

## CHAPTER XV.

## THE LEGUMINOSÆ. PULSE FAMILY.

Herbs, shrubs, or trees. *Leaves* alternate, usually compound and stipulate. *Flowers* irregular or regular. *Calyx* mostly 5-lobed with one lobe next to the bract. *Corolla* irregular and imbricate (often papilionaceous), or regular and valvate, rarely o. One petal next to the axis. *Stamens* usually 10, rarely 5 or many, monadelphous, diadelphous or distinct, mostly perigynous. *Pistil* with a 1-celled carpel becoming a legume or an indehiscent fruit, sometimes jointed. Embryo usually destitute of endosperm.

This vast family contains, at the lowest estimate, 6,500 species, and is excelled in numbers by only one other, viz: the Compositæ, which includes asters, golden rods, sunflowers, dandelions. Plants of the pulse family are widely distributed in every climate and in all kinds of soil. They vary in size from the little pussy clover to the giant locust trees of Brazil. We comprehend only a small portion of their uses and wealth when noticing those species which are cultivated or wild in the United States. Red, white, mammoth and Alsike clovers, lucerne or alfalfa and sainfoin fill a place which could not well be supplied in our pastures and meadows, while peas and beans are scarcely of more importance than the peanut which would be missed in our groceries and on the corners of the streets, as well as by the people of Africa and the tropical islands.

The pulse family is the most wonderful of all the families of plants in the enormous number and variety of its useful products. Its wealth is fairly bewildering. It contains barks of great use for tanning, many delicious perfumes, valuable medicines, tough fibers useful for cords, ropes or coarse cloth. It abounds in du-

erable timber and in ornamental and fragrant woods. For gums it beats the world, and supplies also many valuable coloring materials. It is well supplied with ornamental species.

## PAPILIONACEÆ. PULSE FAMILY PROPER.

*Leaves* mostly pinnate or palmate. *Flowers* usually in axillary or terminal racemes, spikes or heads. *Calyx* of 5 sepals, united, often unequally. *Corolla* perigynous, very irregular, of 5 or rarely fewer petals, papilionaceous; upper petal called the  *vexillum*, or banner, inclosing the others in the bud; 2 lateral called  *alæ* or wings, oblique outside and often adhering to the 2 lower, which are usually united, and called  *carina*, or the keel. *Stamens* 10, very rarely 5, monadelphous or diadelphous, mostly 9 united and a free one next the banner.

This sub-family, or sub-order includes all the clovers and other leguminous forage plants which are considered in this volume.

## TRIFOLIUM, L. TREFOIL, CLOVER.

Herbs, usually low. *Leaves* digitately, rarely pinnately 3-foliate; stipules adnate to the petiole. *Flowers* capitate or spiked, rarely solitary; red, purple or white, rarely yellow; bracts small or 0, sometimes forming a toothed involucre. *Calyx-teeth* 5, sub-equal. *Petals* persistent; wings longer than the keel, the claws of both adnate to the staminal tube. *Upper stamen* free; all the filaments, or 5 of them, dilated at the tip; anthers uniform. *Style* filiform, stigmas oblique or dorsal; ovules few. *Pod* small, indehiscent, 1-4-seeded, nearly enclosed in the calyx. Found in the north temperate and warm regions, rare in southern; species 150. The above generic description is mainly adapted from *Hooker's Flora of the British Islands*.

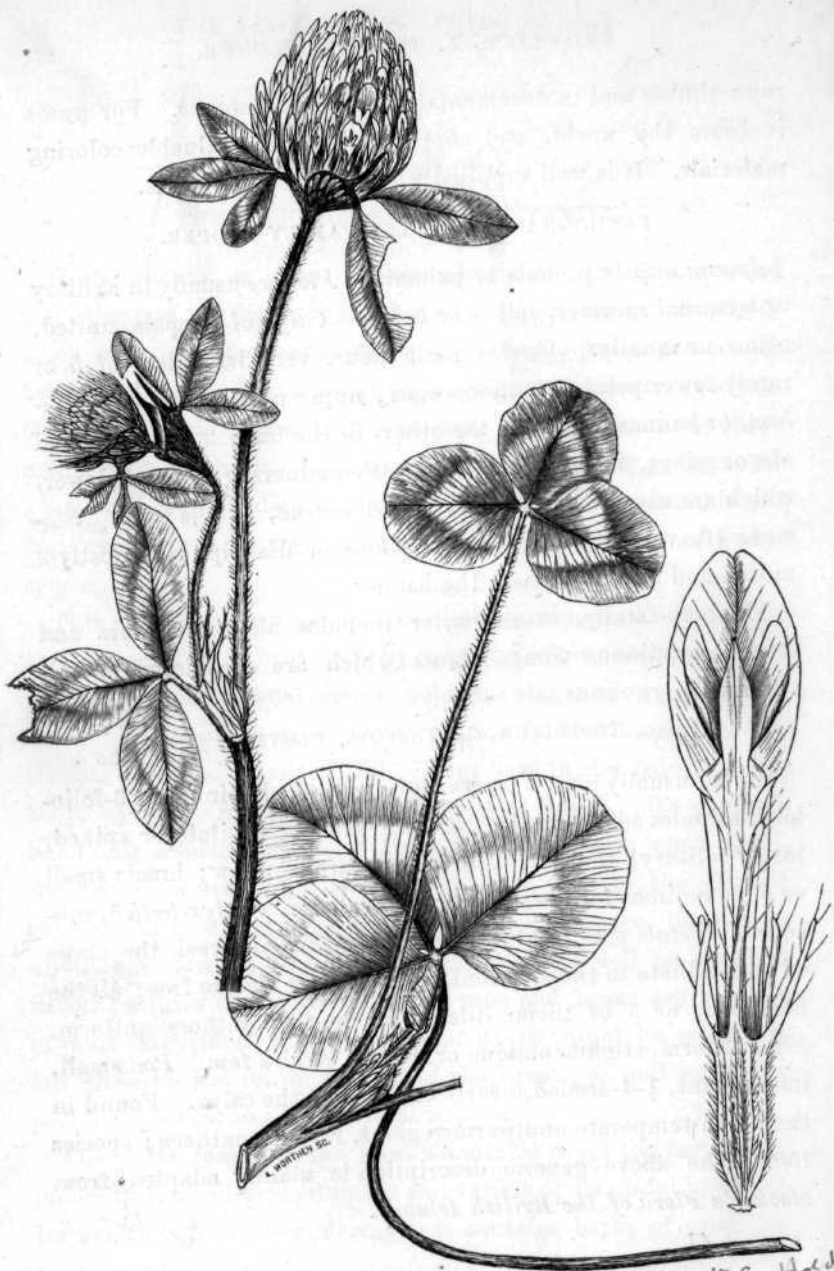


FIG. 128.

Ed. W.S. Holdsworth

**T. pratense, L. Red Clover, Broad leaved Clover, Common Clover, Meadow Trefoil.**—More or less pubescent, leaflets oblong, stipules membranous, free portion appressed to the petiole, heads terminal, sessile, globose, at length ovoid, subtended by opposite leaves with much dilated stipules, calyx-teeth slender, setaceous, erect, or spreading in fruit, the lowest longest.

Pastures, roadsides, etc., ascending to 1,900 ft. in the Highlands [of Great Britain]; flowers from May to September. Annual, biennial or perennial. *Stems* 6–24 in., solid or fistular, robust or slender. *Leaflets*  $\frac{1}{2}$ –2 in., often marked with a white spot or lunate band, finely toothed; stipules often 1–1 $\frac{1}{2}$  in., with long setaceous points. *Heads*  $\frac{1}{2}$ –1 $\frac{1}{2}$  in. diam., pink, purple or dirty white. *Calyx-tube* with a 2-lipped connection in the throat, strongly nerved; teeth not exceeding the petals, very slender, unequal. *Pod* opening by the top falling off. Found in Europe, N. Africa, Siberia, W. Asia to India; introduced in N. America certainly before the Revolution.

**Early History.**—Although in a general way this is a plant familiar to all farmers, there are many things in regard to its habits, variation and other peculiarities yet to learn. The expression “To live in clover” has become proverbial, and is another way of designating a good living. With a field of clover knee high, or up to the eyes, means fat cattle and swine and buncy sheep. Some one styles the plant “The red plumed commander-in-chief of the manurial forces.”

Red clover was known and prized over 2,000 years ago by the Greeks and Romans, but it can hardly be said to have been cultivated, even in the simplest way, till used in England about 1633,—253 years ago, or 44 years before the cultivation of perennial rye grass, and nearly 100 years before that of any other of the true grasses.

For a long time it was propagated by scattering the seed in the chaff with all the weeds and rubbish, as it accumulated at the stack or barn.

**Extent of Roots.**—Red clover usually has a large tap root, with numerous branches extending in all directions. Sometimes the tap root is short and soon equaled by its branches. These roots rarely ever extend less than two feet below the surface, as in moist, compact land, or where the surface is very rich. Where the subsoil is at all open and inclined to be dry, it is not unusual for the roots of clover to reach down six feet or more below the surface; however, the main bulk of the roots are usually within a foot of the surface. Various experiments and careful estimates have shown that fully one-half the weight of a clover plant is below the ground in the form of roots.

Concerning the stems and leaves I shall speak more in detail in the paragraph which treats of variations of the plant.

**The Flower.**—The flower is irregular, papilionaceous and its structure rather difficult to understand without considerable study of specimens or good illustrations. I take pleasure in reproducing the excellent illustrations of Hermann Mühler, as found in his *Fertilization of Flowers*.

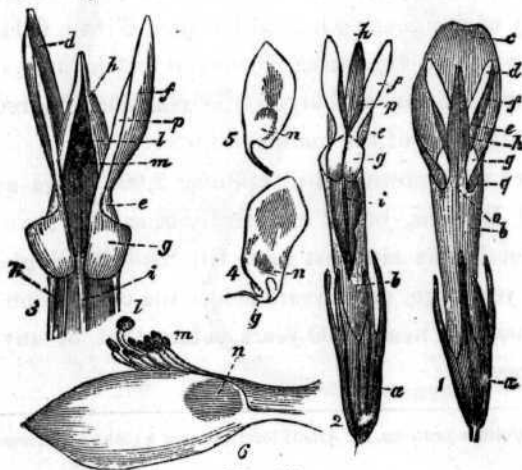


FIG. 129.

The nectar is secreted by small glands at the base, on the inside of the tube formed by the cohesion of the nine inferior filaments, and accumulates around the base of the ovary. In the center is the pistil, the style of which curves upwards, carrying the stigma a little beyond the anthers. The tenth stamen is free, and for most of its length is turned to one side, making it quite easy for the long tongue of a bee to reach the nectar.

In the words of Mühler, "If now a bee inserts its proboscis beneath the *vexillum*, while it clings with its fore legs on to the alæ (which is coherent with the carina) resting its middle and hind legs on a lower part of the inflorescence, the carina and alæ are drawn downwards, and the stigmas and anthers are thrust up against the under side of the bee's head; the stigma, standing highest, receives the pollen brought by the bee, and instantly afterwards the anthers dust the bee with fresh pollen. Cross-fertilization is thus insured; self-fertilization may take place as the bee draws back its head, but is probably neutralized and superseded by the immediately preceding cross-fertilization.

"In order to reach the honey in this way (to the bottom of the tube) an insect must possess a proboscis at least 9 to 10 m. m. long. The pollen is accessible to all insects which can press down the carina; and such insects, whether they reach the nectar or not, will perform cross-fertilization."

