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Grasses and Forage Plants: Part 2 - Leguminous Plants

University of Tennessee Agricultural Experiment Station

J B. Killebrew

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Cutting Alfalfa.

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GRASSES AND FORAGE PLANTS

By J. B. KILLEBREW, A.M., Ph.D.

PART II.—LEGUMINOUS PLANTS

KNOXVILLE, TENN.
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1899

THE AGRICULTURAL EXPERIMENT STATION

OF THE UNIVERSITY OF TENNESSEE.

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The Station has facilities for analyzing and testing fertilizers, cattle foods, milk and dairy products; seeds with reference to their purity or germinating power; for identifying grasses and weeds, and studying forage plants; for investigating the diseases of fruits and fruit trees, grains and other useful plants.

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PART II.

DOMESTICATED LEGUMINOUS PLANTS.

The leguminous plants embrace not less than 6500 species. They are widely distributed in every quarter of the globe and vary in size from a lowly plant that scarcely lifts its head above the surface to the majestic locust trees found in tropical lands.

Of the leguminous plants Dr. Gattinger in his Tennessee Flora enumerates 35 genera, 85 species and 3 varieties, making 88 species and varieties. Nine of these have been introduced, three are woody plants, three are trees and seventy-two belong to the flora found in the counties immediately around Nashville.

For the making of hay and for pasturage many of these leguminous plants rank with the best domesticated grasses in nutritive elements, and in their capacity for furnishing forage for live stock. As a restorer of worn-out soils leguminous plants are far more valuable than the grasses. Every leguminous plant is endowed with nodules, the habitat of special microbes, which have the power of catching free nitrogen from the atmosphere, this nitrogen being assimilated by the plant itself. These microbes are believed to embrace as many species as there are species of leguminous plants, and the cultivation of one leguminous plant is thought to destroy the microbes of another. "Clover sick" is probably due to the destruction of the clover microbes, or bacteria. To preserve the fertility of the soil it is important that leguminous plants become one of the crops in rotation, and there should also be a rotation in the leguminous crops themselves. Clover should alternate with cowpeas, soy beans, crimson clover, etc. Nitrogen, in leguminous plants, occurs in the form of proteids, which make meat and milk, and so is the most valuable constituent in the food for cattle, especially for milch cows. The dry forage of leguminous plants is worth nearly twice as much for such stock as dry hay.

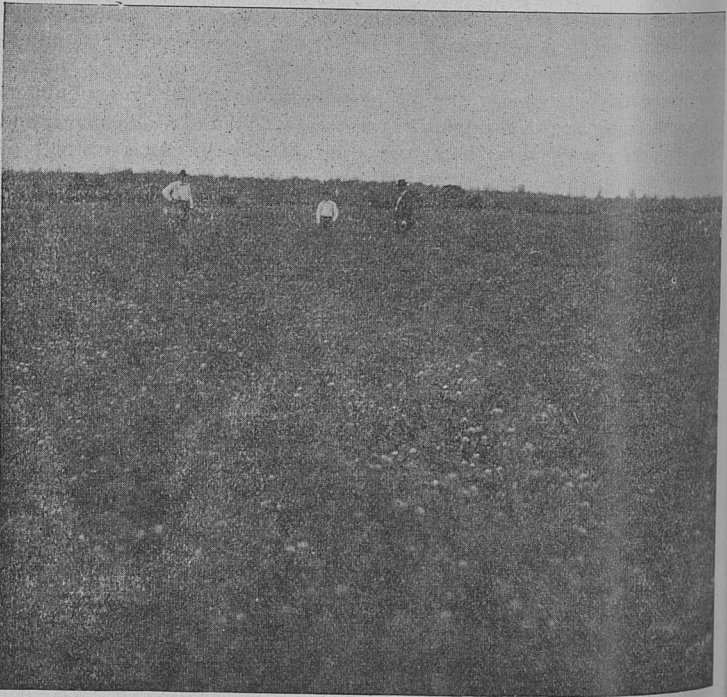
The following domesticated leguminous plants will be discussed in the order named in this bulletin:

- Red Clover—*Trifolium pratense*.
- Crimson Clover—*Trifolium incarnatum*.
- Bur Clover—*Medicago maculata*.
- Alsike Clover—*Trifolium hybridum*.
- White Clover—*Trifolium repans*.
- Sainfoin or Esparcet—*Onobrychis sativa*.
- Melilotus—*Melilotus alba*.
- Lucern, or Alfalfa—*Medicago sativa*.
- Cowpeas—*Vigna catjang*.
- Peanuts—*Arachis hypogæa*.
- Japan Clover—*Lespedeza striata*.
- Soy Bean—*Glycine soja* or *Soja hispida*.

Short mention of other domesticated leguminous plants will also be made.

RED CLOVER—(*Trifolium pratense.*)—(Pasture and Hay.)

There is no forage plant in all respects so useful to the American farmer as red clover. It has been well styled the corner stone of agriculture and this because it seems to be the concomitant or forerunner of all successful agriculture. In the border States a farmer who is too poor to sow clover is too poor to own a farm. In our climate and soils this plant is well nigh indispensable. The soils of Tennessee fatten upon it. It furnishes an immense amount of grazing, yields an abundance of nutritious hay, and is a profitable crop, considered with reference to the seed alone. But beyond all these it acts as a vigorous ameliorator of the soil, increases more than any other forage plant probably the amount



CLOVER FIELD AT SOMERVILLE, TENN.

of available nitrogen, supplies humus and so becomes an important agent in keeping up the productive capacity of the soil, increasing the yield of other crops and thus adding to the prosperity of the farmer who sows it. Scientific inquiry has about reached the conclusion that the little excrescences or tubercles upon the roots of clover enable the plant to utilize the free nitrogen of the atmosphere as an important element of fertility. It must be borne in mind that a soil may contain the most abundant supplies of every substance demanded by a growing plant, and yet that plant may perish of starvation. If these substances are not in a condition to

be dissolved by rain-water or the plant juices they are as impotent to support plant life as the uncrumbled surface of a desert rock. The food must be prepared for plants just as the corn and wheat must be shucked or threshed, ground and baked for the use of man. Clover acts as the miller and baker for other crops. It prepares the food so that it becomes available and digestible by them.

SOILS ADAPTED TO ITS GROWTH—Red clover is a biennial plant, which under judicious tillage, may be made practically a perennial, and is specially adapted to calcareous or limy soils; but it will grow well upon sandy soils, when a "catch" is secured, by the application of a top-dressing of gypsum or barnyard manure. I have seen it growing with vigor upon the feldspathic soils of Johnson county, upon the sandstone soils of the Cumberland table-land, and upon the sandy loams of West Tennessee; but it finds a more congenial soil in the clayey and limy lands of the valley of East Tennessee, or on the red soils of the Highland Rim, and grows most luxuriantly on the limestone loams of the Central Basin. But the deep, black, porous soils of this division are not suited physically for the growing of clover. Such soils become very dry in summer and open in great cracks or fissures. The clover grows well enough at first but is apt to be killed by the dry, hot weather of summer. The clayey lands of West Tennessee, containing nodules of calcareous matter, have no superior for the production of clover. It often grows upon these lands from four to five feet in height, and when it falls forms a mat of great density and thickness. As much as four tons of clover hay have been taken from a single acre. There is also a soil derived from the Dyestone or Clinton formation in East Tennessee that grows clover with surprising luxuriance. On such soils in McMinn county, the ordinary red clover sometimes grows six feet in height. Probably three-fourths of the lands in Tennessee will grow clover remuneratively, and of the soils that will not a large portion are included in the old gullied fields that constitute the shame and mark the shiftlessness of too many farmers. It may be set down as an infallible rule in the State of Tennessee that good farming and abundant clovering go together.

SOWING CLOVER—Clover may be sown in Tennessee upon wheat, rye or oat fields, or alone. Instances have been reported where a splendid stand was obtained by sowing after cultivators in the last working of corn in July. This is unusual however. So is fall sowing. The best time to sow is from the first of January until the first of April. If sown in January or February, the seed ought to be sown upon snow. This is not only convenient in enabling one to distribute the seed evenly over the land, but the gradual melting of the snow, and the slight freezes, bury the seed just deep enough to insure rapid germination when the warm days of March come on. For the same reason, if sown in March, the seed ought to be sown when the ground is slightly crusted by a freeze. If the sowing is deferred until too late for frosty nights, the land should be well harrowed and the seed sown immediately after the harrow. Upon land seeded to wheat, this harrowing will not only serve to secure a good stand of clover, but will add greatly to the yield of the wheat. It will hasten germination and cause a larger proportion of seed

to grow to harrow the land after the seed is sown. With oats, the seeds should be sown after the last harrowing or brushing, with a slight after-brushing to cover them.

It often happens when clover seed is sown with wheat or oats, especially if the land be much worn, that a "catch" will not be obtained. The practice is so universal throughout the country of sowing clover with small grain, that many farmers labor under the impression that this is the only way of seeding land to clover. This idea is erroneous. A better stand of clover with less seed, may always be secured by sowing upon land prepared for clover alone. An excellent catch upon "galled" places may be had by breaking the land well and sowing the seed without any previous or after harrowing. In nine cases out of ten a stand will be secured in this way upon soils where clover sown with small grain will fail in nine cases out of ten. Clover seed sown upon a well harrowed stalk field will, in most cases, secure a stand.

The quantity of seed to sow per acre depends upon the character of the soil, its state of pulverization and also upon the fact whether the land has ever been seeded to clover. Upon good, fresh, rich soils where clover has not been previously grown, one bushel for eight acres should be sown. If the soil is thin and unproductive one bushel for six acres ought to be sown. If the land has been regularly rotated with clover, one half the quantity of seed mentioned above will suffice; sometimes much less. Clover seed, owing to the large quantity of oil which it contains, is nearly indestructible when placed ten or twelve inches beneath the surface.

The frequent failure to secure a good stand of clover should admonish the farmers to exercise more care in the seeding. When sown late in the spring many of the seeds sprout and are killed by dry weather. It would be all the better if the clover seed could be buried a half inch (or even an inch on loose soils) beneath the surface after the middle of March. The common practice in England is to sow not only clover, but all grass seeds, with oats or barley in spring. After the seeds are sown the field is harrowed and then rolled, so as to cover them and at the same time to smooth the surface of the field. While upon well prepared soils a bushel to eight acres is sufficient, yet a bushel to six acres will, in a majority of cases, give better and more satisfactory results. In England 24 pounds are usually sown to the acre when the crop is intended for hay. The smaller the stem the more acceptable it is to cattle. When the clover is thin, the woody fibre is greatly increased. There is no greater blunder committed by the farmer, than to be sparing of grass seed. It is difficult for grass to be too thick. The plants shelter one another; they retain for a longer time the dew and moisture when thickly set, and they must push upward as there is no lateral space to occupy.

GROWTH AND MANURE—Red clover rarely makes much growth the first season, if sown with grain. Should the weather be seasonable after harvest, and the land fertile, it will sometimes attain the height of thirty inches and put out blooms, making an excellent fall pasture. When sown alone, it will always blossom in August.

Sheep and hogs are very injurious to young clover, and should never

be allowed to run on it until the second year. Grasshoppers often eat out the crown and destroy it. Dry weather in a stubble field where the rays of the sun are reflected and repeated a thousand times from the surface of the yellow stubble, is very trying to its vitality. Yet if the land has been well and deeply broken and is moderately, fertile, a sufficient stand may be depended upon.

As soon as the clover begins to grow, in early spring, an application of two bushels of gypsum or land plaster, upon granitic or sandy soils, is absolutely necessary to get a good growth.

An application of gypsum is rarely beneficial upon clayey loams, but its effects are very apparent on strong limestone soils, such as are found in the Central Basin. where from 50 to 100 pounds per acre should be sown upon clover. On the chocolate colored soils of Warren, Montgomery, Stewart and Robertson counties, gypsum benefits clover very little. Upon the soils of the Unaka and Cumberland mountains, it is indispensable, to secure a remunerative yield of foliage.

