	0.8 "
Wheat middlings (standard)	0.8 "	1.3 "
Mixed feed	0.6 "	1.7 "
Wheat bran	0.5 "	2.0 "
H-O dairy feed	0.7 "	1.4 "
Oat middlings	1.5 "	0.7 "
Rye feed	1.3 "	0.8 "
Starchy Feeds.		
Whole oats	1.0 "	1.0 "
Ground oats	0.7 "	1.4 "
Whole wheat	1.9 "	0.5 "
Ground wheat	1.7 "	0.6 "
Whole barley	1.5 "	0.7 "
Barley meal	1.1 "	0.9 "
Whole rye	1.7 "	0.6 "
Rye meal	1.5 "	0.7 "
Whole corn	1.7 "	0.6 "
Corn meal	1.5 "	0.7 "
Corn and cob meal	1.4 "	0.7 "
Corn bran	0.5 "	2.0 "
Hominy meal	1.1 "	0.9 "
Corn and oat feed (Victor)	0.7 "	1.4 "
Quaker dairy feed	1.0 "	1.0 "
Oat feed	0.8 "	1.3 "

HATCH EXPERIMENT STATION

—OF THE—

MASSACHUSETTS

AGRICULTURAL COLLEGE.

BULLETIN NO. 102.

I. ANALYSES OF MANURIAL SUBSTANCES FORWARDED FOR EXAMINATION.

II. ANALYSES OF LICENSED FERTILIZERS COLLECTED IN THE GENERAL MARKETS.

III. MARKET VALUES OF FERTILIZING INGREDIENTS.

DECEMBER, 1904.

The regular Bulletins of this Station will be sent free to all newspapers in the State and to such individuals interested in farming as may request the same. Technical Bulletins are sent only to those persons interested in the subject treated of in each case.

AMHERST, MASS.:
PRESS OF CARPENTER & MOREHOUSE
1904.

HATCH EXPERIMENT STATION

OF THE

Massachusetts Agricultural College,

AMHERST, MASS.

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The co-operation and assistance of farmers, fruit-growers, horticulturists, and all interested, directly or indirectly, in agriculture, are earnestly requested. The Bulletins will be sent free to all newspapers in the State and to such individuals interested in farming as may request the same. General bulletins, fertilizer analyses, analyses of feed-stuffs, and annual reports are published. Kindly indicate in application which of these are desired. Communications may be addressed to the

Hatch Experiment Station, Amherst, Mass.

DIVISION OF CHEMISTRY.

C. A. GOESSMANN.

ANALYSES OF FERTILIZER SUBSTANCES SENT ON FOR FREE EXAMINATION.

WOOD ASHES.

1537-1540. I. Received from Northfield, Mass.
II. Received from Amherst, Mass.
III. Received from Sunderland, Mass.
IV. Received from Sudbury, Mass.

	PER CENT.			
	I.	II.	III.	IV.
Moisture at 100 C.,	18.91	18.30	19.82	3.67
Potassium oxide,	.80	4.80	2.80	5.24
Phosphoric acid,	1.36	1.23	1.69	1.40
Calcium oxide,	34.72	32.54	28.83	26.52
Insoluble matter,	10.65	9.19	13.40	29.15

1541-1543. I. Received from Amherst, Mass.
II. Received from West Newbury, Mass.
III. Received from Sunderland, Mass.

	PER CENT.		
	I.	II.	III.
Moisture at 100 C.,	7.02	6.00	24.60
Potassium oxide,	5.44	4.16	4.08
Phosphoric acid,	1.69	1.28	1.34
Calcium oxide,	29.45	32.12	22.52
Insoluble matter,	15.99	17.35	13.81

1544-1545. I. Cotton Hull Ashes, received from Southwick, Mass.
II. Pulp Ashes, received from East Boston, Mass.

	PER CENT.	
	I.	II.
Moisture at 100 C.,	7.85	none.
Potassium oxide,	21.92	.46
Phosphoric acid,	7.66	.12
Calcium oxide,	*	67.72
Insoluble matter,	*	7.00

NITROGEN COMPOUNDS.

1546-1549. I. Nitrate of Soda, received from Amherst, Mass.
II. Nitrate of Soda, received from Saundersville, Mass.
III. Nitrate of Potash, received from Medway, Mass.
IV. Sulphate of Ammonia, received from Amherst, Mass.

	PER CENT.			
	I.	II.	III.	IV.
Moisture at 100 C.,	3.43	1.63	.67	1.76
Nitrogen,	15.24	15.56	13.90	20.42
Potassium oxide,	—	—	43.88	—

DRIED BLOOD AND RAW HIDE DUST.

1550-1551. I. Dried Blood, received from Amherst, Mass.
II. Raw Hide Dust, received from Westfield, Mass.

	PER CENT.	
	I.	II.
Moisture at 100°C.,	10.35	14.50
Nitrogen,	10.23	13.91
Insoluble matter,	*	1.06

POTASH COMPOUNDS.

1552-1556. I. and II. High Grade Sulphate of Potash, received from Holyoke, Mass.
III. High Grade Sulphate of Potash, received from Amherst, Mass.
IV. Carbonate of Potash, received from Amherst, Mass.
V. Carbonate of Potash, received from Hatfield, Mass.

* Not determined.

	PER CENT.				
	I.	II.	III.	IV.	V.
Moisture at 100 C.,	1.45	1.47	1.36	9.57	.45
Potassium oxide.	46.72	45.72	48.24	20.00	67.20

SILICATE OF POTASH.

1557-1558. I and II. Received from Amherst, Mass.

	PER CENT.	
	I.	II.
Moisture at 100 C.,	12.35	14.96
Potassium oxide.	16.82	16.44

PHOSPHORIC ACID COMPOUNDS.

1559-1561. I. Dissolved Bone, received from Amherst, Mass.
II. Acid Phosphate, received from Amherst, Mass.
III. Dissolved Bone Black, received from Amherst, Mass.

	PER CENT.		
	I.	II.	III.
Moisture at 100 C.,	8.32	8.40	12.76
Total Phosphoric acid.	15.25	15.02	16.94
Soluble Phosphoric acid.	*	7.36	*
Reverted Phosphoric acid.	11.58	5.02	15.25
Insoluble Phosphoric acid.	3.66	2.64	1.69
Nitrogen.	1.70	—	

TANKAGE.

1562-1565. I, II and III. Received from South Lincoln, Mass.
IV. Received from Amherst, Mass.

	PER CENT.			
	I.	II.	III.	IV.
Moisture at 100 C.,	8.23	15.13	22.56	8.66
Total Phosphoric acid.	14.89	18.27	16.81	8.70
Available Phosphoric acid.	6.42	8.55	7.78	5.52
Insoluble Phosphoric acid.	8.47	9.72	9.03	3.18
Nitrogen.	5.06	4.50	4.34	8.68

* Not determined.

GROUND BONE.

1566-1568. I. Steamed Bone, received from Amherst, Mass.
II. Raw Bone, received from Amherst, Mass.
III. Ground Bone, received from Northboro, Mass.

	PER CENT.		
	I.	II.	III.
Moisture at 100 C.,	6.53	8.61	5.67
Total Phosphoric acid.	21.39	25.46	17.46
Available Phosphoric acid,	8.44	5.76	7.14
Insoluble Phosphoric acid.	12.95	19.70	10.32
Nitrogen,	2.24	3.92	5.02

LIME COMPOUNDS.

1569-1571. I. Lime and Nitrate of Soda, received from Amherst, Mass.
II. Patent Process Lime, received from Marion, Mass.
III. Slaked Lime, received from Amherst, Mass.

	PER CENT.		
	I.	II.	III.
Moisture at 100° C.,	1.84	none.	35.53
Calcium oxide,	37.15	57.87	42.60
Nitrogen,	6.40	—	—
Insoluble matter,	1.31	9.03	1.09

MANURE AND COTTON COMPOST.

1572-1576. I, II, III and IV. Manure samples, received from Amherst, Mass.
V. Cotton Compost, received from Hatfield, Mass.

	PER CENT.				
	I.	II.	III.	IV.	V.
Moisture at 100° C.,	72.92	68.00	80.81	81.75	42.51
Nitrogen,	.48	.48	.18	.36	.93
Phosphoric acid,	.50	.38	.10	.22	.39
Potassium oxide,	.49	.46	.28	.48	.56
Insoluble matter,	5.99	12.09	.45	.60	—

COMPOUND FERTILIZERS.

1577-1580. I and II. Received from North Beverly, Mass.
III. Received from Montague, Mass.
IV. Received from Sunderland, Mass.

	PER CENT.			
	I.	II.	III.	IV.
Moisture at 100 C.,	13.81	9.08	5.97	9.15
Total Phosphoric acid,	10.69	12.92	6.52	14.08
Soluble Phosphoric acid,	5.82	.81	4.34	6.02
Reverted Phosphoric acid,	3.97	6.43	1.42	7.34
Insoluble Phosphoric acid,	.90	5.68	.76	.72
Potassium oxide,	4.58	9.34	9.90	5.00
Nitrogen,	1.12	4.86	5.81	2.74

MUCK.

1581-1586. I and II. Received from Sharon, Mass.
III. Salt marsh mud, received from Boston, Mass.
IV, V and VI. Salt marsh mud, received from Woods Hole, Mass.

	PER CENT.					
	I.	II.	III.	IV.	V.	VI.
Moisture at 100 C.,	41.16	39.27	82.64	57.53	53.24	55.08
Organic and vol. matter,	65.10	98.00	89.60	68.57	58.99	62.85
Ash,	34.90	2.00	10.40	31.43	41.04	37.15
Nitrogen,	.60	1.35	.27	.26	.24	.28
Chlorine,	—	—	.83	4.17	1.89	1.36

1587. Plaster (so-called), received from Springfield, Mass.

	PER CENT.
Moisture at 100°C.,	.80
Organic and volatile matter,	5.46
Potassium oxide,	.01
Phosphoric acid,	none.
Calcium oxide,	.49
Magnesium oxide,	.32
Ferric and Aluminic oxides,	7.70
Sodium oxide,	.02
Sulphuric acid,	1 20
Insoluble matter,	84.82

This material is practically useless from a fertilizing standpoint.

II. ANALYSES OF COMMERCIAL FERTILIZERS COLLECTED DURING 1904 IN THE GENERAL MARKETS BY THE AGENT OF THE HATCH EXPERIMENT STATION OF THE MASSACHUSETTS AGRICULTURAL COLLEGE.

Laboratory No.	Name of Brand.	Name of Manufacturer.	Sampled at
	Compound Fertilizers.		
162	Dry Ground Fish	American Agricultural Chemical Co., Boston, Mass.	Hatfield.
16	Bradley's Columbia Fish and Potash	Amer. Agric. Chem. Co., Bradley Fertilizer Co. Branch.	Fall River
54	" " " " "	" " " " " " " "	Weir Village.
453	" " " " "	" " " " " " " "	W. Sp'ngfield
17	Bradley's XL. Superphosphate	" " " " " " " "	Fall River.
192	" " "	" " " " " " " "	Brockton.
227	" " "	" " " " " " " "	Haverhill.
286	" " "	" " " " " " " "	Lowell.
472	" " "	" " " " " " " "	Ayer.
218	Bradley's Complete Manure, 10% Potash	" " " " " " " "	Amesbury.
262	" " " " "	" " " " " " " "	Newburyport
288	Bradley's Seeding Down Manure	" " " " " " " "	Boston.
303	" " " "	" " " " " " " "	Boston.
470	Bradley's Niagara Phosphate	" " " " " " " "	Ayer.
481	Bradley's Complete Manure for Corn, Grain, etc.	" " " " " " " "	Fitchburg.
271	Bradley's Complete Manure for Onions	" " " " " " " "	Newburyport
319	Bradley's Dissolved Bone	" " " " " " " "	Boston.
468	Bradley's Fruit and Vine Manure	" " " " " " " "	Harvard.
232	High Grade Fertilizer, 10% Potash	" " " " " " " "	Amesbury.
454	Darling's General Fertilizer	Amer. Agric. Chem. Co., L. B. Darling Fert. Co. Branch,	Worcester.
441	Darling's Blood, Bone and Potash	" " " " " " " " "	Worcester.
486	" " " " "	" " " " " " " " "	Harvard.
455	Darling's Lawn Dressing	" " " " " " " " "	Worcester.

Laboratory Number.	Name of Brand.	Moisture.	Nitrogen in 100 lbs. Found.	Nitrogen in 100 lbs. Guaranteed.	Phosphoric Acid in 100 lbs. Soluble.	Reverted.	Insoluble.	Total. Found.	Total. Guaranteed.	Available. Found.	Available. Guaranteed.	Potassium Oxide in 100 lbs. Found.	Potassium Oxide in 100 lbs. Guaranteed.
	Compound Fertilizers.												
162	Dry Ground Fish	13.03	8.62	8.24	—	3.40	2.30	5.70	7	3.4	—	—	
16-54-453	Bradley's Columbia Fish and Potash	12.25	1.91	1.65-2.40	3.84	3.27	2.87	9.98	6-8	7.11	5-6	2.70	2-4
17-192-227-286-472	Bradley's X. L. Superphosphate	14.26	2.55	2.5-3.25	5.05	4.42	2.38	11.85	10-14	9.47	9-11	2.12	2-3
218-262	Bradley's Complete 10% Potash	10.66	3.30	3.3-4.12	3.58	2.33	2.66	8.57	7-10	5.91	6-10	10.10	10-12
288-303	Bradley's Seeding Down Manure	14.90	2.49	2.5-3.25	5.03	4.53	2.23	11.79	11-14	9.56	9-11	2.20	2-3
470	Bradley's Niagara Phosphate	17.50	.93	.82-1.65	5.16	2.41	1.69	9.26	8-11	7.57	7-9	1.18	1-2
481	Bradley's Complete for Corn and Grass	8.45	3.45	3.3-4.12	8.06	4.07	1.71	14.74	13-16	13.03	12-14	3.08	3-4
271	Bradley's Complete for Onions	13.13	3.42	3.3-4.12	4.43	4.05	3.70	12.18	9-13	8.48	8-11	6.78	7-8
319	Bradley's Dissolved Bone	6.35	1.76	1.65-2.47	9.37	3.31	1.90	14.58	12-15	12.68	10-12	—	—
468	Bradley's Fruit and Vine Fertilizer	12.80	2.46	1.85-2.88	3.92	3.16	.74	7.82	8.5-11.5	7.08	5.5-7.5	10.10	10-12
232	High Grade Fertilizer, 10% Potash†	12.45	3.52	2.4-3	2.05	4.17	2.30	8.52	7-10	6.22	6-8	9.06	10-12
454	Darling's General Fertilizer	10.52	1.53	1.25-2.05	4.29	3.44	2.43	10.16	7-11	7.73	6-9	3.76	3-5
441-486	Darling's Blood, Bone and Potash†	9.94	3.64	4.10-5	3.24	4.03	2.61	9.88	8-12	7.27	7-10	6.56	7-8
455	Darling's Lawn Dressing	6.87	3.51	3-3	3.65	4.51	2.26	10.52	9	8.16	8	7.42	7

* 7.85% potash in form of sulphate, and 2.25% in form of muriate.

† Republished from July bulletin to correct error in guarantee.

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Laboratory No.	Name of Brand.	Name of Manufacturer.	Sampled at
	Compound Fertilizers.		
171	Great Eastern Vegetable, Vine and Tobacco	Amer. Agric. Chem. Co., Gt. Eastern Fert. Co. Branch,	Sunderland.
406	" " " " " "	" " " " " " " "	Westfield.
450	" " " " " "	" " " " " " " "	Agawam.
416	Quinnipiac Corn Manure	Amer. Agric. Chem. Co., Quinnipiac Co. Branch	Springfield.
458	" " "	" " " " " " "	Worcester.
556	" " "	" " " " " " "	Williamstown.
91	Quinnipiac Onion Manure	" " " " " " "	Hatfield.
539	Read's Standard Superphosphate	Amer. Agric. Chem. Co., Read Fertilizer Co. Branch	Greenfield.
457	Wheeler's Havana Tobacco	Amer. Agric. Chem. Co., M. E. Wheeler & Co. Branch,	Agawam.
505	Wheeler's Bermuda Onion Grower	" " " " " " " "	Gt. Barrington
296	Williams & Clark's Prolific Crop Producer	Am. Ag. Chem. Co., Williams & Clark Fert. Co. Branch	Lowell.
187	Abbott's Tobacco and Potato Special	Abbott and Martin Rendering Co., Columbus, Ohio	Bridgewater.
382	" " " " "	" " " " " " "	Hudson.
191	Harvest King	" " " " " " "	Bridgewater.
381	" "	" " " " " " "	Hudson.
490	" "	" " " " " " "	Leominster.
194	Ideal Grain Grower	" " " " " " "	Bridgewater.
336	Abbott's Tobacco Fertilizer	W. H. Abbott, Holyoke, Mass	Holyoke.
401	" " "	" " " "	Smith's Ferry.
337	Abbott's Eagle Brand	" " " "	Holyoke.
403	" " "	" " " "	Smith's Ferry.
258	Ammoniated Bone with Potash	Armour Fertilizer Works, Baltimore, Md	Danvers.
376	" " " "	" " " " "	S. Framingh'm
471	" " " "	" " " " "	Harvard.

Laboratory Number.	Name of Brand.	Nitrogen in 100 lbs.			Phosphoric Acid in 100 lbs.							Potassium Oxide in 100 lbs.	
								Total.		Available.			
		Moisture.	Found.	Guaranteed.	Soluble.	Reverted.	Insoluble.	Found.	Guaranteed.	Found.	Guaranteed.	Found.	Guaranteed.
	Compound Fertilizers.												
171-406-450	Great Eastern Veg., Vine and Tobacco†	11.52	2.19	2.06-2.88	5.44	2.59	2.51	10.54	10-13	8.03	8-10	7.09	6-7
416-458-556	Quinnipiac Corn Manure	14.81	2.45	2.06-2.88	4.86	3.66	2.69	11.21	10-13	8.52	8-10	1.66	1.5-2.5
91	Quinnipiac Onion Manure	7.90	3.31	3.3-4.12	3.49	4.75	1.30	9.54	9-13	8.24	8-11	7.04	7-8
539	Read's Standard Superphosphate	9.51	1.55	.82-1.65	4.93	3.26	2.38	10.57	10-14	8.19	8-11	3.78	4-5*
457	Wheeler's Havana Tobacco	13.52	2.41	2.4-3	3.30	3.08	1.30	7.68	7-10	6.38	6-8	9.78	10-12*
505	Wheeler's Bermuda Onion Grower	13.50	1.16	.82-1.65	5.92	3.01	1.36	10.29	10-13	8.93	8-11	3.46	4-5
296	Williams & Clark's Prolific Crop Producer	16.43	1.14	.82-1.65	2.72	4.28	2.08	9.08	8-11	7.00	7-9	1.14	1-2
187-382	Abbott's Tobacco and Potato Special	12.73	2.13	1.65-2.45	5.13	3.43	2.64	11.20	10-12	8.56	8-11	3.88	4-5
191-381-490	Harvest King	10.12	2.06	1.2-2	2.33	5.27	3.02	10.62	10-12	7.60	8-11	1.84	2-3
194	Ideal Grain Grower	7.33	.84	.82-1.65	.88	7.08	3.10	11.06	9-11	7.96	7-9	.88	1-2
336-401	Abbott's Tobacco Fertilizer	8.03	4.32	4.5-5.5	.93	7.15	4.53	12.61	12-14	8.08	9-10	10.28	10-11*
337-403	Abbott's Eagle Brand	9.73	2.69	3-4	1.09	8.25	5.32	14.66	14-15	9.34	11-12	11.44	10-11
258-376-471	Ammoniated Bone with Potash	8.38	2.73	2.47-3.29	4.80	1.69	2.28	9.77	8-10	6.49	6-8	2.42	2-3

* Sulphate of potash, the source of potash.

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Laboratory No.	Name of Brand.	Name of Manufacturer.	Sampled at
	Compound Fertilizers.		
281	Armour's Grain Grower	Armour Fertilizer Works, Baltimore, Md	Danvers.
380	" " "	" " " " "	S. Framingh'm
291	Blood, Bone and Potash	" " " " "	Salem.
499	" " " "	" " " " "	Harvard.
361	Beach's Reliance Brand Fertilizer	Beach Soap Co., Lawrence, Mass	Lawrence.
395	Beach's Advance Brand	" " " " "	Lawrence.
332	Berkshire Ammo. Bone Phosphate	Berkshire Fertilizer Co., Bridgeport, Conn.	Bridgewater.
541	" " " "	" " " " "	Pittsfield
388	Berkshire Potato and Vegetable Phosphate	" " " " "	W. Bridgew'r
2	Stockbridge's Strawberry Manure	Bowker Fertilizer Company, Boston, Mass.	Dighton.
367	" " "	" " " " "	Concord.
6	Stockbridge's Cabbage and Cauliflower	" " " " "	Dighton.
245	" " " "	" " " " "	Haverhill.
33	Stockbridge's Top Dressing	" " " " "	Fall River.
78	" " "	" " " " "	Northampton.
68	Stockbridge's Corn, Grain and Fodder	" " " " "	Dighton.
186	Stockbridge's Seeding Down Fertilizer	" " " " "	Bridgewater.
342	" " " "	" " " " "	Waltham.
465	" " " "	" " " " "	Worcester.

Laboratory Number.	Name of Brand.	Moisture.	Nitrogen in 100 lbs. Found.	Nitrogen in 100 lbs. Guaranteed.	Phosphoric Acid in 100 lbs. Soluble.	Reverted.	Insoluble.	Total. Found.	Total. Guaranteed.	Available. Found.	Available. Guaranteed.	Potassium Oxide in 100 lbs. Found.	Potassium Oxide in 100 lbs. Guaranteed.
	Compound Fertilizers.												
281-380	Armour's Grain Grower	10.53	1.77	1.65-2.47	6.72	2.29	1.71	10.72	10-12	9.01	8-10	2.00	2-3
291-499	Bone, Blood and Potash	9.52	4.25	4.12-4.94	7.42	.79	—	8.21	10	8.21	8-10	7.52	7-8
361	Beach's Reliance Brand	5.26	2.25	1.65-2.47	1.89	6.81	3.96	12.66	10-13	8.70	8-10	3.58	3-4
395	Beach's Advance Brand	4.08	3.28	2.47-3.29	1.96	6.74	3.58	12.28	10-13	8.70	8-10	6.44	6-7
332-541	Berkshire Ammo. Bone Phosphate	5.45	1.45	.8-1.5	2.34	4.64	3.38	10.41	10-12	6.98	8-10	3.22	2-3
388	Berkshire Potato and Veg. Phosphate	13.57	1.96	1.7-2.5	1.77	4.43	2.68	8.88	8-10	6.20	6-8	5.02	4-6
2-367	Stockbridge's Strawberry and Sm. Fruits.	11.65	2.68	2.47-3.29	5.07	4.33	2.12	11.52	10-12	9.40	8-10	4.16	4-5
0-245	Stockbridge's Cabbage and Cauliflower	9.80	5.25	4-5	.25	5.31	1.86	7.42	6-8	5.56	4-6	6.22	6-7
33-78	Stockbridge's Top Dressing	9.32	5.08	4.94-5.76	3.05	2.51	1.68	7.24	6-8	5.56	4-6	6.48	6-7
68	Stockbridge's Corn, Grain and Fodder	6.75	3.28	3-4	1.35	5.11	3.00	9.46	8-10	6.46	6-8	7.32	7-9
186-342-465	Stockbridge's Seeding Down	5.37	2.53	2.25-3.25	3.56	3.40	2.07	9.03	9-11	6.96	6-8	11.91	10-12

II. ANALYSES OF COMMERCIAL FERTILIZERS COLLECTED DURING 1904 IN THE GENERAL MARKETS BY THE AGENT OF THE HATCH EXPERIMENT STATION OF THE MASSACHUSETTS AGRICULTURAL COLLEGE.

Laboratory No.	Name of Brand.	Name of Manufacturer.	Sampled at
	Compound Fertilizers.		
15	Bowker's Potato and Vegetable Fertilizer	Bowker Fertilizer Company, Boston, Mass.	Dighton.
185	" " " " "	" " " " "	Bridgewater.
20	Bowker's Lawn and Garden Dressing	" " " " "	Fall River.
278	" " " " "	" " " " "	Newburyport.
404	" " " " "	" " " " "	Springfield.
21	Bowker's Market Garden Fertilizer	" " " " "	Dighton.
95	" " " "	" " " " "	Northampton.
384	" " " "	" " " " "	Concord.
24	Bowker's Early Potato Manure	" " " " "	Dighton.
195	" " " "	" " " " "	Bridgewater.
362	" " " "	" " " " "	Andover.
29	Bowker's Fine Dry Ground Fish	" " " " "	Dighton.
35	Bowker's Bone and Wood Ash Fertilizer	" " " " "	Fall River.
193	" " " " " "	" " " " "	Bridgewater.
314	" " " " " "	" " " " "	Boston.
189	Bowker's Corn Phosphate	" " " " "	Bridgewater.
224	" " "	" " " " "	Haverhill.
543	" " "	" " " " "	N. Adams.
202	Bowker's "D" Fish and Potash	" " " " "	Bridgewater.
419	" " " " "	" " " " "	Springfield.

Laboratory Number.	Name of Brand.	Moisture.	Nitrogen in 100 lbs.		Phosphoric Acid in 100 lbs.							Potassium Oxide in 100 lbs.	
								Total.		Available.			
			Found.	Guaranteed.	Soluble.	Reverted.	Insoluble.	Found.	Guaranteed.	Found.	Guaranteed.	Found.	Guaranteed.
	Compound Fertilizers.												
15-185	Bowker's Potato and Veg. Fertilizer. . . .	14.30	2.78	2.47-3.29	6.63	1.97	1.66	10.26	10-12	8.60	7-9	4.10	4-6
20-278-404	Bowker's Lawn and Garden Dressing. . . .	7.32	3.14	3-4	1.92	3.33	1.84	7.19	8-10	5.25	4-8	5.26	5-6
21-95-384	Bowker's Market Garden	8.86	2.54	2.47-3.25	2.55	4.15	1.80	8.50	7-10	6.70	6-8	9.82	10-12
24-195-362	Bowker's Early Potato Manure.	13.45	3.43	3.29-4.12	5.44	1.87	1.41	8.72	8-10	7.31	7-9	6.88	7-8
29	Bowker's Fine Dry Ground Fish	5.33	8.31	8.22-10	—	5.22	6.04	11.26	6-8	5.22	—	—	—
35-193-314	Bowker's Bone and Wood Ash Fertilizer.	10.58	1.68	1.65-2.25	.13	5.22	4.48	9.83	9-11	5.35	7-9	2.35	2.25-3.25
189-224-543	Bowker's Corn Phosphate.	6.40	1.96	1.65-2.47	5.63	3.10	2.30	11.03	9-11	8.73	8-10	2.08	2-3
202-419	Bowker's "D" Fish and Potash.	10.82	2.60	2.47-3.25	3.52	2.80	2.12	8.44	8-10	6.32	—	2.96	2-3

II. ANALYSES OF COMMERCIAL FERTILIZERS COLLECTED DURING 1904 IN THE GENERAL MARKETS BY THE AGENT OF THE HATCH EXPERIMENT STATION OF THE MASSACHUSETTS AGRICULTURAL COLLEGE.

Laboratory No.	Name of Brand.	Name of Manufacturer.	Sampled at
	Compound Fertilizers.		
216	Bowker's Sure Crop Bone Phosphate	Bowker Fertilizer Company, Boston, Mass.	Haverhill.
237	Bowker's Potash Bone	" " " " "	Haverhill.
475	" " "	" " " " "	Harvard.
138	Bowker's Wood Ashes	" " " " "	N. Hatfield.
243	" " "	" " " " "	Haverhill.
389	" " "	" " " " "	Concord.
531	Bowker's Complete Mixture	" " " " "	Williamstown.
11	Bowker's Bristol Fish and Potash	" " " " "	Dighton.
412	" " " " "	" " " " "	Springfield.
197	Bowker's Gloucester Fish and Potash	" " " " "	Bridgewater.
97	Bowker's Special Onion Manure	" " " " "	Northampton.
318	Breck's Lawn and Garden Dressing	Joseph Breck & Sons, Boston, Mass.	Boston.
310	Farquhar's Lawn and Garden Dressing	Chicopee Rendering Co., Springfield, Mass.	Boston.
19	E. Frank Coe's New Englander Corn Fertilizer	E. Frank Coe Co., New York City	Dighton.
50	E. Frank Coe's Excelsior Potato Fertilizer	" " " " " "	Dighton.
94	E. Frank Coe's Fish and Potash	" " " " " "	East Hadley.
420	E. Frank Coe's Columbian Potato Fertilizer	" " " " " "	Westfield.
559	" " " " "	" " " " " "	S. Williamst'n.
422	Celebrated Special Potato Fertilizer	" " " " " "	Westfield.

Laboratory Number.	Name of Brand.	Moisture.	Nitrogen in 100 lbs.		Phosphoric Acid in 100 lbs.							Potassium Oxide in 100 lbs.	
								Total.		Available.			
			Found.	Guaranteed.	Soluble.	Reverted.	Insoluble.	Found.	Guaranteed.	Found.	Guaranteed.	Found.	Guaranteed.
	Compound Fertilizers.												
216	Bowker's Sure Crop Bone Phosphate	10.26	1.37	.82-1.65	5.50	2.56	1.64	9.70	10-12	8.06	9-11	2.	2-3
237-475	Bowker's Potash Bone..................	9.46	1.20	.82-1.25	2.14	3.74	3.20	9.08	8-9	5.88	6-8	2.20	2-3
138-243-389	Bowker's Wood Ashes..................	14.43	—	—	—	—	—	1.48	1-3	—		6.44	4-6
531	Bowker's Complete Mixture.............	10.89	2.52	2-3	5.08	3.28	1.62	9.98	9-13	8.36	8-10	3.84	4-5
11-412	Bowker's Bristol Fish and Potash	12.94	1.71	1.65-2.5	4.03	4.03	2.86	10.92	8-10	8.06	5-8	2.20	2-3
197	Bowker's Gloucester Fish and Potash ...	12.00	.93	.82-1.50	1.62	6.28	1.44	9.34	9-11	7.90	6-9	1.12	1-2
97	Bowker's Special Onion Manure.........	12.30	3.36	3.3-4.12	4.70	2.14	1.40	8.24	8-10	6.84	6-8	10.48	10-12
318	Breck's Lawn and Garden Dressing......	6.55	5.31	4.12-4.94	1.40	6.44	1.34	9.18	—	7.84	5-6	4.90	5-6
310	Farquhar's Lawn and Garden Dressing..	9.04	4.75	3.3-4.12	.60	6.24	6.60	13.44	14-17	6.84	4-5	5.80	7-8
19	E. Frank Coe's New Englander Corn....	11.67	1.56	.8-1	8.47	1.89	2.12	12.48	9-11	10.36	7.5-9	3.20	3-4*
50	E. Frank Coe's Excelsior Potato.........	8.81	3.12	2.4-3	6.97	1.63	1.68	10.28	9-11	8.60	7-9	7.14	8-9
94	E. Frank Coe's Fish and Potash.........	13.51	2.64	2-3	5.97	4.71	.20	10.88	7-9	10.68	6-8	2.60	2-3
420-559	E. Frank Coe's Columbian Potato	10.95	2.29	1.2-1.5	8.22	1.80	1.46	11.48	10-11	10.02	8.5-10.5	2.58	2.5-3
422	Celebrated Special Potato	11.31	2.18	1.65-2.47	8.27	.83	1.00	10.10	9.5-10.5	9.10	8-9.75	3.74	4-5

* Sulphate of potash, the source of potash.

II. ANALYSES OF COMMERCIAL FERTILIZERS COLLECTED DURING 1904 IN THE GENERAL MARKETS BY THE AGENT OF THE HATCH EXPERIMENT STATION OF THE MASSACHUSETTS AGRICULTURAL COLLEGE.

Laboratory No.	Name of Brand.	Name of Manufacturer.	Sampled at
	Compound Fertilizers.		
430	High Grade Ammoniated Bone Superphosphate	E. Frank Coe Co., New York City	Westfield.
530	" " " "	" " " " " "	Greenfield.
104	American Farmers' Corn King	" " " " " "	Amherst.
427	" " " "	" " " " " "	E. Longm'd'w.
156	American Farmers' Market Garden Special	" " " " " "	Amherst.
157	American Farmers' Complete Potato Fertilizer	" " " " " "	Amherst.
429	" " " " "	" " " " " "	E. Longm'd'w.
573	Tobacco and Onion Fertilizer	" " " " " "	Amherst.
574	New Englander Tobacco Fertilizer	" " " " " "	Amherst.
558	Farmers' Grass and Grain Fertilizer	" " " " " "	S. Williamst'n.
103	American Farmers' Ammoniated Bone	" " " " " "	Amherst.
280	Chemicals for Liquid Plant Food	Eastern Chemical Company, Boston, Mass	Boston.
576	Star Brand Canada Ashes	Wm. E. Fyfe & Co., Clinton, Mass	Clinton.
151	Hardy's Tobacco and Potato Special	Hardy Packing Company, Columbus, Ohio	Sunderland.
220	" " " " "	" " " " "	Amesbury.
495	" " " " "	" " " " "	Leominster.
545	" " " " "	" " " " "	Greenfield.

Laboratory Number.	Name of Brand.	Moisture.	Nitrogen in 100 lbs.		Phosphoric Acid in 100 lbs.							Potassium Oxide in 100 lbs.	
			Found.	Guaranteed.	Soluble.	Reverted.	Insoluble.	Total. Found.	Total. Guaranteed.	Available. Found.	Available. Guaranteed.	Found.	Guaranteed.
	Compound Fertilizers.												
130-530	High Grade Amm. Bone Superphosphate.	10.73	3.00	1.85-2.05	8.32	1.50	1.48	11.30	10.5-11	9.82	9-10	2.50	2.25-2.50†
104-427	American Farmers' Corn King	12.35	2.86	2.4-3.00	7.01	1.77	1.54	10.32	9.5-10.5	8.78	8-10	4.00	4-5*
156	American Farmers' Market Garden	11.47	3.54	3.4-4	7.32	1.46	1.54	10.32	9.5-10.5	8.78	8-9	6.84	7-8**
157-429	American Farmers' Complete Potato	12.36	2.40	1.6-2.0	6.45	1.95	2.40	10.80	8.5-9.5	8.40	7-9	5.34	6-7
573	Tobacco and Onion Fertilizer	7.90	3.39	3.3-4.12	5.83	1.53	1.80	9.16	—	7.36	6.7.5	11.14	8-9
571	New Englander Tobacco	13.69	3.30	3.3-4.12	7.20	1.22	1.94	10.36	—	8.12	8.5-9.5	6.4	6-7**
558	Farmers' Grass and Grain Fertilizer	12.95	1.46	.8-1.	7.68	1.56	1.68	10.92	10-12	9.24	8.5-10	1.84	1.5-2*
103	American Farmers' Ammo. Bone	9.50	2.45	2-3	8.50	3.78	1.54	13.82	9.5-10.5	12.28	8-9.5	2.54	2-3*
280	Chemicals for Liquid Plant Food	.83	12.84	16.3	18.08	4.21	.38	22.67	21.5	22.29	21.5	27.42	26.1
576	Star Brand Canada Ashes	16.70	—		—	—	—	1.50	1-3	—	—	3.88	4.5-8
151-220-405-545	Hardy's Tobacco and Potato Special	12.42	1.87	1.65-2.47	6.75	2.33	3.04	12.12	10-12	9.08	8-11	4.00	4-5

* Sulphate of potash, the source of potash.

† Phosphate of potash, the source of potash.

** Part of potash in form of sulphate, and part as muriate.

II. ANALYSES OF COMMERCIAL FERTILIZERS COLLECTED DURING 1904 IN THE GENERAL MARKETS BY THE AGENT OF THE HATCH EXPERIMENT STATION OF THE MASSACHUSETTS AGRICULTURAL COLLEGE.

Laboratory No.	Name of Brand.	Name of Manufacturer.	Sampled at
	Compound Fertilizers.		
173	Hardy's Complete Manure	Hardy Packing Co., Columbus, Ohio	Sunderland.
214	" " "	" " " " "	Amesbury.
488	" " "	" " " " "	Leominster
222	Hardy's Tankage, Bone and Potash	" " " " "	Amesbury.
492	" " " " "	" " " " "	Leominster.
292	Canada Unleached Hardwood Ashes	John Joynt, Lucknow, Ontario, Can.	Boston.
196	Lister's Special Potato Fertilizer	Lister's Agricultural Chemical Works, Newark, N. J.	Rochester.
272	" " " "	" " " " " "	Newburyport.
546	" " " "	" " " " " "	Greenfield.
204	Lister's High Grade Special for Spring Crops	" " " " " "	Rochester.
446	" " " " " "	" " " " " "	Agawam.
518	" " " " " "	" " " " " "	Ashley Falls.
246	Lister's Success Fertilizer	" " " " " "	Rochester.
506	" " "	" " " " " "	Ashley Falls.
550	" " "	" " " " " "	Greenfield.
402	Lister's Animal Bone and Potash	" " " " " "	Rochester.
377	Swift's Lowell Market Garden Manure	Swift's Lowell Fertilizer Co., Boston, Mass.	Wayland.
482	" " " " "	" " " " " "	Ayer.
200	Swift's Lowell Empress Brand	" " " " " "	New Bedford.
228	" " " "	" " " " " "	Amesbury.

Laboratory Number.	Name of Brand.	Moisture.	Nitrogen in 100 lbs.		Phosphoric Acid in 100 lbs.							Potassium Oxide in 100 lbs.	
								Total.		Available.			
			Found.	Guaranteed.	Soluble.	Reverted.	Insoluble.	Found.	Guaranteed.	Found.	Guaranteed.	Found.	Guaranteed.
	Compound Fertilizers.												
173-214-488	Hardy's Complete Manure	10.68	3.43	3.29-4.11	6.25	2.56	1.80	10.12	10-12	8.81	8-11	7.34	7-8
222-492	Tankage, Bone and Potash	9.27	.92	1.24-2.06	2.08	6.38	2.74	11.20	10-12	8.46	8-11	2.04	2-3
292	Canada Unleached Ashes	16.81	—	—	—	—	—	1.58	1.5-3.5	—	—	3.44	5-8
190-272-546	Special Potato Fertilizer	13.73	2.0	1.65-2.47	5.85	2.33	2.44	10.62	9-11	8.18	8-11	3.11	3-4
204-446-518	High Grade Special for Spring Crops	11.90	1.73	1.65-1.8	6.37	1.61	2.28	10.26	10-13	7.98	8-10	10.	10-10.5
246-506-550	Lister's Success Fertilizer	14.51	1.70	1.24-1.65	7.16	1.98	2.92	12.06	11-13	9.14	9-12	2.44	2-3
402	Animal Bone and Potash	12.41	—	—	5.43	4.07	2.50	12.00	11	9.50	10.	2.26	2
377-482	Swift's Lowell Market Garden	13.	4.09	4.10-4.24	5.93	1.77	1.02	8.72	8-11	7.70	7-9	6.20	6-7
200-228	Swift's Lowell Empress Brand	10.47	1.38	1.23-2.05	5.42	1.90	.80	8.12	7-9	7.32	7-9	2.44	2-3

II. ANALYSES OF COMMERCIAL FERTILIZERS COLLECTED DURING 1904 IN THE GENERAL MARKETS BY THE AGENT OF THE HATCH EXPERIMENT STATION OF THE MASSACHUSETTS AGRICULTURAL COLLEGE.

Laboratory No.	Name of Brand.	Name of Manufacturer.	Sampled at
	Compound Fertilizers.		
210	Swift's Lowell Dissolved Bone and Potash	Swift's Lowell Fertilizer Co., Boston, Mass	Amesbury.
301	Swift's Lowell Lawn and Garden Dressing	" " " " " "	Boston.
326	" " " " " "	" " " " " "	Taunton.
329	" " " " " "	" " " " " "	Hudson.
173	Swift's Lowell Fruit and Vine	" " " " " "	Ayer.
145	Swift's Lowell Potato Phosphate	" " " " " "	Sunderland.
298	" " " "	" " " " " "	Boston.
340	" " " "	" " " " " "	Lexington.
48	Mapes' Potato Manure	Mapes Formula and Peruvian Guano Co., N. Y. City	Taunton.
175	" " "	" " " " " " " "	S. Deerfield.
60	Mapes' Cereal Brand	" " " " " " " "	Taunton.
433	" " "	" " " " " " " "	Worcester.
480	" " "	" " " " " " " "	Leominster.
165	Mapes' Tobacco Manure, Wrapper Brand	" " " " " " " "	S. Deerfield.
431	Mapes' Tobacco Ash Constituents	" " " " " " " "	Southwick.
478	Mapes' Complete Manure, "A" Brand	" " " " " " " "	Fitchburg.
501	" " " " "	" " " " " " " "	Leominster.
526	Mapes' Tobacco Starter, Improved	" " " " " " " "	Greenfield.
40	Mapes' Complete Manure for General Use	" " " " " " " "	Taunton.
52	Mapes' Fruit and Vine Manure	" " " " " " " "	Taunton.
448	" " " " "	" " " " " " " "	Worcester.
56	Mapes' Top Dressing for Grass and Grain	" " " " " " " "	Taunton.
484	" " " " " " "	" " " " " " " "	Fitchburg.

Laboratory Number.	Name of Brand.	Moisture.	Nitrogen in 100 lbs. Found.	Nitrogen in 100 lbs. Guaranteed.	Phosphoric Acid in 100 lbs. Soluble.	Reverted.	Insoluble.	Total. Found.	Total. Guaranteed.	Available. Found.	Available. Guaranteed.	Potassium Oxide in 100 lbs. Found.	Potassium Oxide in 100 lbs. Guaranteed.
	Compound Fertilizers.												
210	Swift's Lowell Dissolved Bone and Potash	11.85	1.65	1.65-2.5	6.73	2.43	1.60	10.82	10-11	9.16	9-11	2.18	2-3
301-326-329	Swift's Lowell Lawn and Garden Dress..	8.65	4.21	4.1-4.92	1.73	5.51	1.68	8.92	8-10	7.24	7-9	5.92	5-6
473	Swift's Lowell Fruit and Vine	10.90	3.29	3.29-4.12	5.53	1.93	.86	8.32	8-11	7.46	7-9	5.62	6-7
145-298-340	Swift's Lowell Potato Phosphate‡	13.53	2.61	2.47-3.3	6.18	2.65	1.30	10.13	9-11	8.83	8-10	6.08	6-7*
48-175	Mapes' Potato Manure............	12.75	3.75	3.71-4.12	2.63	3.75	3.50	9.88	8-10	6.38	8.	7.10	6-8
60-433-480	Mapes' Cereal Brand............	15.63	1.87	1.65-2.47	1.95	4.27	3.14	9.36	8-10	6.22	6.8	3.06	3-3.5
165	Mapes' Tobacco Manure.........	10.15	5.88	6.18	—	2.73	3.70	6.43	4-5	2.73		10.50	10.50†
131	Mapes' Tobacco Ash Constituents..	14.51	.66	.50	—	1.76	5.94	7.70	5-7	1.76	—	15.06	15†
178-501	Mapes' Complete Manure, "A"	14.83	2.72	2.47-3.29	3.91	1.61	4.48	13.00	12-16	8.52	10-12	2.96	2.5-3.5
526	Mapes Tobacco Starter, Improved	10.02	4.25	4.12-4.94	1.53	3.67	3.66	8.86	8-10	5.20	6-8	1.26	1-2
40	Mapes' Complete for General Use......	14.41	3.50	3.29-4.12	2.30	3.76	4.84	10.90	10-12	6.06	8-10	1.32	1-5
52-448	Mapes' Fruit and Vine..................	13.33	2.46	1.65-2.47	1.60	3.52	3.84	8.96	7-9	5.12	5-7	11.08	10-12
56-484	Mapes' Top Dressing for Grass, etc	8.82	5.25	4.94-5.76	2.25	3.61	3.66	9.52	6-8	5.86	5.	8.46	7-8

* Sulphate of potash, the source of potash.

† Carbonate of potash, the source of potash.

‡ Republished from July bulletin to correct error in guarantee.

II. ANALYSES OF COMMERCIAL FERTILIZERS COLLECTED DURING 1904 IN THE GENERAL MARKETS BY THE AGENT OF THE HATCH EXPERIMENT STATION OF THE MASSACHUSETTS AGRICULTURAL COLLEGE.

Laboratory No.	Name of Brand.	Name of Manufacturer.	Sampled at
	Compound Fertilizers.		
57	Mapes' Complete Manure for Light Soils	Mapes Formula and Peruvian Guano Co., N. Y. City	Taunton.
460	" " " " "	" " " " " " " "	Worcester.
437	Mapes' Cauliflower and Cabbage Manure	" " " " " " " "	Worcester.
496	" " " " "	" " " " " " " "	Fitchburg.
554	Mapes' Lawn Top Dressing	" " " " " " " "	Pittsfield.
477	Mapes' Complete Manure	" " " " " " " "	Fitchburg.
49	Chittenden's Ammoniated Bone Phosphate	National Fertilizer Co., Bridgeport, Conn.	Dighton.
69	Chittenden's Fish and Potash	" " " " "	Dighton.
236	" " " "	" " " " "	New Bedford.
71	Chittenden's Market Garden Fertilizer	" " " " "	Sunderland.
184	" " " "	" " " " "	New Bedford.
230	Chittenden's Potato Phosphate	" " " " "	New Bedford.
515	" " "	" " " " "	Gt. Barrington
487	Potato Fertilizer	New England Fertilizer Co., Boston, Mass.	Ayer.
325	New England Superphosphate	" " " " "	Marlboro.
489	" "	" " " " "	Harvard.
136	Home Mixture Tobacco Fertilizer	Olds & Whipple, Hartford, Conn.	Sunderland.
263	P. & P. Grain Grower	Parmenter & Polsey Fertilizer Co., Peabody, Mass.	Peabody.
274	Special Fertilizer for Strawberries	" " " " " " "	Peabody.
276	Star Brand Superphosphate	" " " " " " "	Peabody.

Laboratory Number.	Name of Brand.	Moisture.	Nitrogen in 100 lbs. Found.	Nitrogen in 100 lbs. Guaranteed.	Phosphoric Acid in 100 lbs. Soluble.	Reverted.	Insoluble.	Total. Found.	Total. Guaranteed.	Available. Found.	Available. Guaranteed.	Potassium Oxide in 100 lbs. Found.	Potassium Oxide in 100 lbs. Guaranteed.
	Compound Fertilizers.												
57-460	Mapes' Complete Manure for Light Soils	11.15	5.38	4.94-6.59	2.30	3.06	4.10	9.46	8-10	5.36	6-8	7.14	6-8
437-496	Mapes' Cauliflower and Cabbage Manure	11.15	4.12	4.12-4.94	1.75	3.41	3.28	8.44	6-8	5.16	5-6	7.44	6-8
554	Mapes' Lawn Top Dressing	11.36	3.07	2.47-2.88	.87	1.81	2.28	5.06	3.5-4.5	2.68	—	3.38	2.5-3.5
477	Mapes' Complete Manure	10.75	3.07	2.47-2.88	3.05	4.81	3.58	11.44	10-12	7.86	8-10	7.18	6-7
49	Chittenden's Ammo. Bone Phosphate	11.95	1.86	1.82-2.64	6.98	1.42	2.10	10.50	10-12	8.40	8-9	2.34	2-3
69-236	Chittenden's Fish and Potash	9.72	2.81	2.5-3.0	6.73	1.73	1.80	10.26	8-9	8.46	—	3.86	3-4*
71-184	Chittenden's Market Garden Fertilizer	12.33	2.68	2.47-3.20	6.35	2.05	1.56	10.56	9-10	9.00	7-10	6.04	6-8
230-515	Chittenden's Potato Phosphate	12.58	2.08	2.06-2.88	7.13	1.89	1.90	10.92	10-12	9.02	8-10	6.22	6-7
487	Potato Fertilizer	5.98	1.71	1.64-2.48	3.88	5.38	1.50	8.64	8-10	9.26	7-9	4.18	4-5
325-489	New England Superphosphate	10.35	2.57	2.47-3.3	5.73	3.05	2.04	10.82	10-13	8.78	9-11	4.30	4-5
136	Home Mixture Tobacco Fertilizer	15.61	5.54	4.94-5.77	.60	8.18	1.46	10.24	—	8.78	7.5-8.5	.72	—
263	P. & P. Grain Grower	8.88	.96	.82	2.30	3.06	2.76	8.12	8	5.36	7	2.76	2
274	Special for Strawberries	6.53	2.32	2.47-3.29	4.08	3.86	3.68	11.62	10-13	7.94	9-11	5.94	6-7*
276	Star Brand Superphosphate	9.46	1.74	1.64-2.4	2.20	2.94	3.30	8.44	8-11	5.14	7-9	3.72	2.5-3.5

* Sulphate of potash, the source of potash.

II. ANALYSES OF COMMERCIAL FERTILIZERS COLLECTED DURING 1904 IN THE GENERAL MARKETS BY THE AGENT OF THE HATCH EXPERIMENT STATION OF THE MASSACHUSETTS AGRICULTURAL COLLEGE.

Laboratory No.	Name of Brand.	Name of Manufacturer.	Sampled at
	Compound Fertilizers.		
279	P. & P. Potato Fertilizer	Parmenter and Polsey Fertilizer Co., Peabody, Mass	Peabody.
268	A. A. Brand	" " " " " " "	Peabody.
566	Complete for Potatoes	R. T. Prentiss, Holyoke, Mass	Holyoke.
383	Hubbard's All Soils and All Crops Phosphate	Rogers & Hubbard Co., Middletown, Conn	Bedford.
538	" " " " " " "	" " " " "	Leyden.
385	Hubbard's Potato Phosphate	" " " " "	Bedford.
445	" " "	" " " " "	Agawam.
567	Hubbard's Grass and Grain Fertilizer	" " " " "	Amherst.
146	Hubbard's Corn and General Crops	" " " " "	Sunderland.
380	" " " " "	" " " " "	Bedford.
537	" " " " "	" " " " "	Leyden.
122	High Grade Tobacco and Potato Fertilizer	Rogers Manufacturing Company, Rockfall, Conn	Amherst.
131	High Grade for Oats and Top Dressing	" " " " "	Amherst.
485	" " " " "	" " " " "	Leominster.
491	High Grade Grass and Grain Fertilizer	" " " " "	Leominster.
535	Fish and Potash	" " " " "	Pittsfield.
63	Essex Market Garden and Potato Manure	Russia Cement Company, Gloucester, Mass	Dighton.
170	" " " " " "	" " " " "	So. Deerfield.
99	Essex Complete Manure for Corn, Grain and Grass	" " " " "	Hadley.
359	" " " " " " " "	" " " " "	S. Framingh'm
338	Essex Corn Fertilizer	" " " " "	Gloucester.
469	" " "	" " " " "	Gloucester.

Laboratory Number.	Name of Brand.	Moisture.	Nitrogen in 100 lbs.		Phosphoric Acid in 100 lbs.							Potassium Oxide in 100 lbs.	
								Total.		Available.			
			Found.	Guaranteed.	Soluble.	Reverted.	Insoluble.	Found.	Guaranteed.	Found.	Guaranteed.	Found.	Guaranteed.
	Compound Fertilizers.												
279	P. & P. Potato Fertilizer	10.02	1.84	1.64-2.47	3.40	2.26	3.20	8.86	7-10	5.66	6-8	6.40	6-6.5
268	A. A. Brand	9.42	4.13	4.10-4.51	3.01	3.41	2.20	8.62	8-11	6.42	7-9	8.68	8-10
566	Complete for Potatoes	9.73	2.96	2.88	5.53	3.03	1.54	10.10	—	8.56	8	8.90	10
383-538	Hubbard's All Soils and All Crops	11.27	2.38	2.3-3.0	3.97	7.21	2.68	13.86	12-14	11.18	10-12	3.36	3-4
385-445	Hubbard's Potato Phosphate	11.82	2.06	2-2.50	5.83	6.75	1.86	14.44	10-12	12.58	9-10	5.44	5-6
567	Hubbard's Grass and Grain Fertilizer	9.32	3.01	2.2-3.0	—	6.92	8.44	15.36	16-18	6.92	—	12.08	12-13.5
146-386 537	Hubbard's Corn and General Crops	9.05	2.66	2.5-3.	2.25	4.43	3.38	10.06	8-10	6.68	6-7	8.96	8-9
122	High Grade Tobacco and Potato Fert.	9.67	3.84	3.5	.20	7.70	5.28	13.18	—	7.90	7	7.30	8.75
131-485	High Grade for Oats and Top Dressing	7.27	6.77	6.3-6.8	1.38	6.78	3.66	11.82	9-10.5	8.16	7-9	7.64	7.5-8.5
494	High Grade Grass and Grain	7.00	3.17	3-4	—	5.58	13.02	18.60	15-17	5.58	—	12.60	12.5-14
535	Fish and Potash	6.82	3.64	2.25-4.5	1.83	2.29	4.02	8.14	6-8	4.12	4-5	4.04	3.75-4.5
63-170	Essex Market Garden and Potato	8.49	2.40	2.00	4.86	4.12	3.02	12.	10-13	8.98	8-10	4.98	5-6
99-359	Essex for Corn, Grain and Grass	8.65	3.64	3.3-4.12	3.53	3.59	3.54	10.66	9.5-11	7.12	7-8	9.80	9.5-11
338-469	Essex Corn Fertilizer	8.67	2.47	2-2.5	3.55	7.21	4.06	14.82	11-13	10.76	9-10	3.26	3-3.5

II. ANALYSES OF COMMERCIAL FERTILIZERS COLLECTED DURING 1904 IN THE GENERAL MARKETS BY THE AGENT OF THE HATCH EXPERIMENT STATION OF THE MASSACHUSETTS AGRICULTURAL COLLEGE.

Laboratory No.	Name of Brand.	Name of Manufacturer.	Sampled at
	Compound Fertilizers.		
341	Essex Special Tobacco Manure	Russia Cement Company, Gloucester, Mass.	Amherst.
356	Essex Dry Ground Fish	" " " " "	Amherst.
442	" " " "	" " " " "	Worcester.
363	Essex A 1 Superphosphate	" " " " "	S. Framingh'm
391	Essex Tobacco Starter	" " " " "	Gloucester.
73	Sanderson's Fine Ground Fish	Sanderson's Fertilizer & Chem. Co., New Haven, Conn.	Sunderland.
80	" " " "	" " " " " "	N. Hatfield.
169	" " " "	" " " " " "	Whately.
400	Sanderson's Top Dressing for Grass and Grain	" " " " " "	Southwick.
424	Sanderson's Special, with 10% Potash	" " " " " "	Southwick.
511	Sanderson's Corn Superphosphate	" " " " " "	Ashley Falls.
512	Sanderson's Potato Manure	" " " " " "	N. Egremont.
115	High Grade Tobacco Special	Wilcox Fertilizer Works, Mystic, Conn.	Amherst.
120	Dry Ground Fish Guano	" " " " "	Amherst.
149	" " " "	" " " " "	N. Hadley.
575	Complete Bone Superphosphate	" " " " "	Amherst.
360	All Crops	Whitman & Pratt Rendering Co., Lowell, Mass.	N. Chelmsford
379	"	" " " " " "	Reading.
529	Special Fertilizer, A. A. Brand	A. H. Wood & Co., Framingham, Mass.	Framingham.

Laboratory Number.	Name of Brand.	Moisture.	Nitrogen in 100 lbs.		Phosphoric Acid in 100 lbs.							Potassium Oxide in 100 lbs.	
								Total.		Available.			
			Found.	Guaranteed.	Soluble.	Reverted.	Insoluble.	Found.	Guaranteed.	Found.	Guaranteed.	Found.	Guaranteed.
	Compound Fertilizers.												
341	Essex Special Tobacco Manure	5.60	4.87	4.5-5.3	3.55	3.61	2.44	9.60	8.5-9.5	7.16	7-8	12.16	12-13
350-442	Essex Dry Ground Fish	10.17	8.11	8-10	.38	7.41	6.14	13.96	11-13	7.82		—	—
303	Essex A 1 Superphosphate	5.92	1.38	1-1.25	1.08	5.32	6.18	12.58	9-11	6.40	7-8	2.18	2-2.5
391	Essex Tobacco Starter	10.00	2.78	2.5-3.0	5.55	5.87	3.54	14.96	12-14	11.42	9-11	4.38	2.5-3.0[*]
73-80-169	Sanderson's Fine Ground Fish	12.80	8.42	8.24-9.89	.52	3.72	2.10	6.34	6-8	4.24		—	
400	Top Dressing for Grass and Grain	9.37	4.33	4-5	3.47	3.47	3.94	10.88	—	6.94	7-9	6.66	7-9
424	Special, with 10% Potash	11.05	2.72	2.47-3.33	.43	4.53	3.28	8.24	8-9	4.96	5-7	11.88	10-12
511	Sanderson's Corn Superphosphate	10.65	1.75	1.62-2.5	2.60	4.26	3.42	10.28	10-12	6.86	7-9	2.12	2-3
512	Sanderson's Potato Manure	11.17	1.92	1.07-2.47	1.93	3.49	4.01	9.46	8-9	5.42	5-7	6.86	6-7
115	High Grade Tobacco Special	13.93	3.60	3.3-4.3	.10	4.58	1.00	5.68	7-10	4.68	5-7	9.50	7-9
120-149	Dry Ground Fish Guano	7.80	8.76	8.5-10	1.15	3.57	2.26	6.98	6-9	4.72	4-6	—	—
575	Complete Bone Superphosphate	17.24	2.99	2.05-2.88	3.23	5.23	3.38	11.84	9-12	8.46	8-10	3.84	3-4
360-379	All Crops	8.95	2.61	2.47-3.29	4.38	5.02	1.98	11.38	11-13	9.40	9-11	5.04	4-5
529	Special "A. A." Brand	10.27	1.46	1.24-1.65	6.55	1.69	1.36	9.60	11-13	8.24	9-11	2.28	2-3

[*] Sulphate of potash, the source of potash.

II. ANALYSES OF COMMERCIAL FERTILIZERS COLLECTED DURING 1904 IN THE GENERAL MARKETS BY THE AGENT OF THE HATCH EXPERIMENT STATION OF THE MASSACHUSETTS AGRICULTURAL COLLEGE.

Laboratory No.	Name of Brand.	Name of Manufacturer.	Sampled at
	Chemicals.		
4	Muriate of Potash	American Agricultural Chemical Co., Boston, Mass.	Fall River.
124	" "	" " " " " "	S. Amherst.
188	" "	" " " " " "	New Bedford.
311	" "	" " " " " "	Boston.
5	Nitrate of Soda	" " " " " "	Fall River.
206	" "	" " " " " "	New Bedford.
266	" "	" " " " " "	Boston.
23	Plain Superphosphate	" " " " " "	Fall River.
289	" "	" " " " " "	Boston.
483	" "	" " " " " "	Fitchburg.
154	Dissolved Bone Black	" " " " " "	Hatfield.
290	" " "	" " " " " "	Boston.
493	" " "	" " " " " "	Fitchburg.
555	" " "	" " " " " "	Pittsfield.
562	High Grade Sulphate of Potash	" " " " " "	Pittsfield.
121	Dried Blood	" " " " " "	S. Amherst.
317	Ground South Carolina Phosphate	" " " " " "	Boston.
252	Dried Blood	" " " " " "	Boston.
123	Plain Superphosphate	" " " " " "	S. Amherst.

Laboratory Number.	Name of Brand.	Moisture.	Nitrogen in 100 lbs.		Phosphoric Acid in 100 lbs.							Potassium Oxide in 100 lbs.	
								Total.		Available.			
			Found.	Guaranteed.	Soluble.	Reverted.	Insoluble.	Found.	Guaranteed.	Found.	Guaranteed.	Found.	Guaranteed.
	Chemicals.												
124-188-311	Muriate of Potash	1.22	—	—	—	—	—	—	—	—	—	50.12	50-55
5	Nitrate of Soda	1.95	14.96	15.8	—	—	—	—	—	—	—	—	—
206	" "	2.00	15.43	15.8	—	—	—	—	—	—	—	—	—
266	" "	1.75	15.38	15.0	—	—	—	—	—	—	—	—	—
23-289-483	Plain Superphosphate	11.70	—	—	10.62	4.12	1.48	16.22	13.5-15	14.74	12-14	—	—
154-290-493-555	Dissolved Bone Black	9.92	—	—	13.97	2.33	1.10	17.40	16-19	16.30	15-18	—	—
562	High Grade Sulphate of Potash	.48	—	—	—	—	—	—	—	—	—	49.04	48-50
121	Dried Blood	13.77	12.09	12.35	—	—	—	—	—	—	—	—	—
317	Ground South Carolina Phosphate	.60	—	—	—	—	—	27.50	26.56-28.39	—	—	—	—
252	Dried Blood	9.00	11.22	8.5-10	—	—	—	5.20	—	—	—	—	—
123	Plain Superphosphate	11.47	—	—	12.60	3.77	.95	17.32	15-19	16.37	12-17	—	—

II. ANALYSES OF COMMERCIAL FERTILIZERS COLLECTED DURING 1904 IN THE GENERAL MARKETS BY THE AGENT OF THE HATCH EXPERIMENT STATION OF THE MASSACHUSETTS AGRICULTURAL COLLEGE.

Laboratory No.	Name of Brand.	Name of Manufacturer.	Sampled at
	Chemicals.		
86	Prime Cotton Seed Meal	American Cotton Oil Co., New York City	N. Hatfield.
107	" " " "	" " " " " " "	Hatfield.
159	" " " "	" " " " " " "	N. Hatfield.
251	Linseed Meal	American Linseed Co., New York City	Sunderland.
77	Bowker's Superphosphate	Bowker Fertilizer Company, Boston, Mass	Northampton.
215	" "	" " " " "	Haverhill.
79	High Grade Sulphate of Potash	" " " " "	Northampton.
241	" " " "	" " " " "	Haverhill.
98	Bowker's Muriate of Potash	" " " " "	Northampton.
203	Nitrate of Soda	" " " " "	Bridgewater
247	" "	" " " " "	Haverhill.
390	" "	" " " " "	Concord.
229	" "	" " " " "	Haverhill.
294	Sulphate of Ammonia	" " " " "	Boston.
371	Dried Blood	" " " " "	Concord.
93	Double Manure Salts	" " " " "	Northampton.
153	Old Gold Brand Cotton Seed Meal	T. H. Bunch, Little Rock, Ark	Amherst.
55	Nitrate of Soda	E. Frank Coe Co., New York City	Dighton.
132	Magnolia Brand Cotton Seed Meal	Charles M. Cox & Co., Boston, Mass	Sunderland.

Laboratory Number.	NAME OF BRAND.	Moisture.	Nitrogen in 100 lbs. Found.	Nitrogen in 100 lbs. Guaranteed.	Phosphoric Acid in 100 lbs. Soluble.	Reverted.	Insoluble.	Total. Found.	Total. Guaranteed.	Available. Found.	Available. Guaranteed.	Potassium Oxide in 100 lbs. Found.	Potassium Oxide in 100 lbs. Guaranteed.
	Chemicals.												
86-107-159	Prime Cotton Seed Meal	7.44	6.73	7	—	—	—	—	—	—	—	—	—
251	Linseed Meal	8.84	5.89	6.08-6.40	—	—	—	—	—	—	—	—	
77-215	Superphosphate	7.41	—	—	6.40	7.08	2.44	15.92	15-17	13.48	13-15	—	—
79-241	High Grade Sulphate of Potash	.55	—	—	—	—	—	—	—	—	—	49.24	48-50
98	Muriate of Potash	.40	—	—	—	—	—	—	—	—	—	52.24	50-52
203-247-390	Nitrate of Soda	.45	15.54	15-16	—	—	—	—	—	—	—	—	—
229	" "	1.67	15.60	15-16	—	—	—	—	—	—	—	—	—
294	Sulphate of Ammonia	.13	20.20	19	—	—	—	—	—	—	—	—	—
371	Dried Blood	22.61	9.09	8-11.5	—	—	—	—	—	—	—	—	—
93	Double Manure Salts	1.73	—	—	—	—	—	—	—	—	—	26.68	25-28
153	Old Gold Brand Cotton Seed Meal	7.44	6.85	7	—	—	—	—	—	—	—	—	—
55	Nitrate of Soda	2.42	15.22	—	—	—	—	—	—	—	—	—	—
132	Magnolia Brand Cotton Seed Meal	7.74	6.60	7	—	—	—	—	—	—	—	—	—

II. ANALYSES OF COMMERCIAL FERTILIZERS COLLECTED DURING 1904 IN THE GENERAL MARKETS BY THE AGENT OF THE HATCH EXPERIMENT STATION OF THE MASSACHUSETTS AGRICULTURAL COLLEGE.

Laboratory No.	Name of Brand.	Name of Manufacturer.	Sampled at
	Chemicals.		
211	Acid Phosphate	Swift's Lowell Fertilizer Co., Boston, Mass	Amesbury.
372	" "	" " " " " "	Concord.
223	Nitrate of Soda	" " " " " "	Amesbury.
238	Muriate of Potash	" " " " " "	Amesbury.
354	Dissolved Bone Black	" " " " " "	Concord.
409	Vegetable Potash	Olds & Whipple, Hartford, Conn	Southwick.
257	Acid Phosphate	Parmenter & Polsey Fertilizer Co., Peabody, Mass.	Peabody.
260	Nitrate of Soda	" " " " " "	Peabody.
277	Muriate of Potash	" " " " " "	Peabody.
285	High Grade Sulphate of Potash	" " " " " "	Peabody.
509	Odorless Slag Phosphate.	Jacob Reese, Darby, Pa	Gt. Barrington
113	Nitrate of Soda	Rogers Manufacturing Co., Rockfall, Conn	Amherst.
47	Essex Nitrate of Soda	Russia Cement Co., Gloucester, Mass	Taunton.
70	Muriate of Potash	" " " " "	Taunton.
179	Sanderson's Sulphate of Potash	Sanderson's Fert. and Chem. Co., New Haven, Conn.	Whately.

Laboratory Number.	Name of Brand.	Moisture.	Nitrogen in 100 lbs. Found.	Nitrogen in 100 lbs. Guaranteed.	Phosphoric Acid in 100 lbs. Soluble.	Reverted.	Insoluble.	Total. Found.	Total. Guaran-teed.	Available. Found.	Available. Guaran-teed.	Potassium Oxide in 100 lbs. Found.	Guaran-teed.
	Chemicals.												
211-372	Acid Phosphate,	11.17	—	—	11.37	2.61	1.56	15.54	14	13.98	12		—
223	Nitrate of Soda,	2.05	15.28	15	—	—	—	—	—	—		—	—
238	Muriate of Potash,	1.35	—	—	—	—	—	—	—	—		50.44	50.53
351	Dissolved Bone Black,	11.92	—	—	11.65	3.67	2.30	17.62	15-16	15.32	15	—	—
409	Vegetable Potash,	3.71	—	—	—	—	—	.64	—	—	—	24.68	25.00
257	Acid Phosphate,	12.87	—	—	10.65	4.73	2.04	17.42	12-14	15.38	14	—	—
260	Nitrate of Soda,	2.40	15.25	15-16	—	—	—	—	—	—	—	—	—
277	Muriate of Potash,	2.69	—	—	—	—	—	—	—	—	—	50.	50.52
285	Sulphate of Potash,	.45	—		—	—	—	—	—	—	—	50.08	48.52
509	Odorless Slag Phosphate,	—	—		—	4.96	15.56	20.52	19.03	—	—	—	—
113	Nitrate of Soda,	1.40	15.16	—	—	—	—	—	—	—	—	—	—
47	" "	1.52	15.57		—	—	—	—	—	—	—	—	—
70	Muriate of Potash,	1.62	—	—	—	—	—	—	—	—	—	50.68	—
179	Low Grade Sulphate of Potash,	2.52	—	—	—				—	—	—	31.68	27.02-29.72

II. ANALYSES OF COMMERCIAL FERTILIZERS COLLECTED DURING 1904 IN THE GENERAL MARKETS BY THE AGENT OF THE HATCH EXPERIMENT STATION OF THE MASSACHUSETTS AGRICULTURAL COLLEGE.

Laboratory No.	Name of Brand.	Name of Manufacturer.	Sampled at
	Tankage and Bone.		
201	Fine Ground Bone,	American Agricultural Chemical Co., Boston, Mass.,	New Bedford.
308	" " "	" " " " " "	Boston.
331	" " "	" " " " " "	Bridgewater
287	Ground Tankage,	" " " " " "	Boston.
208	Bradley's Abattoir Bone Dust.	Amer. Agric. Chem. Co., Bradley Fert. Co. Branch.	Haverhill.
118	Fine Ground Tankage.	Amer. Agr. Chem. Co., L. B. Darling Fert. Co. Branch.	S. Amherst.
117	Armour's Bone Meal,	Armour Fertilizer Works, Baltimore, Md.,	Amherst.
275	" " "	" " " " "	Salem.
334	Beach's Fertilizer Bone,	Beach Soap Co., North Lawrence, Mass.,	S. Lawrence.
34	Bowker's Fresh Ground Bone.	Bowker Fertilizer Company, Boston, Mass.,	Dighton.
87	" " " "	" " " " "	Northampton.
300	" " " "	" " " " "	Boston.
392	" " " "	" " " " "	S. Framingh'm
100	Bowker's Tankage,	" " " " "	Northampton.
297	Farquhar's Pure Ground Bone,	Chicopee Rendering Co., Springfield, Mass.,	Boston.
498	" " " "	" " " " "	Leominster.
572	XXX Ground Bone,	E. Frank Coe Co., New York City,	Amherst.
283	Dow's Pure Ground Bone,	John C. Dow & Co., Boston, Mass.,	Boston.
335	" " " "	" " " " "	Amherst.
31	Hargrave's Pure Ground Bone,	Hargraves Manufacturing Co., Fall River, Mass.,	Fall River.

Laboratory Number.	Name of Brand.	Moisture.	Nitrogen in 100 lbs.		Phosphoric Acid in 100 lbs.							Mechanical Analyses.			
			Found.	Guaranteed.	Soluble.	Reverted.	Insoluble.	Total. Found.	Total. Guaranteed.	Available. Found.	Available. Guaranteed.	Fine Bone.	Fine Med.	Medium.	Coarse Med.
	Tankage and Bone.														
201-308-331	Fine Ground Bone.	6.68	3.24	2.47-3.50	—	6.62	15.92	22.54	22.8-23.5	6.62		37.06	21.82	22.61	18.51
287	Ground Tankage.	7.02	8.35	4.90	—	4.34	4.18	8.52	13	4.34	—	53.82	24.61	21.14	.43
208	Bradley's Abattoir Bone Dust.	10.93	2.40	1.65-3.25	—	8.54	15.40	23.94	14-19	8.54		20.73	30.86	27.56	20.85
118	Fine Ground Tankage.	17.22	7.90	7.43-9.26	.43	5.89	2.86	9.18	15-20	6.32		20.73	44.63	27.26	7.38
117-275	Armour's Bone Meal.	5.20	3.01	2.47-3.20	—	8.80	16.42	25.22	24-28	8.80	10-14	58.48	22.13	14.14	5.25
334	Beach's Fertilizer Bone.	6.72	4.08	4.12-4.94	—	5.76	13.82	19.58	19-21	5.76	—	9.64	16.45	53.96	19.95
34-87-300-[illegible]	Bowker's Fresh Ground Bone.	3.00	2.48	2.47-3.25		5.96	15.35	21.31	18-26	5.96	5-7	47.77	24.41	24.60	3.22
100	Bowker's Tankage.	10.10	6.06	4.94-5.77	—	2.94	3.00	5.94	14-16	2.94	—	40.95	20.71	22.53	[illegible]
207-498	Farquhar's Pure Ground Bone.	3.20	2.43	2-3	—	11.56	14.58	26.14	27-29	11.56	—	73.57	25.24	1.1[illegible]	[illegible]
572	XXX Ground Bone.	4.43	2.12	2.47-3.3	—	6.12	22.90	29.02	19-21	6.12	—	11.19	34.43	12.57	[illegible]
283-335	Dow's Pure Ground Bone.	10.75	1.88	1.65-2.47	—	8.84	18.06	26.90	24-26	8.84	—	35.28	33.78	22.5[illegible]	8.44
31	Hargrave's Pure Ground Bone.	24.50	3.37	3.5-4		10.16	11.64	21.80	25-27	10.16	—	27.43	24.55	10.45	28.6[illegible]

II. ANALYSES OF COMMERCIAL FERTILIZERS COLLECTED DURING 1904 IN THE GENERAL MARKETS BY THE AGENT OF THE HATCH EXPERIMENT STATION OF THE MASSACHUSETTS AGRICULTURAL COLLEGE.

Laboratory No.	Name of Brand.	Name of Manufacturer.	Sampled at
	Tankage and Bone.		
181	Bone Meal	Thomas Hersom & Co., New Bedford, Mass.	New Bedford.
183	Meat and Bone	" " "	New Bedford.
368	Swift's Lowell Ground Bone	Swift's Lowell Fertilizer Co., Boston, Mass.	Lexington
438	" " " "	" " " " " "	Boston.
67	Tankage	" " " " " "	Fall River.
324	Marsh's Pure Bone Meal	George E. Marsh & Co., Lynn, Mass.	S. Framingh'm
569	Ground Bone.	D. M. Moulton, Monson, Mass.	Monson.
75	Hubbard's Raw Knuckle Bone Flour	Rogers & Hubbard Co., Middletown, Conn.	Sunderland.
568	Hubbard's Strictly Pure Fine Bone	" " " " "	Amherst.
570	Pure Ground Bone	Rogers Manufacturing Co., Rockfall, Conn.	Amherst.
553	Ground Bone	Salisbury Cutlery Handle Co., Salisbury, Conn.	Pittsfield.
249	Swift Sure Bone Meal	M. L. Shoemaker & Co., Philadelphia, Pa.	Sunderland.
225	Ground Bone	Thomas L. Stetson, Randolph, Mass.	Brockton.
333	" "	" " " " "	Randolph
345	Warren's Pure Ground Bone	A. L. Warren, Northboro, Mass.	Northboro.
327	Pure Ground Bone	Sanford Winter, Brockton, Mass.	Brockton.
350	" " "	" " " "	Brockton.
571	Tankage	J. M. Woodard & Bro., Greenfield, Mass.	Greenfield.

Laboratory Number.	Name of Brand.	Moisture.	Nitrogen in 100 lbs. Found.	Nitrogen in 100 lbs. Guaranteed.	Phosphoric Acid in 100 lbs. Soluble.	Reverted.	Insoluble.	Total. Found.	Total. Guaranteed.	Available. Found.	Available. Guaranteed.	Mechanical Analyses. Fine Bone.	Fine Med.	Medium.	Coarse Med.
	Tankage and Bone.														
181	Bone Meal,	3.00	2.52	2.22	.65	1.80	24.56	27.10	27.04	2.54	10.46	65.16	22.83	8.59	3.48
183	Meat and Bone,	13.50	5.83	4.08	.32	4.60	10.82	15.74	18.82	4.92	8.11	16.57	41.65	22.63	19.15
368-438	Swift's Lowell Ground Bone,	7.20	2.52	2.47-3.29		6.64	19.96	26.62	25.28	6.64	5	52.11	29.29	10.70	7.84
67	Tankage,	4.16	6.97	1.12		7.96	4.66	12.62	16	7.80		24.74	41.21	21.78	12.27
324	Marsh's Pure Bone Meal,	3.78	2.44	—	—	8.26	19.58	27.84	—	8.26		56.16	23.28	14.22	6.34
560	Ground Bone,	8.40	4.21	4-5	—	6.06	14.92	20.98	21-22	6.06		9.52	21.63	37.80	31.05
75	Hubbard's Raw Knuckle Bone Flour,	7.77	3.82	3.5-4		7.08	18.72	25.80	24.5-26	7.08		71.20	26.84	1.96	
568	Hubbard's Strictly Pure Bone,	8.07	3.71	2.85-3.25		5.64	15.40	21.04	22-23	5.64		35.37	26.51	27.38	10.74
570	Pure Ground Bone,	6.30	5.00	—	—	5.72	13.34	19.06	---	5.72		29.06	36.06	28.45	6.43
553	Ground Bone,	9.15	4.08		—	7.46	18.58	26.04	—	7.46		78.26	20.70	1.04	
249	Swift Sure Bone Meal,	2.80	5.94	4.12-4.94		5.06	17.86	22.92	20-23	5.06	—	40.81	44.59	5.00	—
225-333	Ground Bone,	8.15	4.48	4.20		5.26	15.46	20.72	20.66	5.26	—	20.38	27.79	31.88	11.05
345	Warren's Pure Ground Bone,	8.27	4.21	3-7	---	11.70	13.04	24.74	22-72	11.70	—	42.37	33.82	15.80	7.92
327-350	Pure Ground Bone,	18.00	3.63	2-3		12.56	11.00	23.56	23-24	12.56		21.01	37.56	20.70	13.83
571	Tankage,	1.67	4.01	4-5	.20	12.32	10.82	23.34	19-20	12.52		54.44	18.72	10.94	15.90

TRADE VALUES OF FERTILIZING INGREDIENTS IN RAW MATERIALS AND CHEMICALS FOR 1903 AND 1904.

	1903	1904
	CENTS PER POUND	
Nitrogen in ammonia salts,	17.5	17.5
" nitrates,	15.0	16.0
Organic nitrogen in dry and fine ground fish, meat, blood, and in high-grade mixed fertilizers,	17.5	17.5
" " " fine bone and tankage,	16.5	17.0
" " " coarse bone and tankage,	12.0	12.5
Phosphoric acid soluble in water,	4.5	4.5
" " soluble in ammonium citrate,	4.0	4.0
" " in fine ground fish, bone and tankage,	4.0	4.0
" " in cottonseed meal, castor pomace and wood ashes,	4.0	4.0
" " in coarse fish, bone and tankage,	3.0	3.0
" " insoluble (in water and in neutral citrate of ammonia) in mixed fertilizers,	2.0	2.0
Potash as Sulphate, free from Chlorides,	5.0	5.0
" " Muriate (chloride),	4.25	4.25

The above schedule of trade values was adopted by representatives of the Massachusetts, Connecticut, Rhode Island, Maine, Vermont and New Jersey Experiment Stations at a conference held during the month of March, 1904, and is based upon the condition of the fertilizer market in centers of distribution in New England, New York and New Jersey during the six months preceding March, 1904, and refers to the current market prices, in ton lots, of the leading standard raw materials, which furnish nitrogen, phosphoric acid and potash, and which enter largely into the manufacture of our commercial fertilizers.

HATCH EXPERIMENT STATION

—OF THE—

MASSACHUSETTS

AGRICULTURAL COLLEGE.

BULLETIN NO. 103.

I. ANALYSES OF MANURIAL SUBSTANCES FORWARDED FOR EXAMINATION.

II. INSTRUCTIONS REGARDING THE SAMPLING OF MATERIALS TO BE FORWARDED FOR ANALYSIS.

III. INSTRUCTIONS TO MANUFACTURERS, IMPORTERS, AGENTS AND SELLERS OF COMMERCIAL FERTILIZERS.

IV. DISCUSSION OF TRADE VALUES OF FERTILIZING INGREDIENTS FOR 1905.

MARCH, 1905.

The regular Bulletins of this Station will be sent free to all newspapers in the State and to such individuals interested in farming as may request the same. Technical Bulletins are sent only to those persons interested in the subject treated of in each case.

AMHERST, MASS.:
PRESS OF CARPENTER & MOREHOUSE
1905.

HATCH EXPERIMENT STATION

OF THE

Massachusetts Agricultural College,

AMHERST, MASS.

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George E. Stone, Ph. D.,	*Botanist.*
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The co-operation and assistance of farmers, fruit-growers, horticulturists, and all interested, directly or indirectly, in agriculture, are earnestly requested. The Bulletins will be sent free to all newspapers in the State and to such individuals interested in farming as may request the same. General bulletins, fertilizer analyses, analyses of feed-stuffs, and annual reports are published. Kindly indicate in application which of these are desired. Communications may be addressed to the

Hatch Experiment Station, Amherst, Mass.

DIVISION OF CHEMISTRY.

C. A. Goessmann.

ANALYSES OF FERTILIZER SUBSTANCES SENT ON FOR FREE EXAMINATION.

WOOD ASHES.

1588-1591. I. Received from Carlton, Mass.
II. Received from Northfield, Mass.
III. Received from West Newbury, Mass.
IV. Received from Gleasondale, Mass.

	PER CENT.			
	I.	II.	III.	IV.
Moisture at 100° C.,	14.31	19.63	6.00	14.67
Potassium oxide,	4.28	3.64	4.16	3.23
Phosphoric acid,	1.54	1.28	1.28	1.31
Calcium oxide,	30.28	29.58	32.12	28.29
Insoluble matter,	16.26	8.74	17.35	19.20

1592-1595. I. Received from Whitinsville, Mass.
II. Received from Boston, Mass.
III. Received from Amherst, Mass.
IV. Received from North Dartmouth, Mass.

	PER CENT.			
	I.	II.	III.	IV.
Moisture at 100° C.,	27.92	.45	14.15	13.31
Potassium oxide,	2.32	8.68	5.80	5.46
Phosphoric acid,	1.28	2.72	1.54	1.46
Calcium oxide,	31.74	45.05	30.36	49.24
Insoluble matter,	5.48	8.45	12.46	6.67

1596-1599. I. Received from Worcester, Mass.
II. Received from Marblehead, Mass.
III and IV. Received from Sunderland, Mass.

	PER CENT.			
	I.	II.	III.	IV.
Moisture at 100° C.,	.70	2.00	13.42	13.62
Potassium oxide,	4.60	4.68	4.84	4.12
Phosphoric acid,	.52	1.28	1.38	1.40
Calcium oxide,	47.20	32.04	21.17	32.94
Insoluble matter,	4.15	20.37	33.32	15.77

MISCELLANEOUS ASHES.

1600-1603. I. Cotton hull ashes, received from Southwick.
II. Cotton hull ashes, received from Amherst.
III. Wool waste ashes, received from Methuen.
IV. Lime ashes, received from South Deerfield.

	PER CENT.			
	I.	II.	III.	IV.
Moisture at 100° C.,	9.77	10.42	8.40	7.45
Potassium oxide,	22.08	19.04	27.24	1.40
Phosphoric acid,	9.33	6.40	.26	.97
Calcium oxide,	4.80	—	2.88	63.44
Chlorine,	none.	none.	none.	none.
Insoluble matter,	24.25	24.15	27.82	6.13

NITRATE OF SODA.

1604-1608. I. Received from Seekonk, Mass.
II. Received from Sunderland, Mass.
III. Received from Whately, Mass.
IV. Received from Great Barrington, Mass.
V. Received from North Hatfield, Mass.

	PER CENT.				
	I.	II.	III.	IV.	V.
Moisture at 100° C.,	1.31	1.91	1.12	1.27	1.70
Nitrogen,	15.41	15.03	15.24	15.44	14.97

COTTONSEED MEAL.

1609-1612. I. Received from Amherst, Mass.
II. Received from Hatfield, Mass.
III. Received from Southwick, Mass.
IV. Received from Westfield, Mass.

	PER CENT.			
	I.	II.	III.	IV.
Moisture 100° C.,	4.75	5.55	6.77	5.92
Nitrogen,	7.15	7.07	7.10	6.90

1613-1615. I. Received from Amherst, Mass.
II. Received from North Hatfield, Mass.
III. Reveived from Hatfield, Mass.

	PER CENT.		
	I.	II.	III.
Moisture at 100° C.,	7.07	4.82	4.90
Nitrogen,	3.55	6.68	6.52

DRIED BLOOD, SULPHATE OF AMMONIA AND CLOVER ROOTS.

1616-1618. I. High grade blood, received from Great Barrington, Mass.
II. Sulphate of ammonia, received from Great Barrington, Mass.
III. Clover roots, received from Amherst, Mass.

	PER CENT.		
	I.	II.	III.
Moisture at 100° C.,	12.45	.16	5.97
Nitrogen,	9.83	20.60	2.73
Phosphoric acid,	6.83	—	—

HIGH GRADE SULPHATE OF POTASH.

1619-1621. I. Received from Sunderland, Mass.
II. Received from Southwick, Mass.
III. Received from North Hatfield, Mass.

	PER CENT.		
	I.	II.	III.
Moisture at 100° C.,	.43	.50	1.17
Potassium oxide,	50.04	47.56	49.70

DISSOLVED BONE BLACK AND ACID PHOSPHATE.

1622–1626. I. Dissolved bone black, received from Sunderland.
II. Dissolved bone black, received from North Hatfield, Mass.
III. Acid phosphate, received from Whately, Mass.
IV. Acid phosphate, received from Great Barrington.
V. Acid phosphate, received from North Hatfield.

	PER CENT.				
	I.	II.	III.	IV.	V.
Moisture at 100° C.,	4.72	10.60	7.85	5.27	11.10
Total phosphoric acid,	19.06	16.76	16.94	18.63	16.96
Soluble phosphoric acid.	10.74	12.40	4.00	9.89	12.80
Reverted phosphoric acid,	6.74	3.46	10.74	7.51	2.96
Insoluble phosphoric acid,	1.58	.90	2.20	1.23	1.20

DRY GROUND FISH AND TANKAGE.

1627-1631. I. Dry ground fish, received from Sunderland.
II. Dry ground fish, received from North Hatfield.
III. Tankage, received from Agawam, Mass.
IV. Tankage, received from Fall River, Mass.
V. Tankage, received from Great Barrington, Mass.

	PER CENT.				
	I.	II.	III.	IV.	V.
Moisture at 100° C.,	11.68	7.07	4.01	8.82	10.15
Total phosphoric acid,	7.20	7.60	15.82	.76	9.57
Available phosphoric acid,	5.66	4.00	9.16	—	3.56
Insoluble phosphoric acic,	1.54	3.60	6.66	—	6.01
Nitrogen	8.47	8.17	5.47	11.27	7.45

GROUND BONE.

1632-1635. I. Bone dust, received from Springfield, Mass.
II. Ground bone, received from Springfield, Mass.
III. Tankage and bone, received from Amherst, Mass.
IV. Ground bone, received from Sunderland, Mass.

	PER CENT.			
	I.	II.	III.	IV.
Moisture at 100° C.,	1.46	2.98	5.13	5.41
Total phosphoric acid,	31.32	22.52	18.94	26.46
Available phosphoric acid,	14.36	9.34	11.78	10.62
Insoluble phosphoric acid,	16.96	13.18	7.16	15.84
Nitrogen,	.85	3.23	3.34	2.78

MEAT AND BONE.

1636-1638. I. Meat and bone, received from Whately, Mass.
II. Fine ground bone, received from Great Barrington, Mass.
III. Ground bone, damaged by salt water, received from West Barnstable, Mass.

	PER CENT.		
	I.	II.	III.
Moisture at 100° C.,	17.04	6.32	32.81
Total phosphoric acid,	21.36	23.02	17.21
Available phosphoric acid,	4.72	10.86	5.26
Insoluble phosphoric acid,	16.64	12.16	11.95
Nitrogen,	2.95	1.96	1.78

OYSTER SHELL LIME.

1639-1640. I. Received from West Tisbury, Mass.
II. Received from Agawam, Mass.

	PER CENT.	
	I.	II.
Moisture at 100° C.,	none.	none.
Calcium oxide,	59.45	61.62
Phosphoric acid,	.38	—
Carbonic acid,	9.45	—
Insoluble matter,	14.59	3.05

MISCELLANEOUS MATERIAL.

1641-1645. I. Paper mill dustings, received from East Walpole.
II. Wool dustings, received from Norwood, Mass.
III. Wool waste, received from South Braintree, Mass.
IV. Cotton waste, received from Chicopee, Mass.
V. Cotton waste compost, received from Chicopee.

	PER CENT.				
	I.	II.	III.	IV.	V.
Moisture at 100° C.,	1.68	14.10	4.50	6.87	21.70
Nitrogen,	.35	3.65	6.35	1.19	1.34
Potassium oxide,	.60	.29	.84	1.62	.76
Phosphoric acid,	.13	.32	.26	.45	.56
Calcium oxide,	.39	1.02	1.06	2.35	3.35
Ferric and Aluminium oxides,	4.40	—	—	—	—
Ash,	23.41	16.04	16.54	13.57	43.90
Insoluble matter,	14.23	9.25	9.45	8.54	34.42

1646-1651. I. Sewage bed sludge, received from Pittsfield, Mass.
II. Sewage, received from Eastondale, Mass.
III. Sheep manure, received from Worcester, Mass.
IV. Tobacco stems, received from Worcester, Mass.
V. Tobacco dust, received from Byfield, Mass.
VI. Wood charcoal, received from Amherst, Mass.

	PER CENT.					
	I.	II.	III.	IV.	V.	VI.
Moisture at 100° C.,	36.95	22.49	13.30	8.60	4.00	*
Nitrogen,	1.07	.36	2.80	2.20	1.54	*
Potassium oxide,	.20	.09	1.24	5.72	1.53	.36
Phosphoric acid,	.28	.42	1.47	.32	.51	.07
Calcium oxide,	4.34	.59	*	5.46	*	*
Ferric and Alum'm oxides,	2.62	2.79	*	*	*	*
Ash,	30.97	72.89	12.45	23.76	58.68	*
Insoluble matter,	37.80	68.14	6.05	2.70	46.77	*

* Not determined.

MUD, MUCK AND PEAT.

1652-1655. I. Salt marsh mud, received from West Tisbury, Mass.
II. Muck from bottom of pond, received from Millbury.
III and IV. Muck, received from Boston, Mass.

	PER CENT.			
	I.	II.	III.	IV.
Moisture at 100° C.,	51.78	65.03	86.84	78.05
Nitrogen,	.18	.46	.20	.14
Potassium oxide,	.14	.12	.006	.03
Phosphoric acid,	.08	.19	.009	.02
Calcium oxide,	.11	.11	.08	.05
Ash,	41.58	17.37	.92	11.82
Insoluble matter,	37.88	13.67	.43	11.19

1656-1659. I. Air dried muck, received from Boston, Mass.
II and III. Muck, received from Paxton, Mass.
IV. Peat, received from Malden, Mass.

	PER CENT.			
	I.	II.	III.	IV.
Moisture at 100° C.,	63.16	85.26	84.79	77.35
Nitrogen,	.45	.25	.18	.38
Potassium oxide,	.25	—	—	.04
Phosphoric acid,	.58	.03	.02	.08
Calcium oxide,	1.50	.58	.09	1.06
Ash,	13.04	1.72	8.80	4.22
Insoluble matter,	—	.37	8.00	3.12

COMPOUND FERTILIZERS.

1660-1664. I. Received from Springfield, Mass.
II. Received from Seekonk, Mass.
III and IV. Received from Sunderland, Mass.
V. Received from North Hadley, Mass.

	PER CENT.				
	I.	II.	III.	IV.	V.
Moisture at 100° C.,	3.55	3.46	5.43	10.07	6.43
Total phosphoric acid,	7.42	12.86	10.88	9.88	10.10
Soluble phosphoric acid,	—	5.34	7.42	5.93	5.43
Reverted phosphoric acid,	3.96	6.78	2.46	3.01	3.33
Insoluble phosphoric acid,	3.46	.74	1.00	.94	1.34
Potassium oxide,	16.10	6.54	5.48	6.63	6.59
Nitrogen,	—	3.59	3.89	3.44	3.05

1665-1668. I. Received from Southwick, Mass.
II. Received from Leominster, Mass.
III. Received from North Egremont, Mass.
IV. Received from Great Barrington, Mass.

	PER CENT.			
	I.	II.	III.	IV.
Moisture at 100 C.,	10.25	10.90	7.36	11.93
Total phosphoric acid,	10.10	7.54	8.76	10.82
Soluble phosphoric acid,	2.94	4.60	1.45	6.40
Reverted phosphoric acid,	3.84	2.04	3.49	2.86
Insoluble phosphoric acid,	3.32	.90	3.82	1.56
Potassium oxide,	3.78	6.52	5.81	1.72
Nitrogen,	2.93	4.47	1.11	.99

1669-1672. I and II. Received from Holyoke, Mass.
III and IV. Received from Northampton, Mass.

	PER CENT.			
	I.	II.	III.	IV.
Moisture at 100° C.,	8.67	8.40	5.66	7.65
Total phosphoric acid,	10.50	7.68	10.88	15.36
Soluble phosphoric acid,	7.24	6.86	2.95	8.50
Reverted phosphoric acid,	2.24	.82	4.83	4.48
Insoluble phosphoric acid,	1.02	none	3.10	2.38
Potassium oxide,	4.08	8.58	8.18	4.40
Nitrogen,	1.96	5.79	3.21	2.33

In the above analyses of compound fertilizers the samples have been forwarded by private parties instead of being drawn by a duly authorized agent from the Station. For this reason the manufacturer's name, etc., have not been published.

SOILS.

1673-1677. I, II and III. Received from Upton, Mass.
IV. Received from Belmont, Mass.
V. Received from Boston, Mass.

	PER CENT.				
	I.	II.	III.	IV.	V.
Moisture at 100 C.,	24.06	15.70	23.86	18.54	11.28
Nitrogen,	.31	.19	.38	.22	.10
Potassium oxide,	.15	.20	.35	.12	.06
Phosphoric acid,	.33	.58	.62	.17	.04
Calcium oxide,	.49	.70	.46	.10	.49
Ash,	*	*	*	74.48	84.95

* Not determined.

1678-1682. I and II. Received from Boston, Mass.
III. Received from Millbury, Mass.
IV. Received from Foxboro, Mass.
V. Received from Monson, Mass.

	PER CENT.				
	I.	II.	III.	IV.	V.
Moisture at 100° C.,	21.71	16.86	14.83	21.25	22.33
Nitrogen,	.16	.12	.05	.22	.19
Potassium oxide,	.01	.06	-	.08	.16
Phosphoric acid,	.05	.05	.15	.07	.02
Calcium oxide,	.26	.18	.10	.50	.08
Ash,	73.06	78.41	85.49	71.29	71.10

1683-1686. I. Received from Somerville, Mass.
II. Received from Athol, Mass.
III. Received from Amherst, Mass.
IV. Received from Lenox, Mass.

	PER CENT.			
	I.	II.	III.	IV.
Moisture at 100° C.,	8.72	25.63	22.22	.50
Nitrogen,	1.55	.20	.16	.29
Potassium oxide,	.07	.08	.16	.32
Phosphoric acid,	.22	.10	.08	.23
Calcium oxide,	.46	.17	.13	.10
Ash,	29.28	67.83	72.04	90.32

1687-1690. I and II. Received from Haverhill, Mass.
III. Received from Scituate, Mass.
IV. Received from Williamstown, Mass.

	PER CENT.			
	I.	II.	III.	IV.
Moisture at 100° C.,	65.20	31.82	6.96	1.03
Nitrogen,	.56	.35	.31	.27
Potassium oxide,	.04	.09	.09	.36
Phosphoric acid,	.03	.14	.12	.21
Calcium oxide,	.35	.22	.15	.18
Ash,	9.56	56.90	83.30	90.65

INSTRUCTIONS REGARDING THE SAMPLING OF MATERIALS TO BE SENT ON FOR EXAMINATION WITH STATEMENTS OF CONDITIONS TO SECURE ANALYSES FREE OF CHARGE.

It has been deemed advisable to republish in detail the instructions regarding the proper mode of sampling soils, fertilizers and other materials, both in bag and in bulk, and also the instructions regarding the packing, marking and shipment of same to insure prompt delivery, and that the results of analyses may fairly represent the *average composition* of the material in question. Unless the sample forwarded for analysis is an average representative sample, the results of our chemical investigation of the same become of little value. We are much pleased to say, however, that we have every reason to believe that the many samples received during the past year have, as a whole, been taken intelligently, and there are indications that greater care is being exercised by parties sampling material for analysis than ever before. It is our wish, however, that this subject may be called to the attention of as many farmers as possible, as there is still chance for improvement.

It is of the utmost importance that parties forwarding fertilizing substances for examination should take particular pains in sampling, packing and forwarding such materials, in order that the analyses obtained may represent the average composition of the goods sampled, and that no addition or loss of moisture in transportation may happen. The samples received are entered on our records in the order of their arrival at this office, and each sample is assigned a number and is taken up for investigation in the order in which it has been received.

The name of the sender should be enclosed in an envelope and placed inside the receptacle, together with a statement of the nature of the material forwarded for analysis; whether it is an agricultural chemical, mixed fertilizer, a wood ash, or the by-product of some manufacturing industry, or a sample of soil.

The results of all analyses of samples made at the Station, free of charge, are considered at the disposal of the managers for publication, if deemed advisable.

All samples should be addressed to Dr. C. A. Goessmann, Chemical Department of the Hatch Experiment Station, Amherst, Mass., to prevent possible delay. Express charges ought to be prepaid.

SAMPLING OF MATERIAL IN BULK.

In sampling such material as wood ashes, cotton hull ashes, and, in fact, any material in bulk, portions should be taken from various parts of the heap and placed on a thick, smooth piece of paper and thoroughly mixed; from this mixture should be drawn a sample of about one pound, which should be placed in a clean bottle, jar or tin can, tightly stoppered and sealed, in order to retain the moisture of the material unchanged.

SAMPLING OF MATERIAL IN BAGS.

In sampling material which is shipped in bags, portions should be drawn from at least ten per cent of the number of bags present. A fair sample may be obtained by emptying about ten per cent of the bags present on a clean floor or other smooth surface, and thoroughly mixing; small amounts are then taken from different parts of the heap and an average sample drawn as has been previously described.

SAMPLING OF SOILS.

The taking of representative soil samples, when such are desired for chemical investigation, is of the first importance, as without proper care in taking samples the results of a careful chemical analysis become of little value. The sample should be taken from different portions of the field and to a depth not exceeding the downward limit of the surface soil. After selecting a place where a sample is to be taken, pull up all growing vegetation and remove all surface matter which is not a part of the soil. Dig a hole in the soil about two feet square, making the sides smooth and clean by means of a sharp bladed shovel or other instrument; now place a sharp bladed shovel at the point of separation of the surface soil from the subsoil, and by means of another flat bladed instrument shave off a portion (about two inches) from all four sides of the aperture, letting the soil fall into a shovel which is held in a proper position to receive the same. Place the soil in a suitable receptacle, and proceed to take other samples in a like manner from several different parts of the field. The large bulk of soil which has thus been taken is now placed on a clean floor or on a large piece of thick paper and thoroughly broken up and mixed, after which an average sample is drawn and placed in a glass jar or bottle. The bottle is then securely stoppered and sealed, properly labelled and forwarded for the subsequent chemical examination.

Statements should accompany the sample or be sent in a sealed letter, setting forth the locality, depth at which the sample was taken, nature of subsoil and depth, the mode of fertilization and crop rotation which has been in practice, general fitness of land for cultivation and all other information that would be of interest or assistance to the chemist in formulating his report.

Care should be exercised in sampling when the weather conditions are normal, and no time should be lost between the drawing of the sample and the forwarding of same to the laboratory. This point applies with equal force to all materials forwarded for investigation.

APPLICATION FOR FREE ANALYSIS OF FERTILIZERS AND FERTILIZING MATERIAL.

Name of Material . . . .

Name of manufacturer or dealer . . . .

Address of manufacturer or dealer . . . .

Date of purchase . . . .

Price paid per ton . . . .

Whether bought for own use or for sale . . . .

Signature of applicant . . . .

Post Office Address . . . .

A printed copy of the above stated questions will be sent hereafter from this office *to every applicant for analysis free of charge*, to be answered by him according to his best information, before his request can be considered.

III.

INSTRUCTIONS TO MANUFACTURERS, IMPORTERS, AGENTS AND SELLERS OF COMMERCIAL FERTILIZERS AND MATERIALS USED FOR MANURIAL PURPOSES IN MASSACHUSETTS.

1. An application for a certificate of compliance with the regulations of the trade in commercial fertilizers and materials used for manurial purposes in this state must be accompanied:

First, with a distinct statement of the name of each brand offered for sale, the name of the manufacturer and place of factory.

Second, with a statement of the amount of phosphoric acid, of nitrogen and of potassium oxide guaranteed in each distinct brand.

The statement of the percentage of phosphoric acid should include its several forms when present as follows: *Soluble in distilled water, and reverted, as well as total phosphoric acid.* The potash should be guaranteed as *potassium oxide*, and not as sulphate or muriate, although the source from which the potassium oxide is derived may be mentioned on the tag or stencil.

In all cases the guaranteed percentage of *nitrogen should be stated.* The ammonia equivalent of nitrogen may be stated at the option of the manufacturer.*

Third, with the fee charged by the State for a certificate, which is five dollars for each of the following articles: nitrogen, phosphoric acid and potassium oxide guaranteed in any distinct brand.

2. The obligation to secure a certificate applies not only to compound fertilizers, but to all substances, single or compound, used for manurial purposes offered for sale in this State.

3. The certificate of compliance with our State laws must be secured annually before the first of May.

* To reduce ammonia to nitrogen, multiply the per cent. of ammonia by 14 and divide that product by 17 (or multiply the per cent. of ammonia by the factor .824).

4. Manufacturers, importers and dealers in commercial fertilizers can appoint in this State as many agents as they desire after having secured at this office the certificate of compliance with our laws.

5. Agents of manufacturers, importers and dealers in commercial fertilizers are held personally responsible for their transactions until they can prove that the articles they offer for sale are duly recorded in this office.

6. Manufacturers and importers are requested to furnish a list of their agents.

All inquiries regarding the sales of commercial fertilizers.. etc., should be addressed to C. A. Goessmann, Amherst, Mass., Chemist in charge of the official inspection of these articles.

TRADE VALUES OF FERTILIZING INGREDIENTS IN RAW MATERIALS AND CHEMICALS FOR 1904 AND 1905.

	1904	1905
	CENTS PER POUND	
Nitrogen in ammonia salts,	17.5	17.5
" nitrates,	16.0	17.0
Organic nitrogen in dry and fine ground fish, meat, blood, and in high-grade mixed fertilizers,	17.5	18.5
" " " fine bone and tankage,	17.0	18.0
" " " coarse bone and tankage,	12.5	13.0
Phosphoric acid soluble in water,	4.5	4.5
" " soluble in ammonium citrate,	4.0	4.0
" " in fine ground fish, bone and tankage,	4.0	4.0
" " in cottonseed meal, castor pomace and wood ashes,	4.0	4.0
" " in coarse fish, bone and tankage,	3.0	3.0
" " insoluble (in water and in neutral citrate of ammonia) in mixed fertilizers,	2.0	2.0
Potash as Sulphate, free from Chlorides,	5.0	5.0
" " Muriate (chloride),	4.25	4.25
" " Carbonate,		8.0

The above schedule of trade values was adopted by representatives of the Massachusetts, Connecticut, Rhode Island, Maine, Vermont and New Jersey Experiment Stations at a conference held during the month of March, 1905, and is based upon the condition of the fertilizer market in centers of distribution in New England, New York and New Jersey during the six months preceding March, 1905, and refers to the current market prices, in ton lots, of the leading standard raw materials, which furnish nitrogen, phosphoric acid and potash, and which enter largely into the manufacture of our commercial fertilizers. The following is a list of such materials:

Sulphate of ammonia,	Dissolved bone,
Nitrate of soda,	Ground phosphate rock,
Azotine,	Acid phosphate,
Dried blood,	Refuse bone black,
Cotton seed meal,	High grade sulphate of potash,
Castor pomace,	Muriate of potash,
Linseed meal,	Sulphate of potash-magnesia,
Dry ground fish,	Kainite,
Bone and tankage,	Sylvinite,
Crude saltpetre.	

A comparison of the market cost of the different essential ingredients of plant food for 1905, with the previous year, shows the following variation: Nitrogen in form of nitrates is a cent higher per pound. The higher grades of organic nitrogen, including nitrogen classed in high grade mixed fertilizers, are a cent higher in cost than for the year 1904. The cost of the different forms of phosphoric acid and potassium oxide remains the same as in the previous year.

Valuation. The approximate value of a compound fertilizer or any material used for fertilizing purposes is obtained by calculating the value of each of the three essential elements of plant food (nitrogen, phosphoric acid and potassium oxide, including the different forms of each wherever different forms are recognized in the table) in one hundred pounds of the fertilizer, and multiplying each product by twenty to change it to a ton basis. The sum of these values will give the total approximate value of the fertilizer per ton at the principal places of distribution.

In case of bone and tankage, we calculate separately the nitrogen and phosphoric acid value of each grade of mechanical fineness by multiplying the pounds of nitrogen and phosphoric acid per ton by the per cent. of each grade, and multiply these products by the trade values per pound, of nitrogen and phosphoric acid in each grade, and express the final product in cents. Adding the separate values of each grade of both ingredients, we have the valuation of the material in question.

In figuring the commercial value of a compound fertilizer, a suitable amount should be added to cover the expenses incurred in the manufacture and sale of the goods.

The trade value of a fertilizer does not necessarily indicate its exact agricultural value. The trade value of a given fertilizer simply shows its cost in our general markets. The agricultural value of a fertilizer shows its capacity in producing certain agricultural crops, and depends not only upon the condition of the fertility of the soil upon which the fertilizer is used, but also upon the physical condition of the soil, the mode of cultivation, the season and the crop to be raised. Experience alone can determine the general fitness and approximate agricultural value of compound commercial fertilizers and fertilizing materials.

The Following Bulletins are Available for Distribution to Those Who May Desire Them.

No. 3. Tuberculosis.
No. 27. Tuberculosis in college herd; tuberculin in diagnosis; bovine rabies; poisoning by nitrate of soda.
No. 33. Glossary of fodder terms.
No. 35. Agricultural value of bone meal.
No. 41. On the use of tuberculin (translated from Dr. Bang).
No. 64. Analyses of concentrated feed stuffs.
No. 67. Grass thrips; treatment for thrips in greenhouses.
No. 68. Fertilizer analyses.
No. 76. The imported elm-leaf beetle.
No. 77. Fertilizer analyses.
No. 79. Growing China asters.
No. 81. Analyses of fertilizers and manurial substances, instructions to manufacturers, agents, etc.; discussion of trade values; treatment of barnyard manure with absorbents.
No. 82. Orchard management: cover crops in orchards; pruning orchards; report on fruits.
No. 83. Fertilizer analyses.
No. 84. Fertilizer analyses.
No. 86. Orchard treatment for the San José scale. One year's experiments in Massachusetts.
No. 87. Cucumbers under glass.
No. 89. Fertilizer analyses.
No. 90. Fertilizer analyses.
No. 91. Injuries to shade trees from electricity.
No. 92. Fertilizer analyses.
No. 95. Fertilizer analyses; notes on barnyard manure; trade values.
No. 96. Fungicides, insecticides, spraying calendar.
No. 97. A farm woodlot.
No. 98. Inspection of concentrates.
No. 99. Dried molasses-beet-pulp; the nutrition of horses.
No. 100. Analyses of manurial substances and licensed fertilizers; trade values of fertilizing ingredients for 1903 and 1904.
No. 101. Inspection of concentrates.
No 102. Analyses of manurial substances and licensed fertilizers; trade values of fertilizing ingredients for 1903 and 1904.
No. 103. Analyses of manurial substances; instructions regarding sampling of materials; instructions to manufacturers, agents, etc.; trade values of fertilizing ingredients for 1904 and 1905.
Technical, No. 1. Greenhouse aleyrodes; strawberry aleyrodes.
Technical, No. 2. The graft union.
Special bulletin,—The coccid genera Chionaspis and Hemichionaspis.
Index, 1888-95.
Annual Reports,—1898, 1899, 1900, 1901, 1902, 1903, 1904.

HATCH EXPERIMENT STATION

—OF THE—

MASSACHUSETTS

AGRICULTURAL COLLEGE.

BULLETIN NO. 104.

I. ANALYSES OF MANURIAL SUBSTANCES FORWARDED FOR EXAMINATION.

II. MARKET VALUES OF FERTILIZING INGREDIENTS.

III. ANALYSES OF LICENSED FERTILIZERS COLLECTED IN THE GENERAL MARKETS.

JULY, 1905.

The regular Bulletins of this Station will be sent free to all newspapers in the State and to such individuals interested in farming as may request the same. Technical Bulletins are sent only to those persons interested in the subject treated of in each case.

AMHERST, MASS.:
PRESS OF CARPENTER & MOREHOUSE
1905.

HATCH EXPERIMENT STATION

OF THE

Massachusetts Agricultural College,

AMHERST, MASS.

STATION STAFF:

—— ——	*Director.*
WILLIAM P. BROOKS, PH. D.,	*Acting Director and Agriculturist.*
GEORGE E. STONE, PH. D.,	*Botanist.*
CHARLES A. GOESSMANN, PH. D., LL. D.,	*Chemist* (Fertilizers).
JOSEPH B. LINDSEY, PH. D.,	*Chemist* (Foods and Feeding).
CHARLES H. FERNALD, PH. D.,	*Entomologist.*
FRANK A. WAUGH, M. S.,	*Horticulturist.*
J. E. OSTRANDER, C. E.,	*Meteorologist.*
HENRY T. FERNALD, PH. D.,	*Associate Entomologist.*
FREDERICK R. CHURCH, B. SC.,	*Assistant Agriculturist.*
NEIL F. MONAHAN, B. SC.,	*Assistant Botanist.*
HENRI D. HASKINS, B. SC.,	*First Assis't Chemist* (Fertilizers).
EDWARD G. PROULX, B. SC.,	*Second Assis't Chemist* (Fertilizers).
EDWARD B. HOLLAND, M. S.,	*First Chemist* (Foods and Feeding).
PHILIP H. SMITH, B. SC.,	*Ass't Chemist* (Foods and Feeding).
ERWIN S. FULTON, B. SC.,	*Ass't Chemist* (Foods and Feeding).
—— ——	*Inspector* (Foods and Feeding).
SUMNER R. PARKER, B. SC.,	*Dairy Tester* (Foods and Feeding).
JOSEPH G. COOK, B. SC.,	*Assistant in Foods and Feeding.*
GEORGE O. GREENE, M. S.,	*Assistant Horticulturist.*
CLIFTON H. CHADWICK,	*Observer.*

The co-operation and assistance of farmers, fruit-growers, horticulturists, and all interested, directly or indirectly, in agriculture, are earnestly requested. The Bulletins will be sent free to all newspapers in the State and to such individuals interested in farming as may request the same. General bulletins, fertilizer analyses, analyses of feed-stuffs, and annual reports are published. Kindly indicate in application which of these are desired. Communications may be addressed to the

HATCH EXPERIMENT STATION, Amherst, Mass.

DIVISION OF CHEMISTRY.

C. A. Goessmann.

ANALYSES OF FERTILIZER SUBSTANCES SENT ON FOR FREE EXAMINATION.

WOOD ASHES.

1691-1695. I. Received from Hadley, Mass.
II. Received from Springfield, Mass.
III. Received from Townsend Harbor, Mass.
IV and V. Received from North Amherst, Mass.

	PER CENT.				
	I.	II.	III.	IV.	V.
Moisture at 100° C.,	15.15	3.55	7.25	18.67	9.10
Potassium oxide,	5.96	6.48	5.00	5.76	4.96
Phosphoric acid,	1.54	1.98	2.66	1.16	1.54
Calcium oxide,	31.86	38.27	34.48	28.18	27.56
Insoluble matter,	11.78	4.19	18.80	15.14	27.25

1696-1700. I. Received from North Amherst, Mass.
II. Received from Littleton, Mass.
III. Received from Sunderland, Mass.
IV. Received from Amherst, Mass.
V. Received from North Adams, Mass.

	PER CENT.				
	I.	II.	III.	IV.	V.
Moisture at 100° C.,	22.75	6.62	13.70	18.25	.02
Potassium oxide,	3.84	5.08	4.80	4.72	8.40
Phosphoric acid,	1.30	2.56	1.62	1.66	3.94
Calcium oxide,	25.90	26.69	33.66	26.85	45.64
Insoluble matter,	17.91	23.44	13.57	17.96	11.83

1701-1705. I. Received from Concord, Mass.
II, III and IV. Received from East Walpole, Mass.
V. Received from North Amherst, Mass.

	PER CENT.				
	I.	II.	III.	IV.	V.
Moisture at 100 C.,	1.27	.35	.82	1.25	19.82
Potassium oxide,	5.84	.88	.76	8.52	4.12
Phosphoric acid,	4.74	.56	.82	.90	1.16
Calcium oxide,	28.30	3.16	3.76	26.36	22.98
Insoluble matter,	21.03	66.86	58.27	18.41	24.98

NOTE.—Samples II and III are evidently ashes from some refuse material.

1706-1710. I. Received from North Hadley, Mass.
II. Received from Hadley, Mass.
III and IV. Received from Amherst, Mass.
V. Received from Marblehead, Mass.

	PER CENT.				
	I.	II.	III.	IV.	V.
Moisture at 100 C.,	15.99	15.03	5.12	18.60	8.45
Potassium oxide,	6.40	5.80	4.96	5.20	8.16
Phosphoric acid,	1.66	1.34	1.66	1.36	3.40
Calcium oxide,	31.24	33.52	41.41	24.28	33.68
Insoluble matter,	12.05	11.64	8.75	21.63	9.03

1711-1715. I. Received from Concord, Mass.
II and III. Received from Springfield, Mass.
IV and V. Received from Cushman, Mass.

	PER CENT.				
	I.	II.	III.	IV.	V.
Moisture at 100 C.,	20.12	1.96	1.60	16.75	17.08
Potassium oxide,	5.64	4.76	5.84	6.40	6.28
Phosphoric acid,	1.28	1.58	1.92	2.18	2.18
Calcium oxide,	23.92	38.55	36.36	35.34	37.20
Insoluble matter,	19.51	4.60	17.31	14.08	13.43

1716-1719. I. Received from Sunderland, Mass.
II. Received from Amherst, Mass.
III. Received from Cushman, Mass.
IV. Received from Gardner, Mass.

