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Farmer's Guide.

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FARMER'S GUIDE

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INDEX.

INTRODUCTION.

Scientific Facts Concerning Rational Manuring.

All plants in order to grow to best advantage require light, heat, air, water, cultivation and a *fertile soil.*

By a fertile soil is meant a soil capable of producing rich and abundant crops. Two factors are requisite to a fertile soil: first, a physical condition adapted to the crop to be grown, and second, a sufficiency of the plant food called for by such crop.

But fertilizer alone will not insure a good crop. The fertilizer that feeds the plant also feeds the weed. A more perfect cultivation will therefore be necessary. An abundance of plant food, a careful cultivation and a favorable season must all unite to produce a rich harvest.

It should be the object of the farmer to select the soil best adapted to the crop to be

grown, and then to furnish the crop with an abundance of its favorite and essential food. The truly economical farmer will *feed with a generous hand* the growing plant.

Every crop removes from the soil a portion of the plant food contained therein. Continuous cropping will in time exhaust the richest soil, unless the farmer restores the nutritive elements that have been removed.

Science and practical farming have demonstrated that generous living is as necessary to the plant as to the animal. Poor pasturage will produce a worthless stock. Worn out and exhausted soil will produce a spindling and scanty crop.

Agricultural chemistry has demonstrated that plant life calls imperatively for three prime forms of plant food. These three are *phosphoric acid, potash and nitrogen.*

The annual products of the farm (grain, grass, roots, milk, etc.) remove from the soil large quantities of nitrogen, potash and phosphoric acid. A portion of these food

elements is returned to the soil in the form of stable manure, but the remainder have been lost, and the productive capacity of the farm can only be maintained by the use of commercial fertilizers.

To illustrate this fact, let us suppose a farm, on which, during three years, crops of wheat, potatoes and corn have been raised, and where 26,700 pounds, or about 13⅓ tons, of stable manure has been applied per acre. An examination of the composition of the crops removed and of the manure applied will show the following decrease in fertility at the end of the period:

Crops.	Potash. lbs.	Phos. Acid. lbs.	Nitrogen. lbs.
Wheat, 30 bu. (1802 lbs. grain 2671 lbs. straw)	30	22	44
Potatoes, 300 bu., 16,800 lbs. .	97	26	57
Corn, 12 tons, 24,000 lbs. . .	79	36	98
Total plant food removed .	206	84	199
Total plant food supplied by 13½ tons stable manure, .	168	69	134
Total *loss* of plant food . .	38	15	65

The tops or vines of field potatoes are so seldom removed from the field, that they are here considered as having been returned to the soil.

The actual condition of the soil would have been improved, had clover been introduced into this rotation and turned under as green manure, but this practice is scarcely commendable in a rotation of less than five years, and even then, it must be remembered that clover enriches the soil only in nitrogenous matter. The potash and phosphoric acid of the soil must inevitably be exhausted, unless the loss in these elements is made good from outside sources.

From the fact that on most farms the supply of stable manure is insufficient, it becomes necessary to increase the supply of plant food by buying "commercial fertilizers."

Phosphoric acid can best be supplied by "dissolved phosphates," *e. g.*, dissolved phosphate rock, dissolved bone and dissolved bone black. In these prepared fertilizers the phosphoric acid is present in a soluble or available condition, and is readily assimilated by the plant, while in raw or unprepared phosphates, *e. g.*, ground phosphate rock, floats, ground bone, etc., the phosphoric acid

is present in an insoluble or unavailable condition, and is therefore of little value as plant food. Phosphoric acid, from whatever source, when once available, is of equal value. No distinction as to value should be made with reference to the derivation of phosphoric acid. Phosphoric acid, in dissolved rock, is equal in value to phosphoric acid in dissolved bone or dissolved bone black.

The greatest *potash* supply of the world is found at Stassfurt, Germany, where soluble potash salts are mined in large quantities. *Muriate of potash* is the cheapest form of potash. This is usually the best source of potash, except in special cases, where chlorine may injure the quality of the crop, such as tobacco and oranges. For such crops *sulphate of potash* or *sulphate of potash magnesia* should be used. *Kainit* is another form of potash salt, containing chlorine, and is specially valuable upon sandy soils. Kainit is valued not only for its fertilizing properties, but for its power of destroying insect life and curing plant disease. It is a most valuable fertilizer when applied to the cotton crop on the sandy soils of the South Atlantic coast.

Wood ashes is also a valuable source of potash. The amount of potash in wood ashes, however, is small and variable. Wood ashes, if produced upon the farm, should always be used, but they should never be bought outside, as the price of the potash contained in them is, as a rule, *far too high to justify their purchase.*

One fact has been clearly demonstrated by scientific research in plant life: "Soda cannot take the place of potash as a form of plant food." Plants cannot grow without potash, but are indifferent to the presence of soda. They can prosper when soda is entirely absent, but no amount of soda will produce growth when potash is wanting.

The most important materials supplying nitrogen which are largely used in the composition of commercial fertilizers are the following: *Nitrate of soda* and *sulphate of ammonia*, in which the nitrogen is in a soluble or available form. Nitrate of soda is particularly adapted for top dressing during the growing season, and is the quickest acting nitrogenous fertilizer. Dried blood, tankage,

concentrated tankage, azotine, fish scrap, castor pomace and cotton seed meal represent a form of nitrogenous fertilizer where the nitrogen is more slowly available. These substances must therefore be applied early to produce the best effects.

Leguminous crops, such as peas, beans, alfalfa, vetches, clover, etc., gather their nitrogen from the air. An application of nitrogenous fertilizers to such crops is unnecessary. Only potash and phosphoric acid need be supplied.

We should take advantage of this property of leguminous crops, and obtain from them a portion (and sometimes even all) of the nitrogen required by other crops. If plowed under, the legumes will not only furnish nitrogen to the soil, but also humus, which improves its physical condition. This method is called "green manuring."

The heavier the growth of the clover or pea crop, the larger will be the amount of valuable nitrogen which it will gather. A rank growth can be obtained on the poorest

soils, by the liberal use of phosphoric acid and potash.

On sandy land and in a hot climate it is not advisable to plow under a heavy growth of these plants while in a green condition. If the soil is very deficient in vegetable matter, the crop should be allowed to die upon the land and then be plowed under in cool weather. If it is necessary, however, to plow under a green crop, a good dressing of lime, not less than 30 bushels per acre, should be applied to prevent injurious souring of the land.

When the soil is fairly well supplied with vegetable matter, it is not economical to plow under the entire growth of a crop of peas or clover, since the feeding value of such crop is greater than its value as a fertilizer.

Barnyard or stable manure is regarded by many farmers as a "complete fertilizer." This is correct only so far as it contains all three of the fertilizer ingredients, but these ingredients do not exist therein in the proportions required by most crops. Stable

manure contains proportionately too much nitrogen and not enough phosphoric acid and potash to be considered a "complete fertilizer."

By a proper rotation of crops and by "green manuring," stable manure can, in fact, be dispensed with, and in some cases such a course is even preferable. The old saying that stable manure is indispensable to successful farming, is not now regarded as an axiom.

A manure containing an excess of nitrogen will unduly increase the growth of leaf and straw at the expense of fruit or grain. To avoid such result, stable manure should always be supplemented with artificial fertilizers containing *phosphoric acid* and *potash.*

Stable manure, when allowed to decompose by exposure to the air, loses a portion of its nitrogen in the form of volatile ammonia. This loss can be prevented by scattering *kainit* over the surface of the manure heap as it accumulates.

The amount of kainit which should be added to fresh stable manure to prevent loss

of ammonia through heating, is one pound per day for each cow or horse, or for eight head of sheep. The kainit will save more than its cost in the value of the nitrogen which it retains, and will possess its original value as a potash food.

Swampy and peaty soils, which consist largely of humus, and which, as a rule, are rich in nitrogen, derive only slight benefit from stable manure. Such soils need lime, potash, and often phosphoric acid. The application of these forms of fertilizer is followed by largely increased crops.

Lime improves the physical condition of such soils, and by hastening the decomposition of such organic matter present, increases the available supply of plant food. Lime finds also a most valuable office in the "sweetening" of sour soils and in changing heavy soils to a light and porous texture. It is of little value on soils deficient in humus or vegetable mould. *Marl*, *chalk*, *quicklime* and *ground oyster shells* are available sources of lime. Lime and magnesia may be classed among the secondary forms of plant food.

Stable manure should be applied in the autumn. When spread in the autumn upon a sod intended for corn the following spring, and allowed to lie upon the surface, the results will be better than when spread in the spring, or when spread and plowed under in the autumn.

Potash salts should be applied in the fall and winter. Potash will not leach through the soil. If application at such time is not practicable, it should be made a short time prior to sowing or planting. An early application of muriate of potash and kainit will be advantageous, for the following reason: The potash itself will be fixed by the soil, and the chlorine present, which is injurious to a few crops, such as tobacco, will be washed away.

Phosphoric acid should be applied in the fall, especially in its less soluble forms, such as ground bone, etc. The soluble forms of phosphoric acid, such as dissolved rock, dissolved bone black, etc., may be applied in the spring. While phosphoric acid will not leach through heavy soils, it may leach through very sandy soils. An application

in the spring to such soils is therefore preferable.

Phosphoric acid and potash will prove of slight value when applied as "top dressing" during the growing season. When so applied these fertilizers will stay on the surface and out of reach of the roots of the plants.

Phosphoric acid and potash are "fixed" or retained by the soil. They are not volatile, nor do they leach through the soil. It is quite different with nitrogen. When organic matter, exposed to the air, decomposes, a portion of the nitrogen present volatilizes and is lost into the atmosphere. The remainder, unless absorbed by vegetation, is finally washed away. Nitrogen in the form of nitrates readily leaches through the soil. Nitrate of soda, therefore, may well be applied as a *top dressing during the growing season.* Fertilizers containing fish scrap, tankage, dried blood, etc., should be applied in the fall. They are then decomposed and the nitrogen present converted into soluble forms for the following season.

The "commercial fertilizers" now in the market are the most desirable supplements and substitutes for stable manure that can be obtained by the farmer. In complete fertilizers the nitrogen, phosphoric acid and potash are skillfully compounded in various proportions. They are in a finely ground and thoroughly commingled condition, can be applied by drilling. and can be easily mixed with the soil. Their value is accurately determined by the various agricultural stations, and the interests of the farmer carefully protected.

Explanation to the Following Pages.

The kind and amount of fertilizer needed by a certain crop upon a certain soil, or that can be applied with profit, can best be determined by "experiment," and depends not only upon the amount of plant food which the soil already contains, but also upon the physical condition of the soil, and the nature of the previous crop.

We can therefore offer only "suggestions" on this point, since it is the worst sort of quackery to prescribe "doses" for soils. It is hoped that these suggestions may be of value in a general way. These tables are not to be regarded as infallible rules, but as suggestions, founded on a knowledge of the needs of particular plants.

The amounts of the fertilizers recommended for the various crops are meant to be average quantities upon an average soil, and the amount should be varied according to the requirements of the soil and in accordance with the prevailing conditions of each farm.

COMPOSITION OF MATERIALS USED AS SOURCES OF NITROGEN.

	NITROGEN.	EQUIV. IN AMMONIA.	POTASH K_2O.	PHOS. ACID. TOTAL.
Nitrate of Soda	15 to 16	18 to 19½	.....	.....
Sulphate of Ammonia	19 " 22	23 " 26	.....	.....
Dried Blood (high grade)	12 " 14½	14½ " 17½	.....	.....
Dried Blood (low grade)	10 " 11	12 " 14½	.....	3 to 5
Concentrated Tankage	11 " 12½	13½ " 15	.....	1 " 2
Tankage	5 " 6	6 " 7½	.....	11 " 14
Tankage	7½ " 9	9 " 11	.....	8½ " 10½
Dried Fish Scrap	9½ " 11	11½ " 13½	.....	6 " 8
Cotton Seed Meal	6½ " 7½	8 " 9	1½ %....	2 %
Castor Pomace	5 " 6	6 " 7½	1 %.....	2 %
Tobacco Stems	2 " 3	2½ " 4	5 to 8...	about 1 %

COMPOSITION OF MATERIALS USED AS SOURCES OF PHOSPHORIC ACID.

	NITROGEN.	EQUIV. IN AMMONIA.	POTASH. K_2O.	PHOSPHORIC ACID.		
				TOTAL.	AVAILABLE.	INSOLUBLE.
So. Carol. Phos. Rock	....	.....	.....	26 to 27	.....	26 to 27
So. Carol. Acid Phosphate	.....	.....	.....	13 " 16	12½ to 15	1 " 3
Fla. Land Rock	.....	.....	.....	33 " 35	.....	33 " 35
Fla. Pebble Phosphate	.....	.....	.....	26 " 32	.....	26 " 32
Acidulated Fla. Phosphate	.....	.....	.....	16 " 19	15 " 17	1 " 3
Boneblack (spent)	.....	.....	.....	32 " 35	.....	32 " 35
Boneblack (dissolved)	.....	.....	.....	17 " 19	15 " 18	1 " 2
Bonemeal	2½ to 4½	3 to 5½	.....	20 " 25	5 " 8	15 " 17
Bone (dissolved)	2 " 3	2½ " 3½	.....	15 " 17	13 " 15	2 " 3
Belgian Phosphate	.....	.....	.....	7 " 8	.....	7 " 8
Belgian Phosphate	.....	.....	.....	20 " 22	.....	20 " 22
Peruvian Guano	6 " 10	7¼ " 12	1½ to 4	10 " 15	8	2 " 7

COMPOSITION OF MATERIALS USED AS SOURCES OF POTASH.

	PURE POTASH (K_2O) PER CENT.	LIME, PER CENT.	NITROGEN, PER CENT.	AMMONIA, PER CENT.	PHOS. ACID, TOTAL, PER CENT.	CHLORINE, PER CENT.
Muriate of Potash	50	.....	.....	.....	.....	45 to 48
Sulphate of Potash (high grade)	50 to 55	.....	.....	.....	.....	0.3 " 1.5
Sulphate of Potash and Magnesia	27 " 30	0.85	.....	.....	.....	1.5 " 2.5
Kainit	12½	1.12	.....	.....	.....	30 " 32
Sylvinit	16 to 20	.....	.....	.....	.....	42 " 46
Cotton-Seed Hull Ashes	20 " 30	10	.....	.....	7 to 8	.....
Nitrate of Potash, or Saltpetre	43 " 45	.....	13to14	16 to 17	2	.....
Wood Ashes (unleached)	2 " 8	30to35	.....	.....	1 to 2	.....
Wood Ashes (leached)	1 " 2	35 "40	.....	.....	1 " 1½	.....
Tobacco Stems	5 " 8	3.5	2 to 3	2½ to 3½	.....	.....

AVERAGE COMPOSITION OF THE MOST IMPORTANT FARM MANURES.

FARM MANURES.	NITROGEN.	AMMONIA.	POTASH (K_2O).	PHOSPHORIC ACID (P_2O_5).	
				TOTAL.	LIME (CaO).
Cow Manure (fresh)	0.34	0.41	0.40	0.16	0.31
Horse Manure (fresh)	0.58	0.70	0.53	0.28	0.21
Sheep Manure (fresh)	0.83	1.00	0.67	0.23	0.33
Hog Manure (fresh)	0.45	0.54	0.60	0.19	0.08
Hen Dung (fresh)	1.63	1.98	0.85	1.54	0.24
Mixed Stable Manure	0.50	0.60	0.63	0.26	0.70

AMOUNTS OF PHOSPHORIC ACID, NITROGEN AND POTASH ANNUALLY REMOVED FROM ONE ACRE BY VARIOUS CROPS.

CROP.	GRAINS.	STRAW.	CHAFF.	PHOSPHORIC ACID.	NITROGEN.	POTASH.
Wheat	35 bushels	2,700 lbs	300 lbs	24 lbs	59 lbs	31 lbs.
Rye	30 "	4,000 "	250 "	26 "	51 "	45 "
Barley	40 "	2,300 "	390 "	21 "	46 "	38 "
Oats	60 "	2,900 "	275 "	22 "	55 "	62 "
Corn	50 "	4,100 "	950 " cobs	31 "	67 "	80 "
Buckwheat	30 "	2,200 "		30 "	35 "	9 "
Potato	200 "	1,450 " leaves and stubble.		21 "	46 "	74 "
Sugar Beets	15½ tons	3 tons		32 "	69 "	143 "
Mangel-Wurzel	22 "	6 "		46 "	150 "	264 "
	GREEN.	DRY.				
Meadow-Hay		2½ tons		23 "	83 "	85 "
Timothy	6 tons	2 "		32 "	89 "	94 "
Green Corn	11½ "			46 "	85 "	164 "
Red Clover in bloom	8 "	2 "		28 "	105 "	96 "
Lucerne	8 "	2 "		26 "	113 "	71 "
Crimson Clover	7 "	1¾ "		11 "	60 "	36 "
Sugar Cane	20 "			15 "	153 "	44 "
Sorghum	15 "			24 "	121 "	153 "
Cotton	750 lbs. seed	250 lbs. lint		9 "	26 "	10 "
Hops	600 " strobile	1,200 " leaves	1,500 lbs. Ramber	23 "	84 "	53 "
Tobacco	1,600 " leaves	1,300 " stems		23 "	89 "	103 "
Grapes	2 tons grapes	1½ T. tops	2 tons wood	11 "	32 "	39 "
Cabbage	31 " heads			88 "	150 "	360 "
Cucumber	25 "			30 "	86 "	116 "
Onions	1¼ tons			37 "	72 "	72 "
Oranges	20,000 lbs. (fruit)			16 "	24 "	103 "

ALFALFA.