Mr. C. W. Johnston in a prize essay on the application of gypsum to the artificial grasses, says that it should not be considered as a stimulant, but as an essential food. "When the farmer finds that those fields which once produced luxuriant crops of red clover, or sainfoin, will no longer yield them in abundance; if he notices that the young plants spring up very numerous, but die away as the summer advances; if he finds that his fields will only grow clover successfully once in eight or twelve years, and that his neighbors tell him his land is tired of clover, or "clover sick," he may then safely conclude that his crops have gradually exhausted his land of sulphate of lime; and he may, with every confidence of success, apply a dressing of gypsum by scattering it evenly over the ground on the clover plants at the rate of 200 pounds per acre, taking care to choose a wet morning for the application; and this may be done at any season of the year, but it is best either in April or the first days of May." In Tennessee gypsum should be sown in the spring as soon as the clover begins to grow, and again the following spring.

Mr. Smith, of Highstead, England, states that he found the greatest benefit from the use of gypsum to his clover leys; for where the simple soil produced one ton only per acre of hay, the portion of the same soil to which five bushels per acre of gypsum had been applied, yielded three tons—the first only yielding 20 pounds of seed while the latter produced 105 pounds. Mr. Smith, too, first noticed what observation has since confirmed—that cattle, horses, etc., always prefer the clover growing on the portion of the field that had received an application of gypsum to any other. The same remark is made by those who spread coal ashes, which contain a considerable quantity of this earth, on their grass leys.

Red clover, the second year, has two growing seasons. It makes its most vigorous growth from the first of April until the 15th of June, beginning to bloom usually in the latitude of Tennessee about the 15th of May, and attaining its full inflorescence about the first of June. After this, unless pastured by stock or cut for hay, the heads begin to dry up, and stems and leaves begin to fall, forming a mat upon the land. Sometimes this mat is so thick as to catch and concentrate the heat of the sun

to such a degree as to scald the roots and destroy the clover. Usually it is best after clover has attained its full bloom, either to cut it for hay or pasture it until about the first of July, when the stock is removed, or the clover hay cured and taken off. If there is rain enough, a second crop will spring up from the roots at once. This second crop is the most valuable for seed, the seed maturing about the last of August and sooner, if there be copious rains. To make the most abundant yield of clover for grazing, it should be allowed to grow all it will, but never let it make seed, always grazing it down when in full bloom. When grazed down, take off the stock until it blooms again. Several successive crops may thus be made during the summer. The crop of August is unfit for horses or mules, the seed having the effect of salivating them to such a degree as to cause them to lose flesh.

Clover has no superior as a grazing plant. When in full vigor and bloom it will carry more cattle and sheep per acre than blue grass, herd's grass or orchard grass. After it has been grazed to the earth, a few showery days with warm suns will cause it to spring up into renewed vitality, ready again to furnish its succulent herbage to domestic animals. Though very nutritious and highly relished by cattle, it often produces a dangerous swelling called hoven, from which many cows die. When first turned upon clover, cattle should only be allowed to graze for an hour or two, and then be driven off for the remainder of the day, gradually increasing the time of grazing, until they become less voracious in their appetites, never permitting them to run upon clover when wet. Clover made wet by a rain at midday is more likely to produce hoven than when wet by dew. If taken in the stomach of cattle when wet by rain at midday, and after the stalks and leaves are heated by the sun, fermentation in the stomach will occur much sooner than when the herbage is cool, though wet with the morning dew. Cattle are more easily affected by clover than horses, because, being ruminants, they take in the clover rapidly, filling the stomach at once, without chewing. Digestion is for the time checked and a rapid fermentation sets in.

Stock should never be turned upon clover until it blooms. The practice of many farmers, to turn all the stock upon a clover field early in April, is very destructive. The crown of the clover is eaten out, causing it to perish. The tread of heavy cattle has the same effect.

As a soiling crop red clover is excelled by no crop grown in the South. The practice of soiling in thickly settled communities is one much commended by agricultural writers. A half-acre of clover on a rich soil will supply one cow throughout the months of June, July and August, if cut off and fed in a stall, while twice the amount in pasture, according to some English experimenters, will barely subsist a cow during the same period; but this will depend, of course, upon the luxuriance of the growth. Soiling—that is cutting the grass and feeding it green—is a very desirable practice, near small towns, where many persons own small lots and desire to keep a milch cow. No other plant, perhaps, will produce a larger flow of milk.

EFFECTS OF CLOVER UPON SOILS—Numerous facts have taught the farmers of every country where agriculture has flourished, that

in many cases the value of the aftercrop depends upon the preceding crop. In other words a proper rotation is a necessary antecedent to successful farming. The cultivation of some crop with extensive root ramifications, will prepare the soil for the subsequent growth of a cereal. But the farmer should not deceive himself. Every crop takes away a part of the available plant-food and the field has not increased in fertility, but the plant-food has been made more readily effective for the production of a crop. "The physical and chemical condition of the fields has been improved, but the chemical store has been reduced." "All plants," says Liebig, "without exception, exhaust the soil, each of them in its own way, of the conditions for their reproduction."

A field then, which produces more kindly after rotation, is not necessarily more fertile, but is in better physical condition. It has already been mentioned, that the mechanical effects of clover upon soils is not the least among its valuable properties. The reaction rendered possible by the penetration into the soil of the long tap roots and the effect of the dense shade upon the land have a tendency to increase the productiveness of the soil.

Clover, however, is the greatest of all fertilizing plants. Other leguminous plants as well as clover collect nitrogen from the atmosphere and save it, but clover more rapidly improves the physical condition of the soil. A crop of clover taken from the land, while it abstracts some of the elements needed for plant growth, yet, in increasing the content of nitrogen, it gives back to the soil much more of value than it takes away. Clover has been called "a trap for nitrogen," which it catches and preserves for the nourishing of growing crops. Dr. Kedzie says: "Clover hay or sod contains enough phosphoric acid for more than double an average crop, enough nitrogen for more than four average crops and enough potash for six average crops of wheat."

The analysis of red clover indicates what manures would increase its growth. Sulphate of lime or land plaster, the phosphates, wood and coal ashes, are all excellent top dressings for the clover field. Common stable manure, containing as it does all the elements of a good fertilizer, is suitable as a top dressing for any pasture or meadow.

Sulphate of lime is found on limy or sandy soils, to largely increase the growth of clover. When used on a wheat field seeded to clover in early spring, a "catch" of clover will be secured on the thinnest spots and it will grow luxuriantly after such top dressing. The greatest benefits from an application of commercial fertilizers upon wheat are often obtained in this way. A good stand of clover, however secured, is the best possible preparation of land for a succeeding crop of wheat. And this arises not only from the available nitrogen which a clover crop supplies, but from the thorough subsoiling which is effected by the deep, penetrating tap-roots of the clover. They often descend to the depth of four feet in search of food, while its broad leaves "absorb carbon from the atmosphere, changing it into solid matter, and causing elements in the soil to assume organic forms, rendering them more available as food for other crops." If the soil be robbed of its fertility, the deficient elements must be added before clover will "take."

As clover derives a large percentage of the constituents necessary to its growth from the atmosphere, it is all important that there should be a good top growth. Its value as a renovator of the soil depends largely upon the quantity of the roots, and the roots will always be proportioned to the quantity of foliage. For this reason it is better to cut clover off than to feed it off. A writer in the *American Cultivator*, speaking of this subject, says:

"Where a clover sod is desired for future grain or other crop, it will be found that the cutting of clover is generally better than feeding it off because every leaflet upward has rooted downwards, and if a leaflet be taken off the rootlet will not grow, so that if sheep or pigs be fed upon the surface, the constant cropping of the leaves diminishes the under production. Always feeding the top will leave but few roots below. This was illustrated by a practical experiment on a field of clover, divided into two parts. The whole was cut in July; half was left to grow again and the other half fed off. In October the roots of each division were dug up, carefully cleaned and weighed, with a result that showed a proportionate weight of 3,920 pounds to the acre where the clover was cut once and fed afterwards, while the part on which the clover was cut twice yielded at a rate per acre of nearly 8,000 pounds of roots. The system of cutting instead of feeding resulted in leaving two tons extra of vegetable matter, valuable in nitrogen, and which had a perceptible effect on the corn crop that followed."

WHEN TO CUT AND HOW TO CURE CLOVER HAY—
Clover for hay should be mowed at the time when the nutritive elements—those elements which give strength and produce flesh—are at their maximum. Those who are in the habit of feeding stock find that clover cut about the time of full bloom, when a few of the blooms begin to dry up, and just as the reproductive functions are being brought into play for the maturing of seed, will, pound for pound, produce more fat and muscle than that cut at any other stage. The only art in curing hay is to retain as many of the life-giving constituents in it as possible, or to preserve it as nearly as practicable in the same condition in which it is cut, with the water only abstracted.

The plan generally adopted is to mow the clover in the morning and let it lie in the sun several hours until a wisp taken up and twisted will show no exudation of moisture. It is then thrown up into small cocks, say four feet in diameter and four feet high. In these, unless there is appearance of rain, it is allowed to remain for a day or two, when it may be hauled to the barn and stored away without danger of damage. Care should be taken not to let the dew fall upon it as it lies scattered by the mower after it has begun to cure. The dew of one single night, under such conditions, will blacken the leaves and destroy the aroma for which good clover hay is so much prized.

Another plan practised is to mow it and let it lie just long enough in the sun to wilt, and then carry it to an open house and lay it upon beams or tier-poles, where it can receive the free action of the air. After a few days it may be packed down without any danger of fermenting. Cured in this way, in the shade, it retains its green color, is fragrant, and

makes a most excellent feed. The only objections to this plan are the great amount of room under cover required for curing, and the additional burden of hauling while green.

Another plan is to haul it up as soon as it wilts, using about half a bushel of salt to the ton of cured hay. A layer a foot or more in thickness is put down, over which salt is scattered pretty freely, then another layer and salt, continuing to repeat the operation until the space set apart for hay is filled. A rapid fermentation will ensue, and the hay will be cured by the heat of this fermentation, the salt acting as a preventive against putrefaction. Instead of salt, layers of wheat straw may be substituted. By using straw the clover may be cured in the field. The quantity of straw to be used in the rick or stack depends upon the moisture in the clover—the greener the clover the thicker should be the straw. The straw will act as an absorbent and during the process will itself be greatly increased in value as food for stock, having imparted to it the flavor and aroma of the clover plant.

One of the largest farmers in Maury county, Tennessee, whose land is admirably adapted to the growth of clover, and who has made a great success in saving clover hay, gives the following account of his method of saving it:

“Clover should be cut when about half of the first blooms are dead, to make the best hay. My plan is to begin cutting early in the morning and continue throughout the entire day. The next morning just before the hay becomes entirely free from the dew I rake it into windrows, then put it into shocks where it remains from 24 to 36 hours. I never permit it to remain spread out on the ground until it becomes dry and crisp from the heat of the sun. Putting it up into shocks while yet green or half cured causes fermentation to begin immediately, but this fermentation is not excessive because the air can penetrate it and keep it comparatively cool. I rehandle it after it has begun to heat, which airs it well and it then remains perfectly bright and sweet after it is put into ricks or barns. No other rehandling is necessary except that which is incident to the hauling and storing of it. In threatening weather I put up my hay in the barn after one day's sun, but in that case I rehandle it after 36 hours and it is thus aired thoroughly. My opinion is that fermentation, if left undisturbed, will injure the hay for food because it usually induces mould and in this condition it is objectionable to stock. I never stop cutting hay for rain, though a protracted rain will ruin it. One rain only will make it of dull color, but does not materially change its value as food for stock.

“There is no hay known, in my opinion, to southern farmers that equals good clover hay for stock. I prefer it to choice timothy for regular feeding. It is the principal hay, which I use for horses, mules and cows and they never seem to tire eating it and always keep healthy and fat. In the management of my clover fields I usually sow about 50 pounds of gypsum per acre upon young clover and repeat early in March the following year. This gives a very large yield of hay. My clover crop is probably as profitable as any crop I grow. I estimate its value one year with another at \$20 to \$25 per acre.”

