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# Alfalfa Leafcutting Bee: Management for Alfalfa Pollination in South Dakota

R. J. Walstrom

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# Alfalfa Leafcutting Bee

Management for Alfalfa  
Pollination in South Dakota



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.

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

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# Alfalfa Leafcutting Bee

## Management for Alfalfa Pollination in South Dakota

By R. J. Walstrom

Agricultural Experiment Station entomologist  
South Dakota State University

The alfalfa leafcutting bee, *Megachile rotundata* (Fabricius), was introduced into South Dakota from Utah in 1962 for alfalfa pollination testing. This leafcutting 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 leafcutting 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 yellowgreen 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. No reports of adverse reactions to these stings have been reported.

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.

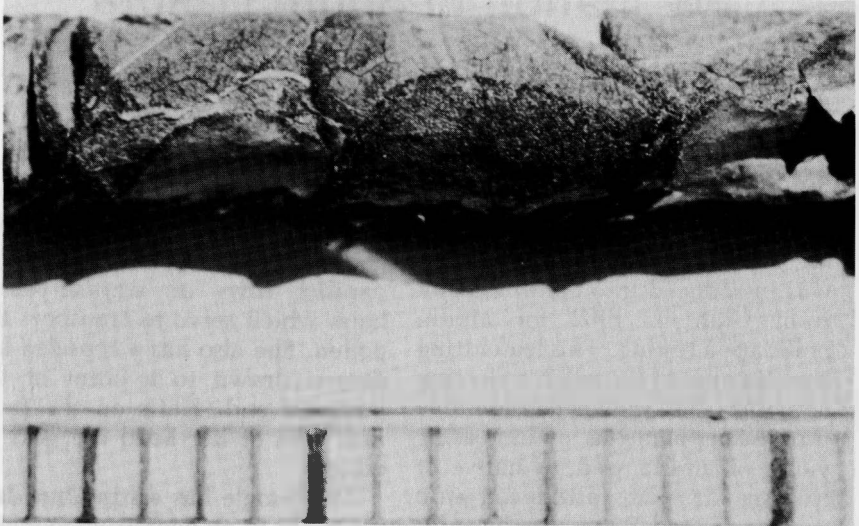
### Life History

Under South Dakota conditions, the alfalfa leafcutting bee over-

winters as the prepupal form in its leaflined 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 spring. The bee re-

mains 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, S.D., in 1964, and as late as July 18, at Piedmont, S.D., in 1965.

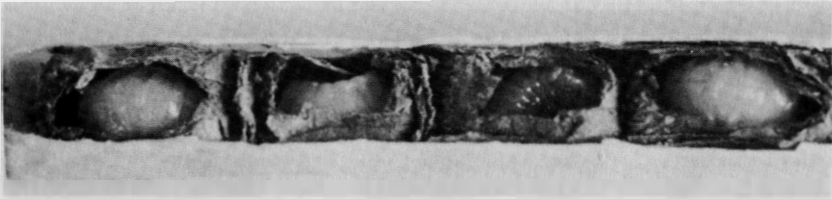


External view of position of leaf pieces which cover three immature bees as found in malt straw. Each scale segment is about 1/16th inch.

In shaded and unheated wintering locations the adults will usually emerge from a few days to two weeks later than from shelters with direct sun exposure. 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 unemerged cells. The first adults to emerge are males, who outnumber females at the rate of about three-to-two.

Mating takes place on warm sun-

exposed soil or building surfaces. Females will normally mate only once, while males may mate several times. An individual female will construct cells of cut leaf material in the holes or straws provided. In each of these cells she will deposit an egg and provision it with pollen. Each female will lay approximately 35 eggs. The larvae complete their growth during the summer and go into winter in the prepupal form. There is apparently a partial second generation per year under western South Dakota



Cutout section of malt straw shows positioning of prepupal forms.

conditions.

### **Field Activities**

Only the females have been observed tripping alfalfa florets and collecting pollen. While the alfalfa leafcutting 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. Alfalfa leafcutting bees and honey bees work well as pollinators in the same field.

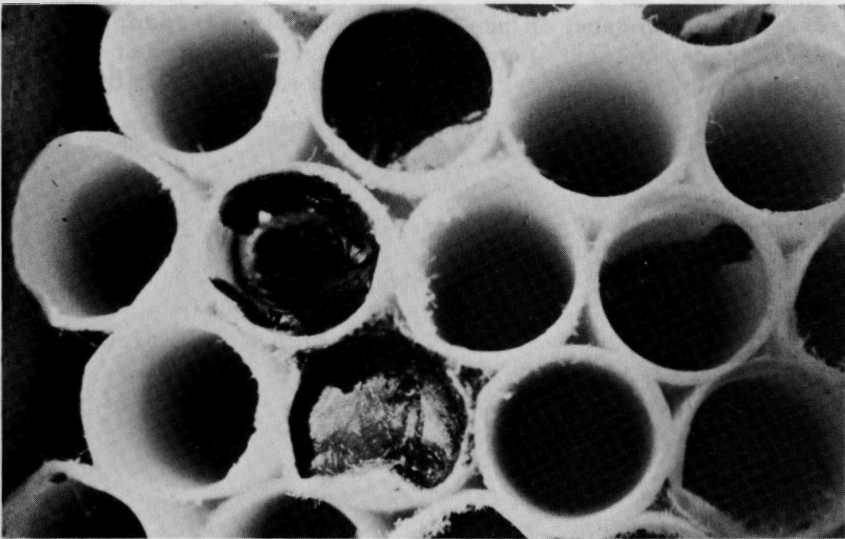
The tiny circular cuttings of plant material for nest construction may come from plants other than alfalfa. Rose and weed foliage and

petunia blossoms have been used in South Dakota.

