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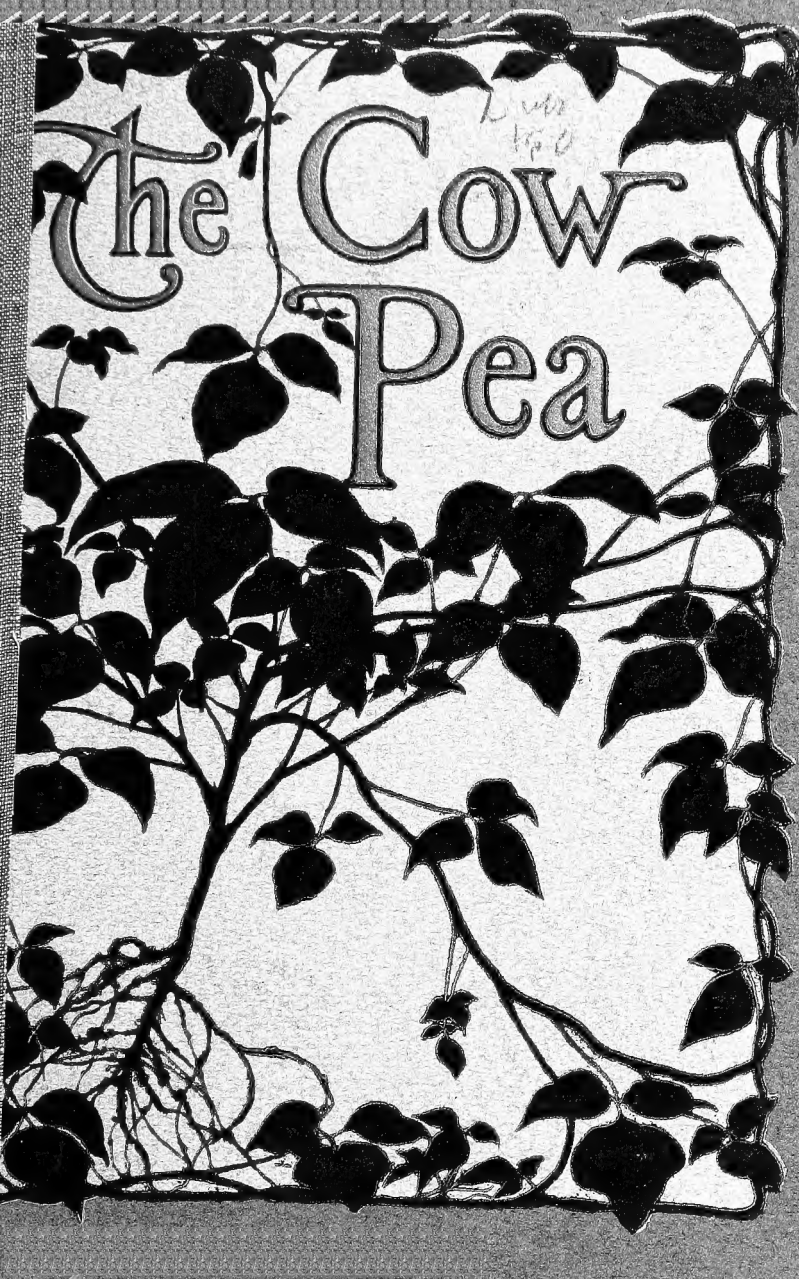
The Cow Pea

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THE COW PEA

PUBLISHED BY THE

Supervising Committee of the Experiment Farm

OF THE

NORTH CAROLINA STATE HORTICULTURAL SOCIETY

SOUTHERN PINES, N. C.

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NOTICE.

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PREFACE.

THE aim in all plant growing is, as in all other business, to secure the largest possible money return, without diminishing the original capital. Everywhere the inquiry is, "How can the productiveness of land be increased?" This pamphlet, in part, answers that query by calling attention to the cow pea: a plant which, by its many valuable qualities, ease of cultivation over a wide territory and cheapness of production, makes it a never failing friend of the tiller of the soil.

As a clear, condensed synopsis of the history, habits, merits and best manner of using the cow pea to the greatest advantage, the following pages will abundantly repay study and practical, every-day application.

THE COW PEA.---ORIGIN AND HISTORY.

THE assertion that "what red clover is to the north and alfalfa to the west, the cow pea is to the south," was, a dozen years ago, strictly true; but to-day it is not the whole truth, for the cow pea has now proved its worth and great value far beyond its former home and even in those sections of the country where red clover and alfalfa are grown as the principal forage or manurial crops.

In by-gone years its worth and cultivation were hardly known north of the Ohio River, but during the last ten years, it has been grown and made profitable crops as far north as Connecticut, Ohio and Iowa, that is to say, about the northern limit of the successful cultivation of dent corn.

The cow pea's botanical name is *vigna sinensis*, and although commonly called a "pea," it is correctly speaking, neither a pea nor a bean and differs widely from both. To be sure, they all belong to the same family (leguminosae), but so do clovers, alfalfa and vetches. According to De Candolle and other authorities, it is a native of India, and was cultivated there at least three thousand years ago. There is no definite record of its introduction into this country, but it is believed to have been sent from England to the Oglethorp Colonies in Georgia about 1734. Its value, even in those days of slow travel, must have been speedily recognized, for by the beginning of the last century the plant was common in all settled parts of the south. It, a native of the tropics, is most at home in the southern

states, but, by its readiness to suit itself to circumstances, it has developed a large number of varieties, some of which fully mature in the short northern summer. Its cultivation is possible and profitable in many of the northern and western states, and in the south has proved itself one of the best annuals for forage as well as green manuring. In the variety of its size, habits, productiveness and uses, as well as to the soils and locations to which it will adapt itself, the cow pea rivals and even surpasses corn. Some sorts mature seed within sixty days from planting; others maintain a vigorous growth for six months or longer, even putting forth flowers till the vines are killed by frost. Some are short, stocky and erect in growth; others rapid climbers; while others trail along on the ground and send forth great masses of vines. The seeds vary in size, color and shape: flat, round, oblong, kidney; black, white, red, purple, yellow, striped, mottled; small, medium, large. The cow pea will grow on any soil not too wet, and in most climates free from frost during two summer months. The stalks and leaves make fine hay, the best of temporary pasture and most excellent green manure; its seeds, green or ripe, are as nutritious as beans and are much relished for use as human food, or, as ripe grain, afford the richest kind of forage for all farm animals.

VARIETIES.

The cow pea has a natural tendency towards variation which constantly results in the envolving of new varieties,

COW PEA VINE, ("WONDERFUL"), SHOWING DEVELOPMENT OF ROOT SYSTEM WITH NODULES.

which become distinctive through cultivation and selection. The number of actually and permanently distinct varieties are comparatively few although different names are given to various forms in different parts of the country. The character of the plant and its seed is modified by various conditions, such as, cultivation, nature of soil, length of growing season, time of planting and, perhaps also, by cross-fertilization. Local names are sometimes given a variety which has been grown for a length of time in a certain neighborhood, but the same sort may be known by an entirely different name in other places but a few miles distant. As examples of this, there is one variety which goes under the names "Unknown," "Wonderful," and "Quadroon;" again "Speckled," and "Whip-poor-Will" are actually the same variety; "Gourd" "Mathews" and "Polecat" are practically the same and the list may be extended almost without limit.

This confusion has been further increased by the practice of calling entirely distinct varieties by the same name, as is the case with the names "Everlasting," "Red Ripper" and others; "Crowder," is applied to any short variety in which the seeds are closely packed together or crowded. "Lady" is used to indicate any variety with slender pods filled with small, plump, oblong seeds.

On account of this confusion in names and the wide difference in appearances and habits of the different varieties, it is difficult to give absolute characteristics which can be uniformly recognized as marking distinct, permanent

varieties. As already stated, every extreme of form and habit may appear; the compact, upright bush, only a foot high without runners, thriving side by side with one of spreading habit, trailing its densely loaded branches 20 to 30 feet on the ground or climbing over trees, fences, corn or any other support within its reach. The pods range from 4 to 18 inches in length, of every color and variety and combination of color containing seeds of every possible shape and form. They are of every possible combination of color, into which white, yellow, green, gray, pink, brown, red, purple and black can enter or blend or mix, as in the "Speckled" and "Calico" varieties.

The season of ripening is as extended as its habits of growth; some kinds mature in two months; others require from six to eight months between planting and harvesting. In general, the habit of growth bears a definite relation to the period required for ripening. The smaller the plant and the more nearly it approaches the bush form, the shorter the time required for the production of its seed; while the more rank its habit and the larger its growth of vines and runners the longer the time required for its maturity. The fertility of the soil, the rain-fall and other climatic conditions, the length of the growing season in the locality, each has its influence and modifies the fidelity with which any given variety will reproduce itself. Bush varieties which mature in the comparatively short seasons of Virginia, planted a few successive years in the longer growing season of Florida or Texas, tend to become

climbers or trailers and to mature later; on the contrary, those which have a trailing habit in the long seasons of the Gulf states, in the cooler north gradually curtail their long southern vines and assume a more bush-like form, and otherwise adjust themselves to the shorter growing season.

The use for which it is wanted determines the character of the variety to be selected, and both character and use have a direct bearing on the practice to be followed in growing the crop. It is wise, therefore, to consider in detail, the chief characteristics of a few of the best known and most widely popular varieties.