### Bumble Bees a Great Help in Fertilizing Red Clover.—

The writer, as well as some of his students, has made many experiments which help to prove the truth of the above heading.

FIG. 129.—*Trifolium pratense*, L.

- 1.—Flower, from below.
  - 2.—Ditto, from above, after removing the vexillum.
  - 3.—Anterior part of flower, twice as much enlarged; the edges of the carina have been forced apart.
  - 4.—Right ala, from within. (The claws of 4 and 5 have been broken short off.)
  - 5.—Right half of the carina from without.
  - 6.—The essential organs emerging from the depressed carina.
- a*, calyx; *b*, tube formed by the coalescence of the nine filaments with the claws of the vexillum, alæ, and carina; *c*, vexillum; *d*, concave part of the inner side of the ala; *e*, lower border of ala, bent outwards; *f*, outward surface of ala; *g*, pouched swelling on the base of the ala; *h*, carina; *i*, style; *k*, superior free stamen; *l*, stigma; *m*, anthers; *n*, point of union between alæ and carina; *o*, point of flexure of the carina; *p*, part of the upper border of the ala, bent outwards; *q*, downward extension of vexillum.—(Mühler.)

The following single experiment will serve as an example: Two fine bunches of the first crop of clover, apparently alike, were covered with mosquito netting. No insects were seen about either, except those mentioned below. On June 29th a bumble bee was placed inside of one netting and seen to work on the flowers.

On July 10th two more bumble bees were introduced and seen to work, and on July 12th more bees were introduced, and were seen to work on the flowers.

On July 31st 50 ripe heads were selected from each plant, and the seeds carefully shelled and counted. The 50 heads on the plant where the bumble bees were excluded yielded seeds as follows:

40 heads yielded.....	0
6 heads yielded one seed each.....	6
1 head yielded.....	2
1 head yielded.....	3
1 head yielded.....	5
1 head yielded.....	9
Total.....	<u>25</u>

The 50 heads on the plant where bumble bees were inserted and seen to work under the netting yielded seeds as follows:

25 heads yielded.....	0
2 heads yielded one each.....	2
5 heads yielded two each.....	10
3 heads yielded three each.....	9
3 heads yielded four each.....	12
3 heads yielded five each.....	15
1 head yielded seven.....	7
1 head yielded eight.....	8
1 head yielded nine.....	9
1 head yielded ten.....	10
1 head yielded twelve.....	12
Total.....	<u>94</u>

In the above experiment both lots of heads were covered alike

with netting, that no one could say the difference in yield of seed was due to the fact that one lot was covered and the other not covered. It will be seen, that where bees were observed to work on the flowers the yield of seeds was nearly four times that where the bees were kept away. But perhaps the two plants would not have yielded the same number of seeds had they been treated in every way precisely alike.

In reply to this suggestion I can offer the following, which shows that in six examples, selected at random, only one was found in which the yield of seeds was nearly twice the number in the heads containing the fewest seeds. On September 13th, 1882, I selected of the second crop of red clover five plants within ten feet of each other, which seemed to be much alike. They had not been covered in any way. The seeds from 50 good heads of each plant were shelled out with the following results: 1, 260; 1, 275; 1, 460; 1, 485; 1, 1,820. It will be seen that 50 heads from plant number five contained only about one-third more seeds than 50 heads from plant number one.

In another place, 50 heads selected from one plant yielded 2,290 seeds, nearly twice as many as plant number one in the first lot.

Mr. C. Darwin covered one hundred flower-heads of red clover by a net and not a single seed was produced, while 100 heads growing outside yielded by careful estimate 2,720 seeds. He says: "It is at least certain that bumble bees are the chief fertilizers of the common red clover."

It may not be out of place to say here that experiments with white clover show that visits of honey bees increase the yield of seeds enormously. In one case

8 protected heads yielded.....	5 seeds
8 visited by bees yielded.....	236 seeds

This is an increase of over 47 fold in favor of the bees.

A large number of carefully conducted experiments made by



many persons on a great variety of plants show results quite as remarkable as those above cited.

Here the bees and bumble bees not only make use of a waste product, but help the plants as well. Most botanists now believe that odor and showy flowers are advertisements for attracting insects, and that nectar and surplus pollen are the wages to compensate insects for services rendered in fertilization.

If this be the case should not the farmer seek to encourage meadow mice, which make the nests sought by bumble bees in which to rear their young. The bumble bees, at least, should be encouraged. It is not improbable that the time may come when queen bumble bees will be reared, bought and sold for their benefit to the crop of clover seed.

**The Sleep of Leaves.**—This can in no way be compared with the sleep of animals, but refers to the fact that the leaves of clovers take different positions at night from those assumed during the day time.

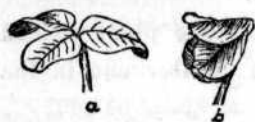


FIG. 130.—*Trifolium repens*; *a*, leaf during the day; *b*, leaf asleep at night.—(Darwin.)

This difference in position is caused by turgescence in the *pulvinus*, which is the name given to a mass of small cells of a pale color found in a certain portion of the leaf stalk.

Experiments show that leaves kept open or spread apart contain more dew in the morning, and hence become cooler than those which approach each other. The leaves crowd together, or "sleep," for the same purpose that pigs crowd together in cold weather, viz: to keep warm. It has been found that the leaves which sleep do not remain quiet during the night, but continue, without exception, to move during the whole twenty-four hours. All non-sleeping leaves are also in incessant motion, circumnutating. The sleep of plants is a mere modified form of this universal circumnutating.

During a warm, dry day leaves also assume the sleeping position, which aids in checking evaporation.

There are more "sleeping" plants among the Leguminosæ than are found in all other families put together.

**A Little Agricultural Chemistry.**—Of the thirteen elements necessary for plant growth the farmer usually need take but little care, except in the supply of potassium, phosphorus and nitrogen, and of these three nitrogen is the most precious and costly to obtain. All agricultural plants draw much of their food from the atmosphere, and of those used by the farmer probably none are much, if any, exceeded by clover in the large proportion of nutriment thus derived. In this respect other leguminous crops are much like red clover.

"Clover seed is the best manure that a farmer can use." Clover has been called "a trap for nitrogen," as it collects and presents large quantities of combined nitrogen in a form ready to nourish growing crops.

In the words of Dr. Kedzie: "With an adequate supply of combined nitrogen all the other chemicals of agriculture become active, while a limited supply of active nitrogen correspondingly limits the action of the rest. For high farming, or the raising of exceptionally large crops, the great want is an abundant and cheap supply of ammonia and the nitrates.

"An acre of good clover will make 5,000 pounds of hay, containing 282½ pounds of mineral matter or ash. In this ash will be 97½ pounds of potash, 96 pounds of lime, 34½ pounds of magnesia, and 28 pounds of phosphoric acid. The hay will also contain 108 pounds of combined nitrogen."

The roots and stubble contain fully as much of these elements as the hay.

Baron J. B. Lawes found that in autumn, after the last crop of clover was cut, that remaining above ground, and to the depth of 72 inches was examined:

Stubble, etc., above ground contained.....	2,669 pounds per acre, dry.
1st nine inches contained.....	3,017 pounds per acre, dry.
2d nine inches contained.....	275 pounds per acre, dry.
3d nine inches contained.....	191 pounds per acre, dry.
Total.....	6,152

This was between three and four times as much dry matter as the residue of the barley.

In the words of Dr. Kedzie: "The clover hay *or sod* contains enough phosphoric acid for more than double an average crop, enough nitrogen for more than four average crops, and potash for more than six average crops of wheat! If any person were preaching the gospel of agriculture he well might hold up the triple leaf of the red clover as the symbol of trinity of blessings to the farmer, furnishing for his cereal crops, from otherwise inadequate sources, a sufficient supply of potassium, phosphorus and nitrogen. If I were designing an emblematic seal of our national agriculture I would make the central figure the clover leaf. For the farmer it is the most effective trap for nitrogen within his reach."

The late George Geddes, of New York, said: "It has been demonstrated beyond a doubt that clover and plaster are by far the cheapest manure that can be had for our lands,—so much cheaper than barnyard manure that the mere loading of and spreading costs more than the plaster and clover. Plow under the clover on the more distant fields when it is at full growth.

"A very considerable part of the cultivated land of Onondaga County has never had any other manuring than this clover and gypsum, and its fertility is not diminishing. The cost per acre is \$2.32."

**The Uses and Value.**—The following as to the use and management of red clover is gleaned from *Harris' Talks on Manures*: "Clover is, unquestionably, the great renovating crop of American agriculture. A crop of clover, equal to two tons of hay,

when plowed under, will furnish more ammonia to the soil than twenty tons of straw-made manure, fresh and wet, or twelve tons of ordinary barnyard manure.

“I prefer to make the clover into hay and feed the animals, as they seldom take out more than from five to ten per cent. of all the nitrogen furnished in the food,—and less still of mineral matter. If you plow it under you are sure of it. There is no loss. In feeding it out you may lose more or less from leaching and injurious fermentation. As things *are* on many farms, it is perhaps best to plow under the clover for manure at once. As things *ought* to be it is a most wasteful practice. Clover is good for wheat; plaster is good for clover. The roots run deep, drawing large amounts of water, and can live on very weak food. The clover takes up this food and concentrates it. The clover does not create the plant food; it merely saves it. To improve sandy land, instead of plowing the clover under or feeding it off, mow the crop just as it commences to blossom and let the clover lie. There would be no loss of fertilizing by evaporation, and the clover hay acts as a mulch. Mow the second crop about the first week in August.”

The following computation of the *relative* money value of one ton of various foods for producing manure is from the experiments of Mr. Lawes:

Cotton seed meal.....	\$27 86
Linseed cake.....	19 72
Beans.....	17 73
Wheat bran.....	14 59
Clover hay.....	9 64
Indian meal.....	6 63
Meadow hay.....	6 43
Oat straw.....	2 90
Potatoes.....	1 50
Turnips.....	86

All agricultural plants draw most of their food, directly or in-

directly, from the atmosphere, and of those used none are exceeded by clover in the large proportion of nutriment thus derived.

If the stubble and roots contain more than half of the manurial value of red clover, and if live stock only appropriate from five to ten per cent. of the nitrogen, and the other 90 to 95 per cent. goes back to the field or dung heap, it certainly must be the best practice, as a rule, to feed red clover instead of plowing it all under.

I have not seen a more concise and valuable summary of this matter than the one by the late Dr. Voelcker, as found in the Journal of the Royal Agricultural Society of England for 1868:

1. "A good crop of clover removes from the soil more potash, phosphoric acid, lime, and other mineral matters, which enter into the composition of the ashes of our cultivated crops, than any other crop usually grown in this country."

2. "There is fully three times as much nitrogen in a crop of clover as in the average produce of the grain and straw of wheat per acre."

3. "Notwithstanding the large amount of nitrogenous matter of ash constituents of plants in the produce of an acre, clover is an excellent preparatory crop for wheat."

4. "During the growth of clover a large amount of nitrogenous matter accumulates in the soil."

5. "This accumulation, which is greatest in the surface soil, is due to decaying leaves dropped during the growth of clover, and to an abundance of roots, containing, when dry, from  $1\frac{1}{2}$  to 2 per cent. of nitrogen."

6. "The clover roots are stronger and more numerous, and more leaves fall on the ground, when clover is grown for seed, than when it is mown for hay; in consequence more nitrogen is left after clover seed than after hay, which accounts for wheat yielding a better crop after clover seed than after hay."