### **ESTABLISHING THE BEES**

Alfalfa leafcutting bees can be purchased from growers in South Dakota and other states. The bees can be shipped easily in the prepupa form in nesting material supplied by the grower. Delivery of the bees should be planned for about mid-May.

The use of paper jumbo malt straws or bored planks have proved satisfactory for the nesting material under South Dakota conditions. Other usable nesting materials include grooved boards or grooved



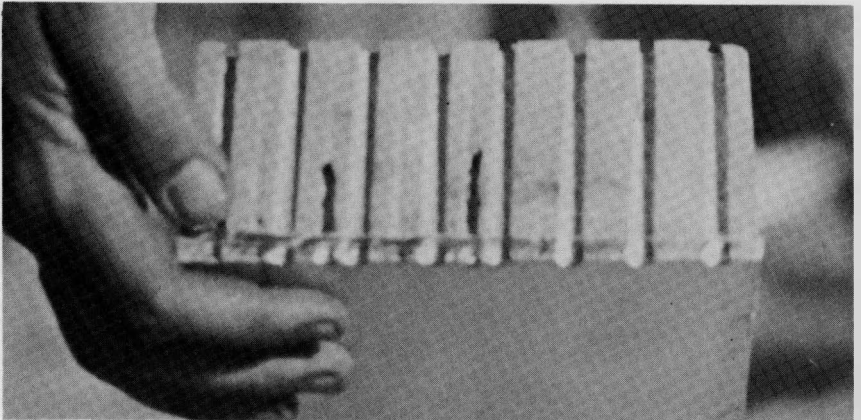
Adult bees provisioning eggs in malt straw nest with leaf pieces and pollen.



Leaves showing the circular cuts made by alfalfa leafcutting bees. The pieces removed are used to line the cells for the immature bees.

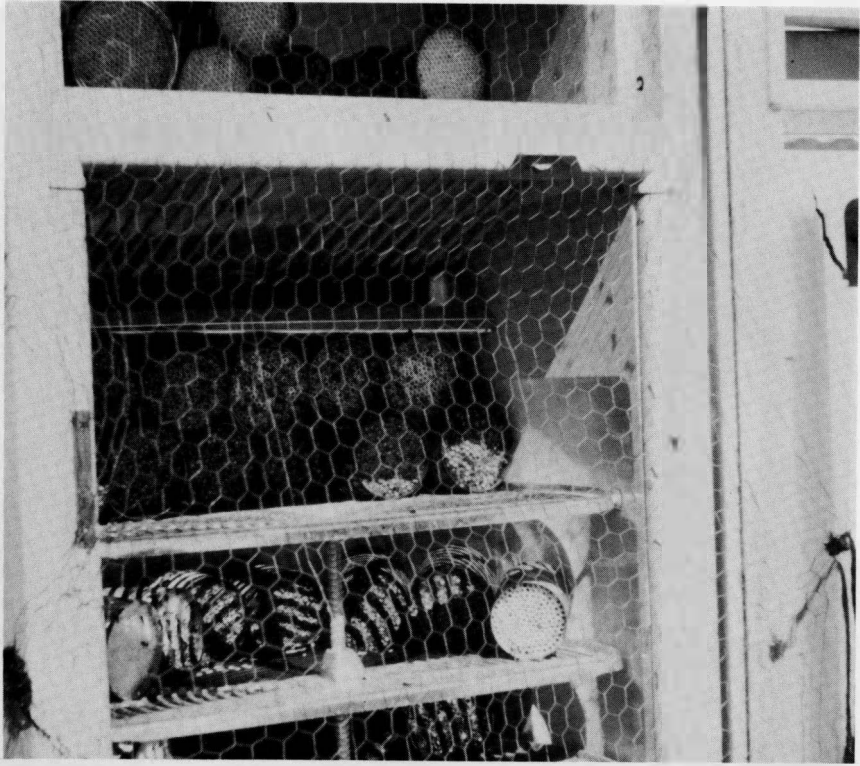
molded plastic which can be banded together for the holes and taken apart for removing the larval or pupal forms. Rolls of cardboard which are corrugated on one side have made suitable temporary nesting material.

Satisfactory shelters have been provided by using old poultry sheds, discarded refrigerators and similar protective structures. Directions for preparing the straws and one type of nest shelter are described in detail in figures 1 and



A completely bored plank showing the aluminum paper backing in position.





An old refrigerator makes a sturdy nesting shelter.

2. Empty nesting straws or bored planks at the ratio of three-to-one for every filled nesting hole or straw should be provided in the shelters before the bees become active. Additional empty straws or bored planks may be required during ideal seasons.

Bees should be moved to the field in the late spring before the adults begin emerging. Where chemicals are applied for injurious alfalfa insect control at bud stage, the bees should not be moved to the field before one week after spraying. Shelters should be placed facing east so that the warming effects of the morning sun can be utilized to initiate morning flight activity as