Hon. L. N. Bonham, of Oxford, Ohio, uses a different method in putting up clover hay. He says:

"For several years I put up clover hay as did my father and other Jersey farmers. I have long since abandoned their method and now put my clover hay in the mow the same day it is cut. The hay is far better, and the labor and risk in making it are far less. I select a bright day and start the mower as soon as the dew is off. By 11 o'clock I have cut as much as can be hauled in between 1 and 5 o'clock. The clover is then all turned and shaken up loose before we go to dinner. By one o'clock it is dry enough to rake into windrows if the day is an average hay day. No time is lost now in getting it into the mow. The hay is warm and free from external moisture. The warmer it is the less moisture is left on it. By five o'clock we have it all in the mow, if we can. If not all in then, we prefer to leave it in the windrow until near noon the next day. After we stop hauling, at 5 p. m., the mower is started to cut what we can haul in the next day. The clover cut so late in the day is not wet with dew, and will not wilt enough to be blackened by the dew. It will be ready to shake up and spread out before ten o'clock the next day, and by one o'clock we can begin to haul it into the mow.

"The clover hay thus made goes into the mow bright and with every leaf and head left on it. The secret of the whole business is, it is free from external moisture, while the warmth of the hay when it goes into the mow hastens the approach of the temperature of the mass up to 122 degrees when the germs which cause increased fermentation are destroyed, and the hay keeps bright and sweet, and comes out fragrant clover, with all the heads and leaves of good color. My mow is 28 by 28, and as tight as good siding and strips painted can make it. There are no windows in the sides to let in air. The clover is put in as compactly as we can get it, to save room, and kept level, to have the heat uniform. Sometimes we sprinkle a half gallon of salt to the load when putting into the mow, but this is of doubtful value.

"To exclude the air from the top of my clover mow, I often cover with straw. But this does not pack closely. I find it better when hauling in wheat to fill up over the clover with wheat. This excludes air, and packs the clover so that it keeps bright to the very top. The old theory that the mow must be open and the clover thrown in loose, and treated to 'plenty of salt,' which may mean much or little, is exploded. Green clover will keep green in the silo if well packed and the air is excluded. Clover hay, put into the mow warm and dry, the day it is cut, will keep brighter and purer and sweeter than if cured longer in the field.

"The trouble, however, in farmers adopting the method I have successfully used, is they do not attach enough importance to the fact that the conditions named must be followed. It will not do to cut clover in the morning and haul it in after sun-down. It will surely mould or come out brown or fire fanged, simply because dew falls at five o'clock. Nor can we cut clover and put in the mow the same day without favora-

ble conditions of sun and air. In neither case will the hay go in free from external moisture."

It should always be borne in mind that clover hay will not shed rain. The best farmers now build open sheds in the field for storing it. When stacked it should either be thatched or have a thick top-covering of wheat straw or other hay. The tedder is thought by many to be indispensable in saving good clover hay. Unquestionably it is of great service, and the hay made by the use of the tedder in dry, hot weather, is superior to that made without, but good hay can be and is made by many farmers who never saw a tedder. Clover hay is more difficult to cure than hay from any of the true grasses, and this arises from the fact that it contains more water than the true grasses. For this reason also, it is more difficult to keep, being more liable to damage in the mow. It will not bear handling or transportation except when damp and while it will always be a favorite hay for home consumption, it will never be shipped to distant markets like timothy hay. For horses and mules clover hay is very nutritious. Many persons make a crop by feeding on clover hay without any grain whatever and the working stock keep fat. Clover is also a superior hay for cattle, producing in milch cows a fine flow of milk. It makes the best hay when the stalks are small and stand thickly upon the ground.

SAVING CLOVER SEED—All the clover seed used in the border states should be produced in them. Besides, there should be a large surplus to be sent to other markets, for no section of the Union will produce, acre for acre, a larger quantity. Six bushels per acre have sometimes been gathered, although the usual average is about three bushels. Large quantities are grown in and shipped from Bedford, Maury, Williamson and other counties in Tennessee.

As the first crop of clover, coming to maturity in June, will not perfect its seed, this must be removed either by feeding or by mowing for hay. The seed must be gathered from the second crop. The quantity of seed will depend much upon the weather. Should there be much rain or heavy winds, the yield will be small, but when the weather has been fine and calm and the seed free from dock or other noxious seeds, the crop will be as remunerative as any other grown by the farmer. A bushel of clover seed will weigh usually about 64 pounds, though 60 pounds is the standard bushel by the statute regulation.

The second crop of clover should be allowed to stand until the husks have become quite brown and the seeds have passed the milky state. It should then be mowed and permitted to lie upon the ground until it is well cured. After it is cured rake it up into swaths. Rain will rather benefit than injure it, making it easier to separate the heads from the haulm, which is done by passing through an ordinary wheat separator. A clover huller attachment is adjusted to the separator below the vibrator, which hulls the seeds, and they are separated from the chaff by the fan, care being taken to shut off as much air as possible by closing the sliding doors. Machines are now made especially for threshing clover seed.

The crop of seed can be largely increased by mowing or feeding off the first crop of clover about the first of June, and then top-dressing with

stable manure. The earlier the first crop is cut the larger will be the crop of seed. By treating the clover fields in this way, the yield of seed is often doubled. Uplands will yield more seed than bottom lands, but they should be enriched by a liberal application of manure. About the first of September is the time to mow for seed, and the straw will thresh all the better for being exposed to the weather for three weeks. The threshing is usually done in the field, though the haulm may be hauled up after being thoroughly dry, and stacked with a good straw covering, or else stored away under shelter on a good tight floor until it suits the convenience of the farmer to thresh. Care should be taken not to run over or tramp upon the clover after it is dried, as many seeds are thus shelled out and lost. The better plan is to haul to the thresher from the field just as soon as the straw is in a proper condition to thresh. This will save the trouble and expense and loss of handling it twice.

Some farmers prefer to sow seed in the chaff, believing that a better stand of clover is thus secured. Usually about thirty bushels in the chaff are considered equivalent to one of cleaned seed. Of course this will depend greatly upon the yield of seed, and experiments ought to be made to determine the relative amount to sow when in chaff.

It is a curious fact and one, I believe, first mentioned by Mr. Darwin, that the bumble bee plays an important part in the fertilization of this plant. Careful observation has determined the fact that the amount of clover seed gathered from a particular field will, other things being equal, be in proportion to the number of bumble bees that feed upon the flowers. In the act of feeding they gather the pollen from one flower and transfer it to the next one upon which they alight, thus acting as important agents in the fertilization of the flower, and consequently in increasing the production of seed.

CRIMSON OR SCARLET CLOVER—(*Trifolium incarnatum*.)— (Pastures and Hay.)

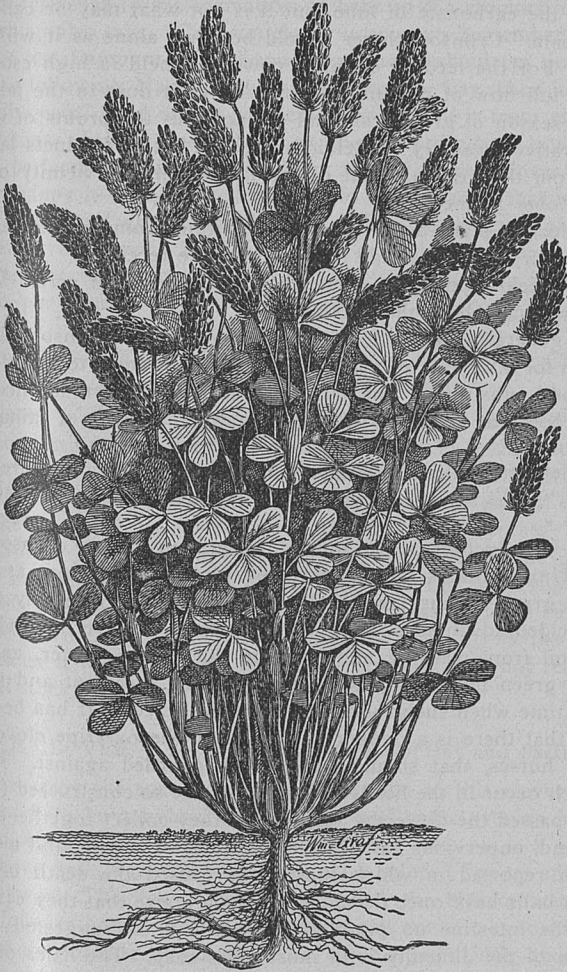
Within the past decade crimson clover has become a staple crop in some of the counties in Tennessee. It is an annual and grows to the height of three feet on good soils. Few things in the vegetable world present a more beautiful sight than a field of crimson clover in full bloom. It seems to be better adapted to southern climates than red clover and it has given satisfaction at the North Carolina Experiment Station and as far south as Louisiana.

Prof. Stubbs, of Louisiana, says: "It is thoroughly at home in every part of the State, making a large crop of excellent hay. A combination of this crop and cowpeas affords the readiest means of quickly restoring worn out lands or of furnishing a continual supply of fresh hay for stock."

A large area of this clover is sown every year in Franklin county, Tennessee, in the Belvidere settlement. In answer to inquiries Mr. Jno. Ruch, of that place, says: "We sow it in August or September, using two or three gallons of seed to the acre. It comes to maturity the last of April or first of May, when it is cut and cured for hay in the same man-

ner as red clover hay. I consider the hay as good, in every particular, as that made of red clover. Crimson clover has given excellent results in Franklin county."

The advantages of crimson clover are chiefly four:



Crimson Clover—*Trifolium incarnatum*.
(U. S. Dept. Agric.)

- 1—It is a good "catch" crop and when a failure of red clover occurs it may be sown upon the same land and so preserve the regular rotation.
- 2—After the clover has been cut in early May, the same land may be ploughed and planted in corn.
- 3—It makes excellent pastures during the fall months after the other green crops have dried up.

4—As a crop for green manuring it ranks high. It is turned under in the spring as it makes its growth during the fall and winter months. In this it differs from all other crops for green manuring.

At Belvidere it is sown on a deep clayey loam impregnated with more or less of the carbonate of lime, but it is not what may be called a calcareous loam. Crimson clover should be sown alone as it will need all the land. For the feeding of milch cows it is held in high esteem as it induces a full flow of rich milk. Growing as it does in the fall, it prolongs the season of green food and so increases the profits of the dairy. A co-operative creamery at Belvidere has its butter products largely increased from the general habit of the farmers in the vicinity of sowing crimson clover in the fall.

This forage plant deserves more attention from the farmers of the South for dairy purposes than it has heretofore received.

It will yield from three to ten bushels of seed per acre. Mr. Ruth says he has made both these extremes.

It is generally believed in those places where crimson clover has been sown for a number of years that though not equal to red clover it is a very good substitute. The farmers who have grown it once feel inclined to continue to grow it, especially when there is a failure of red clover.

A bulletin from the United States Department of Agriculture, recently issued, has this to say in regard to a possible danger in the use of crimson clover:

“The introduction of the annual leguminous plant, crimson clover, into the United States is comparatively recent, but its use as a forage plant and green manure is rapidly extending. This is easily explained by the decided advantages this clover possesses of covering and protecting the soil from washing and leaching during the winter, and of furnishing a green manure for spring crops or a succulent and nutritious food at a time when such food is likely to be scarce. It has been found, however, that there is a danger in the use of the overripe clover, especially with horses, that should be carefully guarded against. The small hairs which occur in the heads of the clover are so constructed (when the plant has passed the flowering stage) that they collect together and form large, round, impervious balls in the intestines of horses, and many cases have been reported in which these have caused the death of animals. When the balls have once developed to such a size that they cannot pass through the intestine no practical remedy can be suggested. But the prevention of the difficulty is in most cases easy. The hairs of crimson clover do not become stiff until the plant has passed the flowering stage and begun to ripen. It should be made a rule, therefore, never to feed crimson clover after the crop has ceased flowering, and especially never to follow the pernicious practice of feeding stock with the straw of crimson clover raised and threshed as a seed crop. By guarding against improper methods of feeding there is no reason why crimson clover should not continue to maintain its well-merited reputation and increase in use as a forage plant and green manure.”