7. "The development of roots being checked when the produce, in a green condition, is fed off by sheep, in all probability leaves still less nitrogenous matter in the soil than when clover is allowed to get riper and is mown for hay; thus, no doubt, accounting for the observation made by pastoral men that, notwithstanding the return of the produce in the sheep excrements, wheat is generally stronger and yields better after clover mown for hay than when the clover is fed off green by sheep."

8. "The nitrogenous matter in the clover-remains, on their gradual decay, are finally transformed into nitrates, thus affording a continuous source of food, on which cereal crops especially delight to grow."

9. "There is strong presumptive evidence that the nitrogen which exists in the shape of ammonia and nitric acid, and descends in these combinations with the rain which falls on the ground, satisfies, under ordinary circumstances, the requirements of the clover crop. This crop causes a large accumulation of nitrogenous matters, which are gradually changed in the soil into nitrates. The atmosphere thus furnishes nitrogenous food to the succeeding wheat indirectly, and, so to say, gratis."

10. "Clover not only provides abundance of nitrogenous food, but delivers this food in a really available power (as nitrates) more gradually and continually, and with more certainty of a good result, than such food can be applied to the land in the shape of nitrogenous spring top dressing."

The above conclusions should be posted up and read daily by every farmer till they are indelibly fixed in his mind.

Owing to the great depth to which the roots penetrate the soil, —frequently six feet or more,—they help to bring up a run-down farm; they bring the valuable ingredients from a great depth and store a large part of them in the large roots near the surface, where they are available for future plant growth.

**Red Clover in Many Lands.**—Red clover is well adapted to many portions of the temperate regions of the earth. It likes best a soil of clay loam, rich in lime, but will thrive better than Timothy and most other true grasses where the land is sandy or gravelly. On good grass land it is usually the custom to sow Timothy with red clover, although it blossoms some three weeks later. Many prefer to sow orchard grass with clover, as they flower and are ready to cut at the same time. Timothy is well adapted to sow with the large, late, or mammoth clover.

Red clover is not only a general favorite in the United States from Maine and New Jersey to Iowa and Illinois, but is very valuable further West and South.

For Kansas, Professor Shelton reports that it deserves a prominent place in the list of forage plants. In some very dry seasons it fails almost entirely, but during the favorable seasons it flourishes abundantly and yields more—both of hay and pasture—than is generally obtained in the East. When land is once seeded it never runs out, as is the case in the Eastern States, but thickens and spreads continually by self-seeding. We believe that nowhere are such large crops of clover seed grown as in Kansas.

In Mississippi, Professor Phares says, red clover grows most luxuriantly on all their lands with tenacious red or yellow clay subsoil, even though the soil be thin; and once set, it remains as long as the farmer desires, provided he does not mow more than twice each year, nor graze too heavily.

In Georgia, the late C. W. Howard says: "This is the most valuable herbaceous plant to the Southern farmer. It bears grazing admirably, makes excellent hay, and in large quantity, and thrives on land of moderate fertility. The doubts as to whether red clover would succeed at the South have been dispelled. At the South it lasts for several years."

Red clover is valuable to enrich the land and hence to enrich

the owner; it is not excelled by any forage crop as a wholesome summer pasture for swine, and some have spoken very highly of its use in winter when fed to swine in the form of hay.

For soiling, a good growth of red clover is very valuable, and it has often been packed into the silo to feed as ensilage in the winter.

**Clover as a Weed-Exterminator.**—We have ample testimony from a great variety of sources that red clover, with a little gypsum and perhaps a top dressing of some other fertilizer, is excellent to smother and kill out our worst weeds.

The following was furnished by special request by J. S. Woodward, now one of the editors of the *Rural New Yorker*: “Canada thistles have long roots which store up nourishment during the latter part of summer and fall to feed the spring growth. I kill the thistles without the loss of a crop as follows: Have the land rich, if possible, at least have it well seeded to clover and by top dressing with plaster, ashes, or by some means get as good growth to the clover as possible. As soon as the clover is in full bloom, and here and there a thistle shows a blossom, mow and make the crop, thistles and all, into hay. After mowing, apply a little plaster to quickly start the growth of clover. You will find this to come much quicker than the thistles. As soon as the clover has a good start, from July 20th to August 5th, plow down, being careful to plow all the land and to fully cover all growth. Then roll and harrow at once, so as to cover every thistle. But few thistles will ever show themselves after this, and they will look pale and weak. When they do show, cultivate thoroughly with a cultivator having broad, sharp teeth, so as to cut every one off under the ground. In two days go over with a sharp hoe and cut off any that may have escaped the cultivator. Watch the thistles, and keep using the hoe and cultivator until freezing weather. You will see them getting scarcer and scarcer each time and looking as though they had the con-



sumption. By plowing this field just before freezing up you will have the land in the finest condition for a spring crop. This plan not only kills thistles but ox-eye daisies and other weeds. It is much better than a summer-fallow, and without the loss of any crop."

**Putting in the Seed.**—Too little care is exercised in selecting the seed, as most of it contains more or less seeds of pernicious weeds, and especially does this caution become more and more necessary as the country becomes older. The troublesome weeds of a farm can generally be directly traced to foul seeds sown with grasses and clovers for the meadows and pastures.

In the northern portion of the United States numerous experiments seem to clearly indicate that it is best to sow seeds of red clover in spring. In some sections it is sown even before freezing ceases, but many now practice sowing just in time for the young plants to begin growth with the first early vegetation. If sown in autumn, especially if late, the young plants are very likely too feeble to survive the winter. If at all in autumn the date should be early enough to give plants a good start. In the warmer portions of our Union clover is often sown in autumn, or even in winter.

Clover seed is most generally sown where wheat and some Timothy were sown the autumn previous, though it is not unfrequently sown in spring, with a thin seeding of oats or barley.

It is a common practice with our best farmers to harrow the ground very lightly before sowing the clover seed. This benefits the wheat as well as favors the growth of the clover.

Where no grass seeds have been sown, at the West, the farmer sows 6, 8 or 10 or even 12 pounds of clover seed to the acre, but at the East 25 or 30 pounds is not thought too much.

In Great Britain, which possesses a moist climate favorable to the development of grasses and clovers, it is the practice to sow **much more seed** than is usually sown in the United States.

There are 16,000 clover seeds to the ounce, or 156,000 to the pound. In ten pounds there are 1,560,000 seeds. In England farmers often sow seeds of grasses and clovers enough, if all grew, to produce 16,878,000 to 27,000,000 plants, which is ten to fifteen times the amount of seed thought sufficient by our western farmers.

The Englishman seeks to get large numbers of fine, small stems instead of fewer large, coarse ones.

In various portions of our country, isolated farmers have sown clover in the spring on well prepared land without the presence of another crop, and they get a crop of grass or clover the first year. This practice deserves more thought from the average farmer.

For further remarks on this last idea consult a former paragraph on seeding without a crop.

**Care of the Young Clover.**—It has often been shown, beyond question, that the young plants will be more certain to live and will grow faster and become stouter, if not sown with a grain crop. If the wheat is thick and large the clover is apt to suffer; if the wheat is thin and light clover is likely to become large and crowd it.

It must not be forgotten that young clover is most generally greatly benefited by even a very light dusting with gypsum, say one-fourth to one-half or even a bushel to the acre.

Sheep and swine must not be allowed to feed young clover, at least very long, because it may be much damaged, or even killed. Clover needs a little time to get its roots well established, and this cannot be done without the aid of green tops.

Clover fails "to catch" for a great variety of reasons. The soil may be very much "run down," or the seed is poor, sown too late, the ground is too rough, not narrowed nor rolled; the oats or wheat get the start and choke it out or enfeeble the plants; the weather in spring is too dry, too hot; the young

plants are fed too closely. The frosts of spring may kill the young plants.

**Winter Killing and Remedies.**—Red clover not unfrequently “winter kills” or “heaves out,” and the dead plants in spring stick up out of the ground several inches, especially in winter, when there has been little snow on the ground and frequent alternations of freezing and thawing. To prevent winter killing see that the plants are well established in autumn and that they are not fed off too closely. Thorough tile drainage is a great benefit. A moderate amount of tops left on the ground will often be of some assistance, or a very thin mulch of straw put on after the ground has first become well frozen. A mulching of straw early in autumn has sometimes done more harm than good. No attempt, at the North, should be made to save red clover over to the third year, as such efforts are not successful.

As spring approaches and the soil warms up it is rather discouraging to find the clover killed out. The proprietor often plows up the ground and puts in another crop, thus leaving the land in a still worse condition for the next seeding to clover. He very likely raises millet or Indian corn or rye or buys of his neighbors a supply of winter feed. In case of partial winter killing the writer cannot help thinking that too little attention has been given “to patching up” such meadows in spring. By this is meant to harrow, re-seed, and, if possible, top dress with some sort of manure.

**The Best Time for Cutting Clover for Hay.**—The following is from the pen of Prof. H. P. Armsby: “What has been shown to be true of meadow hay in this respect applies also to clover. The earlier it is cut the more concentrated and digestible the fodder, while as it grows older the crude fibre increases and it becomes coarse and less easily digestible. In regard to the best times for cutting clover the same rules apply as those given for cutting grass. In regard to the advantages of early

and frequent cuttings, the experiments do not all give such striking results as those on grass."

For further notes in regard to securing clover hay the reader is referred to a former chapter of this work.

**Saving Clover Seed.**—The proper time to cut for seed is a difficult one to state, especially as the heads ripen unevenly. These heads should be examined, for sometimes the earliest contain most seeds, and sometimes the main bulk of the seed is found in heads which mature later in the season.

Some persons have observed that clover, when cut rather early, from the 5th to the 15th of June at the North, is more certain to seed well than that cut later. In some cases they report double the amount of seed from the clover which was cut early. Considering its high price, if there is any prospect of greatly increasing the yield of seeds more experiments are much needed. Some were suggested in the paragraph which treats of the agency of bumble bees in fertilizing the flowers.

In England Dr. A. Voelcker tried some different sort of manures for this purpose with results by no means satisfactory or conclusive. Probably the efforts were made in the wrong direction, as indicated in the preceding paragraphs.

For securing the seed, red clover is ordinarily cut with a reaper which delivers the clover in small gavels. In this way the clover is moved to one side and is not damaged by the tramping of the horses.

The clover is allowed to lie until it is well dried, and probably black and brittle. It may need turning once or more before dry and ready to thresh or draw to the stack or the barn. Clover seed during the harvesting will stand a good deal of abuse and not lose its vitality.

During a very unfavorable season for curing, when there was much rain, the writer tested samples from about sixty different farms in Michigan, and found they averaged 85 per cent. of good

seeds, rarely going as low as 75 per cent., though one small lot went down to 25 per cent. Some went up to 95 per cent.

Clover is usually threshed and cleaned with a machine made for the purpose. The yield runs from less than a bushel to the acre to two bushels, a fair yield, four bushels, a fine yield, or even six bushels, an exceptionally good yield.

**Relative Value of Dark and Light Colored Seeds.**—Dark colored, bright looking seeds are generally considered the best. The results obtained on testing numerous samples on different seasons indicate that there is no difference in favor of the dark seeds either in vitality or the quality of the plants which they produce. It is generally the case that all the seeds, or nearly all, from one plant resemble each other in color and size. Some plants produce yellow seeds, others produce dark ones, others produce seeds of mixed colors.

**Variation of Red Clover.**—The late Professor James Buckman, of England, in *Jour. Royal Agrl. Soc.*, p. 446, 1866, says the American red clover is a much larger and coarser and more hairy plant than that cultivated in England, doubtless due to a longer and warmer summer.