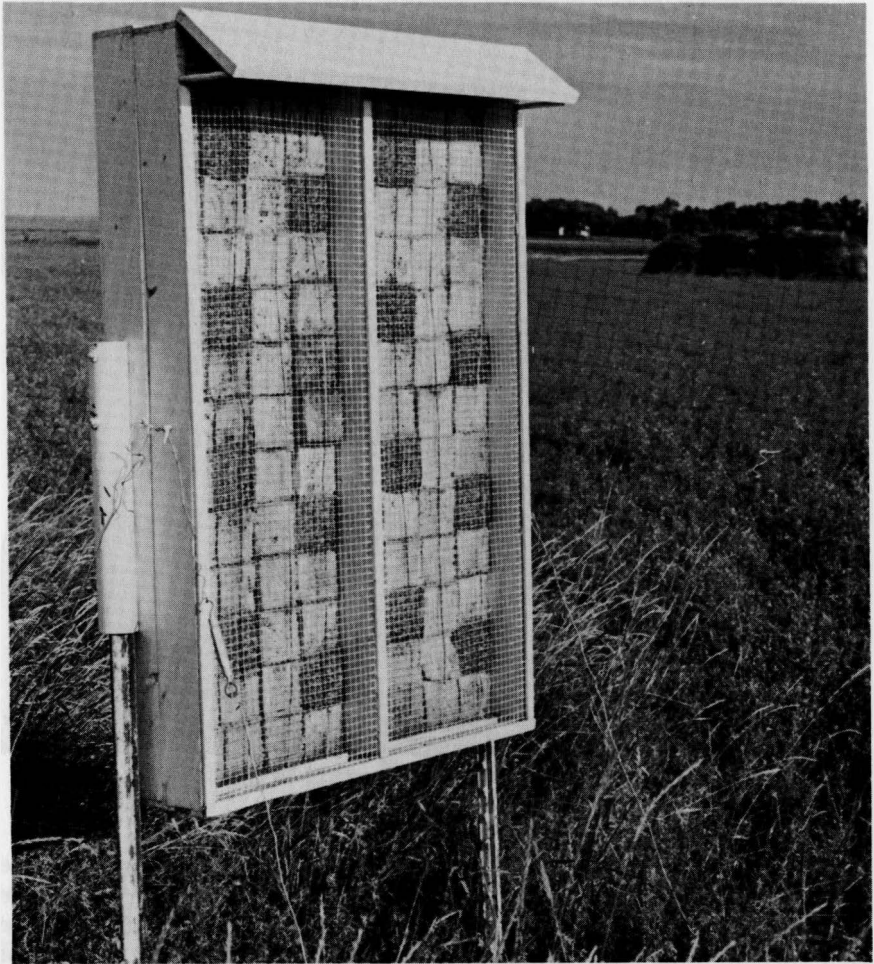
early as possible.

The lower portions of the shelters should be 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. Larger structures should be on skids or on wheels for ease in movement.

### **Movement, Placement of Shelters**

For best pollination coverage, small shelters should be spaced across the alfalfa seed field. A minimum population of 1200 filled straws or holes in planks per acre to be pollinated is recommended. Greater populations prove highly





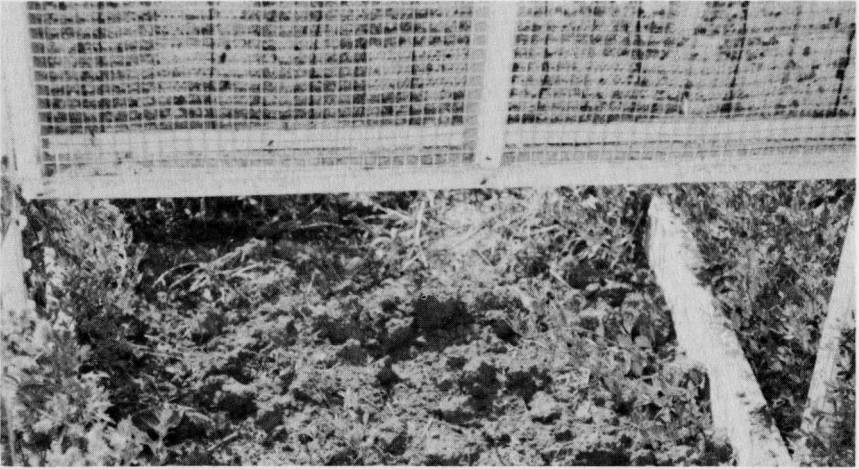
Portable nesting shelter facing east in the seed field.

advantageous in years when working conditions are limited by cool, wet weather. Large trailer-type units should be placed in the center of the field to be pollinated. The open or hardware cloth covered side of the shelters should face east.

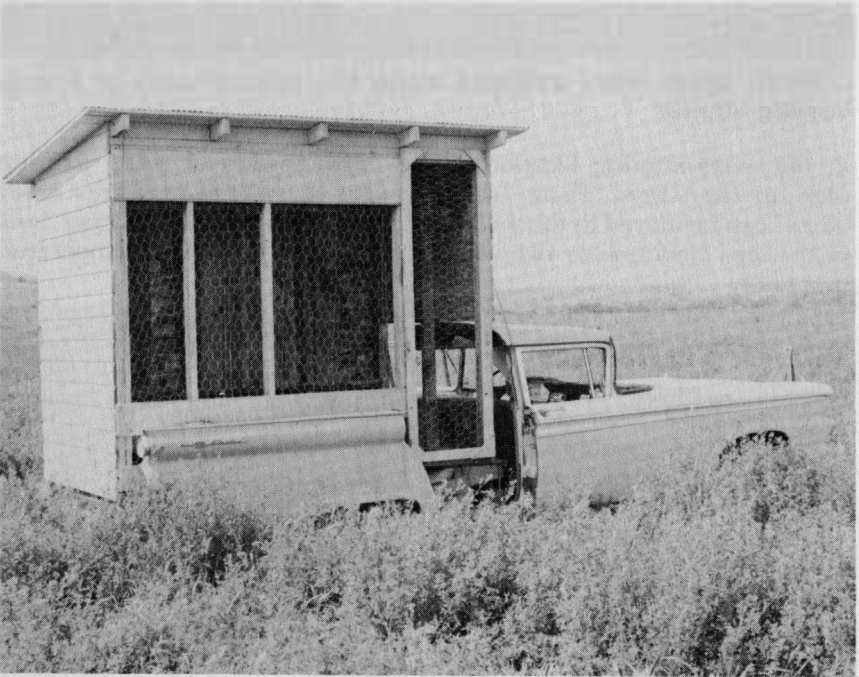
If some of the bees have emerged as adults before the shelters are moved to the seed field, the shelters should be moved at night,

preferably at temperatures below 60° F (15.6° C). 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 if conducted at these temperatures.