Nearly every southern experiment station has made extensive tests of varieties, and been more or less successful in identifying and arranging the different sorts in groups, each of which has some prominent character in common; form, size, shape and color of the seed, habit of growth in the plant, and time of ripening have been used as basis for this grouping. One of the most simple and convenient forms of grouping is given in Bulletin 26 of the Georgia Station which will be found at the end of this pamphlet.

The selection of a variety will naturally depend upon what is wanted in the crop for the same reasons which lead many farmers to plant a dent variety of corn for grain and a flint for silage or fodder, that is to say, because the flint may give a larger and more appropriate stalk and a greater proportion of leaf. If hay is required, Clay, Unknown or Whip-poor-will are suitable, for they are vigorous late maturing, and by their erect habit, make harvesting and

curing easier. If pasture or green manure is wanted, Unknown, Black and Red Ripper are suggested, and they should be planted as early in the season as the weather will permit. If, as is frequently the case, a large yield of seed is wanted, Black, Clay, Whip-poor-will and Unknown are among the heaviest yielders. For table use Large or Small Lady, Sugar and Blackeye are tender and of good flavor.

It must be remembered that these remarks apply to the south where the crop has long been grown and where the habits of the plant are well understood.

The growing season at the north is much shorter and the seed cannot be planted so early. The question of varieties for the north has not yet been fully settled. Early Black has given good satisfaction for grain and pasture. It is an upright growing vine and usually matures its seed which it produces in great profusion. Whip-poor-will and Wonderful have been used successfully at the north for pasture and manurial purposes though they do not always mature seed. The cow pea readily adapts itself to local conditions and some selected strain of these varieties will doubtless prove most useful for northern growers. By picking the first ripening pods for several seasons in succession and saving the early seed for planting, a very valuable local strain or variety may easily be obtained. This method of selection may be followed to obtain a large or a long vine, or, in fact, any size or shape desired to suit it to north or south, upland or lowland

PREPARATION OF THE SOIL.

Although the cow pea will, as a rule, make better growth than any other plant under unfavorable soil conditions, and even where other crops have failed, nevertheless, no plant or crop thrives better on rich land or more amply repays liberal feeding and intelligent treatment than the cow pea. Under congenial circumstances, the growth of this family of plants is little short of wonderful. At the same time, it must be remembered that one of the chief gains for which cow peas are grown, namely, the absorption of nitrogen from the air, is proportionately diminished as the conditions become less favorable. The process of absorbing nitrogen from the atmosphere, a property peculiar to legumes, cannot fully take place under unfavorable soil conditions. In other words, the land should be mellow, well drained and deep. These points have been brought out so strongly and repeatedly by those who have given particular attention to the cultivation of cow peas, that every well informed planter gives his land as deep plowing, thorough tillage and regular and liberal applications of lime as his time and means permit.

The small bacteria, the nature of which is explained later (see page 35) and which live upon and with the cow pea roots and through whose action the nitrogen of the air is absorbed by the plant, play an important part in soil reviving; and for their growth and development the soil must have plenty of air. These bacteria require also a soil that

is not acid, and, therefore, land rich in decaying vegetable matter, and hence likely to be acid, should not be planted to cow peas, and could be but little improved thereby. The chief object in cultivating this plant is to add to the fertility of the land and leave it in better shape to produce crops like corn, which subtract from, rather than add to the supply of plant food in the soil. If the cow pea is to be sown on land with a hard-pan subsoil, the breaking up should be well done with a subsoil plough so as to give it necessary drainage. A water soaked soil is not well adapted to growing the pea because water cuts off the circulation of air, which is essential to the chemical changes by which nitrogen of the air is taken up by the plant. A poorly prepared soil is also unfavorable for plant development because it prevents the roots from reaching out and obtaining food, no matter how hungry the plant may be. Every means should be employed to improve the physical condition of the soil so as to enable the crop to absorb the largest possible amount of nitrogen from the air. In deep, mellow and well drained soils the roots act to the best advantage, and, practically free of cost, turn otherwise unavailable atmospheric nitrogen into rich and necessary plant food stored up for future use. On heavy soils, deep ploughing is indispensible, and the seed-bed must be made fine, firm, smooth and level to secure best results. Generally speaking the cow pea is not at its best on heavy soils, and deep ploughing is not so essential on light soils, still, no matter what the nature of the soil, the work of preparing it for this crop needs to

COW PEA VINE, 14 FEET LONG, ("WONDERFUL" VARIETY) GROWN AT EXPERIMENT FARM, SOUTHERN PINES, N. C

be intelligent and thorough. Ploughing must never be so deep that the undersoil in any quantity is turned up over the top soil, and, if the plough has been habitually worked shallow, this will be avoided by using the subsoil plough. On stubble ground or on old corn land, in light soils, a disc harrow is usually the only implement needed, and has the advantage of rapid working, but shallow ploughing or any other means by which the surface is thoroughly loosened and then worked down fine and smooth is sufficient.

The seed germinates quickly on land well prepared before planting; the young plants make a stronger start; the whole crop grows uniformly and matures at the same time; the work and waste of harvesting is less and the yield larger. It is on the principle that the plant under favorable soil conditions furnishes its own nitrogen as fast as needed, and practically on this fact depends the whole economy of the crop. Rarely indeed, would it pay to grow cow peas if the nitrogen needed for its growth had to be supplied by purchased fertilizer. In this connection and in a measure supplementing what has just been stated, it is noteworthy that while the cow pea responds readily to good culture, no other legume will do as well with a hurried or imperfect working of the soil. Frequently old pastures, "thin spots" and waste fields have gone out of cultivation because it costs too much to provide them with a supply of manure. The average farmer with a scant supply of team or labor and a short cropping season, cannot spare the time to plow, subsoil and fit these impoverished, waste places as he would

be obliged to do for clover or grass, but he can rough in the hardier cow peas.

A single plowing or working with disc, cutaway or springtooth harrow, anything that will tear up the land, will be sufficient to start the cow pea. It may be broadcasted on the rough furrows and covered with a harrow or roller or even "scratched in;" such a rough fitting will not give the best results, but even with this unfavorable start the plant will quickly cover the ground, smother weeds and subdue the soil, besides adding greatly to its fertility. This plan is of special value for northern farmers in New England and other sections where parts of farms have passed out of cultivation. There are many instances where such waste land has been changed in a single season into good corn ground. The plan followed was simply to make an application of the mineral elements of plant food, Potash and Phosphoric Acid, causing a heavy growth of peas, which absorbed much atmospheric nitrogen and by it and the vegetable matter improved both the chemical and physical condition of the soil. It is folly to expect poor culture and heavy rough ground to produce the best paying results with this or any other plant. The point is that no farmer should reject the plant because for any good reason he cannot give it the best of care. Its ability to thrive under hard conditions, its power to take nitrogen from the air, and its wonderful economy in the use of potash and phosphoric acid make it all in all, one of the most wonderful plants recently introduced to the northern farmer.

FERTILIZING FOR COW PEAS.

Cow peas are so commonly recommended for green manuring, that the impression prevails that the growing plant itself needs no fertilizer. This is a mistake and often a serious one; the more it is fed the more food will it store up for the crop which follows. It is true the cow pea has power to draw nitrogen from the air, and use it for its own growth, but for every pound of nitrogen thus absorbed, more than a pound of potash and considerable phosphoric acid must also be taken up; the latter two ingredients do not exist in the air, so they must be supplied artificially. The nitrogen absorbed by the cow pea plant enters into and forms a part of the entire living plant and dry stubble, but cannot be made from nitrogen alone; not one atom of nitrogen can be assimilated unless there are also present certain amounts of potash and phosphoric acid. The growing cow pea must get its potash and phosphoric acid, just as cotton, just as corn, just as every other growing plant gets them,—from the soil to which they must be applied in the shape of a fertilizer. No plant growth whatever are possible when potash, phosphoric acid and nitrogen are not present and available, and no over-supply of one plant food element can compensate for the absence or scarcity of another. Each must be present and in the proper proportion, otherwise there cannot be a full growth. While cow peas do have the property of drawing nitrogen from the air, nevertheless, a certain amount of this ingredient is required in the soil in which they grow and must be artificially supplied, if not

already present. The cow pea plant begins to take up atmospheric nitrogen when its leaves develop, and on poor soils, before this stage is reached, the young plants generally suffer from the lack of nitrogen. This poverty of nitrogen is indicated by a yellowish leaf, absence of vigor in the plant and a general sickly appearance; an application of about 75 pounds of nitrate of soda per acre quickly remedies the trouble.

While an artificial application of nitrogen is regulated by the circumstances described, there are no such conditions affecting potash and phosphoric acid. Experiments at the Louisiana Experiment Station show that one acre of average cow peas contains 65 pounds of nitrogen, 111 pounds of potash and 20 pounds of phosphoric acid; of this the roots and stubble alone contain 8 pounds of nitrogen, 18 pounds of potash and 5 pounds of phosphoric acid. These figures vary of course, with different yields, but the range of variation is not wide and only serves to bring out clearly and boldly the fact that with every pound of nitrogen, a certain amount of potash and phosphoric acid is also assimilated by cow peas. These weights do not fix absolutely the amount of plant food needed by cow peas, but they do suggest approximately and relatively what the crop draws from the soil and what even the least worn fields have returned to them in the shape of plant food to prevent the soil from gradually losing its fertility. Let it be carefully noted, however, that there is, of necessity, some waste in the application of fertilizers; that not all the

ONE WEEK. | TWO WEEKS. | FOUR WEEKS OLD.
UNFERTILIZED ON LEFT; FERTILIZED ON RIGHT.

UNFERTILIZED (SIX WEEKS OLD). FERTILIZED.