The wild clover, as early introduced into Europe, is usually the small hairy plant that we meet with (in England) and greatly different from that described by Sinclair, which is larger and quite smooth. The Professor goes on to say that: "Both when wild and when cultivated it is perhaps as protean in form as any plant the farmer has to deal with. Some are more perennial than others; all are more or less hardy, more or less productive, and these differences have a high significance. However, it seldom happens that any particular type can be obtained pure, though the value of the seed varies just in proportion as it is so.

"There are three desiderata with regard to clover.

"1st. A good sort or sorts.

"2d. Pure seed of the sort.

“3d. Seed from a known and suitable climate.”

The Professor then describes six of the leading varieties, none of which are just like those I find in Michigan.

Not long ago our seeds of red clover came from Europe, and already we have a great change in the plants.

I have for some years past studied quite carefully in different stages of growth, at different seasons and on different soils, many hundreds of plants. I have preserved some of the plants and seeds of a few of the most striking.

There is nearly or quite a month's difference in the time of first flowering. Some plants stool out and send up many stalks; others few. On hot, dry days some plants wilt while others show no signs of wilting. Some plants are tall and large or slender; others are short, even where the soil seems to be uniform. Some are erect, even where there is nothing to crowd them; others spread out at once, even where somewhat crowded. The leaves and stems of some plants are densely pubescent; others are nearly smooth, and between these are all gradations. In this respect the same plant varies a little at different seasons. The stems vary much in length and number of branches and in the color. On some plants the leaves are dark green; on others light green. The leaflets often contain a light spot, which varies in shape, size and intensity. Some are destitute of any trace of spots. Some leaves are firm, and a quarter or more thicker than others; some are thin and flabby. Some leaflets are as broad as long; others are elliptical—lanceolate. The stipules vary in shape, color and position taken.

The heads of flowers vary in size and shape, and so far as seen were sessile, with an involucre of two leaves. The calyx tube and the lobes of the calyx vary in size and hairiness.

The petals vary in length, direction taken, and differ in color from dirty white to pink and bright scarlet. Varying with the season, and probably with the plant, the pistils contain each

from none to two, three or even four seeds. There is a marked difference, as before observed, in the color of the seeds.

Of some plants observed I give the following brief description:

No. 1. Early, stems purplish, few and small, erect, quite hairy, leaflets spotted, rather narrow, leaflets of the involucre lance-elliptical.

No. 8. Late, stems few, stout, sprawling, quite smooth, purplish, leaflets rather narrow, with scarcely a trace of a spot.

No. 17. Very late, stems long, of medium size, spreading, green, quite hairy; leaves light green, spot inconspicuous.

No. 19. A seedling of dark seed, early, stems numerous, large, tall, erect, smooth, purplish, leaflets rather broad, thick, very dark green, with no trace of a spot; flowers dark colored.

**The Model Plant.**—I have begun a few experiments in a very small way by selecting and raising different races of red clover. This variation in our fields is a broad hint at the results which may be obtained by care and study.

For the Northern States we need a red clover which starts early, grows rapidly, has numerous erect, rather stout stems, which are not large. If too woody, the stems make coarse fodder; if they contain too little woody matter, they will not be stiff enough to stand up well. The plant should be rather hairy, as such plants usually endure hot, dry weather best. The model plant should seed freely, and to aid in this, if possible, the tube of the flower should be short enough to permit honey bees to reach the nectar.

The tongue of a honey bee when stretched out is six to seven millimeters in length, while the tube of the corolla of red clover is nine to ten millimeters. It seems by this that there is a wide breach to be gained in growth of tongue or shrinkage of corolla before the honey bee can sip all the nectar from the bottom of the tube of red clover. The tongue must elongate one-third or the tube of the flower shorten as much. The occa-

sional visits of honey bees to the flowers of red clover may be accounted for by supposing they seek pollen, or they seek the honey which has filled a considerable portion of the floral tube. The upper portion of this honey can be reached even with the tongue of the ordinary honey bee.

**Clover Sickness.**—This is a term used in Great Britain to indicate a failure of the plants to thrive after they have once started. Many observations and experiments have been made and much has been written on the topic in regard to the cause and remedies. Except in a very few places in the older portions of the United States, and even these are of questionable authority, no trouble of this nature has appeared on this side of the Atlantic.

Recent investigations by Kutzleb show that clover sickness is not due to parasites, to lack of nitrogen, to lack of water, or to unfavorable physical properties of the soil, but to a deficiency of easily soluble potash, especially in the subsoil. (H. P. Armsby in *Science*, p. 146, 1883.)

It is not improbable as our country grows older that repeated crops of clover may so deprive the subsoil of potash that clover sickness may become common. One who suspects the presence of this trouble should look carefully for insects or some fungus before coming to a conclusion.

To my inquiry in reference to the presence of clover sickness in the State of New York, Professor Roberts replied through the *Philadelphia Press* as follows: "So far nothing like what is known in Europe as 'clover sickness' is present. The clover leaf beetle, *Phytonymus punctatus*, has injured a few fields seriously, but its ravages have been confined to very small areas, sometimes to a single acre or two in a township. The clover seed midge, *Cecidomyia leguminicola*, which prevents the clover from blossoming and destroys the seed, is found in most, if not all, of the counties of western New York. The hay crop is injured by them to only a slight extent.



“The clover root borer, *Cecidomyia trifolii*, plays terrible havoc with the clover the second year. Much has been written on this subject, yet few appear to realize that their failures, after the clover has been well established, come from the injury done by the root borer. If this beetle remains, the four-years’ course must come into general practice.”

**Hoven.**—This is a term applied to cattle which have become sick and bloated after eating too heartily of clover which was fresh and wet. At such times, till the cattle have become used to the feed so as not to be greedy, they should be turned off the clover after eating for an hour or so at a time.

TRIFOLIUM MEDIUM, L. MAMMOTH, GIANT, PEA-VINE CLOVER,  
OR COW GRASS (OF ENGLAND).

The following description of the typical form, as it appears in England, is mainly from *Hooker’s Flora*:

Plant slightly hairy, leaflets oblong, obtuse, or acute; stipules herbaceous, free portion spreading, heads subglobose, terminal, often shortly peduncled, subtended by opposite leaves, *calyx-teeth* setaceous, spreading in fruit, lowest a little longest. June to September, perennial. *Stems* straggling, flexuous, often zigzag. *Leaflets* 1-2 in., rather rigid, almost quite entire, ciliate. *Heads* 1-1½ in. diam. *Flowers* ¾ in., rose-purple. *Calyx-throat* with a ring of hairs, tube 10-nerved, glabrous, teeth reaching half way up the petals. Pod often dehiscent longitudinally. Distributed in Europe, Siberia, Western Asia; introduced in North America.

This clover is *Trifolium medium*, and so named a long time ago by Linnæus. The common name might with propriety, be “medium red clover.” I mention this fact because farmers have lately got in the notion of calling the early red clover “medium” clover.

Mammoth clover is quite similar in appearance to the early red clover, but it flowers later, with Timothy, is very often a peren-

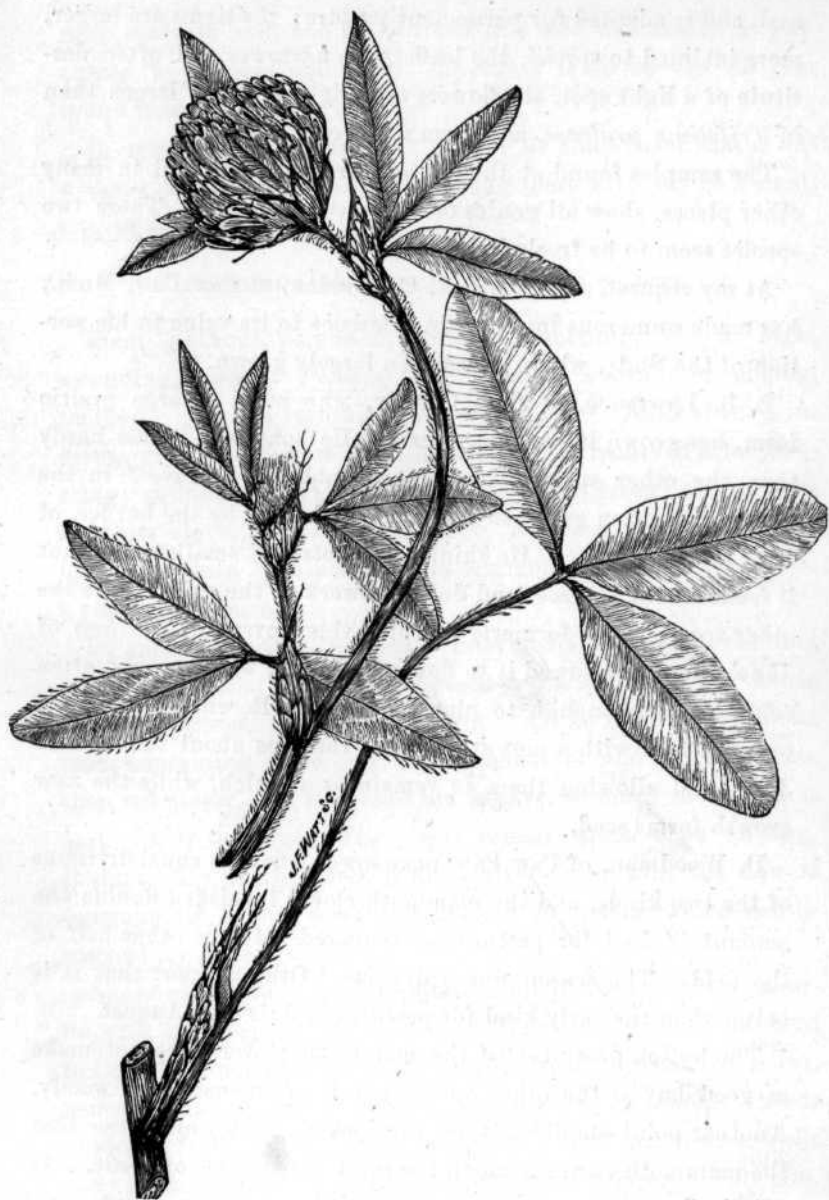


FIG. 131.—*Trifolium medium*, L. (Mammoth Clover,) part of a plant and a lower leaf.  
—(Sudworth.)

nial, and is adapted for permanent pasture; the stems are larger, more inclined to spread, the leaflets are narrower and often destitute of a light spot, the flowers are bright red and larger than in *Trifolium pratense*, and form a less compact head.

The samples found at the Agricultural College, and in many other places, show all grades of intermediate forms. These two species seem to be freely hybridized.

At my request, my friend, A. C. Glidden, of Paw Paw, Mich., has made numerous inquiries in reference to its value in his portion of the State, where it has been largely grown.

L. B. Lawrence, of Cass County, who owns a large prairie farm, has grown it for many years. He considers it less hardy than the other species; it is more liable to "heave" in the spring, and often grows so rank as to kill itself by the burden of stalk on the surface. He thinks the roots are smaller and that it feeds on the surface, and does not work in the subsoil like the other species. He formerly pastured this clover till the first of June, when he allowed it to flower and seed, which would often come off early enough to plow for wheat. Recently he has run over the field with a mower, clipping the tops about the first of June, and allowing them to remain as a mulch, while the new growth forms seed.

D. Woodman, of Paw Paw, once sowed a field in equal divisions of the two kinds, and the mammoth clover furnished double the amount of feed for pasture, as compared with the other half of the field. The season was a dry one. Others report that it is better than the early kind for pastures in July and August.