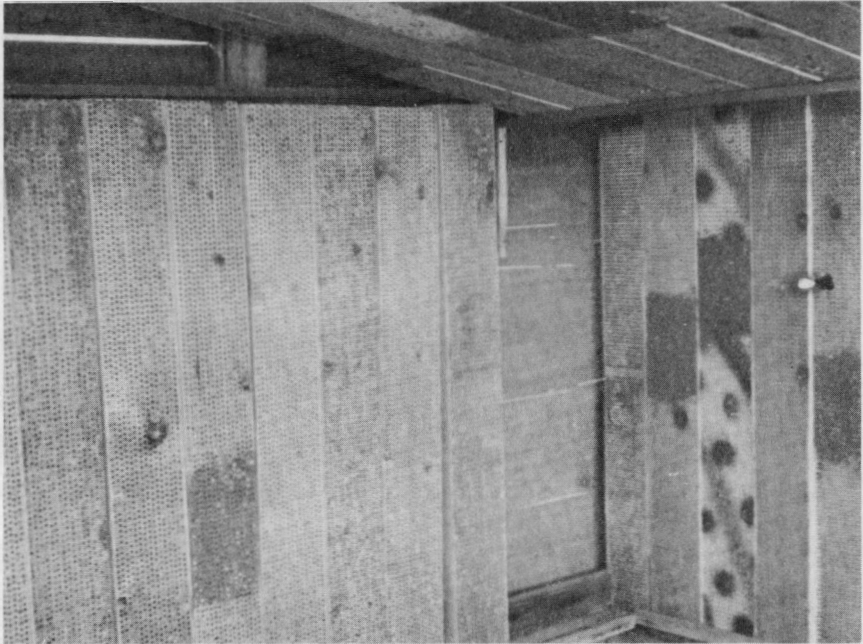
Because evidence indicates that all bees do not return to the nesting sites at night, it is advisable to leave a box or two of empty malt straws



Bare soil maintained under the shelter to provide a resting area for the adult leafcutting bees.



This large nesting shelter, mounted in an old truck bed, can be towed in or out of the field with little effort.



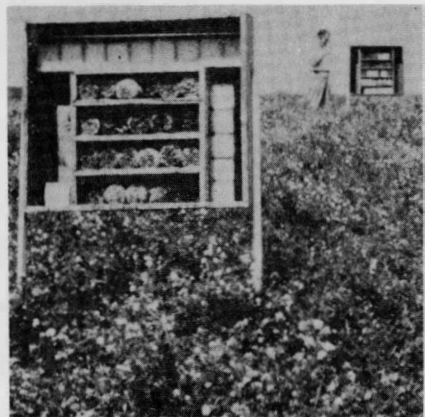
Bored plank nests arranged along the interior walls of a large nesting shelter.

at the overwintering locations to pick up the strays. These "catch boxes" can be moved to the shelters in the seed field one or two evenings later.

### Parasites and Predators

Parasites of the alfalfa leafcutting bee have been detected in South Dakota populations, and they can be expected as the bee populations increase. The minute chalcid wasp, *Pteromalus venustus* Walker has been found to cause some parasitism in South Dakota. the chalcid wasp, *Monodontomerus obscurus* Westwood, has been shown to parasitize the larval or pupal stages of the bee, causing its death. The wasp, *Sapyga pumila* Cress., has also been found in nesting bees in South Dakota.

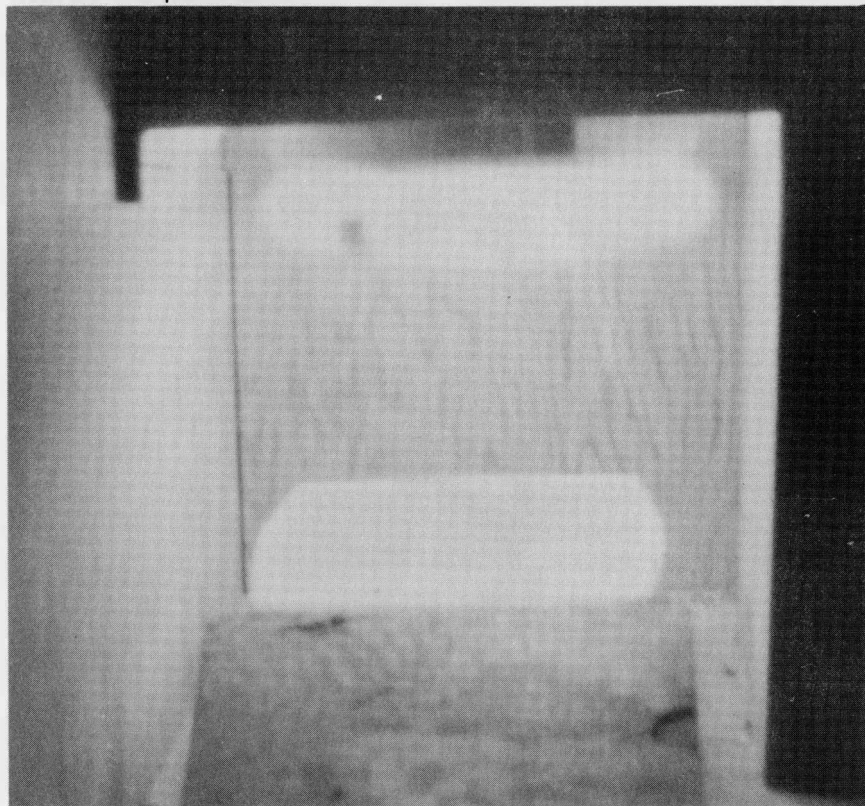
Most species of wasp parasites begin to emerge as adults a few days before the leafcutting bees, and where controlled temperature



Small nesting shelters should be placed at intervals in the field.



