

UNIVERSITY OF KENTUCKY

COLLEGE OF AGRICULTURE

Extension Division

THOMAS P. COOPER, Dean and Director

CIRCULAR NO. 318

CRIMSON CLOVER AND OTHER WINTER LEGUMES



Harvesting crimson clover seed.

Lexington, Ky.

September, 1938

Published in connection with the agricultural extension work carried on by cooperation of the College of Agriculture, University of Kentucky, with the U. S. Department of Agriculture and distributed in furtherance of the work provided for in the Act of Congress of May 8, 1914.

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CRIMSON CLOVER AND OTHER WINTER LEGUMES

By E. N. FERGUS, RALPH KENNEY and W. C. JOHNSTONE

INTRODUCTION

Winter legumes are annual plants of the legume family that complete their development during the fall, winter and spring. Tho they may sometimes grow considerably during the fall, generally speaking they rarely do more than become well established and make a good ground cover. During late winter, as the weather becomes favorable for growth, they begin rapid development that is completed by late spring or early summer.

Crops of this group known to be of agricultural value in Kentucky are crimson clover (*Trifolium incarnatum*), low hop clover (*Trifolium procumbens*), white clover (*Trifolium repens*),* and hairy, or winter, vetch (*Vicia villosa*). Others about which little is known regarding their agricultural possibilities in Kentucky are black medic (*Medicago lupulina*), least hop clover (*Trifolium dubium*), Austrian winter pea (*Pisum arvense*), bur clovers (*Medicago sp.*), and button clover (*Medicago orbicularis*). It appears that the latter group may be suited to southwest Kentucky, but until more is known regarding their adaptability to that section, only small acreages should be sown, and these for the purpose of test. The farmer who is not inclined to experiment may for the present, therefore, be content to confine his selection of winter legumes to the first group.

PART 1. CULTURAL PRACTICES AND USES

Because soil treatment and cultural practices are similar for the production of each of these crops, it seems best to consider them in this place in so far as practicable, leaving important variations for the discussion pertaining to specific crops.

Soil treatment. Despite the fact that most of these legumes are fairly well adapted to rather poor soil, it is best that such soil be

* White clover, tho a perennial, is included in this group for reasons explained in the discussion of the plant.

limed and fertilized for them in so far as possible. Not only will these crops themselves respond profitably, but the crops that follow will also benefit directly from the residual effects of the treatments, and indirectly from the effects of the better legume growth. Land should therefore be limed at the rate of 2 to 3 tons of limestone to the acre, unless it has been recently limed or unless some crop is to follow the legume that may be injured by liming. Phosphate should be applied to all soil outside the Bluegrass region that has not been liberally treated recently, at the rate of 200 pounds or more of 20 percent superphosphate to the acre, or with an equivalent amount of some other carrier of phosphorus. The materials should be applied as far ahead of seeding as practical.

Preparation of seed bed. All seed should be covered to a depth varying with the crop. Obviously the necessary seed bed preparation varies from plowing or disking, and harrowing, in preparation for winter vetch, Austrian winter pea, and bur clover in the pod, to very little harrowing for the smaller-seeded species. In fact, no seed bed need be prepared, apparently, for seeding the latter group on stubble or thin sod land. Heavy sods must be grazed, disked, or clipped and the material removed, else the seedlings will be smothered.

Method of seeding. One of the requirements of good seeding is that the seed shall be evenly distributed. Seed drills and wheelbarrow seeders do the work satisfactorily. It is also possible to sow uniformly with hand seeders, but it is not so easy. Hand broadcasting is satisfactorily done only by one skilled at it. Perhaps all seed sown broadcast, whether with mechanical seeders or by hand, should be divided, half being sown in one direction and half in the other.

Winter vetch and Austrian winter pea, if sown broadcast, should be harrowed in. Bur clover in the hull is best sown broadcast and harrowed in. The smaller-seeded species need not be harrowed in unless the seed bed is very fine.

It appears that crimson clover, winter vetch and Austrian winter pea, tho frequently sown alone with excellent results, should generally be seeded with a small grain or perhaps Italian rye grass. Other winter legumes should always be sown in a sod, in Kentucky.