UNFERTILIZED (EIGHT WEEKS OLD.) FERTILIZED.

UNFERTILIZED (TWELVE WEEKS OLD.) FERTILIZED.

plant food given a soil can be gathered up and realized upon in crops. There is a loss in operation in the soil just as there is in a machine or in applying any other chemical or mechanical force, natural or otherwise. With ordinary fertilizers, this loss in potash has been roughly estimated at about one-third; in phosphoric acid, not less than one-half. Therefore, the actual amount of potash and phosphoric acid to be provided, to enable cow peas to take up and assimilate 65 pounds of nitrogen, is about 167 pounds of actual potash and 40 pounds of phosphoric acid, (equivalent to 334 pounds of muriate of potash and 300 pounds acid phosphate). This is not given here as a fertilizer formula for cow peas, but merely to show what an acre of the crop must actually have.

As already stated and now repeated and emphasized, plant growth can take place only when all three of the necessary constituents are present in sufficient quantities and in an available condition. The moment the supply of any one of these essential constituents is exhausted, normal growth stops and there cannot be a full crop. After the cow pea has developed a few leaves and so long as the plant can continue to take up all of the potash and phosphoric acid required, it will in turn get all the nitrogen it needs from the air. If, however, the supply of either potash or phosphoric acid in the soil is insufficient, then only a corresponding amount of nitrogen will be absorbed from the atmosphere.

The practical application of this is then, "the more

phosphoric acid and potash there is supplied to the growing crop, the larger will be the amount of nitrogen drawn from the air." This condition is well described as making the crop "nitrogen hungry," or, to state the proposition in other words, if liberal quantities of phosphoric acid and potash are supplied and nitrogen not given, the plant absorbs sufficient nitrogen from the air to balance the supply of phosphoric acid and potash already used, and not a particle more. Nitrogen is more expensive than any other element in a complete fertilizer, hence it is economy to assist the cow pea crop to secure, free of cost, the largest possible quantity of nitrogen from the air. The larger the amount of phosphoric acid and potash supplied to the crop, to the limit of its healthy feeding, the greater is the assimilation of the free nitrogen of the air; and so, financially, the larger the investment in phosphoric acid and potash, within the above limits, the greater the repayment or dividend in the form of the more expensive nitrogen. The limit of plant growth is determined largely by the mechanical conditions of the soil and a suitable supply of moisture to make the plant food available. Plants grown on soils in "good condition" can use a larger amount of fertilizer than those on soils too hard and dry for the full development of roots.

Phosphate and potash fertilizers should always be applied before the seed is planted, whether the planting is done broadcast or in drills. In the former case, the fertilizer should be sown broadcast and covered by the plowing or the same harrowing which covers the peas. In the latter,

the fertilizer may be strewn along where the rows are to be and afterwards mixed with the soil by opening the drill with a bull-tongued plow. A better way is to run it through a fertilizer distributor to mix it with and apply it to the soil and open the drill at the same time.

A good mixture for cow peas is 300 lbs. acid phosphate and 100 lbs. of muriate of potash per acre. In case kainit is substituted for muriate, four times as much is required—that is, 400 lbs.—to furnish the same amount of actual potash. If a commercial brand of fertilizer be used for cow peas, perhaps the best proportions, on average soils, are about 8 per cent. available phosphoric acid and 6 per cent. actual potash, applied at the rate of 400 to 500 pounds per acre, and thoroughly mixed in the soil before the peas are sown.

If the young plants display a sickly yellow appearance, about 75 lbs. of nitrate of soda ought to be used as a top dressing, but in order to avoid injury to the plants in top dressing, the nitrate and four or five times its bulk of dry earth should be mixed together to dilute it and insure a more uniform distribution.

As a rule nitrogenous fertilizer is not required for cow peas and under the circumstances above mentioned, and even when actually needed, a small application suffices. The average farm land is deficient in nitrogen but when this element is to be supplied in the form of commercial fertilizer it is better perhaps to apply it to corn, cotton, grain, grass and other crops, which do not obtain it from the air

rather than to the cow pea which does so gather it for itself. It appears that when the cow pea grows on a soil naturally rich and well supplied with nitrogen, the plant becomes "lazy" and draws from the nitrogen already in the soil before exerting its natural and peculiar power of collecting it from the air by means of the little nodules on its roots. Thus every habit and characteristic of the plant shows that the true economy of the cow pea is to restore poor land and make use of potash and phosphoric acid rather than to deplete good land and use nitrogen which can be employed to better advantage in producing other crops which need it more. From discussing fertilizer for cow peas, or other crops, no unvarying rule can be formulated. Soils differ so much that a mixture giving good results on one field may fail or be wasteful on another. Fields on the same farm, often those lying side by side, differ in their crop requirements. One experiment at the Delaware Experiment Station showed that where 160 pounds of muriate of potash were used per acre the yield of cow pea vines was doubled, while phosphoric acid was apparently without effect. Here was a soil naturally strong in phosphoric acid, yet it would not be safe to accept this result as a sure rule for general fertilizing. On most soils of low-producing power, potash is a most useful element for the cow pea, but phosphoric acid is also more or less needed. The one great object of fertilizing is fully to supply the mineral needs of the plant, guided by the well established principle that when these are supplied in abundance there is a corresponding gain in nitrogen.

A little practical experimenting soon indicates about how much potash and phosphoric acid to use. Applications of different quantities of these two ingredients on several parts of a field afford opportunities for comparison. Sandy soils are usually deficient in potash; clays in phosphoric acid, to applications of which they usually quickly respond. On sandy soils the cow pea can make good use of 500 to 600 pounds of kainit and 300 to 350 pounds of acid phosphate per acre. If muriate of potash be used in place of kainit, 135 to 150 pounds will answer. On clay soils less potash and more phosphoric acid may be used. There need be no fear that the potash and phosphoric acid above the actual needs of the crop will be lost. It is far wiser to run the risk of over rather than under supply, inasmuch as most of the surplus will be stored up and available for subsequent crops.

PLANTING.

Cow peas may be planted any time in the spring when the soil is warm enough for planting beans and thereafter, until within two months of when fall frosts are expected. Being of tropical origin, the plant develops, best in warm weather, and nothing is gained by planting too early. This is of special importance in the north. A cold rain may cause delay in germination or decay of seed and result in irregular stands. A few chilling days may give the young plant a check from which it is slow to recover. In practice, the time varies for planting to suit the purpose for which

the crop is grown. The season of beginning its growth materially modifies its time of maturing as well as its tendency to produce vines or runners. It is a common saying that "early planting makes vines, but late planting makes peas." For bulky, luxuriant vines, for late grazing, green manuring, or winter covering for the ground, early planting of some late maturing variety is correct; but, where seed is the object, planting should be timed to allow only for safe maturing before frost. In the south it is common to sow late maturing varieties shortly after cotton is planted, and the early kinds from the opening of the spring to late in August. In the north the season is too short for the late ripening varieties, so early maturing sorts should be planted at about the same time as beans or melons.

The choice and advantage of sowing broadcast or in drills depends on the object in growing the crop, and, incidentally the time of sowing and the cost of seed and labor. In broadcasting, no labor is needed in cultivating, and the vines soon cover and shade the ground, so that the crop costs simply the seed and the sowing and gathering; in drills, the labor and expense are more and the quantity and quality of the yield usually better. More seed is required for broadcasting than for drills and at least one bushel per acre should be used. At the north five pecks are suggested When put in drills these should be $2\frac{1}{2}$ to $3\frac{1}{2}$ feet apart, and the sowing may be done with an ordinary corn drill. A wheat drill can also be used to advantage by plugging or tying up the holes so as to make the rows $3\frac{1}{2}$ feet apart. This will require

about three pecks of seed per acre. When neither a corn drill nor a grain drill is available the planting may be done by hand, scattering the seed in previously opened furrows and covering by hand or by any convenient implement. The covering should be from 1 to 2 inches deep; on very light soils 3 inches does no harm. In a dry season or in naturally loose, dry land, deep planting is advisable. When seed is cheap and labor scarce broadcasting is usually the better plan, but when seed is dear and labor cheap and abundant, drilling pays better. In whatever way the planting be done the ground should be left level and smooth, especially if the crop is to be cut for hay. In the south where crab grass is abundant, its growth is liable to choke out the young peas and check their development in a wet season,—a point which should be given careful consideration in the choice between broadcasting and drilling.

CULTIVATION.

When sown in drills, peas should be cultivated two or three times to keep down weeds and mellow the soil until the vines are large enough to shade the ground. The first cultivation should be given with a smoothing harrow or weeder just as the peas are coming up, and the after-cultivation with a five tooth cultivator, or at least a cultivator which runs very shallow, for deep cultivation is wholly unnecessary. Peas planted between rows of corn, sugar cane or other crops are sometimes given one cultivation when

the main crop is laid by, but oftener receive no attention from planting until gathering; sown broadcast, of course, they cannot be cultivated.