Large nesting shelters should be placed in the center of alfalfa fields to be pollinated.



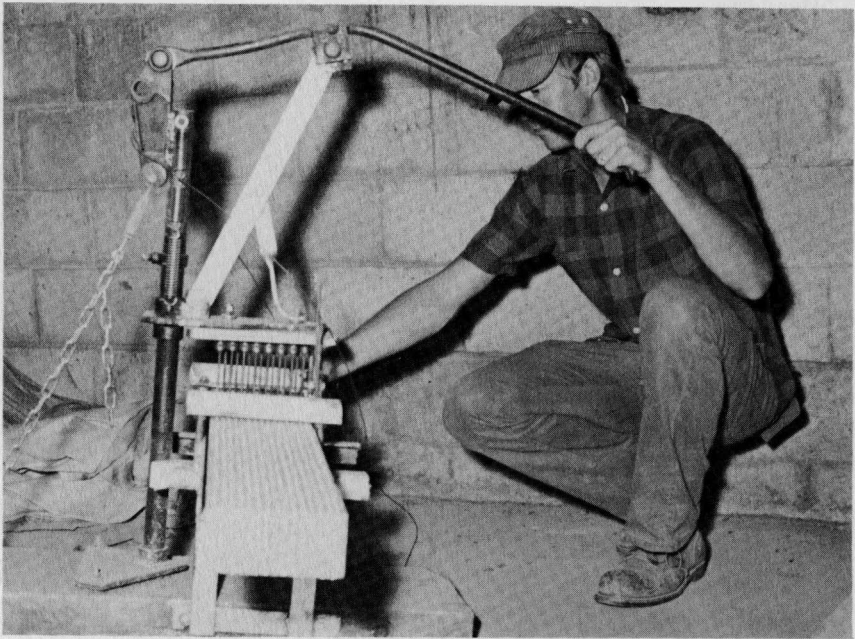
A black light in position over a pan of detergent and water to trap wasp parasites and black flour beetles in an environmental control room.

and humidity rooms are available for winter storage of the bee nests, traps using black light as an attractant can be used to lure these parasites to sticky surfaces or oil trapping materials. Water baths treated with common detergents are also used to drown the wasps attracted to the lights. Some of the insect predators of the leafcutting bees will also be reduced in numbers by using these light traps. Unless glass panels with narrow openings are used to prevent the trapping of the early emerging leafcutting bees, the use of such traps is limited to the period immediately before bee emergence.

If, after about a year, these

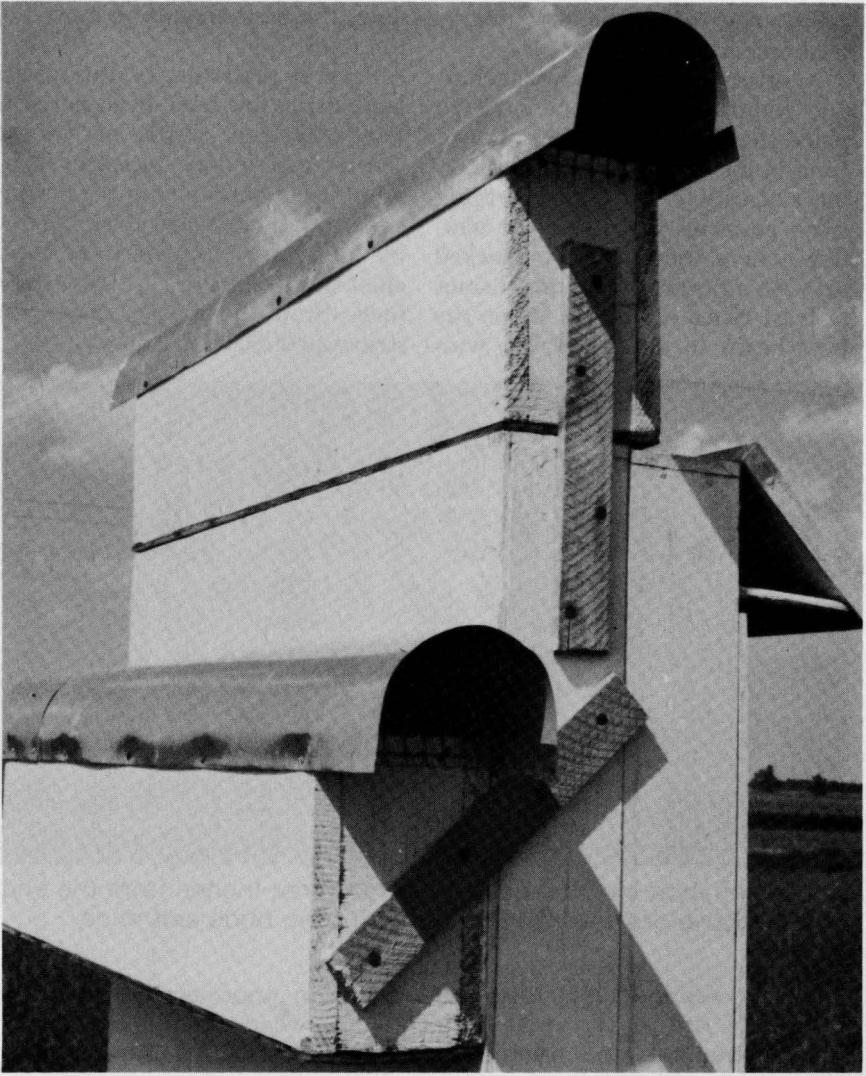
wasps reduce the living bees to the level that 30 percent or more of the holes do not produce adults, traps or other methods should be considered for the control of the parasites.