These various small-grain or grass-legume mixtures are apt to be more effective in controlling soil erosion than the legume alone, and they undoubtedly are more winter hardy, especially if seeding must be done late. Nitrogen fixed by the legume is more largely conserved if a small grain or grass is grown with the legume, and the mixture produces a better pasture than either alone. It appears, therefore, that the winter legumes should seldom be sown alone.

For seeding such mixtures, the seed bed is prepared for the grain crop, which is sown in the usual way. Austrian winter pea is best seeded by drilling or disking it in ahead of the small grain. Vetch may be seeded as suggested for peas or the seed may be mixed with the small grain. Crimson clover may be sown thru the grass-seed attachment of the grain drill, at the time the grain is drilled, or it may be broadcast afterward. A light harrowing may be beneficial if the seed bed is very fine.

Rates of seeding. Seeding rates vary widely. Vetch and Austrian winter pea have large seeds and must be sown at much heavier rates than the smaller-seeded kinds. However, judging from experimental work, it seems desirable to sow the small-seeded kinds at rates considerably in excess of those that would be expected to produce a heavy stand. Recommended acre rates of seeding for the various winter legumes in Kentucky are as follows:

| | Seeded alone or in sod | Seeded with small grain or Italian ryegrass |
|---------------------------|---------------------------|--|
| | pounds | pounds |
| Crimson clover | 12-18 | 8-10 |
| Hop clover | 3-15 | 5-10† |
| White clover | 2-10 | — |
| Vetch | 20-60 | 15-25 |
| Black medic | 10-20 | 8-12† |
| Austrian winter pea | 40-60 | 20-30 |
| Bur clover* | 30-60 | 20-25 |
| Button clover | 10-20 | 8-12† |

* Unhulled. † Mixtures of doubtful value.

Small grains with which the legumes are seeded should be sown at from 4 to 6 pecks to the acre. The lighter rates are preferred for early seeding, and the heavier for late seeding. Apparently about 15 pounds of Italian ryegrass seed to the acre is sufficient for the ryegrass-winter legume mixture. It is not easy to sow a small

amount of seed uniformly; therefore, unless a mechanical seeder that operates successfully at light seeding rates is used, it is best to thoroly mix the seed with fine sand or other suitable inert material to increase the bulk.

Winter legumes may be seeded approximately from August 5 to October 15. The best date varies with sections of the State and with the legume. Generally speaking, seeding dates in southern and western Kentucky are ten to fifteen days later than in northern and eastern Kentucky. Because winter vetch, white clover, hop clover, and black medic are quite winter-hardy, they may be sown late, if necessary, tho it is desirable to sow as early as practicable to ensure as much growth as possible before winter. Crimson clover is slightly less winter hardy; therefore it ought not to be sown so late that it cannot make good growth before winter, tho small plants in sod or winter grain seldom winterkill. Preferred dates for seeding the winter legumes under various conditions in different parts of Kentucky are shown in the following table.

All winter legume seed, except bur clover seed in the hull, should be inoculated shortly before seeding on land for the first time, unless a good crop of another species of legume carrying the effective nodule organism has recently occupied the land. It is most conveniently done with good commercial cultures if the manufacturer's directions are carefully followed. Soil methods are also effective. These consist in obtaining soil from a field that has grown a good crop of a legume affected by the desired organism. This soil may be broadcast over the field at the rate of 200 pounds to the acre and worked into the soil or, more conveniently, it may be partly dried, pulverized, screened, and mixed with the seed until particles adhere to each seed. Slightly moistening the seed before mixing aids materially in obtaining good soil adherence. The seed should then be dried sufficiently, if necessary, to prevent swelling, and sown within two or three days.