(LUCERNE CHILI CLOVER.)

Soil.—Alfalfa shows its best development only on a soil having a mellow subsoil, so that the long tap root can strike down. The soil should contain an ample supply of lime.

Rotation and Fertilizer.—Lucerne should be sown after the soil has been devoted for a year or two to clean cultivated crops requiring the destruction of weeds, for, in its early growth, it is quite feeble and easily choked by weeds. It can be sown with winter grown crops, but is best sown alone. Like other legumes, it does not need nitrogenous manures, but should be well supplied with phosphoric acid and potash. Dressings of fertilizer should be repeated annually in the autumn or winter.

Use per acre 450 pounds of a fertilizer containing:

Available phosphoric acid, 9 per cent.
Potash, 14 "

General Notes and Suggestions.—Alfalfa can never take the place of red clover on the farms of the Eastern States, but has proved of the greatest value in the arid region of the West and Southwest. It is a perennial plant which lasts many years, when once

established and well supplied with phosphoric acid and potash. Alfalfa can be cut for hay several times during the summer, but it is not suited for pasturing since it bloats cattle badly.

ALMOND.

(SEE PEACH.)

APPLES.

Soil.—The apple thrives best in a northern latitude, or sometimes in mountainous locations, and prefers a strong, clay loam, rich in humus, but well drained and free from stagnant water.

Fertilizer.—The ashes of fruit trees show large quantities of lime and potash, indicating that these elements are much needed. It is not advisable to apply a large percentage of nitrogen, as a rank and unfruitful growth is thus produced. For an apple orchard a good annual top dressing, per acre, is 500 lbs. of a fertilizer containing:

Available phosphoric acid, 10 per cent.
Potash, 11 "

Use nitrogenous fertilizers only, in case the growth of the wood is insufficient. An application of 200 pounds of nitrate of soda in such case will be appropriate.

General Notes and Suggestions.—The trees should be set out 35 to 40 feet apart each way. While the trees are small, crops of vegetables may be grown among them, and the orchard should be well cultivated. When the trees have grown to a fair size, the land should be seeded to grass, which should be mown several times during the season, and allowed to decay upon the ground. Do not try to grow hay and fruit in the same field, but keep the land exclusively for fruit. Old orchards fail mainly because the soil is exhausted. Like annual crops, trees require the application of fertilizers.

ARTICHOKE.

Soil.—A warm soil, moderately rich in humus.

Fertilizer.—Use per acre 600 lbs. of a fertilizer containing:

Available phosphoric acid,	8 per cent.
Potash,	8 "
Nitrogen,	3 "

General Notes and Suggestions.—This is a vegetable worthy of more attention than it generally receives. If it is well cared for it will produce a remarkable yield of tubers, and furnish a valuable food for farm animals and also for the table.

ASPARAGUS.

Soil.—Asparagus needs a light loam or a sandy soil; heavy soils will produce a poor quality and quantity of crop.

Fertilizer.—As this crop monopolizes the land for many years, the soil should be well prepared, and its fertility maintained by annual dressings. Large amounts of kainit are essential for this crop. Some growers have obtained best results by the annual use of one ton of kainit per acre. The fertilizer used should be applied during the winter. As a fertilizer, use per acre 500 pounds of a fertilizer containing:

Available phosphoric acid,	8	per cent.
Potash,	5	"
Nitrogen,	4½	"

and apply in addition 700 pounds kainit and 200 pounds nitrate of soda. It will pay to fertilize asparagus liberally, as this will promote quick growth and produce large stalks, commanding a higher price in the market.

General Notes and Suggestions. — It is worthy of note that many growers use common salt successfully upon asparagus. The chief virtue of salt seems to be its property of keeping down weeds for a while. All the benefit of salt can be obtained by the use of

kainit, which contains not only 30 to 35 per cent. of salt, but 12 to 14 per cent. of potash.

BANANAS.

Soil.—A level, moist, sandy soil, rich in humus, is best suited for the banana. A location near the sea is most favorable.

Fertilizer.—Under the above conditions, nitrogen is not needed. If the old stems are cut down and allowed to decay upon the soil, a banana plantation will wonderfully increase the fertility of the land. Lime and potash must be liberally supplied. Use per acre 800 lbs. of a fertilizer containing:

Available phosphoric acid, 11 per cent.
Potash, 6 " "

General Notes and Suggestions.—Several species of "musa" are grown under the names of "banana" and "plantain" in the Tropics, and to some extent in the southern coast States.

BARLEY.

Soil.—A strong clay loam, thoroughly drained, is the most suitable soil for barley. The soil must be one in which plant food is properly proportioned, as an excess of nitrogen causes the straw to become heavy and

fall or lodge. Low, sandy soils will not produce barley of good quality. Heavy, wet, clayey soils are likewise unsuitable for this crop.

Rotation and Fertilizer.—The proper place for the barley in the farm rotation is after a well manured crop of potatoes or Indian corn. The manure that has been used for these will be well decomposed and mingled with the soil. Such crops will usually leave sufficient nitrogen in the soil for the barley. If, however, the soil should need a *fertilizer*, use per acre 500 lbs. of a fertilizer containing:

Available phosphoric acid,	9	per cent.
Potash,	12	"
Nitrogen,	1	"

Use this fertilizer by broadcasting in the early spring. Prof. Wagner's experiments have shown that barley is very responsive to potash fertilizers, and a larger amount than that given above may be advantageous.

General Notes and Suggestions.—There are three species of barley grown: the two rowed (*Hordeum distichum*), the six rowed (*Hordeum vulgare*) and the beardless *Hordeum trifurcatum.*) In raising barley for brewing purposes, especial attention should

be paid to proper manuring. An excess of nitrogen will injure the quality of the grain, but a large amount of potash and a proper proportion of phosphoric acid should always be provided.

BEANS—CASTOR OIL.

Soil.—A light sand or sandy loam soil is the most suitable for this crop.

Fertilizer.—Too much nitrogen in the soil induces an enormous growth of the plant without a corresponding yield of seed. If the soil is poor, use, per acre, 400 lbs. of a fertilizer containing:

Available phosphoric acid, 10 per cent.
Potash, 9 "

General Notes and Suggestions.—The plant forms a tree in India, but in colder climates it is an annual. It can be grown as far north as Southern Illinois. It yields the oil commercially known as castor oil.

BEANS—HORSE.

Soil.—Heavy clay or loam is best suited for the horse bean; it also succeeds very well on reclaimed swamp land or on dried up pond bottoms, and upon moist, sandy soil, rich in humus.

Rotation and Fertilizers Recommended.—This crop does not require a highly cultivated soil, and can follow directly after heavy feeding grains. Use per acre 400 lbs. of a fertilizer containing:

Available phosphoric acid, 10 per cent.
Potash, 10 "

General Notes and Suggestions.—Horse beans are not raised to a great extent in the United States, but are grown largely in Europe. This crop, like other leguminous crops, improves the soil by enriching it in nitrogen and humus.

BEANS—SNAP.

Soil.—Light, sandy loam.

Rotation and Fertilizer Recommended.—It is generally sown as a crop succeeding early cabbages. Use per acre 700 lbs. of a fertilizer containing:

Available phosphoric acid, 8 per cent.
Potash, 12 "
Nitrogen, 2 "

General Notes and Suggestions.—This crop is largely grown in the South. If the beans are to be picked while green, a richer manuring will be advisable; again, although the bean is a "nitrogen gatherer," an applica-

tion of nitrogen will cause the pod to grow more rapidly and prove profitable. If grown for seed, nitrogen should be omitted and only potash and phosphoric acid applied.

BEETS—GARDEN.

Soil.—Sandy loam or light clay.

Fertilizer.—Use per acre 400 lbs. of a fertilizer containing:

Available phosphoric acid,	8 per cent.
Potash,	10 " "
Nitrogen,	3 " "

General Notes and Suggestions.—Careful cultivation is essential.

BEETS—SUGAR.

Soil.—Beets for sugar should be grown on deep, mellow clay loam, but good crops can also be grown on fertile sandy soils, rich in humus.

Rotation and Fertilizer.—Beets can follow almost any crop, but preferably grain crops. They will do well on land on which corn was raised the previous year. The land should be manured and plowed in the autumn after the corn is harvested. They should not, however, be grown too often in succession on the same soil. In the absence

of stable manure, a complete fertilizer should be used, and even in case stable manure has been applied, it should be supplemented by a liberal application of potash. The following application will be ample per acre for beets, 1,000 lbs. of a fertilizer containing:

Available phosphoric acid,	6 per cent.
Potash,	7 " "
Nitrogen,	6 " "

It is best to use sulphate of potash for sugar beets, but if the beets are not intended for the production of sugar, muriate of potash can be used in the place of the sulphate.

General Notes and Suggestions.—Beets are largely grown in Europe for sugar making, and also for cattle feeding. For the latter purpose, the variety called "mangels" is used. In this country, ensilage, made from green corn, has largely taken the place of beets for stock food.

BENNE (SESAMUM).

Soil.—A rich loam abounding in vegetable matter suits this plant.

Fertilizer.—Heavy manuring with stable manure is desirable, or, in place of it, green

manuring. Use per acre 550 lbs. of a fertilizer containing:

Available phosphoric acid, 4 per cent.
Potash, 4 "
Nitrogen, 5 "

General Notes and Suggestions.—Lime the land once in five years, and plow under crops of cow peas.

BLACKBERRY.

Soil.—Sandy or gravelly loam, well drained, but with sufficient humus to retain water in time of drought.

Fertilizer.—Use per acre 650 lbs. of a fertilizer containing:

Available phosphoric acid, 8 per cent.
Potash, 9 "
Nitrogen, 3 "

General Notes and Suggestions.—Like all berries, they should be fertilized with coarse horse manure or with litter. Suckers and weeds should be kept under control.

BUCKWHEAT.

Soil.—This plant does well on poorer soils, both light and heavy. It grows upon sandy as well as upon peaty soil. When a farmer has low, undrained places which can-

not be plowed in the spring, he may plant them to advantage with buckwheat.

Rotation and Fertilizer.—Buckwheat can follow grain or hoed crops. If sown upon dry and poor upland soil, it will pay to use some fertilizers upon it; but on low, black lands, which suit it best, these are not needed. On poor lands 300 lbs. of a fertilizer containing:

Available phosphoric acid,	8	per cent.
Potash,	8	"
Nitrogen,	3	"

will give good results.

General Notes and Suggestions.—Buckwheat is sometimes sown in July as a shade crop to protect crimson clover, and if used for this purpose, it will pay to apply phosphate and potash in double quantities. The Japanese variety has been found much superior to the old sort.

CABBAGE.

(KALE, CAULIFLOWER AND OTHER VARIETIES OF BRASSICA OLERACEA.)

Soil.—Cabbages grow well on mellow, fertile soil. They are, however, particularly well adapted to reclaimed meadows and

turned-under sod lands. Under all circumstances the crop requires an abundance of moisture, though decidedly wet soils must be avoided.

Rotation and Fertilizer.—Any crop that leaves the soil in a good condition can precede cabbage. Cabbage should not follow itself for any length of time, as it is liable to take and transmit plant disease, and to be attacked by insects. Use per acre 1,500 lbs. of a fertilizer containing:

Available phosphoric acid,	7 per cent.
Potash,	9 " "
Nitrogen,	4 " "

General Notes and Suggestions.—Early cabbages are an important product in the Southern States; they are set out in November. The early cabbage crop, being grown at the season when the nitrification is not active, must be specially supplied with an abundance of the most stimulating fertilizers. The late crop of cabbages planted in July or August do not need such heavy manuring. Late cabbages should be planted on heavier soil than the earlier cabbages. The late crops should always, if possible, be planted on the inverted sod, probably clover stubble after the hay has been cut.

CANE—SUGAR.

Soil.—Deep, sandy loam, bottom lands, alluvial, "canebrake."

Rotation and Fertilizer.—This plant can follow cotton or indigo, also rice and grain crops. Use per acre 750 lbs. of a fertilizer containing:

Available phosphoric acid, 8 per cent.
Potash, 10 "
Nitrogen, 3 "

Use bagasse ashes from cane mills. Avoid fertilizers containing chlorine, also avoid fresh stable manures. On very heavy soils an occasional application of lime is beneficial.

General Notes and Suggestions.—If reclaimed, salt or brackish marsh land is to be planted to cane, crops with heavy foliage should be grown on the land for several previous seasons.

CARROTS.

Soil.—Sandy loam is recommended for carrots, as they stand dry weather well and require a warm soil. Carrots are injured by too much moisture.

Rotation and Fertilizer.—Carrots should follow some crop that has been heavily

manured with stable manure the previous year, and then they need only to be well supplied with phosphoric acid and potash. Direct application of stable manure is not advisable, as it is apt to render the roots forked and unsightly. When the land has not been heavily manured the previous year, use per acre 500 lbs. of a fertilizer containing:

Available phosphoric acid, 8 per cent.
Potash, 10 "
Nitrogen, 3 "

General Notes and Suggestions.—Carrots form a valuable addition to the food of horses and cows in winter. The yellow variety intended for the table should be planted in a rich loam.

CASSAVA.

Soil.—Cassava thrives best on sandy soil full of humus.

Fertilizer.—It should have a full supply of potash, like all plants which store large quantities of starch. Use per acre 300 lbs. of a fertilizer containing:

Available phosphoric acid, 8 per cent.
Potash, 10 " "
Nitrogen, 3 " "

General Notes and Suggestions.—Cassava is a tuberous rooted plant belonging to the

Euphorbiaceæ, or Spurge family. The plant has a general resemblance to the castor oil plant, to which it is related. This species is attaining considerable importance in the South as a source of starch. The large, fleshy roots give a large quantity of starch, which is sold under the name tapioca. The plant thrives well in all the Southern States at far north as North Carolina, but is most at home in the Florida peninsula. It is grown from cuttings of the stem, which are kept buried in winter. From its enormous yield this plant ought to constitute the chief source of the manufacture of glucose.

CELERY.

Soil.—Celery is grown best upon moist, low lands. A black, peaty soil will give fine looking celery. The best quality can only be grown upon a moist, clay loam. Land intended for celery should be so situated, that it can be readily irrigated, for no plant suffers so severely from drought.

Rotation and Fertilizer.—Stable manure applied directly to the crop is apt to make rusty celery. It is better to plant celery after a crop of early cabbage that has been heavily manured. In this case only a light

application of fertilizer will be needed. The crop may follow a crop of early grass, since, for winter use, celery need not be set out until August or even September in the South. Use per acre 700 lbs. of a fertilizer containing:

Available phosphoric acid,	7 per cent.
Potash,	7 "
Nitrogen,	4 "

On swamp lands, increase potash one-half, and diminish nitrogen in same proportion.

General Notes and Suggestions.—If the crop is grown on muck or swamp land, it should be so thoroughly drained that permanent water never rises within three feet of the surface. As such soils are rich in nitrogen and proportionately poor in potash, they should be well supplied with the latter.

CHERRY.

Soil.—Cherries thrive on any dry and fertile upland soil.

Fertilizer.—The treatment recommended for the peach will in a general way be suitable for the cherry, except that it is better to put the orchard in grass, as in the case of apples and pears.

General Notes and Suggestions.—In the

Northern States, cherries should be budded on mazard stocks; in the South, always on mahaleb stocks. The sour cherries, dukes and morellos, do well on the southern coasts; but it is a useless attempt to raise sweet cherries in the South, except in the Piedmont and mountain sections.

CHICORY.

General Notes and Suggestions.—Chicory, so far as we are aware, is not cultivated in the United States. It has been introduced and is now a troublesome weed in many sections. While to some extent the sale of the roots might be a source of profit, the plant so easily becomes a very troublesome weed that we would not encourage its culture when general cropping is pursued. It succeeds best upon a fertile limestone clay loam; and like all tuberous rooted plants needs liberal supplies of potash.

CLOVER—ALSIKE.

General Notes and Suggestions.—This is a perennial clover that grows best on wet soils where other clovers do not thrive. It is a good plant to mix with redtop, fowl meadow grass and other grasses that like moist land. Fertilize the same as other clovers.

CLOVER—CRIMSON.

Soil.—A light, sandy loam is recommended. It thrives even on lighter soil than is adapted to red clover. It requires little humus and comparatively little moisture.

Rotation and Fertilizer.—The clover may be sown after grains and root crops. Use per acre 600 lbs. of a fertilizer containing:

Available phosphoric acid, 10 per cent.
Potash, 12 " "

General Notes and Suggestions.—This is an annual clover of recent introduction in American agriculture, but it seems to be of much value particularly in the sandy lands of the Southern States, where the perennial red clover burns out in summer. It is also of great value to supplement the red clover at the North, and as a quickly grown foliage crop. It withstands the cold of winter better than the red clover, and its feeding value as hay is much higher. It is a good plan to sow it with buckwheat in midsummer, or it can be sown in the North in corn late in the season. In the South it should be sown in August or September, and it is better to sow oats sparingly with it to prevent the young plants from being withered by the sun. This clover should be cut for

hay as soon as fairly in bloom, as it soon becomes woody when the blooms elongate.

CLOVER—RED.

Soil.—Deep clay loam is the soil for red clover, but if a supply of mineral food is present it will thrive on other soils. Limestone clays are especially favorable to this clover, but it will grow even on peaty soil. It will not thrive on newly broken prairie soils.