Northern fruit growers have discovered a new use for cow peas. After much discussion it has been decided that a wise treatment for bearing orchards is to give thorough surface cultivation until about August first, and then leave the ground to some "cover" crop, that is, a crop that will make a rapid growth through the late summer, form a soft carpet for falling fruit and for protecting the land during winter and then leave a large quantity of vegetable matter for plowing under in the spring. As early in the spring as possible, cow peas are sown in drills through the orchard—or even in hills 2½ feet apart—and from the time the plants are up, constant and thorough cultivation is given. By August first, the vines are too large for the cultivator and they are left to grow at will. In some instances crimson clover is sown among the cow pea vines at the last cultivation, and, with a variety like Early Black, the clover makes a fair start and covers the ground after the frost kills the cow pea vines. Such an orchard treatment has many advantages, for which no other plant combines in itself all the virtues and recommendations that it can be planted early, permits constant and thorough cultivation, provides a vast amount of vegetable matter, decays during winter and permits early spring plowing. Some orchardists find it pays, as well as benefits the fruits and trees, to turn in hogs and sheep in time for them to eat the early wind-fall

COW PEAS FOR GREEN MANURING IN YOUNG PEAR ORCHARD. EXPERIMENT FARM, SOUTHERN PINES, N. C.

fruit and work up the excellent pasture into fat, marketable live-stock.

SAVING FOR HAY.

Cow pea hay is best if cut and properly cured when the earliest pods begin to ripen. There is less hay, and that inferior in quality and nutriment, if the harvesting be too early, but stems become hard and woody, parts of the leaves and seeds drop and are lost, and the hay is even less valuable when cutting is too long delayed, than when it is done before any pods are ripe. This hay cures slowly and is subject to heating—similar to red clover—for which reason it needs to be thoroughly dry before it is stacked or mowed in a barn. Unnecessary handling causes loss of leaves and should be avoided. The hay-making should begin only when the weather promises to be fair. Curing cannot be "rushed," like that of grasses, hence it is better to allow the crop to become a trifle over-ripe rather than attempt to save it in rainy weather. The dry yield is usually from two to three tons per acre, and no hay crop of that size can be cut, dried and stored without great labor.

Prof. E. R. Lloyd, of Mississippi, who has had a long experience with the crop, describes his method of harvesting and curing it as follows:

"The mower is started in the morning as soon as the dew is off and run until noon, or until as much has been cut as can be handled in the afternoon As soon as the top of

the cut vines is well wilted, the field is run over with a tedder to turn the vines over and expose them more thoroughly to the air and sun. When the crop is very heavy the tedder is used the second time, though this is seldom necessary. Vines which have been cut in the morning and teddered in the afternoon, may usually be put into small cocks the next afternoon, and, if the weather promises to be favorable, left to remain in the cocks two or three days before they are hauled to the barn. If it should rain before the vines are put in cocks, they are not touched until the surface is well dried off, and then teddered as though freshly cut. Those in cocks are not opened until well dried on the outside and are then only handled enough to secure a thorough airing. A light rain does little damage to the hay, even after the curing has begun, if handled promptly and properly, and a heavy rain for a day or two may fall on freshly cut vines and do little or no damage. The essential point in making hay is to do the work as rapidly as possible, and to avoid any handling of the vines when wet with either dew or rain. We find that it pays well to use a tedder for stirring up the freshly cut vines so as to admit sun and air freely, though if a tedder cannot be had, the work can be done nearly as well, though more slowly, by using a fork."

Mr. C. B Matthews, of Virginia, after growing the crop for more than thirty years, says:

"I cut with a rake reaper, beginning in the morning after the dew is off and continuing to cut until 3 P. M.

throwing the vines in small piles. If the ground is dry and the weather clear, I put the piles into medium sized shocks on the following day, handling carefully with the fork, to avoid shattering peas and leaves. In two or three days, if the weather is favorable, the shocks are ready to be housed or to put into stacks. Not having house room, I stack and top off with wheat straw. The peas are gotten out as the hay is needed in the winter."

The two dangers to be guarded against in saving the hay are over-drying, so that the leaves become brittle, drop off and waste, and failure-to-dry so that the thick, succulent stems retain sufficient moisture to cause mould and decay. The former danger may practically be escaped by cutting before the plants become ripe; the latter, by leaving the hay in cocks until it is so dry that no moisture can be twisted from the larger stems.

Some growers provide for curing the hay by erecting sheds with tiers of poles, somewhat resembling tobacco barns. The wilted vines are placed in layers on these poles to give free access of air above and below each layer to cause gradual evaporation of juice and moisture and perfect curing. This method makes hay of the very finest quality, but is too slow and expensive to be practiced on a large scale.

It is not safe to bale the hay directly from the field. Even when it appears perfectly dry, it may still contain sufficient moisture to cause heating and moulding if packed at once. The only safe plan is to put it for a few weeks

into stacks covered with straw, or into a barn, where it should not be piled to deep, and allow it thus to remain until all "sweating" is over and it is thoroughly dry. It may then be packed without danger of afterwards finding rusty or mouldy hay in the center of the bales.

It is somewhat doubtful if the cow pea can be recommended for universal hay making at the north. It ripens at a season not favorable for curing green fodder and when other farm work is pressing. Good hay has been made from it at the north, but the chances are against great success with it and the northern farmer will do better to regard it as a manurial or pasture crop. Some northern dairymen have used it as a soiling crop cut green and fed to the cows, still its chief value in cold climates is as a nitrogen gatherer and soil restorer.

SAVING SEED.

When the pea crop is grown between corn rows, or is fairly ripe before it is grazed, or remains on the ground for a winter cover, it is usually good economy to gather the seed. This is commonly done by hand-picking, often by women and children, who work for a share, usually one-half of the crop.

Some growers prefer the plan of storing the unshelled pods through the winter. This serves in a measure but not completely to protect the seed from weevil. Others, in order to save storage room, thresh as soon as the pods are thor-

oughly dry. Instead of gathering the seed separately, some delay cutting until a considerable proportion of the pods are ripe, and then depend on the peas shelled in handling and found in the bottom of the mow for a seed-supply for the next crop.

Threshing may be done any time after the pods are thoroughly dry; on farms where only a few bushels of seed are saved this is usually done with a flail. When grown in quantity, they are commonly threshed more easily, rapidly and economically by a "pea-huller." Sometimes the crop is cured as hay and then run through an ordinary threshing machine from which the concaves and alternate teeth of the cylinder have been removed, and the speed reduced by putting on a 20 or 24 inch cylinder head. The yield of seed varies greatly, ranging from 6 to 10 bushels per acre, grown between corn rows and only once picked, to 20 to 30 bushels, or more, grown alone allowed fully to mature and all the seed saved.

The same weevil which attacks the garden bean, lays her eggs on cow pea pods before they are gathered, and there is not now any known means of preventing her doing so. If the seed be stored where there is an even temperature, a few degrees above freezing, there is further danger of a second and third brood hatching during the winter, and seriously injuring the seed before spring. This injury can be prevented by treating the stored seed with carbon bisulphide, which affords a cheap and complete protection. The treatment is very simple and should be given as soon as the

seed is threshed and before it is stored for the winter. Put the seed into tight barrels or boxes and pour in about one ounce of bisulphide for each bushel of seed. As soon as the poison has been poured in, tightly cover the top of the barrel or box with old sacks or any convenient material to confine the fumes of the chemical and enable it to kill all insects present. If the seed be kept for late planting, it may again become infested in the spring, when a second treatment should be given. The bisulphide does not injure the peas for planting, or for table use, but is **very inflammable** and must be kept away from any fire. A lighted lamp or lantern, or even a lighted pipe, must not be brought into the building where the seed has been treated, until the peculiar odor of the chemical has disappeared, which will be in about three days.

GRAZING AND SOILING.

Cow peas are among the best of crops for grazing and soiling, as they give more and better feed, in their season, with less expense than any other crop which can be grown. By a judicious selection of varieties, fields ready for use can be secured at any time from midsummer until cold weather, and a good part of what is needed for this purpose can be grown as a "catch crop" without interference with the regular crops grown on the same ground. This is especially so when they are grown between corn rows, being planted when the corn is "laid by" and grazed after the corn

COW PEAS. UNFERTILIZED ON RIGHT; FERTILIZED ON LEFT.
EXPERIMENT FARM, SOUTHERN PINES, N. C.

is gathered. Probably one-half of the cow peas grown in the southern states are grown and grazed in this way, and are always regarded as furnishing the best possible grazing for milch cows, fattening animals and hogs. The erect varieties are preferred for this purpose, as the climbers tangle the corn and interfere with its gathering. When pastured, the droppings from the animals return nearly all of the fertilizing elements of the crop to the soil, and benefit the field nearly as much as though the entire crop were plowed under as a green manure. The meat and milk produced represent clear profit. The crop does not bear continuous grazing, still it gives abundant feed for a month or six weeks, and by arranging a succession of fields, good pasture may be provided during several months.

More actual feed is produced with less waste per acre when the vines are cut or pulled for soiling, for which this is a standard crop wherever soiling is practiced. Heavier yields are secured by planting the climbing varieties with corn or sorghum in the same rows, at the same time, by which method each crop produces nearly as much as either one planted alone. The stubble of vines cut before they have blossomed frequently sends up a considerable second growth, but the total yield is seldom more than that secured by a single cutting at maturity.

THE COW PEA AS A RENOVATING CROP.

The cow pea always leaves the soil which grows it, in a better condition than it was before the crop was planted.

It acts mechanically, by sending its long tap roots deep into the subsoil, loosening and making it more porous, and chemically, by collecting and assimilating the free nitrogen of the air and making it available food for future crops. Soil improvement is the chief object for which it is grown in this country. Not that its extensive acreage is due alone to its fertilizing effect, but its value for that purpose is an additional and important reason why it is used in preference to any other hay or forage crop. How to use this renovating and fertilizing power to its full and best advantage is a matter of prime importance.