Only three species of nodule organisms affect the winter legumes under consideration; consequently, these legumes may be arranged in the three following groups, according to the organism concerned. Other common legumes affected by the same organism have been

TIME TO SOW WINTER LEGUMES

| Kind | Seeded alone on specially prepared seed bed | | Seeded with small grain or Italian ryegrass | | Seeded in sod | |
|---------------------|---|-------------------------|---|-------------------------|-------------------------|-------------------------|
| | North and east Kentucky | South and west Kentucky | North and east Kentucky | South and west Kentucky | North and east Kentucky | South and west Kentucky |
| Crimson clover | Aug. 5-20 | Aug. 10-Sept. 1 | Aug. 20-Sept. 10 | Sept. 1-20 | Aug. 25-Sept. 15 | Sept. 15-Oct. 1 |
| Hop clover | Not recommended | Not recommended | Not recommended | Not recommended | Sept. 5-Oct. 10 | Sept. 15-Oct. 20 |
| White clover | Not recommended | Not recommended | Not recommended | Not recommended | Sept. 5-Oct. 10 | Sept. 15-Oct. 20 |
| Vetch | Aug. 15-Sept. 10 | Aug. 25-Sept. 20 | Aug. 15-Sept. 20 | Sept. 1-Oct. 1 | Sept. 1-25 | Sept. 10-Oct. 5 |
| Black medic | Not recommended | Not recommended | Not recommended | Not recommended | Sept. 5-Oct. 10 | Sept. 10-Oct. 20 |
| Austrian winter pea | Not recommended | Aug. 25-Sept. 10* | Not recommended | Sept. 1-20* | Not recommended | Sept. 5-Oct. 1* |
| Bur clover | Not recommended | Not recommended | Not recommended | Sept. 1-20* | Not recommended | Sept. 5-Oct. 1* |
| Button clover | Not recommended | Not recommended | Not recommended | Sept. 1-20* | Not recommended | Sept. 5-Oct. 1* |

* Recommended with reservations; see text.

added to each group, as an aid in selecting suitable soil for inoculation:

| Group 1 | Group 2 | Group 3 |
|----------------|---------------------|---------------|
| Crimson clover | Vetch | Black medic |
| Hop clover | Austrian winter pea | Bur clover |
| White clover | Garden pea | Button clover |
| Red Clover | | Alfalfa |
| Alsike clover | | Sweet clover |

Uses. Winter legumes as a group are of value in Kentucky principally for soil improvement and conservation and for winter and spring pasture. Generally speaking, they serve the three purposes at the same time, yielding immediate returns in livestock products and later profits in improved yields of subsequent crops. The pasturage that they furnish in the spring, relieving the permanent pasture of early overgrazing, is immensely important for the farmer who is trying to manage his permanent pastures for high production.

Some of these crops may undoubtedly be harvested for seed profitably, and a few may be made into hay, but the weather is frequently so unfavorable for hay making at the time they should be harvested that they are better used otherwise. Summer legumes are much more satisfactory for making into hay.

If used wholly as green-manure crops, they should be plowed under only when in condition to produce beneficial effects. That will be before the mass is too large or too woody to become incorporated properly in the soil. Generally speaking, they should be plowed under when 18 inches or less tall, and at least two weeks before a subsequent crop is seeded.

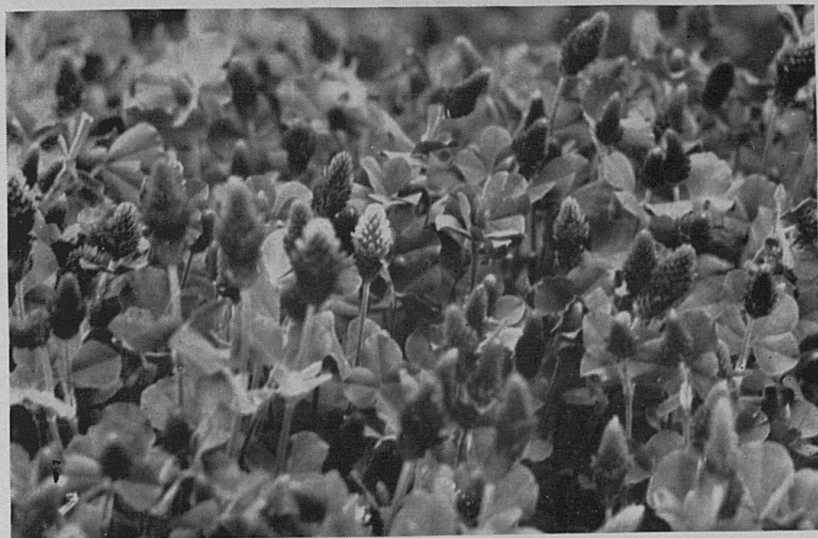
Insect pests and diseases. Insects rarely, if ever, seriously injure any of the winter legumes, and diseases apparently are unimportant except on crimson clover, tho some damage may be done to most of them by organisms that cause stems to become black and, when severe, to drop their leaves.

