

Some Insects Injurious to Red Clover

By T. H. PARKS

Extension Entomologist

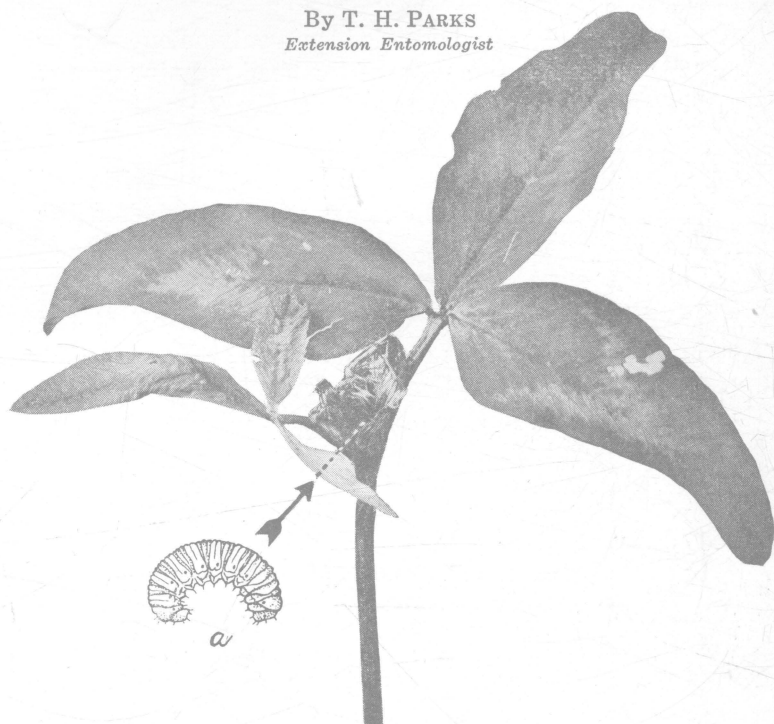


Fig. 1. Blighted clover head. Damage caused by larvae of the lesser clover-leaf weevil. (a) Larva greatly enlarged. (Original.)

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READ THIS FIRST

Find Your Trouble, Then Turn to the Page Cited

Why do many of the red clover heads refuse to bloom in June?

Lesser Clover-leaf Weevil. See page 4.

Why do some red clover heads bloom only on one side or on top, while the remainder of the head remains green?

Clover-flower Midge, page 8 or *Clover-seed Caterpillar,* page 11.

What makes the blackened and irregular cavities at the bases of the clover branches where these join the main stem?

Lesser Clover-leaf Weevil. See page 4.

What makes some red clover plants break off at the ground when being cut for hay or seed?

Clover Root-borer. See page 6.

What causes the brown "honeycombed" clover roots?

Clover Root-borer. See page 6.

What eats spiral grooves and cavities into the outside of red clover roots?

Clover-root Curculio. See page 7.

What are the very small pink maggots sometimes found in the heads?

Clover-flower Midge. See page 8.

What is the tiny white maggot found by crushing some gray clover or alfalfa seeds?

Clover-seed Chalcis-fly. See page 12.

What eats the numerous holes in the new leaves of clover in April and May?

Clover-leaf Weevil. See page 10.

Can I kill grasshoppers in red clover? See page 14.

Are sweet clover and alsike clover damaged as badly by insects as red clover? See page 16.

INTRODUCTORY

Only one-tenth of the land in cultivated crops in Ohio is now growing clover. During the past ten years the average yearly clover acreage was but one-half that of oats and increased no more than oats. Clover is undoubtedly the best crop to plow under for corn. Besides its fertilizer value it leaves fewer injurious grain insects than any other crop in our rotation.