Rotation and Fertilizer.—Clover should be grown in rotation alternately with grain, cotton or tobacco. An addition of lime, if in the form of carbonate or sulphate (plaster), is beneficial to its growth. On soils which are deficient in lime, a top dressing of one ton per acre of fresh water-slaked lime has a wonderful effect. It is usually a waste of money to apply nitrogenous fertilizers to red clover, since it is one of the class of plants (legumes) which capture and fix in the soil the atmospheric nitrogen. For this reason, clover is a so-called "soil improver," and it can be raised continuously in rotation on the same land, provided the necessary supply of phosphoric acid and potash is given. Use per acre 500 lbs. of a fertilizer containing:

Available phosphoric acid, 9 per cent.
Potash, 14 " "

General Notes and Suggestions.—This clover is an almost invariable crop in the different systems of rotation now practiced. It is not only one of the best fodder crops, but also one of the best for green manuring. Clover can be sown, and usually is sown, with small grain, and it can also be sown alone with great success. It can be profitably sown in growing corn at the last working, and in this way we can gain a season in the crop, and use it as a preparatory crop for wheat the following year, with a certainty of getting a better crop of wheat than if the wheat immediately followed the corn. In the Northern States clover usually lasts only two years. On clay soils in the South it will last longer. On sandy soils in the South it rarely succeeds, and its place can be taken by cow peas in summer and crimson clover in winter.

CLOVER—WHITE.

Soil.—The soil recommended is the same as for red clover, except that a soil with more humus is preferable. White clover thrives on prairie soils, where red clover cannot be grown.

Rotation and Fertilizer.—The same as for red clover.

General Notes and Suggestions.—White clover is inferior to red, where the latter can be grown, for all purposes except pasturage and bee feeding. It is useful to mix with grasses for permanent pasture. It is not commonly sown, however, in this country, for it comes in naturally in all permanent grass lands. On lands used for pasturing horses it is not desirable, since it causes a salivation or slobbering in horses.

CLOVER—JAPAN.

This plant has completely overrun the country, from Virginia southward, since the war. Particularly on moist clay soils it has proved to be a valuable plant for making good pasturage on waste lands. It is not suitable for regular crop rotation. The plant will thrive in the densest woods, and by its use the woodlands may be made valuable pasture. Japan clover has almost banished broomsedge in the mountainous districts of North Carolina. It is an annual, and seeds late in the fall, so that probably it will never become naturalized much further north than its present limits. While it will grow on the poorest land, it is greatly benefited by potash and phosphoric acid. In the far South

on moist clay soils it can be grown for hay, but elsewhere it is only useful for summer pasture.

COCOANUT PALM.

Soil.—The cocoanut palm does not thrive away from the sea coast, and needs a sandy, moist soil, with plenty of vegetable matter.

Fertilizer.—The only fertilizing material needed will be the seaweed, which is convenient and abundant, and an occasional dressing of lime and kainit.

General Notes and Suggestions—The cocoanut palm can only be grown to advantage in one locality of the United States. This is along the seashore of the eastern side of the Florida peninsula, south of Jupiter inlet.

CORN—INDIAN.

Soil.—A mellow loam, inclining more to sand than clay, is the most suitable soil, and if abounding in vegetable mould, it is particularly favorable.

Rotation and Fertilizer—A sod of clover or meadow grass, upon which farm manure has been used during the previous year as top dressing, is the best possible preparation for this crop. With such a preparation it will

not pay to purchase nitrogen, since the growth and culture of corn is during the hot season, when bacterial nitrification is active in the organic matter of the soil. A liberal application of phosphate and potash will pay particularly in the South, where it is the common practice to sow field peas in the corn in summer, or when the corn is to be followed by wheat, oats or barley. Use per acre 550 lbs. of a fertilizer containing:

Available phosphoric acid,	8	per cent.
Potash,	10	"
Nitrogen,	2½	"

When planted on land destitute of sod, no plant grown on the farm will better repay heavy applications of stable manure, reinforced by acid phosphate and potash.

General Notes and Suggestions.—Corn gives the best yield when planted in drills 4½ feet apart, with the stalks thinned to 20 to 24 inches in the row. On light, sandy soils in the South it is found necessary to give it more room, but even there, on strong, clay loam, with a buried sod, the best crop can be grown at the first-named distance. In the South, crimson clover may be sown among the corn to give a winter pasture. The land is turned under again in spring

for corn, and if a good supply of phosphate and potash is given to the clover, the process can be repeated for years on a clay loam soil, without any diminution of the crop.

CORN—SWEET.

Soil.—A sandy or gravelly loam, a limestone soil, or alluvial soil is recommended.

Rotation and Fertilizer.—Sweet corn may be planted after roots and vegetables, tomatoes, etc. Use per acre 500 lbs. of a fertilizer containing:

Available phosphoric acid,	8	per cent.
Potash,	9	"
Nitrogen,	3½	"

General Notes and Suggestions.—Northern localities are best adapted to this crop, as a far sweeter kernel is produced than in southern latitudes.

COTTON.

Soil.—Cotton prefers a somewhat sandy soil of a level character and well stored with humus.

Rotation and Fertilizer.—If the meal and hulls from the seed are returned to the soil, cotton is not an exhaustive crop. The practice so long followed in the South of planting

the same land year after year with cotton has brought ruin to the soil, not because of the exhaustive nature of the crop, but because of the constant washing of the soil by the heavy rains of the South and its exposure to the sun. With a carefully planned rotation of crops, and liberal fertilization, the cotton lands will not deteriorate. An application of a few hundred pounds of commercial fertilizer often makes all the difference between a profitable crop and a total failure.

On some soils kainit is a complete specific against red rust and some other troubles to which cotton is subject. On heavy clay soils stable manure is the best fertilizer, but as cotton farmers seldom keep much stock, this article is alway lacking. In some sections farmers are of the opinion that cotton will not succeed after a crop of peas or clover, but in such cases it is usually a lack of potash that causes the failure. Use per acre 500 to 900 lbs. of a fertilizer containing:

Available phosphoric acid, 8 per cent.
Potash, 3 "
Nitrogen, 2 "

On sandy soils, deficient in potash, it will pay to add a liberal dressing of kainit.

General Notes and Suggestions.—It is a good practice, now being adopted, to sow among the cotton at last cultivation 15 pounds per acre of crimson clover seed. This prevents the soil from washing in winter, and also fixes nitrogen for the succeeding crop.

CRANBERRY.

Soil.—The cranberry is a native of moist meadows, swamps and marshes. Its favorite soil is peat or muck, and under cultivation these natural requirements must be met. The artificial meadow should be covered with a coating of sand 3 to 6 inches deep.

Fertilizer.—Because of its habits of growth and requirements, a fertilizer for cranberry must be peculiar. The plant first grows vine and afterwards fruit, the two growths differing materially in composition and consequent food requirements. For old bogs use per acre 600 lbs. of a fertilizer containing:

Available phosphoric acid,	8 per cent.
Potash,	10 " "
Nitrogen,	2 " "

For new bogs the best results are obtained when the quantity of nitrogen in the fertilizer is materially increased.

General Notes and Suggestions.—Successful artificial cranberry culture necessitates a water supply, so situated and under control that the entire meadow may be easily and rapidly flowed, not only for irrigation, but as protection against insects, disease and frost. This object is most easily attained by damming the stream, producing the marsh at such an elevation that the water from the pond thus created may be conducted by gate or sluice to the meadow.

CUCUMBERS AND MELONS.

(CANTALOUPES, WATERMELONS.)

Soil.—Cucumbers and melons should be planted on a sandy loam.

Rotation and Fertilizer.—The ground should be checked out and holes dug at the intersections. Fill these holes with a composition of rotted leaf mold from the forest, and on each hill scatter a handful of the following fertilizer:

Available phosphoric acid,	8 per cent.
Potash,	8 "
Nitrogen,	3 "

or at about the rate of 1,200 lbs. per acre.

Now cover with soil, and scatter seeds on hill, and cover. When up and well started

out of reach of insects, thin to two plants to a hill, and apply a top dressing of a tablespoonful of nitrate of soda around each hill of plants.

General Notes and Suggestions.—Cucumbers and muskmelons should be planted 5 x 5 feet apart, and watermelons 10 x 10 feet. A too heavy application of nitrogenous manures to these crops will produce hollow fruit and a tendency to an early decay. Cotton seed meal for the first application of nitrogenous matter is preferable to nitrate of soda, because the former becomes more gradually available.

CURRANTS.

Soil.—A light clay loam, free from excess of water, also a deep, sandy loam, are recommended.

Fertilizer.—Use per acre 550 lbs. of a fertilizer containing:

Available phosphoric acid,	7 per cent.
Potash,	11 "
Nitrogen,	3 "

General Notes and Suggestions.—Pruning the currant is too frequently neglected. Old wood should be carefully removed every autumn.

EGG PLANT.

Soil.—They require a light and exceedingly rich soil, and do best on land which has for years been cultivated for garden vegetables, and heavily manured annually. A thin soil, no matter how well manured, will not probably grow a good crop of egg plant.

Fertilizer.—Use per acre 2,000 lbs. of a fertilizer containing:

Available phosphoric acid,	5	per cent.
Potash,	10	"
Nitrogen,	4	"

Prepare the land well, and mark it out with a plow the distance named under "General Suggestions;" scatter the fertilizer in the furrows each way; then lap two furrows over the first ones, and set the plants at the crossings, having first flattened the ridges.

General Notes and Suggestions. — Egg plants are a profitable crop for the market gardener, when put on the market early and in good condition. The seed must be sown in boxes, in a warm greenhouse, early in March, potted off in small flower-pots, from which they can be turned into the open ground when it is warm, without any disturbance of the roots. Set he plants three

feet apart each way, and cultivate thoroughly and often.

ENDIVE.

Soil.—Loam; light, clay soil.

Rotation and Fertilizer.—(See Lettuce.)

FIGS.

Soil.—Figs prefer a level, moist, sandy soil, and one not too rich in nitrogenous matters. They reach their best perfection near the ocean or salt water estuaries.

Fertilizer.—Figs need but little fertilizing. A good dressing will be, per acre, 400 lbs. of a fertilizer containing:

Available phosphoric acid, 10 per cent.

Potash, 12 "

General Notes and Suggestions.—Figs can be grown to great perfection in all of our Southern States. Figs need little pruning, except to keep them clean of the mass of suckers that are apt to grow from the crown of the roots. They are easily grown from ripe wood cuttings set in the ground in fall, and covered with forest leaves for protection in winter.

FLAX.

Soil.—Flax needs a moist soil and an abundant rain fall, but dislikes a hot climate. It needs a fairly good soil. A good loam or a newly broken up sandy loam is preferred. Upon very heavy clay or on very light, dry, sandy soils the flax yields poorly, and the fibre is of a poor quality.

Rotation and Fertilizer.—Flax may follow any well manured crop except beets or turnips. It requires the finest preparation of the soil, and a soil free from weeds.

Farm yard manures should not be used directly on the crop. Use per acre 400 lbs. of a fertilizer containing:

Available phosphoric acid,	8 per cent.
Potash,	9 " "
Nitrogen,	3 " "

General Notes and Suggestions.—Flax is grown either for the seed or for the fibre of its elongated bast cells. It is an annual plant, two feet high, with blue flowers. If sown for seed alone, ¾ bushel of seed per acre is enough; if for seed and fibre, one bushel; and if for fibre only, 1½ to 2 bushels. The time for sowing is early spring.

GINGER.

Soil.—Ginger should have a deep, sandy, peaty soil, one which never suffers from drought, and yet is free from standing water.

Fertilizer.—If planted in proper soil, only phosphoric acid and potash will be required. Use per acre 500 lbs. of a fertilizer containing:

Available phosphoric acid, 10 per cent.
Potash, 11 " "

General Notes and Suggestions.—Ginger of commerce is the creeping rhizome or root-stock of the plant. It is largely grown in the West Indies, and can be grown in a number of the Southern States. Ginger is grown by cutting the rhizomes into short pieces, each with an eye or bud.

GOOSEBERRY.

Soil.—The soil and fertilizer for the gooseberry should be the same as for currants.

General Notes and Suggestions.—This fruit is too frequently neglected or unknown. It is really a delicious berry, more easily grown than the currant, and by many considered superior.

GRAPES.

Soil.—Grapes need a well drained soil, and prefer a sandy, gravelly or rocky soil, and thrive on hillsides where few other plants will. Badly drained soil is not suited for the grape.

Rotation and Fertilizer.—In planting a vineyard upon new land it is best to precede with a crop of cow peas or of clover. In Europe, stable manure is largely used for grapes. In this country it is said that stable manure induces a rapid and poorly ripened wood, and a growth more ready to succumb to attacks of fungous diseases. We therefore prefer to grow leguminous crops between the grape rows (cow peas and crimson clover), and depend upon the clover for all nitrogen, but large applications of potash and phosphoric acid are indispensable. Use per acre 700 lbs. of a fertilizer containing:

Available phosphoric acid, 9 per cent.
Potash, 14 " "

and apply in the early spring. If no legumes are raised, use 200 lbs. of nitrate of soda in addition. Apply also once in five years 30 bushels of fresh water slaked lime per acre.

General Notes and Suggestions.—The grapes of the United States belong to many species. Most of those grown in the Eastern and Middle States belong to Vitis Labrusca, the fewer number to Vitis Æstivalis and Vitis Riparia. In the South, Scoppernong and other varieties of V. Rotundifolia are largely grown. Vitis Vinifera, the grape of Europe, Asia and Africa, is grown only under glass in the East, but is the principal grape of the Pacific Coast, New Mexico and Arizona. The best grape regions of the North are on the lake shores of Western New York and Lake Erie. The best section for grapes in the South is the long leaf pine section of North Carolina.

GRASS LANDS.
(PERMANENT.)

Fertilizer.—To keep a permanent pasture in good order, and to increase its capacity for supporting stock, the soil should be fed. As a top dressing, use per acre 700 lbs. of a fertilizer containing:

Available phosphoric acid, 10 per cent.
Potash, 12 "

Apply this every second year, and it will constantly improve the pasturage.

At frequent intervals during the summer a smoothing harrow should be run over the pasture to scatter the droppings of the animals, and thus prevent the growth of bunches or tussocks of grass which cattle will not eat.

General Notes and Suggestions.—The sweetest of pasture grasses are grown upon uplands, and the keeping of hill lands permanently in grass is an important matter, not only for the stock, but for the benefit to the land in preventing washing. But the pasturing of stock, particularly of growing animals, and of cows whose milk is sold, exhausts the phosphate and potash of the soil very rapidly, and it is important that these be restored if the sod is to be kept in the best condition.

The kinds of grasses best adapted to this purpose will depend upon the character of the soil and the climate. In limestone districts, the main pasture should, in the Middle States, be the "Kentucky blue grass" (*Poa pratensis*), with orchard grass in beginning. On clay uplands of the granitic formations or on the red sandstone formations in the Middle States use Virginia blue grass (*Poa compressa*) and Rhode Island bent grass, with orchard grass to start the sod and pro-

tect the slower grasses. The same rule will apply to the mountain regions of Virginia, North Carolina, South Carolina and Georgia. For the southern coast plain there is no grass which can equal the Bermuda grass (*Cynodon dactylon*). This, mixed with Texas blue grass (*Poa arachnifera*), will make a perfect summer and winter pasture from North Carolina to the Gulf of Mexico.

GRASS FOR LAWNS.

It is just as easy to have a good lawn in any part of the United States as anywhere else, if the preparation is right and the grasses used are suited to the soil and the climate. From Virginia northward there is no better grass needed than the Kentucky blue grass (*Poa pratensis*), but in the South, and on a sandy soil anywhere, this grass does not do so well. On the sandy soils of the South, success can only be attained by giving the lawn a good coat of clay, for the grass will surely burn out without it. Many people fail to get a good, permanent lawn in the South because they endeavor to enrich the sandy soil by spreading black soil from the woods or swamp on the land. This dries to a powder in hot weather and destroys the

grass. The better plan is to make a compact bed of clay, and then enrich it by top dressings. For this purpose nothing is better than raw bone meal. Use 400 pounds of bone meal with 200 pounds Muriate of Potash per acre. The lawn must be well prepared, and the surface made smooth and fine. The seed should be sown at the rate of not less than five bushels per acre and well raked in. In the South use a mixture of redtop, perennial rye grass and herd fescue in equal parts. Bermuda grass will also make a good summer lawn in the South, and, if mixed with Texas blue grass, will give a green lawn the year round. Regular mowing with the lawn mower is essential to a good lawn anywhere. The cut grass should be allowed to remain as a mulch. The top dressing suggested should be used annually. If the growth of the grass is not rank enough, it will be very beneficial to occasionally give a top dressing of nitrate of soda, using 100 pounds per acre during the growing season.

GRASS FOR MEADOWS.

Fertilizer.—A heavy growth of grass means enrichment of the soil, and it is only

on lands kept rich by liberal fertilization and by rotation of crops that heavy crops of hay can be cut. When meadows are kept mown for several years, they should be annually top dressed with 500 pounds of a fertilizer containing:

Available phosphoric acid, 10 per cent.
Potash, 11 "

This application should be made in the early spring or during the winter as top dressing and harrowed in. An occasional top dressing of lime may also be beneficial. Under such treatment meadows will continue to improve every year. Sour grasses and mosses will gradually disappear, and grasses of good quality and clovers will take their places. Not only will the quantity of hay be largely increased, but its quality greatly improved.

General Notes and Suggestions.—As with the permanent pasture grasses, the kinds of grass to be used will depend upon the nature of the soil and the character of the climate. Our country is so large that no general rules can be made for all.