The notion prevails that the mammoth clover does not make as good hay as the other species; it is often coarse and woody. Another point should not be overlooked. They all agree that the mammoth clover is much the most productive of seeds. As this is the case, we may expect it will soon become more common than it is at present. Farmers will select the large kind to

raise seeds to sell, and many times this seed will finally be purchased by farmers and sown, supposing it to be the early or round leaved red clover.

In managing this plant, it should be understood that if left without pasturing or mowing in spring there will only be a small crop of seed.

## TRIFOLIUM HYBRIDUM, L. ALSIKE CLOVER.

Plant glabrous, perennial. *Stems*, branching, 1-2 ft. high, ascending, weak. *Petioles* long; leaflets obovate or oblong, toothed. *Stipules* rather long, nerves green. *Heads* about  $\frac{3}{4}$  in. diam., globular, flowers pinkish, pedicellate, recurved after flowering; peduncles 2-4 in. *Calyx* white, teeth green; pod same as in white clover. Found in Europe, North Africa, West Asia; introduced into N. America. Its common name is derived from a parish in Sweden.

In appearance it is so nearly intermediate between red and white clover that Linnaeus supposed it was a hybrid, and hence its specific name. It is not a hybrid. Alsike likes rather moist land, containing some clay. It is smoother and more delicate than red clover, and the stems are weaker, so much so that it is quite likely to lodge. The stems remain green after seeding. It stands dry weather well, is not apt to winter kill, the flowers continue for a long time and abound in nectar, which can be reached by honey bees.

Alsike clover has a good reputation for pasture and is a favorite with bee-keepers. It frequently yields 3-8 bushels of seed to the acre, and these are only half the size of those of red clover, hence only about half as much seed is sown to the acre. This is produced from the first crop, though it is often pastured a while early in the season. It is two or three years coming to full size, and does best for pasture when sown with some stout grasses. The aftermath is very light.

When ripe it shells more easily than red clover, and is more apt to waste, hence more care is needed in the harvesting.

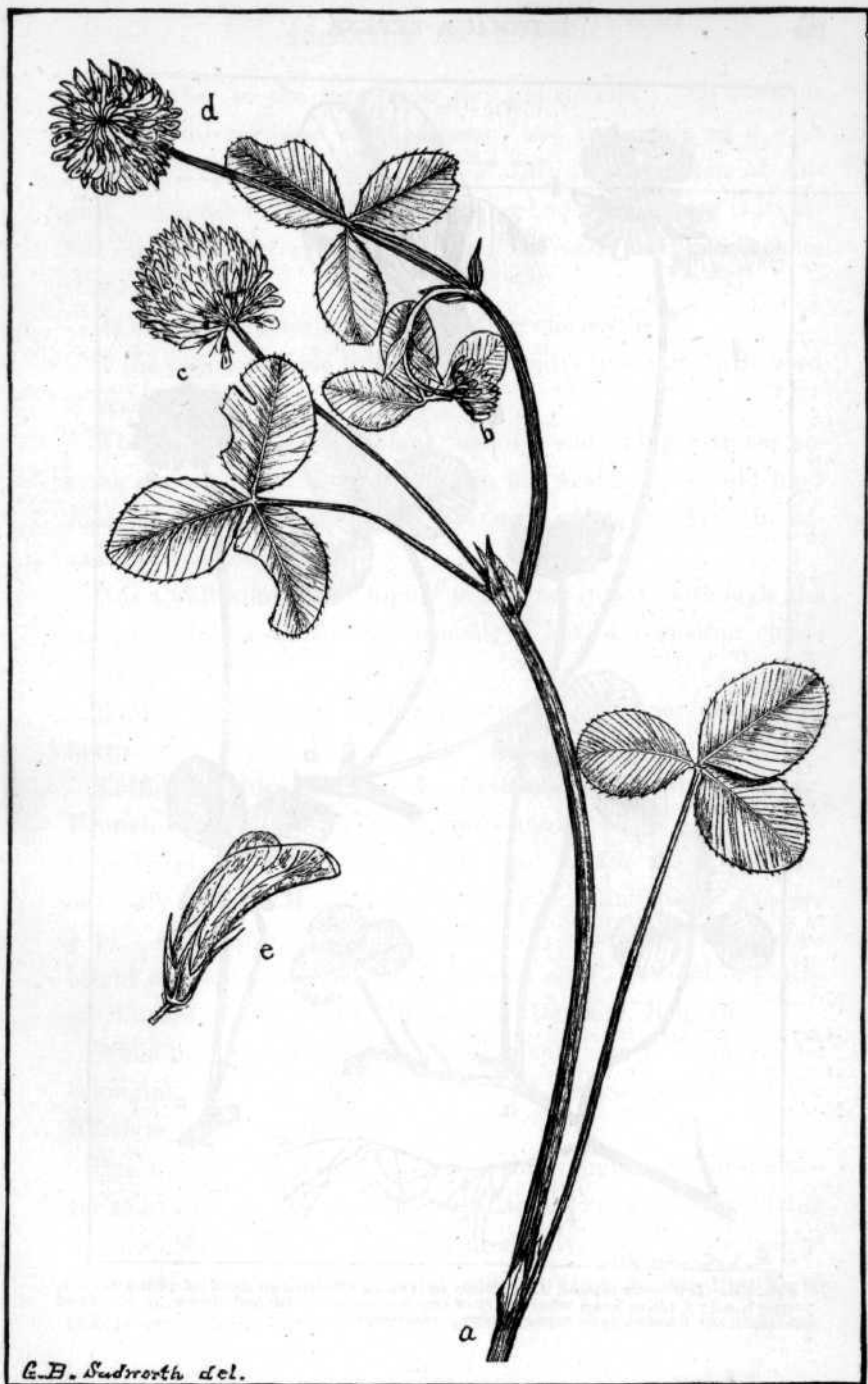
**Trifolium repens, L. White or Dutch Clover.**—A smooth perennial; stems creeping and rooting at the joints. *Stipules* small, narrow, acuminate; *petioles* 2-4 in., *leaflets* obovate or obcordate, obscurely toothed, often with a light mark towards the base. *Heads*, or close umbels, 1 in. diam.; peduncles 3-8 in. *Flowers* white or rosy, pedicels reflexed after flowering. *Pod* 4-6 seeded. In pastures of Europe, Russian Asia, N. Africa, India, N. America, at the North. This is the Shamrock of the modern Irish.

The following, from Wm. Gorrie, gives a fair notion of its estimate among the farmers of England: "It has long been almost universally sown for pastures, but many consider its merits highly over-rated; for although it makes a great display on favorite soils, yet it is neither fattening nor cared for by stock when they have a sufficient choice of pasturage. No attempt has been made to secure improved varieties."

Below follows the opinion of Dr. S. A. Knapp, of Iowa, who says: "It flourishes when the true grasses wither; it appears to defy equally poverty of soil, cold, excessive moisture or extreme drought. It is perennial, which gives it a great advantage over red clover, and renders it an almost necessary substitute where close grazing is practiced. It is extremely hardy, and turns its sprightly green leaves to the lingering snows of spring and stoutly resists the sharp frosts of approaching winter. It resists drought with true clover stubbornness, and thrives in the slough or upon the knoll with almost equal vigor. It furnishes a large amount of highly nutritive material. It has more protein and more fat than red clover. In flesh-forming material it is nearly 20 per cent. richer than blue grass. The product is about eight tons of

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FIG. 132.—*Trifolium hybridum, L.* (Alsike Clover,) a, part of a plant; e, a flower enlarged.—(Sudworth.)



G. B. Sudworth del.

FIG. 132.

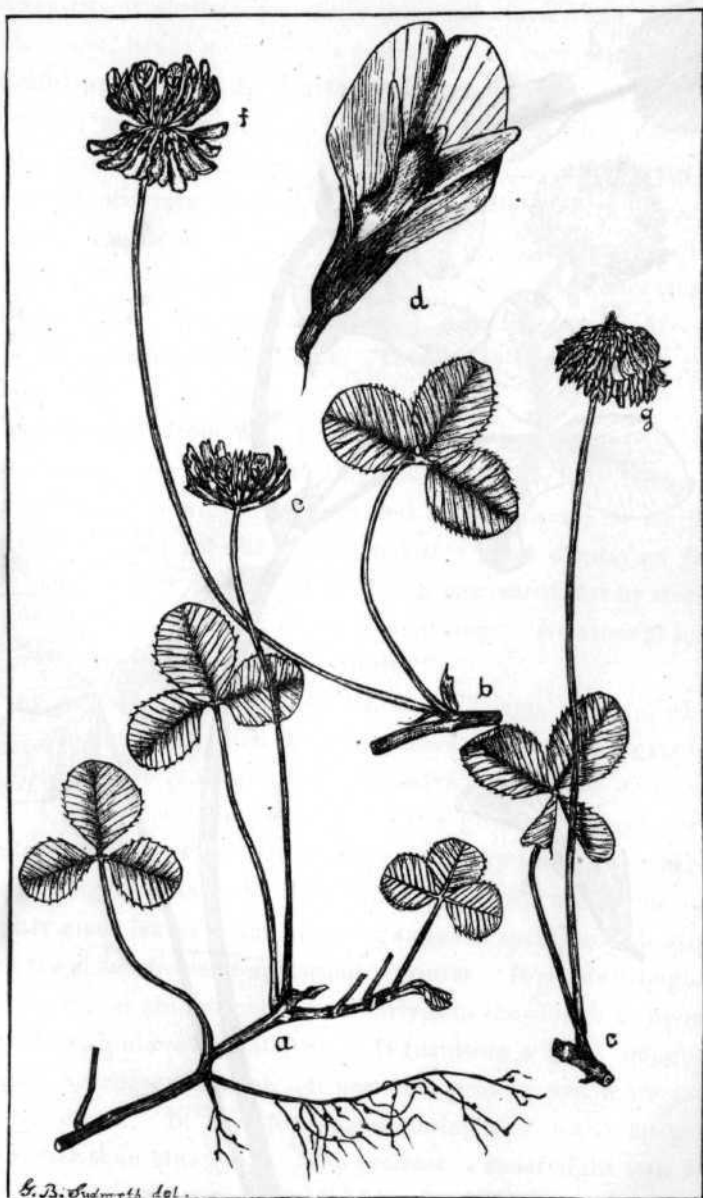


FIG. 133.—*Trifolium repens*, L. (White or Dutch Clover,) a, part of plant with c, young head; f, older head where part of the flowers have turned down; g, old head where all the flowers have turned down.—(Sudworth.)

green fodder to the acre upon rich prairie soil. The flower is excellent during most of the season, and the cattle eat it with avidity, except during the months of July and a portion of August. Almost the sole objection urged to white clover is its effect on horses during the maturing of the seed." It makes them "slobber."

Its dwarf character makes it unfit for the scythe.

If the soil is suitable it spreads so rapidly that very little seed is necessary.

White clover is a fickle plant, coming and going with the varying seasons. It often burns out in hot weather. An old hard road, once abandoned, is likely to send up white clover in advance of the grasses.

It is a well known and highly prized bee plant, although the season is often a short one, especially if hot, dry weather comes on early.

White clover is often sown with some of the finer grasses for lawns.