No reports from the farmers growing crimson clover in Tennessee make any mention of having lost stock directly or indirectly by feeding it.

Mr. J. Kaserman, a very successful farmer in Franklin county, Tennessee, who has sown crimson clover for many years, mentions one disadvantage of crimson clover hay, for horses especially, in the fact that the chaff causes a dust, which is injurious to horses. He, however, says nothing in reference to the formation of balls in the stomach of horses. Mr. Kaserman also says: "Crimson clover is sown in September or October and the usual amount of seed sown per acre is about ten pounds. It matures the following May, and ought to be cut for hay when it is in full bloom. The usual yield of hay per acre on good soil is from one to one and a half tons. I do not consider it as good as red clover in sustaining stock. If perfectly cured it keeps about as well as red clover hay, but being very sappy it is harder to cure. I do not consider that it has any advantages over red clover, but it is easier to get a stand of crimson clover than of red clover. It is sown alone or with winter oats to be cut together for hay. In this section the yield of seed has been from four to six bushels per acre."

BUR CLOVER—SPOTTED MEDICK—CALIFORNIA CLOVER.
(*Medicago maculata.*)—(Grazing.)

Bur clover is admirably adapted to lowlands that are well drained. Sown in connection with Bermuda grass it is a great desideratum, inasmuch as it makes its principal growth during winter months and disappears just about the time Bermuda grass begins to grow. Both together make a continuous pasture for cattle and hogs. Horses, however, do not relish it. It is unfit for growing in any place where Bermuda grass will not thrive. In some of the lands on the Mississippi River it would be a valuable addition to the pasture plants. It is an annual and so must be sown every year, but is hardly so valuable as the crimson clover, because it will only grow on very rich soils and is not relished by all kinds of stock. It is worthless for hay.

ALSIKE CLOVER—(*Trifolium hybridum.*)—(Hay and Pasture.)

Linnaeus gave the specific name of hybridum to this clover because he imagined it to be a hybrid of the white and red clover as in its appearance it seems to be intermediate between the two. It is a perennial, has a slenderer stalk, a narrower leaf and paler colored flowers and foliage than red clover. The flower stalks are larger, the blossoms more fragrant and fuller of honey and for this reason it is sometimes sown by beekeepers for the making of honey. The blooms are faintly tinged with pink when they first open. Afterwards they deepen into a pale red. The seed is kidney shaped and is less than half the size of the seed of red clover.

It is a good idea to sow the seed with red clover, as, being a perennial, the clover will cover the ground when red clover runs its biennial course and alsike clover does not get its full strength until the third year after sowing. It does well also sown with orchard grass, for when sown alone the stems are so weak it is liable to fall and lodge. The sturdy culms of orchard grass will hold it up. It consorts well with herd's grass also.

This clover is not well adapted to dry, sandy or gravelly soils with porous or leachy subsoils. It prefers moist clayey soils. It does best in the climate of Tennessee on rich bottom lands, on deep clayey lands, and even in the swampy lands where the wild growth should be exterminated by plowing and the land thoroughly drained of its surplus water. It yields a very superior quality of hay and a great deal of it. A Michigan correspondent of the *Western Rural* mentions four tons of finely cured hay as having been cut from one acre of land where the soil had been deeply broken and the land was rich, moist and underdrained. It grows to the height of three and a half feet on such land and much thicker than red clover. It stands dry and cold weather better than any other clover, is not easily winter killed and is a great favorite with those who have tested it. In giving an estimate of its value the correspondent referred to, says:

"For soiling cows, horses, etc., when pastures fail, it is equal or superior to green corn, and attended with much less trouble in the gathering and feeding. During the past year, I cut three crops from the same ground, standing at the first cutting from two to three feet in height; last cutting one foot in height, as thick as it could stand, small, delicate stalks, with numerous branches, and perfectly glorified with a mass of small peach-blow colored blossoms, filling the air with the most delightful and exhilarating perfume, and swarming with bees every fair day. The root is like that of red clover, but longer and more fibrous. The haulm is small, tender and nutritious; when well cured, as it should be, in full bloom, every part will be eaten with avidity by all kinds of stock.

There is no plant known that will produce so much good honey, butter, cheese, beef, mutton, wool and hay per acre, as this plant, not even excepting corn. In using the latter for soiling, you get only the haulm, while in the alsike you get the haulm and a large yield of honey; and if the ground is prepared as well by deep tilth, manure, and plaster or other fertilizers, as for corn, you will get as much by weight of the haulm.

It bears feeding to an enormous degree. I think its fattening qualities superior to the famous blue grass of Kentucky, and as it will flourish well on such soils as I have designated, from the Gulf to Lake Superior, farmers can easily divine its immense advantage to their pockets. Besides, the expense of 'seeding down' every three or four years is saved. It is a great renovator and disintegrator of hard, tenacious soils. Its long tap roots and numerous fibres reach deep for its pabulum, and thus loosen the soil and endure drought well. Some think there are two kinds of this clover. I think not. The difference in growth, etc., in diverse localities, is owing to the character of the soil. I never saw any but the large kind on land once covered with beech, maple, oak, bass, lever wood, etc., and I never saw any but the small kind on light, sandy and gravelly soils. Also on pebbly soils with calcareous debris and good tenacious subsoil it succeeds well."

This clover is very prolific in the yield of seed. From three to eight bushels are usually gathered per acre from a good stand. The yield will average probably five bushels per acre. In its capacity for seeding land this is equivalent to about fourteen bushels of red clover seed, as the

proportions are 16,000 of red clover and 45,000 of alsike clover seed in an ounce. The seed varies from a dark green to a violet color; weight 94 to 100 pounds per bushel.

The farmers of the South would do well to try this species of clover by sowing it with red clover or herd's grass in the spring of the year upon bottom land, and upon mellow and moist, well-drained clayey soils. The many moist bottoms along the streams would suit it. The valley of East Tennessee offers some excellent soils for its growth as well as the Highland Rim of Middle Tennessee, and the uplands of Northern Alabama and Georgia.

WHITE CLOVER—(*Trifolium repens.*)—(For Pasture.)

This hardy species of clover grows in almost every part of the United States and Europe. It is said to be the shamrock of Ireland. Various estimates have been made as to its value, many persons claiming that it is totally worthless, while others place it among the most valuable of the grazing plants. In Tennessee it unquestionably stands next to blue grass for pastures. It is to the pasture what red clover is to the meadow. All stock, even hogs, will fatten on it, but after its first inflorescence it salivates horses. To the beekeeper it is very valuable, being one of the best honey-making plants in the South.

It is rarely sown in any of the states, but it comes up spontaneously, sometimes almost disappearing one year and in another year completely covering the pastures and yards. Farmers often speak of white clover years and this is due to the prevalence of early rains in the spring. Whenever blue grass is pastured too heavily white clover comes to its relief and supplies good grazing during the dryer months of summer. It will grow on almost any character of soil, sterile or fertile, cold or warm, moist or dry. It is virtually a perennial plant, which gives it a great advantage as a pasture grass over red clover. Analyses have determined its highly nutritive qualities. It is said to be richer in these than blue grass. It is not fit for a meadow as its dwarfy growth makes it difficult to cut, though hay made from it is said to be excellent. A good pasture of white clover is by no means to be despised by thrifty farmers. The seed may be bought from seed stores and sown at the rate of about one bushel for twelve acres.

The time of sowing is the same as that for red clover.

SAINFOIN OR ESPARCET (Century Diet)—(*Onobrychis sativa.*)—(Hay.)

This is a perennial leguminous plant resembling the pea more than it does clover. It has straggling, smooth, tapering stems from two to three feet long. Its flowery stalks are higher than the leaves, ending in a spike of crimson or variegated flowers. This is what the French call a sacred grass and is considered more valuable in that country than almost any other.

It will grow upon dry calcareous soils, which are too sterile for growing either clover or alfalfa. The soil must be well drained for it dies whenever the ground becomes saturated with water. Sainfoin requires two or three years to arrive at maturity and is rather difficult to

establish because the plants are very delicate when young, but when once established it will last a score of years.

Instances are given in France where it has lasted on a single piece of land, with rich soil, a hundred years. The yield of hay is not so great as that from red clover or alfalfa, but it is of a very superior kind and is more nutritious than that of red clover. It is highly valued as a butter-making hay and its seeds are said to be superior to oats for feeding stock and more nutritious. They are excellent for feeding to poultry to incite them to lay.

Sainfoin will stand a large amount of heat though it is sensitive to cold. The writer has seen it growing in Stewart county, Tennessee, having been brought there by a Swiss family. It would probably grow well in all parts of the South, especially on dry soils. It requires two bushels of seed, as usually cleaned, for sowing an acre and it should be sown from the first of May to the end of June on well prepared land. In order to insure germination the seed must be covered with a harrow. When very clean seed are used half as much as has been indicated will be sufficient.

In all those places where the ground is too dry or too sterile for growing red clover, sainfoin might be introduced with profit. Possibly it would do well upon the benches of the Cumberland mountain and upon the siliceous soils of the Highlands and on the high ridgy lands of East Tennessee where there is some lime in the soils.

Sainfoin will make from ten to twenty-five bushels of seed per acre, forty pounds being the weight of a bushel.

For pasturing it is not a very desirable plant, as it does not have the ability to withstand tramping as well as red clover.

MELILOTUS—SWEET CLOVER—(*Melilotus alba.*)

This forage plant is highly commended as a restorative crop for calcareous soils. It acts also as a drainage plant. The roots descend to the depth of several feet, and, being large, they supply innumerable downward drains for carrying off stagnant water. This gives warmth to the soil and permits the roots of succeeding crops to descend to a greater depth in search of food.

The writer has often grown this in a small way in a garden but his experience is that no stock will eat it. It makes a splendid growth upon rich soils, attaining the height of six feet or more. It starts very early in the spring and soon becomes a conspicuous object with its bluish green foliage. It is said by observant writers that stock will soon learn to eat and relish it. It is a biennial, but it makes a very luxuriant growth the first year and two crops of hay may be harvested during the summer succeeding the spring in which it is sown.

Prof. S. M. Tracy, of the Mississippi Experiment Station, says: "While the hay from this plant will not sell as well as that from Lespedeza, the crop is heavier, furnishes pasture earlier in the spring, and is by far the most valuable crop we have for a natural fertilizer. Seed must be sown in August or February at the rate of half a bushel to the acre."

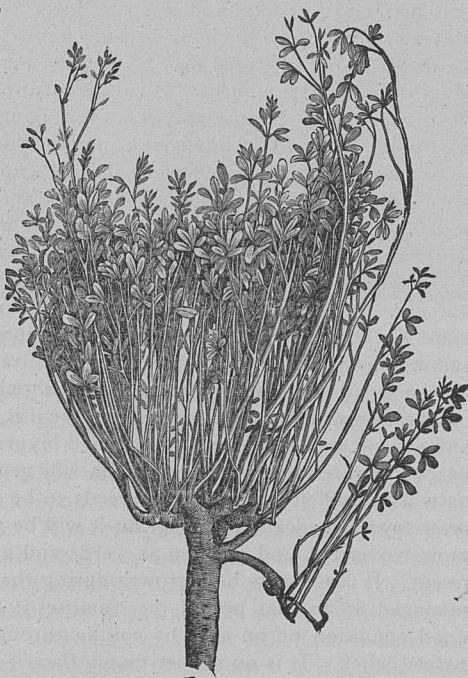
Whether this plant is suitable for feeding stock or not there is no doubt it is an excellent plant for building up worn-out soils, and for this purpose, if for no other, it may be recommended to the farmers of the South for restoring fertility to lands of a calcareous nature. It has a dense foliage; it grows rapidly; its roots are abundant; it has the capacity like clover of gathering nitrogen from the atmosphere; it is more hardy than clover and it is much easier to secure a stand upon run-down soils. It therefore supplies a want for some localities where the land needs humus and an increased supply of nitrogen.

