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Alfalfa Leaf-Cutter Bee: Management for Alfalfa Pollination in South Dakota

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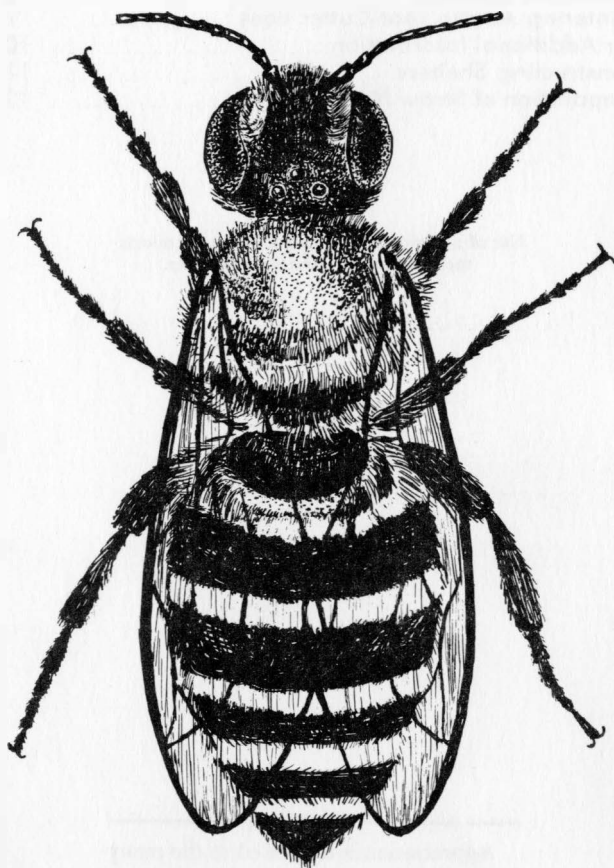
Walstrom, R. J. and Jones, P. A., "Alfalfa Leaf-Cutter Bee: Management for Alfalfa Pollination in South Dakota" (1968). *Bulletins*. Paper 544.

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Alfalfa Leaf-Cutter Bee

Management for Alfalfa Pollination in South Dakota



About 10 times natural size.

**Entomology-Zoology Department
Agricultural Experiment Station
South Dakota State University, Brookings**

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Use of a trade name does not indicate endorsement of one product over another.

Appreciation is expressed to the many farmers and ranchers who have cooperated in these studies by maintaining alfalfa leaf-cutter bees and recording on-the-spot observations.

Alfalfa Leaf-Cutter Bee

Management for Alfalfa Pollination in South Dakota

By R. J. Walstrom and P. A. Jones,
Agricultural Experiment Station entomologists,
South Dakota State University

The alfalfa leaf-cutter bee, *Megachile rotundata* (Fabricius), was introduced into South Dakota from Utah in 1962 for alfalfa pollination testing. This leaf-cutting bee, because of its pollen collecting activities, has shown considerable promise as a means of increasing yields of alfalfa seed. A native of Eurasia, it was introduced into eastern United States in the mid-thirties and by 1958 had moved across the country into Oregon. There is some indication that the alfalfa leaf-cutter bee may have become established in isolated locations in South Dakota during this initial cross-country movement.

DESCRIPTION

The adult bees are slightly larger than house flies with some slight range in size due to variations in the diameter of the cells in which the individual bees were reared. The coloration is predominantly black with yellow-green bands of hairs on the dorsal portion of the abdomen. Across the ventral surface of the abdomen, the female has thick, parallel rows of whitish-yellow hairs

which serve to transport the pollen. She also has a rounded abdomen drawn to a point at the posterior end. Hairs on the front and sides of her head are gray in color. The female has a sting but does not use it in an aggressive manner. The few cases of stings by these bees in South Dakota have occurred when a female was accidentally crushed or trapped in loose clothing. The male's appearance differs in that he has yellow hairs on the head; his abdomen is straight on the sides and blunt on the posterior end; and he does not have the pollen carrying hairs on the ventral abdominal surface.