**Trifolium incarnatum, L. Crimson or Italian Clover, French Clover.**—A soft, erect, hairy annual 1-2 ft. high. *Stipules* broad, with short, broad leafy tips; *leaflets* broad, obovate, or nearly round. Heads 1-2 in., oblong or cylindrical. *Flowers*  $\frac{1}{2}$  in. *Calyx* soft, hairy, teeth narrow, nearly equal. *Petals* bright crimson or scarlet or a pale cream color. Found in southern Europe, and cultivated in France, Germany, Belgium.

When in flower this is a beautiful plant. As it is an annual belonging to a warm climate, it does not seem so popular at the North as red clover.

One writer, a farmer in Virginia, speaks highly of crimson clover to sow in autumn alone, or with Italian rye-grass, for cutting the next May. He says it is very productive, and is an excellent clover for one crop, or rather for one mowing, which should be taken early, as it becomes coarse and woody if allowed to mature.



After repeated trials on a small scale the writer thinks it of no value for Michigan. Prof. Gulley is of the same opinion in reference to Mississippi.

Several other species of true clovers are often met with and sometimes cultivated with more or less success, but we do not intend to treat the subject exhaustively.

MEDICAGO, L. MEDICK.

Herbs with pinnately 3-foliolate leaves; leaflets usually toothed; stipules adhering to the petiole. *Flowers* small, in short spikes, or loose heads, violet or yellow. *Calyx*-teeth 5, nearly equal, keel obtuse, shorter than the wings. *Stamens* diadelphous, the upper one free; anthers uniform. *Pod* small, with few seeds, very much curved, or spirally twisted, indehiscent, often spiny.

Found in Europe, W. Asia, N. Africa, introduced into N. America.

**M. sativa, L. Lucerne, Alfalfa, Purple Medick, Chilian Clover, French Clover, Spanish Trefoil.**—An upright, deeply rooting, smooth perennial, 1-2½ ft. high. *Leaflets* obovate-oblong, toothed, tip notched. *Flowers* in a short dense raceme, blue or purple; peduncles longer than the leaves. *Pod* ¼ in. diam., spirally twisted. Origin not certainly known; now cultivated in Southern Europe and America.

The common French name is *Lucerne*; the Spanish name for the same species is *Alfalfa*, a name which followed the plant into South America and thence to Mexico and California and the dry countries this side.

It was known and prized by the Greeks and Romans 2,500 years ago, and was spoken of by Columella as the most valuable plant for fodder.

To begin with, there are a few things which the inquirer should not fail to keep constantly in mind. Lucerne is "a child of the sun;" likes a rich loam or sand with a deep porous sub-

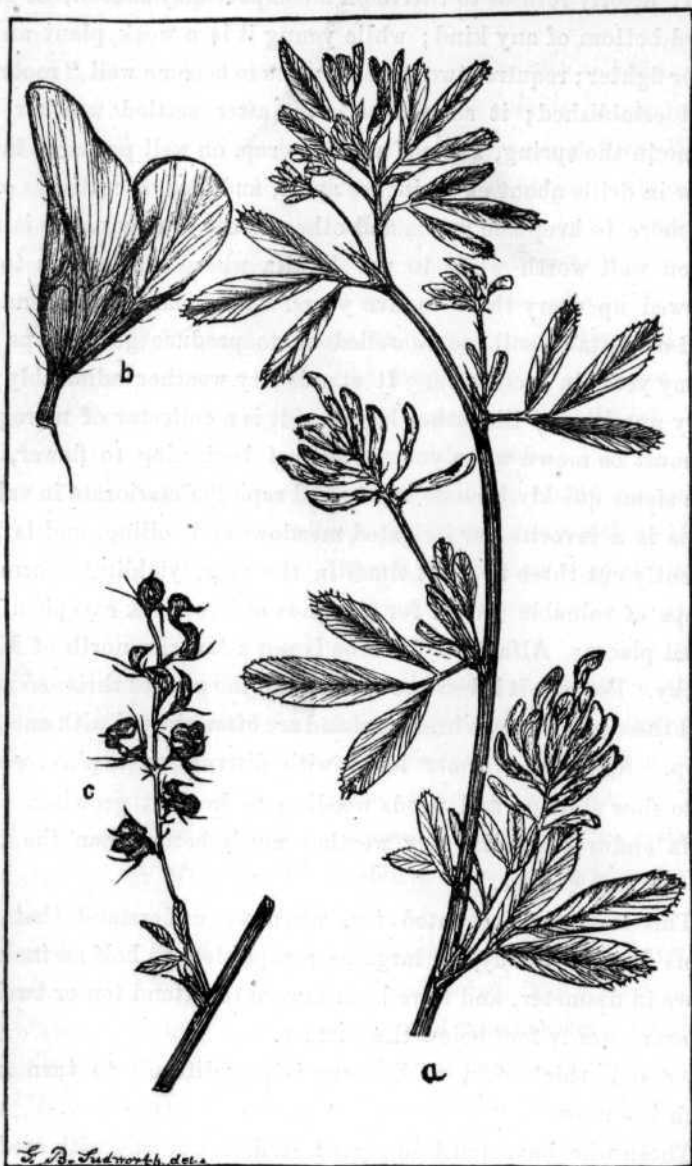


FIG. 134.—*Medicago sativa*, L. (Lucerne, Alfalfa,) a, part of the top of a plant; b, flower enlarged; c, young pods.—(Sudworth.)

soil; utterly refuses to thrive on a compact clay subsoil, or in a hard bottom of any kind; while young it is a weak plant and a poor fighter; requires two or three years to become well "rooted" and established; it should be sown after settled weather has come in the spring, without another crop, on well prepared land. Sow in drills about eight inches apart, and hoe or cultivate once or more to keep the weeds and other plants in check. It is not often well worth while to use Alfalfa where the land is to be plowed up every three to five years. This plant is a perennial, and on suitable soil can be relied on to produce good crops for many years in succession. It stands dry weather admirably; is very nutritious; like other legumes, it is a collector of nitrogen. It must be mown when young and just beginning to flower, for the stems quickly become woody and rapidly deteriorate in value. This is a favorite for irrigated meadows and soiling, and is frequently cut three to eight times in the year, yielding enormous crops of valuable fodder for all kinds of live stock except in isolated places. Alfalfa or Lucerne is not a favorite north of Kentucky. Perhaps it is because clovers and the grasses thrive so well, and these can be sown broadcast and are often started with another crop. Again, the farmer looks with distrust on a plant which is so slow starting and needs weeding to keep it growing. Alfalfa endures extreme dry weather much better than the true clovers and grasses.

This is easily accounted for, when we understand that the roots become woody, as large as a pipe stem to half an inch or more in diameter, and have been known to extend ten or twelve, or even twenty feet below the surface.

An old, thick field of Lucerne is very difficult to turn over with the plow.

Those who have tried imported seed of Lucerne with seed of Alfalfa from California claim that plants of the latter will not endure the cold as well, but will stand heat and drought better.

Fifteen to twenty pounds, and even more, are usually sown to the acre.

Honey bees seem to extract the honey without any trouble.

Dr. H. P. Armsby states that "Lucerne is even richer in protein than red clover, but it is inclined to a more rapid formation of woody fiber after the flowers appear. It demands early cutting even more than clover. On account of its excess of protein it should be fed in connection with some feeding-stuff poor in protein, such as roots or straw, to realize the best effect."

Mr. Gorrie, of England, reports, that when properly managed the quantity of cattle which can be kept in good condition on an acre of Lucerne, during the whole season, exceeds belief. It is no sooner mown than it pushes out fresh shoots.

Prof. J. R. Page, of Virginia, considers it one of the most certain as well as one of the best crops the farmer can cultivate for soiling purposes. He finds no difficulty in getting a good stand and a profitable return, and recommends it very highly. It is cured in the same way as clover.

At the Agricultural College in Central Michigan, Lucerne, when hoed and properly started for the first year has not killed out during severe winters, while it beats everything to endure prolonged drought. It is not suitable to mix with clover, as the latter overtops and crowds the Lucerne. I can report no systematic attempt in Michigan to establish, mow and feed crops of lucerne.

In 1883 Prof. E. M. Shelton, of Kansas, said: "We have no hesitation in saying that, all things considered, it is a most valuable clover, especially for the western and southwestern sections of the state. Along the Arkansas river, where irrigation is practiced, it has proved a most invaluable forage plant. More accounts come to us of failure with Alfalfa than with any other clover or grass, and this is because of the difficulty in starting the plants and in selecting and preparing the soil properly. It

must not be sown with another crop, neither mowed nor pastured during the first year. The dangers which threaten it most are the common mole and pocket-gopher; the latter burrowing among and cutting the roots, has destroyed several acres on the college farm. We have cut three and even four large crops from the same ground in one season."

Early in 1885 Prof. Shelton states in the *Rural New Yorker* that Alfalfa has proved with us the most useful of all clovers for the purpose of pasturage. It endures uninjured, close cropping, all kinds of stock consume it greedily, and it has never winter killed. It requires much field room in curing, and soon spoils with light rains. For hog pastures I know of no other plant so valuable.

Prof. A. E. Blount reports for Colorado: "J. S., near the college, keeps large herds of sheep, some cattle, horses and hogs. When fed on Alfalfa cattle grow faster; cows give more and better milk; horses are more healthy and do more work with a fourth of the grain; sheep make better mutton and lose less wool; and hogs fatten, almost ready for market, without any grain. He cuts his crops three times, averaging about two tons to the cutting. By letting the first crop grow until July he raises from 5 to 10 bushels of seed per acre."

He says he has samples four feet long, grown in thirty days. It does not spread except by seeding. It is too tender to sow in the fall, but should be sown in spring after the frost has gone. Harrow it in with or without a crop.

President Ingersoll, of the same place, told me that Alfalfa was the only forage plant that would grow at their place and keep green without irrigation. It is a favorite forage crop in Colorado and its cultivation is extending very rapidly.

For Mississippi and vicinity Prof. D. L. Phares considers Lucerne very valuable. It sometimes gets two feet high by the middle of February. He knows some plots of it now in fine con-

dition that are known to have been growing for over thirty-five years, without any marks of decay.

Prof. F. A. Gulley, of the same state, thinks it is too difficult to get it well started.

The late C. W. Howard, of Georgia, believed, as a forage plant at the South, Lucerne is very far superior to all others. For feeding it should be cut a day in advance and used in a wilted state. *It must never be pastured*, as live stock in that climate bite out the crowns of the plants and kill them. It is ready to cut a month in advance of red clover.

**Medicago lupulina, L. Black Medick, Nonesuch.**—A procumbent, branching, pubescent annual or biennial. *Leaflets* obovate, toothed at the apex. *Peduncles* longer than the leaves bearing ovoid heads of small yellow flowers. *Pods* small, one-seeded, black when ripe, kidney-shaped. Found in Europe, N. Africa, West Asia to India; introduced in N. America.

On rich land it often affords considerable pasture, reminding one of white clover in its habit. It is not likely worth cultivating in this country because we have something better.

**Medicago maculata, Willd. Spotted Medick, Burr Clover, California Clover.**—A procumbent or spreading, branching annual. *Leaflets* obovate or obcordate, often with a black central spot, minutely toothed. *Peduncles* 3-5 flowered; flowers yellow. *Pod*  $\frac{1}{4}$  in. broad, making 3-5 coils, quite compact, with a double row of long, curved spines. Found in Europe, N. Africa; introduced in N. America. The pod makes something like a burr, so much so that it adheres to wool. It is too tender and short lived to be of value at the North, but has some good words from people of the South.

Prof. D. L. Phares, of Mississippi, considers it a valuable plant. He has grown it about thirty-five years, and says it furnishes good grazing from February till April or May. Cattle do not incline to eat it at first, but they learn, and finally acquire a

great fondness for it. It seeds freely every year. Crab grass occupies the ground from June to October after the Medick has seeded.