	PER CENT.			
	I.	II.	III.	IV.
Moisture at 100°C.,	20.60	19.50	22.47	32.05
Potassium oxide,	5.00	4.72	3.84	2.45
Phosphoric acid,	1.72	1.28	1.54	.69
Calcium oxide,	35.56	34.61	43.56	23.26
Insoluble matter,	15.70	18.02	11.53	21.41

MISCELLANEOUS ASHES.

1720-1724. I. Lime ashes, received from North Adams, Mass.
II. Lime ashes, received from South Deerfield, Mass.
III. Cotton hull ashes, received from Amherst, Mass.
IV and V. Leather scrap ashes, received from Boston, Mass.

	PER CENT.				
	I.	II.	III.	IV.	V.
Moisture at 100°C.,	.05	8.65	3.82	12.20	10.16
Potassium oxide,	4.80	4.24	26.76	1.20	1.00
Phosphoric acid,	1.58	1.26	8.76	1.80	1.86
Calcium oxide,	56.02	37.56	*	13.00	13.08
Insoluble matter,	3.29	3.07	14.26	52.06	52.15
Nitrogen,	*	*	*	.16	.14

NOTE.—The nitrogen in the above leather scrap ashes is probably in form of cyanogen compounds.

POTASH COMPOUNDS.

1725-1728. I. Muriate of potash, received from West Millbury, Mass.
II. Muriate of potash, received from Webster, Mass.
III. Sulphate of potash, received from Amherst, Mass.
IV. Carbonate of potash, received from Amherst, Mass.

* Not determined.

	PER CENT.			
	I.	II.	III.	IV.
Moisture at 100° C.	1.55	4.70	.87	none
Potassium oxide,	46.88	25.76	27.44	62.08
Magnesium oxide,	*	12.40	15.32	*
Sulphuric acid,	*	*	45.19	*
Chlorine,	*	1.50	1.10	none
Insoluble matter,	*	*	3.12	.10

NOTE.—Sample II is not muriate of potash, as the name would indicate, but sulphate of potash-magnesia or low grade sulphate of potash.

GROUND BONE AND GROUND MEAT AND BONE.

1729-1731. I. Meat and bone, received from Rochester, Mass.
II and III. Ground bone, received from Easthampton, Mass.

	PER CENT.		
	I.	II.	III.
Moisture at 100° C.,	4.50	7.67	3.82
Total phosphoric acid,	17.78	25.72	24.22
Available phosphoric acid,	9.79	12.42	11.24
Insoluble phosphoric acid,	7.99	13.30	12.98
Nitrogen,	5.03	3.71	2.17

MISCELLANEOUS MATERIAL.

1732-1737. I. German peat moss, received from Townsend Harbor, Mass.
II. River mud, received from Bondsville, Mass.
III. Wool mill refuse, received from Webster, Mass.
IV. Charcoal, received from Springfield, Mass.
V. Nitrate of soda, received from West Millbury, Mass.
VI. Burned bone, received from Taunton, Mass.

* Not determined.

	PER CENT.					
	I.	II.	III.	IV.	V.	VI.
Moisture at 100° C.,	9.50	61.95	11.65	3.65	1.17	8.05
Nitrogen,	.72	.19	.75	*	15.16	*
Potassium oxide,	.06	.15	.86	.44	*	*
Phosphoric acid,	.05	.05	.13	.26	*	31.98
Calcium oxide,	.21	.26	*	*	*	*
Ash,	1.74	30.22	63.77	*	*	*
Insoluble matter,	.36	*	53.74	1.58	*	*

COTTONSEED MEAL.

1738-1742. I. Received from North Hatfield, Mass.
II and III. Received from Bradstreet, Mass.
IV. Received from Agawam, Mass.
V. Received from Sunderland, Mass.

	PER CENT.				
	I.	II.	III.	IV.	V.
Moisture at 100° C.,	6.67	5.70	6.40	6.40	6.82
Nitrogen,	6.51	6.75	6.89	6.93	6.22

1743-1747. I. Received from North Hadley, Mass.
II. Received from North Hatfield, Mass.
III and IV. Received from Sunderland, Mass.
V. Received from Sunderland, Mass.

	PER CENT.				
	I.	II.	III.	IV.	V.
Moisture at 100° C.,	5.67	6.06	7.74	7.87	8.32
Nitrogen,	6.50	6.64	6.45	6.66	6.34

1748-1753.
I, II and III. Received from Sunderland, Mass.
IV. Received from Easthampton, Mass.
V. Received from Southwick, Mass.
VI. Received from Amherst, Mass.

	PER CENT.					
	I.	II.	III.	IV.	V.	VI.
Moisture at 100° C.,	7.78	7.63	7.71	7.00	6.80	7.81
Nitrogen,	6.53	6.36	6.12	6.68	6.92	6.43

* Not determined.

BARNYARD MANURE.

1754-1756.

I, II and III. Received from Monson, Mass.

	PER CENT.		
	I.	II.	III.
Moisture at 100 C.,	68.54	82.98	82.48
Nitrogen,	.42	.33	.35
Potassium oxide,	.25	.27	.46
Phosphoric acid,	.17	.10	.12
Calcium oxide,	.42	.34	.39
Ash,	17.54	2.61	4.74
Insoluble matter,	14.63	1.01	1.17

1757-1759.

I and II. Received from Amherst, Mass.

III. Hen manure, received from Amherst, Mass.

	PER CENT.		
	I.	II.	III.
Moisture at 100°C.,	82.73	81.15	51.77
Nitrogen,	.34	.36	.56
Potassium oxide,	.46	.61	.59
Phosphoric acid,	.32	.34	1.33
Acidity,	.21	.21	*
Insoluble matter,	.80	1.03	22.68

COMPOUND FERTILIZERS.

1760-1763.

I and II. Received from Sunderland, Mass.

III. Received from Lunenburg, Mass.

IV. Received from Grafton, Mass.

	PER CENT.			
	I.	II.	III.	IV.
Moisture at 100 C.,	6.78	2.95	2.52	8.02
Total phosphoric acid,	9.72	13.90	11.98	9.72
Soluble phosphoric acid,	5.25	8.38	*	3.68
Reverted phosphoric acid,	2.55	2.88	6.74	3.60
Insoluble phosphoric acid,	1.92	2.64	5.24	2.44
Potassium oxide,	7.30	5.20	10.84	10.12

* Not determined.

Nitrogen,	4.62	2.89	5.80	3.92
Nitrogen in form of nitrates,	*	*	*	1.55
Nitrogen in form of ammoniates,	*	*	*	1.22
Organic nitrogen,	*	*	*	1.15
Calcium oxide,	*	*	*	11.19

1764-1768. I. Received from South Amherst, Mass.
II. Received from Hatfield, Mass.
III. Received from Fitchburg, Mass.
IV. Nitrogenous Peruvian guano, received from Grafton, Mass.
V. Phosphatic Peruvian guano, received from Grafton, Mass.

	PER CENT.				
	I.	II.	III.	IV.	V.
Moisture at 100° C.,	10.07	8.20	6.65	13.22	12.47
Total phosphoric acid,	11.82	11.04	3.78	9.34	18.06
Soluble phosphoric acid,	3.20	2.55	2.68	2.18	3.58
Reverted phosphoric acid,	3.80	2.61	.52	5.44	7.82
Insoluble phosphoric acid,	4.82	5.88	.58	1.72	6.66
Potassium oxide,	8.56	9.64	11.24	1.92	3.02
Nitrogen,	3.11	3.33	7.85	6.87	2.97
Nitrogen in form of nitrates,	*	*	*	.95	.76
Nitro. in form of ammoniates,	*	*	*	3.25	1.76
Organic nitrogen,	*	*	*	2.67	.45
Calcium oxide,	*	*	*	10.21	15.48

SOILS.

1769-1773.
I and II. Received from Newton, Mass.
III. Received from Gloucester, Mass.
IV. Received from Canton, Mass.
V. Received from Boston, Mass.

	PER CENT.				
	I.	II.	III.	IV.	V.
Moisture at 100° C.,	11.66	1.02	56.87	20.05	2.88
Ash,	78.84	96.38	28.77	73.54	93.01
Nitrogen,	.34	.10	.37	.24	.14
Potassium oxide,	.20	.22	.32	.18	.17
Phosphoric acid,	.21	.15	.26	.15	.10
Calcium oxide,	.75	1.17	.43	.62	.49

* Not determined.

1774-1778.
I, II, III, IV and V. Received from New Bedford, Mass.

	PER CENT.				
	I.	II.	III.	IV.	V.
Moisture at 100 C.,	23.18	21.93	1.19	21.73	28.43
Ash,	71.68	72.58	92.38	77.93	64.97
Nitrogen,	.19	.19	.19	.15	.23
Potassium oxide,	.18	.25	.25	.17	.17
Phosphoric acid,	.11	.15	.14	.07	.09
Calcium oxide,	.29	.38	.48	.44	.39

1779-1783. I. Received from New Bedford, Mass.
II, III, IV and V. Received from Boston, Mass.

	PER CENT.				
	I.	II.	III.	IV.	V.
Moisture at 100 C.,	31.20	86.36	88.46	30.56	13.23
Ash,	63.19	1.07	.57	63.56	83.93
Nitrogen,	.21	.32	.19	.13	.07
Potassium oxide,	.15	.01	.009	.07	.08
Phosphoric acid,	.07	.03	.005	.004	.01
Calcium oxide,	.51	.06	.06	.19	.24
Chlorine,	*	trace	trace	.0004	.0004

1784-1787.
I and II. Received from Boston, Mass.
III and IV. Received from East Whately, Mass.

	PER CENT.			
	I.	II.	III.	IV.
Moisture at 100° C.,	7.15	32.67	5.83	24.81
Ash,	90.71	60.14	89.91	72.80
Nitrogen,	.07	.18	.11	.06
Potassium oxide,	.09	.05	.46	.40
Phosphoric acid,	.04	.03	.30	.13
Calcium oxide,	.30	.23	.65	.64
Chlorine,	.0004	.0004	*	*

* Not determined.

TRADE VALUES OF FERTILIZING INGREDIENTS IN RAW MATERIALS AND CHEMICALS FOR 1904 AND 1905.

	1904	1905
	CENTS PER POUND	
Nitrogen in ammonia salts,	17.5	17.5
" nitrates,	16.0	17.0
Organic nitrogen in dry and fine ground fish, meat, blood, and in high-grade mixed fertilizers,	17.5	18.5
" " " fine bone and tankage,	17.0	18.0
" " " coarse bone and tankage,	12.5	13.0
Phosphoric acid soluble in water,	4.5	4.5
" " soluble in ammonium citrate,	4.0	4.0
" " in fine ground fish, bone and tankage,	4.0	4.0
" " in cottonseed meal, castor pomace and wood ashes,	4.0	4.0
" " in coarse fish, bone and tankage,	3.0	3.0
" " insoluble (in water and in neutral citrate of ammonia) in mixed fertilizers,	2.0	2.0
Potash as Sulphate, free from Chlorides,	5.0	5.0
" " Muriate (chloride),	4.25	4.25
" " Carbonate,		8.0

The above schedule of trade values was adopted by representatives of the Massachusetts, Connecticut, Rhode Island, Maine, Vermont and New Jersey Experiment Stations at a conference held during the month of March, 1905, and is based upon the condition of the fertilizer market in centers of distribution in New England, New York and New Jersey during the six months preceding March, 1905, and refers to the current market prices, in ton lots, of the leading standard raw materials, which furnish nitrogen, phosphoric acid and potash, and which enter largely into the manufacture of our commercial fertilizers.

II. ANALYSES OF COMMERCIAL FERTILIZERS COLLECTED DURING 1905 IN THE GENERAL MARKETS BY THE AGENT OF THE HATCH EXPERIMENT STATION OF THE MASSACHUSETTS AGRICULTURAL COLLEGE.

Laboratory No.	Name of Brand.	Name of Manufacturer.	Sampled at
	Compound Fertilizers.		
11	Dry Ground Fish	American Agricultural Chemical Co., Boston, Mass.	N. Hatfield.
433	" " "	" " " " " "	Hatfield.
35	Grass and Lawn Top Dressing	" " " " " "	Weir.
64	" " " "	" " " " " "	Seekonk.
242	" " " "	" " " " " "	Brockton.
264	" " " "	" " " " " "	Bridgewater.
327	High Grade Fertilizer, with 10% Potash	" " " " " "	Newburyport.
411	" " " " " "	" " " " " "	Oxford.
12	Bradley's Comp. Manure for Potatoes and Vegetables	Amer. Ag. Chem. Co., Bradley Fertilizer Co. Branch	N. Hatfield.
57	" " " " " "	" " " " " " " "	Fall River.
170	" " " " " "	" " " " " " " "	Boston.
14	Bradley's X. L. Superphosphate	" " " " " " " "	N. Hatfield.
56	" " "	" " " " " " " "	Fall River.
219	" " "	" " " " " " " "	Haverhill.
37	Bradley's Eclipse Phosphate	" " " " " " " "	Weir.
209	" " "	" " " " " " " "	Lowell.
132	Baker's "A. A." Ammoniated Superphosphate	" " " " H. J. Baker & Bro. Branch	New Bedford.
372	" " " "	" " " " " " " "	Springfield.
379	" " " "	" " " " " " " "	Worcester.
350	Clark's Cove King Philip Alkaline Guano	" " " " Clark's Cove Fert. Co. Branch	Hudson.
360	" " " " " "	" " " " " " " "	Spencer.
260	Crocker's Potato, Hop and Tobacco Phosphate	" " " " Crocker Fert. & Ch. Co. Branch	Haverhill.
383	" " " " " "	" " " " " " " "	Worcester.
110	Darling's Farm Favorite	" " " " L. B. Darling Fert. Co. Branch	N. Amherst.
199	" " "	" " " " " " " "	S. Amherst.

Laboratory Number.	NAME OF BRAND.	Moisture.	Nitrogen in 100 lbs. Found.	Nitrogen in 100 lbs. Guaranteed.	Phosphoric Acid in 100 lbs. Soluble.	Reverted.	Insoluble.	Total. Found.	Total. Guaranteed.	Available. Found.	Available. Guaranteed.	Potassium Oxide in 100 lbs. Found.	Potassium Oxide in 100 lbs. Guaranteed.
	Compound Fertilizers.												
11	Dry Ground Fish	7.59	8.29	8.24	—	3.86	1.64	5.50	7	3.86	—	—	—
433	Dry Ground Fish	8.96	8.25	8.24	—	2.98	2.58	5.56	7	2.98	—	—	—
35-64-242-264	Grass and Lawn Top Dressing	6.46	5.28	3.91-4.73	1.40	3.84	1.72	6.96	6-9	5.24	5-7	2.96	2-3
327-411	High Grade Fertilizer, with 10% Potash	10.00	2.52	.24-3.00	3.75	2.71	2.18	8.64	7-10	6.46	6-8	10.10	10-12
12	Bradley's Comp. Manure for Pot. and Veg.	10.07	3.36	3.30-4.12	5.73	2.57	1.40	9.70	9-13	8.30	8-11	6.88	7-8
57-170	Bradley's Comp. Manure for Pot. and Veg.	10.13	4.28	3.30-4.12	5.13	3.71	2.04	10.88	9-13	8.84	8-11	7.16	7-8
14-56-219	Bradley's X. L. Superphosphate	14.51	2.29	2.50-3.28	6.08	3.32	2.36	11.76	11-14	9.40	9-11	2.27	2-3
37-209	Bradley's Eclipse Phosphate	11.60	1.16	1.03-2.50	5.83	2.01	2.82	10.66	10-15	7.84	9-12	2.20	2-3
132-372-379	Baker's "A. A." Ammon. Superphosphate	11.51	2.73	2.50-3.27	5.85	3.29	3.14	12.28	11-14	9.14	9-11	2.30	2-3
350-360	Clark's Cove King Philip Alkaline Guano	11.42	1.17	1.03-2.50	5.53	2.79	2.30	10.62	10-15	8.32	8-12	2.18	2-3
260-383	Crocker's Potato, Hop and Tob. Phosphate	12.13	2.11	2.06-2.88	4.03	5.49	2.76	12.28	10-12	9.52	8-10	3.18	3-4
110-199	Darling's Farm Favorite	11.79	2.10	2.06-2.88	4.68	3.42	2.72	10.82	10-13	8.10	8-10	3.08	3-4

II. ANALYSES OF COMMERCIAL FERTILIZERS COLLECTED DURING 1905 IN THE GENERAL MARKETS BY THE AGENT OF THE HATCH EXPERIMENT STATION OF THE MASSACHUSETTS AGRICULTURAL COLLEGE.

Laboratory No.	Name of Brand.	Name of Manufacturer.	Sampled at
	Compound Fertilizers.		
116	Darling's Potato Manure	Amer. Ag. Chem. Co., L. B. Darling Fert. Co. Branch	N. Amherst.
198	" " "	" " " " " " " "	S. Amherst.
101	Great Eastern Garden Special	" " " " Great Eastern Fert. Co. Branch	Sunderland.
441	" " " "	" " " " " " " "	E. Longm'd'w.
473	" " " "	" " " " " " " "	Westfield.
96	Soluble Pacific Guano	" " " " Pacific Guano Co. Branch	S. Amherst.
172	" " "	" " " " " " "	Plymouth.
329	" " "	" " " " " " "	Newburyport.
291	Packers' Union Universal Fertilizer	" " " " Packers' Union Fert. Co. Branch.	Gardner.
59	Quinnipiac Potato Manure	" " " " Quinnipiac Co. Branch	Seekonk.
391	" " "	" " " " " " "	Oxford.
66	Quinnipiac Potato Phosphate	" " " " " " "	Fall River.
532	" " "	" " " " " " "	Williamstown.
324	Read's Practical Potato Special	" " " " Read Fertilizer Co. Branch	Newburyport.
386	Read's Standard Superphosphate	" " " " " " " "	Worcester.
330	Standard Guano for all Crops	" " " " Standard Fertilizer Co. Branch	Newburyport.
307	Tucker's Special Potato Fertilizer	" " " " Henry F. Tucker Co. Branch	Newburyport.
472	" " " "	" " " " " " " "	Southwick.
175	Wheeler's Bermuda Onion Grower	" " " " M. E. Wheeler & Co. Branch	Concord.
194	Wheeler's Potato Manure	" " " " " " " "	Concord.
489	" " "	" " " " " " " "	S. Williamst'n.
210	Williams & Clark's Prolific Crop Producer	" " " " Williams & Clark Fert. Co. Branch	Lowell.
399	" " " " "	" " " " " " " " "	Worcester.
248	Williams & Clark's Royal Bone Phosphate	" " " " " " " " "	Haverhill.

Laboratory Number.	Name of Brand.	Moisture.	Nitrogen in 100 lbs.		Phosphoric Acid in 100 lbs.							Potassium Oxide in 100 lbs.	
								Total.		Available.			
			Found.	Guaranteed.	Soluble.	Reverted.	Insoluble.	Found.	Guaranteed.	Found.	Guaranteed.	Found.	Guaranteed.
	Compound Fertilizers.												
116-198	Darling's Potato Manure	11.31	2.89	2.50-3.25	2.55	4.47	3.12	10.14	8-11	7.02	6-8	5.22	5-6
101-441-473	Great Eastern Garden Special	10.67	3.01	3.30-4.12	4.15	3.97	3.00	11.12	9-13	8.12	8-11	7.04	7-8
96-172-329	Soluble Pacific Guano	12.69	2.06	2.06-2.88	4.73	3.53	2.94	11.20	10-13	8.26	8-10	1.80	1.50-2.50
291	Packers' Union Universal Fertilizer	9.63	1.03	.82-1.65	4.23	4.31	1.34	9.88	10-14	8.54	8-11	4.06	4-5
59-391	Quinnipiac Potato Manure	9.91	2.05	2.50-3.25	3.68	3.02	2.64	9.34	8-11	6.70	6-8	5.38	5-6
66-532	Quinnipiac Potato Phosphate	11.77	2.30	2.06-2.88	4.78	3.38	3.02	11.18	10-13	8.16	8-10	3.32	3-4
324	Read's Practical Potato Special	12.55	1.02	.82-1.05	4.60	2.56	1.36	8.52	5-8	7.16	4-6	6.72	8-10
386	Read's Standard Superphosphate	10.72	1.02	.82-1.65	4.90	3.56	1.54	10.00	10-14	8.46	8-11	4.16	4-5
330	Standard Guano for all Crops	12.37	1.07	1.03-2.50	5.62	2.46	2.30	10.38	10-15	8.68	8-12	2.00	2-3
307-472	Tucker's Special Potato Fertilizer	11.64	2.19	2.06-2.88	4.95	3.73	2.56	11.24	10-13	8.68	8-10	3.38	3-4
175	Wheeler's Bermuda Onion Grower	12.13	1.05	.82-1.65	4.38	2.78	2.66	9.82	10-14	7.16	9-11	4.06	4-5
194-489	Wheeler's Potato Manure	12.77	2.13	2.06-2.88	4.58	3.46	2.60	10.64	10-13	8.04	8-10	3.10	3-4
210-309	Williams & Clark's Pacific Crop Producer	13.67	1.37	.82-1.65	3.85	3.27	2.56	9.68	8-11	7.12	7-9	1.58	1-2
248	Williams & Clark's Royal Bone Phosphate	12.01	1.16	1.03-2.50	5.28	2.86	2.64	10.78	10-15	8.14	8-12	2.08	2-3

II. ANALYSES OF COMMERCIAL FERTILIZERS COLLECTED DURING 1905 IN THE GENERAL MARKETS BY THE AGENT OF THE HATCH EXPERIMENT STATION OF THE MASSACHUSETTS AGRICULTURAL COLLEGE.

Laboratory No.	Name of Brand.	Name of Manufacturer.	Sampled at
	Compound Fertilizers.		
252	Abbott's Tobacco and Potato Special	The Abbott & Martin Rendering Co., Columbus, Ohio.	Bridgewater.
284	" " " " "	" " " " " " "	Leominster.
265	Harvest King	" " " " " " "	Bridgewater.
296	" "	" " " " " " "	Leominster.
414	Eagle Brand Fertilizer	W. H. Abbott, Holyoke, Mass.	Holyoke.
481	" " "	" " " "	Amherst.
531	" " "	" " " "	Whately.
417	Abbott's Animal Fertilizer	" " " "	Holyoke.
480	" " "	" " " "	Amherst.
90	High Grade Potato Fertilizer	Armour Fertilizer Works, Baltimore, Md.	Amherst.
162	" " " "	" " " " "	Plymouth.
498	" " " "	" " " " "	S. Williamst'n
97	Bone, Blood and Potash	" " " " "	Amherst.
173	" " " "	" " " " "	Plymouth.
527	" " " "	" " " " "	Pittsfield.
216	Beach's Reliance Brand	Beach Soap Co., Lawrence, Mass.	Lawrence.
93	Ammoniated Bone Phosphate	Berkshire Fertilizer Co., Bridgeport, Conn.	N. Amherst.
518	" " "	" " " " "	Hinsdale.
103	Potato and Vegetable Phosphate	" " " " "	N. Amherst
139	" " " "	" " " " "	Somerset.

Laboratory Number.	Name of Brand.	Moisture.	Nitrogen in 100 lbs. Found.	Nitrogen in 100 lbs. Guaranteed.	Phosphoric Acid in 100 lbs. Soluble.	Reverted.	Insoluble.	Total. Found.	Total. Guaranteed.	Available. Found.	Available. Guaranteed.	Potassium Oxide in 100 lbs. Found.	Potassium Oxide in 100 lbs. Guaranteed.
	Compound Fertilizers.												
252-284	Abbott's Tobacco and Potato Special	11.16	1.69	1.65-2.45	4.73	5.13	1.48	11.34	10-12	9.86	8-11	4.12	4-5
265-296	Harvest King	12.06	.86	1.20-2.00	4.05	4.69	1.92	10.66	10-12	8.74	8-10	1.90	2-3
414-481-531	Eagle Brand Fertilizer..................	8.90	1.84	3-4	.32	6.82	6.52	13.66	14-15	7.14	11-12	11.01	10-11*
417-480	Abbott's Animal Fertilizer	10.57	2.81	3-4	1.02	9.12	6.02	16.16	18-20	10.14	13-14	—	
90-162-498	High Grade Potato Manure..............	8.90	1.87	1.65-2.47	6.03	2.53	1.80	10.36	10	8.56	8-10	10.08	10-11†
97-173-527	Bone, Blood and Potash	9.14	4.37	4.12-4.94	6.45	2.37	1.28	10.10	10	8.82	8-10	7.36	7-8‡
216	Beach's Reliance Brand	6.27	2.04	1.65-2.47	1.75	8.19	3.18	13.12	10-12	9.91	8-10	4.06	3-4
93-518	Ammoniated Bone Phosphate............	8.63	1.57	.8-1.50	2.73	6.09	3.48	12.30	10-12	8.82	8-12	2.60	2-3
103-139	Potato and Vegetable Phosphate.........	9.74	2.35	1.65-2.47	1.85	3.51	4.38	9.74	8-10	5.36	6-8	4.36	4-6

* Sulphate of potash, the source of potash.

† Enough chlorine present to unite with 8.38% potassium oxide.

‡ Enough chlorine present to unite with 3.05% potassium oxide.

II. ANALYSES OF COMMERCIAL FERTILIZERS COLLECTED DURING 1905 IN THE GENERAL MARKETS BY THE AGENT OF THE HATCH EXPERIMENT STATION OF THE MASSACHUSETTS AGRICULTURAL COLLEGE.

Laboratory No.	Name of Brand.	Name of Manufacturer.	Sampled at
	Compound Fertilizers.		
147	Stockbridge Special Complete Manure	Bowker Fertilizer Co., Boston, Mass	Braintree.
171	" " " "	" " " " "	Concord.
188	" " " "	" " " " "	Dighton.
274	" " " "	" " " " "	Braintree.
408	" " " "	" " " " "	Oxford.
495	" " " "	" " " " "	Williamsto'n.
55	Potato and Vegetable Fertilizer	" " " " "	Dighton.
71	Market Garden Fertilizer	" " " " "	Dighton.
222	" " "	" " " " "	Haverhill.
72	Bowker's Early Potato Manure	" " " " "	Dighton.
234	" " " "	" " " " "	Bridgewater.
141	Farm and Garden Phosphate	" " " " "	Boston.
220	" " " "	" " " " "	Haverhill.
228	" " " "	" " " " "	Bridgewater.
241	" " " "	" " " " "	Bridgewater.
541	" " " "	" " " " "	N. Adams.
160	Bowker's Potato and Vegetable Phosphate	" " " " "	Plymouth.
249	" " " " "	" " " " "	Haverhill.
548	" " " " "	" " " " "	Gt. Barrington
168	Bowker's Hill and Drill Phosphate	" " " " "	Boston.
232	" " " " "	" " " " "	Lexington.
539	" " " " "	" " " " "	Hinsdale.
180	Bowker's Lawn and Garden Dressing	" " " " "	Boston.
261	" " " " "	" " " " "	Haverhill.

Laboratory Number.	Name of Brand.	Moisture.	Nitrogen in 100 lbs. Found.	Nitrogen in 100 lbs. Guaranteed.	Phosphoric Acid in 100 lbs. Soluble.	Reverted.	Insoluble.	Total. Found.	Total. Guaranteed.	Available. Found.	Available. Guaranteed.	Potassium Oxide in 100 lbs. Found.	Potassium Oxide in 100 lbs. Guaranteed.
	Compound Fertilizers.												
147-171-188	Stockbridge Special Complete Manure....	10.47	1.61	4.94-5.76	2.15	4.09	.98	7.22	6-8	6.24	4-6	6.26	6-7
274-408-495	" " " " ...	10.47	1.61	4.94-5.76	2.15	4.09	.98	7.22	6-8	6.24	4-6	6.26	6-7
55	Potato and Vegetable Fertilizer..........	14.65	2.05	2.47-3.29	4.45	4.43	1.22	10.10	9-12	8.88	7-9	3.90	4-6
71-222	Market Garden Fertilizer................	12.32	2.36	2.47-3.29	3.53	2.55	2.28	8.36	7-9	6.08	6-8	10.36	10-11
72-234	Bowker's Early Potato Manure	14.36	3.15	3.29-4.12	4.28	3.08	2.10	9.46	8-10	7.36	7-9	7.00	7-8
141-220	Farm and Garden Phosphate	11.85	1.84	1.65-2.47	3.53	4.65	2.82	11.00	9-11	8.18	8-10	2.02	2-3
228-241-541	" " " "	11.85	1.84	1.65-2.47	3.53	4.65	2.82	11.00	9-11	8.18	8-10	2.02	2-3
160-249-548	Bowker's Potato and Vegetable Phosphate	12.32	1.73	1.50-2.50	4.15	3.99	2.84	10.98	11-13	8.14	7-11	2.20	2-4
168-232-539	Bowker's Hill and Drill Phosphate.......	15.90	2.35	2.47-3.29	7.03	2.39	1.92	11.34	10-12	9.42	9-11	2.12	2-3
180-261	Bowker's Lawn and Garden Dressing	7.30	3.33	3-4	2.73	3.97	1.30	8.00	8-10	6.70	4-8	5.96	5-6*

* Enough chlorine was present to unite with 4.17% potassium oxide.

II. ANALYSES OF COMMERCIAL FERTILIZERS COLLECTED DURING 1905 IN THE GENERAL MARKETS BY THE AGENT OF THE HATCH EXPERIMENT STATION OF THE MASSACHUSETTS AGRICULTURAL COLLEGE.

Laboratory No.	Name of Brand.	Name of Manufacturer.	Sampled at
	Compound Fertilizers.		
187	Bowker's Blood, Bone and Potash	Bowker Fertilizer Co., Boston, Mass	Concord.
207	" " " " "	" " " " "	Lowell.
547	" " " " "	" " " " "	Gt. Barrington
438	Fish and Potash, "Square Brand"	" " " " "	Northampton.
521	" " " "	" " " " "	Deerfield.
451	Bowker's Tobacco Ash Elements	" " " " "	Southwick.
77	Bristol Fish and Potash	" " " " "	Dighton.
358	" " " "	" " " " "	Springfield.
140	Breck's Market Garden Manure	Joseph Breck & Sons, Boston, Mass	Boston.
174	Breck's Lawn and Garden Dressing	" " " " "	Boston.
95	Red Brand Excelsior Guano	E. Frank Coe Co., New York City	S. Amherst.
106	New Englander Corn Fertilizer	" " " " " "	S. Amherst.
117	New Englander Potato Fertilizer	" " " " " "	S. Amherst.
130	Gold Brand Excelsior Guano	" " " " " "	Dighton.
1	Canada Hard Wood Ashes	Wm. E. Fyfe & Co., Clinton, Mass	Sunderland.
114	" " " "	" " " " " "	Sunderland.
496	Clay's London Fertilizer	R. & J. Farquhar & Co., Boston, Mass	Pittsfield.

Laboratory Number.	Name of Brand.	Moisture.	Nitrogen in 100 lbs.		Phosphoric Acid in 100 lbs.							Potassium Oxide in 100 lbs.	
								Total.		Available.			
			Found.	Guaranteed.	Soluble.	Reverted.	Insoluble.	Found.	Guaranteed.	Found.	Guaranteed.	Found.	Guaranteed.
	Compound Fertilizers.												
187-207-547	Bowker's Bone, Blood and Potash........	10.26	3.83	4.10-5.94	5.05	3.21	1.44	9.70	10-12	8.26	8-10	7.24	7-8
438-521	Fish and Potash, "Square Brand"	9.07	2.50	2.25-3.25	3.35	2.83	2.44	8.62	8-10	6.18	—	4.44	4-6
451	Tobacco Ash Elements..................	7.32	.69	—	.12	7.84	6.90	14.90	—	7.96	6-7	15.36	15-18†
77-358	Bristol Fish and Potash	13.00	1.75	1.50-2.50	3.90	4.36	3.00	11.26	8-10	8.26	5-8	2.26	2-3
140	Breck's Market Garden Manure..........	14.07	2.61	2.50-3.25	5.97	3.17	3.40	12.54	11-14	9.14	9-11	2.40	2-3
174	Breck's Lawn and Garden Dressing......	6.75	4.85	4.12-4.94	1.05	3.63	1.68	6.36		4.68	5-6	5.28	5-8‡
95	Red Brand Excelsior Guano	9.05	3.26	3.5-4.00	6.68	1.40	2.54	10.62	10-12	8.08	9-12	6.52	6-8*
106	New Englander Corn Fertilizer	13.98	1.20	.80-1.00	4.95	2.61	3.32	10.88	9-10	7.56	7.5-9.5	3.70	3-4*
117	New Englander Potato Fertilizer.........	13.80	1.33	.80-1.00	5.40	2.30	3.18	10.88	9-10	7.70	7.5-9	3.24	3-4*
130	Gold Brand Excelsior Guano............	13.42	2.64	2.4-3.3	6.48	.88	1.54	8.90	9-10	7.36	7.5-9	6.46	6-7*
1	Canada Hard Wood Ashes	15.90	—	—	—	—	—	1.58	1-3	—	—	4.52	4-5.8†
114	Canada Hard Wood Ashes	13.10	—	—	—	—	—	1.66	1-5	—	—	6.32	4-5.8‡
496	Clay's London Fertilizer	12.96	4.13	—	.15	.87	6.48	7.50	—	1.02		.18	

* Sulphate of potash, the source of potash.

† Carbonate of potash, the source of potash.

‡ Enough chlorine present to unite with 3.02% potassium oxide

II. ANALYSES OF COMMERCIAL FERTILIZERS COLLECTED DURING 1905 IN THE GENERAL MARKETS BY THE AGENT OF THE HATCH EXPERIMENT STATION OF THE MASSACHUSETTS AGRICULTURAL COLLEGE.

Laboratory No.	Name of Brand.	Name of Manufacturer.	Sampled at
	Compound Fertilizers.		
166	Hardy's Tobacco and Potato Special	Hardy Packing Co., Chicago, Ill	Concord.
314	" " " " "	" " " " "	Amesbury.
27	Lister's Success Fertilizer	Lister's Agricultural Chemical Works, Newark, N. J.	New Bedford.
301	" " "	" " " " " "	Fitchburg.
280	Lister's High Grade Special for Spring Crops	" " " " " "	Fitchburg.
463	" " " " " "	" " " " " "	Agawam.
516	" " " " " "	" " " " " "	Ashley Falls.
23	Swift's Lowell Potato Manure	Swift's Lowell Fertilizer Co., Boston, Mass.	New Bedford.
501	" " " "	" " " " " "	Greenfield.
61	Superior Fertilizer, with 10% potash	" " " " " "	Seekonk.
150	" " " " "	" " " " " "	Braintree.
62	Swift's Lowell Potato Phosphate	" " " " " "	Taunton.
268	" " " "	" " " " " "	Hingham.
43	Mapes' Corn Manure	Mapes' Formula & Peruvian Guano Co., New York City	Taunton.
309	" " "	" " " " " " "	Fitchburg.
51	Mapes' Potato Manure	" " " " " " "	Taunton.
231	" " "	" " " " " " "	Bridgewater.
393	" " "	" " " " " " "	Worcester.
534	" " "	" " " " " " "	Pittsfield.
287	Mapes' Economical Potato Manure	" " " " " " "	Leominster.
316	" " " "	" " " " " " "	Fitchburg.
373	" " " "	" " " " " " "	Worcester.

Laboratory Number.	Name of Brand.	Moisture.	Nitrogen in 100 lbs.		Phosphoric Acid in 100 lbs.							Potassium Oxide in 100 lbs.	
								Total.		Available.			
			Found.	Guaranteed.	Soluble.	Reverted.	Insoluble.	Found.	Guaranteed.	Found.	Guaranteed.	Found.	Guaranteed.
	Compound Fertilizers.												
166-314	Hardy's Tobacco and Potato Special	11.22	1.60	1.65-2.47	5.13	3.39	1.80	10.32	10-12	8.52	8-11	4.00	4-5
27-301	Lister's Success Fertilizer.............	12.25	1.61	1.24-1.66	4.33	4.19	2.56	11.08	11-15	8.52	9-12	2.70	2-3
280-463-516	Lister's High Gr. Spec. for Spring Crops .	11.80	1.71	1.65-1.88	5.80	3.20	1.28	10.28	10-13	9.00	8-10	10.64	10-10.5
23-501	Swift's Lowell Potato Manure	10.78	1.67	1.64-2.46	5.13	2.27	1.24	8.64	8-11	7.40	7-9	4.12	4-5
61-150	Superior Fertilizer, with 10% potash	11.92	3.72	3.39-4.22	5.28	2.50	.86	8.64	8-11	7.78	7-9	9.26	10-11
62-268	Swift's Lowell Potato Phosphate.........	10.03	2.58	2.46-3.30	5.80	2.36	2.02	10.18	9-12	8.16	8-10	6.02	6-7
43-309	Mapes' Corn Manure....................	7.43	2.60	2.47-2.88	3.00	5.14	2.64	10.78	10-12	8.14	8-10	6.66	6-7
51-231-393-534	Mapes' Potato Manure	7.37	3.72	3.71-4.12	3.85	4.09	1.74	9.68	8-10	7.94	6-8	7.26	6-8*
287-316-373	Mapes' Economical Potato Manure	4.88	3.58	3.29-4.12	1.75	3.33	.94	6.02	6-8	5.08	4-5	9.10	8-10*

* Sulphate of potash, the source of potash

II. ANALYSES OF COMMERCIAL FERTILIZERS COLLECTED DURING 1905 IN THE GENERAL MARKETS BY THE AGENT OF THE HATCH EXPERIMENT STATION OF THE MASSACHUSETTS AGRICULTURAL COLLEGE.

Laboratory No.	Name of Brand.	Name of Manufacturer.	Sampled at
	Compound Fertilizers.		
10	Chittenden's Dry Ground Fish	National Fertilizer Co., Bridgeport, Conn	Hatfield.
123	" " " "	" " " " "	Sunderland.
15	Chittenden's Complete Root Fertilizer	" " " " "	Hatfield.
22	" " " "	" " " " "	New Bedford.
102	" " " "	" " " " "	N. Amherst.
16	Chittenden's Complete Tobacco Fertilizer	" " " " "	Hatfield.
120	" " " "	" " " " "	Sunderland.
18	Chittenden's Ammoniated Bone Phosphate	" " " " "	New Bedford.
288	" " " "	" " " " "	Leominster.
490	" " " "	" " " " "	Gt. Barrington
25	Chittenden's Fish and Potash XXX	" " " " "	New Bedford.
26	" " " " "	" " " " "	New Bedford.
13	Olds & Whipple's Complete Tobacco Fertilizer	Olds & Whipple, Hartford, Conn	Hatfield.
437	" " " " "	" " " "	E. Whately.
454	" " " " "	" " " "	Westfield.
416	Complete for all Crops	R. T. Prentiss, Holyoke, Mass	Holyoke.
552	" " "	" " " "	Amherst.
247	Hubbard's Corn Phosphate	Rogers & Hubbard Co., Middletown, Conn	Andover.
487	" " "	" " " " "	Gt. Barrington
500	Hubbard's Soluble Corn and General Crops	" " " " "	Whately.
536	" " " " " "	" " " " "	Leyden.
424	Fish and Potash	Rogers Manufacturing Co., Rockfall, Conn	E. Whately.
478	Complete Potato and Vegetable Manure	" " " "	Amherst.
355	Ross Bros.' Lawn and Garden Fertilizer	Ross Bros., Worcester, Mass	Worcester

Laboratory Number.	NAME OF BRAND.	Moisture.	Nitrogen in 100 lbs. Found.	Nitrogen Guaranteed.	Phosphoric Acid in 100 lbs. Soluble.	Reverted.	Insoluble.	Total. Found.	Total. Guaranteed.	Available. Found.	Available. Guaranteed.	Potassium Oxide in 100 lbs. Found.	Potassium Oxide Guaranteed.
	Compound Fertilizers.												
10-123	Chittenden's Dry Ground Fish..........	10.68	8.33	8.24-9.89	—	4.40	3.36	7.76	6-8	4.40	—	—	—
15	Chittenden's Complete Root Fertilizer....	5.93	3.37	3.30-4.10	4.60	3.52	2.26	10.38	10-18	8.12	8-10	6.98	6-7
22-102	Chittenden's Complete Root Fertilizer....	11.55	3.43	3.30-4.10	5.30	2.88	1.80	9.98	10-12	8.18	8-10	7.14	6-7
16-120	Chittenden's Complete Tobacco Fertilizer.	8.08	3.44	3.30-4.10	5.12	4.02	2.12	11.26	10-14	9.14	8-11	4.70	5-6*
18-288-490	Chittenden's Ammo. Bone Phosphate	11.99	2.16	1.65-2.41	5.75	2.75	2.68	11.18	10-14	8.50	8-11	2.28	2-3
25-26	Chittenden's Fish and Potash XXX......	10.65	2.75	2.50-3.50	3.90	2.98	1.54	8.42	7-9	6.88	5-7	3.02	3-4
13-437-454	Olds & Whipple's Complete Tobacco Fert.	7.52	4.80	4.53-5.36	1.60	3.58	2.58	7.76	—	5.18	3-4	5.75	5.5-6.5†
416-552	Complete for all Crops...	9.96	2.51	2.46-3.29	6.68	3.16	.94	10.78	10-12	9.84	8-10	5.40	5-7
247-487	Hubbard's Corn Phosphate	11.04	1.13	1-1.50	6.08	3.72	1.40	11.20	10-12	9.80	8-10	4.22	3.5-4.0
500-536	Hubbard's Soluble Corn and Gen. Crops .	6.96	2.51	2.50-3.0	2.53	5.53	2.32	10.28	8-10	8.06	6-7	8.81	8-9
421	Fish and Potash.......................	7.29	3.58	3.25-4.50	2.07	2.35	3.08	7.50	6-8	4.42	4-5	4.16	3.75-4.50
178	Complete Potato and Vegetable Manure..	8.67	2.69	2.25-3.25	4.90	3.56	3.46	11.92	10-12	8.46	8-10	5.50	5-6
356	Ross Bros' Lawn and Garden Fertilizer ..	10.14	2.37	2.5-3.00	.38	2.20	2.46	5.04	6-8	2.58	—	5.32	5.5-6

* Sulphate of potash, the source of potash.

† Carbonate of potash, the source of potash.

II. ANALYSES OF COMMERCIAL FERTILIZERS COLLECTED DURING 1905 IN THE GENERAL MARKETS BY THE AGENT OF THE HATCH EXPERIMENT STATION OF THE MASSACHUSETTS AGRICULTURAL COLLEGE.

Laboratory No.	Name of Brand.	Name of Manufacturer.	Sampled at
	Compound Fertilizers.		
409	Complete Animal Fertilizer	N. Roy & Son, South Attleboro, Mass	S. Attleboro.
36	Essex Odorless Lawn Dressing	Russia Cement Co., Gloucester, Mass	Taunton.
286	" " " "	" " " " "	Leominster.
46	Essex XXX Fish and Potash	" " " " "	Taunton.
285	" " " "	" " " " "	Leominster.
506	Sanderson's Corn Superphosphate	Sanderson's Fert. and Chemical Co., New Haven, Conn.	Hinsdale.
69	Sanderson's Potato Manure	" " " " " " "	Dighton.
542	" " "	" " " " " " "	Hinsdale.
121	Sanderson's Tobacco Formula "B."	" " " " " " "	Sunderland.
125	" " " "	" " " " " " "	Sunderland.
377	" " " "	" " " " " " "	Southwick.
425	" " " "	" " " " " " "	E. Whately.
3	Swift's Sure Superphosphate	M. L. Shoemaker & Co., Philadelphia, Pa	Sunderland.
17	" " "	" " " " "	Hatfield.
122	" " "	" " " " "	Sunderland.
359	" " "	" " " " "	Springfield.
215	All Crops Fertilizer	Whitman & Pratt Rendering Co., Lowell, Mass	Lowell.
282	Vegetable Grower	" " " " " "	Fitchburg.
427	" "	" " " " " "	Northampton.
76	Potato, Onion and Vegetable Manure	Wilcox Fertilizer Works, Mystic, Conn	Dighton.
99	" " " " "	" " " " "	Amherst.
83	Wilcox Fish and Potash	" " " " "	Dighton.
98	" " " "	" " " " "	Amherst.
390	" " " "	" " " " "	Springfield.

Laboratory Number.	Name of Brand.	Moisture.	Nitrogen in 100 lbs. Found.	Nitrogen in 100 lbs. Guaranteed.	Phosphoric Acid in 100 lbs. Soluble.	Reverted.	Insoluble.	Total. Found.	Total. Guaranteed.	Available. Found.	Available. Guaranteed.	Potassium Oxide in 100 lbs. Found.	Potassium Oxide in 100 lbs. Guaranteed.
	Compound Fertilizers.												
409	Complete Animal Fertilizer	3.79	2.91	3-4	.35	6.31	13.86	20.52	18-19	6.66	6-8	6.50	6-7
36-286	Essex Odorless Lawn Dressing	7.10	3.72	3.7-4.5	2.03	4.73	3.22	9.98	8-10	6.76	6-7	7.10	7-8
46-285	Essex XXX Fish and Potash	8.99	2.30	2.1-3.00	4.23	4.97	3.38	12.58	12-14	9.20	9-10.5	2.26	2.25-3.25
506	Sanderson's Corn Superphosphate	15.02	1.93	1.62-2.50	6.73	2.37	1.46	10.56	10-12	9.10	7-9	2.02	2-3
69-542	Sanderson's Potato Manure	11.98	2.01	1.67-2.47	3.70	3.71	1.31	8.78	8-9	7.44	7-10	5.88	6-7
121-125-377-425	Sanderson's Tobacco Formula "B."	11.67	3.29	3.29-4.12	1.38	5.50	4.04	10.92	10-12	6.88	6-8	6.74	6-8†
3-17-122-359	Swift's Sure Superphosphate	7.29	2.94	2.88-4.12	8.80	2.48	2.40	13.68	13-17	11.28	8-11	5.08	4.5-6
215	All Crops Fertilizer	9.48	2.93	3-4	5.63	4.59	1.58	11.80	11-13	10.22	9-11	5.80	4-5
282-427	Vegetable Grower	7.16	3.87	3.29-4.11	4.63	3.83	3.38	11.84	10-13	8.46	8-9	6.74	7-8
76-99	Potato, Onion and Vegetable Manure	11.16	3.69	3.30-4.30	6.55	2.67	.76	9.98	8-10	9.22	7-9	7.04	6-8
83-98-390	Wilcox Fish and Potash	10.83	2.72	2.40-3.29	2.10	3.88	2.38	8.36	6-8	5.98	5-7	4.02	3-5

† Enough chlorine present to unite with 5.17% potassium oxide.

The Following Bulletins are Available for Distribution to Those Who May Desire Them.

No. 3. Tuberculosis.
No. 27. Tuberculosis in college herd; tuberculin in diagnosis; bovine rabies; poisoning by nitrate of soda.
No. 33. Glossary of fodder terms.
No. 35. Agricultural value of bone meal.
No. 41. On the use of tuberculin (translated from Dr. Bang).
No. 64. Analyses of concentrated feed stuffs.
No. 67. Grass thrips: treatment for thrips in greenhouses.
No. 68. Fertilizer analyses.
No. 76. The imported elm-leaf beetle.
No. 77. Fertilizer analyses.
No. 79. Growing China asters.
No. 81. Analyses of fertilizers and manurial substances, instructions to manufacturers, agents, etc.; discussion of trade values; treatment of barnyard manure with absorbents.
No. 82. Orchard management; cover crops in orchards; pruning orchards; report on fruits.
No. 83. Fertilizer analyses.
No. 84. Fertilizer analyses.
No. 86. Orchard treatment for the San José scale. One year's experiments in Massachusetts.
No. 87. Cucumbers under glass.
No. 89. Fertilizer analyses.
No. 90. Fertilizer analyses.
No. 91. Injuries to shade trees from electricity.
No. 92. Fertilizer analyses.
No. 95. Fertilizer analyses; notes on barnyard manure; trade values.
No. 96. Fungicides, insecticides, spraying calendar.
No. 97. A farm woodlot.
No. 98. Inspection of concentrates.
No. 99. Dried molasses-beet-pulp; the nutrition of horses.
No. 100. Analyses of manurial substances and licensed fertilizers; trade values of fertilizing ingredients for 1903 and 1904.
No. 101. Inspection of concentrates.
No 102. Analyses of manurial substances and licensed fertilizers; trade values of fertilizing ingredients for 1903 and 1904.
No. 103. Analyses of manurial substances; instructions regarding sampling of materials; instructions to manufacturers, agents, etc.; trade values of fertilizing ingredients for 1904 and 1905.
Technical, No. 1. Greenhouse aleyrodes; strawberry aleyrodes.
Technical, No. 2. The graft union.
Special bulletin.—The coccid genera Chionaspis and Hemichionaspis.
Index, 1888-95.
Annual Reports.—1898, 1899, 1900, 1901, 1902, 1903, 1904, 1905.

HATCH EXPERIMENT STATION

—OF THE—

MASSACHUSETTS

AGRICULTURAL COLLEGE.

BULLETIN NO. 105.

TOMATOES UNDER GLASS.

METHODS OF PRUNING TOMATOES.

AUGUST, 1905.

The regular Bulletins of this Station will be sent free to all newspapers in the State and to such individuals interested in farming as may request the same. Technical Bulletins are sent only to those persons interested in the subject treated of in each case.

AMHERST, MASS.:
PRESS OF CARPENTER & MOREHOUSE
1905.

HATCH EXPERIMENT STATION

OF THE

Massachusetts Agricultural College,

AMHERST, MASS.

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The co-operation and assistance of farmers, fruit-growers, horticulturists, and all interested, directly or indirectly, in agriculture, are earnestly requested. The Bulletins will be sent free to all newspapers in the State and to such individuals interested in farming as may request the same. General bulletins, fertilizer analyses, analyses of feed-stuffs, and annual reports are published. Kindly indicate in application which of these are desired. Communications may be addressed to the

Hatch Experiment Station, Amherst, Mass.

Division of Botany.

GEORGE E. STONE.

TOMATOES UNDER GLASS.

The forcing of tomatoes for the winter market has been carried on for many years in this state. There is considerable demand for tomatoes during winter and spring and they usually find a ready sale at 20 to 30 cents, or more, per pound in the markets. Tomatoes require about the same conditions as cucumbers. They however suffer less from deficiency of light than cucumbers. Tomatoes require night temperatures ranging from 60° to 65° F. and day temperatures from 80° to 85° F.; and an even higher temperature in strong sunshine is desirable. A tomato house should be well lighted and possess good facilities for ventilation. As is the case with other crops, during periods of cloudy weather lower temperatures should be maintained and less water is necessary. The house should be kept tolerably moist. If, however, there is any danger from infection with Mildew (Cladosporium fulvum) the moisture should be reduced. This fungus can be held in check by maintaining tolerably dry conditions in the house and by keeping moisture from the foliage.

SOIL AND FERTILIZERS.

Tomatoes, unlike lettuce, do not appear to be susceptible to slight variations in soil texture. Soil suitable for the production of other market garden crops under glass is well adapted to tomatoes. A soil made by mixing decomposed sod, loam and horse manure in about equal parts furnishes a good foundation for a tomato soil. This soil can be used over and over again if well supplied with horse manure each year. Although a very limited amount of commercial fertilizers is applied to greenhouse crops in this state, tomatoes respond quickly and are appreciably stimulated by their use according to our observations on plants grown in fairly rich soil in pots. There is nothing, however, that appears to be superior to horse manure in the growing of market garden crops,—an idea long maintained and put into practice by our large market gardeners. Too rich a soil, however, should be avoided, inasmuch as the plant is likely to run too much to vines, and the foliage will display peculiar pathological features characteristic of over feeding.

Experiments have been made by investigators on the influence of chemical fertilizers upon the growth and development of tomato crops. W. J. Green* found no advantage in using nitrate of soda and other chemical fertilizers upon the growth of tomatoes grown in a well prepared compost. J. Troop[1] experimented with various fertilizers on outdoor and greenhouse crops of tomatoes. His results show some gain in yields by the use of fertilizers on outdoor crops but no material gain is noted on greenhouse crops.

Drs. E. H. Jenkins and W. E. Britton[2] found that the yield of tomatoes from benches in rich composted loam averaged larger when no chemical fertilizers were added, although they found when using a soil composed of coal ashes and peat a larger crop was obtained by the use of chemical fertilizers than from a rich compost of turf and manure. They obtained the best results with 6.4 lbs. of nitrate of soda: 1 lb. of dissolved bone black and 2.4 lbs. of muriate of potash per 100 square feet of bench space.

E. B. Vourhees[3] found that the crop may be materially increased by the use of chemical fertilizers, especially nitrate of soda, but that this result depended upon the method of application and the presence in the soil of a full supply of potash and phosphoric acid. He found that maturity was not affected when a small quantity was used in one application, but a large quantity similarly applied affects maturity. These results have been substantiated by A. T. Jordan[4], who maintains that nitrogen is the ruling element in the growth of tomatoes.

L. H. Bailey[5] observed that the early application of nitrate of soda produced early maturity, whereas intermittent and prolonged applications delayed the crop. Nitrate of soda being an incomplete fertilizer, he recommends that it should not be used to the exclusion of other fertilizer, unless the soil is rich in potash and phosphoric acid.

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* Ohio Agr. Exp. Sta. Bul. No. 43. 1892.
1. Ind. Agr. Exp. Sta. Rpt. 13, 1901, p. 56-70.
2. Conn. Agr. Exp. Sta. Rpt. 21, 1897, p. 293.
3. N. J. Agri. Exp. Sta. Bul. No. 79, 1891.
4. N. J. Agr. Exp. Sta. Bul. No. 141, 1800.
5. N. Y. (Cornell Univ.) Agr. Exp. Sta. Bul. No. 32.

W. Stuart[*] obtained an increased yield by the use of chemical fertilizers on greenhouse tomatoes grown in a soil more or less deficient in plant food. The largest yield was obtained from the use of a fertilizer containing acid phosphate, nitrate of soda and muriate of potash, although nitrate of soda and acid phosphate alone proved nearly as efficacious.

Undoubtedly in some cases a limited amount of nitrate of soda or a complete fertilizer can be applied to crops of greenhouse tomatoes advantageously as an aid in starting them. Where the soil, however, is of the nature of a well manured compost containing a large amount of organic matter, due to the repeated applications of a liberal supply of horse manure, commercial fertilizers are not absolutely necessary, inasmuch as the soil in such cases contains practically all of the elements necessary for the plants' development.

SOLID BEDS AND BENCHES VERSUS POT CULTURE.

Various methods of cultivating tomatoes have been in vogue. Many practical growers and experimenters have made use of pots and boxes in growing greenhouse tomatoes, while others have used shallow benches or solid beds.

A. T. Jordan[1] found that benches gave better returns than boxes holding 2½ cu. ft. of soil, or 10 inch pots, and according to W. J. Green and C. W. Waid[2] raised benches are superior to solid beds in the early ripening of fruit. On the other hand, L. H. Bailey[3] states that 18 inch boxes, containing a foot of soil and placed one foot apart, with four plants in each box, afford one of the neatest and best means of growing tomatoes in the greenhouse. Some practical growers in this state have used 12 inch pots for growing their crops, and the results which they have obtained have induced them to recommend this method of cultivation. Our experience in growing tomatoes in 10 inch pots, covering a period of some years, has not led us to regard this method of culture very highly.

To obtain robust plants of good color and texture capable of producing a large yield, we prefer solid beds or raised benches to pots or small boxes. Our experience has been that Lorillard tomatoes grown in 10 or 12 inch pots at any season of the year are likely to be poorly

*. Ind. Agr. Exp. Sta. Rpt. 14.
1. N. J. Agr. Exp. Sta. Bul. No. 141, 1899.
2. Ohio Agr. Exp. Sta. Bul. No. 153.
3. N. Y. (Cornell Univ.) Agr. Exp. Sta. Bul. 28, 1891.

colored and more or less spindling. Undoubtedly 18 inch boxes are greatly superior to 10 inch pots since the amount of soil they will hold is considerably greater. We are of the opinion that better plants can be grown, and that larger yields and larger individual fruits can be obtained from crops in beds and benches, where the root development is not restricted, than in pots. Root restriction would seem, however, to favor early maturity.

TRANSPLANTING.

The usual method of starting tomato plants is to sow the seed in flats and when they reach the height of a few inches to transplant into 2½ or 3 inch pots. After remaining in these a short time they may be shifted to 6 inch pots. When they are a foot or more in height they are placed in the beds, or occasionally one other transplanting from 6 inch pots into 10 inch pots takes place. In all cases we have transplanted twice in pots and occasionally three times. The last transfer before plainting in beds was into pots 10 inches in diameter. There appears, however, to be some difference of opinion as to the value of so many transplantings.

L. H. Bailey* found that two transplantings in pots gave better results than three transplantings in pots, but he states that much depends upon conditions, etc., while R. L. Watts[1] found that tomatoes not transplanted ripened earlier than transplanted ones. The yield, however, was only one half that given by those transplanted. He also found that one transplanting gave better results than two transplantings. J. F. C. DuPre[2] found that transplanting once or twice before putting in the field would make the plants stocky and increase the number of roots, therefore giving them a better start. On the other hand, J. Troop[3] obtained slightly better yields on plants not transplanted than from those transplanted. The general consensus of opinion is in favor of transplanting once or twice. In greenhouse culture transplanting is often an advisable practice simply because of saving in space and coal.

* N. Y. (Cornell Univ.) Agr. Exp. Sta. Bul. No. 32.
1. Tenn. Agr. Exp. Sta., 5th Rpt., 1892.
2. So. Car. Agr. Exp. Sta., Bul. No. 16, 1894.
3. Ind. Agr. Exp. Sta., 13th Rpt., 1901.

POLLINATION.

Greenhouse space is altogether too valuable to be utilized in growing plants which do not produce a maximum yield. W. W. Munson*, who has given pollination of tomatoes considerable attention, maintains that it is essential to have an abundance of pollen applied to the stigma to obtain normal, symmetrical fruit with an abundance of seed. In growing crops of tomatoes under glass during the winter, it is necessary to resort to some artificial means of pollination. Several methods have been adopted and the most common one consists of using a stick or ladle, one foot or more long, having a flat or spoon like surface at one end to hold the pollen. By this means the pollen is readily transferred from one flower to another. A spoon, watch glass, or camels hair brush can be used in place of the ladle if preferred. Another method is to shake or jar the plants very frequently. This method is not so tedious and some growers have used this method more or less successfully, while others have been unsuccessful and condemn it. Rose Brothers, Fitchburg, Mass., who operate half a dozen tomato houses, practice shaking or jarring the plants, and they succeed by this method in pollinating about 50 per cent of the blossoms. Pollination, however, should be done when the house is relatively dry, inasmuch as a dry atmosphere is more conducive to fertilization.

We have employed various methods of pollinating, including shaking the vines, but the results have not always been satisfactory, and in some instances shaking or jarring the plants has been about as successful as other methods. Very careful and frequent pollination by hand, however, is effectual. In one instance we made daily use of an electric fan wheel, which caused considerable agitation to the vines in the house, but as a means of pollination this method was a failure. During the warm spring and summer days when the ventilators are open fertilization readily takes place without resorting to artificial means, and we have never had any difficulty in getting fruit to set on summer crops under glass.

*Maine Agr. Exp. Sta., Rpt. 1892, p. 40.

LENGTH OF TIME REQUIRED TO MATURE GREENHOUSE CROPS OF TOMATOES.

From a considerable amount of data based upon our own experience and that of others the average time elapsing between sowing tomato seed and first maturity of fruit is about 145 days. About one half of this time is occupied by the plants in flats and pots, the remaining portion of about 75 days represents the period between final transplanting and maturity. These figures are based upon the averages of a number of crops grown during winter and spring.

Where proper greenhouse facilities are at hand the plants during the first 75 days can occupy less valuable space, and if not planted too close together when finally set out some other quick growing crop may be carried along at the same time.

PRODUCTIVENESS OF TOMATOES.

Many of the records of fruit production given for crops have been based upon the number of pounds per square foot of bench surface rather than upon the yield per plant.

L. H. Bailey* found that greenhouse tomatoes yield about two pounds per square foot of ground surface, and A. C. Beal[1] obtained from 2 to 2½ pounds per square foot. W. J. Green and C. W. Waid[2] obtained over two pounds per square foot of bench surface and W. Stuart obtained yields of from 3 pounds to 3.4 pounds per square foot S. A. Beach[3] planted 1½ feet apart in benches and his experiments show a yield of from 11 to 24 ounces per square foot of bench surface.

A. T. Jordan[4] reports as an average of two winter and two spring crops 28.5 ounces per square foot. His lowest yield was 19.5 ounces in the winter crop and his largest yield 51.9 ounces for a spring crop. The maximum yield obtained in our experiments where the plants were 2½ feet apart in the rows was 2.4 pounds per square foot of bench surface. Exact comparisons cannot, however, be made of the productiveness of tomatoes under glass in these various experiments, since the number of feet of ground surface which the plants occupied was not the same in all cases, and other modifying conditions entered

* N. Y. (Cornell Univ.) Buls. Nos. 28 & 32, 1891.

1. Ill. Agr. Exp. Sta. Bul. No. 81, 1902.
2. Ohio Agr. Exp. Sta. Bul. No. 153, 1904.
3. N. Y. (Geneva) Agr. Exp. Sta., Bul. No. 125, 1897.
4. N. J. Agr. Exp. Sta. Bul. No. 141, 1899.

into the problem. The average yield per plant will furnish a better criterion for comparison in some respects, although in the production of tomatoes under glass the yield per square foot of bench surface should constitute the basis for comparison in the economic production of crops, since it is the object in greenhouse culture to grow the largest amount of produce in the least possible space consistent with favorable conditions. The average yield of our crops which were grown during the winter and spring season was 9 to 12 pounds of ripe fruit per plant.

The average yield in our northern climate should be from 4 to 12 pounds of fruit per plant. A certain number will have to be discarded on account of inferior size and rot. In order to make a profit from a winter or spring crop of tomatoes the fruit ought not to be sold for less than 20 cents per pound. We know of one gardener who recently had an opportunity to sign a contract with a hotel in the east to deliver greenhouse tomatoes at 60 cents per pound. From 40 to 60 cents per pound are prices occasionally obtained.

Considering the length of time required to mature tomatoes, their liability to disease and the price usually obtained for the product, we consider cucumbers superior to tomatoes, and lettuce better than either, from the point of view of financial returns. Much, however, depends upon the market and prices obtained for these crops. At least three crops of lettuce can be grown to one of either tomatoes or cucumbers. Moreover, a lettuce crop practically covers every square foot of ground surface of a house. Three crops of lettuce at 75 cents per dozen would give a yield of 40 cents a square foot of ground surface.

Under the best management in a house 18 ft. in diameter each of these crops may be expected to give returns per linear foot as follows:

Tomatoes at 25 cents per lb., 6 lbs. per plant.	$4.50
Cucumbers, 5 doz. per plant, $1.00 per doz.,	5.00
Lettuce at 75 cents per dozen heads, (Three crops)	6.50

It should be added, however, that these estimates should not be taken as conclusive, as many factors enter here to modify the conditions: but on the whole the majority of experienced men would consider lettuce and cucumbers as giving better financial returns than tomatoes. It should be noted, moreover, in connection with this, that it does not require so much coal to heat a lettuce house as it does for a cucumber or tomato house.

METHODS OF PRUNING TOMATOES.

THE INFLUENCE OF PRUNING, OR REMOVING THE LOWER LEAVES, UPON THE GROWTH OF STEMS AND FRUIT OF TOMATOES.

Fig. 1.
Tomato plants grown to two stems in twelve inch pot.

Some experiments were made on a few plants in which their growth was registered and recorded, in some instances each day. The increase in the size of the fruit was also noted. The growth of the plants was measured by means of a thread attached to the apex of the leaders and passing over a wheel which gave an amplification of about eight times to the growth of the plant. The increase in the size of fruit was obtained either by caliper measurements or by immersing in water while the fruit was attached to the plant, the size of the fruit being obtained by the amount of displaced water. In some cases the fruit was weighed instead of being measured by the above methods. The water displacement method of measuring proved quite satisfactory and accurate. In all the experiments in this series we used the Lorillard variety of tomato, and, with the exception of those in Table I, double stem plants were employed, grown in 10 inch pots. Both the pruned and check plants in this series had all auxiliary suckers removed but the check plants were not otherwise interfered with. In figure 1, page 10, is shown a tomato plant before cutting the lower leaves.

Table I, shows the results of five experiments in which a number of the lower leaves were removed from the stem of the pruned plant.

Table I, showing the percentage of average increased growth of stems and fruit of pruned tomato plants over check plants. Single stem plants used. Pruning consisted in removing the lower leaves.

No. of Exp.	No. of Plants employed.	Percent gain of pruned over checks	Stem.	Fruit.
I	3 Checks			
	3 Pruned	4 days after cutting	34%	30%
II	3 Checks			
	3 Pruned	5 days after cutting	44%	16%
III	1 Check			
	2 Pruned	5 days after cutting	24%	20%
IV	3 Checks			
	3 Pruned	5 days after cutting	31%	8%
V	2 Checks			
	3 Pruned	7 days after cutting	27%	16%
	Averages		32%	18%

In Experiments 1, 2 and 3 the fruit was measured with calipers: in 4 and 5 the displacement of water was employed as a means of determining the increased growth. The plants were carefully mated in all instances as regards development and size of fruit, and measurements were taken in each experiment three to four days before the leaves were removed. The number of experiments shown in this table is not sufficient to give accurate averages. They do, nevertheless, show that pruning or cutting off of a few of the lower leaves produces some modifications in the rate of growth of the stems or leaders and fruit.

The average percent as given for the five experiments is 32 for the growth of stem, and 18 for the fruit. Or in other words pruning the lower leaves induces a greater response in the growth of the leader than in the growth of the fruit.

Table II, showing average increase growth of fruit on 9 check and 9 pruned tomato plants. Two stem plants used. Pruning consisted in removing the lower leaves. Duration of experiment, one month.

	No. of fruit measured.	Average increase in size.
Checks	15	40 cubic centimeters
Pruned	15	51 " "

Gain of pruned over check plants 21%.

The results of a similar experiment are shown in the above table where eighteen plants were used, nine of which were pruned and nine left as checks. In this experiment, however, no measurements were taken of the growth in length of the plants, but fifteen typical green tomatoes of uniform size and degree of development were measured, while attached to the plant, by the displaced water method. This experiment lasted four weeks, the fruit being measured at the time of pruning and again four weeks later. The average size of the fifteen young green fruit on the check plants was 15.3 cubic centimeters and that for the pruned was 15.4 cubic centimeters before pruning. The average increase growth of the fifteen tomatoes on the pruned plants over that of the checks was 21 per cent as the result of removing the lower leaves.

Another experiment similarly conducted, which lasted two months, in which 16 plants were used, 8 checks and 8 pruned, gave the following results.

Table III, showing the amount of fruit, etc., obtained from 8 check and 8 pruned tomato plants. Two stem plants used. Pruning consisted in removing the lower leaves. Duration of experiment, two months.

	No. of fruit.	Average yield per plant.	Total weight.	Average weight.
Checks	77	9.6	2885 grams	37 grams
Pruned	84	10.5	3375 "	40 "

Gain of pruned over check plants 10%

In this experiment the pruning was the same as in the preceding one. No measurements, however, were made of the fruit but the weight of the fruit on the pruned and check plants was taken when it was matured, and also that of the remaining fruit at the close of the experiment. The data in this table show that there was 8 per cent more fruit and 14 per cent more in weight on the pruned than on the check plants. The average weight of the fruit on the pruned plants exceeded that of the checks by 10 per cent, and at the close of the experiment, it was found that the pruned plants had produced 17 per cent more ripe fruit than the check plants.

Table IV, showing the amount of fruit, etc., obtained from twenty-six check and twenty-six pruned tomato plants. Two stem plants used. Pruning consisted in removing the lower leaves. Duration of experiment, three months.

	No. of fruit.	Average yield per plant.	Total weight.	Average weight.
Checks	303	11.6	17253 grams	56 grams
Pruned	264	10.1	15983 "	60 "

Gain of pruned over check plants 6%.

Table IV gives the results of an experiment similar to the preceding one, in which 52 plants were used, one half of which were pruned and the other half left as checks. They were grown in 10 inch pots, no measurements being made of the plants, but the ripe fruit was picked and weighed as it matured. This experiment lasted three months,at the close of which the remaining green fruit was weighed. The pruned plants, as before, had the lower leaves removed. There was 12 per cent more fruit on the check plants than on the pruned, and there was 10 per cent more ripe fruit on the pruned plants than on the checks.

These experiments, which consisted in the removal of a few of the lower leaves, show that pruning exerts an appreciable influence on the development of the stem and fruit. They were not conducted, however, with the special purpose of ascertaining whether this method of pruning constituted the most desirable one. the object being to obtain some idea concerning the plasticity of the tomato plant. as well as to determine just how much a certain type of pruning will affect the plant. For practical purposes other methods of pruning are better, a feature which will be discussed later. The experiments, nevertheless, are instructive as showing how pruning a few of the lower leaves, which constitute secondary organs, affects the growth of the stem and fruit. It should be borne in mind, however, that besides the removal of the lower leaves, usually a half dozen or more from each plant, the plants were grown to a double stem in all cases except those given in Table I. This necessitated, where the experiments were prolonged, nipping out all the branches and auxiliary shoots as fast as they appeared, in both the check and pruned plants. Moreover, the plants were all grown in 10 inch pots and this method of culture has a tendency to check profuse development. There is some difference shown in Table I in the growth of fruit and leaders, as the result of cutting the lower leaves. It might be expected that the fruit would respond less under such treatment than the stems.

The experiments shown in the other tables were more or less prolonged, as the result of which the differences in the increased size and weight of fruit were smaller. This is what in general might be expected, inasmuch as the longer the period elapsing between stimulation (cutting) and the time of noting the response, the less striking would be the effect. This is especially true where the nature of stimulation is of a character which is not destined to produce important modifications in the development of the plant. Where the stimulation is more pronounced, or repeatedly applied, more important differences will be seen between the development of the pruned and unpruned plants. Moreover, where a single application of a stimulus of an insignificant character is applied, such, for example, as occurred in removing only a few of the lower leaves of a tomato plant, it would be expected that the plant would soon recover from the loss of foliage or gain a sufficient amount to counter-balance the loss and functionate normally. In this case the removing of a few leaves from the plant would not affect its normal development to any great extent. On this supposition, one would expect to find little or no effect of pruning two or three months afterwards. That such is the case is readily seen by the results shown by the various experiments. When the experiment lasted one month the increase in the size of fruit was 21 per cent, when of two months duration it was 10 per cent; when it lasted three months it was 6 per cent.

EXPERIMENTS GIVING THE RESULTS OF DIFFERENT METHODS OF PRUNING TOMATOES.

The pruning of tomato plants is quite extensively practiced in various parts of the United States on outdoor crops, and it is exceptional when indoor crops do not receive pruning. Pruning is largely practiced for restricting the growth of vines, and for the purpose of obtaining larger and better fruit. At the same time better light conditions prevail as a result of pruning and this is advantageous in ripening the fruit. It is generally maintained, moreover, that the maturity of fruit is hastened by pruning. In the greenhouse where space is valuable it is quite essential that the largest and best crops should be grown on the least possible area consistent with hygienic conditions.

Various methods of pruning and training are in vogue and they all have special features to commend them. The various systems of pruning accomplish certain results, although there is a difference of opinion as to which is the best system to practice when some practical object is in view. Cultural conditions, such as arise from differences in the soil, moisture and light, available plant food, distance of planting, depth of soil, etc., play a more or less important rôle in modifying the results of experimentation, and the conclusions arrived at in these experiments should be interpreted with these facts in mind. We have observed a crop of tomatoes pruned to a single stem that had stalks an inch or more in diameter, and which grew some 25 feet or more long, that produced little or no fruit. This crop had practically run to vines. This was due to nothing more nor less than supplying the plants with an abnormally large amount of water under peculiar circumstances. The tomato plant, besides forming a number of axillary shoots or suckers usually develops two or three strong main stalks or branches. Most of the methods of pruning in vogue consist in nipping out these axillary growths or suckers, thus allowing the leader and one or more of the strong branches to develop, as the case may be. This was the method of growing the plants employed by us in these experiments. That is, in our two and three shoot system, etc., we made use of the leader and one or more of the naturally strong branches, but in no instance did we utilize suckers for bearing stems. Occasionally cutting the leader back, or heading in, as it is termed, is practiced: and cutting out one or more of the dead or older leaves at the base is often resorted to. Then again the leaves are pruned by some growers who nip the ends or "head" them in for the purpose of inducing a better growth of fruit. Some gardeners also make a practice of cutting off the leader near the surface of the ground when the plant is small, in which case new leaders are formed. The idea underlying this method of pruning is to get leaders started nearer the base of the plant.

We have never given this method of pruning an extensive trial. R. L. Watts* found, however, that cutting back vigorous plants at the time of setting, leaving only two or three inches of the stems above ground, decreased the yield and retarded maturity of fruit. He also found that cuttings which are sometimes made use of in starting crops produced less fruit than seedlings, but maturity was about the same in each. On the other hand, J. F. C. DuPre[1] found in his experiments with outdoor plants in the south that tomatoes grown from cuttings mature a better crop than from late seedlings, and J. Troop[2] obtained slightly larger yields from cuttings than from transplanted plants. Our limited experience with cuttings has given unsatisfactory results in greenhouse culture.

Some growers occasionally allow suckers or axillaries to grow and develop fruit, but this method does not recommend itself to us, since suckers are much weaker than the strong branches which tomatoes naturally form. These axillary branches, or suckers, are, at the best, weaklings and do not obtain much of the general supply of the products of absorption and metabolism elaborated in the plant; and, even when they are encouraged to grow by pruning the main shoots or leaders, their growth is weak and the amount of fruit they produce is according to our experience insignificant.

In the so-called bronzing of roses which is a peculiar pathological effect common to certain leaves located near where a new shoot is appearing, we have an example of a strong, vigorous growing branch robbing an adjacent organ to such an extent that it gradually becomes sickly and eventually dies and falls off. The axillary

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* Tenn. Agr. Exp. Sta. 5th Ann. Rpt. 1902.
1. So. Car. Agr. Exp. Sta., Bul. No. 16, 1894.
2. Ind. Agr. Exp. Sta. 13th Ann. Rpt. 1900.

Fig. 2.
Single Stem Plant.

shoots of the tomato resemble somewhat the condition of the rose leaf in bronzing, since they are more or less crowded and stunted in appearance and obtain a limited amount of nourishment. They are of little or no account and add nothing to the general welfare of the plant, and in any system of pruning the axillary suckers should be nipped out as soon as they occur, and not allowed to develop at the expense of the plant.

The experiments in this series were made for the purpose of testing the effects of various methods of pruning on the size and production of fruit, and on crops grown during several years. They were conducted in two different types of greenhouses, both of which were heated with hot water. One of these houses had been devoted to lettuce and the other to crops of cucumbers. The temperature, light and moisture conditions in both houses were suitable for tomatoes at any season of the year. The cucumber house, which is designated as No. 1, is 24 ft. by 24 ft. and runs east and west with the roof sloping towards the south. It has five benches 18 ft. long, 2½ ft. wide and 1 ft. deep, running east and west, each bench having an elevation six inches higher than the one adjacent to it on the south side. The glass in the lower part of the house is about 6 ft. from the benches, and in the upper part about 8 ft. from them. Each bench is furnished with a wire trellis upon which the plants are trained.

House No. 2 is an even span structure, 12 ft. by 40 ft., running east and west with ground beds in the same direction. The plants in this house were trained to sticks placed obliquely. The plants on the south side in each house were the more favorably situated with respect to light, but the experiments were so arranged

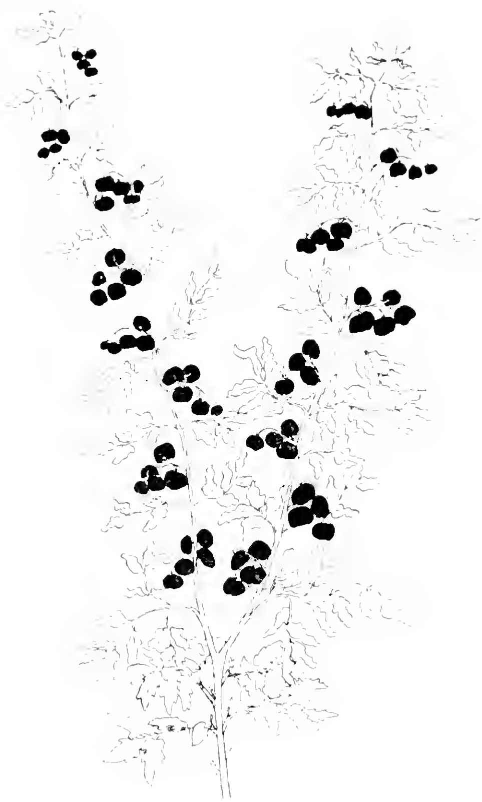

Fig. 3.
Two Stem Plant.

that an equal number of plants in each system of pruning were under identical conditions. The depth of the soil of the beds in each house was such that the roots had plenty of space to grow in. Plants, however, grown in shallow benches will show distinctly different features from those grown in deep benches or in solid beds. Both houses were provided with 16 by 24 inch glass in the roof, and good light conditions prevailed on the sides. The texture of the soil was practically the same in both houses. Perhaps House No. 2, which had been used for lettuce, had been more frequently manured and the soil in it contained slightly more organic matter.

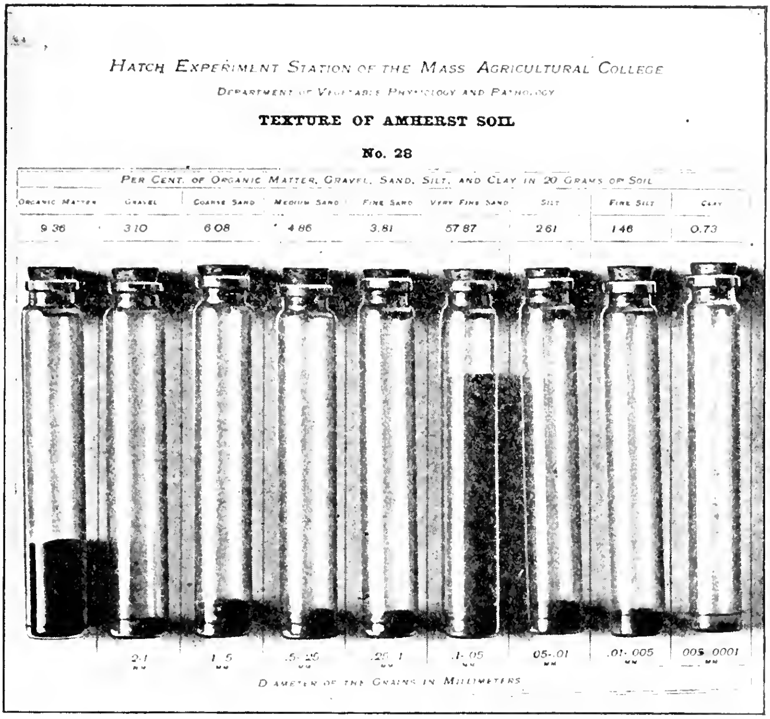

Fig. 4.

The soil was a typical Amherst loam containing about 10 per cent organic matter, and characterized as predominating in fine sand, which, when not abounding in organic matter, has a marked tendency to become compact with constant watering. The results of mechanical analysis of a similar soil are shown in Fig. 4. No commercial fertilizers have ever been applied to the soil. Many liberal applications of horse manure, however, have been frequently dug in as is customary in houses devoted to lettuce, cucumbers and tomatoes in this section.

The object of the tomato experiments was to ascertain which constitutes the best method of pruning in greenhouses, and, incidentally, to study the conditions which are essential for obtaining vigorous and healthy crops free from disease. We experimented with the single, double, triple and four shoot systems, and also with normal or

Fig. 5.
Three Stem Plant. Leaders Cut.

unpruned plants. Compare Figures 2, 3 and 5. In the single shoot system the plants were pruned to a single leader, and the two, three and four shoot plants were obtained by allowing the strong secondary branches to develop. In addition to the above systems of pruning, in some cases cutting the leader or heading in was practiced. In all instances where pruning was practiced the supernumerary axillary shoots, or suckers, occurring on the plants were cut out as soon as they became at all conspicuous. In the normal or unpruned plants these axillary shoots were not interfered with, consequently they had an abundance of foliage due to non-restricted growth. In all cases the seeds were sown in flats and when they had attained a height of four or five inches they were transplanted into 3 inch pots. They were subsequently transferred to 6 inch pots and in some cases were further transplanted into 12 inch pots. When the plants were from one foot to eighteen inches high they were transplanted in the beds. In all the experiments careful records were kept of the amount and weight of fruit obtained from each plant, and the dates at which the fruit matured were recorded.

In the following tables and the text, we have employed the words stems, shoots and leaders as synonymous terms. Technically, the tomato plant possesses but one true leader or stem, and the lateral growths are branches. It is not an uncommon practice, however, to use these terms as we have employed them.

Table V, showing the results of pruning tomatoes (Lorillard) grown in house No. 2. Three rows 3 ft. apart, or a total of 45 plants 28 in. apart in the row. Harvested July and August.

System of pruning	No. of plants.	No. of fruit.	Total weight grms.	Average weight grms.	Average weight per plant grms.	Average No. of fruit per plant.
1 shoot	8	236	31977	135	3997	29.5
2 shoots	14	585	71456	122	5104	41.7
3 shoots*	8	289	43556	150	5444	36.1
Normal	15	688	72369	105	4824	45.8

*Leaders cut back.

The preceding table gives results of pruning to the one, two and three shoot systems as compared with normal or unpruned plants. When the experiment was completed all the remaining green fruit was picked and weighed, but the green fruit is not included in the table, and if added it would not materially affect the results. The largest amount of fruit was given by the normal plants, while the least amount of fruit is given by the single shoot system. The average weight of the individual fruit is less for the normals than for any of the others, while the three shoot system gave the highest average, followed by the one and two stem plants. The plants in the three shoot system in this experiment had the leaders removed just above the fourth cluster of fruit, consequently they were restricted in the amount of fruit formed and in their stem development. The average weight of fruit per plant is the largest in the three stem plants and the smallest in the single shoot system, but the average number of fruit per plant is greatest on the normals, followed by the two, three and one stem plants. The fruit, however, matured earlier in the single shoot system.

During the first eight days of harvesting, the amount of matured fruit obtained from the various systems was as follows: Single stem, 21; double stem, 11; three stem, 19 and on the normals 2. For the first 15 days of harvesting we have 57 matured fruit for the single stems, 45 for the two stems, 49 for the three stems and 28 for the normals, thus this experiment shows considerable gain in maturity of fruit as a result of pruning.

Table VI, showing the results of pruning tomatoes (Lorillard) grown in House No. 2. Two rows of vines 4 ft. apart, or a total of 26 plants 32 in. apart in the row. Harvested June and July.

System of pruning	No. of plants.	No. of fruit.	Total weight grms.	Average weight grms.	Average weight per plant grms.	Average No. of fruit per plant.
2 shoots	8	366	40509	110	5063	45
3 shoots	8	353	35731	101	4466	44
4 shoots	8	468	40217	885	5027	58

In the preceding table are given the results of pruning to the two, three and four stem system. The average weight of the individual fruit was the greatest in the two stem and less on the three and four stem plants. The average number of fruit per plant was the greatest where there are four stems and smallest where there are two leaders. There was practically no difference as regards early maturity of fruit between the different systems of pruning.

Table VII, showing the results of pruning tomatoes (Lorillard) grown in house No. 1. Harvested June and July. Plants 30 in. apart.

System of pruning	No. of plants.	No. of fruit.	Total weight grms	Average weight grms	Average weight per plant grms	Average No. of fruit per plant
1 shoot	9	426	38460	90	4273	47
2 shoots	15	993	91283	91	6085	66
3 shoots	4	266	25006	94	6251	66
Normal	4	247	15770	63	3942	61

In this table we have the results obtained from the one, two and three stem system, and that produced by normal or unpruned plants. This experiment differs from the experiments in Table V in the three shoot plants not having their leaders cut back. The total yield of the normal plants was not so large as shown in V. The average weight of the individual fruit is quite close here on all the pruned plants; that of the unpruned or normals being very much lower. The average number of fruits per plant is highest in two and three stem plants and smallest in the one stem and normal plants. In the average weight of fruit per plant the two and three stem show the highest average. On the whole there are not very important differences shown by the various systems of pruning plants in this experiment. All of the pruned plants, however, ripened more fruit during the first seventeen days of harvesting than the normal or unpruned plants.

Table VIII, showing the results of pruning tomatoes (Lorillard) grown in House No. 2. Two rows of vines 4 ft. apart, or a total of 26 plants 32 in. apart in the row. Harvested May to July.

System of pruning.	No. of plants	No. of fruit	Total weight grms.	Average weight grms.	Average weight per plant grms.	Average No. of fruit per plant.
2 shoots	13	652	42213	64.74	3247	50
3 shoots	13	828	63964	77.25	4920	63

The three shoot system in this trial gave a greater average weight of ripe fruit per plant than the two leader system, also a larger average weight of fruit per plant. During the first month of harvesting the crop 19 per cent more ripe fruit was picked from the two stem plants than from the three stem plants. There was 21 per cent more fruit on the three stem plants than on the two stem plants, and the total weight of the former exceeded the latter by 34 per cent. The gain in the average weight of individual fruit was 16 per cent in favor of the three stem system. The following summary table includes the results of the four preceding tables, and from this we are able to obtain some idea of the average results of pruning as applied to the various systems practiced.

SUMMARY TABLE.

Showing the results of the experiments from Tables V to VIII inclusive.

System of pruning	No. of plants.	No. of fruit.	Total weight of fruit grms.	Average weight of fruit grms.	Average weight of fruit per plant grms.	Average No. of fruit per plant.
1 stem	17	662	35218	112	4135	38
2 stems	50	2596	61365	96	4874	50
3 stems	25	1447	41567	90	5212	57
4 stems	8	468	40217	85	5027	58
Normal	19	935	44069	84	4383	53
3 stems, leaders cut	8	289	43556	150	5444	36

To convert grams into ounces divide by 28.

Where no pruning or cutting back of the leaders was practiced the one stem system gave the largest average weight of individual fruit, as well as the smallest average number of fruit per plant. The average weight of individual fruit per plant decreases from the single stem to the normal in nearly uniform succession. On the other hand, the smallest average weight of fruit per plant is shown by the one stem system and this increases in the normal, two, four and three stem plants in the order named. There were, however, not so many four stem plants utilized since only one experiment was made with them. The greatest average weight of individual fruit, as well as the greatest weight per plant, however, was given by the three stem system where the leader was headed in, whereas in the average number of fruit per plant this system is lowest. There was only one experiment in which heading in was practiced. On the whole there has been a gain in the time of maturity of the fruit from pruning, and this is most pronounced in the one stem plant.

In general, however, these experiments show that if we wish to obtain large fruit with a tolerably good number per plant the single leader constitutes one of the best systems, with the two, three and four shoot systems following in tolerably uniform succession. No doubt the largest fruit and the greatest acceleration in maturity can be obtained by heading in the leader. This, in our opinion, constitutes the best method of pruning as it is based on a law governing correlated growth, namely, that the mutilation of primary organs causes the greatest response in secondary organs, and, conversely, the mutilation of secondary organs causes the greatest response in primary organs.

It is well worth while here to consider the results obtained by other experimentors along this line. Among others who have made experiments in pruning tomatoes may be mentioned the following: A. C. Beal* obtained better results with the single stem system than with the three stem system. He reports the yield as being $1\frac{1}{5}$ pounds for the former and $\frac{4}{5}$ pounds for the latter per square foot of bench surface. The leaders were also headed in or pinched back in his plants when they had reached a height of eight feet.

R. L. Watts[1] tested the one, two and three stem system. He obtained a general gain in time of ripening of the whole crop on the one stem plants; but little or no difference between the two and three stem plants. Most of the fruit on the pruned plants ripened earlier than on the unpruned. There was a regular increase in the number of fruit in the one stem to the normal or unpruned, but the largest individual tomatoes were formed on the one and two stem plants. He reports the weight of unsound fruit as greatest on the unpruned plants.

A. T. Jordan[2] compared the single and three stem system of pruning and found that the single stem was superior to the three stem system. He found the average yield of the single stem plants to be less: the average yield per square foot of bench surface, however, was greater on the single stem system. The plants were pinched or cut back when they reached the glass or when about six feet high.

W. J. Green and C. W. Waid[3] practiced cutting out all axillary shoots or suckers. They found the single and double stem system the best. The single stem system of pruning, moreover, gave the highest yield per square foot of ground surface. They recommend pruning to the single stem with the plants grown one foot apart in the rows. "Plants set $1\frac{1}{2}$ feet apart pruned to two stems were the second in yield and the average size was not affected. Those planted two feet

* Ill. Agr. Exp. Sta., Bul. No. 81. 1902.

1. Tenn. Agr. Exp. Sta., 5th Ann. Rpt., 1892.
2. N. J. Agr. Exp. Sta., Bul. No. 141, 1899.
3. Ohio Agr. Exp. Sta., Bul. No. 153. 1904.

apart and pruned to two stems were third in yield and the highest in the amount of rot."

S. A. Beach[1] found the single stem training superior to the three stem training for forcing of tomatoes in this climate in greenhouses, both in the amount of fruit ripening earlier in the season and in the yield for equal areas. He found, however, slight differences in the average size of fruit produced, but on the whole the fruit on the single stem plants seemed to average slightly larger than on the three stem plants.

E. J. Kyle and E. C. Green[2] state that the single stem method has proven most profitable from the fact that its use produces the earliest ripenings besides causing a uniformity in size that cannot be otherwise obtained. They recommend that when three well formed clusters have established themselves to pinch all others that form as well as the terminal bud itself.

L. H. Bailey[3] found in outdoor culture that single stem tomatoes gave twice as much yield per square foot of ground surface as ordinary culture, together with somewhat earlier results and greatly decreased injury from rots. He recommends for greenhouse culture the single stem with the leader pinched back. He also recommends cutting off the lower leaves when they commence to deteriorate or interfere in any way with the development of the fruit.

F. S. Earle[4] regards pruning to the one shoot system as being practicable for outdoor crops of tomatoes in the south. From his experiments he obtained decidedly heavier and earlier pickings on pruned plants than on unpruned ones, the average weight of the fruit being from 5 to 15 per cent greater.

On the other hand, J. F. C. DuPre[5] maintains that while pruning and training may be practicable on a small scale it is not on a large scale when outdoor culture is practiced.

It would appear from these experiments covering a wide range of conditions that the general consensus of opinion is in favor of pruning, that it promotes maturity and larger sized fruit. The single stem plants are also superior to the others giving a larger yield per square foot of ground surface.

1. N. Y. (Geneva) Agr. Exp. Sta. Bul. No. 125, 1897.
2. Texas Agr. Exp. Sta. Bul. No. 65, 1903.
3. N. Y. (Cornell Univ.) Bull's. Nos. 28 and 32, 1891. See also the Forcing Book, Chapt. IX.
4. Ala. Agr. Exp. Sta. Bul. No. 108, 1900.
5. So. Car. Agr. Exp. Sta., Bul. No. 16, 1894.

Table IX, showing number of pounds of fruit per square foot of bench surface obtained in our experiments, estimated on basis of five square feet per plant.

1 stem	1.84 lbs.
2 stems	2.24 "
3 "	2.32 "
4 "	2.25 "
Normal	1.95 "
3 stems leaders cut	2.43 "

If we consult Table IX where is shown the number of pounds of fruit per square foot of ground surface, it will be observed that our results apparently do not agree with those of other experimentors. The single stem plants showed the least amount of fruit per square foot of ground surface, followed by the normals, two stem, four and three stem and the three stem plants with leaders cut. Our largest yield per square foot of ground surface is shown in the experiments where the three leaders were cut back. It should be remembered, however, that we were not testing our yield from the point of view of production per square foot of ground surface and that our plants were in all cases at least 2½ feet apart and some times more than this, the single, double, three stem plants, etc. alternating with one another. The amount of space, therefore, which the single stem plants occupied on the trellis was practically only ½ to ¼ of that occupied by the two and four stem plants respectively. We have estimated five square feet of bench surface for each plant. If, however, we consider the actual space which the different plants occupied on the trellis then it would be necessary to estimate upon a different basis, inasmuch as the three stem plants occupied about three times more trellis space than the single stem plants, and if we make comparisons on this basis we would obtain quite different results.

Estimating the yield on the approximate amount of trellis space for the different systems we would obtain for the one shoot system 4.78 pounds: two stem, 3.74 pounds: three stem, 2.86 pounds: four stem, 2.57 pounds; normals, 2.08 pounds and three stem with leaders cut back, 2.99 pounds, or, in other words, for the amount of trellis space occupied by the single stem plants they were decidedly the best yielders, and the normal plants the poorest yielders.

Our conclusions, therefore, are not at variance with those of other experimentors. Namely, that the single shoot plants produce the largest amount of fruit when the amount of trellis space occupied by them which is practically equivelant to ground space is taken into consideration. Our experiments also agree with those of others in respect to early maturity of fruit on pruned plants and the larger size of such fruit. In other words, there is some gain in the maturity of fruit and also a gain in the average size of the individual fruit by pruning.

EXPERIMENTS SHOWING THE EFFECTS OF MUTILATION, OR CUTTING, ON GROWTH.

The experiments in this series, which were made in a more detailed manner than those already reported, show the influence which mutilation of various kinds has upon the growth of plants. They represent results that are typical of a very large number of experiments made by us on various species of plants, including some of the simpler and lower forms of organisms as well as the higher types of plant life.

The plants in all of these experiments were as evenly paired as possible, and in the majority of cases daily measurements were made previous to mutilating them in order to obtain plants of a uniform rate of growth. Moreover, the conditions under which these plants were grown were such that temperature, moisture and other modifying factors did not exert any appreciable influence on the character of the results.

Table X, Experiment showing the effects of cutting primary roots on the growth of stems (hypocotyls) of Helianthus annuus, L. 16 plants used, 8 normal and 8 cut. All but 3 centimeters of the primary roots were removed in the cut plants. Plants cultivated in sawdust. Growth of normal plants equals 100%.

	Average daily growth in millimeters.						
	1	2	3	4	5	6	7
Normal	7.1	9.3	12.7	14.0	18.6	22.7	16.3
Cut	3.7	7.3	9.7	11.7	18.0	20.3	16.1
Percentage } Daily growth	52%	78%	76%	84%	97%	89%	99%
Cut to uncut } Total growth							82%

Average height of hypocotyls before cutting 2.3 centimeters.

The experiment shown in the preceding table represents the results obtained by cutting primary roots on the growth of the stems (hypocotyls) of the sunflower. All but three centimeters of the primary roots were removed and the differences in the daily increase, in the normal and cut plants, are represented by the percentages at the bottom of the table. It will be noticed that the growth of the cut plants was less that of the normal ones throughout the experiment which lasted seven days; also that the decrease, or retardation, in the growth of the cut plant as compared with that of the normal was greatest at first, and that the cut plants made considerable attempt towards recovery. The actual relative position of the normal and cut plant as regards growth after cutting is shown by the percentage of total growth. A correlative effect usually manifests itself in experiments of this nature in the formation of numerous secondary roots near the cut surfaces of the primary roots.

The following experiment shows the effect of splitting the primary roots upon their growth.

Table XI. Experiment showing the effects of splitting on the growth of primary roots of Vicia Faba. 6 plants used. 3 normal and 3 cut. Primary roots split between points 20 and 30 millimeters from their apexes. Plants cultivated in sawdust. Growth of normal plant equals 100%.

	Average daily growth in millimeters.						
	1	2	3	4	5	6	7
Normal	12.3	24.6	19.3	26.0	15.3	15.0	13.3
Split	7.0	17.6	22.0	22.6	18.6	14.0	17.3
Percentage Split to unsplit: Daily growth	56%	71%	113%	87%	121%	93%	130%
Percentage Split to unsplit: Total growth							96%

Original length of roots 3 centimeters.

Unlike the preceding experiment where the cutting was more or less removed from the measured growing zones, we have here the region of mutilation coinciding closely with the zones of measured growth. At first a similar retardation as the result of mutilation or splitting the roots is shown here as in the preceding experiment. Later a considerably accelerated growth of the mutilated plants took place. At the end of seven days the plants with split roots had nearly reached the same length as the normal plants.

Table XII. Experiment showing the effects of cutting primary roots on the growth of secondary roots of Vicia Faba. 8 plants used, 1 normal and 7 cut. All but six centimeters of the primary roots were removed. Plants cultivated in water in a moist chamber. Duration of experiment seven days.

	Average length of secondary roots in centimeters.
Normal	11
Cut	35

Original length of roots 8-10 centimeters.

In this experiment the pruning consisted in cutting all of the secondary roots on each plant except six, while the primary roots were shortened to about six centimeters. This experiment lasted a number of days and it will be observed that there was considerable increase in the growth of the secondary roots of the cut plants over that of the normal. Numerous small tertiary roots occurred on the secondary roots of the pruned plants, but these were not measured, therefore the whole correlative effect is not shown here.

Table XIII. Experiment showing the effects of cutting secondary roots on the growth of primary roots of Vicia Faba. 12 plants used, six normal and six cut. Plants cultivated in water under a bell glass. Growth of normal plants equal 100%.

	Average daily growth in millimeter.						
	1	2	3	4	5	6	7
Normal	11.0	13.6	5.2	4.4	2.8	1.0	0.6
Cut	10.4	16.0	7.0	10.2	10.0	8.8	8.0
Percentage } Daily growth	95%	117%	135%	232%	357%	88%	133%
Cut to uncut } Total growth							182%

Original length of roots 16 centemeters.

Table XIV. Experiment showing the effects of cutting secondary roots on the growth of primary roots of Vicia Faba. 10 plants used, one normal and nine cut plants. Plants cultivated in water in a moist chamber. Duration of experiment 49 days.

	Average length of primary roots in centimeters.
Normal	45
Cut	88

Original length of roots 8-10 centimeters.

The effects of cutting secondary roots on the growth of primary roots is shown in the two preceding tables. In one case the experiment lasted seven days and in the other forty-nine days. In one experiment, Table XIII, the secondary roots were cut only once. In the experiment shown in Table XIV they were cut as often as they appeared, and in the latter case there occurred 59 secondary roots on the normal and an average of 229 on the cut plants. On one of the cut plants there also appeared fifty-one additional secondary roots on the stem above the seed. In both experiments a large acceleration took place in the growth of the primary roots. In Table XIII there is shown a slight retardation at the time of the first measurement. Recovery was so quick in this instance that the usual degree of retardation was hardly perceptible. Had observation, however, been made during briefer periods than twenty-four hours a decided retardation would have been seen, inasmuch as the first effect of the shock caused by cutting is invariably a greatly retarded growth. The nearer the cutting to those parts of the plants under observation the more pronounced is the retardation. The retardation apparently manifested itself very quickly after mutilation, and the accelerated growth is very pronounced in this instance. The effects of mutilation on organs in which measurements were made during shorter periods of time can be seen from the following table.

Table XV. Experiment showing the effects of splitting primary roots upon the growth of stems (hypocotyls) of Lupinus luteus, L. 18 plants used, 9 normal and 9 split roots. Primary roots split between points 20 and 30 millimeters from their apexes. Plants cultivated in sawdust. Growth of normal plants equals 100%.

	Average growth in millimeters. (Hours.) 6	12	24	48	72	96
Normal	1.6	2.2	5.1	11.5	8.1	9.3
Split	0.7	2.1	5.1	12.5	8.3	9.8
Percentage Split to unsplit — Period growth	44%	95%	100%	109%	102%	105%
Percentage Split to unsplit — Total growth						102%

Original length of roots, 31 millimeters.

The first measurements made six hours after cutting showed a falling off of 56% in the growth of the split roots. A greater retardation no doubt would have been observed here if measurements had been made previous to six hours as is shown in experiments when shorter intervals in the time of measurements were observed. It can be seen, however, from this experiment that retardation and acceleration commence to show themselves very early after mutilation.

The effects of mutilation on growth as shown in the preceding experiments give us some idea of the extent of the shock produced from this form of stimulation. The first effect of mutilation is a disturbance of the normal activities of the plant, which so far as growth is concerned shows itself in a more or less pronounced retardation. This is followed by an attempt of the organism to recover, or an accelerated growth. The maximum period of retardation appears shortly after cutting, and the maximum period of acceleration at least that obtained from a large number of experiments, would appear to take place in plants making ordinary growth about twenty-four hours after cutting. The degree of retardation and acceleration appears to be more marked in rapidly growing plants, or those that are more plastic, and is especially marked in the less differentiated cryptogams. In some of the lower types of organisms retardation is so brief and acceleration in growth so rapid that very close intervals in the time of measurement are necessary to observe the effects of mutilation.

This series of experiments demonstrates that mutilation causes decided changes in the growth of the organism, and when these mutilations are of a nature not to seriously interfere with the normal condition of the plant, recovery takes place in a few days and the normal functions are restored. The organs nearest the zone of mutilaton show the effects of stimulation, as a rule, in more pronounced degree than those more remote. When pruning is of a certain character, such as shown by the experiments in Tables XII, XIII and XIV, decided correlations takes place which exerts considerable influence on the configuration of the organism.

In the latter experiment we have an opportunity to observe the effects which pruning secondary organs has upon the growth of primary organs, and, conversely, the effect that pruning primary organs has upon secondary organs. When pruning of this nature is practiced pronounced results are likely to show themselves. Or, in other words, the pruning of primary organs induces a marked stimulus to secondary organs, and, conversely, the pruning of secondary organs induces marked changes in the growth of primary organs.

In the splitting of roots the injuries were of an insignificant character, and no very serious consequences of a permanent nature were likely to follow, since in this case none of the organs were removed and the nature of the mutilation did not affect the morphological balance of the organism.

In the destruction of the leaders of any terminal organ we seriously interfere with the normal geotropic irritability of the organism, and mutilations of this character are sufficient to induce quick and decided response. The degree of irritability or response to stimulation is more marked in secondary organs when the primary organs are cut, and vice versa. This appears to be a marked case of specific irritability, as we have a particular type of stimulation producing tolerably definite results.

In conclusion, it may be stated that mutilation acts as a severe shock and sets the self-regulatory functions of the organism into activity, inducing a series of changes and responses which manifest themselves according to the nature, degree of intensity and method of applying the stimulus, and they are also dependent upon the nature of the organism stimulated.

GENERAL CONSIDERATIONS IN REGARD TO PRUNING.

One of the fundamental requirements of pruning consists in the ability or power of the organism to respond to stimuli. In plants as well as animals, stimulation and response go hand in hand and the manner of responding or reacting on the part of the organism depends upon the nature, degree of intensity and method of applying the excitory cause or stimulus, and also upon the nature of the organ stimulated. The responses of organisms to stimuli are manifold and specific. Every cell, tissue and organ of the plant presents tolerably definite relations to every other, and these are suited or accommodated to the requirements of the organism. Whenever the component parts of a plant are stimulated or its normal functions are interrupted in any way the organism undergoes modifications. If the stimulus or excitory cause is of a certain definite nature characteristic response follows, although different stimuli may give rise to similar responses. There is continually taking place in the plant organism a series of responses due to complex, internal or automatic impulses, or to external or environmental causes which give rise to innumerable correlative changes in the organism. Such factors as heat, light, moisture, gravity, electricity, etc., act continually as stimuli as do the products of absorption and metabolism. Whenever the plant is deprived of any of its organs it proceeds along definite lines to make good the loss in order that the balance or reciprocal relationship existing between them may be maintained.

The mutual relationship existing between the component parts of a plant is of importance, and when this relationship is interfered with by mutilation, etc., correlation follows. The plant organism, however, is not to be compared to a lifeless machine for there exists a capacity or power of automatic adjustment. or a self regulatory function which frequently manifests itself in a surprisingly brief period. This capacity for self-regulation which the plant is endowed with, the carrying out of which simulates instinct or even intelligence on its part, differentiates it from a mere machine. That this inherent self-regulatory characteristic, or power for mutually adjusting its component parts to each other, is of the greatest importance is obvious, as it enables the organism to overcome obstacles which might otherwise prove fatal.

Fig. 6.
Showing leaf spur formed on end of fruit cluster.

There are a number of examples offered by plants which show the results of the application of stimuli due to mutilation, but it is only necessary to allude to a few of them here. The stimulating or modifying factors which practical gardeners apply to plants show themselves in various ways. In applying stimuli to plant organisms in the form of mutilations, or pruning, we obtained certain discernable specific reactions which demonstrate that there are certain definite laws underlying these phenomena. To prune intelligently these laws should be understood and if we wish to obtain the best results from pruning they should be taken into consideration. Definite results are obtained by pruning certain organs, but it does not necessarily follow that the results which are produced on one set of organs would be produced on another.

The application of stimuli to plants is not, however, always conducive to the most desirable morphological and physiological development of the organism, and this holds good for pruning as well as in the application of other forms of stimuli. For example, tomatoes can be pruned to such an extent that if they are grown in a well manured soil they exhibit many abnormal morphological and physiological characteristics. When grown under such conditions they frequently show unusually large, more or less curled and crumpled, highly colored, spotted leaves. Not infrequently in this method of cultiva

Fig. 7.

Showing corresponding leaves from pruned and unpruned plants. Large leaf from pruned plant: small leaf from normal or unpruned plant.

tion leafy proliferations are formed on the fruit stalk and vascular areas. The peculiar coloring and spotting of the leaves is a form of indigestion, as it were, and is similar to, if not identical with, the physiological disorder known as the mosaic disease common to tobacco, etc. Where the soil is unusually rich in manure or fertilizers, these troubles appear to be aggravated and we obtain in addition to the above characteristics unusually thick stems, contorted and twisted leaves, curled up leaders and petioles and abnormal growths along the vascular areas. Such cases are apparently in part the result of over feeding,* and, since severe and constant pruning restricts the development of foliage and branches, it would also appear to be responsible for multiplying and aggravating over feeding symptoms by limiting the vegetative portions of the plant, thereby preventing its properly caring for or digesting the absorbed food. Normal, or unpruned plants, when grown under precisely the same conditions, do not display such symptoms, as they are able with their profuse development of foliage to properly care for the amount of plant food which they absorb.

Young suckers or sprouts seen growing on stumps of forest trees often present similar characteristics to those shown by pruned tomato plants. The leaves on such sprouts are frequently highly colored and much contorted, since they are supplied from root systems which previously supported large trees and they present all the characteristics of over feeding. The cases just cited represent morphological and physiological conditions of a pathological nature and are rather exceptional. There are, however, many correlated effects due to natural causes which must be regarded as beneficial to the organism.

In the singular case of mushrooms and other plants breaking through thick concrete or raising flag stones, etc.: of roots splitting or raising large bowlders, sometimes developing a pressure in the cells equal to many atmospheres, we have a peculiar correlative effect manifested in the increased osmotic properties of cells. In the same manner, applying tension to plants or stretching them by weights acts as a stimulus causing them to respond readily and to develop mechanical tissues, and a similar development of mechanical tissues is shown in certain tendrils, etc. as a result of contact stimulation.

*There appears to exist more or less confusion in the symptoms characteristic of Mosaic disease, Oedema and over feeding.

The destruction of the leader in various trees is followed by the formation of one or more new leaders from terminal laterals which assume the functions of the one destroyed. In such cases a plagiotropic organ becomes an orthotropic organ, and what holds true for various trees is characteristic of many plants both as regards primary and secondary organs, etc.

The effects of continual pruning of branches on the growth of leaders is well illustrated in forests. Where pine or chestnut trees are grown close together the lower limbs are being continually pruned by natural agencies. The result is a tall, straight shaft with a limited crown, whereas when these trees are growing unrestricted in the open their branches remain intact and they develop freely causing the tree to become thick and stocky, and present quite a different aspect from those grown in close proximity to one another. On the other hand, the constant pruning of leaders causes an accelerated growth of branches causing them to elongate and thicken up. The cutting of the leader of a cucumber plant induces the growth of axillaries, and pruning the axillary shoots at certain places not only increases the amount of fruit in certain axils but it restricts the fruit to certain desirable positions. Naturally, however, in the cucumber plant axillary shoots are produced in abundance and it is seldom necessary to manipulate the leader to induce their growth. Sometimes, however, they do not form in each axil and then it becomes necessary to resort to the cutting of the leader in order to induce them to grow. Heading in a secondary organ has the same effect on tertiary organs as the cutting of primary organs has on secondary organs. For example, the heading in of an axillary of the cucumber plant induces fruit to set more abundantly at certain points. It also induces new leaders or tertiary shoots to form on secondary organs or branches. This in turn affects the formation of fruit. Or, in other words, the fruit can be conceutrated on the cucumber plant in certain desired positions thus obviating the unnecessary spreading of the vines over a large area.

Since the fruit cluster of the tomato plant corresponds to a secondary organ, and since the pruning of primary organs induces the greatest effect on secondary organs, the cutting of the leader would stimulate the growth of fruit. On the other hand, cutting of the axillary shoots, branches and leaves (secondary organs) induces a greater growth in the length of the stem.

Fig, 8.
A curled leaf from pruned plant.

To induce, therefore, a desirable correlation or divert the energies of a tomato plant to the fruit, it is essential, among other things, to cut the leader.

SUMMARY.

The most important results concerning the pruning of tomatoes are given in the section on page 15.

The pruning of axillaries or suckers, leaves and branches affects the development of both the fruit and stem. With this system of pruning, however, most of the energies of the plant are directed towards the leader. On the other hand, pruning or heading in the leader throws most of the energies of the plant into the fruit.

There is a general relationship existing between the average weight of individual fruits and the number per plant. The largest individual fruits occur generally on those plants giving the smallest number.

Pruning tomatoes appreciably hastens maturity of fruit and increases the size of the same.

When no cutting of the leader took place the average weight of the individual fruit decreased from the single stem to the normal or unpruned plants; the average weight of the single stem fruit being 112 grams, that of the normal 84 grams. On the other hand, the smallest average weight of fruit per plant occurred on the single stem system.

The greatest average weight of individual fruit, as well as the greatest average weight per plant, is given by the three stem system where the leader is headed in: whereas, in the average number of fruits per plant this system is lowest.

The largest yield per square foot of ground surface in our method of culture (5 square feet per plant) was given by the three stem plants with leader cut.

The largest yield based on trellis space was given by the one stem system of pruning.

Undoubtedly the best system of growing greenhouse tomatoes is to plant twelve to sixteen inches apart in the rows, prune to the one stem system and head in or cut back the leaders above the fourth or sixth cluster of fruit, as circumstances require.

The physiological effects of pruning or mutilating, manifest themselves at first in the retardation or cessation of the growth activities, which are eventually followed by an accelerated growth. The degree of response is determined by the nature of the organs mutilated and the extent of the injury.

The Following Bulletins are Available for Distribution to Those Who May Desire Them.

No. 3. Tuberculosis.
No. 27. Tuberculosis in college herd: tuberculin in diagnosis: bovine rabies: poisoning by nitrate of soda.
No. 33. Glossary of fodder terms.
No. 35. Agricultural value of bone meal.
No. 41. On the use of tuberculin (translated from Dr. Bang).
No. 64. Analyses of concentrated feed stuffs.
No. 67. Grass thrips: treatment for thrips in greenhouses.
No. 68. Fertilizer analyses.
No. 76. The imported elm-leaf beetle.
No. 77. Fertilizer analyses.
No 81. Analyses of fertilizers and manurial substances, instructions to manufacturers, agents, etc.: discussion of trade values; treatment of barnyard manure with absorbents.
No. 82. Orchard management; cover crops in orchards; pruning orchards; report on fruits.
No. 83. Fertilizer analyses.
No. 84. Fertilizer analyses.
No. 86. Orchard treatment for the San José scale. One year's experiments in Massachusetts.
No. 87. Cucumbers under glass.
No. 89. Fertilizer analyses.
No. 90. Fertilizer analyses.
No. 91. Injuries to shade trees from electricity.
No. 92. Fertilizer analyses.
No. 95. Fertilizer analyses: notes on barnyard manure; trade values.
No. 96. Fungicides, insecticides, spraying calendar.
No. 97. A farm woodlot.
No. 98. Inspection of concentrates.
No. 99. Dried molasses-beet-pulp; the nutrition of horses.
No. 100. Analyses of manurial substances and licensed fertilizers: trade values of fertilizing ingredients for 1903 and 1904.
No. 101. Inspection of concentrates.
No 102. Analyses of manurial substances and licensed fertilizers: trade values of fertilizing ingredients for 1903 and 1904.
No. 103. Analyses of manurial substances; instructions regarding sampling of materials; instructions to manufacturers, agents, etc.; trade values of fertilizing ingredients for 1904 and 1905.
No. 104. Analyses of manurial substances: market values of fertilizing ingredients; analyses of licensed fertilizers.
Technical, No. 1. Greenhouse aleyrodes: strawberry aleyrodes.
Technical, No. 2. The graft union.
Special bulletin.—The coccid genera Chionaspis and Hemichionaspis.
Index, 1888-95.
Annual Reports.—1898, 1899, 1900, 1901, 1902, 1903, 1904, 1905.

HATCH EXPERIMENT STATION

—OF THE—

MASSACHUSETTS

AGRICULTURAL COLLEGE.

BULLETIN NO. 106.

CONDIMENTAL STOCK AND POULTRY FOODS.

SEPTEMBER, 1905.

The regular Bulletins of this Station will be sent free to all newspapers in the State and to such individuals interested in farming as may request the same. Technical Bulletins are sent only to those persons interested in the subject treated of in each case.

AMHERST, MASS.:
PRESS OF CARPENTER & MOREHOUSE
1905.

HATCH EXPERIMENT STATION

OF THE

Massachusetts Agricultural College,

AMHERST, MASS.

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The co-operation and assistance of farmers, fruit-growers, horticulturists, and all interested, directly or indirectly, in agriculture, are earnestly requested. The Bulletins will be sent free to all newspapers in the State and to such individuals interested in farming as may request the same. General bulletins, fertilizer analyses, analyses of feed-stuffs, and annual reports are published. Kindly indicate in application which of these are desired. Communications may be addressed to the

HATCH EXPERIMENT STATION, Amherst, Mass.