It is a matter of common observation that it is becoming more difficult to grow good crops of red clover, and especially red clover seed, in some sections of Ohio that formerly grew it extensively. As proof of this, the total production of clover seed from 1910 to 1920 was approximately two-thirds of that produced from 1900 to 1910. Insects are partially responsible for this. Soil conditions and plant diseases are other important factors. This bulletin has to do only with some of the more important insects, with some suggestions about how to avoid their damage. Owing to their habits, some are very difficult to control. Others have been studied enough to make it possible to point out weak places in their life cycle. Taking advantage of these, the grower can, by slightly changing his methods of caring for this crop, sometimes prevent what would otherwise be serious loss. It is difficult to outline a method of crop management that will strike effectively at all of the clover insects. For this reason it is necessary to use methods of prevention against those which one is certain have caused the heaviest loss in recent years, and reduce their damage as much as possible.

By referring to the following pages, one will be better able to decide what insects have contributed to recent clover losses, and to identify those which may appear in the future. Help in determining the insects which cause specific troubles may be secured of the County Agent or by mailing samples to the Extension Entomologist, the Ohio State University, Columbus, or to the Ohio Agricultural Experiment Station, Wooster.

Some Insects Injurious to Red Clover

By T. H. Parks

Lesser Clover-leaf Weevil

The presence of this insect is detected by pulling off some branches of red clover during the first week in June, and examining the base of the branch and joining part of the stem for irregular black cavities that have been eaten one-half way thru the stems (see Figs. 1 and 2). These cavities have been made by the larvae of this insect. The general results in the field are a stunting of the growth just previous to blossoming time, which is attended with lack of bloom and dead foliage. Many heads which did not bloom, if torn apart, will reveal the presence of a small greenish straw-colored grub or larva, which has been eating at the base of the head just above the point where it is seated. This results in a mass of gray or brown fuzz filling the stunted head instead of the normal flowers. The damage is over by the third week in June and is not observed again until the following year.



Fig. 2. Damage to stem. (a) larva.

This weevil has been the cause of the most serious insect trouble to red clover in western Ohio during the past three years. In 1919, when the month of June was dry, the loss in hay tonnage was heavy. Its damage is not so severe during good growing weather.

The adult of this worm is a small green-backed snout beetle which lives over winter in leaves in woodlots, under matted bluegrass, and among the clover crowns in the clover fields. The beetles lay eggs during May beneath the leaf-stipules, where the little worms upon hatching find food, and later travel to the branch above, where new cavities are eaten. Some find their way to the developing head before they are matured. In July the worms have changed to beetles, which remain in the clover fields during the remainder of the season. Clover is damaged only during the second year of growth.

Control

It was found in 1920 that cutting the hay crop about one week earlier than is now customary is of great advantage. When the damage is severe, the hay tonnage decreases from the time the worms stop feeding until the crop is cut, due to the dying of damaged branches and their leaves. In Miami County in 1920 the maximum tonnage was secured by cutting the hay June 17, while the majority of the farmers cut their crop one week to 10 days later. By June 15 most of the worms were changing to beetles and the damage to the crop was about over. When cut at that time the new growth started immediately, while that cut earlier made no new growth until then. This was due to the worms leaving the drying hay for the new growth.

The following table shows the weight per acre, hay condition, and approximate time when the new growth started at the Miami County Experiment Farm where the experiments were made in 1920:

Result of Experiments to Determine Best Time to Cut Hay

Plat No	When cut	Hay condition	Yield per acre	When new growth started
1.....	June 8	Dry	†1 ton 350 lbs.	June 15 to 17
2.....	June 12	Fair	2 tons 350 lbs.	June 15 to 17
3.....	June 17	Fair	2 tons 1000 lbs.	June 17
4.....	June 21	Tough	2 tons 700 lbs.	
5.....	June 25	Fair	2 tons 650 lbs.	
6.....	June 29	Dry	2 tons 700 lbs.	

The worms were about one-half grown when the first plat was cut, and these worms left the drying hay in 24 hours and began feeding upon the new growth. It was prevented from starting until June 15. Most of the hay in the county was cut June 25 to July 1. By that time the new growth in Plat 3 was well started and no further damage resulted to it.