PART 2. THE SPECIES

CRIMSON CLOVER

Crimson clover is an erect, pubescent, many-stemmed plant that is especially distinguished from the other legumes by its long, numerous, compact heads of crimson colored flowers.

This clover possesses several good qualities that make it the most generally useful, in Kentucky, of the winter legumes. The cost of seeding an acre is usually among the lowest of the crops, and the seed is easily sown. It stands pasturing well and without



Crimson clover is a good cover, pasture and green-manure crop.

much wasting of leaves and stems, is adapted to medium productive soil as well as to the best soil, is palatable, nutritious, and quite productive. The crop, however, has some objectionable qualities that have prevented its more general use in Kentucky. Perhaps the most serious of these is the rather frequent loss of stands in the seedling stage. This situation arises because the seed germinates quickly; consequently seedlings made on a dry soil germinate with the first shower that wets the surface soil, only to perish because of insufficient moisture in the subsurface. Furthermore, stands from late seedings are likely to die during the winter unless the weather is mild and not conducive to heaving. If, however, the

late seeding is made in a sod or with a small grain or with Italian ryegrass, the stands seem to be sufficiently protected by the companion crop to survive even severe winters.

The practice of seeding crimson clover in permanent pastures appears to be increasing in favor and has much to recommend it. Earlier grazing is made possible in the spring, and the clover has a beneficial effect upon the grass that greatly increases the summer and fall pasturage. Apparently there seldom is appreciable smothering of the grass by the clover, tho the possibility should be considered and the clover clipped and removed whenever it is impossible to graze a very heavy growth.



Small grain and crimson clover grow well together, protect the soil, and make excellent pasture.

Crimson clover makes sufficiently good growth in Kentucky on soil of medium productivity to justify its use even when it is impossible to apply lime and fertilizer. However, the crop responds so favorably to the soil treatments suggested in Part 1 that it is worth while to incur considerable expense to make them.

Seeding. Practically all crimson clover seed sown in Kentucky is hulled, but some unhulled seed is used even tho it is more troublesome to obtain and more difficult to sow. Unhulled seed has one advantage that recommends its use—it requires more moisture for germination than is supplied by a shower of rain. There-

fore, when sown on a dry soil, it does not germinate until sufficient rain has fallen to sustain the seedlings. It seems, however, that the general availability and ease of sowing are such outstanding advantages in favor of hulled seed that it doubtless will always be the outstanding choice of farmers in general. For sowing in permanent pastures the hulled seed seems to be superior to unhulled seed, and for most other seeding it is as good or better, except when weather conditions are unfavorable, as previously mentioned.

Recommended seeding practices are discussed in Part 1.



A mixture of Italian ryegrass and crimson clover prevents erosion and makes good grazing.

Use. Crimson clover is valuable primarily for soil improvement and pasture. Usually a stand serves both purposes. For pasture it is especially prized because of its rapid growth, excellent palatability, and high nutritive value. It is likely to cause bloating of cattle and sheep, especially if they are turned on it when hungry and without easily available salt and water.

Crimson clover makes good hay when cut in early bloom and well cured. If it is to be fed to horses or mules it must be cut before any heads become brown; otherwise "hair balls" formed in the intestines from certain parts of these mature flowers may kill the animals.