DEPARTMENT OF FOODS AND FEEDING.

Condimental Stock and Poultry Foods.

JOSEPH B. LINDSEY.*

A. INTRODUCTION.

The 65 samples of stock and poultry foods and condition powders herein reported were secured in most cases from fresh stock out of unbroken packages. There is no intention to show prejudice against this class of material. The bulletin includes the composition of the various brands as ascertained by the chemist and microscopist together with such remarks concerning their nutritive, medicinal and economic values, as seem warranted by the analytical results. The most important results obtain by feeding Pratts food to a number of cows, are reported on pages 20–22.

* The examination of the various condimental foods herein reported was largely under the supervision of Mr. E. B. Holland, to whom due credit should be given. He was assisted by Mr. P. H. Smith and Mr. W. E. Tottingham. The microscopic work was executed by Mr. A. V. Osmun.

B. TABLES OF COMPOSITION.

1. Stock Foods.

MANUFACTURER AND BRAND.	FODDER ANALYSIS.						ASH.	
	Water.	Ash.	Protein.	Fiber.[1]	N-free Extract.	Fat.[2]	Salt.[3]	Acid Insoluble.
	%	%	%	%	%	%	%	%
Ame & Co., Boston, Mass.								
Standard	11.94	5.51	14.31	4.77	58.97	4.17	3.35	0.15
Anglo-American Mfg. Co.,[4] Boston, Mass.								
Anglo-American	12.57	12.60	16.37	5.80	47.92	4.74	9.21	0.19
Ashland Stock Food Co., Ashland, O.								
Ashland	9.69	21.71	6.37	19.71	41.07	1.45	13.50	0.42
Banner Food Co., Auburn, N. Y.								
Banner	12.69	10.26	22.42	13.34	37.77	3.52	4.87	0.77
Banner Pepto	11.61	11.14	22.46	17.52	31.45	5.82	5.36	1.07
Baum's Castorine Co.,[5] Syracuse, N. Y.								
Baum's	12.07	10.87	25.71	18.50	25.78	7.07	3.55	0.59
Capitol Food Co., Tiffin, O.								
Capitol	13.98	28.96	10.32	7.53	33.78	5.43	9.98	6.53
W. D. Carpenter Co., Chicago, Ill.								
Nutriotone	9.87	21.05	20.18	5.90	37.24	5.76	12.62	1.63
Engle's Animal Health Food Co., Boston.								
Engle's Animal Health	11.04	12.18	17.29	6.59	48.28	4.62	8.50	1.14
J. J. Fleck, Tiffin, O.								
Fleck's	9.71	8.96	15.67	9.54	49.75	6.37	3.55	0.47
Gilchrest An. Food Co., Townsend, Mass.								
Gilchrest's	11.16	5.91	15.44	2.37	58.06	7.06	2.64	0.56
Greene Chick. Feed Co., Marblehead, Mass								
Chicago Horse	12.69	9.52	20.75	7.10	44.73	5.21	0.25	1.06
Dr. Hess & Clark, Ashland, O.								
Dr. Hess	12.27	15.04	15.23	6.74	47.90	2.82	9.24	0.61
International Stock Food Co., Minneapolis								
International	9.47	15.80	14.35	10.85	44.70	4.83	11.96	0.41
Edwin G. Knight,								
Knight's English Vegetable	11.80	13.80	14.74	9.30	45.86	4.50	9.49	0.49

[1] A high fiber content is usually due to charcoal or a woody filler, such as mustard hulls, cocoa shells, etc.
[2] Free sulfur accounts in many cases for the apparent high percentage of fat.
[3] Calculated from the chlorine titre. All amounts under 0.50 per cent. are probably incidental.
[4] Unknown. Letters returned.
[5] United Breeders' Company of America, Syracuse, N. Y.

B. TABLES OF COMPOSITION.

1. Stock Foods.

BASIC INGREDIENTS.	OTHER INGREDIENTS IDENTIFIED	Size of package	Cost a pound[1]
		lbs.	cts
Corn, wheat offal	Mustard hulls, anise, fennel, sulfur, salt	50	6.5
Wheat offal	Cottonseed meal, fenugreek, sulfur, salt, charcoal	—	—
Mustard hulls	Wheat offal, fenugreek, saltpeter, Epsom salts, salt, charcoal.	3	8.3
Linseed meal	Corn, wheat offal, fenugreek, saltpeter, sulfur, Epsom salts, salt, charcoal.	—	—
Linseed meal	Wheat offal, fenugreek, Epsom salts, lime phosphate, salt, charcoal.	2	12.5
Linseed meal	Saltpeter, sulfur, Epsom salts, salt, charcoal	2	12.5
Wheat offal	Cinnamon, sulfur, ashes, salt	—	—
Linseed meal, wheat offal	Corn, cottonseed meal, fenugreek, sulfur, salt, charcoal	2[2]	25.0
Wheat offal, oat hulls	Corn, cottonseed meal, weed seeds, fenugreek, salt	10	7.5
Wheat offal	Oats, linseed meal, fenugreek, pepper, sulfur, Epsom salts, salt, charcoal.	8	6.3
Corn meal, wh. middlings	Fennel, saltpeter, salt	5	10.0
Lin. meal, wh. offal, corn	Fenugreek, Epsom salts	25	7.0
Wheat bran	Peas, pepper, saltpeter, salt, charcoal	7[2]	7.1
Wheat offal	Cayenne, salt, charcoal	1.7	14.7
Wheat bran	Corn, oats, fenugreek, salt	—	—

[1] The "cost a pound" was calculated, so far as possible, on the basis of a twenty-five cent package.
[2] Approximate.

B. TABLES OF COMPOSITION.

1. Stock Foods.—(Continued.)

MANUFACTURER AND BRAND.	FODDER ANALYSIS.						ASH.	
	Water.	Ash.	Protein.	Fiber.	N—free Extract.	Fat.	Salt.	Acid Insoluble.
	%	%	%	%	%	%	%	%
Mackenzie & Winslow, Fall River, Mass.								
American Triumph	9.29	13.43	14.70	10.88	46.73	4.97	8.42	0.19
Merriam & Rolph, Fitchburg, Mass.								
Arabian	10.86	4.58	18.03	6.00	55.24	5.29	0.17	0.24
Mollin's Vet. Rem. & Food Co., Boston.								
Dr. Mollin's Veterinary	10.84	5.42	16.19	8.05	53.75	5.75	0.17	1.23
Myers Royal Spice Co., Niag. Falls, N.Y.								
Myer's Royal Spice	12.42	9.36	15.14	7.26	50.73	5.09	5.78	0.90
Myer's Royal Spice	20.92	13.41	16.23	6.15	41.84	1.45	10.81	0.61
Pasture Stock Food Co., Chicago, Ill.								
Pasture	10.01	13.87	16.19	4.65	50.76	4.52	11.10	0.65
Pratt Food Co., Philadelphia, Pa.								
Pratts	10.60	5.66	15.23	6.20	55.13	7.18	2.64	0.17
Pratts Animal Regulator	12.79	10.93	9.70	3.37	60.50	2.71	8.75	0.23
Pratts Animal Regulator	9.09	11.27	9.70	3.50	61.95	4.49	9.21	0.21
Royal Co-Op. Mfg. Co., Indianapolis, Ind.								
Royal	11.04	7.18	16.81	13.20	49.11	2.66	0.08	2.45
Security Stock Food Co., Minneapolis.								
Security (Glutenized)	7.74	31.99	10.88	5.70	34.21	9.48	21.37	3.05
Security (Glutenized)	7.44	30.97	10.36	6.09	35.66	9.48	20.59	3.16
U. S. Dairy Co., East Ryegate, Vt.								
Dairy Milk Producer	6.60	33.41	10.97	4.59	43.01	1.42	21.29	0.22
Crem-O-Dairy Calf Producer	7.95	50.92	2.59	9.08	29.20	0.26	0.58	0.50
Dairy Pig Grower	6.09	47.79	14.17	11.85	18.13	1.97	0.17	2.93
G. E. Vincent, Catskill, N. Y.								
Orange Electric	12.17	5.62	13.82	7.73	55.06	5.60	2.97	0.26
W. A. Wann,[1] New York, N. Y.								
Weston's Medical	12.24	6.22	17.16	4.09	56.30	3.99	4.04	0.11
White Food Co., Taunton, Mass.								
White's	10.28	5.75	18.60	8.37	51.29	5.71	0.74	0.16
Wilbur Stock Food Co., Milwaukee, Wis.								
Wilbur's	12.47	10.30	16.50	9.55	46.52	4.66	6.52	0.56

[1] Deceased.

B. TABLES OF COMPOSITION.

1. Stock Foods.—(Continued.)

BASIC INGREDIENTS.	OTHER INGREDIENTS IDENTIFIED.	Size of package	Cost a pound
		lbs.	cts.
Wheat offal	Corn, fenugreek, salt, charcoal, tumeric	6.5	11.5
Wheat offal	Corn, fenugreek, ginger	5	10.0
Wheat offal	Corn, anise, fenugreek, ginger	10	9.0
Corn, wheat offal	Linseed meal, oats, cocoa shells, mustard hulls, fenugreek, pepper, salt, tumeric.	2	12.5
Corn, wheat offal	Linseed meal, cocoa shells, mustard hulls, fenugreek, pepper, salt, tumeric.	2	12.5
Corn, wheat offal	Linseed meal, fenugreek, ginger, salt, charcoal	1.5	16.7
Corn, wheat offal	Fenugreek, salt	6.6	7.6
Corn	Fenugreek, gentian, salt, charcoal	1.2	20.8
Corn	Fenugreek, gentian, salt, charcoal	1.2	20.8
Wheat bran	Corn, linseed meal, charcoal	1.4	17.9
Wheat offal	Pepper, sulfur, salt, Venetian red	1.6	15.6
Wheat offal	Pepper, sulfur, salt, Venetian red	1.6	15.6
Corn, wheat offal	Fenugreek, saltpeter, salt, shells, charcoal	—	—
Shells	Wheat bran, linseed hulls, sodium bicarbonate, charcoal.	—	—
Shells	Cocoanut shells, corn cobs, sodium bicarbonate, charcoal	—	—
Corn	Linseed meal, wheat offal, fenugreek, saltpeter, salt, charcoal.	1.3	19.2
Wheat offal	Corn, cottonseed meal, linseed meal, cocoa shells, fenugreek, salt.	—	—
Wheat bran	Buckwheat, digitalis, fenugreek	12	6.3
Wheat bran	Corn, linseed meal, rye, salt, charcoal	1.5	16.7

2. Poultry Foods.

MANUFACTURER AND BRAND.	FODDER ANALYSIS.						ASH.	
	Water.	Ash.	Protein.	Fiber.	N-free Extract.	Fat.	Salt.	Acid Insoluble.
	%	%	%	%	%	%	%	%
Ashland Stock Food Co., Ashland, O.								
Ashland	7.96	32.06	10.23	5.50	42.03	2.22	2.48	4.01
Banner Food Co., Auburn, N. Y.								
Banner	12.68	10.56	22.29	13.47	37.53	3.47	4.95	0.80
Capitol Food Co., Tiffin, O.								
Capitol	12.82	12.00	14.53	10.59	37.74	12.32	1.98	2.80
W. D. Carpenter Co., Chicago, Ill.								
Poultriotone	11.35	19.01	16.76	7.34	44.03	1.51	4.62	1.10
Poultriotone	9.51	19.99	16.59	6.55	43.67	3.69	4.79	1.96
Charles M. Cox Co., Boston, Mass.								
Flagg's[1]	13.97	14.82	17.03	6.26	45.29	2.63	2.56	1.31
Empire Egg Maker Co., Vergennes, Vt.								
Empire Egg Maker	6.70	51.08	12.25	4.52	23.68	1.77	0.36	6.52
J. J. Fleck, Tiffin, O.								
Fleck's	8.16	25.53	15.93	9.65	35.18	5.55	0.00	4.50
Flower City Pl. Food Co., Rochester, N.Y.								
Eggo	11.87	5.20	19.53	6.91	51.16	5.33	0.17	0.29
Gilchrest An. Food Co., Townsend, Mass.								
Gilchrest's	12.07	7.40	15.88	5.89	52.50	5.36	0.83	0.40
Greene Chick. Feed Co., Marblehead, Mass								
Condimental	6.50	42.66	11.67	5.77	31.92	1.48	0.50	5.44
Dr. Hess & Clark, Ashland, O.								
Dr. Hess' Panacea	10.23	38.99	11.14	3.81	34.22	1.61	11.14	3.04
Internat'nal Stock Food Co., Minneapolis.								
International	12.10	7.03	14.35	11.64	50.84	3.44	1.90	1.50
Henry, Johnson & Lord, Burlington, Vt.								
Prolific	9.70	33.46	20.09	9.25	21.30	6.20	7.64	2.43
Mollins Vet. Rem. & Food Co., Boston.								
Mollins' Compound	9.42	9.86	13.34	19.50	43.80	4.08	0.08	1.21
Myers Royal Spice Co., Niag. Falls, N.Y.								
Myers' Spice	12.20	18.33	13.25	8.20	44.07	3.95	13.58	1.45
Pratt Food Co., Philadelphia, Pa.								
Pratts	12.31	6.05	13.38	6.95	53.80	7.51	0.00	1.88

[1] Manufacture discontinued.

2. Poultry Foods.

BASIC INGREDIENTS.	OTHER INGREDIENTS IDENTIFIED.	Size of package.	Cost a pound.
		lbs.	cts.
Wheat offal	Corn, oats, pepper, Epsom salts, salt, shells, Venetian red	1.8	13.9
Linseed meal	Corn, oats, wheat offal, saltpeter, Epsom salts, salt, charcoal.	—	—
Wheat bran	Mustard hulls, pepper, sulfur, charcoal, Princess metallic	—	
Corn, wheat offal	Sulfur, salt, meat and bone, charcoal	1	25.0
Corn, wheat offal	Sulfur, salt, meat and bone, charcoal	1	25.0
Wheat offal	Pepper, salt, Princess metallic	—	—
Shells	Cottonseed meal, pepper, bone, Venetian red	—	—
Mustard hulls	Pepper, sulfur, Epsom salts, sand, shells, Venetian red	2	12.5
Wheat offal	Corn, linseed meal, fenugreek, pepper	1.6	15.6
Wheat offal	Corn, rice, pepper, sulfur	1.6	15.[illegible]
Wheat bran, shells	Corn, buckwheat, slippery elm, sand	1.5	16.7
Wheat offal, shells	Pepper, iron sulfate, saltpeter, salt, sand, Princess metallic.	1.5*	16.7
Wheat offal	Cayenne, fenugreek, gentian, salt	1.7	14.7
Linseed meal, shells	Wheat offal, mustard hulls, pepper, Epsom salts, salt, bone, sand, charcoal.	1	25.0
Wheat offal	Fenugreek, charcoal	1	50.0
Corn	Cottonseed meal, grass and weed seeds, mustard hulls, cayenne, fenugreek, saltpeter, sulfur, salt, sand, tumeric	1	10.7
Corn, wheat offal	Gentian, Venetian red	1.5	16.7

* Approximate.

2. Poultry Foods.—(Continued.)

MANUFACTURER AND BRAND.	FODDER ANALYSIS.						ASH.	
	Water.	Ash.	Protein.	Fiber.	N—free Extract.	Fat.	Salt.	Acid Insoluble.
	%	%	%	%	%	%	%	%
Royal Co-Op. Mfg. Co., Indianapolis, Ind.								
Royal Mixture	0.31	99.69	—	—	—	—	0.41	8.33
Wm. Rust & Sons, New Brunswick, N.J.								
Rust's Egg Producer	8.74	61.22	18.96	5.01	4.05	2.02	0.05	2.06
Security Stock Food Co., Minneapolis.								
Security Eggmaker (Albuminized)	10.68	22.83	11.32	11.20	35.27	9.70	4.70	4.84
Security Eggmaker (Albuminized)	9.02	22.67	11.19	10.53	37.58	9.01	4.46	4.67
F. C. Sturtevant Co., Hartford, Conn.								
Imperial Egg	4.66	69.16	5.84	5.60	11.48	3.26	0.00	7.89
Tri-Plex Food Co., New Brunswick, N. J.								
Tri-Plex	9.28	40.02	17.60	3.34	25.83	3.93	0.08	1.19
Wonder Food Co.,[1] Bingham, Me.								
Wonder	11.98	11.18	22.16	14.34	36.89	3.45	4.62	0.99

3. Condition Powders.

C. B. & F. H. Goss, Melrose, Mass.								
Goss	9.25	23.13	15.93	6.88	28.05	16.76	8.22	1.84
C. H. Hadley & Co., Boston, Mass.								
Cureido	6.88	22.48	5.88	19.58	32.31	12.87	0.08	9.17
I. S. Johnson & Co., Boston, Mass.								
Sheridan's	11.55	17.41	15.67	11.46	28.52	15.39	0.08	1.12
Henry H. Kurr & Co., Boston, Mass.								
Kurr's Compound	12.52	1.94	9.48	1.90	66.82	7.34	0.00	0.32
Mollins Vet. Rem. & Food Co., Boston.								
Mollins' Great Discovery	9.44	15.63	13.69	9.78	46.32	5.14	8.83	1.19
Wm. Rust & Sons, New Brunswick, N. J.								
Rust's Havens Climax	11.96	8.93	22.51	11.27	36.28	9.05	2.31	1.83
L. S. S. Co., Dunkirk, N. Y.								
Wright's	10.56	37.85	10.18	11.20	22.55	7.66	18.53	2.23

[1] Unknown. Letters returned.

2. Poultry Foods.—(Continued.)

BASIC INGREDIENTS.	OTHER INGREDIENTS IDENTIFIED.	Size of package.	Cost a pound.
		lbs.	cts.
Magnesium limestone	Sand, Princess metallic	2	25.0
Shells, wheat offal	Linseed meal, cayenne, sulfur, bone, charcoal	1	25.0
Wheat bran	Gentian (?), pepper, saltpeter, Epsom salts, salt, shells, charcoal, Princess metallic.	1.6	15.6
Wheat bran	Gentian (?), pepper, saltpeter, Epsom salts, salt, shells, charcoal, Princess metallic.	1.6	15.6
Shells	Wheat bran, cayenne, sand, Venetian red	1.6	15.6
Shells, wheat offal	Corn, oats, linseed meal, pepper, sulfur, bone, sand, charcoal.	1.6	15.6
Linseed meal	Corn, wheat offal, fenugreek, pepper, saltpeter, sulfur, Epsom salts, salt, charcoal.	—	—

3. Condition Powders.

Wheat offal	Corn, linseed meal, pepper, saltpeter, sulfur, salt	—	—
Corn	Fennel, fenugreek, pepper, sulfur, shells, charcoal, trace Venetian red.	1	50.0
Wheat offal	Linseed meal, cayenne, ginger, sulfur, Epsom salts, bone, shells, charcoal.	.25	100.0
Corn	Gentian, ginger, sugar, sulfur	1	50.0
Wheat offal	Fenugreek, gentian, salt, charcoal	.25	100.0
Linseed meal	Corn, millet seed, wheat offal, mustard hulls, fenugreek, pepper, salt.	.8	31.3
Wheat offal	Linseed meal, nux vomica, pepper, sulfur, Epsom salts, salt, bone, shells, charcoal.	—	—

C. A TALK ABOUT THE RESULTS.

It is not claimed that the number of ingredients identified in the above foods is in all cases complete, for in such mixtures one is likely to cover up another, and it is occasionally difficult to positively identify each single ingredient. It is believed, however, that the examination is sufficiently complete to give a correct idea of the general character of such foods.

Basic or Food Ingredients. The chemist and microscopist have found these foods to consist principally of ordinary grains and concentrates, such as wheat by-products (bran and middlings), corn meal and linseed meal. In some cases a few hundred pounds to the ton of linseed, cottonseed, and occasionally meat and bone meal have been added obviously to increase the amount of protein; such mixtures contained from 10 to 20 per cent of that nutrient. Occasionally the presence of considerable quantities of mustard hulls, cocoa shells, cocoanut shells and weed seeds is noted, used evidently as a filler.

The *poultry foods* more frequently reveal the presence of from 10 to 50 per cent of ground oyster shells or noticeable quantities of ground bone, which accounts for the exceptionally high ash percentage.

Nutritive and Commercial Values of the Food Ingredients. It having been shown that the bulk of these foods is made up of ordinary ground grains and by-products, it must be evident to all, that they cannot have a greater nutritive value than is to be found in the materials of which they are composed. The extravagant claims made by the manufacturers concerning their wonderful nutritive properties is in no way substantiated by the analytical results. It also must be clear that their commercial value from a *nutritive standpoint* cannot exceed one to one and a half cents a pound. Certainly no one would entertain the idea of purchasing these mixtures at the prices asked, because of any particular nutritive value they may possess.

Character of the Medicinal Ingredients. In addition to the various cereals and by-products, these foods contain small quantities of a variety of substances, most of which possess simple medicinal qualities, to which it is understood is attributed the wonderful nutritive and curative properties claimed for them. The *condition powders* so called, generally contain larger quantities of these medicines than the stock and poultry mixtures. The medicinal substances are described as follows:

Fenugreek and *fennel* are the ground seeds of plants grown in Southern Europe, known botanically as Trigonella Foenum Graecum and Foeniculum vulgare. They are aromatic substances, used to excite the action of the stomach, thereby relieving indigestion and gas, and also to impart an agreeable flavor. It was formerly believed that fenugreek increased the quantity and improved the quality of milk, but such ideas are now largely exploded. The quantity used is comparatively small.

Anise or Aniseed, (Pimpenella Anisum), is the seed of a plant cultivated in Spain and Malta. It has a pleasant warm taste and an agreeable odor and is used for much the same purpose as fenugreek.

Gentian, occasionally recognized, is the dried root of the plant known as Gentiana lutia and is grown in Central and Southern Europe. It is very bitter and is used as a stomach tonic, promoting an increased secretion of the gastric juice.

Ginger is the powdered underground stem of Zingiber officinale, grown principally in India and the West Indies. It stimulates the various membranes with which it comes in contact, and is used as an apetizer and to reduce the griping effects of purgatives.

Pepper, the common black form, is obtained from the brown berries of an East India climbing plant, Piper nigrum. Cayenne pepper consists of the dried ripe fruit of Capsicum fastigiatum and annum. Both kinds are used as a stomachic and to increase the activity of the reproductive organs.

Salt, of which many of the mixtures contained from 2 to 20 per cent, was used as an appetizer.

Sulfates of magnesia and soda, in the form of Epsom and Glaubers salts, are purgatives and are frequently spoken of as "salts."

Saltpeter, nitrate of potash or nitre, is used in medicine to excite the action of the kidneys and to reduce fever.

Sodium bi-carbonate is employed to neutralize an undue acidity of the stomach.

Sulphur is used as a laxative, alterative, and as a stimulant of mucus surfaces.

Iron, found as the oxide—Venetian red or Princess metallic*—is not used medicinally, but is employed to color or disguise the real

*Dry paints.

character of the food. Sulfate of iron used as a restorative and tonic, was seldom identified.

Charcoal. Its medicinal value consists in its ability to check fermentative changes, and to absorb undesirable gases. In most cases it appears to have been ground fine and mixed with the other ingredients to conceal their identity.

Tumeric, the powdered root of an East Indian plant, the Curcuma longa, is a stomachic but is used principally as coloring matter.

Cost of the Medicinal Substances at Wholesale.

The prices quoted below were taken from a New York paper known as the *Oil, Paint and Drug Reporter.*

	Wholesale price a pound. (Cents.)
Fenugreek seeds	2.75- 3.00
Fennel seeds	5.00- 5.25
Anise or Aniseed	5.00- 5.50
Gentian (powder)	4.00- 4.50
Ginger root	7.00- 8.50
Black pepper	11.00-12.00
Red pepper	11.00-12.00
Salt	0.50- 0.75
Epsom salts	0.85- 1.30
Glaubers salts	0.50- 0.60
Saltpeter	4.50- 5.50
Sodium bi-carbonate	1.30- 1.70
Sulphur	2.20- 2.60
Venetian red (iron oxide)	0.50- 0.50
Tumeric	3.50- 4.00

Quantity of Medicinal Ingredients.

No attempt was made to determine the exact quantity of each of the several drugs employed. Most of the foods contained from 5 to 40 per cent of ash. Ordinary grains and by-products rarely contain more than 5 per cent ash, the excess in the present cases was made up of such mineral substances as oyster shells, bone, sand, common salt, (2 to 20 per cent), Epsom or Glaubers salts (about 5 per cent), nitre (1 or more per cent) and Venetian red. The vegetable drugs, fenugreek, fennel, anise, gentian, ginger and pepper were employed in sufficient quantities to produce an agreeable odor and smart taste, probably in quantities varying from 5 to 10 per cent of the whole mixture. In some cases the total quantity of mineral and vegetable drugs constituted from one-sixth to one-third of the mixture, while in other cases, the amount of such substances was very much less.

Cost and Selling Price Compared.

It has been shown that none of the mineral drugs, excepting nitre, cost much over a cent a pound, and that the vegetable drugs varied in price from 3 to 12 cents a pound. Judging from all the data at hand, the cost of the entire mixtures,—grains and drugs—, could rarely have exceeded two and one-half to three cents a pound. In many cases it could not have been more than two cents a pound.

The retail prices varied from six to twenty-five cents a pound, depending on the brand and quantity purchased. Condition powders are much higher priced, from thirty cents to one dollar a pound. Is it not strange that many are willing to pay extravagant prices for materials possessing such ordinary feeding and medicinal values ! ! ! It is hoped that poultrymen have sufficient commonsense to purchase bran, corn meal, salt, oyster shells, charcoal and meat scraps separately, rather than pay from ten to twenty cents a pound for such mixtures put up in attractive packages for which the manufacturers make the most astounding and unreasonable claims.

Utility of these Foods.

Their food value has been shown to be no greater than that of the ordinary grains of which they are largely composed. Their medicinal value depends largely upon the aromatic seeds and roots used as a tonic for the stomach, on charcoal as an absorbent, and on the purgative effect of the Epsom or Glaubers salts. The quantity recommended to be fed daily is usually so small (one ounce or less) that very little effect can be expected unless the material is fed for a considerable length of time. While it is probably true that some of these stock foods may prove beneficial under certain conditions, it is also true that most of them are heterogeneous mixtures and evidently put together by parties quite ignorant of the principles of animal physiology, pathology and veterinary medicine.

Claims Made by Manufacturers.

The following are the principal claims made by one of the largest manufacturers of stock and poultry foods.

Horses: Gives greater speed endurance. Imparts new life and strength. Makes colts grow very rapidly and keeps brood mares and colts healthy. Guaranteed to save corn and oats. Makes horses fat, gives glossy coat and fine appearance.

Cattle: Increases the milk yield 15 to 25 per cent and increases the richness of the milk. Removes taint from milk, cream and butter, and makes milk more healthful for human use. Such milk will convey some of the beautiful elements of the vegetable ingredients we use into the systems of your children and they will be stronger to ward off disease. Makes calves grow as fast as new milk. Saves 30 days time in fattening cattle and 15 to 25 per cent of the grain usually required.

Hogs: Cures and prevents hog cholera and is the quickest hog grower ever discovered. Makes juicy and tender meat.

Poultry: It prevents disease and cures chicken cholera. It greatly increases egg production and makes chickens grow very rapidly.

The amount advised to be fed daily to horses and cattle to accomplish these marvelous results is two-thirds of an ounce!!! The material costs 14 cents a pound in 25 pound lots.

The Connecticut, Pennsylvania, Rhode Island, Virginia and Massachusetts stations have found this stock food to consist principally of wheat (bran and middlings) to which has been added fine charcoal, a bitter substance resembling gentian, cayenne and common salt. Another large manufacturer makes essentially the same claims as above, and the material sells at 6 cents a pound in 25 pound lots. The same experiment stations found it to be composed largely of corn meal with small quantities of fenugreek, gentian, charcoal and salt.

Farmers, dairymen and poultrymen!!!! What would be your opinion of any experiment station worker who would make such statements concerning the nutritive, medicinal or commercial value of corn meal, wheat bran, charcoal, gentian and salt? Do you think there is any humbug in the claims made by the manufacturers of such goods? The question is left for you to decide. You may be the judge.

Do Healthy Animals Need Medicine?

Dr. Paige, the veterinarian at this college, very pointedly expresses the most advanced views of the profession when he says, "Animals in a state of health do not need condition powders or tonic foods. There is in the body of a healthy animal a *condition of equilibrium of all body functions*. The processes of digestion and assimilation are at their best. All that is required to maintain this condition of balance, is that the animal be kept under sanitary conditions and receive a sufficient supply of healthful nutritive food and pure water. While tonics may improve the appetite so that the animal will temporarily consume and digest more food, should this increased quantity of nutrients consumed not be appropriated by the tissues of the body, harm may result from thus overloading the lymphatic system, or from an increased action of the excreting organs."

Treatment of Sick Animals.

The writer believes it unwise to give drugs to animals when it can possibly be avoided. Even such simple substances as "salts," ginger, gentian and the like, should be used as sparingly as possible. If an animal is out of condition, and it is believed a tonic will be helpful, try the following suggested by Bartlett of the Maine station:

"Pulverized gentian, one pound; pulverized ginger, one-fourth pound; pulverized saltpeter, one-fourth pound; pulverized iron sulfate, one-half pound. Mix and give one tablespoonful in the feed once a day for ten days, omit for three days, then give ten days more. Cost of the above twenty cents a pound."

In exceptional cases when skilled medical treatment appears absolutely necessary, it is far wiser to employ a reliable veterinarian than to attempt home doctoring by the indiscriminate use of patent medicines or powders recommended to cure everything.*

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*This bulletin does not decry the various veterinary medicines put up by pharmacists and veterinary surgeons for the use of stockmen. The claims made for them are, as a rule, quite reasonable and they unquestionably have their proper sphere of usefulness.

D. RESUME OF EXPERIMENTS WITH STOCK AND POULTRY FOODS.

A number of experiment stations have carried on experiments with these foods and the results are briefly cited below.

Plumb[1] fed American stock food to swine as an ingredient of the daily ration without securing any increase in live weight. The cost of producing a pound of live weight with the condimental food was 3.0 cents, and without 2.6 cents. Another experiment was conducted with Rusk's and Standard stock foods, with quite similar results.

The Kansas station[2] tried both the Acme and Globe stock foods. The Acme produced slightly more milk than the ration not containing it, but at an increased cost of 2.3 cents a pound of butter fat. The ration containing the Globe food produced slightly less milk than the same ration without it; the butter fat produced with the condimental ration cost 11.7 cents, and without, 11 cents. The station remarked that such materials, were "worthless for dairy cows accustomed to a good balanced ration."

At the Iowa station[3] four lots of six pigs each were fed a basal ration of corn meal to which different kinds of tankage, beef meal and Standard stock food were added. The lots receiving the corn and tankage or beef meal, yielded from seven to thirty-five per cent greater profit than did the corn meal ration, and the lot receiving corn and Standard stock food yielded 10 per cent greater profit than did the corn when fed alone. The increase in growth was probably due to the extra protein and ash contained in the tankage and stock food.

In another experiment at the same station with steers[4], Iowa stock food when fed in conjunction with corn and wheat straw, returned $1.40 less net profit than did a ration of corn and straw: Standard stock food $8.92 less and International stock food $8.16 less. The addition of Standard and International stock foods to the corn rations reduced the value of the corn 21 and 24 cents a bushel below that received when corn was fed alone.

Snyder[5] at the Minnesota station concluded that steers digested alfalfa hay fed with corn more thoroughly without the addition of a condimental food than when one was added.

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[1] Indiana experiment station, Bulletin 93.
[2] Kansas experiment station, Bulletin 119.
[3] Iowa experiment station, Bulletin 65.
[4] Iowa experiment station, Bulletin 60.
[5] Minnesota experiment station, Bulletin 80.

Hills[1] fed Nutriotone to seven cows in accordance with instructions of the circular. He states "the material does not appear to have increased productiveness in this particular experiment."

Bartlett[2] made a similar trial of the value Nutriotone using five Jersey cows. He states that "Nutriotone was taken in preference to any other compound, not because it is believed to be any better or worse than any other of a like nature, but for the reason that it is being extensively advertised and persistently sold by the Company's agents not only as a curative agent, but as a stimulant of the production of flesh and milk." His conclusion is as follows: "In neither of these cases did Nutriotone seem to have any effect favorable or unfavorable. The slightly smaller flow with Nutriotone does not mean anything in particular, except to add increased emphasis to the falseness of the claim that two large tablespoonfuls fed with each feed "will produce a great increase of much richer milk."

Brooks[3] fed Sheridan's condition powders to poultry in three experiments and states that he obtained no noticeable increase in egg production and that the powders did not pay for their use.

Sir John Lawes[4] instituted experiments with a condimental food using six pigs and twenty sheep to determine its effect on growth and fattening. He concludes the description of his experiments as follows:

"It is clear that nothing was gained by adding to the barley-meal and bran, one-fifth of its weight of food, costing about five times as much money. The results previously published of experiments with pigs, taken together with those now recorded in regard to sheep, seem *sufficiently conclusive against the assumption that the use of the so-called condiments increases the assimilation of food, by fattening animals in a state of health. They are equally conclusive on the subject of the profit or loss to the feeder from the use of such substances. In conclusion, I feel bound to say, that I should require much clearer evidence than any that has hitherto been adduced, to satisfy me that the balance-sheet of my farm would present a more satisfactory result at the end of the year, were I to give each horse, ox, sheep, and pig, a daily allowance of one of these costly foods.*"

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[1] Vermont experiment station, 8th report, page 150.

[2] Maine experiment station, 12th report, pages 51-55.

[3] Massachusetts experiment station reports, 1896, pp. 46-49; 1898, p. 90.

[4] Journal of the Royal Agricultural Society, Vol. 19, 1850. Rothamsted Memoirs, Vol. 11, 1883.

E. DEMONSTRATION EXPERIMENT.

Pratts Food vs. Corn Meal and Wheat Middlings.

An experiment was recently carried out at this station to compare the effect of equivalent amounts of Pratts food* and a mixture of corn meal and wheat middlings on the yield and quality of milk. The object of the trial was to prove the claims of the Pratt Food Company that their food will "produce richer milk and more of it;" in other words, to determine the economy of using this food according to directions in place of ordinary grains and by-products of similar composition.

Plan of the experiment: Four cows that had calved in the early autumn were divided as equally as possible in groups of two each. Each animal was fed essentially the same basal ration consisting of first cut hay, rowen, distillers' grains and fine middlings. In addition, two of the cows were given two measures (one-half pound) of Pratts food daily, and the other two the same amount of an equal mixture of corn meal and wheat middlings to offset the food value of the Pratts food. Midway of the first half of the test the quantity of Pratts food and of the corn and middling mixture was increased to three-quarters of a pound daily. In the second half of the test, the cows that had been receiving Pratts food in the first half, were given the corn and middlings mixture, and vice versa. Thus the four cows received in addition to the regular basal ration, Pratts food and the corn and middlings mixture for four consecutive weeks.

The general care and feeding of the animals: The sampling of the feeds and milk was carried out as in previous experiments, every precaution being used to insure accuracy of results. The test was made in the experiment station barn, which is especially set aside for such work. In order to economize space, summaries of the results only are presented. The detailed record of each animal is on file.

*This food was selected, not because it was thought to be better than other foods of a similar nature, but because it is widely and persistently advertised as possessing remarkable nutritive and curative properties.

Duration of Experiment.

Dates.	With Pratts Food.	Without Pratts Food.
Oct. 31 through Nov. 27.	Cows: Roda and Linnie.	Daisy and Doliska.
Dec. 5 through Jan. 1.	Cows: Daisy and Doliska.	Roda and Linnie.

Each half of the test was preceded by a preliminary period of one week, not included in the above dates.

Average Daily Rations Consumed by Each Cow (Pounds).

Character of Rations.	Hay.	Rowen.	Distillers' Grains.	Wheat Middlings.	Pratts Food.	Corn and Middlings Mixture.
With Pratts Food.	11	10	3	3	.63	—
Without Pratts Food.	11	10	3	3	—	.63

It will thus be seen that the average daily fodder consumption was exactly the same in both halves of the trial.

Dry and Digestible Nutrients in Daily Rations (Pounds).

Character of Rations.	Dry Matter.	Digestible Organic Nutrients.					Nutritive Ratio.
		Protein.	Fiber.	Starchy Matter.	Fat.	Total.	
With Pratts Food.	24.44	2.63	4.27	7.61	.87	15.38	1 : 5.3
Without Pratts Food.	24.44	2.64	4.27	7.64	.87	15.42	1 : 5.3

It was assumed that Pratts Food had the same digestibility as the corn and middlings mixture. The two rations contained practically the same amount of digestible nutrients.

Herd Gain in Live Weight (Pounds).

	With Pratts Food.	Without Pratts Food.
Herd Gain.	12	20

The above figures simply indicate that during both halves of the trial each herd made a very slight gain in live weight.

Herd Yield of Milk and Milk Ingredients (Pounds).

Character of Rations.	Total Milk.	Daily Yield. per cow.	Total Solid Matter.	Total Butter Fat.	Butter Equivalent.
With Pratts Food.	3048.20	27.22	411.80	139.49	162.73
Without Pratts Food.	2998.07	26.77	403.32	135.99	158.64

The four cows fed Pratts Food produced during a period of four weeks 50.13 pounds more milk than did the same cows when fed the corn and middlings mixture, being a daily increase of .45 of a pound to the cow. Such results are substantially identical, the slight variations being within the limit of a reasonable experimental error.

Average Composition of the Herd Milk (Per Cent).

	Total Solids.	Fat.
With Pratt's Food.	13.51	4.58
Without Pratt's Food.	13.45	4.54

The results are the same in each case. So far as this trial is concerned the claim is refuted that Pratts Food produces a richer milk. It is a well known fact that the richness of milk depends primarily on the breed and individuality of the animal and also upon the stage of lactation, and is not due to the influence of any particular food or medicine.

Food Cost of Milk and Butter. (Cents).

Character of Rations.	Cost 100 Pounds Milk.	Cost 1 Pound Butter.
With Pratts Food.	99.7	18.7
Without Pratts Food.	90.5	17.0
Percentage increased cost with Pratts Food.	10.2	10.0

In making the above calculations Pratts Food was reckoned at 6 cents a pound and the other feed stuffs at regular market rates. The increased cost of Pratts Food over ordinary grains *increased the cost of both milk and butter by fully 10 per cent.*

Dry and Digestible Matter Required to Produce Milk and Butter.

Character of Rations.	Dry Matter.			Digestible Matter.		
	100 Pounds Milk.	1 Pound Solids.	1 Pound Fat.	100 Pounds Milk.	1 Pound Solids.	1 Pound Fat.
With Pratts Food.	89.8	6.6	19.6	56.5	4.2	12.4
Without Pratts Food.	91.3	6.8	20.1	57.6	4.3	12.7

The results are practically identical. Pratts Food gave results similar to a like quantity of a mixture of corn meal and wheat middlings.

The experiment shows clearly:

1. That Pratts Food did not substantially increase the quantity of milk and milk ingredients over that produced by a like amount of ordinary feed stuffs.

2. That Pratts Food failed to increase the richness of the milk.

3. That the cost of milk and butter was increased fully 10 per cent when Pratts Food was fed.

4. That no effect favorable or otherwise upon the general health and condition of the animals was noted from the addition of Pratts Food to the daily ration.

Dairymen are at liberty to draw their own conclusions from the above results.

THE INSPECTION OF CONCENTRATES.

During the winter and spring of 1905, the inspector canvassed the entire State twice, and collected 481 samples of feeds. It was not considered necessary to take samples of each brand found so long as it was properly marked and presented a normal appearance. Those that were considered at all suspicious were promptly examined by both the chemist and microscopist, and the attention of retail dealers, jobbers and manufacturers called to any irregularities. The entire collection was tested during the late spring and early summer. For financial reasons it was not possible to publish in bulletin form the detailed results of the examination. The following notes are presented:

Cottonseed meal was of good color, and of satisfactory mechanical condition. There was a tendency in many instances to reduce the minimum protein guarantee to 41 per cent or lower. This would indicate that the very highest grade meal was not being offered.

Several samples of Sea Island cottonseed meal, manufactured by the Florida Cotton Oil Co., were collected. It analyzed about 25 per cent protein, 7 per cent fat and 18 per cent fiber. At $30.00 a ton for prime cottonseed meal, each percentage of protein is worth about 70 cents. Meal containing but 25 per cent protein would be valued at $17.50, or scarcely more than half the price of the prime article.* *Buyers should not overlook this fact.*

Gluten feeds varied somewhat in guarantees and noticeably in composition, although free from adulteration.

Distillers' dried grains. Some lots had an acid odor, others a smoky and charred appearance, due to the slop being improperly cared for before drying, and to the drying apparatus employed.

Brewers' by-products. Of the two samples of brewers' grains collected, one tested 16.60 per cent protein and the other 34.10 per cent. Such goods ought never to be purchased without a guarantee of composition.

* It is also probable that low grade meal would not be as fully digested as prime meal, which would still further reduce its value.

Wheat feeds. Owing to the inferior quality of the 1904 wheat, millers were unable to recover as large a proportion of the flour as usual. The resulting offal, being abnormally starchy, naturally contained less than the usual percentage of protein and fat.

Many of the wheat by-products contained an undue amount of screenings, such as oats, hulls, pieces of straw and weed seeds, and quite often corn. The latter varied in quantity from a mere trace to some 30 per cent. The inferior wheat itself was sometimes incorporated.*

Molasses feeds—Sucrene, Holstein and Hammond—consisted of some fine cut absorbent, malt sprouts and molasses, fortified with cottonseed meal or other protein concentrate. Unless well dried they decompose during warm weather. Such feeds usually met their guarantees, but are not as economical as genuine high grade protein by-products.

Corn meal. Considerable inferior corn meal was offered, due to the inferior quality of the 1904 crop. Mouldy and sour corn meal may show a satisfactory chemical analysis, and still be unsuited for feeding horses and dairy stock. Such material, usually offered at a discount, can be used with care as a food for swine Under the present feed law, no restrictions are placed upon the sale of poor corn. Purchasers can generally detect such a condition, and reputable dealers would not knowingly offer it for first class stock.

Hominy meal was bright, clean, sweet and of satisfactory composition. Considerable yellow hominy, made from yellow corn, was offered. It is equal in value to white meal.

Poultry foods. A great variety of poultry foods was collected. Practically all were free from objectionable admixtures. A description of these feeds can be found by consulting Bulletin No. 101.

* Buyers should refuse to purchase feed to which has been added an undue proportion of hulls and screenings.

HATCH EXPERIMENT STATION

—OF THE—

MASSACHUSETTS

AGRICULTURAL COLLEGE.

BULLETIN NO. 107.

I. ANALYSES OF MANURIAL SUBSTANCES FORWARDED FOR EXAMINATION.
II. MARKET VALUES OF FERTILIZING INGREDIENTS.
III. ANALYSES OF LICENSED FERTILIZERS COLLECTED IN THE GENERAL MARKETS.

DECEMBER, 1905.

The regular Bulletins of this Station will be sent free to all newspapers in the State and to such individuals interested in farming as may request the same. Technical Bulletins are sent only to those persons interested in the subject treated of in each case.

AMHERST, MASS.:
PRESS OF CARPENTER & MOREHOUSE
1905.

HATCH EXPERIMENT STATION

OF THE

Massachusetts Agricultural College,

AMHERST, MASS.

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The co-operation and assistance of farmers, fruit-growers, horticulturists, and all interested, directly or indirectly, in agriculture, are earnestly requested. The Bulletins will be sent free to all newspapers in the State and to such individuals interested in farming as may request the same. General bulletins, fertilizer analyses, analyses of feed-stuffs, and annual reports are published. Kindly indicate in application which of these are desired. Communications may be addressed to the

HATCH EXPERIMENT STATION, Amherst, Mass.

DIVISION OF CHEMISTRY.

C. A. GOESSMANN.

ANALYSES OF FERTILIZING SUBSTANCES SENT ON FOR FREE EXAMINATION.

WOOD ASHES.

1788-1791. I. Received from South Deerfield, Mass.
II. Received from Millis, Mass.
III. Received from Sunderland, Mass.
IV. Received from North Hadley, Mass.

	PER CENT.			
	I.	II.	III.	IV.
Moisture at 100° C.,	28.66	25.81	14.64	16.62
Potassium oxide,	3.79	3.69	3.96	2.96
Phosphoric acid,	1.41	1.42	.38	1.30
Calcium oxide,	32.58	25.90	25.80	25.61
Insoluble matter,	13.59	10.94	22.67	24.58

LIME ASHES.

1792-1796. I. Received from South Deerfield, Mass.
II and III. Received from Hadley, Mass.
IV and V. Received from Amherst, Mass.

	PER CENT.				
	I.	II.	III.	IV.	V.
Moisture at 100° C.,	8.65	14.59	19.35	9.93	18.26
Potassium oxide,	4.24	1.02	2.08	1.90	1.84
Phosphoric acid,	1.26	.52	1.02	.18	1.26
Calcium oxide,	37.56	45.04	37.79	48.56	56.96
Insoluble matter,	3.07	28.93	7.77	10.58	3.21

1797. I. Cob ashes "so called," Greenfield, Mass.

	PER CENT.
	I.
Moisture at 100° C.,	9.75
Potassium oxide, (total),*	42.48
Potassium oxide (soluble in water),	31.16
Phosphoric acid, (" " "),	6.68
Phosphoric acid (total),*	7.08
Calcium oxide,	2.70
Insoluble matter,	24.15
Nitrogen,	1.18

1798-1800.

I, II and III. Cotton seed meal, received from Hatfield, Mass.

	PER CENT.		
	I.	II.	III.
Moisture at 100° C.,	6.31	6.00	10.26
Nitrogen,	6.60	4.81	6.20

1801-1803. I. Genuine Peruvian guano, received from Marblehead, Mass.
II. Meat and bone, received from Acushnet, Mass.
III. Tankage, received from South Lincoln, Mass.

	PER CENT.		
	I.	II.	III.
Moisture at 100° C.,	6.67	4.99	19.91
Total phosphoric acid,	9.10	13.20	13.78
Available phosphoric acid,	7.90	8.74	8.80
Insoluble phosphoric acid,	1.20	4.46	4.98
Potassium oxide,	1.86	—	—
Nitrogen,	6.45	5.45	5.33

*The material was fused with sodium carbonate and dissolved in dilute hydrochloric acid for these tests.

1804-1806. I. Factory waste, received from East Walpole, Mass.
II. Kiln dried pulverized sheep manure, received from Whitinsville, Mass.
III. Sheep manure, received from Bourne, Mass.

	PER CENT.		
	I.	II.	III.
Moisture at 100 C.,	50.70	5.67	8.75
Ash,	32.20	27.70	14.02
Nitrogen,	.47	2.09	2.33
Potassium oxide,	.18	.95	3.42
Phosphoric acid,	.30	1.49	1.63
Calcium oxide,	6.35	8.37	1.62

FERTILIZERS.

1807-1810. I. Received from Fitchburg, Mass.
II. Received from Bradstreet, Mass.
III. Received from Mason, N. H.
IV. Received from Amherst, Mass.

	PER CENT.			
	I.	II.	III.	IV.
Moisture at 100° C.,	6.65	3.58	14.99	2.50
Total phosphoric acid,	3.78	10.14	9.46	6.62
Soluble phosphoric acid,	2.68	.25	3.58	—
Reverted phosphoric acid,	.52	6.33	4.44	5.12
Insoluble phosphoric acid,	.58	3.56	1.44	1.50
Potassium oxide,	11.24	10.42	6.92	6.48
Nitrogen.	7.85	1.32	2.93	.53

1811-1814.

I and II. Received from Granby, Mass.
III. Received from Webster, Mass.
IV. Received from Rochester, Mass.

	PER CENT.			
	I.	II.	III.	IV.
Moisture at 100° C.,	4.60	9.60	7.61	12.48
Total phosphoric acid,	8.22	10.64	7.98	8.70
Soluble phosphoric acid,	.01	2.05	5.28	3.48
Reverted phosphoric acid,	7.17	5.01	.72	3.30
Insoluble phosphoric acid,	1.04	3.58	1.98	1.92
Potassium oxide,	11.22	8.32	7.00	7.58
Nitrogen,	7.38	4.42	4.33	4.50

1815-1817. I. Received from Bedford, Mass.
II and III. Received from Dighton, Mass.

	PER CENT.		
	I.	II.	III.
Moisture at 100° C.,	4.94	7.12	12.87
Total phosphoric acid,	11.06	9.72	11.26
Soluble phosphoric acid,	2.05	1.40	1.40
Reverted phosphoric acid,	5.93	5.24	6.32
Insoluble phosphoric acid,	3.08	3.08	3.54
Potassium oxide,	8.54	5.46	6.03
Nitrogen,	4.95	3.05	2.90

SOILS.

1818-1820. I. Received from Orange, Mass.
II. Received from Westfield, Mass.
III. Received from Wilbraham, Mass.

	PER CENT.		
	I.	II.	III.
Moisture at 100° C.,	7.90	25.40	77.11
Ash,	78.35	68.60	21.35
Nitrogen,	.41	.22	.12
Potassium oxide,	.18	.28	.05
Phosphoric acid,	.19	.19	.028
Calcium oxide,	.45	.71	.20

1821-1823.
I, II and III. Received from Boston, Mass.

	PER CENT.		
	I.	II.	III.
Moisture at 100° C.,	36.12	26.40	30.47
Ash,	60.61	65.93	63.12
Nitrogen,	.12	.21	.21
Potassium oxide,	.08	.24	.18
Phosphoric acid,	.13	.25	.12
Calcium oxide,	.47	.62	.83

MUCK.

1824-1825. I. Received from Boston, Mass.
II. Received from Sharon, Mass.

	PER CENT.	
	I.	II.
Moisture at 100° C.,	82.06	8.56
Ash,	.74	7.35
Nitrogen,	.28	1.20
Potassium oxide,	.02	.07
Phosphoric acid,	.02	.09
Calcium oxide,	.08	.71

II. ANALYSES OF COMMERCIAL FERTILIZERS COLLECTED DURING 1905 IN THE GENERAL MARKETS BY THE AGENT OF THE HATCH EXPERIMENT STATION OF THE MASSACHUSETTS AGRICULTURAL COLLEGE.

Laboratory No.	Name of Brand.	Name of Manufacturer.	Sampled at
	Compound Fertilizers.		
366	Tobacco Starter and Grower	American Agricultural Chemical Co., Boston, Mass	W. Springfield
530	" " " "	" " " " " "	Greenfield.
48	Bradley's Potato Fertilizer	Am. Agric. Chem. Co., Bradley Fertilizer Co. Branch	Weir.
322	" " "	" " " " " " " "	Amesbury.
78	Bradley's Potato Manure	" " " " " " " "	Fall River.
218	" " "	" " " " " " " "	Lowell.
276	" " "	" " " " " " " "	Haverhill.
158	Bradley's Complete Manure, 10% Potash	" " " " " " " "	Boston.
339	" " " " "	" " " " " " " "	Newburyport.
182	Bradley's Complete Top Dressing for Grass and Grain	" " " " " " " "	Boston.
319	" " " " " " " "	" " " " " " " "	Amesbury.
354	" " " " " " " "	" " " " " " " "	Spencer.
205	Bradley's English Lawn Fertilizer	" " " " " " " "	Lowell.
269	" " " "	" " " " " " " "	Weymouth.
212	Bradley's Corn Phosphate	" " " " " " " "	Lowell.
227	" " "	" " " " " " " "	S. Framingh'm
315	Bradley's Complete Manure for Corn and Grain	" " " " " " " "	Fitchburg.
49	Columbia Fish and Potash	" " " " " " " "	Weir.
87	" " " "	" " " " " " " "	Fall River.
63	Church's Fish and Potash "D."	" " " " " " " "	Fall River.
94	" " " " "	" " " " " " " "	S. Amherst.
352	" " " " "	" " " " " " " "	Springfield.

Laboratory Number.	Name of Brand.	Moisture.	Nitrogen in 100 lbs.		Phosphoric Acid in 100 lbs.							Potassium Oxide in 100 lbs.	
			Found.	Guaranteed.	Soluble.	Reverted.	Insoluble.	Total. Found.	Total. Guaranteed.	Available. Found.	Available. Guaranteed.	Found.	Guaranteed.
	Compound Fertilizers.												
366-530	Tobacco Starter and Grower............	8.47	3.30	3.30-4.13	6.72	2.90	1.80	11.42	10-13	9.62	8-10	4.50	4-5
48-322	Bradley's Potato Fertilizer..............	12.85	2.36	2.06-2.88	4.10	4.10	2.22	10 42	10-13	8.20	8-10	3.14	3-4
78-218-276	Bradley's Potato Manure	11.20	2.70	2.50-3.25	3.70	3.32	2.44	9.46	8-11	7.02	6-8	5.30	5 6
158-339	Bradley's Complete Manure, 10% Potash..	9.77	3.30	3.30-4.12	2.83	4.15	2.02	9.00	7-10	6.98	6-10	10.04	10-12
182-319-354	Bradley's Com. Top Dress., Grass & Grain	6.31	4.95	4.95-5.76	.30	5.80	1.16	7.26	6-8	6.10	5-7	3.42	2.50-3.50†
205-269	Bradley's English Lawn Fertilizer........	6.49	5.41	4.65-5.75	.59	5.31	1.16	7.06	6	5.90	5	3.28	2.50-3.50†
212-227	Bradley's Corn Phosphate	12.76	2.10	2.06-2.88	4.47	4.33	2.72	11.52	10-13	8.80	8-10	1.78	1.50-2.50
315	Bradley's Comp. Manure for Corn & Grain	10.96	3.02	3.30-4.12	5.97	6.95	2.30	15.22	13-16	12.92	12-14	3.06	3-4
49-87	Columbia Fish and Potash...............	11.26	2.10	1.65-2.47	4.35	3.59	1.28	9.22	6-9	7.94	5-7	2.08	2-3
63-94-352	Church's Fish and Potash "D.".........	11.86	2.32	2.07-2.90	4.05	3.43	2.12	9.60	7.50-10.50	7.48	6-8	2.74	2-3

† 182-319-354—Enough chlorine present to unite with 2.52% potassium oxide.
205-269— " " " " " " 1.07% "

II. ANALYSES OF COMMERCIAL FERTILIZERS COLLECTED DURING 1905 IN THE GENERAL MARKETS BY THE AGENT OF THE HATCH EXPERIMENT STATION OF THE MASSACHUSETTS AGRICULTURAL COLLEGE.

Laboratory No.	Name of Brand.	Name of Manufacturer.	Sampled at
	Compound Fertilizers.		
343	Baker's Complete Potato Manure	Amer. Ag. Chem. Co., H. J. Baker & Bro. Branch	Worcester.
376	Clark's Cove Potato Fertilizer	" " " " Clark's Cove Fert. Co. Branch	Spencer.
403	Clark's Cove Bay State Fertilizer "G. G."	" " " " " " " " "	Hudson.
449	Clark's Cove Great Planet Manure	" " " " " " " " "	E. Longm'd'w.
382	Crocker's Ammoniated Corn Phosphate	" " " " Crocker's Fert. & Chem. Co. Br'h	Worcester.
254	Cumberland Potato Fertilizer	" " " " Cumberland Bone Phos. Co. Br'h	Marlborough.
256	Cumberland Superphosphate	" " " " " " " " "	Marlborough.
113	Darling's Potato and Root Crop Manure	" " " " L. B. Darling Fert. Co. Branch	N. Amherst.
201	Darling's Complete Manure	" " " " " " " " "	S. Amherst.
337	Darling's Blood, Bone and Potash	" " " " " " " " "	Harvard.
112	Great Eastern Vegetable, Vine and Tobacco	" " " " Great Eastern Fert. Co. Branch	Sunderland.
345	" " " " " "	" " " " " " " " "	Springfield.
410	" " " " " "	" " " " " " " " "	Oxford.
363	Great Eastern Northern Corn Special "A."	" " " " " " " " "	Westfield.
394	" " " " " "	" " " " " " " " "	Oxford.
378	Great Eastern General Fertilizer	" " " " " " " " "	Springfield.
528	" " " "	" " " " " " " " "	S. Williams'tn
321	Pacific Potato Special	" " " " Pacific Guano Co. Branch	Newburyport.
340	Pacific Nobsque Guano for all Crops	" " " " " " " "	Newburyport.
488	Packers' Union Potato Manure	" " " " Packers' Union Fert. Co. Branch	S. Williamst'n
540	Packers' Union Animal Corn Fertilizer	" " " " " " " " "	Greenfield.

Laboratory Number.	Name of Brand.	Moisture.	Nitrogen in 100 lbs.		Phosphoric Acid in 100 lbs.							Potassium Oxide in 100 lbs.	
								Total.		Available.			
			Found.	Guaranteed.	Soluble.	Reverted.	Insoluble.	Found.	Guaranteed.	Found.	Guaranteed.	Found.	Guaranteed.
	Compound Fertilizers.												
343	Baker's Complete Potato Manure	8.96	3.18	3.30-4.13	3.35	4.07	2.30	9.72	7-10	7.42	6-10	9.14	10-12
376	Clark's Cove Potato Fertilizer	12.22	2.76	2.06-2.88	4.95	3.63	2.48	11.06	10-13	8.58	8-10	3.18	3-4
403	Clark's Cove Bay State Fertilizer " G. G."	12.83	2.33	2.06-2.88	5.62	2.58	2.68	10.88	10-13	8.20	8-10	1.74	1.50-2.50
449	Clark's Cove Great Planet Manure	12.13	3.28	3.30-4.12	4.33	4.95	2.44	11.72	9-13	9.28	8-11	6.92	7-8
382	Crocker's Ammoniated Corn Phosphate	13.63	2.10	2.06-2.88	4.93	3.31	2.94	11.18	10-13	8.24	8-10	2.16	1.50-2.50
254	Cumberland Potato Fertilizer	11.55	2.37	2.06-2.88	3.42	4.90	2.46	10.78	10-13	8.32	9-12	3.22	3-4
256	Cumberland Superphosphate	12.60	2.23	2.06-2.88	3.68	5.16	3.32	12.16	10-13	8.84	8-10	2.00	1.5-2.5
113	Darling's Potato and Root Crop Manure	11.12	3.02	3.30-4.12	5.18	4.08	1.16	10.42	9-13	9.26	8-11	7.04	7-8
201	Darling's Complete Manure	11.02	3.30	3.30-4.10	3.48	2.60	2.10	8.18	7-10	6.08	6-10	10.02	10-12
337	Darling's Blood, Bone and Potash	12.67	4.22	4.10-5.00	4.03	3.89	1.60	9.52	8-12	7.92	7-10	6.34	7-8
112-345-410	Gt. Eastern Vegetable, Vine and Tobacco	11.98	2.79	2.6-2.88	4.70	3.78	2.18	10.66	9-14	8.48	8-12	6.82	6-8
363-394	Gt. Eastern Northern Corn Special "A"	13.18	2.91	2.50-3.25	4.33	3.75	3.04	11.12	11-14	8.08	9-11	3.40	2-3
378-528	Gt. Eastern General Fertilizer	14.21	1.09	.82-1.65	5.28	2.78	1.86	9.92	10-14	8.06	8-11	3.92	4-5
321	Pacific Potato Special	14.06	2.44	2.06-2.88	4.95	4.39	1.48	10.82	10-13	9.34	8-10	3.50	3-4
340	Pacific Nobsque Guano for all Crops	12.38	1.42	1.03-2.50	5.50	3.42	1.44	10.36	10-15	8.92	8-12	2.17	2-3
488	Packers' Union Potato Manure	13.90	2.14	2.06-2.88	2.73	5.59	3.96	12.28	10-13	8.32	8-10	6.82	6-7
540	Packers' Union Animal Corn Fertilizer	13.71	2.93	2.50-3.12	6.07	3.91	2.14	12.12	11-14	9.98	9-11	2.40	2-3

II. ANALYSES OF COMMERCIAL FERTILIZERS COLLECTED DURING 1905 IN THE GENERAL MARKETS BY THE AGENT OF THE HATCH EXPERIMENT STATION OF THE MASSACHUSETTS AGRICULTURAL COLLEGE.

Laboratory No.	Name of Brand.	Name of Manufacturer.	Sampled at
	Compound Fertilizers.		
543	Packers' Union Gardeners' Complete Manure	Amer. Ag. Chem. Co., Packers' Union Fert. Co. Branch	Greenfield.
54	Quinnipiac Market Garden Manure	" " " " Quinnipiac Co. Branch	Seekonk.
79	Quinnipiac Phosphate	" " " " " " "	Seekonk.
520	" "	" " " " " " "	Pittsfield.
108	Quinnipiac Corn Manure	" " " " " " "	So. Amherst.
398	" " "	" " " " " " "	Oxford.
428	Quinnipiac Onion Manure	" " " " " " "	Hatfield.
538	Quinnipiac Climax Phosphate	" " " " " " "	Pittsfield.
407	Quinnipiac Seeding Down Manure	" " " " " " "	Oxford.
401	Read's Vegetable and Vine Fertilizer	" " " " Read Fert. Co. Branch	Worcester.
402	Read's Farmers' Friend Superphosphate	" " " " " " " "	Worcester.
455	Read's High Grade Farmers' Friend Superphosphate	" " " " " " " "	S. Longmead'w
371	Wheeler's Havana Tobacco Grower	" " " " M. E. Wheeler Co. Branch	Springfield.
458	" " " "	" " " " " " " "	Agawam.
486	Wheeler's Corn Fertilizer	" " " " " " " "	N. Pittsfield.
502	" " "	" " " " " " " "	Williamstown.
544	" " "	" " " " " " " "	Greenfield.
418	Abbott's Tobacco Fertilizer	W. H. Abbott, Holyoke, Mass.	Smith's Ferry.
479	" " "	" " " "	Holyoke.
509	" " "	" " " "	Whately.

Laboratory Number.	Name of Brand.	Moisture.	Nitrogen in 100 lbs.		Phosphoric Acid in 100 lbs.							Potassium Oxide in 100 lbs.	
			Found.	Guaranteed.	Soluble.	Reverted.	Insoluble.	Total. Found.	Total. Guaranteed.	Available. Found.	Available. Guaranteed.	Found.	Guaranteed.
	Compound Fertilizers.												
543	Packers' Union Gardeners' Comp. Manure	12.16	2.99	2.40-3.00	3.30	3.36	1.50	8.16	7-10	6.66	6-8	9.56	10-12
54	Quinnipiac Market Garden Manure	10.61	3.34	3.30-4.12	5.05	3.95	1.38	10.38	9-13	9.00	8-11	7.00	7-8
79-520	Quinnipiac Phosphate	13.73	2.60	2.50-3.25	5.05	4.23	2.60	11.88	11-14	9.28	9-11	2.04	2-3
108-398	Quinnipiac Corn Manure	13.68	2.25	2.06-2.88	5.42	3.14	3.46	12.02	10-13	8.56	8-10	1.82	1.50-2.50
428	Quinnipiac Onion Manure................	11.93	3.37	3.30-4.12	3.70	4.44	3.24	11.38	9-13	8.14	8-11	6.78	7-8
538	Qninnipiac Climax Phosphate...........	11.05	1.24	1.03-2.50	4.50	3.72	1.46	9.68	10-15	8.22	8-12	1.90	2-3
407	Quinnipiac Seeding Down Manure.......	12.57	1.69	1.03-2.50	5.65	3.47	1.30	10.42	10-15	9.12	8-12	2.18	2-3
401	Read's Vegetable and Vine Fertilizer	3.41	2.45	2.06-2.88	4.73	3.29	3.50	11.52	10-13	8.02	8-10	6.04	6-7
402	Read's Farmers' Friend Superphosphate..	12.13	2.66	2.06-2.88	3.88	4.52	1.40	9.80	10-13	8.40	8-10	3.04	3-4
455	Read's High Gr. Farmers' Fr. Superphos.	11.95	3.23	3.30-4.11	4.23	2.67	1.16	8.06	7-9	6.90	6-8	9.60	10-11
371-458	Wheeler's Havana Tobacco Grower......	9.41	2.92	2.40-3.00	2.85	5.11	1.82	9.78	7-10	7.96	6-8	9.56	10-12†
486-502-544	Wheeler's Corn Fertilizer...............	13.27	2.21	1.65-2.47	2.85	5.09	2.94	10.88	10-14	7.94	8-11	2.60	2-3
418-479-509	Abbott's Tobacco Fertilizer.............	10.05	3.28	4.5-5.5	.65	7.49	3.20	11.34	12-14	8.14	8-10	11.10	10-11*

† 371-458—Enough chlorine present to unite with 3.14% potassium oxide.

* Sulphate of potash, the source of potash.

II. ANALYSES OF COMMERCIAL FERTILIZERS COLLECTED DURING 1905 IN THE GENERAL MARKETS BY THE AGENT OF THE HATCH EXPERIMENT STATION OF THE MASSACHUSETTS AGRICULTURAL COLLEGE.

Laboratory No.	Name of Brand.	Name of Manufacturer.	Sampled at
	Compound Fertilizers.		
115	Armour's All Soluble	Armour Fertilizer Works, Baltimore, Md.	Amherst.
155	" " "	" " " " "	Plymouth.
526	" " "	" " " " "	S. Williamst'n
143	Armour's Grain Grower	" " " " "	Plymouth.
262	" " "	" " " " "	Haverhill.
163	Ammoniated Bone with Potash	" " " " "	Plymouth.
237	" " " "	" " " " "	Marlborough.
523	" " " "	" " " " "	North Adams.
559	American Farmers' Brand Corn and Potato Fertilizer	" " " " "	Amherst.
560	American Farmers' Brand Market Garden Special	" " " " "	Amherst.
561	American Farmers' Brand Corn King Fertilizer	" " " " "	Amherst.
217	Beach's Advance Brand Fertilizer	Beach Soap Co., Lawrence, Mass.	Lawrence.
109	Complete Tobacco Fertilizer	Berkshire Fertilizer Co., Bridgeport, Conn.	N. Amherst.
136	" " "	" " " " "	Somerset.
397	" " "	" " " " "	Oxford.
259	Stockbridge's Complete for Corn, Grain and Fodder Corn	Bowker Fertilizer Co., Boston, Mass.	Andover.
364	" " " " " " "	" " " " "	Springfield.
67	Bowker's Soluble Animal Fertilizer	" " " " "	Fall River.
145	Pure Unleached Hardwood Ashes	" " " " "	Boston.
230	" " " "	" " " " "	Brockton.
176	Bowker's Potash Bone	" " " " "	Plymouth.
226	" " "	" " " " "	Haverhill.

Laboratory Number.	Name of Brand.	Moisture.	Nitrogen in 100 lbs.		Phosphoric Acid in 100 lbs.							Potassium Oxide in 100 lbs.	
								Total.		Available.			
			Found.	Guaranteed.	Soluble.	Reverted.	Insoluble.	Found.	Guaranteed.	Found.	Guaranteed.	Found.	Guaranteed.
	Compound Fertilizers.												
115-155-526	Armour's All Soluble	12.07	3.26	2.47-3.29	5.80	2.64	1.56	10.00	—	8.44	8-10	4.16	4-5
143-262	Armour's Grain Grower	9.26	1.97	1.65-2.47	6.10	2.98	1.58	10.66	—	9.08	8-10	2.24	2-3
163-237-523	Ammoniated Bone with Potash	10.51	2.70	2.47-3.29	2.75	5.65	1.30	9.70	—	8.40	6-8	2.50	2-3
559	Amer. Farm. Brand Corn and Potato Fert.	8.07	1.95	1.65-2.47	7.03	.93	1.04	9.00	8-9	7.96	7-9	6.24	6-7†
560	Amer. Farm. Brand Mark. Garden Special	9.14	3.68	3.30-4.12	8.12	1.76	1.02	10.90	9-10	9.88	8-10	7.20	7-8†
561	Amer. Farm. Brand Corn King Fertilizer	8.92	2.62	2.47-3.30	7.65	1.99	.98	10.62	9-10	9.64	8-10	4.24	4-5
217	Beach's Advance Brand Fertilizer	7.23	2.76	2.47-3.29	1.40	9.84	1.46	12.70	10-13	11.24	8-10	7.28	6-7†
109-136-397	Complete Tobacco Fertilizer	8.86	2.99	2.47-3.29	4.58	3.43	2.60	10.61	10-12	8.01	8-10	6.50	6-8†
259-364	Stockbridge's Comp. for Corn, Grain, etc.	13.72	2.45	2.47-3.29	4.80	3.58	2.68	11.06	10-12	8.38	8-11	4.36	4-6
67	Bowker's Soluble Animal Fertilizer	15.77	2.35	2-3	4.68	3.24	1.80	9.72	10-12	7.92	9-11	4.06	4-5
145-230	Pure Unleached Hardwood Ashes	14.72	—	—	—	—	—	1.36	1-3	—	—	4.30	4-7
176-226	Bowker's Potash Bone	11.50	1.02	.82-1.65	1.92	4.44	2.50	8.86	7-9	6.36	6-8	2.00	2-3

† 109-136-397—Enough chlorine present to unite with 2.99% potassium oxide.
217 — " " " " " 4.85% " "
559 — " " " " " 1.89% " "
560 — " " " " " 2.10% " "

II. ANALYSES OF COMMERCIAL FERTILIZERS COLLECTED DURING 1905 IN THE GENERAL MARKETS BY THE AGENT OF THE HATCH EXPERIMENT STATION OF THE MASSACHUSETTS AGRICULTURAL COLLEGE.

Laboratory No.	Name of Brand.	Name of Manufacturer.	Sampled at
	Compound Fertilizers.		
208	Bowker's High Grade Fertilizer	Bowker Fertilizer Co., Boston, Mass.	Lowell.
246	Bowker's Sure Crop Bone Phosphate	" " " " "	Haverhill.
351	Bowker's Tobacco Starter	" " " " "	Springfield.
368	Bowker's Ten Per Cent. Manure	" " " " "	Hudson.
429	Bowker's Fine Ground Fish	" " " " "	Northampton.
431	" " " "	" " " " "	Northampton.
529	" " " "	" " " " "	Deerfield.
517	Bowker's Complete Mixture	" " " " "	Williamstown.
573	Bowker's Gloucester Fish and Potash	" " " " "	Amherst.
567	Bowker's Fish and Potash, "D" Brand	" " " " "	Amherst.
569	Bowker's Corn Phosphate	" " " " "	Amherst.
570	Bowker's Tobacco Ash Fertilizer	" " " " "	Amherst.
568	Bowker's Ammoniated Food for Flowers	" " " " "	Amherst.
75	Bowker's Clover Brand Bone and Wood Ash Fertilizer	" " " " "	Fall River.
270	" " " " " " " "	" " " " "	Lexington.
318	Bowker's Ammoniated Dissolved Bone	" " " " "	Newburyport.
426	Bowker's Special Fertilizer for Seeding Down	" " " " "	Northampton.
434	Bowker's Square Brand Bone and Potash	" " " " "	Northampton.
549	Bowker's Potash and Staple Phosphate	" " " " "	Gt. Barrington
128	Lawn and Garden Dressing	Chicopee Rendering Co., Springfield, Mass.	Boston.
154	Farquhar's Vegetable and Potato Fertilizer	" " " " "	Boston.

Laboratory Number.	Name of Brand.	Moisture.	Nitrogen in 100 lbs.		Phosphoric Acid in 100 lbs.							Potassium Oxide in 100 lbs.	
			Found.	Guaranteed.	Soluble.	Reverted.	Insoluble.	Total. Found.	Total. Guaranteed.	Available. Found.	Available. Guaranteed.	Found.	Guaranteed.
	Compound Fertilizers.												
208	Bowker's High Grade Fertilizer..........	14.07	2.47	2.47-3.29	5.60	3.64	1.54	10.78	10-13	9.24	6-9	4.38	4-5
246	Bowker's Sure Crop Bone Phosphate.....	12.91	1.07	.82-1.65	2.75	5.43	1.98	10.16	10-12	8.18	9-11	1.94	2-3
351	Bowker's Tobacco Starter	13.30	2.48	2.47	8.47	2.63	1.02	12.12	10	11.10	5	3.90	3.*
368	Bowker's Ten Per Cent. Manure.........	8.93	1.28	.75-1.50	2.73	3.95	1.28	7.96	7-8	6.68	5-7	8.56	10-12
429-431-529	Bowker's Fine Ground Fish..............	9.42	8.95	8-10	—	7.20	2.82	10.02	6-8	7.20	—	—	—
517	Bowker's Complete Mixture..............	13.16	2.26	2-3	5.92	3.46	2.18	11.56	9-13	9.38	8-10	4.22	4-5
573	Bowker's Gloucester Fish and Potash	9.84	1.17	.82	7.35	2.13	.76	10.24	9	9.48	4	1.38	1.
567	Bowker's Fish and Potash, "D" Brand...	10.37	2.62	2.47	8.00	1.80	.64	10.44	8	9.80	2	2.18	2.
569	Bowker's Corn Phosphate................	10.21	1.66	1.65	7.12	1.72	1.02	9.86	9	8.84	6	2.28	2.
570	Bowker's Tobacco Ash Fertilizer.........	3.58	3.69	3.29	—	5.50	5.50	11.00	6	5.50	2	12.66	13.*
568	Bowker's Ammoniated Food for Flowers..	7.49	2.68	2	.32	7.22	4.34	11.88	6	7.54	3	3.50	2.*
75-270	Bowker's Clov. Br. Bone & Wood Ash Fert.	11.90	1.81	1.75-2.25	—	7.04	3.84	10.88	9-11	7.04	7-9	3.16	2.25-3.25
318	Bowker's Ammoniated Dissolved Bone...	10.94	1.81	1.12-2.12	3.53	4.67	2.68	10.88	10-12	8.20	7-9	2.00	2-3
426	Bowker's Special Fert. for Seeding Down.	5.65	2.12	1.75-2.75	1.28	4.54	1.80	7.62	6-8	5.82	4-6	5.32	6-7
434	Bowker's Square Brand Bone and Potash.	11.29	1.93	1.65-2.47	3.20	6.92	3.96	14.08	7-9	10.12	6-8	2.10	2-3
549	Bowker's Potash and Staple Phosphate...	9.13	1.11	.82	4.00	4.20	2.04	10.24	9	8.20	8	2.94	3.
128	Lawn and Garden Dressing...............	8.16	4.40	3.30-4.12	.15	10.59	2.48	13.22	14-17	10.74	4-5	7.06	7-8
154	Farquhar's Vegetable and Potato Fert....	8.88	4.42	3-4	2.55	6.41	2.94	11.90	7-8	8.96	—	6.46	7-8

* Sulphate of potash, the source of potash.

II. ANALYSES OF COMMERCIAL FERTILIZERS COLLECTED DURING 1905 IN THE GENERAL MARKETS BY THE AGENT OF THE HATCH EXPERIMENT STATION OF THE MASSACHUSETTS AGRICULTURAL COLLEGE.

Laboratory No.	Name of Brand.	Name of Manufacturer.	Sampled at
	Compound Fertilizers.		
157	E. Frank Coe's Excelsior Potato Fertilizer	E. Frank Coe Co., New York City	Dighton.
290	E. Frank Coe's Special Grass and Grain Fertilizer	" " " " " "	Gardner.
293	Standard Grade Ammoniated Bone Superphosphate	" " " " " "	Gardner.
294	E. Frank Coe's Columbian Corn Fertilizer	" " " " " "	Gardner.
443	" " " " "	" " " " " "	Westfield.
491	" " " " "	" " " " " "	Ashley Falls.
295	E. Frank Coe's Columbian Potato Fertilizer	" " " " " "	Gardner.
448	" " " " "	" " " " " "	Westfield.
504	" " " " "	" " " " " "	Ashley Falls.
475	E. Frank Coe's Celebrated Special Potato Fertilizer	" " " " " "	Westfield.
177	E. Frank Coe's High Grade Ammoniated Bone	" " " " " "	Dighton.
456	" " " " " "	" " " " " "	Westfield.
292	XXV Ammoniated Bone Phosphate	" " " " " "	Gardner.
447	E. Frank Coe's Alkaline Bone Phosphate	" " " " " "	E. Longm'dow
342	Eureka Liquid Fertilizer	Eureka Liquid Fertilizer Co., Boston, Mass.	Amherst.
452	Tankage, Bone and Potash	Hardy Packing Co., Chicago, Ill.	Southwick.
503	" " " "	" " " " "	Greenfield.
466	Hardy's Complete Manure	" " " " "	Southwick.
124	Canada Ashes	Thomas Joynt, St. Helena, Ontario, Canada	Sunderland.
191	Canada Unleached Hard Wood Ashes	John Joynt, Lucknow, Ontario, Canada	Boston.
277	" " " " "	" " " "	Amherst.
375	" " " " "	" " " "	Southwick.

Laboratory Number.	Name of Brand.	Moisture.	Nitrogen in 100 lbs.		Phosphoric Acid in 100 lbs.							Potassium Oxide in 100 lbs.	
								Total.		Available.			
			Found.	Guaranteed.	Soluble.	Reverted.	Insoluble.	Found.	Guaranteed.	Found.	Guaranteed.	Found.	Guaranteed.
	Compound Fertilizers.												
157	E. Frank Coe's Excelsior Potato Fertilizer	10.46	2.75	2.47-3.00	4.95	3.49	1.92	10.36	9-12	8.44	7-9	10.18	8-9†
290	E. Frank Coe's Spec. Grass & Grain Fert.	14.08	1.33	.82-1.65	7.03	2.45	2.04	11.52	10-12	9.48	8.50-10	1.74	1-2†
293	Standard Grade Ammo. Bone Superphos.	15.41	1.93	1.65-2.06	6.40	2.12	1.34	9.86	9-11	8.52	8-11	3.08	2.25-3.*
294-443-491	E. Frank Coe's Columbian Corn Fertilizer	12.95	2.02	1.20-1.50	6.43	2.81	2.18	11.42	10-11	9.24	8.50-10	3.12	2.50-3.*
295-448-504	E. Frank Coe's Columbian Potato Fert.	16.06	1.86	1.20-1.50	6.08	2.36	1.80	10.24	10-11	8.44	8.50-10.5	2.96	2.50-3.‡
475	E. Frank Coe's Cele. Special Potato Fert.	15.12	2.14	1.60-2.00	5.75	2.95	1.02	9.72	10-11	8.70	8-11	4.50	4-5*
177-456	E. Frank Coe's High Grade Ammo. Bone.	11.81	2.21	1.85-2.47	7.20	2.32	2.38	11.90	11-13	9.52	9-11	2.44	2.25-3.25‡
292	XXV Ammoniated Bone Phosphate	13.62	1.23	.82-1.65	6.55	3.05	2.04	11.64	10-11	9.60	8.50-10.5	1.88	1.50-2.50‡
447	E. Frank Coe's Alkaline Bone Phosphate.	15.28	1.99	1.20-1.50	6.55	2.71	.64	9.90	10-11	9.26	8.50-10	3.12	2.50-3.00‡
342	Eureka Liquid Fertilizer	83.85	2.60	1.37	2.63	—	—	2.63	7.81	—	—	1.29	6.26
452-503	Tankage, Bone and Potash	8.68	1.24	1.24-2.06	1.85	7.57	1.96	11.38	10-12	9.42	8-11	2.12	2-3
466	Hardy's Complete Manure	9.26	3.42	3.29-4.11	6.15	2.63	1.46	10.24	12	8.78	11	7.74	8.†
124	Canada Ashes	14.55	—	—	—	—	—	1.40	—	—	—	5.76	5-6
191-277-375	Canada Unleached Hard Wood Ashes	18.10	—	—	—	—	—	1.54	1.5-3.00	—	—	5.78	5-8

† 157. Enough chlorine present to unite with 6.14% potassium oxide.
290. " " " " " " 1.14% " "
466. " " " " " " 4.67% " "

‡ Sulphate of potash, the source of potash.

II. ANALYSES OF COMMERCIAL FERTILIZERS COLLECTED DURING 1905 IN THE GENERAL MARKETS BY THE AGENT OF THE HATCH EXPERIMENT STATION OF THE MASSACHUSETTS AGRICULTURAL COLLEGE.

Laboratory No.	Name of Brand.	Name of Manufacturer.	Sampled at
	Compound Fertilizers.		
126	Lister's Special Potato Fertilizer	Lister's Agricultural Chemical Works, Newark, N. J.	New Bedford.
404	" " " "	" " " " " "	Oxford.
300	Lister's Potato Manure	" " " " " "	Fitchburg.
457	" " "	" " " " " "	Agawam.
405	Lister's Special Corn Fertilizer	" " " " " "	Oxford.
459	" " " "	" " " " " "	Agawam.
467	" " " "	" " " " " "	Agawam.
406	Lister's Animal Bone and Potash	" " " " " "	Oxford.
545	" " " " "	" " " " " "	Hinsdale.
554	Lister's Oneida Special	" " " " " "	Amherst.
70	Swift's Lowell Market Garden Manure	Swift's Lowell Fertilizer Co., Boston, Mass	Seekonk.
336	" " " " "	" " " " " "	Ayer.
84	Swift's Lowell Animal Brand	" " " " " "	Fall River.
142	" " " "	" " " " " "	New Bedford.
432	" " " "	" " " " " "	Hatfield.
131	Swift's Lowell Empress Brand	" " " " " "	New Bedford.
470	" " " "	" " " " " "	Southwick.
189	Swift's Lowell Lawn Dressing	" " " " " "	Boston.
236	" " " "	" " " " " "	Boston.
266	Swift's Lowell Bone Fertilizer for Corn and Grain	" " " " " "	Lexington.
333	" " " " " " " "	" " " " " "	Ayer.
485	" " " " " " " "	" " " " " "	Ashley Falls.

Laboratory Number.	Name of Brand.	Moisture.	Nitrogen in 100 lbs.		Phosphoric Acid in 100 lbs.							Potassium Oxide in 100 lbs.	
								Total.		Available.			
			Found.	Guaranteed.	Soluble.	Reverted.	Insoluble.	Found.	Guaranteed.	Found.	Guaranteed.	Found.	Guaranteed.
	Compound Fertilizers.												
126-404	Lister's Special Potato Fertilizer	14.22	1.81	1.65-2.47	5.80	3.26	1.94	11.00	9-11	9.06	8-11	3.20	3-4
300-457	Lister's Potato Manure	11.14	3.30	3.30-4.12	4.68	3.78	2.10	10.56	9-13	8.46	8-11	7.10	7-9
405-459-467	Lister's Special Corn Fertilizer	13.52	1.74	1.65-2.47	7.08	1.86	2.32	11.26	9-11	8.94	8-11	3.36	3-4
406-545	Lister's Animal Bone and Potash	10.61	.24	—	7.18	4.12	1.80	13.10	11	11.30	10	1.88	2.
554	Lister's Oneida Special	11.31	.88	.82	2.95	3.25	2.14	8.34	—	6.20	7.00	1.00	1.00
70-336	Swift's Lowell Market Garden Manure	6.67	4.30	4.10-4.90	5.75	1.35	1.80	8.90	8.11	7.10	7-9	6.32	6-7
84-142-432	Swift's Lowell Animal Brand	10.36	2.66	2.46-3.20	6.78	1.68	2.04	10.50	10-13	8.46	9-11	4.50	4-5
131-470	Swift's Lowell Empress Brand	10.03	1.38	1.23-2.05	5.75	1.67	1.54	8.96	8-11	7.42	7-9	2.34	2-3
189-236	Swift's Lowell Lawn Dressing	5.26	4.33	4.10-4.92	5.62	1.57	.64	7.83	8-11	7.19	7-9	5.16	5-6
266-333-485	Swift's Lowell Bone Fert. for Corn & Grain	11.65	1.75	1.64-2.46	6.45	1.93	1.40	9.78	9-12	8.38	8.10	3.18	3-4

II. ANALYSES OF COMMERCIAL FERTILIZERS COLLECTED DURING 1905 IN THE GENERAL MARKETS BY THE AGENT OF THE HATCH EXPERIMENT STATION OF THE MASSACHUSETTS AGRICULTURAL COLLEGE.

Laboratory No.	Name of Brand.	Name of Manufacturer.	Sampled at
	Compound Fertilizers.		
305	Swift's Lowell Dissolved Bone and Potash	Swift's Lowell Fertilizer Co., Boston, Mass.	Amesbury.
348	Swift's Lowell Perfect Tobacco Grower	" " " " " "	Springfield.
323	Swift's Lowell Special Vegetable Manure	" " " " " "	Amesbury.
325	Swift's Lowell Fruit and Vine for Strawberries	" " " " " "	Ayer.
31	Mapes' Complete Manure for General Use	Mapes Formula & Peruvian Guano Co., New York City	Taunton.
38	Mapes' Complete Manure for Light Soils	" " " " " " " " "	Taunton.
50	Mapes' Cereal Brand	" " " " " " " " "	Taunton.
312	" " "	" " " " " " " " "	Fitchburg.
510	" " "	" " " " " " " " "	Pittsfield.
304	Mapes' Complete Manure, "A" Brand	" " " " " " " " "	Leominster.
310	" " " " "	" " " " " " " " "	Fitchburg.
308	Mapes' Top Dresser, Improved	" " " " " " " " "	Fitchburg.
334	Mapes' Top Dresser, Improved, (half strength)	" " " " " " " " "	Fitchburg.
385	Mapes' Average Soil Complete Manure	" " " " " " " " "	Worcester.
440	Mapes' Tobacco Ash Constituents	" " " " " " " " "	Westfield.
453	Mapes' Tobacco Starter, Improved	" " " " " " " " "	Southwick.
469	" " " "	" " " " " " " " "	Agawam.
525	" " " "	" " " " " " " " "	So. Deerfield.
514	Mapes' Tobacco Manure (Wrapper Brand)	" " " " " " " " "	So. Deerfield.
311	Mapes' Fruit and Vine Manure	" " " " " " " " "	Fitchburg.
395	" " " " "	" " " " " " " " "	Worcester.

Laboratory Number.	Name of Brand.	Moisture.	Nitrogen in 100 lbs. Found.	Nitrogen in 100 lbs. Guaranteed.	Phosphoric Acid in 100 lbs. Soluble.	Reverted.	Insoluble.	Total. Found.	Total. Guaranteed.	Available. Found.	Available. Guaranteed.	Potassium Oxide in 100 lbs. Found.	Potassium Oxide in 100 lbs. Guaranteed.
	Compound Fertilizers.												
305	Swift's Lowell Dissolved Bone and Potash	10.91	1.71	1.65-2.50	6.15	3.13	1.36	10.64	10-11	9.28	9-11	2.26	2-3
348	Swift's Lowell Perfect Tobacco Grower ..	10.50	4.20	4.12-4.94	2.88	4.34	1.28	8.50	8-10	7.22	7-9	7.14	6-7*
323	Swift's Lowell Special Vegetable Manure.	10.65	3.42	3.29-4.12	5.75	2.03	1.54	9.32	9-12	7.78	8-10	7.46	7-8
325	Swift's Lowell Fruit and Vine for Strawb's	9.67	3.00	3.29-4.12	5.28	2.22	2.18	9.68	8-11	7.50	7-9	6.37	6-7
31	Mapes' Complete Manure for General Use	8.74	3.89	3.29-4.12	2.65	5.05	2.10	9.80	10-12	7.70	8-10	5.16	4-5
38	Mapes' Complete Manure for Light Soils .	8.57	5.73	4.94-6.59	2.60	4.56	1.64	8.80	8-10	7.16	6-8	7.60	6-8
50-312-510	Mapes' Cereal Brand	8.95	1.88	1.65-2.47	2.30	3.82	3.20	9.32	8-10	6.12	6-8	3.52	3.00-3.50
304-310	Mapes' Complete Manure, "A" Brand	10.11	2.87	2.47-3.29	3.33	6.83	2.94	13.10	12-16	10.16	10-12	2.92	2.50-3.50
308	Mapes' Top Dresser, Improved	5.32	9.70	9.88	2.10	5.68	1.20	8.98	8	7.78	—	6.64	4*
334	Mapes' Top Dresser, Imp. (half strength).	6.88	4.95	4.94	.35	2.67	1.74	4.76	4	3.02	3	2.84	2
385	Mapes's Average Soil Complete Manure..	8.88	5.49	4.12-4.94	3.55	3.61	1.26	8.42	8-9	7.16	7-8	6.56	5-6
440	Mapes' Tobacco Ash Constituents........	13.36	.53	.50	—	1.60	4.32	5.92	5.70	1.60	—	14.84	15.00†
453-469-525	Mapes' Tobacco Starter, Improved.......	13.80	4.66	4.12-4.94	1.68	5.40	2.46	9.54	8-10	7.08	6-8	2.20	1-2*
514	Mapes' Tobacco Manure, Wrapper Brand	11.51	5.94	6.18	.10	4.76	1.00	5.86	4.50	4.86	—	9.44	10.50**
311-395	Mapes' Fruit and Vine Manure	9.86	2.16	1.65-2.47	1.45	3.23	2.92	7.60	7-9	4.68	5-7	11.68	10-12*

* Sulphate of potash, the source of potash.

**Carbonate of potash, the source of potash.

† 440. Enough chlorine present to unite with 3.58% potassium oxide, the remainder of the potash in form of carbonate.

II. ANALYSES OF COMMERCIAL FERTILIZERS COLLECTED DURING 1905 IN THE GENERAL MARKETS BY THE AGENT OF THE HATCH EXPERIMENT STATION OF THE MASSACHUSETTS AGRICULTURAL COLLEGE.

Laboratory No.	Name of Brand.	Name of Manufacturer.	Sampled at
	Compound Fertilizers.		
332	Mapes' Cauliflower and Cabbage Manure	Mapes' Formula & Peruvian Guano Co., New York City	Fitchburg.
367	" " " " "	" " " " " " " " "	Worcester.
381	Chittenden's Fish and Potash	National Fertilizer Co., Bridgeport, Conn.	Southwick.
28	Chittenden's Universal Phosphate	" " " " "	New Bedford.
492	" " "	" " " " "	Gt. Barrington
32	Chittenden's Market Garden Fertilizer	" " " " "	New Bedford.
41	" " " "	" " " " "	Sunderland.
192	Chittenden's Potato Phosphate	" " " " "	New Bedford.
563	New England Corn Phosphate	New England Fertilizer Co., Boston, Mass.	Amherst.
564	New England Superphosphate	" " " " " "	Amherst.
565	New England High Grade Potato Fertilizer	" " " " " "	Amherst.
566	New England Potato Fertilizer	" " " " " "	Amherst.
60	Plymouth Rock Brand	Parmenter & Polsey Fertilizer Co., Peabody, Mass.	Dighton.
272	" " "	" " " " " " "	Peabody.
328	" " "	" " " " " " "	Harvard.
80	Special Fertilizer for Strawberries	" " " " " " "	Dighton.
253	" " " "	" " " " " " "	Peabody.
85	Special Potato Fertilizer	" " " " " " "	Dighton.
238	" " "	" " " " " " "	Plymouth.

Laboratory Number.	Name of Brand.	Moisture.	Nitrogen in 100 lbs.		Phosphoric Acid in 100 lbs.							Potassium Oxide in 100 lbs.	
								Total.		Available.			
			Found.	Guaranteed.	Soluble.	Reverted.	Insoluble.	Found.	Guaranteed.	Found.	Guaranteed.	Found.	Guaranteed.
	Compound Fertilizers.												
332-367	Mapes' Cauliflower and Cabbage Manure.	8.81	4.13	4.12-4.94	2.38	4.62	1.22	8.22	6-8	7.00	6	6.45	6-8
381	Chittenden's Fish and Potash............	9.91	3.05	3-4	6.05	.45	2.56	9.06	6-8	6.50	—	4.38	4-5
28-492	Chittenden's Universal Phosphate........	11.60	1.22	.80-1.20	5.92	3.12	3.20	12.24	10-12	9.04	8-10	1.94	1-2
32-41	Chittenden's Market Garden Fertilizer....	11.74	2.29	2.50-3.25	3.53	4.13	3.22	10.88	10-12	7.66	8-10	6.52	6-7
192	Chittenden's Potato Phosphate...........	7.45	2.18	2.06-2.86	3.85	3.61	3.32	10.78	10-13	7.46	8-10	6.18	6-7
563	New England Corn Phosphate...........	10.72	1.82	1.64	6.07	2.41	1.66	10.14	9	8.48	8	3.54	3.
564	New England Superphosphate	12.19	2.64	2.47	6.72	2.62	3.32	12.66	10	9.34	9	4.34	4.
565	New England High Grade Potato Fert....	12.11	2.63	2.47	6.33	1.69	2.72	10.74	9	8.02	8	6.68	6.
566	New England Potato Fertilizer...........	10.76	2.09	1.64	5.28	2.14	1.80	9.22	8	7.42	7	4.72	4.
60-272-328	Plymouth Rock Brand	10.14	2.53	2.47-3.29	5.12	2.86	2.30	10.28	9-13	7.98	8-11	4.42	4-4.25
80-253	Special Fertilizer for Strawberries........	15.55	2.27	2.47-3.29	5.62	4.16	1.10	10.88	10-13	9.78	9-11	6.20	6-7
85-238	Special Potato Fertilizer.................	11.69	3.15	3.29-4.12	6.07	2.37	1.54	9.98	9-13	8.44	8-11	7.16	7-9

II. ANALYSES OF COMMERCIAL FERTILIZERS COLLECTED DURING 1905 IN THE GENERAL MARKETS BY THE AGENT OF THE HATCH EXPERIMENT STATION OF THE MASSACHUSETTS AGRICULTURAL COLLEGE.

Laboratory No.	Name of Brand.	Name of Manufacturer.	Sampled at
	Compound Fertilizers.		
239	(A) (A) Brand	Parmenter & Polsey Fertilizer Co., Peabody, Mass.	Marlborough.
335	" "	" " " " " " "	Harvard.
243	(P) & (P) Potato Fertilizer	" " " " " " "	Peabody.
283	" " "	" " " " " " "	Harvard.
250	Lawn Dressing	" " " " " " "	Peabody.
374	" "	" " " " " " "	Hudson.
271	(P) & (P) Grain Grower	" " " " " " "	Peabody.
275	Star Brand Superphosphate	" " " " " " "	Peabody.
419	Complete for Potatoes and Root Crops	R. T. Prentiss, Holyoke, Mass.	Holyoke.
550	" " " " " "	" " " "	Holyoke.
258	Hubbard's Grass and Grain Fertilizer	Rogers & Hubbard Co., Middletown, Conn.	Andover.
468	" " " " "	" " " " " "	E. Longm'dow
511	Hubbard's Soluble Tobacco Manure	" " " " " "	Gt. Barrington
267	Hubbard's Oats and Top Dressing	" " " " " "	Andover.
445	" " " " "	" " " " " "	Southwick.
422	Hubbard's Potato Phosphate	" " " " " "	Northampton.
442	" " "	" " " " " "	Agawam.
513	" " "	" " " " " "	Hinsdale.
460	Hubbard's Soluble Potato Manure	" " " " " "	E. Longm'dow
462	" " " "	" " " " " "	Southwick.

Laboratory Number.	Name of Brand.	Moisture.	Nitrogen in 100 lbs.		Phosphoric Acid in 100 lbs.							Potassium Oxide in 100 lbs.	
								Total.		Available.			
			Found.	Guaranteed.	Soluble.	Reverted.	Insoluble.	Found.	Guaranteed.	Found.	Guaranteed.	Found.	Guaranteed.
	Compound Fertilizers.												
239-335	(A) (A) Brand	10.74	4.07	3.29-4.12	5.03	2.59	1.54	9.16	9-13	7.62	8-11	7.82	7-9
243-283	(P) & (P) Potato Fertilizer	8.33	1.79	1.65-2.47	3.35	2.03	1.94	7.32	7-10	5.38	6-8	6.02	6-6.50
250-374	Lawn Dressing	7.12	4.78	4.94-6.50	5.60	1.68	.52	7.80	8-11	7.28	7-9	5.20	5-6
271	(P) & (P) Grain Grower	8.86	1.02	.82	4.63	2.67	1.02	8.32	8	7.30	7	2.28	2
275	Star Brand Superphosphate	11.04	1.85	1.64-2.46	5.22	1.80	2.44	9.46	8-11	7.02	7-9	2.76	2.50-3.50*
419-550	Complete for Potatoes and Root Crops	8.58	3.01	2.88-3.70	6.40	3.26	.70	10.36	10-12	9.66	8-10	10.04	10-12†
258-468	Hubbard's Grass and Grain Fertilizer	6.76	2.97	2.20-3.00	—	6.52	9.72	16.24	16-18	6.52	6.60-7.20	12.27	12-13.5
511	Hubbard's Soluble Tobacco Manure	9.12	5.18	5-6	.33	7.09	5.88	13.30	10-12	7.42	7-8.50	10.02	10-11*
267-445	Hubbard's Oats and Top Dressing	2.78	8.86	8.50-9.50	—	4.48	3.96	8.44	8-9	4.48	3.9-4.35	8.37	8-9.50
422-442-513	Hubbard's Potato Phosphate	10.42	2.04	2-2.50	5.60	4.12	2.18	11.90	10-12	9.72	9-10	5.52	5-6
460-462	Hubbard's Soluble Potato Manure	8.46	4.98	5-6	.37	8.27	4.70	13.34	10-12	8.64	7-8.50	6.01	5-6*

† 419-550. Enough chlorine present to unite with 3.18% potassium oxide.

* Sulphate of potash, the source of potash.

II. ANALYSES OF COMMERCIAL FERTILIZERS COLLECTED DURING 1905 IN THE GENERAL MARKETS BY THE AGENT OF THE HATCH EXPERIMENT STATION OF THE MASSACHUSETTS AGRICULTURAL COLLEGE.

Laboratory No.	Name of Brand.	Name of Manufacturer.	Sampled at
	Compound Fertilizers.		
476	Hubbard's Market Garden Phosphate	Rogers & Hubbard Co., Middletown, Conn	Agawam.
493	Hubbard's All Soils and All Crops Phosphate	" " " " " "	Whately.
482	Rogers' Corn and Onion Manure	Rogers Manufacturing Co., Rockfall, Conn	Amherst.
53	Essex Complete Manure for Potatoes, Roots and Veg	Russia Cement Co., Gloucester, Mass	Taunton.
273	" " " " " " " "	" " " " "	Marlborough.
144	Essex Complete Manure for Corn, Grain and Grass	" " " " "	Somerset.
317	" " " " " " " "	" " " " "	W. Newbury.
148	Essex Rhode Island Special	" " " " "	Somerset.
353	" " " "	" " " " "	Spencer.
152	Essex Dry Ground Fish	" " " " "	Somerset.
524	" " " "	" " " " "	Deerfield.
289	Essex "A1" Superphosphate	" " " " "	Leominster.
355	" " "	" " " " "	S. Framingh'm
297	Essex Market Garden and Potato Manure	" " " " "	Leominster.
326	" " " " " "	" " " " "	W. Newbury.
507	Essex Corn Fertilizer	" " " " "	Greenfield.
556	Essex Special Tobacco Manure	" " " " "	Hadley.

Laboratory Number.	Name of Brand.	Moisture.	Nitrogen in 100 lbs.		Phosphoric Acid in 100 lbs.							Potassium Oxide in 100 lbs.	
								Total.		Available.			
			Found.	Guaranteed.	Soluble.	Reverted.	Insoluble.	Found.	Guaranteed.	Found.	Guaranteed.	Found.	Guaranteed.
	Compound Fertilizers.												
476	Hubbard's Market Garden Phosphate....	7.54	3.44	3.50-4.50	41.67	2.89	2.04	9.60	16-11	7.56	7.5-9.5	12.50	10-11
403	Hubbard's All Soils and All Crops Phosp.	10.70	2.55	2.30-3.00	6.35	3.37	2.82	12.54	12-14	9.72	10-12	3.46	3-4
482	Rogers' Corn and Onion Manure.........	6.01	3.87	3.60-4.00	1.75	2.99	5.76	10.50	8-9	4.74	6-7	7.40	7-8
53-273	Essex Comp. Manure for Pot., Roots, Veg.	3.94	3.76	3.7-4.5	4.23	3.49	4.34	12.06	9-11	7.72	7-7.75	9.06	8.5-10
144-317	Essex Comp. Man. for Corn, Grain, Grass.	10.35	3.37	3.3-4.1	4.45	3.25	2.56	10.26	9.5-11	7.70	7-8	9.52	9.5-11
148-353	Essex Rhode Island Special	10.98	3.18	3-3.50	2.30	5.24	3.84	11.38	9-11	7.54	8-9	6.82	6.5-7
152-524	Essex Dry Ground Fish	9.38	7.74	8-10	—	9.02	6.20	15.22	11-13	9.02	—	—	—
289-355	Essex "A1" Superphosphate	5.47	1.17	1-1.25	.30	5.58	6.78	12.66	9-11	5.88	7-8	1.84	2-2.50*
297-326	Essex Market Garden and Potato Manure.	7.25	2.97	2-2.50	3.63	4.11	4.44	12.18	10-13	7.74	8-10	6.54	5-6
507	Essex Corn Fertilizer...................	8.37	2.27	2-2.50	4.62	4.34	4.22	13.18	11-13	8.96	9-10	3.19	3-3.5
556	Essex Special Tobacco Manure	5.81	4.29	4.5-5.3	2.25	3.73	4.52	10.50	8.5-9.5	5.98	7-8	13.13	12-13*

* Sulphate of potash, the source of potash.

II. ANALYSES OF COMMERCIAL FERTILIZERS COLLECTED DURING 1905 IN THE GENERAL MARKETS BY THE AGENT OF THE HATCH EXPERIMENT STATION OF THE MASSACHUSETTS AGRICULTURAL COLLEGE.

Laboratory No.	Name of Brand.	Name of Manufacturer.	Sampled at
	Compound Fertilizers.		
555	Essex Grass and Top Dressing Fertilizer	Russia Cement Co., Gloucester, Mass.	Hadley.
58	Walker's Complete Phosphate	Sanderson's Fert. and Chemical Co., New Haven, Conn.	Dighton.
74	Walker's Complete Fertilizer	" " " " " " " "	Dighton.
185	Walker's High Grade Fertilizer	" " " " " " " "	Dighton.
574	" " " "	" " " " " " " "	Dighton.
86	Niantic Fish, Bone and Potash	" " " " " " " "	Dighton.
465	" " " " "	" " " " " " " "	Southwick.
369	Old Reliable Superphosphate	" " " " " " " "	Southwick.
89	Sanderson's Formula "A" Fertilizer	" " " " " " " "	Dighton.
387	" " " "	" " " " " " " "	Southwick.
149	Sanderson's Fine Ground Fish	" " " " " " " "	Dighton.
546	" " " "	" " " " " " " "	Whately.
3	Swift Sure Superphosphate	M. L. Shoemaker & Co., Philadelphia, Pa.	Sunderland.
17	" " "	" " " " " "	Hatfield.
122	" " "	" " " " " "	Sunderland.
359	" " "	" " " " " "	Springfield.
298	Potato Plowman	Whitman & Pratt Rendering Co., Lowell, Mass.	Fitchburg.
82	Wilcox Potato Fertilizer	Wilcox Fertilizer Works, Mystic, Conn.	Dighton.
483	Wilcox High Grade Tobacco Special	" " " " "	Amherst.
105	Wilcox Dry Ground Fish Guano	" " " " "	Amherst.
346	" " " " "	" " " " "	Springfield.
439	" " " " "	" " " " "	Hatfield.
484	" " " " "	" " " " "	Amherst.

Laboratory Number.	Name of Brand.	Moisture.	Nitrogen in 100 lbs. Found.	Nitrogen in 100 lbs. Guaranteed.	Phosphoric Acid in 100 lbs. Soluble.	Reverted.	Insoluble.	Total. Found.	Total. Guaranteed.	Available. Found.	Available. Guaranteed.	Potassium Oxide in 100 lbs. Found.	Potassium Oxide in 100 lbs. Guaranteed.
	Compound Fertilizers.												
555	Essex Grass and Top Dressing Fertilizer.	8.44	5.44	5-5.5	2.40	4.90	4.86	12.16	10-12	7.30	8-9	8.02	8-8.50*
58	Walker's Complete Phosphate.	14.37	2.03	1.65-2.47	1.75	5.21	2.44	9.40	10-12	6.96	7-9	2.36	2-3
74	Walker's Complete Fertilizer	9.79	2.44	2.4-3.3	2.73	4.83	1.40	8.96	9-11	7.56	7-9	6.20	6-8
185	Walker's High Grade Fertilizer	8.14	3.17	3.3-4.12	2.25	5.75	2.82	10.82	10-12	8.00	8-10	5.58	6-8
574	" " " "	10.05	3.13	3.3-4.12	2.00	6.04	2.68	10.72	10-12	8.04	8-10	5.55	6-8
86-465	Niantic Fish, Bone and Potash..........	14.50	1.86	1.65-3.29	1.53	3.79	3.20	8.52	6-8	5.32	4-6	5.66	4-6
369	Old Reliable Superphosphate	16.84	2.70	2.5-3.5	5.28	3.96	.76	10.00	10-12	9.24	7-8	1.64	2-3
89-387	Sanderson's Formula "A" Fertilizer	9.62	3.30	3.30-4.00	3.25	3.33	2.82	9.40	9-10	6.58	6-8	6.00	6-8
149-546	Sanderson's Fine Ground Fish..........	9.09	7.84	8.24-9.89	—	3.88	2.68	6.56	6-8	3.88	—	—	—
3-17-122-359	Swift Sure Superphosphate**...........	7.29	2.94	2.88-4.12	8.80	2.48	2.40	13.68	13-17	11.28	8-11	5.08	4.5-6
298	Potato Plowman	5.46	3.50	3.30-4.10	1.75	7.19	6.66	15.00	9-12	8.94	7-9	6.04	6-7
82	Wilcox Potato Fertilizer...............	12.14	2.35	2.05-2.88	2.25	4.41	2.56	9.22	7-9	6.66	6-8	5.34	4.5-5.5
483	Wilcox High Grade Tobacco Special.....	23.06	3.55	3.30-4.30	.50	6.68	.34	7.52	7-10	7.18	5-7	8.32	7-9†
105-346-439-484	Wilcox Dry Ground Fish Guano	8.77	8.89	8.5-10	—	4.66	2.38	7.04	8-9	4.66	4-6	—	—

** Republished from July bulletin to correct error in name.

* Sulphate of potash, the source of potash.

† Enough chlorine present to unite with 1.39% potassium oxide.

II. ANALYSES OF COMMERCIAL FERTILIZERS COLLECTED DURING 1905 IN THE GENERAL MARKETS BY THE AGENT OF THE HATCH EXPERIMENT STATION OF THE MASSACHUSETTS AGRICULTURAL COLLEGE.

Laboratory No.	Name of Brand.	Name of Manufacturer.	Sampled at
	Chemicals.		
24	Nitrate of Soda	American Agricultural Chemical Co., New York City	New Bedford.
134	Sulphate of Ammonia	" " " " " " "	Boston.
146	Dissolved Bone Black	" " " " " " "	Boston.
203	" " "	" " " " " " "	So. Amherst.
153	Muriate of Potash	" " " " " " "	Fall River.
200	" " "	" " " " " " "	So. Amherst.
164	Kainit	" " " " " " "	Boston.
202	Plain Superphosphate	" " " " " " "	So. Amherst.
362	" "	" " " " " " "	Worcester.
331	High Grade Sulphate of Potash	" " " " " " "	Newburyport.
4	Prime Cotton Seed Meal	The American Cotton Oil Co., New York City	Hatfield.
119	" " " "	" " " " " " " "	Sunderland.
9	Cleveland Flax Meal	American Linseed Co., Chicago, Ill.	Hatfield.
68	Superphosphate	Bowker Fertilizer Co., Boston, Mass	Dighton.
225	"	" " " " "	Haverhill.
129	Dissolved Bone Black	" " " " "	Concord.
138	" " "	" " " " "	Dighton.

Laboratory Number.	Name of Brand.	Moisture.	Nitrogen in 100 lbs.		Phosphoric Acid in 100 lbs.							Potassium Oxide in 100 lbs.	
								Total.		Available.			
			Found.	Guaranteed.	Soluble.	Reverted.	Insoluble.	Found.	Guaran-teed.	Found.	Guaran-teed.	Found.	Guaran-teed.
	Chemicals.												
24	Nitrate of Soda	2.08	15.72	15.6	—	—	—	—	—	—	—	—	—
134	Sulphate of Ammonia	.80	20.66	20.50	—	—	—	—	—	—	—	—	—
146-203	Dissolved Bone Black	9.21	—	—	8.00	6.48	3.56	18.04	16-19	14.48	15-16	—	—
153-200	Muriate of Potash	2.05	—	—	—	—	—	—	—	—	—	49.26	50.54-53.70
164	Kainit	1.79	—	—	—	—	—	—	—	—	—	12.58	12-13
202-362	Plain Superphosphate	9.99	—	—	7.10	6.28	2.12	15.50	13.5-16	13.38	12-14	—	—
331	High Grade Sulphate of Potash	.64	—	—	—	—	—	—	—	—	—	49.80	48.63-51.33
4	Prime Cotton Seed Meal	2.92	6.76	6.50	—	—	—	—	—	—	—	—	—
119	" " " "	7.77	6.37	6.50	—	—	—	—	—	—	—	—	—
9	Cleveland Flax Meal	7.25	5.74	5.92	—	—	—	—	—	—	—	—	—
68-225	Superphosphate	21.09	—	—	9.85	2.91	1.08	13.84	—	12.76	13-15	—	—
129-138	Dissolved Bone Black	8.90	—	—	7.30	7.40	1.86	16.56	16-20	14.70	15-18	—	—

II. ANALYSES OF COMMERCIAL FERTILIZERS COLLECTED DURING 1905 IN THE GENERAL MARKETS BY THE AGENT OF THE HATCH EXPERIMENT STATION OF THE MASSACHUSETTS AGRICULTURAL COLLEGE.

Laboratory No.	Name of Brand.	Name of Manufacturer.	Sampled at
	Chemicals.		
135	High Grade Sulphate of Potash	Bowker Fertilizer Co., Boston, Mass	Boston.
223	" " " " "	" " " " "	Haverhill.
186	Dried Blood	" " " " "	Dighton.
196	Sulphate of Ammonia	" " " " "	Boston.
233	Nitrate of Soda	" " " " "	Bridgewater.
240	" " "	" " " " "	Boston.
213	Muriate of Potash	" " " " "	Lowell.
229	" " "	" " " " "	Bridgewater.
572	Bowker's Kainit	" " " " "	Amherst.
281	Ground South Carolina Phosphate	" " " " "	Boston.
357	Owl Brand Pure Cotton Seed Meal	F. W. Brode & Co., Memphis, Tenn	Springfield.
2	Old Gold Brand Cotton Seed Meal	T. H. Bunch, Little Rock, Ark	Sunderland.
5	" " " " " "	" " " " "	Hatfield.
446	Muriate of Potash	E. Frank Coe Co., New York City	E. Longm'dow
471	Nitrate of Soda	" " " " " "	E. Longm'dow

Laboratory Number.	Name of Brand.	Moisture.	Nitrogen in 100 lbs.		Phosphoric Acid in 100 lbs.							Potassium Oxide in 100 lbs.	
			Found.	Guaranteed.	Soluble.	Reverted.	Insoluble.	Total. Found.	Total. Guaranteed.	Available. Found.	Available. Guaranteed.	Found.	Guaranteed.
	Chemicals.												
135-223	High Grade Sulphate of Potash	.25	—	—	—	—	—	—	—	—	—	49.08	48-52
186	Dried Blood	9.20	10.11	9.5-11.5	—	—	—	1.66	—	—	—	—	—
196	Sulphate of Ammonia	1.70	20.32	19-20	—	—	—	—	—	—	—	—	—
233-240	Nitrate of Soda	2.45	15.68	15-16	—	—	—	—	—	—	—	—	—
213-229	Muriate of Potash	2.31	—	—	—	—	—	—	—	—	—	48.84	50-52
572	Bowker's Kainit	1.24	—	—	—	—	—	—	—	—	—	13.00	12
281	Ground South Carolina Phosphate	.85	—	—	—	2.94	25.84	28.78	26.56-28.39	2.94	—	—	—
357	Owl Brand Pure Cotton Seed Meal	7.48	6.85	7	—	—	—	—	—	—	—	—	—
2	Old Gold Brand Cotton Seed Meal	6.87	6.93	7	—	—	—	—	—	—	—	—	—
5	" " " " " "	5.84	6.51	7	—	—	—	—	—	—	—	—	—
446	Muriate of Potash	1.60	—	—	—	—	—	—	—	—	—	51.64	50-52
471	Nitrate of Soda	1.25	15.86	15	—	—	—	—	—	—	—	—	—

II. ANALYSES OF COMMERCIAL FERTILIZERS COLLECTED DURING 1905 IN THE GENERAL MARKETS BY THE AGENT OF THE HATCH EXPERIMENT STATION OF THE MASSACHUSETTS AGRICULTURAL COLLEGE.

Laboratory No.	Name of Brand.	Name of Manufacturer.	Sampled at
	Chemicals.		
8	Prime Cotton Seed Meal	The Hunter Bros. Milling Co., St. Louis, Mo	Hatfield.
104	" " " "	" " " " " " "	Sunderland.
302	" " " "	" " " " " " "	Ayer.
430	Carbonate of Potash	A. Klipstein Co., 122 Pearl St., New York City	Hatfield.
313	Acid Phosphate	Swift's Lowell Fertilizer Co., Boston, Mass	Amesbury.
251	Muriate of Potash	" " " " " "	Amesbury.
303	" " "	" " " " " "	Ayer.
39	Nitrate of Soda	" " " " " "	Raynham.
257	" " "	" " " " " "	Amesbury.
118	Vegetable Potash	Olds & Whipple, Hartford, Conn	Sunderland.
450	" "	" " " " "	Agawam.
515	" "	" " " " "	Whately.
421	Castor Pomace	" " " " "	Hatfield.
88	Nitrate of Soda	Parmenter & Polsey Fertilizer Co., Peabody, Mass	Dighton.
52	" " "	Russia Cement Company, Gloucester, Mass	Taunton.
384	High Grade Sulphate of Potash	Sanderson Fert. and Chemical Co., New Haven, Conn	Southwick.
436	" " " " "	" " " " " " " "	Hatfield.