In strong contrast to the established fact that most other cultivated crops decrease the fertility of the soil, stands the fact that the cow pea increases it. A few other plants, including the beans, clovers, alfalfa, vetches and melilotus, all like it belonging to the legume family, produce a similar fertilizing effect. The formerly, but no longer fully accepted, explanation of the fertilizing power of these plants was that their long tap roots bring up plant food from the subsoil, and, on their decay, leave it within reach of shallow rooted plants, usually grown after peas. They do, to some extent, act in this way, but not sufficiently to account for anything like their full effects. This explanation failed to account for the difference soon recognized on soils deficient in nitrogen between the soil effects of legumes and of other deep-rooting plants, in satisfying the demands of the crops which followed. Experiments,

undertaken to solve this problem, demonstrated the fact that leguminous, or pod-bearing plants, are capable of growing on artificial soils originally wholly devoid of nitrogen. This led to the discovery that legumes had the faculty of taking up the free nitrogen of the atmosphere holding it fast and mingling it with the soil,—a discovery of the greatest importance, in view of the fact, that plants of other families wholly lack this power to make use of the unlimited air supply of nitrogen constantly surrounding them.

Nitrogen is the most expensive, and at the same time, one of the three necessary fertilizer elements. It forms but two to three per cent. of the weight of common plants, but it is absolutely necessary to their growth, without it their development is impossible. Now the air contains about four-fifths of its weight in nitrogen, and in the air resting upon a farm there is nitrogen enough to produce many crops, yet such plants as corn, wheat, potatoes and cotton cannot utilize it, and so may be starving surrounded, literally enveloped with plenty. It is of no more use to them than the waters of a lake would be to a man floating in it in a water-tight cask. This is not true of the cow pea and legumes, or pod-bearing plants, so markedly possessing the rare faculty of utilizing the nitrogen of the air. They are able to absorb this atmospheric nitrogen and convert it into such forms that other plants can use it. Those who have used nitrate of soda know that it will show in crops quicker than cotton seed meal or tankage. Yet, after the latter has been in a warm, damp soil for some time, it also

becomes available and the plant quickly responds to its use. The reason for this is, though the meal, the blood and the tankage contain nitrogen, certain chemical changes must take place before this nitrogen can feed the plant. In the nitrate of soda these changes have already taken place which explains why the nitrate is at once effectual. In like manner, atmospheric nitrogen is not available to most plants, but the cow pea is capable of making it over and combining it so that it is. Those who have seen the pigeon feed its young have a clear illustration of the way the cow pea plant feeds other plants. The mother pigeon gathers, swallows, and partly digests the food, and then brings it up to her mouth as "pigeon milk" and feeds it to her young. This subject is explained at some length to show why the cow pea on poor land gives such wonderful results with only the addition of the mineral elements, potash and phosphoric acid. The value of most manures depends largely upon their rapidity of decay, to bring their nitrogen to plant support. The cow pea vine decays quickly and is probably the "quickest" in its manurial effects of any green manuring crop.

An examination of the roots of a healthy cow pea, or other legume, discloses many little bunches, enlargements, "nodules" or "tubercles," varying in size from that of a small pinhead to a pea. These have about the consistency and much the appearance of very small potatoes, but an examination with the microscope shows that they contain vast numbers of living things, actually myriads

of minute living organisms, scientifically named bacteria. These bacteria draw the small mineral part of their nourishment from the roots on which they grow, but the far greater nitrogen supply essential to their life, they gather from the air which circulates through the soil. Each individual of these low forms of animal life exists only for a few hours, and at death mingles with the soil and goes through a process of decomposition, similar to that which takes place in other organic matter. The only difference is that when vegetable matter decays, it leaves in the soil only what it has taken from it, but these bacteria add the nitrogen they have absorbed from the air, and changed into a form available for succeeding crops.

When plants, other than legumes, such as rye, mustard, oats, etc., are used for green manuring, they really add nothing to the soil, except what they have absorbed from the same source during their growth. It is true, though, that they change some of the plant food, which the soil already contains, into a more easily available condition, but the cow pea and other legumes do the same and also enrich the soil by their accumulations of nitrogen, which, as stated, is the most expensive element of fertility.

The value of any material as a soil renovator, depends largely on the nitrogen, potash and phosphoric acid it contains. The following table, from the Year Book (1895) of the U. S. Department of Agriculture, gives the average percentages of nitrogen, potash and phosphoric acid in common hay and fodder crops. As these percentages are

largely influenced by the water content of the material, the table also shows the percentage of moisture :

Hay or Forage.	Water per cent.	Nitrogen per cent.	Potash per cent.	Phosphoric Acid per cent.
Cow peas	10.95	1.95	1.47	.52
Red Clover	11 33	2.07	2.20	.38
Alfalfa	6.55	2.19	1.68	.51
Timothy	7.52	1.26	.90	.53
Wheat Straw	12.56	.59	.51	.12

Cow peas cut for hay are more or less immature; in the fully mature crop the plant food percentages change, that of potash especially, becoming considerably larger.

The assertion has been made that the cow pea crop leaves the soil in better condition than it found it, which is strictly true only when the whole crop is turned under for manure,—green manuring. The cow pea, like every other legume, harvested or removed from the ground where grown, leaves the soil as rich in nitrogen as before it was planted, but unless, while it is growing, potash and phosphoric acid are supplied fully to satisfy its hunger for them, it actually leaves the soil much poorer than it found it. The great value of the growing cow pea, next to its power of taking nitrogen from the air, is its wonderful ability to utilize potash and phosphoric acid. When these minerals are liberally used on the cow pea crop, the soil gains far more than the cost of the fertilizer,– the growth is much larger and more rank and the atmospheric nitrogen secured corresponds in abundance.

COW PEAS FOR GREEN MANURING AT EXPERIMENT FARM, SOUTHERN PINES, N. C.

The renovation of soils through the use of cow peas depends largely on the use to which they are put. The stubble and roots contain considerable fertilizer, and the nitrogen is mostly gain; but much potash and phosphoric acid are removed in the crop taken off, and unless this loss be made good by applications of mineral plant food, cow peas actually exhaust the soil. This point is important and needs always be kept clearly in mind. Cow peas, in common with wheat, require plant food, notably potash and phosphoric acid; but wheat requires nitrogen plant food, cow peas do not. The whole difference between legumes and non-legumes is stated in this one point of feeding. Among legumes, the cow pea stands first and pre-eminent as a crop producer of fertilizer nitrogen. It may be grown between crops of wheat and thus furnish nitrogen for many successive crops.

The soil improvement is well illustrated by an examination of the last foregoing table. A ton of timothy hay contains 25 pounds of nitrogen, 18 pounds of potash and 10 pounds of phosphoric acid. All this must be supplied by the soil. A ton of cow pea hay contains 40 pounds of nitrogen, 30 pounds of potash, and 10 pounds of phosphoric acid, of which only the latter two need be supplied by the soil. Suppose both are returned to the soil in the shape of farmyard manure; estimating roughly, in the case of timothy, the soil receives back what it gave to the timothy, but in that of the cow pea, it receives not only what it gave, but 40 pounds of nitrogen in addition thereto.

UTILIZING THE CROP AS A FERTILIZER.

Among the many methods of using the cow pea crop for benefiting the soil are:

1. Plowing under the entire crop while green.

2. Allowing the crop to remain and decay on the surface of the ground during the winter and plowing it under in the spring.

3. Grazing the field and then plowing under the stubble roots and droppings of the cattle.

4. Mowing the field for hay and then plowing under the stubble roots.

While it is true that ploughing under the entire green crop will add the greatest amount of plant food to the soil, nevertheless it is not always economy to follow that method. The forage is worth as much for food as an equal weight of red clover, and since about 80 per cent. of the fertilizing value is retained in the manure, it often pays better to feed the pasture or hay and return the resulting manure to the land. On good soils the roots and stubble from the peas furnish all of the nitrogen, and it remains only to supply an amount of phosphoric acid and potash suited to the following crop. On a very light soil it is not desirable to turn under a heavy mass of green forage, thus to make it still lighter and looser and liable to suffer from hot dry weather, but it is better to wait until the vines have had time to become thoroughly decayed. Again, a late maturing crop on land not protected by a growing crop or sod, during the

winter is often nearly wasted, and its fertilizing elements washed away by heavy rains leaching through the unfrozen ground. It has been found in the south, that ploughing under a crop of cow peas is very likely to sour the land, and, therefore, it is not to be recommended.

From what has been stated, it is clear that judgment must be used regarding plowing under the entire crop, otherwise a positive injury may be done to the soil.

On other lands and under other conditions, plowing under the entire green crop is often the most profitable and best disposition which can be put. Where humus is lacking and needed, especially on stiff clays, nothing else available so quickly betters the physical condition of the soils so well as to loosen them up by turning under the entire bulk of vines. The after-effect of such plowing under on a heavy soil, which grows only a light crop of peas is little short of wonderful. Whenever, on such a soil, a light crop of peas mature early enough to be followed by another crop of peas, or winter growing wheat, oats or vetch, it is usually better to plow under than to graze when other pastures are good. Weather conditions, which are apt to prevail at harvest time, often serve as a guide as to whether plowing under or harvesting is most desirable.

As a protection to a light soil, liable to wash, during the winter, it is often actual economy to allow the pea crop to decay on the surface and postpone plowing until spring; in this to be sure, there is some loss of fertilizer by winter winds and washing, but there is more than a compensation in what the vines retain and hold in place.

Theoretically the most economical way to use the crop is to graze the fields and plow under the stubble. The solid and liquid droppings of the animals contain nearly all of the plant food that was in the forage. There is a small loss, but it is hardly as great as when the vines are left on the ground during the winter.