If the statement that stock soon learn to love it is true, it makes it still more valuable to the farmer, for the immense amount of dry forage which can be made from it when grown upon soils even of moderate fertility, is almost incredible.

ALFALFA OR LUCERN—(*Medicago sativa.*)—(Hay.)

Alfalfa, or lucern, stands unrivalled among all the forage plants for its abundant yield, its longevity, its hardiness when once established, its extended habitat and its great antiquity. From the vast highlands of Western Asia it was introduced into Greece at the time of the Persian War, 470 years B. C. It was cultivated extensively by the Romans, was carried into France probably when Caesar invaded Gaul, and then into Spain. From Spain it came to Mexico and then to South America, and from South America to California. It was introduced into New York before it was brought to California.

Alfalfa is now cultivated to some extent in every State and Territory in the Union, and in every State and Territory it has met with more or less success. Wherever it has been well established it has received great favor. It is a child of the sun and revels in heat that would destroy any other species of clover. Its nutritive elements are almost identical with those of red clover. It has one advantage, however, of red clover, in that it is a perennial plant. It does not at all resemble clover in its appearance. The purple pea-like flowers are in long, loose clusters or racemes, and are scattered over the entire plant.



Alfalfa—*Medicago sativa.* (U. S. Dept. of Agric.)

SOILS ADAPTED TO ITS GROWTH—Alfalfa does not grow well on any soil that has a hard pan or on thin soils. It is a deep rooted plant and must have a deep soil. Wherever the roots find a permeable soil they will descend to a great depth and on river banks they have been traced to the depth of 60 or 70 feet. On the rich sandy soils of the South it is invaluable, and will grow luxuriantly and make enormous yields of hay. Underlying rocks or impervious subsoils, or sour, marshy soils, or crawfishy soils, or stiff, clayey soils are fatal to its growth. So is stagnant water. It will grow on favorable soils at almost any height from sea level up to an elevation of 7000 feet.

Alfalfa is not affected so much by altitude as by the depth and warmth of the soil and the depth of the water-table beneath the surface. A rich, sandy loam, limy with a porous subsoil suits it best. A region in which the rainfall is excessive is not favorable for the growth of alfalfa as the plants are quickly killed even by surface water. Nor is the presence of a large proportion of iron in the soil favorable to the growth of this plant. Soils that have a large content of lime, phosphoric acid, potash and magnesia are those best adapted to its growth, but lime seems to be the most essential. A considerable amount of sand in the soil is not objectionable.

HOW TO PREPARE THE SOIL—The soil should be prepared in the most thorough manner. It must be finely pulverized; it must be broken deeply and subsoiled and it must be free from any trash or weeds. It is better to sow alfalfa after some hoed crop, as tobacco, cotton, potatoes and root crops such as beets, carrots, turnips and rutabagas. In the middle South the seed may be sown in the fall or spring. October and March are the best months. It is best to sow the seed in drills from 15 to 20 inches apart. Twenty to twenty-five pounds of seed per acre will be required. When the plants have come up and grown high enough a small cultivator should be run between the rows so as to destroy any grass or weeds that may have made their appearance. Many persons sow the seed broadcast but if this is done it must be upon land that has been kept free from any noxious weeds by crops or clover.

Alfalfa when young is an exceedingly delicate plant and requires much nursing. It is sown by some persons with oats or wheat but in the climate of Tennessee when so sown the young plants rarely survive the summer heat. No crop requires more extraordinary preparation to secure a good stand than alfalfa, but it should be remembered that one preparation will last for a generation, for if it is planted upon suitable soil and a good stand obtained it may yield luxuriant crops for thirty or forty years. It rarely happens that alfalfa will grow tall enough the first year or will be sufficiently free from weeds to be mowed for hay, yet if it has been sown broadcast in the spring it will be wise management to run the mower over the land as often as weeds and grass may grow high enough to cut. It reaches its best growth during the third year. When properly managed up to that period the number of cattle which can be kept in good condition on an acre by soiling throughout the whole season surpasses belief. It is no sooner mown than it pushes out fresh shoots, and wonderful as the growth of clover sometimes is, that of alfalfa is far more

rapid. Upon soils suitable for it it will last for many years, shooting its roots—tough and fibrous almost as those of liquorice—downward for nourishment, until they are altogether out of the reach of drought. In the dryest and most sultry weather when every blade of grass droops for want of moisture, alfalfa will hold up its stems as fresh and green as in a showery spring.

Alfalfa has been fully tested in Tennessee, Georgia, Alabama and Kentucky, and has given great satisfaction. Horses are very fond of it, and it is claimed by many that they require no other food, except when they have been at work. Five tons of good hay may be made to the acre. It is estimated that five horses may be supported during the entire



CUTTING ALFALFA.

year from one acre of alfalfa in full growth. It is ready for the mower a month before red clover, and springs up long before the usual pasture grasses.

ALFALFA FOR PASTURE—Alfalfa is indifferently suited for pasture. The tramping of stock upon the land compacts it so much that the plants rapidly deteriorate. It is often pastured in the west but rarely when it is intended for making hay, as, when once pastured, so many roots are destroyed as to greatly diminish the yield of forage. It is, however, extensively used as a pasture for hogs and they do not seem to injure it as much as heavier stock. One acre of alfalfa will furnish abundant forage for ten to twenty hogs throughout the season. It is a great pork producer.

Mr. Jared G. Smith, the Assistant Agrostologist of the United States Department of Agriculture, states that ten pigs put on a field of it will gain 100 pounds each during the season from May to September. He says that pigs will come out of the field in autumn in capital condition to fatten with corn or small grain. For a hog pasture alfalfa should be mowed once or twice during the summer so that young and tender herbage may be supplied, which is more nutritious than the forage from older plants.

ALFALFA HAY—It requires much skill to properly cure alfalfa hay. Being ranker usually than red clover, and cut when the first blooms begin to appear, it is full of sap and must be managed with great discretion and judgment. The best method of saving the hay is to cut it in the morning after the dew has been dissipated. It should lie in the sun until it is wilted, then raked into windrows; after remaining for 24 hours it may be carried to the barns or open sheds, or stacked in the field. It should be handled just as little as possible. It sheds its leaves much more easily than red clover and, as the leaves are the most nutritious part of the hay, handling greatly impairs its value.

In wet weather it is very difficult to save alfalfa hay without moulding. If a rain should fall upon it, while in the windrow, hard enough to pass through it, it should be shaken up just as soon as the sun comes out, but the sun does great damage to it by drying the leaves and so causing them to shatter when the hay is being handled. Therefore the best plan in such a case is to throw the windrows into small cocks before the leaves are thoroughly dry, but these cocks must be small enough for the air to circulate through them. A hard rain will diminish the value of the hay, under any circumstances, fully one-half. If very much injured it should be used as a top-dressing. It will be more valuable employed for this purpose than for hay. In sub-tropical regions the hay may be cut seven or eight times a year. The writer has seen it growing in the northern part of Mexico with such luxuriance that it seemed almost impossible for an ordinary mower to cut it. In the State of Chihuahua, upon bottom lands where alfalfa is irrigated after each cutting, the yield sometimes reaches fifteen tons in a single year. It is cut every four weeks and the seasons last from February to November. With the stimulating effects of heat and moisture upon the rich soils in the valleys of that region the amount of hay which may be obtained from a single acre is often great enough to supply the demands of a considerable ranch. Alfalfa hay is rich in protein but it is deficient in fat and carbohydrates. It is therefore recommended that some of the coarser fodders, such as wheat or oat straw, millet or root crops, be added to the feed. Prof. Smith says that "one ton of alfalfa hay and three tons of green fodder will furnish food for one milch cow of a thousand pound weight for 136 days without notable loss of any of the digestible compounds in the forage."

There is no better hay, however, for all kinds of domestic animals and especially for young and growing cattle and horses, and for sheep. Alfalfa is well adapted to the use of persons living in small towns or villages who have a lot they wish to devote to hay for a horse and a cow. No other kind of forage crop will equal it in the quantity and quality of

its produce, for all experience has demonstrated that it is as good as the best. From such a lot alfalfa may be cut green and fed every night and morning. Care must be taken, however, not to feed too much, or to feed it to cattle when it is wet, as it is liable to produce bloat or hoven. Sheep are also liable to be affected in the same way, but horses and hogs are not.

Prof. Smith warns the orchardists against planting it in an orchard. The roots descend so much deeper than the roots of the fruit trees that the latter are often killed. It is a good forerunner for an orchard because the roots penetrate the subsoil deeply and in their decay furnish an excellent fertilizer for fruit trees, inasmuch as the alfalfa roots have the power to collect nitrogen from the air just as other leguminous plants, and the field is greatly enriched.

In an analysis of the soils upon which alfalfa is grown it is found that they differ widely in their chemical composition. However, the carbonate of potassium and the carbonate of lime are usually the most abundant ingredients, followed by the phosphate of lime. In clayey and chalky soils the carbonate of lime reaches nearly 50 per cent. Alfalfa will produce the largest quantity of forage for domestic animals and will, at the same time, enrich the lands upon which it is grown.

COWPEAS—(*Vigna catiang.*)—(Pasture, Ensilage and Dry Forage.)

No agricultural product of the South has come so rapidly into well merited and almost universal favor within the past twenty years as cow peas. Though they were introduced into South Carolina over 150 years ago it is but within recent years that they have been grown in all the Southern States. They are now a staple crop in the border states and are grown in every portion of them. Twenty years ago their cultivation was confined mainly to the cotton growing districts, but at present they have taken to a large extent the place of clover, and especially where the lands have become "clover sick," or the clover crop uncertain. Cowpeas, in fact, richly deserve to be called the "clover of the South." It is a leguminous plant and appropriates nitrogen from the atmosphere as all other plants of the same family do. They supply as much humus to the soil as clover, and may be successfully grown upon soils that are so sterile clover would wither and die on them.

There are many varieties or subvarieties of the cowpea. These varieties often take local names derived from the persons who introduced them. The best established varieties for the Southern States are the eureka No. 1, the unknown, clay and black; in the Central and Northern section the eureka No. 2, black, black eye, whippoorwill and Carolina. Some of these are bunch varieties and some trailing or climbing.

SOILS FOR COWPEAS—One of the greatest advantages which the cowpea possesses over every other forage or fertilizing crop grown is its adaptability to every soil. The writer has seen it growing with strong foliage upon a dozen different soils in the State of Tennessee. Some varieties seem to prefer one soil, and some another, but all varieties will make a satisfactory growth upon any soil. But the cowpea is especially valuable for dry sandy soils, inasmuch as clover rarely does well upon such soils.

The peas may be sown at any time from the first of May until the last of July. It takes from sixty to eighty days for them to mature. The soil may be prepared by breaking it with a two horse plow. The peas should then be sown at the rate of one bushel and a half per acre and the ground afterwards well harrowed. Some farmers prefer to drill the peas in rows two and a half to three feet apart, the peas being at intervals of one or two inches in the row. After they have come up a cultivator should be run between the rows. Peas furnish a large amount of feed when planted between the corn rows at the last plowing of the corn. The bush varieties ripen soonest but the California cowpea, the clay pea and the black pea are more profitable as they do not rot so readily in wet weather and will remain sound and keep a large number of stock the best part of the winter after the corn has been gathered. The whippoorwill pea planted by itself will give the earliest returns.

Stubble ground after oats or wheat is turned to good account by breaking and sowing it with peas. The pasture comes on at a time when it is most needed. In the southern part of Tennessee and in Northern Alabama a crop of peas grown on stubble land goes a long ways towards fattening hogs for slaughter.

COWPEAS FOR HAY—It is generally conceded that when properly harvested and cured cowpea hay is the equal of red clover hay in every particular and indeed much richer in protein. The only exception to this general admission as to the value of cowpea hay comes from the Kansas Experiment Station, where it is reported that stock would not eat the vines green, cured or in ensilage.

Recent experiments at this Experiment Station go to show that in two tons of timothy hay and in three tons of cowpea hay, each the product of one acre, the following results were obtained:

FERTILIZING MATERIALS.