Laboratory Number.	Name of Brand.	Moisture.	Nitrogen in 100 lbs.		Phosphoric Acid in 100 lbs.							Potassium Oxide in 100 lbs.	
								Total.		Available.			
			Found.	Guaranteed.	Soluble.	Reverted.	Insoluble.	Found.	Guaran-teed.	Found.	Guaran-teed.	Found.	Guaran-teed.
	Chemicals.												
8-104-302	Prime Cotton Seed Meal	5.22	6.78	6.88	—	—	—	—	—	—	—	—	—
430	Carbonate of Potash	1.95	—	—	—	—	—	—	—	—	—	64.00	64.71
313	Acid Phosphate	8.36	—	—	8.30	3.42	1.20	12.92	12-15	11.72	—	—	—
251-303	Muriate of Potash	1.88	—	—	—	—	—	—	—	—	—	51.30	50-53
39-257	Nitrate of Soda	6.55	15.82	14.83-15.66	—	—	—	—	—	—	—	—	—
118-450-515	Vegetable Potash	2.85	—	—	—	—	—	—	—	—	—	23.96*	25
421	Castor Pomace	8.26	5.27	4.74-5.77	—	—	—	—	—	—	—	—	—
88	Nitrate of Soda	.98	15.70	15.64	—	—	—	—	—	—	—	—	—
52	" " "	.99	15.72	15.64	—	—	—	—	—	—	—	—	—
384-436	High Grade Sulphate of Potash	.20	—	—	—	—	—	—	—	—	—	51.10	48.63-51.34

* Total potassium oxide, 32.52%.

II. ANALYSES OF COMMERCIAL FERTILIZERS COLLECTED DURING 1905 IN THE GENERAL MARKETS BY THE AGENT OF THE HATCH EXPERIMENT STATION OF THE MASSACHUSETTS AGRICULTURAL COLLEGE.

Laboratory No.	Name of Brand.	Name of Manufacturer.	Sampled at
	Bones and Tankage.		
184	Fine Ground Bone	American Agricultural Chemical Co., New York	Boston.
263	" " "	" " " " " "	Bridgewater.
204	Fine Ground Tankage	" " " " " "	So. Amherst.
221	Bradley's Abattoir Bone Dust	American Agric. Chem. Co., Bradley Fert. Co. Branch	Haverhill.
224	" " " "	" " " " " " " "	Haverhill.
535	Bone Meal	Armour Fertilizer Works, Baltimore, Md.	No. Adams.
34	Bowker's Fresh Ground Bone	Bowker Fertilizer Co., Boston, Mass.	Taunton.
245	" " " "	" " " " "	Haverhill.
512	" " " "	" " " " "	No. Adams.
571	Bowker's 8-9 Tankage	" " " " "	Amherst.
127	Flower of Bone	" " " " "	Boston.
206	Bowker's Market Bone	" " " " "	Lowell.
461	XXX Pure Ground Bone	E. Frank Coe Co., New York City	E. Longm'dow
151	Dow's Pure Ground Bone	John C. Dow & Co., Boston, Mass	Boston.
278	" " " "	" " " " " "	Amherst.
19	Meat and Bone	Thomas Hersom & Co., New Bedford, Mass	New Bedford.
20	Pure Bone Meal	" " " " " " "	New Bedford.
183	Swift's Lowell Ground Bone	Swift's Lowell Fertilizer Co., Boston, Mass.	Boston.
338	" " " "	" " " " " "	Ayer.
344	" " " "	" " " " " "	Worcester.

Laboratory Number.	Name of Brand.	Moisture.	Nitrogen in 100 lbs.		Phosphoric Acid in 100 lbs.							Mechanical Analysis.	
								Total.		Available.			
			Found.	Guaranteed.	Soluble.	Reverted.	Insoluble.	Found.	Guaranteed.	Found.	Guaranteed.	Fine.	Coarse.
	Bones and Tankage.												
184-263	Fine Ground Bone	2.58	2.31	2.45-3.25	—	11.38	14.26	25.64	23	11.38	—	65.93	34.07
204	Fine Ground Tankage	15.04	6.31	5-5.78	—	8.16	7.70	15.86	13.74-16.03	8.16	—	55.16	44.84
221-224	Bradley's Abattoir Bone Dust	9.27	3.26	1.65-3.25	—	8.56	11.52	20.08	14-18	8.56	—	48.62	51.38
535	Armour's Bone Meal	3.35	3.03	2.47-3.29	—	15.32	11.90	27.22	24-28	15.32	—	67.22	32.78
34-245-512	Bowker's Fresh Ground Bone	5.68	2.75	2.47-3.29	—	8.82	9.60	18.42	18-22	8.82	5-7	67.71	32.29
571	Bowker's 8-9 Tankage	5.20	6.28	6.59	.15	8.93	4.10	13.18	9	9.08	—	53.93	46.07
127	Flower of Bone	3.33	2.39	—	—	15.52	11.08	26.60	—	15.52	—	97.93	2.07
206	Bowker's Market Bone	6.30	2.22	1.65-2.47	—	5.54	12.62	18.04	20-22	5.54	—	61.28	38.72
461	XXX Pure Ground Bone	5.16	2.29	2.47-3.29	—	13.84	13.72	27.56	19-21	13.84	—	51.00	49.00
151-278	Dow's Pure Ground Bone	2.37	2.47	2.06-2.47	—	11.38	16.28	27.66	24-26	11.38	—	64.13	35.87
19	Meat and Bone	4.13	5.50	4.66	—	9.00	8.34	17.34	13.88	9.00	8.14	62.71	37.29
20	Pure Bone Meal	3.77	2.39	2.22	—	13.14	14.68	27.82	27.04	13.14	10.40	69.39	30.61
183-338-344	Swift's Lowell Ground Bone	4.66	2.49	2.47-3.29	—	12.30	15.00	27.30	23-25	12.30	—	70.11	29.89

II. ANALYSES OF COMMERCIAL FERTILIZERS COLLECTED DURING 1905 IN THE GENERAL MARKETS BY THE AGENT OF THE HATCH EXPERIMENT STATION OF THE MASSACHUSETTS AGRICULTURAL COLLEGE.

Laboratory No.	Name of Brand.	Name of Manufacturer.	Sampled at
	Bones and Tankage.		
161	Swift's Lowell Tankage	Swift's Lowell Fertilizer Co., Boston, Mass.	Concord.
181	Marsh's Pure Bone Meal	George E. Marsh & Co., Lynn, Mass.	Concord.
562	Ground Bone	D. M. Moulton, Monson, Mass.	Amherst.
137	New England Ground Bone	New England Fertilizer Co., Boston, Mass.	Boston.
306	“ “ “	“ “ “ “ “ “	Fitchburg.
244	Pure Ground Bone	Parmenter & Polsey Fertilizer Co., Peabody, Mass	Peabody.
347	“ “ “	“ “ “ “ “ “ “	Worcester.
558	Hubbard's Pure Ground Raw Knuckle Bone Flour	The Rogers & Hubbard Co., Middletown, Conn.	Amherst.
557	Hubbard's Strictly Pure Fine Bone	“ “ “ “ “ “ “	Amherst.
214	Pure Ground Bone	T. L. Stetson, Randolph, Mass	Brockton.
412	“ “ “	“ “ “	Amherst.
279	Warren's Ground Bone	A. L. Warren, Northboro, Mass	Amherst.
392	“ “ “	“ “ “ “	Hudson.
211	Pure Ground Bone	Whitman & Pratt Rendering Co., Lowell, Mass.	Lowell.
341	Ground Bone	Sanford Winter, Brockton, Mass.	Amherst.
537	Tankage	J. M. Woodard & Bro., Greenfield, Mass.	Greenfield.

Laboratory Number.	Name of Brand.	Moisture.	Nitrogen in 100 lbs.		Phosphoric Acid in 100 lbs.							Mechanical Analysis.	
								Total.		Available.			
			Found.	Guaranteed.	Soluble.	Reverted.	Insoluble.	Found.	Guaranteed.	Found.	Guaranteed.	Fine.	Coarse.
	Bones and Tankage.												
161	Swift's Lowell Tankage	15.59	6.26	6.59	.45	8.23	6.04	14.72	9.16	8.68	—	55.19	44.81
181	Marsh's Pure Bone Meal	2.80	2.50	2.46-3.07	—	11.28	16.60	27.88	23-25	11.28	6-8	61.60	38.40
562	Ground Bone	6.82	4.37	4-5	—	8.26	11.18	19.44	21-22	8.26	—	12.99	87.01
137-306	New England Ground Bone	2.29	2.09	2.46-3.30	—	8.18	18.60	26.86	22-25	8.18	—	99.49	.51
244-347	Pure Ground Bone	3.98	2.62	2-3	—	6.94	19.32	26.26	16-20	6.94	6-8	60.55	39.45
558	Hubbard's P. G. Raw Knuckle Bone Flour	7.98	3.95	3.82-4.00	—	7.04	18.04	25.08	24.7-25.6	7.04	—	12.92	87.08
557	Hubbhard's Strictly Pure Fine Bone	7.17	3.92	2.85-3.25	—	8.62	14.18	22.80	22-23	8.62	—	45.71	54.29
214-412	Pure Ground Bone	5.15	4.09	4.20	—	9.44	10.78	20.22	20.66	9.44	—	37.39	62.61
279-392	Warren's Ground Bone	5.67	4.30	3.7	—	8.86	13.10	21.96	22.72	8.86	—	48.69	51.31
211	Pure Ground Bone	3.15	2.33	2.47-3.30	—	11.08	16.86	27.94	25-29	11.08	—	59.11	40.89
341	Ground Bone	4.36	2.37	2-3	—	8.10	18.16	26.26	23-24	8.10	—	63.69	36.31
537	Tankage	3.82	4.44	4-5	—	12.56	8.12	20.68	19-20	12.56	—	58.05	41.95

TRADE VALUES OF FERTILIZING INGREDIENTS IN RAW MATERIALS AND CHEMICALS FOR 1904 AND 1905.

	1904	1905
	CENTS PER POUND	
Nitrogen in ammonia salts,	17.5	17.5
" nitrates,	16.0	17.0
Organic nitrogen in dry and fine ground fish, meat, blood, and in high-grade mixed fertilizers,	17.5	18.5
" " " fine bone and tankage,	17.0	18.0
" " " coarse bone and tankage,	12.5	13.0
Phosphoric acid soluble in water,	4.5	4.5
" " soluble in ammonium citrate,	4.0	4.0
" " in fine ground fish, bone and tankage,	4.0	4.0
" " in cottonseed meal, castor pomace and wood ashes,	4.0	4.0
" " in coarse fish, bone and tankage,	3.0	3.0
" " insoluble (in water and in neutral citrate of ammonia) in mixed fertilizers,	2.0	2.0
Potash as Sulphate, free from Chlorides,	5.0	5.0
" " Muriate (chloride),	4.25	4.25
" " Carbonate,	.	8.0

The above schedule of trade values was adopted by representatives of the Massachusetts, Connecticut, Rhode Island, Maine, Vermont and New Jersey Experiment Stations at a conference held during the month of March, 1905, and is based upon the condition of the fertilizer market in centers of distribution in New England, New York and New Jersey during the six months preceding March, 1905, and refers to the current market prices, in ton lots, of the leading standard raw materials, which furnish nitrogen, phosphoric acid and potash, and which enter largely into the manufacture of our commercial fertilizers.

The Following Bulletins are Available for Distribution to Those Who May Desire Them.

No. 3. Tuberculosis.
No. 27. Tuberculosis in college herd: tuberculin in diagnosis; bovine rabies: poisoning by nitrate of soda.
No. 33. Glossary of fodder terms.
No. 35. Agricultural value of bone meal.
No. 41. On the use of tuberculin (translated from Dr. Bang).
No. 64. Analyses of concentrated feed stuffs.
No. 67. Grass thrips: treatment for thrips in greenhouses.
No. 68. Fertilizer analyses.
No. 76. The imported elm-leaf beetle.
No. 77. Fertilizer analyses.
No 81. Analyses of fertilizers and manurial substances; instructions to manufacturers, agents, etc.: discussion of trade values; treatment of barnyard manure with absorbents.
No. 82. Orchard management; cover crops in orchards; pruning orchards; report on fruits.
No. 83. Fertilizer analyses.
No. 84. Fertilizer analyses.
No. 87. Cucumbers under glass.
No. 89. Fertilizer analyses.
No. 90. Fertilizer analyses.
No. 92. Fertilizer analyses.
No. 95. Fertilizer analyses; notes on barnyard manure; trade values.
No. 96. Fungicides, insecticides, spraying calendar.
No. 97. A farm woodlot.
No. 98. Inspection of concentrates.
No. 99. Dried molasses-beet-pulp; the nutrition of horses.
No. 100. Analyses of manurial substances and licensed fertilizers; trade values of fertilizing ingredients for 1903 and 1904.
No 102. Analyses of manurial substances and licensed fertilizers; trade values of fertilizing ingredients for 1903 and 1904.
No. 103. Analyses of manurial substances; instructions regarding sampling of materials; instructions to manufacturers, agents, etc.; trade values of fertilizing ingredients for 1904 and 1905.
No. 104. Analyses of manurial substances; market values of fertilizing ingredients; analyses of licensed fertilizers.
No. 105. Tomatoes Under Glass and Methods of Pruning Tomatoes.
No. 106. Condimental Stock and Poultry Foods.
No. 107. Fertilizer Analyses.
Technical, No. 1. Greenhouse aleyrodes; strawberry aleyrodes.
Technical, No. 2. The graft union.
Special bulletin,—The coccid genera Chionaspis and Hemichionaspis.
Index, 1888-95.
Annual Reports.—1898, 1899, 1900, 1901, 1902, 1903, 1904, 1905, 1906.

HATCH EXPERIMENT STATION

—OF THE—

MASSACHUSETTS

AGRICULTURAL COLLEGE.

BULLETIN NO. 108.

INSPECTION OF CONCENTRATES.

JANUARY, 1906.

The regular Bulletins of this Station will be sent free to all newspapers in the State and to such individuals interested in farming as may request the same. Technical Bulletins are sent only to those persons interested in the subject treated of in each case.

AMHERST, MASS.:
PRESS OF CARPENTER & MOREHOUSE
1906.

HATCH EXPERIMENT STATION

OF THE

Massachusetts Agricultural College,

AMHERST, MASS.

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CLIFTON H. CHADWICK,	*Observer.*

The co-operation and assistance of farmers, fruit-growers, horticulturists, and all interested, directly or indirectly, in agriculture, are earnestly requested. The Bulletins will be sent free to all newspapers in the State and to such individuals interested in farming as may request the same. General bulletins, fertilizer analyses, analyses of feed-stuffs, and annual reports are published. Kindly indicate in application which of these are desired. Communications may be addressed to the

HATCH EXPERIMENT STATION, Amherst, Mass.

DEPARTMENT OF FOODS AND FEEDING.

INSPECTION OF CONCENTRATES.

JOSEPH B. LINDSEY.*

CONTENTS.

INTRODUCTION.

During September and October of 1905, the inspector canvassed the State and sampled 363 lots of feed. It was not considered necessary to take a sample of each brand found, so long as it was properly marked and gave evidence of being of standard quality. This bulletin contains the detailed analytical results of the Autumn collection†, together with such remarks and suggestions relative to the character, quality and usefulness of the various feed stuffs as the conditions warrant. The consumer should bear in mind that dealers

*With the co-operation of E. B. Holland, P. H. Smith, A. C. Whittier and F. G. Helyar.

†It also contains the analyses of cottonseed and linseed meals, and poultry feeds collected in the Winter and Spring of 1905, and hitherto unpublished.

and manufacturers were promptly notified of any irregularity in the guarantee, or deficiency in quality *as soon as the same was recognized*, and that a constant watch is kept to see that the spirit of the feed law is fully complied with. The consumer can feel sure that he has a special agent continually on the lookout to protect his interests.

The Feed Law and the Dealer.

The feed law requires a statement of brand or trade mark, name and address of manufacturer or responsible party, net weight of package, and guarantee of protein and of fat. In addition, standard feed stuffs containing admixtures of foreign substances must be properly marked with the name of the admixture, so that the consumer may have a fair understanding of just what he is purchasing. These several requirements entail no hardship upon the reputable manufacturer, neither do they put any restriction whatsoever upon legitimate trade; *they really protect the square dealer against the deceptions and misrepresentations of unscrupulous parties.* In other words, they only require the merchant "to state what he sells, and to sell what he states."

The large majority of manufacturers, jobbers and retailers willingly conform to the requirements of the law. Difficulty is frequently experienced in obtaining a proper statement of guarantee. The guarantee is sometimes omitted entirely, is higher than the feed stuff can maintain, or the protein and fat are not stated separately. The weight of the package also is often omitted. The retailer is necessarily the party held for violation of the law, both as to proper tagging and as to quality of the products, and while he in turn may look for redress to the jobber or maufacturer, it does not lessen his responsibility. The station has endeavored to be very patient with all offenders, giving them full opportunity to conform to the statute requirements. The writer recognizes the diversity of conditions governing the purchase and sale of concentrated feeds, and has been willing to condone many technical violations of the law, especially when it appeared that no intentional offence was intended. Some parties seem inclined to take advantage of this leniency, *and such it is intended to call to a sharp account.*

In carrying out the provisions of the feed law, the station invites the fullest co-operation of manufacturer, jobber, retailer and consumer, and will do its utmost to see that all parties get a *square deal.* To those who do not desire to do what is honorable, the station raises a warning finger ! ! ! !

WHY IS ONLY A PROTEIN AND FAT GUARANTEE REQUIRED ?

Since many concentrates contain a considerable quantity of fiber, and nearly all a large quantity of extract (starchy) matter, the question is often asked why these should not also be included in the guarantee. *Protein* is guaranteed because it is the most *necessary* and *costly* article for the farmer to purchase. A *fat* guarantee is required, firstly, because it furnishes 2.2 times as much energy as starch, and secondly, because an excess (above 7–10 per cent) is objectionable, tending not only to interfere with the processes of digestion and normal milk secretion, but also to produce a premature rancidity of the feed. The percentages of protein and fat *serve as an index* of the composition of the feed. By comparing the percentages found with the *feed standards*, published on page 6 one can readily see whether the feed is of average composition.

There is a tendency to adulterate many feeds with finely ground oat hulls and corn cobs, substances containing a very high percentage of fiber. Now fiber is not as valuable a nutrient as the extract or starchy matter, and an excess in concentrates is not desirable. A *guarantee of fiber* in addition to protein and fat would prove helpful by showing at once whether such adulteration had actually taken place.

*The extract or starchy matter** while a valuable nutrient is largely produced upon the farm in the form of hay, corn and other cereals, and the farmer does not need, as a rule, to purchase large quantities of it ; hence it was not included in the guarantee. When laws regulating the sale of concentrated feeds were first made, many manufacturers, dealers and farmers were unacquainted with the chemical terms employed, and the use of too many would have naturally led to misunderstanding and confusion. It was thought that a guarantee of protein and of fat would reveal the character of the feed sufficiently to enable the consumer to purchase intelligently.

*Add the percentage of protein and fat, plus 14 per cent for water and ash, substract the sum from 100 and the remainder will be a reasonably close approximation of the percentage of fiber and extract matter (carbohydrates) contained in the feed.

STANDARDS FOR CONCENTRATES.

A standard for comparison is always necessary in passing judgment on the composition of concentrated feeds. The percentages of protein and fat *serve as an index* of their character in the majority of cases. To be of *standard quality*, the various concentrates should be free from mould and rancidity, in good mechanical condition, and maintain the following percentages of protein and fat :

	FEED STUFF.	PROTEIN.	FAT.
Protein Feeds.	*Blood meal,*	85	0.2
	Cottonseed meal (high grade),	43	8–10
	Cottonseed meal (medium grade),	38–41	7–9
	Cottonseed meal (low grade),	24	5–6
	N. P. linseed meal,	38	2
	O. P. linseed meal,	32	6
	Gluten meal,	35	1
	Gluten feed,	25	3
	Germ oil meal,	25	10
	Distillers' dried grains,	32	10
	Malt sprouts,	25	1
	Brewers' dried grains,	22	5
	Wheat middlings (flour),	18–20	5
	Wheat middlings (standard),	17–19	5
	Mixed feed,	16–19	4.5
	Wheat bran,	15–17	4.5
	Dairy feeds,	18–20	4–5
	Sugar feeds,	15	2
	Oat middlings,	17	7
	Rye feed,	15	3
Starchy (Carbohydrate) Feeds.	*Ground oats,*	11	4
	Ground wheat,	11	2
	Barley meal,	11	1.5
	Rye meal,	10	1.5
	Corn meal,	9	3
	Hominy meal,	10	7.5
	Provender,	10	3.5
	Corn and oat feed,	8–10	3–5
	Fortified oat feed,	12–14	3–5
	Oat feed,	5–8	2
	Corn bran,	9	5
	Dried beet-pulp,	8	0.3
Poultry Feeds.	*Meat scraps,*	50	15
	Meat and bone meal,	40	10
	Bone meal,	25	—
	Poultry mash and meal,	15	4–5
	Chick and scratching grains,	10	3
	Alfalfa meal,	18	1.5
	Clover meal,	12	2

CLASSIFICATION OF CONCENTRATES.

Protein Feeds.	CLASS I. 30 to 45% protein. 50 to 60% carbohydrates.* 75 to 90% digestible.	*Cottonseed meal (high and medium grades).* *N. P. and O. P. linseed meals.* *Chicago and Cream gluten meals.* *Ajax Flakes, Biles Fourex, Blue Ribbon and Continental distillers' grains.*
	CLASS II. 20 to 30% protein. 60 to 70% carbohydrates.* 65 to 85% digestible.	*Buffalo, Globe, Pekin, Tiger and Warner's gluten feeds.* *Germ oil meal.* *Malt sprouts and brewers' dried grains.*
	CLASS III. 15 to 20% protein. 70 to 75% carbohydrates.* 60 to 75% digestible.	*Flour and standard wheat middlings, mixed feed and wheat bran.* *Buffalo creamery, Bibby's, H-O, and Protena dairy feeds.* *Green Diamond, Hammond, Holstein and Sucrene sugar feeds.* *Oat middlings and rye feed.*
Starchy (Carbohydrate) Feeds.	CLASS IV. 8 to 14% protein. 75 to 85% carbohydrates.* 60 to 90% digestible.	*Oat, wheat, barley, rye, corn and hominy meals.* *Provender and corn and cob meal.* *Corn and oat and fortified oat feeds.* *Corn bran and dried beet-pulp.* *Oat feed.*
	CLASS V. 8% and less protein. 85% carbohydrates.* 35 to 60% digestible.	*Peanut feed.* *Corn cobs.*

*Including fats reduced to carbohydrates.

ANALYSES OF CONCENTRATES.

Autumn Collection, 1905.

I. Protein Feeds.

BLOOD MEAL.

Manufacturer or Jobber, Brand and Retailer.	Sampled at:	Water	Protein.		Fat.		Fiber.
			Found.	Guar.	Found.	Guar.	
		%	%	%	%	%	%
Armour Fertilizer Co., Chicago.							
W. N. Potter's Sons & Co	Northampton	—	85.86	85-87	0.18	.2-.3	—
Swift & Co., Chicago.							
A. E. Lawrence & Son	Ayer	—	86.70	87.50	0.24	—	—
Average		—	86.28	—	0.21	—	—

COTTONSEED MEAL.

Manufacturer or Jobber, Brand and Retailer.	Sampled at:	Water	Protein Found.	Protein Guar.	Fat Found.	Fat Guar.	Fiber.
High Grade.							
American Cotton Oil Co., New York.							
G. R. Hastings & Son	Boylston	8.13	41.77	41.00	9.03	9.00	—
W. H. Belden	Bradstreet†	—	42.20	41.00	—	9.00	—
J. B. Bridges & Co	S. Deerfield†	—	42.51	41.00	—	9.00	—
R. W. Biggs & Co., Memphis, Tenn.							
Canary, C. S. Barber	Bernardston	9.08	45.59	43.00	7.87	9.00	—
F. W. Brode & Co., Memphis, Tenn.							
Owl, C. D. Holbrook Co	Palmer†	—	45.77	43.00	—	9.00	—
Owl, F. H. Crane & Sons	Quincy	7.68	41.11	41.00	9.38	7.00	—
T. H. Bunch, Little Rock, Ark.							
Old Gold, Manvell Milling Co	Ashley Falls†	—	43.43	43.00	—	9.00	—
Old Gold, J. Wadsworth & Co	Northboro†	—	44.27	43.00	—	9.00	—
Old Gold, Briggs & Co	Taunton	8.33	41.81	43.00	10.07	9.00	—
Butler-Kyser Oil Co., Huntsville, Ala.							
W. P. Whittemore	Roslindale†	—	42.25	‡41.00	—	‡9.00	—
Chapin & Co., Boston.							
Green Diamond, B. W. Brown	Concord	8.57	41.29	43.00	8.37	9.00	—
Green Diamond, J. W. Raymond	Concord†	—	41.90	43.00	—	9.00	—
Green Diamond, Thorne Bros	Millis†	—	42.38	43.00	—	9.00	—
Green Diamond, J. B. Bridges & Co	S. Deerfield	8.66	41.42	43.00	8.73	9.00	—
Green Diamond, G. R. Drake	W. Bridgewat'r	8.99	43.61	43.00	7.93	9.00	—
Green Diamond, A. E. Gilbert	W. Brookfield†	—	44.45	43.00	—	9.00	—
Green Diamond, A. E. Gilbert	W. Brookfield	8.62	40.89	43.00	8.88	9.00	—
Chas. M. Cox Co., Boston.							
Magnolia, E. M. Elmer	Buckland†	—	42.73	43.00	—	9.00	—
Magnolia, Ropes Bros	Danvers†	—	43.39	43.00	—	9.00	—
Magnolia, W. J. Meek	Fall River†	—	44.71	43.00	—	9.00	—
Magnolia, H. Bullukian	Franklin†	—	43.75	43.00	—	9.00	—
Magnolia, H. K. Webster Co	Lawrence	7.64	40.94	43.00	10.68	9.00	—

† Spring collection, 1905.
‡ Guaranteed by J. E. Soper & Co., Boston.

COTTONSEED MEAL—(CONTINUED).

Manufacturer or Jobber, Brand and Retailer.	Sampled at:	Water	Protein. Found.	Protein. Guar.	Fat. Found	Fat. Guar.	Fiber.
		%	%	%	%	%	%
Chas. M. Cox Co., Boston.							
Magnolia, ... Highland Mills	Newton H'd's	8.26	42.11	43.00	8.47	9.00	—
Magnolia, ... Prentiss, Brooks & Co	Westfield†	—	43.92	43.00	—	9.00	—
E. A. Cowee	Worcester	6.92	42.16	38.50	12.70	7.00	—
Humphreys, Godwin & Co., Memphis, Tenn							
Dixie, ... Carpenter & French...	N. Reading† ..	—	46.42	43.00	9.52	9.00	—
Dixie, ... F. E. Brooks	S. Fram'g'm†.	—	45.28	43.00	—	9.00	—
Dixie, ... Pierce & Winn Co.....	Arlington	8.48	41.77	41.00	7.67	9.00	—
Dixie, ... W. N. Potter & Sons..	Greenfield† ...	—	42.16	41.00	—	9.00	—
Dixie, ... Burr Co	Ludlow	8.91	41.29	41.00	7.51	9.00	—
Dixie, ... Daly Bros	Uxbridge	8.72	41.81	41.00	8.26	9.00	—
Hunter Bros. Milling Co., St. Louis.							
A. M. Haggart	Franklin† ...	—	42.46	43.00	—	9.00	—
S. R. Carter	W. Berlin† ...	—	43.31	43.00	—	9.00	—
W. A. Kaiser & Co., Memphis, Tenn.							
Eagle, ... S. J. Reed	Amherst	9.39	42.29	43.00	7.25	9.00	—
Eagle, ... S. A. Eastman	Milford†	—	44.14	43.00	—	9.00	—
D. L. Marshall Co., Boston.							
Phoenix, ... J. F. Hunt	Lynn†	—	44.18	43.00	—	9.00	—
Phoenix, ... H. A. Crossman	Needham† ...	—	40.98	43.00	7.60	9.00	—
Mississippi Cotton Oil Co., Greenville, Miss							
B. W. Brown	Concord	8.63	42.69	40.00	10.89	—	—
S. B. Greene & Co	Watertown ...	8.58	42.87	40.00	10.80	—	—
Sledge & Wells Co., Memphis, Tenn.							
Star, ... J. Burkhardt	Beverly†	—	43.22	43.00	—	9.10	—
Star, ... J. Lally Jr.	Milford†	—	43.05	43.00	—	9.10	—
J. E. Soper & Co., Boston.							
W. P. Whittemore	Roslindale ...	9.21	42.11	41.00	7.48	9.00	—
Highest	....	9.39	46.42	—	12.70	—	—
Lowest	....	6.92	40.89	—	7.25	—	—
Average	....	8.49	42.87	—	8.95	—	—
Medium Grade.							
American Cotton Oil Co., New York.							
Bedford Coal & Grain Co	Bedford†	—	40.06	41.00	8.01	9.00	—
Squier & Co	Munson†	—	40.06	41.00	9.04	9.00	—
Squier & Co	Munson	8.35	39.14	41.00	7.47	9.00	—
G. S. Ladd	Sturbridge† ..	—	39.36	41.00	8.54	9.00	—
Chas. M. Cox Co., Boston.							
F. F. Woodward & Co	Ayer	7.86	38.87	38.50	8.45	7.00	—
Georgia Cotton Oil Co., Augusta, Ga.							
J. W. Waite	Easthampton .	8.86	37.73	38.61	7.09	8.00	—
S. A. Eastman	Milford	9.40	38.08	38.61	7.10	8.00	—
Potter Grain Co	Shelb'ne Falls	8.70	37.20	38.61	6.83	8.00	11.08

† Spring collection, 1905.

COTTONSEED MEAL—(CONTINUED).

Manufacturer or Jobber. Brand and Retailer.	Sampled at:	Water.	Protein. Found.	Protein. Guar.	Fat. Found.	Fat. Guar.	Fiber.
		%	%	%	%	%	%
Hunter Bros. Milling Co., St. Louis.							
J. B. Frost	Shelb'ne Falls†	—	40 01	43 00	7.10	9.00	—
Warner Bros	Sunderland†	—	39.97	43.00	—	9.00	—
Cutler Co.	N. Wilbrah'm†	—	38.30	38.57-41	8.96	8-9	—
D. L. Marshall Co., Boston.							
Phoenix .... S. B. Green & Co	Watertown	8.54	39.84	43.00	10.17	9.00	—
N. Carolina Cotton Oil Co., Henderson, N.C.							
Lummus & Parker	Danversport	8.87	40.41	38.61	7.22	8.00	—
Sledge & Wells Co., Memphis, Tenn.							
Star, ... A. P. Ames & Co	Peabody	8.41	40.06	43.00	9.42	9.00	—
J. E. Soper & Co., Boston.							
City Mills Co.	Holyoke	9.16	36.59	38.50	7.46	8.00	10.66
Walker Bros., Griffin, Ga.							
H. A. Crossman	Needham	8.29	40.54	—	9.73	—	—
J. T. & R. S. Wells, Memphis, Tenn.							
W. W. Holmes	Webster	7.81	37 99	43.00	12.39	9.00	—
Wilson & Holden	Worcester	7.81	37.20	43.00	13.82	9.00	—
Unknown.							
G. C. Turner	Chester	8.41	38.79	—	8.23	—	—
Highest		9.40	40.54	—	13.82	—	—
Lowest		7.81	36.59	—	7.09	—	—
Average		8.50	38.95	—	8.72	—	—
Low Grade.							
T. Eddleston, Newton, Mass.							
G. M. Foster	Lowell	10.09	26.72	24.00	4.89	4.00	—
Pierce & Winn Co.	Arlington	9.33	27 52	23.00	5.46	4.00	—
G. B. Pope & Co.	Waltham	9.42	27.29	23.00	5.46	4.00	—
Florida Cotton Oil Co., Jacksonville, Fla.							
Sea Island, ... Rice Bros	Boston†	9.01	24 62	24.00	7.49	6.00	17.75
Sea Island, ... Torrence, Vary & Co.	Lynn†	—	25.89	24.00	6.82	6.00	—
Sea Island, ... W. W. Holmes	Webster	10.23	24.39	24 00	5 86	6.00	—
J. B. Garland & Son., Worcester.							
Healthful, ... J. B. Garland & Son	Worcester	10.37	24.79	24.00	5.17	6.00	—
Average		9.74	25.89	—	5.88	—	—

† Spring collection, 1905.

LINSEED MEAL.

Manufacturer or Jobber, Brand and Retailer.	Sampled at:	Water.	Protein.		Fat.		Fiber.
			Found.	Guar.	Found.	Guar.	
		%	%	%	%	%	%
1. New Process.							
American Linseed Co., Chicago.							
Cleveland Flax, Bedford Coal & Grain Co	Bedford	9.67	36.82	40.00	1.96	3.00	—
Cleveland Flax, S. A. Eastman	Milford	10.24	37.34	40.00	2.03	3.00	—
Squier & Co	Monson	9.77	36.95	40.00	2.98	3.00	—
S. Gannett	Milton†	—	37.69	37-40	2.34	1-3	—
A. S. Gurney	Wareham†	—	37.78	37-40	2.65	1-3	—
Charlemont Co-op Ass'n	Charlemont	—	38.34	36-40	3.59	1-3	—
Average		9.89	37.49	—	2.59	—	—
2. Old Process.							
American Linseed Co., New York.							
W. N. Potter's Sons & Co	Hadley	9.44	36.91	32-36	7.51	5-7	—
G. H. Beale	Huntington†	—	34.71	32-36	6.52	5-7	—
H. H. Capen	Spencer	10.32	33.92	32-36	6.95	5-7	—
Flint Mill Co., Milwaukee.							
C. P. Washburn	Middleboro†	—	30.94	29-34	6.61	5-7	—
Hauenstein & Co., Buffalo.							
F. A. Sherwin	Groton†	—	35.62	35.65	—	7.62	—
C. G. Burnham	Holyoke†	—	35.53	35.65	7.03	7.62	—
Kellogg & Miller, Amsterdam, N. Y.							
A. D. Potter	Orange	9.43	35.67	36.70	9.32	7.83	—
R. W. Renfrew & Son	Pittsfield†	—	34.71	36.70	10.80	7.83	—
C. E. Ward	Buckland†	—	33.13	‡1.00	10.32	‡1.00	—
Mann Bros., Buffalo.							
C. B. Benedict	Gt Barrington†	—	35.76	34.15	—	6.05	—
E. H. Smith	Northboro†	—	35.49	34.15	7.63	6.05	—
Metzger Seed and Oil Co. Toledo, Ohio.							
Burr Co	Ludlow	9.32	32.69	30.00	5.71	5.00	—
Midland Linseed Co., Minneapolis.							
J. Cushing & Co	N. Cambridge†	—	34.14	32-37½	9.17	5.5-8.5	—
Howe Bros	Gardner†	—	32.03	30-35	7.95	5.5-8.5	—
Burbeck & Brett	N. Abington	9.50	33.13	30.00	7.25	5.00	—
Average		9.60	34.29	—	7.91	—	—

VISCID OIL MEAL.

Manufacturer or Jobber, Brand and Retailer.	Sampled at:	Water.	Protein Found.	Protein Guar.	Fat Found.	Fat Guar.	Fiber.
Milwaukee Elevator Co., Milwaukee.							
Chandler Gr. & Mill. Co	Lawrence	9.31	29.00	34.00	10.63	5.00	—

† Spring collection, 1905.
‡ Guaranteed by retailer.

GLUTEN MEAL.

Manufacturer or Jobber, Brand and Retailer.	Sampled at:	Water.	Protein. Found.	Protein. Guar.	Fat. Found.	Fat. Guar.	Fiber.
		%	%	%	%	%	%
Glucose Sugar Refining Co., Chicago.							
Chicago, ...Scott Grain Co	Amesbury ...	9.27	33.39	38.00	3.00	3.00	—
Chicago, ...S. A. Eastman........	Milford	10.47	33.30	38.00	4.02	3.00	—
Chicago, ...J. Paull & Co.........	Taunton	10.40	33.61	38.00	2.71	3.00	—
Chicago, ...E. A. Cowee..........	Worcester ...	11.05	32.78	38.00	4.22	3.00	—
Cream, ...Mackenzie & Winslow	Fall River ...	8.20	34.80	35.50	2.48	3.00	—
Cream, ...Wilson & Holden, ...	Worcester ...	10.85	33.43	35.50	4.23	3.00	—
Average, ...	....	10.04	33.55	—	3.44	—	—

GLUTEN FEEDS.

Manufacturer or Jobber, Brand and Retailer.	Sampled at:	Water.	Protein. Found.	Protein. Guar.	Fat. Found.	Fat. Guar.	Fiber.
Buffalo Cereal Co., Buffalo.							
C. F. Eddy Co........	W. Newton ..	9.94	25.45	28.00	4.27	3.00	—
Flint Mill Co., Milwaukee.							
C. S. Barber..........	Bernardston ..	9.80	24.31	27.00	3.84	3.00	—
G. P. Rogers	Worcester ...	8.87	25.45	27.00	3.63	3.00	—
Glucose Sugar Refining Co., Chicago.							
Buffalo, ...W. A. Haynes Co.....	Maynard	8.43	24.70	27.50	3.83	2.50	—
Buffalo, ...Wallace Bros.........	Clinton	9.99	25.14	25.00	2.96	3.00	—
Buffalo, ...W. L. Palmer.........	Medway......	10.52	25.14	25.00	3.44	3.00	—
Buffalo, ...H. A. Crossman	Needham	7.91	24.18	25.00	3.61	3.50	—
Buffalo, ...H. C. Puffer Co	Springfield ...	8.65	23.87	25.00	3.17	3.00	—
Buffalo, ...Curley Bros	Wakefield	6.61	25.14	25.00	2.60	3.50	—
Buffalo, ...H. G. Hill	Williamsburg	8.20	26.63	25 00	3.08	3.00	—
Pekin,..........G. M. Foster	Lowell	8.41	24 74	25.00	3.68	3.00	—
Pekin,..........E. C. Paull	Taunton	7.67	24.04	25.00	3.83	3.00	—
Pekin,..........W. W. Holmes	Webster......	7.84	24.74	25.00	4.06	3.00	—
Pekin,..........J. B. Garland & Son...	Worcester ...	8.21	24.48	25.00	3.93	3.00	—
New York Glucose Co., New York.							
Globe,..........W.N.Potter'sSons&Co	Hadley	7.52	27.56	26.00	3.07	2.50	—
Globe,..........J. M. Johnson	Medfield	8.15	26.59	26.00	3.38	2.50	—
Globe,..........H. C. Puffer Co	Springfield ...	7.93	25.62	26.00	3.22	2.50	—
St. Louis Syrup & Pres. Co., St. Louis.							
Tiger, ...City Mills Co.........	Holyoke......	7.31	25.27	25.00	3.80	2.75	—
Tiger, ...A. J. Richards & Son .	Quincy	9.31	25 09	25.00	3.95	2.75	—
Tiger, ...G. B. Pope & Co	Waltham	10.45	26.94	25.00	3.63	2.75	—
Tiger, ...Blake, Sampson & Co.	Worcester ...	8.86	25.14	25.00	3.60	2.75	—
Warner Sugar Ref'ng Co., Waukegan, Ill.							
Warner's, ...G. S. Whitney	Concord J'c'n	8.82	23.52	25.00	4.13	3.00	—
Warner's, ...J. C. Belville & Co	Feeding Hills	9.15	24.00	25.00	4.06	3.00	—
Unknown.							
W. P. Whittemore	Roslindale ...	9.28	22.25	28.00	2.55	3.00	—
Average, ...	....	8.66	25.01	—	3.56	—	—

GLUTEN FEEDS.—(Continued).

Manufacturer or Jobber, Brand and Retailer.	Sampled at:	Water.	Protein. Found.	Protein. Guar.	Fat. Found.	Fat. Guar.	Fiber.
		%	%	%	%	%	%
Low Grade.							
Douglas & Co., Cedar Rapids, Iowa.							
F. E. Smith	Amherst	7.04	17.42	26.50	3.56	3.30	—
E. H. Dyer	Belchertown	7.44	16.72	26.50	3.74	3.00	—
B. W. Brown	Concord	8.13	16.81	26.50	4.04	3.30	—
A. M. Haggart	Franklin	7.28	19.88	26.50	4.51	3.30	—
B. F. Kingsbury & Co.	Taunton	7.78	17.64	26.50	3.12	3.30	—
L. A. Snow	Upton	7.13	17.46	26.50	3.63	3.30	—
Michigan Starch Co., Travers City, Mich.							
Golden Rod, ...J. Burkhart.	Beverly	9.06	19.88	27.00	4.32	4.00	—
J. E. Soper & Co., Boston.							
Bay State, ...C. G. Burnham	Holyoke	7.67	15.88	26.00	4.39	3.00	—
Average.		7.69	17.71	—	3.91	—	—
Average analysis Spring collection, 1905.		—	24.84	—	3.14	—	—

DISTILLERS' DRIED GRAINS.

Manufacturer or Jobber, Brand and Retailer.	Sampled at:	Water.	Protein. Found.	Protein. Guar.	Fat. Found.	Fat. Guar.	Fiber.
J. W. Biles Co., Cincinnati.							
Fourex, ...J. B. Bridges & Co.	S. Deerfield	7.25	32.29	33.00	12.23	11.00	—
Fourex, ...J. S. Nason & Co	Westboro	8.02	33.61	33.00	12.55	11.00	—
Chapin & Co., Boston.							
Ajax Flakes, ...H. C. Puffer Co	Springfield	5.69	30.62	33.00	12.23	12.00	—
Ajax Flakes, ...M. J. Jencks	Webster	7.09	33.25	33.00	12.71	12.00	—
Continental Cereal Co., Peoria, Ill.							
Continental, ...W. A. Haynes	Maynard	6.75	29.84	35.00	11.06	12.50	—
Dewey Bros., Blanchester, Ohio.							
Corn Protegran, Cutler Co	W. Brookfield	7.37	33.13	33.00	12.58	8.50	—
Low Grade.							
Charles A. Krause Grain Co., Milwaukee.							
Blue Ribbon,...H. C. Puffer Co	Springfield	6.68	26.02	33.00	10.94	11.00	—
Average,		6.98	31.25	—	12.04	—	—
Average analysis Spring collection, 1905,		—	32.35	—	11.83	—	—

MALT SPROUTS.

Manufacturer or Jobber, Brand and Retailer.	Sampled at:	Water.	Protein. Found.	Protein. Guar.	Fat. Found.	Fat. Guar.	Fiber.
Chas. M. Cox Co., Boston.							
W. A. Haynes	Maynard	10.03	25.32	25-27	1.53	1.50-3.	—
Chas. A. Krause Grain Co., Milwaukee.							
M. C. Richmond	Adams	10.64	29.18	26.00	1.08	1.50	—

MALT SPROUTS.—(CONTINUED).

Manufacturer or Jobber, Brand and Retailer.	Sampled at:	Water.	Protein.		Fat.		Fiber.
			Found.	Guar.	Found.	Guar.	
		%	%	%	%	%	%
Meurer, Deutsch Sickert & Co., Milwaukee.							
C. D. Holbrook & Co.	Palmer	10.63	27.20	25.00	1.11	2.00	—
Henry Rang & Sons., Chicago.							
Malden Grain Co	Malden	9.09	23.96	26.20	0.96	1.11	—
Malden Grain Co	Malden	8.82	22.99	26.20	1.30	1.11	—
D. W. Ranlet, Boston.							
Jaquith & Co	Woburn......	10.62	25.98	23-25	1.05	1-1.5	—
Average, ...	....	9.97	25.77	—	1.17	—	—
Average analysis Spring collection, 1905,	....	—	27.43	—	0 96	—	—

BREWERS' GRAINS.

Manufacturer or Jobber, Brand and Retailer.	Sampled at:	Water.	Protein Found.	Protein Guar.	Fat Found.	Fat Guar.	Fiber.
Chas. A. Krause Grain Co., Milwaukee.							
Superior,.......E. A. Kellogg & Son ..	Feeding Hills	7.46	28.65	22.00	7.75	11.00	—
Superior, ...H. C. Puffer Co.......	Springfield ...	8.85	34.10	22.00	6.59	11.00	12.21
Low Grade.							
E. P. Mueller, Milwaukee.							
H. A. Crossman	Needham	10.11	16.59	24.86	6.26	5.69	12.16

WHEAT MIDDLINGS.

Manufacturer or Jobber, Brand and Retailer.	Sampled at:	Water.	Protein Found.	Protein Guar.	Fat Found.	Fat Guar.	Fiber.
1. Flour.							
Chas. M. Cox Co., Boston.							
F. H. Crane & Sons...	Quincy	10.00	17.25	—	4.35	—	—
Northwest. Consol. Mill. Co., Minneapolis.							
XXX Comet, ...A. D. Potter..........	Orange.......	10.87	17.29	—	4.95	—	—
Pillsbury-Washburn Co., Minneapolis.							
Daisy,..........C. S. Barber..........	Bernardston .	10.41	17.46	—	4.86	—	—
Washburn-Crosby Co., Minneapolis.							
Adrian,.........G. F. Procter & Co ...	Revere	10.62	17.64	—	5.07	—	—
Average, ...	....	10.84	17.41	—	4.81	—	—
Average analysis Spring collection, 1905,	....	—	15.91	—	4.01	—	—
2. Standard.							
Berger-Crittenden Milling Co., Milwaukee							
Badger, ...R. McCrea & Son	Dalton	9.55	15.67	—	4.94	—	—

WHEAT MIDDLINGS—(CONTINUED).

Manufacturer or Jobber, Brand and Retailer.	Sampled at:	Water.	Protein. Found.	Protein. Guar.	Fat. Found.	Fat. Guar.	Fiber.
		%	%	%	%	%	%
Seymour Carter, Hastings, Minn.							
Snowball, ...F. F. Woodward Co.,	W. Fitchburg	10.01	17.86	—	5.14	—	—
Snowball, ...C. Jones.............	Lynn	10 77	16.19	—	4.54	—	—
Chas. M. Cox Co., Boston.							
Puritan, ...B. W. Brown.........	Concord	10.42	15.58	—	4.43	—	—
Globe Milling Co., Perham, Minn.							
A. P. Ames & Co	Peabody	10.60	15.32	—	5.09	—	—
New Prague F.M. Co., New Prague, Minn.							
E. C. Paull	Taunton	10.18	16.62	—	5.31	—	—
J. B. Garland & Son ..	Worcester....	9.12	16.50	—	5.46	—	—
Northwest.Consol.Mill.Co., Minneapolis.							
D. H. Craig	Plymouth	10.73	15.75	—	4.84	—	—
Northwest. Elevator & Mill Co., Toledo.							
Taylor's, ...D. H. Craig	Plymouth	10.35	18.16	—	4.23	—	—
Pillsbury-Washburn Co., Minneapolis.							
Brown, ...Burr Co..............	Ludlow	10.03	14.48	—	5.24	—	—
Sheffield-King Milling Co., Minneapolis.							
White, ...Highland Mills	Newton	10.36	15.09	—	4.24	—	—
Star & Crescent Milling Co., Chicago.							
E. H. Doble & Co.....	W. Quincy ...	10.52	16.50	—	4.84	—	—
ValleyCityMillingCo.,GrandRapids,Mich.							
R. McCrea & Son	Dalton	11.03	15.84	—	4.61	—	—
Washburn-Crosby Co., Minneapolis.							
A. J. Richards & Son .	Quincy	10.70	15.71	—	4.91	—	—
Unknown.							
J. Burkhardt..........	Beverly	11.02	16 02	—	4.51	—	—
Hingham Grain Mill ..	Hingham	10.29	17.77	—	5.72	—	—
Highland Mills	Newton H'd's	10 06	15.79	—	4.59	—	—
Average.	....	10.34	16.17	—	4.86	—	—
Average analysis Spring collection, 1905,	....	—	15.83	—	—	—	—

WHEAT MIXED FEED.

Manufacturer or Jobber, Brand and Retailer.	Sampled at:	Water.	Protein. Found.	Protein. Guar.	Fat. Found.	Fat. Guar.	Fiber.
Acme Milling Co., Indianapolis, Ind.							
Acme,...........Lummus & Parker	Danversport..	10.41	16.81	—	4.54	—	—
Acme,..........Robinson & Jones	Natick	10.18	16.23	—	4.32	—	—
American Cereal Co., Chicago.							
Buckeye, ...C. G. Burnham	Holyoke	10.11	15.79	17 75	4.67	4.70	—
Buckeye, ...J. Lally, Jr	Milford	10.68	16.19	17.75	4.45	4.70	—

WHEAT MIXED FEED.—(CONTINUED.)

Manufacturer or Jobber, Brand and Retailer.	Sampled at:	Water.	Protein.		Fat.		Fiber.
			Found.	Guar.	Found.	Guar.	
		%	%	%	%	%	%
Annan, Burg & Co., St. Louis.							
Diamond, ...J. W. Doon & Son....	Natick	10.59	15.79	—	4.67	—	—
Diamond, ...W. P. Whittemore	Roslindale ...	9.55	15.84	—	4.46	—	—
Diamond, ...W. P. Whittemore	Roslindale ...	11.07	15.40	—	4.78	—	—
Ansted & Burk, Springfield, Ohio.							
H. Knight	Newburyport	9.74	16.90	—	4.39	—	—
Bay State Milling Co., Winona, Minn.							
Bay State,......Brockelman Bros.	Clinton	10.31	15.14	—	4.98	—	—
Burbeck & Breck, North Abington, Mass.							
All Right, ...Burbeck & Breck.....	N. Abington.	10.46	16.90	—	4.51	—	—
Chapin & Co., Boston.							
Edison, ...J. S. Beless...........	W. Bridgew'ter	9.89	15.93	—	4.39	—	—
Erie, ...W. L. Palmer.........	Medway	9.34	15.23	—	4.24	—	—
Pine Tree,......Eastern Grain Co.....	Bridgewater ..	10.55	16.28	—	5.08	—	—
Chas. M. Cox Co., Boston.							
Columbia, ...J. S. Nason & Co.....	Westboro	10.62	14.35	—	4.68	—	—
Eagle Fancy, ...A. S. Gurney & Co ...	Wareham	11.97	13.65	—	3.78	—	—
Fancy, ...H. K. Webster Co....	Lawrence	10.08	14.87	—	4.68	—	—
Monogram,.....E. A. Cowee..........	Worcester....	10.65	14.48	—	4.75	—	—
Wirthmore, ...C. Jones	Lynn	10.33	14.88	17.00	4.04	4.00	—
Flint Mill Co., Milwaukee.							
Huron, ...F. E. Smith	Amherst	10.81	15.32	—	4.68	—	—
Huron, ...H. W. Kimball	Westboro	10.83	15.01	—	4.66	—	—
Rutland,........A. E. Gilbert	W. Brookfield	10.92	15.01	—	4.64	—	—
Vermont, ...G. A. Stevens	Worcester....	10.28	15.01	—	4.70	—	—
Garland Milling Co., Greenburg, Ind.							
Garland,........F. E. Brooks	S. Framing'm	9.65	13.95	—	3.94	—	—
Rodney J. Hardy & Son, Boston.							
Berkshire, ...J. W. Doon & Son....	Natick	9.88	14.35	—	4.06	—	—
Isaac Harter Milling Co., Toledo, Ohio.							
Wilson & Holden	Worcester....	10.52	15.97	—	4.19	—	—
Hunter Bros. Milling Co., St. Louis.							
Matchless,......Mackenzie & Winslow	Fall River....	9.90	16.14	—	4.37	—	—
Sunshine, ...J. W. Doon & Son....	Natick	10.63	15.67	—	4.21	—	—
Sunshine, ...Curley Bros	Wakefield	11.08	16.14	—	4.40	—	—
J. E. M. Milling Co., Frankfort, Ky.							
Kyome, ...J. O. Ellison & Co	Haverhill	9.79	17.07	—	4.41	—	—
Kyome, ...S. E. Benson	Melrose	9.72	15.14	—	3.92	—	—
Lawrenceburg Roller Mills, Lawrenceburg, Ind.							
Snowflake,......C. G. Jordan	Weymouth ...	9.67	17.20	—	4.46	—	—
Noblesville Milling Co., Noblesville, Ind.							
N. M. Co's, ...Haverhill Milling Co..	Haverhill	10.01	15.71	—	4.45	—	—

WHEAT MIXED FEEDS.—(Continued).

Manufacturer or Jobber, Brand and Retailer.	Sampled at:	Water	Protein. Found.	Protein. Guar.	Fat. Found.	Fat. Guar.	Fiber.
		%	%	%	%	%	%
Northwest. Consol. Mill Co., Minneapolis.							
Planet, ...W. N. Potter & Sons..	Greenfield ...	10.08	15.27	—	4.76	—	—
Phoenix Milling Co., Minneapolis.							
Phoenix, ...F. F. Woodward & Co	Ayer	9.85	14.97	—	4.92	—	—
Pillsbury-Washburn Co., Minneapolis.							
Fancy, ... Bedford Coal&Grain Co	Bedford	11.78	16.19	—	4.93	—	—
Rex Mills, Kansas City, Mo.							
Rex, ...Lummus & Parker	Danversport..	10.68	16.37	—	4.61	—	—
Rex,............A. M. Haggart........	Franklin	10.90	15.62	—	4.21	—	—
Royal Milling Co., Minneapolis.							
Ben Hur,.. ....F. F. Woodward & Co.	W. Fitchburg	10.12	17.16	—	5.11	—	—
Henry Russell, Albany, N. Y.							
Regular, ...J. M. Johnson	Medfield	10.10	14.57	—	4.73	—	—
Regular, ...Hathaway& Mackenzie	New Bedford	10.06	14.70	—	4.85	—	—
Russell-Miller Milling Co., Minneapolis.							
Occident, ...J. Loring & Co........	Watertown ...	10.54	14.09	—	4.96	—	—
Occident, ...J. B. Garland & Son ..	Worcester ...	9.94	14.83	—	5.12	—	—
Schultz, Baujan & Co., Beardstown, Ill.							
C. F. Eddy	W. Newton...	9.58	14.04	—	4.00	—	—
Sheffield-King Milling Co., Minneapolis.							
Gold Mine, ...A. M. Thompson	Worcester ...	9.98	14.74	—	4.44	—	—
Sparks Milling Co., Alton, Ill.							
Try-Me,........J. F. Shine............	Dedham	10.02	15.88	—	4.47	—	—
Stratton & Co., Concord, N. H.							
Lexington Grain Co ..	Lexington ...	11.35	15.67	—	4.55	—	—
Valley City Mill. Co., Grand Rapids, Mich.							
Farmer's Favorite.R. McCrea & Son, ..	Dalton	10.20	14.74	—	4.40	—	—
WaggonerGates M.Co., Independence, Mo.							
W. J. Meek	Fall River....	9.37	16.63	—	4.85	—	—
Unknown.							
H. M. Co.,......J. Lally, Jr	Milford	9.66	14.66	—	4.04	—	—
Cairo,..........J. P. Seabury	N. Dartmouth	10.45	15.62	—	4.43	—	—
G. W., ...J. M. Johnson	Medfield	9.91	14.09	—	4.51	—	—
A. E. Gilbert	W. Brookfield	10.30	14.53	—	4.54	—	—
Highest	....	11.97	17.20	—	5.12	—	—
Lowest	....	9.34	13.65	—	3.78	—	—
Average................	....	10.29	15.44	—	4.52	—	—
Average analysis Spring collection, 1905	....	—	14.86	—	—	—	—

WHEAT FEEDS WITH ADMIXTURES.

Manufacturer or Jobber, Brand and Retailer.	Sampled at:	Water	Protein.		Fat.		Fiber.
			Found.	Guar.	Found.	Guar.	
		%	%	%	%	%	%
Brooks Elevator Co., Minneapolis.							
Peerless, ...A. Dodge & Son......	Beverly	10.50	15.27	13.15	3.73	3.50	—
Royal, ...South Shore Grain Co	Quincy	10.53	15.75	16.61	4.69	5.48	—
J. H. Cressey & Co., Boston.							
Indiana, ...Butman & Cressey....	Lynn.........	9.15	12.73	12.05	3.79	3.20	—
Indiana,.........S. A. Eastman........	Milford	9 93	10 58	12.05	2.04	3.20	—
Indiana,........C. H. Spring..........	Newt'n L.Falls	9.19	12.60	12.05	3.51	3.20	—
Indiana Milling Co., Terre Haute, Ind.							
Jersey, ...O. B. Burnham	Beverly	9.27	10.23	12 05	2.88	3.20	—
Jersey, ...C. D. Holbrook & Co .	Palmer	9.13	11.67	12.05	3.25	3.20	—
Jersey, ...J. B. Bridges & Co....	S. Deerfield ..	9.42	11.63	12.05	3.13	3.20	—
Jennings & Fulton, Boston.							
Dairy,..........J. H. Nye	Brockton	9.35	11.63	12.05	3.40	3.26	—
J. H. Rodebaugh, Buffalo.							
Stone Mills,....Mackenzie & Winslow	Fall River....	9.98	11.02	12.59	2.79	3.19	—
Average..............	....	9.65	12.31	—	3.32	—	—
Average analysis Spring collection, 1905	....	—	12.00	—	2.94	—	—

WHEAT BRAN.

Ansted & Burk Co., Springfield, Ohio.							
H. Knight	Newburyport	10.35	15.14	—	3.97	—	—
Berger=Crittenden MillingCo.,Milwaukee							
R. McCrea & Son	Dalton	9.57	14.44	—	4.11	—	—
Barber Milling Co., Minneapolis.							
E. C. Paull	Taunton	9.73	16.81	—	4.43	—	—
Hunter Bros. Milling Co., St. Louis.							
Hunter's Extra, Eastern Grain Co.....	Bridgewater ..	9.93	15.71	—	4.23	—	—
J.F.Meyer & SonsMill. Co.,Springfield,O.							
Albatross, ...South Shore Grain Co	Quincy	10.43	15.93	—	4.89	—	—
NewPragueFlour.MillCo.,NewPrague,Ind							
Go-Far, ...G. F. Proctor & Co ..	Revere	9.66	13.38	—	4.53	—	—
N'western Elevator & Mill Co.,Toledo, O.							
Taylor's,........D. H. Craig	Plymouth	9.94	15.75	—	4.11	—	—
Pillsbury=Washburn Co., Minneapolis.							
E. A. Kellogg & Sons .	Feeding Hills	9.51	15.34	—	4.99	—	—
Star and Crescent Milling Co., Chicago.							
J. F. Shine	Dedham	9.40	14.09	—	5.02	—	—

WHEAT BRAN—(Continued).

Manufacturer or Jobber, Brand and Retailer.	Sampled at:	Water.	Protein. Found.	Protein. Guar.	Fat. Found.	Fat. Guar.	Fiber.
		%	%	%	%	%	%
Valley City Mill.Co., Grand Rapids, Mich.							
R. McCrea & Son.....	Dalton	10.84	14.92	—	4.43	—	—
Washburn=Crosby Co., Minneapolis.							
Burr Co	Ludlow.......	9.75	13.82	—	4.42	—	—
E. S. Woodworth & Co., Minneapolis.							
BedfordCoal&GrainCo	Bedford	8.59	13.08	—	3.92	—	—
Unknown.							
W. J. Meek...........	Fall River....	9.43	15.06	—	4.24	—	—
Canada, ...C. S. Barber..........	Bernardston ..	9.97	14.35	—	4.49	—	—
Hingham Grain Co....	Hingham	10.32	14.17	—	4.58	—	—
South Shore Grain Co	Quincy.......	9.38	14.09	—	4.52	—	—
Average	....	9.80	14.63	—	4.43	—	—
Average analysis Spring collection, 1905	....	—	14.21	—	—	—	—

DAIRY FEEDS.

Manufacturer or Jobber, Brand and Retailer.	Sampled at:	Water.	Protein. Found.	Protein. Guar.	Fat. Found.	Fat. Guar.	Fiber.
J. Bibby & Sons, Liverpool, Eng.							
Bibby's Cake, ..G. B. Pope & Co......	Waltham	10.17	18.69	20.00	6.23	5.00	—
Bibby's Cake, ..G. B. Pope & Co......	Waltham	10.71	18.78	20.00	6.09	5.00	—
J. W. Biles Co., Cincinnati.							
Union Grains, ..W.N.Potters' Sons&Co	Hadley.......	8.01	23.65	24.00	7.47	7.00	—
Union Grains, ..J. M. Johnson	Medfield	8.30	25.19	24.00	6.62	7.00	—
Union Grains, ..C. B. & F. H. Goss....	Melrose	7.57	23.96	24.00	7.86	7.00	—
Union Grains, ..W. N. Potter Co......	Shelb'ne Falls	8.51	23.61	24.00	6.59	7.00	—
Union Grains, ..Jaquith & Co.........	Woburn......	7.36	23.13	24.00	7.63	7.00	—
Buffalo Cereal Co., Buffalo.							
Creamery ......C. F. Eddy & Co	W. Newton ..	8.47	20.18	20.00	5.41	5.00	—
Flint Mill Co., Milwaukee.							
Vulcan Grains,..H. W. Kimball	Westboro	8.19	21.68	24.00	4.45	7.00	—
H=O Co., Buffalo.							
H-O, ...Cutler Co	N. Wilbraham	7.69	19.27	18.00	5.42	4.50	—
H-O, ...A. E. Gilbert	W. Brookfield	8.26	18.56	18.00	4.99	4.50	—
Ralston Purina Co., St. Louis.							
Protena,........City Mills Co.........	Holyoke	9.01	20.62	20.00	3.53	3.50	—
Protena,........South Shore Grain Co	Quincy	8.14	18.07	20.00	4.47	3.50	—
Protena,........E. W. Kenerson & Co	Worcester....	8.85	21.41	20.00	4.87	3.50	—

SUGAR FEEDS.

Manufacturer or Jobber, Brand and Retailer.	Sampled at:	Water	Protein. Found.	Protein. Guar.	Fat. Found.	Fat. Guar.	Fiber.
		%	%	%	%	%	%
American Milling Co., Chicago.							
Sucrene Dairy. . . City Mills Co	Holyoke.	12.05	15.44	16.50	3.45	3.50	—
Sucrene Dairy,. . W. W. Holmes	Webster	12.31	15.84	16.50	3.49	3.50	—
Sucrene Horse, Mackenzie & Winslow	Fall River....	9.73	13.39	13.50	2.69	3.50	—
Suerene Horse, A. J. Richards & Son	Quincy	7.61	13.08	13.50	2.91	3.50	—
Chapin & Co., Boston.							
Green Diamond, F. E. Smith	Amherst	9.85	12.20	16.50	1.88	3.50	—
Green Diamond, A. E. Gilbert..........	W. Brookfield	9.77	12.60	16.50	2.03	3.50	—
Green Diamond, H. W. Kimball	Westboro	10.68	11.58	16.50	1.96	3.50	—
F. W. Goeke & Co., St. Louis.							
Holstein, ... Bedford Coal & Grain Co	Bedford	12.26	11.93	15.23	1.89	3.27	—
Henry Tate & Sons, London, Eng.							
Molassine Meal, C. B. & F. H. Goss ..	Melrose	21.41	7.68	—	0.42	—	5.25
Western Grain Products Co., Milwaukee.							
Hammond. ..... A. M. Haggart........	Franklin	8.48	16.06	17.00	3.29	3.50	—
Hammond, ... J. Bouvier............	New Bedford	11.29	14.83	17.00	3.13	3.50	—
Average	....	11.40	13.15	—	2.47	—	—

RYE FEEDS.

Manufacturer or Jobber, Brand and Retailer.	Sampled at:	Water	Protein. Found.	Protein. Guar.	Fat. Found.	Fat. Guar.	Fiber.
Geo. Callanan, Castleton, N. Y.							
G. C. Turner	Chester	11.74	15.14	12.00	2.59	2.00	—
Oneonta Milling Co., Oneonta, N. Y.							
W. N. Potter & Co....	Charlemont ..	11.58	14.70	14.75	3.21	3.50	—
W. N. Potter & Sons..	Greenfield ..	10.65	16.67	14.75	3.33	3.50	—
Red Mills Feed Co., Ashley Falls, Mass.							
Red Mills Feed Co....	Ashley Falls..	11.59	14.57	14.00	2.75	3.00	—
Average.............	....	11.39	15.27	—	2.97	—	—
Average analysis Spring collection, 1905	....	—	14.58	—	2.82	—	—

BUCKWHEAT FEEDS.

Manufacturer or Jobber, Brand and Retailer.	Sampled at:	Water	Protein. Found.	Protein. Guar.	Fat. Found.	Fat. Guar.	Fiber.
Burkett Mills, Penn Yan, N. Y.							
City Mills Co	Holyoke	10.14	13.56	—	3.67	—	18.67
Dayton Milling Co., Towanda, Penn.							
W. Baylies	New Bedford	10.64	18.07	12.13	4.43	1.62	25.13

CALF MEAL.

Manufacturer or Jobber, Brand and Retailer.	Sampled at:	Water	Protein. Found.	Protein. Guar.	Fat. Found.	Fat. Guar.	Fiber.
J. W. Barwell, Waukegan, Ill.							
Blatchford's,.... H. J. Hill	Williamsburg	10.39	24.18	25.00	3.89	5.00	—
Chapin & Co., Boston.							
Triangle, ... J. Cushing & Co	Fitchburg	7.63	23.08	22.00	12.31	10.00	5.05
Triangle, ... A. E. Gilbert	W. Brookfield	7.17	22.25	22.00	12.93	10.00	—

II. Starchy (Carbohydrate) Feeds.

CORN MEAL.

Manufacturer or Jobber, Brand and Retailer.	Sampled at:	Water.	Protein. Found.	Protein. Guar.	Fat. Found.	Fat. Guar.	Fiber.
		%	%	%	%	%	%
Chandler Gr. & Mill. Co., Lawrence, Mass.							
A. . . . . G. M. Foster	Lowell	12.94	8.65	—	3.77	—	—
B. . . . . G. M. Foster	Lowell	11.95	9.70	—	3.12	—	—
Husted Milling & Elevator Co., Buffalo.							
Briggs & Co.	Taunton.	12.69	8.60	—	3.65	—	—
Damaged, ... J. W. Doon & Son. . . .	Natick	12.38	9.13	—	2.80	—	—
Scott Grain Co	Amesbury	12.94	8.74	—	3.83	—	—
No. 1, ... H. K. Webster Co. . . .	Lawrence	12.93	9.17	—	3.47	—	—
Damaged, ... H. K. Webster Co	Lawrence	11.95	9.26	—	3.05	—	—
Average.	. . . .	12.54	9.04	—	3.38	—	—

HOMINY MEAL.

Manufacturer or Jobber, Brand and Retailer.	Sampled at:	Water.	Protein. Found.	Protein. Guar.	Fat. Found.	Fat. Guar.	Fiber.
American Corn Milling Co., Chicago.							
F. F. Woodward & Co.	Ayer	8.53	10.05	10.5-12	7.99	7.5-9	—
Wilder & Wotton.	Lowell	8.14	9.88	10.5-12	7.47	7.5-9	—
Briggs & Co.	Taunton.	8.41	10.75	10.5-12	7.76	7.5-9	—
American Hominy Co., Indianapolis, Ind.							
Robinson & Jones.	Natick	8.46	9.48	10.24	8.52	7.72	—
D. H. Craig	Plymouth	8.76	10.31	10.24	8.58	7.72	—
Buffalo Cereal Co., Buffalo.							
Howard's, ... G. F. Wetherbee	Gardner	9.28	10.27	10.50	8.62	8.50	—
Mackenzie & Winslow.	Fall River. . . .	9.06	9.88	10.50	7.02	8.50	—
Highland Mills	Newton High .	9.28	9.79	10.50	8.11	8.50	—
Chapin & Co., Boston.							
Green Diamond, Potter Grain Co.	Shelb'ne Falls	9.21	10.14	10.00	8.74	7.00	—
Green Diamond, W. J. Meek.	Fall River. . . .	7.71	10.62	10.00	9.99	7.00	—
Chas. M. Cox Co., Boston.							
Paragon, ... A. Dodge & Son.	Beverly	8.51	10.84	10.50	10.41	7.50	—
Paragon, ... E. A. Cowee.	Worcester	8.87	11.63	10.50	6.90	7.50	—
Wirthmore, ... City Mills Co.	Holyoke.	9.22	10.14	9.50	7.65	7.50	—
Wirthmore. . . . . . Chandler Gr. & Mill. Co	Lawrence	8.05	10.93	9.50	10.04	7.50	—
Wirthmore, ... F. A. Fales & Co.	Norwood	9.57	10.23	9.50	8.96	7.50	—
Wirthmore, ... Curley Bros	Wakefield	8.56	10.49	9.50	9.07	7.50	—
Yellow . . . . A. D. Potter.	Orange.	9.25	10.84	10.00	8.73	7.00	—
S. A. Eastman.	Milford	9.80	11.32	10.50	7.12	7.50	—
R. J. Hardy & Sons, Boston.							
White, ... Morse Bros.	Southbridge . .	8.80	10.75	10.00	8.20	7.50	—

HOMINY MEAL—(CONTINUED).

Manufacturer or Jobber, Brand and Retailer.	Sampled at:	Water.	Protein.		Fat.		Fiber.
			Found.	Guar.	Found.	Guar.	
		%	%	%	%	%	%
Hunter Bros. Milling Co., St. Louis.							
G. S. Whitney	Concord Junc.	7.95	10.18	11.02	8.85	7.70	—
City Mills Co.........	Holyoke......	7.62	10.53	11.02	7.62	7.70	—
Wilson & Holden.....	Worcester	7.73	9.48	11.02	9.10	7.70	—
Miner-Hillard Mill. Co., Wilkes-Barre, Pa.							
J. Burkhardt..........	Beverly	8.98	10.58	10.00	9.26	7.50	—
W.N.Potter's Sons&Co	Hadley	8.41	10.40	10.00	8.37	7.50	—
Narragansett Mill. Co., E.Providence, R.I.							
Chops, ...Fisher Churchill Co...	Dedham	9.00	10.88	11.00	9.00	7.00	—
Chops, ...J. S. Beless...........	W. Bridgew'tr	9.55	10.59	11.00	8.78	7.00	—
Portsmouth Cereal Co., Portsmouth, Ohio.							
Scioto, ...A. Altman............	New Bedford.	8.91	9.74	10.00	8.27	8.00	—
M. G. Rankin & Co., Milwaukee, Wis.							
A. P. Ames & Co......	Peabody	8.96	10.58	10.00	7.60	7.50	—
J. E. Soper & Co.. Boston.							
Blue Ribbon ...Brockelman Bros	Clinton.......	8.40	10.71	11.00	8.47	8.00	—
Blue Ribbon,...Lummus & Parker	Danversport..	8.77	10.44	11.00	8.62	8.00	—
Suffern, Hunt & Co., Decatur, Ill,							
C. D. Holbrook & Co..	Palmer.......	8.78	10.58	11.02	8.71	7.70	—
South Shore Grain Co.	Quincy	8.91	10.67	11.02	9.16	7.70	—
Blake, Sampson & Co.	Worcester....	9.73	10.14	11.02	8.41	7.70	—
U. S. Frumentum Co., Detroit, Mich.							
Frumentum, ...B. W. Brown	Concord......	9.05	10.71	10.14	8.51	8.76	—
Samuel W. Weidler Co., Cincinnati, Ohio.							
B. W. Brown	Concord......	7.70	11.32	10.25	9.09	7.75	—
Below Standard.							
Toledo Elevator Co., Toledo, Ohio.							
Star, ...A. J. Butler	Adams	7.41	8.74	9.88	6.48	7.31	9.72
Star, ...Hathaway&Mackenzie	New Bedford.	7.94	8.65	9.88	6.35	7.31	10.30
Star, ...F. E. Brooks.........	S. Framingh'm	8.66	8.86	9.88	6.03	7.31	—
H. Knight............	Newburyport .	8.68	8.95	10.60	6.36	8.27	—
Highest	....	9.80	11.63	—	10.41	—	—
Lowest...............	....	7.41	8.65	—	6.03	—	—
Average..............	....	8.68	10.28	—	8.28	—	—
Average analysis Spring collection, 1905,.	....	—	10.22	—	7.83	—	—

PROVENDER.

Manufacturer or Jobber, Brand and Retailer.	Sampled at:	Water	Protein.		Fat.		Fiber.
			Found.	Guar.	Found.	Guar.	
		%	%	%	%	%	%
E. A. Cowee, Worcester, Mass.							
Crockett Bros	Worcester	11.32	10.01	—	4.06	—	—
C. S. Barber	Bernardston	11 05	8 95	—	3 56	—	—
Cutler Co	N. Wilbraham	10.60	10.27	—	4 30	—	—
Cutler Co	W. Brookfield	10.66	9.48	—	4.18	—	—
Morse Bros	Southbridge	9.99	10 01	—	4 74	—	—
J. S. Nason & Co.	Westboro	11.12	9.44	—	4.21	—	—
Ogden & Thompson	Brighton	11.01	10.01	—	4.32	—	—
Potter Grain Co.	Shelb'ne Falls	10.37	9.97	—	4.07	—	—
G. A. Stevens	Worcester	9.04	11.10	—	4.38	—	—
F. F. Woodward & Co.	Fitchburg	9.99	9.74	—	4.22	—	—
Average		10.53	9.90	—	4.20	—	—

CORN AND OAT FEED.

American Cereal Co., Chicago.							
C, R. W. Renfrew & Son.	Pittsfield	8.40	8.51	—	3.89	—	—
Schumacher's, J. H. Bosworth	Chicopee Falls	9.18	9.52	13.00	3.24	5.00	11.64
Schumacher's, Wallace Bros	Clinton	8.52	9.74	13.00	3.31	5.00	—
Schumacher's, G. S. Whitney	Concord Junc.	7 67	11.45	13.00	4.89	5.00	—
Schumacher's, G. P. Rogers	Worcester	8.32	10.75	13.00	4.34	5.00	—
Victor, J. H. Bosworth	Chicopee Falls	9.02	7.95	9.00	2.92	4.00	—
Victor, Burr Co.	Ludlow	9.04	8.74	9.00	3.16	4.00	—
Victor, J. Lally, Jr	Milford	8.82	8.95	9.00	4.12	4.00	—
Brown Milling Co.*							
Queen Stock, F. A. Fales	Norwood	10.82	8.51	9.20	2.48	4.00	—
Buffalo Cereal Co., Buffalo.							
XXX, Tyler Coal & Grain Co	Hyde Park	8.59	10.36	9.00	5.43	4.50	11.14
Chas. M. Cox Co., Boston.							
Wirthmore Stock, John F. Shine	Dedham	8.00	9.79	10.00	6.87	4.00	—
Wirthmore Stock, Burbeck & Brett	N. Abington	8.63	9.60	10.00	6.93	4.00	—
Wirthmore Stock, D. H. Craig	Plymouth	8.72	9.74	10.00	7 44	4.00	—
Wirthmore Stock, A. M. Thompson	Worcester	8.83	9.52	10.00	6.35	4.00	8.99
J. H. Cressey & Co., Boston.							
XX Badger Stock, J. Bouvier	New Bedford	9.33	8.30	12.00	4.10	4.20	—
Edward Ellsworth Co., Buffalo.							
De Fi, A. E. Gilbert	W. Brookfield	7.50	8 95	8.30	3.32	3.00	—
Empire Mills, Olean, N. Y.							
Empire, J. W. Day & Co.	Lynn	8.20	8.60	7.63	4.44	2.97	—
Flint Mill Co., Milwaukee, Wis.							
Pearl Cooked, Prentiss, Brooks & Co.	Westfield	7.68	10.40	10.00	8.28	6.00	—
Pearl Cooked, G. P. Rogers	Worcester	7.71	10.14	10.00	7.21	6.00	—

*Address unknown.

CORN AND OAT FEED—(CONTINUED).

Manufacturer or Jobber, Brand and Retailer.	Sampled at:	Water.	Protein.		Fat.		Fiber.
			Found.	Guar.	Found.	Guar.	
		%	%	%	%	%	%
J. B. Garland & Son, Worcester.							
A. Red Tag,......W. W. Holmes	Webster......	8.02	10.67	12.00	3.77	3.50	—
A. Red Tag,......J. B. Garland & Son ..	Worcester....	7.86	11.10	12.00	4.64	3.50	—
B. Red Tag,......W. W. Holmes	Webster......	7.73	10.71	10.00	4.11	3.25	—
B. Red Tag,......J. B. Garland & Son ..	Worcester....	7.60	10.32	10.00	3.85	3.25	—
Great Western Cereal Co., Chicago.							
Boss,.............J. N. Waite	Easthampton .	8.23	8.86	9.00	4.04	4.00	—
Durham, ...G. A. Stevens.........	Worcester....	8.09	8.21	9.00	5 41	4.00	—
W. H. Haskell & Co., Toledo, Ohio.							
Haskell's Stock, ..W. L. Palmer.........	Medway......	6.56	9.56	10.00	7.34	6.25	—
Haskell's Stock, ..S. A. Eastman........	Milford	6.77	9.26	10.00	6.22	6.25	—
Haskell's Stock, ..E. W. Kenerson & Co.	Worcester....	7.30	8.65	10.00	5.83	6.25	—
H-O Co., Buffalo.							
N. E. Stock,......A. E. Gilbert..........	W. Brookfield.	9.06	9.39	9.00	4.01	4.00	—
N. E. Stock,......Prentiss, Brooks & Co.	Westfield.....	8.10	9.79	9.00	4.54	4.00	—
Husted Milling & Elevator Co., Buffalo.							
Monarch Chops,..B. F. Kingsbury & Co.	Taunton	8.89	8.78	8.09	3.80	4.16	—
Niagara Milling & Elevator Co., Buffalo.							
Niagara Special,..A. Altman............	New Bedford.	9.74	8.78	8.31	4.01	3.83	—
M. C. Richmond, Adams, Mass.							
Richmond Horse,.M. C. Richmond	Adams........	8.20	10.97	10.00	6.23	5.50	—
Highest	....	10.82	11.45	—	8.28	—	—
Lowest	....	6.56	7.95	—	2.48	—	—
Average	....	8.34	9.53	—	4.86	—	—

FORTIFIED OAT FEED.

Manufacturer or Jobber, Brand and Retailer.	Sampled at:	Water.	Protein Found.	Protein Guar.	Fat Found.	Fat Guar.	Fiber.
American Cereal Co., Chicago.							
Quaker Dairy,..L. A. Snow...........	Upton........	7.75	12.25	14.00	3.49	3.50	16.81
Quaker Dairy,..H. G. Hill............	Williamsburg .	7.96	12.42	14.00	3.93	3.50	—
Buffalo Horse & Dairy Feed Co., Buffalo.							
Horse, ...Mackenzie & Winslow.	Fall River....	8.83	11.84	12.00	3.78	4.00	—
Buffalo Cereal Co., Buffalo.							
Horse, ...J. Loring & Co........	Watertown ...	8.49	11.84	12.00	5.60	4.50	9.06
Flint Mill Co., Milwaukee, Wis.							
Wonder Horse,.F. E. Smith	Amherst	7.98	11.80	13.50	4.68	4.00	11.67
Wonder Horse,.A. E. Gilbert	W. Brookfield.	8.47	11.93	13.50	4.31	4.00	—
H-O Co., Buffalo.							
H-O Horse,.....C. O. Parsons	Florence	8.32	13.38	12.00	5.38	4.50	—
H-O Horse,.....A. E. Gilbert.........	W. Brookfield.	9.09	12.64	12.00	4.67	4.50	—
Average..............	....	8.36	12.26	—	4.48	—	—

OAT FEED.

Manufacturer or Jobber, Brand and Retailer.	Sampled at:	Water	Protein. Found.	Protein. Guar.	Fat. Found.	Fat. Guar.	Fiber.
		%	%	%	%	%	%
American Cereal Co., Chicago.							
Vim, ...Pierce & Winn	Arlington	7.23	4.17	6.50	1.37	2.75	—
Vim, ...C. D. Holbrook Co ...	Palmer.......	6.79	7.42	6.50	2.13	2.75	—
Great Western Cereal Co., Chicago.							
Friend's, ...J. Burkhardt..........	Beverly	7.89	6.14	8.00	2.48	3.00	—
St. Albans Grain Co., St. Albans, Vt.							
J. S. Nason & Co.....	Westboro	7.27	6.10	5.00	2.20	2.00	—
Average..............	....	7.30	5.96	—	2.05	—	—

MISCELLANEOUS STARCHY FEEDS.

Manufacturer or Jobber, Brand and Retailer.	Sampled at:	Water	Protein. Found.	Protein. Guar.	Fat. Found.	Fat. Guar.	Fiber.
Alma Sugar Co., Alma, Mich.							
Dried beet pulp, ..C. G. Burnham	Holyoke......	3.34	8.39	8.50	0.38	0.50	—
F. F. Woodward & Co., Fitchburg, Mass.							
Corn bran,........F. F. Woodward & Co.	Fitchburg	9.43	8.21	—	3.69	—	—
Pratt Cereal Oil Co., Decatur, Ill.							
Germaline, ...W. N. Potter & Co....	Charlemont...	9.60	13.60	12.90	2.77	1.29	—
Natural Food Co., Niagara Falls, N. Y.							
Shred. wheat waste, A. Dodge & Son......	Beverly	8.11	10.79	10.00	2.80	2.00	—
Shred. wheat waste. W. W. McLeod.......	Wellesley Hills	8.00	11.72	10.00	2.00	2.00	—

III. Poultry Feeds.

MEAT SCRAPS.

Manufacturer or Jobber, Brand and Retailer.	Sampled at:	Water	Protein. Found.	Protein. Guar.	Fat. Found.	Fat. Guar.	Ash.
		%	%	%	%	%	%
High Grade.							
W. H. Abbott, Holyoke, Mass.							
W. H. Abbott	Holyoke	—	50.24	48.00	17.99	20.00	21.02
American Agricultural Chemical Co., N.Y.							
Phillips, Bates & Co. ..	Greenbush ...	—	55.11	40.00	17.01	15.00	16.08
G. B. Pope & Co......	Waltham.....	—	51.07	40.00	16.25	15.00	19.60
A. E. Gilbert	W. Brookfield.	7.61	50.63	40.00	15.08	15.00	19.66
S. D. Andrew's Son, Providence, R. I.							
XXXXX, ... Handley, Jacobson & Co	S. Dartmouth.	—	58.27	50-55	13.35	12.00	17.54
T. E. Borden	N. Westport..	—	56.77	55.00	13.36	12.00	18.47
Beach Soap Co., Lawrence, Mass.							
Star, ... H. Bruckman.........	Lawrence	—	44.36	50.00	—	20.00	22.00
Butchers Rendering Co., Fall River, Mass.							
E. O. Parker..........	Stoughton....	7.31	52.04	40.00	11.94	15.00	27.09
Bowker Fertilizer Co., Boston.							
F. E. Cousins.........	Lincoln	—	53.09	30.00	16.09	20.00	20.83
Livingston Grain Co.	Lowell	—	50.02	30.00	14.55	20.00	18.86
Joseph Breck & Sons, Boston.							
J. F. Freese	E. Walpole...	—	47.65	50-55	20.63	15-17	21.10
Ham & Co....	Woburn......	—	47.08	50-55	22.01	15-17	21.26
L. B. Darling Fert. Co., Pawtucket, R. I.							
E. A. Briggs & Co.....	Attleboro	—	48.00	50.00	17.20	16.00	25.57
J. C. Dow, Boston.							
G. E. Cushman	Kingston	—	47.78	50-55	19.69	15-17	21.20
W. L. Palmer.........	Medway	7.60	49.01	50-55	21.66	15-17	18.60
M. H. Cushing & Co...	Middleboro...	—	48.75	50-55	20.61	15-17	19.64
Hinckley Rend. Co., Somerville, Mass.							
W. K. Gilmore & Sons	Walpole......	—	44.57	30-35	13.42	10-15	28.26
Geo. E. Marsh Co., Lynn. Mass.							
Lincoln Mill......	N. Scituate...	—	51.86	45-55	16.51	10-15	18.87
Seymour & McDonald.	S. Lancaster..	—	49.76	45-55	15.86	10-15	23.49
Mason Mfg. Co., Woonsocket, R. I.							
Wallace Bros.....	Clinton.......	4.65	50.37	45.00	23.08	18.58	20.36
N. E. Dressed Meat & Wool Co., Boston.							
J. W. Day & Co.......	Lynn.........	—	51.16	53-57	15.48	10-15	21.69
Parmenter & Polsey F. Co., Peabody, Mass							
Ropes Bros...........	Danvers......	6.32	50.54	45-50	15.23	10-12	24.06
C. H. Smith	Dighton......	—	54.14	45-50	16.06	10-12	16.06
A. P. Ames & Co.....	Peabody	—	48.57	45-50	17.27	10-12	21.42

MEAT SCRAPS—(CONTINUED).

Manufacturer or Jobber, Brand and Retailer.	Sampled at:	Water	Protein. Found.	Protein. Guar.	Fat. Found.	Fat. Guar.	Ash.
		%	%	%	%	%	%
Poultry Supply Co., Boston.							
XXX Poultry, .. Poultry Supply Co....	Boston	—	56.38	53-57	15.49	10-15	16.18
M. L. Shoemaker & Co., Philadelphia.							
Warner Bros	Sunderland...	—	57.61	34.00	15.55	14.00	16.53
Spratts Patent, Ltd., Newark, N. J.							
Crissel,.........N. E. Poul. Supply Co.	Springfield....	—	65.20	—	12.52	—	13.77
Swift's Lowell Fert. Co., Boston.							
Burr Co...............	Ludlow	6.59	45.28	40-50	13.74	15-20	30.93
Burbeck & Brett......	N. Abington..	—	46.50	40-50	18.73	15-20	22.33
S. L. Davenport	N. Grafton ...	—	48.87	40-50	15.13	15-20	24.30
H. K. Webster & Co., Lawrence, Mass.							
H. K. Webster & Co...	Lawrence	—	52.04	55.00	17.65	12.00	18.60
Average.............	....	6.68	51.06	—	16.64	—	20.82
Second Grade.							
Beach Soap Co., Lawrence, Mass.							
Burnham Bros........	Gloucester ...	—	37.99	40.00	15.69	20.00	31.70
H. Bruckman.........	Lawrence	—	40.50	40.00	16.84	20.00	28.84
L. T. Frisbie Co., Hartford, Conn.							
C. B. Benedict	Gt. Barrington	—	37.64	40-50	16.26	15-20	35.38
Geo. L. Harding, Binghamton, N. Y.							
N. E. Poultry Sup. Co.	Springfield ...	—	37.51	42-50	21.14	30-35	33.52
A. L. Warren, Northboro, Mass.							
J. Wadsworth & Co...	Northboro. ..	—	32.60	40.00	13.30	10.00	29.84
Whitman & Pratt Rend.Co., Lowell,Mass							
C. H. Symmes........	Winchester...	—	39.27	35-40	20.64	10-15	30.17
Geo. E. Woodill, Natick, Mass.							
Sprague & Williams ..	S. Framingh'm	—	35.01	20-25	16.41	10-16	34.84
Young & Halstead, Troy, N. Y.							
Lamb Bros. & Co.	Orange	—	40.23	42.00	25.49	25.00	25.81
Average.............	....	—	37.59	—	18.22	—	31.26

MEAT AND BONE MEAL.

Manufacturer or Jobber, Brand and Retailer.	Sampled at:	Water	Protein. Found.	Protein. Guar.	Fat. Found.	Fat. Guar.	Ash.
High Grade.							
American Agricultural Chemical Co.,N.Y.							
Bradley's Superior, D. Seffens............	Conway	—	45.19	30.00	9.68	8.00	36.20
A. E. Gilbert	W. Brookfield.	4.96	36.99	30.00	13.06	8.00	39.84

MEAT AND BONE MEAL—(CONTINUED).

Manufacturer or Jobber, Brand and Retailer.	Sampled at:	Water	Protein. Found.	Protein. Guar.	Fat. Found.	Fat. Guar.	Ash.
		%	%	%	%	%	%
Armour Fertilizer Co., Chicago.							
Ropes Bros.	Danvers	6.32	46.99	—	8.81	—	31.20
Bowker Fertilizer Co., Boston.							
Animal Meal,...Whitman Gr. & Coal Co	Whitman	—	39.45	30.00	14.16	5.00	38.98
Animal Meal,...H. G. Hill.	Williamsburg.	5.48	37.38	30.00	12.19	5.00	38.16
Geo. E. Marsh Co., Lynn, Mass.							
Bedford Coal & Gr. Co.	Bedford	6.03	36.20	36.00	8.26	8.00	41.80
Swift's Lowell Fertilizer Co., Boston.							
A. E. Lawrence & Son.	Ayer	—	43.57	40-50	10.94	8-15	29.57
Whitman & Pratt Rend. Co., Lowell, Mass.							
F. A. Sherwin	Groton	—	35.19	32-35	14.05	10-15	39.54
Average		5.70	40.12	—	11.39	—	36.91
Second Grade.							
Beach Soap Co., Lawrence, Mass.							
A. E. Lawrence & Son.	Ayer	—	23.64	26.00	8.87	10.00	55.62
Ropes Bros.	Danvers	3.72	22.99	26.00	9.15	10.00	58.00
Joseph Breck & Sons, Boston.							
W. L. Palmer	Medway	—	28.04	32-35	9.73	10-12	43.44
E. W. Kenerson & Co.	Worcester	6.97	30.98	22.00	10.77	10.00	42.09
Average		5.36	26.41	—	9.63	—	49.79

FISH.

International Glue Co., Boston.							
E. H. Doble & Co.	W. Quincy	—	44.49	40.86	1.16	2.44	43.58

GRANULATED MILK.

Geo. L. Harding, Binghamton, N. Y.							
A. E. Lawrence & Son.	Ayer	9.79	35.93	43-50	9.66	15-20	26.53
Hollis, Park & Pollard, Boston.							
H. Knight	Newburyport.	—	41.89	—	10.97	—	22.28
Average		9.79	38.91	—	10.32	—	24.41

POULTRY MASH AND MEAL.

Manufacturer or Jobber, Brand and Retailer.	Sampled at:	Water	Protein. Found.	Protein. Guar.	Fat. Found.	Fat. Guar.	Ash.
		%	%	%	%	%	%
American Cereal Co., Chicago, Ill.							
Mackenzie & Winslow.	Fall River ...	—	12.77	14.00	5.94	4.50	3.36
J. W. Doon & Son....	Natick		12.81	14.00	5.97	4.50	3.04
Bryant & Soule, Middleboro, Mass.							
Morning Mash,.Bryant & Soule.......	Middleboro...	—	16.32	14.00	5.44	5.00	7.63
Buffalo Cereal Co., Buffalo, N. Y.							
Tyler Grain & Coal Co.	Hyde Park ...	—	16.50	17.00	5.18	5.00	3.05
C. F. Eddy Co........	W. Newton...	8.49	16.81	17.00	6.15	5.00	3.09
E. A. Cowee..........	Worcester....	—	16.67	17.00	5.76	5.00	3.07
W. W. Copeland & Co., No.Hanson,Mass.							
Meat Cereal ....W. W. Copeland & Co.	N. Hanson ...	—	14.21	11.5-13	5.02	3.5-7.0	5.61
Cyphers Incubator Co., Boston.							
Forcing Food,..Cyphers Incubator Co.	Boston	—	14.83	18.17	3.14	7.11	2.00
Laying Food,...Cyphers Incubator Co.	Boston	—	16.06	15.26	3.45	5.50	2.20
J. W. Day & Co., Lynn, Mass.							
N. F. Mayo	Franklin Park.	—	13.51	11.50	4.53	3.50	6.74
J. W. Day & Co.......	Lynn.........	—	14.83	11.50	6.16	3.50	5.55
J. W. Day & Co.......	Lynn.........	7.24	16.55	11.50	6.09	3.50	6.24
E. H. Doble & Co., West Quincy, Mass.							
Goldthwaite's Cont'l,E. H. Doble & Co....	W. Quincy ...	—	14.70	14-15	3.58	3.5-4.5	7.58
Goldthwaite's Cont'l,E. H. Doble & Co....	W. Quincy ...	8.89	15.40	14-15	3.94	3.5-4.5	6.95
Greene Chick.Feed Co.,Marblehead,Mass.							
Perfect, ...J. F. Whitaker........	Springfield ...	—	12.86	12.00	5.41	2.00	3.28
H-O Co., Buffalo, N. Y.							
G. F. Greene Coal Co.	Brockton.....	—	16.55	17.00	6.55	5.50	3.20
C. O. Parsons.........	Florence	8.69	17.16	17.00	5.80	5.50	2.83
Cutler Co	W. Brookfield.	8.55	16.99	17.00	6.04	5.50	2.66
Hollis, Park & Pollard, Boston.							
Dry Mash, ...Hollis, Park & Pollard.	Boston	10.24	23.57	23.57	3.48	3.48	11.11
Wet Mash,.....Hollis, Park & Pollard.	Boston	9.73	20.02	20.02	4.39	4.39	6.93
Ralston Purina Co., St. Louis, Mo.							
Purina Fattening,.Torrence, Vary & Co..	Lynn..........	—	11.41	21.00	6.19	5.50	4.26
Purina Mash,.....Torrence, Vary & Co..	Lynn..........	—	21.20	21.00	5.72	5.50	5.14
Purina Mash,.....J. F. Kirk	New Bedford.	—	16.28	21.00	5.00	5.50	5.07
Rice Bros., Boston.							
Morning Meat..Rice Bros.............	Boston	—	17.77	12.00	4.57	3.02	5.68
Ropes Bros., Danvers, Mass.							
Poultry Hash,...Ropes Bros	Danvers......	8.98	17.77	18.00	4.23	4.00	5.07
Ross Bros., Worcester, Mass.							
A. E. Gilbert	W. Brookfield.	7.60	11.72	12.00	3.29	3.50	16.97

POULTRY MASH AND MEAL—(CONTINUED).

Manufacturer or Jobber, Brand and Retailer.	Sampled at:	Water.	Protein.		Fat.		Ash.
			Found.	Guar.	Found.	Guar.	
		%	%	%	%	%	%
G. T. Savage Poultry Supply Co., Boston.							
Meat Cereal, ... Wallace Bros.	Clinton	—	15.75	11.50	4.66	3.50	4.70
L. H. Southworth, W. Stoughton, Mass.							
L. H. Southworth	W. Stoughton.	—	17.25	15.00	5.79	4.50	10.00
Tyler Grain & Coal Co., Hyde Park, Mass.							
Soft Feed, ... Tyler Grain & Coal Co.	Hyde Park	—	12.60	11.32	6.41	3.47	4.06
Soft Feed, ... Tyler Grain & Coal Co.	Hyde Park	9.44	12.20	11.32	6.89	3.47	4.02
Average		8.79	15.77	—	5.16	—	5.37

CHICK AND SCRATCHING GRAINS.

Manufacturer or Jobber, Brand and Retailer.	Sampled at:	Water.	Protein Found.	Protein Guar.	Fat Found.	Fat Guar.	Ash.
Chick.							
Joseph Breck & Sons, Boston.							
Hygienic, ... J. Breck & Sons	Boston	—	9.21	8-10	2.71	2-3	17.20
Chamberlain, Kirkwood, Mo.							
Chamberlain's Perf't, Carpenter & French	N. Reading	—	11.72	14.06	2.56	2.93	24.42
City Mills Co., Holyoke, Mass.							
City Mills Co.	Holyoke	—	11.32	11.00	4.23	4.00	6.67
J. Cushing & Co., Fitchburg, Mass.							
Gilt Edge, ... J. Cushing & Co	Fitchburg	—	10.79	—	3.23	—	1.63
Gilt Edge, ... E. O. Parker	Stoughton	12.00	9.83	8.00	2.97	3.00	2.13
Cyphers Incubator Co., Boston.							
H. Knight	Newburyport	—	11.80	10.47	4.49	3.31	8.62
J. W. Day & Co., Lynn, Mass.							
Climax, ... J. W. Day & Co	Lynn	—	11.37	10-11	3.47	2-3	4.15
Thos. W. Emerson Co., Boston.							
Gem, ... Scott Grain Co.	Amesbury	11.55	10.62	9.50	2.98	4.50	2.06
Gem, ... J. M. Johnson	Medfield.	—	10.93	9.50	4.32	4.50	2.07
Greene Chick. Feed Co., Marblehead, Mass.							
G. F. Green Coal Co.	Brockton.	—	11.23	11.00	3.90	3.00	1.81
A. C. Griffin, Pittsfield, Mass.							
OK, ... Green River Grain Co.	Greenfield	—	9.65	10.20	3.83	4.10	13.98
OK, ... Dexter Root Co	Springfield	—	9.79	10.20	3.90	4.10	11.03
Geo. L. Harding, Binghamton, N. Y.							
Unexcelled Baby, Eastern Poultry and Pigeon Supply Co.	Boston.	—	10.58	15-20	3.23	5-7	6.88
Hollis, Park & Pollard, Boston.							
Gritless, ... Burbeck & Brett	N. Abington	11.56	10.32	—	3.06	—	1.85

CHICK AND SCRATCHING GRAINS—(CONTINUED).

Manufacturer or Jobber, Brand and Retailer.	Sampled at:	Water.	Protein. Found.	Protein. Guar.	Fat Found.	Fat Guar.	Ash.
		%	%	%	%	%	%
Hale Knight, Newburyport, Mass.							
Corn Screenings, . H. Knight	Newburyport	—	11.37	—	3.04	—	9.88
Ralston Purina Co., St. Louis, Mo.							
Purina, J. F. Kirk	New Bedford	—	11.93	10.20	4.17	3.60	2.50
M. H. Rolfe, Newburyport, Mass.							
Choice, M. H. Rolfe	Newburyport	—	16.67	12.50	4.42	4.00	2.38
Ross Bros., Worcester, Mass.							
Wyandotte, E. A. Kellogg & Sons	Feeding Hills	10.77	9.52	8.25	3.33	2.25	8.24
Wyandotte, Rich & Grigson	Wayland	—	8.86	8.25	2.81	2.25	10.90
G. T. Savage Poultry Supply Co., Boston.							
G. T. Savage	Boston	—	10.88	9.50	4.89	4.50	2.06
Unknown.							
First, Connor & Harding	Malden	—	10.14	—	2.80	—	7.45
Average		11.47	10.88	—	3.54	—	7.04
Scratch Grains.							
Joseph Breck & Sons, Boston.							
Complete, J. Breck & Sons	Boston	—	9.56	8-10	2.60	2-3	17.76
J. Cushing & Co., Hudson, Mass.							
J. Cushing & Co.	Hudson	—	11.19	—	3.52	—	2.69
J. Cushing & Co., Winchendon, Mass.							
J. Cushing & Co	Winchendon	—	9.61	—	4.18	—	12.44
Thos. W. Emerson Co., Boston.							
T. W. Emerson Co	Boston	—	11.80	12.50	3.31	2.50	2.08
C. H. Felker & Co., Brockton, Mass.							
C. H. Felker & Co.	Brockton	11.80	9.83	10.00	3.46	3.00	1.70
Geo. H. Harding, Binghamton, N. Y.							
Egg Builder, N. E. Poultry Sup. Co.	Springfield	—	11.37	12-15	4.50	4-7	11.13
Hollis, Park & Pollard, Boston.							
Broiler, Hollis, Park & Pollard.	Boston	11.04	11.84	10.93	3.84	3.48	3.46
Hollis, Park & Pollard.	Boston	12.57	10.93	11.93	3.48	3.48	2.11
Ralston Purina Co., St. Louis.							
Purina Pigeon, Torrence, Vary & Co.	Lynn	—	10.88	10.20	3.05	3.60	5.19
Cutler Co	N. Wilbraham.	—	10.75	10.10	3.52	3.60	2.12
W. W. Rawson & Co., Boston.							
W. W. Rawson & Co.	Boston	11.04	12.42	11.00	4.60	4.00	2.43
Rice Bros., Boston, Mass.							
Rice Bros.	Boston	—	11.45	—	2.65	—	2.83

CHICK AND SCRATCHING GRAINS—(CONTINUED).

Manufacturer or Jobber, Brand and Retailer.	Sampled at:	Water.	Protein.		Fat.		Ash.
			Found.	Guar.	Found.	Guar.	
		%	%	%	%	%	%
Ropes Bros., Danvers, Mass.							
Ropes Bros.	Danvers	10.34	12.02	12.00	4.03	4.00	2.53
Ross Bros., Worcester, Mass.							
Every Day, F. M. Keefe	Waltham	—	12.02	12.00	3.66	3.00	2.18
Every Day, A. E. Gilbert	W. Brookfield.	—	12.16	12.00	3.39	3.00	2.27
Average		11.36	11.19	—	3.39	—	4.86

ALFALFA AND CLOVER MEALS.

Manufacturer or Jobber, Brand and Retailer.	Sampled at:	Water.	Protein Found.	Protein Guar.	Fat Found.	Fat Guar.	Ash.
Alfalfa.							
Ralston Purina Co., St. Louis.							
Purina, Prentiss, Brooks & Co.	Easthampton.	9.03	19.62	18.00	1.91	3.50	10.87
Purina No. 1, Mackenzie & Winslow.	Fall River	—	19.27	18.00	1.93	3.50	—
Purina No. 2, Mackenzie & Winslow.	Fall River	—	15.05	18.00	1.26	3.50	—
Purina, L. A. Snow	Upton	—	21.94	18.00	2.08	3.50	—
Average		9.03	18.97	—	1.80	—	10.87
Clover.							
W. P. Curtiss & Co., Ransomville, N. Y.							
McIntyre & Clark	Marlboro	—	11.49	11.00	1.77	1.50	—
L. L. Davendorph, Lafargeville, N. Y.							
Cut Clover, J. Loring & Co.	Watertown	—	9.26	10.00	1.71	1.00	—
Thos. W. Emerson & Co., Boston.							
Thorne Bros.	Millis	—	11.63	10.00	2.09	1.00	—
Hudson Valley Clover Co., Lynn, Mass.							
Alltop, Greene & Co	Marblehead	—	15.36	16 00	2.73	3.00	—
Alltop, W. W. Holmes	Webster	—	15.53	16.00	3.00	3.00	—
Average		—	12.65	—	2.26	—	—

DISCUSSION OF THE RESULTS OF THE INSPECTION.

I. Protein Feeds.

Blood Meal.
Page 8.

Blood meal, occasional samples of which are found in local markets, is prepared for animal feeding by the western packing houses. It is the highest grade concentrate offered, containing 86 per cent of protein, the balance consisting of water and ash. As a source of protein, especially prepared blood meal is probably worth twice as much as high grade cottonseed meal. One-half to one pound daily, mixed with corn and oats may be fed with benefit to hard worked horses, and it may serve as a component of the daily grain ration for dairy cows.* It is also valuable as a remedy against scours in calves.†

Cottonseed and Linseed Meals.
Pages 8–11.

The station has adopted the following tentative standard for *cottonseed meal*: *High grade meal* should contain 43 per cent protein and 8–10 per cent fat. *Medium grade meal* should have a minimum of 38 per cent protein, and 7–9 per cent fat. Both should have a sweet nutty taste, and a bright yellow color. *Low grade meal*, contains less than 38 per cent protein, and is generally dark in color. Cottonseed meal obtained from seed grown in Texas, Arkansas, Tennessee and Missouri, usually tests higher in protein than that produced in Georgia and the Carolinas, which is known as south-eastern meal.

Many of the samples collected in Massachusetts have not analyzed as high in protein as those secured in previous years. This is due probably to trade conditions, the best grades being disposed of early in the season for home or foreign consumption.

AVERAGE ANALYSES AND PRICES.

	High and Medium Grades. 1904.	High Grades. 1905.	Medium Grade. 1905.	Average High and Medium Grades. 1905.
No. of samples,	62	42	19	61
Protein,	43.6	42.9	38.9	41.6
Fat,	9.0	8.9	8.7	8.8
Price a ton,	\$28.87	—	—	\$29.08

*Three pounds each of bran, and corn or hominy meals, and one pound of blood meal.
†A teaspoonful thoroughly stirred into each feeding of milk. Feed should be reduced.

Cottonseed meal most certainly ought to be sold at retail on the basis of its protein percentage; a 38 per cent meal is not worth as much as a 43 per cent meal. One does not notice such distinctions at present. German buyers are much more particular in this respect. Some shippers place a higher guarantee on their product than can be maintained. Thus, Hunter Bros. Milling Co. guarantee 43, and the tests show only 40. Meal sold by D. L. Marshall Co. shows a similar shortage. *More care must be exercised in this matter.*

Cottonseed meal has continually advanced in price since 1894, and at the present writing (Dec. 28) is retailing at $32 a ton. Even at this price a first class article is one of the cheapest sources of protein.

Six samples of *low grade meal*, averaging 25.90 per cent protein and 5.9 per cent fat, and selling at $26.17 a ton, were collected. Even after making a reasonable allowance for the value of the fiber, fat and extract matter, the writer would not consider such material worth for feeding more than two-thirds as much as high grade meal.

Linseed meals. A 40 per cent guarantee on Cleveland flax meal is considered too high, the samples collected barely reaching 37 per cent. The old process meals practically all met their guarantees. Both Kellogg & Miller, and Hauenstein & Co. put out high grade meals.

AVERAGE ANALYSES AND PRICES.

	New Process.		Old Process.	
	1904.	1905.	1904.	1905.
No. of samples,	6	6	15	15
Protein,	37.24	37.49	33.10	34.29
Fat,	3.46	2.49	8.00	7.91
Retail price a ton,	$28.75	$31.50	$29.00	$33.87

The linseeds are sold in comparatively small quantities. These feeds are highly esteemed especially by English farmers, and the continued export demand keeps the prices above where their use on a large scale is considered the part of economy by local feeders.

Corn Gluten By-Products. **Pages 12–13.**

Gluten meal. Four samples of Chicago were guaranteed to contain 38 per cent protein, and tested but 33.27 per cent. The two samples of Cream meal fell below the protein guarantee 1.4 per cent. The average ton price of the six samples was $30.80.

Gluten feed has a high digestibility, is one of the best feeds for milk production, and at prices usually prevailing is almost always an economical concentrate. A first grade gluten feed ought to contain 25 per cent protein and 3 per cent fat.

One lot put out by the Buffalo Cereal Co. was guaranteed 28 per cent protein, and tested 25.45 per cent. Two lots of the Flint Mill Co.'s product were guaranteed 27 per cent protein and analyzed 24.88 per cent. Eleven samples of Buffalo averaged 24.82, and carried a 25 per cent guarantee.

Three samples of Globe carried a 26 per cent protein guarantee and tested 26.59 per cent. This brand almost always meets its guarantee.

The Tiger brand (four samples) averaged 25.61 per cent protein and carried a 25 per cent guarantee. Warner's gluten tested only slightly below its 25 per cent protein guarantee.

Douglas & Co.'s gluten feed was guaranteed 26.50 per cent protein and the six samples averaged only 17.65 per cent. This is not a first grade product, and a guarantee so far above its actual test is entirely unwarranted.* The material does not appear to be adulterated, but contains an undue proportion of starch. Properly guaranteed it would be a perfectly legitimate article of trade. One sample of Golden Rod, put out by the Michigan Starch Co., was guaranteed 27 per cent and tested 19.88 per cent.

Bay State gluten feed, put out by J. E. Soper & Co., only one sample of which was collected, tested 15.88 per cent protein, and was guaranteed 26 per cent. Soper & Co. state that this in no way represents their product. Further comment is therefore withheld for the present.

AVERAGE ANALYSES AND PRICES.

	All samples 1905. First Grade.	Low Grade.
No. of samples,	55	8
Protein,	25.01	17.71
Fat,	3.56	3.91
Price a ton,	$26.60	$26.43

*The jobbers handling this material have advised us that they have discontinued its sale.

Distillers' and Brewers' By-Products. Pages 13–14.

Distillers' dried grains. The two samples of Biles Fourex maintained their guarantee of 33 per cent protein and 11 per cent fat, were bright, only faintly acid and free from the burnt, smoky odor.

The Continental gluten feed is a brand of distillers' grains. Its protein guarantee of 35 per cent is too high. It tested 29.84 per cent.

The *Blue Ribbon brand*, put out by C. A. Krause Grain Co., tested only 26.02 per cent protein, and was guaranteed 33 per cent. It was dark in color, and tasted quite burnt and sour.

AVERAGE ANALYSES AND PRICES.

	1904.	All collections. 1905.
No. of samples,	15	23
Protein,	32.43	32.00
Fat,	12.48	11.90
Price a ton,	\$27.12	\$27.29

Malt sprouts. Five of the seven samples collected fully met their guarantees. One lot from Krause Grain Co. was especially high in crude protein, testing 29.18 per cent.

AVERAGE ANALYSES AND PRICES.

	1904.	All collections. 1905.
No. of samples,	8	11
Protein,	26.85	26.52
Fat,	1.22	1.06
Price a ton,	\$19.25	\$22.55

The price of sprouts advanced decidedly in 1905. They are an economical protein concentrate. (See Bulletin No. 94).

Brewers' grains are rarely found in Massachusetts markets. The two samples put out by the Krause Grain Co., were bright, and of an exceptionally high protein content, averaging 31.37 per cent. The lot from E. P. Mueller, on the other hand, was very deficient in protein, being guaranteed to contain 24.86 per cent and testing only 16.59 per cent. Such misrepresentatio s do not inspire confidence on the part of the buyer.

Wheat By-Products. Pages 14-19. Many of the wheat by-products contained an undue proportion of screenings, such as light oats, hulls, weed seeds and quite often corn ; inferior wheat itself was sometimes incorporated. Buyers should examine these feeds and refuse to purchase those which reveal an excessive amount of such material, which must be regarded as actual adulteration.

AVERAGE ANALYSES AND PRICES.

	Wheat Middlings, Flour. 1904.	All collections. 1905.
No. of samples,	9	21
Protein,	18.70	16.20
Fat,	4.62	4.20
Price a ton,	$28.72	$27.82

	Wheat Middlings, Standard. 1904.	All collections. 1905.
No. of samples,	22	58
Protein,	17.64	15.93
Fat,	5.22	4.82
Price a ton,	$26.29	$24.39

	Wheat Mixed Feed. 1904.	All collections. 1905.
No. of samples,	72	128
Protein,	16.50	15.09
Fat,	4.62	4.45
Price a ton,	$25.87	$24.39

	Wheat Bran. 1904.	All collections. 1905.
No. of samples,	15	36
Protein,	16.07	14.39
Fat,	4.44	4.55
Price a ton,	$24.40	$23.09

The 1904 wheat was generally inferior and naturally produced inferior by-products. In many cases millers were unable to recover as large a proportion of the flour as usual, and the resulting offal being abnormally starchy, contained less than the average percentage of protein and fat.

Wheat Feeds with Admixtures. **Page 18.**

These mixtures, sold under the name of mixed feed, varied somewhat in composition. They were nearly all properly guaranteed and buyers have only themselves to blame if they purchase them for straight bran and middlings. The Jersey, put out by the Indiana Milling Co., the Indiana, sold by J. H. Cressey & Co., the Dairy, offered by Jennings & Fulton, and a brand bearing the name of J. H. Rodebaugh, Buffalo, are all of the same general type. They were guaranteed to contain 12.05 and 12.59 per cent protein, and averaged 11.23 per cent; they consisted of approximately 500–600 pounds of ground corn cobs to the ton and the balance of wheat by-products. In the Peerless and Royal brands, but little cob was noticed, but a considerable quantity of screenings, weed seeds and the like.

ANALYSES AND PRICES.

	1904.	All collections. 1905.
No. of samples,	22	17
Protein,	12.09	12.18
Fat,	3.57	3.16
Fiber,	13.23	—
Price a ton,	$25.28	$22.13

If genuine mixed wheat feed containing 16 per cent protein and 4.5 per cent fat was sold for $23, during 1905, the above mixtures could not be considered worth over $17 or $18 a ton.

Miscellaneous Dairy Feeds. **Page 19.**

Bibby's dairy cake, composed of ground cottonseed, carob bean, cereal products, fenugreek and salt, nearly met its guarantee. Its ton price is out of proportion to its feeding value.

Union grains, put out by the J. W. Biles Co., is a mixture of distillers' grains, corn or hominy meal, malt sprouts, wheat by-products, cottonseed meal and salt. The manufacturers claim it to be a ready ration for dairy stock, and the claim appears to be well founded. It is believed that dairymen who carefully study the feed question can secure equally as good a ration at a little less price. The point is: *will you buy your concentrates and mix them yourself, or hire somebody to do it for you!*

Buffalo creamery feed, composed of corn, oat by-products and cottonseed meal, met its guarantee. It cannot be considered particularly economical at $26 a ton.

Vulcan Blended Grains, consisting of barley, mill by-products of corn, oats and wheat, malt sprouts and meat scraps, fell several per cent below its protein and fat guarantee.

H. O. Dairy feed contained broken corn, mill by-products of oats and wheat, cottonseed meal and peanuts. It more than met its guarantee.

Protena consisted of corn, oat and wheat by-products, and alfalfa meal. It met its guarantee of 20 per cent protein and 3.5 per cent fat and retailed at from $25 to $28 a ton.

Most of the above proprietary feeds must be regarded as expensive when compared with suitable home mixtures of standard grains and by-products.

Molasses Feeds. **Page 20.**

Sucrene dairy was guaranteed 16.50 per cent protein and tested 15.64 per cent. Sucrene horse feed nearly met its guarantee.

Three samples of Green Diamond tested 12.13 per cent protein, and 1.96 per cent fat and were guaranteed to contain 16.50 protein and 3.50 fat. The manufacturers claim that this deficiency was entirely unintentional and that they have taken measures to correct it.

One sample of Holstein, put out by F. W. Goeke & Co. showed a similar shortage.

The Hammond, made by the Western Grain Products Co., was guaranteed 17 per cent protein and analyzed 15.44 per cent.