Life History

The alfalfa leaf-cutter bee under South Dakota conditions overwinters as the prepupal form in its leaf-lined cell. Usually about seven such cells are placed end-to-end in a hollow tube or straw used for a nest. In this form the bee has completed its larval, or worm-like, development and is ready to change into the inactive pupal stage with the onset of warm weather in the

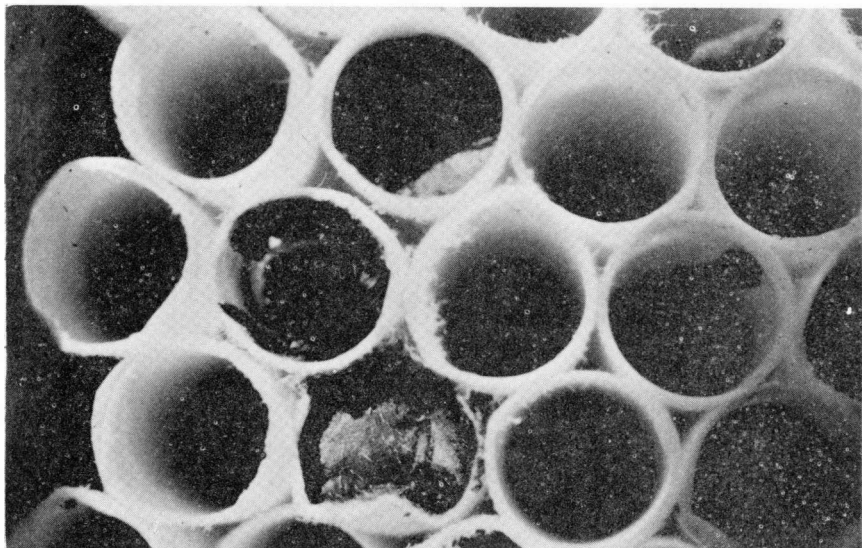


Cutout section of malt straw shows positioning of prepupal forms.

spring. The bee remains as a pupa until it emerges as an adult sometime after mid-June. In South Dakota where nests have been exposed to the warming rays of the sun, the first adults have appeared as early as June 17 at Ideal in 1964 and as late as July 18 at Piedmont in 1965. In shaded and unheated wintering locations the adults will usually emerge from a few days to 2 weeks later. Ordinarily, the bees emerge first from the cells at the front of the tubes or straws while the truly older forms await their turn to emerge. This orderly procedure prevents the damaging of un-emerged cells. The first adults to

emerge are males, who outnumber the females at the rate of about three to one. Mating takes place on warm sun-exposed soil or building surfaces. An individual female will construct cells and deposit and provision with pollen approximately 35 eggs. There is apparently only one generation per year under South Dakota conditions. The larvae complete their growth during the summer and go into winter in the prepupal form.

Adult bees provisioning eggs in malt straw nest with leaf pieces and pollen.



Field Activities

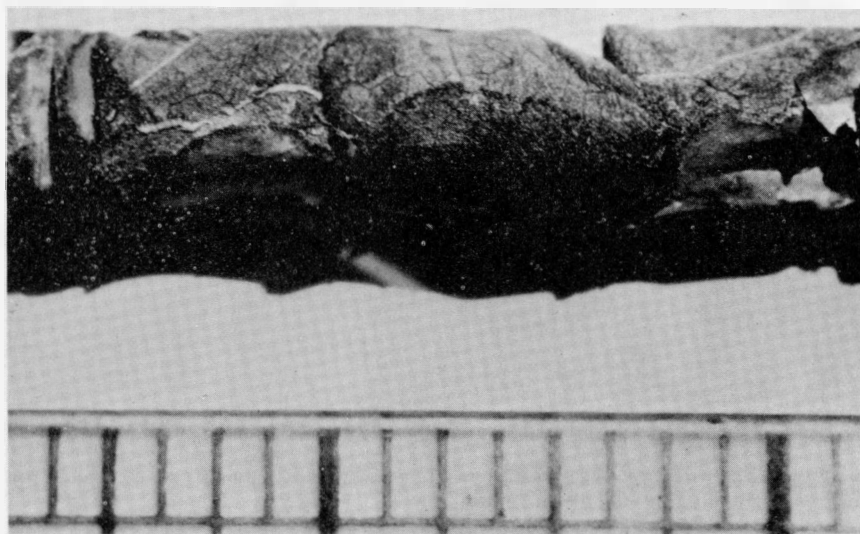
Only the females have been observed tripping alfalfa florets and collecting pollen. While the alfalfa leaf-cutter bee has been known to collect pollen from sweet clover and other plant species, it is almost specific in collecting alfalfa pollen when alfalfa blossoms are available. The tiny circular cuttings of plant material for nest construction may come from other than alfalfa. Rose foliage and petunia blossoms have been used in South Dakota. Observations under cage and field conditions at Brookings have disclosed no impairment of pollination efficiency for either species when alfalfa leaf-cutter bees and honey bees worked the same alfalfa field.