Some crimson clover is harvested for seed in Kentucky, and it appears that the tendency is to increase the acreage used for that purpose. It is not difficult to harvest, tho careful handling of the crop is required to prevent shattering of the seed. The crop should be cut a few days after the last heads become brownish. For most farmers the crop will be most conveniently cut with a field mower. Unless the crop is lodged, it is desirable to cut high in order to reduce the amount of material that has to be handled. To avoid excessive shattering of the seed, mowing should be done while dew is on the plants, and the material bunched or windrowed as cut by special attachments on the cutter bar of the mowing machine. In taking the crop to the huller or to storage to await hulling, it should be handled little and carefully, and hauled on a wagon with a tight bottom.

The seed may be hulled satisfactorily with a clover seed huller or grain threshing machine equipped with special hulling concaves and screens. The small combine harvester also successfully threshes crimson clover.

Seed intended for home use may be saved in the hull. Usually this is most easily done by harvesting the heads with a comb stripper. Commonly this tool is made by constructing a "comb" on an open side of a shallow box. The teeth for the comb, which are made of hard wood pointed at one end, have in cross section the shape of the side view of a tall bucket. The unpointed ends of the teeth are fastened to the back of the comb, which is a broad piece of wood, with the narrow side down. The teeth should be $\frac{1}{4}$ inch apart. Dimensions of the parts of the comb will vary somewhat, depending upon the size of the stripper. For the smallest strippers the teeth should be 1 inch wide. Larger sizes will require somewhat broader teeth because the length will be greater, requiring greater strength. The length of the teeth varies from 6 inches in hand strippers to 18 inches or more in the large ones which are swung between two wheels and drawn by mule or horse. The latter should be supported in such fashion as permits their being adjusted as to height above ground and of their tilting to accommodate the teeth to varying heights of clover while stripping. The shafts of the

implement should be long enough to allow hitching the mule or horse well ahead of the comb.

The ordinary hand bluegrass seed stripper has been used successfully to harvest crimson clover seed after the sides of the teeth have been cut off sufficiently to make a space of $\frac{1}{4}$ inch between them. Doubtless the pan stripper could be used if similarly modified, tho perhaps the teeth are too short to permit fast operation.

Diseases. Crimson clover is frequently injured somewhat, and occasionally seriously, by crown, or stem, rot (*Sclerotinia trifoliorum*). The disease kills plants during mild winter weather and during the spring. Crowns of the dead plants may be lifted readily from the taproot, and more or less spherical but irregularly shaped white to black masses may be found in and about many of the dead crowns and taproots. These bodies are conclusive evidence of the disease. There is no practical remedy for it, nor can it be prevented by any known method. Fortunately the disease rarely destroys the entire stand, and only infrequently reduces it seriously. Even when the disease is quite prevalent in a field, enough plants usually survive to produce a good covering.

HOP CLOVERS

Of the three hop clovers, only the one known as low hop clover seems to be common in Kentucky. This is an erect-growing, rather leafy plant that branches much if not crowded. Its yellow flowers are rather loosely arranged in small but conspicuous heads of much the same shape as red clover. The flowers, however, droop on maturity. Usually its height is between 6 and 10 inches, but it varies from 3 to 18 inches or more, depending upon moisture and soil productivity. The plant is inconspicuous during fall and winter, but during the spring it becomes very noticeable because of its abundant bloom. Only the low hop clover is considered in this discussion, tho it applies almost equally to the smaller, somewhat less productive and less common least hop clover (*Trifolium dubium*).

Hop clover seems to be one of the least sensitive legumes to low soil productivity, but like other worth-while legumes it is much benefited by soil treatment and makes its best development on good soil.

Observed grazing indicates that the palatability of hop clover varies from season to season, in relation to other pasture plants, more than other pasture legumes—at any rate, livestock graze it readily in some years but largely avoid it in others. It seems to be quite nutritious, however. Like other pasture legumes it has a beneficial effect on yield and nutritive qualities of the grasses in the pasture; consequently there is no objection and much advantage to its presence in a pasture even in those seasons when it is little grazed, despite the fact that in such seasons it adds somewhat to the problem of pasture management.