The manufacturers of some of these products *must either reduce their guarantees or conform to them. Neither the station nor the consumer will long tolerate misrepresentations.*

Molassine meal, an imported product, contained approximately two-thirds molasses, while the balance consisted largely of some unrecognized fibrous material used as an absorbent. The protein percentage was 7.68; the price was not learned. Its chief value consists in the molasses it contains, the latter being in a dry, easily handled condition.

Miscellaneous Protein Feeds. Page 20.

Rye feed, a mixture of rye bran and middlings, tested about 15 per cent protein, 3 per cent fat, and contained but little fiber. It is quite digestible (82 per cent) and is probably worth the price asked (average four samples, $25.33 a ton.)

Buckwheat feeds, two samples of which were collected, were of rather inferior character, containing a considerable quantity of the bran. The latter is very indigestible, and inferior for feeding. Genuine buckwheat middlings should contain 25 per cent of protein, 7 per cent fat, and not over 10 per cent fiber. Such material is a valuable dairy feed and is usually an economical source of digestible matter and protein.

Blatchford's calf meal, a mixture of linseed and cottonseed meals, cereals, carob bean, and fenugreek, has been found satisfactory as a partial milk substitute for robust calves. The price asked ($3.50 a hundred) is not considered extravagant.

Chapin's calf meal, (Triangle brand)met its guarantee. It has not been microscopically examined at this Station, but is claimed to be composed of flaxseed meal, a little blood meal, malted grains and a gluten product.

II. Starchy (Carbohydrate) Feeds.

Corn and Hominy Meals. Pages 21-22.

Corn is purchased chiefly for its starchy matter, and the slight variations noted in its protein content, providing it is sweet and of good color, are of minor importance. Damaged—mouldy and sour—corn meal may show a satisfactory percentage of protein and fat, and still be quite unsuited for feeding horses and dairy stock. Such material, usually offered at a substantial discount, can frequently be used *with care* as a food for swine. Under the present feed law no restrictions are placed upon the sale of such material.

Hominy meal or Chop, usually made from white corn, is the residue from hominy mills and from breweries. One also notes occasional lots of yellow hominy, derived from yellow corn. It is probably equal in value to white meal. Hominy is more bulky than corn and has about the same nutritive value. All of the samples collected were bright, clean and sweet, and with the exception of one brand, of satisfactory composition. *The Star Brand*, put out by the Toledo Elevator Co., is inferior to most of the hominy offered, being low in protein and fat, and high in woody fiber.

Some manufacturers guarantee 11 per cent of protein and fail to maintain it. It is believed that a 10 per cent protein guarantee is as high as it is safe to go with the feed. The average of 70 samples collected in 1905, was 10.25 per cent protein and 8.09 per cent fat; the average retail price was $24.41.

Provender, Corn and Oat Feeds. **Pages 23-24.**

The ten samples of provender collected were of a nice bright color, being mixtures of good corn and crushed oats. They averaged 9.90 per cent protein, and 4.20 per cent fat.

Schumacher's stock food is a mixture of corn, oat offal, and feed barley. The four samples collected fell several per cent below their protein guarantee and were also deficient in fat. Several samples tasted quite bitter.

Victor corn and oat feed (oat offal with some corn) practically maintained its protein guarantee in two out of three cases. It was not very sweet.

Wirthmore stock food consisted of hominy and some oat offal. It was sweet, nearly met its protein guarantee and exceeded the guarantee of fat nearly three per cent.

Badger XX stock food, put out by J. H. Cressey & Co., contained a peanut by-product. It was guaranteed to contain 12 per cent of protein, and analyzed but 8.30 per cent.

Pearl cooked feed, consisting of hominy and oat offal, fully met its guarantee of 10 per cent protein and 6 per cent fat.

Red Tag A and B contained wheat middling in addition to oat offal and some corn. The A brand was quite bitter.

Boss and Durham, put out by the Great Western Cereal Co., contained a little wheat middlings in addition to oat offal, corn, and corn hulls. They nearly met their guarantees. The latter had a bitter taste.

Haskell's stock food consisted of hominy and some oat offal. It was guaranteed to contain 10 per cent protein and 6.25 per cent fat, and the three samples tested 9.15 protein and 6.46 per cent fat. Its protein guarantee is usually a little too high.

New England stock food contained a little wheat middlings. It met its guarantee. The samples tasted bitter.

The various corn and oat feeds may be divided into two classes:

1st. Those that consist largely of oat refuse with some corn frequently of poor quality, and occasionally a little red dog middlings to increase the protein. Many of these mixtures have a rancid, bitter taste, and are unattractive to the eye.

2nd. Those that consist principally of hominy, to which has been added more or less oat offal. They are generally sweet, and more attractive than the former class.

Query!! Why pay nearly or quite as much for many of these mixtures as for clean bright corn or hominy meals? Think about it, feeders!!

Fortified Oat Feeds.
Page 24.

These feeds consisted of oat offal as a basis (800 to 1200 or more pounds to the ton) to which has been added corn, wheat middlings, and a concentrate rich in protein.

Quaker Dairy consisted of oat offal, middlings and some cottonseed. It was guaranteed 14 per cent protein and 12.32 was found.

Buffalo Cereal Co.'s horse feed was composed of oat by-products, corn, middlings and a little linseed. It practically met its guarantee.

Wonder Horse feed contained oat offal, hominy and middlings. It fell one per cent below its protein guarantee.

H. O. Horse feed was composed of oat offal, corn and peanuts. It had a bitter taste. The products put out by the H. O. Company almost always meet their guarantees.

Miscellaneous Starchy Feeds.
Page 25.

Dried beet pulp is as represented. It is quite digestible, but not economical, as a rule, for eastern farmers to purchase for milk production, as it is so deficient in protein.

Corn Bran (8.21 per cent protein) is quite digestible and may be considered economical at $15 a ton.

Germaline—ground corn germs from which the oil has been extracted—contained 13.60 per cent of protein and fully met its guarantee. It must be rather superior in feeding value to corn meal.

III. Poultry Feeds.

Animal By-Products. Pages 26-28.

Of the several animal by-products available for poultry feeding, meat scraps and meat and bone meal are the most prominent. Bone meal, dry ground fish and granulated milk are occasionally offered.

Meat scraps are a relatively coarse, dry material, of varying proportions of flesh, bone and fat. Preference should be given to bright, clean, finely ground brands of a high protein content (50 per cent), small amounts of bone (ash) and a low percentage of fat (15 per cent). Scraps, free from taint, are one of the most satisfactory animal foods for poultry. The average retail price of the different lots sampled was about $2.50 a hundred.

Meat and bone meals are not as widely distributed as meat scraps and appear chiefly as a few standard brands. They are dry, finely ground products, averaging lower in protein and fat, and decidedly higher in bone (ash) than scraps. A good grade should contain 40 per cent of protein, 10 per cent of fat and 35 per cent of ash. The retail price, $2.25 a hundred, was rather high as compared with scraps.

Fish. Dry ground fish resembles the better grades of animal meal in protein content (40–45 per cent) but contains rather more bone (ash), a very little fat (1–2 per cent) and has a somewhat lower feeding value.

Granulated milk. There was very little so-called granulated milk on the market. The two lots sampled tested similar to animal meal and had probably an equal feeding value.

Poultry Mixtures. Pages 29-32.

There are three distinct classes of these mixtures, the ground products, meals or mashes, to be fed wet or dry; the finely cracked grains and seeds for chick feeding; and the whole grains and large seeds for mature fowls.

The meals and mashes are composed chiefly of corn, oats and wheat or wheat offal, fortified with some animal by-product, and lightened with ground alfalfa, clover, hay or breakfast food waste. To this is often added charcoal as an anti-ferment, and more or less grit or shells. Ash determinations readily show the presence of any appreciable amount of grit or shells and have discouraged their use as a filler. Barley, rye, linseed and cottonseed, millet seed, peanut waste, buckwheat and peas have been occasionally noted. It is rather impracticable to try and set any definite standard for a feed of this character, but a mixture formulated somewhat as outlined, carrying 15 per cent of protein and 4–5 per cent of fat, with a low percentage of ash, should prove satisfactory at $1.50 to $1.75 a hundred. It is desirable that a poultry ration should contain a variety of ingredients, but in proprietary mixtures their quality is not always the best. The Maine experiment station recommends 200 lbs. bran, 100 lbs. middlings, 100 lbs. corn meal, 100 lbs. linseed meal, 100 lbs. gluten meal and 100 lbs. beef scraps. Such a mixture will not cost over $1.50 a hundred, and is certainly more economical, feeding value considered, than many of the commercial mixtures. Dry feeding and feeding with whole grains in preference to moist mashes, is now being considerably practiced.

Scratching grains. The various brands for chickens and for older fowls show a very similar composition, averaging 11 per cent protein and 3.5 per cent fat, but vary somewhat in their ingredients and noticeably in fineness. The chick grains were composed of wheat, corn, oats (often hulled), millet seed, Kaffir corn, grit and charcoal.

The *poultry grains*, coarsely cracked if at all, contained wheat, corn, Kaffir corn, barley, oats, sunflower seeds, buckwheat, millet seed, linseed cake, peas, pop-corn, charcoal, shells and grit. Meat products were seldom present, but there was a tendency to overload with grit in some instances. The retail price was about $2.35 a hundred for the chick grains, and $1.85 for the coarse grains, which was rather excessive considering the food value of the ingredients. It is believed that for older fowls poultrymen will do better to buy corn, oats, wheat and barley separately, than to purchase them in commercial poultry mixtures.

Alfalfa, as well as *clover meals*, are now obtainable for winter feeding. The former should carry 18 per cent protein, and the latter 12 per cent. Preference should be given to bright, clean lots, free from excess of coarse woody stalks. The price ($1.80 a hundred) is rather in excess of their value. Poultrymen by raising corn and clover can considerably reduce their outlay for food.

MOLASSES AND MOLASSES FEEDS.

Molasses. The residuum molasses from Porto Rico is at present being offered in New England for feeding purposes at 13 cents a gallon of 12 pounds. The station is devoting considerable time to studying the value of this product for the purpose of animal nutrition, and intends publishing its results in bulletin form when completed. The experiments are sufficiently advanced to justify the following statements :

1st. The molasses contains 24 to 28 per cent of water, 3 per cent of nitrogenous matter and 7 to 8 per cent of ash ; the balance consists of sugar and allied substances. It is a strictly carbohydrate feed, belonging to the same group as corn and hominy meals. Molasses is a perfectly legitimate feed stuff, the only questions for consideration relate to its relative economy and its suitability for different farm animals.

2nd. It will probably be shown to contain some 1200 pounds of digestible organic matter in a ton, against 1500 pounds in a ton of corn meal. On this basis alone it would have—pound for pound—80 per cent of the nutritive value of corn. Its value will probably be somewhat enhanced over this figure, because of its other desirable qualities.

3rd. Molasses has failed to produce any particularly favorable effect upon animals that were previously in normal condition, neither has it noticeably changed the quality of the milk. It has not been tried at this station upon horses that were not in satisfactory physical condition.

4th. Molasses may constitute one-sixth to one-fourth of the grain ration for horses (one pint to one-quart daily.) A larger quantity tends to make them logy. The same amount may be fed daily as a constituent of the grain ration for dairy stock. For young pigs, weighing 50 pounds, we have begun with an ounce daily in connection with sweet skim milk and corn meal, and gradually increased, until, when the pigs averaged 230 pounds, each was receiving 4 pounds daily. These pigs continue to grow well, and show no unfavorable effects from the molasses ration. Whether it will prove more economical than corn meal for fattening has not been demonstrated. The station intends giving this matter further study.

5th. Molasses being very deficient in nitrogenous matter must be fed in connection with some protein concentrate, when used as the component of a ration for dairy stock and growing pigs.

6th. It is believed the chief use of molasses for Northern farmers will consist in its apparently favorable action upon the organs of digestion, and in improving the palatability of corn stover, malt sprouts and similar feed stuffs, rather than as a nutrient to be fed in any large quantity in place of the best grades of concentrated feeds. (This applies particularly to horses and to dairy stock.)

7th. It is inconvenient to handle, requires more time to feed than ordinary grains, and in Summer attracts a large number of flies.

8th. The wise husbandman will produce upon his farm in the form of hay, corn and other cereals, the greater part, if not all of the carbohydrate feeds required, and will supplement them when necessary by *purchasing feeds rich in protein.* These latter feeds are necessary for milk production, as well as for increasing the fertility of the farm.

Molasses Feeds. Page 20.

1st. These mixtures, known as Sucrene, Holstein and Green Diamond sugar feeds, consist of finely cut hay, ground corn stalks, oat offal or similar material as a basis, together with one-quarter to one-third molasses, cereal by-products, malt sprouts in some cases, and sufficient cottonseed or other concentrate to increase the percentage of protein.

2nd. They contain from 12 to 15 per cent of protein, 10 to 12 per cent of fiber, and a small per cent of fat, the balance being of a carbonaceous nature.

3rd. Experiments made at this station have shown them to be about 70 per cent digestible, equivalent to 1200 to 1250 pounds of digestible matter in a ton, as against 1500 to 1550 in corn meal and gluten feed.

4th. At ordinary prices, they furnish digestible matter as cheaply as it can be had in wheat bran and cottonseed meal, but at a considerable advance in cost over that contained in corn meal or gluten feed. As sources of digestible protein, the sugar feeds are *decidedly expensive*: thus, cottonseed meal, distillers' dried grains and gluten feed furnish digestible protein for 2.7 to 3.8 cents a pound, while, in the form of sugar feeds, it costs in the vicinity of 8 cents.

5th. Dairy animals eat the sugar feeds readily, and they can be safely fed as one-half, or as the entire grain ration if desired. The less digestible protein contained in the roughage ration, the less satisfactory results will be obtained from the sugar feeds.

6th. The manure obtained from a bran and gluten feed ration, or from a ration made up of other nitrogenous concentrates, will contain more nitrogen and consequently have a higher fertilizing value than that secured from the sugar feed ration.

7th. The writer cannot, from the standpoint of economy, advocate feeds of this character in place of cottonseed meal, gluten feed, distillers' and brewers' dried grains, malt sprouts, flour middlings, corn and hominy meals.

GRAIN RATIONS FOR STOCK.

Most of the home grown coarse feeds are high in carbohydrates, low in protein and comparatively indigestible. All of the best grades of concentrates have a high degree of digestibility, and most of them—excepting the cereals—are high in protein and low to medium in carbohydrates. It is necessary, therefore, to feed the concentrates in connection with the roughage, first to increase the digestible matter (food actually available) and second, to increase the amount of protein in the daily ration.

Grain rations should be palatable, and bulky. Heavy concentrates such as cottonseed meal, flour middlings or gluten meal, should be mixed with bran, malt sprouts, distillers' grains, cut hay, or silage. If not thus diluted, they are likely to be imperfectly chewed, digested and assimilated, and are a frequent cause of digestion disturbances.

There is no "best" grain ration. Some feeds give more satisfactory results than others, and some are decidedly more economical. The following mixtures are offered as types. Their relative economy will depend upon the temporary market prices of their several components.

(*a*) *Cows in Milk.*

I.	II.
100 lbs. bran,	100 lbs. bran,
100 lbs. flour middlings,	100 lbs. gluten feed,
150 lbs. gluten feed,	25 lbs. cottonseed or linseed meal.
Mix and feed (7 lbs.) 8 qts. daily.	Mix and feed (7 lbs.) 8–9 qts. daily.

III.

125 lbs. bran,
100 lbs. cottonseed or linseed meal,
125 lbs. corn or hominy meal,
Mix and feed (7 lbs.) 8 qts. daily.

IV.

125 lbs. bran,
100 lbs. fine middlings,
100 lbs. gluten meal,
Mix and feed (7 lbs.) 8 qts. daily.

V.

150 lbs. bran,
200 lbs. gluten feed,
Mix and feed (7 lbs.) 9 qts. daily.

VI.

200 lbs. distillers' grains,
100 lbs. mixed feed,
50 lbs. corn or hominy meals,
Mix and feed (7 lbs.) 9 qts. daily.

VII.

200 lbs. distillers' grains,
150 lbs. fine middlings,
Mix and feed (7 lbs.) 7 qts. daily.

VIII.

100 lbs. malt sprouts,
125 lbs. corn or hominy meals,
125 lbs. gluten feed,
Mix and feed (7 lbs.) 7 qts. daily.

IX.

2 lbs. (3½ qts.) malt sprouts,
2 lbs (1½ qts.) cottonseed meal,
3 lbs. (1 qt.) molasses,
Mix for daily ration.

X.

100 lbs. cottonseed meal,
100 lbs. flour middlings,
150 lbs. corn or hominy meal.
Mix and feed 7 lbs. (5 qts.) daily.*

Seven pounds is the usual quantity to be fed daily to cows producing 10–12 quarts of average milk. The richer the milk, the more food is needed to produce a definite quantity. Grain prices being high, feeders in localities where there is not a quick demand for milk may find it economy to use but 5 pounds of grain daily, and a maximum amount of home grown roughage.† Heavy milking Holsteins weighing 1200 or more pounds, generally require from 10–14 pounds of grain daily, depending upon the flow of milk. The usual daily roughage ration for the above grain mixtures will consist of what hay the animal will eat clean (18–24 pounds) or one bushel of corn silage and 10–16 pounds of hay.

(b) *Young Stock.*

Most of the above rations will serve well for growing stock. From

*To be thoroughly mixed with silage or hay as a diluter.

†Early cut hay, hay of peas and oats cut in blossom, clover rowen, and well eared silage all aid in reducing the grain bill.

1 to 2 pounds daily is the usual allowance, depending upon the size and condition of the animal, to be fed in combination with hay, or hay and silage. The writer finds a mixture by weight of equal parts of bran and fine middlings quite satisfactory. A calf six months old receives about a pound of this mixture daily, which is increased to 2 or possibly 3 pounds when it reaches twelve to eighteen months.

(*c*) *Horses.*

Rations for horses, as well as a discussion of feeds and methods of feeding will be found in Bulletin No. 99, copies of which are still available.

WEIGHT OF CONCENTRATES.

This table has been prepared by weighing a carefully measured quantity of the several feeds.

FEED STUFF.	One Quart Weighs.	One Pound Measures.
PROTEIN FEEDS.		
Cottonseed meal	1.5 lbs.	0.7 qts.
N. P. linseed meal	0.9 "	1.1 "
O. P. linseed meal	1.1 "	0.9 "
Gluten meal	1.7 "	0.6 "
Gluten feed	1.3 "	0.8 "
Germ oil meal	1.4 "	0.7 "
Distillers' dried grains	0.5-0.7 "	1.0-1.4 "
Malt sprouts	0.6 "	1.7 "
Brewers' dried grains	0.6 "	1.7 "
Wheat middlings (flour)	1.2 "	0.8 "
Wheat middlings (standard)	0.8 "	1.3 "
Wheat mixed feed	0.6 "	1.7 "
Wheat bran	0.5 "	2.0 "
H-O dairy feed	0.7 "	1.4 "
Oat middlings	1.5 "	0.7 "
Rye feed	1.3 "	0.8 "
STARCHY FEEDS.		
Whole oats	1.0 "	1.0 "
Ground oats	0.7 "	1.4 "
Whole wheat	1.9 "	0.5 "
Ground wheat	1.7 "	0.6 "
Whole barley	1.5 "	0.7 "
Barley meal	1.1 "	0.9 "
Whole rye	1.7 "	0.6 "
Rye meal	1.5 "	0.7 "
Whole corn	1.7 "	0.6 "
Corn meal	1.5 "	0.7 "
Corn and cob meal	1.4 "	0.7 "
Corn bran	0.5 "	2.0 "
Hominy meal	1.1 "	0.9 "
Corn and oat feed (Victor)	0.7 "	1.4 "
Quaker dairy feed	1.0 "	1.0 "
Oat feed	0.8 "	1.3 "

MARKET PRICES OF CONCENTRATES.

FEED STUFFS.	Monthly Wholesale Ton Prices—1905.												Average.
	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	
Cottonseed meal	$25.94	$25.73	$26.50	$26.50	$26.50	$26.80	$26.82	$27.20	$27.44	$26.75	$27.69	$29.34	$26.94
Linseed meal	28.13	26.81	27.75	28.69	29.00	—	—	—	—	—	—	—	28.08
Gluten meal	—	—	—	—	—	—	28.50	28.50	28.50	28.50	—	—	28.50
Gluten feed, sacked	25.40	25.41	25.80	25.36	22.88	24.73	24.38	24.75	25.13	25.25	26.05	26.55	25.15
Gluten feed, bulk	†24.78	†24.15	†24.65	†22.90	†22.90	†23.90	—	—	—	—	—	—	23.88
Distillers' grains	*25.50	*25.75	*25.50	*24.50	*24.00	*24.75	*24.50	*24.75	*24.75	*25.75	*26.00	*27.00	25.23
Red Dog	23.66	23.00	23.65	23.07	22.75	23.00	22.96	23.08	23.06	22.75	22.82	23.13	23.09
Wheat middlings	21.82	21.38	21.73	20.10	20.13	20.48	20.21	19.95	19.74	19.63	20.26	21.03	20.54
Mixed feed	22.97	22.13	22.08	21.00	20.69	20.68	20.25	19.90	19.60	19.63	19.93	21.43	20.86
Bran, Spring	20.82	19.60	19.70	18.16	17.98	18.00	17.59	16.98	17.16	16.90	17.57	18.58	18.25
Bran, Winter	22.25	21.38	21.40	19.88	18.81	22.56	18.31	17.85	17.63	17.52	18.32	19.19	19.59
Hominy meal	22.44	20.69	21.57	21.13	21.35	†21.65	22.75	22.40	22.07	22.48	22.75	22.25	21.96
Corn meal	21.40	21.20	22.20	22.20	22.80	24.60	24.60	24.00	23.80	25.40	24.40	22.20	23.23
Corn No 2, yellow	—	—	21.08	21.04	21.78	23.22	23.68	23.04	22.82	24.08	23.22	19.64	22.36
Oats, No. 2 clipped white	24.38	24.38	24.74	23.88	24.06	24.38	24.94	22.32	21.44	22.80	23.76	24.68	23.81
Feed barley	21.34	21.34	21.92	23.12	22.20	23.32	23.12	21.78	21.34	21.34	22.88	21.68	22.12
Rye, No. 2	32.50	32.50	32.50	32 50	31.20	30.00	28.22	23.92	23.68	23.40	27.86	26.60	28.74

*Chapin & Co.

†Flour and Feed.

QUESTIONS FOR CONSIDERATION.

1. Can you afford to buy attractively named stock foods, consisting of oat offal mixed with more or less corn,—frequently of inferior quality,—when clear corn or hominy meal can be had for the same money?

2. Isn't it more economical for you to buy standard concentrates and mix your own grain rations, rather than purchase uncertain mixtures, and at the same time pay somebody else for doing the mixing?

3. Do you consider it good business policy to purchase proprietary mixtures containing only 10 to 20 per cent of protein, when you can secure the highest grade protein feeds for about the same money?

These bulletins are published for YOUR benefit. If you can suggest ways in which they can be made more helpful, let us hear from you!!!

HATCH EXPERIMENT STATION

—OF THE—

MASSACHUSETTS

AGRICULTURAL COLLEGE.

BULLETIN NO. 109.

I. ANALYSES OF MANURIAL SUBSTANCES FORWARDED FOR EXAMINATION.

II. ANALYSES OF PARIS GREEN AND OTHER INSECTICIDES FOUND IN THE GENERAL MARKETS.

III. INSTRUCTIONS REGARDING THE SAMPLING OF MATERIALS TO BE FORWARDED FOR ANALYSIS.

IV. INSTRUCTIONS TO MANUFACTURERS, IMPORTERS, AGENTS AND SELLERS OF COMMERCIAL FERTILIZERS.

V. DISCUSSION OF TRADE VALUES OF FERTILIZING INGREDIENTS FOR 1906.

MARCH, 1906.

The regular Bulletins of this Station will be sent free to all newspapers in the State and to such individuals interested in farming as may request the same. Technical Bulletins are sent only to those persons interested in the subject treated of in each case.

AMHERST, MASS.:
PRESS OF CARPENTER & MOREHOUSE
1906.

HATCH EXPERIMENT STATION

OF THE

Massachusetts Agricultural College,

AMHERST, MASS.

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The co-operation and assistance of farmers, fruit-growers, horticulturists, and all interested, directly or indirectly, in agriculture, are earnestly requested. The Bulletins will be sent free to all newspapers in the State and to such individuals interested in farming as may request the same. General bulletins, fertilizer analyses, analyses of feed-stuffs, and annual reports are published. Kindly indicate in application which of these are desired. Communications may be addressed to the

HATCH EXPERIMENT STATION, Amherst, Mass.

DIVISION OF CHEMISTRY.

C. A. Goessmann.

I.

ANALYSES OF FERTILIZER SUBSTANCES, REFUSE MATERIALS AND SOILS SENT ON FOR EXAMINATION.

WOOD ASHES.

1826-1829. I. Received from Northfield Farms, Mass.
II. Received from Northampton, Mass.
III and IV. Received from Rochester, Mass.

	PER CENT.			
	I.	II.	III.	IV.
Moisture at 100° C.,	15.12	3.15	17.84	4.88
Potassium oxide,	3.09	4.84	2.81	6.25
Phosphoric acid,	1.46	1.02	1.62	1.80
Calcium oxide,	33.04	35.44	31.64	35.60
Insoluble matter,	11.98	23.31	21.89	22.43

1830-1833. I. Received from Littleton, Mass.
II. Received from Taunton, Mass.
III. Received from Worcester, Mass.
IV. Received from Marlboro, Mass.

	PER CENT.			
	I.	II.	III.	IV.
Moisture at 100° C.,	9.99	11.52	9.25	15.75
Potassium oxide,	5.20	4.72	7.02	5.04
Phosphoric acid,	1.40	1.54	1.54	1.28
Calcium oxide,	19.28	29.64	33.63	28.08
Insoluble matter,	12.94	14.62	14.37	11.83

1834-1837. I. Received from Worcester, Mass.
II. Received from North Amherst, Mass.
III. Received from Sunderland, Mass.
IV. Received from Concord, Mass.

	PER CENT.			
	I.	II.	III.	IV.
Moisture at 100° C.,	18.46	12.86	17.98	7.37
Potassium oxide,	2.75	4.64	6.38	4.28
Phosphoric acid,	1.25	.92	1.44	1.36
Calcium oxide,	28.81	25.65	22.56	22.70
Insoluble matter,	*	22.56	14.35	30.25

1838-1840. I. Received from North Hadley, Mass.
II and III. Received from North Amherst, Mass.

	PER CENT.		
	I.	II.	III.
Moisture at 100° C.,	14.05	20.63	14.10
Potassum oxide,	3.92	5.88	5.78
Phosphoric acid,	1.02	1.40	1.38
Calcium oxide,	27.06	23.38	26.67
Insoluble matter,	20.51	17.38	19.58

COTTON HULL ASHES.

1841-1843. I. Received from Amherst, Mass.
II. Received from Southwick, Mass.
III. Received from Amherst, Mass.

	PER CENT.		
	I.	II.	III.
Moisture at 100° C.,	8.99	6.67	11.92
Potassium oxide,	25.00	21.68	18.88
Phosphoric acid,	7.68	7.24	8.58
Calcium oxide,	*	10.23	*
Insoluble matter,	*	14.27	*

LIME ASHES.

1844-1847. I. Received from Sunderland, Mass.
II. Received from Boston, Mass.
III and IV. Received from South Deerfield, Mass.

* Not determined.

	PER CENT.			
	I.	II.	III.	IV.
Moisture at 100° C.,	9.59	.89	8.36	none.
Potassium oxide,	1.44	2.52	3.72	3.00
Phosphoric acid,	.40	1.02	1.00	.58
Calcium oxide,	29.33	43.75	41.04	49.74
Insoluble matter,	7.68	34.93	6.17	4.98

REFUSE ASHES.

1848-1850. I. Received from Springfield, Mass.
II. Received from Boston, Mass.
III. Received from Springfield, Mass.

	PER CENT.		
	I.	II.	III.
Moisture at 100° C.,	.23	8.44	1.50
Potassium oxide,	1.49	1.36	3.00
Phosphoric acid,	1.12	.86	.38
Calcium oxide,	3.92	9.81	24.74
Insoluble matter,	89.00	47.06	39.98

NITRATE OF SODA.

1851-1854. I. Received from Seekonk, Mass.
II. Received from Ashley Falls, Mass.
III. Received from North Amherst, Mass.
IV. Received from Whately, Mass.

	PER CENT.			
	I.	II.	III.	IV.
Moisture at 100° C.,	1.10	2.13	.42	1.45
Nitrogen,	15.34	15.28	15.13	15.60

1855-1858. I. Received from Amherst, Mass.
II and III. Received from Dighton, Mass.
IV. Received from Bradstreet, Mass.

	PER CENT.			
	I.	II.	III.	IV.
Moisture at 100° C.,	2.63	.78	.43	1.96
Nitrogen,	14.84	15.58	15.46	15.62

COTTONSEED MEAL, LINSEED MEAL AND BLOOD.

1859-1864.

I and II. Cottonseed meal, received from Hatfield, Mass.
III. Cottonseed meal, received from North Hadley.
IV. Cottonseed meal, received from Bradstreet, Mass.
V. New process linseed meal, received from Hatfield, Mass.
VI. Dried blood, received from Raynham, Mass.

	PER CENT.					
	I.	II.	III.	IV.	V.	VI.
Moisture at 100° C.,	5.36	5.92	9.14	7.11	10.83	8.70
Nitrogen,	6.69	6.31	6.37	6.59	5.67	9.74
Phosphoric acid,	*	*	3.29	3.39	1.79	7.44
Potassium oxide,	*	*	1.90	2.10	1.32	*
Calcium oxide,	*	*	*	.42	*	*

POTASH SALTS.

1865-1868. I. High grade sulphate of potash, received from North Amherst, Mass.
II. High grade sulphate of potash, received from Whately, Mass.
III. High grade sulphate of potash, received from Raynham, Mass.
IV. High grade sulphate of potash, received from Bradstreet, Mass.

	PER CENT.			
	I.	II.	III.	IV.
Moisture at 100° C.,	.40	1.43	1.15	2.83
Potassium oxide,	49.40	48.20	49.50	48.04

1869-1872. I. Carbonate of potash, received from Easthampton.
II and III. Carbonate of potash, received from Springfield.
† IV. Carbonate of potash, received from New York city.

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*Not determined.

† Sample four was received from a New York firm in response to a request for quotations on carbonate of potash, and was represented to be a calcined carbonate of potash. It showed the presence of 29.70% carbonic acid (CO_2) which would be the carbonic acid equivalent of 93.20% carbonate of potash, leaving 3.53% of potassium oxide in form of caustic potash (4.2% caustic potash). This caustic potash would not be objectionable as the caustic potash in coming in contact with the air would at once absorb carbonic acid and form carbonate of potash. All of the above samples were of good quality and contained but slight traces of chlorine and sulphates.

	PER CENT.			
	I.	II.	III.	IV.
Moisture at 100° C.,	5.36	4.92	.50	none.
Potassium oxide,	62.60	63.95	67.12	67.12

1873-1876. I. Muriate of potash, received from New Bedford.
II. Muriate of potash, received from Dighton.
III. Double manure salts, received from Hatfield.
IV. Kainit, received from Dighton.

	PER CENT.			
	I.	II.	III.	IV.
Moisture at 100° C.,	.90	.02	5.86	3.98
Potassium oxide,	50.04	52.60	28.32	12.48

PHOSPHORIC ACID COMPOUNDS.

1877-1880. I. Dissolved bone black, received from Whately.
II. Dissolved bone black, received from Bradstreet.
III. Plain superphosphate, received from North Amherst, Mass.
IV. Dissolved bone, received from Raynham, Mass.

	PER CENT.			
	I.	II.	III.	IV.
Moisture at 100° C.,	1.41	11.85	7.95	6.66
Total phosphoric acid,	19.18	17.28	16.38	16.70
Soluble phosphoric acid,	5.88	6.40	3.85	6.98
Reverted phosphoric acid,	6.40	6.00	6.91	6.90
Insoluble phosphoric acid,	6.90	4.88	5.62	2.82
Nitrogen,	*	*	*	1.21

GROUND BONE, TANKAGE AND DRY GROUND FISH.

1881-1884. I. Ground bone, received from Easthampton, Mass.
II, III and IV. Ground bone, received from Concord Junction.

	PER CENT.			
	I.	II.	III.	IV.
Moisture at 100° C.,	4.30	4.42	6.45	5.86
Total phosphoric acid,	28.78	23.28	23.16	21.50
Available phosphoric acid,	10.86	6.72	7.04	6.02
Insoluble phosphoric acid,	17.92	16.56	16.12	15.48
Nitrogen,	1.83	3.66	3.49	2.19

* Not determined.

1885-1888. I. Ground bone, received from Hinsdale, Mass.
II. Ground bone, received from Boston, Mass.
III. Tankage, received from Seekonk, Mass.
IV. Tankage, received from Concord, Mass.

	PER CENT.			
	I.	II.	III.	IV.
Moisture at 100° C.,	4.56	13.20	5.07	17.02
Total phosphoric acid,	19.88	27.04	11.12	16.12
Available phosphoric acid,	8.96	9.82	4.72	7.68
Insoluble phosphoric acid,	10.92	17.22	6.40	8.44
Nitrogen,	4.07	2.12	4.28	5.50

1889-1892. I. Tankage, received from Framingham, Mass.
II. Dry ground fish, received from North Amherst.
III. Dry ground fish, received from Agawam, Mass.
IV. Dry ground fish, received from Bradstreet, Mass.

	PER CENT.			
	I.	II.	III.	IV.
Moisture at 100° C.,	6.32	14.42	11.86	4.49
Total phosphoric acid,	15.10	8.82	7.06	6.40
Available phosphoric acid,	5.40	5.88	4.56	5.38
Insoluble phosphoric acid,	9.70	2.94	2.50	1.02
Nitrogen,	5.00	7.87	9.30	8.47

LIME COMPOUNDS.

1893-1894. I. Carbonate of lime, received from Springfield, Mass.
† II. Prepared lime, received from Springfield, Mass.

	PER CENT.	
	I.	II.
Moisture at 100° C.,	.77	1.25
Calcium oxide,	51.65	63.36
Carbonic acid,	38.85	6.16
Magnesium oxide,	*	3.80
Insoluble matter,	.42	4.31

* Not determined.

†Sample two contains, according to the above analysis, 73.36% of air slaked lime and 14% of carbonate of lime. It would be a better lime for agricultural purposes than number one as it would be more active.

REFUSE SUBSTANCES.

1895-1898. I. Cotton waste, received from Westport, Mass.
II. Cotton seed compost, received from Sunderland.
III. Rotted cotton waste, received from Wellesley.
IV. Damaged cocoa, received from Boston, Mass.

	PER CENT.			
	I.	II.	III.	IV.
Moisture at 100° C.,	7.14	41.91	51.62	6.60
Nitrogen,	1.26	.81	.52	3.10
Potassium oxide,	1.58	.32	.76	2.94
Phosphoric acid,	.38	.62	.44	1.66
Calcium oxide,	3.06	1.82	*	trace
Ash,	13.14	*	*	7.14
Insoluble matter,	5.48	*	13.94	*

1899-1903. I. Glue refuse, received from Boston, Mass.
II. Leather dust, received from North Adams, Mass.
III. Bone soup, received from North Grafton, Mass.
IV. Refuse from wool washings, received from South Barre, Mass.
V. Factory refuse, received from Lowell, Mass.

	PER CENT.				
	I.	II.	III.	IV.	V.
Moisture at 100° C.,	28.03	8.40	91.11	38.16	2.59
Nitrogen,	1.90	5.76	1.42	.38	.59
Potassium oxide,	*	*	.01	.64	.52
Phosphoric acid,	.37	.06	.04	.09	trace
Calcium oxide,	*	*	*	.93	*
Ash,	*	2.40	*	51.18	3.74
Insoluble matter,	11.67	.17	*	45.49	*

MISCELLANEOUS SUBSTANCES.

1904-1907. I. Muck, received from Buckland, Mass.
II. Muck, received from New Lenox, Mass.
III. Muck, received from Hatfield, Mass.
IV. Peat, received from Bernardston, Mass.

* Not determined.

	PER CENT.			
	I.	II.	III.	IV.
Moisture at 100° C.,	70.82	85.92	6.34	21.00
Nitrogen,	.43	.30	1.59	1.62
Ash,	16.37	2.73	*	23.88
Potassium oxide,	.10	.03	*	.13
Phosphoric acid,	.17	.01	*	.03
Calcium oxide,	1.08	.46	*	.21

1908-1911. I. Mud from the decomposition of seaweed, received from Milford, Mass.

II. Granulated tobacco stems, received from Holyoke, Mass.

III. Peruvian Guano, received from Boston, Mass.

IV. Pigeon manure, received from Harwich, Mass.

	PER CENT.			
	I.	II.	III.	IV.
Moisture at 100° C.,	78.93	10.86	5.96	19.47
Nitrogen,	.55	2.00	2.07	4.49
Phosphoric acid,	.04	.90	18.22	2.33
Available phosphoric acid,	*	*	7.90	*
Insoluble phosphoric acid,	*	*	10.32	*
Potassium oxide,	.15	8.07	.69	1.76
Calcium oxide,	.24	*	*	2.03
Ash,	*	34.00	*	16.00
Insoluble matter,	13.97	.93	*	8.09

COMPLETE FERTILIZERS.

1912-1915.

I and II. Received from Sunderland, Mass.

III. Received from Hatfield, Mass.

IV. Received from Weir, Mass.

	PER CENT.			
	I.	II.	III.	IV.
Moisture at 100° C.,	2.96	5.35	9.37	9.75
Total phosphoric acid,	10.90	.52	8.82	8.82
Soluble phosphoric acid,	*	*	.15	1.75

* Not determined.

Reverted phosphoric acid,	8.86	*	3.81	4.25
Insoluble phosphoric acid,	2.04	*	4.86	2.82
Potassium oxide,	14.50	28.46	5.50	5.32
Nitrogen,	*	*	4.69	2.93
Calcium oxide,	12.61	18.55	*	*
Sulphuric acid,	17.96	16.52	*	*
Chlorine,	1.04	2.30	*	*
Carbonic acid,	7.29	15.27	*	*

1916-1920. I. Received from Bridgewater, Mass.
II. Received from Southwick, Mass.
III. Received from Oxford, Mass.
IV. Received from Deerfield, Mass.
V. Received from Agawam, Mass.

	PER CENT.				
	I.	II.	III.	IV.	V.
Moisture at 100° C.,	9.20	8.10	7.89	4.95	14.12
Total phosphoric acid,	11.44	10.74	8.24	6.24	12.02
Soluble phosphoric acid,	3.05	4.38	.85	2.72	8.00
Reverted phosphoric acid,	5.19	3.16	3.75	1.52	1.98
Insoluble phosphoric acid,	3.20	3.20	3.64	2.00	2.04
Potassium oxide,	.82	6.46	3.70	11.22	4.18
Nitrogen,	.49	3.09	5.13	5.65	1.73

1921-1924. I. Received from Worcester, Mass.
II. Received from Seekonk, Mass.
III. Received from Southwick, Mass.
IV. Received from Holyoke, Mass.

	PER CENT.			
	I.	II.	III.	IV.
Moisture at 100° C.,	7.04	9.73	7.10	8.78
Total phosphoric acid,	8.22	9.86	5.38	4.78
Soluble phosphoric acid,	1.30	6.40	.58	3.13
Reverted phosphoric acid,	4.84	2.30	3.00	.63
Insoluble phosphoric acid,	2.08	1.16	1.80	1.02
Potassium oxide,	7.61	7.34	5.08	6.00
Nitrogen,	5.09	3.41	4.60	3.80

* Not determined.

1925-1928. I. Received from Holyoke, Mass.
II. Received from Worcester, Mass.
III. Received from Holyoke, Mass.
IV. Received from Hatfield, Mass.

	PER CENT.			
	I.	II.	III.	IV.
Moisture at 100° C.,	8.83	8.39	7.92	7.67
Total phosphoric acid,	10.54	10.16	8.22	3.46
Soluble phosphoric acid,	6.25	4.28	5.65	—
Reverted phosphoric acid,	3.11	3.28	1.93	2.36
Insoluble phosphoric acid,	1.18	2.60	.64	1.10
Potassium oxide,	8.24	7.12	8.62	8.56
Nitrogen,	2.89	3.00	6.84	4.18

SOILS.

1929-1933.
I, II and III. Received from Barre, Mass.
IV. Received from West Newton, Mass.
V. Received from Wellesley, Mass.

	PER CENT.				
	I.	II.	III.	IV.	V.
Moisture at 100° C.,	16.75	21.92	23.09	10.75	5.72
Nitrogen,	.15	.15	.17	.13	.27
Ash,	77.84	74.76	71.76	86.19	85.60
Potassium oxide,	.30	.18	.22	.15	.27
Phosphoric acid,	.18	.20	.23	.23	.62
Calcium oxide,	.93	.50	.07	1.02	1.67

1934-1938.
I and II. Received from North Easton, Mass.
III, IV and V. Received from Foxboro, Mass.

	PER CENT.				
	I.	II.	III.	IV.	V.
Moisture at 100° C.,	13.75	17.13	13.27	24.32	13.12
Nitrogen,	.10	.16	.15	.25	.20
Ash,	*	*	80.15	67.27	79.57
Potassium oxide,	.18	.17	.09	.12	.11
Phosphoric acid,	.08	.20	.25	.17	.29
Calcium oxide,	*	*	.97	.93	1.22

* Not determined.

1939-1943.

I, II, III, and IV. Received from Foxboro, Mass.
V. Received from Hubbardston, Mass.

	PER CENT.				
	I.	II.	III.	IV.	V.
Moisture at 100° C.,	31.05	10.47	12.00	19.93	16.59
Nitrogen,	.16	.20	.14	.16	.22
Ash,	62.75	82.47	71.50	73.45	76.60
Potassium oxide,	.11	.21	.16	.10	.33
Phosphoric acid,	.16	.19	.22	.18	.10
Calcium oxide,	.92	.93	1.07	.80	1.57

1944-1948. I. Received from Hadley, Mass.
II and III. Received from Worcester, Mass.
IV. Received from Boston, Mass.
V. Received from Mansfield, Mass.

	PER CENT.				
	I.	II.	III.	IV.	V.
Moisture at 100° C.,	8.52	8.44	23.63	8.33	9.96
Nitrogen,	.14	.27	.11	.20	.19
Ash,	84.90	85.55	79.91	89.52	83.07
Potassium oxide,	.22	.41	.15	.06	.16
Phosphoric acid,	.45	.06	.04	.05	.07
Calcium oxide,	.45	1.13	1.20	.52	.51

1949-1953.

I and II. Received from Mansfield, Mass.
III. Received from Haverhill, Mass.
IV. Received from East Holliston, Mass.
V. Received from Bryantville, Mass.

	PER CENT.				
	I.	II.	III.	IV.	V.
Moisture at 100° C.,	7.58	8.76	14.91	11.33	26.10
Nitrogen,	.12	.15	.15	.17	.17
Ash,	87.37	85.50	74.95	83.97	66.53
Potassium oxide,	.06	.14	.17	.13	.13
Phosphoric acid,	.10	.25	.38	.13	.10
Calcium oxide,	1.92	1.09	1.11	.89	.83

1954-1958.

I and II. Received from Brookfield, Mass.
III, IV and V. Received from Norton, Mass.

	PER CENT.				
	I.	II.	III.	IV.	V.
Moisture at 100° C.,	33.81	25.85	22.93	17.14	21.43
Nitrogen,	.35	.29	.13	.08	.11
Ash,	54.99	65.65	72.07	79.12	74.03
Potassium oxide,	.10	.10	.11	.02	.09
Phosphoric acid,	.17	.23	.15	.11	.10
Calcium oxide,	.41	.62	.61	.58	.81

1959-1963.

I, II, III and IV. Received from Amherst, Mass.
V. Greenhouse soil, received from Pittsfield, Mass.

	PER CENT.				
	I.	II.	III.	IV.	V.
Moisture at 100° C.,	.33	.88	.45	1.95	23.07
Nitrogen,	.035	.155	.065	.105	.33
Ash,	97.80	93.48	97.15	03.63	67.58
Potassium oxide,	.34	.18	.09	.16	.32
Phosphoric acid,	.10	.21	.06	.32	.35
Calcium oxide,	1.06	1.30	.76	1.20	.42

II. ANALYSIS OF PARIS GREEN, ARSENATE OF LEAD AND OTHER INSECTICIDES.

I. Paris Green, manufactured by C. T. Raynolds & Co., New York City, and collected of Joseph Breck & Sons, Boston, Mass.

II. Paris Green, manufactured by A. B. Ansbacher & Co., New York City, and collected of Joseph Breck & Sons, Boston, Mass.

III. Lion Brand Paris Green, manufactured by James A. Blanchard, New York City, collected of Joseph Breck & Sons, Boston, Mass.

IV. Paris Green, manufactured by Leggett & Bro., New York City, collected of W. W. Rawson & Co., Boston, Mass.

V. Paris Green, manufactured by James A. Blanchard, New York City, collected of R. & J. Farquhar & Co., Boston, Mass.

	PER CENT.				
	I.	II.	III.	IV.	V.
Moisture at 100° C.,	.92	.88	1.07	.68	.58
Arsenious oxide,	61.16	56.17	54.49	57.48	56.53
Copper oxide,	27.00	27.95	28.25	29.95	28.80
Soluble arsenious oxide,	13.59	2.92	2.40	2.52	3.01
Insoluble matter,	.34	.25	.24	.22	.15

I and II. Swift's Arsenate of lead, manufactured by the Merrimac Chemical Co., Boston, Mass. I. collected of W. W. Rawson & Co., Boston, Mass. II. collected of Schlegel & Fottler Co., Boston, Mass.

III. Fungicide, said to be imported from Europe, sent in by a large agricultural warehouse in the western part of the state.

	PER CENT.		
	I.	II.	III.
Moisture,	39.73	56.86	3.00
Lead oxide,	39.44	28.00	—
Arsenious oxide,	13.64	9.71	—
Insoluble matter,	—	—	—
Calcium carbonate,	—	—	30.32
Air slaked lime,	—	—	17.89
Zinc chromate,	—	—	5.14
Zinc oxide,	—	—	6.41

III.

INSTRUCTIONS REGARDING THE SAMPLING OF MATERIALS TO BE SENT ON FOR EXAMINATION WITH STATEMENTS OF CONDITIONS TO SECURE ANALYSES FREE OF CHARGE.

It has been deemed advisable to republish in detail the instructions regarding the proper mode of sampling soils, fertilizers and other materials, both in bag and in bulk, and also the instructions regarding the packing, marking and shipment of same to insure prompt delivery, and that the results of analyses may fairly represent the *average composition* of the material in question. Unless the sample forwarded for analysis is an average representative sample, the results of our chemical investigation of the same become of little value. We are much pleased to say, however, that we have every reason to believe that the many samples received during the past year have, as a whole, been taken intelligently, and there are indications that greater care is being exercised by parties sampling material for analysis than ever before. It is our wish, however, that this subject may be called to the attention of as many farmers as possible, as there is still chance for improvement.

It is of the utmost importance that parties forwarding fertilizing substances for examination should take particular pains in sampling, packing and forwarding such materials, in order that the analyses obtained may represent the average composition of the goods sampled, and that no addition or loss of moisture in transportation may happen. The samples received are entered on our records in the order of their arrival at this office, and each sample is assigned a number and is taken up for investigation in the order in which it has been received.

The name of the sender should be enclosed in an envelope and placed inside the receptacle, together with a statement of the nature of the material forwarded for analysis; whether it is an agricultural chemical, mixed fertilizer, a wood ash, or the by-product of some manufacturing industry, or a sample of soil.

The results of all analyses of samples made at the Station, free of charge, are considered at the disposal of the managers for publication, if deemed advisable.

All samples should be addressed to Dr. C. A. Goessmann, Chemical Department of the Hatch Experiment Station, Amherst, Mass., to prevent possible delay. Express charges ought to be prepaid.

SAMPLING OF MATERIAL IN BULK.

In sampling such material as wood ashes, cotton hull ashes, and, in fact, any material in bulk, portions should be taken from various parts of the heap and placed on a thick, smooth piece of paper and thoroughly mixed ; from this mixture should be drawn a sample of about one pound, which should be placed in a clean bottle, jar or tin can, tightly stoppered and sealed, in order to retain the moisture of the material unchanged.

SAMPLING OF MATERIAL IN BAGS.

In sampling material which is shipped in bags, portions should be drawn from at least ten per cent of the number of bags present. A fair sample may be obtained by emptying about ten per cent of the bags present on a clean floor or other smooth surface, and thoroughly mixing ; small amounts are then taken from different parts of the heap and an average sample drawn as has been previously described.

SAMPLING OF SOILS.

The taking of representative soil samples, when such are desired for chemical investigation, is of the first importance, as without proper care in taking samples the results of a careful chemical analysis become of little value. The sample should be taken from different portions of the field and to a depth not exceeding the downward limit of the surface soil. After selecting a place where a sample is to be taken, pull up all growing vegetation and remove all surface matter which is not a part of the soil. Dig a hole in the soil about two feet square, making the sides smooth and clean by means of a sharp bladed shovel or other instrument ; now place a sharp bladed shovel at the point of separation of the surface soil from the subsoil, and by means of another flat bladed instrument shave off a portion (about two inches) from all four sides of the aperture, letting the soil fall into a shovel which is held in a proper position to receive the same. Place the soil in a suitable receptacle, and proceed to take other samples in a like manner from several different parts of the field. The large bulk of soil which has thus been taken is now placed on a clean floor or on a large piece of thick paper and thoroughly broken up and mixed, after which an average sample is drawn and placed in a glass jar or bottle. The bottle is then securely stoppered and sealed, properly labelled and forwarded for the subsequent chemical examination.

Statements should accompany the sample or be sent in a sealed letter, setting forth the locality, depth at which the sample was taken, nature of subsoil and depth, the mode of fertilization and crop rotation which has been in practice, general fitness of land for cultivation and all other information that would be of interest or assistance to the chemist in formulating his report.

Care should be exercised in sampling when the weather conditions are normal, and no time should be lost between the drawing of the sample and the forwarding of same to the laboratory. This point applies with equal force to all materials forwarded for investigation.

APPLICATION FOR FREE ANALYSIS OF FERTILIZERS AND FERTILIZING MATERIAL.

Name of Material . . . .

Name of manufacturer or dealer . . . .

Address of manufacturer or dealer . . . .

Date of purchase . . . .

Price paid per ton . . . .

Whether bought for own use or for sale . . . .

Signature of applicant . . . .

Post Office Address . . . .

A printed copy of the above stated questions will be sent hereafter from this office *to every applicant for analysis free of charge*, to be answered by him according to his best information, before his request can be considered.

We occasionally receive samples that bear no mark of identification and therefore have to be thrown away. For this reason we have had shipping tags printed and applicants for analysis will upon request be furnished printed shipping tags which will facilitate the shipping of samples and insure their safe delivery and recognition.

IV.

INSTRUCTIONS TO MANUFACTURERS, IMPORTERS, AGENTS AND SELLERS OF COMMERCIAL FERTILIZERS AND MATERIALS USED FOR MANURIAL PURPOSES IN MASSACHUSETTS.

1. An application for a certificate of compliance with the regulations of the trade in commercial fertilizers and materials used for manurial purposes in this state must be accompanied :

First, with a distinct statement of the name of each brand offered for sale, the name of the manufacturer and place of factory.

Second, with a statement of the amount of phosphoric acid, of nitrogen and of potassium oxide guaranteed in each distinct brand.

The statement of the percentage of phosphoric acid should include its several forms when present as follows : *Soluble in distilled water, and reverted, as well as total phosphoric acid.* The potash should be guaranteed as *potassium oxide*, and not as sulphate or muriate, although the source from which the potassium oxide is derived may be mentioned on the tag or stencil.

In all cases the guaranteed percentage of *nitrogen should be stated.* The ammonia equivalent of nitrogen may be stated at the option of the manufacturer.*

Third, with the fee charged by the State for a certificate, which is five dollars for each of the following articles: nitrogen, phosphoric acid and potassium oxide guaranteed in any distinct brand.

2. The obligation to secure a certificate applies not only to compound fertilizers, but to all substances, single or compound, used for manurial purposes offered for sale in this State.

3. The certificate of compliance with our State laws must be secured annually before the first of May.

4. Manufacturers, importers and dealers in commercial fertilizers can appoint in this State as many agents as they desire after having secured at this office the certificate of compliance with our laws.

5. Agents of manufacturers, importers and dealers in commercial fertilizers are held personally responsible for their transactions until they can prove that the articles they offer for sale are duly recorded in this office.

6. Manufacturers and importers are requested to furnish a list of their agents.

All inquiries regarding the sales of commercial fertilizers, etc., should be addressed to C. A. Goessmann, Amherst, Mass., Chemist in charge of the official inspection of these articles.

*To reduce ammonia to nitrogen, multiply the per cent. of ammonia by 14 and divide that product by 17 (or multiply the per cent. of ammonia by the factor .824).

V.

TRADE VALUES OF FERTILIZING INGREDIENTS IN RAW MATERIALS AND CHEMICALS FOR 1905 AND 1906.

	1905	1906
	CENTS PER POUND	
Nitrogen in ammonia salts,	17.5	17.5
" nitrates,	17.0	16.5
Organic nitrogen in dry and fine ground fish, meat, blood, and in high-grade mixed fertilizers,	18.5	18.5
" " " fine bone and tankage,	18.0	18.0
" " " coarse bone and tankage,	13.0	13.0
Phosphoric acid soluble in water,	4.5	4.5
" " soluble in ammonium citrate,	4.0	4.0
" " in fine ground fish, bone and tankage,	4.0	4.0
" " in cottonseed meal, castor pomace and wood ashes,	4.0	4.0
" " in coarse fish, bone and tankage,	3.0	3.0
" " insoluble (in water and in neutral citrate of ammonia) in mixed fertilizers,	2.0	2.0
Potash as Sulphate, free from Chlorides,	5.0	5.0
" " Muriate (chloride),	4.25	4.25
" " Carbonate,	8.0	8.00

The above schedule of trade values was adopted by representatives of the Massachusetts, Connecticut, Rhode Island, Maine, Vermont and New Jersey Experiment Stations at a conference held during the month of February, 1906, and is based upon the condition of the fertilizer market in centers of distribution in New England, New York and New Jersey during the six months preceding March, 1906, and refers to the current market prices, in ton lots, of the leading standard raw materials, which furnish nitrogen, phosphoric acid and potash, and which enter largely into the manufacture of our commercial fertilizers. The following is a list of such materials :

Sulphate of ammonia,
Nitrate of soda,
Azotine,
Dried blood,
Cotton seed meal,
Castor pomace,
Linseed meal,
Dry ground fish,
Bone and tankage,
Crude saltpetre.

Dissolved bone,
Ground phosphate rock,
Acid phosphate,
Refuse bone black,
High grade sulphate of potash,
Muriate of potash,
Sulphate of potash-magnesia,
Kainit,
Sylvinite,

A comparison of the trade values of the essential elements of plant food for 1906, with the previous season, shows that the only variation is in nitrogen in form of nitrates which is one-half cent lower in cost than during the previous season, 1905. The other forms of nitrogen as well as the different forms of phosphoric acid and potassium oxide cost the same as in the previous year.

Valuation. The approximate value of a compound fertilizer or any material used for fertilizing purposes is obtained by calculating the value of each of the three essential elements of plant food (nitrogen, phosphoric acid and potassium oxide, including the different forms of each wherever different forms are recognized in the table) in one hundred pounds of the fertilizer, and multiplying each product by twenty to change it to a ton basis. The sum of these values will give the total approximate value of the fertilizer per ton at the principal places of distribution.

In case of bone and tankage, we calculate separately the nitrogen and phosphoric acid value of each grade of mechanical fineness by multiplying the pounds of nitrogen and phosphoric acid per ton by the per cent. of each grade, and multiply these products by the trade values per pound, of nitrogen and phosphoric acid in each grade, and express the final product in cents. Adding the separate values of each grade of both ingredients, we have the valuation of the material in question.

In figuring the commercial value of a compound fertilizer, a suitable amount should be added to cover the expenses incurred in the manufacture and sale of the goods.

The trade value of a fertilizer does not necessarily indicate its exact agricultural value. The trade value of a given fertilizer simply shows its cost in our general markets. The agricultural value of a fertilizer shows its capacity in producing certain agricultural crops, and depends not only upon the condition of the fertility of the soil upon which the fertilizer is used, but also upon the physical condition of the soil, the mode of cultivation, the season and the crop to be raised. Experience alone can determine the general fitness and approximate agricultural value of compound commercial fertilizers and fertilizing materials.

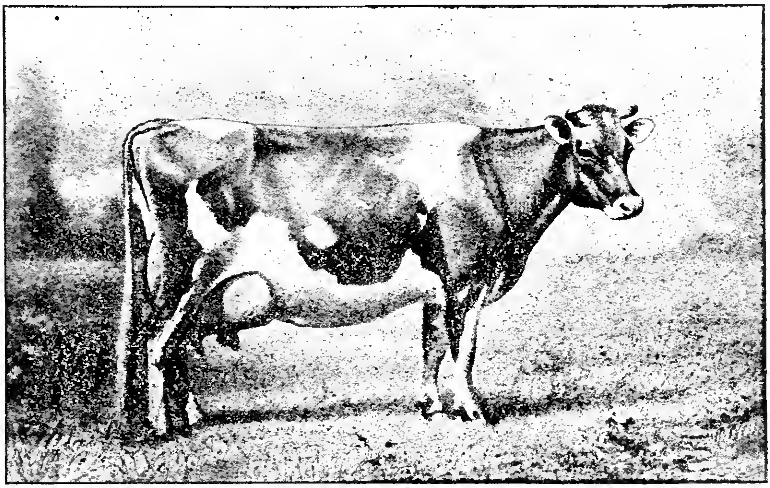
HATCH EXPERIMENT STATION

OF THE

MASSACHUSETTS AGRICULTURAL COLLEGE.

BULLETIN NO. 110.

MARKET MILK.



THE DAIRY TYPE.

JUNE, 1906.

The regular Bulletins of this Station will be sent free to all newspapers in the State and to such individuals interested in farming as may request the same. Technical Bulletins are sent only to those persons interested in the subject treated of in each case.

AMHERST, MASS.:
PRESS OF CARPENTER & MOREHOUSE
1906.

HATCH EXPERIMENT STATION

OF THE

Massachusetts Agricultural College,

AMHERST, MASS.

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WILLIAM P. BROOKS, PH. D.,	*Director and Agriculturist.*
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CHARLES H. FERNALD, PH. D.,	*Entomologist.*
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CHARLES P. HALLIGAN, B. SC.,	*Assistant Horticulturist.*
T. A. BARRY,	*Observer.*

The co-operation and assistance of farmers, fruit-growers, horticulturists, and all interested, directly or indirectly, in agriculture, are earnestly requested. The Bulletins will be sent free to all newspapers in the State and to such individuals interested in farming as may request the same. General bulletins, fertilizer analyses, analyses of feed-stuffs, and annual reports are published. Kindly indicate in application which of these are desired. Communications may be addressed to the

HATCH EXPERIMENT STATION, Amherst, Mass.

DIVISION OF FOODS AND FEEDING

MARKET MILK.

J. B. LINDSEY* and P. H. SMITH.

CONTENTS.

INTRODUCTION.

The production of butter in Massachusetts is slowly declining, while the demand for first-class milk and cream for direct consumption shows a steady increase. Public opinion is gradually being educated to require that such an important article of food be produced under proper sanitary conditions. Those who have studied the sanitary milk problem cannot fail to be impressed with the progress made during the past decade. Chemists and bacteriologists have made exhaustive investigations; rural architects and others have suggested plans and constructed sanitary stables; manufacturers of dairy supplies have devised a great variety of apparatus for the purpose of applying the knowledge which science has brought to light; and now

* The undersigned suggested and assisted in planning the investigation, made suggestions from time to time, and together with Mr. Smith, prepared this bulletin for publication. The inspection of stables and the collection and analyses of milk samples were carried out by Mr. Smith, to whom full credit should be given. J. B. LINDSEY

boards of health and milk inspectors in some of the larger cities and towns are beginning systematic inspections and insisting that the stables of the producers be kept clean and well ventilated, that the cows be kept free from filth and fed on suitable food, and that the product be so handled as to render it clean and safe for human consumption. The investigation reported in the following pages was undertaken for the purpose of ascertaining as nearly as possible the chemical and bacteriological composition of market milk within a given area, as well as the conditions governing its production.

The area canvassed comprised the country supplying Amherst and Northampton, and is probably quite representative of the conditions existing in the cities and towns of Massachusetts where no milk is brought from a distance by rail. Before describing the investigation proper, it has seemed wise to devote a few pages to the character and composition of normal milk, in order that the reader may have a comprehensive idea of the subject under consideration.

PART I.

CHARACTER, COMPOSITION AND FOOD VALUE OF MILK.

Properties of Milk. Normal milk is an opaque, almost white fluid, nearly free from germ life when first drawn from the udder. The lack of transparency is due partly to the fat held in suspension and partly to a suspension of the nitrogenous and mineral matter. It has a slight smell and a mild sweetish taste. When allowed to stand for any length of time, a multitude of fat globules rise to the surface and form what is termed cream. On continuous standing, the sugar of milk is converted by bacteria into lactic acid, and the milk coagulates or sours.

Ingredients of Milk. The larger part of milk consists of water, which contains a variety of substances in suspension and solution. The substances largely dissolved in the water are casein and albumen, milk sugar, and the ash or mineral matter, which together form the *milk serum.*[1] The fat is suspended in the milk in microscopic globules, which are semi-solid, and with the serum, form what is termed an emulsion.

Milk fat. The fat globules in milk are exceedingly minute (from .0016 of a millimeter to .01 of a millimeter in diameter). The globules in the milk produced by Jersey and Guernsey cows are larger in size than those produced by Holsteins or Ayrshires. The globules are largest in the milk of new milch cows, and the cream from such milk separates quickly. The percentage of fat in pure milk varies between 2.25 and 8 per cent., with an average of about 4 per cent. Cream may be defined as that portion of milk into which a large part of its fat has been gathered. Cream contains from 15 to 50 per cent. of fat, depending upon the method of separation.

Milk albuminoids (nitrogenous matter). Casein, which forms some 85 per cent. of the total albuminoids, exists in milk combined with lime in a semi-dissolved condition, and possesses a certain degree of opacity (lack of transparency). It forms with the fat the chief ingredients of milk curd, and of full cream cheese.

Albumen differs from casein in being completely dissolved in milk, and in separating from the serum when milk is heated to from 158° to 167°. Lactoglobulin, mucoid protein and fibrin are other nitrogenous substances which exist in milk in small quantities.

Milk albuminoids represent that part of the milk which forms flesh in the growing animal or human being.

Milk sugar, recognized late in the seventeenth century, is found only in milk, where it exists in a state of perfect solution. It is not as easily soluble in water as cane sugar, and possesses only a slightly sweetish taste. The quantity in normal cows' milk varies from 3 to 6 per cent., with a probable average of 4.80 per cent. The sugar can be separated from the milk, and brought into a solid form, resembling powdered white sugar. It is used more or less by druggists and in infant food preparations. The commercial demand for it is limited, and does not warrant its manufacture in large quantities.

Milk ash consists of potash, soda, lime, magnesia and iron, combined with phosphoric, hydrochloric and sulfuric acids. The potash, lime and phosphoric acid form the largest portion of the ash.

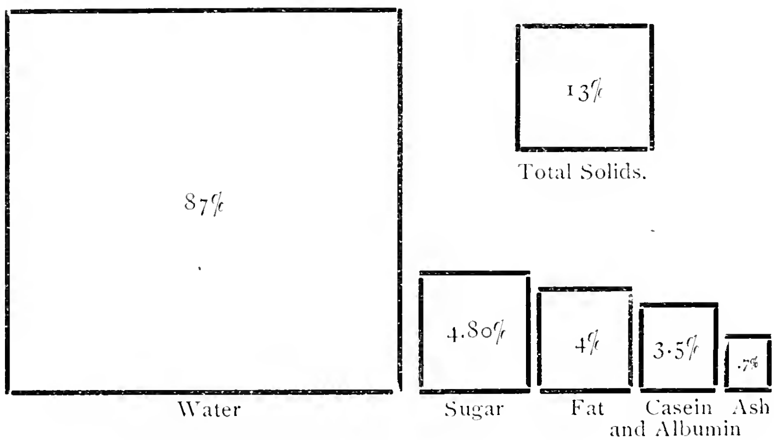
[1] That portion of the casein which can be removed by filtration through filter paper, is not generally included in normal serum.

Chemical Composition of Milk.

Milk varies widely in composition, depending upon the breed and individuality of the cow, stage of lactation and weather conditions. Food, as a rule, has little effect in permanently changing the proportions of the several ingredients. One hundred pounds of milk of good average quality should contain about the following amounts of the different constituents :[1]

		Pounds in 100 or Per Cent.
Water,		87.00
Fat,		4.00
Albuminoids	Casein,	3.00
	Albumin,	.50
Milk sugar,		4.80
Ash,		.70
		100.00

The total solids include all of the ingredients excepting the water. The proportions may be expressed by the following squares[2]:



For ordinary purposes, the chemist determines only the total solids and the fat, and obtains the solids not fat by difference. The following figures, according to Hucho[3] and Koenig[3], give the approximate average composition of the milk of different breeds :

[1] The average composition of 793 samples of milk from pure bred and grade cows according to Koenig is 12.88% solids and 3.06% of fat : of 200,000 samples of mixed milk analyzed by the Aylesbury Dairy Co., London, (See Richmond) is 12.90% solids and 3.00% fat Wiley says recent analyses of average milk show 12.90% solids and 4% fat. The average of 4103 samples made at this Station (Jersey blood predominating) is 13.03% solids and 4.43% fat.

[2] See Farmers' Bulletin No. 42, U. S. Dept. of Agriculture.

[3] Woll's Handbook, p. 213 and 214.

	Total Solids.[1] %	Fat. %	Solids not Fat.[2] %
Holstein,[3]	12.00	3.25	8.75
Ayrshire,	12.50	3.70	8.80
Shorthorn,	12.90	3.80	9.10
Devon,[3]	13.40	4.40	9.00
Jersey,	14.70	5.00	9.70
Guernsey,	14.70	5.00	9.70

While the above figures may be taken as types, they do not mean that every cow of a distinct breed will yield milk of the above composition. In fact, many Jerseys produce milk with no more than 4.50 per cent. fat, while individuals of the Holstein breed frequently yield milk as rich as do Ayrshires, or even some Jerseys.

Pure and Impure Milk.

Pure milk may be defined as the natural product of a healthy cow, drawn and cared for in a cleanly manner. Milk from diseased cows or from animals in a low physical condition cannot be considered suitable for human consumption. Milk may become tainted from dead skin and particles of manure that fall into the pail during milking, from stable dust, from improperly cleaned milk utensils, from dirty milkers and from bad odors. All forms of material referred to as dirt are full of germ life, or bacteria. Under the microscope bacteria exhibit a variety of forms; many have been classified, as have the higher plants, into families, genera, species and varieties. Some forms have not as yet been studied and classified. Bacteria live upon and decompose vegetable and animal matter. Warmth and moisture are quite necessary for their rapid multiplication. Warm milk forms a very favorable medium for the growth of bacteria, which having once gained access, increase with wonderful rapidity, producing numerous changes which will be explained and discussed in Part III of this bulletin.

Food Value of Milk.

Milk is not a beverage, but an easily digested, perfect food.

The *casein and allied substances* (proteid bodies) furnish the body material for building and repairs, and also serve as a source of energy.

The fat and sugar serve as sources of heat and energy, while the mineral matter aids in the formation of the various body tissues.

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[1] Includes all ingredients excepting water.

[2] Includes all ingredients excepting water and fat.

[3] Koenig.

The food value of milk may be illustrated by the following table :[1]

KIND OF FOOD.	Price a lb.	Cost of 1 lb. Protein.[2]	Cost of 1000 Calories of Energy.	Amount for $1.00. Protein.	Fat.	Carbohydrates.	Energy in Calories.
	cts.	cts.	cts.	lb.	lb.	lb.	
Milk, 6c qt.	3	0.94	10	1.1	1.3	1.7	10,300
Milk, 7c qt.	3.5	1.09	11	0.9	1.1	1.4	8,850
Milk, 8c qt.	4	1.24	12	0.7	0.9	1.1	7,400
Beef, sirloin	25	1.60	25	0.6	0.6	—	4,100
Beef, round	16	0.87	18	1.1	0.8	—	5,600
Beef, shoulder clod	12	0.75	17	1.3	0.8	—	5,950
Mutton chops	16	1.22	11	0.8	1.7	—	8,900
Roast pork, loin	12	0.92	10	1.1	1.9	—	10,350
Oysters, solid, 35c qt.	18	3.10	80	0.3	0.1	0.2	1,250
Eggs, 36c doz.	24	2.09	39	0.5	0.4	—	2,600
Eggs, 24c doz.	16	1.39	26	0.7	0.6	—	3,850
Wheat flour	2.5	0.26	2	3.9	0.4	29.4	65,400
Wheat bread	6	0.77	5	1.3	0.2	8.7	20,000
Wheat breakfast food	7.5	0.73	4	1.3	0.2	9.8	22,235
Oat breakfast food	7.5	0.53	4	1.9	0.9	8.6	23,950
Potatoes, 60c bush	1	0.67	3	1.5	0.1	14.0	29,500
Corn (canned)	10	4.21	23	0.2	0.1	1.8	4,300
Celery.	5	6.65	77	0.2	—	0.5	1,300
Bananas	7	10.00	27	0.1	0.1	1.8	3,700
Strawberries	7	8.75	47	0.1	0.1	0.9	2,150

[1] Taken from Farmers' Bulletin 142, entitled "Principles of Nutrition and Nutritive Value of Food" See also Farmers' Bulletin 74, entitled "Milk as Food," published by the U. S. Dept. of Agriculture, for a fuller discussion of this subject.

[2] The cost of 1 lb. of protein, means the cost of enough of the given material to furnish 1 lb of protein without regard to the amounts of the other nutrients present; the same may be said of the cost of 1000 calories of energy. These estimates are therefore unsatisfactory in that neither gives credit for the value of the other.

Beef, pork, mutton and eggs are more particularly protein foods, (serve to build the body and repair waste), while milk and bread supply all of the food requirements. Hence, either bread or milk would furnish a better balanced food than meat for supplying the daily needs of the body.

The table shows that milk of average quality (1/8 part total solids) at ordinary prices, furnishes protein cheaper than do the more expensive cuts of meat, and for much less money than it can be had in oysters and eggs. The cereals (which contain but little water and can be had for a few cents a pound), supply the protein for rather less than it can be secured in milk. Milk furnishes a definite amount of energy for less money than it can be purchased in beef, and for decidedly less than it can be secured in oysters and eggs. Vegetables such as corn and celery, and fruit such as strawberries and bananas, as compared with milk, are very expensive sources of both protein and total energy.

A better way of ascertaining the relative economy of the different foods is a comparison of the quantities of both nutrients and energy which can be purchased for a definite sum. Thus the last four columns of the table show that $1.00 spent for milk at 6 cts. a quart furnishes 1.1 lbs. protein, 1.3 lbs. fat, 1.7 lbs. carbohydrates and 10,300 lbs. calories of energy, while the same sum spent for sirloin steak at 25 cts. a lb. furnishes .6 lb. protein, .6 lb. fat and 4,100 calories of energy. The cereals and potatoes furnish cheaper protein and energy than does milk. One cannot live, however, exclusively on such foods. Experiments have shown that dietaries in which milk was substituted for other animal foods were cheaper and quite as satisfactory. Milk requires no cooking, contains no waste, is palatable, easily digested, and is entitled to be classed among the economical human foods, and ought to be more generally consumed.

PART II.

THE COMMON METHOD OF PRODUCING MARKET MILK.

The investigation into the conditions governing the production of market milk over the area defined in the first part of this bulletin was undertaken and completed during the winter months. In this report only a brief resumé of the observed conditions is presented, much fuller tabulated data being on file.[1]

Location, Plan and Condition of Stables.

In nearly all cases the stables, built of wood, were of old-fashioned construction, being located in the south side of the storage barn beneath a hay mow, or in a leanto, which formed a part of the barn. In the former case, the boards above, which formed the ceiling of the stable and the floor of the mow were frequently loosely put together, allowing bad odors to easily permeate the hay, and hay seed and dust to fall through upon the animals. Rarely, if ever, was the interior sealed with matched boards or otherwise, the studding and spaces between being generally filled with dust and cobwebs.[2] The floor of the stable was constructed of plank, and the animals stood in one row on the customary raised platform, with heads facing the driveway through the barn, and were tied with rigid stanchions, or with the so-called Warriner swinging stanchion. In some cases an ordinary gutter, formed by placing a piece of two by four on edge, served to catch and retain the droppings; in other cases no gutter was provided. The distance from the cows to the rear of the stable was generally so short (2 to 4 ft.) that the floor and rear wall were badly spattered, and frequently presented an extremely untidy appearance. In a number of cases outrageously dirty barns were observed, while in a few instances one saw much to commend, and felt that at the ordinary prices prevailing for milk, little more could be required.[3]

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[1] The authors desire to express their appreciation of the courtesy extended to them by the many farmers and dealers who allowed an inspection of their premises or who gave information concerning their methods of milk production.

[2] In a few cases these had been brushed down, and in one or two instances whitewash had been applied, adding greatly to the appearance of the barn.

[3] There were a few variations from the ordinary type of construction, but barns built in accordance with modern sanitary plans were not observed.

Light and Ventilation. The stables as a whole were poorly lighted, and in many cases quite dark. The few half-sash windows, too often thickly covered with fly spots, dust and cobwebs, were kept closed during the winter, and so fastened that it was difficult to open them. Comparatively little provision for proper ventilation was noted. Many of the stables had doors in front of the cows, which were kept closed during cold weather, excepting when the animals were fed. Occasionally an air shaft was observed, but in no case could it be said that the stables were ventilated in accordance with the teachings of modern sanitary science. The animals were generally turned into a yard for water once daily, during which time the doors were likely to remain open and the stable received its daily airing. Only four stables were noted in which each animal was allowed over 500 cubic feet of air, the average allowance being in the vicinity of 300 feet. This condition, together with the imperfect ventilation, frequently made the air decidedly foul.

Condition of Barnyard. Storage of Manure. As a rule, the yard was located on the south side of the barn, and was in some cases well drained. Instances were noted, however, where it was lower than the land immediately surrounding it, thus forming a basin for water, which stood in pools during a thaw, and for a considerable time in the early spring months. Such lack of drainage, together with the droppings from the cattle, made a disagreeable and unhealthy place in which to require the animals to remain a portion of each day.

The manure was removed from the stable once and occasionally twice daily. Sometimes it was thrown into the barn cellar, and at other times out of the window into the barnyard and exposed to the weather. An altogether too common method of storing was in a shed or leanto, directly in the rear of the cows. As the pile grew it not only shut out the light and air from the stable, but also fouled the barnyard and naturally produced very disagreeable conditions. In barns without a cellar, a too common practice was to allow the liquid to run through the floor directly beneath the animals.

Condition and Care of Cattle. In altogether too many instances the animals were dirty, the sides and flanks being covered with manure, and it is doubtful if the majority of the animals observed were carded and cleaned with any regularity, and in some cases, it is believed that currycomb and brush were never employed. One person remarked soberly that his cows "were carded every week," as if this was sufficient to keep them in a cleanly condition. Rejected corn stalks, sweepings from the hay mow, sawdust and sand, served as sources of bedding, but too often the supply was limited or totally lacking. A few herds were watered in the stable and not turned out until spring, a practice which, in the judgment of the writers, is to be condemned.

Health of the Animals.

Judged from a casual inspection, most of the cows were in reasonably good health, although it hardly seems possible that animals kept for a considerable length of time in dark, poorly ventilated stables could be in prime physical condition and capable of supplying a first-class human food.[1] In no case was a herd found which had been subjected to the tuberculin test, and most dairymen seemed opposed to its use. It was a source of satisfaction to find individual instances in which, although the arrangements were of the simplest, the stable was light and passably clean, the air fairly pure and the animals well groomed.

Food and Water Supply.

Most of the herds were well nourished, and in no case was the character of the food supply found to be objectionable. More or less grain, in the form of corn and hominy meals, cottonseed meal, gluten feed, distillers' dried grains and wheat by-products, was fed during the entire year, naturally a greater quantity in the winter. The prevailing roughage was hay, corn stover and silage. Silos were noted in 60 per cent. of the places visited. Most of the herds were pastured during the summer, the pasturage occasionally being supplemented with hay, green oats, or peas and oats, millet, corn fodder and grain, although no system of continuous soiling was practiced. The water supply, as a rule, seemed to be satisfactory, it being derived from springs or wells at proper distances from outbuildings.[2]

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[1] A few instances were noted of diseased animals, probably suffering from tuberculosis.

[2] Some barnyard wells were noted, and a few in too close proximity to the house at which the dairy utensils were washed and the waste water thrown upon the ground nearby, a practice which cannot fail to pollute the well It is to be regretted that it did not seem possible to sample and analyze the water supply of each dairy

Breeds of Cattle. Method of Replenishing Herd. The Jersey grade predominated, especially east of the Connecticut river, while west of the river a considerable number of Holstein grades were observed. There was the usual collection of cows of no particular breed, while herds of pure bred stock were found in only one instance. A few milkmen raised at least a portion of their stock, but the majority, because of a lack of skim milk as a food for the calves, believed it better suited to their conditions to purchase as needed. Eighteen of the 29 dairies inspected kept a pure bred sire. It is to be regretted, however, that so few seemed to have any definite ideas concerning the establishment of a permanent improved dairy herd.

Care and Handling of Milk. It was not possible, as a rule, to be present at the milking, but from the information obtained it seemed evident that few made any special preparation in the way of change of clothing, etc. In occasional instances only were the udders of the cows brushed, washed or wiped with a damp cloth. The milk was drawn into ordinary open tin pails, and when filled the contents were strained through a wire strainer, frequently covered with cheese cloth, into an $8\frac{1}{2}$ quart can, which stood upon the barn floor, or on a shelf in rear of the cows. After the milking was completed, the cans were removed to the dairy room located at an end of the barn or in a small building near by, and stood in ice water until ready for delivery. Some milk rooms were very dirty, and in too close proximity to the stable. Only a few possessed a large tank in which the entire milking could be poured and mixed, thus preventing the delivery of an uneven product. No more milk was bottled than was necessary to supply the demand, the larger part being retailed from cans. One milk bottling machine was noticed, the bottles being filled by its use immediately after milking, and set away in cold water or cracked ice.

A few dairymen possessed separators for the purpose of obtaining a thick cream, while others retailed only a thin cream, raised by the deep setting process. Babcock machines for determining the quality of the milk produced by individual cows, or by the dairy herd, were not in use, although in some instances the product was sent to the experiment station for analysis. Most dealers seemed to be confident that the milk produced by their herds was up to the standard required by law, although they did not always feel sure that such was the case with the portion purchased.

The dairy utensils were generally cleaned in the home kitchen with the aid of hot water, and placed out of doors in the sun. In only a few cases were producers supplied with steam for a more thorough sterilization.

Demands of the Trade.

There seemed to be a concensus of opinion among dealers that the public wished cheap milk. From the milkman's standpoint, the average consumer cared little concerning the method or cost of production, so long as he received an article apparently free from dirt, bad odor and of a reasonable degree of richness. It was not believed that milk produced under better sanitary conditions would generally command the extra price warranted by the increased cost of production.

Cost of Production and Distribution.

It did not seem possible to obtain any positive ideas from producers relative to the expense of production and distribution, although the opinion was frequently expressed that it cost 2½ to 3 cents to produce a quart of milk, and about 2 cents a quart to peddle it. So far as could be ascertained, farmers did not keep any records of the yearly production of their herds, and the number who seemed to know how much milk a cow should produce yearly to be considered profitable, was very limited. Such a lack of systematic accounting is to be regretted, it being most assuredly for the interest of the producer who would achieve the greatest measure of success to note carefully the debit and credit of his various farm operations. The consumers (in the area covered in the investigations) were somewhat scattered, and the peddlers relatively numerous. The cost of distribution naturally would be lower had the peddlers been fewer, and had each been able to confine himself to a definite district, thus avoiding the crossing and recrossing of each other's routes.[1]

Conclusions.

As a result of the investigation, briefly stated, one may safely draw the following conclusions:

1. The ordinary method of housing and caring for dairy stock is far from ideal, yet it is capable of being

[1] This, of course, would not be practicable unless the control of the distribution could be in the hands of one or two large concerns.

considerably improved at a minimum outlay of time and expense.

2. The majority of the stables were unnecessarily dirty, poorly lighted and badly ventilated.

3. The condition of many barnyards should be improved, as well as the method of storing and caring for the manure.

4. By far too many dairy animals were poorly groomed, and some were disgracefully dirty.

5. The physical health of the dairy stock appeared reasonably satisfactory in most cases. It is not believed, however, that animals kept in dark and poorly ventilated barns can be in the best physical condition to furnish a first-class human food.

6. The water in the majority of cases, and food supply in all cases, were satisfactory from the standpoint of health; many cases were noted where the producer could have improved his methods of food production and purchase to his own pecuniary advantage.

7. Modern dairy appliances for the handling of milk were not in general use. The average dairyman, however, gave the milk much better care than he did the animals producing it.

8. Many dairymen were very deficient in a proper understanding of modern dairy methods.

9. In the interest of both producer and consumer, the following improvements are urgently needed: *Cleaner barns, more light, fresher air, cleaner animals* and *better sanitary methods of caring for the manure.*

PART III.

THE CHEMICAL AND BACTERIOLOGICAL COMPOSITION OF MARKET MILK.

One hundred and thirteen samples of milk were collected and examined during the months of July, August, September, December, January, February and March; they were obtained largely from milkmen while engaged in retailing the product. In many cases the retailer produced only a portion of the amount sold, though occasionally he produced his entire supply. When a whole or part of the supply was purchased, the station representative in some instances visited individual producers in company with the purchaser and took samples of the product.

1. Acidity of Market Milk.

Freshly drawn milk possesses a slight amphoteric (acid and alkaline) reaction, due to the presence of acid and neutral phosphates, alkaline carbonates and free carbonic acid. Fresh milk is free from lactic acid which is a product of fermentation. Richmond states that 100 cubic centimeters of fresh milk require about 20 cubic centimeters of 1-10 normal sodium hydrate to neutralize it, and the number of cubic centimeters required he designates "degrees of acidity."[1] Most of the samples collected were tested at different times for acidity, the first test being made in the afternoon of the day of collection. During the entire time they stood in the laboratory where the temperature was from 70° to 80° Fahr.

[1] Milk from different cows varies somewhat from this figure. Only 10 c. c. of milk were used in the present investigation, so that the results presented have been multiplied by 10. It is possible that had more than 10 c. c. of milk been used, the results might have differed slightly. They are at least comparative.

TABLE OF ACIDITY.

Laboratory Number.†	Date of Sampling.	Mean hourly temperature on date of sampling.	Degrees of Acidity. First day.	Second day.		Third day.		Fourth day.	
			4 P.M.	8 A.M.	4 P.M.	8 A.M.	4 P.M.	8 A.M.	4 P.M.
1	Sept. 5, 1904.	60.9°	13.9	14.4	15.3	66.9*	—	—	—
1	Dec. 7, 1904.	24.4°	15.4	16.1	17.6	27.6	31.6	78.6*	—
1	Jan. 10, 1905.	26.0°	15.0	14.5	14.9	36.3	85.1*	—	—
1	Mar. 31, 1905.	52.1°	14.8	14.8	14.8	—	—	**	—
1	July 11, 1905.	75.7°	12.3	27 9	75.5*	—	—	—	—
1	Aug. 15, 1905.	57.2°	12.6	14.2	14.2	41.0	72.2*	—	—
2	Sept. 5, 1904.	60.9°	15.3	42.7	78.0*	84.7	—	—	—
2	Dec. 17, 1904.	11.5°	14.3	14.9	16.7	59.4*	74.0	—	—
2a	Jan. 10, 1905.	26.0°	15.8	17.4	18.3	58 7*	83.1	—	—
2b	Jan. 10, 1905.	26.0°	14.3	14.6	16.1	35.6	64.9*	82.5	—
2	Mar. 7, 1905.	21.4°	—	—	—	—	—	—	—
2	Aug. 22, 1905.	72.3°	12.5	47.0	81.6*	—	—	—	—
3	Sept. 5, 1904.	60.9°	12.9	15.3	21.8	68.4*	—	—	—
3	Dec. 7, 1904.	24.4°	14.3	15.1	20.4	68.3*	81.9	—	—
3	Dec. 17, 1904.	11.5°	15.8	17.4	23.8	65.2*	74.3	—	—
3	Mar. 7, 1905.	21.4°	—	—	—	—	—	—	—
3	July 11, 1905.	75.7°	13.1	50.0*	—	—	—	—	—
3	Aug. 15, 1905.	57.2°	12.3	14.0	19.6	54.7	67.8*	—	—
3	Aug. 22, 1905.	72.3°	10.4	16.5	57.6	77.7*	—	—	—
3a	Aug. 22, 1905.	72.3°	12.0	13.1	21.9	80.9*	—	—	—
4	Sept. 5, 1904.	60.9°	15.4	24.3	51.9	78.9*	—	—	—
4	Dec. 7, 1904.	24.4°	16 7	17.7	21.6	80.1*	—	—	—
4	Dec. 17, 1904.	11.5°	15 6	16 0	17.0	30.4	48.6*	—	—
4	Jan. 24, 1905.	4.0°	15.3	15.5	19.8	37.4	51.1	76.0	79.4*
4	Mar. 7, 1905.	21.4°	—	—	—	—	—	—	—
4	July 11, 1905.	75.7°	15.0	77.9*	—	—	—	—	—
4	Aug. 15, 1905.	57.2°	12.0	26.3	62.6	93.5*	—	—	—
4	Aug. 22, 1905.	72.3°	13.0	73.0*	—	—	—	—	—
4a	Jan. 24, 1905.	4.0°	15.0	15.0	17.8	55.2	70.3*	84.4	—
4b	Jan. 24, 1905.	4.0°	13.2	14.8	17.8	42.6	55.1	73.5*	—
5	Sept. 5, 1904.	60.9°	12.8	34.5	64.2	76 4*	—	—	—
5	Dec. 7, 1904.	24.4°	15.0	16.5	28.0	80.0*	—	—	—
5	Jan. 10, 1905.	26.0°	13.1	13.7	14.0	26.0	46.0	74.6*	—
5	Mar. 7, 1905.	21.4°	—	—	—	—	—	—	—
5	July 11, 1905.	75.7°	14.3	77.5*	—	—	—	—	—
5	Aug. 15, 1905.	57.2°	13.3	17.5	31.2	72.5*	—	—	—
5a	Aug. 15, 1905.	57.2°	12.9	23.9	64.7*	—	—	—	—

† The laboratory numbers refer to the producer or peddler, and the letters used in connection with the numbers signify that the milk was not his own product, but was purchased of another producer.

* Curdled.

** Curdled, acidity not determined.

TABLE OF ACIDITY—(Continued.)

Laboratory Number	Date of Sampling.	Mean hourly temperature on date of sampling.	Degrees of Acidity.						
			First day.	Second day.		Third day.		Fourth day.	
			4 P.M.	8 A.M.	4 P.M.	8 A.M.	4 P.M.	8 A.M.	4 P.M.
7	Sept. 5, 1904.	60.9°	13.4	14.3	18.9	78.0*	—	—	—
7	Dec. 7, 1904.	24.4°	15.9	16.3	19 3	57.7	78.0*	—	—
7	Dec. 17, 1904.	11.5°	16.5	16.6	16.1	27.7	47.5*	—	—
7	Mar. 7, 1905.	21.4	—	—	—	—	—	—	—
7	July 11, 1905.	75.7°	13.3	62.3*	—	—	—	—	—
8	Jan. 10, 1905.	26.0°	16.3	16.9	22.0	67.9*	87.3	—	—
8	Mar. 7, 1905.	21.4°	—	—	—	—	—	—	—
8	Aug. 22, 1905.	72.3°	15.5	53.4	70.1*	—	—	—	—
8a	Jan. 10, 1905.	26.0°	21.3	35.2	53.6	94.0*	—	—	—
9	Dec. 17, 1904.	11.5°	14.6	15.8	15.7	71.2*	78.5	—	—
10	Jan. 10, 1905.	26.0°	15.3	15.8	16.8	28.0	69.4	82.2*	—
11	Jan. 24, 1905.	4.0°	14.4	21.2	49.5	81.9*	—	—	—
12	Jan. 24, 1905.	4.0°	16.9	17.8	24.4	70.9*	80.6	—	—
13	Jan. 24, 1905.	4.0°	15.5	16.0	15.9	17.6	19.8	30.5	39.3§
13	Jan. 31, 1905.	9.2°	16.0	16.9	17.3	24.1	42.8	73.5	86.8*
13	Feb. 7, 1905.	18.4	17.2	17.5	18.0	20.4	27.6	48.1*	—
13	Feb. 14, 1905.	6.7	—	—	—	—	—	—	—
14	Dec. 22, 1905.	19.1°	14.8	16.4	19 3	72.5	73.8	—	—
14a	Dec. 29, 1905.	24.5°	13.1	12.9	18.0	40.0	62.4	75.4*	—
14a	Feb. 7, 1905.	18.4	15.0	15.6	18.6	65.2*	76.3	—	—
14a	Aug. 1, 1905.	62.7°	12.5	23.0	46.3	**	—	—	—
14b	Dec. 29, 1904.	24.5	13.8	13.6	16 7	34 6	53.2	67.8*	—
14b	Feb. 7, 1905.	18 4	14.8	16.0	22.4	65.4*	80.0	—	—
14b	Aug. 1, 1905.	62.7	14.1	29 1	56 9*	—	—	—	—
14c	Dec. 29, 1905.	24.5°	16.5	18.3	22.5	55.8	74.8	86.3*	—
14c	Aug. 1, 1905.	62.7°	13.6	18.7	39.6	**	—	—	—
14d	Dec. 29, 1904.	24 5	14 0	14.3	16.1	43.8	62.6	76.0*	—
14d	Aug. 1, 1905.	62.7	12 9	15.8	41.2	**	—	—	—
14e	Dec. 29, 1904.	24.5	13.3	15.0	16.5	36.2	55.1	82.3*	—
14e	Aug. 1, 1905.	62 7	17 6	54.6	*	—	—	—	—
14f	Jan. 31, 1905.	6.2	13 6	15.6	20.3	41.9	62.0	78.2	78.1
14f	Mar. 31, 1905.	52.1	13.5	50 0	73.0*	—	—	—	—

* Curdled.

** Curdled, acidity not determined.

§ Not curdled at end of fifth day.

TABLE OF ACIDITY—(CONTINUED.)

Laboratory Number.	Date of Sampling.	Mean hourly temperature on date of sampling.	Degrees of Acidity. First day. 4 P.M.	Second day. 8 A.M.	Second day. 4 P.M.	Third day. 8 A.M.	Third day. 4 P.M.	Fourth day. 8 A.M.	Fourth day. 4 P.M.
15	Dec. 22, 1904.	19.1°	15.5	17.4	30.8	57.6	70.9*	—	—
15a	Feb. 14, 1905.	6.7°	—	—	—	—	—	—	—
15a	Mar. 31, 1905.	52.1°	14.5	28.4	70.9*	—	—	—	—
15a	Aug. 29, 1905.	64.0°	14.8	15.6	28.6	75.5*	—	—	—
15b	Feb. 14, 1905.	6.7°	—	—	—	—	—	—	—
15b	Aug. 29, 1905.	64.0°	12.7	13.2	20.3	54.5*	—	—	—
15c	Feb. 14, 1905.	6.7°	—	—	—	—	—	—	—
15c	July 25, 1905.	66.0°	14.6	15 6	29.2	**	—	—	—
15c	Aug. 29, 1905.	64.0°	14.0	14.0	18.8	68 8*	—	—	—
15d	Feb. 14, 1905.	6.7°	—	—	—	—	—	—	—
15e	Feb. 14, 1905.	6 7°	—	—	—	—	—	—	—
15f	Feb. 14, 1905.	6.7°	—	—	—	—	—	—	—
15f	July 25, 1905.	66 0°	16.5	20.3	56.9	**	—	—	—
15g	July 25, 1905.	66.0°	14.1	14.6	26.2	**	—	—	—
16	Dec. 22, 1905.	19.1°	17.9	18.3	29.0	76.4*	83.2	—	—
16	Mar. 31, 1905.	52.1°	13.6	20.8	40.0	**	—	—	—
16	July 18, 1905.	81.3°	15.5	**	—	—	—	—	—
17a	Jan. 31, 1905.	9.2°	12.3	15.2	22.0	56.9	67.4	70.6	75.0
17a	July 18, 1905.	81.3°	15 3	*	—	—	—	—	—
17b	Jan. 31, 1905.	9.2°	14.8	17.4	17.4	27.5	42.1	71.9	81.6*
17b	Mar 24, 1905.	33.5°	15.0	15.0	18.9	**	—	—	—
17c	July 18, 1905.	81.3°	16.3	**	—	—	—	—	—
18	Feb. 7, 1905.	18.4°	15.2	21.8	35.9	73.1*	82.0	—	—
18	Mar. 24, 1905.	33 5	19.2	79.0*	—	—	—	—	—
18	July 25, 1905.	66 0°	14.5	47 1	78.8*	—	—	—	—
18	Aug. 29, 1905.	64.0°	17.5	25.7	62.6	90.0*	—	—	—
19	Dec. 29, 1904.	24.5°	15.8	18.9	18.9	59.0	78.5	85.9	—
19	Feb. 7, 1905.	18.4°	13.9	14.8	20.1	77.0*	82.6	—	—
20	Feb. 7, 1905.	18.4°	15.5	21.0	40.3	75.1*	80.0	—	—
20	Mar. 31, 1905.	52.1°	18.4	30.8	64 8*	—	—	—	—
20	July 18, 1905.	81.3°	14.0	**	—	—	—	—	—
21	Mar. 24, 1905.	33.5°	12.9	14.1	25.7	**	—	—	—
21	July 18, 1905.	81.3°	14.4	**	—	—	—	—	—

* Curdled.

** Curdled, acidity not determined.

TABLE OF ACIDITY—(CONTINUED.)

Laboratory Number.	Date of Sampling.	Mean hourly temperature on date of sampling.	Degrees of Acidity.						
			First day.	Second day.		Third day.		Fourth day.	
			4 P.M.	8 A.M.	4 P.M.	8 A.M.	4 P.M.	8 A.M.	4 P.M.
22	Feb. 7, 1905.	18.4°	‡10.3	12.1	15.2	41.6	60.2*	75.8	—
22	Mar. 31, 1905.	52.1°	14.3	25.0	42.1	**	—	—	—
23	Mar. 24, 1905.	33.5°	14.5	15.6	15.6	—	**	—	—
23	Aug. 29, 1905.	64.0°	14.7	14.7	19.4	77.3*	—	—	—
24	Mar. 24, 1905.	33.5°	15.4	15.9	22.4	—	**	—	—
24	July 25, 1905.	66.0°	‡11.2	26.2	52.3*	—	—	—	—
25	Dec. 22, 1904.	19.1	17.1	18.3	26.1	58.6	65.0*	—	—
26	Dec. 22, 1904.	19.1°	15.4	16.6	27.0	79.3	—	—	—
27	Jan. 31, 1905.	9.2°	15.1	16.0	16.9	42.2	66.6	84.1*	—
28	Jan. 31, 1905.	9.2°	12.9	14.2	15.3	18.7	36.8	70.1	79.5*
29	Jan. 31, 1905.	9.2°	18.2	20.0	20.0	31.1	74.4*	89.2	—

* Curdled.
** Curdled, acidity not determined.
‡ Probably watered.

The results of the first test made on the day of collection show extremes of 12.0° and 21.3° with an average of 14.7°. Two samples known to have been watered, and one sample noticeably below the normal were excluded from the average. During the second day two tests were made, one in the morning and one in the afternoon, a slight increase of acidity being noted each time in the majority of cases. In case of some samples the increase was very marked on the afternoon of the second day, while in a few samples sufficient lactic acid had been produced to cause the curdling of the milk. On the morning of the third day the acidity showed a marked increase and a general curdling had taken place. In some few cases curdling did not actually occur until the fourth day, although the milk had a disagreeable odor. The milk produced by the experiment station showed very little change in acidity until the beginning of the third day, and none of the several samples curdled until the fourth day.

Lactic acidity being due to the action of lactic acid germs does not necessarily indicate a dirty milk. Any appreciable degree of acidity above the normal (13° to 20°) would be an evidence of old milk, or it might indicate that the milk had not been properly protected from dirt or dust, or that it had been kept at too high a temperature. Because of the normal acidity of the milk when first tested, and because most of the milk did not sour for 36 hours thereafter, one may safely conclude that the larger part of the product was not over 12 to 24 hours old at the time of collecting the samples. The two samples of milk known to have been watered tested 10.3° and 11.2°, and one very suspicious tested 10.4°. It seems quite probable that milk testing 11° or lower has received more or less water.

2. *Chemical Analysis of the Milk.*

The analyses of the samples reported in the following table were made in the usual manner. The fat was determined by the Babcock method, the total solids by evaporation on sand, and the solids not fat by difference.

TABLE OF ANALYSES.

Lab. Number.	Date of Sampling.	Total Solids.	Fat.	Solids not Fat.
		%	%	%
1	Sept. 5, 1904.	13.35	4.60	8.75
1	Dec. 7, 1904.	13.35	4.43	8.92
1	Jan. 10, 1905.	13.74	4.80	8.94
1	Mar. 31, 1905.	12.89	4.40	8.49
1	July 11, 1905.	12.62	4.18	8.44
1	Aug. 15, 1905.	13.61	5.00	8.61
2	Sept. 5, 1904.	13.63	4.73	8.90
2	Dec. 17, 1904.	13.84	4.88	8.96
2	Mar. 7, 1905.	12.77	3.88	8.89
2	Aug. 22, 1905.	12.50	4.20	8.30
2a	Jan. 10, 1905.	13.87	4.78	9.09
2b	Jan. 10, 1905.	13.86	5.23	8.63
3	Sept. 5, 1904.	12.38	4.10	8.28
3	Dec. 7, 1904.	13.95	5.35	8.60
3	Dec. 17, 1904.	13.87	4.85	9.02
3	Mar. 7, 1905.	14.08	5.00	9.08
3	July 11, 1905.	11.16[1]	3.45	7.71
3	Aug. 15, 1905.	14.02	5.68	8.34
3	Aug. 22, 1905.	12.33	4.40	7.93
3a	Aug. 22, 1905.	12.38	4.40	7.98
4	Sept. 5, 1904.	12.93	4.10	8.83
4	Dec. 7, 1904.	14.10	4.83	9.27
4	Dec. 17, 1904.	13.49	4.53	8.96
4	Jan. 24, 1905.	13.54	4.43	9.11
4	Mar. 7, 1905.	14.07	5.08	8.99
4	July 11, 1905.	13.46	4.60	8.86
4	Aug. 15, 1905.	12.00	3.60	8.40
4	Aug. 22, 1905.	12.34	4.10	8.24
4a	Jan. 24, 1905.	14.52	5.38	9.14
4b	Jan. 24, 1905.	12.07	3.85	8.22
5	Sept. 5, 1904.	12.60	4.25	8.35
5	Dec. 7, 1904.	13.58	4.93	8.65
5	Jan. 10, 1905.	13.27	4.30	8.97
5	Mar. 7, 1905.	12.19	3.80	8.39
5	July 11, 1905.	12.42	4.30	8.12
5	Aug. 15, 1905.	12.73	4.50	8.23
5a	Aug. 15, 1905.	13.83	5.25	8.58

[1] Probably watered.

TABLE OF ANALYSES.—(Continued.)

Lab. Number.	Date of Sampling.	Total Solids.	Fat.	Solids not Fat.
		%	%	%
7	Sept. 5, 1904.	14.79	5.75	9.04
7	Dec. 7, 1904.	13.56	4.70	8.86
7	Dec. 17, 1904.	15.15	5.85	9.30
7	Mar. 7, 1905.	13.55	4.50	9.05
7	July 11, 1905.	12.63	4.30	8.33
8	Jan. 10, 1905.	14.76	5.33	9.43
8	Mar. 7, 1905.	14.05	4.73	9.32
8	Aug. 22, 1905.	13.56	4.73	8.83
8a	Jan. 10, 1905.	13.95	4.90	9.05
9	Dec. 17, 1904.	14.49	5.23	9.26
10	Jan. 10, 1905.	12.72	3.83	8.89
11	Jan. 24, 1905.	14.32	5.30	9.02
12	Jan. 24, 1905.	13.58	4.55	9.03
13	Jan. 24, 1905.	14.27	5.20	9.07
13	Jan. 31, 1905.	14.49	5.30	9.19
13	Feb. 7, 1905.	15.84	6.80	9.04
13	Feb. 14, 1905.	15.17	5.85	9.32
14	Dec. 22, 1904.	12.91	4.13	8.78
14a	Dec. 29, 1904.	12.53	4.08	8.45
14a	Feb. 7, 1905.	13.37	4.50	8.87
14a	Aug. 1, 1905.	10.53[1]	2.73	7.80
14b	Dec. 29, 1904.	13.03[2]	4.85	8.18
14b	Feb. 7, 1905.	13.05	4.70	8.35
14b	Aug. 1, 1905.	12.90	4.50	8.40
14c	Dec. 29, 1904.	12.71	3.93	8.78
14c	Aug. 1, 1905.	12.03	3.90	8.13
14d	Dec. 29, 1904.	13.02	4.25	8.77
14d	Aug. 1, 1905.	12.40	3.93	8.47
14e	Dec. 29, 1904.	14.46	6.05	8.41
14e	Aug. 1, 1905.	11.99	3.60	8.39
14f	Jan. 31, 1905.	12.18	3.40	8.78
14f	Mar. 31, 1905.	12.61	3.65	8.96

[1] Contained 0.66 ash.
[2] Contained 0.70 ash.

TABLE OF ANALYSES.—(CONTINUED.)

Lab. Number.	Date of Sampling.	Total Solids.	Fat.	Solids not Fat.
		%	%	%
15	Dec. 22, 1904.	13.46	4.35	9.11
15a	Feb. 14, 1905.	13.94	4.88	9.06
15a	Mar. 31, 1905.	13.65	4.65	9.00
15a	Aug. 29, 1905.	12.88	4.50	8.38
15b	Feb. 14, 1905.	12.99	4.30	8.69
15b	Aug. 29, 1905.	12.12[1]	4.18	7.94
15c	Feb. 14, 1905.	12.01	3.98	8.03
15c	July 25, 1905.	12.01	3.60	8.41
15c	Aug. 29, 1905.	11.92[1]	4.00	7.92
15d	Feb. 14, 1905.	12.25	3.68	8.57
15e	Feb. 14, 1905.	13.21	4.40	8.81
15f	Feb. 14, 1905.	14.02	4.90	9.12
15f	July 25, 1905.	15.02	5.40	9.62
15g	July 25, 1905.	12.35	3.80	8.55
16	Dec. 22, 1904.	13.63	4.60	9.03
16	Mar. 31, 1905.	13.29	4.35	8.94
16	July 18, 1905.	12.49	3.93	8.56
17a	Jan. 31, 1905.	12.49	3.95	8.54
17a	July 18, 1905.	12.39	3.90	8.49
17b	Jan. 31, 1905.	12.18	4.00	8.18
17b	July 18, 1905.	12.92	4.20	8.72
17c	Mar. 24, 1905.	13.25	4.28	8.97
18	Feb. 7, 1905.	13.82	4.63	9.19
18	Mar. 24, 1905.	13.85	4.25	9.60
18	July 25, 1905.	12.36	3.98	8.38
18	Aug. 29, 1905.	12.69	4.20	8.49
19	Dec. 29, 1904.	13.18	4.10	9.08
19	Feb. 7, 1905.	14.18	5.28	8.90
20	Feb. 7, 1905.	13.64	4.98	8.66
20	Mar. 31, 1905.	13.62	4.40	9.22
20	July 18, 1905.	12.28	3.73	8.55
21	Mar. 24, 1905.	12.71	3.88	8.83
21	July 18, 1905.	12.66	4.00	8.66
22	Feb. 7, 1905.	11.15[1]	4.15	7.00
22	Mar. 31, 1905.	12.95	4.00	8.95

[1] Probably 10 per cent. water added.

TABLE OF ANALYSES.—(CONTINUED.)

Lab. Number.	Date of Sampling.	Total Solids.	Fat.	Solids not Fat.
		%	%	%
23	Mar. 24, 1905.	12.14	3.60	8.54
23	Aug. 29. 1905.	12.68	4.05	8.63
24	Mar. 24, 1905.	13.38	4.63	8.75
24	July 25, 1905.	9.48[1]	3.03	6.45
25	Dec. 22, 1904.	13.48	4.15	9.33
26	Dec. 22, 1904.	13.47	4.83	8.64
27	Jan. 31, 1905.	13.10	4.10	9.00
28	Jan. 31. 1905.	14.20	4.98	9.22
29	Jan. 31, 1905.	14.27	4.83	9.44

The chemical analyses of 110 samples gave average results of 13.23 per cent. total solids, 4.49 per cent. fat, and 8.74 per cent. solids not fat.[2] In general it may be said that the solid ingredients contained in the milk were above the legal requirements. Only two samples collected were known to have been watered (about 10 per cent) while 5 other lots were considered somewhat suspicious. Fifty samples, or 44 per cent. of the entire number collected, contained 4.5 per cent. or more of fat, and in most cases 13.5 per cent. or over of solid matter, and may be designated as "rich"; twenty samples contained 5 per cent. or more of fat.

The milk collected west of the Connecticut river was not as rich in solid ingredients as that obtained in the territory of Amherst and vicinity, most of the samples testing between 3.75 and 4.50 per cent. of fat. Such milk may be pronounced of average chemical quality.

[1] Probably considerable water added

[2] The Massachusetts standard calls for 13 per cent. solids and 3.7 per cent. fat from October to April, and 12 per cent. solids and 3 per cent. fat during the remaining six months.

All of the milk retailed at 6 cents a quart, quite often in glass bottles if desired. In so far as the food value of the milk was concerned, it is certain that the consumer was paying a very moderate price for this article of food.

3. Bacteriological Analysis of the Milk.

Common forms of Bacteria in Milk.

The most common forms of bacteria usually found in milk may be classified and briefly described as follows:

I. Acid bacteria. (B. *acidi lactici*, I and II, and B. *lactis aerogenes*). The name was given because they produce lactic acid from the sugar of the milk. The common forms of lactic acid organisms are comparatively few in fresh milk—usually below 30 per cent of the the total number of bacteria—but develop with great rapidity at ordinary temperature (70° Fahr.) and as a rule overcome the other forms. Ordinarily most of the bacteria in old milk consist of the harmless lactic acid organisms.

II. Rapid and Slow Liquefiers. A number of different species compose this group which is so named because of its ability to liquefy gelatin. Rapid liquefiers are relatively few in number in fresh clean milk, and are eventually overcome by the lactic acid bacteria. They produce putrefaction by attacking the nitrogenous matter of the milk, and their presence in large numbers probably renders the milk unwholesome.

Slow liquefiers produce enzymes and most of them cause putrefaction. They are not found in the milk as it comes from the udder, nor are they found in well cleaned milk pails, and their presence in milk in considerable numbers is an indication of dirty cows or stable. Such milk must be regarded as unsanitary.

III. All Others. Under this grouping is included a considerable variety of species, such as the so-called neutrals, those producing yellow or red brown colonies, and those peculiar to certain samples of milk, and not found in other samples.[1]

[1] Pathogenic bacteria, which cause such diseases as tuberculosis, diphtheria and typhoid fever also gain access to milk, but are not considered in this connection.

Number of Bacteria in Milk.

Freshly drawn milk that has been produced under strictly sanitary or aseptic methods should contain but a few hundred bacteria to the cubic centimeter. Such milk will keep for a considerable length of time, especially if held at a low temperature.

Country milk produced by ordinary methods, but drawn from reasonably clean cows, kept in passably clean stables, ought not as a rule to contain more than 5,000 to 25,000 bacteria per cubic centimeter when first placed upon the market. Such milk, if free from objectionable flavor and odor, may be regarded as satisfactory for general consumption.

Country milk, produced under conditions ordinarily prevailing, is likely to contain 50,000 or more bacteria per cubic centimeter when first offered for sale. Milk offered in large cities often contains from several hundred thousand to many million bacteria to the cubic centimeter. The city of Boston forbids the sale of milk containing over 500,000 bacteria to the cubic centimeter.

Meaning of Bacteria in Milk.

1. A large number of bacteria in market milk (100,000 or more to the cubic centimeter) means that the milk is old, or that it has been kept at too high a temperature, or that it has been produced under unsanitary conditions.[1]

2. Strictly fresh milk contains, as a rule, comparatively few lactic acid organisms (rarely above 25 or 30 per cent. of the total number present). The few lactic acid bacteria develop rapidly, especially at ordinary temperatures, and at the end of two days very largely overcome the other species. Milk containing chiefly lactic acid organisms is usually old, but not necessarily dirty.

3. The presence of many liquefiers is an indication that filth has gained access to the milk. A noticeable percentage of liquefiers in milk containing a high total count is very indicative of filthy conditions.[2]

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[1] High temperature is a more potent cause of the rapid increase of bacteria than unsanitary conditions, unless the latter are particularly bad

[2] These interpretations are based particularly upon the researches of Conn. See Fifteenth report of the Storrs experiment station, pp. 33-98.

BACTERIOLOGICAL EXAMINATION.[1-2]

Laboratory Number.	Date of Sampling.	Mean hourly temperature on date of sampling.	Odor.		Number of Bacteria.				
			Cold.	Warm.	Total.	Acid Producers.	Slow Liquefiers.	Rapid Liquefiers.	All Others.
1	Sept. 5, 1904.	60.9°	—	—	30,000†	—	—	—	—
1	Jan. 10, 1905.	26.0°	Normal.	Normal.	2,300†	—	—	—	—
1	Mar. 31, 1905.	52.1°	Normal.	Normal.	4,050	1,250 **30.8%**	150 **3.7%**	25 **0.6%**	2,625 **64.9%**
1	July 11, 1905.	75.7°	—	—	2,200	1,000 **45.5%**	100 **4.5%**	—	1,100 **50.0%**
1	Aug. 15, 1905.	57.2°	Normal.	Normal.	600	100 **16.7%**	—	—	500 **83.3%**
2	Sept. 5, 1904.	60.9°	—	—	477.500†	—	—	—	—
2	Dec. 17, 1904.	11.5°	Normal.	Rank.	17,600†	—	—	—	—
2a	Jan. 10. 1905.	26.0°	Slightly barny.	Slightly barny.	9,900†	—	—	—	—
2b	Jan. 10. 1905.	26.0°	Very barny.	Very barny.	24,900†	—	—	—	—
2	Mar. 7. 1905.	21.4°	—	—	3.400	1,200 **35.3%**	200 **5.9%**	100 **2.9%**	1,900 **55.9%**
2	Aug. 15, 1905.	57.2°	Normal.	Normal.	9,900	1,900 **19.2%**	500 **5.1%**	—	7,500 **75.7%**
3	Sept. 5, 1904.	60.9°	—	—	15,000†	—	—	—	—
3	Dec. 17, 1904.	11.5°	Normal.	Barny.	24,500†	—	—	—	—

[1]Through the courtesy of Dr. Stone, the bacteriological examination of the milk was made in the laboratory of the Department of Vegetable Pathology. Acknowledgment is also made of the many helps and suggestions received from Dr. J. B. Paige and Mr. A. V. Osmun.

[2]A sugar-gelatin-litmus culture media was employed in making the bacteriological determinations. See Conn, Bacteria in Milk and its Products, p. 268.

† Plated on lactose agar, total count only.

BACTERIOLOGICAL EXAMINATION.—(CONTINUED.)

Laboratory Number.	Date of Sampling.	Mean hourly temperature on date of sampling.	Odor.		Number of Bacteria.				
			Cold.	Warm.	Total.	Acid Producers.	Slow Liquefiers.	Rapid Liquefiers.	All Others.
3	Mar. 7, 1905.	21.4°	—	—	16,800	5,500 **32.7%**	500 **3.0%**	—	10,800 **64.3%**
3	July 11, 1905.	75.7°	—	—	17,500‡	—	—	—	—
3	Aug. 15, 1905.	57.2°	Slightly barny.	Normal.	31,700	8,100 **25.6%**	—	100 **0.3%**	23,500 **74.1%**
3	Aug. 22, 1905.	72.3°	Strong.	Slightly strong.	22,200	—	1,000 **4.5%**	400 **1.8%**	20,800 **93.7%**
3a	Aug. 22, 1905.	72.3	Normal.	Normal.	2,000	200 **10.0%**	—	—	1,800 **90.0%**
4	Sept. 5, 1904.	60.9°	—	—	135,000†	—	—	—	—
4	Dec. 17, 1904.	11.5°	Normal.	Barny.	54,400†	—	—	—	—
4	Jan. 24, 1905.	4.0°	Slightly barny.	Barny.	273,500	4,000 **1.4%**	11,000 **4.0%**	3,000 **1.1%**	255,500 **93.5%**
4	Mar. 7, 1905.	21.4°	—	—	10,100	1,000 **9.9%**	1,100 **11.0%**	1,000 **9.9%**	7,000 **69.2%**
4	July 11, 1905.	75.7°	—	—	100,000§	60,000 **60.0%**	—	—	40,000 **40.0%**
4	Aug. 15, 1905.	57.2°	Normal.	Normal.	2,300,000	250,000 **10.9%**	1,350,000 **58.7%**	50,000 **2.2%**	650,000 **28.2%**
4	Aug. 22, 1905.	72.3°	Slightly barny.	Normal.	82,000	31,000 **37.8%**	25,000 **30.0%**	—	26,000 **32.2%**
4a	Jan. 24, 1905.	4.0°	Barny.	Very barny.	60,000	14,000 **23.3%**	3,000 **5.0%**	—	43,000 **71.7%**
4b	Jan. 24, 1905.	4.0°	Slightly barny.	Slightly barny.	207,500	84,000 **41.0%**	17,000 **8.2%**	6,000 **2.8%**	100,500 **48.0%**

† Plated on lactose agar, total count only.
‡ Rapid growing, rank smelling, surface growers.
§ Mould spores present.