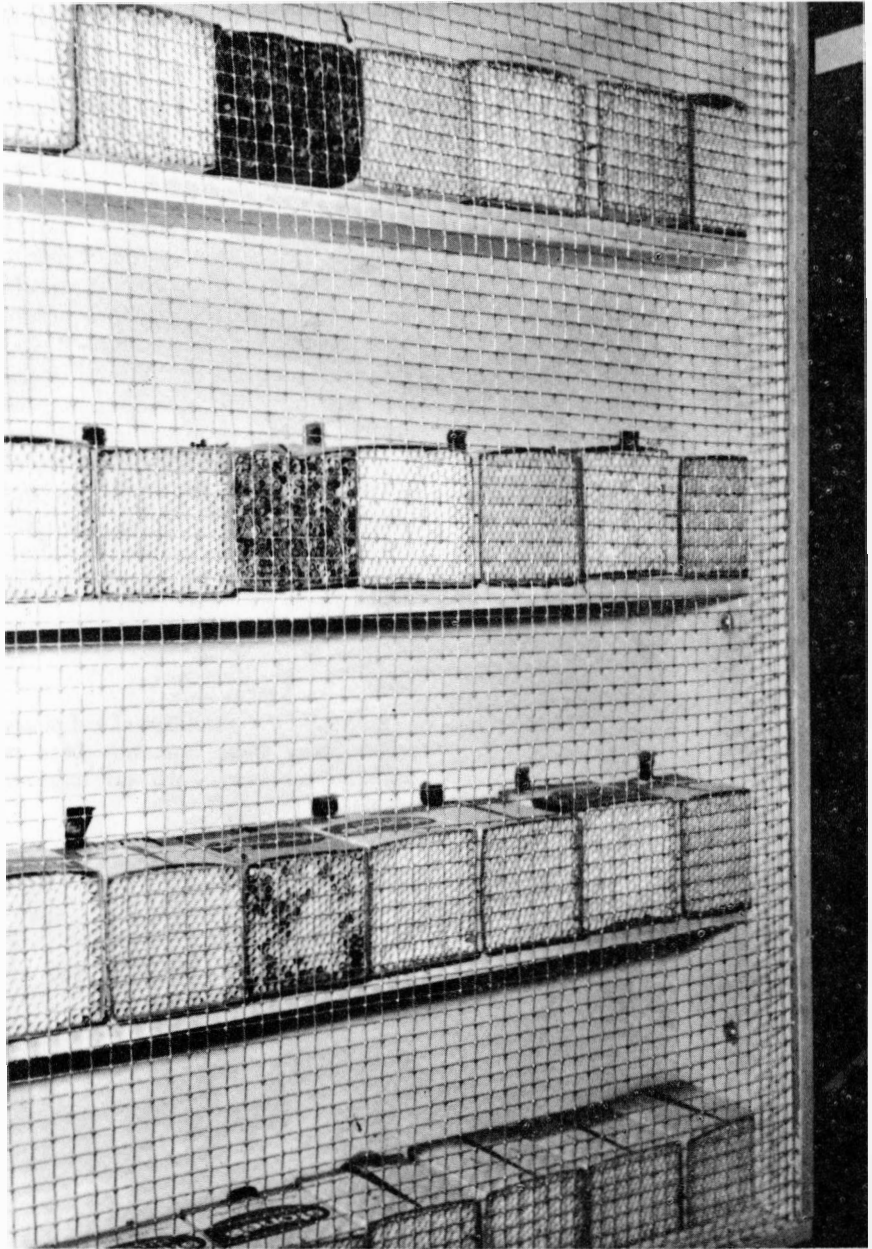
ESTABLISHING THE BEES

Alfalfa leaf-cutter bees can be purchased from growers in South Dakota and other states. The bees can be easily shipped in the prepupa form in the nesting material