NITROGEN	PHOSPHORIC ACID	POTASH	WORTH
Timothy—25 lbs. at 12 cts.	10 lbs. at 5 cts.	18 lbs. at 5 cts.	\$4.40
Cowpeas—58 lbs. at 12 cts.	15 lbs. at 5 ct..	40 lbs. at 5 cts.	9.71

FOOD MATERIALS.

	PROTEIN	CARBOHYDRATES	FATS
Timothy	118 lbs.	1500 lbs.	50 lbs.
Cowpeas	500 lbs.	1700 lbs.	87 lbs.

“We see, thus, that legumes furnish three to four times as much protein and more carbohydrates and fats than common hay. They contain over twice as much nitrogen and twice as much potash. This nitrogen is derived from the air, and removing it does not deplete the soil. The best plan is, thus, to feed leguminous plants and return to the soil the manure, which will still contain four-fifths of all the fertilizing elements. As nitrogen of the air is the cheapest source of nitrogen for plants, so it

is the cheapest source of protein for animals. Soiling is a good plan for dairymen. Save the manure. Grow more legumes. They furnish the cheapest manure for the soil and the cheapest food for stock, because they obtain from the air the nitrogen necessary for plants and animals, which costs 12 to 15 cents a pound."

The director of the Delaware Station testifies that in one experiment the yield of dry hay per acre was 2353 pounds, which contained 58 pounds fat, 147 pounds ash, 320 pounds protein, 1596 pounds fibre and carbohydrates and 232 pounds of moisture. Comparing it with wheat bran it was shown that the bran leads in fat, but in all other respects the dried vines excel.

"The proper stage for cutting peas for hay," says the Hon. H. M. Polk, "is when the first pods begin to turn yellow and while the leaves are green and the stems soft. The greatest care must be exercised in curing cowpeas for hay. The vines are full of moisture and they will not shed water. They should be cut in clear weather after the dew is off and treated very much as clover when cut for hay. The great end to be accomplished is to cure the vines to the extent of getting rid of a part of the moisture without having the leaves burned by the sun. When exposed too long to the sun the leaves become dry, fall off the stems and are lost. When put up too green and too compactly, they heat, and when fermentation of the juices in the vine and unripe pods occurs, the hay is seriously damaged, if not completely spoiled. Mildewed hay of any kind is very poor food for stock, and when eaten at all it is only taken from necessity to ward off starvation. Some planters house their pea hay in open sheds, or loosely in barns, with rails so fixed as to prevent compacting. Others stack in the open air around poles on which are left limbs from two to four feet long, to keep the mass of vines open to the air. The top of the stack must be covered with hay or straw that will shed water."

COWPEAS AS A SOIL RESTORER—Not even clover surpasses the cowpea as a soil renovator. The most badly worn and abused soil may be quickly brought to a condition for profitable production by planting a succession of pea crops upon it. Nor are the best results obtained by plowing under the pea vines when green. Careful experiments made at the Georgia Station show:

(1) That the best disposition of a crop of field peas is to convert the vines into hay.

(2) The next best is to permit the peas to ripen and gather them (or pasture them.)

(3) Turning the pea vines under green gave the poorest economic results.

To which the director adds the following note:

"It may be truly said that the practice of turning under a crop of cowpea vines—ready for the mower, and in a few days for the barn and for the cattle—has no more reason to sustain it than would the practice of turning under a crop of wheat, oats, corn or cotton at its most vigorous stage of growth. Nearly every form of stock food would be a valuable and effective fertilizer if applied immediately and directly to the soil; but the farmer in an economic sense can no more afford to manure his soil

with a crop of pea vines that are ready to mow, than he can to sow good sound wheat bran on his land as a fertilizer."

Of the capacity of the cowpea as a fertilizing agent Prof. Stubbs, of the Louisiana Experiment Station, says:

"Valuable as this plant is for its vine and fruit as food, its superlative excellence lies in the property which it has of restoring worn soils. This property it shares with all leguminous plants, but it surpasses them all in producing the maximum results in a minimum of time. Clovers, trefoils, lupine and alfalfa are used in different countries as soil renovators. They are planted in the fall or spring and occupy the ground the entire season or longer for good results. In the South the cowpea is planted in the late spring or early summer and the crops of vines or peas are harvested or buried for fertilizing purposes in early fall. The growth and development of this plant is both rapid and enormous, particularly when planted on good land. It perhaps assimilates more plant food in a short time than any other leguminous plant.

This plant in common with all others of the pulse family, assimilates the nitrogen of the air and if phosphates, potash and lime be present in the soil, it will grow with great rapidity and luxuriance. The manner of assimilation of nitrogen has recently been patiently investigated by scientists, and while the exact process by which it is accomplished is not yet clearly understood, the primary cause is clearly shown. If a farmer will pull up carefully, with its roots, a pea vine plant from his field, and examine closely each rootlet, he will, if he has selected a healthy growing specimen, find each one covered with wart-like protuberances or tubercles. These tubercles, if examined under a powerful microscope, will be found filled with micro-organisms called bacteria. They are living on the plant and are drawing from it the mineral matter requisite for their existence. Simultaneously, however, they are assimilating the free nitrogen of the air which reaches them through the porosity of the soil. These bacteria have a very ephemeral existence but great facility for rapid multiplication. Hence millions die every few moments. This living together of the plant and its seeming parasite, each acting as a purveyor of food for the other, is a most remarkable discovery made almost simultaneously by Dr. W. O. Atwater of this country, and Hellriegel of Germany. While it has long been known that leguminous plants had these nodules on their roots, and longer still that they were in some way nitrogen gatherers, and therefore soil improvers, yet the relations between these nodules and the plant were determined only a few years since by these distinguished scientists."

Much more might be written to show the great value of the pea crop. Summing up its chief merits we have:

1—The pea will thrive upon every variety of soil and will grow on land too poor to grow clover.

2—It will produce a heavy and rich crop to be returned to the soil in a shorter period than any other green manuring crop.

3—On the same land in one year two crops can be grown, but it requires two years for clover to produce a hay crop, so it will be seen that four crops of peas may be grown in the same time as one crop of clover.

4—The pea crop feeds lightly upon the soil but largely upon the at-

mosphere, appropriating nitrogen through the agency of the bacteria that infest its roots.

5—It is one of the best preparatory crops for wheat, as it leaves the soil in excellent condition, adding a large content of nitrogen which is an essential element in the growing of wheat.

6—The rapidity of its growth makes it the only crop in the South that may be used as a manurial crop between the harvesting of grain and the sowing of it on the same land.

7—It grows as vigorously as clover and in connection with that plant makes the South peculiarly rich in those vegetable agents that improve the soil.

8—It may be grown in connection with the corn crop, furnishing almost as much nutriment as the corn crop itself, with a positive benefit to the land.

9—It is a substantial factor in the production of cheap beef, pork, milk and butter.

10—It doubles the capacity of the land for wintering stock, and gives double the material for making manure heaps.

11—The galled and waste places in the South can be more quickly and cheaply restored by a judicious cultivation of the pea, and by proper rotation of other crops with it, than in any other way.

12—By adding humus it preserves the humidity of the soil and so enables the crops to resist droughts.

13—The vines of cowpeas furnish the very best material for ensilage.

14—The composition of cowpeas and pea vine hay shows that they have a very high feeding value for all domestic animals.

PEANUTS—(*Arachis hypogaea*.)—(Forage for Cattle and Seed for Hogs.)

Peanuts have long been a staple crop in some portions of the South. They were introduced into Tennessee from North Carolina about sixty years ago and for a long time the crop was regarded as one of the most profitable that was made in the State. Within recent years, however, the price has fallen so low that the quantity raised has sensibly decreased.

Two varieties are grown in Tennessee, the red and the white.

The red is an upright grower and produces a small nut, the epidermis or outer coating of which is dark red in color.

The white grows with spreading branches that lie flat on the ground. These branches bear peanuts almost throughout their entire length. It is highly important in growing white peanuts to have the land very mellow so as to permit the bearing "spikelet" to penetrate the ground. The white peanuts command a better price than the red. The pods are larger and whiter and present altogether a much better appearance.

A few Spanish peanuts are grown in places. They are earlier than the other varieties and have an upright growth like the red. They mature a larger proportion of the nuts, so that, though the nuts are small, there are fewer inferior nuts or "pops." There is another advantage which is claimed for this variety and that is that the pods cluster around the vines so closely that when the vine is pulled up nearly every nut clings to it,

making the loss very inconsiderable in harvesting. The flavor of the Spanish nut is very delicate and the kernel does not differ materially in chemical composition from the Tennessee nut, except in its larger content of water. Many people, however, prefer the larger nuts and so these usually outsell the Spanish peanut, but the Spanish variety is a much surer crop. When the white variety by reason of bad seasons makes comparative failure, the Spanish peanut often makes a large yield and it is also more valuable for the feeding of hogs than the white peanuts. It is said that when it is planted in Tennessee in a few years it grows as large as the Tennessee nut. Extremely warm weather is not necessary for the fruitage of the peanut. Cool weather will cause the pods to form as readily as the hottest weather in July. It requires five months to mature the white variety. The Spanish variety will mature in about four months.

The best peanuts are planted early and therefore an early spring is desirable, with no beating rains, especially if the land is strongly argillaceous, for when the ground is baked the delicate young stem cannot penetrate the hard crust. A bad stand then results, which is scarcely to be remedied by replanting. The regions growing the best nuts for eating are embraced in Virginia, Tennessee and Kentucky. The extreme Southern States grow the peanuts fully as well as the states mentioned, but they contain so much oil as to impair their flavor and make them more indigestible. On the other hand, when grown in the far South they are better for fattening purposes, and far better for making peanut oil, which is now regarded as one of the most valuable of the oil products.

Peanuts have been successfully grown in Tennessee for many years in the counties of Perry, Hickman, Humphreys, Dickson, Lewis and Wayne, situated in that natural division of the state known as the Highland Rim, and in a few counties in West Tennessee.

THE BEST SOIL—The best soil for the peanut is a light colored clayey soil, filled with finely-comminuted, cherty, angular gravel, which makes the ground loose and prevents it from baking. The ground should be well drained and light in color, for it is a singular fact that there is a correlation between the color of the soil and the color of the nut, black or deep red soils making a dark colored nut and light or whitish soils a light-colored nut. The darker soils may, and most frequently do, make a larger yield per acre but the nuts do not command such a good price and are classed in a lower grade.

Land with much humus is not suited to the growth of peanuts. The soil should be strong but with a small amount of vegetable matter in its composition. Peanuts, therefore, do not yield well after clover or in freshly cleared lands. In such conditions the amount of vine is excessive and such land is best for growing peanut hay, but the quantity of good peanuts is very small. The best results are obtained by planting the crops after corn or tobacco or potatoes, or after any crop that requires clean cultivation.

TIME AND MANNER OF PLANTING—The land for peanuts in Tennessee is usually prepared during the latter part of April after the danger of frost is passed. It should be well broken and finely pulverized

with a harrow. For white peanuts or the spreading variety the land is checked off in rows two and one-half to three feet apart, and two kernels, after being carefully hulled by hand, are dropped at the points of intersection of the furrows like corn and covered with a hoe to the depth of one and one-half to two inches. In shelling the nuts care must be taken not to break the delicate covering that surrounds the kernels, for this will impair or totally destroy their vitality. If the land after planting should become compacted by a hard rain, a light harrow should be run over it when the land is dry enough to plow, in order to break the obstructing crust, so that the very delicate shoot can make its way to the surface. Red peanuts are planted in ridges like cotton. The rows are run off three feet apart and four furrows thrown on these. The ridges thus made are opened on top by a bull-tongue plow or coulter and the seed dropped at intervals of eight to twelve inches apart and covered two inches deep by a board like that employed for covering cotton seed, or it would be better to procure a one-horse corn planter, adjusted so as to open the ridges to the proper depth and to drop the kernels at the required intervals, and at the same time, cover them. About two bushels and one-half in the hull are required to plant an acre. The brown millipede, the cutworm, the wood mouse, and the mole are all great enemies of the peanut when just planted. Replanting should begin, if the plant does not appear above ground, in ten days.