BACTERIOLOGICAL EXAMINATION.—(CONTINUED.)

Laboratory Number.	Date of Sampling.	Mean hourly temperature on date of sampling.	Odor.		Number of Bacteria.				
			Cold.	Warm.	Total.	Acid Producers.	Slow Liquefiers.	Rapid Liquefiers.	All Others.
5	Sept. 5, 1904.	60.9°	—	—	247,500†	—	—	—	—
5	Jan. 10, 1905.	26.0°	Normal.	Normal.	5,900†	—	—	—	—
5	Mar. 7, 1905.	21.4	—	—	8,400	700 **8.3%**	1,000 **12.0%**	100 **1.2%**	6,600 **78.5%**
5	July 11, 1905.	75.7	—	—	—‡	—	—	—	—
5	Aug. 15, 1905.	57.2°	Normal.	Strong.	200,000	55,000 **27.5%**	5,000 **2.5%**	10,000 **5.0%**	130,000 **65.0%**
5a	Aug. 15, 1905.	57.2°	Normal.	Slightly strong.	200,000	25,000 **12.5%**	10,000 **5.0%**	5,000 **2.5%**	160,000 **80.0%**
7	Sept. 5, 1904.	60.9°	—	—	20,000†	—	—	—	—
7	Dec. 17, 1904.	11.5°	Normal.	Barny.	14,300†	—	—	—	—
7	Mar. 7, 1905.	21.4°	—	—	4,400	1,200 **27.3%**	200 **4.5%**	—	3,000 **68.2%**
7	July 11, 1905.	75.7°	—	—	300,000	68,000 **22.7%**	8,000 **2.7%**	15,000 **5.0%**	209,000 **69.6%**
8	Jan. 10, 1905.	26.0°	Slightly old.	Normal.	101,800†	—	—	—	—
8a	Jan. 10, 1905.	26.0°	Old.	Old.	3,635,900†	—	—	—	—
8	Mar. 7, 1905.	21.4°	—	—	249,000	91,000 **36.5%**	3,000 **1.2%**	—	155,000 **62.3%**
8	Aug. 22, 1905.	72.3°	Slightly strong.	Rank.	365,000	35,000 **9.6%**	25,000 **6.8%**	—	305,000 **83.6%**

† Plated on lactose agar, total count only.
‡ Plate destroyed by rapid liquefiers.

BACTERIOLOGICAL EXAMINATION.—(CONTINUED.)

Laboratory Number.	Date of Sampling.	Mean hourly temperature on date of sampling.	Odor.		Number of Bacteria.				
			Cold.	Warm.	Total.	Acid Producers.	Slow Liquefiers.	Rapid Liquefiers.	All Others.
9	Dec. 17, 1904.	31.5°	Normal.	Normal.	102,800†	—	—	—	—
10	Jan. 10, 1905.	26.0°	Slightly barny.	Slightly barny.	6,700†	—	—	—	—
11	Jan. 24, 1905.	4.0°	Normal.	Slightly tainted	304,000‡	297,000 **97.0%**	6,000 **2.0%**	1,000 **1.0%**	—
12	Jan. 24, 1905.	4.0°	Normal.	Normal.	20,050†	6,800 **33.9%**	12,000 **6.0%**	—	12,050 **60.1%**
13	Jan. 24, 1905.	4.0°	Normal.	Normal.	3,900	200 **5.1%**	400 **10.3%**	—	3,300 **84.6%**
13	Jan. 31, 1905.	9.2°	Normal.	Slightly barny.	6,200	2,100 **33.9%**	300 **5.0%**	100 **1.6%**	3,700 **59.5%**
13	Feb. 7, 1905.	18.4°	Normal.	Normal.	850	500 **58.8%**	—	—	350 **41.2%**
13	Feb. 14, 1905.	6.7°	Normal.	Normal.	67,450§	—	—	—	—
14	Dec. 22, 1904.	19.1°	Normal.	Normal.	119,800*†	—	—	—	—
14a	Dec. 29, 1904.	24.5°	Normal.	Slightly barny.	167,000†	—	—	—	—
14b	Dec. 29, 1904.	24.5°	Slightly barny.	Rank.	93,800†	—	—	—	—
14c	Dec. 29, 1904.	24.5°	Barny, tainted.	Barny, sour.	938,400†	—	—	—	—

† Plated on lactose agar, total count only.
‡ Practically all acid producers.
§ Practically all slow liquefiers.
* Pasteurized.

BACTERIOLOGICAL EXAMINATION.—(Continued.)

Laboratory Number.	Date of Sampling.	Mean hourly temperature on date of sampling.	Odor.		Number of Bacteria.				
			Cold.	Warm.	Total.	Acid Producers.	Slow Liquefiers.	Rapid Liquefiers.	All Others.
14d	Dec. 29, 1904.	24.5°	Normal.	Normal.	143,200†	—	—	—	—
14e	Dec. 29, 1904.	24.5°	Very barny.	Very barny.	149,500†	—	—	—	—
14a	Feb. 7, 1905.	18.4°	Normal.	Normal.	53,000	11,000 **20.8%**	4,000 **7.6%**	—	38,000 **71.6%**
14a	Aug. 1, 1905.	62.7	Barny.	Old.	810,000	165,000 **20.4%**	1,5000 **1.9%**	10,000 **1.2%**	620,000 **76.5%**
14b	Feb. 7, 1905.	18.4°	Normal.	Normal.	55,000	17,000 **30.9%**	5,000 **9.1%**	1,000 **1.8%**	32,000 **58.2%**
14b	Aug. 1, 1905.	62.7°	Slightly barny.	Slightly old.	1,720,000	200,000 **11.6%**	100,000 **5.8%**	20,000 **1.2%**	1,400,000 **81.4%**
14c	Aug. 1, 1905.	62.7°	Old.	Normal.	365,000	145,000 **39.7%**	30,000 **8.2%**	15,060 **4.1%**	175,000 **48.0%**
14d	Aug. 1, 1905.	62.7°	Barny.	Slightly old.	225,000	60,000 **26.7%**	30,000 **13.3%**	—	135,000 **60.0%**
14e	Aug. 1, 1905.	62.7°	Very rank.	Rank.	46,800,000	28,850,000 **61.6%**	3,750,000 **8.0%**	100,000 **0 2%**	14,100,000 **30.2%**
14f	Jan. 31, 1905.	9.2°	Normal.	Normal.	16,000	3,000 **18.8%**	3,000 **18.8%**	2,000 **12.4%**	8,000 **50.0%**
15	Dec. 22, 1904.	19.1°	Barny.	Barny.	54,800†	—	—	—	—
15a	Feb. 14, 1905.	6.7°	—	Rank.	22,800	8,600 **37.7%**	800 **3.5%**	—	13,400 **58.8%**
15b	Feb. 14, 1905.	6.7°	—	Slightly barny.	296,000	91,000 **30.7%**	12,000 **4.1%**	—	193,000 **65.2%**
15c	Feb. 14, 1905.	6.7°	—	Normal.	10,250	2,100 **20.4%**	500 **5.0%**	100 **1.0%**	7,550 **73.6%**

† Plated on lactose agar total count only.

BACTERIOLOGICAL EXAMINATION.—(Continued.)

Laboratory Number.	Date of Sampling.	Mean hourly temperature on date of sampling.	Odor.		Number of Bacteria.				
			Cold.	Warm.	Total.	Acid Producers.	Slow Liquefiers.	Rapid Liquefiers.	All Others.
15c	July 25, 1905.	66.0°	Normal.	Normal.	25,000	5,000 **20.0%**	5,000 **20.0%**	—	15,000 **60.0%**
15c	Aug. 29, 1905.	64.0°	Normal.	Normal.	10,100	3,600 **35.6%**	300 **3.0%**	—	6,200 **61.4%**
15d	Feb. 14, 1905.	6.7°	—	Normal.	15,500	3,400 **21.9%**	2,000 **12.9%**	100 **0.6%**	10,000 **64.6%**
15d	Aug. 29, 1905.	64.0°	—	—	27,700	8,500 **30.7%**	900 **3.2%**	—	18,300 **66.1%**
15e	Feb. 14, 1905.	6.7°	—	Normal.	14,600	4,200 **28.8%**	—	—	10,400 **71.2%**
15f	Feb. 14, 1905.	6.7°	—	Normal.	25,900	7,200 **27.8%**	600 **2.2%**	—	18,100 **70.0%**
16	Dec. 22, 1904.	19.1°	Bad.	Very bad.	57,800†	—	—	—	—
16	Mar. 31, 1905.	52.1°	Normal.	Off flavor.	148,000	8,000 **5.4%**	15,000 **10.1%**	1,000 **0.7%**	124,000 **83.8%**
16	July 18, 1905.	81.3°	Old, rank.	Very rank.	890,000	540,000 **60.7%**	120,000 **13.5%**	—	230,000 **25.8%**
17a	Jan. 31, 1905.	9.2°	Rank.	Rank.	198,000	131,000 **66.2%**	5,000 **2.6%**	1,000 **0.6%**	61,000 **30.6%**
17a	July 18, 1905.	81.3°	Old.	Barny.	1,730,000	1,060,000 **61.2%**	15,000 **0.9%**	25,000 **1.5%**	630,000 **36.4%**
17b	Jan. 31, 1905.	9.2°	Normal.	Normal.	46,000	14,000 **30.4%**	4,000 **8.7%**	—	28,000 **60.9%**
17b	July 18, 1905.	81.3°	Old.	Old.	1,250,000‡	790,000 **63.2%**	20,000 **1.6%**	10,000 **0.8%**	430,000 **34.4%**
17c	Mar. 24, 1905.	33.5°	Normal.	Normal.	5,950	1,650 **27.7%**	550 **9.2%**	50 **0.8%**	3,700 **62.3%**

† Plated on lactose agar, total count only.
‡ Mould spores present.

BACTERIOLOGICAL EXAMINATION.—(CONTINUED.)

Laboratory Number.	Date of Sampling.	Mean hourly temperature on date of sampling.	Odor.		Number of Bacteria.				
			Cold.	Warm.	Total.	Acid Producers.	Slow Liquefiers.	Rapid Liquefiers.	All Others.
18	Feb. 7, 1905.	18.4°	Normal.	Normal.	192,000	105,000 **54.7%**	9,000 **4.7%**	1,000 **0.5%**	77,000 **40.1%**
18	Mar. 24, 1905.	33.5°	Tainted.	Tainted.	11,509,000§	—	—	—	—
18	July 25, 1905.	66.0°	Slightly rank.	Rank.	1,900,000	250,000 **13.2%**	200,000 **10.5%**	100,000 **5.3%**	1,350,000 **71.0%**
19	Dec. 29, 1904.	24.5°	Slightly barny.	Slightly barny.	865,300†	—	—	—	—
19	Feb. 7, 1905.	18.4°	Normal.	Old.	134,000	34,500 **25.8%**	30,500 **22.7%**		69,000 **51.5%**
20	Feb. 7, 1905.	18.4°	Normal.	Old.	324,500	166,500 **51.3%**	18,000 **5.5%**	1,000 **0.3%**	139,000 **42.9%**
20	Mar. 31, 1905.	52.1°	Rank.	Tainted.	107,000	51,500 **48.2%**	30,500 **28.5%**	—	25,000 **23.3%**
20	July 18, 1905.	81.3°	Barny.	Barny.	90,000	25,000 **27.8%**	—	—	65,000 **72.2%**
21	Mar. 24, 1905.	33.5°	Slightly barny.	Slightly barny.	15,000	4,750 **31.7%**	500 **3.3%**	250 **1.7%**	9,500 **63.3%**
21	July 18, 1905.	81.3°	Slightly barny.	Slightly barny.	270,000	50,000 **18.5%**	120,000 **44.5%**	10,000 **3.7%**	90,000 **33.3%**
22	Feb. 7, 1905.	18.4°	Slightly barny.	Barny.	41,000	10,000 **24.4%**	4,000 **9.8%**	—	27,000 **65.8%**
22	Mar. 31, 1905.	52.1°	Normal.	Normal.	47,000	23,500 **50.0%**	2,000 **4.3%**	—	21,500 **45.7%**

† Plated on lactose agar, total count only.
§ Practically all acid producers.

BACTERIOLOGICAL EXAMINATION.—(CONCLUDED.)

Laboratory Number.	Date of Sampling.	Mean hourly temperature on date of sampling.	Odor.		Number of Bacteria.				
			Cold.	Warm.	Total.	Acid Producers.	Slow Liquefiers.	Rapid Liquefiers.	All Others.
23a	Mar. 24, 1905.	33.5°	Normal.	Normal.	9,450	2,100 **22.2%**	1,350 **14.3%**	—	6,000 **63.5%**
23a	Aug. 29, 1905.	64.0°	Normal.	Normal.	19,000	6,500 **34.2%**	300 **1.6%**	—	12,200 **64.2%**
24	Mar. 24, 1905.	33.5°	Slightly barny.	Slightly barny.	47,000	23,700 **50.4%**	1,250 **2.7%**	1,250 **2.7%**	20,800 **44.2%**
24	July 25, 1905.	66.0°	Tainted.	Tainted.	2,200,000	1,400,000 **63.6%**	—	—	802,000 **36.4%**
25	Dec. 22, 1905.	19.1°	Barny.	Barny.	49,500†	—	—	—	—
26	Dec. 22, 1905.	19.1°	Barny.	Slightly barny.	43,800†	—	—	—	—
27	Jan. 31, 1905.	9.2°	Normal.	Slightly barny.	17,000	9,000 **53.0%**	2,000 **11.8%**	—	6,000 **35.2%**
28	Jan. 31, 1905.	9.2°	Rank, barny.	Very rank.	7,000	2,000 **28.5%**	—	1,000 **14.3%**	4,000 **57.2%**
29	Jan. 31, 1905.	9.2°	Slightly barny.	Slightly barny.	15,000	7,000 **46.7%**	1,000 **6.6%**	—	7,000 **46.7%**

† Plated on lactose agar, total count only.

INTERPRETATION OF THE RESULTS.

The first eleven numbers represent milk collected from Amherst milkmen.

Number one: Samples were collected during winter, spring and summer months. They were remarkedly free from bacteria, did not have any objectionable taste or odor, and in no case contained a large number of liquefiers. This milk was produced under the most cleanly conditions of any found in this vicinity. The cows were well brushed and bedded, and the stable fairly cleaned and passably ventilated. Not much more could be expected from one retailing milk at six cents a quart.

Number two: The several samples, with one exception, contained comparatively few bacteria and were evidently fresh. Most of them had a bad odor, being indicative of poor handling. The stable and cows were rather dirty, and the former poorly ventilated.

Number three: Comparatively small number of total bacteria and few liquefiers, indicating new milk. Colonies from sample collected July 11, on which total count only was made, gave a rank odor of manure. Sanitary conditions of stable not satisfactory.

Number four: An excessive number of bacteria in nearly all samples collected. In most cases the percentage of lactic acid bacteria present does not indicate old milk. In many cases the relative number of liquefiers (especially slow liquefiers) was excessive, which is indicative of a dirty milk. Many samples had a barny odor. Cows were dirty, lacked bedding and fresh air. Improvement urgently needed.

Number five: Three out of five samples contained an excessive number of bacteria for country milk. Milk had a bad odor; stable not clean, cows very dirty, and milk room in bad condition.

Number seven: Three out of four samples contained few bacteria, an indication of fresh milk, well cared for. Sample collected July 11 was old, or kept at too high a temperature; it contained too many liquefiers. Barn fairly clean and ventilated by air shafts. Cows bedded and fairly clean. Water supply in danger of pollution.

Number eight: Excessive bacteria and dirty milk with old rank smell. Stable dark and filthy; cows dirty.

Number nine: Excessive total number of bacteria; condition of stable, milk room and cows very bad.

Number eleven : Old milk with tainted smell. Excessive number of bacteria.

Number thirteen : Samples from experiment station herd, taken directly after milking. Cows clean, well bedded, stable clean and well ventilated. With one exception, milk contained few bacteria, and mostly harmless species. Sample collected Feb. 14 contained an excessive number, nearly all being slow liquefiers. A number of cows suffering from bowel epidemic which explains trouble.

Number fourteen : Milk supply was obtained from a number of producers. Sanitary conditions at distributing center were bad. The milk contained altogether too large a number of bacteria and the percentage of liquefiers in many cases was excessive. Many samples had a rank odor.

Number fifteen : Peddler supplied by a number of producers. In majority of cases not an excessive total number of bacteria ; in some cases too many liquefiers. The milk, as a rule, was free from objectionable odors. Peddler personally visited producers and endeavored to secure a satisfactory product. Stables of many producers bad.

Number sixteen : Too large a number both of total bacteria and of liquefiers. Milk stale with very bad odor.

Number seventeen : Samples a and b contained an excessive number of bacteria ; the large percentage of acid producing germs indicates old milk. The milk had a rank smell. Stables and cows very dirty. Sample c had few bacteria and milk was free from odor ; fairly clean stable and cows.

Number eighteen : Excessive number both of total bacteria and of liquefiers. Milk old with very bad odor. Stable and cows dirty.

Number nineteen : Total number of bacteria and number of liquefiers excessive. Milk had old, strong smell. Stable and cows filthy.

Number twenty : Excessive total number of bacteria, about one-half being acid producing germs. Milk had old barny odor. Stable not visited.

Number twenty-one : Excessive total bacteria and liquefiers in sample collected July 18th. Milk appeared old and had strong barny smell. Large producer and dealer. Cows very dirty and stable dark, scarcely 250 cubic feet of air space being allowed each cow with no adequate means of ventilation.

Number twenty-two : Milk did not contain an excess of bacteria.

One sample had barny odor. Barn in better condition than average and more care used in handling milk. Cows not cleaned. Large producer and distributer. Conditions ought to be improved.

Number twenty-three: Comparatively few bacteria in milk. Too large a percentage of liquefiers in sample (a). Milk free from objectionable odor, evidently fresh and clean. Stable with plenty of air space, and well lighted. Cows fairly clean. Well in barn cellar, in danger of pollution.

Number twenty-four: Sample collected July 25th, had high percentage of lactic acid germs, indicating old milk, which was confirmed by chemical test. Milk had off flavor and odor. Cows dirty, stables dirty, poorly lighted and badly ventilated.

Number twenty-five: Not a large number of bacteria. Milk smelled barny. Evidently fresh milk, improperly cared for.

Number twenty-six: Same as twenty-five.

Number twenty-seven: Few total bacteria, but too large a proportion of slow liquefiers. Milk smelled barny. Cows well bedded and not extremely dirty. Milk room very dirty. Probably fresh milk which had received poor care.

Number twenty-eight: Few total bacteria but too large a proportion of rapid liquefiers. Cows badly nourished. Milk had a very rank odor, evidently fresh, but badly cared for.

Number twenty-nine: Few total bacteria. Milk smelled barny; cows and stable very dirty. Probably quite fresh milk.

Conclusions to Part III.

1. The examination of the 113 samples of market milk showed extremes of 12.0° and 21.0° degrees of natural acidity with an average of 14.7°. These tests may be considered normal and indicate that scarcely any of the milk had begun to develop lactic acid (turn sour) when first collected. It is believed that milk testing 11° or less of natural acidity has received more or less water.

2. The investigation showed that the larger part of the milk was above the average in chemical composition, hence at six cents a quart the consumer was paying a comparatively low price for this article of food.

3. A large total number of bacteria, 100,000 or more, and a relatively large number of liquefiers, in nearly every case went hand in hand

with dirty cows and dirty barns. When the cows were brushed, and bedded, and the barns kept in a passably sanitary condition, the total bacterial content, as a rule, was relatively low. In some cases, milk produced in unsanitary barns and drawn from dirty cows did not contain an excessive total count. This may be explained on the ground that the milker was more than usually careful while milking and that the milk was fresh and had been placed in clean vessels and rapidly cooled.

4. Out of 101 samples examined bacteriologically 50 samples contained more than 50,000 bacteria, 41 samples more than 100,000, 13 samples over 500,000, and 9 samples over 1,000,000 to the cubic centimeter.

5. In only 14 out of 69 cases did the percentage of acid producing organisms comprise more than 50 per cent. of the total bacteria present. In the majority of samples the percentage varied between 10 and 35. Such figures would indicate that much of the milk was comparatively fresh when offered for sale.

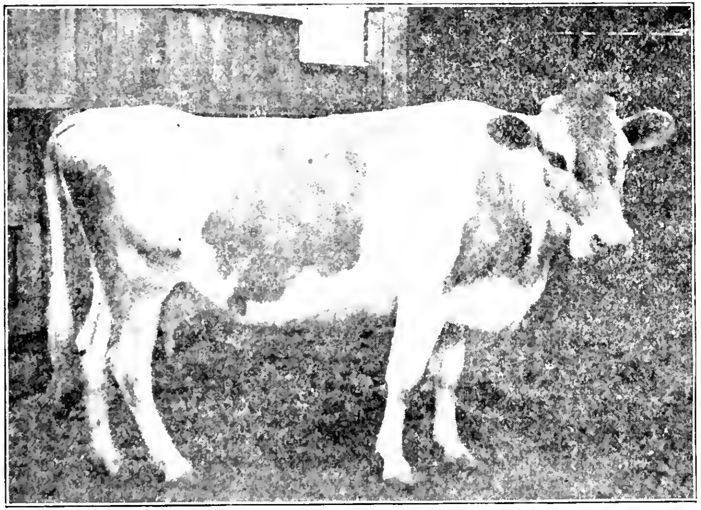
6. Thirty-two per cent. (22 samples) of the 69 samples examined contained 10 per cent or more of liquefiers.

7. Of 84 samples examined 55 or 65.5 per cent. had either an old, strong, barny or very disagreeable smell, only 34.5 per cent. being of normal character. This condition is evidently to be traced to a number of sources such as dirty cows, careless milkers, old milk, and especially to allowing the milk to stand exposed to the atmosphere of the stable for a time after milking.

8. The milk appeared to be comparatively free from visible dirt particles, although upon standing a slight sediment was noticed in many samples. No effort was made to quantitatively determine the amount.

9. The large number of total bacteria, the excess of liquefiers, and the objectionable odor in so many samples, as well as the many badly kept stables, previously referred to, make clear that a great deal of the milk offered for general consumption was not produced under satisfactory sanitary conditions. It is believed that the conditions prevailing in the area canvassed would be similar in other portions of the State.

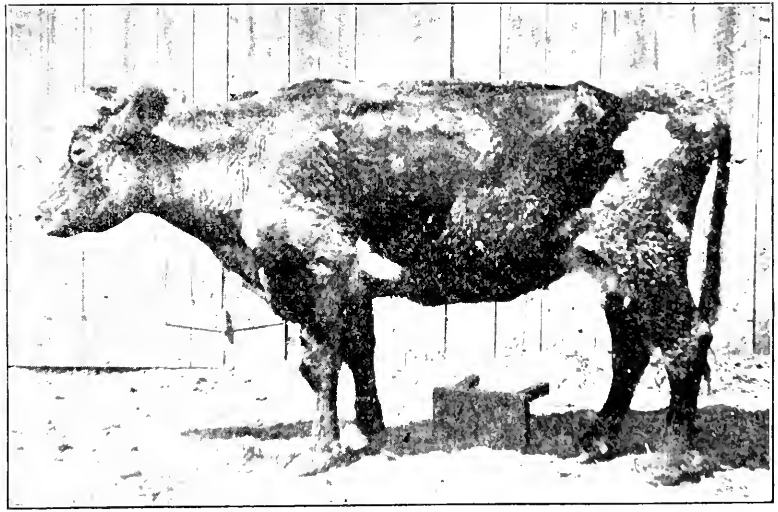
Effect of Cleanliness on Bacterial Content of Milk.



Cow from Clean Dairy.

Date. 1905.	Bacteria in 1 cubic centimeter (c. c) 1 c. c. = 1 500 pt.
Jan. 10,	2300
Mar. 31,	4050
July 11,	2200
Aug. 15,	600

This milk contained few bacteria because animals and barn were kept clean, and milk was cooled at once.



Cow from Dirty Dairy.

Date. 1905.	Bacteria in 1 cubic centimeter (c. c.) 1 c. c. 1-500 pt.
Feb. 7,	192.000
Mar. 24,	11,509,000
July 25,	1,900,000
July 29,	1,000.000

This milk contained a very large number of bacteria as a result of dirty animals and barn, and carelessness in handling milk.

These dairies illustrate the different conditions prevailing on two ordinary farms. The milk retailed in each case for 6 cents a quart.

PART IV.

SUGGESTIONS TO PRODUCER AND CONSUMER.

Certified or sanitary milk may be defined as the product of healthy, well groomed cows, kept in thoroughly clean, well lighted and well ventilated stables: such milk is drawn, cared for and delivered in accordance with the teachings of modern sanitary science[1]. Milk thus produced should contain very few bacteria, be quite free from all objectionable odors, and the larger part of the product,—excepting milk for infant feeding, is expected to contain 5 per cent or more of fat. Experience teaches that it costs ten cents or more a quart to profitably produce and deliver certified milk, and consequently for the present at least, it is beyond the reach of the average consumer.

Duties of the Producer.

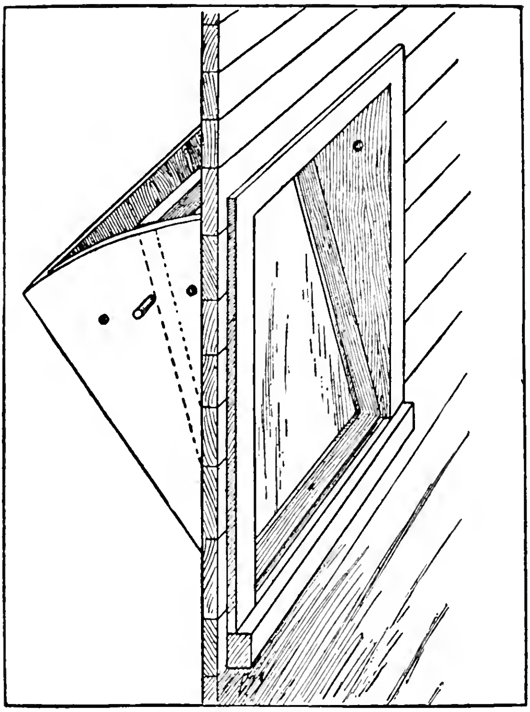
The producer of what might be termed common or ordinary country milk, is under obligation to the public to produce a reasonably clean article. It is intended in what follows to briefly outline what the public has a right to expect of every producer of milk intended for human consumption.[2]

1. Care of the Stable.

Light and Air. Dark interiors are unwholesome for man or beast. Numerous windows should be cut in barns previously dark, particularly in the south and east, and a few in the west side. Use 9 by 13 half sash, hinged at the bottom and opening inward, the triangular space between the sash and sides being closed. The sash should be regulated by pins (see figure) so that it can be opened to whatever extent desired. The top of the windows should be near the ceiling of the stable. *Be sure and keep the windows clean.*

[1]Numerous articles and pamphlets have been written treating in detail of the methods necessary to produce such milk. See especially the article entitled "Market Milk: A Plan for its Improvement" by A. A. Pearson, 17th Annual Report of the Bureau of Animal Industry, Washington, D. C.

[2]It is considered hardly necessary in this connection to enter into a minute description of the several processes connected with the production of clean milk, but rather to emphasize the most important requirements.



Sheringham valve or window opening inward. *

One way to remove the foul air is to construct round galvanized iron or even wooden shafts, the latter made of tightly fitted matched boards. The interior opening of the shafts should be about a foot from the floor with a flap near the ceiling to be opened or shut as required: the exterior opening should be several feet above the highest point of the barn roof. The shaft should contain a damper to regulate the outgo. It is difficult without having a particular stable in mind, to give specific directions concerning location, or the number and size of shafts. In general it may be said that one large flue will prove more effective than several small ones; this arrangement, however, must be governed somewhat by the form of the stable. Allowing some 400 cubic feet of air space for each animal, a flue 2 by 2 feet, inside measure, should change the air sufficiently often for a stable containing 20 cows. Whenever the

* From Experiment Station Work, Vol. II, No. 4.

construction allows it, the shaft should be located in the centre of the stable. In long narrow stables, it should be opposite the greatest number of air intakes. In the type of stable usually prevailing in New England, it may be advisable to place a shaft at each end of the manure gutter. It may be possible in some cases, if the windows are sufficient, to get along without the air shaft. Observation and experience will enable one to regulate the intake and outgo of air.

Another method, known as the Moody system, introduces fresh air through an opening in the manger front, and allows the foul air to escape through windows or cupolas above. This system, which has much to commend it, is best employed when animals are housed in wings separate from the main barn. Whatever system is employed, direct drafts should be avoided, but there should be sufficient supply of fresh air, so that upon entering the barn it will not seem close and stuffy. Even if ordinary swing doors are used in front of the cows, they should only be partially closed, even in very cold weather.

The barn should have a thorough airing each day, while the animals are in the barnyard.[1]

Cleanliness of the Stable.

The stable should be kept free from cobwebs and dust. A few hours once a month will be all the time necessary. At least once each year (better twice) scrape the sides of the stable that have become at all fouled with manure and apply, either with brush or force pump, a coat of whitewash. If you do not care to whitewash, spray thoroughly at least twice yearly with a 5 per cent. solution of carbolic acid or creolin. Either of these disinfectants is cheap, and can be easily obtained at agricultural warehouses, or wholesale druggists. The droppings ought to be removed at least once each day and twice daily if the animals are confined during the entire twenty-four hours. Land plaster or Kainit sprinkled in the gutters proves an excellent deodorizer.

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[1] It is of course impossible in this connection to go into any extended discussion of stable construction and ventilation. The aim of the writer has simply to call the attention of the farmer possessing the ordinary type of stable to the necessity of supplying fresh air to his stock, and to suggest a few inexpensive methods of doing it. For a fuller discussion of this subject, see the Physics of Agriculture by F. H King; the Ontario Agricultural College and Experiment Farm Report, No. 119; and the valuable illustrated paper by Dr. J. B. Paige in the 48th report of the Mass. State Board of Agriculture, p. 110. *An excellent resumè* (illustrated) of these several publications may be found in Experiment Station work, Vol. 11, No. 4, to be had free of the Department of Agriculture, Washington, D C.

2. *Care of the Cows.*

Clean Cows. Animals that furnish milk for human consumption ought most certainly to be kept clean. They should be carded and brushed at least once daily, during the season of confinement, and also in summer if occasion requires it. The udders and flanks should be brushed shortly before each milking. A good idea is to keep the hair on the udder and flanks cut close by the use of a pair of clippers. Wipe the udder of each cow before milking with a clean damp cloth wrung out in a pail of clean lukewarm water. It will aid very much in keeping dirt from getting into the milk.

Bedding in the form of sawdust, shavings, straw, or swale hay is an absolute necessity. Horse manure is unsuited for a bedding material.

Manure and the Barnyard. If you have a manure cellar, keep it well ventilated and respectable. Remove the accumulations as often as possible and do not have a reeking mass of decomposing material directly beneath your cows, continually giving off odors that penetrate every nook and corner of the cow stable and storage barn.

If you store your manure in a shed outside the cattle stable, do not pile it up directly against the sides of the barn so that it will obstruct the light or leach into the stable. Storage pits should have tightly cemented bottoms so as to save the liquid portion. The best plan is to get the manure from the stable into the field as soon as possible. That the barnyard ought to be well drained goes without saying. It should be situated on a natural slope, and be protected by buildings or fences from cold winds. A basis of cobble stones covered with ashes and cinders makes a very satisfactory bottom. The animals should be turned into this yard as often as the weather permits for a number of hours daily during the season of confinement.

3. *Water Supply.*

Every dairy farmer should carefully guard his water supply. Wells located in or near barnyards are almost sure to be foul, while those near the house are likewise in danger from privy and sink drainage, or from the rinsings of dirty milk vessels thrown upon the surface of the ground near the well. If the soil once becomes contaminated, it requires a long time to purify itself even after the source of pollution has been removed. Contaminated water is likely to gain access to the milk as a result of the cleansing of the milk vessels, or when used for cooling. Epidemics of typhoid and other diseases are frequently traced to the polluted well. A spring some distance from any building, located if possible on elevated land and carefully protected, especially from animals, should furnish an ideal supply for house and stable. It should be delivered through iron pipe, coated with asphaltum, or galvanized iron pipe ; *lead pipe should never be employed.*

4. Care of the Milk.

The Milker. The hands of the milker should be washed immediately before milking, and he should put on a different suit from the one he has been wearing to do barn or field work. A pair of light weight overalls and jumper would serve admirably. This suit should be kept clean, be hung in a clean airy place, and be worn *only during the milking.*

The Milk. The first few streams of milk usually contain a large number of bacteria, and should be discarded. As soon as drawn, the milk should be removed *immediately* from the stable and strained, preferably into a tank or large can,thus mixing the milk of a number of cows. The covered milk pail (the Gurler or a similar device),while not necessary,assists in keeping out dust and dirt particles.[1] Do not leave a pail full of milk standing in the stable even for a few minutes, otherwise a barny odor will develop. The strainers, whether of wire or cloth, should be kept absolutely clean. Aeration by the use of one of the several aerators removes the animal odor, and is quite necessary if one is making a certified product. If practiced, it should be done in a perfectly clean atmosphere, otherwise the milk is likely to take on odor as well as bacteria. The milk should be cooled without delay to a temperature of 40°Fahr., then covered and thus held until ready for delivery.

[1]Stocking objects to the use of the cotton pad over the mouth of the covered pail, claiming that it does not keep out the bacteria, but serves to break up the colonies and causes their more rapid propagation. The mouth or opening is to be free from any filter.

If sold in bottles, the latter when filled should be placed in ice water or packed in chipped ice.

The Dairy Room. The place where the milk is handled *must be kept clean* ; the walls and ceiling should receive an occasional coat of paint or whitewash, and the windows and door be screened. The floor ought to be of cement, and in no case allowed to become dirty and sour from spilled milk. It is best to have this room in a building entirely separate from the main barn or cow stable.

The Dairy Utensils. Milk pails, strainers, cans, as well as separator and bottles, if used, should first be rinsed with cold water, washed with steam or boiling water with the aid of a scrubbing brush, and placed in a clean airy place to dry. Do not allow any milk to accumulate in seams or corners.[1] In the cleaning process use a cloth as little as possible, for unless frequently and thoroughly scalded, it is sure to furnish a lodgment for numberless bacteria.

The above requirements as briefly outlined, namely, *light, air, clean barns, clean cows, pure water, well drained barnyards, clean milkers, clean milk vessels, and care in handling milk*, are essentials which the public has a right to expect. They do not require an outlay of capital sufficient to put them beyond the reach of the ordinary producer, and he who will conform to them will have done all that can be reasonably expected of him.

Milk is the principal food of infants and young children ; it is largely used by invalids, and it forms one of the articles of food in every household. It is, of necessity, produced in such a way as to render it easily liable to contamination, and it is a most favorable medium for bacterial growth. It is not for the true interest of the dairyman to allow the consumer to gain the impression that this most desirable and universally used food is produced, cared for and distributed in an unsanitary manner. It is the belief of the writers that dairys supplying milk for human consumption should be subject to a regular system of sanitary inspection. The work along this line recently inaugurated by the State Board of Health ought to be welcomed by all intelligent dairymen. A certificate of commenda-

[1] All joints and seams should be flushed with solder to prevent accumulations of dried milk and dirt particles.

tion from a competent authority, stating conditions governing the production of Mr. A's or Mr. B's milk to be satisfactory, will most certainly inspire confidence and ought to induce a larger per capita consumption.

Finally, the producer personally and through organization should endeavor to educate the public to a better appreciation of the food and economic value of clean milk.

Duties of the Consumer.

The consumer ought to be willing to pay a fair price for milk produced under reasonable sanitary conditions. Milk with five per cent. fat is certainly worth more than that with three or four per cent., and clean milk ought to command a premium over that produced under dirty conditions. The average consumer has shut his eyes to these differences. To him milk has been rather of a household necessity, to be bought as cheaply as possible. As to the methods and care used in its production, he has been lamentably ignorant. In all probability he has never once inspected the source of his daily supply. If his children become ill, he willingly employs physician and nurse, but he is likely to begrudge the dairyman a little advance in price that will encourage him to produce a safe and wholesome food product for his entire family. He pays dollars to overcome the illness, instead of dimes to remove the cause.

Since 1897, the cost of producing milk has noticeably increased. Thus the cost of grain has advanced 50 to nearly 100 per cent., wages for farm labor have risen, and satisfactory help is difficult to obtain. During this time the average price of milk in the towns and smaller cities has remained nearly stationary, being six, and in exceptional instances, seven cents a quart. Now the consumer should not overlook the fact that *it costs money* to have clean barns, clean cows, clean dairy utensils, and neat and attractive surroundings. It means extra labor, and a better class of farm help than is ordinarily procurable.

The records of the station herd since 1895 have shown that the average food cost of a quart of 5 per cent. milk has been 2.5 cents; while for the last two years the food cost of a quart of such milk has been 2.75 cents. To this should be added the cost of caring for the cows and milk, ice supply, delivery of milk, bad debts, and a fair profit. The writers are firmly of the opinion that, when reasonably satisfactory sanitary conditions prevail, milk testing 4.5 to 5 per cent. of butter fat ought to bring 8 cents a quart at retail, in order for the producer to secure a fair return on his investment. Strictly sanitary or certified milk will cost several cents in advance of this figure.

The consumer demands that other food necessities be produced and handled in a cleanly manner, and willingly pays a fair price for them. Why should he not do the same for clean milk?

The consumer can further aid the producer by placing the milk in a refrigerator or other cool place *as soon as received.* It should not be forgotten that milk absorbs odors easily, and is rapidly contaminated by dust particles, hence milk kept in open vessels, pitchers and pans, should be covered to avoid such sources of trouble. It is hardly necessary to state that all vessels should be thoroughly washed in boiling water and well aired, before receiving the daily milk supply. Co-operate with the producer and the producer will co-operate with you.

HATCH EXPERIMENT STATION

—OF THE—

MASSACHUSETTS

AGRICULTURAL COLLEGE.

BULLETIN NO. 111.

I. ANALYSES OF MANURIAL SUBSTANCES FORWARDED FOR EXAMINATION.

II. ANALYSES OF LICENSED FERTILIZERS COLLECTED IN THE GENERAL MARKETS.

III. MARKET VALUES OF FERTILIZING INGREDIENTS.

JULY, 1906.

The regular Bulletins of this Station will be sent free to all newspapers in the State and to such individuals interested in farming as may request the same. Technical Bulletins are sent only to those persons interested in the subject treated of in each case.

AMHERST, MASS.:
PRESS OF CARPENTER & MOREHOUSE
1906.

HATCH EXPERIMENT STATION

OF THE

Massachusetts Agricultural College,

AMHERST, MASS.

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The co-operation and assistance of farmers, fruit-growers, horticulturists, and all interested, directly or indirectly, in agriculture, are earnestly requested. The Bulletins will be sent free to all newspapers in the State and to such individuals interested in farming as may request the same. General bulletins, fertilizer analyses, analyses of feed-stuffs, and annual reports are published. Kindly indicate in application which of these are desired. Communications may be addressed to the

HATCH EXPERIMENT STATION, Amherst, Mass.

DIVISION OF CHEMISTRY.

C. A. Goessmann.

I. ANALYSES OF FERTILIZER SUBSTANCES, REFUSE MATERIALS AND SOILS SENT ON FOR EXAMINATION.

WOOD ASHES.

1964-1967. I. Received from Deerfield, Mass.
II. Received from Sunderland, Mass.
III and IV. Received from North Hadley, Mass.

	PER CENT.			
	I.	II.	III.	IV.
Moisture at 100°C.,	17.38	22.59	13.10	23.63
Potassium oxide,	4.80	7.24	4.52	3.44
Phosphoric acid,	1.08	1.18	.94	.44
Calcium oxide,	27.44	23.94	25.21	21.39
Insoluble matter,	14.15	16.12	22.87	23.16

1968-1971. I. Received from Concord, Mass.
II. Received from Billerica, Mass.
III. Received from Amherst, Mass.
IV. Received from North Amherst, Mass.

	PER CENT.			
	I.	II.	III.	IV.
Moisture at 100°C.,	24.63	15.62	13.96	22.32
Potassium oxide,	3.96	3.76	6.42	6.76
Phosphoric acid,	.92	1.27	1.11	1.35
Calcium oxide,	32.64	26.26	32.69	27.20
Insoluble matter,	9.59	21.74	13.37	11.50

1972-1975.
I and II. Received from Sunderland, Mass.
III. Received from North Hadley, Mass.
IV. Received from Sunderland, Mass.

	PER CENT.			
	I.	II.	III.	IV.
Moisture at 100° C.,	19.14	14.48	24.66	25.17
Potassium oxide,	5.10	3.88	3.90	5.04
Phosphoric acid,	1.25	1.17	1.13	1.40
Calcium oxide,	29.24	28.00	31.00	26.90
Insoluble matter,	12.00	23.66	10.40	11.29

1976-1979. I. Received from Deerfield, Mass.
II. Received from Amherst, Mass.
III. Received from Sunderland, Mass.
IV. Received from North Hadley, Mass.

	PER CENT.			
	I.	II.	III.	IV.
Moisture at 100° C.,	17.76	.65	11.59	10.07
Potassium oxide,	4.66	7.54	6.60	4.70
Phosphoric acid,	.99	2.90	1.80	.82
Calcium oxide,	28.95	41.77	31.01	32.42
Insoluble matter,	14.73	13.34	19.08	17.98

1980-1984. I. Received from Littleton, Mass.
II. Received from North Amherst, Mass.
III. Received from Sudbury, Mass.
IV and V. Received from North Hadley, Mass.

	PER CENT.				
	I.	II.	III.	IV.	V.
Moisture at 100° C.,	11.80	22.17	26.17	1.35	1.10
Potassium oxide,	7.44	6.04	5.04	3.04	3.20
Phosphoric acid,	1.66	1.62	.72	1.16	.76
Calcium oxide,	32.20	28.52	33.88	43.24	43.04
Insoluble matter,	12.95	14.56	11.98	4.04	4.14

LIME ASHES AND LIME COMPOUNDS.

1985-1988. I. Lime ashes, received from Sunderland, Mass.
II. Prepared lime, received from Hatfield, Mass.
III. Oyster-shell lime (unburned), received from South Deerfield, Mass.
IV. Oyster-shell lime (unburned), received from North Hatfield, Mass.

	PER CENT.			
	I.	II.	III.	IV.
Moisture at 100°C.,	21.65	5.83	9.74	11.18
Potassium oxide,	1.68	*	*	*
Phosphoric acid,	.82	*	.34	*
Calcium oxide,	38.88	41.47	46.46	34.32
Insoluble matter,	13.65	none	*	*
Nitrogen,	—	—	.17	*

NITRATE OF SODA.

1989-1992. I. Received from Amherst, Mass.
II. Received from Warren, Mass.
III. Received from Waltham, Mass.
IV. Received from Orange, Mass.

	PER CENT.			
	I.	II.	III.	IV.
Moisture at 100°C.,	2.40	2.15	1.26	1.77
Nitrogen,	15.50	14.30	15.81	15.36

SULPHATE OF AMMONIA AND SALTPETER.

1993-1995. I. Sulphate of ammonia, received from Amherst, Mass.
II. Nitrate of potash, received from New York City.
III. Saltpeter waste, received from Concord, Mass.

	PER CENT.		
	I.	II.	III.
Moisture at 100°C.,	1.22	.08	8.68
Nitrogen,	21.20	11.42	3.15
Potassium oxide,	—	45.60	31.80

DRIED BLOOD AND LINSEED MEAL.

1996-1998.
I and II. Dried blood, received from New Lenox, Mass.
III. Linseed meal, received from No. Hatfield, Mass.

	PER CENT.		
	I.	II.	III.
Moisture at 100°C.,	3.95	5.64	9.72
Nitrogen,	11.19	9.54	5.25
Phosphoric acid,	2.38	2.78	†

† Linseed meal contains about 1.75% Phosphoric acid and 1.30% Potassium oxide.

* Not determined.

COTTON SEED MEAL.

1999-2002.

I and II. Received from Hadley, Mass.
III. Received from Hatfield, Mass.
IV. Received from Southwick, Mass.

	PER CENT.			
	I.	II.	III.	IV.
Moisture at 100°C.,	6.07	5.95	6.52	5.48
Nitrogen,	6.66	6.89	6.78	6.68

2003-2007. I. Received from Southwick, Mass.
II. Received from Hadley, Mass.
III. Received from Westfield, Mass.
IV. Received from Greenfield, Mass.
V. Received from North Hatfield, Mass.

	PER CENT.				
	I.	II.	III.	IV.	V.
Moisture at 100°C.,	4.58	8.71	8.21	5.35	8.36
Nitrogen,	6.11	6.39	6.24	5.98	6.53

2008-2012. I. Received from North Hatfield, Mass.
II. Received from Bradstreet, Mass.
III. Received from North Hadley, Mass.
IV. Received from Sunderland, Mass.
V. Received from North Hadley, Mass.

	PER CENT.				
	I.	II.	III.	IV.	V.
Moisture at 100°C.,	6.15	7.80	8.27	5.70	7.78
Nitrogen,	6.62	5.93	6.36	6.69	6.25

2013-2016. I. Received from Florence, Mass.
II and III. Received from North Hadley, Mass.
IV. Received from Sunderland, Mass.

	PER CENT.			
	I.	II.	III.	IV.
Moisture at 100°C.,	7.12	7.57	7.75	9.76
Nitrogen,	6.17	6.56	6.54	6.52

POTASH COMPOUNDS.

2017-2019. I. High grade sulphate of potash, received from New Lenox, Mass.

II. Potash magnesia sulphate, received from Amherst, Mass.

III. Carbonate of potash and magnesia, received from Amherst, Mass.

	PER CENT.		
	I.	II.	III.
Moisture at 100°C.,	.97	6.47	7.55
Potassium oxide,	51.36	25.28	21.74
Magnesium oxide,	*	10.87	20.62
Sulphuric acid,	*	42.16	*

PHOSPHORIC ACID COMPOUNDS.

2020-2023. I. Dissolved bone-black, received from New Lenox, Mass.

II and III. Acid phosphate, received from New Lenox, Mass.

IV. Burned bone, received from Greenfield, Mass.

	PER CENT.			
	I.	II.	III.	IV.
Moisture at 100°C.,	5.60	5.98	4.06	14.40
Total phosphoric acid,	14.82	17.40	19.44	28.38
Soluble phosphoric acid,	8.70	9.70	6.73	*
Reverted phosphoric acid,	4.64	3.40	6.11	*
Insoluble phosphoric acid,	1.48	4.30	6.60	*

2024-2026. I. Phosphatic slag, received from Holyoke, Mass.

II. Phosphatic slag, received from Waltham, Mass.

III. Dissolved bone, received from New Lenox, Mass.

	PER CENT.		
	I.	II.	III.
Moisture at 100°C.,	1.04	.12	3.61
Total phosphoric acid,	18.40	17.10	17.02
Soluble phosphoric acid,	*	—	4.90
Reverted phosphoric acid,	*	10.12	6.74
Insoluble phosphoric acid.	*	6.98	5.38
Nitrogen,	—	—	1.78

* Not determined.

GROUND BONE, TANKAGE, FISH, ETC.

2027-2030. I. Ground bone, received from Worcester, Mass.
II. Fine ground bone and tankage, received from New Lenox, Mass.
III. Tankage, received from Concord, Mass.
IV. Dry ground fish, received from North Hatfield, Mass.

	PER CENT.			
	I.	II.	III.	IV.
Moisture at 100°C.,	5.50	5.70	11.64	9.48
Total phosphoric acid,	28.52	12.26	15.40	6.96
Available phosphoric acid,	6.78	4.50	6.06	4.41
Insoluble phosphor. acid,	21.74	7.76	9.34	2.55
Nitrogen,	2.13	5.75	6.41	7.51

2031-2033. I. Bone waste, received from Greenfield, Mass.
II. Horn waste, received from Greenfield, Mass.
III. Beef scrap, received from Amesbury, Mass.

	PER CENT.		
	I.	II.	III.
Moisture at 100°C.,	7.03	8.47	7.12
Total phosphoric acid,	27.40	16.78	9.42
Available phosphoric acid,	3.40	*	3.10
Insoluble phosphoric acid,	24.00	*	6.32
Nitrogen,	3.65	5.18	7.46

MISCELLANEOUS MATERIALS.

2034-2036.
I and II. Sheep manure, received from Framingham, Mass.
III. Cotton waste, received from Agawam, Mass.

	PER CENT.		
	I.	II.	III.
Moisture at 100°C.,	7.19	8.07	7.97
Nitrogen,	2.30	2.26	.74
Potassium oxide,	1.96	1.06	1.74
Phosphoric acid,	1.69	.78	.38
Insoluble matter,	4.82	4.80	20.03
Calcium oxide,	*	.80	*

* Not determined.

2037-2039. I. Sludge from filter beds, received from Southboro, Mass.
II. Manure and lime, received from Hubbardston, Mass.
III. Leather refuse, from settling tanks, received from Norwood, Mass.

	PER CENT.		
	I.	II.	III.
Moisture at 100°C.,	75.77	3.80	3.60
Nitrogen,	.52	.52	2.44
Potassium oxide,	.05	.57	*
Phosphoric acid,	.07	.26	.26
Calcium oxide,	*	7.41	*
Insoluble matter,	1.87	31.23	25.95

CHINCHA PERUVIAN GUANO.

2040-2042. I. Received from New Lenox, Mass.
II. Received from Hatfield, Mass.
III. Received from Dudley, Mass.

	PER CENT.		
	I.	II.	III.
Moisture at 100°C.,	5.48	12.39	12.26
Total phosphoric acid,	9.26	9.64	10.36
Soluble phosphoric acid,	2.10	2.55	2.55
Reverted phosphoric acid,	5.08	4.61	4.49
Insoluble phosphoric acid,	2.04	2.48	3.32
Potassium oxide,	1.80	1.85	1.94
Nitrogen,	7.54	7.50	7.19

LOBOS PERUVIAN GUANO.

2043-2047. I. Received from New Lenox, Mass.
II. Received from Hatfield, Mass.
III. Received from Easthampton, Mass.
IV. Received from Waltham, Mass.
V. Received from Dudley, Mass.

* Not determined.

	PER CENT.				
	I.	II.	III.	IV.	V.
Moisture at 100 C.,	5.09	10.78	10.80	14.97	10.39
Total phosphoric acid,	19.36	13.82	17.60	17.84	19.26
Soluble phosphoric acid,	3.23	2.43	2.78	2.10	3.35
Reverted phosphoric acid,	6.81	3.51	6.96	6.12	5.59
Insoluble phosphoric acid,	9.32	7.88	8.06	9.62	10.32
Potassium oxide,	3.76	4.18	3.42	4.40	3.72
Nitrogen,	3.04	3.77	3.69	2.99	3.56

COMPOUND FERTILIZERS.

2048-2052. I. Received from Westfield, Mass.
II. Received from Worcester, Mass.
III, IV and V. Received from North Hatfield, Mass.

	PER CENT.				
	I.	II.	III.	IV.	V.
Moisture at 100°C.,	15.93	16.51	8.88	11.21	9.86
Total phosphoric acid,	7.82	21.96	11.12	10.06	11.42
Soluble phosphoric acid,	2.95	14.35	1.93	5.05	3.25
Reverted phosphoric acid,	2.69	4.75	4.23	3.55	3.77
Insoluble phosphoric acid,	2.18	2.86	4.96	1.46	4.40
Potassium oxide,	3.76	3.74	6.24	6.80	7.62
Nitrogen,	3.01	1.10	3.69	3.01	3.41

2053-2057. I. Received from West Brookfield, Mass.
II. Received from Bradstreet, Mass.
III. Received from Pottersville, Mass.
IV. Received from Waltham, Mass.
V. Received from Dudley, Mass.

	PER CENT.				
	I.	II.	III.	IV.	V.
Moisture at 100 C.,	8.08	8.52	33.80	10.57	7.21
Total phosphoric acid,	3.76	10.90	1.48	12.64	10.50
Soluble phosphoric acid,	.75	*	1.08	1.45	3.45
Reverted phosphoric acid,	1.71	8.24	—	6.13	3.21
Insoluble phosphoric acid,	1.30	1.66	.40	4.06	3.84
Potassium oxide,	9.04	3.80	.28	11.66	8.73
Nitrogen,	2.49	3.48	.74	4.34	4.82

* Not determined.

2058-2062.

I and II. Received from Sunderland, Mass.
III, IV and V. Received from Deerfield, Mass.

	PER CENT.				
	I.	II.	III.	IV.	V.
Moisture at 100 C.,	13.93	10.62	10.05	6.71	8.29
Total phosphoric acid,	7.32	6.26	8.18	1.54	5.76
Soluble phosphoric acid,	.33	.95	3.55	none	none
Reverted phosphoric acid,	3.50	3.39	3.17	1.16	1.92
Insoluble phosphoric acid,	3.46	1.92	1.46	.38	3.84
Potassium oxide,	4.68	6.34	6.30	5.90	7.24
Nitrogen,	4.65	4.65	3.25	4.52	4.07

SOILS.

2063-2065. I. Received from Upton, Mass.
II. Received from Amherst, Mass.
III. Received from North Adams, Mass.

	PER CENT.		
	I.	II.	III.
Moisture at 100°C.,	1.25	.87	4.72
Nitrogen,	.04	.16	.22
Potassium oxide,	.36	.28	.59
Phosphoric acid,	.16	.11	.14
Calcium oxide,	.91	1.04	.37
Ash,	96.82	*	*

2066-2068. I. Received from North Adams, Mass.
II. Received from Amherst, Mass.
III. Received from North Weymouth, Mass.

	PER CENT.		
	I.	II.	III.
Moisture at 100°C.,	5.05	30.29	22.34
Nitrogen,	.24	.15	.27
Potassium oxide,	.52	.20	.26
Phosphoric acid,	.09	.05	.10
Calcium oxide,	.29	.51	.52

II. ANALYSES OF COMMERCIAL FERTILIZERS COLLECTED DURING 1906 IN THE GENERAL MARKETS BY THE AGENT OF THE HATCH EXPERIMENT STATION OF THE MASSACHUSETTS AGRICULTURAL COLLEGE.

Laboratory No.	Name of Brand.	Name of Manufacturer.	Sampled at
	Compound Fertilizers.		
64	Grass and Lawn Top Dressing	American Agricultural Chemical Co., Boston, Mass.	Hatfield.
175	" " " " "	" " " " " "	Seekonk.
197	High Grade Fertilizer 10% Potash	" " " " " "	Bridgewater.
291	" " " " "	" " " " " "	Newburyport.
299	" " " " "	" " " " " "	Southboro.
429	Tobacco Starter and Grower	" " " " " "	Greenfield.
499	" " " "	" " " " " "	Southwick.
137	Baker's A. A. Ammoniated Superphosphate	Am. Agr. Chem. Co., H. J. Baker & Bro., Branch	New Bedford.
404	" " " "	" " " " " " " " "	Worcester.
14	Bradley's Comp. Manure, Potatoes and Vegetables	Am. Agr. Chem. Co., Bradley Fertilizer Co., Branch	Bradstreet.
158	" " " " " "	" " " " " " " "	New Bedford.
201	" " " " " "	" " " " " " " "	Concord.
219	" " " " " "	" " " " " " " "	Bedford.
290	" " " " " "	" " " " " " " "	Lawrence.
310	" " " " " "	" " " " " " " "	Arlington.
22	Bradley's X. L. Superphosphate	" " " " " " " "	Bradstreet.
185	" " "	" " " " " " " "	New Bedford.
231	" " "	" " " " " " " "	Lexington.
302	Clark's Cove Potato Fertilizer	Am. Agr. Chem. Co., Clark's Cove Fertilizer Co., Branch	Hudson.
394	" " " "	" " " " " " " " "	Spencer.
406	Clark's Cove King Philip Alkaline Guano	" " " " " " " " "	Spencer.

Laboratory Number.	Name of Brand.	Moisture.	Nitrogen in 100 lbs.		Phosphoric Acid in 100 lbs.							Potassium Oxide in 100 lbs.	
								Total.		Available.			
			Found.	Guaranteed.	Soluble.	Reverted.	Insoluble.	Found.	Guaranteed.	Found.	Guaranteed.	Found.	Guaranteed.
	Compound Fertilizers.												
64-175	Grass and Lawn Top Dressing	8.25	4.90	3.91-4.73	1.93	3.75	1.74	7.42	6-9	5.68	5-7	2.26	2-3
197-291-299	High Grade Fertilizer 10% Potash	10.10	3.13	2.47-3.29	2.40	4.10	4.68	11.18	7-10	6.50	6-8	10.00	10-12
429-499	Tobacco Starter and Grower	9.70	3.56	3.5-4.12	6.03	3.05	1.58	10.66	10-13	9.08	8-10	5.26	4-5*
137-404	Barker's A. A. Ammoniated Superphos'te.	13.50	2.81	2.50-3.25	6.20	1.08	4.16	11.44	11-14	6.28	9-11	2.41	2-3
14-158-201-219-290-310	Bradley's Comp. Manure for Pot. and Veg.	9.92	3.45	3.30-4.12	4.10	3.58	2.74	10.42	9-13	7.68	8-11	6.96	7-8
22-185-231	Bradley's X. L. Superphosphate	13.60	2.65	2.50-3.25	6.05	3.19	2.38	11.62	11-14	9.24	9-11	2.10	2-3
302-394	Clark's Cove Potato Fertilizer	13.29	2.33	2.06-2.88	5.70	2.56	3.02	11.28	10-13	8.26	8-10	3.20	3-4
406	Clark's Cove King Philip Alkaline Guano.	12.61	1.35	1.03-2.50	6.23	1.89	2.40	10.52	10-15	8.12	8-12	2.02	2-3

* Enough chlorine to unite with 2.10% potassium ozide.

II. ANALYSES OF COMMERCIAL FERTILIZERS COLLECTED DURING 1906 IN THE GENERAL MARKETS BY THE AGENT OF THE HATCH EXPERIMENT STATION OF THE MASSACHUSETTS AGRICULTURAL COLLEGE.

Laboratory No.	Name of Brand.	Name of Manufacturer.	Sampled at
	Compound Fertilizers.		
285	Crocker's Potato, Hop and Tobacco Phosphate	Am. Agr. Chem. Co., Crocker Fert. & Chem. Co., Branch	Haverhill.
389	" " " " " "	" " " " " " " " "	Worcester.
392	Crocker's A. A. Complete Manure	" " " " " " " " "	Worcester.
58	Darling's Blood, Bone and Potash	Am. Agr. Chem Co., L. B. Darling Fert. Co., Branch,	S. Amherst.
409	" " " " "	" " " " " " " " "	Worcester.
61	Darling's Farm Favorite	" " " " " " " " "	S. Amherst.
400	" " "	" " " " " " " " "	Oxford.
31	Great Eastern General Fertilizer	Am. Agric. Chem. Co., Great Eastern Fert. Co., Branch	Sunderland.
102	" " " "	" " " " " " " " "	Sunderland.
437	" " " "	" " " " " " " " "	S. Williamst'n.
110	Great Eastern Vegetable, Vine and Tobacco	" " " " " " " " "	Sunderland.
454	" " " " " "	" " " " " " " " "	Oxford.
85	Pacific Potato Special	Am. Agr. Chem. Co., Pacific Guano Co., Branch	Amherst.
188	" " "	" " " " " " " "	Bridgewater.
271	" " "	" " " " " " " "	Newburyport.
280	Pacific Nobsque Guano	" " " " " " " "	Newburyport.
355	Packers' Union Potato Manure	Am. Agr. Chem. Co., Packers' Union Fert. Co., Branch	Amesbury.
426	" " " "	" " " " " " " "	Greenfield.
435	Packers' Union Animal Corn Fertilizer	" " " " " " " "	Greenfield.
494	" " " " "	" " " " " " " "	E. Longm'dow
25	Quinnipiac Potato Phosphate	Am. Agr. Chem. Co., Quinnipiac Co., Branch	Easthampton.
153	" " "	" " " " " " "	Fall River.

Laboratory Number.	Name of Brand.	Moisture.	Nitrogen in 100 lbs. Found.	Nitrogen in 100 lbs. Guaranteed.	Phosphoric Acid in 100 lbs. Soluble.	Reverted.	Insoluble.	Total. Found.	Total. Guaranteed.	Available. Found.	Available. Guaranteed.	Potassium Oxide in 100 lbs. Found.	Potassium Oxide in 100 lbs. Guaranteed.
	Compound Fertilizers.												
285-389	Crocker's Potato, Hop and Tobacco Phos	13.40	2.48	2.06-2.88	4.83	3.07	3.12	11.02	10-13	7.90	8-10	3.28	3-4
392	Crocker's A. A. Complete Manure	9.25	3.38	3.30-4.12	4.13	3.23	3.10	10.46	9-16	7.36	8-11	7.00	7-8
58-409	Darling's Blood, Bone and Potash........	10.62	4.19	4.10-5.00	3.20	3.90	3.50	10.60	8-12	7.10	7-10	7.52	7-8
61-400	Darling's Farm Favorite	12.65	2.27	2.06-2.88	5.63	2.15	3.32	11.10	10-13	7.78	8-10	3.24	3-4
31-102-437	Great Eastern General Fertilizer	14.28	1.18	.82-1.65	4.23	3.78	2.63	10.64	10-14	8.02	8-11	3.76	4-5
110-454	Gt. Eastern Vegetable, Vine and Tobacco	12.03	2.22	2.06-2.88	5.58	2.64	2.94	11.16	10-13	8.22	8-10	6.06	6-7
85-188-271	Pacific Potato Special	13.55	2.34	2.06-2.88	5.38	2.50	2.92	10.80	10-12	7.88	8-10	3.66	3-4
280	Pacific Nobsque Guano.................	12.84	1.17	1.03-2.50	4.03	3.47	3.40	10.90	10-15	7.50	7-10	2.16	2-3
355-426	Packers' Union Potato Manure...........	12.94	2.33	2.06-2.88	5.43	2.93	2.74	11.10	10-12	8.36	8-10	6.24	6-7
435-494	Packers' Union Animal Corn Fertilizer ...	14.11	2.94	2.50-3.25	5.50	2.88	3.54	11.92	11-14	8.38	9-11	2.60	2-3
25-153	Quinnipiac Potato Phosphate.............	13.28	2.16	2.06-2.88	4.60	3.38	3.58	11.56	10-13	7.98	8-10	3.42	3-4

II. ANALYSES OF COMMERCIAL FERTILIZERS COLLECTED DURING 1906 IN THE GENERAL MARKETS BY THE AGENT OF THE HATCH EXPERIMENT STATION OF THE MASSACHUSETTS AGRICULTURAL COLLEGE.

Laboratory No.	Name of Brand.	Name of Manufacturer.	Sampled at
	Compound Fertilizers.		
48	Quinnipiac Phosphate	Am. Agr. Chem. Co., Quinnipiac Co., Branch	Easthampton.
418	" "	" " " " " " "	Pittsfield.
277	Read's Practical Potato Special	" " " " Read Fert. Co., Branch	Newburyport.
469	" " " "	" " " " " " " "	Charlton.
440	Read's Standard Superphosphate	" " " " " " " "	Greenfield.
463	" " "	" " " " " " " "	Charlton.
275	Standard Guano for all Crops	" " " " Standard Fert. Co., Branch	Newburyport.
283	Tucker's Special Potato Fertilizer	" " " " Henry F. Tucker Co., Branch	Newburyport.
417	Wheeler's Corn Fertilizer	" " " " M. E. Wheeler & Co., Branch	Pittsfield.
448	Wheeler's Havana Tobacco Grower	" " " " " " " " "	Greenfield.
486	" " " "	" " " " " " " " "	Agawam.
282	Williams and Clark's Royal Bone Phosphate	" " " " Williams & Clark Fert. Co., Branch	Haverhill.
293	Williams & Clark's Americus Corn Phosphate	" " " " " " " " " "	Southboro
194	Abbott's Tobacco and Potato Special	Abbott & Martin Rendering Co., Columbus, Ohio	Bridgewater.
307	" " " " "	" " " " " "	Hudson.
195	Harvest King	" " " " " "	Bridgewater.
503	" "	" " " " " "	Southwick.
68	Blood, Bone and Potash	Armour Fertilizer Works, Baltimore, Md.	Amherst.
161	" " " "	" " " " "	Seekonk.
78	Armour's All Soluble	" " " " "	Amherst.
135	" " "	" " " " "	Fall River.
361	Beach's Advance Brand	Beach Soap Co., Lawrence, Mass.	Lawrence.

Laboratory Number.	Name of Brand.	Moisture.	Nitrogen in 100 lbs.		Phosphoric Acid in 100 lbs.							Potassium Oxide in 100 lbs.	
								Total.		Available.			
			Found.	Guaranteed.	Soluble.	Reverted.	Insoluble.	Found.	Guaranteed.	Found.	Guaranteed.	Found.	Guaranteed.
	Compound Fertilizers.												
48-418	Quinnipiac Phosphate	13.69	2.62	2.50-3.25	5.53	3.47	3.66	12.66	11-14	9.00	9-11	2.50	2-3
277-469	Read's Practical Potato Special	11.97	1.40	.82-1.65	3.30	4.20	2.86	10.36	5-8	7.50	4-6	5.86	8-10
440-463	Read's Standard Superphosphate	11.37	1.02	.82-1.65	3.68	4.16	2.82	10.66	10-14	7.84	8-11	4.26	4-5
275	Standard Guano For All Crops	12.39	1.34	1.03-2.50	5.00	3.18	2.60	10.78	10-15	8.18	8-12	2.20	2-3
283	Tucker's Special Potato Fertilizer	14.79	2.21	2.06-2.88	6.33	1.55	2.58	10.46	10-13	7.88	8-10	3.10	3-4
417	Wheeler's Corn Fertilizer	13.10	2.24	1.65-2.47	4.83	3.05	3.18	11.06	10-14	7.88	8-11	2.68	2-3
448-486	Wheeler's Havana Tobacco Grower	8.30	2.35	2.47-3.00	5.65	.91	1.58	8.14	7-9	6.56	6-8	11.00	10-12
282	Williams & Clark's Royal Bone Phosphate	11.40	1.25	1.03-2.50	5.50	2.84	2.44	10.78	10-15	8.34	8-12	2.10	2-3
293	Williams & Clark's Americus Corn Phos'te	12.47	2.41	2.06-2.88	5.30	2.70	3.60	11.60	10-13	8.00	8-12	1.80	1.5-2.5
194-307	Abbott's Tobacco and Potato Special	9.20	1.58	1.65-2.47	.70	5.94	3.68	10.32	10-12	6.64	8-11	4.34	4-5
195-503	Harvest King	9.23	1.27	1.20-2.00	1.53	6.49	3.42	11.44	10-12	8.02	8-11	2.20	2-3
68-161	Blood, Bone and Potash	10.60	3.79	4-4.94	7.00	1.02	1.22	9.24	10-12	8.02	8-10	7.06	7-8
78-135	Armour's All Soluble	11.60	2.82	2.88-3.70	5.85	1.31	1.28	8.44	10-13	7.16	8-10	4.34	4-5
361	Beach's Advance Brand	7.51	3.44	2.47-3.29	3.55	5.27	2.66	11.48	10-13	8.82	8-10	6.02	6-7

II. ANALYSES OF COMMERCIAL FERTILIZERS COLLECTED DURING 1906 IN THE GENERAL MARKETS BY THE AGENT OF THE HATCH EXPERIMENT STATION OF THE MASSACHUSETTS AGRICULTURAL COLLEGE.

Laboratory No.	Name of Brand.	Name of Manufacturer.	Sampled at
	Compound Fertilizers.		
95	Potato and Vegetable Phosphate	Berkshire Fertilizer Co., Bridgeport, Conn.	N. Amherst.
422	" " "	" " " " "	Hinsdale.
108	Ammoniated Bone Phosphate	" " " " "	N. Amherst.
427	" " "	" " " " "	Hinsdale.
26	Stockbridge's Complete Grain Manure	Bowker Fertilizer Co., Boston, Mass.	Northampton.
50	Stockbridge's Manure for Potatoes and Vegetables	" " " " "	Northampton.
138	" " " " " "	" " " " "	Fall River.
344	" " " " " "	" " " " "	Lancaster.
27	Bone and Wood Ash Fertilizer	" " " " "	Northampton.
242	" " " " "	" " " " "	Dighton.
303	" " " " "	" " " " "	Boston.
62	Bowker's Early Potato Manure	" " " " "	Amherst.
122	" " " "	" " " " "	Dighton.
147	Bowker's Market Garden Fertilizer	" " " " "	Dighton.
279	" " " "	" " " " "	Lawrence.
345	" " " "	" " " " "	Lancaster.
467	Bowker's Tobacco Starter	" " " " "	Springfield.
205	Breck's Lawn and Garden Dressing	Joseph Breck & Sons, Boston, Mass.	Boston.
207	Breck's Market Garden Manure	" " " " "	Boston.
178	Garden Truck	Buffalo Fertilizer Company, Buffalo, N. Y.	Seekonk.
395	Fish Guano	" " " " "	Oxford.
323	Farquhar's Vegetable and Potato Fertilizer	Chicopee Rendering Co., Springfield, Mass.	Boston.

Laboratory Number.	Name of Brand.	Moisture.	Nitrogen in 100 lbs. Found.	Nitrogen in 100 lbs. Guaranteed.	Phosphoric Acid in 100 lbs. Soluble.	Reverted.	Insoluble.	Total. Found.	Total. Guaranteed.	Available. Found.	Available. Guaranteed.	Potassium Oxide in 100 lbs. Found.	Potassium Oxide in 100 lbs. Guaranteed.
	Compound Fertilizers.												
95-422	Potato and Vegetable Phosphate	10.40	2.06	1.7-2.5	3.88	2.08	2.38	8.34	8-10	5.96	6-8	4.02	4-6
108-427	Ammoniated Bone Phosphate	11.42	1.58	.8-1.5	5.35	3.09	.92	9.36	10-12	8.44	8-10	2.72	2-3
26	Stockbridge's Complete Grain Manure	5.97	3.25	3.29-4.12	4.23	4.97	2.26	11.46	11-12	9.20	6-8	6.32	7-9
50-138-344	Stockbridge's Manure for Pot and Veg.	8.27	3.50	3.29-4.12	3.85	4.11	1.18	9.14	7-10	7.96	5-7	10.06	10-12
27-242-303	Bowker's Bone and Wood Ash Fertilizer	16.80	2.27	1.65-2.47	.30	4.30	3.48	8.08	8-10	4.60	6-8	2.70	2-3
62-122	Bowker's Early Potato Manure	11.70	3.15	3.29-4.12	5.40	1.12	1.76	8.28	8-10	6.52	7-9	7.00	7-8
147-279-345	Bowker's Market Garden Fertilizer	9.82	2.48	2.47-3.29	4.45	1.77	1.48	7.70	7-9	6.22	6-8	9.72	10-11
467	Bowker's Tobacco Starter	8.50	2.43	2.47-3.29	7.10	2.04	2.58	11.72	10-12	9.14	8-10	2.60	3-4
205	Breck's Lawn and Garden Dressing	10.02	5.75	4.12-4.94	2.25	4.33	1.22	8.80	6-8	6.58	5-6	5.70	5-6
207	Breck's Market Garden Manure	12.22	3.15	2.5-3.5	5.85	2.51	3.64	12.00	11-14	8.36	9-11	2.44	2-3
178	Garden Truck	10.12	2.68	3.38-4.10	3.25	5.07	1.68	10.00	9-12	8.32	8-10	7.08	7-9
395	Fish Guano	13.97	.83	.82-1.64	1.31	6.63	1.68	9.62	10-12	7.94	—	2.06	2-3
323	Farquhar's Vegetable and Potato Fertilizer	5.85	4.27	3-4	.58	5.70	7.72	14.00	7-8	6.28	—	7.08	7-8

II. ANALYSES OF COMMERCIAL FERTILIZERS COLLECTED DURING 1906 IN THE GENERAL MARKETS BY THE AGENT OF THE HATCH EXPERIMENT STATION OF THE MASSACHUSETTS AGRICULTURAL COLLEGE.

Laboratory No.	Name of Brand.	Name of Manufacturer.	Sampled at
	Compound Fertilizers.		
327	Farquhar's Lawn and Garden Dressing	Chicopee Rendering Co., Springfield, Mass.	Boston.
450	Clay's London Fertilizer	R. & J. Farquhar & Co., Boston, Mass.	Pittsfield.
191	Hardy's Tobacco and Potato Special	Hardy Packing Co., Chicago., Ill.	Boston.
311	" " " " "	" " " " "	Arlington.
365	Hardy's Tankage, Bone and Potash	" " " " "	Lowell.
370	" " " " "	" " " " "	Leominster.
223	Ferti Flora	C. W. Hastings, Ashmont, Mass.	Boston.
42	Canada Ashes	John Joynt, Lucknow, Ontario, Can.	Whately.
514	" "	" " " " "	Southwick.
28	Lister's Success Fertilizer	Lister's Agricultural Chem. Works, Newark, N. J.	Belchertown.
478	" " "	" " " " " "	Worcester.
30	Lister's Special Corn Fertilizer	" " " " " "	Belchertown.
91	Mapes' Economical Potato Manure	Mapes Formula and Peruvian Guano Co., N. Y. City	Sunderland.
237	" " " "	" " " " " " " "	Taunton.
233	Mapes' Manure for Light Soils	" " " " " " " "	Taunton.
18	Chittenden's Complete Fertilizer	National Fertilizer Co., Bridgeport, Conn.	Bradstreet.
165	Chittenden's Complete Fertilizer for Roots	" " " " "	Seekonk.
65	Chittenden's Conn. Valley Tobacco Starter	" " " " "	Hatfield.
516	Chittenden's Conn. Valley Tobacco Grower	" " " " "	N. Hadley.
155	Chitenden's Potato Phosphate	" " " " "	New Bedford.
273	" " "	" " " " "	S. Lawrence.
425	" " "	" " " " "	Gt. Barrington.

Laboratory Number.	Name of Brand.	Moisture.	Nitrogen in 100 lbs.		Phosphoric Acid in 100 lbs.							Potassium Oxide in 100 lbs.	
			Found.	Guaranteed.	Soluble.	Reverted.	In-soluble.	Total. Found.	Total. Guaran-teed.	Available. Found.	Available. Guaran-teed.	Found.	Guaran teed.
	Compound Fertilizers.												
327	Farquhar's Lawn and Garden Dressing ...	4.74	4.00	3.30-4.12	.15	2.63	11.54	14.32	14-17	2.78	4-5	8.74	7-8
450	Clay's London Fertilizer..................	17.09	4.58	—	—	4.94	5.44	10.38	—	4.94	—	.88	—
191-311	Hardy's Tobacco and Potato Special.....	9.88	1.24	1.65-2.47	1.30	6.60	3.54	11.44	10-12	7.90	8-11	3.88	4-5
365-376	Hardy's Tankage, Bone and Potash......	10.50	1.06	1.24-3.06	.80	7.88	3.88	12.56	10-12	8.68	8-11	2.02	2-3
223	Ferti Flora......	84.07	3.22	3.25	3.37	—	—	3.37	3.33	3.37	3.33	3.02	3.3
42-514	Canada Ashes..........................	13.56	—	—	—	—	—	.90	1.5-3.00	—	—	4.40	5.8†
28-478	Lister's Success Fertilizer................	12.40	1.40	1.24	5.30	4.06	2.02	11.38	11	9.36	9	2.54	2
30	Lister's Special Corn Fertilizer	11.85	1.80	1.65-2.47	5.30	4.18	1.04	10.52	9-11	9.48	8-11	3.12	3.4
91-237	Mape's Economical Potato Manure	7.95	3.75	3.29-4.12	1.53	2.63	2.60	6.76	6-8	4.16	4-5	8.12	8-10*
233	Mapes' Comp. Manure for Light Soils....	9.75	4.96	4.94-6.54	—	4.28	4.06	8.34	8-10	4.28	6-8	7.36	6.8
18	Chittenden's Complete Fertilizer	11.35	3.29	3.30-4.10	4.62	3.18	3.20	11.00	10-12	7.80	8-11	6.33	5-6
165	Chittenden's Complete Fertilizer for Roots	9.76	3.42	3.30-4.10	2.81	4.45	3.66	10.92	10-12	7.26	8-10	7.66	5.6
65	Chittenden's Conn Valley Tobacco Starter	6.75	8.56	8.24-9.06	.50	3.04	1.40	4.94	3-4	3.54	—	2.62	2.5-3*
516	Chittenden's Conn. Valley Tobacco Grower	10.67	5.22	4.94-5.77	.73	1.07	1.84	4.21	4-5	2.40	—	8.52	8.9†
155-273-425	Chittenden's Potato Phosphate..........	12.88	2.16	2.06-2.83	5.75	2.95	2.82	11.52	10-13	8.70	8-10	6.20	6-7

*Sulphate of potash, the source of potash.
†Carbonate of potash, the source of potash.

II. ANALYSES OF COMMERCIAL FERTILIZERS COLLECTED DURING 1906 IN THE GENERAL MARKETS BY THE AGENT OF THE HATCH EXPERIMENT STATION OF THE MASSACHUSETTS AGRICULTURAL COLLEGE.

Laboratory No.	Name of Brand.	Name of Manufacturer.	Sampled at
	Compound Fertilizers.		
202	New England Potato Fertilizer	New England Fertilizer Co., Boston, Mass.	Brockton.
206	New England Corn Phosphate	" " " " " "	Brockton.
364	" " " "	" " " " " "	Ayer.
1	Complete Tobacco Fertilizer	Olds & Whipple, Hartford, Conn.	No. Hadley.
8	" " "	" " " "	Hatfield.
40	Home Mixture for Onions	" " " "	Hadley.
60	Home Mixture	" " " "	Whately.
106	Special Potato Fertilizer	Parmenter & Polsey Fertilizer Co., Peabody, Mass.	Sunderland.
115	" " "	" " " " " " "	Dighton.
119	P. & P. Potato Fertilizer	" " " " " " "	Dighton.
127	Plymouth Rock Brand Fertilizer	" " " " " " "	Dighton.
466	" " " "	" " " " " " "	Oxford.
113	Complete for Corn and Grain	R. T. Prentiss, Holyoke, Mass.	Holyoke.
54	Hubbard's Grass and Grain Fertilizer	Rogers & Hubbard Co., Middletown, Conn.	Amherst.
471	" " " " "	" " " " "	N. Wilbraham.
66	Hubbard's Soluble Tobacco Manure	" " " " "	Amherst.
485	" " " "	" " " " "	Agawam.
104	High Grade Soluble Tobacco Manure	Rogers Manufacturing Co., Rockfall, Conn.	Sunderland.
513	" " " " "	" " " " "	Westfield.
410	Complete Potato and Vegetable Fertilizer	" " " " "	Worcester.
477	" " " " "	" " " " "	N. Wilbraham.
390	Ross' Lawn and Garden Fertilizer	Ross Brothers & Co., Worcester, Mass.	Worcester.
497	Roy's Animal Fertilizer	N. Roy & Son, South Attleboro, Mass.	S. Attleboro.

Laboratory Number.	Name of Brand.	Moisture.	Nitrogen in 100 lbs.		Phosphoric Acid in 100 lbs.							Potassium Oxide in 100 lbs.	
								Total.		Available.			
			Found.	Guaranteed.	Soluble.	Reverted.	Insoluble.	Found.	Guaranteed.	Found.	Guaranteed.	Found.	Guaranteed.
	Compound Fertilizers.												
202	New England Potato Fertilizer	10.77	1.65	1.64-2.46	5.35	1.19	2.80	9.34	8-11	6.54	7-9	3.84	4-5
206-364	New England Corn Phosphate	12.00	1.74	1.64-2.46	6.25	2.69	2.82	11.76	9-12	8.94	8-10	3.26	3-4
1	Complete Tobacco Fertilizer	5.80	4.57	4.53-5.35	—	2.94	1.54	4.48	3-4	2.94	3-4	5.78	3.5-6.50†
8	" " "	8.02	4.75	4.53-5.35	.30	3.48	1.90	5.58	3-4	3.78	3-4	6.20	5.5-6.50†
40	Home Mixture for Onions	14.58	3.62	3.29-4.12	.03	6.59	1.26	7.88	—	6.62	6-7	6.28	6.5-7.5
60	Home Mixture	8.09	4.97	—	.35	.27	.28	.90	—	.62	—	7.08	—
106-115	Special Potato Fertilizer	10.35	3.40	3.29-4.12	5.15	2.99	2.86	11.00	9-13	8.14	8-11	7.24	7-9
119	P. & P. Potato Fertilizer	8.77	1.79	1.65-2.47	1.73	3.13	3.02	7.88	7-10	4.86	6-8	6.76	6-6.5
127-466	Plymouth Rock Brand Fertilizer	11.48	2.61	2.47-3.29	5.75	2.19	2.04	9.98	9-13	7.94	8-11	4.54	4-4.25
113	Complete for Corn and Grain	12.05	4.16	2.88-3.29	5.53	3.59	.20	9.32	9-11	9.12	8-10	6.82	8-10
54-471	Hubbard's Grass and Grain Fertilizer	7.43	3.27	2.20-3.00	—	5.12	11.52	16.64	16-18	5.12	6.60-7.20	10.94	12-13.5
60-485	Hubbard's Soluble Tobacco Manure	10.20	5.08	5-6	.32	6.08	5.76	12.16	10-12	6.40	7-8.50	10.40	10-11*
104-513	High Grade Soluble Tobacco Manure	6.50	5.06	5-6	.48	6.26	4.04	10.78	8-10	6.74	6-8	11.10	10-12†
410-477	Complete Potato and Vegetable Fertilizer	10.90	3.03	2.25-3.25	4.33	3.47	2.18	9.98	10-12	7.80	8-10	5.30	5-6
390	Ross' Lawn and Garden Fertilizer	8.62	2.22	2.5-3.00	—	3.32	3.84	7.16	6-8	3.32	—	4.54	5.50-6.00
497	Roy's Animal Fertilizer	14.70	1.69	5.42	6.40	2.16	.52	9.08	16.20	8.56	8.14	6.34	4.16

*Sulphate of potash, the source of potash.
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II. ANALYSES OF COMMERCIAL FERTILIZERS COLLECTED DURING 1906 IN THE GENERAL MARKETS BY THE AGENT OF THE HATCH EXPERIMENT STATION OF THE MASSACHUSETTS AGRICULTURAL COLLEGE.

Laboratory No.	Name of Brand.	Name of Manufacturer.	Sampled at
	Compound Fertilizers.		
118	Essex Comp. for Corn, Grain and Grass	Russia Cement Co., Gloucester, Mass.	Somerset.
264	" " " " " " "	" " " " "	Hadley.
407	" " " " " " "	" " " " "	Worcester.
121	Essex Comp. for Potatoes, Roots and Vegetables	" " " " "	Dighton
148	" " " " " " "	" " " " "	Somerset.
214	" " " " " " "	" " " " "	Taunton.
261	" " " " " " "	" " " " "	Hadley.
20	Sanderson's Formula "A"	Sanderson's Fertilzer and Chemical Co., New Haven, Ct.	Bradstreet.
56	" " "	" " " " " " " "	Hadley.
228	" " "	" " " " " " " "	Dighton.
10	Swift Sure Superphosphate	M. L. Shoemaker & Co., Philadelphia, Pa.	Hatfield.
103	" " "	" " " " " " "	Sunderland.
23	Concentrated Plant Food	Sterling Chemical Co., Cambridgeport, Mass.	Boston.
94	Dissolved Bone and Potash	Swift's Lowell Fertilizer Co., Boston, Mass.	S. Amherst.
259	Dissolved Bone	" " " " " "	Taunton.
2	Swift's Lowell Perfect Tobacco Grower	" " " " " "	Hatfield.
70	Fish and Potash	Wilcox Fertilizer Works, Mystic, Conn.	Amherst.
179	" " "	" " " " "	New Bedford.
71	Dry Ground Fish Guano	" " " " "	Amherst.
133	" " " "	" " " " "	Fall River.
367	All Crops Fertilizer	Whitman & Pratt Rendering Co., Lowell, Mass.	Lowell.
371	Corn Success	" " " " " " "	Lowell.

Laboratory Number.	Name of Brand.	Moisture.	Nitrogen in 100 lbs.		Phosphoric Acid in 100 lbs.							Potassium Oxide in 100 lbs.	
			Found.	Guaranteed.	Soluble.	Reverted.	Insoluble.	Total. Found.	Total. Guaranteed.	Available. Found.	Available. Guaranteed.	Found.	Guaranteed.
	Compound Fertilizers.												
118-264-407	Essex Comp. Man. for Corn, Grain & Grass	10.05	3.70	3.3-4.1	6.07	2.51	1.92	10.50	9.5-11	8.58	7-8	8.90	9.5-11
121-148-214-261	Essex Comp. Man. for Pot., Roots and Veg.	5.02	3.70	3.7-4.5	3.75	5.37	6.34	15.46	9-11	9.12	7-8	9.16	8.5-10
20-56-228	Sanderson's Formula "A" Fertilizer	12.45	3.57	3.33-4.25	5.35	2.17	2.28	9.80	9-10	7.52	6-8	6.61	6-8
10-103	Swift Sure Superphosphate	8.28	3.05	2.88-4.12	5.85	4.77	3.78	14.40	14.65	10.62	9-11	5.08	4.50-6.50
23	Concentrated Plant Food	12.25	6.88	6	17.42	.74	—	18.16	12	18.10	12	9.12	6*
94	Dissolved Bone and Potash..............	11.70	1.90	1.65-2.50	5.73	2.85	2.26	10.84	10-11	8.58	9-11	2.26	2-3
259	Dissolved Bone	6.61	2.46	1.65-2.47	5.60	8.42	3.08	17.10	14-16	14.02	12-14	.94	—
2	Swift's Lowell Perfect Tobacco Grower...	6.17	4.01	4.12-4.94	3.13	3.91	5.88	12.92	8-10	7.04	7-9	6.84	6-7†
70-179	Fish and Potash	16.63	2.85	2.46-3.28	2.83	4.31	.46	7.60	6-8	7.14	5-7	3.86	3-4
71-133	Dry Ground Fish Guano.................	7.35	9.08	8.50-10	—	3.80	2.72	6.52	4-6	3.80	4-6	—	—
367	All Crops Fertilizer....................	6.50	2.56	2.47-3.29	4.15	3.27	5.24	12.66	11-13	7.42	9-11	4.80	4-5
371	Corn Success	7.12	2.50	1.64-2.47	4.90	3.34	7.68	15.92	10-13	8.24	8-10	3.32	3-4

*Sulphate of potash, the source of potash.
†Carbonate of potash, the source of potash.

II. ANALYSES OF COMMERCIAL FERTILIZERS COLLECTED DURING 1906 IN THE GENERAL MARKETS BY THE AGENT OF THE HATCH EXPERIMENT STATION OF THE MASSACHUSETTS AGRICULTURAL COLLEGE.

Laboratory No.	Name of Brand.	Name of Manufacturer.	Sampled at
	Cotton Seed and Linseed Meal.		
19	Cleveland Flax Meal	American Linseed Co , Chicago, Ill.	Hatfield.
41	" " "	" " " " "	N. Hatfield.
524	Cotton Seed Meal	American Cotton Oil Co., New York City	Hadley.
525	" " "	" " " " " " "	N. Hadley.
3	" " "	Hunter Bros. Milling Company, St. Louis, Mo.	Hatfield.
5	" " "	" " " " " " "	Hatfield.
9	" " "	" " " " " " "	Hatfield.
11	" " "	" " " " " " "	Hatfield.
13	" " "	" " " " " " "	Bradstreet.
6	" " "	Olds & Whipple, Hartford, Conn.	Hatfield.
	Ground Bone.		
330	Dow's Pure Ground Bone	John C. Dow & Company, Boston, Mass.	Boston.
411	" " " "	" " " " " " "	Boston.
141	Pure Bone Meal	Thomas Hersom & Co., New Bedford, Mass.	New Bedford.
184	Meat and Bone	" " " " " " "	New Bedford.
396	Pure Ground Bone	The Home Soap Co., Worcester, Mass.	Worcester.

Laboratory Number.	NAME OF BRAND.	Moisture.	Nitrogen in 100 lbs. Found.	Nitrogen in 100 lbs. Guaranteed.	Phosphoric Acid in 100 lbs. Soluble.	Reverted.	Insoluble.	Total. Found.	Total. Guaranteed.	Available. Found.	Available. Guaranteed.	Potassium Oxide in 100 lbs. Found.	Potassium Oxide in 100 lbs. Guaranteed.
	Cotton Seed and Linseed Meal.												
19-41	Cleveland Flax Meal	9.52	6.00	5.76-6.41		—			—	—	—	—	—
524	Cotton Seed Meal	6.07	6.66	6.5	—	—	—		—	—	—	—	—
525	Cotton Seed Meal	7.57	6.56	6.5	—	—	—	—	—	—	—		—
3	Cotton Seed Meal	6.22	6.13	6.5		—	—			—	—		—
5	Cotton Seed Meal	5.84	6.93	6.5	—	—		—		—	—		—
9	Cotton Seed Meal	9.00	6.65	6.18-6.59	—	—		—	—	—	—	—	—
11	Cotton Seed Meal	7.43	5.86	6.50		—	—	—	—	—	—	—	—
13	Cotton Seed Meal	7.74	5.80	6.50	—	—	—	—	—		—	—	—
6	Cotton Seed Meal	6.24	6.04	—	—	—	—		—		—		
												Mechanical Analyses. Fine.	Coarse.
	Ground Bone.												
330-411	Dow's Pure Ground Bone	4.22	2.05	1.65-2.47		5.32	20.76	26.08	24.26	5.32	—	52.92	47.08
141	Pure Bone Meal	8.02	2.28	2.22		6.64	20.32	26.96	27.04	6.64	10.40	40.43	59.57
184	Meat and Bone	5.22	5.29	4.66		6.04	10.66	16.70	13.88	6.04	8.14	40.01	59.99
396	Pure Ground Bone	5.92	2.48	2-3		12.18	15.24	27.42	28.29	12.18	—	35.66	64.34

III.

TRADE VALUES OF FERTILIZING INGREDIENTS IN RAW MATERIALS AND CHEMICALS FOR 1905 AND 1906.

	1905	1906
	CENTS PER POUND.	
Nitrogen in ammonia salts,	17.5	17.5
" " nitrates,	17.0	16.5
Organic nitrogen in dry and fine ground fish, meat, blood, and in high-grade mixed fertilizers,	18.5	18.5
" " " fine bone and tankage,	18.0	18.0
" " " coarse bone and tankage,	13.0	13.0
Phosphoric acid soluble in water,	4.5	4.5
" " soluble in ammonium citrate,	4.0	4.0
" " in fine ground fish, bone and tankage,	4.0	4.0
" " in cottonseed meal, castor pomace and wood ashes,	4.0	4.0
" " in coarse fish, bone and tankage,	3.0	3.0
" " insoluble (in water and in neutral citrate of ammonia) in mixed fertilizers,	2.0	2.0
Potash as Sulphate, free from Chlorides,	5.0	5.0
" " Muriate (chloride),	4.25	4.25
" " Carbonate,	8.0	8.00

The above schedule of trade values was adopted by representatives of the Massachusetts, Connecticut, Rhode Island, Maine, Vermont and New Jersey Experiment Stations at a conference held during the month of February, 1906, and is based upon the condition of the fertilizer market in centers of distribution in New England, New York and New Jersey during the six months preceding March, 1906, and refers to the current market prices, in ton lots, of the leading standard raw materials, which furnish nitrogen, phosphoric acid and potash, and which enter largely into the manufacture of our commercial fertilizers.

HATCH EXPERIMENT STATION

—OF THE—

MASSACHUSETTS AGRICULTURAL COLLEGE.

BULLETIN NO. 112.

THE EXAMINATION OF CATTLE AND POULTRY FOODS.

JANUARY, 1907.

The regular Bulletins of this Station will be sent free to all newspapers in the State and to such individuals interested in farming as may request the same. Technical Bulletins are sent only to those persons interested in the subject treated of in each case.

AMHERST, MASS.:
PRESS OF CARPENTER & MOREHOUSE
1907.

HATCH EXPERIMENT STATION

OF THE

Massachusetts Agricultural College,

AMHERST, MASS.

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T. A. BARRY,	*Observer.*

The co-operation and assistance of farmers, fruit-growers, horticulturists, and all interested, directly or indirectly, in agriculture, are earnestly requested. The Bulletins will be sent free to all newspapers in the State and to such individuals interested in farming as may request the same. General bulletins, fertilizer analyses, analyses of feed-stuffs, and annual reports are published. Kindly indicate in application which of these are desired. Communications may be addressed to the

HATCH EXPERIMENT STATION, Amherst, Mass.

DIVISION OF FOODS AND FEEDING.

The Examination of Cattle and Poultry Foods.

JOSEPH B. LINDSEY.*

CONTENTS.

INTRODUCING BULLETIN No. 112.

This bulletin is published in accordance with the Acts and Resolves of Massachusetts for 1903, Chapter 122. During the year 1906 the inspector has collected 703 samples of feeds in 124 different towns. The results herein reported were obtained from samples collected mostly during the months of August, September and October and represent what might be termed the Autumn collection. In some instances the analytical data secured from samples collected earlier in the year is also given. Because of the limited funds available it is not possible to publish more than one regular feed bulletin annually; hence general and special circulars, private letters and newspaper contributions are sent whenever it is deemed necessary. Most of the concentrates offered are properly guaranteed, and the disposition of the majority of local dealers is to conform to

*With the co-operation of E. B. Holland, P. H. Smith and L. S. Walker.

the statute requirements. Cases of intentional adulteration are few, although there are many mixtures on the market that sell for considerably more than their actual value.

Difficulties experienced. Difficulty is frequently met with in securing from the manufacturer or dealer *a proper form of guarantee.* The guarantee is sometimes omitted entirely, is higher than the feed can maintain, or the protein and fat are stated together and not separately as they should be. The weight of the package is often omitted entirely. In order to make clear the requirements of section 1 the following form of guarantee is suggested which should be printed on the package, or on a tag to be attached to the package:

100 LBS.

BREWERS' DRIED GRAINS

Manufactured by

JAMES SMITH & CO.,

St. Louis, Mo.

Guaranteed Analysis.

Protein 24 per cent.

Fat 4.5 per cent.

Feeds Exempt from Guarantee. It has not been deemed necessary to assume any oversight of the sale of wet brewers' grains, wet malt refuse, wet yeast refuse and similar products. Hays and straws; the grains,—wheat, rye, barley, oats, Indian corn, buckwheat and broom corn—when whole, ground separately or ground together; wheat bran, wheat middlings, and wheat mixed feed (bran and middlings) are exempt under section 3 of the statute, but this exemption applies only when these products are unmixed with other substances and sold as distinct articles of commerce. Poultry meals and scratching grains composed solely of the grains mentioned above, when free from other seeds, by-products and materials like charcoal, grit, shells, etc., are also exempt. Unground wheat screenings when sold unmixed with other substances are considered exempt; ground wheat screenings however, must conform to the law.

Bulk Sales. The Station has not the least desire to check the buying and selling of feed in bulk; it only insists that goods thus purchased be offered and sold in conformity to the statute requirements. The retailer must have plainly printed cards or tags on which are stated the brand, name and address of the manufacturer, and the guarantee of protein and of fat, tacked in a conspicuous place on or near the bin containing the bulk feed. If the retailer bags the feed in his own sacks, and so offers the same for sale, *guarantee tags must be attached to the bags the same as with other feeds.* This fact must not be overlooked.

STANDARDS FOR CATTLE AND POULTRY FOODS.

A standard for comparison is always necessary in passing judgment on the composition of concentrated feeds. The percentages of protein, fat and fiber *serve as an index* of their character in the majority of cases. To be of *standard quality*, the various concentrates should be free from mould and rancidity, in good mechanical condition, and maintain the following percentages of protein, fat and fiber :*

	FEED STUFF.	PROTEIN.	FAT.	FIBER.
Protein Feeds.	*Blood Meal,*	85	0.2	—
	Cottonseed meal (high grade),	41–46	8–10	7
	Cottonseed meal (medium grade),	36–41	7–9	8
	Cottonseed meal (low grade),	24	5–6	18
	N. P. linseed meal,	38	2	9
	O. P. linseed meal,	32	6	9
	Gluten meal,	35	1	2
	Gluten feed,	25	3	7.5
	Germ oil meal,	22	10	9.5
	Distillers' dried grains,	32	10	12
	Malt sprouts,	25	1	12.5
	Brewers' dried grains,	22	5	12
	Wheat middlings (flour),	18–20	5	3.5
	Wheat middlings (standard),	17–19	5	7
	Wheat mixed feed,	16–18	4.5	8.5
	Wheat bran,	15–17	4.5	10
	Oat middlings,	17	7	2.5
	Rye feed,	15	3	4
Starchy (Carbohydrate) Feeds.	*Ground oats,*	11	4	10
	Ground wheat,	11	2	3
	Barley meal,	11	1.5	6
	Rye meal,	10	1.5	2
	Corn Meal,	9	3	2
	Hominy meal,	10	7.5	4.5
	Provender,	10	3.5	6
	Corn and oat feed,	8–10	3–5	—
	Fortified oat feed,	12–14	3–5	—
	Oat feed,	5–8	2	20–26
	Corn bran,	9	5	10
	Dried beet-pulp,	8	0.3	18
Poultry Feeds.	*Meat scraps,*	50	15	—
	Meat and bone meal,	40	10	—
	Bone meal,	25	—	—
	Poultry mash and meal,	15	4–5	—
	Chick and scratching grains,	10	3	—
	Alfalfa meal, entire plant,	15	1.5	25
	Clover meal, entire plant,	12	2	25

*Fiber is the least valuable of the several constituents: the above standards for fiber represent the maximum percentage which the feed should contain to be of standard quality.

CHEMICAL EXAMINATION OF CATTLE AND POULTRY FOODS.

Autumn Collection, 1906.

I. Protein Feeds.

COTTONSEED MEAL.

Manufacturer or Jobber, Brand and Retailer.	Sampled at:	Water.	Protein.		Fat.		Fiber.
			Found.	Guar.	Found.	Guar.	
		%	%	%	%	%	%
High Grade.							
Alabama Cotton Oil Co., Huntsville, Ala.							
Bosworth & Wood....	Leominster...	8.35	41.73	38.61	8.66	8.00	—
American Cotton Oil Co., New York.							
F. F. Woodward & Co	Ayer†	8.17	41.85	41.00	9.33	9.00	—
B. W. Brown	Concord†.....	7.59	41.24	41.00	10.00	9.00	—
Hawes & Pierce	Foxboro†	8.36	42.25	41.00	10.01	9.00	—
F. W. Brode & Co., Memphis, Tenn.							
Owl, ...A. Dodge & Son......	Beverly	7.66	41.73	41-43	10.65	7-9	—
Owl, ...W. W. McIntyre......	Marlboro†....	7.67	42.29	41-43	9.63	7-9	—
Owl. ....South Shore Grain Co.	Quincy†	7.91	42.38	41-43	8.78	7-9	—
T. H. Bunch, Little Rock, Ark.							
Old Gold, ...G. M. Foster	Lowell†	7.63	43.43	41.00	8.68	9.00	—
Old Gold, ...Cutler Co.............	S.Fram'gham†	6.53	42.83	41.00	7.79	9.00	—
Chapin & Co., Boston.							
Green Diamond, Burr Co...............	Ludlow†	5.76	42.11	43.00	9.44	9.00	—
Green Diamond, C. B. Sawin & Son ...	Southboro†...	6.72	43.00	43.00	9.34	9.00	—
Green Diamond, H. K. Webster Co. ...	Lawrence† ...	8.23	43.13	41-43	9.46	9.00	—
Chas. M. Cox Co., Boston.							
Magnolia, ...S. A. Eastman........	Milford†	7.68	41.24	43.00	8.24	9.00	—
Magnolia, ...Squier & Co.	Monson†	7.23	42.91	43.00	9.50	9.00	—
Rodney J. Hardy & Son, Boston.							
Morse Bros...........	Southbridge† .	7.79	45.59	41.00	8.87	9.00	—
Humphreys, Godwin & Co., Memphis, Tenn							
Dixie, ...Cutler Co	N. Wilbrah'm†	7.88	41.64	41.00	8.01	9.00	—
Hunter Bros. Milling Co., St. Louis.							
Potter & Co..........	Athol†	7.91	41.38	41.00	8.31	9.00	—
W. N. Potter Grain Co.	Gardner......	8.96	40.98	41.00	7.63	9.00	—
Red Mills Feed Co....	Ashley Falls†.	6.69	41.94	38-41	6.89	8.00	—
D. L. Marshall Co., Boston.							
Phoenix, ...Eastern Grain Co.	Bridgewater†	7.08	42.46	41.00	8.78	9.00	—
Phoenix, ...Wachusett Gr. & Prod. Co	Clinton†......	7.45	41.85	41.00	8.87	9.00	—
Nat. Cottonseed Prod. Co., Memphis, Tenn.							
Indian, ...W. P. Griffen.........	Pittsfield†	8.86	41.24	—	7.60	—	—
J. T. & R. S. Wells, Memphis, Tenn.							
Star, ...M. H. Cushing & Co.	Middleboro†..	7.77	41.24	41-43	7.74	9-10	—
Average, ...	....	7.65	42.19	—	8.79	—	—

†Spring collection, 1906.

COTTONSEED MEAL—(CONTINUED).

Manufacturer or Jobber, Brand and Retailer.	Sampled at:	Water.	Protein.		Fat.		Fiber.
			Found.	Guar.	Found.	Guar.	
		%	%	%	%	%	%
Medium Grade.							
F. W. Brode & Co., Memphis, Tenn.							
Owl, ...Prentiss, Brooks & Co.	Westfield†	7.49	40.18	41-43	13.36	7-9	—
Owl, ...H. C. Puffer Co	Springfield ...	8.68	39.60	38.6-41	7.49	—	—
Chapin & Co., Boston.							
Green Diamond, W. J. Meek	Fall River....	8.06	40.76	41-43	8.47	9.00	—
Green Diamond, Marlboro Grain Co. ..	Marlboro†	8.71	37.08	41-43	6.58	9.00	—
Green Diamond, J. Cushing Co.........	Winchendon†.	9.59	37.34	41-43	6.35	9.00	—
Green Diamond, E. A. Cowee	Worcester† ...	8.10	40.80	41-43	8.44	9.00	—
Chas. M. Cox Co., Boston.							
Magnolia, ...W.N. Potter & Sons ..	Greenfield....	8.42	39.14	43.00	9.05	9.00	—
Georgia Cotton Oil Co., Augusta, Ga.							
H. G. Hill Est.	Williamsburg.	10.43	38.92	41.00	7.42	9.00	—
Humphreys, Godwin & Co., Memphis, Tenn							
Dixie, ...Beaver Coal & Grain Co	Norwood†	6.85	40.80	41.00	10.29	9.00	—
Hunter Bros. Milling Co., St. Louis.							
E. A. Cowee	Worcester† ...	7.28	40.85	41.00	9.15	9.00	—
Sprague & Williams ..	S. Framingh'm	7.02	38.52	38-41	7.57	8.00	—
W. A. Kaiser & Co., Memphis, Tenn.							
Eagle, ...E. H. Smith..........	Northboro† ...	7.57	40.10	43.00	10.50	9.00	—
J. E. Soper & Co., Boston.							
Mackenzie & Winslow	Fall River....	8.36	40.41	41.00	7.47	9.00	—
F. W. Mahoney & Co.	Fall River	8.89	40.72	41.00	7.63	9.00	—
Lexington Grain Co. ..	Lexington † ...	9.03	36.46	41.00	6.06	9.00	—
Highland Mills.......	Newton H'd's†	6.99	40.45	41.00	9.01	9.00	—
Highland Mills.......	Newton H'l'ds	7.74	40.32	41.00	8.66	9.00	—
L. A. Snow...........	Upton†	8.48	38.87	41.00	6.74	9.00	—
C. A. Tindall & Co., Memphis, Tenn.							
Imperial, ...H. C. Puffer Co.	Springfield† ..	9.37	38.70	40-45	7.81	8.5-10	—
J. T. & R. S. Wells, Memphis, Tenn.							
Star, ...H. H. Capen	Spencer†	5.34	39.49	41-43	13.15	9-10	—
Average.............	....	8.17	39.48	—	8.56	—	—
Low Grade.							
Florida Cotton Oil Co., Jacksonville, Fla.							
Sea Island, ...A. D. Copeland.......	Brockton†	10.20	24.39	25.30	6.90	6.00	—
Sea Island, ...S. R. Carter	W. Berlin	10.63	23.69	25.30	7.77	6.00	—
Sea Island, ...Jacquith & Co.........	Woburn†	10.01	24.04	25.30	6.41	6.00	—
Sea Island, ...B. F. Kingsbury & Co.	Taunton†	9.94	24.35	24.00	6.61	6.00	—
D. L. Marshall & Co., Boston.							
Glenwood.......J. B. Bridges & Co. ...	S. Deerfield† ..	9.92	18.96	22.00	4.18	5.00	—
Glenwood, ...G. B. Pope & Co......	Waltham	9.26	22.81	22.00	5.48	5.00	—

†Spring collection, 1906.

COTTONSEED MEAL—(CONTINUED).

Manufacturer or Jobber, Brand and Retailer.	Sampled at:	Water	Protein. Found.	Protein. Guar.	Fat. Found.	Fat. Guar.	Fiber.
		%	%	%	%	%	%
Narragansett Mill Co., E. Providence, R. I.							
B. F. Kingsbury & Co.	Taunton	9.18	23.34	38-41	5.19	7-9	—
J. E. Soper & Co., Boston.							
Lexington Grain Co...	Lexington	8.92	35.67	41.00	6.58	9.00	—
J. Lindsley Wells Co., Memphis, Tenn.							
Star, ... W. L. Palmer	Medway	9.21	33.34	38.62	6.73	8-9	—
Average.............	....	9.70	25.62	—	6.21	—	—

LINSEED MEAL.

Manufacturer or Jobber, Brand and Retailer.	Sampled at:	Water	Protein. Found.	Protein. Guar.	Fat. Found.	Fat. Guar.	Fiber.
1. New Process.							
First Grade.							
American Linseed Co., Chicago.							
Cleveland Flax, Lummus & Parker....	Danversport† .	9.02	36.95	36.00	2.62	1.00	—
Cleveland Flax, C. B. Sawin & Son....	Southboro	9.46	37.55	36-38	2.88	1-3	—
Nathan Tufts & Sons.	Charlestown ..	10.71	36.95	36-40	2.62	1-3	—
H. C. Puffer Co.	Springfield† ..	9.27	36.68	36-40	2.80	1-3	—
L. A. Snow...........	Upton†	9.54	36.46	36-40	2.20	1-3	—
Average.............	....	9.60	36.92	—	2.62	—	—
Second Grade.							
American Linseed Co., Chicago.							
Squier & Co.	Monson	11.61	33.04	37-40	2.73	1-3	—
F. E. Brooks	S. Framingh'm	10.01	33.08	36-40	1.75	1-3	—
Average	....	10.81	33.06	—	2.24	—	—
2. Old Process.							
First Grade.							
American Linseed Co., New York.							
Bryant & Soule.......	Middleboro ..	10.55	34.57	32-36	6.75	5-7	—
Cutler Co.............	N. Wilbr'h'm†	10.28	35.23	32-36	7.21	5-7	—
A. B. Bacon	Spencer†	10.86	34.84	32-36	6.93	5-7	—
Taunton Grain Co.....	Taunton	10.25	33.75	32-36	7.30	5-7	—
Chapin Co., Boston.							
Export, ... Potter & Co...........	Athol	9.84	34.84	36.00	6.32	7.00	—
Export, ... Evans & Bowker......	Baldwinsville†	8.85	34.49	36.00	10.97	7.00	—
Export, ... R. S. Chaffin	Charlemont† .	10.09	34.18	36.00	6.64	7.00	—
Hauenstein & Co., Buffalo.							
F. A. Sherwin	Groton†	9.25	35.23	35.65	7.05	7.62	—
Kelloggs & Miller, Amsterdam, N. Y.							
W. N. Potter & Sons .	Greenfield	10.01	34.66	36.70	7.52	7.83	—

†Spring collection, 1906.

LINSEED MEAL—(CONTINUED).

Manufacturer or Jobber, Brand and Retailer.	Sampled at:	Water.	Protein. Found.	Protein. Guar.	Fat. Found.	Fat. Guar.	Fiber.
		%	%	%	%	%	%
Lackawanna Mill. & Elev. Co., Buffalo.							
International,... A. F. Butler	Adams	10.45	33.75	32.56	5.81	6.00	—
Mann Bros., Buffalo.							
W. P. Whittemore....	Jamaica Plain†	9.86	35.36	34.15	7.64	6.05	—
Midland Linseed Co., Minneapolis.							
Seymour & McDonald	S. Lancaster..	9.36	32.95	32.5-37.5	8.83	5.5-8.5	—
W. N. Potter & Sons, Greenfield.							
Amsterdam, ... W. N. Potter & Sons .	Greenfield† ...	8.45	34.01	33-37	9.32	7-8	—
Amsterdam, ... Potter Grain Co.......	Shelburne Fls†	8.92	34.40	33-37	10.45	7-8	—
Red Wing Linseed Mills, Red Wing, Minn.							
Wallace Bros.	Clinton†	7.33	33.83	30.00	7.97	7.50	—
Average	....	9.62	34.41	—	7.78	—	—
Second Grade.							
Metzger Seed & Oil Co., Toledo, O.							
E. H. Smith..........	Northboro....	10.46	30.36	30-36	8.40	5-7	—
Weld & Beck.........	Southbridge ..	10.56	31.28	30-36	7.07	5-7	—
W. G. Davis Co.......	Westfield.....	11.30	29.84	30-36	7.19	5-7	—
Red Wing Linseed Mills, Red Wing, Minn.							
Wachusett Gr.&Pro.Co	Clinton.......	9.20	30.23	30.00	7.53	7.50	—
Average	....	10.38	30.43	—	7.55	—	—

GLUTEN FEED.

Manufacturer or Jobber, Brand and Retailer.	Sampled at:	Water.	Protein. Found.	Protein. Guar.	Fat. Found.	Fat. Guar.	Fiber.
First Grade.							
Corn Products Refining Co., Chicago.							
Globe, ... E. A. Briggs & Co.....	Attleboro	8.88	25.05	25.00	3.44	2.50	—
Globe, ... W.N.Potters Sons&Co.	Northampton .	9.82	24.66	25.00	3.06	2.50	—
Glucose Sugar Refining Co., Chicago.							
Buffalo, ... A. D. Copeland.......	Brockton	9.37	24.83	25.00	2.36	3.00	—
Buffalo, ... E. A. Cowee..........	Worcester	10.03	24.00	25.00	2.70	2.50	—
Buffalo, ... Eastern Grain Co.	Bridgewater ..	9.78	25.09	24.00	4.81	2.50	—
Buffalo, ... J. Cushing & Co.......	S. Acton	9.13	24.00	24.00	2.34	2.50	—
Pekin,.......... W. W. Holmes.	Webster	8.87	25.71	25.00	2.92	2.50	—
Pekin,.......... Wilson & Holden.....	Worcester	8.39	25.45	25.00	3.08	2.50	—
Narragansett Mill. Co., E.Providence, R.I.							
W. E. Freeze.........	E. Walpole ...	9.02	27.82	20.00	3.02	2.50	—
New York Glucose Co., New York.							
Globe, ... A. B. Bacon..........	Spencer	9.63	24.79	26.00	4.10	2.50	—
St. Louis Syrup & Pres. Co., St. Louis.							
A. J. Richards & Son .	Quincy.......	10.26	24.74	25.00	3.17	2.75	—

†Spring collection, 1906.

GLUTEN FEED.—(CONTINUED).

Manufacturer or Jobber, Brand and Retailer.	Sampled at:	Water.	Protein. Found.	Protein. Guar.	Fat. Found.	Fat. Guar.	Fiber.
		%	%	%	%	%	%
Warner Sugar Ref'ing Co., Waukegan, Ill.							
Warners, ...South Shore Grain Co.	Quincy	11.21	24.22	25.00	3.40	3.00	—
Warners, ...G. F. Green Coal Co. .	Brockton	8.76	24.39	—	3.31	—	—
Average, ...	....	9.47	24.98	—	3.21	—	—
Average analysis Spring collection 1906	....	9.58	25.69	—	3.69	—	—
Second Grade.							
Corn Products Refining Co., Chicago.							
Buffalo, ...B. W. Brown	Concord......	8.15	23.30	25.00	6.12	3.50	—
Buffalo, ...James Lally Jr.	Milford	9.87	22.60	25.00	3.84	3.50	—
Buffalo, ...Prentice & Son	Milford	10.23	23.04	25.00	3.69	3.50	—
Buffalo, ...F. A. Fales & Co.	Norwood.....	9.27	22.68	25.00	4.22	3.50	—
Globe, ...Sprague & Williams ..	S. Framingh'm	9.89	23.04	25.00	5.05	2.50	—
Queen,.........J. Franks	New Bedford.	7.38	23.43	25.00	2.30	2.50	—
Morse Bros.	Southbridge ..	10.86	23.65	25.00	2.79	2.50	—
Deutsch & Sickert, Milwaukee, Wis.							
Prima, ...B. W. Brown	Concord......	7.05	23.43	24.00	3.50	4.00	—
Yellow, ...Lexington Grain Co. ..	Lexington	8.49	19.62	22.00	3.79	4.00	—
Glucose Sugar Refining Co., Chicago.							
Buffalo, ...C. H. Morgan	Boylston	10.22	23.69	25.00	2.79	2.50	—
Buffalo, ...J. H. Bosworth	Chicopee Falls	10.04	23.69	25.00	3.92	2.50	—
Buffalo, ...Cutler Co.............	Warren	10.00	22.55	24.00	2.31	2.50	—
Narragansett Mill. Co., E.Providence,R.I.							
W. T. McLaughlin....	Jamaica Plain	9.57	23.87	20.00	4.49	2.50	—
St. Louis Syrup & Pres. Co., St. Louis.							
Tiger,............J. C. Bellville & Son.	Feeding Hills	11.32	23.17	25.00	4.18	2.75	—
J. E. Soper & Co., Boston.							
Bay State,......F. A. Dodge Est.	Saundersville	8.52	20.62	24.00	3.44	3.00	—
Bay State,......J. N. Waite	Easthampton	8.74	20.05	22.00	4.77	9.00	—
New England,..J. Burkhardt..........	Beverly	5.96	23.04	22.00	15.56	9.00	—
New England,..Lexington Grain Co. ..	Lexington	8.81	20.40	22.00	9.03	9.00	—
Warner Sugar Ref'ing Co., Waukegan, Ill.							
Warners,.......C. B. Sawin & Son....	Southboro....	8.93	23.30	25.00	3.80	3.00	—
Average, ...	....	9.12	22.59	—	4.72	—	—
Average analysis Spring collection, 1906	....	8.38	20.22	—	5.69	—	—

DISTILLERS' DRIED GRAINS.