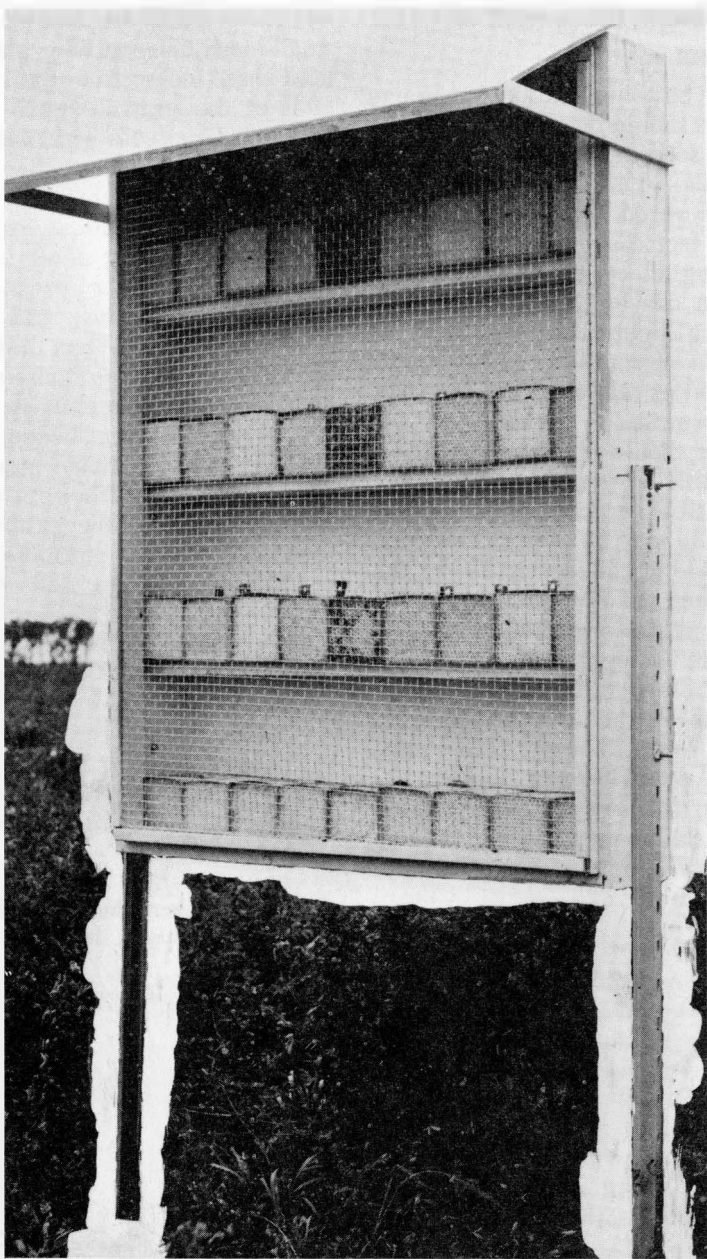
supplied by the grower. The use of paper jumbo malt straws (3/16-inch diameter) has proved most satisfactory for the nesting material under South Dakota conditions. Directions for preparing the straws and nest shelters are described in detail in figures 1 and 2. Empty nesting straws at the ratio of five to one for every filled straw should be provided in the shelters before the bees become active. Bees should be moved to the field in the late spring before emergence of adults begins, if possible. Shelters should be placed so that the lower portions are 2 feet above ground level. Keeping the soil free of vegetation for 4 feet in front of the shelters will provide a resting area for the bees.

External view of position of leaf pieces which cover three immature bees as found in malt straw. Each scale segment is about 1/16th inch.





A close-up of the nesting shelter (shown on next page) illustrating placement of protective hardware cloth and use of about five empty malt straw containers for every filled container at start of season.



Nesting shelter is exposed to the south or east. Note sun shade (top) and supporting posts.