Grazing the field and turning under the stubble and animal droppings does away with the difficult, often expensive, work of plowing under a great mass of vines, when labor is scarce or wages high Cow pea pastures are especially valuable for milch cows and growing hogs, and make more milk and pork per acre than any other grazing. Hogs use the crop more closely than cows, and are less particular about quality of food, so it is well to let them finish what the cattle have left. Hogs make good growth and fatten on such pasture, yet it is better to add some other and suitable feed during the last month or so of their feeding for market or pork, or "finish off" on corn, as otherwise meat and fat are likely to be too soft, and lacking in quality and delicacy of flavor. As intimated above, a fairly good pea crop is rather difficult to plow under with its entire mass of fresh, green vines, but grazing a few days, makes the covering easier and causes practically no loss of plant food.

On soils already in condition to produce a heavy growth of peas, and where grazing is not convenient, if the crop be made into hay, the soil is still greatly improved. The roots, stubble and waste from the hay, furnish all the nitrogen needed for the following crop, and the hay costs simply the

WELL DEVELOPED COW PEA VINES, SHOWN BY CAPT. McNAIR, SUPERINTENDENT EXPERIMENT FARM, SOUTHERN PINES, N. C.

labor of harvesting it. A heavy pea crop on such land generally pays better made into hay than pastured or plowed under. In this connection note that this book is for every-day use and deals with average conditions. Of late some able and scientific writers, probably blessed with ample means, have been protesting against the wastefulness of plowing under cow peas. It is asserted that vines, to make a ton of hay, if turned under green, add only about as much actual fertility to the soil as one-third of a ton of high grade guano, but, turned into hay, fed to live stock and their liquid and solid excrements carefully saved and returned to the land, increase the fertility twice as much. All this and more is strictly true and worthy of consideration and diligent study, but vast numbers of tillers of the soil lack live-stock, suitable buildings and yards, labor and bank accounts. The farmer may find it much more profitable to follow the less economical method of plowing under than of buying complete fertilizer, converting into hay or leaving his fields unfertilized. He may make the cow pea a "catch crop" year after year until he thus brings his land to a high state of productiveness, at no further cost to him than that of his labor at seasons when his labor has no actual cash value.

To repeat, briefly, a heavy crop of vines is more profitable grazed off or made into hay; a light crop on stiff soils is more profitable plowed under green. A light crop in a very sandy soil or liable to wash during the winter should be left to decay on the surface of the ground.

COW PEA HAY.

According to chemical analysis, well matured cow pea hay ranks with, or even surpasses, clover and alfalfa hay, both of which have feeding values about equal to wheat bran. This is explained in the following more scientific chapter, "Food Elements and Values." Here is simply and briefly shown the comparatively great feeding value of this particular hay on farms where stalks and ordinary cured grasses yield the chief fodder and are often supplemented by feeding with them corn meal or corn on the cob. A fodder or forage to be economical must be something more than cheap in money cost. It must be composed, in correct proportions of all those elements of food necessary for producing and sustaining animal growth. To give too much of one kind of food and not enough of another is certainly wasteful, and may mean even starvation. Corn, corn fodder and dried grasses generally are fat producers; cow pea hay is a muscle, structure and vigor producer. In the South where crab and such other natural grasses grow and are cut and cured with the cow pea, the resulting mixed hay contains very nearly the correct and proper proportions of muscle and fat-producing elements. At the New Jersey Experiment Station, an acre of cow peas produced muscle-making food (protein) equivalent to that contained in 2,500 pounds of wheat bran.

FOOD ELEMENTS AND VALUES.

The most important and valuable parts of food are:—First, mineral substances, which serve for the development

and support of bone, blood, nerves and muscles. These constituents of food are grouped under one heading and are known as "The Ash." Second, materials which contain nitrogen. These are converted into lean meat, skin, hair, the casein and albumen of milk, etc., and are termed by chemists the "Proteins." Third, sugars, starches, oils, fats and similar materials, often classed chemically as "nitrogen free" and "ether extracts"—"Carbo-Hydrates."

These three, "ash, protein, and carbo-hydrates," vary in degree of digestibility, which is also affected by the source whence each is derived. Generally speaking, fats and sugars are more easily digested than starches or proteins—grain, than hay; hay, than straw. In addition to the needs enumerated is that of heat and energy for the animal body, which gets its glow and power, as does a steam engine, by the consumption of carbon. For producing this heat and energy, "fats" and "ether extracts" are about two and four-tenths times more effective, pound for pound, than starches, sugars and other "nitrogen-free" materials, that is 2.4 times the digestible parts of each and not their total amounts. This may be stated in the form of a working rule. Ascertain the chemical and digestible composition of the food under investigation and multiply the amount of digestible fat by 2.4, and to the product add the amounts of fibre, starch, etc., ("nitrogen-free extracts"). The sum shows approximately the digestible carbo-hydrates contained, which divided by the digestible proteins gives the relative value or ratio of these two. This subject is extensively

treated in "The Digestibility of American Feeding Stuffs," published in Experiment Stations Bulletin of the U. S. Agricultural Department.

The economical and profitable growth and support of animals require their food to contain one part of protein to from five to seven parts of carbo hydrates. Within this range, the proper ratio must be determined by the animal fed and the object in feeding. The cow pea is distinctly a protein feed, as may be seen from the following table of Prof. W. A. Henry, in his book, "Feeds and Feeding."

FOOD CONSTITUENTS OF COW PEAS AND OTHER FEEDING STUFFS.

	Ash, Per Cent.	Protein	Carbo Hydrates.	Ether Extract.	Nutritive Ratio.
Cow Peas, Grain,	3.2	18.3	54.2	1.1	1:3.1
Soy Beans, "	4.7	29.6	22 3	14.4	1:1.9
Oats, "	3.0	9.2	47 3	4.2	1:6.2
Corn, "	1.5	7.9	66 7	4.3	1:9.7
Wheat, "	5.8	12.2	39.2	2.7	1:3.7
Cottonseed Meal,	7.2	37.2	16.9	12.2	1:1.2
Cow Pea Hay,	7.5	10.8	38.6	1.1	1:3 8
Soy Bean "	6.2	10.8	38.7	1 5	1:3.9
Clover "	6.2	6.8	35.8	1.7	1:5.9
Timothy "	4.4	2.8	40.4	1.4	1:16.7

The cow pea, then, belongs strictly to the protein class, with a narrow nutritive value in close relation to carbo-

hydrates, in the ratio of one to three and one-tenth for the seed and one to three and eight-tenths for the hay, while timothy and other true-grass hay has a wide ratio of about one to six and seven-tenths. Between the ratios of from one to five and from one to seven, under ordinary circumstances, is proper and economical feeding. The cow pea or any other ration over-rich in protein shonld be mixed with a carbo-hydrate; two tons of cow pea hay fed mixed with one ton of timothy or like hay is a far richer and more profitable forage than the three tons fed separately. Where there is not a natural mixture at time of growth and harvesting (to which reference is made in the preceding chapter) it should be made at feeding time,—cow peas with grasses, or roots, or corn-fodder or the like. Without some such combination, part of the protein is lost because animals are unable to digest and assimilate that which is in excess of the correct ratio.

It has already been incidentally stated that cow peas, clovers and other legumes contain an excess of protein while corn-fodder, timothy, red top and such grasses do not contain enough. This is strictly true and worthy always of consideration, still there are times and circumstances under which means must be adapted to ends even if scientific rules are disregarded. Sometimes it is cheaper and better economy to let the excess of cow pea protein waste than to incur unprofitable expense to secure the chemically correct proportion,—to graze a bulky growth of vines to make plowing-under possible,—to feed coarse, cheap cow pea

hay alone rather than to buy high priced timothy or other feed to mix with it. For milch cows and fattening animals, it is better to have the nutritive ratio too narrow than too wide. The foregoing table shows a close resemblance in the composition of pea vine hay and wheat bran and practical experience is in harmony with the table. Many dairymen find in the cheap pea a substitute for the costly bran. In this connection, the director of the Delaware Experiment Station says: "It was found that with pea vines in a ration, bran could be dispensed with. The butter yields were slightly increased by their use without impairing the quality." The discovery and recognition of this fact has done much to advance the dairy interests in the south.

COW PEAS FOR ENSILAGE.

Well preserved pea vines make silage far superior to corn, sorghum and other crops commonly used for this purpose, but it is difficult to preserve them alone. A growth sufficiently rank to make them profitable for silage is such a matted, tangled mass of vine that it is almost impossible to run it through a silage cutter; and, stored without cutting they cannot be so closely packed as to exclude the air and prevent mould and decay, and consequent loss.

The most practical method with them for the silo is to grow cow peas and corn in the same rows, so that the vines may twine around the stalks, and the whole be easily cut and handled together. The mixing of the two crops adds

largely to the yield and makes the silage of much better quality. A ton of such a mixture has a feeding value fully 10 per cent. higher than that of an equal weight made from corn alone. For this purpose the "Whip-poor-will" is one of the best varieties and should be planted with a common hand corn planter when the corn is about six inches high. By planting at that time, the vines run nearly or quite to the tops of the stalks and mature a good part of their seed by the time the corn is fit for cutting. The vines thus twined about the stalks are readily run through the cutter. Corn silage is poor, but that of cow peas is rich in protein, so the mixture makes a more satisfactory food than that of either taken separately.

COW PEAS IN CROP ROTATIONS.

