POLLINATION OF LEGUME SEED IN ILLINOIS

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THE PRODUCTION OF LEGUME SEED has always been an important source of supplemental income for farmers in Illinois. Red clover is the most commonly grown legume seed crop in Illinois, with the state having greater acreage and total production of red clover than most other states. Lespedeza and sweetclover are also produced in commercial quantities.

Pollination requirements

Red clover and sweetclover are essentially self-sterile and must be cross-pollinated by insects to set seed. Each floret, or individual flower, must receive pollen from another floret in order to produce a seed. Lespedeza has two types of flowers, one of which produces seed without insect visits. The other type may produce more seeds when the florets are visited by insects.

Alsike clover requires cross-pollination by insects. It is attractive to honey bees, but less so than sweetclover, which offers competition for pollinators. It should be managed for seed production in about the same way as red clover.

Crownvetch will not set seed without insect visits. It is not attractive to bees and provides little nectar and pollen for them. For this reason, several strong colonies of bees that are rearing brood heavily are needed for each acre of crownvetch grown for seed. Best results have been achieved by rotating new colonies to the field at about weekly intervals.

Other legumes, such as alfalfa, white Dutch clover, and birdsfoot trefoil, also require cross-pollination by insects but are not usually grown for seed in Illinois.

Soybeans are automatically self-pollinated, usually before the blossom opens. Many kinds of bees, including honey bees, visit soybean flowers but do not seem to have any beneficial effect on yields.

Pollinators

Bees are the most important pollinators of legume seed. They are well suited for the job because many bee species prefer the nectar and the pollen of legumes to that of other plants. They visit only one species of plant at a time and transfer pollen from one flower to another on their hairy bodies. Many different kinds of solitary bees visit legumes in Illinois. These bees

live alone and nest in the soil, in plant stems, and in many other places. They are highly efficient pollinators but usually do not develop sufficient populations to set commercial crops of seeds. Their numbers have been reduced in Illinois by cultivation of nesting areas, by lack of forage, and by pesticides.

Bumble bees are social bees that live in a colony established in the spring by an overwintered queen. Each colony may have several hundred members during the single season that it lives. Bumble bees are good pollinators, especially on crop plants, such as red clover, that have long florets. Only rarely, however, are there sufficient bumble bees to set a good crop of legume seed on Illinois farms.

Of all the bees, honey bees are the most important pollinators. They live in large perennial colonies, containing up to 60,000 bees, and can be managed and moved to provide the population of bees needed for any particular crop. They show preferences for certain plants and our management must take this behavior into account. In June, for example, when red clover is in first bloom, honey bees are busy visiting other more attractive clovers such as white Dutch. In July, when red clover is in second bloom, honey bees visit it readily for pollen and do a good job of pollinating the flowers.

Unfortunately for the seed producer in Illinois, the number of honey bee colonies (hives) in the state is too small to provide enough bees to set a good crop without bringing them to the seed fields. There were only about 76,000 hives in Illinois in 1970, down 59 percent in 20 years. This number of bees is not sufficient for legume seed production even if there were no other wild and cultivated crops that attracted them. We can no longer expect that pollinators will be automatically available for the crops we plant.

To provide adequate pollination of a legume seed crop, you must know what population of bees is needed on the blossoming plants and then place enough honey bee colonies close by to achieve the desired population. On most legume species, one bee per square yard will set a commercial crop. For red clover, two or more strong colonies (hives) per acre are usually needed to provide an adequate bee population on the field. On the other legumes grown in Illinois, such as sweetclover, one colony per acre is usually sufficient.

Evaluating pollination

Seed producers should evaluate the pollination and seed set of their crop during the bloom period to see if there are adequate pollinator populations. This can be done by counting bees per square yard and by examining individual flower heads or racemes, as well as by checking the appearance of the entire field. Unpollinated clover florets remain fresh and upright for many days. After being visited by insects, the florets wilt, droop downward, and take on a brown color. The presence of large numbers of fresh-looking, open florets indicates insufficient numbers of pollinators on the field. These florets will give the entire field a bright pink color in the case of red clover. If most of the florets are being pollinated quickly, the field will be browner in color. The grower should arrange to bring in additional colonies of bees immediately if he detects a lack of adequate pollination.

Providing bees

Honey bee colonies can be rented from commercial beekeepers throughout Illinois. Many amateur beekeepers also have sufficient colonies to rent them, but they usually lack the experience and means for moving the hives when they are needed.

A contract or pollination agreement should be used when renting bees because it explains what is expected of both parties involved. It also specifies the colony standards, timing of moves, and use of pesticides. Pollination agreement forms are available from your county extension adviser or from the Extension Apiculturist, 107B Horticulture Field Laboratory, University of Illinois, Urbana, Illinois 61801.

A colony used in legume seed pollination should consist of the following elements at the minimum:

- A two-story hive (or equivalent).
- Five or six frames containing 600 to 800 square inches of brood.
- Enough bees to cover 10 frames.
- A laying queen.
- 10 to 20 pounds of reserve honey, and room for honey storage.
- The colony should be free of disease.

Growers who rent bees should learn to evaluate the colonies themselves or should at least have the beekeeper show them the makeup of representative colonies if there are questions about standards.

Place the bees in or beside the legume fields after bloom begins but before the amount of bloom has reached about 10 percent. This timing allows the bees to begin visiting the field immediately and provides the greatest potential seed set. The bees may be placed in a single location on fields 10 to 15 acres in size. As field size increases, or on long fields, it is better to place the bees at two or more locations around or in the seed field. Remove the bees when the field looks brown and no new blossoms can be seen.

Management

Pollination is the critical factor in legume seed production, but it can make a crop only if all other management practices are sound. These include production of a good stand of an adapted variety, adequate nutrients, control of weeds and insect pests, and proper harvesting. Potentially harmful insect populations on the crop must be controlled before the bees are brought to the field. During bloom no *highly toxic* insecticides should be used without first moving the bees. Moderately toxic or nontoxic materials can be used if proper precautions are taken. Circular 940, Pesticides and Honey Bees, rates insecticides for their hazard to bees and explains the necessary precautions when they are used around the hives or on plants visited by bees.

Plan to produce red clover seed only on the second crop in Illinois because of the lack of suitable pollinators earlier in the season. Cut the first crop for hay in June and be ready to move bees to the field when it comes into bloom the second time.

Results to be expected

There is no magic in the pollination process, and adequate pollination alone will not necessarily guarantee a seed crop. However, where all other crop production factors are favorable, pollination by an adequate bee population will insure a good crop. Research on legume seed production has shown that soil pH and fertility level, insect control, and adequate pollination

are the keys to a better crop. The biggest single negative factor is inadequate pollination. In the Midwest, the proper use of one to two hives of bees per acre of red clover has usually increased yields one to three bushels per acre. Results are generally better on large fields than on small fields.

The best average yields in experiments with red clover seed production have been as much as 12 times above those attained on the farm. If growers in Illinois could attain yields comparable to those attained in the experiments, a yield of as much as 960 pounds of seed per acre could be expected. It is unlikely that this level of production can be attained on the farm, but it is not unreasonable to expect yields of 200 to 300 pounds (4 to 5 bushels) of red clover seed rather than the usual 60 to 100 pounds when conditions are favorable and a good population of pollinator bees is in the seed field throughout the blooming period.

This circular was prepared by Elbert R. Jaycox, Professor of Apiculture.

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