Spraying experiments in April, to kill the parent beetles before they deposited their eggs, were only partially successful. It made a remarkable difference in the ability of the crop to blossom, but further work will be necessary to determine if it is practical.

The worms were present in lesser numbers in alsike clover, but it did not suffer severely under their attack. A mixture of alsike and red clover was preferable to red clover alone in the infested area.

Sweet clover and alfalfa are not infested by this insect.

†Heavy rain when hay was dry enough to take up resulted in many leaves being lost.

Clover Root-borer

No insect has caused more general damage to red clover in Ohio than the clover root-borer. The insect is very small, the adult beetle being about one-eighth inch long, dark brown in color, and can be found in the clover roots during almost the entire year. The larvae are very small white grubs which, together with the pupae

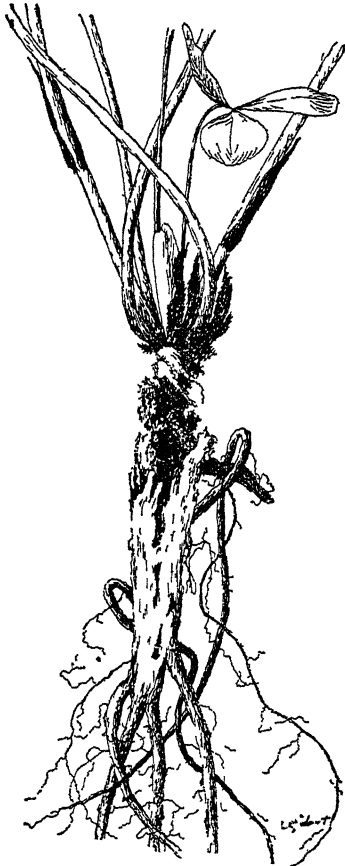


Fig 3 Clover roots damaged by clover root-borers

and adults, are found within the old clover roots, thru which they burrow. (Fig. 3.) Old roots are often honey-combed with their burrows near the upper surface. This greatly weakens the plants, which can often be broken off easily at the surface of the ground. The adult beetles winter in these burrows, and during May many of them seek new fields and new plants in which to lay their eggs. The larvae after hatching soon burrow downward into the root, and by midsummer have become full grown and are changing to beetles. There is but one generation each year.

This insect does not attack clover during the first year of its growth, as the roots are too small. When infested with many larvae, the plants die during the second summer before maturing a seed crop. Frequently such plants will tear loose from the ground when being cut for hay.

The ability of infested plants to withstand an attack will depend upon the season. During a dry summer the damage is greatest, the plants frequently dying in spots over the field.

Control

Owing to the habits of this insect, effective control is difficult. The only reliable measure to be suggested is to plow under the infested roots as soon as the hay crop is removed. This will starve many of the grubs before they are matured. Such a remedy is seldom followed owing to the lack of labor for plowing at that time of year. If it could be more generally followed in sections where

this pest has prevailed, the problem would be largely solved. A rotation of corn-oats-clover-wheat would lend itself to this program. This practice, together with allowing the clover to stand only two



Fig. 4. Adult and larva of clover root-borer (line shows actual size of insect).

years, would do much to reduce the pest to subjugation in any community.

Sweet clover is not known to be infested. In Ohio the damage to alfalfa and alsike clover has been very small. These plants have been very little infested where red clover is common.

Clover-root Curculio

This insect is of comparatively recent importance as an injurious species in Ohio. During early June the small white larvae or grubs can be found thruout the soil in a two-year-old field of red clover. They burrow thru the soil and eat the young fibrous feeding roots. Much damage is also done by the larvae eating into the main or tap root of the plant. The results are numerous grooves and feeding cavities eaten into the root from without. Sometimes these assume a spiral shape around the root and completely encircle it. Such plants when handicapped by dry weather, turn yellow and die in



Fig. 5. Damage from clover-root curculio:
(a) Red clover root showing work of grubs
(b) Red clover leaf showing work of beetles
(From Bulletin 85, Bureau of Entomology, U. S. D. A.)

patches over the field. The roots of such plants will be found with much of the outer surface eaten off, and scabby and brown.