For strong, clay loams or limestone lands from the mountains of Virginia northward,

the time-honored Timothy grass (*Phleum pratense*) is as yet unrivaled for yield and salable quality. It is commonly mixed with corn, but the combination is not as successful as a mixture of clover with an earlier grass. On moist lands, sow redtop grass with the Timothy to give it a dense bottom. From central and eastern Virginia southward, Timothy grass is not the best hay grass. On clay uplands in the South a mixture of orchard grass, fall meadow fescue and fall meadow oats grass will make the best hay and heaviest crop. A little red clover should be mixed with this, as all are early and can be cut together. On the sandy lands of the southern coast plain, the advisability of attempting the culture of meadow grasses on uplands is doubtful. On low, black bottom lands, Johnson grass (*Sorghum Halepense*) will give enormous crops at several cuttings, but it is hard to break up, and its scattered seeds are apt to start the grass as a weed when not wanted. But for yield of hay in the South it is unequalled. Bermuda grass, also, on similar lands, will make a choice hay. The annual grasses, such as the native crab grass, will give wonderful crops on heavily enriched soil.

HEMP.

Soil.—Hemp is best grown on soils abounding in humus. The mechanical texture of the soil is not so important, provided it is kept well drained and fertile. When the soil is fertile, hemp is often grown year after year on the same land.

Fertilizer.—Hemp is a gross feeder, particularly upon potash. Use per acre 800 lbs. of a fertilizer containing:

Available phosphoric acid,	4½ per cent.
Potash,	9 "
Nitrogen,	5½ "

General Notes and Suggestions.—Hemp originated in the Chinese territory, but is now cultivated in all parts of the world. When grown on soils abounding in humus and in a northern latitude, it yields a finer fibre than when grown in hot countries.

HOPS.

Soil.—High, dry, loamy soils are best suited for hops.

Fertilizer.—This plant is a perennial, and therefore occupies the land for years. The preparation of the land preceding the planting should be deep and perfect and the sub-

soil should be loosened. Use per acre 1,000 lbs. of a fertilizer containing:

Available phosphoric acid,	8 per cent.
Potash,	10 "
Nitrogen,	3 "

It is to be noted that the amount of potash for hops should be large, and a larger percentage of potash than the above recommended may be used with profit, while care should be taken not to use too large quantities of phosphoric acid and nitrogen; if this precaution is not observed the product will be of large size, but the quality will be inferior. Hops are grown from cuttings of the roots set in holes eight inches below the surface, and are trained on poles and wire. The plant is diœcious, that is, the male blossoms are borne on one plant and the female on another. The female blooms are the hops of commerce. It was formerly thought necessary to have a proportion of male plants, but this is not now practiced.

HORSE RADISH.

Soil.—A deep but not heavy clay loam is best suited for horse radish.

Fertilizer.—Use per acre 600 lbs. of a fertilizer containing:

Available phosphoric acid,	7 per cent.
Potash,	10 " "
Nitrogen,	4 " "

LENTILS.

Soil.—Lentils flourish well upon light marl or light loamy soil, or even upon dry, stony soil rich in lime. On such soils peas would not grow well.

Rotation and Fertilizer.—Grain or hoed crops should precede lentils. Use the same fertilizer as for peas.

LETTUCE.

Soil.—In outdoor culture the soil best adapted to this crop is a mellow loam, well enriched with nitrogenous fertilizers, as the crispness and quality depend largely upon the rapidity of its growth. Lettuce is now grown in large quantities under glass in winter in specially prepared soil made of rotted grass sods and manure.

Fertilizer.—Use per acre 1,000 lbs. of a fertilizer containing:

Available phosphoric acid, 6 per cent.
Potash, 10 "
Nitrogen, 5 "

When grown in coldframes, use to each 3 x 6 foot sash, one pound of the following mixture:

Available phosphoric acid, 9¾ per cent.
Potash, 15 "
Nitrogen, 2½ "

General Notes and Suggestions.—In the open ground lettuce can be planted between early cabbages, and then cut out before the cabbages need all the space. In this case they will not need independent fertilization.

LUCERNE.

(SEE ALFALFA.)

LUPINE.

Soil.—Lupine does best, both as a source of seed and for green fodder, upon very light sandy soil, poor in lime. Heavy loams and clays are not favorable for the yellow variety, but the other varieties will do fairly well upon them.

Rotation and Fertilizer.—There is not much choice as to rotation, as this crop does well upon the poorest soils. To obtain the

largest amount of seed we may plant it after grain or potatoes. For green manure the lupine can follow winter rye and be sown directly on the plowed up stubble. It will grow to such an extent that when it is plowed under the result will be equal to a light manuring with stable manure.

As a fertilizer use per acre from 300 to 500 pounds of kainit.

The lupine needs a large amount of potash to grow to perfection, but it does not seem to be responsive to applications of phosphate. Lime is positively injurious to this plant.

General Notes and Suggestions.—The lupine may not do well on soil upon which it is planted for the first time, for the reason that the bacteria necessary for its growth are not sufficiently present. Continued planting will finally adapt the soil to this crop. By means of exact scientific experiments it has been proved that in a sterilized soil containing no organic matter or life, no root nodules can be formed. Such a soil must first be charged with the bacteria, either by means of a watery solution of good soil, or from the root nodules themselves. Only when this has been done successfully can the nodules be developed, and the nitrogen be assimi-

lated. Most kinds of soil contain these bacteria, and only in rare cases is it necessary to supply them. Such a case might be necessary upon a reclaimed swamp where considerable fire had been applied in the work of reclaiming. According to experiments made in reclaiming swamp lands at the Experiment Station in Bremen, the soil was made fit for lupines by the addition of small quantities of soil containing clover roots from a field where clover had been successfully grown.

MANGEL-WURZEL.

(SEE BEETS.)

MILLET.

Soil.—These grasses require a rich, moist loam to make a good crop. They thrive well also on low peaty or marshy soils.

Fertilizer.—They should be manured like the other grasses.

General Notes and Suggestions.—Under the name of millet are included a number of different species of annual grasses. *Panicum miliaceum*, or common millet, is grown largely for hay. Italian, or golden millet, German millet, golden wonder millet and

Japanese millet, all belong to *Setaria Italica* and are all annuals. *Pennisetum spicatum* is pearl millet or cat-tail millet. These are all valuable forage plants of quick summer growth. All should be cut as soon as fairly out of bloom, except the pearl millet, which should be cut before the flower heads are fairly out, when it will grow again. They are exhaustive crops, and their place can be taken to advantage by cow peas or annual clover.

MINT.

Soil.—Alluvial, clay loam, or peaty soils, which must not be overcharged with surplus water, are recommended for mint.

Fertilizer.—Use per acre 700 lbs. of a fertilizer containing:

Available phosphoric acid,	7	per cent.
Potash,	7	"
Nitrogen,	4	"

MUSTARD.

Soil.—Mustard grows on any soil, but prefers a medium rich loam.

Rotation and Fertilizer.—Mustard, when grown for seed, can follow an early crop of crimson clover, or in the South a crop of

early potatoes. Use per acre 300 lbs. of a fertilizer containing:

Available phosphoric acid,	7 per cent.
Potash,	8 "
Nitrogen,	3 "

General Notes and Suggestions.—Mustard has often been grown as green manure. When thus treated it does not enrich the soil in nitrogen, for it does not belong to the so-called leguminous plants, and has not the property of absorbing nitrogen from the air. The advantage of raising it for green manure consists in furnishing humus to the soil, and also in preventing leaching during the winter. If leguminous crops can be substituted, they will be preferable to mustard as green manure.

OATS.

Soil.—Oats adapt themselves to all sorts of soil better than any other cereal. They thrive on thin uplands and do excellently on reclaimed swamp lands. They are not particular as to the physical character of the soil, but usually prefer a mellow loam.

Rotation and Fertilizer.—When sown in the spring, as is usual in the North, they do well after a crop of Indian corn planted the

previous season. Winter oats cannot follow a corn crop north of Virginia, since they should be sown in September, before the corn is out of the way. Spring oats will not need fertilizer when following a well manured corn crop of the previous year, or when planted on new ground, or on reclaimed swamp lands.

Winter oats do best after a crop of peas or clover grown for pasturage. In this case no nitrogenous fertilizer need be used in autumn, though a light dressing of 30 to 50 pounds of nitrate of soda may be profitably applied in the spring. In South Carolina such an application is found to make a wonderful increase in the crop. On light land it would be best to give the winter oats 400 lbs. of a fertilizer containing:

Available phosphoric acid, 8 per cent.
Potash, 5 "
Nitrogen, 2½ "

All experiments tend to show that for oats it is important that a fair percentage of nitrogen be supplied in the fertilizer, even though they follow a nitrogen gathering crop.

General Notes and Suggestions.—Spring oats do best in northern latitudes, but the

varieties of winter oats usually sown from Virginia southward are doubtless hardy enough anywhere in the winter wheat belt. Thorough compacting of the soil is as important in the culture of oats as in that of wheat, but a more shallow drilling is better. A depth of three inches has been found best for wheat, and two inches for oats.

Both oats and wheat, in common with most small grains, suffer from the attacks of smut (*ustilago*). The spurs of these fungous plants attach themselves to the grain. When the grain is planted they germinate and enter the tissues of the plant at an early stage of its growth. The best plan to destroy the smut in wheat, barley or oats is to keep the seed 15 minutes in water heated to 132½ degrees Fahrenheit. An accurate thermometer should be used and the temperature carefully maintained at the given point.

OLIVE.

Soil.—The olive thrives best on calcareous, gravelly, and dry soils, in an arid climate.

Fertilizer.—Phosphate and potash fertilizers are needed for the olive. Sow crimson clover among the trees in September, and

plow under in May, using with the clover 300 lbs. of a fertilizer containing:

Available phosphoric acid, 10 per cent.
Potash, 8 "

General Notes and Suggestions.—The climate of the California foothills seems to suit the olive best, and olive oil is becoming an important article of commerce. While olive trees will grow on poor soils, yet they will repay careful cultivation and feeding.

ONIONS.

Soil.—Onions do best upon a light, loamy soil and one that has been kept free from weeds by careful culture. They can be grown a number of years on the same land if properly fertilized. Onions thrive well on soil which contains much humus, and which is consequently retentive of moisture. Muck soils are often selected for onion farms.

Rotation and Fertilizer.—It is well to have onions preceded by a crop which frees the soil from weeds, as, for example, potatoes. Onions need lime for their development, and to make good crops they require heavy manuring. Commercial fertilizers are better for onions than animal manures, since

the former contain no seed producing weeds. Use per acre 1,500 lbs. of a fertilizer containing:

Available phosphoric acid,	6 per cent.
Potash,	7 "
Nitrogen,	4 "

General Notes and Suggestions.—The common practice in the South has been to use sets or small bulbs grown the previous year from thickly sown seed. But good crops can be raised anywhere from the black seed by sowing early. From Virginia southward sow the seed in February. Sets for growing early-grown onions should be planted in the fall. Stable manure is also objectionable, for the reason that it fosters the onion maggot. If the onion farm is located on muck soil, a maximum quantity of phosphoric acid and potash should be applied and only a small amount of nitrogen, because such soils are rich in the latter and poor in the former ingredients. Too much nitrogen will also retard the ripening and curing.

THE ORANGE AND LEMON.

Soil.—A deep, mellow and well drained soil is necessary for oranges. Good groves

can be made on quite sandy land if attention is paid to fertilization and the growing of nitrogen gathering crops. Black, rich hammock land in Florida will also make fine oranges if well drained.

Rotation and Fertilizer.—The orange needs ample supplies of lime, particularly when grown on black land. The phosphatic rock now being dug so plentifully in Florida, will make a good application to orange trees on hammock land. It should be finely pulverized and used at the rate of not less than one ton per acre, as it becomes available for plant food very slowly. If heavily applied in connection with 200 pounds or more of sulphate of potash per acre, good results may be expected. It is a good plan to sow crimson clover at the beginning of the rainy season. Tramp it down and permit it to decay in winter, when the crop is being gathered, and then plow it under in the spring. If no leguminous crops are raised, the following fertilizer is recommended:

Available phosphoric acid, 7 per cent.
Potash, 12 "
Nitrogen, 3 "
(Potash in the form of sulphate.)

Apply 20 lbs. to each tree twice a year.

First application from November 15 to December 15, and second application from May 15 to June 15.

General Notes and Suggestions.—The great success of the orange crop in Florida and California shows that we can excel any other country in the fine quality of the fruit produced. For shipping to European countries the varieties called russets are not desirable.

PARSNIPS.

Soil.—The same soil is recommended as for carrots.

Fertilizer.—The parsnip requires about one-fifth more plant food than the carrot; and as regards the amount of phosphoric acid, in comparison with that required by the carrot, the quantity might with advantage be doubled.

PEACH AND ALMOND.

Soil.—The peach and almond thrive on a light upland and on quite sandy soil.

Fertilizer.—The following manurial treatment is recommended for peach orchards: In August sow crimson clover between the rows of trees, and plow it under in April or

May of the following year, and add at the same time 1,000 lbs. of a fertilizer containing:

Available phosphoric acid, 5 per cent.
Potash, 7 "

If leguminous crops are not raised in the orchard, use from 100 to 200 lbs. of nitrate of soda per acre. Cultivate until the fruit is ripe, and then sow clover again. In this way the orchard will be kept healthy and the trees will live longer. When the trees, being naturally short-lived, ultimately fail, the soil will be in a condition to grow any crop. A heavy application of potash will make the peach trees thrifty, and they will resist longer the attacks of the "yellows."

General Notes and Suggestions.—The famous peach sections are in the sandy soils of Delaware and in the long leaf pine region of Moore County, North Carolina. The almond is longer lived than the peach. The hard shell almond is hardy in latitudes from 40 degrees southward. The soft shell almond thrives best in a dry climate like California. Both of these should have regular but shallow culture during all the growing season as long as they live. In locations south of the

State of Pennsylvania, both peach and almond should be planted fully exposed to the north. If planted in the South in a warm, sunny exposure, they bloom out in winter and the blossoms are frequently destroyed by a return of cold.

PEANUT.

Soil.—A sandy soil rich in lime is important. No other will make a good crop.

Fertilizer.—The peanut being a leguminous plant, does not need applications of nitrogenous manures. Lime is very essential to this crop, especially if the soil abounds in vegetable matter. But the great need of all these legumes is potash, and to make potash most available there should be plenty of phosphoric acid present. If well supplied with these fertilizers, the plant will acquire from the air all the nitrogen needed for its growth. A poor soil with proper fertilizers will make a better crop of peanuts than a very fertile soil. Use per acre 600 lbs. of a fertilizer containing:

Available phosphoric acid, 9 per cent.
Potash, 15 "

Give also an ample supply of lime.

PEARS.

Soil.—Pears require a soil similar to the apple, but unlike the apple they thrive on moist lands on our southern coast.

Fertilizer.—As regards fertilizers, pears should be treated about in the same manner as the apple.

General Notes and Suggestions.—The disease called "fire blight" is always worse on cultivated pear trees. Therefore plant them in a sod, and keep the sod fertile and regularly mown like a lawn. Since fire blight is a fungous disease, the best remedy is to remove all diseased branches and trees and burn them up. The saws used for the purpose should be kept clean as they might transfer the disease from one tree to another.

PEAS—COW.

Soil.—The cow pea does well on any soil, and it will grow on the poorest lands if properly fertilized. A sandy soil probably suits it best.

Fertilizer.—Like other legumes it needs no artificial application of nitrogen, but is a greedy feeder upon potash and phosphoric acid. If plenty of these food elements is

supplied the growth will be enormous, and a very heavy crop of forage will be obtained, giving food for stock and permanently improving the soil at the same time. While peas will grow on the poorest land their best effects are only obtained when a rank growth is produced by fertilization with potash and phosphoric acid. The capacity of the plant to collect nitrogen is in proportion to its development. It is therefore of the utmost importance to feed well the plants that are going to supply the soil for other crops. Use per acre 400 lbs. of a fertilizer containing:

Available phosphoric acid, 10 per cent.
Potash, 10 "

General Notes and Suggestions.—The plant cultivated in the South under the name of field or cow pea is really a bean. The proper botanical name of the plant is a matter of much confusion and uncertainty, but there is no doubt as to its value to the farmer, particularly from Virginia southward. It is valuable both for hay and as one of the most efficient of the nitrogen collecting crops grown, and by its use the Southern farmer can do more towards the improvement of his land in one summer than the Northern farmer can do with clover in two. One of

the best varieties for green manuring as well as for seed, is the so-called "wonderful or unknown pea." Cut the peas when podded but not yet ripe, and cure them for cow feed. The stubble, when well plowed and prepared, makes the best possible preparation for a crop of wheat, better than if the fertilizer had been all applied directly to the wheat. When used for this purpose from one to two bushels of seed should be used per acre. Much interest has of late been shown in this crop in localities far north of where it has formerly been grown, and favorable results have been obtained as far north as northern Ohio.

PEAS—GREEN.

Soil.—A good sandy loam or light clay loam is recommended.

Fertilizer.—As the pea belongs to the leguminous plants it needs little or no application of nitrogen when intended for mature growth. But as the garden pea is grown early and used green it is benefited by a nitrogenous application. Use per acre 900 lbs. of a fertilizer containing:

Available phosphoric acid,	8 per cent.
Potash,	11 " "
Nitrogen,	1½ " "

General Notes and Suggestions.—Peas are quite liable to a disease which retards the time of ripening and the full development of the seed; but if mineral fertilizers are applied in sufficient amounts the injury from diseases is much reduced or even avoided. In the South green peas can be raised very profitably for shipping North. They are then sown about the 1st of December and are ready for market the 1st of March. The raising of this crop on a large scale requires considerable experience, but is quite profitable. It will bring as much as $300 per acre net profit. The expense of raising will not be over $1.00 per crate of one bushel, and it will bring from $1.50 to $5.00 per crate. A crop of one hundred and fifty bushels per acre may be raised on an average.