Movement, Placement of Shelters

For best pollination coverage, shelters should be spaced across the alfalfa seed field at about 200-yard intervals. The open or hardware cloth covered side of the shelters should face east or south so that the warming effects of the early morning sun can be utilized to initiate morning flight activity as early as possible. If some of the bees have emerged as adults before the shelters are moved to the seed field, the shelters should be moved at night, preferably at temperatures below 60°F. Mosquito netting or window screening may be used to cover the open side of the shelter during the move but are not essential to the success of the operation. Since evidence indicates that all of the bees do not return to the nesting sites at night, it will be advisable to leave a box or two of empty malt straws at the overwintering location to pick up the straws. These "catch boxes" can be moved to the shelters in the seed field one or two evenings later.

Parasites and Predators

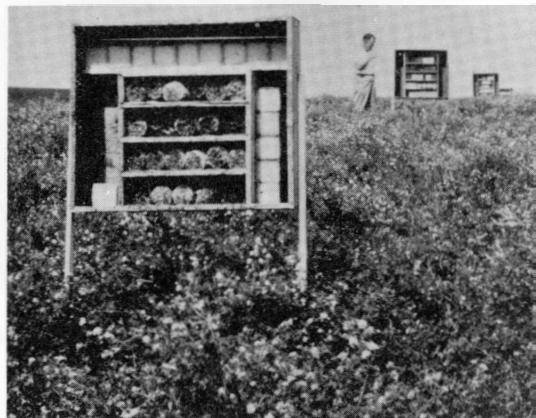
While parasites of the alfalfa leaf-cutter bee have not been detected in South Dakota populations, they can be expected as the bee populations increase. In western states a chalcid wasp, *Melistobia chatybilii*, has been shown to parasitize the larval or pupal stages of the bee causing its death.

Several predators have been noted in South Dakota. Birds of various species can reduce immature and adult bee populations at the nesting site if the shelters are

not protected by hardware cloth or small-mesh chicken wire placed at least three inches from the exposed ends of the straws. Downy woodpeckers, *Dryobates pubescens*, are a particular problem where nests are unprotected. The eastern Kingbird, *Tyrannus tyrannus*, has been observed collecting adult bees on the wing. The deer mouse, *Peromyscus maniculatus*, has been found to nest in shelters during the fall in the field. The house mouse, *Mus musculus*, has damaged nests in protected storage locations during the winter. Damage by mice is primarily caused by their feeding on pollen stores and other protein material in the cells and is more severe in unprotected straw nests than in wooden and plastic nesting material. The ½-inch hardware cloth covering has prevented this damage.

Insect predators of several species have damaged the alfalfa leaf-cutter bees' nests in South Dakota. Dermestids of several species including the larder beetle, *Dermes-*

Nesting shelters should be placed at 200-yard intervals in the field.



tes lardarius, have caused the death of the larval and pupal forms of the bee. The larder beetle larvae are attracted to the pollen stored in the cells and as they break into the cells cause death of the immature bees by eating their needed food and exposing them to the elements. Ants of several species kill the immature bees in a similar fashion by removing the pollen stores. Some species have been observed removing the immature bees. Protection from ants can be obtained by carefully treating the lower six inches of the shelter supports and a six inch radius of the soil surrounding the supports with a 2% dieldrin spray. A half cup of 10% dieldrin granules scattered in the same area around each support has also given good ant control. Dermestids are difficult to control. The best method for reducing their damage has been to remove the residues expelled from the cells by the bees from the shelves and lower portion of the shelter. These residues, particularly when wet, attract the dermestids to the nesting sites.

Insecticide Hazards

Alfalfa leaf-cutter bees are highly susceptible to the damaging effects of most of the commonly used agricultural insecticides. Whenever possible, insecticides should be applied to control injurious insects when the seed field is in the bud stage and before the bees are placed in the field. Two to three days should elapse after spraying before moving the bees into a treated field. Where spraying is necessary after bees are in the field and the plants are in bloom, it is best to remove the bee shelters at night to a cool

(50°-60° F.), dry cellar which can be kept dark. The field should be sprayed at night to protect other pollinators, and the bees returned 2 to 3 days later to their original sites. It is important that each shelter be returned to the exact location in the field from which it was removed so that the individual female bee can return to her own straws.

If insecticides are needed to control injurious insects in adjoining fields, care must be taken to prevent drifting of the chemicals into the blooming alfalfa or over the nests of the alfalfa leaf-cutter bees. Contact your county agricultural Extension office for the recommended insecticides to use for control in the alfalfa seed field. Some insecticides are less toxic than others to the pollinators. Research is continuing to provide the best controls for insects which reduce alfalfa seed yields in South Dakota.