The worms change to beetles in small cells just beneath the soil surface. The adults are about one-eighth inch long, and of a grayish-black color which harmonizes well with their surroundings. The beetles feed above the ground on the clover leaves. The damage done by them is of minor importance. The beetles appear in mid-summer and remain near clover and alfalfa crowns during late summer and fall. Eggs are laid singly on the soil near these plants. The beetles pass the winter in old clover crowns and in bluegrass sod. Some can always be found about volunteer plants. There is one brood annually.

During 1919 much damage was done by the larvae of this insect in western Ohio. During 1920 they were present only in limited numbers and no damage was observed. Natural control evidently brought about this reduction.

Control

This insect is of such recent economic importance as a pest, that no extensive control experiments have been made. Webster in Farmers' Bulletin 649 recommends disking or harrowing alfalfa fields as soon as the first crop is removed. This will kill many of the pupae in their cells in the soil.

Clover fields will not lend themselves well to such treatment, and if this course is taken with them, the hay crop will have to be removed early in order to destroy the pupae before they have changed to beetles. It is hoped that natural control will make this unnecessary. Recent observations indicate that natural control can take care of a serious outbreak.

Clover-flower Midge

This insect is of importance only in clover-seed-growing regions. The clover-flower midge, as the name implies, infests only the flower. There the tiny pink maggot feeds upon those parts that would normally develop into a seed. One maggot infests but a single seed. When a clover head becomes heavily infested, it produces flowers only in scattering numbers over the head, or perhaps not at all.

The head at this time differs from that infested by the lesser clover-leaf weevil in that the head does not die and turn brown, but remains green with a few scattered flowers on it. The tiny maggots are the young of very small gnats or flies, that lay their eggs

in the green heads when they first appear in May. The maggot works its way into the floret and destroys the part of the flower which gives rise to the seed. When mature, the maggot is pink, and entirely fills the floret, taking the place of the seed. During

June the maggots drop out of the clover heads and pupate in the soil. During July there is another generation of adults which lays eggs in the heads of the seed crop. The second generation of maggots develops in the clover during August, and either hibernates in the soil or develops another generation, depending upon the rainfall during this time. It is the summer generation that so badly damages the seed crop.

Red clover is the chief food plant. White and alsike clover have never been found to be seriously infested.

Control

Localities which have experienced damage from this insect can control it thoroughly by altering the time



Fig. 6. Clover head injured by clover-flower midge.
(Original)*

when the clover blooms. The first generation of adults must have clover heads upon which to deposit eggs. If they cannot find these, there will be no summer generation to infest the seed crop.

Close pasturing of the first crop until late in May has the effect of bringing the seed crop into bloom after the adults are gone. This method has been repeatedly observed to be very effective in combating this pest. Cutting the first crop early in June will give the same result, in this case the midge larvae being removed with the heads before these larvae have matured. This will insure the seed crop being fairly free from infestation. An individual field can be protected by this method even the neighbor-

*Note.—Figures 1a, 6, 7, 8, 9, and 10 are from drawings made by Mrs. W. F. Balduf.

ing fields are heavily infested. This is due to the fact that the seed crop on the early cut field is blooming before the summer brood of adults has appeared. Clipping in early May will not insure freedom from infestation.

Clover-leaf Weevil

During the month of May, when the clover is starting to grow, one frequently observes both large and small circular holes eaten into the new leaves. Some may be one-third eaten away. This is done by the larvae or worms of the clover-leaf weevil. The small



Fig. 7. Red clover plant showing larvae of clover-leaf weevil feeding. (Original.)

larvae are difficult to find, and feed on the young leaves at the crowns of the plants. When full grown, the larvae are about one-half inch long, and have a white stripe along the middle of the

back. The larger larvae when found during the day, are curled up into a ball on the ground. They feed at night. During some seasons their work is quite conspicuous, and causes some alarm among the growers. By June first the damage has about disappeared, and the clover does not again show the effect of their work until the following spring.