PINEAPPLE.

Soil.—A light sandy loam is the best for pineapples.

Rotation and Fertilizer.—Before planting a field of pineapples, it is well to raise upon it for one season a good crop of cow peas. These should be fertilized very heavily, say with 800 pounds of kainit and 600 pounds of

acid phosphate per acre. During the early growth of the pineapple plant it needs a considerable amount of nitrogen. This is best supplied by using cotton seed meal at the rate of about 1,000 pounds per acre. As the plant becomes older, considerable amounts of potash and phosphoric acid are needed. The usual applications of acid phosphate, etc., are liable to produce injury by destroying the foliage and centres of growth. It is therefore well to use phosphoric acid in the form of bone meal. A grown up pineapple field may receive per annum 2,000 lbs. of a fertilizer containing:

Available phosphoric acid,	7	per cent.
Potash,	8	" "
Nitrogen,	3	" "

(Potash in the form of Sulphate.)

To prevent injury to foliage some special mechanical devices are sometimes used for making these applications.

General Notes and Suggestions.—The only portion of the United States in which pineapples can well be grown is the southeastern part of Florida and the Indian River beyond the frost line.

PLUMS.

Soil.—All plums prefer a soil of a rather compact and clayey nature, but will do well on soil of quite a sandy character.

Fertilizer.—Like all hard wood trees, plums require large supplies of potash, and will be greatly benefited by an annual dressing of 1,000 lbs. of a fertilizer containing:

Available phosphoric acid, 5 per cent.
Potash, 7 "

If the soil is poor in nitrogen, use from 100 to 200 pounds nitrate of soda in addition.

General Notes and Suggestions.—The plums now in cultivation belong to a number of species native to several parts of the world. Though they differ from each other in many respects, their culture is the same. The Japan plums are now the most popular, as they suffer less from the attacks of insects than the European sorts formerly grown. Some of the American varieties, such as the wild goose, have also been found profitable for market fruit.

POTATOES—IRISH.

Soil.—Potatoes thrive best on a mellow loam, well drained, and inclined rather to

sand than clay. Badly drained and heavy soils produce smaller crops and potatoes of poor quality.

Rotation and Fertilizer.—The best of all crops to precede potatoes is clover or a new grass sod plowed under the previous fall. It has been found that south of Maryland the early crop of Irish potatoes needs a more liberal supply of nitrogen than in the North, since the whole growth is made in the early growing season, before bacterial nitrification becomes active. Barnyard manure seems to promote the fungous disease known as scab, so that potato growers of experience now generally avoid barnyard manures for Irish potatoes and depend entirely upon commercial fertilizers. A fertilizer rich in potash is essential. For general purposes use per acre 700 lbs. of a fertilizer containing:

Available phosphoric acid,	7	per cent.
Potash,	11	"
Nitrogen,	3	"

Much larger quantities of the above-named fertilizer are often used with much profit, and we have heard of farmers using 2,000 pounds per acre, and obtaining the best pay-

ing results. Sulphate of potash is mostly employed as a source of potash for potatoes. By observations that have been made, it seems that the sulphate produces a better quality, however. Some have experienced that muriate produces a good quality, and as high, if not a higher, yield than the sulphate. A large crop of potatoes can be grown south of Virginia from seed of the early crop, planted in August. This crop does not require such heavy fertilization, and can be grown after some well-manured early crop. This late crop makes the best seed for planting the following spring.

General Notes and Suggestions.—Scabby potatoes are so common and so inferior for all purposes, that the recently discovered method of prevention by Professor Bailey, now used by many of the largest potato growers of the country, is here given. The disease is caused by a fungous growth. The remedy is based upon the killing of the germ producing the disease, and the material is the same as used in antiseptic surgery. "The seed potato, either cut or whole, is soaked for two hours in a weak solution of corrosive sublimate and dried before planting."

POTATOES—SWEET.

Soil.—The only soil in which sweet potatoes develop their best qualities is a sandy soil. There must not be present an excess of nitrogenous matter.

Rotation and Fertilizer.—The sweet potato crop does well after a cleanly cultivated corn crop, but better upon a fall plowed sod. When potatoes have been grown on same land for years, and the vines left to decay thereon, the soil is said to become "potato sick." A heavy dressing of potash and phosphoric acid overcomes the sickness, but it is best to grow some other crop on the land for a while. Use per acre 550 lbs. of a fertilizer containing:

Available phosphoric acid,	7 per cent.
Potash,	9 "
Nitrogen,	4 "

Sulphate of potash is generally preferred as a source of potash for sweet potatoes. If sweet potatoes are raised after corn, add from 50 to 100 pounds of nitrate of soda. If they are planted after a fall-plowed sod, no nitrogen should be used.

General Notes and Suggestions.—There is no botanical relation between the sweet potato and the Irish potato, although both are

called potatoes. The sweet potato belongs to the same family of plants as the morning-glory. The potato sprouts are set on shallow ridges, which should not be made too high, as in such case potatos grow long and unsightly, and in a dry season suffer more from the drought.

PUMPKINS.

(SEE SQUASH.)

QUINCE.

Soil.—Quinces, like plums, prefer a moist clay soil, and seem to thrive better in the vicinity of salt water. They need above all a soil abounding in vegetable matter or humus.

Fertilizer.—The fertilizer recommended for the pear will do equally well for the quince, but the latter seems satisfied with lighter applications.

General Notes and Suggestions.—Quinces are commonly treated with utter neglect, but they will well repay good culture. They can be easily grown from cuttings set in the open ground in the fall. The best sorts are the "Champion" for the South, and the

"Orange" for the North. The trees should be well cultivated when young, and when they come into bearing the orchard should be seeded down to grass and kept mown like a lawn, and all the cut grass allowed to decay on the land.

RADISHES.

Radishes, being grown mainly during the early and cool season, need a liberal supply of nitrogen as the more rapidly they are grown the more crisp and palatable they are. Market gardeners grow radishes largely as a catch crop, scattering the seed between other crops which have been heavily manured. They are also sometimes sown in the rows of early beets, as they come up quickly and are soon pulled out of the way before the beets get much size and need all the room. Radishes, especially those with long roots, like a deep and light soil. The turnip-rooted kinds can be grown on much shallower soil. A good fertilizer for radishes per acre is 800 lbs. of the following mixture:

Available phosphoric acid,	7 per cent.
Potash,	10 "
Nitrogen,	3 "

RAMIE.

Soil.—Sandy loam.

Fertilizer.—Liberal fertilizing is necessary. Frequently the plantations are resown but once in twenty-five years. Apply compost, mixed with the old leaves of the plant, as well as 650 lbs. of a fertilizer containing:

Available phosphoric acid,	6 per cent.
Potash,	5 "
Nitrogen,	2 "

General Notes and Suggestions.—The fertilizer ought to make a quick growth of stalks, in order to produce the best quality of fibre. The crop is very exhausting to the soil, the yield being 5 to 10 tons of dry stalks per acre. It may be propagated either by divisions of roots, cuttings, layers or seed. Two to four crops are cut per year. It is adapted to California and the Gulf States.

RAPE.

Soil.—Strong loam or clay, well supplied with humus, is recommended. It does well on thoroughly cultivated reclaimed marshes.

Rotation and Fertilizer.—Almost any crop which leaves the soil in a friable condition, such as hoed crops or green crops turned under, may precede rape.

Use per acre 600 lbs. of a fertilizer containing:

Available phosphoric acid, 8 per cent.
Potash, 9 " "
Nitrogen, 4 " "

General Notes and Suggestions.—Rape is a very heavy feeder, and stable manure is recommended in addition to artificial fertilizers.

RASPBERRIES.

Soil.—A deep, rich clay loam and a northern exposure suit the plant well.

Fertilizer.—Use per acre 700 lbs. of a fertilizer containing :

Available phosphoric acid, 7 per cent.
Potash, 12 " "
Nitrogen, 3 " "

General Notes and Suggestions.—Two general classes of raspberries are cultivated, and they are derived from several botanical species. The two classes are the red raspberries and the black caps. The former are grown entirely from suckers and root cuttings, while the cap sorts are grown by rooting the tips of the shoots of the season as they grow. Raspberries are much more at home in the Northern States than in the

Southern. The red sorts are not worth growing south of Maryland, but the black caps do fairly well. The planting and culture are the same as recommended for blackberries. The plantation should be renewed every five years. The ground should be thoroughly cultivated early in the season, and then well mulched. Old canes should be removed early in the spring.

RHUBARB.

As rhubarb is grown in gardens solely for its leaf stalks, it is essential that these should be induced to grow to the most complete development. To this end a deep and very fertile soil is essential. A soil of a clayey nature and inclined to be moist is best adapted to this crop, as it suffers quickly from drought. Depth of soil is of the first importance, for the large roots need plenty of room for proper development. Good rhubarb cannot be grown except on very rich soil. There is no danger of getting it too rich. Heavy applications of stable manure make the best possible fertilization, but in its absence mix 1,300 pounds of the following fertilizer with twenty loads of black

mold from the forest, and apply the whole to an acre. Fertilizer containing:

Available phosphoric acid, 8 per cent.
Potash, 7 " "
Nitrogen, 3 " "

The best crop to precede rhubarb is clover.

RICE.

Soil.—Water rice or swamp rice needs low lands, diked and ditched for flooding and draining. Upland rice is best grown on black, peaty soils which never suffer from drought.

Fertilizer.—Upon the peaty soils for upland rice no nitrogen is needed, but a dressing of 300 lbs. acid phosphate and 100 lbs. muriate of potash per acre pays well.

Planters of water rice find that it pays well to use 450 lbs. of a fertilizer containing:

Available phosphoric acid, 6 per cent.
Potash, 6 " "
Nitrogen, 3 " "

Sometimes, as in Italy, about three bushels of lupine seeds per acre are also sown upon the rice fields. These lupine seeds gradually decay in the water, and furnish the necessary nitrogen for the rice.

General Notes and Suggestions.—The swamp rice constitutes the bulk of the rice of commerce, and can only be grown in this country from North Carolina south to the Gulf. Its culture, to be profitable, must be upon a large scale, and with an expensive outfit. It needs a low muck soil.

In Eastern North Carolina and southward, large quantities of upland rice are grown. The seed is planted in hills ten inches to fifteen inches apart, in rows wide enough to admit of horse culture, each hill containing a number of plants.

RUTA BAGAS.

(See Turnips.)

RYE.

Soil.—Rye does well upon soils light in texture and containing but little nitrogen. A soil rich in nitrogenous matter will produce a rank growth of straw, but a deficient crop of grain. It succeeds far better on light, high, dry soil than upon low, heavy land.

Rotation and Fertilizer.—Rye comes in very well after a crop of Indian corn. If put on a good clover sod or pea farm the growth of straw is apt to be too rank. It is

always best to put a hoed or cultivated crop, either of corn or potatoes, before rye, to use up any excess of nitrogen that may be present in the soil. Soil otherwise well suited to rye is usually poor in potash. If it is in a fairly fertile condition, we should not use any nitrogen at all. Use 350 lbs. of a fertilizer containing:

Available phosphoric Acid, 11 per cent.
Potash, 6 "

General Notes and Suggestions.—From the fact that rye requires but a small quantity of nitrogen it is not wise to fertilize it with stable manure.

SOILING.

Crops.—Vetches, crimson clover, red clover, buckwheat, spurry, fodder corn, fodder cabbage, etc.

The term "soiling" has been applied to the practice of keeping cattle confined and feeding them on green-cut food. A much larger number of animals can be kept on the same piece of land than by pasturing them. The practice is a good one, at times, even where grazing is the usual practice, for in our climate there are times in almost every summer in which the pastures fail to give an

adequate supply of food by reason of dry weather. At such times, some crops planted for cutting while green will be found of great value. Few people fully realize the quantity of food at can be cut from an acre of fertile soil by keeping up a regular succession of crops. The earliest crop that is available for soiling purposes is, probably, crimson clover, sown in the previous August. The ordinary red clover will follow this closely, with some fall sown rye to help it out, and by the time these are used up, early sown corn will be ready to cut. There can be a regular succession of corn and cow peas kept up until frost, and by sowing in August, winter vetches can then be ready, in the South, and, with rye, will furnish green food most of the winter, and, if a silo is at hand, the corn and pea can be preserved for the winter supply. For the best results in soiling it is essential that the land be very fertile, and, if not naturally so, it will be necessary to fertilize quite heavily at the start. The clover, as we have said, will not need nitrogenous fertilizers, but the other crops should have a liberal supply of complete fertilizer. After a little while, the increased production of manure will enable

the farmer to dispense with any artificial manures, except an occasional application of potash and phosphoric acid, for, unless some food grown elsewhere is fed, these mineral matters in the soil must eventually be exhausted, and they cannot be obtained from the air as the nitrogen can.

The same kinds of manure should be applied to these fodder crops, as previously stated when discussing each separately.

SORGHUM.

Soil.—Sorghum does well on a sandy loam or gravelly soil, and on prairie soil, even when comparatively dry.

Fertilizer.—See "Sweet Corn."

General Notes and Suggestions.—It is cultivated like corn, but does well on drier soils.

SPINACH.

Soil.—Spinach prefers a warm, light and well-drained soil, and an abundance of nitrogenous food.

Rotation and Fertilizer.—Market gardeners in the South sow it on land intended for

the crop of early snap beans in spring, and sow the seed in rows, two and a half to three feet apart, in August or September. The crop is cut out during winter, and enough plant food is left in the soil to carry the crop of beans through, and these are in turn followed by melons, manured in the hill. Use per acre 1,200 lbs. of a fertilizer containing:

Available phosphoric acid,	8 per cent.
Potash,	6 " "
Nitrogen,	3 " "

General Notes and Suggestions.—Spinach is one of our most hardy vegetables, and stands the winters in nearly all parts of the United States. There are a number of varieties in cultivation, some with smooth and some with prickly seeds. It was formerly the practice to advise the sowing of the prickly seeded sorts in the fall and the smooth ones in spring, but there is really no difference as to hardiness, and either can be sown as may be convenient. The smooth seeded sorts are more largely sown now than the prickly varieties. The most popular variety is the Norfolk Savoy leaved. The Viroflay is probably the most productive sort.

SPURRY.

This plant has been brought into notice lately as a forage plant, well adapted to sandy soils. It has been found valuable on the sandy lands of Michigan, but is of little or no value in a warm climate. Care is needed to prevent its becoming a troublesome weed. The lands which are in the best mechanical condition for it are usually deficient in potash, and a fertilizer well supplied with this is of the first importance. Use per acre 1,500 lbs. of a fertilizer containing:

Available phosphoric acid,	8 per cent.
Potash,	10 " "
Nitrogen	1 " "

SQUASHES AND PUMPKINS.

The treatment advised for melons will apply equally well to these crops. Where Indian corn is grown on rich land in the Northern States, it is a common practice to plant pumpkins and the winter varieties of squashes among the corn, and it is claimed that a good crop of pumpkins is gotten without any injury to the corn crop. In this case no further manure will be needed than that applied to the corn crop. Where these plants are

grown by themselves they will thrive with the same treatment as melons, but they prefer a stronger and more clayey soil than watermelons. Use per acre 1,600 lbs. of a fertilizer containing:

Available phosphoric acid,	5 per cent.
Potash,	5 "
Nitrogen,	4 "

STRAWBERRY.

Soil.—Strawberries want a rich, moist soil. One in which water is found at a depth of only a few feet, and which has a porous subsoil through which moisture can freely rise by capillary attraction, will be found an ideal strawberry soil. Water or moisture is of the first importance, and if a strawberry plantation is situated so that it can be irrigated, far better results can be obtained than on land not so treated. Sandy loam is the best.

Fertilizer.—The soil for strawberries can hardly be too rich, but heavy manuring with barnyard manures tends to make the land weedy; therefore, artificial fertilizers are preferable. Before planting apply 100 lbs. high grade sulphate of potash per acre. It is well to set the plants in rows four feet

apart, and the plants one foot apart in the row. Turn manures in along the rows so that the row becomes matted with plants the first season. Keep land between rows well cultivated. The following spring apply per acre 1,500 lbs. of a fertilizer containing:

Available phosphoric acid,	8 per cent.
Potash,	9 " "
Nitrogen,	3 " "

Work these in by spreading between the rows and cultivating.

General Notes and Suggestions.—The strawberry has been more improved in America than elsewhere. Years ago growers tried to raise the European Fragaria Vesca here, but gradually discovered that success here depended upon growing varieties suited to our climate. In the past twenty years so many fine seedlings have been raised from American stock that are fully suited to our needs that none of the European sorts are now imported at all. Our own sorts are much superior for our climate.

In selecting plants care should be taken to secure varieties of both sexes; failure to give due attention to this essential of strawberry culture has frequently resulted in barren beds. If transplanted in August, a

crop may be harvested the following year. After the plants have borne one full crop in the second season from setting, plow them down for a crop of late cabbage or potatoes in same land, and set another bed every season. You will thus always have a bed at its best each year.

SUNFLOWER.

Soil.—The sunflower is adapted to all soils, but will do best on deep, strong loam with plenty of moisture.

Rotation and Fertilizer.—Sunflowers may follow any crop, and they come in well after a buried clover sod. Use per acre 500 lbs. of a fertilizer containing:

Available phosphoric acid,	8	per cent.
Potash,	8	"
Nitrogen,	3	"

General Notes and Suggestions.—Sunflowers should not be grown, as is commonly done, around fields, or between rows of other crops, as they are very exhausting to both fertility and moisture. The seed is a most useful fattening grain, particularly for sheep and fowls; and from the seeds an oil is made which is said to be fully equal to olive oil for table use.