Wintering Alfalfa Leaf-Cutter Bees

Alfalfa leaf-cutter bees have been successfully overwintered in most areas in South Dakota with only wind protection on the north and west sides of the shelters. The ½-inch mesh hardware cloth covering is essential during the winter months to prevent damage due to mice.

It is recommended that at least half of the shelters be placed in an unheated building for the first few winters to assure some wintering success in new locations in South Dakota. Excessive humidity of over 85% should be avoided in wintering locations. Structures which have been treated with long-residue in-

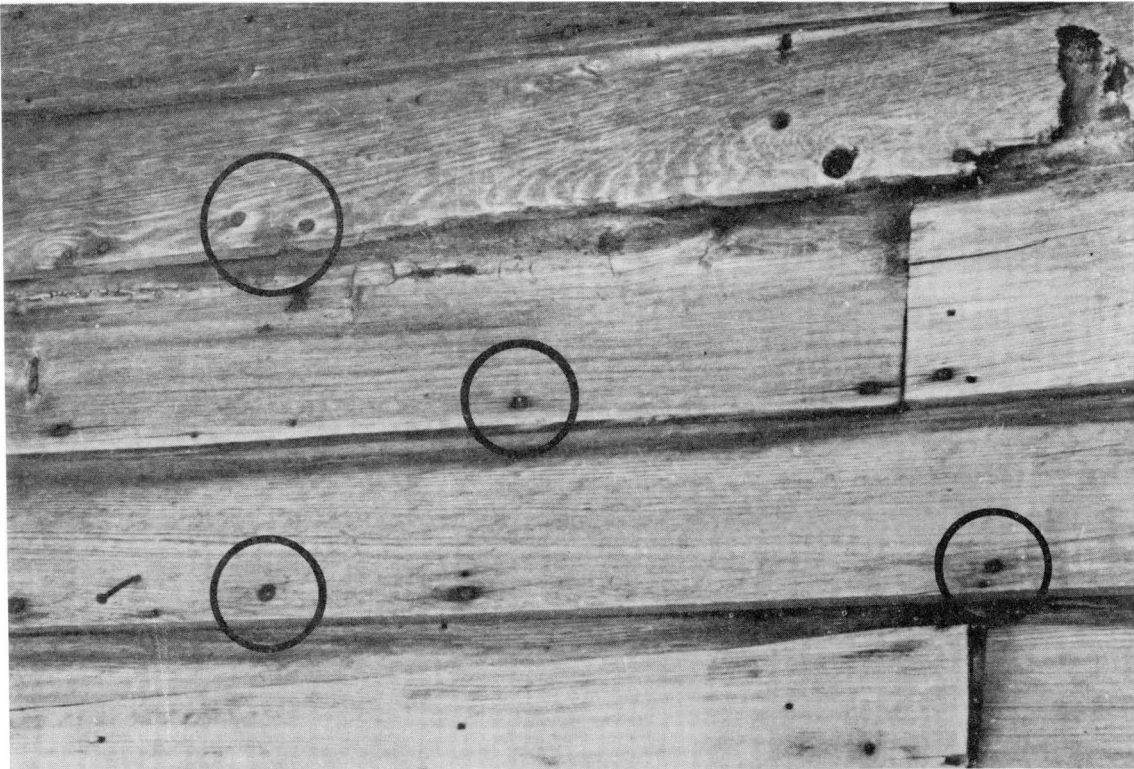


secticides or which are used as storage areas for insecticides are not recommended as wintering locations.