**Medicago denticulata, Willd. Burr-Clover.**—This annual much resembles the last and is often confounded with it. The pods are loosely spiral and deeply reticulated.

A writer in the *American Agriculturist* for 1878 speaks highly of the plant.

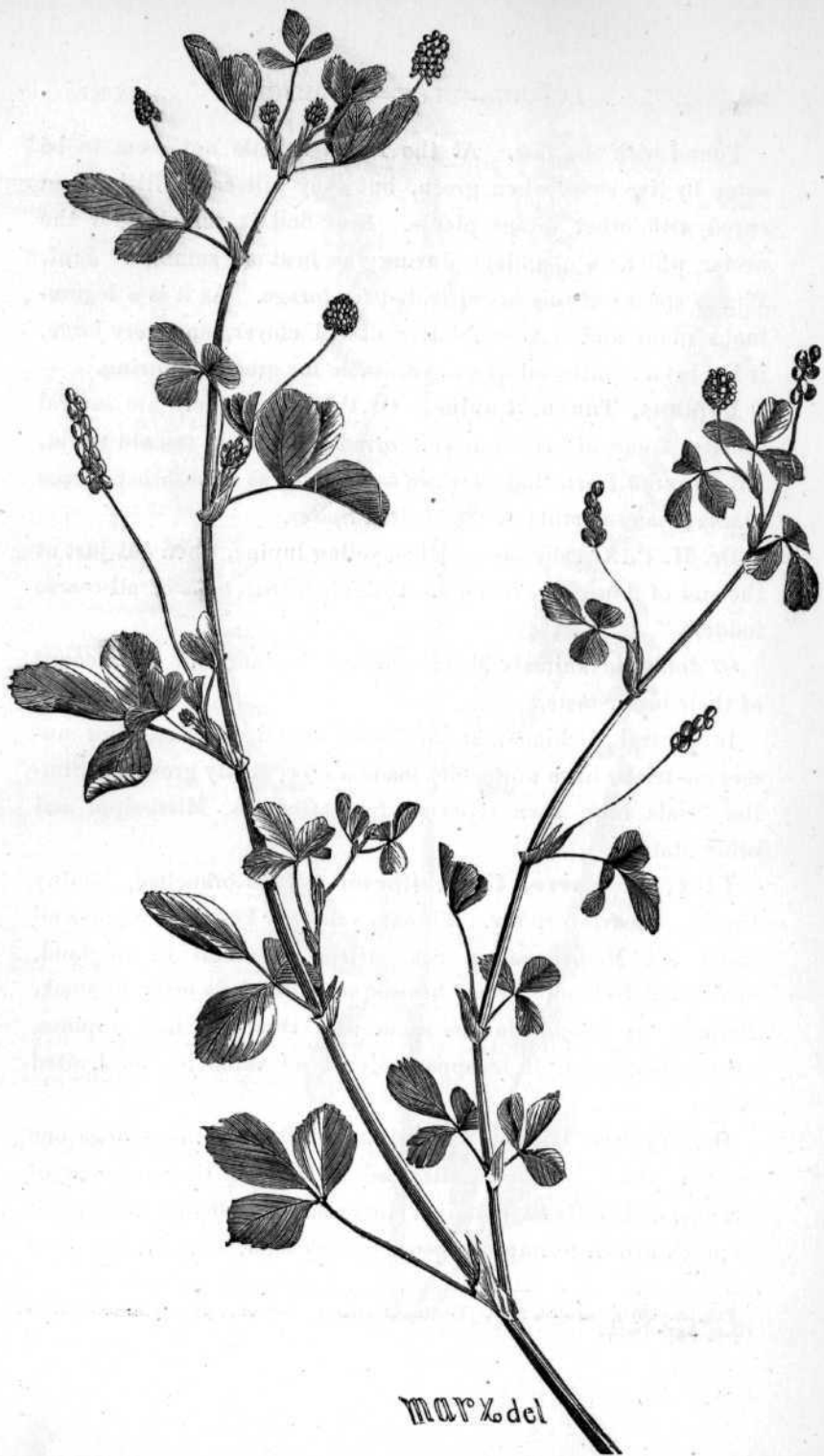
Burr-Clover grows wild all over the plains and foot-hills, and affords much pasture. Even the burrs grow in such profusion that they afford a good supply of dry concentrated food. They collect, by force of the wind, in the hollows of the ground. It is tenacious of life and will bear close feeding.

#### MELILOTUS, TOURNEFORT. MELILOT.

Annual or biennial, fragrant when bruised or in drying. *Leaves* pinnately 3-foliolate, nerves ending in teeth; *stipules* slightly adhering to the petiole, often cut. *Flowers* small, yellow or white, in long, loose axillary racemes. *Calyx-teeth* 5, nearly equal. *Petals* deciduous; keel shorter than the wings, obtuse. *Anthers* uniform. Pod with one or few seeds, small, straight, thick, indehiscent. Plants abound in an etherial oil (cumarin) rendering them objectionable to stock. Warm and temperate regions of the old world.

**Melilotus officinalis, Willd. Yellow Melilot, Sweet Clover.**—This is an annual or biennial with yellow flowers, apparently of little importance except for bees.

**Melilotus alba, Lam. White Melilot, Bokara Clover, Sweet Clover.**—An erect, branching, woody, annual or biennial 2-6 or 8 ft. high. *Leaflets* truncate. *Flowers* small, white, in long racemes. *Pods* black when ripe.



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FIG. 135.



Found with the last. At the North it does not seem to be eaten by live stock when green, but they will eat a little when cured with other forage plants. Bees find it valuable for the nectar which is abundant during the heat of summer. Prof. Phares speaks of this as cultivated for forage. As it is a leguminous plant and a near relative of red clover, and very large, it has been mentioned as quite suitable for green manuring.

**Lupinus, Tourn. Lupine.**—Of this genus there are several species, some of which have proved valuable in the old world, but I cannot learn that they are as valuable as some other forage plants in any portion of the United States.

Dr. H. P. Armsby says: "The yellow lupine, when cut just at the end of flowering, is the most highly nitrogenous of all coarse fodders."

Of domestic animals sheep only eat lupines well on account of their bitter taste.

In Central Michigan, at any rate, several varieties, after numerous trials, have uniformly made a slow, sickly growth. Similar trials have been reported from Georgia, Mississippi and other states.

**Ulex, L. Furze, Ulim, Gorse.**—Much-branched, thorny shrubs. Leaves prickly. Flowers yellow. Found in regions all about the Mediterranean Sea. Often abundant in England, Wales and Ireland. When bruised or wilted it is eaten by stock. Perhaps we might do the same with thistles. Like lupines, above mentioned, it is apparently of no value in the United States.

**Onobrychis, Tourn. Sainfoin.**—To this genus belongs one species which is much cultivated in parts of the continent of Europe and in Great Britain. In France this leguminous plant is much grown to improve poor, hungry land, and will last 4 to

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FIG. 136.—*Melilotus alba*, Lam. Portion of a plant in flower and fruit, natural size.—(U. S. Agri. Dept.)

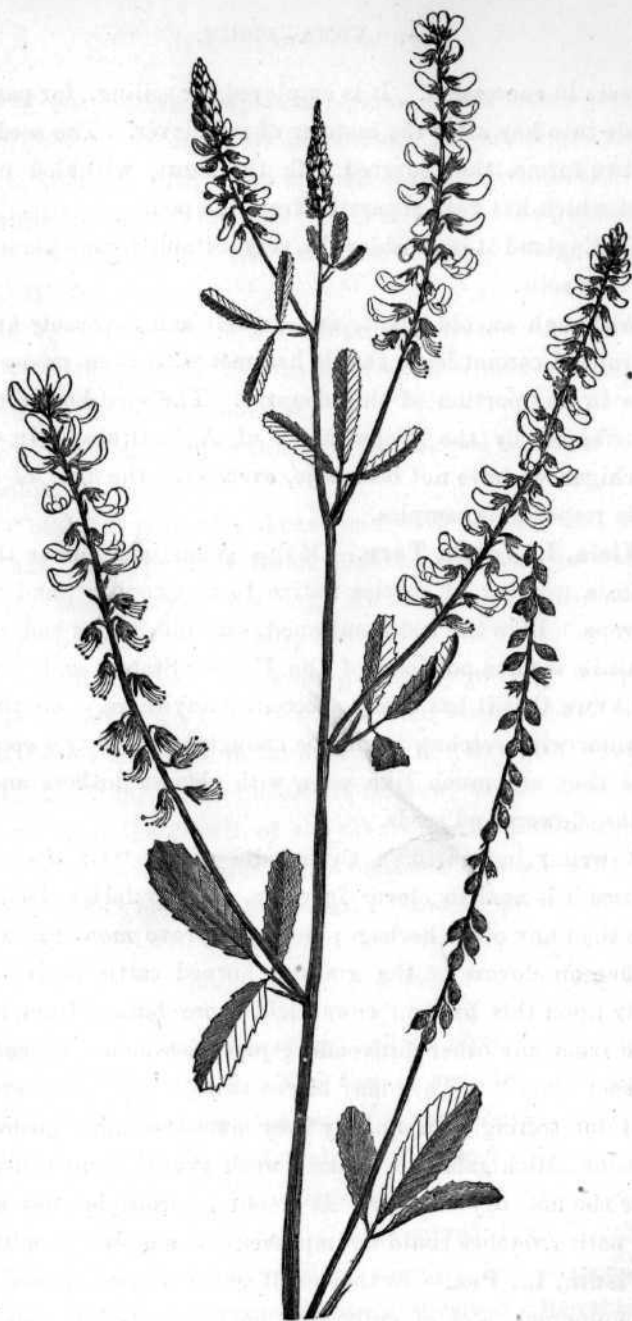


FIG. 136.

7 years in succession. It is employed for soiling, for pasture, or made into hay after the manner of red clover. The seed is sold in two forms, that covered with the short, wrinkled pod, and that which has been separated from the pod.

In England it is considered a very suitable forage plant for calcareous soils.

Although an old plant, and so well and favorably known in Europe, I cannot learn that it has met with even moderate success in any portion of this country. The seed has been widely distributed by the Department of Agriculture. In Central Michigan we have not been able, even with the best of care, to raise respectable samples.

**Vicia, L. Vetch, Tare.**—Of this genus of legumes there are quite a number of species native to this country, and many in Europe. Like the last mentioned, sainfoin, it has had repeated trials in various portions of the United States, and yet we do not know that it has really succeeded anywhere. To those not familiar with vetches, it may be enough to say in this connection that they are much like peas, with slender leaflets and small stalks, flowers and seeds.

A writer in Morton's Cyclopedia says: "Of the artificial grasses it is next to clover in value. Sheep fatten faster upon this than any other herbage; horses improve more rapidly upon it than on clovers or the grasses; horned cattle thrive surprisingly upon this fodder; cows yield more butter from the tare than from any other provender; pigs voraciously consume and prosper upon it. They may be cut twice a year, and are much used for soiling. In quality they much resemble lucerne. At Lansing, Michigan, they make a weak growth, and will not endure the hot, dry weather. It is not improbable that some of our native vetches could be improved and adapted to cultivation.

**Pisum, L., Pea.**—To this small genus of two species, belong the numerous races of cultivated field and garden peas. They

thrive in cool, moist, temperate regions. Like other legumes, they draw much from the air and subsoil, and are most excellent crops to alternate with wheat and the true forage grasses. They like moist loamy soil, but this should not be in the highest condition, else the plants "run too much to vines," at the expense of a good crop of seeds.