TOBACCO.

Soil.—There is no crop grown which varies so much in quality, because of the soil upon which it is grown and the fertilizers used, as tobacco. For a leaf of high quality for smoking purposes, it is essential that the soil be light and rich in vegetable matter. A low, rich clayey soil will produce a rank and heavy crop, but will not produce tobacco of fine quality.

The fine gold leaf tobacco of North Carolina, so highly prized for cigarettes and chewing tobacco, is grown upon a light gravelly soil. A red clay produces sometimes a fine, rich mahogany-colored leaf of high value. Limestone soils, too, will produce tobacco of high grade.

Rotation and Fertilizer.—The heaviest crops, though not the highest in quality, are grown after a crop of clover. The next year, with proper fertilization, the same land will bring a crop of higher value. Potash is of the utmost importance to this crop, which consumes large quantities of it; but in order to obtain a leaf that will burn well, all the forms of potash salts containing chlorine, such as kainit or muriate, must be avoided. Use only the pure sulphate of pot-

ash. Stable manure is preferably applied to the crop preceding tobacco, rather than directly to the tobacco. Use per acre 600 lbs. of a fertilizer containing:

Available phosphoric acid,	7	per cent.
Potash,	10	" "
Nitrogen,	3½	" "

At the Virginia Agricultural Experiment Station, nitrogen in the form of dried blood gave most profitable results.

General Notes and Suggestions.—As most tobacco is used for smoking purposes, the chief aim of the grower is to obtain a leaf with good burning qualities. Heavy loam, clay or peat soils will not do this. The plant being of tropical origin, a warm soil is essential, and one with but moderate quantities of organic matter produces the leaf of finest texture. Rank organic manures, tankage, fish, etc., must be avoided, as well as all materials containing chlorine.

TOMATOES.

Soil.—Tomatoes are not particular as to soil, but for the production of early fruit, the soil should be light and warm. For late tomatoes a heavy soil is best.

Fertilizer.—The early crop grown South for shipment North should be well fed. On

an acre use 1,200 lbs. of a fertilizer containing:

Available phosphoric acid,	7 per cent.
Potash,	6 " "
Nitrogen,	4 " "

The tomato needs a good supply of readily available nitrogen, but the nitrogen will not supply all its wants, and, therefore, good supplies of the acid phosphate and muriate of potash are needed.

General Notes and Suggestions.—To get tomatoes early it is necessary to start early and sow the seed under glass, so as to have the plants well advanced by the time it is safe to put them in the open ground. The best plan is to start the plants in shallow boxes of rich soil in a greenhouse, or in a sunny window of a well warmed room. In any given locality the seed should be sown fully ten weeks before the time when it will be safe to transplant them in the open air, so that the planting will vary with latitude. As soon as the plants have developed the second set of leaves, transplant them into other boxes a little deeper, and plant them two inches apart. Three weeks before the time to set them out in the open air, transplant them in a coldframe four inches apart, and

protect with sashes at night and on cold days, but expose to the air at every favorable opportunity, so as to gradually harden them to the open air and make them stout and short.

Plants treated in this way will transplant with ease, and come into fruit a month or more sooner than those sown in the open air. For late use and for canning it is only necessary to sow the seed in the open air as soon as the soil is warm in spring, and transplant when of sufficient size. In field culture the plants are set 4 by 5 feet apart, and cultivated like corn. In gardens where room is scarce, it is well to train them up in some manner. For this purpose nothing is better than the common galvanized wire netting sold for chicken yards, fastened to stakes. That three feet wide is sufficiently wide. Where there is plenty of room larger crops can be had by allowing the plants to fall on the ground. Where tomatoes are affected by blight, spraying with Bordeaux mixture will be found an efficient protection.

TREES AND SHRUBS IN NURSERY.

Soil.—For general nursery purposes a soil of medium texture, deeply worked and well

supplied with decayed vegetable matter, is needed. A fertile clay loam, which has been well cultivated in grain, grass and clover for some years, and which has been for some years in sod, is in the best condition to grow trees and shrubbery.

Fertilizer.—If nursery stock is located on good soil, nitrogenous manures should be but sparingly used, as they tend to the production of a rank and sappy growth of wood which does not ripen well. The ashes of all hard-wooded trees abound in potash, and it is evident that they should be well supplied with this food, so that they can make that firm and well ripened growth which is essential to their success in a cold climate, or a warm one, either. But the potash will hardly have its best effects unless an abundance of phosphoric acid is present. Use per acre 600 lbs. of a fertilizer containing:

Available phosphoric acid,	8 per cent.
Potash,	7 " "
Nitrogen,	3 " "

General Notes and Suggestions.—The land should be well and deeply plowed in the autumn previous to planting, and should be further deepened by running a subsoil plow

in each furrow so as to break it fully fifteen inches deep.

TURNIPS.

Soil.—Turnips thrive best upon a mellow loam, fairly intermediate between clay and sand; but fine crops can be made on any sandy land, well supplied with food.

Rotation and Fertilizer.—Turnips can follow after clover, lucerne, grain, and after grain fodder crops gathered early.

As they are of quick growth, they need a liberal supply of nitrogenous food. Both cow manure and sheep manure are better than horse stable manure for turnips. If these are wanting, use per acre 450 lbs. of a fertilizer containing:

Available phosphoric acid,	8 per cent.
Potash,	8 "
Nitrogen,	2½ "

VETCH.

Soil.—Vetch succeeds almost equally well upon heavy or light soils, provided the drainage is good, and the land not subject to drought. In the South it flourishes on the most sandy soils, and makes a wonderful growth on rich lands.

Fertilizer.—Being one of the legumes, the vetch, like clover, does not need nitrogenous

fertilizers. The same treatment recommended for crimson clover will do for the vetch.

General Notes and Suggestions.—The vetch is a very useful plant for winter pasture in the South; but in the Northern States it should not be sown until spring.

It does well sown among growing corn, or alone after corn is off. Vetches make good hay, but a very light product for the appearance when growing.

WHEAT.

Soil.—For winter wheat the best soil is a rather compact clay loam, thoroughly well drained. Soils of quite a sandy character can be made to produce fair crops of wheat by good culture. Spring wheat can be grown to advantage in northern sections of the country, and on lands so well filled with humus, and of such a moist character, that winter wheat would be thrown out by the frost. Heavy, tenacious, clayey soils are not adapted to winter wheat.

Rotation and Fertilizer.—The best place in a farm rotation for wheat is after a crop of clover or Southern cow peas. Good crops can also be grown after corn or tobacco, but

when wheat is the leading crop it should have the best place in the rotation.

For winter wheat, if the preceding crop was clover or peas, no nitrogen at all need be applied in the fall; but on most lands it may be found profitable to give a top dressing of nitrate of soda just before the rapid growth begins in spring. Another advantage in this is that the fertilizer containing phosphoric acid and muriate of potash needed, can, if intimately mixed, be readily applied with the drill at the time of sowing. If organic nitrogen, as in cotton seed, is used, it should be applied at time of sowing. Use per acre 400 lbs. of a fertilizer containing:

Available phosphoric acid,	6 per cent.
Potash,	5 "
Nitrogen,	3 "

If nitrate of soda is to be used in the spring, we would leave out two-thirds of the nitrogen in the fall, and use 100 lbs. nitrate of soda in the spring. For spring wheat, apply 400 lbs. of a fertilizer containing:

Available phosphoric acid,	9 per cent.
Potash,	5 "
Nitrogen,	2 "

For light soil increase potash in the first formula.

General Notes and Suggestions.—There are many varieties of wheat, but the general treatment is the same for all. The preceding crop of clover or peas should always be mown or pastured off closely, and if to be followed by winter wheat, the soil should be broken deeply not later than August 10. Earlier would be better, for, while the breaking should be deep, it should be done early enough to get the remaining growth well decayed, and the soil settled into that compact condition favorable to wheat. All weed growth should be kept down, after breaking, by frequent harrowings and rollings, so that by sowing time the surface shall be fine and altogether free from clods. For spring wheat, the plowing should be deferred as late as possible in the fall before the ground freezes, so that frosts may mellow the surface and a single harrowing suffice in April.

The time for sowing winter wheat varies from September in the northern part of the winter wheat belt to November on the southern limit. In the principal winter wheat sections, the 10th of October is generally considered the best time. Spring wheat is sown as early as the soil can be worked in the spring.

DISTANCES RECOMMENDED FOR PLANTING.

Apples (standard)	20 to 30 feet each way.
Apples (dwarf)	6 to 10 " " "
Pears (standard)	20 " " "
Pears (dwarf)	10 to 15 " " "
Quinces	12 " " "
Peaches	20 to 25 " " "
Plums	15 to 20 " " "
Cherries	14 to 20 " " "
Figs	10 to 15 " " "
Japan Persimmons	20 to 25 " " "
Mulberries	20 to 25 " " "
Blackberries	6 to 8 feet by 4 feet.
Raspberries	6 by 2 feet.
Currants	4 to 5 feet by 4 feet.
Gooseberries	4 to 5 " " " "
Strawberries:	
Hills	15 x 15 inches.
Matted rows	4 x 1 foot.
Asparagus	4 x 2 feet.
Rhubarb	4 x 2 "
Grapes	8 x 9 "
Oranges	30 x 30 "

NUMBER OF PLANTS PER ACRE AT VARIOUS DISTANCES.

DIST. INCHES.	PLANTS.	DIST. INCHES.	PLANTS.	DIST. FEET.	PLANTS.	DIST. FEET.	PLANTS.
1 X 1	6,272,640	10 X 48	13,068	4 X 5	2,178	9 X 10	484
1 X 3	2,090,880	15 X 15	27,878	4 X 6	1,816	9 X 11	440
1 X 4	1,568,160	15 X 30	13,939	4 X 7	1,556	9 X 12	403
1 X 5	1,254,527	15 X 36	11,616	5 X 5	1,742	10 X 10	435
2 X 2	1,568,160	18 X 36	9,680	5 X 6	1,452	10 X 12	363
2 X 3	1,045,440	18 X 48	7,260	5 X 7	1,242	10 X 15	290
2 X 4	784,080			5 X 8	1,089	10 X 18	242
2 X 5	627,264	FEET.		5 X 9	968	10 X 20	217
3 X 3	696,960	1 X 1	43,560	6 X 6	1,210	12 X 12	302
3 X 4	522,720	1 X 2	21,780	6 X 7	1,037	12 X 15	242
3 X 5	318,175	1 X 3	14,520	6 X 8	907	12 X 20	181
4 X 4	392,040	1 X 4	10,890	6 X 9	808	15 X 15	193
4 X 5	313,642	1 X 5	8,712	6 X 10	726	15 X 18	161
5 X 5	250,905	2 X 2	10,890	7 X 7	888	15 X 20	145
6 X 6	174,240	2 X 3	7,260	7 X 8	777	18 X 18	134
7 X 7	128,013	2 X 4	5,445	7 X 9	691	18 X 20	121
8 X 8	98,010	2 X 5	4,356	7 X 10	622	18 X 24	100
9 X 9	77,440	3 X 3	4,840	8 X 8	680	20 X 20	108
10 X 10	62,726	3 X 4	3,630	8 X 9	605	20 X 24	90
10 X 20	31,362	3 X 5	2,904	8 X 10	554	20 X 30	72
10 X 24	26,132	3 X 6	2,420	8 X 11	495	30 X 24	60
10 X 30	20,908	3 X 7	2,074	8 X 12	453	30 X 30	48
10 X 36	17,424	4 X 4	2,722	9 X 9	537	30 X 36	40

Approximate Average Analysis of the Fresh Orange.

BY PROF J. J. EARLE, Chemist Florida Experiment Station.

The average is taken from 15 varieties analyzed by Prof. Earle.

Weight of one Orange, in grammes,		203.45
" " " " ounces,		7.27
" " 44,000 Oranges, in ounces (being fair average yield per acre)		319.88
Moisture,	per cent.	87.33
Nitrogen,	"	.121
Organic matter, exclusive of nitrogen,	"	11.55
Silica,	"	.010
Sulphuric acid,	"	.043
Phosphoric acid,	"	.082
Ferric oxide,	"	.005
Lime,	"	.232
Magnesia,	"	.048
Potash,	"	.508
Soda,	"	.041
Chlorine,	"	.011

QUANTITY OF FERTILIZER IN 1,000 ORANGES.

Silica,	in ounces,	.73
Sulphuric acid,	"	3.10
Phosphoric acid,	"	6.02
Ferric oxide,	"	.41
Lime,	"	16.69
Magnesia,	"	3.53
Potash,	"	37.63
Soda,	"	3.02
Chlorine,	"	.82
Nitrogen,	"	8.75

QUANTITY OF FERTILIZER IN 44,000 ORANGES.

Silica,	in ounces,	32.12
Sulphuric acid,	"	136.4
Phosphoric acid,	"	264.88
Ferric oxide,	"	18.04
Lime,	"	734.4
Magnesia,	"	155.32
Potash,	"	1655.72
Soda,	"	132.88
Chlorine,	"	36.08
Nitrogen,	"	385.00

EXTRACTS

ABOUT

POTASH FERTILIZATION

TAKEN FROM THE

ANNUAL REPORTS FOR 1890

OF THE

AGRICULTURAL EXPERIMENT STATIONS

IN THE

UNITED STATES.

INDEX.

BARLEY.

Indiana. Exp. Station, Bulletin No. 33. Oct., 1890.

In a system of farming, having in view larger crops and permanent improvement of the land, phosphoric acid and *potash* should be used in considerably greater amounts than the crops require, while nitrogen compounds should be used in amounts not greatly in excess of the needs of the crop.

Exp. with Barley.

Fertilizers were applied as top dressing 17 days after sowing. Complete fertilizers produced the highest increase of 12.28 bushels per acre (total yield 21.5 bushels). Fertilization generally increases the proportion of grain of a barley crop.

Maine. Exp. Station, Annual Report for 1890.

Clay Loam.—Experiments for the purpose of comparing the effect of soluble with insoluble phosphate and of stable manure with complete fertilizers. Stable manure produced the lowest yield of grain of barley.

BEANS.

Rhode Island. Exp. Station, Annual Report, 1890.

The experiments were made with single fertilizing elements only, and not with combinations, as should have been. The application of *sulphate of potash* increased the average yield of twelve varieties 38.1 %, and the application of *muriate of potash* only increased the yield 20.4 %.

CORN (MAIZE).

Connecticut. Experiments by Mr. M. H. Dean, Lime Rock.

Soil, light loam, with very little vegetable matter.

320 lbs. of *muriate of potash* together with 320 lbs. of nitrate of soda produced 44.4 bushels, that is, eight times as much as the unmanured plots, which produced 5.5 bushels on the average. The results of this experiment show that, in this

case, nitrogen played a most important part in the formation of seed, and that *potash* produced the most marked effect on growth of stalks.

Exp. by Mr. R. S. Hinnson, Oxford.

Potash produced the most marked effect. In every case where it was omitted, there was a heavy falling off in the yields, both of corn and stover; both nitrogen and *potash* seem to be needed to produce a fair crop.

Exp. by Mr. C. E. May, Woodstock.

Soil, light loam, with a medium amount of vegetable matter, well adapted to the growth of corn; subsoil, fine yellow loam.

Potash used alone had a more marked effect than phosphoric acid. About equally good results were obtained when each of these ingredients was combined with nitrogen. In this experiment nitrogen was clearly the regulating ingredient.

Exp. by Mr. H. P. Loomis, South Manchester.

Soil, medium compact loam, with a reddish clay subsoil.

The best results on this soil appeared to come from the use of large quantities of the soluble phosphates together with 100 or 150 lbs. of *muriate of potash*, and about 25 lbs. of nitrogen from some readily available source.

Exp. by Mr. J. H. Tucker, Lebanon.

Soil, clay loam, having quite a large amount of organic matter; subsoil, tenacious clay, apt to be moist in wet seasons.

Large quantities of phosphoric acid and small quantities of *potash* appeared to have given the best financial results on this soil.

Exp. by Mr. L. H. Healey, North Woodstock.

Soil, clay loam, with a compact clay subsoil.

The largest yield came from the use of 500 lbs. of slag with 150 lbs. of *potash*.

Georgia. State Station, Bulletin No. 8. July, 1890.

Soil, chocolate loam, underlayed by red clay.

Nitrogen increased the yield materially, especially in form of nitrate of soda. The best results were obtained from mixed minerals, combined with a moderate dose of nitrate of soda.

Kentucky. State Station, Bulletin No. 33.

Soil, blue grass soil, limestone. The increased yield through the use of 160 lbs. of *muriate of potash* and 320 lbs. of nitrate of soda amounts to 39 bushels of corn per acre and 980 lbs. of fodder. The clear profit was $8.40 per acre. The results obtained this year are almost identical with those of the last two years, that is:

(1) That in those plots where *potash* was one of the ingredients of the fertilizers used there was a marked increased yield, both in corn and fodder.

(2) That in plot 15, where a fertilizer was used without *potash*, there was scarcely any increase in yield over those plots containing no fertilizer.

(3) That the greatest increased yield was made by using a combination of *potash* and nitrogen.

(4) That the use of muriate of *potash* alone resulted in a marked increased yield over the plots containing no fertilizer.

(5) That there was a profit in the use of fertilizers in every instance where *potash* was one of the ingredients, the largest net profit arising from the use of a mixture of nitrate of sodium and *muriate of potash*.