J. W. Biles Co., Cincinnati, O.							
Fourex, ...J. Cushing & Co.	Fitchburg† ...	7.76	33.04	33.00	13.02	11.00	—
Fourex, ...W. N. Potter Sons&Co.	Northampton.	7.92	33.08	33.00	12.79	11.00	—
Fourex, ...G. A. Bigelow	Princeton† ...	7.75	30.94	33.00	12.16	11.00	—
Fourex, ...W. J. Jencks..........	Webster	7.67	31.68	33.00	12.40	11.00	—

DISTILLERS' DRIED GRAINS.—(CONTINUED).

Manufacturer or Jobber, Brand and Retailer.	Sample.	Water	Protein. Found.	Protein. Guar.	Fat. Found.	Fat. Guar.	Fiber.
		%	%	%	%	%	%
Chapin & Co., Boston.							
Ajax Flakes, ...C. S. Barber	Bernardston† .	4.98	33.39	33.35	14.05	12.00	—
Ajax Flakes,....Eastern Grain Co.	Bridgewater ..	8.07	31.50	33.00	12.81	12.00	—
Ajax Flakes.....B. W. Brown.........	Concord......	6.68	34.89	33.00	13.79	12.00	—
Ajax Flakes,....H. C. Puffer Co.......	Springfield† ..	5.94	31.50	33.00	13.77	12.00	—
Ajax Flakes,....W. W. Holmes.......	Webster	6.02	31.63	33.00	14.14	12.00	—
Ajax Flakes,....H. G. Hill Est.	Williamsburg.	7.81	31.77	33.00	13.48	12.00	—
Continental Cereal Co., Peoria, Ill.							
Continental, ...J. Shea...............	Lawrence† ...	7.27	32.08	35.00	11.75	12.00	—
J. D. Page & Co., Syracuse, N. Y.							
Empire State. ..J. E. Merrick & Co....	Amherst†	5.61	31.90	36.22	11.33	11.76	—
Average, ...	....	6.96	32.28	—	12.87	—	—
Second Grade.							
J. W. Biles Co., Cincinnati, O.							
Fourex. ....Potter Co.............	Athol†	7.63	29.27	33.00	12.28	11.00	—
Fourex, ...W. R. Williams.......	Oxford†	7.03	28.74	33.00	10.53	11.00	—
Fourex, ...B & A.D.FessendenCo.	Townsend†...	6.97	30.80	33.00	11.95	11.00	—
Chapin & Co., Boston.							
Ajax Flakes,....J. W. Doon & Son....	Natick	7.69	29.92	33.00	12.27	12.00	—
Deutsch & Sickert Co., Milwaukee, Wis.							
Climax, ...P. W. Eaton & Co.....	Williamsburg†	5.84	30.76	34.00	13.07	11.00	—
C. A. Krause Grain Co., Milwaukee, Wis.							
Blue Ribbon, ..Ropes Bros.	Salem†	6.81	24.39	33.00	6.55	11.00	—
Blue Ribbon, ..H. C. Puffer Co.......	Springfield† ..	7.30	26.33	—	11.45	—	—
Blue Ribbon, ..H. C. Puffer Co.......	Springfield† ..	7.83	26.37	—	10.76	—	—
Blue Ribbon, ..P. W. Eaton & Co. ...	Williamst'wn†	7.76	22.72	33.00	6.02	11.00	—
Eagle, ...Ropes Bros.	Salem†	7.98	19.92	26.50	9.28	11.50	—
Average, ...	....	7.28	26.92	—	10.43	—	—

MALT SPROUTS.

Manufacturer or Jobber, Brand and Retailer.	Sample.	Water	Protein. Found.	Protein. Guar.	Fat. Found.	Fat. Guar.	Fiber.
A. P. Aldrich & Son, Boston.							
Malden Grain Co.	Malden	11.07	24.00	26.20	1.48	1.11	—
Chas. M. Cox Co., Boston.							
B. W. Brown	Concord†	8.45	32.25	25-27	1.56	1.5-3.0	—
J. W. Doon & Son....	Natick	11.10	25.98	25-27	1.27	1.5-3.0	—
G. A. Stevens	Worcester† ..	6.91	30.32	25-27	1.31	1.5-3.0	—
C. Zwickel Milling Co., Buffalo.							
Bedford Coal & Gr Co.	Bedford†	9.96	27.07	25.00	1.51	2.00	—

†Spring collection 1906.

MALT SPROUTS—(CONTINUED).

Manufacturer or Jobber, Brand and Retailer.	Sampled at:	Water	Protein. Found.	Protein. Guar.	Fat. Found.	Fat. Guar.	Fiber.
		%	%	%	%	%	%
D. W. Ranlet, Boston.							
F. M. Keefe..........	Waltham	12.11	26.33	23-25	1.95	1-1.5	—
Average.............	....	9.93	27.66	—	1.51	—	—
Low Grade.							
Thomas Ronald, Boston.							
A. N. Whittemore & Co	Worcester....	11.19	23.04	25-26	2.02	1.91	—

BREWERS' DRIED GRAINS.

Anheuser Busch Brew. Assoc., St. Louis.							
C. G. Burnham	Holyoke†	7.90	24.92	24.00	8.21	7.50	—
Chas. D. Holbrook Co.	Palmer	9.82	28.48	24.00	8.10	7.50	—
Atlantic Export Co., Milwaukee.							
John Shea...........	Lawrence	6.85	28.52	25.00	7.94	7.00	—
Old Colony Brewing Co., Fall River.							
Taunton Grain Co.....	Taunton.	9.34	24.22	—	6.59	—	—
Ralston Purina Co., St. Louis.							
Anheuser Busch,..J. E. Merrick & Co....	Amherst.	8.53	22.81	24.00	7.16	7.50	—
South Shore Grain Co	Quincy.	9.32	23.43	24.00	6.18	7.50	—
Average............	....	8.63	25.40	—	7.36	—	—

WHEAT MIDDLINGS.

1. Flour.							
Dwight Flour Mills, Minneapolis.							
W. W. McIntyre......	Marlboro.....	12.29	17.11	—	4.35	—	—
Hunter Bros. Milling Co., St. Louis.							
A. E. Lawrence & Son	Ayer	10.61	15.53	16.00	4.35	4.00	—
G. S. Whitney........	Concord Junc.	10.49	16.14	15.75	4.59	4.00	—
Imperial Mills, Duluth, Minn.							
Red dog, ...G. F. Wetherbee Est..	Gardner......	10.58	18.51	20.00	4.46	5.25	—
Minnesota Mill Co., Little Falls, Minn.							
Wilder & Wotten	Lowell........	10.07	18.78	—	5.41	—	—
Northwest. Cons. Mill. Co., Minneapolis							
XXX Comet, ...W. Lord	Athol	10.44	19.04	20.25	5.84	5.25	—

†Spring collection 1906.

WHEAT MIDDLINGS—(CONTINUED).

Manufacturer or Jobber, Brand and Retailer.	Sampled at:	Water.	Protein.		Fat.		Fiber.
			Found.	Guar.	Found.	Guar.	
		%	%	%	%	%	%
Pillsbury-Washburn Co., Minneapolis.							
XX Daisy, ... C. F. Rice	Brookfield....	11.35	19.39	20.00	5.46	4.50	—
A, ... F. A. Fales & Co.....	Norwood.....	12.24	17.07	—	4.59	—	—
Royal Milling Co., Minneapolis.							
Ben Hur, ... F. F. Woodward & Co.	W. Fitchburg	10.19	19.35	18.00	6.44	5.00	—
Saginaw Milling Co., Saginaw, Mich.							
J. W. Raymond.......	Concord	10.84	15.01	—	4.64	—	—
South. Milling Co., Kansas City, Mo.							
K. C. K., ... E. C. Frost..........	Shelbu'e Falls	12.13	16.46	—	3.89	—	—
Washburn Crosby Co., Minneapolis.							
Adrian, ... W. T. McLaughlin....	Jamaica Plain.	11.35	18.38	19.00	4.62	4.50	—
E. S. Woodworth & Co., Minneapolis.							
Snow's Cream, ... Bosworth & Wood....	Leominster...	11.45	19.53	—	5.46	—	—
Unknown.							
Red dog, ... E. A. Cowee.........	Worcester....	11.02	19.00	—	5.26	—	—
Average.............	....	11.08	17.81	—	4.95	—	—
2. Standard.							
Banner Milling Co., Buffalo.							
Banner, ... C. D. Holbrook Co....	Palmer.......	11.97	16.85	—	4.79	—	—
Bay State Milling Co., Winona, Minn.							
Norton & Warren.....	Warren	12.18	16.99	14-18	5.33	3-6	—
Seymour Carter, Hastings, Minn.							
Snowball, ... W. N. Potter Grain Co	Gardner......	11.59	17.38	18.00	5.46	5.00	—
Chas. M. Cox Co., Boston.							
Wirthmore, ... C. G. Jordan..........	Weymouth ...	11.31	17.51	—	5.61	—	—
Flint Mill Co., Milwaukee.							
E. H. Smith..........	Northboro ..	11.56	17.72	—	5.77	—	—
Hecker-Jones-Jewell Mill.Co., NewYork.							
Walker Grain Co.....	North Adams.	10.98	16.67	—	4.79	—	—
Imperial Mills, Duluth, Minn.							
G. F. Wetherbee Est. .	Gardner......	11.24	16.94	16.25	5.07	5.00	—
Listman Milling Co., La Crosse, Wis.							
Elmco, ... Bond & Moulton	Charlton	11.60	18.25	20.22	5.62	5.56	—
New Prague F. M. Co., N. Prague, Minn.							
Go Far, ... Beaver Coal& GrainCo	Norwood.....	11.81	17.03	—	5.78	—	—
Go Far, ... Bliss & Co...........	Taunton	10.03	17.38	—	5.88	—	—
New York City Milling Co., New York.							
C. H. Smith.........	Dighton......	10.77	17.68	—	4.83	—	—

WHEAT MIDDLINGS—(CONTINUED).

Manufacturer or Jobber, Brand and Retailer.	Sampled at:	Water.	Protein. Found.	Protein. Guar.	Fat. Found.	Fat. Guar.	Fiber.
		%	%	%	%	%	%
Northwest. Cons. Mill. Co., Minneapolis.							
W. Lord	Athol	9.81	15.62	16.75	5.28	5.00	—
Pillsbury-Washburn Co., Minneapolis.							
B., ...Morse Bros	Southbridge. .	10.06	15.75	14-16	5.14	4.50-5.25	—
Royal Milling Co., Minneapolis.							
Ben Hur,.........F. F. Woodward & Co.	W. Fitchburg.	11.17	16.28	17.00	5.71	4.00	—
Standard Milling Co., Buffalo.							
S. Crosby & Son......	Boston	11.23	16.63	—	4.77	—	—
S. Stewart, Morris, Minn.							
N. Tufts & Sons......	Charlestown..	10.32	17.20	—	5.42	—	—
Wells Flour Milling Co., Wells, Minn.							
Feedwell,.........Albert T. Butler......	Adams	11.09	18.69	—	6.36	—	—
Average.............	....	11.10	17.09	—	5.39	—	—

WHEAT MIXED FEED.

Manufacturer or Jobber, Brand and Retailer.	Sampled at:	Water.	Protein. Found.	Protein. Guar.	Fat. Found.	Fat. Guar.	Fiber.
Acme Milling Co., Indianapolis, Ind.							
Acme,...........H. P. Howland	Spencer..	11.50	16.02	—	4.29	—	—
American Cereal Co., Chicago.							
Buckeye, ...P. Pion & Son........	Worcester....	12.10	16.10	13-17	4.81	4-4.7	—
Annan, Burg & Co., St. Louis.							
Diamond,........C. G. Burnham	Holyoke	12.55	15.53	—	4.55	—	—
Banner Milling Co., Buffalo.							
Banner, ...H. K. Webster & Co..	Lawrence	10.26	16.67	—	5.09	—	—
Banner, ...Van Deusen & Foley..	Springfield ...	13.00	16.06	—	5.12	—	—
Blish Milling Co., Seymour, Ind.							
Bullseye, ...J. Franks	New Bedford.	10.41	16.02	—	4.80	—	—
Chapin & Co., Boston.							
Erie, ...H. K. Webster & Co..	Lawrence	9.75	16.37	—	4.98	—	—
Tip Top, ...J. W. Doon & Son....	Natick	11.84	15.97	18.00	5.03	4.50	—
Claro Milling Co., Claro, Minn.							
Claro,...........Chandler Gr. & Mill.Co	Lawrence	10.54	16.37	14-17	5.67	3-5	—
Chas. M. Cox Co., Boston.							
Columbia, ...H. A. Crossman	Needham	11.74	15.58	—	5.28	—	—
Eagle,...........W. J. Meek..........	Fall River....	10.57	16.32	—	4.53	—	—
Wirthmore, ...J. H. Nye	Brockton.....	10.26	16.81	17-19	5.16	4-5	—
Wirthmore, ...J. O. Dean & Co.......	South Easton.	11.52	16.02	17-19	5.08	4-6	—
Wirthmore, ...G. A. Stevens.........	Worcester....	11.89	15.09	17-19	4.06	4-5	—

WHEAT MIXED FEED—(CONTINUED).

Manufacturer or Jobber, Brand and Retailer.	Sampled at:	Water.	Protein.		Fat.		Fiber.
			Found.	Guar.	Found.	Guar.	
		%	%	%	%	%	%
Flint Mill Co., Milwaukee.							
Vermont, ...W. G. Davis Co	Westfield	11.43	16.85	—	5.04	—	—
Garland Milling Co., Greensburg, Ind.							
Garland, ...Potter Grain Co	Athol	10.31	17.07	—	4.61	—	—
Imperial Milling Co., Duluth, Minn.							
Boston,.... ......W. N. Potter Sons&Co	Northampton.	11.95	16.19	16.00	4.84	4.50	—
Boston. ....F. A. Fales & Co.	Norwood.....	12.91	16.19	16.00	4.68	4.50	—
Kehlor Flour Mills Co., St. Louis.							
J. Cushing & Co.......	South Acton..	12.47	14.97	—	4.52	—	—
Lawrenceburg Roller Mills, Lawrenceburg, Ind.							
Snowflake, ...W. N. Potter Sons&Co	Northampton.	11.66	16.76	—	3.86	—	—
Snowflake, ...A. J. Richards & Son.	Weymouth ..	10.87	16.23	—	4.54	—	—
Listman Mill Co., La Crosse, Wis.							
Elmco,..........Bond & Moulton......	Charlton	12.00	16.37	17.81	4.60	5.22	—
John F. Meyer & Sons Milling Co., Springfield, Mo.							
Albatross........South Shore Grain Co.	Quincy	11.43	16.63	14.00	4.39	3.50	—
R. P. Moore, Princeton, Ind.							
King, ...Howe Bros	Gardner......	10.20	16.55	—	4.82	—	—
Northwest. Cons. Mill. Co.. Minneapolis.							
Planet, ...W. N. Potter Grain Co	Gardner.....	10.16	17.68	16.00	5.54	5.00	—
Phoenix Milling Co., Minneapolis.							
Phoenix, ...W. W. McIntyre......	Marlboro.....	12.68	16.10	17.00	4.87	4.50	—
Pillsbury-Washburn Co., Minneapolis.							
Pillbury's, ...G. M. Foster.........	Lowell	10.15	16.81	—	4.75	—	—
Rex Mill Co., Kansas City, Mo.							
W. L. Palmer.........	Medway	12.25	16.76	—	4.71	—	—
Henry Russell, Albany, N. Y.							
Regular,..........Sykes Coal & Grain Co	North Adams.	10.33	16.50	—	5.21	—	—
Russell-Miller Milling Co., Minneapolis.							
Occident,.........F. Knight	Charlton Dep.	12.11	16.63	—	5.28	—	—
Occident,.........J. Wadsworth & Co...	Northboro. ..	11.98	16.90	—	5.44	—	—
Occident..........Cutler Co	N. Wilbraham	12.18	16.59	—	5.27	—	—
Occident,.........L. H. Southworth.....	W. Stoughton.	11.68	16.63	—	5.08	—	—
Saginaw Milling Co., Saginaw, Mich.							
Samico, ...J. W. Raymond.......	Concord	11.05	14.35	—	4.58	—	—
Sheffield-King Milling Co., Minneapolis.							
Gold Mine,.......F. A. Fales & Co	Norwood.....	13.18	16.32	17.00	4.76	4.50	—
Gold Mine,.......Wilson & Holden.....	Worcester....	12.08	16.10	17.00	4.90	4.50	—

WHEAT MIXED FEED—(CONTINUED).

Manufacturer or Jobber, Brand and Retailer.	Sampled at:	Water.	Protein.		Fat.		Fiber.
			Found.	Guar.	Found.	Guar.	
		%	%	%	%	%	%
Sparks Milling Co., Alton, Ill.							
Try Me,..........C. Jones..............	West Lynn ..	10.12	16.37	—	4.53	—	—
Waggoner-Gates M. Co., Indepen'ce, Mo.							
Eastern Grain Co.....	Bridgewater. .	11.46	15.67	—	4.56	—	—
Unknown.							
C. G. Burnham	Holyoke	11.98	15.49	—	4.25	—	—
Highest	....	13.18	17.68	—	5.67	—	—
Lowest.	....	9.75	14.35	—	3.86	—	—
Average..............	....	11.45	16.25	—	4.82	—	—

WHEAT FEEDS WITH ADMIXTURES.

Manufacturer or Jobber, Brand and Retailer.	Sampled at:	Water.	Protein Found.	Protein Guar.	Fat Found.	Fat Guar.	Fiber.
J. H. Cressey & Co., Boston.							
Indiana,..........Griffen Bros..........	Fall River....	8.70	13.91	12.05	4.14	3.20	—
Indiana,..........Malden Grain Co.....	Malden	8.07	13.08	12.05	3.52	3.20	—
Indiana,..........J. A. Bouvier	New Bedford.	7.99	12.81	12.05	3.62	3.20	—
Indiana,..........J. Franks.............	New Bedford.	8.78	12.81	12.05	3.59	3.20	—
Indiana,..........Goding Bros..........	North Easton	10.46	11.76	12.05	3.05	3.20	—
Indiana Milling Co., Terre Haute, Ind.							
Jersey, ...H. K. Webster & Co..	Lawrence	8.14	11.10	12.05	3.09	3.20	—
Jersey, ...Mackenzie & Winslow.	Fall River....	8.23	12.38	12.05	3.40	3.20	—
Jersey, ...Hathaway& Mackenzie	New Bedford.	9.46	13.65	12.05	3.92	3.20	
Average.............	....	8.60	12.69	—	3.54	—	—

WHEAT BRAN.

Manufacturer or Jobber, Brand and Retailer.	Sampled at:	Water.	Protein Found.	Protein Guar.	Fat Found.	Fat Guar.	Fiber.
Ballard & Ballard Co., Louisville, Ky.							
Ballard's,.........N. Tufts & Son.......	Charlestown..	10.90	15.67	15.25	4.25	4.60	—
Seymour Carter, Hastings, Minn.							
Cloverleaf, ...G. S. Whitney........	Concord Junc.	9.81	14.79	14.30	4.95	4.70	—
Chapin & Co., Boston.							
Gilt Edge Flakes,.E. H. Smith..........	Northboro ...	12.58	15.32	14-18	5.16	3-6	—
Crete Mills, Crete, Neb.							
Walker Grain Co......	North Adams.	9.70	14.04	—	4.24	—	—
Everett, Aughenbaugh & Co., Waseca, Minn.							
E. A. C. O ....N. Paquin & Sons....	Fall River....	10.56	14.62	14-17	4.90	3-5	—
Hunter Bros. Milling Co., St. Louis.							
E. J. Adams..........	Gt. Barrington	9.78	15.84	14.00	4.54	3.50	—
Wilson & Holden.	Worcester....	11.62	14.62	14.00	4.07	3.50	—
G. S. Whitney........	Concord Junc.	10.63	15.32	13.00	4.34	3.50	—

WHEAT BRAN (CONTINUED).

Manufacturer or Jobber, Brand and Retailer.	Sampled	Water.	Protein.		Fat.		Fiber.
			Found.	Guar.	Found.	Guar.	
		%	%	%	%	%	%
Imperial Mill Co., Duluth, Minn. Duluth Imperial...A. L. Clark	Leominster	9.41	16.23	15.00	4.77	4.00	—
W. J. Jennison Co., Minneapolis. G. H. Turner	Charlemont	9.36	16.02	16.00	4.61	4.00	—
Minnesota Mill Co., Little Falls, Minn. H. E. Noyes & Son	Lowell	10.19	15.05	—	3.97	—	—
N. Prague Flour Mill Co., N. Prague, Minn Go Far, ...Bliss & Co.	Taunton	13.14	14.21	—	4.77	—	—
Northwest. Cons. Mill Co., Minneapolis. Potter & Co.	Athol	9.60	15.14	14.25	5.03	4.00	—
Pillsbury-Washburn Co., Minneapolis. Pillsbury's, ...C. H. Morgan	Boylston	11.77	14.39	12¾-14¼	5.22	4-4.35	—
Jas. Quirk Mill. Co., Montgomery, Minn Cutler Co.	Warren	10.87	14.13	14.50	5.03	4.50	—
Henry Russell, Albany, N. Y. Hathaway & Mackenzie	New Bedford.	9.83	15.71	—	4.43	—	—
Simmons Milling Co., Red Wing, Minn. Bixota, ...Bosworth & Wood	Leominster	8.90	15.36	15.00	4.59	4.00	—
Southwest. Milling Co., Kansas City, Mo K. C. K., ...Wilder & Wotten	Lowell	10.79	14.62	—	3.99	—	—
S. Stewart, Morris, Minn. Butman & Cressey	Lynn	9.73	16.14	—	5.28	—	—
Thompson Milling Co., Lockport, N. Y. P. W. Eaton & Co.	Williamstown	9.96	15.32	—	5.53	—	—
Valley City Mill. Co., Gr. Rapids, Mich. Cutler Co	Warren	12.13	15.32	—	4.40	—	—
Voigt Milling Co., Grand Rapids, Mich. C. Jones	West Lynn	10.21	14.97	—	4.40	—	—
Washburn-Crosby Co., Minneapolis. W. N. Potter Grain Co	Gardner	10.18	14.70	15.00	4.99	4.00	—
Watson Mill Co., Wichita, Kansas. Stanley & Harlow	Charlestown	10.88	16.72	—	4.70	—	—
Wells Flour Milling Co., Wells, Minn. Feedwell, ...A. T. Butler	Adams	9.96	15.05	—	4.97	—	—
Highest		13.14	16.72	—	5.53	—	—
Lowest		8.90	14.13	—	3.97	—	—
Average		10.42	15.17	—	4.69	—	—

DAIRY FEEDS.

Manufacturer or Jobber, Brand and Retailer.	Sampled at:	Water.	Protein. Found.	Protein. Guar.	Fat. Found.	Fat. Guar.	Fiber.
		%	%	%	%	%	%
J. Bibby & Sons, Liverpool, Eng.							
Bibby's Cake, ...J. Loring & Co........	Watertown†..	10.45	21.41	18-20	7.14	6-8	—
Bibby's Cake, ...J. Loring & Co	Watertown...	10.60	19.92	18-20	5.97	6-8	—
J. W. Biles Co.. Cincinnati.							
Union Grains,....Potter & Co..........	Athol†	8.20	23.61	24.00	7.72	7.00	—
Union Grains,....J. Cushing & Co.......	Fitchburg† ..	9.72	23.74	24.00	8.09	7.00	—
Union Grains,....Cutler Co.............	N. Wilbrah'm†	6.80	22.86	24.00	7.11	7.00	—
Union Grains,....G. A. Bigelow	Princeton† ...	10.29	24.27	24.00	7.64	7.00	—
Union Grains,....Cutler Co.............	Warren	10.90	25.01	24.00	7.12	7.00	—
Union Grains,....E. A. Cowee..........	Worcester....	10.08	23.96	24.00	5.86	7.00	9.43
Average.............	....	9.33	23.91	—	7.26	—	—
Buffalo Cereal Co., Buffalo.							
Creamery,........B. W. Brown	Concord†.....	8.20	19.79	20.00	4.16	5.00	—
Creamery, ...G. M. Foster..........	Lowell†..... ..	7.13	20.62	20.00	4.28	5.00	—
Creamery,........W. W. McIntyre......	Marlboro.....	10.39	21.11	20.00	4.20	5.00	—
Creamery,........Prentiss, Brooks & Co.	Westfield.....	9.86	19.88	20.00	4.27	5.00	—
Average.............	....	8.87	20.35	—	4.23	—	—
Chapin & Co., Boston.							
Alfalfa, ...Frank E. Smith.......	Amherst†	8.12	20.79	20.00	4.06	4.00	16.69
Alfalfa, ...A. E. Gilbert	W. Brookfi'ld†	7.87	19.92	20.00	4.38	4.00	—
Flint Mill Co., Milwaukee.							
Chapin's Alfalfa,..E. A. Briggs Co......	Attleboro	9.48	20.36	20.00	4.03	4.00	—
Chapin's Alfalfa, Dennison,Plummer&Co	New Bedford.	9.37	19.74	20.00	3.21	4.00	—
Vulcan Grains, ...Walker Grain Co.	North Adams.	8.43	23.34	24.00	6.53	7.00	—
H-O Co., Buffalo.							
Algrane Butter,...Torrence, Vary & Co..	Lynn.........	8.29	19.13	18.00	5.49	4.50	—
Algrane Milk, ...W. H. Cunningham...	Malden	7.97	14.62	14.00	3.73	4.00	—
Paragon, ...W. T. McLaughlin....	Jamaica Plain	8.04	19.00	18.00	4.58	4.50	—
H-O, ...E. A. Briggs Co.......	Attleboro	8.11	19.13	18.00	5.49	4.50	—
H-O, ...J. W. Doon & Co.	Natick†	7.44	19.00	18.00	4.43	4.50	—
H-O, ...South Shore Grain Co.	Quincy†, ...	7.09	19.53	18.00	5.00	4.50	—
H-O, ...Cutler Co	Warren†	7.26	21.41	18.00	5.18	4.50	—
H-O, ...Cutler Co	W. Brookfield.	6.44	19.53	18.00	4.25	4.50	—
Average*............	....	7.52	19.53	—	4.92	—	—
Husted Milling and Elev. Co., Buffalo.							
Husted, ...W. R. Williams.......	Oxford.	11.16	17.64	18-20	3.75	3-4	—
Ralston Purina Co., St. Louis.							
Protena,..........G. M. Foster	Lowell	8.98	19.88	20.00	3.59	3.50	17.12
Protena,..........Milford Grain Co.	Milford	10.14	21.72	20.00	3.57	3.50	—
Protena,..........J. W. Doon & Son....	Natick†	8.80	18.92	20.00	3.38	3.50	—
Protena,..........H. P. Howland	Spencer.	10.25	18.92	20.00	2.53	3.50	—
Protena,..........P. Pion & Son........	Worcester†...	7.52	20.67	20.00	4.86	3.50	—
Average.............	....	9.14	20.02	—	3.59	—	—

†Spring collection, 1906. *Excepting Algrane Milk.

MOLASSES FEEDS.

Manufacturer or Jobber, Brand and Retailer.	Sampled at:	Water.	Protein. Found.	Protein. Guar.	Fat. Found.	Fat. Guar.	Fiber.
		%	%	%	%	%	%
Alfalfa Meal Co., Omaha, Neb.							
Payne's Alfalmo, .W. R. Williams........	Oxford......	26.74	10.53	15.00	0.33	3.50	—
American Cereal Co., Chicago.							
Molac Dairy, ...J. W. Waite..........	Easthampton.	14.18	12.64	16-18	3.05	3-4	11.96
Molac Dairy, ...Livingston Grain Co..	Lowell†	11.47	17.07	16-18	2.92	3-4	13.32
Molac Dairy, ...Livingston Grain Co..	Lowell	12.99	14.17	16-18	3.27	3-4	—
Molac Dairy, ...W. R. Williams	Oxford.......	12.02	16.67	16-18	3.71	3-4	—
Molac Dairy, ...P. W. Eaton & Co....	Williamstown†	11.63	17.68	16-18	3.12	3-4	12.25
Average..............	....	12.46	15.65	—	3.21	—	—
Molac Horse, ...Sheppard & Harding..	Charlestown. .	12.98	11.80	11-13	2.68	3-4	—
Molac Horse, ...J. W. Waite..........	Easthampton	13.74	10.44	11-13	2.83	3-4	—
Molac Horse, ...Livingston Grain Co..	Lowell†.......	14.06	10.44	11-13	2.04	3-4	13.31
Molac Horse, ...F. A. Fales & Co.....	Norwood.....	12.91	11.10	11-13	2.83	3-4	—
Molac Horse, ...E. A. Cowee	Worcester....	13.45	9.70	11-13	3.11	3-4	—
Average..............	....	13.43	10.70	—	2.70	—	—
American Milling Co., Chicago.							
Sucrene Dairy,.....Bedford Coal & Gr. Co	Bedford†.....	13.09	16.67	16.50	2.89	3.50	—
Sucrene Dairy,.....Mackenzie & Winslow	Fall River†...	13.24	18.30	16.50	3.23	3.50	—
Sucrene Dairy,....Marlboro Grain Co...	Marlboro.....	11.99	17.03	16.50	3.81	3.50	—
Sucrene Dairy,....W. L. Palmer	Medway	12.32	16.99	16.50	3.29	3.50	—
Sucrene Dairy,....M. H. Cushing & Co..	Middleboro†..	9.94	19.00	16.50	4.11	3.50	8.60
Sucrene Dairy,....Milford Grain Co	Milford†	12.27	16.90	16.50	3.42	3.50	—
Sucrene Dairy,....Sprague & Williams..	S. Framing'm†	11.77	14.26	16.50	2.54	3.50	9.07
Average..............	....	12.09	17.02	—	3.33	—	—
Sucrene Horse, ..C. H. Felker & Co....	Brockton.	15.08	14.79	13.50	2.34	3.50	—
Sucrene Horse, ..W. L. Palmer	Medway.	11.89	13.04	13.50	2.56	3.50	—
Sucrene Horse, ..M. H. Cushing & Co..	Middleboro†..	10.19	12.81	13.50	2.49	4.50	7.63
Sucrene Horse, ..S. A. Eastman........	Milford†	9.69	12.11	13.50	2.36	4.50	7.96
Sucrene Horse, ..S. B. Green & Co.....	Watertown ...	12.29	16.28	13.50	3.31	3.50	—
Average..............	....	11.83	13.81	—	2.61	—	—
Chapin & Co., Boston.							
Green Diamond,..W. A. Haynes Co.....	Maynard†	6.37	19.48	16.50	3.14	3.50	10.10
Green Diamond,..Dennison Plummer Co	New Bedford†	6.48	16.37	16.50	3.22	3.50	10.77
Green Diamond,..Dennison Plummer Co	New Bedford.	13.48	16.99	16.50	2.96	3.50	—
Green Diamond,..E. H. Smith	Northboro ...	10.92	12.90	16.50	2.28	3.50	—
Green Diamond,..Cutler Co.............	N. Wilbraham	10.21	13.51	16.50	2.18	3.50	—
Green Diamond,..Weld & Beck.	Southbridge. .	11.38	13.82	16.50	2.84	3.50	—
Green Diamond,..C. B. Sawin & Son....	Southboro† ..	5.59	15.49	16.50	2.90	3.50	10.58
Average..............	....	9.20	15.51	—	2.79	—	—
F. W. Goeke & Co., Boston.							
Holstein,..........B. W. Brown	Concord†	11.36	11.45	15.23	1.95	3.27	10.12
Holstein, ...F. A. Fales & Co	Norwood.....	14.26	11.76	15.23	1.90	3.27	—
E. P. Mueller, Milwaukee.							
Molasses Grains, .C. G. Burnham.......	Holyoke†	11.29	15.27	20.00	2.35	3.00	—
Molasses Grains, .C. G. Burnham.......	Holyoke†	14.22	15.27	20.00	2.19	3.00	—
Molasses Grains, .Prentice & Son.	Milford	13.66	19.00	24.34‡	2.45	—	—

†Spring collection, 1906. ‡Protein and fat.

MOLASSES FEEDS (CONTINUED).

Manufacturer or Jobber, Brand and Retailer.	Sampled at:	Water.	Protein.		Fat.		Fiber.
			Found.	Guar.	Found.	Guar.	
		%	%	%	%	%	%
Western Grain Prod. Co., Milwaukee.							
Hammond, ...E. J. Adams..........	Gt. Barr'ngt'n†	10.98	15.14	17.00	3.93	3.00	11.88
Hammond, ...Berkshire Coal &Gr.Co	North Adams.	13.81	15.84	17.00	3.39	3.50	—

RYE FEEDS.

Manufacturer or Jobber, Brand and Retailer.	Sampled at:	Water.	Protein Found.	Protein Guar.	Fat Found.	Fat Guar.	Fiber.
Boutwell Milling & Grain Co., Troy, N.Y.							
C. G. Burnham	Holyoke	11.60	16.59	14.58	3.45	3.22	—
Cutler Co., North Wilbraham.							
Cutler Co....	N. Wilbraham	12.58	14.92	15.00	2.85	3.00	—
Oneonta Milling Co., Oneonta, N. Y.							
Potter Grain Co.......	Shelbu'ne Fls†	10.60	16.50	14.75	3.27	3.50	—
Average..............	....	11.59	16.00	—	3.19	—	—

CALF MEAL.

Manufacturer or Jobber, Brand and Retailer.	Sampled at:	Water.	Protein Found.	Protein Guar.	Fat Found.	Fat Guar.	Fiber.
J. W. Barwell, Waukegan, Ill.							
Blatchford's, ...Potter & Co..........	Athol†	9.42	23.22	25.00	4.03	5.00	—
Blatchford's, ...G. R. Doane..........	N. Brookfield.	10.72	27.25	25.00	4.65	5.00	—
Chapin & Co., Boston.							
Triangle, ...W. A. Haynes Co	Maynard†	6.58	24.31	22.00	12.06	10.00	—
Triangle, ...Hathaway&Mackenzie	New Bedford†	7.16	21.94	22.00	11.80	10.00	—
Laval Ration,.....J. W. Doon & Son ...	Natick	8.43	21.85	15.00	10.12	9.00	—

†Spring collection, 1906.

II. Starchy (Carbohydrate) Feeds.

CORN MEAL.

Manufacturer or Jobber, Brand and Retailer.	Sampled at:	Water.	Protein. Found.	Protein. Guar.	Fat. Found.	Fat. Guar.	Fiber.
		%	%	%	%	%	%
Buffalo Cereal Co., Buffalo.							
A, ... C. A. Ketchum	Salem........	12.52	7.90	—	2.88	—	—
B, ... W. Baylies...........	New Bedford.	11.06	10.44	—	7.28	—	3.37
Husted Milling and Elev. Co., Buffalo.							
H. A. Crossman	Needham	12.69	8.91	—	3.44	—	—

HOMINY MEAL.

Manufacturer or Jobber, Brand and Retailer.	Sampled at:	Water.	Protein. Found.	Protein. Guar.	Fat. Found.	Fat. Guar.	Fiber.
American Corn Milling Co., Chicago.							
J. Cushing & Co.......	South Acton..	9.31	11.28	10.5-12	10.53	7.5-9	—
M. F. Baringer, Philadelphia.							
Keystone,......... J. B. Frost............	Shelb'rne Fls†	7.82	12.20	10.50	10.91	7.90	--
Buffalo Cereal Co., Buffalo.							
F. Diehl & Son.	Wellesley	8.11	11.10	10.50	7.64	8.50	—
W. W. McIntyre......	Marlboro.....	11.41	10.79	10.25	8.47	8.00	—
M. J. Jencks..........	Webster	11.34	10.71	9.5-12	8.77	7.5-9	—
Chapin & Co., Boston.							
Green Diamond,.. G. F. Green Coal Co..	Brockton.	9.36	10.58	10-11	8.00	7-9	—
Niagara, ... Seymour & McDonald	S. Lancaster..	10.45	10.49	10-11	8.14	7-8	—
Chas. M. Cox Co., Boston.							
Wirthmore,....... A. B. Bacon..........	Spencer	9.49	10.93	9.5-12	8.91	7.5-9	—
Wirthmore,....... Norton & Warren.....	Warren	10.59	10.49	9.5-12	8.07	7.5-9	—
Yellow,........... J. Cushing & Co......	South Acton .	10.07	11.19	10-12	9.35	7-9	—
Yellow,........... Bliss & Co	Taunton	10.55	10.09	10-12	7.38	7-9	—
W. H. Haskell & Co., Toledo, Ohio.							
Haskell's, ... J. Loring & Co	Watertown ..	10.88	10.40	10.25	8.07	8.10	—
F. L. Kidder & Co., Paris, Mo.							
Peerless, ... Lexington Grain Co...	Lexington† ...	9.62	9.30	10.76	5.76	7.70	—
Peerless, ... M. F. Wilbur.........	W.Somerville†	9.91	9.44	10.76	6.53	7.70	—
Miner-Hillard Mill.Co., Wilkes-Barre, Pa.							
D. H. Craig...........	Plymouth	9.52	11.10	10-12	9.56	7.5-9	—
A. W. Charter........	Springfield ...	8.62	11.32	10-12	10 03	7.5-9	—
S. D. Viets Co........	Springfield ...	8.64	11.19	10-12	9.99	7.5-9	—
Noblesville Milling Co., Noblesville, Ind							
J. W. Doon & Son....	Natick†	8.96	10.79	10.5-12	9.50	7.5-8	—
Patent Cereals Co., Geneva, N. Y.							
Potter Grain Co.......	Shelb'rne Fls†	9.98	10.88	10-11	7.82	7-8	—
A. Fitch & Co........	W. Somerv'le†	10.03	11.19	10-11	8.41	7-8	—
A. B. Porter & Co., Philadelphia.							
Pearl,............. Lummus & Parker....	Danversport..	9.97	11.14	8-11	8.82	6-9	—

†Spring collection, 1906.

HOMINY MEAL—(CONTINUED).

Manufacturer or Jobber, Brand and Retailer.	Sampled at:	Water.	Protein. Found.	Protein. Guar.	Fat. Found.	Fat. Guar.	Fiber.
		%	%	%	%	%	%
W. N. Potter & Sons, Greenfield, Mass.							
Marshall,.........Walker Grain Co.....	North Adams.	10.65	10.36	11.00	8.27	8-9	—
M. G. Rankin & Co., Milwaukee.							
Sterling,..........Wilson & Holden.....	Worcester....	9.89	10.49	11.00	8.69	7.50	—
J. E. Soper & Co., Boston.							
Blue Ribbon,......G. A. Stevens	Worcester....	8.48	11.19	11.00	9.13	8.00	—
Red Ribbon,.......G. B. Pope & Co.	Waltham.....	8.59	11.19	10.00	10.17	8.00	4.42
Suffern, Hunt & Co., Decatur, Ill.							
C. A. Pierce..........	Hinsdale†	8.65	10.84	11.02	9.14	7.70	—
U. S. Frumentum Co., Detroit, Mich.							
Frumentum,.......S. R. Carter..........	W. Berlin	8.28	11.41	10.14	9.09	8.76	—
Highest	....	11.41	12.20	—	10.91	—	—
Lowest..............	....	7.82	9.30	—	5.76	—	—
Average.............	....	9.60	10.82	—	8.71	—	—
Low Grade.							
Toledo Elevator Co., Toledo, Ohio.							
Star, ...G. R. Doane	N. Brookfield.	10.39	8.65	7-10	6.26	6.50	9.54

CORN AND OAT FEED.

Manufacturer or Jobber, Brand and Retailer.	Sampled at:	Water.	Protein. Found.	Protein. Guar.	Fat. Found.	Fat. Guar.	Fiber.
American Cereal Co., Chicago.							
Corn, oat & barley, G. P. Rogers.........	Worcester....	10.25	10.84	13.00	4.41	5.00	—
Schumacher's,.....Livingston Grain Co..	Lowell	8.21	11.02	11-13	4.64	4-5	10.60
Schumacher's,.....Dexter Root Co.......	Springfield ...	10.08	10.93	11-13	3.54	4-5	—
Victor, ...Spfd Commis. House..	Springfield ...	9.15	7.33	9.00	2.73	4.00	—
Victor, ...J. O. Dean & Co......	South Easton.	10.32	8.82	7.5-9	3.76	3-4	—
Buffalo Horse & Dairy Feed Co., Buffalo.							
Horse Feed,......Bliss & Co	Taunton	8.67	6.63	8.74	3.12	4.60	—
Chas. M. Cox Co., Boston.							
Wirthmore, ...A. J. Richards & Son..	Weymouth ..	9.46	9.39	10-12	6.18	4-5	—
J. H. Cressey & Co., Boston.							
XX Badger, ...W. G. Davis Co......	Westfield	10.80	8.56	12.00	3.19	4.20	—
Diamond Elev. & Mill. Co., Minneapolis							
O. O. White, ...A. T. Butler..........	Adams	10.66	10.01	10.51	5.75	5.75	—
Ellsworth & Co., Buffalo.							
De Fi, ...N. Tufts & Son.......	Charlestown ..	6.96	9.52	8.00	3.89	3.00	—
De Fi, ...South Shore Grain Co.	Quincy...... ..	8.14	9.56	8.00	3.01	3.00	—
De Fi. ....M. J. Jencks..........	Webster	7.02	9.92	8.00	2.99	3.00	—
Empire Mills, Olean, N. Y.							
XX Empire,......J. A. Bouvier	New Bedford.	10.52	8.12	7.63	3.91	3.97	—

CORN AND OAT FEED—(CONTINUED).

Manufacturer or Jobber, Brand and Retailer.	Sampled at:	Water.	Protein. Found.	Protein. Guar.	Fat. Found.	Fat. Guar.	Fiber.
		%	%	%	%	%	%
Flint Mill Co., Milwaukee.							
Pearl Cooked, ... Prentiss, Brooks & Co.	Westfield	10.99	10.27	10.00	7.59	6.00	—
Great Western Cereal Co., Chicago.							
Boss,............. G. F. Wetherbee Est .	Gardner......	9.13	9.52	8.50	4.39	3.50	—
Excelsior, ... Bedford Coal & Gr.Co.	Bedford.	8.24	10.53	9.00	7.51	4.20	—
G. F. Green Coal Co.. Brockton, Mass.							
Green's,.......... G. F. Green Coal Co...	Brockton.....	9.40	10.49	10.00	5.32	4.50	—
W. H. Haskell & Co., Toledo, Ohio.							
Haskell's,......... W. L. Palmer	Medway	10.00	9.13	10.00	6.55	6.25	—
Haskell's,......... J. Loring & Co.......	Watertown ..	10.00	9.48	10.00	6.68	6.25	—
Haskell's,......... E. W. Kenerson......	Worcester....	8.32	9.92	10.00	7.54	6.25	—
H-O Co., Buffalo.							
N. E. Stock,...... J. H. Nye.............	Brockon	8.89	8.51	9.00	3.70	4.00	—
N. E. Stock,...... J. F. Shine.	Dedham	9.62	10.40	9.00	4.13	4.00	—
N. E. Stock,...... C. G. Burnham	Holyoke	9.36	10.32	9.00	4.77	4.00	—
N. E. Stock,...... E. C. Frost	Shelburne Fls.	8.34	10.40	9.00	4.71	4.00	—
Husted Milling and Elev. Co., Buffalo.							
Monarch Chop,... E. J. Adams...........	Gt. Barrington	7.98	8.12	7.5-9	4.09	3.5-4.5	—
Monarch Chop,... B. F. Kingsbury & Co.	Taunton	10.80	8.34	7.5-9	4.06	3.5-4.5	—
Husted's Horse,... J. Marin & Co........	Haverhill	8.53	11.06	12-13	4.15	4-5	—
Husted's Prov'der, B. W. Brown	Concord......	8.80	8.21	7-9.5	3.83	4-6	—
Oneonta Milling Co., Oneonta, N. Y.							
Provender, ... Bedford Coal & Gr.Co.	Bedford.	10.15	9.21	8.75	2.45	3.50	—
Sykes Coal and Gr. Co., N. Adams, Mass.							
Best,............. Sykes Coal & GrainCo.	North Adams.	10.07	9.48	10-12	7.56	4-5	—
Highest	....	10.99	11.06	—	7.59	—	—
Lowest..............	....	6.96	6.63	—	2.45	—	—
Average.............	....	9.30	9.47	—	4.67	—	—

FORTIFIED STARCHY FEEDS.

Manufacturer or Jobber, Brand and Retailer.	Sampled at:	Water.	Protein. Found.	Protein. Guar.	Fat. Found.	Fat. Guar.	Fiber.
American Cereal Co., Chicago.							
Quaker Dairy,.... J. W. Doon & Son	Natick	8.53	13.16	12-14	3.53	3-4	—
Quaker Dairy,.... E. H. Doble & Co.....	West Quincy .	8.20	14.97	12-14	4.33	3-4	—
A. H. Brown & Bros., Boston.							
Queen, ... C. H. Felker & Co....	Brockton.....	8.81	12.86	10.00	8.26	4.00	—
Queen, ... Weld & Beck	Southbridge. .	8.52	12.46	12.00	8.24	4.00	7.08
Buffalo Cereal Co., Buffalo.							
Horse, ... S. Crosby & Son......	Boston	9.10	12.25	12.00	4.73	4.50	—
Horse, ... J. Loring & Son	Watertown ..	9.87	12.34	12.00	5.07	4.50	9.83
Buffalo Horse & Dairy Feed Co., Buffalo							
Horse, ... J. H. Nye.............	Brockton.	7.72	11.93	12.00	3.46	4.00	10.26

FORTIFIED STARCHY FEEDS—(CONTINUED).

Manufacturer or Jobber, Brand and Retailer.	Sampled at:	Water.	Protein.		Fat.		Fiber.
			Found.	Guar.	Found.	Guar.	
		%	%	%	%	%	%
Chas. M. Cox Co., Boston.							
Wirthmore Imp., .J. H. Nye	Brockton	9.49	12.95	12.00	4.36	4.50	—
Green River Grain Co., Greenfield, Mass.							
O. K. Horse, ...W. N. Potter Grain Co.	Gardner	8.20	12.99	12.00	5.97	4.25	7.29
H-O Co., Buffalo.							
H-O Horse, ...N. Tufts & Sons	Charlestown	9.12	12.73	12.00	4.74	4.50	—
H-O Horse, ...Beaver Coal & Gr. Co.	Norwood	8.87	12.69	12.00	4.76	4.50	—
H-O Horse, ...H. P. Howland	Spencer	9.45	12.90	12.00	4.98	4.50	10.12
Average		8.82	12.85	—	5.20	—	—

OAT FEED.

Manufacturer or Jobber, Brand and Retailer.	Sampled at:	Water.	Protein Found.	Protein Guar.	Fat Found.	Fat Guar.	Fiber.
Chas. M. Cox Co., Boston.							
F. Diehl & Son	Wellesley	7.73	4.17	2-5	1.40	1-3	—
Great Western Cereal Co., Chicago.							
Friend's, ...A. Culver Co.	Rockland†	6.09	7.28	8.00	2.35	3.00	—
Royal, ...G. A. Bigelow	Princeton†	6.82	6.06	7.60	1.96	2.80	—
H-O Co., Buffalo.							
Jim Dandy, ...H. Knight	Newburyport	5.96	7.50	8.34	2.75	3.62	—
Independent Cereal Mill. Co., Peoria, Ill.							
Colonial, ...W. G. Horton	Ipswich†	5.67	6.98	8.25	2.92	2.10	—
Colonial, ...F. M. Keefe	Waltham†	7.21	5.97	8.25	2.55	2.10	—
Colonial, ...F. M. Keefe	Waltham	7.49	7.99	8.25	3.60	2.10	—
Cream, ...F. M. Keefe	Waltham	6.95	4.91	8.25	1.80	2.10	—
St. Albans Grain Co., St. Albans, Vt.							
Jaquith & Co.	Woburn†	8.16	3.43	5-7	0.97	2-3	—
Average		6.90	6.03	—	2.26	—	—

MISCELLANEOUS STARCHY FEEDS.

Manufacturer or Jobber, Brand and Retailer.	Sampled at:	Water.	Protein Found.	Protein Guar.	Fat Found.	Fat Guar.	Fiber.
E. C. Paull Co., Taunton, Mass.							
Barley feed, ...Taunton Grain Co.	Taunton	11.29	10.79	10.00	1.87	2.00	13.96
American Cereal Co., Chicago.							
Zest wheat feed, ..L. H. Southworth	W. Stoughton.	9.39	10.53	12-13	2.60	1.75-2	—
Natural Food Co., Niagara Falls, N. Y.							
Shred. wheat waste, A. D. Copeland	Brockton	7.36	11.45	10-12	3.09	2.00	—
Shred. wheat waste, F. A. Fales	Norwood†	9.57	11.63	10-12	1.81	2.00	—
A. H. Brown & Bros., Boston.							
Dried grains, ...Bedford Coal & Gr. Co.	Bedford	8.16	12.77	10.00	4.51	2.50	—
Dried grains, ...H. A. Crossman	Needham	9.74	12.90	10.00	4.10	2.50	—
Dried grains, ...Jaquith & Co.	Woburn	8.58	12.81	10.00	4.22	2.50	—
Rock County Sugar Co., Janesville, Wis.							
Dried beet pulp, ...City Mills Co.	Holyoke	5.50	12.46	8.50	0.40	0.59	—

†Spring collection 1906.

III. Poultry Feeds.

MEAT SCRAPS.

Manufacturer or Jobber, Brand and Retailer.	Sampled at:	Water.	Protein. Found.	Protein. Guar.	Fat. Found.	Fat. Guar.	Ash.
		%	%	%	%	%	%
First Grade.							
American Agric. Chem. Co., New York.							
G. F. Green Coal Co..	Brockton.....	8.41	54.23	30.00	12.74	15.00	20.11
Bowker Fertilizer Co., Boston.							
E. A. Cowee..........	Jefferson	7.55	56.91	30.00	13.01	20.00	20.65
Joseph Breck & Sons, Boston.							
J. F. Shine...........	Dedham	9.45	49.27	50-55	17.82	15-17	21.04
Butchers' Rendering Co., Fall River.							
B. F. Kingsbury & Co.	Taunton	7.52	46.16	40-60	14.61	15-20	29.04
L. B. Darling Fert. Co., Pawtucket, R.I.							
Pawtucket, ...Bryant & Soule.	Middleboro ..	8.42	54.41	50.00	11.57	16.00	22.74
J. C. Dow & Co., Boston.							
W. M. Robinson......	Dorchester† ..	7.21	48.39	50-55	21.83	15-17	20.89
S. R. Carter..........	West Berlin..	11.43	49.01	50-55	14.44	15-17	23.37
N. E. Dressed Meat & Wool Co., Boston.							
Burbeck & Brett......	N. Abington..	10.37	61.91	53-57	13.49	10-15	13.37
Springfield Rendering Co., Springfield.							
City Mills.............	Holyoke	8.11	46.03	40-60	13.54	15-20	28.78
J. A. Torrey, Rockland, Mass.							
Burbeck & Brett......	N. Abington..	9.25	45.33	46.00	18.03	19.00	22.37
A. L. Warren, Northboro, Mass.							
J. Wadsworth & Co...	Northboro ...	7.39	54.05	54.00	18.58	15.00	17.39
Worcester Rendering Co., Auburn, Mass.							
E. W. Kenerson.......	Worcester....	7.51	47.08	40-60	13.76	15-20	29.46
Average.............	....	8.55	51.07	—	15.29	—	22.43
Second Grade.							
Eastern Grain Co., Bridgewater, Mass.							
Eastern Grain Co.....	Bridgewater. .	8.54	41.90	40-50	12.89	15-20	33.46
Hinckley Rend. Co., Somerville. Mass.							
T. W. Emerson.......	E. Weymouth.	7.10	37.99	40-60	12.86	10-15	37.62
Highland Mill........	Newton H'gds	8.44	41.64	40-50	10.84	15-20	36.47
Geo. E. Woodell, Natick, Mass.							
Cutler Co.............	S. Framing'm.	7.94	42.83	20-25	21.29	10-16	26.60
Average.............	....	8.01	41.09	—	14.47	—	33.54

†Spring collection, 1906.

MEAT AND BONE MEAL.

Manufacturer or Jobber, Brand and Retailer.	Sampled at:	Water.	Protein. Found.	Protein. Guar.	Fat. Found.	Fat. Guar.	Ash.
		%	%	%	%	%	%
First Grade.							
Bowker Fertilizer Co., Boston.							
Animal Meal,.....E. A. Cowee..........	Jefferson......	5.07	35.80	30.00	11.41	5.00	42.03
D. W. Romaine, New York.							
H. Bruckman.........	Lawrence	5.71	38.83	45.00	19.12	15.00	28.04
G. A. Stevens	Worcester....	8.34	54.72	45.00	15.02	15.00	14.84
Whitman & Pratt Ren. Co., Lowell, Mass.							
Animal Meal,.....Seymour & McDonald	S. Lancaster..	5.91	42.51	32-35	14.65	10-15	30.02
Average.............	....	6.26	42.97	—	15.07	—	28.74
Second Grade.							
Beach Soap Co., Lawrence, Mass.							
G. A. Stevens	Worcester....	6.39	33.66	26.00	9.92	10.00	44.96
Joseph Breck & Sons, Boston.							
Poultry and Swine, Joseph Breck & Sons.	Boston	6.39	30.71	32-35	9.61	10-13	43.30
J. C. Dow & Co., Boston.							
Dow's Favorite, ..S. R. Carter..........	West Berlin..	9.42	34.75	32-35	10.00	10-12	36.53
Dow's Favorite, ..E. H. Doble & Co.....	West Quincy.	8.09	31.06	32-35	10.08	10-12	42.31
Geo. E. Marsh Co., Lynn, Mass.							
Seymour & McDonald	S. Lancaster..	5.55	33.57	36-46	6.03	8-12	47.85
Average.............	....	7.17	32.75	—	9.13	—	42.99

BONE MEAL.

Manufacturer or Jobber, Brand and Retailer.	Sampled at:	Water.	Protein. Found.	Protein. Guar.	Fat. Found.	Fat. Guar.	Ash.
Hinckley Rend. Co., Somerville, Mass.							
J. W. Doon & Son....	Natick†	7.78	24.44	—	2.72	—	63.41
Swift's Lowell Fertilizer Co., Boston.							
E. A. Cowee..........	Worcester....	8.00	24.66	10-15	1.33	5-10	64.79
Bowker Fertilizer Co., Boston.							
E. A. Briggs & Co....	Attleboro† ...	5.22	16.81	20.00	4.84	—	69.67
C. F. Rice...........	Brookfield....	3.70	14.66	20.00	9.10	—	67.84

GRANULATED MILK.

Manufacturer or Jobber, Brand and Retailer.	Sampled at:	Water.	Protein. Found.	Protein. Guar.	Fat. Found.	Fat. Guar.	Ash.
Geo. L. Harding, Binghamton, N. Y.							
Wallace Bros.........	Clinton†	9.30	48.00	43-50	1.16	15-20	22.79

†Spring collection, 1906.

POULTRY MASH AND MEAL.

Manufacturer or Jobber, Brand and Retailer.	Sampled at:	Water.	Protein.		Fat.		Ash.
			Found.	Guar.	Found.	Guar.	
		%	%	%	%	%	%
American Cereal Co., Chicago.							
American,........Phillips, Bates & Co ..	Hanover	9.59	13.65	12-14	6.62	3.5-4.5	3.27
Buffalo Cereal Co., Buffalo.							
W. W. McIntyre......	Marlboro.....	7.94	16.67	17.00	6.21	5.00	3.27
Buffalo Horse & Dairy Feed Co., Buffalo.							
B. H. D. Co.'s,....J. Loring & Co.......	Watertown ..	10.24	18.74	17.00	5.12	5.50	9.38
W. F. Chamberlain, St. Louis.							
Perfect Mash,.....Joseph Breck & Sons..	Boston	7.43	11.28	14.06	3.81	2.93	18.56
J. W. Day & Co., Lynn, Mass.							
Meat Mash, ...J. W. Day & Co......	Lynn.........	9.67	15.49	11.50	4.65	3.50	5.49
Dexter Root Co., Springfield, Mass.							
Dexter Root Co.......	Springfield ...	11.16	19 00	16.00	5.20	4.00	6.29
E. H. Doble & Co., West Quincy, Mass.							
Goldthwaite's Con'l,E. H. Doble & Co.....	West Quincy†	10.57	15.32	14-15	4.47	3.5-4.5	7.11
Goldthwaite's Con'l,E. H. Doble & Co.....	West Quincy.	10.39	15.09	14-15	4.45	3.5-4.5	6.37
C. H. Felker & Co., Brockton, Mass.							
O. K.,............C. H. Felker & Co....	Brockton	10.20	13.77	15.67	4.80	3.03	5.14
Flint Mill Co., Milwaukee.							
Wonder, ...C. O. Parsons.........	Florence......	7.19	20.84	22.00	6.48	4.00	4.99
Wonder, ...W. W. McIntyre......	Marlboro.....	8.76	19.92	22.00	5.78	4.00	5.21
Wonder, ...H. A. Crossman	Needham	8.76	21.55	22.00	6.90	4.00	4.64
Wonder, ...Weld & Beck.........	Southbridge ..	7.17	22.29	22.00	7.33	4.00	4.65
Green River Grain Co., Greenfield, Mass.							
W. N. Potter Co......	Gardner......	10.73	17.68	16.46	4.48	4.14	3.31
H-O Co., Buffalo.							
Algrane,..........C. O. Parsons	Florence......	8.05	16.99	—	6.74	—	3.34
Algrane,..........Cutler Co.............	S. Framingh'm	8.78	18.16	17.00	5.58	5.50	3.14
Paragon, ...W. T. McLaughlin ...	Jamaica Plain	8.88	17.81	17.00	5.79	5.50	3.06
Paragon, ...W. P. Whittemore....	Jamaica Plain	9.28	17.95	17.00	6.14	5.50	3.64
Husted Milling and Elev. Co., Buffalo.							
BerkshireCoal & Gr.Co	North Adams	9.74	15.27	12-14	3.70	4.50	3.69
Park & Pollard Co., Boston.							
Dry Mash, ...Park & Pollard Co....	Boston	9.60	18.65	23.57	3.21	3.48	11.76
Dry Mash, ...Burbeck & Brett......	N. Abington .	7.88	24.00	23.57	2.79	3.48	17.05
Fattening Food, ..Burbeck & Brett......	N. Abington..	11.35	11.67	—	2.85	—	2.77
Growing Food,...Park & Pollard Co....	Boston	11.45	14.83	—	3.97	—	3.93
Ralston Purina Co., St. Louis.							
Purina Mash,.....Milford Grain Co.....	Milford	9.34	18.96	17.00	2.75	5.00	4.99
Purina Mash,.....D. H. Craig..........	Plymouth	10.21	16.55	—	2.41	—	5.00
W. M. Robinson, Dorchester, Mass.							
Hub,.............W. M. Robinson......	Dorchester† .	11.36	11.76	—	4.34	—	3.62
Hub,.............W. M. Robinson......	Dorchester ..	9.88	12.81	12-14	4.25	4-5	3.76
Reno, ...W. M. Robinson......	Dorchester† .	10.30	22.16	—	6.59	—	6.20
Reno, ...W. M. Robinson......	Dorchester ..	8.89	23.08	20-22	6.04	6-7	7.61

†Spring collection, 1906.

POULTRY MASH AND MEAL—(CONTINUED).

Manufacturer or Jobber, Brand and Retailer.	Sampled at:	Water.	Protein. Found.	Protein. Guar.	Fat. Found.	Fat. Guar.	Ash.
		%	%	%	%	%	%
L. H. Southworth, W. Stoughton, Mass.							
Special, ...L. H. Southworth.....	W. Stoughton.	9.40	17.99	15.00	5.43	4.50	7.52
Spratt's Patent Ltd, Newark, N. J.							
No. 3,............T. H. Emerson	E. Weymouth.	8.64	18.21	20.00	3.38	4.50	9.83
Average.............	....	9.45	17.36	—	4.91	—	6.08

CHICK AND SCRATCHING GRAINS.

Manufacturer or Jobber, Brand and Retailer.	Sampled at:	Water.	Protein. Found.	Protein. Guar.	Fat. Found.	Fat. Guar.	Ash.
Chick.							
Joseph Breck & Sons, Boston.							
Hygienic, ...Joseph Breck & Sons .	Boston	11.11	10.79	8-10	2.74	2-3	1.73
Hygienic, ...J. F. Shine	Dedham	13.01	10.49	8-10	2.92	2-3	1.48
Bryant & Soule, Middleboro, Mass.							
Bryant & Soule.......	Middleboro ..	8.54	9.48	7.00	3.09	2.00	9.30
Cyphers Incubator Co., Buffalo.							
Norton & Warren	Warren	10.20	9.83	12.44	2.83	3.40	13.25
Thos. W. Emerson Co., Boston.							
Gem,.............M. H. Cushing & Co..	Middleboro ..	12.20	10.93	9.50	3.42	4.50	2.77
Gem,.............C. G. Jordan..........	Weymouth ...	11.31	10.84	9.50	3.03	4.50	2.63
A. C. Griffen, Pittsfield, Mass.							
O. K.,............C. F. Rice	Brookfield....	9.45	10.36	10.20	3.14	4.10	14.11
O. K.,............H. C. Puffer Co.......	Springfield ..	10.07	9.70	10.20	3.52	4.10	14.29
Park & Pollard Co., Boston.							
Interm'd'e Gritless, Burbeck & Brett......	N. Abington..	12.40	11.72	10.93	2.28	3.48	1.52
Husted Milling and Elev. Co., Buffalo.							
Burbeck & Brett......	N. Abington..	10.97	13.04	12-14	4.13	4-5	2.06
W. R. Williams.......	Oxford.......	11.07	12.38	12-14	4.05	4-5	2.12
Ralston Purina Co., St. Louis.							
Purina, ...Milford Grain Co.....	Milford	10.25	12.02	10.20	3.74	3.60	2.46
Purina, ...S. R. Carter..........	West Berlin..	11.14	11.58	11.00	3.90	3.00	2.15
W. M. Robinson, Dorchester, Mass.							
Hopes, ...W. M. Robinson....	Dorchester† .	10.33	9.09	—	2.64	—	13.55
Hopes, ...W. M. Robinson......	Dorchester ..	10.40	10.53	9.5-11	3.43	2.5-3.5	8.32
Ross Bros., Worcester, Mass.							
Wyandotte, ...H. P. Howland	Spencer......	10.05	9.00	8.25	2.47	2.25	13.59
Average............	....	10.78	10.74	—	3.21	—	6.58

†Spring collection 1906.

CHICK AND SCRATCHING GRAINS—(CONTINUED).

Manufacturer or Jobber, Brand and Retailer.	Sampled at:	Water.	Protein.		Fat.		Ash.
			Found.	Guar.	Found.	Guar.	
		%	%	%	%	%	%
Scratching Grains.							
Joseph Breck & Sons, Boston.							
Complete, ...Joseph Breck & Sons.	Boston.......	10.65	9.74	8-10	2.80	2-3	10.81
Complete, ...W. W. Holmes	Webster.	10.30	9 97	8-10	3.04	2-3	7.54
Bryant & Soule, Middleboro, Mass.							
Bryant & Soule.......	Middleboro ..	12.17	10.32	9.00	3.42	2.00	1.90
A. D. Copeland, Brockton, Mass.							
Blended Grains, ..A. D. Copeland.......	Brockton	11.06	10.58	8.50	2.92	2.50	1.82
Darling & Co., Long Island City, N. Y.							
T. J. McDonald	Lowell	10.90	10.93	10.00	3.32	2.00	1.80
E. H. Doble & Co., West Quincy, Mass.							
Goldthwaite's,.....E. H. Doble & Co....	West Quincy.	11.48	10.23	8.50	3.84	2.50	1.86
E. H. Doble & Co.....	West Quincy†	11.63	10.53	—	3 23	—	2.01
Thos. W. Emerson Co., Boston.							
Emerson's, ...M. H. Cushing & Co..	Middleboro ..	11.99	12.60	12.50	3.42	2.50	2.11
C. H. Felker & Co., Brockton, Mass.							
C. H. Felker & Co....	Brockton.....	11.95	10.75	10.00	3.58	3.00	1.76
H-O Co., Buffalo.							
Algrane, ...C. G. Burnham	Holyoke	11.54	11.67	—	3.17	—	1.67
Algrane, ...H. L. Patrick	Hopedale	11.61	11.54	—	3.93	—	1.85
Husted Milling and Elev. Co., Buffalo.							
Competition, ...BerkshireCoal&Gr.Co.	N. Adams....	10.73	11.28	12-14	3.38	4-5	1.92
N. E. Poultry Sup. Co., Springfield, Mass							
Quality Develop'g, N. E. Poultry Sup. Co.	Springfield ...	11.62	12.81	12-14	3.16	3-4	3.43
Quality Laying, ...N. E. Poultry Sup. Co.	Springfield ...	11.47	12.90	12.5-14	3.59	4-5	3.94
Quality Pigeon,...N. E. Poultry Sup. Co.	Springfield ...	11.84	12.51	13-15	4.86	3-4	2.26
Park & Pollard Co., Boston.							
Park & Pollard Co....	Boston	11.68	10.67	10.93	3.14	3.48	1.75
Burbeck & Brett......	N. Abington..	11.91	10.75	10.00	3.27	3.00	1.65
W. M. Robinson, Dorchester, Mass.							
No. 2,............W. M. Robinson	Dorchester ..	13.05	10.18	9.25-11	3.43	2.75-3.50	1.68
W. M. Robinson......	Dorchester ..	11.41	10.27	9-11	3.59	2-3	1.59
Ross Bros., Worcester, Mass.							
Everyday,.........A. E. Gilbert.........	W. Brookfield	12.13	11.67	12.00	3.12	3.00	2.12
G. F. Savage Poultry Sup. Co., Boston.							
Standard,.........N. Tufts & Son	Charlestown..	11.68	10.49	10-11	2.92	2.5-3	1.61
Standard,.........Hingham Grain Co ..	Hingham	10.93	10.40	10-11	3 26	2.5-3	1.55
Average.............	....	11.08	11.04	—	3.38	—	2.67

†Spring collection, 1906.

CHICK AND SCRATCHING GRAINS—(CONTINUED).

Manufacturer or Jobber, Brand and Retailer.	Sampled at:	Water	Protein.		Fat.		Ash.
			Found.	Guar.	Found.	Guar.	
		%	%	%	%	%	%
Miscellaneous Scratching Grains.							
Hulled oats. ....Dexter Root & Co....	Springfield ...	12.05	14.70	—	6.37	—	—
Red wheat,.........Dexter Root & Co....	Springfield ...	10.21	12.38	—	2.00	—	—
Red wheat,.........M. J. Jencks..........	Webster	13.93	12.38	—	1.54	—	—
White wheat,........Weld & Beck	Southbridge ..	14.10	12.38	—	1.80	—	—
White wheat,........Dexter Root & Co.....	Springfield ...	13.80	10.40	—	1.77	—	—
Kaffir corn..........W. W. Hall...........	Malden	11.70	10.49	—	3.16	—	—

ALFALFA AND CLOVER MEALS.

Alfalfa.							
Ralston Purina Co., St. Louis.							
Purina,...........C. H. Felker & Co....	Brockton.....	7.71	15.40	18.00	1.30	3.50	8.27
Purina,...........Prentice & Son.......	Milford	6.96	10.71	—	1.23	—	7.32
Purina,...........Cutler Co	N. Wilbraham	9.74	14.00	—	1.26	—	8.64
Average.............	....	8.14	13.37	—	1.26	—	8.07
Clover.							
W. R. Curtis & Co., Ransomville, N. Y.							
F. F. Woodward & Co.	Fitchburg† ...	10.28	13.65	—	2.11	—	—
Thos. W. Emerson Co., Boston.							
Gem,.............P. Pion & Son........	Worcester† ...	8.25	10.71	12.00	1.68	2.00	—
Hudson Valley Clover Co., Lynn, Mass.							
Alltop, ...Eastern Grain Co.....	Bridgewater† .	11.24	15.27	16.00	2.99	3.00	—
Alltop, ...J. W. Day & Co.......	Lynn†	10.47	15.53	16.00	3.34	3.00	—
Average.............	....	10.06	13.79	—	2.53	—	—

†Spring collection. 1906.

EXPLANATION AND DISCUSSION OF THE RESULTS.

Cottonseed and Linseed Meals. Pages 7-10.

The Interstate Cottonseed Crushers' Association at its May meeting 1906, graded cottonseed meal as follows:

SECTION 2. *Choice meal* must be finely ground, perfectly sound and sweet in odor, free from excess of lint and hulls, and by analysis must contain at least 8 per cent of ammonia (41.15 per cent protein.)

SECTION 3. *Extra prime meal* must be finely ground, of sweet odor, reasonably bright in color, yellow, not brown or reddish, and by analysis must contain at least 7.5 per cent of ammonia (38.50 per cent protein.)

SECTION 4. *Prime meal* must be finely ground, of sweet odor, reasonably bright in color, and by analysis must contain at least 7 per cent of ammonia (36 per cent protein).

SECTION 5. *Off meal:* Any cottonseed meal which is distinctly deficient in any of the requirements of prime quality, either in color, odor, texture or analysis, or all, shall be deemed Off Meal and should be sold by sample.

The Station has adopted substantially the above grading. It designates as high grade meal (choice) that testing 41 per cent or more protein; as medium grades (extra prime and prime) those testing from 36 to 41 per cent protein; as low grade (off) all meals testing below 36 per cent protein. It likewise adopts the same requirements as to mechanical condition, taste, color and odor as the Association.

There have been collected, examined and reported 23 samples of high grade and 29 samples of medium grade meals. Most of them met their protein guarantees and were of good color and taste.

Two samples of Chapin's Green Diamond brand were guaranteed 41 per cent protein and 9 per cent fat, and tested only 37.08 and 37.34 per cent protein and 6.58 and 6.35 per cent fat. One sample of Cox's Magnolia brand carried a 43 per cent guarantee and tested 39.14 per cent protein.* A lot put out by J. E. Soper & Co. called for 41 per cent protein and 9 per cent fat, and showed 36.46 per cent protein and 6.06 per cent fat.

* C. M. Cox Co. claim that this does not truly represent their product.

It is evident that jobbers frequently are not informed concerning the quality, or do not use sufficient care in tagging their goods. Cottonseed meal is supposed to be purchased at wholesale on a guaranteed basis. The consumer as well as the jobber certainly has a right to a pro rata rebate, on goods that are not substantially as represented.

AVERAGE ANALYSES AND RETAIL PRICES.

	High and Medium Grades. 1904	High and Medium Grades. 1905	High Grades. 1906	Medium Grades. 1906	High and Medium Grades. 1906
No. Samples,	62	61	23	29	52
Protein,	43.6	41.6	42.19	39.48	40.68
Fat,	9.0	8.8	8.79	8.56	8.66
Price a ton,	$28.87	$29.08	$32.54	$32.53	$32.54

The cottonseed meal offered in Massachusetts has shown a gradual decline in quality during the last three years as the above figures show. Previous to 1904 the quality of the meal was decidedly superior to most of that now offered as the following tabulated data taken from our own records make clear:

	1897	1898	1899	1900	1901	1902	1903
No. Samples,	16	32	50	43	69	34	67
Protein,	45.13	45.17	44.46	45.28	45.60	43.93	43.42
Fat,	12.30	10.55	10.67	10.62	9.57	9.20	9.23

The average retail price in 1899 was $24.00 a ton and a steady advance has been noted since that time. It is evident that the highest grade meal (Arkansas and Texas product) is not now being shipped into Massachusetts markets.

Low grade meal. Four samples of Sea Island meal collected averaged 24.12 per cent protein and retailed for about $26.00 a ton. Two samples of Glenwood brand, put out by D. L. Marshall & Co. averaged 20.88 per cent protein and 4.83 per cent fat and sold for $26.00 a ton. One sample put out by the Narragansett Milling Co. bore a 38 per cent protein guarantee and tested 23.34 per cent protein. A sample of Star brand, bearing the name of J. Lindsley Wells & Co., Memphis, was guaranteed 38.62 per cent protein and showed but 33.34 per cent.

Cottonseed meal testing 24 per cent protein does not have more than 60 per cent of the value of that testing 40 per cent when used for fertilizing purposes, and not over 70 per cent. of the value of 40 per cent meal when used for feeding purposes. At prevailing prices the low grade meals are *very expensive. Why do farmers buy them!!*

Linseed meal. Of the seven samples of new process meal collected, five samples met their minimum guarantee of 36 per cent protein; two samples tested only 33 per cent protein and were classed as second grade meals. It is understood that flaxseed is not being treated by the naptha process for the removal of the oil to such an extent as formerly.

Nineteen samples of old process meals were examined, of which fifteen tested 32 or more per cent of protein and were classed as first grade, and four averaged 30.43 per cent protein and were designated second grade meals. The price asked for the second grade meals was 29 cents a ton more than that charged for those of first quality. Economical buyers should carefully scrutinize both the minimum guarantee and the name of the manufacturer before purchasing.

AVERAGE ANALYSES AND RETAIL PRICES.

	New Process.			Old Process.		
	1904	1905	1906	1904	1905	1906
No. Samples,	6	6	7	15	15	19
Protein,	37.24	37.49	35.82	33.10	34.29	33.57
Fat,	3.46	2.49	2.51	8.00	7.91	7.76
Price a Ton,	$28.75	$31.50	$32.46	$29.00	$33.87	$34.00

The new process meals tested rather below the protein percentage found in 1904 and 1905; the price was one dollar a ton higher than last year. The old process meals showed no striking difference in composition or cost from those examined in 1905.

Corn Gluten By-Products **Pages 10-11.**

Gluten meal and germ oil meal were not found in the market. It is understood that the former is no longer manufactured, and that the latter is sold abroad as oil cake.

Gluten feed. Thirty-two samples of gluten feed are reported, of which 13 tested above 24 per cent protein and are classed as first grade, and 19 tested below 24 per cent and are referred to as second grade. One sample from Deutsch and Sickert, put out by the Lexington Grain Co. tested but 19.62 per cent protein; two samples of Bay State averaged only 20.33 per cent protein; one sample of New England showed 20.40 per cent protein. These low testing goods were guaranteed to contain 22 per cent protein,[1] and retailed for fully as much as many goods testing 24 or more per cent. They were not adulterated, but were the result of corn low in protein, or of imperfectly developed corn, which prevented a satisfactory separation of the starch.

AVERAGE ANALYSES AND RETAIL PRICES.

	1905.		1906.	
	First Grade.	Second Grade.	First Grade.	Second Grade.
No. Samples,	55	8	13	19
Protein,	25.01	17.71	24.98	22.59
Fat,	3.56	3.91	3.21	4.72
Price a Ton,	$26.60	$26.43	$28.00	$26.94

In composition, the first grades average about the same as in 1905, while the quality of the second grades shows a distinct improvement. Prices have ruled somewhat higher the present year.

Distillers' and Brewers' By-Products. Pages 12-13.

Distillers' grains. Twenty-two samples were collected and examined. Those testing above 31 per cent protein are classed as first grade, and those below, as second grade. The composition of the same brand frequently shows considerable variation. Thus four samples of Fourex average noticeably above 31 and three samples below.

Two samples of Blue Ribbon brand put out by the C. A. Krause Grain Co. of Milwaukee were not guaranteed; two other samples bore a guarantee of 33 per cent protein, and the four samples averaged 24.95 per cent. protein, and retailed for fully as much as the best grades. These goods had a dark color, a charred appearance, a strong acid taste and a smoky odor, and could not be considered in any way satisfactory.[2]

[1] One sample of Bay State had a protein guarantee of 24 per cent.

[2] A first grade of distillers' grains should contain at least 30 per cent protein, be light in color, free from a burnt odor, and should taste only slightly acid. Such goods are economical for milk production. The consumer should critically inspect the article before buying.

AVERAGE ANALYSES AND RETAIL PRICES.

	1904.	1905.	1906. First Grade.	1906. Second Grade.	1906. Average.
No. samples,	15	23	12	10	22
Protein,	32.43	32.00	32.28	26.92	29.85
Fat,	12.48	11.90	12.87	10.43	11.75
Price a ton,	$27.12	$27.29	$28.23	$28.13	$28.18

Malt sprouts. These goods are sold and appreciated only in restricted localities. They may be regarded as an economical feed.

AVERAGE ANALYSES AND RETAIL PRICES.

	1904.	1905.	1906.
No. samples,	8	11	6
Protein,	26.85	26.52	27.66
Fat,	1.22	1.06	1.51
Price a ton,	$19.25	$22.55	$21.13

The quality of the sprouts offered was fully as high as formerly, and the price not excessive. One sample, testing 23.04 per cent protein, is not included in the above average.

Brewers' dried grains. Heretofore but few brewers' grains have been for sale in Massachusetts. Of late the Ralston Purina Mills have been offering the by-product of the Anheuser Busch breweries. This feed was of a light color, free from any undue acidity, and substantially maintained its guarantee. Experiments with brewers' grains have shown them to be an economical and satisfactory protein concentrate, both for dairy stock and for horses.[1]

Wheat By-Products. **Pages 13–18.**

It is a source of satisfaction to note that many mills and large jobbers are placing a guarantee of composition upon their mill by-products.[2] The writer would especially urge upon all manufacturers not to run the screenings, either ground or unground, into their several brands. It is believed that the addition of light oats, hulls, weed seeds and the like will in the end work fully as much harm to the manufacturers as to the consumers.

Wheat middlings were found, on the whole, to be of good quality. From a nutritive standpoint they are often cheaper than bran or mixed feed. The consumer should refuse to purchase those containing the black, partially broken hulls of weed seeds.

[1] See Bulletin 94, entitled Distillery and Brewery By-Products.

[2] In the present collection some 21 different brands bear a guarantee.

Mixed feed is very popular at present ; some brands contain scarcely any middlings, while others have a liberal admixture. Among the latter, free from screenings, were noted the Occident, Try Me, Wirthmore, Snowflake, Albatross, Phoenix, Goldmine and Boston.[1]

Wheat bran, when free from screenings, was of good average quality.

Buyers are cautioned against the poorly cleaned article.

AVERAGE ANALYSES AND RETAIL PRICES.

	1904.	1905.	1906.
		Wheat Middlings, Flour.	
No. of samples,	9	21	26
Protein,	18.70	16.20	17.67
Fat,	4.62	4.20	4.83
Price a ton,	$28.72	$27.82	$25.79
		Wheat Middlings, Standard.	
	1904.	1905.	1906.
No. of samples,	22	58	35
Protein,	17.64	15.93	17.30
Fat,	5.22	4.82	5.39
Price a ton,	$26.29	$24.39	$24.62
		Wheat Mixed Feed.	
	1904.	1905.	1906.
No. of samples,	72	128	67
Protein,	16.50	15.09	16.29
Fat,	4.62	4.45	4.71
Price a ton,	$25.87	$24.39	$23.99
		Wheat Bran.	
	1904.	1905.	1906.
No. of samples,	15	36	31
Protein,	16.07	14.39	15.11
Fat,	4.44	4.55	4.77
Price a ton,	$24.40	$23.09	$23.18

The quality of the several products appears to be better than that put out a year ago. The retail prices show no substantial variation.

[1] It is understood that the more middlings present, the more valuable the feed. Dairymen may often find it to their advantage to purchase bran and fine middlings separately and mix in the proportion by weight of two-thirds bran and one-third middlings, or one-half of each.

Wheat Feeds with Admixtures. Page 17.

These feeds appear to be confined to two brands, the Indiana and Jersey, the former bearing the name of J. E. Cressey & Co., and the latter of the Indiana Milling Co., Terre Haute. They were not generally offered, but samples were collected from Griffin Bros. and Mackenzie & Winslow, Fall River; J. A. Bouvier, J. Franks and Hathaway & Mackenzie of New Bedford; Malden Grain Co., Malden, and H. K. Webster, Lawrence. These brands are guaranteed to consist of wheat bran, winter wheat middlings, winter wheat ship stuff, and corn cob meal. The samples collected consisted principally of bran and ground corn cobs, in the proportion of approximately 1,400 to 1,500 pounds of the former and 500 to 600 pounds of the latter. They averaged 12.69 per cent of protein and 3.54 per cent fat, against 15.11 per cent protein and 4.77 per cent fat in wheat bran, and sold for $22.86 a ton, against an average of $23.18 for bran. Such material cannot be worth more than the bran which it contains, minus the cost of freight at the rate of $5 a ton on the cobs. Our observations lead us to infer that these goods are frequently offered untagged, or sold for straight bran, the tags having been removed before delivery. *We cannot caution buyers too strongly to be—on their guard—against such deception.*

Dairy Feeds. Page 19.

These feeds are composed of a mixture of several grains or by-products, and are evidently intended as a complete grain ration for dairy stock.

Biles' Union Grains contained distillers' dried grains, malt sprouts, oat and wheat by-products, hominy, linseed and cottonseed meals and salt. It met its guarantee, and cost from $28 to $30 a ton.

Creamery feed, put out by the Buffalo Cereal Co., met its 20 per cent protein guarantee, but fell short of its 5 per cent fat guarantee some three-quarters of a per cent. Oat, corn and wheat by-products, as well as cottonseed and linseed meals were noted in its composition; it retailed at $24 to $29 a ton.

Chapin's alfalfa meal is not a straight ground alfalfa hay, but a mixture of alfalfa meal, distillers' dried grains, mill products of oats and wheat and cottonseed meal. It substantially met its 20 per cent protein and 4 per cent fat guarantees. It had nearly 17 per cent of fiber, due to the presence of the alfalfa hay. The retail price was about $26 a ton.

Vulcan blended grains fell a little below its 24 and 7 per cent guarantees; its retail price was $28 a ton. The mill products of wheat, as well as malt sprouts, cottonseed and linseed meals, a little barley and corn, were noted in its composition.

Algrane butter feed contained oats, corn, wheat and peanut by-products and cottonseed meal. It met its guarantee of 18 per cent protein and 4.5 per cent fat, and retailed for $28 a ton.

Algrane milk feed tested 14.62 per cent protein and 3.73 per cent fat, and sold for $28 a ton. Considerable oat residue, as well as some corn and wheat by-products and a little cottonseed meal were noted in its composition.

H-O dairy feed more than met its 18 and 4.5 per cent guarantees, and retailed for $28 a ton. It was made up of noticeable quantities of oat residues, broken corn, wheat and peanut products and cottonseed meal.

Protena dairy feed contained alfalfa meal as a basis, together with corn and wheat products and cottonseed meal. Five samples averaged 20.02 per cent protein, 3.59 per cent fat and 17 per cent fiber, the latter due to the presence of the alfalfa. The cost was about $26 a ton.

While many of the above proprietary mixtures ought to prove quite satisfactory as a complete grain ration for dairy stock, it is believed that dairymen, by following the instructions in this bulletin can prepare equally as desirable and in most cases better rations for less money.

Molasses Feeds.
Pages 20-21.

Most of these feeds have the same type of composition, namely the by-products of oats and barley, malt sprouts and grain screenings in some cases, one-third molasses, together with gluten feed, cottonseed meal or other high grade protein concentrates.

Molac dairy feed substantially met its 16 per cent protein and 3 per cent fat guarantees, and retailed for about $24 a ton. It averaged 12.50 per cent fiber, indicating rather more hulls than some other brands. Weed seeds were noted.

Molac horse feed tested 10.70 per cent protein, 2.70 per cent fat and 13.31 per cent fiber. Weed seeds (screenings) were noted. Both the above feeds are coarse and show the presence of considerable quantities of grain hulls.

Sucrene and Green Diamond feeds resemble each other in appearance and chemical composition. The average of 7 samples of the former showed 17.02 per cent protein, 3.33 per cent fat, and it retailed for $25.57 a ton. Seven samples of the latter averaged 15.51 per cent protein, 2.79 per cent fat, and it sold for $25.14 a ton. Sucrene contained 8.83 fiber and Green Diamond 10.50 per cent, showing that the latter contained rather more grain hulls. In both brands weed seeds were quite noticeable.

Sucrene horse feed is similar to Sucrene dairy feed, excepting that it contains less protein: its retail price was about $27 a ton.

Holstein feed is coarse in appearance; it was guaranteed to contain 15.23 per cent protein and 3.27 per cent fat, while less than 12 per cent protein and 2 per cent fat were found. A similar shortage was noted last year.

Hammond feed was also rather below its protein guarantee, the same as a year ago. It contained 11.88 per cent fiber, showing the presence of approximately 25 per cent grain hulls.

Payne's alfalmo feed is composed principally of alfalfa meal and 50 to 60 per cent molasses.[1] It contained but 10.53 per cent protein and 0.33 per cent fat, against a guarantee of 15 and 3.50.

Mueller's molasses grains, a mixture of brewers' dried grains, malt sprouts, dried beet pulp and molasses, was decidedly below the protein guarantee. The careful buyer will pass by feeds showing such a discrepancy.

The better grades of molasses feeds test rather higher in protein than formerly, are readily eaten, and can be safely fed as the entire grain ration if desired. At prevailing prices they do not furnish digestible matter as cheaply as it can be obtained from home mixed rations and as sources of digestible protein they are *decidedly expensive.* The writer cannot from a standpoint of economy advocate these mixtures in place of those that can be made by the ordinary

[1] This feed was abnormally high in moisture—26.74 per cent—and is likely to undergo decomposition during warm weather.

dairyman from cottonseed meal, gluten feed, distillers' and brewers' dried grains, malt sprouts, flour middlings, corn and hominy meals.

II. Starchy (Carbohydrate) Feeds.

Corn and Hominy Meals. **Pages 22-23.**

Corn meal. It is not possible for the station to make a general inspection of the corn meal in the market. Samples are examined only when particular information is requested, or when unusual conditions are noted.

The A and B brands of meal, put out by the Buffalo Cereal Co., evidently have been screened or sifted, the A brand representing the finer and the B the coarser portions. The A brand has the more attractive appearance, and contains noticeably less protein and fat and more starch than the B. If sweet, the latter is likely to prove fully as satisfactory a food for animals.

Damaged corn meal, which continues to be offered, has a dark, scorched appearance, and a mouldy, sour taste. It has not been injured sufficiently to interfere with its normal protein, fat and fiber percentages. It is not considered suitable for cattle and horses. After cooking it can probably be used (with care) as a food for swine.

Second grade corn meal, which is frequently shipped from the west, is made from imperfectly developed corn ; it contains less starch and is not as valuable as the fully developed grain.

Hominy meal or chop, the residue from hominy mills and breweries, is usually derived from white corn, although lots from yellow corn are occasionally noted.[1] The samples collected were bright in appearance and sweet to the taste ; such material is equal in feeding value to an average quality of corn meal.

One sample of *Star brand*, put out by the Toledo Elevator Co., contained an admixture of *corn cobs* ; it tested 8.65 per cent protein and retailed for $24.00. A word to the wise, etc.

[1] White and yellow varieties have substantially equal nutritive value.

AVERAGE ANALYSES AND RETAIL PRICES.

	1905.	1906.
No. samples.	70	63
Protein.	10.25	10.54
Fat.	8.09	8.48
Price a ton.	$24.41	$24.32

These feeds may be divided into two classes:

Corn and Oat Feeds. **Pages 23-24.**

Class 1. Those consisting of a mixture—in varying proportions—of broken corn and oat residues, occasionally a small amount of flour middlings to increase the protein, and frequently a little salt. In some brands the corn was of poor quality, being bitter, musty and sour. To class 1 belong the Victor, Husted's, Monarch chop and provender, Buffalo Horse and Dairy Co.'s horse feed, Ellsworth & Co.'s De Fi, Great Western Cereal Co.'s Boss, H-O Co.'s New England stock, Oneonta provender, and Cressey & Co.'s XX Badger.[1]

Class 2. Mixtures of hominy, light oats and oat residues. To some brands are added oat or wheat middlings to raise the protein percentage and salt to increase the palatability. Many feeds in class 2 have a bright, clean appearance, a sweet taste and apparently more hominy than there is corn in class 1. Among the feeds in this class may be mentioned Diamond E. & M. Co.'s O. O. white, Great Western Cereal Co.'s Excelsior, Chas. M. Cox Co.'s Wirthmore, Flint Mill Co.'s Pearl Cooked, Haskell's stock and Sykes C. and G. Co.'s Best.

The thirty samples of corn and oat feeds reported on pages 23-24 averaged 9.47 per cent protein and 4.67 per cent fat, and varied in price from $23 to $27 a ton.

The protein and fat percentages, the approximate quantity of hulls present and the appearance and taste are the factors to be considered in estimating the relative values of these feeds.

Inasmuch as nice bright corn or hominy meal can generally be bought for the same price, or even less, the writer fails to see the economy of purchasing most of these mixtures!!! Is not the writer correct?

[1] This feed contained some hominy. It repeatedly falls decidedly below its protein guarantee.

Schumacher's stock food represents the corn, oat and barley residues from the manufacture of cereal products for human consumption. It was guaranteed 11-13 per cent protein and 4-5 per cent fat, and contained 11 per cent protein, 4.2 per cent fat, 10.6 per cent fiber, and retailed at from $25 to $26 a ton. This feed does not contain a much larger proportion of hulls than is to be found in ground oats, and at the price asked may be considered a reasonably economical food for horses, but not as desirable as corn or hominy meals for swine and dairy cattle.

Fortified Starchy Feeds. **Pages 24-25.**

The feeds included in this class evidently are intended as a food for horses, to be sold at somewhat less than straight corn and oats. They averaged 12.85 per cent protein and 5.20 per cent fat, and had an average retail price of $26.46 a ton. The several brands enumerated below fully met their guarantees:

Quaker dairy consisted of oat residues and a protein concentrate. This brand generally contains about twice the quantity of hulls that is found in pure ground oats. It was sweet and retailed for $24 a ton.

Queen stock food consisted largely of hominy, some oats and barley or their residues, a protein concentrate and salt. Screenings were noted in one case. Its retail price was $27 a ton.

Buffalo Cereal Co.'s horse feed was made up largely of the mill products of oats and some corn. It cost $26 a ton.

Buffalo Horse and Dairy Co.'s horse feed may be spoken of as a fortified oat feed. The sample had a rancid and sour taste, but was of good color. It cost $25 a ton.[1]

O. K. horse feed was a mixture of corn, hominy, oat and wheat products.

H-O horse feed contained oat and peanut residues, corn and a wheat product. It had a dark color; the retail price was from $25.50 to $29 a ton.

It is unquestionably true that these feeds possess considerable merit providing they are sweet, do not contain too large a proportion

[1] Another feed bearing the same name, guaranteed and testing lower in protein is referred to in class 1 of the previous group.

of oat hulls and can be bought at a reasonable figure. Fortified feeds consisting almost entirely of oat residues are likely to contain an excess of oat hulls, which render them unfit to be fed unless mixed with corn, hominy or other products. It is the belief of the writer that, as a rule, it will be the part of economy to purchase a mixture of one-third ground oats and two-thirds cracked corn in place of most of the above mixtures.

Miscellaneous Starchy Feeds. Page 25.

Oat feeds. Nine samples of oat feeds, representing five different brands, were collected. They contained from 3.43 to 8 per cent protein, and from 1 to 2.92 per cent fat, and retailed at from $17 to $23 a ton. Such material consists of from 60 to 80 per cent hulls, and at prices asked must be a very expensive feed.

Zest and shredded wheat feeds represent the residues or waste from the manufacture of wheat foods for human consumption. As a food for young chickens they probably have a special value, because of their mechanical condition and high digestibility.

Dried grains, put out by A. H. Brown & Bros., is evidently the residue from the manufacture of Mellen's or a similar food. If it does not contain over 8 per cent of fiber, it may have 80 per cent of the feeding value of corn meal.

Dried beet pulp is the residue of the beet after the extraction of the sugar. It has approximately two-thirds to three-fourths of the feeding value of corn meal. As high as 8 to 10 pounds can be fed daily, but so large an amount should be thoroughly moistened with water at least several hours before feeding. The New Jersey station reports some 10 per cent more milk from a daily ration containing 9 pounds of dried beet pulp (soaked before being fed) than from one containing 45 pounds of corn silage.

Poultry Feeds.

Massachusetts has a large poultry industry, and a great variety of feed stuffs are offered; the number of brands in the market shows steady increase from year to year.

Animal By-Products. **Pages 26-27.**

Meat scraps are relatively coarse dry material of varying proportions of flesh, bone and fat. During the summer months lots of tainted scraps are frequently found. Preference should be given to bright, clean goods, free from taint, ground neither too coarse nor too fine, possessing a high protein content (50 per cent) a moderate amount of ash (20 per cent) and not over 15 per cent of fat. The 16 samples reported have been divided into first grade,—those testing 45 per cent protein or above—and second grade,—those testing below 45 per cent protein. The 12 first grade scraps averaged 51.07 protein, 15.29 fat and 22.43 ash, and the average retail price was $2.53 a hundred. The second grade scraps averaged 41.09 protein, 14.47 fat and 33.54 ash; the average retail price was $2.40 a hundred. These scraps contained more bone and less meat than the first grade. The station cannot recommend any particular brand. Buyers are advised to study the analyses given on pages 26-27, to note the odor and mechanical condition of the goods, and to purchase accordingly.

Meat and bone meals are not so freely offered as meat scraps. They are dry, finely ground, contain less meat and fat and noticeably more ash than do the scraps. To be of first grade, they should contain 40 per cent protein, 10 per cent fat, 40 per cent ash, and be free from bad odor. They are worth in the vicinity of 20 per cent less than first grade scraps. The 9 samples reported have been divided into first and second grades, depending upon the protein per cent.

Bone meals, a few samples of which were collected, have been made from either kettle rendered bone, or from bone steamed under pressure. The latter contains rather less protein and can be sold at a little lower price. Two samples collected fell decidedly below their guarantees.

Meals and Mashes. Pages 28–29.

These mixtures are composed chiefly of corn, ground hulled oats or oat residues, wheat or wheat by-products and fortified with some animal by-product or with cottonseed or linseed meal, and sometimes lightened with ground alfalfa, clover, or breakfast food waste. Charcoal is often observed, (used as an anti-ferment,) and occasionally grit or shells. It is not good economy to purchase goods containing the latter materials, the presence of which can be detected by the ash percentage (over 5 per cent) or often with the unaided eye. Ground barley, rye, millet seed, buckwheat and peas are occasionally observed, all of which, are in no way objectionable. One also notes in some brands peanut waste, buckwheat hulls, oat hulls and weed seeds, none of which in any quantity belong in a first class food. These mixtures vary from 11 to 23 per cent protein, from 2.5 to 6.5 per cent fat, and from 3 to 18 per cent ash, showing that the makers had no definite ideas concerning the nutrients needed, and that in some cases they were put together as cheaply as possible. The average retail price was about $1.75 a hundred pounds, whether they contained much or little protein and ash.

It is a fact that exact knowledge concerning the nutrition of poultry and particularly of laying fowls is exceedingly limited, and the present understanding of the subject is based largely upon observation and experience, rather than upon strictly scientific inquiry. Judging from the composition of the egg and from a variety of experiments, it is recognized that laying hens must have a food which contains a liberal percentage of protein to produce the egg white and yolk, considerable fat to furnish material for building the fatty part of the yolk[1], and a moderate amount of ash. Experience has taught that the cereals alone do not furnish protein and ash as rapidly as they are needed by fowls bred for egg production, nor to induce the quickest development of growing stock. From its observations, the Maine experiment station recommends the following mixture for layers; 200 lbs. wheat bran, 100 lbs. middlings, 100 lbs. gluten meal,[2] 100 lbs. linseed meal, 100 lbs. corn meal and 100 lbs. beef scraps; this combination contains approximately 24 per cent protein, 7 per

[1] Whether the yolk can be formed as easily from the starchy matter and protein has not so far as the writer is aware, been scientifically demonstrated.

[2] Out of the market: substitute gluten feed.

cent fat, 6 per cent ash, 7 per cent fiber, and 46 per cent starchy matter, and would cost $1.50 a hundred unmixed at retail. The writer has had good success with a mixture of 100 lbs. corn meal, 50 lbs. wheat bran, 50 lbs. flour middlings, 50 lbs. gluten feed and 50 lbs. beef scrap; it contains 22 per cent protein, 6 per cent fat, 5 per cent ash, 4 per cent fiber and 51 per cent starchy matter, and costs $1.50 a hundred unmixed at retail. The scrap may be omitted and mixed in with the grains as often as it is deemed necessary. Such mixtures may be fed either dry, or made into a friable mash with skim milk or hot water together with a little salt. Either of the above combinations will certainly be productive of good results and will cost less than the average ready ration.

After a chemical and microscopic study of the various poultry mashes on the market, the writer suggests the following *don'ts*!

1. Don't buy a feed that contains much in excess of 5 to 6 per cent ash.

2. Don't buy a feed that has noticeable quantities of grain hulls, hay or weed seeds.

3. Don't purchase one that is guaranteed to contain less than 15 per cent of protein.

4. Don't purchase a food that is bitter, mouldy or sour.

5. Don't fail to make a careful examination of both guarantees and physical condition before ordering.

6. Don't forget that if you are a large consumer, you can prepare a first class mixture for $1.50 a hundred pounds.

Scratching Grains.
Pages 29-31.

Chick feeds are composed of finely cracked wheat, corn, hulled oats, kaffir corn, and often millet seed, grit and charcoal. They average in the vicinity of 11 per cent protein and 3 to 4 per cent fat. A reasonable quantity of grit (10 to 15 per cent) is not objectionable, but it is generally more economical to purchase it separately than to pay 2½ or more cents a pound for it. These mixtures have been found to be sweet and of good quality in most instances. While from the standpoint of nutrition they must be considered expensive, yet the profit to the manufacturers is probably not excessive, because of the cost of cracking, screening and putting up in small packages. They furnish, with the addition of a little meat scrap, a very desirable food for the first four to six weeks of the life of the chick.

Poultry grains have been found to contain corn (whole and cracked), wheat, kaffir corn, barley, oats and sunflower seeds. Other constituents frequently observed are buckwheat, millet seed, peas, popcorn, screenings, charcoal, shells and grit. In some cases the corn was noticed to be of poor quality and the wheat shrunken. The average price was $1.85 a hundred pounds. The consumer should carefully observe before purchasing that the mixture is sweet and free from screenings and grit. The writer prefers to buy corn, oats, barley and wheat separately, believing it to be more economical. Mixtures of the above grains of good quality can be had for $1.50 a hundred. From the standpoint of economy, shells, grit and charcoal should likewise be purchased by themselves. While poultry need a variety of food, for economical reasons it is not advisable to feed too great a proportion of oats, buckwheat and barley, because these grains contain considerable woody fiber, which poultry are not able to digest and assimilate.

Red wheat vs. white wheat. It is doubtful if in case both varieties are equally well developed, one is to be preferred above the other. In fact, it is well known that both climate and soil have great influence on the quality of wheat, and gradually modify varieties. Shrunken wheat is likely to have relatively more protein in proportion to the starch than plump wheat, for the reason that the latter material has not had opportunity to become fully developed.

Alfalfa and clover meals are frequently found in the market. The former will contain 14 to 15 per cent protein, and the latter about 12 to 13 per cent. Ground alfalfa tops will test 18 to 20 per cent protein, and ground clover tops 15 to 16 per cent. The tops are much to be preferred for poultry. Poultrymen should grow their own clover, cutting and curing it when in the bud.

CONCENTRATED INFORMATION FOR BUSY FARMERS.

The Why of Grain Feeding.

Most of the home grown coarse feeds are high in carbohydrates, low in protein and comparatively indigestible. Such feeds, containing a high percentage of woody fiber, require considerable more energy for their digestion than do the grains and their by-products. Nearly all of the concentrates are very digestible, have comparatively little fiber, and many are high in protein and low to medium in carbohydrates. The concentrated feeds are used, therefore, in connection with the home grown coarse feeds, first, to increase the total digestible matter; second, to furnish food that will digest with a minimum expenditure of energy; and third, to increase the amount of protein in the daily ration.

An illustration. Many experiments have demonstrated that a 1000 pound cow producing daily 12 quarts of an average quality of milk, needs approximately the following amounts of digestible nutrients:

Digestible.	Protein.	Fat.	Fiber and Starchy Matter.	Total.
Pounds,	2 to 2.5	.5	13.00	16.00

Now if the animal were fed daily as much of an extra quality of hay as she could consume, she would receive:

Digestible.	Protein.	Fat.	Fiber.	Starchy Matter.	Total.
Pounds,	1.3	.3	5.4	7.60	14.60

The ration is deficient both in total nutrients and in protein, for the reason that the hay has comparatively a low digestibility, and lacks protein. If 7 pounds of the hay were replaced by an equal weight of corn meal, the hay and corn meal would furnish:

Digestible.	Protein.	Fat.	Fiber.	Starchy Matter.	Total.
Pounds,	1.4	.47	4.1	10.25	16.22

The corn meal being very digestible but a one-sided or starchy feed, would sufficiently increase the total digestible nutrients, but not the protein. If four pounds of the corn meal were replaced by two pounds of bran and two pounds of cottonseed meal, the several nutrients would supply:

Digestible.	Protein.	Fat.	Fiber.	Starchy Matter.	Total.
Pounds,	2.17	0.60	4.25	8.83	15.85

The replacing of seven pounds of hay with three pounds of corn meal rich in digestible matter, and with four pounds of bran and cottonseed meal especially rich in digestible protein, furnishes a ration containing less fiber and more starchy matter than is contained in the hay; such a combination likewise gives the required amount of total digestible matter, and digestible protein.

Home Grown Protein.

Is it possible for the Massachusetts farmer to grow economically the larger part of the protein needed by his dairy stock? The writer, in view of his observation and experience, is obliged to return a negative answer. The leguminous crops best suited to New England conditions are peas, vetches, clovers and soy beans.

Peas sown with oats in the Spring produce a satisfactory green crop for July soiling, and furnish rather more protein than oats sown by themselves.

Peas grown as a grain crop, while a satisfactory source of protein, do not recommend themselves as economical for Massachusetts conditions.

Spring vetch can be sown with oats in a manner similar to peas, but the seed costs more, and it is no more valuable for forage than the latter.

Sand vetch can be sown with wheat about September 1st, and yields an excellent forage from May 25th to June 7th. The vetch, however, is a poor seeder and the seed is quite expensive ($6.00 to $7.50 a hundred pounds). It cannot therefore, be considered an economical forage plant.[1]

Alfalfa is too uncertain a crop at the present time to recommend itself to Massachusetts dairymen. It is worthy of trial in a small way on well drained land free from a hardpan subsoil. Whether it will be a profitable crop for general use in Massachusetts, is yet to be demonstrated.[2]

Clover in the writer's judgment may be considered the alfalfa of the eastern states, and it deserves a great deal more attention from dairy farmers than is ordinarily given it. It is really a biennial, or at least a short lived perennial, and is best grown in rotation. It is preferred to sow the seed about August 1st at the rate of 15-20

[1]Fifteenth report of Hatch Experiment Station, pp. 63-67.
[2]Eighteenth report of Hatch Experiment Station, pp. 42-43.

pounds to the acre. An application of 150 pounds of high grade sulfate of potash, 500 pounds of phosphatic slag,[1] and 50 to 100 pounds of nitrate of soda to the acre will prove decidedly beneficial.[2] Two and perhaps three cuttings should be expected the next season, with a total yield of three or more tons to the acre. Three tons would furnish some 3000 pounds of digestible matter, which would include nearly 500 pounds of digestible protein. The clover can be used as a soiling crop or hayed. The fertilizer and labor cost of clover production is comparatively low, it improves the mechanical condition of the soil, leaves the soil richer in nitrogen, is a large producer of protein, and is well adapted to climatic conditions ordinarily prevailing in Massachusetts. It is the most satisfactory crop for the production of home grown protein.[3]

Soy beans, of which Brooks' medium green is the most suitable variety, is worthy of consideration as a source of home grown protein. Sixteen quarts of seed are required to the acre, which may be sown in drills 2½ feet apart with an Eclipse or similar corn planter. Time of seeding, method of fertilizing[4] and cultivation are much the same as for corn.

The yield of green fodder will be from 8 to 10 tons to the acre, and cutting may begin August 20th, if used for soiling. The crop may also be harvested at the same time as corn and ensiled (one-third beans and two-thirds corn), which is probably the best way of utilizing the plant. An acre of soy beans will furnish about 3,000 pounds of digestible dry matter including 630 pounds of digestible protein, against 4000 pounds of digestible dry matter including 275 pounds of total digestible protein from an acre of corn. While the corn and bean mixture makes a satisfactory feed, it is believed that the value of the extra protein from the bean is more than offset by the increased yield of total digestible matter from the corn and by the increased cost of caring for and harvesting the crop of beans.

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1. Or 300 pounds of acid phosphate if basic slag is not obtainable.

2. The amount of plant food needed will depend upon the condition of the land and its previous treatment. If previously dressed with considerable quantities of barnyard manure, the nitrate of soda may be omitted.

3. See the excellent treatise on clover in *Massachusetts Crop Report* for July, 1906, by W. P. Brooks, published by State Board of Agriculture, Boston.

4. As a fertilizer for this crop to be sown broadcast in the spring, the following is recommended per acre: 50 lbs. nitrate of soda, 400 lbs. dry ground fish, 300 lbs. acid phosphate and 200 lbs. high grade sulfate of potash.

Soy beans mature their seed and yield 1200 to 1500 pounds (20 to 25 bushels)[1] per acre. The seed is very digestible and the above yield will furnish 1,000 pounds of digestible organic matter, of which one-half will be digestible protein. Fifteen hundred pounds of cottonseed meal will furnish a like amount of digestible organic matter and protein,[2] which at present market prices has a value of $25. Inasmuch as the soy bean straw has no feeding value, the yield of fifteen hundred pounds of beans to the acre would not be considered sufficient to warrant the growing of the seed for feeding purposes. It is believed therefore, that under present conditions it will prove more economical as a rule for dairymen possessing satisfactory markets and railroad facilities, to purchase their protein in the form of high grade concentrates, rather than to attempt to grow it in the form of soy bean forage or seed.

What Kinds of Grain shall the Dairyman buy?

In spite of the fact that it is possible by the aid of clover, peas and similar crops to produce considerable protein upon the farm, the Massachusetts dairyman will still find it necessary to purchase no small amount of grain if the dairy herd is to be kept in a profitable working condition.

The chief and most economical sources of protein are to be found in the form of cottonseed and linseed meals, glutens, distillers' and brewers' dried grains, malt sprouts, bran and middlings,—by-products from the oil, glucose, beer, whiskey and flour industries. Generally speaking the higher the protein percentage in the feed the more economical it is as a source of protein. Thus by making a reasonable allowance for the value of the starchy matter and fat, cottonseed meal is generally the cheapest source of protein, followed in succession by gluten feed, distillers' grains, brewers' grains, flour middlings, standard middlings and bran. This order is not always likely to hold true because of market fluctuations. Bran while relatively expensive as a source of nutrition, is valuable as a diluter or distributer of the heavy concentrates, and as a slight laxative.

Corn, hominy and barley meals are about equally nutritious, and the most economical carbohydrates. Since the average farmer pro-

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1. A legal bushel is 58 lbs.

2. Brooks has pointed out (Sixth report of this station pp. 13-14) that soy bean meal produced rather more milk and a better quality of butter than cottonseed meal. Like quantities of the two meals however must have somewhat similar values for the purposes of nutrition.

duces these cereals, and because of their deficiency in protein and mineral ingredients, it will not as a rule be good economy for him to purchase them in any considerable quantity excepting to supplement his home products to be fed to poultry, horses and swine. Milk producers on the other hand whose cultivated area is limited, and who *purchase all* of their grain, will find it advisable to have one-third of their grain ration consist of corn or hominy, in order to secure the necessary digestible matter.

Many of the proprietary dairy feeds, as well as mixtures of corn and oat residues are quite deficient in protein and relatively expensive.

PROPRIETARY AND HOME MIXED GRAIN RATIONS.

Home Mixed Rations. A home mixed ration may be prepared on the farm by combining two or three standard concentrates such as are to be found in nearly all local markets.

The following types are suggested :

1.

100 lbs. wheat bran,
100 lbs. flour middlings,
150 lbs. gluten feed,
Mix and feed 7 lbs. (8-9 qts.) daily.

7 lbs. contains :

1.25 lbs. digestible protein,
5.00 lbs. digestible organic matter.
Ration costs 9.2 cents.
1 lb. digestible protein costs 4.3 cents.
1 lb. digestible organic matter costs 1.84 cents.

2.

100 lbs. wheat bran,
100 lbs. gluten feed,
35 lbs. cottonseed meal,
Mix and feed 7 lbs. (8-9 qts.) daily.

7 lbs. contains :

1.40 lbs. digestible protein,
4.70 lbs. digestible organic matter.
Ration costs 9.3 cents.
1 lb. digestible protein costs 4.17 cents
1 lb. digestible organic matter costs 2.00 cents.

3.

125 lbs. wheat bran,
100 lbs. cottonseed or linseed meal,
125 lbs. corn or hominy meal,
Mix and feed 7 lbs. (8 qts.) daily.

7 lbs. contains:

1.24 lbs. digestible protein,
4.66 lbs. digestible organic matter,
Ration costs 9.3 cents.
1 lb. digestible protein costs 4.46 cents.
1 lb. digestible organic matter costs 2.00 cents.

4.

150 lbs. bran,
200 lbs. gluten feed.
Mix and feed 7 lbs. (9 qts.) daily.

7 lbs. contains :

1.25 lbs. digestible protein,
4.80 lbs. digestible organic matter.
Ration costs 9.1 cents.
1 lb. digestible protein costs 4.3 cents.
1 lb. digestible organic matter costs 1.9 cents.

5.[1]

200 lbs. distillers' grains,
150 lbs. flour middlings,
Mix and feed 7 lbs, (8-9 qts.) daily.[2]

7 lbs. contains:

1.4 lbs. digestible protein,
5.2 lbs. digestible organic matter.
Ration costs 9.6 cents.
1 lb. digestible protein costs 3.8 cents.
1 lb. digestible organic matter costs 1.9 cents.

6.

100 lbs. malt sprouts,
125 lbs. corn or hominy meal,
125 lbs. gluten feed.
Mix and feed 7 lbs. (7 qts.) daily.

7 lbs. contains:

1.12 lbs. digestible protein,
5.19 lbs. digestible organic matter,
Ration costs 8.7 cents.
1 lb. digestible protein costs 4.1 cents.
1 lb. digestible organic matter costs 1.7 cents.

7.

150 lbs. brewers' grains,
100 lbs. corn or hominy meal.
100 lbs. gluten feed.
Mix and feed 7 lbs. (8 qts.) daily.

7 lbs. contains:

1.14 lbs. digestible protein,
4.7 lbs. digestible organic matter.
Ration costs 8.8 cents.
1 lb. digestible protein costs 4.4 cents.
1 lb. digestible organic matter costs 1.9 cents.

8.

200 lbs. brewers' grains,
100 lbs. corn meal.
50 lbs. cottonseed meal.
Mix and feed 7 lbs. (9 qts.) daily.

7 lbs. contains:

1.26 lbs. digestible protein,
4.40 lbs. digestible organic matter.
Ration costs 8.9 cents.
1 lb. digestible protein costs 4.2 cents.
1 lb. digestible organic matter costs 1.9 cents.

Proprietary Grain Rations. By a proprietary mixture is meant a combination of several grains or by-products offered as a complete or ready grain ration for dairy stock. The requirements of a ready ration may be outlined as follows:

1. It must be bulky, one pound measuring from one to one and two-tenths quarts. Heavy rations are likely to cause indigestion.

2. It must be palatable and free from mould and rancidity.

3. It should contain 16 to 18 pounds of *digestible* protein in 100. The total protein in such a mixture should be at least 70 per cent digestible, and better 80 to 85 per cent. If the total protein was only 70 per cent digestible, it would be necessary to supply 24 per cent in the ration (70 per cent of 24 = 16.8); if 80 per cent digestible, 21 per cent would be required (80 x 21 = 16.8).

4. It should contain approximately 70 pounds of *digestible* organic nutrients in 100, and not over 9 per cent of total fiber. The fiber should not be derived from corn cobs or similar material.

---

1. Another ration may consist of 150 lbs. distillers' grains, 50 lbs. cottonseed and 50 lbs. bran. Mix and feed 7 lbs. (10 qts.) daily.

2. Six pounds of this mixture would make quite a satisfactory daily ration.

5. At the present prices of grain a ready ration meeting the above demands should not cost over $26 to $27 a ton, or $1.30 to $1.35 a hundred pounds.[1]

There are at best very few proprietary mixtures that fulfil the above requirements. The station is at present making a study of ready rations in order to ascertain more exactly their value as compared with those that may be prepared by the farmer.