From  $1\frac{1}{2}$  to 4 bushels of seed to the acre is sown broadcast or in drills, yielding 15 to 25 bushels of seed, which is a very nutritious food for swine and sheep.

The greatest enemies to this crop are the pea weevil or "bug" and mildew.

Of "buggy" peas only about one-fourth per cent will usually grow, and these produce feeble plants. Seed can be obtained from the North, where the bugs are not troublesome, and the young crop can be fed out bugs and all.

The weevil can be killed when young, by putting the peas as soon as threshed in a tight box with some bisulphide of carbon. There is some difference in varieties, but hot, dry weather is quite sure to favor the development of mildew, which weakens and often prevents the growth of the plants or the production of a good crop of seeds. In favorable localities enough attention is not paid to this crop, both for feeding and to precede a crop of wheat.

#### DOLICHOS, L. COW PEA.

*Calyx* campanulate, lobes or teeth short, often obtuse, the two upper more or less united. The *banner* rounded, with inflexed appendages at the base; the *wings* falcate-obovate adhering to the *keel*, which is incurved and often beaked, but not spiral. The odd stamen free from the banner. *Anthers* uniform. *Ovary* subsessile, many ovuled; *style* curved, barbed, or with a pencil of hairs below the terminal stigma. *Pod* shaped like a scymetar, falcate, or linear, compressed, 2-valved, often thickened

at the sutures; valves flat or convex. *Seeds* thick or compressed, hilum short or long, covered or naked. Plants herbaceous or shrubby, climbing, erect, or prostrate. *Leaves* pinnate, 3-foliate, stipellate. *Stipules* small. *Flowers* violet, flesh colored, yellow or white. Solitary or clustered in the axiles. About 20 species, found in the cooler parts of Africa, in Asia, Australia, and America.

**Dolichos Chinensis, L. Cow Pea, Bush Pea, Chinese Pea.**

Leaflets vary much in shape, and are oval, broadly ovoid, or rhomboid. Flowers few at the end of the peduncle. *Pods* 3-8 in. long, mostly straight, 2, 3, or 4 to a stalk. *Seeds* black, white, red, cream colored, purple, or spotted. The style of foliage, absence of tendrils, shape of seed, and the raising of the seed leaves above the ground in germination, all indicate that it is more nearly related to the bean than the common pea.

It has been cultivated in China from remote antiquity, and is a favorite forage crop in the Southern States, where it takes the place of red clover at the North.

There are many varieties in cultivation which differ much in foliage, size of plant, size, color and shape and yield of seeds.

Some are quite bushy and spread into a tangled mass. Even in Central Michigan some of these peas make a rank growth, completely covering the ground two feet and a half high.

At the North, horses refuse to eat it, but at the South, probably from "education," all grazing domestic animals are very fond of cow peas, either fresh or dried.

The following notes are mainly gleaned from an article by P. J. Berckmans, of Georgia, as found in the *American Agriculturist* for 1876:

Almost any land will grow the cow pea, though the "Clay," "Red" and "Black" succeed better on poor land than the "Lady" or "Crowder" varieties.

Spring crops are sown in April, and fall crops after taking off

wheat or oats. From four to six pecks per acre are sown broadcast, the larger amount on poor soil. On good soils two crops of forage are often cut from one sowing, provided the season is favorable. The crop is sometimes plowed under. As with young clover, so plaster is sown on cow peas.

All the plain or semi-colored varieties are of a spreading nature and are best suited for forage. The "Red," "Clay" and "Black," of the plain kinds, and the "Whippoorwill," of the semi-colored, are most esteemed. The "Red Ripper," or "Tory" may be sown in fall if preferred.

The speckled varieties are usually bushy in growth, and unfit for forage. They are raised for market and the table.

The "Lady Pea" and "White Table" are used for culinary purposes, sometimes for snaps, or shelled in the green state; when dry they are very desirable for soup, or they may be baked the same as the white bean.

The vines are fit to cut for fodder when the pods begin to turn yellow. The vines often lodge badly, and are usually cut with a scythe. A few grains of corn mixed in with the seed gives some stalks for support.

The main difficulty in curing pea hay is to retain the leaves on the stalks; to ensure which they must be handled very little. The wilted vines may be loosely piled and remain so for two or three weeks till cured and ready for storing.

On good land, and good culture, two tons of forage per acre may be expected, and sometimes two cuttings in a year, with a yield of two tons at each cutting. The yield of seed varies from 30 to 40 bushels per acre, or more commonly 10 bushels. The latter is likely to be the yield when sown in rows in corn fields.

For feeding stock, well cured cow pea hay is more nutritious than any hay produced from grasses, millet, or other plants.

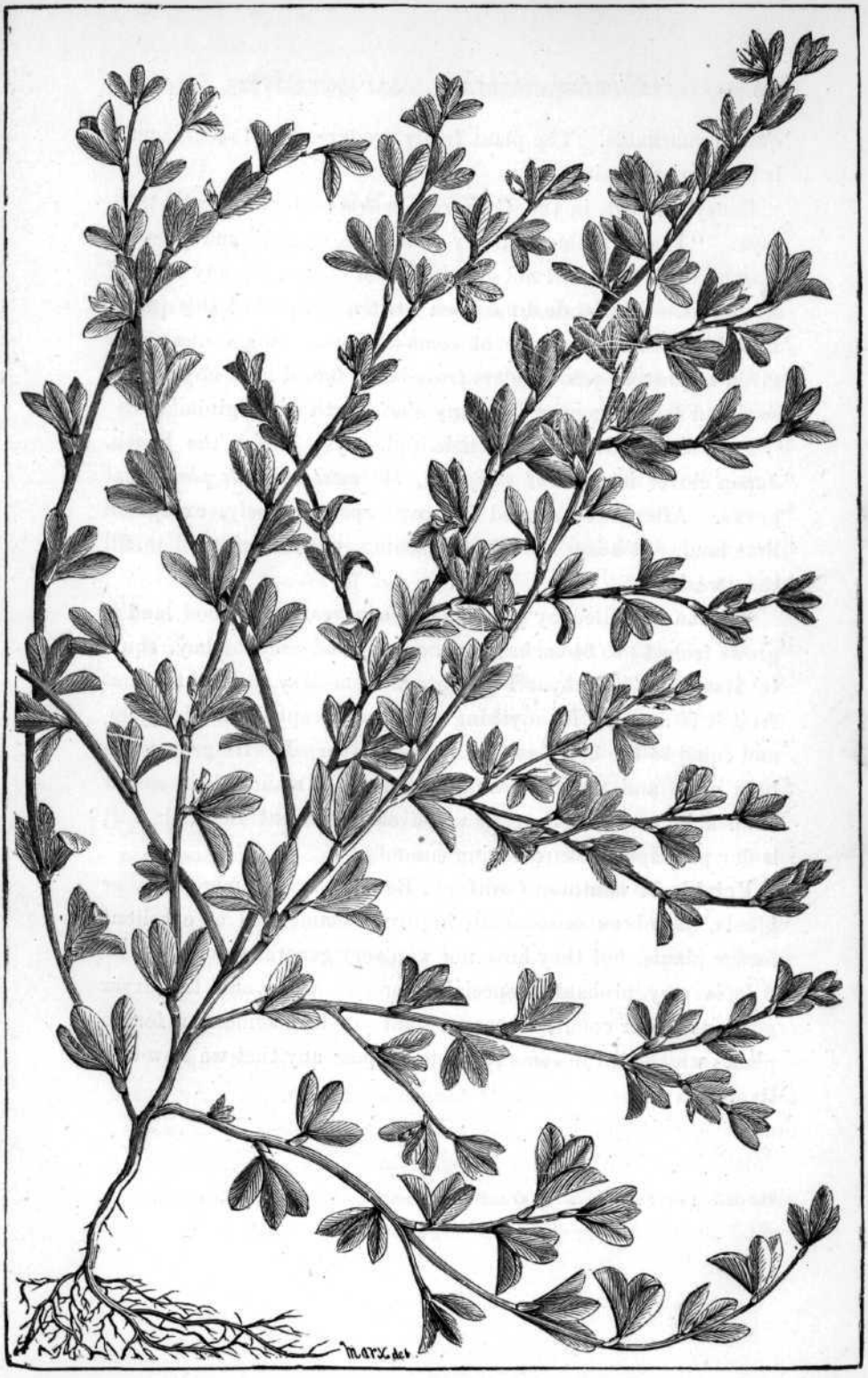
When the pods are left until they are filled the value of the food is much increased. When fed upon such fodder, horses

and mules should receive less corn or oats than when fed on any other provender. In some parts of the country the peas are often troubled with pea weevil or "bug." To prevent this Prof. Phares lets them remain in the pod till ready to use, or when dry, then thresh them and mix with road dust.

With reference to the cow pea for Mississippi, Professor Gulley reports as follows: "For hay and for plowing in to fertilize the land, we sow broadcast a bushel to a bushel and a half to the acre, harrow in and cut with a mower as we would clover. Black and red peas make more vines and will stand wet weather without rotting, when speckled peas will be entirely spoiled. I sow the black and red exclusively, cut for hay, feed off with stock or leave them to rot on the ground for manure. For seed we sow in drills and cultivate once or twice. Peas are a slow crop to gather, as they do not ripen evenly. I consider this crop one of the most valuable for hay or ensilage or for restoring the fertility of the soil. It stands first."

**Lespedeza striata, Japan Clover.**—This is a low perennial herb, with small trifoliolate leaves and very small flowers, producing a small, flattish, indehiscent one-seeded pod. The seeds to this were accidentally brought to South Carolina about 1849, probably in connection with importations of tea from China. It has spread continually and quite rapidly over the South, and has quite tenaciously held its own, even crowding Bermuda grass.

The writer knows little of this plant, and ventures to quote some very conflicting opinions as to its value. Several writers speak of it as very suitable for poor soils for grazing in dry, hot weather. The stems spread close to the ground, seldom growing over a foot high. It is quite firm and hard, and at first not a favorite with stock. They learn to eat and thrive on it because of its nutritive qualities, which chemical analysis makes



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quite remarkable. The plant freely produces small seeds, and it is hard to exterminate.

Henry Stewart, in the *Country Gentleman* for January, 1886, says: "I assert emphatically that unless cattle and pigs are starved to it, they will not eat the Japan clover, or any kind of *Lespedeza*. A good deal has been written in favor of this plant. In a few places it may be of some service. This statement is given to prevent your readers from being fooled into buying the seed and trying to grow it in any place north of Virginia."

Prof. F. A. Gulley, of Mississippi, says: "For the South, Japan clover is, *without exception, the most valuable plant* that grows. After once started it grows spontaneously, except on lime land. It keeps hills from washing, even coming in to fill the 'washes.'

"It can be killed by plowing for one year. On good land it grows from 12 to 24 inches high, cuts a good crop of hay, equal to first-class Timothy. For pasture from May 15th to the first frost it is as good as anything we have except Bermuda grass, and equal to the best pastures at the North. It will grow when blue grass and the clovers fail entirely. It stands dry weather admirably, and on some soils will even choke out Bermuda. It is our principal pasture during summer."

**Prickly or common Comfrey, Barage**, and numerous other plants, have been occasionally highly recommended as excellent forage plants, but they have not won very general favor.

It is very probable, especially for the South and the dryer portions of our country, that we shall yet find some new forage plants which will in some respects surpass any that we now cultivate.