The cow pea is one of the annual legumes which can be used to advantage in crop rotation; it is possible to select a variety which will occupy the ground and mature at any time during the hot weather. The planting may be early in the spring so as to get the crop out of the way in time for sowing fall wheat or oats, or it may follow the harvesting of either of those crops and still mature before frost. There are other varieties which will occupy the ground during the entire season when it is not needed for other purposes. Whenever land would otherwise be idle during any two months of warm weather, a crop of cow peas may be grown upon it with profit in the crop itself and with

benefit to the land by keeping it from being burned by the heat, whipped by the wind, washed by rains or made foul by weeds.

The particular rotation followed must depend on the other crops grown, but the cow pea succeeds under so many different conditions that it can fit almost any rotation system. The proper rotation on each farm depends upon the location, the special needs of the soil, and the business management of the farmer, so, in this respect, no specific directions can be given here. The best that can be said, and a rule that may always be followed with advantage is, to sum up what has just been said, no matter what other crops are grown or rotations followed, whenever the land can be spared during any two months of warm weather, put in a crop of cow peas. There will be a profit in the crop itself and the ground will be put in the best possible condition for the following crop.

COW PEAS COMPARED WITH OTHER LEGUMES.

Each of the leguminous crops, cow peas, alfalfa, red clover, melilotus and others has its place—its advantages and disadvantages. At least one of these crops must be grown on every economically managed farm, for the growing of legumes is the least expensive method of restoring exhausted soils, keeping strong soils good and providing plant food for future crops.

Red clover has long been a standard crop, wherever it could be grown, valued alike for its hay and its fertilizing effect in the soil. It does not thrive on all soils or under all conditions. Where it has been grown for a long time, the soil becomes "clover sick" and fails to produce the abundant yields of former years. It is a perennial and so can not be made profitable in the South unless it occupies the land at least 18 months; in the North it is expected to occupy the land at least two years. It is not adapted to growth over as wide a range of territory as the cow pea, and on many soils comparatively sterile or in a bad mechanical condition fails, while the cow pea produces a heavy crop. In fact, cow peas are often grown on such soils to prepare the land for seeding to clover.

Alfalfa is undoubtedly the best perennial legume for the Western country where irrigation is practiced, and is also of great value in the Southern part of the country where red clover does not succeed, but it has many of the weak points of red clover. Both crops are liable to "bad catches," "winter killing," "dying out," "root-rot," and other troubles to which the cow pea is a stranger. It is rarely profitable east of the Mississippi and north of the Ohio Rivers.

Melilotus is of great value on many soils in the South, though little esteemed in the North. It only grows on soils rich in lime, occupies the ground for two years and yields a hay inferior to that made from cow peas.

The beggar weed has the advantage of being a volun-

teer, springing up with crowfoot and crabgrass after other crops have been laid by or harvested, and then it makes good fall grazing. It has no merit at the North, is of very little value for hay, and thrives only on the sandy soils in the extreme South.

Vetch and crimson clover are both annual winter growing legumes of value within their individual and limited spheres. Where they flourish, there are no better winter growing forage and fertilizing crops, and each is often used to precede or follow a cow pea crop. Unfortunately neither can be grown over a very wide extent of territory.

The velvet bean makes a more vigorous growth than the cow pea, its vines often reaching 75 to 100 feet in length. It grows on a variety of soils, but, to mature, requires the whole of a very long season. North of latitude 31 degrees, that is beyond the Gulf region, it seldom ripens seed. Two crops of early cow peas can be grown in less time than one crop of this bean. Where it grows naturally, it makes good grazing and is, perhaps, the best crop where the summer growth is to be left on the surface of the ground as a winter covering, but it is difficult to make it into hay, and practically impossible to plow it under green.

The cow pea makes as good hay or pasturage as any other legume; its fertilizing effect on the soil is not excelled; it is hardier and can be grown on a greater variety of soils, under greater extremes of climate and over a wider extent of territory, and can better fill the place as a "catch crop," either early or late in the season, than any other

COW PEAS FOR GREEN MANURING. FERTILIZED ON RIGHT; UNFERTILIZED ON LEFT.
EXPERIMENT FARM, SOUTHERN PINES, N. C.

Other leguminous crops are sometimes more desirable in certain localities and for certain purposes, but undoubtedly it is more valuable to the country at large than is any other one known legume.

SUMMARY.

1. The cow pea can be grown in all parts of the country where dent corn succeeds.

2. Different varieties produce plants of widely different habits, some erect and shrub shaped, others with long trailing or climbing vines; some ripen seed within two months from planting, others require six months or longer for their maturity.

3. The variety for planting is to be selected according to the use to which the crop is to be put, and the time of planting.

4. Thorough preparation of the soil before planting is as profitable for cow peas as for any other crop; the greater the care in this respect, the greater the satisfaction and profit in the yield.

5. Phosphoric acid and potash need to be applied liberally to promote the heaviest growth and to ensure absorption of the greatest possible amount of nitrogen from the air.

6. A small amount of quick-acting nitrogenous fertilizer is sometimes valuable in giving the young plants a prompt and vigorous start, but too much is unprofitable.

7. Cow peas may be planted whenever the ground is warm enough for planting beans or melons.

8. Drill-planting requires less seed and more cultivation, and the yield is usually heavier than when sown broadcast.

9. When saved for hay the crop should be handled like red clover, but must not be baled until some weeks after it is gathered or before it is thoroughly dry. Its yield is usually from 2 to 3 tons per acre of dry hay.

10. Seed stored for winter should be treated, at the time of storing, with an ounce of bisulphide of carbon to each bushel to prevent injury by weevils. This treatment should be repeated in the spring if the seed is kept until summer.

11. The cow pea is one of the best plants for temporary pastures, and, by a proper selection of varieties, gives good grazing from early summer until late fall. As a grazing crop it is especially valuable for producing milk, growing young stock (especially pigs) and fattening all kinds of domestic fowls and animals.

12. The cow pea is one of the most effective fertilizing plants. It draws its nitrogen from the air and so free of cost obtains and stores this otherwise most expensive element of fertility.

13. A heavy growth of vines usually pays better grazed or made into hay; a light crop, on stiff soil, is more profitable plowed under green; and a light crop, on very sandy soil, or on soil liable to wash during winter, is best left to decay on the surface of the ground.

14. Hay made from cow peas is very rich in protein, and if mixed with that of any of the true grasses the feeding value of the mixture is far greater than either fed alone.

15. Cow pea hay is an excellent substitute for wheat bran, is comparatively cheaper, and therefore, of special value to dairymen.

16. When grown together there is very little trouble in handling cow peas and corn for the silo, and the combined silage of much better quality than that made from corn alone.

17. The cow pea can be used to great advantage as a green manure crop at any time during the summer and in almost every crop rotation.

18. The cow pea can be grown successfully over a wider extent of territory and on a greater variety of soils than any other legume, and there are few farms on which it cannot find a profitable place.

EXTRACT OF BULLETIN 26 OF THE GEORGIA EXPERIMENT STATION.

1. FORM OF PEA.

(*a*) **Spherical.** Nearly all varieties having round or spherical seeds are "Crowders," that is, the seeds are packed closely in the rather short pods.

(*b*) **Kidney-shaped**, includes all varieties except those grouped as "Spherical."

2. COLOR OF SEED.

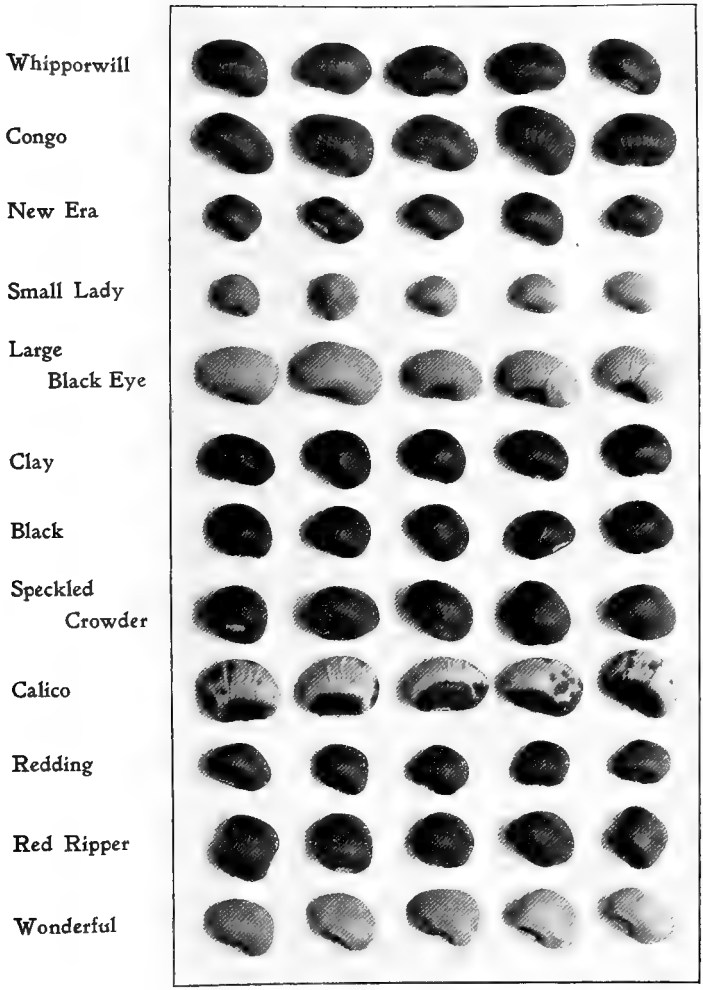
(*a*) **White.** Blackeye, Bluehull, Browneye, Conch, Green, Large Lady, Large White, Pony, Purplehull, Redeye, Rice, Small Lady, Small White, Sugar, Taylor, Vacuum, White, White Brownhull, White Crowder, White Giant.