The worm pupates in a strong webbed cocoon beneath the soil surface. This is about the size of a hazelnut. From this emerges the adult beetle in June and July. They are stout, brown snout-beetles which remain among the clover plants during the remainder of the summer and lay their eggs during the fall. The small worms hatch in October and pass the winter in the clover crowns. There is but one generation.

Rarely does the insect do serious damage to the crop. It is held in check by natural control, the greatest factor of which is a fungous disease that kills the larvae before they become full grown. Very few of the newly hatched larvae ever live to become beetles.

The chief food plants are red and white clover. Alfalfa is also fed upon.

Control

There is rarely need for artificial control measures against this insect. It is usually held in check by disease before the damage has become very severe. During some seasons much damage is done in limited localities. Experiments show that this can be stopped immediately by the application of arsenate of lead either as a dust or as a spray. Plowing under the clover at the end of the second year effectively destroys practically all that are in the old crop.

Clover-seed Caterpillar

In its ability to diminish the seed crop, this pest ranks with the flower midge and the seed chalcis-fly. Attacking a clover head that is green, or partially in bloom, the little caterpillar eats out a cavity in the head, destroying many of the unopened buds and some of the tender green seeds.

The adult is a little brown moth which deposits its eggs near the base of a green clover head. The larva eats into the head, destroying the florets as it goes. It makes a large dirty excavation at the base of the florets, and is readily found by tearing open the head. Heads are often destroyed by it before they are many days old. Large heads are injured only locally at first, but such heads frequently lose the remainder of their florets, producing no seed.

During most of the season the work of the insect is unnoticed. It sometimes infests as much as 20 percent of the heads, the resultant loss in seed yield being attributed to unknown causes. There are three generations in the latitude of central Ohio.

The chief food plant is red clover.

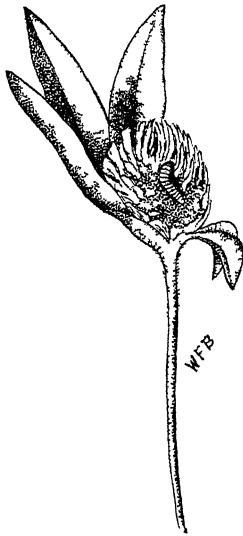


Fig 8 Clover-seed caterpillar feeding in red clover head (Original)

Control

Cutting and storing the hay crop early in June as advised for the clover-flower midge, will kill the larvae within the heads. Besides this method, Osborn and Gossard of the Ohio Experiment Station recommend the following:

Do not allow clover to run for more than two years.

Pasture clover in the fall of the first year.

Plow under old fields in the fall or early spring.

On most farms the last three methods are already in practice in Ohio. This probably accounts for the absence of serious damage from this insect during most seasons.

Clover-seed Chalcis-fly

When the seeds are rubbed by hand from a ripe clover head, there are often a few seeds which are neither yellow nor purple, but are of an ashy-gray color. These, when pinched, are easily crushed, and reveal the presence of a white larva within. This is the larva of the clover-seed chalcis-fly. It develops within the growing seed, and when full grown, completely fills the seed, leaving the shell intact.