FERTILIZERS—Many peanut-growers object to the use of any manure whatever, but in this they undoubtedly commit an error. The application of a large amount of stable manure would prove detrimental, but in small quantities it is highly beneficial. The best fertilizer for the peanut is an ammoniated superphosphate of lime with some potash. An application of lime in its caustic state on other than limestone soils during the fall previous to planting would be beneficial. The peanut must have lime, but not too much of it. The heavy limestone soils will produce a great quantity of pops. No top-dressing of lime of any kind should be made. The superphosphate and the nitrogenous manures may be strewn in the furrows at the rate of 300 pounds to the acre. Ashes or kaint will supply potash, and a greater amount than 150 pounds to the acre is not necessary. Cottonseed meal and barnyard manure in limited quantities are excellent fertilizers for this crop. Being a leguminous plant the peanut has the power of extracting nitrogen from the atmosphere

CULTIVATION—If the land has been well prepared before the peanuts are planted the after-cultivation is very simple and inexpensive. The weeds should be kept down by using a narrow harrow or a double cultivator. Many growers use a one-horse turning plow and bar off the soil from the peanuts when they first come up. Afterwards in the cultivation of the white peanut this middle ridge is leveled down with a harrow or double shovel. For the red or upright growers the dirt at the second plowing is usually thrown back to them, if they have attained a height great enough not to be covered up by the process. The peanut will thrive with the same cultivation that is given to corn. Any cultivation is good that will destroy the weeds and keep the land in good tilth, but it must

not be extended beyond the period when the peanuts begin to form, and especially must this caution be observed in the case of the trailing or white peanuts. Level cultivation is far better for the white peanut and equally good for the red.

Many years ago it was thought that a necessary requirement in the cultivation of the white peanut was to cover the bloom. This practice has long been discontinued, for it not only does no good, but it does much damage and decreases the yield of the crop. The "spikelets" form above ground after the fall of the flowers, but the ground should be soft enough to permit the sharp thorn-like points to penetrate the surface. When once beneath the surface the ovary at the end of the "spikelet" begins to enlarge and ripens into a pale, yellowish, wrinkled pod, slightly curved, sometimes contracted in the middle, and containing generally two, sometimes three and rarely four kernels. A dry spring is always desirable for planting and cultivating, but when the "spikelets" begin to push down into the ground frequent showers are indispensable to a large yield.

HARVESTING—The harvesting must always take place before frost, for the nuts and haulm are both greatly injured, if not ruined, by frost. If the fall should be wet, or the peanuts mature very early, many of the first formed nuts will be ruined by sprouting. Dry weather should always be selected for harvesting. It cannot be done when the ground is wet, for then the dirt will adhere to the nuts and ruin them or at least greatly detract from their market value by injuring their color.

The crop of white peanuts is harvested by running a furrow on each side of the row with a bull-tongue plow or a pea-digger, so as to dislocate the roots. Care must be taken not to detach the nuts from the vine in running the side furrow. After the plow has been run on each side of the row (and it is sometimes necessary to run twice on a side) then lift the vines gently with the hand, carefully shaking the dirt off, and lay them on the ground. Let them remain in this way, if the sun is shining, from six to eight hours. The vines will wilt like clover, when they may be brought together and stacked. The stacks are made around a pole planted in the ground and rising some eight feet above the surface. A platform made of old rails rests upon logs placed around the pole and upon this the stack is built. The platform protects the nuts and vines from the mold and dampness of the ground. In stacking, the nuts should be put on the inside next to the stack-pole, but not so close as to prevent the air from circulating freely from the bottom to the top of the stack. To make the stack entirely secure it should have a capping of hay or corn fodder. Put up in this manner the nuts will keep securely all the winter should it be desired.

The red nuts are more easily harvested than the white, as they have but few roots and the nuts adhere closely about the stem. In loose land they may be pulled up without running a furrow on each side of the row, though to do this will make the work much easier. There are but few red nuts now grown in Tennessee. An over-production of them for a few years reduced prices below the cost of the labor required in producing them.

Usually the nuts are allowed to stand in the stacks about four weeks

and are then picked off by hand, the white nuts always. The red nuts are sometimes threshed off by taking up bundles and beating them against a rail or the side of a box. This latter plan greatly injures the nuts. Five to six bushels of red peanuts can be picked off the vines in a day by a nimble-fingered person, but the picking of three to four bushels of the white is considered a good day's work. Women and children are said to be much more expert in this work than men. The price paid for picking is about ten cents a bushel. After this they ought to be screened in a cylinder so as to separate them from the dust and leaves and also for the purpose of brightening the hulls by abrasion. After sunning they are put in sacks containing four to five bushels. So much may be added to the selling price of the peanut crop by proper cleaning and assorting that it has been found profitable in all localities where many peanuts are grown to erect great recleaning houses. These houses are four stories high. The upper or fourth floor contains a large hopper into which the peanuts as they are delivered by the farmers are poured. They run down through pipes to the third floor, where they pass through a screen or cylinder and by abrasion the nuts are cleaned and the hulls brightened. From the cylinder the nuts are carried to the second floor, where they are passed through a fan by which the light ones are blown out. The heavier ones are caught on an endless belt passing longitudinally over the surface of a long table. On both sides of the table employes, usually girls or boys, stand and pick out all black or discolored nuts. At one end of the table is a sizer, where the nuts are separated into three classes: Jumbos, or fancy, which are very large nuts; No. 1 and No. 2. On the lower floor all grades are caught and sacked. The puffs and black or discolored nuts are shelled and sold to confectioners. The owners of the recleaning establishments buy the nuts direct from the farmers and resell them on the market after they have been cleaned and assorted.

YIELD PER ACRE—The weight of a bushel of peanuts in Tennessee is twenty-three pounds; in Georgia twenty-eight; in North Carolina and Virginia twenty-two pounds. The Tennessee peanuts are larger than those of Georgia and smaller than those of North Carolina and Virginia. Of those raised in Tennessee, less than one-fourth are of the red variety. The usual yield per acre is from thirty to fifty bushels, though as high as 100 bushels are sometimes made. The white peanuts will make from ten to twenty bushels per acre more than the red, but not being so easily cultivated or gathered, they were until recently considered less valuable as a crop.

USES OF THE NUT—The present consumption of peanuts by the American people for eating purposes alone reaches 4,000,000 bushels. This is largely in excess of what we produce. It is estimated that the peanut crop of the world now amounts to 600,000,000 pounds or 26,087,000 bushels. Much of this product is used in the Old World for making oil, which is regarded as an excellent substitute for olive oil, as it has an agreeable taste and odor. The shelled nuts will yield about 40 per cent. of oil. It is said that the Tennessee nut yields an oil that is often used and is highly esteemed for culinary purposes. Estimating that the hulls of the peanuts make 6 per cent. by weight and that 40 per cent. of oil may

be extracted from the kernels, there should be obtained 8.65 pounds of oil from each bushel of twenty-three pounds. This would give in liquid measure 1.15 gallons, which at the price of \$1 per gallon, would make \$1.15 for the oil extracted from one bushel of peanuts. Manufacturers use this oil as a substitute for olive oil in fulling cloth. A large amount is used in the manufacture of soap. It is not very desirable as a lighting fluid, as it does not give as clear light as whale oil or petroleum. For fattening of hogs peanuts are exceedingly valuable, and have proved very satisfactory on account of their large content of fatty matter. Hogs are very fond of them.

THE VINE AS A FORAGE CROP—The haulm or vine, when carefully harvested, before it has been injured by frost, is an excellent food for cattle and sheep. Horses are exceedingly fond of it, but the amount of dirt which necessarily adheres to it is apt to produce a disagreeable cough. The red peanut makes better hay than the white, because it grows erect, and is, therefore, freer from dirt. Usually about one ton is saved per acre, though upon strong land, where the vines grow luxuriantly, two or more tons have been saved. Many practical farmers prefer this hay to clover hay. Like clover hay it must be handled carefully, or the leaves will fall off, leaving nothing but the stems, that are practically worthless. It produces a copious flow of rich, creamy milk when fed to milch cows. Ewes in lambing time can have no better food given them than well-cured peanut hay, because it increases the flow of milk and enriches its quality.

JAPAN CLOVER—BUSH CLOVER—KING GRASS—(*Lespedeza striata*)—(Grazing and Hay.)

There were numerous species of *Lespedeza* found in the South as far back as the time of the Spanish occupation of Louisiana. They were then observed and mentioned in Spanish records and regarded, at the time, as being good forage plants. The seeds of the *Lespedeza striata* were introduced into South Carolina about 1849 from Japan or China or probably from both, doubtless coming over in tea chests. Its existence in Japan was mentioned as early as 1784, by a German chemist, who saw it growing in that country. A few years after its first appearance in South Carolina it had spread as far as Macon, Ga. It appeared in Tennessee about 1870 and spread rapidly through many counties in the State, covering old fields, rooting out broom sedge and other grasses, and showing such a vigor of growth and tenacity of life as to arrest the attention of every observant farmer. It will grow with great luxuriance on the poorest soils, and will resist the severest droughts. Soils that are totally unfit for the growth of any other plant will produce Japan clover high enough to make good pasturage. On more fertile lands it will grow to the height of two feet or more. It is an annual and should be sown in the State of Tennessee during the month of March, but it is rarely necessary to sow it at all as, when it once becomes established in any spot, it soon spreads throughout the locality. It is an excellent plant for restoring fertility to old fields and many of these in the state have been reclaimed through its instrumentality. In many of the Southern States it is regarded as the

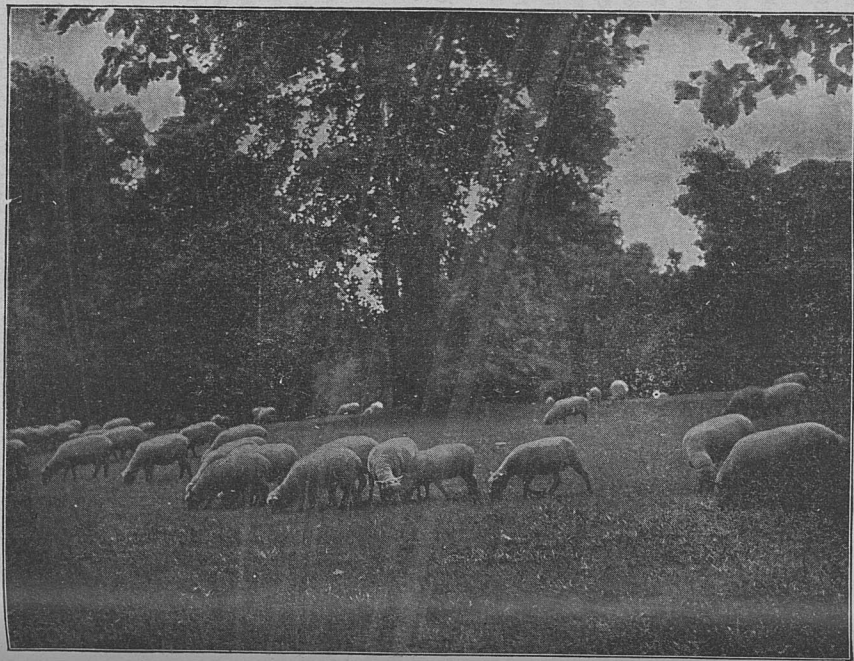
most valuable of all forage plants for the very reason that it will grow on the most sterile or exhausted soils. It is largely used for hay, especially when grown on calcareous soils, being said to have a high feeding value, though less than that of the cowpea and clover. It does not stand cold weather. The first frost will kill it, and occasionally it suffers from hot weather when grown upon thirsty, sandy soils. Its roots penetrate to a great depth in the soil and like all other leguminous plants it collects nitrogen from the atmosphere. It is much more highly esteemed in the extreme Southern States than it is in Tennessee.