(6) That there was a loss by the use of fertilizers where *potash* was not one of the ingredients.

(7) That so far, *potash* has shown its effect the third season after application.

Massachusetts. Exp. by Mr. W. S. Phillips, Marble Head.

Soil, fine gravelly loam.

The results of the use of nitrogen and *potash* are quite similar in kind, though *potash* causes the larger and the most profitable increase. For this I should advise for corn a fertilizer rich in potash, containing materials to furnish about: *Potash* 80 lbs., nitrogen 25 lbs., and phosphoric acid 25 lbs.

Exp. by Mr. Frank Wheeler, Concord.

Soil, a good sandy loam, with almost sandy loam subsoil.

Notwithstanding the high condition of the soil, the *potash*, wherever used, produced a very perceptible improvement from the first. These comparisons make it evident, that on this soil *potash* was the ingredient most needed, but it produces its most marked increase when used with nitrogen and phosphoric acid, and more when used with either of these than when simply used alone.

Exp. by Mr. A. D. Copeland, Bridgewater.

Soil, very poor gravelly loam.

The soil needed nitrogen, phosphoric acid and *potash;* but the latter to a far greater extent than either of the others. They, if *potash* was also present, produced a considerable increase, but if it was absent only a very small one. The two together are almost powerless to increase the crop. *Potash*, on the other hand, even alone causes considerable increase; with either nitrogen or phosphoric acid, the increase due to *potash* is doubled; with both of them and *potash* the increase due to the latter is doubled yet again, amounting to no less than about seventeen bushels of corn per acre.

Exp. by Mr. I. Brydon, Yarmouth.

Soil, a fine sandy loam.

Nitrogen, *potash* and phosphoric acid were all needed. Each when used with the two others gives a larger increase than when used alone or with either one of the others. All are not equally deficient, however, but in order of necessity rank: *Potash*, nitrogen and phosphoric acid. Potash effects the growth of stem and leaf to a remarkable degree. For this soil I should advise a fertilizer strong in *potash* and nitrogen.

Exp. by Mr. Pling Moore, Worcester.

Soil, good medium loam.

The striking benefit of *potash* as compared with nitrogen and phosphoric acid is clearly brought out by these comparisons. For corn on this soil I should recommend the use of fertilizers rich in *potash* and phosphoric acid and with a small percentage of nitrogen.

Exp. by Mr. L. W. West, Hadley.

Soil, a heavy loam, with clayey subsoil.

A gain of $40.46 per acre has been produced by fertilizers rich in *potash*. All through the season it was evident that the growth was far more benefited by *potash* than by any other element. These figures make evident in a striking manner the beneficial effects of *potash*. Alone, and in every combination, *potash* produces a remarkable increase; but nitrate of soda, too, seems to have been required, for the combination of this with *potash* produces a much larger crop than potash alone. For this soil I am confident that the most profitable results would be attained by using light dressings of manure

with a little quick-acting nitrogenous fertilizer and a considerable amount of *potash*

Exp. by Mr. D. B. Dewey, New Lenox.

Soil, a fine compact loam, inclined clayey and cold.

In July the plots which had received *potash* appeared to be doing distinctly better than the others. These comparisons make it quite evident, that this soil most needed *potash*, which alone, and in nearly every combination, seems to have produced a profitable increase. Phosphoric acid does little or no good, while nitrate of soda, especially when used where there is *potash*, does produce a small increase. For this soil it is evident, that for corn a fertilizer should be rich in *potash*.

Exp. at Station Grounds, South Acre, Amherst.

Soil, a fine yellow loam, with gravel or sand at the depth of two or three feet.

These comparisons make it evident that this soil still needs *potash* in greater amount than either of the other elements of plant food. The gain from its use alone on plot 4 amounts to no less than $14.66. Other plots gave larger crops, but no other equalled this one in point of profit on the fertilizer used. The result last year was similar; and it is true for both years that even if labor be taken into account, the plot where *potash* alone was used gave the largest net profit. In view of the results of two years' work upon this soil, I cannot doubt that with barn yard or stable manure it would pay to use *muriate of potash* for corn upon this land. If fertilizer only is to be used, I would recommend materials which would supply per acre about 80 lbs. of *actual potash*, 30 lbs. of phosphoric acid and 20 lbs. of nitrogen in available form.

Exp. on Station Grounds, North Acre, Amherst.

Soil, similar to the South Acre.

The teaching of the results brought out by these comparisons is plain. This soil most needs *potash* for the profitable production of corn, and this should be supplied to the full extent used in our experiments.

For corn on this soil the profit may doubtless be enhanced by using manure in small account, in connection with *potash*, rather than by large applications of manure alone. This plan is to be followed this year upon the general crop of the college farm.

Exp. by Mr. G. L. Cooley, North Half-Acre, Sunderland.

Soil, alluvial formation.

The indication is strong that the fertilizer for corn must be rich in *potash* to give profitable returns on this land.

Conclusions.

1. Our results show that soils differ widely in their requirements.

2. *Potash*, however, proves much more beneficial or proves much more largely beneficial than either nitrogen or phosphoric acid.

3. *Potash* as a rule most largely increases the yield of both grain and stover, but its effect upon stover production is greater than upon grain production.

4. Barn yard manures are, as a rule, relatively deficient in *potash*, probably because of the loss of a large proportion of the urine, which contains about four-fifths of the total *potash* of the excretions.

5. The relative deficiency of many of our soils may, I think be largely accounted for from the following facts:

(a) Manure as a rule lacks this ingredient, as just pointed out.

(b) Farmers, who have used commercial fertilizers have, as a rule, bought phosphates or fertilizers rich in phosphoric acid, and containing little or no potash.

6. The relative deficiency of *potash* in so many soils, shown now by the results of the work of two seasons, I believe justifies the following general advice.

(a) In breaking up sod land for corn, particularly that which is in fair condition, but which has been under ordinary farm management, if fertilizers only are to be used, apply those which are rich in *potash*. Use materials which will supply 80 to 100 lbs. of *actual potash*, from 25 to 30 lbs. of phosphoric acid and 15 to 20 lbs. of nitrogen per acre.

(b) If a special corn fertilizer is to be used, apply only a moderate quantity, say 400 to 500 lbs. per acre, and use with it about 125 lbs. of *muriate of potash*. It is believed this combination will produce as good a crop as 800 to 1,000 lbs. of corn fertilizers, and it will cost considerably less.

(c) With ordinary barn yard or stable manure for corn, use *potash*. I would recommend using about four cords manure and 100 lbs. of *muriate of potash* per acre.

(d) For fodder or ensilage corn, use either in fertilizers or with manure one-fourth more *potash* than above recommended.

Missouri. State Station, Bulletin No. 14, 1891.

So far it appears from the trials that *potash* is the element most desired by the corn in our land.

New Hampshire. State Station, Bulletin No. 12, 1891.

The average chemical composition of fertilizers for New Hampshire should be phosphoric acid 9-11%, *potash* 9-15%, nitrogen 2-4%; whereas fertilizers offered us in the market average, phosphoric acid 11%, potash 2.5%, nitrogen 2.5%.

Formula recommended for corn:

Dissolved bone black.....	325 lbs.
Muriate of potash	100 "
Sulphate of ammonia.....	75 "
	500 lbs. per acre.

Rhode Island. Station Experiment, Kingston.

Soil, sandy loam.

Mixed minerals as well as *muriate of potash* alone produced a large profit. The soil appears to be deficient in *potash*, phosphoric acid and nitrogen; *potash* appeared to be especially lacking.

Exp. by Mr. Courtland P. Chapman, Westerly.

Soil, rich loam and slightly sandy.

Potash produced the best results, and nitrogen the poorest; it appears that the soil lacks available *potash* more than phosphoric acid, though both are somewhat deficient, and that in general the application of any considerable quantity of nitrogen was not profitable.

Exp. by Mr. J. B. Vaughan, Nooseneck.

Soil, poor sandy loam.

Complete fertilizer produced the best results, nitrogen was the predominating element needed. Nitrogen, phosphoric acid, and *potash* were all lacking. *Potash* and phosphoric acid applied alone proved unprofitable, which was not the case when combined with nitrogen in the most available form.

Exp. by Mr. H. Hartwell Jencks, Lime Rock.

Soil, dark loam.

Potash was most needed (*muriate of potash* gave the largest profit), but also phosphoric acid and nitrogen. *Potash* appears to have been more deficient than phosphoric acid.

Exp. by Mr. A. H. Tefft, Jamestown.

Soil, black loam.

In general the application of chemicals in this experiment increased both the total crop and net profits.

Exp. by Messrs. Capwell and Tillinghast, Summit.

Soil, light loam.

The soil was most deficient in phosphoric acid. *Potash* and nitrogen seemed to be about equally deficient, and a combination of the two produced large additional yields only when combined with phosphoric acid.

Exp. by Mr. A. A. Sherman, Davisville.

Soil, medium loam.

There was a deficiency of all three of the essential elements, *potash* being apparently most deficient. The profits from the use of mixed minerals were good in every case.

Exp. by Mr. Elmer K. Watson, Nayatt Point.

Soil, black loam.

Potash, more especially, and also phosphoric acid were chiefly lacking.

General results of the experiments:

The Experiments

show that there existed a wide variation in the fertility of the soils, and that cases of one-sided exhaustion were not of uncommon occurrence. In four cases, at least, *potash* appeared most deficient, and it is interesting to observe that the two most marked cases of a deficiency in phosphoric acid were upon old pastures.

COTTON.

Alabama. Station at Auburn.

The best results were obtained with a combination of *kainit* and phosphate; 195 lbs. of dissolved bone black and 150 lbs. of *kainit*, per acre, yielded, at a cost of $3.90, a clear

profit of $13.95, which is equal to 135%, and is the highest yield obtained from the use of artificial fertilizers. It is noted that *kainit* prevented or retarded the appearance of blight. . . *Kainit* causes the cotton plant to retain the leaves after they had blighted where none is used.

Exp. by Mr. E. J. Beasley, Covington Co., Red Level P. O.

Red sandy soil ; subsoil, clay.

The best effects were obtained from a combination of phosphoric acid, *potash* and nitrogen. *Potash* and nitrogen materially increased the productive power of the phosphoric acid. The three elements combined upon plot 9 produced 330 lbs. of seed cotton per acre more than phosphoric acid and nitrogen without *potash*. The three combined produced 770 lbs. more than the production of the unaided soil, as indicated by the average yield of the unfertilized plots.

Exp. by Mr. M. A. Bishop, Madison, Madison Co.

Deep red soil, with stiff, red subsoil.

Phosphoric acid produced best effect if used in combination with *potash* and nitrogen.

Exp. by Mr. R. H. Cross, Letohatchie, Lowndes Co.

Sandy loam, with yellow clay subsoil.

This soil plainly needed all three of the elements, but the effect of phosphoric acid is less marked than usual, upon sandy soil, while that of *potash* is more conspicuous than usual.

Exp. by Mr. J. A. Davison, Yantley Creek, Choctaw Co.

Sandy soil with some lime, clay subsoil.

The results of this experiment point to the need of phosphoric acid, the effect of which is, however, improved by the addition of nitrogen and *potash*.

Arkansas. Exp. at Pine Bluff.

In comparing two fertilizer mixtures (one of them containing *potash* (*kainit*), that which contained *potash* produced the better results.

General fertilizers upon cotton : *Kainit*, 300 lbs. to the acre, produced the highest yield of any single or combined fertilizer.

Georgia. Exp. Station, Bulletin No. 10.

Clay soil, shading into sandy land.

The results indicate that the soil is deficient in both phosphoric acid and *potash*, especially in the former on sandy portion, and in the latter on the clayey portion. Neither phosphoric acid alone nor *potash* alone gave as good results as when combined with each other. Nitrogen produced little or no effect, but very decided effects when mixed with phosphoric acid and *potash*.

Louisiana. Station at Calhoun.

The effects of *potash* is undecided for the reason that the plots not treated with *potash* were badly attacked by blight. Might not the presence of *potash* have acted as germicide to prevent this disease?

Mississippi. Exp. Station, Annual Report, 1890.

Furman's formula, and a mixture of 250 lbs. of cotton seed meal, 50 lbs. of *kainit* and 200 lbs. of acid phosphate produced the highest yield, and a profit of about $11 per acre. In 1889 the greatest increase came from the plots which received 200 lbs. of *kainit* per acre, and this increase was secured at the smallest expense per hundred pounds, 53 cents.

Exp. at the Holly Springs Station.

Upland clay soil.

Kainit alone produced a profit of $10.50. 100 lbs. of cotton seed meal and 100 lbs. of *kainit* produced a net profit of $21.60. The yields from these plots indicate very clearly the necessity for the use of *potash* fertilizers. Plot 4, which received 200 lbs. of *kainit*, gave much the largest as well as most profitable yield of any plot fertilized with a single ingredient, and a larger yield than did plot 6, where acid phosphate was substituted for one half the amount of *kainit* applied to plot 4.

Thin clay, upland soil (field No. 2):

160 lbs. of cotton seed meal and 40 lbs. of *kainit* gave the highest profit amounting to $15.28 per acre.

Low land, quite sandy soil (field No. 3):

Experiment was not reliable, but *kainit* gave the best results of the single elements.

It has been the uniform experience during three seasons that the purchase of concentrated nitrogenous fertilizers is not profitable; that acid phosphate alone is only occasionally

profitable; that *potash* fertilizers, either in form of *kainit* or *sulphate of potash*, have always given a fair profit. We have also found, that a fertilizer containing a large percentage of *potash* with a smaller amount of phosphoric acid has invariably given a greater net profit than has any single commercial salt. While good results have always been obtained by the use of a mixture of *potash* and phosphoric acid salts, results have been still better when the soil has received a fair supply of vegetable matter in addition.

Prof. Connell's Exp. at the Station.

Sandy clay soil; 400 lbs. of *kainit*, used alone, produced the highest profit of $17.66 per acre.

Holly Springs Branch Station.

Light sandy soil. The indications of the entire soil are that such soil needs both potash and phosphoric acid as well as a liberal supply of vegetable matter.

OATS.

Connecticut. Exp. by G. A. Ross, Jewett City.

A light sandy loam, with a sandy subsoil. There was quite an increase from the use of mixed minerals, and a still greater increase wherever nitrogen was applied.

Indiana. Exp. Station, Bulletin No. 33, Oct., 1890.

Fertilizers were applied 17 days after sowing; the largest yield was from complete fertilizers, and produced an increase of 11.50 bushels per acre; a total yield of 44 bushels. Fertilization generally increases the proportion of grain of the oat crop. The grain lodged more on those lots which received commercial fertilizers.

Massachusetts. State Station, Annual Report for 1890.

The results obtained left no doubt about the fact that our farmland had been in an exceptional degree impoverished in potash in consequence of a too close rotation of grass and corn. In the majority of cases where muriate of potash has furnished the *potash*, the manuring of the crop was somewhat later than when *sulphate of potash* was used. The plots containing *potash magnesia sulphate*, as the *potash* source, yielded the largest amount of grain.

Rhode Island. State Station, Annual Report, 1890.

Mixed chemicals were compared with commercial fertilizers (Horsefoot's Guano), the fertilizer as well as the guano produced a large increase of grain and straw, but mixed chemcals were superior to the commercial brand.

PEAS.

Maine. Exp. Station, Annual Report, 1890.

Soil, clay loam.

The highest yield was obtained from bone black and muriate of potash, and at the least expense.

POTATOES.

Connecticut. Exp. by Mr. M. H. Dean, in the Housatonic Valley.

Soil, light loam, somewhat sandy, with a light loam subsoil. Nitrogen produced very little effect, which is attributed to an insufficient supply of potash in the fertilizer. More potash may have been needed to meet the deficiencies of the soil. The mixed minerals gave a large increase, raising the amount from 137 bushels per acre on the unmanured land to 218 bushels per acre upon that fertilized with minerals.

Georgia State Station, Bulletin No. 8, July, 1890.

The results seem to warrant the conclusion that a fertilizer containing all the food elements in the same proportion and in available form, as a good stable manure, gives the largest increase, and that incomplete fertilizers, while they show a gain over the unfertilized plots, are not remunerative. A quick growing crop like the potato, which has only a short time in which to mature, cannot be grown successfully unless a bountiful supply of all the elements of plant food is provided; that is, the greatest yield is obtained where the soil contains an excess of all the elements of plant food in available form over and above the requirement of the plant.

Maine. Exp. by Mr. O. B. Keene, of Easton.

Potash and ammonia produced a large increase of potatoes in this experiment, which is interesting in showing the remarkable effect of commercial fertilizers on some soils. The average of the plots receiving no fertilizers was 132 bushels

per acre. The average of the plots receiving nitrate of soda and *muriate of potash* was 262 bushels per acre. Here the crop was doubled by adding 150 lbs. of nitrate of soda and 100 lbs. of *muriate of potash.* The cost of the chemicals in this case was $5.50. The extra cost of 130 bushels of potatoes was about 4.2 cents per bushel. The use of acid South Carolina rock costing $5.50 caused an additional gain to that made by the nitrate of soda and *muriate of potash*, of 65 bushels, at a cost of 8 cents per bushel.

Massachusetts. State Station, Annual Report, 1890.

The records were destroyed by fire ; following statement was made from memory : It appears that the special potato fertilizer in the market furnish too small a portion of *potash.* It will pay to use them in moderate quantities, if at all, in connection with *sulphate of potash* for the heavier, and *muriate of potash* for the lighter soils.

New Hampshire. State Station, Bulletin No. 12. March, 1891.