In late May or June the wasp parasites can be trapped by removing the leafcutting bee pupal cases from the bored planks, or by separating the individual straws and covering them to a depth of two inches with clean sawdust in wooden or metal pans. The leafcutting bees can work their way through the sawdust barrier. Empty nesting straws or boards should be provided for the new adults. A



Immature forms of the leafcutting bee can be removed from completely bored planks with machines such as this hand operated punch.





Wooden trays mounted on the top and back of a nesting shelter hold immature forms of the alfalfa leafcutting bee covered with a two-inch barrier of sawdust. Small wasp parasites are trapped in the sawdust, while newly emerged bees move through this barrier to nest in empty straws or bored planks in the shelter.



rain cover over the sawdust is recommended.

Another parasite control technique requiring little expense is to place the bee nests in late May or June in an unheated building having a glass window. The emerging wasp parasites will fly to the window where they should be sucked up with a portable vacuum cleaner at least twice each day. When the bees begin to appear at the win-

dow, the nests should be moved to the field.

Several predators of the alfalfa leafcutting bee 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 spaced at least three inches from the exposed end of the straws or hole in the planks.



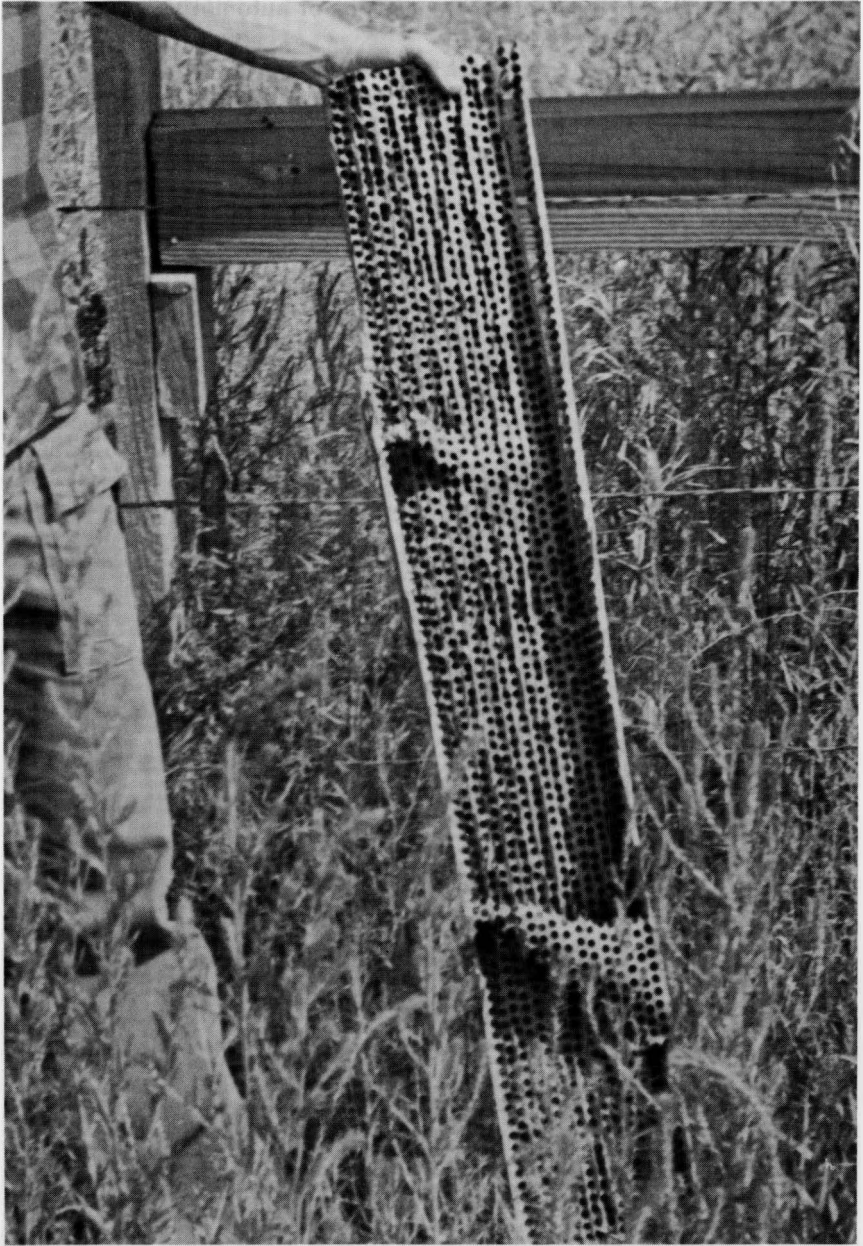
The half-inch hardware cloth spaced three inches from the ends of the straws provides nest protection from birds and mice.

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 damaged nests when unprotected in storage locations during the winter.

Damage by mice is caused primarily 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 1/2-inch hardware cloth covering has prevented this damage.