Hop clover undoubtedly has a large place in Kentucky as a permanent-pasture legume. It is the only winter legume that maintains itself well on soil too poor for white clover, which is the only other legume found abundantly in permanent pastures during winter and spring in Kentucky. Hop clover, therefore, must be depended upon for the winter-legume portion of permanent pastures over a large part of Kentucky. Tho the plant is widely distributed, it is not sufficiently plentiful in most of those pastures to improve their productivity. It should be included in permanent pasture mixtures and sown generally in the established permanent pastures of the State, especially in southern and western parts.

Use. As previously indicated, this legume is of great value in pastures. It is not a simple matter, however, to manage them always so that the clover recurs regularly, especially pastures of heavy sods, because the grass must be fairly short during fall and early winter to prevent smothering the legume seedlings. This is best avoided by close grazing, but sometimes it is necessary to clip and remove the excess herbage. The hop clover, in turn, should be prevented by grazing or clipping from becoming rank enough during the spring to smother the grasses and other kinds of pasture plants, including Korean and other annual lespedezas.

Hop clover does not seem to produce bloating, but it causes horses and mules to slobber if they graze it intensively after the seed has matured.

Because of hop clover's usual short growth it is seldom practicable to make hay of it, tho a heavy growth of mixed grass and hop clover in a pasture will make a considerable yield of good hay, and

the pasture will be better for its removal, provided it is not cut closer than average hay stubble. This hay will prove of value during drouthy summer weather, to supplement the reduced pasturage.

Unpastured stands of hop clover and excess growth of it in pastures may be harvested for seed by cutting with a mower and threshing or hulling when dry. For home use, the material may be scattered thinly over pastures in which it is desired to get a start of the crop.

WHITE CLOVER

White clover, also known as Dutch clover, has a perennial habit of growth and behaves as a perennial on productive soil in Kentucky. However, it usually grows so much better during cool weather, especially in the spring, than in summer that for practical purposes it may be considered a winter legume in this State.

White clover is a smooth, leafy, essentially white-flowered plant with wholly prostrate stems that root at the nodes. It acquires its name from the color of its flowers which, tho mostly white, are variously tinted with pink or purple. The heads are shaped somewhat like red clover, but more spherical and less compact. White clover grows rapidly under favorable conditions so that the plant spreads rapidly. Its usual height is from 2 to 4 inches, but sometimes it reaches a height of 8 inches or more.

There are at least two varieties of white clover—the ordinary and the Ladino, or giant white. There are numerous strains of ordinary white clover, some of which perhaps may be considered varieties, but the important differences so far as its agricultural value in Kentucky is concerned are in adaptation—a kind obtained from one source being differently adapted from another from a different source. Limited tests on the Experiment Station farm at Lexington indicate that Kentucky-grown seed is best adapted, and that Louisiana-grown is next best. Inasmuch as seed is practically never saved in Kentucky, it is recommended that Kentucky farmers use Louisiana seed.

Ladino makes about twice the growth of ordinary white clover in central Kentucky, but its degree of adaptation to the State is not known. It seems, however, to be at least reasonably well suited, tho perhaps not quite so winter-hardy as the native kind.

There are several geographical strains of Ladino, but nothing is known of their relative adaptability to Kentucky.

Tho white clover is always used as a pasture plant in Kentucky, it is one of the most important legumes. It is well adapted for growing with bluegrass and other good sod-forming grasses when properly grazed, persists under severe grazing and tramping, is quite drouth-resistant, and reseeds abundantly. These qualities, together with its excellent palatability and high nutritive value, account for the important place the legume holds in Kentucky agriculture.



White clover in Kentucky bluegrass pasture.

In addition to the obvious advantages of white clover, it has a pronounced beneficial effect on the productivity, nutritive value and vigor of the grass with which it grows. While these effects are produced by other legumes also, it may be said that white clover, because of its persistence and recurrence in permanent pastures, has exerted them to a greater extent in pastures than other legumes. It may truthfully be said that the pastures of the Bluegrass region of Kentucky owe their fame to white clover equally as much as to bluegrass.