The adult is a small, four-winged, wasp-like insect, less than one-tenth inch long, and black in color. The adult places the egg in the developing seed when the clover heads begin to turn brown. One adult may infest most of the seeds in one head. The damage is frequently severe in the late-maturing seed crop. There are about three broods annually, the adults becoming most numerous during the latter part of the season. Frequently 10 to 20 percent of the seeds are destroyed by the

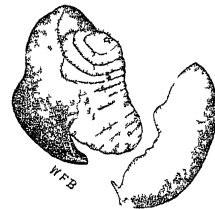


Fig 9 Infested seed broken to show larva of clover-seed chalcis-fly (Original.)

larvae. These infested seeds usually contain larvae at threshing time and are blown out with the chaff or at the recleaner of the machine. Some find their way into the grain bags. These seeds will not grow, and if the larvae have not been damaged in hulling, adults will emerge from them and find their way to the new heads in the spring. The insect will not multiply in the dried seeds. The

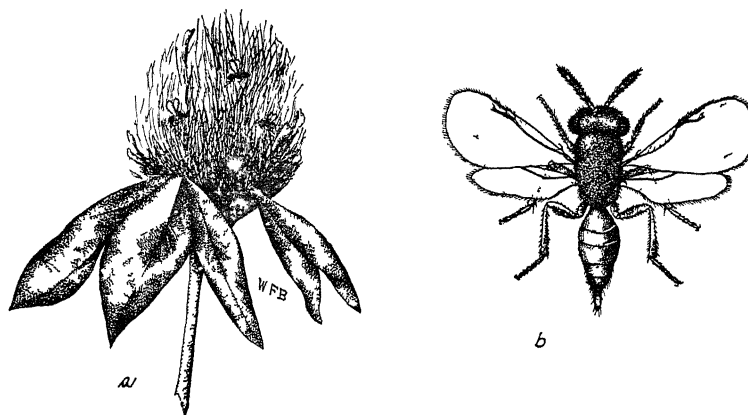


Fig 10 (a) Adults of the clover-seed chalcis-fly laying eggs in developing seeds in green clover head (Original)
 (b) Adult clover-seed chalcis-fly greatly enlarged (Original)

most of the adults that appear in the spring come from volunteer heads and shattered seeds which have remained on the ground over winter.

Alfalfa seed is also seriously infested, and one should examine this closely when purchasing it. Sweet clover, alsike, and white clover are not known to be infested.

Control

Red clover cannot bloom at any time and escape this pest. Late maturing seed is nearly always more badly infested than that harvested earlier. This is due to the increase in numbers of adults as the season progresses. The practice of clipping the first crop early, or pasturing it in May will probably be a benefit by hastening the maturing of the seed crop. This method is not so effective as for the clover-flower midge. Burning all infested seeds which come from the recleaner at hulling time is strongly urged. The chaff should be worked into manure before the following May to prevent the adults from finding their way to new clover heads. Care should be taken in purchasing seed to see that it is free from gray swollen kernels which may contain the dead larvae of this pest and be worthless for seed.

Grasshoppers

During some years an enormous amount of damage is done by grasshoppers, both to the young clover during the first year of its growth and to the seed crop. Grasshoppers do their damage after midsummer, hence the hay crop escapes attack. In some seasons the hoppers eat the blossoms from the seed heads as fast as they develop, and make the seed crop worthless. During the summer of 1919 thousands of acres of young clover starting in the wheat and oats stubble were destroyed by the hoards of hungry grasshoppers. The damage from them is present every year, but during most years is not serious enough to be observed.

Grasshoppers hatch from eggs placed in clusters beneath the soil surface in firm ground in clover fields, pastures, and fence rows. Bluegrass pastures are the most suitable places for them to lay their eggs in Ohio. About July 1 the young hoppers can usually be found in large numbers in these pastures, where they remain until a few weeks later, when they migrate to clover fields. They are very fond of young clover and will eat it off close to the ground. Many hatch in clover sod of the second year's standing. Alfalfa sod is also a favorable place for them to reproduce. The eggs are laid in the fall and in this stage the insect passes the winter. There is but one generation each year tho the eggs keep hatching thruout several weeks during the spring and summer.

Control

Poisoning the newly hatched hoppers with poisoned bran mash is the only effective remedy. The formula for this is:

Bran—25 pounds or that amount of bran and sawdust
one-half each.