Insect predators of several species have damaged the alfalfa leafcutting bee nests in South Dakota. Dermestids of several species including the larder beetle, *Dermestes lardarius* Linn., and the black flour beetle, *Tribolium madens* (Charp.) have caused the death of the larval and pupal forms



Damage caused by woodpeckers to a bored plank nest which was not protected by half-inch hardware cloth or small-mesh chicken wire.

of the bee. The beetles are attracted to the pollen stored in the cells and they and their larvae break into the cells, causing death of the immature bees by eating their needed food and exposing them to the elements.

Dermestids are difficult to control. One method for reducing their damage has been to eliminate the build-up of residues expelled from the cells by the bees to the shelves and lower portion of the shelter. These residues, particularly when wet, attract the dermestids to the nesting sites.

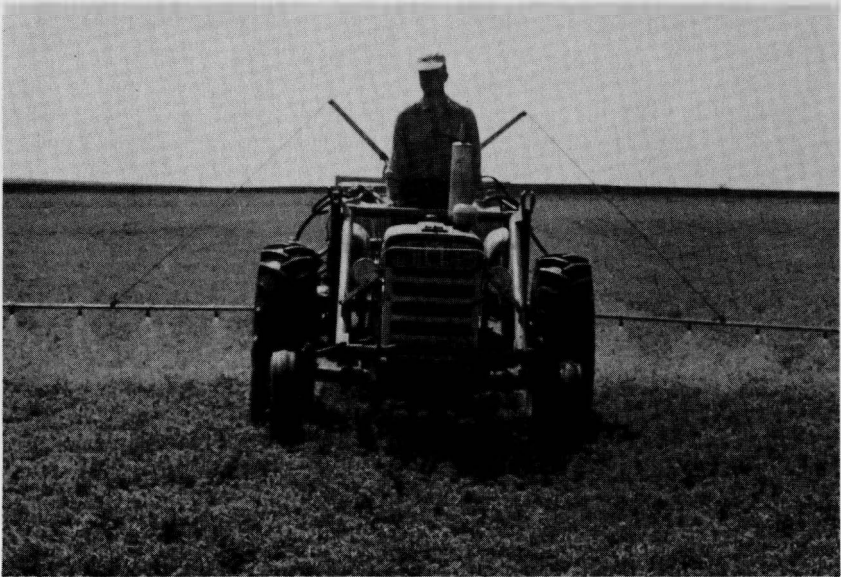
Ants of several species kill the immature bees in a similar fashion by removing the pollen stores. Some species have been observed removing the immature bees. Protection from ants can be obtained by carefully treating the lower six inches of the shelter supports with a

coating of automotive grease.

### **Insecticide Hazards**

Alfalfa leafcutting bees are highly susceptible to the damaging effects of most of the commonly used agricultural insecticides. When needed, 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. A week 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 or 10°-15.6° C), dry cellar which can be kept dark. The field should be sprayed at night to protect other pollinators, and the bees returned two to three days later to their



Insecticides should be applied to alfalfa in the bud stage before the leafcutting bees are moved into the field.



Nesting shelters should not be present in fields during actual irrigation operations.

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 leafcutting bees.

Contact your county agricultural Extension office for the recommended insecticides to use for injurious insect control in the alfalfa seed field. Some insecticides are less toxic than others to the pollinators.

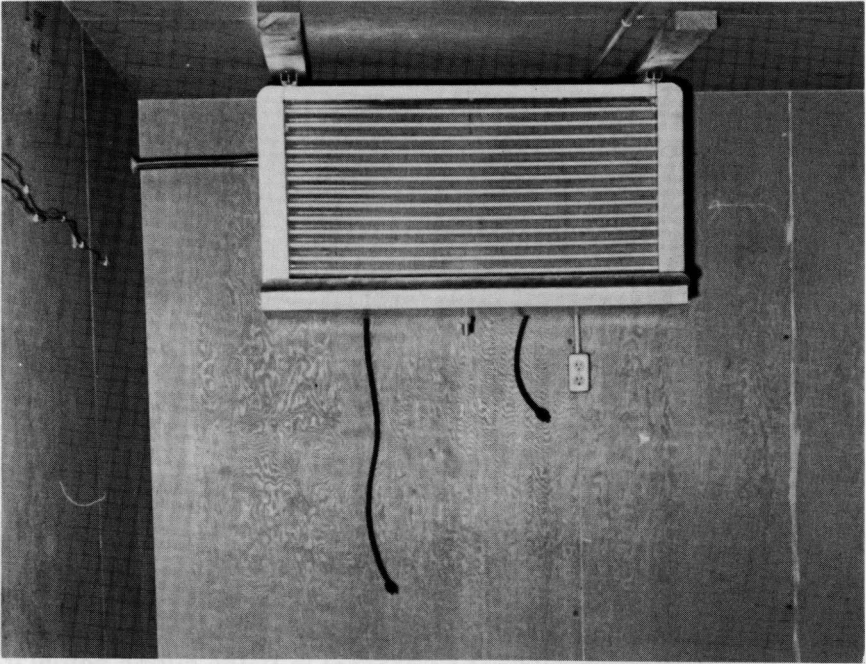
Research is continuing to provide the best controls for insects which reduce alfalfa seed yields in South Dakota.

### **Irrigation Hazards**

Alfalfa seed operations utilizing irrigation require a few special techniques for managing leafcutting bees. Generally, irrigation water is applied to the field before the plants bloom, preferably when in the early bud stage. Leafcutting bees should not be placed in the field until after irrigation is completed. Irrigating cools the bees, and they drop to the ground where they drown. If irrigation is needed after the bees have been placed in the field, the bees should be removed and returned to the field as soon as possible.