Unfortunately, white clover has certain objectionable features that detract somewhat from its popularity, if they do not limit its use. It causes horses to slobber. This is important in the opinion of some horsemen; others regard it as more than offset by the plant's excellent pasture and nutritive qualities. Another and more serious objection is the bloating it causes in cattle. However, this rarely happens even on the most luxurious growth if the cattle always have access to plenty of water and salt and are never turned on the pasture when hungry or if they are kept on it continually.

White clover thrives only on good soil, and it is essential that poor soil be treated as suggested in Part 1 for a vigorous growth of it in pastures; in fact, it is desirable to apply a phosphate fertilizer at a heavier rate than indicated in Part 1, to soil deficient in available phosphorus, because white clover is very responsive to an ample supply of the element in available form. Weak and unthrifty white clover in old permanent pastures responds remarkably well to top-dressing with limestone and phosphate fertilizer, and sometimes also to muriate or sulfate of potash applied at the rate of 100 pounds to the acre.

Use. As already stated, white clover is used wholly for pasture in Kentucky. There are times, however, when it makes so much growth that it is impossible to graze it off. Excess growth then might well be made into hay to the advantage of the pasture, provided it is not cut close. The feed could then be used when the pastures become short.

Even tho white clover is only a pasture legume, much can be done by pasture practices to affect its usefulness. Briefly stated, white clover is encouraged by rather close fall grazing of the pasture grasses, because that reduces competition from the grasses sufficiently to allow the clover to spread thruout the sod. Pastures of heavy sods in which the grass is permitted to grow tall during the fall seldom have a good growth of white clover during the following year.

Occasionally white clover produces considerable seed, which perhaps can be harvested to advantage because of the demand for adapted seed. Tho somewhat difficult to take up, because the growth is usually short, the seed is rather easily threshed or hulled.

HAIRY VETCH

Winter, or hairy, vetch is a hairy, purple-flowered, viny legume that has found favor with many farmers in a few sections of the State. It behaves normally as a winter annual, but individual plants may live for two years. The chief advantages that commend the crop are its winter hardiness, toleration of soil acidity, and good soil-building and soil-conserving qualities. Objectionable qualities that have prevented its wider farm use are its viny and rather prostrate habit of growth, relatively high acre cost of seeding, and tendency to become a weed in grain fields.



A stem of hairy or winter vetch in bloom.

Because of its viny nature and consequent tendency to mat on the ground, vetch is commonly sown with one of the small grains. These support it physically so that it may be pastured to better advantage or more easily made into hay than if grown alone.

Vetch is wholly winter-hardy in Kentucky and adapted to all soils in the State if not wet, tho many need moderate treatment for its satisfactory production.

Vetch is more tolerant of soil acidity than most cultivated le-

gumes, and perhaps no soil in the State is so acid that it will not produce good growth of the crop if other soil factors are favorable. The crop also makes fair growth on soil of moderate mineral content, but good growth ought not to be expected on a poor, acid soil; consequently the soil treatments recommended in Part I are advised for this crop in so far as practicable.



A mixture of vetch and small grain protects and enriches the soil.

Seeding. Because vetch seed is too large to become covered readily by stubble or other litter on the ground, a seed bed should always be prepared. It makes little difference how it is obtained, but it should be firm and at least moderately fine. Vetch differs from most cultivated legumes in that the seedlings come thru the ground from deep seeding; consequently it may be sown 3 inches deep or more if necessary—an advantage in dry weather over other legumes except field peas.

Use. Vetch undoubtedly always will be used in Kentucky principally for soil improvement and soil conservation, for which purposes it has outstanding value, especially for use on soil that for one reason or another it is impractical to lime. Alone it is only moderately satisfactory for pasture because it is rather unpalatable to livestock, but when sown with more palatable crops it is eaten rather freely.