Paris green or white arsenic—1 pound.

Ground oranges or lemons—3 fruits.

Sirup—2 quarts.

Water (about)—3 gallons.

Thoroly mix the dry bran and poison. Make a dilute lemonade or orangeade of the last three materials. Pour this slowly over the poisoned bran while stirring. Mix well until the mass is uniformly moist but not soggy. Scatter this evenly and very thinly over the field where the grasshoppers are feeding. Apply in evening or early morning. The above amount should cover 5 acres of ground. Apply if possible when the clover is small, or just after removing the hay crop. It is difficult to get a good kill of grasshoppers in

clover that is tall and blooming. Do not look for dead grasshoppers until 48 hours after applying. Repeat in a few days if necessary. When clover is tall, two or three applications may be necessary. For more favorable conditions one application is often enough.

Miscellaneous Clover Insects

A few species of clover insects are of minor importance during most seasons, tho always present. Practically all of them have been observed to cause serious damage, but under Ohio conditions they rarely call for control measures. The most important of these are the following:

- Clover plant lice
- Clover leafhopper
- Clover stem-borer
- Clover leaf-tyer
- Fall army worm
- Green clover worm

The injuries due to some of these insects are apt to be overlooked because of the minute size of the pest or the light degree of attack. The combined result of their work, which may be of considerable importance, is frequently attributed to such causes as poor soil and climatic conditions. This is especially true of the first three.

All of these are usually held in check by natural conditions and become pests only when these are removed. For example, clover plant lice become troublesome only in extremely dry weather. Except for the fall army worm, practical control measures are little known.

General Farm Practices to Avoid Damage from Clover Insects

No general revision can be made of the present methods of handling the clover crop and successfully prevent damage from all of the different insects. Certain insects lend themselves to control by advancing the time of cutting the first crop. These insects are among the most destructive, and the seed grower who is able to properly diagnose his trouble may prevent a heavy loss by changing the blooming period of the seed crop so that it does not come at a time to receive the eggs of the flower midge or seed caterpillar. The time to cut the hay crop to avoid these seed infesting insects depends upon the season, but in the average season in central Ohio is about the first week in June.

The lesser clover-leaf weevil, which has been the most important pest in western Ohio during the past two years, is difficult to control. Recent experimental tests show that increase in tonnage of the hay crop can be secured by cutting the crop about one week before this is usually done by the most of the growers. This also enables the second growth to start earlier. With a normal season, this coincides closely with the recommendations made for clover-flower midge and seed caterpillar.

Clover should not be allowed to remain on the same ground for more than two years in succession, and should not be allowed to reseed itself. Clover root-borer trouble is almost sure to follow in old stands. Plowing under the infested roots is the only means of destroying this insect, which sometimes takes a heavy toll of the clover during its second year.

Piles of clover chaff, if allowed to remain in the field, infest the new crop with seed chalcis-fly. This will be avoided if the chaff is worked into manure during the winter, and hauled on the land later.

Clover seed growers should be on the lookout for damage by grasshoppers, and poison them while young. They can destroy a seed crop in a few days.

Any means that will make it possible to get better stands of red clover will better distribute the annual toll the crop pays to insects. Likewise, better drainage, liming, and other factors that pertain to soil fertility and the availability of plant food, will do much to offset the damage likely to be inflicted by insects. If the surroundings are healthful the clover will have more resisting power.

Substituting Other Clovers

Some farmers are turning to alsike and sweet clover as substitutes for red clover. It may be profitable to temporarily make this substitution where one has difficulty in getting a good stand of red clover. Both of these clovers are less favorable food plants for insects than red clover. Mixtures containing red and alsike clover, or red, sweet, and alsike clover have their advantages for hay and pasture crops. These mixtures are now being used successfully in some counties. As a suitable crop for a three- or four-year rotation, alsike and sweet clover had better be considered as only temporary substitutes since they have not yet crowded out red clover as "King of Ohio Legumes."