Mr. H. B. McGehee, of Woodville, Miss., says: "My experience is that *Lespedeza striata* (Japan clover) is the most satisfactory and best all-around forage crop we have in Southwest Mississippi. It is the quickest grown, easiest handled and affords the most abundant yield of any hay crop we have. We prepare our lands and sow in October or March one-half bushel of seed to the acre. It yields from one and one-half tons to three tons per acre, reseeds itself, and the meadows may be left from two to three years without replowing. Often after preparing lands and sowing our fall oats we sow *Lespedeza* among the young growing oats some time in March, after all danger of a freeze is over, and thereby get two crops from the same piece of land during one year. Stock of all kinds eat this hay readily and fatten on it. It sells on a local market for from \$12 to \$15 per ton. Ours is a loamy, sandy soil, with a good deep sub-soil."

Prof. S. M. Tracy, says of this plant: "*Lespedeza* is the standard clover plant of the South. It will grow on the poorest and driest soils and, pound for pound, is the best hay I have ever used for fattening or for milch cows. Three years ago last October, our barn containing the hay we had stored for winter use was destroyed by fire. The last of October is late for making hay in Mississippi. On the day after the fire we put our mowing machines into a field of *Lespedeza*, which we had before thought hardly worth the cutting, and in two weeks we had stored a fresh supply of hay, mostly *Lespedeza*, but with a liberal mixture of asters, golden rod and plum bushes; but even this hay gave us better results in milk and butter than did equal weights of imported timothy."

Mr. Samuel McRamsey, of Warren county, Tennessee, who was in the dairy business for many years, says: "This clover made its appearance in this locality in 1870. It is fast covering the whole country. It supplies much grazing from the first of August until frost. It is short, but very hardy. Sheep are very fond of it, and cattle will eat it. It is killing out the broom sedge wherever it appears. It grows exceedingly well on red clay, and with a little care covers red hillsides that are much too common all over the state. If it will do this and destroy the broom sedge, it should be cultivated. It is not good for meadow and is only valuable for pasture."

Upon the farm of the writer in Montgomery county, Tennessee, the chief soil of which is a deep clayey loam belonging to the Lithostrotion bed of the subcarboniferous formation, *Lespedeza* appeared about 1880, and it quickly took possession of several wooded lots and also spread in some older fields that were not in cultivation. At first cattle were totally



SHEEP IN THE MEADOW.

indifferent to it and would not eat it, but gradually both cattle and sheep began to relish it. The advantage of this plant is its drought-resisting quality. On good soils it will remain green and continue to grow until the advent of frost. Broom sedge, in many places, especially in fence corners, has yielded to its conquering march. It is far less troublesome than broom sedge in every particular, and if it does no other good it will be regarded as a benefactor in its ability to destroy one of the most troublesome of all growths to meadows and pastures. During the period of dry weather it will turn brown upon thin soils, but the first rain will give it a new growth.

The best estimate of its value was made many years ago by Prof. E. M. Pendleton, of Georgia. He says: "I am willing to concede to it several things that do not apply to any other plant we have ever grown in this latitude.

"It has great powers of endurance, so far as the roots are concerned; but the branches and leaves will parch and die out under a burning sun very soon, especially where it grows sparsely. During a wet summer it luxuriates wherever propagated on poor hill-sides as well as on meadow lands. It loves, however, rainy seasons on thirsty lands and I fear will not prove to be all we desire in such localities. It however, reminds us of an anecdote of Mr. Dickson, when he was showing some gentlemen his farm during the prevalence of a severe drought. As they passed through a corn field in which some of the stalks were actually dying for lack of moisture, one of them called his attention to several in that condition. 'Yes,' said he: 'I perceive the fact, but it dies game.' And so of the Japan clover; it dies from severe drought, but rallies again as soon as the rain sets in.

"It is good pasturage for stock and I think would make good hay, if cut and cured. But I do not believe that our stock like it as well as the native grasses and I doubt whether it is as nutritious as the Bermuda. As cattle love variety, however, this may subserve a good purpose in that way. My opinion, however, is, from a not very close observation in the matter, that they would soon tire out on it exclusively.

"It furnishes a large supply of vegetable matter to the soil, and I believe will prove to be the best humus-making plant we have at the South, where so much is needed from our clean cotton culture. As it is said to be difficult to gather the seed in large quantities, I intend to plow up the surface where it has seeded, and rake up the grass and top soil, and sow this dirt over my oat and wheat fields, and especially on the poor places. My opinion is that a most luxuriant growth of this clover will follow, which can be turned under in the fall while green, and thus furnish not only humus but nitrogen to the soil.

"Another rare quality of this plant is indicated in the name I have given it—'King grass'—in the fact that it absolutely roots out and destroys every living plant in its wide-spread path. Not even old Bermuda, which has so long held undisputed sway over his circumscribed fields, can resist its encroachments. I have a bottom long since given up to the Bermuda. Recently I passed through it and found that the Lespedeza had almost completely throttled it, though like Mr. Dickson's corn it died

game, as here and there, peering above its enemy, could be seen at an isolated sprig of Bermuda, which, as it cannot stand shade, will have to yield entirely before the close of another season. I have but little doubt that any pest, like coco or Bermuda, could be rooted out by this 'King grass' in a few years in any locality, and would recommend it to be sown on such fields, if for no other purpose. I intend to give it a fair trial myself on one or two similar localities."

The North Carolina Experiment Station has this to say:

"The ability to grow on land too poor to produce even broom sedge and to crowd out all other plants; its dying each winter and leaving its roots to fertilize the soil; and its possessing the nitrogen-fixing power peculiar to the pulse family of plants, place Japan clover at the head of renovating plants adapted to the climate of Southern States. It is unequalled as a restorer of worn fields, such as are generally turned out to grow up in pines."

SOY BEAN—COFFEE BEAN—SOJA BEAN—(*Glycine hispida*.—
(Forage, Ensilage and Pasture.)

This plant has recently been introduced into cultivation in the United States, though it has been known in China and Japan from a remote antiquity. It is one of the crops grown for human food in oriental countries. It yields a large amount of seed while the forage, both green and dry, is capable of sustaining and even fattening domestic animals. Experiments that have been tried in Tennessee in its culture have been fairly successful.

The soy bean is an annual, belongs to the leguminous family, and is grown for the same purposes as cowpeas and clover. As a soil renovator, as a hay and as ensilage it is nearly the equal in every respect of red clover.

There are many varieties of the soy bean. The early varieties are thought to be the best to cultivate for seed. The medium early green is the best for hay and this with the medium early black is best for soiling and for ensilage. Soy beans will grow upon almost any soil, but that which is supplied with potash, phosphoric acid and lime is said to give the best results. Good crops have been made on very thin soils in Kansas and South Carolina. It is a great drought-resister and will suffer less from continued dry weather than almost any ordinary field crop. It will grow in every latitude in which corn will mature. It is not so sensitive to cold as cowpeas or the ordinary garden bean. It will bear moisture well and a case is given by Mr. Robert C. Morris, of Illinois, where soy beans stood three weeks in water during the month of July without any permanent injury. For hay the beans should be sown at the rate of one bushel per acre upon land well prepared by thorough pulverization. The seed may be covered with a harrow. If planted mainly for seed it is best to plant in drills, say 30 inches apart, and cultivate in the same manner as corn. About five or six plants should be left for every foot in the row. It is best to stir the earth after every rain, but not to work the plants when they are wet either from rain or dew. The haulm of the soy bean is very rich in fat and muscle making constituents and should always be fed in

connection with fodder, corn or sorghum. It should be cut for hay when the plants are in late bloom or when a few of the pods begin to form. It is a hay very difficult to cure, much more so than red clover, and it is necessary after cutting to throw the plants into a windrow until they have wilted, then to put them up in cocks with small diameter so that the air can pass freely through them. Handling the hay injures it very much in causing the leaves to be broken off and lost. Probably the best plan for saving the hay is to stack it around a pole upon which long limbs have been left. These limbs admit the air, which causes the hay to cure



Soy Bean—Glycine hispida.

(U. S. Dept. Agric.)

much better, but as soy bean hay does not shed rain the stack should be capped with wheat straw or hay that will shed water.

When harvesting the crop for seed it may be cut with a scythe or mower and put up into small cocks until the pods become thoroughly dry. The threshing may then be done with a flail or with a threshing machine. The soy bean will yield upon good strong land from ten to fifteen tons of green forage per acre which will make from two to three tons of cured hay. At the North Carolina Station an experiment was made with the soy bean and cowpea upon the same character of soils, both grown under similar conditions. While the soy bean yielded 2 1-4 tons of cured hay per acre the cowpea yielded less than a ton.

The yield of the soy bean is very prolific, running from 25 to 40 bushels per acre and even 100 bushels have been reported under very favorable conditions. The soy bean like the cowpea may be sown upon stubble land after the wheat or oat crop is harvested. Two crops may thus be grown upon the same land and the land left in much better condition than it would be after the wheat or oat crop. In fact the bean crop is often worth twice as much as the wheat or oat crop, the seed selling for \$1.00 to \$2.00 per bushel, and the haulm is as valuable as an equal amount of red clover hay. All the analyses which have been made of the soy bean show that it compares well in useful qualities with other leguminous plants. The green haulm has nearly the same composition as red clover. It is richer in protein and fat than the cowpea.

In a comparison of many analyses made, it appears that the soy bean stands as well in digestibility as the clovers, cowpeas, alfalfa or any other legume whatever. As a soiling crop it is regarded as one of the most important. A succession of forage may be had from summer to autumn by sowing several varieties that mature at different times. As an ensilage crop it is surpassed by few. It is said that the silage keeps well and is readily eaten by stock, and the animals show good results in flesh and in the production of milk. When, as often happens, the bean is allowed to get too ripe for hay it may, with more profit, be used as silage. The hay, being coarse, is not eaten so voraciously as red clover hay or peanut hay, and that of many other leguminous plants.

Probably the best use which can be made of the soy bean in the South is for the fattening of hogs. When so used the labor and expense of harvesting is saved. It also forms an excellent pasturage for sheep. Prof. Georgeson, in his experience at the Kansas Station, has this to say in regard to its value for the production of pork:

"It was found that a lot of three pigs which was fed for 126 days on a ration consisting for the first eleven weeks of Kaffir corn meal alone, and the last seven weeks of Kaffir corn meal and shorts, gained a total of 191 pounds, while a similar lot fed two-thirds Kaffir corn meal and one-third soy bean meal gained 547 pounds in the same time. Another lot of three pigs which was fed on corn meal for the first eleven weeks of the experiment, and a mixture of two-thirds corn meal and one-third shorts for the last seven weeks of the experiment, made a total gain of 306 pounds in 126 days, while a similar lot of three pigs fed on two-thirds corn meal and one-third soy bean meal throughout the experiment gained 544 pounds in the same time. The largely increased gains in these pigs must be credited chiefly to the soy bean meal."

The soy bean may also be regarded as a valuable acquisition as an aid in the restoration of soils. It, like all other leguminous plants, adds nitrogen to the soil. For this purpose it is highly valued in Japan, and is one of the crops planted in rotation with the cereal crops. It is now generally believed that if planted in a corn field at the last plowing it will not only do much to enrich the field but it will also furnish almost as much food for live stock as the corn crop itself.

Prof. Jared G. Smith, Assistant Agrostologist of the United States Department of Agriculture, says that "the feeding value of the bean has

been found to be greater than that of any other known forage plant except the peanut." This is certainly very high commendation.

The farmers of Tennessee would do well to test the value of this bean practically on all the different varieties of soils. It would unquestionably be a valuable addition to the crops of the Cumberland table-land. It would be valuable in the sandy soils of West Tennessee but it would grow with the greatest luxuriance upon the valley lands of East Tennessee and upon the limestone soils of the Central Basin and the clayey lands of the Highland Rim.



Herd's Grass—*Agrostis alba*.



Timothy—*Phleum pratense*.



Tall Meadow Fescue—*Festuca elatior*.



Meadow Oat Grass—*Arrhenatherum avenaceum*.



Perennial Rye Grass—*Lolium perenne*.

FIVE IMPORTANT MEADOW GRASSES.