(*b*) **Buff or Cream.** Clay, Everlasting, Green, Unknown.

(*c*) **Pink and Red.** Clovin, Flat Red, Large Red, Pale Red, Purplehull, Red, Red Crowder, Redding, Red Ripper, Red Yellowhull, Small Red, Tory.

(*d*) **Mottled and Speckled.** Black and White, Calico, Chocolate, Coffee, Gourd, Granite, Indian, King, Lilac Redpod, Matthews, New Era, Redpod, Saddleback, Speckled, Crowder, Whip-poor-will, White and Brown, Williams.

(*e*) **Black.** Black, Constitution, Congo, Shinney.



TWELVE LEADING VARIETIES OF COW PEAS. NATURAL SIZE.

3. SIZE OF SEED.

(*a*) **Large.** Bluehull, Calico, Coffee, Congo, Gourd, Granite, Indian, King, Large Blackeye, Large Red, Large White, Lilac Redpod, Matthews, Red Ripper, Red Yellowhull, Speckled, Crowder, Vacuum, White Crowder.

(*b*) **Medium.** Black, Blackeye, Browneye, Chocolate, Clay, Conch, Green, Large Lady, New Era, Pea of Backwoods, Pony, Purplehull, Crowder, Quadroon, Red, Red Crowder, Redeye, Red Pod, Shinney, Taylor, Unknown, White and Brown, White Brownhull, Whip-poor-will, Williams, Wonderful.

(*c*) **Small.** Black and White, Bluehull, Colvin, Constitution, Everlasting, Flat Red, Green, Pale Red, Redding, Rice, Saddleback, Shrimp, Small Lady, Sugar, White.

4. GROWTH AND HABIT OF PLANT.

What has already been said shows that any grouping based alone on habit of growth must be almost wholly arbitrary. The entire character of growth and fruiting is influenced, modified and even entirely changed by early or late planting, by location North or South, by soils, by rainfall and other climatic conditions.

In the list given below, varieties are grouped according to their growth, when planted in May and June, on soil of medium fertility, in the Northern part of the Gulf States.

(*a*) **Trailing.** Black, Black and White, Coffee, Conch, Everlasting, Large Red, Large White, Redeye, Tory, Williams.

(*b*) **Half Trailing.** Bluehull, Calico, Chocolate, Coffee, Congo, Constitution, Granite, Gourd, Large Lady, Lilac Redpod, Matthews, New Era, Pony, Purplehull, Crowder, Redding, Red Ripper, Red Yellowpod, Rice, Shinney, Shrimp, Sugar, Taylor, Vacuum, White, White Brownhull, Williams.

(*c*) **Erect.** Blackeye, Browneye, Clay, Coffee, Flat Red, Green, Pale Red, Red Crowder, Speckled, Crowder, Unknown, Whip-poor-will, Wonderful.

Planted early on rich soil, nearly all varieties grouped as "Erect" develop a more or less trailing habit late in the season, and then may be included in group (b), but planted late, or on thin soil, they remain bushy and erect. A wise comprehension of this paragraph will save the beginner from disappointment in growing this crop.

5. TIME OF MATURITY.

a) **Early.** Black and White, Bluehull, Browneye, Chocolate, Coffee, Congo, Granite, Green, King, Large White, New Era, Red Crowder, Redeye, Red Yellowpod, Rice, Saddleback, Whip-poor-will.

(*b*) **Medium.** Blackeye, Clay, Coffee, Green, Indian, Large Lady, Lilac, Red Pod, Pony, Rice, Small Lady, White, White and Brown, White Brownhull.

(*c*) **Late.** Black, Bluehull, Calico, Clay, Conch, Everlasting, Flat Red, Gourd, Matthews, Pale Red, Purplehull, Crowder, Quadroon, Red, Redding, Red Ripper, Rice, Shinney, Shrimp, Small Red, Speckled Crowder, Sugar, Taylor, Unknown, White Crowder, Williams, Wonderful.

Peculiarities and characteristics of some of the more common varieties named in this grouping, are the following:

Bluehull. Half-trailing, or sometimes trails but slightly; small leaves and tender stems; medium in size and blue-black in color; seeds large, white and wrinkled; matures early.

Calico. Half-trailing, or sometimes widely trailing; small leaves and slender stems; dark green and vigorous; pods large and yellow; seeds very large, mottled red and white; ripens late.

Clay. Tall, erect; large, dark green leaves; stems of vigorous growth; pod large and yellow; seeds kidney-shaped, medium size, cream colored; medium to late in ripening.

Gourd. Trailing or half-trailing; small leaves and stems; pods yellow and very long; seeds large, mottled black and white; ripens very late.

Large Lady. Half-trailing; slender leaves and stems; pods yellow and small; seeds kidney-shaped, white, medium in size; ripens medium early.

Pony. Half-trailing; leaves and stems dark green, medium size; pod small and yellow; seeds kidney-shaped, medium size; white and wrinkled; medium in time of ripening.

Red Ripper. Vigorous, half-trailing; large, dark green leaves and stems; pod yellow, medium size; seeds large, dull red; matures very late.

Unknown. A very vigorous grower; erect when planted late, but widely trailing when planted early; pod large, nearly white; seeds medium size, buff or cream colored; matures late.

Whip-poor-will. Usually an erect grower and rarely climbs; pods gray, long and full; seeds large, nearly spherical, mottled red and white; matures early. One of the best varieties for late planting and growing between corn rows.

White. Trailing, or half trailing; small leaves and slender stalks; pod yellow, medium size; seeds small, kidney-shaped, white; matures early.

White Brownhull. Vigorous growing, half trailing; small leaves and slender stems; pod medium size, dark brown or nearly black; seeds medium size, white; medium early.

The Louisiana Station reports a test of 46 different varieties and gives the yield of vines and seeds of the ten leading sorts as follows:

YIELD OF GREEN VINES.

(POUNDS PER ACRE)

1.	Red Ripper,	25,256
2.	Unknown,	21,730
3.	White Brownhull,	21,320
4.	Clay,	20,664
5.	Calico,	20,008
6.	White,	19,352
7.	Pony,	19,352

8.	Large Lady,	19,106
9.	Gourd,	18,368
10.	Bluehull,	17,748

YIELD OF SEED.

(BUSHELS PER ACRE)

1.	Calico,	37.1
2.	Clay,	34 3
3.	White Brownhull,	33.8
4.	White,	31.9
5.	Unknown,	30 5
6.	Gourd,	30.3
7.	Pony,	29.7
8.	Rice,	28.3
9.	Large Lady,	27.8
10.	Red Ripper,	27.1

COMPOSITION OF FERTILIZER MATERIALS USED AS SOURCES OF NITROGEN.

	Nitrogen.	*Equivalent in Ammonia.*	*Potash* K_2O.	*Phosphoric 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 FERTILIZER MATERIALS USED AS SOURCES OF PHOSPHORIC ACID.

	Nitrogen.	*Equivalent in Ammonia.*	*Potash, K_2O*	*PHOSPHORIC ACID.*		
				Total.	*Available.*	*Insoluble.*
So. Carolina Phos. Rock	.....	.....	.....	26 to 27	.....	26 to 27
So. Carolina Acid Phosphate	.....	.....	.....	13 " 16	12 to 15	1 " 3
Florida Land Rock	.....	.....	.....	33 " 35	.....	33 " 35
Florida Pebble Phosphate	.....	.....	.....	26 " 32	.....	26 " 32
Florida Acid Phosphate	.....	.....	.....	14 " 19	13 to 16	1 " 3
Tennessee Phosphate	.....	.....	.....	34 " 39	.....	34 " 39
Tennessee Acid Phosphate	.....	.....	.....	14 " 19	13 to 16	1 " 3
Bone-Black (spent)	.....	.....	.....	32 " 35	.....	32 " 35
Bone-Black (dissolved)	.....	.....	.....	17 " 19	16 to 17	1 " 2
Bone-Meal	$2\frac{1}{2}$ to $4\frac{1}{2}$	3 to $5\frac{1}{2}$	.....	20 " 25	5 " 8	15 " 17
Bone (dissolved)	2 " 3	$2\frac{1}{2}$ " $3\frac{1}{2}$	.....	15 " 17	13 " 15	2 " 3
Peruvian Guano	6 " 10	$7\frac{1}{4}$ " 12	$1\frac{1}{2}$ to 4	10 " 15	.. 8	2 " 7

COMPOSITION OF FERTILIZER MATERIALS USED AS SOURCES OF POTASH.

	Pure Potash, (K_2O) Per Cent.	*Lime, Per Cent.*	*Nitrogen, Per Cent.*	*Ammonia, Per Cent.*	*Phosphoric 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 Magnesia	27 30	0.85	.....	.....	....	1.5 " 2.5
Carbonate of Potash Magnesia	18½	.....	.....	.....	.....	.....
Kainit	12.4	1.12	.....	.....	.....	30 to 32
Sylvinit	16 to 20	.....	.....	.....	.....	42 " 46
Cotton-Seed-Hull Ashes	20 " 30	10	.....	.....	7 to 8	.....
Nitrate of Potash or Saltpeter	43 " 45	.....	13 to 14	16 to 17	.....	.....
Wood-Ashes (unleached)	2 " 8	30 to 35	.....	.....	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.*	*Equivalent in 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

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