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Alkali Bees--How to Manage Them for Alfalfa Pollination

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How To Manage Them for Alfalfa Pollination

Fortunate is the alfalfa seed grower who has a large alkali bee nesting site near his field. He can count on high yields if he takes care of his other seed production problems. Although alkali bees are more efficient than honey bees as alfalfa pollinators, they are much less abundant on most alfalfa fields in Utah. Like alfalfa leaf-cutting bees they trip nearly every flower they visit. Unlike leaf-cutting bees (or honey bees), alkali bees visit flowers down in the plant growth as well as near the top.

Alkali bees are nearly as large as honey bees and are marked by iridescent coppery-green stripes across the abdomen. Their densely populated breeding areas occur on moist, salty ground.

How Alkali Bees Live

Alkali bees construct nest burrows from 6 to 10 inches deep in the soil. They are highly gregarious, but each female builds and provisions her own nest without help from her neighbors. A successful nest contains from 15 to 20 brood cells, in each of which is placed a ball of honey-moistened pollen and a single egg. As soon as the egg is laid, the mother bee seals the cell and has no further contact with her offspring. Most of the nests are constructed and provisioned during July and early August. The larva matures by late August and becomes a pupa during the following May or June. The adult emerges from late June to mid-July and lives for about a month. Emergence may be delayed for several weeks by a cool spring.

The Nesting Site

The following are characteristics of an ideal nesting site:

1. Soil composed of fine, sandy loam (a high percentage of clay is undesirable)
2. A well-drained, nearly smooth surface (the best sites are usually on hummocks or gentle slopes)
3. A constant underground supply of moisture extending upward to the surface (thoroughly saturated soil is too wet)
4. A bare or only sparsely vegetated surface
5. Salty crust, if present, not thick or hard
6. No fluffy, dry layer under the crust (sodium chloride and calcium chloride tend to prevent or control the fluffy layer)

Why Nesting Populations Decline

A good nesting site may contain more than a million nests and remain populous for many years. More commonly, however, after a few years the population suffers a drastic decline or disappears altogether. The principal causes of such a decline are:

1. Bloom-stage applications of highly toxic insecticides
2. Plowing
3. Digging by skunks which feed on alkali bee larvae
4. Flooding
5. Drying of soil by:
   a. Drainage ditches
   b. Lining of irrigation canals
   c. Withholding irrigation water from areas ordinarily receiving it
6. Encroachment by dense growth of saltgrass, kochia or other salt-tolerant vegetation

7. Development of either a fluffy layer or a thick, hard crust

8. Excessive tramping by livestock

9. Increased population of parasites

10. Build-up of fungus organisms, especially *Aspergillus*

11. Heavy rains during the nesting season

These causes, except for untimely rains, are at least partially under the grower's control. Many farming practices which are ordinarily desirable, if done without regard for alkali bees, can sharply reduce seed yields by damaging nesting sites of alkali bees. Growers should remember that land occupied by an alkali bee site is worth many times the same acreage devoted to crop production.

Protecting Nesting Sites

Seed growers should find all nesting sites within several miles of their fields and take whatever steps are needed to protect them. Usually, nesting sites can be protected most effectively on a community basis. Remember that the value of bees extends beyond property lines, as does the influence of many farming practices, such as spraying and drainage. Most of the measures involve simple control over farming practices. Simply fencing off a nesting site does not necessarily protect it. This may permit excessive growth of vegetation which removes soil moisture and shades the surface. Weeds can be eliminated by mowing or by spraying with herbicides. Skunks are readily controlled by baiting or trapping. Seed growers can organize and offer a bounty for skunks on an area-wide basis.

Controlling alkali bee parasites is a more difficult problem. Fortun-

ately for Utah, the bee fly, probably the most important of several parasite has been a serious problem only in Salt Lake, Box Elder and Cache Counties.

The usual control method is to swat adult flies as they hover over the alkali bee nests or to squash them on the ground, after they emerge as adults and before they are hardened enough to fly. Early in the nesting season and from 9:00 a.m. to 12:30 p.m. are the best times for control.

A decline in nest density often results from a year-to-year build-up of fungus (*Aspergillus*) in the soil. By systematically removing about 20 percent of the nesting bed (to a depth of about 10 inches) each year and backfilling with fresh soil, it should be possible to maintain relatively "clean" beds. The removed soil can often be taken out as "plugs" with overwintering larvae and used or sold for stocking newly prepared beds.