The records are those of previous experiments and indicate that *potash* is the most needed in the soils, that were tested, and that commercial mixtures of fertilizers contain a too small percentage of *potash.* In this experiment one dollar invested in the best combination of fertilizer gave an increase worth seven dollars ; one dollar invested in manure gave only $3.60 increase, and $1.00 invested in commercial brands of fertilizers an increase of $4.20. Every new test adds to the probability of the correctness of my position, relative to the need of vastly more *potash* than our fertilizer manufacturers give us. Formula recommended for potatoes : Dissolved bone black 340 lbs. and *muriate of potash* 160 lbs. per acre.

New Jersey. State Station, Bulletin No. 80. March, 1891.

Experiments were made in three locations, all in Middle Essex County. Good results were obtained with mineral manures alone, while the best profits resulted from a mixture of chemical manure with barnyard manure, yielding a profit of $68.91 in one case ; *kainit* was less effective than *muriate* or *sulphate*, and *sulphate* did not produce a larger yield than *muriate of potash.* Nitrate of soda did not prove a valuable fertilizer for potatoes. *Sulphate of potash* produced the best results as to quality.

New York. Geneva Station, Annual Report, 1890.

Special experiments with *potash* and nitrogen.

These results indicate: 1. That for potatoes *muriate of potash* is a good safe fertilizer, even on some clay soils, where potash may be said to be present in considerable quantity. 2. That while *potassium sulphate* helps the crop, it is far less effective than the *chloride*, and not desirable when *chloride* can be obtained. 3. That the application of nitrogen in sodium nitrate and ammonium sulphate has been beneficial on some plots, but always at too great cost for profit.

Rhode Island. State Station, Annual Report, 1890.

Phosphoric acid was most needed; *muriate of potash* in combination produced nearly twice as much as *sulphate of potash* in combination. The great difference in yield in favor of the *muriate* is worthy of note, but additional work is necessary to substantiate results.

RYE.

Rhode Island. Third Annual Report, 1890.

Potash did not increase the amount of straw, but produced a heavier yield in grain. *Potash* increased the gain of grain two or three fold.

SORGHUM.

Arkansas. Third Annual Report, 1890.

Effect upon contents of sugar. *Kainit* alone and in combination produced an increase of sugar from ⅓ to ¾ %.

The indications are strongly in favor of the conclusions: That application of *kainit* had a beneficial influence upon the amount of sugar in the canes and juice.

Without exception *muriate of potash* has noticeably increased the total yield per acre . . . The results secured from similar experiments on sorghum at Rio Grande, Cape May Co., during 1885, 1886 and 1887, corroborate the above statements in nearly every particular, and admit of the conclusion that *potash* is the element which exerts the most marked effect upon the yield of sorghum and upon the production of sugar.

SWEET POTATOES.

Arkansas. Exp. at the Newport Branch Station.

Kainit used alone produced the highest profit, amounting to $25.50 per acre.

Delaware. Exp. by Mr. Manlove Hayer at Dover.

Potash used alone yielded an increase of 79 bushels per acre. The adjoining plot shows that nearly $40 per acre was gained by the use of $4 worth of *potash.*

Exp. by Mr. John Dager at Camden.

Taking all things into consideration, the *muriate of potash* gave potatoes most uniform in size and best all around for the market, and the probabilities are that Mr. Dager would succeed best by selecting the *muriate;* financially $4 worth of this salt yielded $24 worth of product.

Test with Scarlet Clover as Green Manure and Fertilizer

Of any single element *potash* yielded the largest returns. Of the combinations, scarlet clover, *potash* and phosphoric acid, costing $8 per acre, returned $52 worth of potatoes.

Exp. by Mr. Chas. Wright near Seaford, Sussex Co.

That story is that unfertilized ground can produce 41 bushels of sweet potatoes per acre, but that, with an excess of *potash*, the same ground could produce 105 bushels, a gain of 64 bushels, worth $32, for an expenditure of $4. Both phosphoric acid and nitrogen increased yields, but relatively to a very trifling extent; the presence or absence of *potash* determined the crop.

Conclusion.

On the practical outcome of the series, the results are positive enough. Dropping all theories they stand as follows: *Muriate of potash* when used alone at Dover returned $10, at Camden it returned $6, and at Seaford it returned $8 for every dollar invested in its purchase.

Georgia. Bulletin No. 10, December, 1890.

Red clay soil, with clay subsoil.

The best results were obtained with a mixture of 320 lbs. of superphosphate, 360 lbs. cotton seed meal and 640 lbs. of *kainit*, or in place of *kainit*, 160 lbs. of *muriate of potash.* The

value of increase above the cost of the fertilizer varied according to the variety of potato from $37.43 to $102.83 per acre. The cost of fertilizer was $10.27 or $9.40 respectively.

Conclusion.

The yield of sweet potatoes is governed by the amount of *potash* in the fertilizer. A fertilizer, as in the experiment, analyzing 8% phosphoric acid, 3% ammonia and 10% of *potash*, is the most effective for sweet potatoes.

New Jersey. Exp. by Mr. G. E. Farry, Farmingdale, Monmouth County.

Very light, sandy soil.

Complete fertilizer produced a profit of $30.05 per acre; nitrate of soda was not beneficial if used alone.

TOMATOES.

Arkansas. State Station, Third Annual Report, 1890.

Nitrate of soda produced the best effect, while *kainit*, used alone, yielded a profit of $20.50 per acre; after nitrogen, in sodium nitrate, *potash* seems to be the most efficient in increasing the yield.

Delaware. Exp. by Mr. John Heyd, Near Felton, Kent County.

Neither alone nor in combination with phosphoric acid and *potash* did the nitrate of soda prove that it caused an increase sufficient to pay for its purchase and use. If a profit results from any application, it must be credited to the mixture of phosphoric acid and *potash*. At $6 per ton of tomatoes, the amount of said increase would be $15; the cost of the application would approximate one-half of said sum.

Georgia. State Station, Bulletin No. 10, 1890.

The results indicate that mixed minerals with larger rations of nitrogen are productive of the largest yield and greatest earliness. The effect of nitrogen depends upon the presence of the mineral elements, phosphate and *potash*.

Maryland. State Station, Bulletin No. 10, 1890.

Potash appeared to increase the crop more than either of the other elements of plant food, and nitrogen stood next in

this respect. Nitrate of soda and *muriate of potash* can be recommended as special fertilizer for the tomato.

Summary by the Director.

Potash alone, as *muriate*, gave good results, better than some mixtures. Phosphoric acid had little effect on the quantity of the crop. Nitrate and *muriate of potash* can be recommended as special fertilizers for the tomato. *Potash* fertilizers seemed to decrease sugar and increase acid in the tomatoes. All three fertilizing elements increased these same elements in the fruit. The vines and roots of the tomatoes are very rich in *potash*.

WHEAT.

Kentucky. Exp. by Mr. Anderson, Jeffries, Glendale, Hardin Co.

This indicates that fertilizer rich in *potash* would be best on this land.

Exp. by Mr. J. W. Stringer, Franklin, Simpson Co.

The addition of *potash* to bone meal produced an increase of 4 bushels per acre.

Exp. by Mr. J. W. Netherton, Prospect, Jefferson Co.

It seems that acid phosphate, cotton seed meal and *muriate of potash* protect the plant to some extent from winter freezes.

POTASH AS INSECTICIDE.

New Jersey. Bulletin No. 66, March, 1890.

According to the experience of many farmers, *potash salts* are very effective as insecticides, destroying grub and cut worms, scales on peach trees, cabbage maggots, plant lice and corn-root louse. By experiment it was shown that *potash salts*, preferably *kainit*, was very effective in killing insects, while not injurious to the plants.

Kainit Against the Rose Chafer in Vineyards. Bulletin No. 82, July, 1891.

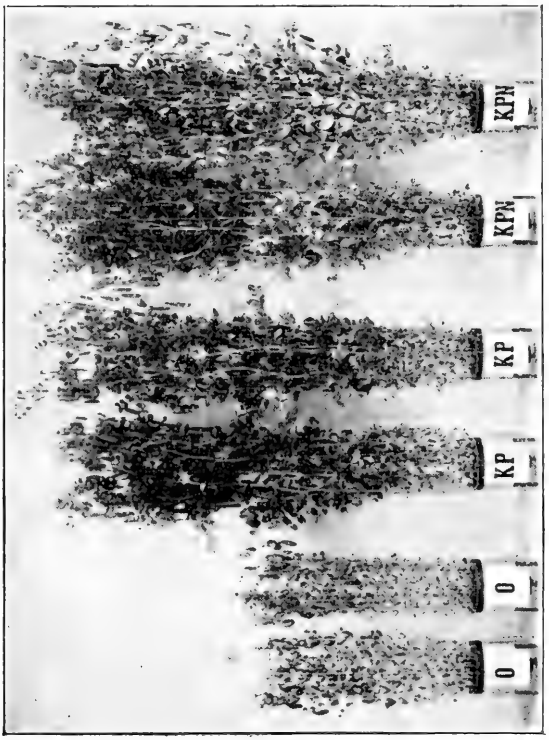
Either late in the fall or early in spring land should be plowed and top-dressed with *kainit*.

Potash has been heretofore known only as a fertilizer of very high grade. Experiments made by me during the past

year prove that it has a high value as an insecticide as well. It is effective against plant lice of all kinds, against many naked larvæ and against the wire worms on potatoes. It also kills cabbage maggots.

Though I have tested it principally on overground insects, yet its greatest field of usefulness is against those pests that live in the ground or about the roots of plants. In localities in which corn is infected by cut worms, etc., a heavy dressing of *potash* before planting will destroy almost all insects in the ground at that time. For the corn-root louse I have no doubt this will prove a perfect remedy. Where potato ground is infested with the wire worm, a heavy dressing with *kainit* will bring relief. Peach orchards that are infested with the black peach aphis on the roots, can be renovated by the use of this same substance. On bringing the matter to the attention of farmers, many have been able to recollect that with the use of *potash* certain insect troubles ceased; but they had not heretofore credited the *potash* with this result. This item is especially recommended to peach growers in South Jersey. The *kainit* is preferable to the *muriate* as an insecticide.

Professor Wagner's experiments, showing that leguminous plants draw their supply of nitrogen from the air.



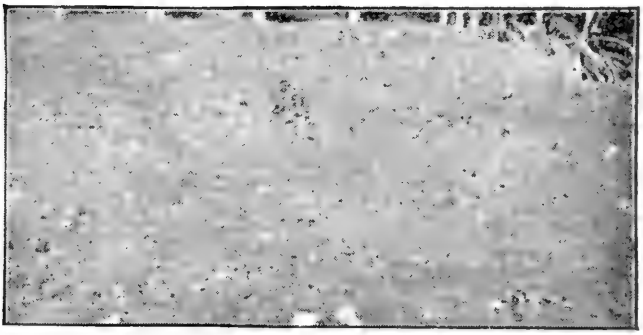
Potash and phosphoric acid without any nitrogen produced a large crop of peas, while the addition of nitrogen to the mineral fertilizers showed very little effect.

Professor Wagner's experiments, showing that "green manuring" with leguminous plants can supply all the nitrogen needed by a succeeding crop.

In the last two experiment vessels a crop of vetches was raised and worked into the soil the autumn preceding the planting of oats. No further application of nitrogen was made, and yet the crop was as good, or even better than where nitrate of soda was used.

Experiments made at the Rhode Island Experiment Station on beets, showing the effects of lime on sour soils.

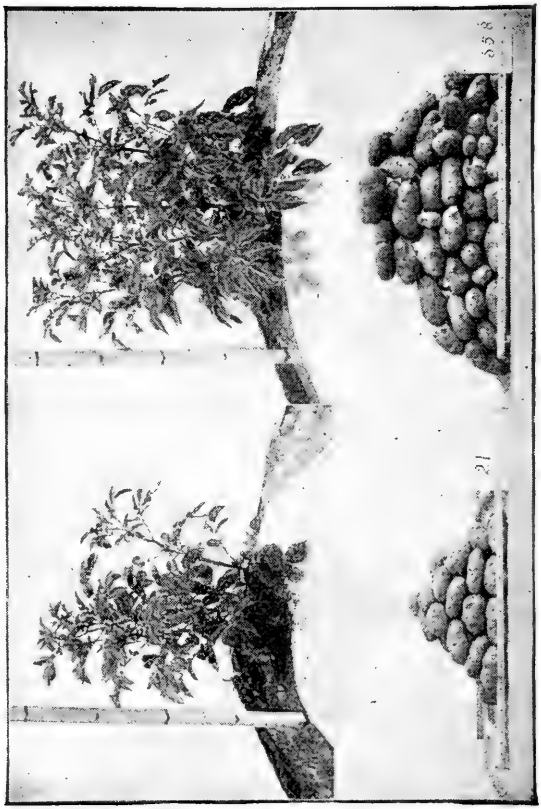
SULPHATE OF AMMONIA,
WITH LIME.



SULPHATE OF AMMONIA,
WITHOUT LIME.

With lime, a luxuriant crop was produced; without lime, it was a total failure.

Experiments made at the West Virginia Experiment Station, showing the effect of potash upon potatoes.



The unfertilized land produced at the rate of 86 bushels per acre. Where kainit and acid phosphate were applied, the yield was 248 bushels of potatoes per acre.

Experiments made at the Alabama Experiment Station, showing that potash will cure red rust in cotton and largely increase the yield.

NO FERTILIZER.

POTASH AND NITROGEN.

The use of potash and nitrogen upon cotton produced an increase of 225 per cent. (429 lbs. of cotton per acre, against 132 lbs. where no potash was used.)

NO FERTILIZER.
The two vines yielded little more than one-half pound of grapes.

POTASH (KAINIT) AND NITROGEN.
The two vines yielded three and one-half pounds of grapes.

POTASH (KAINIT), NITROGEN AND PHOSPHORIC ACID.
The two vines yielded four and one-half pounds of grapes. The vines are not old enough to bear a full crop.

Experiments by Mr. E. Lierke, of Germany, upon grape vines on poor sandy soil.—The Experiments illustrate the predominant effect of potash and nitrogen upon grapes; they also show that phosphoric acid must be used in addition, in order to obtain the best yields and quality.

Experiments made on Corn at the Massachusetts Experiment Station.

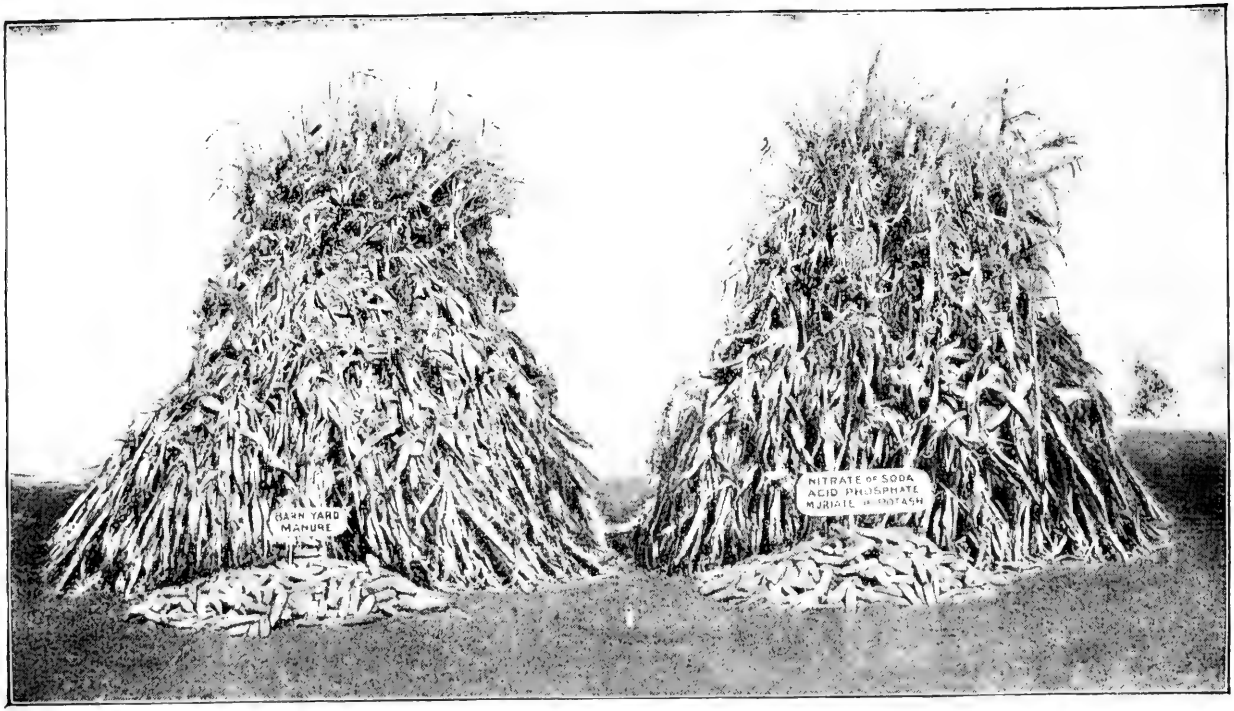
NO FERTILIZER.

ACID PHOSPHATE AND MURIATE OF POTASH.

Each stack, the entire yield from one-twentieth of an acre.

Acid phosphate and muriate of potash (without nitrogen) produced a large increase in yield.

Experiments made on Corn at the Massachusetts Experiment Station.



BARN YARD MANURE. NITRATE OF SODA, ACID PHOSPHATE, MURIATE OF POTASH.

Each stack, the entire yield from one-twentieth of an acre.

Chemical Fertilizer produced as large if not a larger yield than Stable Manure.