BLACK MEDIC

Black medic is also commonly known as yellow trefoil. Tho many plants are biennial under favorable conditions, the species is essentially a winter annual. It is frequently mistaken for hop clover because both flower at about the same time and the blooms appear much alike. However, it can readily be distinguished from hop clover by its prostrate growth, rather square, pubescent stems, and large, rather compact group of seed pods. Under favorable



Black medic in a Kentucky bluegrass pasture.

conditions black medic makes a mat 6 to 10 inches thick by early summer, in Kentucky. Ordinarily, however, it produces less than half this amount, so that the plant may be considered only a pasture legume.

Black medic grows on a wide variety of soils, provided they are not strongly acid, but it is of practically no value in Kentucky except on the better soils. The plant is a close relative of alfalfa and has similar but somewhat less exacting soil requirements. Tho it is adapted to soil of rather low available mineral content, it responds to the soil treatment recommended in Part I.

Use. Unfortunately, sufficient information is not available to

permit a positive statement as to the place of black medic in permanent pasture production in Kentucky, but its palatability, nutritive value, and relatively low acre seeding cost are qualities that commend it for the permanent pasture mixture. Were it not for its too aggressive growth under some conditions, it could be recommended without reservation. Until more is known regarding its habits in permanent pastures, however, it should be sown only for trial.

Experience in seeding the crop in pastures for the first time in Kentucky has been somewhat discouraging because only poor to fair stands were obtained. Perhaps failure to effect complete inoculation of the seedlings is the principal cause of failure, because once a thin stand is obtained it usually becomes much better and, on the whole, persistent, tho apparently seldom producing heavy growth similar to white clover and lespedeza.

Inasmuch as this plant has about the same relation to other species of plants in a pasture as hop clover, it seems that pasture management for maintaining black medic in the proper relation to other plant species should be essentially as described for the pasture containing hop clover.

AUSTRIAN WINTER PEA

The Austrian winter pea is a viny, soft-stemmed, semiprostrate plant. Except for its colored flowers and coarser growth, it is similar in appearance to the garden pea. The two plants also seem to be similar in soil adaptation and are fundamentally alike in climatic adaptation in that both are cool-weather crops, but differ in that the Austrian kind is much more cold resistant. The Austrian winter pea has attained much popularity in Tennessee and southward in recent years primarily as a soil-improving crop. The chief advantage on which its popularity rests seems to be its wide soil adaptation, relatively low seeding cost, and early maturity.

Tho this crop appears to be sufficiently cold resistant to survive subnormal winter temperatures of western and southern Kentucky, it is doubtful whether it makes sufficient growth during any but the most favorable winter in Kentucky to justify its extensive use. Other objections to the crop are its very slight fall growth, its

procumbent habit, and the softness of its stems. It therefore is neither an effective cover crop nor a satisfactory pasture, tho it is very palatable. If it is grown with a winter grain or Italian ryegrass, as perhaps it should always be in Kentucky to ensure a ground cover, the vines are supported so that the crop is also more usable for pasture.



Austrian winter pea should be sown with a small grain.

BUR CLOVERS

Two bur clovers may be of some value to Kentucky farmers—the southern bur clover (*Medicago arabica*) and Tifton bur clover (*Medicago rigidula*). Both are procumbent and otherwise similar in appearance, except that the latter lacks the dark purple-spotted leaf of the former. Both are highly valued in the Cotton Belt for early pasture and soil improvement.

Tho these crops are sufficiently winter hardy for use in southwest Kentucky, if sown with rye grass or a winter grain, it seems they should be grown only in a small way until their adaptability is determined. The Tifton species is reported to be more winter hardy than the southern bur clover.

Both species produce seed in a bur-like pod, and most of the seed on the market is in that form. It may be sown without inoculation because the organism is carried in the particles of dirt adhering to the burs. The hulled seed, however, should be inocu-

lated. The burs are large. They should be sown in such a way that they are covered lightly.

BUTTON CLOVER

Button clover is similar to southern bur clover in habit of growth and soil adaptation, but differs perhaps in being slightly less cold resistant. On the whole, the discussion of the culture and agricultural value of southern bur clover applies to button clover, with the important exception that seeding practices are essentially the same as for black medic because commercial seed is normally hulled. Difficulty of harvesting the seed has resulted in very limited supplies.