Creating New Sites

The first step toward increasing alkali bee numbers is to study the conditions that create the existing nesting site. By reproducing these conditions on soils of the same basic type, the sites can be expanded and new ones created.

A hard-pan layer a foot or more under the surface is important to promote enough lateral underground movement of water to maintain moist conditions near the surface over large areas. More investigation is needed to develop economical ways of forming such a layer where it does not already exist. In some soils simple compaction by heavy machinery may be enough. In others, a layer of clay packed 2 or 3 feet below the surface may do a good

job. With a suitable soil, a hard-pan layer and a water supply, the next step is to construct a series of blind parallel ditches to grade and run water through on a schedule that will keep the whole area moist, especially during June, July and August.

In naturally saline soils, subirrigation will usually increase surface salinity to the desired level. If salt does not appear at the surface, a concentrated brine should be sprinkled on the surface at a rate of about 9 pounds of actual salt per square yard to help hold moisture at the surface. A simple but somewhat less satisfactory alternative is to mix granulated stock salt into the top 2 inches at the same rate.

It is also possible to build permanent nesting sites by the following method in areas where the proper conditions are otherwise difficult to achieve and maintain. Water should be nearby where it can be pumped or siphoned to the site.

1. Construct a level-bottomed excavation 3 1/2 feet deep with a 1 to 1 or 2 to 1 side slope.
2. Line the excavation with 0.008-inch polyethylene or 0.006-inch vinyl film.
3. Cover the film with several inches of soil to protect it.
4. Add an 8 to 10-inch layer of clean gravel (1/4 to 1-inch diameter).
5. Install wide-diameter tile or pipe into the gravel layer and extend it several inches above grade. Mound extra gravel around its base and place a cap over it.
6. Install perforated drain pipe radiating horizontally from the lower end of stand pipe (described above) to corners of excavation. Place tar paper strips on the gravel over this pipe to protect it from plugging.
7. Scatter straw or place a layer of cheesecloth over the gravel to hold back soil.

8. Fill to slightly above grade level with moist, fine, sandy loam (in most cases the native soil). The finished, smoothed surface should be gently crowned.

9. Add salt to this as described above.

10. Apply water through the pipes until the entire surface becomes moist. With a pipe at each end, water can be seen rising in one pipe when it is applied in the other.

One watering in June usually lasts all season. A shallower bed with less gravel may attract nesting bees as well as a deep bed, but more frequent watering is required. The size and number of beds depends on the resources of the grower concerned. A nest population of 2,000 should be enough to pollinate each acre of alfalfa. This population can usually be achieved on about 200 square feet of nesting site. If the desired site is larger than the available plastic sheet, you can overlap two sheets on a rounded ridge of soil extending along the bottom of the excavation.

Colonizing the Sites

Newly created areas can be colonized by installing undisturbed blocks of soil taken in the fall or spring from existing sites. Steel cylinders about 12 by 12 inches and slit open on one side are driven into an established breeding site and pried loose with a plug of soil enclosed. At the new site the cylinder is opened slightly to release the plug into a prepared excavation. One cylinder can be used to obtain the plugs, which can then be wrapped with lighter material and placed on a truck bed. It is also possible to saw soil cubes with a chain saw or a disc saw mounted on a tractor. From 100 to 200 plugs should be used to establish a new population.

When existing sites are protected and plenty of forage is available, the bees usually increase until many of them move into new areas of suitable ground within a mile or so of their nesting sites.

Simultaneous programs of protecting existing sites and creating new areas favorable for nesting have paid off well in Idaho, Oregon and Washington. The same practices should be profitable in Utah. Many attempts to construct sites have failed when the growers used "short cuts."

Timing the Crop

Seed growers should attempt to bring their alfalfa into bloom when alkali bees are most numerous and active, normally from mid-July through early August. In most areas this can be done with a delayed first crop or an early second crop.

Protecting Your Bees from Insecticides

Available data indicate that alkali bees are killed by the same insecticides that kill honey bees. Of the materials useful for lygus bug control, dylox and toxaphene are least damaging to alkali bees. Night applications are less dangerous to alkali bees than daytime applications, but in any case, materials highly toxic to bees, such as dieldrin, parathion, low-volume malathion and carbaryl, should not be used.

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