ADDITIONAL INFORMATION

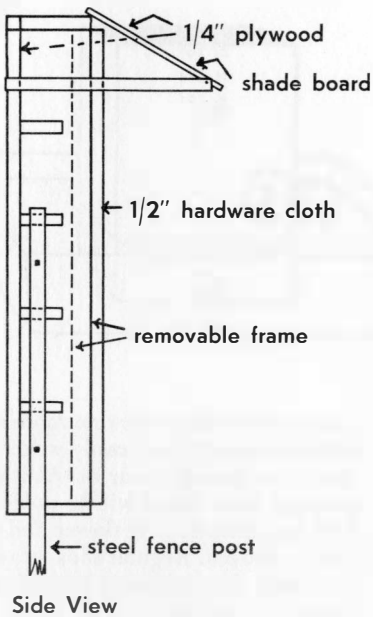
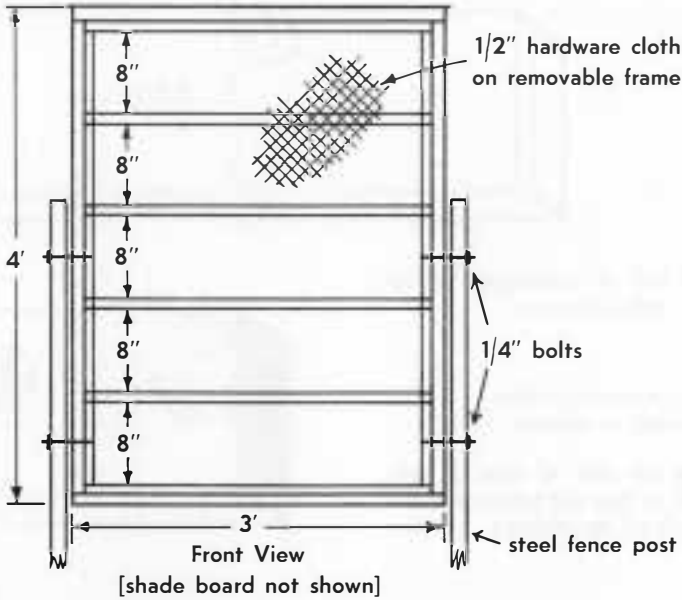
If you desire a list of sources where alfalfa leaf-cutter bees may be purchased, contact the Entomology-Zoology Department, South Dakota State University, Brookings, South Dakota, 57006. Research is continuing and solutions to your specific problems may be available through the Department.

Bees prefer to obtain water from moist soil such as this near a stock tank (left). Nail holes (circled below) used as nests when other materials, such as malt straws, are not available.



ALFALFA LEAF-CUTTER BEE SHELTER

Figure 1



NOTE: This shelter is designed for the utilization of half-length jumbo malt straws as nesting material. The general structure is well suited to the housing of drilled wooden planks or banded bundles of grooved boards.

PREPARING MALT STRAWS FOR NESTING MATERIAL

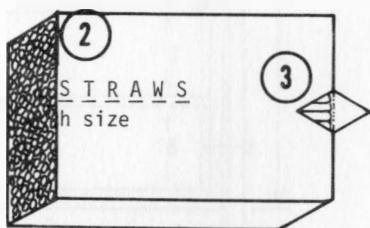
Figure 2



1—Cut full box of unwrapped straws with band saw

2—Reverse cut straws so that smooth surface is exposed

3—Cut flap on side of base of box (Thumbtack in flap will hold box to the back of the shelter.)

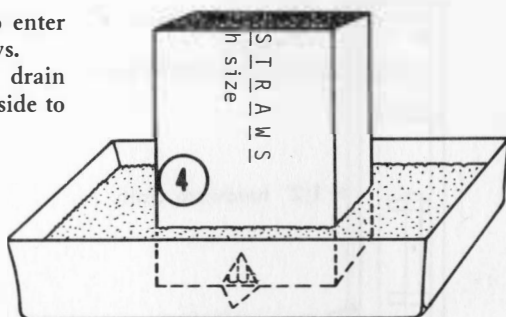


4—a. Dip box in melted wax to a depth of $\frac{1}{2}$ inch.

b. Allow time for the wax to enter flap hole and saturate straws.

c. Lift box and permit it to drain over pan before placing it aside to cool and harden.

Prevent Fire Hazard by heating wax pan in larger pan of water.



Wax composition in order of preference:

1. $\frac{1}{2}$ Beeswax + $\frac{1}{2}$ Paraffin
2. All Beeswax (Expensive)
3. All Paraffin (Melts in hot weather)

Best acceptance by the bees has been found with the paper jumbo malt straw (approximately $\frac{3}{16}$ -inch diameter).

Unwrapped straws provide more straws per box and are most easily waxed. Special order through your distributor. Extra large malt straws will be used by the bees but acceptance is slower and use is not as efficient. Regular soda straws are too small. Plastic straws are sometimes avoided by the bees.