That the several home mixed rations which precede, prepared from standard concentrates, meet the requirements as above outlined may be demonstrated by the following tabulation :

	One lb. measures in qts.	In 100 Pounds.					Cost of 2,000 Pounds.
		Total Protein.	Digestible Protein	Protein Digestible	Digestible Organic Matter.	Total Fiber.	
		lbs.	lbs.	%	lbs.	%	
Ration I...	1.3	21.4	18.0	84.0	71.0	6.9	$26.30
Ration II...	1.3	24.9	20.0	82.0	67.0	8.3	26.58
Ration III...	1.1	22.0	17.9	80.0	67.0	6.1	26.58
Ration IV...	1.3	22.0	18.0	82.0	69.0	8.4	26.00
Ration V...	1.2	26.3	20.0	78.0	74.3	8.4	27.42
Ration VI...	1.0	20.4	16.0	78.0	74.2	6.9	24.86
Ration VII...	1.1	20.4	16.3	80.0	66.9	7.7	25.14
Ration VIII...	1.3	22.7	18.1	80.0	62.8	8.3	25.42
Average.....	1.2	22.5	18.0	80.5	69.0	7.6	$26.04[1]

The table shows : That a pound of the several mixtures measures from 1 to 1.3 quarts, averaging 1.2 quarts ; that the rations contain from 20.4 to 26.3 per cent or pounds of total protein in 100, averaging 22.5 per cent, and that this protein is from 78 to 84 per cent digestible, averaging 80.5 per cent : that the rations contain from 16 to 20 per cent of digestible protein, averaging 18 per cent : that the rations average 69 pounds of digestible organic matter in 100, and 7.6 per cent of total fiber ; that a ton of the mixtures costs from $24.86 to $27.42, averaging $26.04.

[1] Prices of some concentrates have advanced since the above calculations were made. The difference, however, would not be marked.

Quantity of Grain Daily. The quantity of grain to be fed daily naturally depends upon the size of the cow, the quantity of the daily milk yield, and the local market value of the milk. The richer the milk the more food required to produce a given quantity and vice versa. Seven pounds daily is a fair average amount for cows weighing 800-900 pounds, which produce 10 quarts of 5 per cent milk daily. Grain prices continue high and feeders in localities where there is not a quick demand for milk may find it economy to use only 5 pounds of grain daily, and a maximum amount of home grown coarse feeds.[1] Heavy milking Holsteins weighing 1,200 pounds may require 12 or more pounds of grain daily, depending upon their ability to utilize it. It is not good economy to unduly force the cow, especially if it is desired to keep her in the herd from year to year.

The usual daily roughage ration to go with the grain mixtures will consist of what hay the animal will eat clean (18-24 lbs.) or one bushel of corn silage and 10-16 lbs. of hay.

1. Early cut hay, hay of peas and oats cut when in blossom, clover hay, rowen and well-eared corn silage all aid in reducing the grain bill.

WEIGHT vs. MEASURE OF CATTLE FOODS.

This table has been prepared by weighing a carefully measured quantity of the several feeds.

FEED STUFF.	One Quart Weighs.	One Pound Measures.
PROTEIN FEEDS.		
Cottonseed meal	1.5 lbs.	0.7 qts.
N. P. linseed meal	0.9 "	1.1 "
O. P. linseed meal	1.1 "	0.9 "
Gluten meal	1.7 "	0.6 "
Gluten feed	1.3 "	0.8 "
Germ oil meal	1.4 "	0.7 "
Distillers' dried grains	0.5-0.7 "	2.0-1.4 "
Malt sprouts	0.6 "	1.7 "
Brewers' dried grains	0.6 "	1.7 "
Wheat middlings (flour)	1.2 "	0.8 "
Wheat middlings (standard)	0.8 "	1.3 "
Wheat mixed feed	0.6 "	1.7 "
Wheat bran	0.5 "	2.0 "
H-O dairy feed	0.7 "	1.4 "
Oat middlings	1.5 "	0.7 "
Rye feed	1.3 "	0.8 "
STARCHY FEEDS.		
Whole oats	1.0 "	1.0 "
Ground oats	0.7 "	1.4 "
Whole wheat	1.9 "	0.5 "
Ground wheat	1.7 "	0.6 "
Whole barley	1.5 "	0.7 "
Barley meal	1.1 "	0.9 "
Whole rye	1.7 "	0.6 "
Rye meal	1.5 "	0.7 "
Whole corn	1.7 "	0.6 "
Corn meal	1.5 "	0.7 "
Corn and cob meal	1.4 "	0.7 "
Corn bran	0.5 "	2.0 "
Hominy meal	1.1 "	0.9 "
Corn and oat feed (Victor)	0.7 "	1.4 "
Quaker dairy feed	1.0 "	1.0 "
Oat feed	0.8 "	1.3 "

MARKET PRICES OF CATTLE FOODS FOR 1906.

FEED STUFFS.	Monthly Wholesale Ton Prices—1906.												Average.
	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	
Cottonseed meal	$31.00	$31.13	$30.42	$30.54	$31.30	$32.00	$29.00	$27.94	$28.47	$30.31	$30.10	$29.30	$30.13
Linseed meal	32.50	† 32.00	† 39.62	† 29.69	† 30.30	† 30.50	—	—	—	30.00	30.10	29.44	30.46
Gluten feed (sacked)	27.15	26.40	24.95	24.15	24.05	25.23	—	25.40	25.52	26.21	26.70	28.15	25.81
Distillers' dried grains	* 26.25	* 26.50	* 25.25	* 25.00	* 24.25	* 24.75	* 25.25	* 25.25	* 25.50	* 26.63	* 26.13	* 27.63	25.70
Flour middlings (Red Dog)	23.63	24.07	22.90	24.00	24.55	25.25	25.50	25.35	25.63	26.63	27.05	25.75	25.03
Standard middlings (shorts)	22.25	22.41	21.83	23.07	22.98	22.19	22.10	22.35	22.44	23.51	24.08	23.60	22.73
Mixed feed	21.97	22.22	22.15	23.19	23.45	22.88	22.00	21.93	21.85	22.72	24.33	24.63	22.78
Bran, Spring	20.22	20.76	20.15	21.81	21.55	20.28	19.04	18.55	19.63	21.63	22.95	22.75	20.78
Bran, Winter	21.17	21.75	21.22	22.95	22.48	21.31	19.63	19.13	20.72	22.06	23.40	23.63	21.62
Hominy meal	22.10	21.19	21.00	25.08	23.86	24.38	23.73	23.11	24.00	24.25	23.39	23.10	23.27
Corn meal	20.80	19.80	20.00	22.40	23.40	24.00	24.00	23.40	23.40	22.40	22.40	21.60	22.30
Corn, No. 2 yellow	19.28	18.46	19.07	20.96	22.04	22.50	22.50	22.14	21.64	20.71	21.03	20.40	20.89
Oats, No. 2, clipped white‡	24.68	23.75	23.56	24.68	25.62	28.44	29.44	25.62	25.32	25.88	26.06	26.40	25.79
Feed barley	20.75	20.42	20.58	20.75	20.42	21.04	21.46	21.04	20.00	21.04	21.58	22.70	20.98
Rye, No, 2	25.89	25.89	26.18	25.89	25.68	26.79	26.24	26.07	26.61	24.46	25.61	26.40	25.98

* Chapin & Co. † Flour and Feed. ‡ 32 pounds to the bushel.

WHY! OH! WHY!!

Buy low grade cottonseed meal containing 18 to 24 per cent protein and 35 to 50 per cent hulls in place of high grade meal having 38 or more per cent protein?

Don't you refuse to take wheat bran or middlings to which weed seeds (screenings) have been added?

Do you purchase ground corn cobs mixed with bran, instead of genuine wheat mixed feed?

Help to increase the other fellow's profit by paying as much for mixtures of poor corn and oat residues as for nice bright corn or hominy meals?

Do you neglect to examine the feed and the guarantee before purchasing?

Will you purchase unguaranteed feeds?

Spend your money for "panaceas" and "electric egg producers," made up of bran, Venetian red, pepper, salt, charcoal and fenugreek, and which cost 6 to 50 cents a pound?

Will you be humbugged by gaudy chromos and red ink?

HATCH EXPERIMENT STATION

——OF THE——

MASSACHUSETTS

AGRICULTURAL COLLEGE.

BULLETIN NO. 113.

I. ANALYSES OF MANURIAL SUBSTANCES FORWARDED FOR EXAMINATION.

II. ANALYSES OF LICENSED FERTILIZERS COLLECTED IN THE GENERAL MARKETS.

III. MARKET VALUES OF FERTILIZING INGREDIENTS.

JANUARY, 1907.

The regular Bulletins of this Station will be sent free to all newspapers in the State and to such individuals interested in farming as may request the same. Technical Bulletins are sent only to those persons interested in the subject treated of in each case.

AMHERST, MASS.:
PRESS OF CARPENTER & MOREHOUSE
1907.

HATCH EXPERIMENT STATION

OF THE

Massachusetts Agricultural College,

AMHERST, MASS.

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The co-operation and assistance of farmers, fruit-growers, horticulturists, and all interested, directly or indirectly, in agriculture, are earnestly requested. The Bulletins will be sent free to all newspapers in the State and to such individuals interested in farming as may request the same. General bulletins, fertilizer analyses, analyses of feed-stuffs, and annual reports are published. Kindly indicate in application which of these are desired. Communications may be addressed to the

HATCH EXPERIMENT STATION, Amherst, Mass.

DIVISION OF CHEMISTRY.

C. A. Goessmann.

I. ANALYSES OF FERTILIZER SUBSTANCES, REFUSE MATERIALS AND SOILS SENT ON FOR EXAMINATION.

NITROGEN COMPOUNDS.

2069-2072. I. Nitrate of soda, received from Braggville.
II. Nitrate of potash, received from Sunderland.
III. Dried blood, received from Amherst.
IV. Hoof meal, received from Amherst.

	PER CENT.			
	I.	II.	III.	IV.
Moisture at 100° C.,	7.44	2.28	9.49	8.95
Nitrogen,	14.80	12.36	8.49	14.45
Potassium oxide,	—	43.48	—	—
Phosphoric acid,	—	—	4.70	—

COTTONSEED MEAL.

2073-2076.
I., II. and III. Received from Hatfield, Mass.
IV. Received from Feeding Hills, Mass.

	PER CENT.			
	I.	II.	III.	IV.
Moisture at 100° C.,	10.42	8.08	8.48	8.46
Nitrogen,	6.54	6.39	6.54	6.39

Note.—Cottonseed meal contains from 2 to 3% of phosphoric acid and from 1.5 to 2.5% of potassium oxide, of which about 1.25% is soluble in water.

POTASH COMPOUNDS.

2077-2080. I. Carbonate of potash, received from Hatfield.
II. Carbonate of potash, received from Easthampton.
III. Carbonate of potash, received from Amherst.
IV. Sulphate of potash-magnesia, received from Amherst.

	PER CENT.			
	I.	II.	III.	IV.
Moisture at 100° C.,	5.29	none.	6.25	3.61
Potassium oxide,	62.50	63.69	58.80	28.08

2081-2084. I. High grade sulphate of potash, received from Amherst.
II. High grade sulphate of potash, received from Hatfield.
III. High grade sulphate of potash, received from Feeding Hills.
IV. Muriate of potash, received from Amherst.

	PER CENT.			
	I.	II.	III.	IV.
Moisture at 100° C.,	.88	.51	.53	none.
Potassium oxide,	49.86	50.30	53.60	50.69

PHOSPHORIC ACID COMPOUNDS.

2085-2089. I. Dissolved bone black, received from Amherst.
II. Acid phosphate, received from Amherst.
III. Basic slag, received from Amherst.
IV. South Carolina rock phosphate, received from Amherst.
V. Dissolved bone, received from Amherst.

	PER CENT.				
	I.	II.	III.	IV.	V.
Moisture at 100° C.,	11.59	12.83	none.	.61	5.18
Total phosphoric acid,	17.87	16.40	18.65	25.66	16.87
Soluble phosphoric acid,	17.45	10.50	*	—	7.67
Reverted phosphoric acid,	.42	2.98	13.30	*	4.23
Insoluble phosphoric acid,	—	2.92	5.35	—	4.97
Nitrogen,	—	—	—	—	1.91

* Not determined.

GROUND BONE, FISH AND TANKAGE.

2090-2095. I. Raw bone, received from Amherst.
II. Steamed bone, received from Amherst.
III. Ground bone, received from Franklin.
IV. and V. Dry ground fish, received from Amherst.
VI. Tankage, received from Amherst.

	PER CENT.					
	I.	II.	III.	IV.	V.	VI.
Moisture at 100° C.,	8.69	8.41	none.	10.29	10.33	7.87
Total phosphoric acid,	24.87	28.80	24.18	6.36	7.42	6.59
Available phosphoric acid,	*	*	5.42	*	*	*
Insoluble phosphoric acid,	*	*	18.76	*	*	*
Nitrogen,	3.99	2.09	3.64	8.62	8.82	7.12

COMPOUND FERTILIZERS.

2096-2100. I., II., III. and IV., received from Hadley.
V. Cottonseed meal and carbonate of potash received Hatfield.

	PER CENT.				
	I.	II.	III.	IV.	V.
Moisture at 100° C.,	6.72	11.18	9.13	7.95	12.26
Total phosphoric acid,	6.58	12.82	14.90	12.02	—
Soluble phosphoric acid,	.15	7.23	5.73	4.24	—
Reverted phosphoric acid,	2.43	1.17	2.49	3.89	—
Insoluble phosphoric acid,	4.00	4.40	6.68	3.88	—
Potassium oxide,	14.00	3.92	8.16	9.56	19.00
Nitrogen,	6.07	2.35	3.32	2.85	4.11

ASHES.

2101-2104. I. and II., received from South Deerfield.
III. Received from Deerfield.
IV. Received from Shawmut.

* Not determined.

	PER CENT.			
	I.	II.	III.	IV.
Moisture at 100° C.,	.96	.63	5.29	2.48
Potassium oxide,	6.96	1.48	3.92	4.12
Phosphoric acid,	1.12	.34	1.22	1.22
Calcium oxide,	30.79	43.56	27.18	21.63
Insoluble matter,	13.37	4.59	14.36	8.48

NOTE.—Number II is undoubtedly a sample of lime ashes.

2105-2107. I. Received from Sunderland.
II. Lime ashes, received from Hadley.
III. Soot from soft coal, received from Farnumsville.

	PER CENT.		
	I.	II.	III.
Moisture at 100° C.,	21.74	4.38	32.61
Potassium oxide,	3.12	2.74	.04
Phosphoric acid,	1.16	.34	trace
Calcium oxide,	24.43	30.98	4.80
Nitrogen,	—	—	.97
Insoluble matter.	10.22	5.45	16.55

MISCELLANEOUS MATERIAL.

2108-2110. I. Wool waste, received from Pittsfield.
II. Washings from paper manufacture, received from East Walpole.
III. Barnyard manure, received from Amherst.

	PER CENT.		
	I.	II.	III.
Moisture at 100° C.,	5.90	93.43	72.62
Nitrogen,	5.34	.18	.40
Potassium oxide,	.18	.14	.49
Phosphoric acid,	.17	trace	.36
Calcium oxide.	—	trace	8.08

SOILS.

2011-2015. I. Received from Framingham.
II., III. and IV. Received from Arlington.
V. Received from Ponce, P. R.

	PER CENT.				
	I.	II.	III.	IV.	V.
Moisture at 100° C.,	25.27	.98	.94	1.14	4.92
Nitrogen,	.13	.12	.14	.15	.43
Potassium oxide,	.17	.18	.22	.30	.48
Phosphoric acid,	.25	.11	.10	.24	trace
Calcium oxide,	.42	1.38	.48	.54	19.51

Officially Collected Commercial Fertilizers, 1906.

Furnishing Nitrogen, Phosphoric Acid and Potash.*

Name of Manufacturer and Brand.	Where Sampled.	Laboratory Number.
American Agricultural Chemical Co, Boston, Mass.		
High Grade Tobacco Manure	Bradstreet	12
American Agricultural Chemical Co., H. J. Baker & Bro. Branch.		
Baker's Complete Potato Manure	Worcester	350
American Agricultural Chemical Co., Bradley Fertilizer Co. Branch.		
Bradley's Columbia Fish and Potash	Weir Village	131
" " " " "	Fall River	181
Bradley's Potato Manure	Fall River	142
" " "	Lexington	227
" " "	Oxford	455
Bradley's Complete Top Dressing for Grass and Grain	New Bedford	159
" " " " " " " "	Lawrence	272
Bradley's Complete Manure, 10% Potash	Boston	212
" " " " "	Lexington	234
Bradley's Potato Fertilizer	Brockton	221
" " "	Weir	254
Bradley's English Lawn Fertilizer	Haverhill	278
Bradley's Eclipse Phosphate	Danvers	312
" " "	Lowell	375
Bradley's Niagara Phosphate	Danvers	317
Bradley's Seeding Down Manure	Boston	328
" " " "	Haverhill	383
Bradley's Corn Phosphate	Boston	332
" " "	Lowell	369
Church's Fish and Potash, "D" Brand	North Amherst	111
" " " " " "	New Bedford	180
" " " " " "	South Deerfield	434
" " " " " "	Greenfield	445
American Agricultural Chemical Co., Clark's Cove Fert. Co. Branch.		
Clark's Cove Great Planet Manure	East Longmeadow	488
Clark's Cove Bay State Fertilizer, G. G.	Hinsdale	430
American Agricultural Chem. Co., Crocker Fert. & Chem. Co. Branch.		
Crocker's Ammoniated Corn Phosphate	Worcester	401
American Agricultural Chemical Co., L. B. Darling Fert. Co. Branch.		
Darling's Potato and Root Crop Manure	North Amherst	67
" " " " " "	Oxford	459
Darling's Potato Manure	North Amherst	107
American Agricultural Chemical Co., Great Eastern Fert. Co. Branch.		
Great Eastern Grass and Oats Fertilizer	Great Barrington	423
" " " " " "	South Williamstown.	431

* In this bulletin the columns headed "Potassium Oxide" designate the compound now usually termed Potash in our agricultural publications. WM. P. BROOKS, Director.

Officially Collected Commercial Fertilizers, 1906.

Furnishing Nitrogen, Phosphoric Acid and Potash.

	Nitrogen in 100 lbs.		Phosphoric Acid in 100 lbs.							Potassium Oxide in 100 lbs.	
						Total.		Available.			
Moisture.	Found.	Guaranteed.	Soluble.	Reverted.	Insoluble.	Found.	Guaranteed.	Found.	Guaranteed.	Found.	Guaranteed.
7.25	6.80	5.78-6.59	3.65	3.69	.04	7.38	6-8	7.34	5-7	9.08†	10-12
10.02	3.70	3.30-4.13	2.97	3.07	3.32	9.36	7-10	6.04	6-10	10.14	10-12
10.15	2.48	1.65-2.40	3.53	4.13	1.62	9.28	6-8	7.66	5-7	2.30	2-3
11.06	2.93	2.50-3.25	3.00	5.44	.90	9.34	8-11	8.44	6-8	5.52	5-6
8.13	5.25	4.95-5.78	1.70	4.54	1.36	7.60	6-8	6.24	5-7	2.68	2.50-3.00
6.11	3.44	3.30-4.12	3.05	4.31	1.74	9.10	7-10	7.36	6-10	10.00	10-12
14.08	2.31	2.06-2.88	5.73	3.99	1.26	10.98	10-12	9.72	8-10	3.14	3-4
9.28	5.69	4.35-5.78	2.18	5.52	1.34	9.04	6-8	7.70	5-7	5.80	2.5-3.5
12.20	1.34	1.65-2.50	2.15	7.53	1.40	11.08	10-15	9.68	8-12	2.06	2-3
12.60	1.42	.82-1.65	4.67	3.57	1.62	9.86	8-11	8.24	7-9	2.48	1-2
11.82	2.71	2.50-3.25	5.23	4.85	1.92	12.00	11-14	10.08	9-12	2.08	2-3
8.76	2.48	2.06-2.88	5.93	3.25	2.30	11.48	10-13	9.18	8-10	1.80	1.5-2.5
10.08	2.50	2.07-2.90	3.97	3.33	1.60	8.90	7.50-10.50	7.30	6-8	2.16	2-3
10.28	3.59	3.30-4.12	3.68	5.04	2.64	11.36	9-13	8.72	8-11	7.78	7-8
13.40	2.42	2.06-2.88	5.03	4.03	3.58	12.64	10-13	9.06	8-10	1.94	1.5-2.5
14.54	2.64	2.06-2.88	5.65	3.43	2.44	11.52	10-13	9.08	8-10	1.96	1.5-2.5
10.47	3.66	3.30-4.12	3.73	5.17	3.00	11.90	9-13	8.90	8-11	7.52	7-8
10.91	3.01	2.50-3.25	3.73	3.71	1.16	8.60	8-11	7.44	6-8	5.44	5-6
12.90	.20	—	5.60	5.38	2.04	13.02	12-14	10.98	11-14	2.06	2-3

† 12. Enough chlorine present to unite with 1.16% potassium oxide.

Officially Collected Commercial Fertilizers, 1906.

Furnishing Nitrogen, Phosphoric Acid and Potash.

Name of Manufacturer and Brand.	Where Sampled.	Laboratory Number.
American Agricultural Chemical Co., Great Eastern Fert. Co. Branch.		
Great Eastern Northern Corn Special	Oxford	458
" " " " "	East Longmeadow	490
Great Eastern Garden Special	East Longmeadow	489
American Agricultural Chemical Co., Pacific Guano Co. Branch.		
Soluble Pacific Guano	Newburyport	276
American Agricultural Chem. Co., Packers' Union Fert. Co. Branch.		
Packers' Union Gardeners' Complete	Greenfield	443
American Agricultural Chemical Co., Quinnipiac Co. Branch.		
Quinnipiac Onion Manure	Hatfield	59
Quinnipiac Corn Manure	South Amherst	100
" " "	Williamstown	439
Quinnipiac Market Garden Manure	Fall River	139
" " " "	Seekonk	163
Quinnipiac Climax Phosphate	Pittsfield	420
American Agricultural Chemical Co., Read Fertilizer Co. Branch.		
Read's High Grade Farmer's Friend Superphosphate	Greenfield	446
" " " " " "	East Longmeadow	487
American Agricultural Chemical Co., Henry F. Tucker Co. Branch.		
Tucker's Bay State Special	Southwick	500
American Agricultural Chem. Co., Williams & Clark Fert. Co. Branch.		
Williams & Clark's Potato Phosphate	Southboro	296
Williams & Clark's Americus H. G. Special for Potatoes	Southboro	293
Williams & Clark's Americus Potato Manure	Southboro	301
Williams & Clark's Americus Ammoniated Bone Superphosphate	Southboro	309
Williams & Clark's Prolific Crop Producer	Lowell	357
" " " " " "	Worcester	398
W. H. Abbott, Holyoke, Mass.		
Abbott's Tobacco Fertilizer	Hatfield	43
Abbott's Onion Fertilizer	North Hatfield	51
Abbott's Eagle Brand Fertilizer	Holyoke	484

Officially Collected Commercial Fertilizers, 1906.

Furnishing Nitrogen, Phosphoric Acid and Potash.

	Nitrogen in 100 lbs.		Phosphoric Acid in 100 lbs.							Potassium Oxide in 100 lbs.	
						Total.		Available.			
Moisture.	Found.	Guaranteed.	Soluble.	Reverted.	Insoluble.	Found.	Guaranteed.	Found.	Guaranteed.	Found.	Guaranteed.
14.60	2.70	2.50-3.25	6.55	2.46	3.15	12.10	11-14	9.01	9-11	2.30	2-3
10.17	3.55	3.30-4.12	2.65	6.61	1.92	11.18	9-13	9.26	8-11	7.68	7-8
13.40	2.34	2.06-2.88	4.83	3.63	3.40	11.02	10-13	8.46	8-10	1.04	1.5-2.5
8.87	3.14	2.40-3.00	2.47	3.29	3.38	9.14	7-10	5.76	6-8	10.00	10-12
10.27	3.71	3.30-4.12	2.73	4.91	3.88	11.52	9-13	7.64	8-11	7.98	7-8
13.45	2.62	2.06-2.20	4.67	3.77	3.58	12.02	10-13	8.44	8-10	1.82	1.50-2.50
10.25	3.58	3.30-4.12	3.05	7.03	1.94	12.02	9-13	10.08	8-11	7.36	7-8
12.50	1.45	1.03-2.50	5.50	3.66	2.30	11.46	10-13	9.16	8-12	2.24	2-3
11.10	3.54	3.30-4.13	2.90	3.00	2.74	9.54	7-10	6.80	6-10	8.72	10-12
10.15	3.57	3.30-4.12	4.13	3.31	2.90	10.34	9-13	7.44	8-11	7.90	7-8
11.00	3.14	2.50-3.25	5.13	2.61	3.70	11.44	8-11	7.74	6-8	6.42	5-6
10.40	3.64	3.30-4.12	2.08	5.66	4.56	12.30	9-13	7.74	8-11	7.10	7-8
13.07	2.20	2.06-2.88	6.87	2.31	2.30	11.48	10-13	9.18	8-10	3.30	3-4
11.50	3.24	2.50-3.25	4.58	4.40	3.96	12.94	11-14	8.98	9-11	4.58	2-3
11.37	1.48	.82-1.65	4.70	4.00	2.54	11.24	8-11	8.70	7-9	1.82	1-2
10.63	4.52	4-5	2.63	6.45	1.46	10.54	11-12	9.08	8-10	11.38†	10-11
10.67	4.11	3.5-4	2.55	7.43	2.12	12.10	10-12	9.98	8-9	6.90†	7-8
12.33	3.58	2.5-3.00	2.25	9.53	2.18	13.96	13-14	11.78	11-12	6.74†	10-11

† 43. Enough chlorine present to unite with 1.14% potassium oxide.
51. " " " " " 0.76% " "
484. " " " " " 0.94% " "

Officially Collected Commercial Fertilizers, 1906.

Furnishing Nitrogen, Phosphoric Acid and Potash.

Name of Manufacturer and Brand	Where Sampled.	Laboratory Number.
Armour Fertilizer Works, Baltimore, Md.		
High Grade Potato	Amherst	80
" " "	Fall River	132
Fruit and Root Crop Special	Amherst	89
" " " " "	Fall River	137
Fish and Potash Mixture	New Bedford	143
" " " "	Seekonk	162
Complete Potato	Seekonk	161
" "	Worcester	397
American Farmers' Corn King	Seekonk	166
Market Garden Special	Seekonk	173
Ammoniated Bone with Potash	Concord	211
" " " "	Danvers	315
Armour's Grain Grower	Hudson	300
" " "	Danvers	319
Beach Soap Company, Lawrence, Mass.		
Beach's Reliance Brand	Lawrence	382
Berkshire Fertilizer Co., Bridgeport, Conn.		
Berkshire Complete Root Fertilizer	North Amherst	109
" " " "	South Deerfield	452
Berkshire Grass Fertilizer	Oxford	465
Bowker Fertilizer Co., Boston, Mass.		
Stockbridge's Manure for Top Dressing	Northampton	29
" " " " "	Northampton	32
Stockbridge's Manure for Small Fruits	Dighton	109
Stockbridge's Manure for Cabbages and Cauliflower	Dighton	238
Stockbridge's Manure for Peas and Beans	Marlborough	305
Bowker's Potato and Vegetable Fertilizer	Amherst	79
" " " " "	Concord	192
" " " " "	Dighton	257
Bowker's Fish and Potash, "D" Brand	Dighton	145
Bowker's Farm and Garden Phosphate	Bridgewater	189
" " " " "	Worcester	340
Bowker's Bone, Blood and Potash	Concord	198
" " " " "	Lowell	356
Bowker's Ammoniated Food for Flowers	Boston	222
Bowker's Hill and Drill Phosphate	Lexington	232
" " " " "	Haverhill	270
" " " " "	Boston	326
Bowker's Lawn and Garden Dressing	Lawrence	269
" " " " "	Boston	335
Bowker's Ammoniated Dissolved Bone	Lawrence	281
Bowker's Corn Phosphate	Haverhill	294
" " "	Pittsfield	424
" " "	North Adams	433
Bowker's High Grade Fertilizer	Marlboro	295
" " " "	Lowell	306
Bowker's 10% Manure	Hudson	304

Officially Collected Commercial Fertilizers, 1906.

Furnishing Nitrogen, Phosphoric Acid and Potash.

	Nitrogen in 100 lbs.		Phosphoric Acid in 100 lbs.							Potassium Oxide in 100 lbs.	
						Total.		Available.			
Moisture.	Found.	Guaranteed.	Soluble.	Reverted.	Insoluble.	Found.	Guaranteed.	Found.	Guaranteed.	Found.	Guaranteed.
11.88	1.65	1.64-2.47	4.80	4.54	.72	10.06	10-13	9.34	8-10	8.02	10-12
12.50	1.88	1.65-2.46	7.30	2.38	.70	10.38	10-13	9.68	8-10	5.50	5-6
12.78	2.40	2.06-2.47	5.93	1.05	.90	7.88	7-8	6.98	6-7	2.02	2-3
12.85	1.07	2-3	6.72	1.50	.86	9.08	8-9	8.22	7-8	6.78	6-7
13.25	3.16	3-4	7.10	2.48	.76	10.34	9-10	9.58	8-9	4.50	4-5
9.57	3.44	4-5	7.83	1.93	1.02	10.78	9-10	9.76	8-9	7.04	7-8
10.79	2.62	2.47-3.29	4.75	2.25	1.62	8.62	7-9	7.00	6-8	2.03	2-3
11.40	2.37	1.65-2.00	5.85	3.11	1.40	10.36	10-13	8.96	8-10	2.52	2-3
9.55	2.60	1.65-2.47	5.38	4.00	1.90	11.28	10-13	9.38	8-10	5.58	3-4
11.45	2.75	2.5-4.00	7.00	1.50	1.36	9.86	10-12	8.50	8-10	6.50	6-8
11.05	5.10	5-6	1.92	2.98	1.80	6.70	5-6	4.90	4-6	2.91	2-3
9.07	4.88	4.01-5.76	3.85	1.90	1.04	6.78	6-8	5.74	4-6	6.21	6-7
11.28	2.78	2.47-3.29	6.55	4.29	3.02	13.68	10-12	10.84	8-10	3.82	4-5
9.37	5.37	4.01-5.76	4.75	1.35	.94	7.04	6-8	6.10	4-6	6.56	6-7
7.92	5.01	2.47-3.29	2.08	3.68	3.86	9.62	9-11	5.76	5-7	10.54	10-12
17.42	2.67	2.47-3.29	5.55	3.01	2.08	10.62	9-12	8.54	7-9	4.24	4-6
11.72	2.80	2.14-3.14	4.73	2.71	2.56	10.00	8-10	7.44	5-7	2.00	2-3
12.14	2.03	1.65-2.47	5.05	3.97	2.18	11.20	9-11	9.02	8-10	2.06	2-3
9.91	3.94	4.10-5.04	4.35	3.83	2.08	10.26	10-12	8.18	8-10	7.30	7-8
6.94	3.19	2.	1.35	9.39	1.54	12.28	6.	10.74	4.	3.38†	2.
12.63	2.59	2.47-3.35	5.60	4.18	1.18	10.96	10-13	9.78	9-11	2.04	2-3
8.23	3.40	3-4	1.95	4.83	1.54	8.32	8-10	6.78	7-11	5.30	5-6
14.21	2.23	1.5-2.5	6.72	1.86	1.80	10.38	10-12	8.58	7-9	2.12	2-3
11.76	1.02	1.65-2.57	6.88	1.92	1.82	10.62	9-11	8.80	8-10	2.02	2-3
17.30	2.88	2.25-3.25	6.40	2.36	3.08	11.84	10-12	8.76	8-10	4.43	4-5
10.51	1.22	.82-1.65	4.68	.54	1.02	6.24	6-8	5.22	5-7	10.08	10-11

† 222. Enough chlorine present to unite with 0.95% potassium oxide.

Officially Collected Commercial Fertilizers, 1906.

Furnishing Nitrogen, Phosphoric Acid and Potash.

Name of Manufacturer and Brand.	Where Sampled.	Laboratory Number.
Bowker Fertilizer Company, Boston, Mass.		
Bowker's Six Per Cent Potato Fertilizer	Lawrence	360
Bowker's Complete Mixture	South Wiliamstown	414
Bowker's Seeding Down Fertilizer	Great Barrington	416
Bowker's Tobacco Ash Elements	South Deerfield	436
" " " "	Springfield	476
Bowker's Tobacco Carbonate	South Deerfield	441
Bowker's Complete Alkaline Tobacco Grower	South Deerfield	444
" " " " "	Northampton	518
Bowker's Potash Bone	Pittsfield	451
Bowker's Bristol Fish and Potash	Amherst	77
" " " " "	Dighton	150
Buffalo Fertilizer Company, Buffalo, N. Y.		
York State Special	Oxford	402
Farmers' Choice	Amherst	521
Vegetable and Potato	Amherst	522
High Grade Manure	Amherst	520
The Coe-Mortimer Company, New York City.		
New Englander Corn and Potato Fertilizer	South Amherst	88
Columbian Potato Fertilizer	South Amherst	93
" " "	Gardner	379
" " "	East Longmeadow	496
Excelsior Potato Fertilizer	Dighton	209
Gold Brand Excelsior Guano	Dighton	217
Columbian Corn Fertilizer	Gardner	341
" " "	East Longmeadow	491
XXV Ammoniated Bone Phosphate	Gardner	381
Celebrated Special Potato	Westfield	509
High Grade Ammoniated Bone Superphosphate	Westfield	510
Chincha Peruvian Guano	North Hadley	517
Lobos Peruvian Guano	Hatfield	529
Eastern Chemical Co., Boston, Mass.		
Imperial Plant Food	Boston	526
Lister's Agricultural Chemical Works, Newark, N. J.		
Animal Bone and Potash	Belchertown	34
Potato Manure	Belchertown	36
" "	Somerset	125
" "	Marlborough	297
Lister's Special Potato	Belchertown	39
" " "	Somerset	144

Officially Collected Commercial Fertilizers, 1906.

Furnishing Nitrogen, Phosphoric Acid and Potash.

	Nitrogen in 100 lbs.		Phosphoric Acid in 100 lbs.							Potassium Oxide in 100 lbs.	
						Total.		Available.			
Moisture.	Found.	Guaranteed.	Soluble.	Reverted.	Insoluble.	Found.	Guaranteed.	Found.	Guaranteed.	Found.	Guaranteed.
9.85	1.32	.82 1.65	2.63	3.69	1.28	7.60	7-9	6.32	6 8	5.86	6 7
14.02	2.56	2-3	7.07	1.67	1.62	10.36	9-13	8.74	8 10	4.12	4 5
9.47	2.30	2.06-2.88	4.03	1.57	1.54	7.14	6-8	5.60	4-6	5.98	6 7
7.08	1.15	—	None	4.84	9.92	14.76	—	4.84	6 7	15.00†	15-18
11.94	1.00	—	.21	5.65	6.66	12.52	—	5.86	6 8	15.88†	15-16
9.47	4.70	4 5	None	2.60	5.56	8.16	5-6	2.60	4 5	5.08	5-6
9.56	1.10	.82-1.65	2.78	2.70	1.58	7.06	7-9	5.48	6-8	2.12	2-3
11.67	2.11	1.50 2.50	4.65	3.65	2.10	9.80	8 10	7.70	5 8	2.42	2-3
10.62	1.59	1.65-2.46	4.63	4.13	2.12	10.88	10-12	8.76	8-10	4.16	5-6
7.21	1.52	.82-1.65	4.20	4.56	3.48	12.24	9-12	8.76	8-10	5.20	5-6
7.04	3.04	2.47-3.30	4.60	3.90	2.10	10.60	9-12	8.50	8-10	7.90	7-8
5.74	3.70	3.30-4.12	4.38	2.06	2.32	9.36	8-9	7.04	7 9	10.94	10-12
8.13	1.14	.80-1.60	7.20	1.32	2.10	10.62	9 10	8.52	7.5-9.5	3.18*	3-4
9.51	1.87	1.20-1.50	6.60	2.58	2.82	12.00	10-11	9.18	8.5 10.5	3.12	2.5-3.00
12.27	3.20	2.47-3.12	5.85	2.27	1.62	9.74	9-11	8.12	7 9	6.72	8-9
12.80	2.68	2.4-3.3	6.50	2.24	1.76	10.50	9-10	8.74	7.5 9	5.10	6-7
9.47	2.03	1.23-1.65	6.55	3.11	1.90	11.56	10.5-11.5	9.66	8.5-11.5	2.94	2.5-3.00
9.53	1.79	.80-1.65	7.00	2.54	2.44	11.98	10-12	9.54	8.5 10.5	1.82	1.5-2.5
12.96	2.04	1.65-2.00	6.98	2.62	1.40	11.00	10-11	9.60	8-11	3.62†	4-5
11.67	2.97	1.85-2.00	7.19	1.88	1.76	10.82	10-12	9.06	9-11	2.58	2.25-3.00
10.65	7.33	7.06	2.49	4.90	2.72	10.01	8.5	7.29	6.5	1.98	2.
10.40	3.41	3.15	2.78	5.75	9.04	17.57	19.00	8.53	10.	3.90	3.30
.02	13.22	13.	23.16	—	—	23.16	25.3	23.16	25.3	27.70	[illegible]
14.80	.40	—	7.25	4.03	1.08	12.36	11.	11.28	8.	1.94	2.
8.53	3.81	3.30-4.12	2.53	4.85	3.96	11.34	9-12	7.38	8-10	7.28	7-8
8.88	2.56	1.63-2.47	5.48	3.00	2.26	10.74	9.	8.48	8.	3.38	3.

* Sulphate of potash, the source of potash.

† 430. Enough chlorine present to unite with 1.37% potassium oxide.

441. " " " " " 3.55% " " remainder of potash present as carbonate.

509. " " " " " 0.67% " "

Officially Collected Commercial Fertilizers, 1906.

Furnishing Nitrogen, Phosphoric Acid and Potash.

Name of Manufacturer and Brand.	Where Sampled.	Laboratory Number.
Lister's Agricultural Chemical Works, Newark, N. J.		
High Grade Special for Spring Crops	Agawam	473
Lister's Oneida Special	Amherst	513
S. Major, South Somerset, Mass.		
Major's Bone Phosphate No. 1	South Somerset	333
Edward MacMulkin, Boston, Mass.		
Ideal Plant Food	Boston	[illegible]
Mapes Formula and Peruvian Guano Co., New York City.		
Grass and Grain Spring Top Dressing	Taunton	211
" " " " " "	Boston	320
Mapes' Potato Manure	Taunton	245
" " "	South Deerfield	262
Mapes' Lawn and Top Dressing	Taunton	248
" " " " "	Pittsfield	440
Mapes' Complete Manure for General Use	Taunton	251
" " " " " "	Boston	331
Mapes' Fruit and Vine Manure	Taunton	252
" " " " "	Fitchburg	346
Mapes' Cereal Brand	Taunton	256
" " "	Leominster	377
Mapes' Corn Manure	Taunton	258
" " "	Fitchburg	379
Mapes' Tobacco Manure	South Deerfield	265
Mapes' Cauliflower and Cabbage Manure	Fitchburg	342
Mapes' Complete Manure, "A" Brand	Worcester	391
Mapes' Top Dresser, Improved (Half Strength)	Southwick	504
Mapes' Tobacco Starter, Improved	Southwick	505
Mapes' Tobacco Ash Constituents	Southwick	507
National Fertilizer Company, Bridgeport, Conn.		
Chittenden's Connecticut Valley Tobacco Starter	Hatfield	55
" " " " "	North Hadley	512
Chittenden's Fish and Potash	New Bedford	136
" " " "	Fall River	243
" " " "	Greenfield	438
Chittenden's Market Garden Fertilizer	Somerset	140
" " " "	South Lawrence	234
Chittenden's Ammoniated Bone Phosphate	New Bedford	160
" " " "	South Lawrence	274
Chittenden's Universal Phosphate	New Bedford	132
" " "	South Lawrence	358

Officially Collected Commercial Fertilizers, 1906.

Furnishing Nitrogen, Phosphoric Acid and Potash.

	Nitrogen in 100 lbs.		Phosphoric Acid in 100 lbs.			Total.		Available.		Potassium Oxide in 100 lbs.	
Moisture.	Found.	Guaranteed.	Soluble.	Reverted.	Insoluble.	Found.	Guaranteed.	Found.	Guaranteed.	Found.	Guaranteed.
8.33	2.23	1.65-2.47	1.13	1.47	0.86	10.46	9-10	9.60	9-11	10.14	10-10.5
5.05	1.31	.82-1.65	2.65	4.07	2.02	8.74	—	7.22	7.	1.10	1.00
6.72	4.00	4-5	1.19	4.03	2.00	8.75	8-9	6.60	6-8	10.70	10-12
[illegible].10	2.58	2-3	.05	.00	11.56	13.20	13-14	1.64	1-2	1.80	1-2
6.22	5.01	4.94-5.76	1.03	3.87	2.90	7.80	6-8	4.90	5.	7.40	7-8
6.68	4.13	3.71-4.12	2.25	3.97	3.40	9.62	8-10	6.22	6.	7.24*	6-8
5.00	3.84	3.29-4.12	1.23	3.03	2.50	7.50	6-8	4.30	4-5	8.88†	8-10
7.01	3.10	2.47-2.88	1.68	2.06	1.10	4.84	3.5-4.5	3.74	—	3.34	2.5-3.5
8.65	5.63	3.29-4.12	.88	5.26	4.66	10.80	10-12	6.14	8-10	4.04*	4-5
8.27	2.30	1.65-2.47	—	13.79	3.40	7.24	7-9	3.79	5-7	11.42*	10-12
7.25	2.16	1.65-2.47	.93	3.37	4.84	9.16	8-10	4.30	5-6	3.02*	3.0-3.5
7.22	2.80	2.47-2.88	1.30	5.02	4.78	11.10	10-12	6.32	8-10	6.40*	5-7
7.35	0.67	0.16	—	3.06	3.00	6.06	4.50	3.06	—	11.34*	10.50
6.63	4.12	4.12-4.94	2.08	3.80	2.70	8.64	6-8	5.88	6.	6.20	6-8
10.30	3.38	2.47-3.20	3.05	5.61	4.94	13.50	12-16	8.66	10-12	3.10*	2.5-3.0
8.15	4.77	4.04	.65	2.09	1.41	4.15	4.	2.74	—	4.40†	2.
7.65	4.87	4.12-4.94	3.18	2.90	3.30	9.34	8-10	5.98	6-8	1.90	1-2
11.87	1.07	.50	—	2.48	4.70	7.16	5.70	2.48		15.14	15.
7.17	8.00	8.23-9.00	.50	2.33	2.12	4.78	3-4	2.85	—	1.70*	2.00-3.00
8.20	3.12	2.90-3.50	3.88	2.78	3.11	9.80	7-9	6.60	5-7	3.50*	3-4
11.20	5.23	2.5-3.25	6.07	2.37	2.91	11.38	10-13	8.44	8-10	6.31*	5-7
11.21	2.60	1.65-2.47	5.35	2.66	3.05	11.06	10-11	8.01	8-11	2.70	2-3
10.55	1.50	.82-1.00	5.83	3.33	2.56	11.72	10-12	9.16	8-10	2.22	1-2

* Sulphate of potash, the source of potash.

† Carbonate of potash, the source of potash.

‡ 262. Enough chlorine present to unite with 1.80% potassium oxide.

470. " " " " " 1.27% " "

504. " " " " " 1.07% " "

507. " " " " " 1.72% " " [illegible] of potash as carbonate.

Officially Collected Commercial Fertilizers, 1906.

Furnishing Nitrogen, Phosphoric Acid and Potash.

Name of Manufacturer and Brand.	Where Sampled.	Laboratory Number.
National Fertilizer Company, Bridgeport, Conn.		
Chittenden's Complete Tobacco Manure	Springfield	457
New England Fertilizer Company, Boston, Mass.		
High Grade Potato Fertilizer	Brockton	208
" " " "	Boston	359
New England Superphosphate	Brockton	218
Parmenter & Polsey Fertilizer Co., Peabody, Mass.		
Special Fertilizer for Strawberries	Dighton	120
Star Brand Superphosphate	Dighton	128
P. & P. Grain Grower	Peabody	316
A. A. Brand	Peabody	320
" "	Oxford	408
Lawn Dressing	Peabody	322
R. T. Prentiss, Holyoke, Mass.		
Top Dressing	Holyoke	114
Complete Potato	Holyoke	116
Rogers & Hubbard Company, Middletown, Conn.		
Hubbard's Soluble Potato Manure	Amherst	69
" " " "	Seekonk	171
" " " "	East Longmeadow	402
Hubbard's Market Garden Phosphate	Amherst	74
Hubbard's Complete Phosphate	Amherst	84
" " "	Leyden	413
" " "	Agawam	432
Hubbard's Oats and Top Dressing	Amherst	86
" " " " "	Seekonk	168
Hubbard's Soluble Corn and General Crops	Amherst	92
" " " " " "	Hinsdale	421
" " " " " "	East Longmeadow	495
Hubbard's Potato Phosphate	Leyden	415
" " "	Agawam	430
Rogers Manufacturing Company, Rockfall, Conn.		
Fish and Potash	Worcester	339
High Grade Complete Corn and Onion Manure	Fitchburg	386
All Round Fertilizer	Worcester	388
Russia Cement Company, Gloucester, Mass.		
Essex XXX Fish and Potash	Somerset	126
" " " " "	Hadley	260
" " " " "	Leominster	343
Essex Market Garden and Potato Manure	Somerset	140
" " " " " "	Hadley	267
" " " " " "	Leominster	354

Officially Collected Commercial Fertilizers, 1906.

Furnishing Nitrogen, Phosphoric Acid and Potash.

	Nitrogen in 100 lbs.		Phosphoric Acid in 100 lbs.							Potassium Oxide in 100 lbs.	
						Total.		Available.			
Moisture	Found.	Guaranteed.	Soluble.	Reverted.	Insoluble.	Found.	Guaranteed.	Found.	Guaranteed.	Found.	Guaranteed.
8.85	3.31	3.3-4.1	.33	3.05	3.66	7.04	10-12	4.28	8 10	3.00*	5.40 6.48
7.05	3.48	2.46-3.30	5.88	3.09	4.42	13.38	9-12	8.96	8 10	6.66	6-7
9.57	2.30	2.47-3.30	5.58	3.30	4.66	13.54	10 13	8.88	9 11	3.00*	4-5
9.93	3.42	2.47-3.29	6.15	3.27	1.50	10.92	10-13	9.42	9-11	6.00*	6-7
8.20	1.98	1.65-2.47	4.20	2.90	3.22	10.32	8-11	7.10	7-9	3.00*	2.5-3.5
7.04	1.61	.82-1.00	5.43	3.77	.26	9.40	8-11	9.20	7 9	2.32*	2.0-2.5
8.77	3.69	4.10-4.51	4.43	3.60	3.14	11.26	8-11	8.12	7-9	7.18*	8-10
8.02	4.69	4.12-4.94	5.43	2.03	.70	8.22	8-11	7.46	7-9	5.24*	5-6
10.15	5.90	5.77-6.59	5.70	1.82	.64	8.16	8-10	7.52	7 8	7.82*	8-10
10.51	3.29	2.88-3.29	6.80	1.26	1.28	9.34	8-10	8.06	7-8	9.90*	10 12
10.11	5.62	5-6	.65	6.99	6.26	13.90	10-12	7.04	7-8.50	5.10†	5-6
8.50	3.77	3.50-4.50	6.03	3.07	.90	10.00	10-11	9.10	7.5-9.5	12.08	10-11
8.17	1.28	1.00-1.50	3.00	4.52	2.50	10.02	10-12	8.12	8 10	5.08	3.50-4.00
3.25	8.00	8.5-9.50	.10	4.30	4.46	8.86	8-9	4.40	3.9-4.35	7.20	8.00 9.50
8.53	2.77	2.50-3.00	2.30	4.26	2.66	9.22	8-10	6.56	6-7	8.44	8 9
10.90	2.51	2.00-2.50	6.53	2.95	1.58	11.06	10 12	9.48	9 10	5.80	5-6
6.25	3.94	3.25-4.50	1.92	2.90	2.50	7.32	6-8	4.82	4-5	3.94	3.75-4.50
7.09	4.31	3.54-3.91	4.27	2.23	3.04	9.54	8-9	6.50	6-7	6.50	7-8
9.70	2.38	1.65-2.65	3.85	4.39	2.26	10.50	10-12	8.24	8-10	3.02	2-3
7.07	2.82	2.06-2.88	1.23	3.11	8.06	12.40	12-14	4.34	9-10.5	2.68	2.25-3.25
6.72	2.45	2.00-2.50	1.08	5.80	5.68	12.56	10-13	6.88	8-10	5.42	5-6

* Sulphate of potash, the source of potash.

† Enough chlorine present to unite with 1.81% potassium oxide.

Officially Collected Commercial Fertilizers, 1906.

Furnishing Nitrogen, Phosphoric Acid and Potash.

Name of Manufacturer and Brand.	Where Sampled.	Laboratory Number.
Russia Cement Company, Gloucester, Mass.		
Essex Rhode Island Special	Somerset	151
" " " "	Spencer	408
Essex Odorless Lawn Dressing	Taunton	199
" " " "	Haverhill	268
Essex Grass and Top Dressing	Hadley	263
" " " " "	Gardner	347
" " " " "	Spencer	403
Essex A1 Superphosphate	Gardner	373
" " "	Leominster	380
Essex Corn Fertilizer	Leyden	442
Essex Tobacco Starter	Southwick	506
Sanderson's Fertilizer and Chemical Co., New Haven, Conn.		
Sanderson's Tobacco Formula "B"	Whately	47
Sanderson's Top Dressing for Grass and Grain	Whately	57
Walker's Complete Phosphate	Dighton	229
Sanderson's Potato Manure	Dighton	246
" " "	North Wilbraham	456
Atlantic Coast Bone, Fish and Potash	Southwick	515
The Smith Agricultural Chemical Co., Columbus, Ohio. Abbott & Martin Rendering Co. Branch.		
Abbott's Ideal Grain Grower	Bridgewater	200
Swift's Lowell Fertilizer Co., Boston, Mass.		
Swift's Lowell Animal Brand for all Crops	South Amherst	97
" " " " " " "	New Bedford	152
Swift's Lowell Potato Manure	South Amherst	99
Swift's Lowell Lawn Dressing	New Bedford	148
" " " "	Concord	210
Swift's Lowell Special Vegetable Manure	Seekonk	167
Swift's Lowell Empress Brand	Southwick	502
Swift's Lowell Superior Fertilizer	Seekonk	169
" " " "	Concord	225
Swift's Lowell Market Garden Manure	Seekonk	174
" " " " "	Taunton	253
Swift's Lowell Bone Fertilizer for Corn and Grain	Lexington	224
Swift's Lowell Special Grass	Lexington	236
Swift's Lowell Potato Phosphate	Taunton	240
" " " "	Hudson	308
" " " "	Ayers	352
" " " "	Springfield	472
Wilcox Fertilizer Works, Mystic, Conn.		
High Grade Potato Special	Amherst	76
Potato, Onion and Vegetable Manure	Amherst	81
" " " " "	New Bedford	177
Wilcox Potato Fertilizer	Amherst	98
" " "	Fall River	134
Grass Fertilizer	Seekonk	156
Whitman & Pratt Rendering Co., Lowell, Mass.		
Vegetable Grower	Hadley	532

Officially Collected Commercial Fertilizers, 1906.

Furnishing Nitrogen, Phosphoric Acid and Potash.

	Nitrogen in 100 lbs.		Phosphoric Acid in 100 lbs.			Total.		Available.		Potassium Oxide in 100 lbs.	
Moisture.	Found.	Guaranteed.	Soluble.	Reverted.	Insoluble.	Found.	Guaranteed	Found.	Guaranteed.	Found.	Guaranteed.
8.26	3.07	3.00 3-50	2.18	6.08	4.20	12.40	9-11	8.20	8-9	7.12	6.50 7.00
2.90	4.14	3.7-4.5	1.60	2.84	5.10	9.54	8-10	4.44	6-7	8.08	7 8
5.62	5.43	5.0 5.5	3.10	4.04	5.06	12.20	10-12	7.14	8-9	8.30	8.0-8.5
4.38	1.53	1.00-1.25	1.70	3.66	7.48	12.84	9-11	5.36	7-8	2.22	2.0-2.5
8.05	2.69	2.0-2.5	1.75	5.98	5.62	13.35	11-13	7.73	9-10	3.00	3.0-3.5
3.51	2.95	2.50-3.00	4.62	4.48	5.98	15.08	12-14	9.10	9-11	3.70†	2.5-3.00
8.36	3.94	3.33-4.00	.93	4.17	5.96	11.06	10-12	5.10	6-8	6.78†	6-8
9.43	4.53	4-5	4.43	2.55	2.10	9.08	7-9	6.98	7-9	7.86	7-9
13.12	1.98	1.67-2.47	5.75	2.39	2.22	10.36	10-12	8.14	7-9	2.48	2-3
12.40	1.75	1.67-2.47	1.92	3.08	2.82	7.82	8-9	5.00	5-7	6.06	6-7
17.23	2.25	1.67-2.47	3.45	2.43	.82	6.70	6-8	5.88	4-6	4.44	4-5
6.20	1.07	.82-1.65	.42	7.68	3.28	11.38	9-11	8.10	7-9	1.02*	1-2
11.93	2.49	2.46-3.30	5.98	3.14	3.28	12.40	10-13	9.12	9-11	4.04	4-5
10.37	1.63	1.64-2.46	5.95	1.09	1.86	9.80	8-11	7.04	7-9	4.16	4-5
3.68	4.54	4.11-4.94	5.82	1.54	.64	8.00	8-10	7.36	7-9	5.38†	5-6
10.67	4.26	3.29-4.12	5.75	2.59	2.84	11.18	9-12	8.34	8-10	7.80	7-8
8.77	1.60	1.23-2.05	5.28	2.00	2.32	9.60	8-11	7.28	7-9	3.56	2-3
6.98	3.64	3.71-4.53	5.52	2.14	2.86	10.52	8-11	7.66	7-9	9.32	10-11
6.12	4.68	4.10 4.92	4.03	3.99	4.00	12.02	8-11	8.02	7-9	6.06†	6-7
12.60	2.19	1.64-2.46	6.55	2.09	3.12	11.76	9-12	8.64	8-10	3.08	3-4
6.07	4.80	4.12	4.10	3.74	4.18	12.02	8.	7.84	7.	6.36	6.
8.76	2.77	2.46-3.30	5.60	2.34	3.32	11.26	9-12	7.94	8-10	6.28	6-7
7.01	4.56	3.30-4.30	—	3.04	5.38	8.42	7-10	3.04	5-7	7.54*	7 9
10.37	3.64	3.30-4.30	5.95	2.33	1.58	9.86	8-10	8.28	7-9	7.08	6-8
10.95	3.82	2.05-2.88	2.30	4.60	1.62	8.52	7-9	6.90	6-8	5.08	4.5-5.5
10.98	4.22	4.11-4.94	3.25	4.23	1.74	9.22	7-10	7.48	6-8	5.80	4.28-4.86
9.13	3.32	3.29-4.11	5.73	2.49	6.68	14.90	10-13	8.22	8-9	8.16	7-8

* Sulphate of potash, the source of potash.

† 47. Enough chlorine present to unite with 2.33% potassium oxide.
174-253. " " " " " 2.33% " "
146-210. " " " " " 4.50% " "
506. " " " " " 0.39% " "

Officially Collected Commercial Fertilizers, 1906.

Ground Bone, Tankage, and Dry Ground Fish.

Name of Manufacturer and Brand.	Where Sampled.	Laboratory Number.
American Agricultural Chemical Co., Boston, Mass.		
Fine Ground Bone	New Bedford	183
" " "	Boston	334
" " "	Boston	336
Dry Ground Fish	Bradstreet	21
Fine Ground Tankage	South Amherst	63
American Agricultural Chemical Co., Bradley Fertilizer Co. Branch.		
Bradley's Abattoir Bone Dust	Leominster	374
W. H. Abbott, Holyoke, Mass.		
Animal Fertilizer	Holyoke	481
Armour Fertilizer Works, Baltimore, Md.		
Bone Meal	North Adams	432
Bowker Fertilizer Company, Boston, Mass.		
Fine Ground Dry Fish	Northampton	37
" " " "	Springfield	473
Fresh Ground Bone	Northampton	44
" " "	Taunton	239
Market Bone	Fall River	157
Buffalo Fertilizer Company, Buffalo, N. Y.		
Bone Meal	Oxford	402
The George E. Marsh Company, Lynn, Mass.		
Marsh's Pure Bone Meal	Concord	103
D. M. Moulton, Monson, Mass.		
Ground Bone	Monson	523
National Fertilizer Company, Bridgeport, Conn.		
Chittenden's Fine Ground Bone	Seekonk	170
Parmenter & Polsey Fertilizer Company, Peabody, Mass.		
Pure Ground Bone	Peabody	314

Officially Collected Commercial Fertilizers, 1906.

Ground Bone, Tankage, and Dry Ground Fish.

	Nitrogen in 100 lbs.		Phosphoric Acid in 100 lbs.			Total.		Available.		Mechanical Analysis.	
Moisture.	Found.	Guaranteed.	Soluble.	Reverted.	Insoluble.	Found.	Guaranteed.	Found.	Guaranteed.	Fine.	Course.
10.86	2.02	2.47 3.29	—	6.26	16.66	23.04	22.80	6.26	—	39.07	60.93
10.12	3.02	3.24	—	2.34	3.42	5.76	7.	2.34	—		—
14.63	5.07	3.00 5.79		6.83	9.02	16.40	13.74-16.03	6.83	—	35.45	64.55
5.00	2.03	1.65 3.00	—	5.86	18.40	24.30	14 18	5.86	—	64.21	35.79
10.00	3.57	3 4	3.20	12.12	1.02	16.34	15 16	15.32	12 13	37.99	62.01
4.84	2.70	2.47 3.29	—	9.80	18.02	27.82	24 28	9.80	10-14	44.95	55.05
9.24	9.06	9.24 9.88	—	2.80	2.80	5.60	6-8	2.80	—	—	—
11.84	2.57	2.47-3.29	—	7.70	15.50	23.24	18 22	7.70	5 7	52.73	47.27
9.40	1.50	1.65 2.47	—	7.34	15.20	22.54	20-22	7.34	—	53.60	46.40
4.80	3.75	2.46 3.25	—	8.80	14.30	23.10	25 27	8.80	—	48.95	51.05
9.72	2.44	2.46 3.07	—	9.34	17.60	27.00	23-25	9.34	8 9	65.50	34.50
7.20	4.49	4 5	—	7.56	11.76	19.32	21 22	7.56	—	10.80	89.20
7.61	2.88	2.47 3.30	—	8.78	16.20	24.98	22.55 25.55	8.78	—	38.56	61.44
3.76	2.78	2.47 2.87	—	9.50	16.94	26.44	23-25	9.50	8 9	55.66	44.34

Officially Collected Commercial Fertilizers, 1906.

Ground Bone, Tankage, and Dry Ground Fish.

Name of Manufacturer and Brand.	Where Sampled.	Laboratory Number.
Rogers & Hubbard Company, Middletown, Conn.		
Hubbard's Raw Knuckle Bone Flour	Amherst	73
Russia Cement Company, Gloucester, Mass.		
Essex Dry Ground Fish	Somerset	244
Essex Dry Ground Fish	Hadley	266
Sanderson Fertilizer and Chemical Co., New Haven, Conn.		
Fine Ground Fish	Whately	52
" " "	Hadley	82
" " "	Dighton	249
M. L. Shoemaker & Co., Limited, Philadelphia, Pa.		
Swift Sure Bone Meal	Sunderland	90
Thomas L. Stetson, Randolph, Mass.		
Pure Ground Bone	Brockton	204
" " "	Randolph	412
Swift's Lowell Fertilizer Company, Boston, Mass.		
Swift's Lowell Ground Bone	Concord	230
" " " "	Fitchburg	385
Swift's Lowell Tankage	Concord	226
A. L. Warren, Northboro, Mass.		
Warren's Ground Bone	Northboro	370
Sanford Winter, Brockton, Mass.		
Winter's Ground Bone	Brockton	338
J. M. Woodard & Brother, Greenfield, Mass.		
Tankage	Greenfield	428

Officially Collected Commercial Fertilizers, 1906.

Ground Bone, Tankage, and Dry Ground Fish.

	Nitrogen in 100 lbs.		Phosphoric Acid in 100 lbs.							Mechanical Analysis.	
						Total.		Available.			
Moisture.	Found.	Guaranteed.	Soluble.	Reverted.	Insoluble.	Found.	Guaranteed.	Found.	Guaranteed.	Fine bone.	Coarse bone.
6.07	3.97	3.50-4.00	—	4.84	16.98	21.82	24.5-26.0	4.84	-	46.93	53.07
6.80	7.96	8-10	—	6.88	7.94	14.82	11-13	6.88	—	—	—
7.99	7.58	8.24-9.88	—	3.40	2.80	6.20	6-8	3.40	—	—	—
3.05	5.18	4.12-4.94	—	7.42	16.64	24.06	20-23	7.42	—	58.24	41.76
5.88	4.24	4.20	—	7.68	15.22	22.90	20.66	7.68	12.28	19.05	80.95
6.82	2.30	2.46-3.30	—	10.82	17.86	28.68	23-25	10.82	—	53.47	46.53
5.51	5.69	6.59	—	4.18	9.04	13.22	11.45	4.18	—	45.68	54.32
10.05	3.19	3-4	—	10.10	15.48	25.58	22-23	10.10		46.33	53.67
13.01	3.16	2-3	—	6.46	16.70	23.16	23-24	6.46	6-8	34.19	65.81
9.02	4.53	4-5	—	7.38	12.02	19.40	19-20	7.38	7-8	12.74	87.26

Officially Collected Commercial Fertilizers, 1906.

Phosphoric Acid Compounds and Ashes.

Name of Manufacturer and Brand.	Where Sampled.	Laboratory Number.
American Agricultural Chemical Co., Boston, Mass.		
Dissolved Bone Black	South Amherst	53
" " "	Haverhill	292
Plain Superphosphate	South Amherst	96
Bowker Fertilizer Co., Boston, Mass.		
Plain Superphosphate	Northampton	53
" "	Springfield	460
Dissolved Bone Black	Leominster	372
The Coe-Mortimer Company, New York City.		
Basic Slag	Concord	203
" "	Fitchburg	348
Sanderson Fertilizer and Chemical Co., New Haven, Conn.		
Plain Superphosphate	Dighton	255
Swift's Lowell Fertilizer Co., Boston, Mass.		
Acid Phosphate	Concord	196
" "	Springfield	461
Dissolved Bone Black	Boston	321
" " "	Fitchburg	393
WOOD ASHES.		
Bowker Fertilizer Company, Boston, Mass.		
Pure Unleached Hard Wood Ashes	Lawrence	286
" " " " "	Boston	333
R. & J. Farquhar & Company, Boston, Mass.		
Canada Unleached Hard Wood Ashes	Boston	313
Fyfe, Fay & Plummer, Clinton, Mass.		
Unleached Wood Ashes	Sunderland	528
George L. Monroe & Son, Oswego, N. Y.		
Unleached Canada Hard Wood Ashes	Marlborough	306
W. H. Nash, Boston, Mass.		
Lime Kiln Ashes	Boston	531

Officially Collected Commercial Fertilizers, 1906.

Phosphoric Acid Compounds and Ashes.

	Nitrogen in 100 lbs.		Phosphoric Acid in 100 lbs.							Potassium Oxide in 100 lbs.	
						Total.		Available.			
Moisture.	Found.	Guaranteed.	Soluble.	Reverted.	Insoluble.	Found.	Guaranteed.	Found.	Guaranteed.	Found.	Guaranteed.
12.64	—	—	12.75	4.93	.34	18.02	16-19	17.68	15-18	—	—
13.37	—	—	11.93	4.17	.64	16.74	13.5-16.	16.10	12-14	—	
12.23	—	—	9.43	5.67	1.04	16.14	13.5-16.	15.10	12-14	—	—
11.55	—	—	11.00	4.52	1.80	17.32	16-18	15.52	14-16	—	—
11.48	—	—	8.83	5.73	1.48	16.04	16-20	14.56	15-18	—	—
none	—	—	—	6.72	12.27	18.99	18	6.72	—	—	—
13.27	—	—	12.18	2.62	.34	15.14	—	14.80	14-16	—	—
11.90	—	—	11.93	2.41	2.44	16.78	15-17	14.34	14-16	—	—
11.45	—	—	8.63	4.43	2.86	15.92	12-15	13.06	12-15	—	
12.22	—	—	10.75	4.11	2.10	16.96	—	14.86	15-18	—	
15.32	—	—	—	—	—	1.30	1-3	—	—	4.96	4-7
13.65	—	—	—	.78	.86	1.64	1.5-3.	.78	—	5.24	5-8
10.14	—	—	—	—	—	1.25	1-3	—	—	5.10	4.5-8.
7.74	—	—	—	—	—	1.12	1-3	—	—	7.79	6-8
.39	—	—	—	—	—	1.02			—	2.52	—

Officially Collected Commercial Fertilizers, 1906.

Chemicals Furnishing Nitrogen.

Name of Manufacturer and Brand.	Were Sampled.	Laboratory Number.	Moisture.	Nitrogen in 100 lbs. Found.	Nitrogen in 100 lbs. Guaranteed.
American Agricultural Chemical Co, Boston, Mass.					
Nitrate of Soda	South Amherst	87	2.32	15.55	15.6
Bowker Fertilizer Company, Boston, Mass.					
Nitrate of Soda	Northampton	45	2.14	15.67	15.5
Sulphate of Ammonia	Boston	337	.76	20.78	19-20
Dried Blood*	Leominster	405	7.55	9.30	9.5-11.0
The Coe-Mortimer Company, New York City					
Nitrate of Soda	Pittsfield	419	1.70	15.64	15.
Parmenter & Polsey Fertilizer Co., Peabody, Mass.					
Nitrate of Soda	Peabody	117	1.32	15.30	15.64
Russia Cement Company, Gloucester, Mass.					
Nitrate of Soda	Somerset	124	1.71	15.62	15.64
Sanderson Fertilizer and Chemical Co., New Haven, Conn.					
Nitrate of Soda	Hadley	75	2.42	15.31	15.64-16.43
" " "	Dighton	190			
Swift's Lowell Fertilizer Company, Boston, Mass.					
Nitrate of Soda	Taunton	250	.70	15.63	14.82-15.64

*The sample contained 10.28% phosphoric acid of which 9.64% was available.

Officially Collected Commercial Fertilizers, 1906.

Chemicals Furnishing Potash.

Name of Manufacturer and Brand.	Where Sampled.	Laboratory Number.	Moisture.	Potassium Oxide in 100 lbs. Found.	Potassium Oxide in 100 lbs. Guaranteed.
American Agricultural Chemical Co., Boston, Mass.					
High Grade Sulphate of Potash	Bradstreet	7	1.31	50.68	48.64 51.34
" " " " "	Boston	325			
Muriate of Potash	South Amherst	72	3.20	47.52	50-55
" " "	Springfield	474			
Bowker Fertilizer Co., Boston, Mass.					
Sulphate of Potash—Magnesia	Northampton	35	3.95	25.92	26-28
" " " "	Agawam	483			
Muriate of Potash	Northampton	38	1.98	49.80	50-55
" " "	Dighton	123			
High Grade Sulphate of Potash	Fall River	154	1.47	48.16	48-52
" " " " "	Springfield	470			
Kainit	Haverhill	288	2.07	12.84	12-13
"	Boston	324			
A. Klipstein & Company, New York City.					
Carbonate of Potash	Amherst	530	none	67.12	67.
National Fertilizer Company, Bridgeport, Conn.					
High Grade Sulphate of Potash	Leominster	368	.17	48.88	48-50
Olds & Whipple, Hartford, Conn.					
Vegetable Potash	Hatfield	15	2.60	*25.52	25
Sanderson Fertilizer and Chemical Co., New Haven Conn.					
High Grade Sulphate of Potash	Hadley	83	.12	49.80	48.64-51.34
Muriate of Potash	Dighton	247	.11	52.08	50-52
Swift's Lowell Fertilizer Company, Boston, Mass.					
High Grade Sulphate of Potash	Taunton	255	1.15	49.20	48-52
Muriate of Potash	Fitchburg	340	.17	52.28	50-52

*Potash mostly as carbonate.

III.

TRADE VALUES OF FERTILIZING INGREDIENTS IN RAW MATERIALS AND CHEMICALS FOR 1905 AND 1906.

	1905	1906
	CENTS PER POUND	
Nitrogen in ammonia salts.	17.5	17.5
" " nitrates,	17.0	16.5
Organic nitrogen in dry and fine ground fish, meat, blood, and in high-grade mixed fertilizers,	18.5	18.5
" " " fine bone and tankage,	18.0	18.0
" " " coarse bone and tankage,	13.0	13.0
Phosphoric acid soluble in water,	4.5	4.5
" " soluble in ammonium citrate,	4.0	4.0
" " in fine ground fish, bone and tankage,	4.0	4.0
" " in cottonseed meal, castor pomace and wood ashes,	4.0	4.0
" " in coarse fish, bone and tankage,	3.0	3.0
" " insoluble (in water and in neutral citrate of ammonia) in mixed fertilizers,	2.0	2.0
Potash as Sulphate, free from Chlorides,	5.0	5.0
" " Muriate (chloride),	4.25	4.25
" " Carbonate,	8.0	8.00

The above schedule of trade values was adopted by representatives of the Massachusetts, Connecticut, Rhode Island, Maine, Vermont and New Jersey Experiment Stations at a conference held during the month of February, 1906, and is based upon the condition of the fertilizer market in centers of distribution in New England, New York and New Jersey during the six months preceding March, 1906, and refers to the current market prices, in ton lots, of the leading standard raw materials, which furnish nitrogen, phosphoric acid and potash, and which enter largely into the manufacture of our commercial fertilizers.

HATCH EXPERIMENT STATION

—OF THE—

MASSACHUSETTS

AGRICULTURAL COLLEGE.

BULLETIN NO. 114.

THE ORIENTAL MOTH
A RECENT IMPORTATION.

JANUARY, 1907.

The regular Bulletins of this Station will be sent free to all newspapers in the State and to such individuals interested in farming as may request the same. Technical Bulletins are sent only to those persons interested in the subject treated of in each case.

AMHERST, MASS.:
PRESS OF CARPENTER & MOREHOUSE
1907

HATCH EXPERIMENT STATION

OF THE

Massachusetts Agricultural College,

AMHERST, MASS.

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The co-operation and assistance of farmers, fruit-growers, horticulturists, and all interested, directly or indirectly, in agriculture, are earnestly requested. The Bulletins will be sent free to all newspapers in the State and to such individuals interested in farming as may request the same. General bulletins, fertilizer analyses, analyses of feed-stuffs, and annual reports are published. Kindly indicate in application which of these are desired. Communications may be addressed to the

Hatch Experiment Station, Amherst, Mass.

DIVISION OF ENTOMOLOGY.

A New Oriental Moth in Massachusetts.

Cnidocampa flavescens (Walk.)

H. T. Fernald.

DISCOVERY OF THE INSECT.

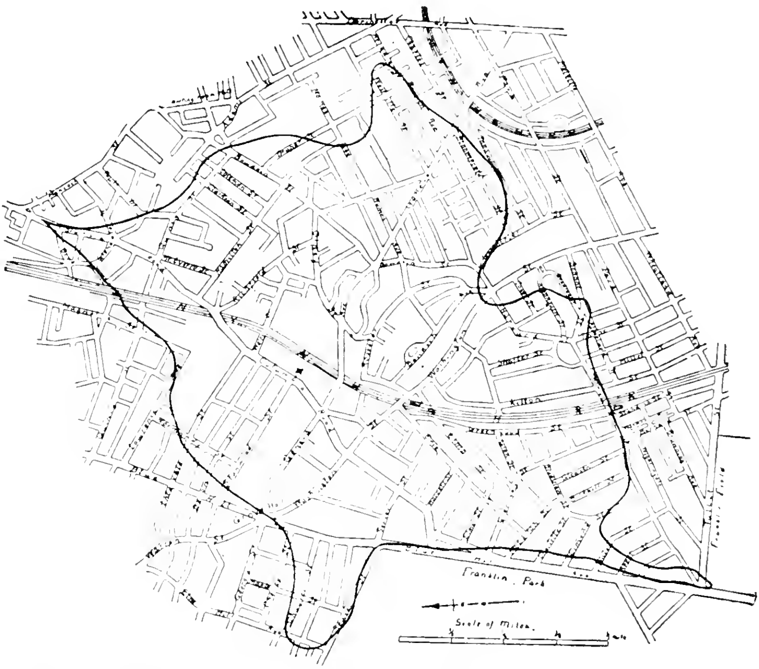
In February, 1906, peculiar cocoons discovered on several kinds of fruit trees in Dorchester were sent to the Gypsy Moth Commismission for identification, and as they were not at once recognized were forwarded by Mr. A. H. Kirkland, Superintendent of the Commission, to the Hatch Experiment Station for examination.

Prolonged study of these cocoons showed that nothing like them had ever been reported in Massachusetts, and that it was probable that they were cocoons of some foreign insect and they were preserved in order to obtain the moths, which began to appear about the twentieth of June. These were also carefully studied and finally identified as probably a Chinese and Japanese moth, known in Japan as "Ira-mushi," but in order to make the identification positive specimens were sent to Sir George Hampson of the British Museum who confirmed the identification.

At this time the cocoons had been reported as occurring in three small house lots only, but through the kindness of Mr. Frank A. Bates and Mr. Joseph Silva of the Gypsy Moth Commission, a further examination was made, which showed that it was present over a considerably larger territory, and a study of its distribution through Dorchester was begun.

DISTRIBUTION.

Dorchester, formerly a town adjoining Boston, is now a part of that city and is mainly a residential district, well provided with shade and fruit trees. Quite a portion of the Public Park system is in this region, Franklin Park, Franklin Field and Columbia Road being portions included.



Map of infested region as located Nov. 1906 is shown by the heavy line. The probable original center is marked by a spot.

An examination of the infested region made in November, 1906, as determined by the presence of cocoons on the trees, showed that these were most abundant in a neglected Pear orchard on Columbia Road, close beside where there was once a Japanese nursery. This nursery was removed several years ago, and the lot has since been built on, but the great abundance of cocoons of this insect around the place, together with the fact that it is a Japanese insect is very suggestive as to the way in which it may have reached this country.

Columbia Road is a wide double street with a central strip of lawn and young trees, a row of which is also on each side, and the cocoons were found on these trees for a distance of nearly a mile and a half. Streets crossing Columbia Road were then followed until no cocoons could be found for several blocks, and the approximate outline of the infested territory was thus determined. This is very irregular in form but as a whole extends farther south-west from the probable center of infestation than in any other direction, and the longest distances in the territory are almost two miles in a north-east, south-west direction by a mile and a half at right angles to this.

This territory is rolling ground, with several hill-tops perhaps a hundred feet higher than streets an eighth of a mile away, and it was very noticeable that on the hill-tops in most cases no cocoons could be found. This and the fact that where the infestation is slight most of the cocoons are not high up in the trees would suggest that perhaps the moth does not fly high under usual conditions.

FOOD PLANTS.

The cocoons were almost invariably present on Norway maples which may be considered their preferred food. Other kinds of maples were occasionally infested to a slight extent. Near the outer limits of the infested area the Norway maples were almost always the only trees infested, but toward the center others were added. So far as could be judged by relative abundance of the cocoons the Norway maple, pear, apple and cherry (cultivated and wild) were the most favored food plants though cocoons were also found on the crab-apple, willows, black birch, cut-leaved white birch, oak, American elm, Wahoo elm, blackberry, beech, poplar, mountain ash and buck-thorn. One cocoon found on a rose bush was probably accidental as this bush was directly under a cherry, and was the only infested plant of its kind though large numbers were examined. Cocoons were not found on the peach, hickory, sumach, horse chestnut, gingko or spruce though these were frequently met with in the infested area.

ABUNDANCE.

Near the apparent center of infestation the cocoons were very abundant, as many as a hundred being found on a tree in some cases. Judging from the distribution of the cocoons the eggs are not laid in clusters but perhaps half a dozen or less on a tree by a single moth and the larger numbers would represent the deposition of eggs by quite a number of insects.

DATE OF INFESTATION.

A determination of the time when this insect was introduced into Massachusetts is impossible to make with any certainty and only conjectures can be offered. If it was brought in on Japanese nursery stock it was undoubtedly before 1902, as official inspection of the nurseries was begun in that year and none of the inspectors observed these cocoons either then or during subsequent inspections till the present summer. Before 1902 the Japanese nursery in this locality was inspected for a year or two at the request of the owners by Mr. A. H. Kirkland and if it had been present then, it would certainly have been discovered. These facts taken in connection with the rather large area over which the insect now occurs lead to the opinion that if it was introduced on nursery stock it was probably before the year 1900.

LIFE HISTORY.

The life history of *Cnidocampa flavescens* does not seem to have been fully worked out in the Orient, and has thus far not been completed here.

The insect passes the winter in the cocoon but does not pupate until spring, retaining during the winter its larval form but losing most of its color. The moths emerge from the cocoon during the latter part of June and first of July and one in confinement laid about fifty eggs on the side of a breeding cage but these failed to hatch and were undoubtedly infertile. The length of time spent in the egg therefore cannot be stated nor the time during which the larva feeds, but it is probable that cocoon making occurs during the latter part of September or the first of October, and it is evident that there is but one brood a year.

DESCRIPTIONS.

Egg. The unfertilized eggs referred to above were regularly oval in form, measured one and three-eighths mm. by three-fourths mm. and were creamy white in color. The chorion showed a slight pearly luster under a lens, but no markings or micropyle were perceptible with this magnification. The eggs were laid side by side, touching each other, on the wood of the frame of the breeding cage though leaves and twigs of trees were available.

Larva. The larva is one of the "slug caterpillars" but as it has not thus far been reared here the following description has been prepared from inflated specimens removed from the cocoon and will certainly need modification when compared with feeding larvæ.

Head small, 3 mm. in diameter, its clypeus and sides brown of varying depth, the top and front down to and at the sides of the clypeus light; with a light spot or sometimes an elongation of the light color into the brown of the side at about the level of the top of the clypeus. Anterior margin of the labrum deeply and broadly notched, dark brown. Eyes placed in a dark spot. Legs pale resinous yellow, very small, their claws dark brown. Second (prothoracic) segment rather small; prothoracic shield rounded triangular, with a pair of quite large brown spots in front, a small pair behind, and a few minute brown dots on the sides. Subdorsal row of horns well developed and bearing spines; small on the third, much larger on the fourth, and very large on the fifth segment, the spines on these three segments being black except at their bases. The subdorsal horns and their spines are very minute on the sixth and tenth segments, larger on the seventh, eighth and ninth, their spines being pale, tipped with black. Horns and spines of this row on the eleventh segment about like those on the fifth; those on the twelfth and thirteenth about like those on the third. Lateral horns and spines small on the third segment and quite near the subdorsal ones; those on the fourth larger, lying only a short distance in front of and above the first abdominal stigma which has moved upward nearly to the line of the lateral horns. Lateral horns absent on the fifth segment; fairly well developed on the sixth to tenth segments inclusive, but not very noticeable, only the tips of the spines being black; much larger on the eleventh and twelfth segments and with more black on the spines. Stigmata pale brown, slightly oval. Below each stigma a short distance are two or three small, slender hairs. There are no traces of prolegs. As regards the colors and their distribution Dyar says: "Purplish brown dorsally, including a diffuse white dorsal band with dark edges, distinct only centrally. Sides green, just covering the lateral horns of joint 4, reaching up to the subdorsal horns on joints 7 to 9, retreating to the lateral horn on joint 11, but covering joints 12 and 13 and with an angular patch about the subdorsal horns of joint 11; green spots below the subdorsal horns of joints 4 and 5. A white broken lateral band with dark edges; subventral edge pale, with a dark line above."

Length of inflated specimens about 25 mm.: greatest diameter (at the fourth and fifth segments) about 8 mm. These measurements are probably greater than would be obtained from a living caterpillar.

Cocoon. The cocoon is about 14 mm. in length and 10 mm. in width, the smallest one found in a lot of over a hundred measuring 17 mm. by 8 mm. It is almost perfectly oval in outline though there is sometimes a very slight constriction near one end marking the line of attachment where the lid of the cocoon which separates from the remainder when the moth escapes, joins the main portion. The cocoon is whitish and brown, often so mingled as to present a rather striking pattern and suggestive of certain oriental designs. In time, as the cocoon weathers, the brown seems to fade, giving a dirty grayish color to the structure. The lid in fresh cocoons is nearly always quite uniformly brown in color.

The cocoon is very tough and firm and is so solidly fastened to the tree that it is frequently broken in the attempt to remove it. Its location varies but the preferred position seems to be in or beside an axil between a branch one-half or three-quarters of an inch in diameter and a smaller twig. Occasionally one will be found attached to the side of a twig near its tip where the diameter of the twig is considerably less than that of the cocoon, and in a few cases they have been found on the larger limbs, no attention in these cases being paid to the presence of any small branches which might offer axillary attachments. In one case a cocoon was discovered on the side of an erect trunk which was at least four inches in diameter.

The tendency to place the cocoons toward the tips on the smaller branches is very strong, probably four-fifths being in this region. In one case a fresh cocoon was found on the surface of a fresh winter tent of the Brown-tail moth, and as the latter during the fall of 1906 did not complete their tents till about the tenth of September this gives some indication as to the probable time of cocoon making.

Within the cocoon the caterpillar assumes a short, stout form somewhat resembling a fullgrown Ox Warble though smaller. It loses its colors, becoming yellowish white, and in this condition it hibernates, transforming to a pupa sometime later than March of the following spring.

At emergence from the cocoon the lid is in some manner separated from the rest of the cocoon, leaving a circular opening with smooth even edges from one to three millimeters from the end. Through this opening the pupa works its way partly out, then stops and the moth escapes, generally leaving a portion of the empty pupa case protruding from the opening of the cocoon.

Adult. The only descriptions of the moth published have been the original one by Walker and a still briefer one by Butler. More complete descriptions of the genus *Cnidocampa* (new name for Monema, preoccupied) and of the species, are accordingly given here.

Genus *Cnidocampa* Dyar. Body short, stout. Head rather small, bent somewhat downward below the axis of the body, frons rounded, densely clothed with scales which project forward above and between the eyes and also in a vertical median line between the eyes, forming a T-shaped ridge. A narrow strip just in front of the tongue bare, pale straw yellow, glistening. Labial palpi upturned, nearly as long as the head and thorax together, the first segment short, the second nearly twice the length of the third, thickly clothed with rather long appressed scales. Maxillary palpi absent. Tongue short, naked at base where it separates into two distinct unconnected halves; apparently not functional. Eyes large, nearly hemispherical, their inner margins converging somewhat downward. Ocelli absent. Antennæ extending about two-thirds the length of the costa of the fore wing, filiform, the central two-thirds having a very slightly greater vertical diameter than the base and tip; perceptibly thicker in the male than in the female; without pectinations but quite thickly covered with minute scales.

Thorax thickly clothed with long hairs and scales which form a pair of long flattened tufts behind on the upper side and extend backward over the base of the abdomen. A similar flattened tuft arising in front of the base of the fore wing extends backward beneath it, and another, more erect, passes from the side of the body inward in front of the hind coxa and femur concealing these from in front. Tegulæ well developed, extending over the base of the hind wings. Fore wings with a slightly convex costal margin. Outer margin quite strongly, evenly rounded and directly continuous with the slightly less rounded inner margin. Hind wings shorter, but longer than the abdomen, when folded; the base of the fore wing and the base, and that part of the hind wing supported by the internal veins thickly clothed with long hairs.

The venation characteristic of the family Cochlidiidæ, as given by Hampson is: "fore wing with two internal veins; vein 1b forked at the base. Hind wing with vein 8 arising free, then bent down and usually anastomosing shortly with 7 near the base of the cells; three internal veins." Additional features of the venation in *Cnidocampa* are as follows: Fore wing. Cell completely divided by a longitudinal vein which forks externally, the hind fork joining the base of 5, the other the base of 6. Base of 4 and 5 joined by a faint cross vein, the two veins a little nearer to each other at their bases than are 3 and 4. Vein 3 arising from the median a little more than half way from 2 to 4. A cross vein passes forward from the junction of the anterior fork and the base of 6, to the subcostal. Veins 7 and 10 connate or stalked from the upper angle of the cell; 8 and 9 stalked from near the basal fourth. Vein 11 leaving the subcosta at about the middle of the cell and bending forward, and from a point about opposite the end of the cell onward, running very close to vein 12. Hind half of the cell longer and narrower than the front half. Hind wing. Cell divided by a longitudinal vein from its outer end, which joins the median vein at the inner third of the cell. Vein 2 arising from about the middle of this posterior cell; veins 3, 4 and 5 from near its end, 4 being from its apex. The cross vein forming the external end of the anterior half of the cell arises a little beyond the middle of the posterior half of the cell and passes forward and a little obliquely outward, Veins 6 and 7 from a short stalk from the upper angle of the cell; 5 and 6 approaching each other somewhat then diverging.

Legs rather stout, the under side of the femora quite heavily fringed with hair-like scales. Fore and hind tibia and metatarsus fringed on the outer side with long hair-like scales, longer in the male; the same conditions being present to a less degree on the middle legs, and here too, more developed in the male. Hind tibia with a pair of spurs on the inner side at the tip and a second pair near the middle, all four spurs being nearly of equal length.

Cnidocampa flavescens (Walk.) Expanse of wings 32 to 40 mm. Head, thorax and inner portion of the wings above, dull chrome yellow; outer portion of fore wings light chestnut brown with a yellowish tinge inwardly, darker toward the outer margin. Near the hind margin of the wing in this region the yellowish is replaced by a pinkish tinge. Front of the head below the horizontal bar of the T-shaped ridge of scales, brown - pink; palpi light chestnut, with numerous black scales giving a finely speckled appearance, their tips blacker. Antennæ light chestnut with a silky luster. Thorax without markings above except that near the middle line the yellow is a little paler. Fore wings with a light chestnut colored discal spot varying somewhat in size, depth of color, and limits, sometimes blending with the similar color outside. From the costa near the apex a dark brown line passes backward to near a point a little internal to the angle, on the inner margin. This line as a whole is arched outward somewhat, but may be slightly sinuate during its course. A shorter, broader and less sharply defined line arising at the same place on the costa runs toward the center of the wing making a sinuous course, passing external to the discal spot, and terminates near the middle of the wing. The strength with which this line is developed and its exact course vary. The color of the wing external to the outer line is quite uniform but the costa and outer margin are narrowly edged with black. The front half of the wing between the two lines is the portion where the chestnut color is tinged with yellow, while behind, the pinkish replaces the yellow. Internal to the inner line the chestnut varies in the distance to which it extends, sometimes reaching to and blending with the discal spot and behind this extending some distance toward the base of the wing, then retreating to about the middle of the internal margin. There is usually a small chestnut spot near the internal margin, lying in the yellow, about one third of the distance from the base of the wing to the anal angle. The fringe on the outer margin of the fore wing is dull white with a black line running through it. Hind wings above uniformly dull clay. Fringe brown at base, whitish beyond, with two dividing dark lines. Basal segment of the abdomen above, of the same color as the thorax, the remainder brown-pink, without markings. Under surface of fore wings pale brown, lighter near the base and internal margin; with a decided pinkish shade along the basal half of the costa which is very narrowly edged with dark brown. Hind wings beneath of the same general shade as the fore wings, the outer half of the costa slightly tinged with dark. The outer half of the wing is sprinkled sparsely with black scales perceptible with a lens. Body beneath of the same color as the abdomen above but with a decided pink shade. Coxal clothing orange red. Legs light chestnut, sprinkled with black scales, the femora and tibiæ with a pinkish tinge beneath, the tarsi quite grayish.

Described from three male and three female specimens.

THE ORIENTAL MOTH IN ASIA.

In the Orient this insect has an extensive distribution. In Japan it has been captured on the island Yezo and from there southward at least as far as Yokohama. On the main land it has been taken at Chabarofoka and Blagoweschtschensk in Amur, north of the fiftieth degree of latitude, and Graeser says that at the latter place cocoons could be found by the hundreds in the gardens and forests. Farther south it is abundant in the province of Chi-li near Peking, it being possible there to obtain the cocoons by the thousand, and this is also true near Shanghai. The most southern point from which it has been reported is on the Yiang-tse-Kiang river just north of the thirtieth degree of latitude.

Such a distribution as this in North America would include all the United States except the peninsula of Florida; northern Mexico and southern Canada. So far as the climate is concerned therefore, it is likely that this insect could live almost anywhere in the United States.

Food plants reported from Asia are the Celtis, birch, elm and Japanese Persimmon (*Diospyros kaki*).

WILL IT BECOME A PEST HERE?

This is a difficult question to answer. The Oriental moth belongs to the family Cochlidiidæ and members of this family are not usually of much economic importance. In this case however, we have an insect which has probably reached this country without being accompanied by any of the enemies which presumably hold it in check in its native land, and it has already shown its ability to live and spread in this climate.

No evidence of the presence here of enemies has thus far been found except that about one cocoon in a thousand has a hole in the side and is empty though the lid is still in place, showing that the moth has not emerged. It is possible that this is the work of birds, but if so the small number of cocoons attacked is not encouraging to the idea that birds will prove important enemies of this insect.

While the writer is of the opinion that the Oriental Moth is not likely to become a very dangerous pest in this country the experience of Massachusetts with the Gypsy and Brown-tail moths has been so serious that the possibility that this may become another enemy of importance should not be ignored. It is doubtful if five years after their arrival in Massachusetts either of the above named insects had done injury enough to attract any more attention than is the case with the Oriental Moth at the present time and it would be a mistake not to recognize the possibility that we have here the first start of what may perhaps prove to be another serious pest.

ACKNOWLEDGMENTS.

The thanks of the writer are hereby tendered to Sir George Hampson of the British Museum ; to Mr. A. H. Kirkland, Mr. Frank A. Bates and Mr. Joseph Silva of the Gypsy Moth Commission ; to Mr. Samuel Henshaw of Harvard University ; and to Dr. H. G. Dyar and Mr. E. G. Titus of Washington, D. C., for assistance during the study of this insect. To Prof. C. H. Fernald he is indebted for much assistance in all parts of the work and particularly in connection with the descriptions of the adult.

BIBLIOGRAPHY.

Monema flavescens Walk., Cat. Lep. Het. B. M., V, 1112, 1855.

" " Butler, Ill. Typ. Sp. Lep. Het. B. M., II, 14, Pl. XXV, f. 5., 1878.

" " Pryer, Trans. As. Soc. Japan, XII, 41, 1884.

Miresa " Graeser, Berl. Ent. Zeit., XXXII, 121, 1888.

Monema " Leech, Proc. Zool. Soc. Lond., p. 610, 1888.

Miresa " Staud., Rom. Mem. sur les Lep., VI, 300, 1892.

Monema " J. Joannis, Bull. Soc. Ent. Fr., p. 147, 1896.

Monema (Miresa) flavescens Grib., " " " " p. 179, 1896.

Monema flavescens R. du Buysson, Ann. Soc. Ent. Fr., LXVII, 80, 1898.

" " Leech, Trans. Ent. Soc. Lond., p. 103, 1899.

" " R. du Buysson, Bull. Soc. Ent. Fr., p. 29, 1901.

Cnidocampa " Dyar, Proc. U. S. Nat. Mus., XXVIII, 952, 1905.

Monema flavescens nigrans J. Joannis, Bull. Soc. Ent. Fr., p. 251, 1901.

Kräpelin (Mitt. a. d. Naturhist. Mus. Hamb., XVIII, 196, 1901) undoubtedly referred to this insect but gave it no name.

The name *Monema* being preoccupied, this insect was subsequently referred to *Miresa*. Dyar however, does not consider it as referable to this genus and has proposed *Cnidocampa* as a substitute for *Monema*.

EXPLANATION OF PLATE.

[*From Photographs by the Author.*]

FIG. 1. Adult moth.

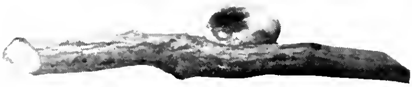
FIG. 2. Did a bird do this?

FIG. 3. "The lid is off."

FIG. 4. Cluster of cocoons on Norway maple.

FIG. 5. Cocoon on pear twig × 3½.

1



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BULLETIN No. 115. FEBRUARY, 1907.

MASSACHUSETTS AGRICULTURAL EXPERIMENT STATION.

PRELIMINARY REPORT

ON

CRANBERRY INSECTS

BY

HENRY J. FRANKLIN, B. S.

This bulletin gives brief descriptions and accounts of the habits of some of the more injurious insects attacking the cranberry and makes suggestions as to methods of destroying them.

Requests for bulletins should be addressed to the
Agricultural Experiment Station,
Amherst, Mass.

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AMHERST, MASS.

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AGRICULTURAL EXPERIMENT STATION,
AMHERST, MASS.

DIVISION OF ENTOMOLOGY.

Preliminary Report on Cranberry Insects.

BY HENRY J. FRANKLIN, B. S.,

Special Assistant in Entomology.

INTRODUCTION.

This bulletin is published as a preliminary report on cranberry insects and their control, based on the observations and experiments of a single season on the bogs of Cape Cod. It is prepared to indicate briefly the methods which now promise to be most effective for controlling the more important cranberry insects, and all full details of the life histories, habits and descriptions of the insects are intentionally reserved for a later publication following more extended studies, both on the bog and in the laboratory, which are now being arranged for.

This work has been carefully followed by Profs. C. H. and H. T. Fernald, who have aided in planning the experiments and in reaching conclusions from their results.

THE CRANBERRY FRUIT WORM.

Mineola vaccinii (Riley).

This, the worst insect pest of the cranberry in Massachusetts, also known as the berry worm, is familiar in its injurious stages to every grower. On account of its peculiar life history it is difficult to control satisfactorily, though on bogs with abundant water supply, or even good winter flowage, its injury may be greatly reduced and at little expense. Dry bogs and those which have the winter flowage drawn off early in the spring suffer worst as a rule from this insect's attack, especially the former, while those which have the winter flowage held on late every year are practically immune. No bog on which the water was kept until after the middle of May, during the past season, even though that had not, in many cases, been the usual practice, was at all seriously troubled. Unfortunately, the custom of holding the winter flowage late every spring seriously reduces the crop and gives the vines a strong tendency to the excessive growth of wood. For this reason, if the water be used in this way to keep down the fruit worm, the grower is simply getting out of one difficulty into another even more serious. Occasional late holding does not, however, seem to cause any serious injury.

According to Prof. J. B. Smith, it has been found by experiments on this insect in confinement, that early submergence in the fall is very destructive to those caterpillars which have but recently formed their cocoons. (The worms pass the winter in cocoons in the sand on the surface of the bog.)

In fighting the fruit worm, as well as other cranberry insects, water is the grower's cheapest and most effective weapon. Where available in sufficient abundance for a complete winter flowage, it can probably be so handled as to reduce the injury by this insect to a point where insecticides, even if entirely successful, would never be desirable, as the expense connected with their use would be greater than the benefit derived. On dry bogs, however, insecticides seem to be the only practicable remedy.

Recommendations for treatment :—

A. On bogs which have abundant water supply for winter flowage and for rapid reflowage :—

1. *Reflow immediately after picking, for ten days or two weeks. Draw off this flowage and, after allowing the foliage to ripen, put on the water for the winter.* If, in a series of closely connected bogs, some bearing early varieties only are so situated that they may be flowed independently of the others, reflow them as soon as the fruit is off, without waiting to finish picking the other bogs.

2. *Draw off the winter flowage early in April as a rule, but every third or fourth year hold it until after the middle of May.*

3. *On some bogs which are level enough to permit it and on which the vining is heavy, the practice of holding the water up among the vines, but not covering them, for a week or ten days in late June would probably be effective.*

B. On winter flowed bogs which have not water supply for more than one reflowage or which cannot be reflowed rapidly enough to prevent injury from frost :—

1. *Put on the winter flowage as soon as possible after the cranberry foliage has ripened and hardened.*

2. *Hold this flowage every spring until the 20th of April, and every third or fourth year until after the middle of May.* It is the custom with many growers to draw off the winter flowage late in March or early in April. The more advanced in development the buds of any plant are, the more likely are they to be destroyed by spring frosts. By holding the water until the 20th of April the buds would probably be held back sufficiently to prevent much loss by frost in most cases, while they would not be retarded enough to seriously affect the blossoming or fruiting of the vines. While this practice of holding the water on the bog would thus tend to help in the frost problem, it would also tend to reduce the fruit worm injury, as it is evident that the longer the water covers the bog the greater is the number of worms destroyed.

3. *In the case of bogs which have water supply enough for abundant reflowage but which it takes several days to cover, put the water on for ten days or two weeks immediately after picking.* Then draw this flowage off and allow the foliage to ripen and turn before flooding for the winter.

C. On bogs which are dry or have scanty winter flowage :—

Here only insecticides seem to offer much chance for success. An arsenate of lead spray alone would probably never be at all effective on account of its poor adhesion to the small fruit. The use of adhesives with this poison promises well, but needs more extensive trial. It is essential, if any insecticide be used against the fruit worm, that it be applied before the worm has hatched from the egg, so that the first meal eaten shall be a poisoned one, and that it be of such a nature that it will adhere in some quantity to the stem end of the young berry, where the worm enters. Any spray, in order to give satisfactory results, must be applied two or three times, as the egg-laying and hatching period of the insect is a long one, and the berries are, during this period, constantly increasing in size and number. One spraying would be necessary early in July and another somewhat after the middle of the month.

D. For all bogs :—

1. *Bury the "screenings," to destroy any worms which may be in them.*

2. *Clean out all cracks and crevices where worms may have spun up in the screen house—if this is near the bog*—to guard against possible infestation from this source.

THE FIRE WORM.

Eudemis vacciniana (Pack.)

This insect is also known as the Vine Worm and the Blackhead Cranberry Worm, the latter being really the best (and least used) name. Its eggs adhere during the winter to the under sides of the leaves, and hatch in the spring, whether the vines have been covered with water or not. Hatching begins late in April or early in May, and apparently continues for at least two weeks. A second brood of worms is produced from the eggs laid by the moths of the first brood. These hatch late in June and early in July.

It is essential, whatever the bog conditions may be, that measures be taken to destroy the caterpillars of both broods as soon as possible after hatching. Most growers have two weapons at their disposal—arsenical poison and water. Some bogs are without water supply, and in such cases arsenical poisoning is the only remedy available. The second brood can only be reached by poisons even where there is plenty of water, as the use of the latter would, in most cases, prove disastrous to vines and crop. It seems probable, however, that if the water be handled rightly, the first brood may be either exterminated altogether, or at least so reduced that the second one will not be worth treating.

Observations on several bogs strongly indicate that holding the winter flowage late enough in the spring to satisfactorily control this insect, in Massachusetts, would prove decidedly injurious.

Repeated reflowing to destroy the young caterpillars as they hatch will not clear a bog satisfactorily, unless it be kept up later than is advisable. Such treatment seems to prolong the hatching period, and usually the last worms to hatch are not destroyed. Reflowing seems to kill the caterpillars in all stages, but fails to reach the eggs, and, as experiments show, the same treatment applied to the pupæ at the time of general pupation would probably have to be continued for several days to be successful. Such a reflow, necessarily late as it would be, would be attended with considerable risk. Apparently then, the time for an effective reflow is before the worms begin to pupate to any extent and yet as late as possible before any pupation begins, so that a complete hatching of the eggs may be assured.

On bogs which cannot be reflowed, spraying with arsenate of lead, as the best of the arsenical poisons, seems to be the only treatment advisable. It has been a matter of considerable discussion among the growers as to whether spraying with this poison is really effective against the fire worm. The insect could probably never be permanently cleared from a badly infested bog by such treatment, were the poison used at any strength. Each brood of worms must be fought season after season until, perhaps, exceptional weather conditions or some other natural factor may step in and assist the grower in getting rid of the pest, but the results of experiments leave little doubt that, if the poison be thoroughly applied at the right time, at sufficient strength and with proper spraying apparatus, it will prove effectual in keeping the insect under control. These experiments were tried on the second brood, but there seems to be no reason to suppose that such spraying would be any less effective against the first. The spraying should be done as soon as the worms begin to hatch, so that their first meal may be a poisoned one. If they are allowed to work long before the poison is applied, they will spin themselves up in the leaves of the uprights in such a manner that the poison will not in most cases be placed so that the insect will get it. Furthermore, in the case of the second brood, they will very soon destroy the buds from which the fruit-buds of the following season are to be produced and thus do serious injury in their early stages. The eggs of both broods are oval in outline, flattened against the leaves, bright yellow in color and about the size of fly specks. Though they are not known to the average grower, they are plainly visible to the naked eye and may be easily found when present in any abundance, by turning over the vines in the fall or early spring and examining the under sides of the leaves carefully. As the eggs usually turn dark colored just before hatching, this change marks the time when spraying should begin, and can be watched for. If one is unacquainted with the appearance of the eggs, he will have a fairly satisfactory forewarning, in the case of the second brood, by means of the few tips which become spun up in advance of the rest.

Recommendations for treatment:—

A. On bogs with winter flowage and sufficient water supply to reflow once or several times :—

1. *Draw off the winter flowage before or by the middle of April, allowing the worms to hatch normally* and proceed in their development.

2. *If the worms be allowed to mature in this way, without anything being done to prevent their work, they will, in many cases, do severe injury. To reduce this, spray with arsenate of lead at the rate of seven pounds to fifty gallons of water very late in April or early in May.* If the grower knows the fire worm eggs, he can regulate the time of his spraying to suit their hatching.

3. *Do not reflow for any reason whatever until the worms begin to come down out of the vines to pupate. When this happens, put on the water for two or three days.*

4. *In timing the reflow, watch carefully any freshly sanded spots* which may be present on the bog or any spots on which the vines, for any reason, get an earlier start than elsewhere, for it is on such spots that the worms may be expected to reach maturity first.

5. *If trouble with the second brood is expected, spray* as soon as the eggs begin to hatch or the first spun up tips are seen, *with arsenate of lead of the strength recommended for the first brood.*

B. On dry bogs and bogs having winter flowage only :—

1. As in most cases bogs which have only water enough for winter flowage become uncovered more or less before the season becomes far advanced in the spring, because of seepage, evaporation, etc., the

late holding of water, even were it otherwise advisable, would not prove satisfactory. *Therefore, draw off the flowage from such bogs before or by the middle of April.*

2. *Follow directions for spraying given under Number 2 above for the first brood and under Number 5 for the second.*

FALSE ARMY WORM.

Calocampa nupera Lintner.

This insect, not heretofore reported as a cranberry feeder was, during the past season, probably the third worst pest on the Cape, only the fruit worm and fire worm exceeding it in the amount of injury done. From the reports of the growers it must have been more or less troublesome for several years. It has been confounded with the cranberry span-worm and with the true army worm. The caterpillars resemble those of the true army worm considerably, but when full grown they are larger and more handsome. The larvæ of the true army worm have strongly mottled heads, and are without white spots. Those of this insect, however, have clear greenish yellow heads and noticeable white spots on the back. When very young, these worms are quite different in appearance and in action from what they are as they approach full growth. For several days after hatching from the egg they are whitish in color and to the naked eye are without markings. At this stage, they resemble span-worms in their looping movements. The eggs are laid in small masses, usually on the under sides of the leaves, probably in the fall but possibly in the very early spring. Each egg is less than one-half the size of an ordinary pin-head, slightly flattened, brownish-gray in color, and with the surface marked by numerous ridges which radiate from the top. They begin to hatch early in May, and apparently continue to do so until the middle of the month. On account of their small size, the caterpillars are seldom noticed in their early stages by the ordinary grower, even when present in damaging numbers. They are very ravenous and feed on various weeds and grasses, as well as on the cranberry, and in their last stages they vary in general color from light green to almost black. They reach full growth about the first of July, being then two inches long, and go into the ground to pupate. The moths emerge irregularly during August and September.

The buds at the tips of the uprights do not develop to form the new growth to any extent before many of the worms have become a third grown or more, and as these worms show a decided preference for the more tender portions of the vines they first attack the buds and devour them entirely, or eat out their centers, leaving a sort of shell. As each bud might produce a "rough-neck," bearing several blossoms, the actual injury done is out of all proportion to the amount of plant tissue consumed. Few growers notice this first injury, it being only when the new growth has become well developed and they see the leaves and blossom buds disappearing in damaging quantities that they realize that the insect is seriously destructive. Yet this early injury should not be overlooked, for it is a very important part of the sum total of the work which the insect does.

In dealing with this insect, it is important to know early in the spring, whether the bog is infested, and, if so, how serious the trouble is likely to be. Some evidence on this point might be gained by a careful search for the eggs very early in May. If a bog has been troubled in one season, it is likely to be infested again the following year, though this is not necessarily the case. For some time after the young caterpillars hatch, they may be easily swept from the vines by means of a collector's net. Such a net greatly facilitates the examination of a bog, while the worms are in their early stages, for by sweeping the vines with it vast numbers of them, which would not otherwise be noticed, are brought to light. By this means, after some practice, a person may very readily determine to what extent a bog is infested. In general, it may be said that, if only four or five caterpillars are collected by fifty sweeps of an ordinary net, when tried on various parts of a bog, the infestation is only slight, and would better, in most cases, be disregarded unless abundant water supply is available. If, however, every fifty sweeps collects fifteen to twenty or more, the trouble is likely to be serious and treatment is needed.

Reflowing a bog for twenty-four hours will destroy these caterpillars in all stages or wash them ashore, where they will feed readily on grasses and weeds, and, if there be even a shallow ditch filled with water surrounding the bog, they will not crawl back to do injury. They should not, however, be allowed to live on the margins and come to maturity there, to reinfest the vines the following season.

Holding the winter flowage until after the middle of May seems to be effective against this insect, but whether the water accomplishes this result by keeping the moths from laying their eggs in the spring or by destroying the vitality of eggs which have passed the winter under the water it is impossible to state.

Extensive spraying operations, with arsenate of lead used at the rate of 5 to 10 pounds per fifty gallons of water, against this insect have been observed and the results carefully noted. In no case was the spraying attempted until the worms were from a third to half grown, and the results were all poor. Further, laboratory experiments showed that these caterpillars will stand a considerable amount of poison without being affected. As the new growth, on which they feed mainly, is very smooth and is developing rapidly during the time they are at work, it is not likely that enough poison could ever be made to adhere to the vines to make spraying for this insect a satisfactory method of treatment when the worms are at all well along in growth, and it is even doubtful if it would pay.

Contact poisons have been experimented with to some extent, but in no case with successful results.

It seems probable that spraying with arsenate of lead will be found to be most effective against this insect, if done when the worms are very young and before the new growth has developed to any extent. The chances of success, at this time, should be greater, because the leaves at the tips of the old uprights are standing up so as to form a sort of a cup which will hold the spray until the poison can dry down on the bud. Then, too, the worms at this stage can probably be killed with a proportionally small amount of poison. Of course, the earlier the caterpillars are destroyed the greater will be the injury averted.

Recommendations for treatment :—

A. On bogs with abundant water supply for reflowage :—

1. *Examine the bogs carefully from time to time, from May 1st to May 15th. If any caterpillars appear, reflow for twenty-four to thirty-six hours as soon after May 15th as practicable. If the young caterpillars are present in abundance, this will save a great amount of injury to the buds. Furthermore, less difficulty will be experienced at this time with worms which survive the flooding and are washed ashore alive.*

2. *If caterpillars are present a few days after the first reflow, put on the water again for 24 to 36 hours.*

3. *As far as possible destroy all the worms which are washed ashore alive during a reflow. In case the grower is favored with weather damp enough to make it safe, this may probably be most conveniently done by spraying the margins where the worms come ashore, with kerosene and then setting it afire while the water is still on the bog.* If the grower is not so favored, it is probable that the spraying alone would be fairly effectual.

B. On bogs with winter flowage and enough water supply for one good reflow :—

1. *Hold the winter flowage late (until toward the 20th of May) every third or fourth year, if the bog is being regularly attacked by this pest.* This treatment also holds for the fruit worm under similar bog conditions.

2. *On other years, draw off the winter flowage about the 15th or 20th of April.* This leaves about a month during which the vines would be uncovered before the worms could be destroyed by flooding and, with only one reflow possible, the shorter the time during which flooding might be necessary to protect from frost the better.

3. *Do not reflow for the caterpillars until danger from frost is practically past unless they are so plentiful as to threaten serious injury.* Of course, if frost so threatens, between the 15th and 25th of May, that it seems necessary to reflow on that account, the water will then destroy the worms.

4. *If the water must be used before it will destroy the worms*, then the only resort is arsenical poisoning, as recommended below for dry bogs.

5. *If the worms become very plentiful, it would be better, in most cases, to use the water about the 20th of May and run the risk of later frosts.*

6. *If the bog is not level and water for only a partial reflow is to be had*, this water may be used as in 1, 2 and 3 for the portions of the bog which can be covered, and the remainder may be treated as recommended for dry bogs.

C. On bogs with winter flowage only :—

1. *Hold the winter flowage until after the middle of May every third or fourth year.* This is also recommended for the fruit worm.

2. *On other years, treat as for dry bogs.*

D. On dry bogs :—

1. *If the young worms are found to be hatching plentifully, spray at once (early in May) with arsenate of lead used at the rate of seven pounds to fifty gallons of water.*

2. These caterpillars show a strong tendency to work at night and hide under the vines or anything else that they can find during the day. *On this account, in case the caterpillars have become so far developed that it is not practicable to spray,* lay down boards for them to hide under and destroy those that collect there.

THE YELLOWHEAD CRANBERRY WORM.

Acleris minuta (Robinson).

This insect, so closely resembling the fire-worm in its manner of work, may be distinguished from that species, in its caterpillar state, by means of its yellow head. The two species are often confused by the ordinary grower, but their life histories are different in many respects. The yellowhead passes the winter in the moth stage and not in the egg, as does the fire worm. It is two brooded in Massachusetts, like the fire worm, and seems to infest dry bogs for the most part, probably seldom troubling long those with abundant water supply. It is important, in treating for this insect, to know when the eggs begin to hatch. These eggs resemble those of the fire worm so closely that they cannot be distinguished from them even with a microscope, and the same general indications of hatching may be looked for in both species.

The results of spraying experiments, tried on the second brood, show that arsenate of lead spray, properly applied, is very effective against this insect, not only preventing injury to the leaves and fruit, but also, in the case of this brood, saving from destruction the buds formed at the tips of the uprights for the following season's growth. It has also been demonstrated that in a wet season it will be advisable to spray more than once for the second brood, on account of the long hatching period of the eggs.

Recommendations for treatment:—

1. *If this insect becomes injurious on a bog which has water for winter flowage, hold this flowage until after the 20th of May, and thus keep the moths off the bog until they have deposited their eggs on the various upland plants, which they will seek if they cannot get the cranberry.*

2. *On dry bogs, spray for both broods with arsenate of lead used at the rate of seven pounds to fifty gallons of water as soon as the eggs begin to hatch (approximate dates: May 15 and July 4).* In case of a wet season, follow the first spraying for the second brood with another applied at the same strength and about ten days later than the first.

THE CRANBERRY GIRDLER.

Crambus hortuellus (Hübner).

The cranberry is not the only food plant of this insect, nor, indeed, is it the preferred one. Grasses and other plants are readily attacked by it, and the cranberry feeding habit seems to have been secondarily acquired. The insect is commonly known on the Cape as the "root worm" and the "girdle worm." The moths are first seen flying early in June, and they continue on the wing in small numbers, as late as the last days in July. The caterpillars feed on the stems of the vines just beneath the surface of the sand, causing a characteristic girdling injury, which later as a result, causes the foliage to wither and turn brown. Sometimes, when there is a serious infestation, this browning is seen over considerable areas. A similar effect is often seen resulting from fungus or other injury, but the girdler's work may be recognized by the girdled appearance of the dead or dying vines at or just beneath the surface of the sand. The worms become full grown in November, and then make their cocoons of silk and sand in which they pass the winter to pupate in late spring.

The conditions under which the caterpillars feed prevent treatment with sprays. Some growers claim that heavy sanding of bogs attacked by the girdler gives satisfactory results. Whether such treatment will destroy the worms in large numbers has not been proved; but, even if it does not do this, it will help the vines to recover from their injury more quickly. Burning the vines on a badly infested area is to be recommended, as they are practically destroyed anyway, and the benefit derived from the killing of the worms will more than make up for any loss incurred by such treatment; and the area burned over may then be reset at once. The burning should be done with a gasoline torch, at a time when the vines will not otherwise burn readily, in order to guard against setting a fire which might escape from control, and it should be done early in the season before the growth starts.

The flooding of an infested bog for a week or ten days immediately after picking has been found to give satisfactory results by those growers who have tried it, and as this method of treatment also helps against the fruit worm, it is to be especially recommended. The fact that the moths begin flying in considerable numbers in early June, and that they take readily to grasses and other plants growing on the upland suggests another remedy for bogs with abundant water supply for reflowage.

Recommendations for treatment:—

A. On bogs which can be reflowed:—

1. *Reflow immediately after picking, for a week or ten days.*

2. *If the early fall flowing has been neglected, reflow for a day or two about the 10th of June.*

B. On dry bogs:—

1. *Burn infested areas as indicated above.*

2. Heavy sanding would probably be advantageous.

SPITTLE INSECTS.

These peculiar insects, which form little masses of froth on the vines, sometimes appear in large numbers, and are believed by many growers to cause considerable injury. While it is true that they suck some juice from the vines, they do not kill the uprights nor do they prevent them from developing fruit satisfactorily.

HATCH EXPERIMENT STATION

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Bulletins and Reports, 1888-1907

AMHERST, MASSACHUSETTS
1907

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ABBREVIATIONS: R=Annual Report. B=Bulletin. Tech B=Technical Bulletin. Figure preceding dash designates number of report or bulletin. Figure following dash designates page.

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