### **Wintering Alfalfa Leafcutting Bees**

Alfalfa leafcutting bees have been successfully overwintered in



Temperature control equipment installed in environmental control rooms for alfalfa leafcutting bees will maintain a 35° F. (1.67° C.) temperature during the overwintering period.

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 from mice. The use of unheated buildings for overwintering bee nests is a very common procedure in South Dakota. Excessive humidity of over 75% should be avoided in wintering locations. Buildings which have been treated with highly residual insecticides, or which are used as storage areas for insecticides, are not recommended as wintering locations. Environmental control rooms provide the best overwintering method. Temperatures should be maintain-

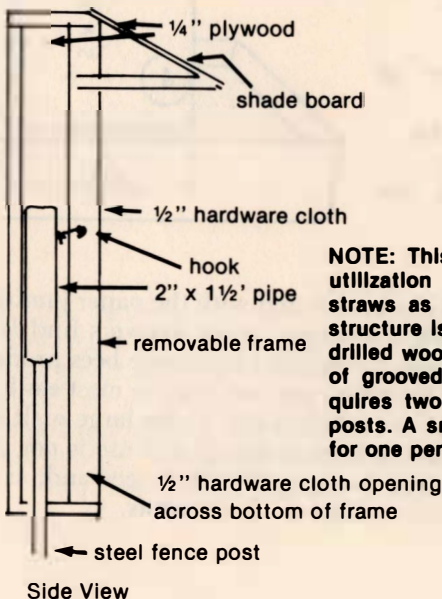
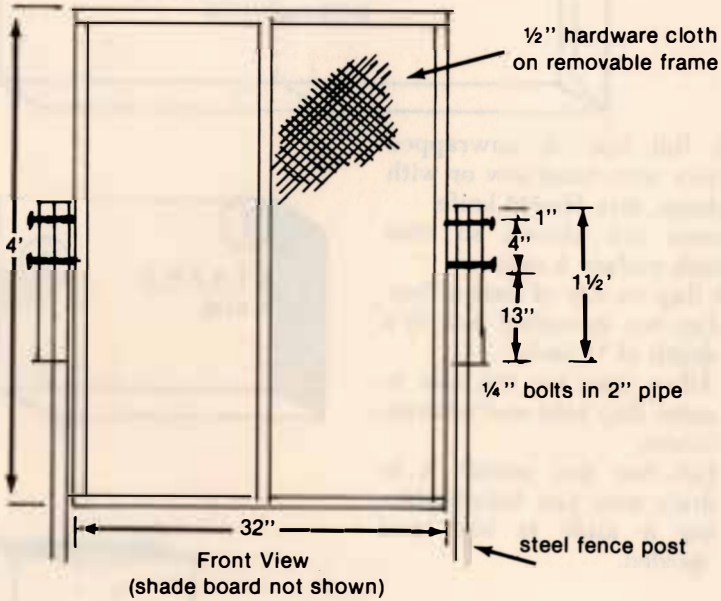
ed at 35°F. (1.67°C.) with a relative humidity of 50%. Exact timing of the emergence of the bees overwintered in environmental control rooms can be obtained by raising the temperature to 85°F (29.4°C.) and the relative humidity to 70% for 18 days.

#### **ADDITIONAL INFORMATION**

If the reader desires a list of sources where alfalfa leafcutting bees may be purchased, he may contact the Entomology-Zoology Department, South Dakota State University, Brookings, South Dakota, 57007. Research is continuing and solutions to the reader's specific problems may be available through the department.

# Alfalfa Leafcutting Bee Shelter

Figure 1

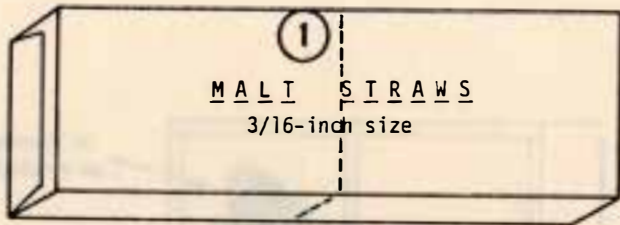


**NOTE:** This shelter is designed for the utilization of half-length jumbo malt straws as nesting material. The general structure is well suited to the housing of drilled wooden planks or banded bundles of grooved boards. This size shelter requires two persons to place it on steel posts. A smaller size would be desirable for one person to handle.

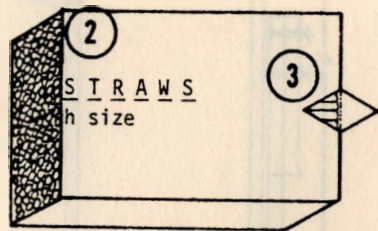


# PREPARING MALT STRAWS FOR NESTING MATERIAL

Figure 2



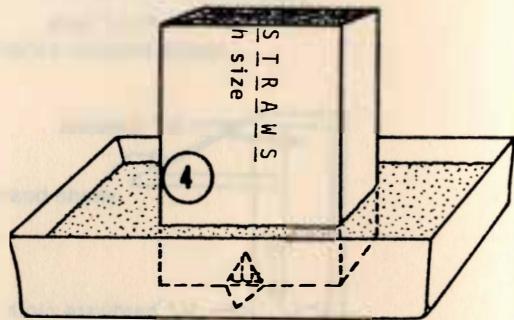
- 1—Cut full box of unwrapped straws with band saw or with a sharp, thin bladed knife
- 2—Reverse cut straws so that smooth surface is exposed
- 3—Cut flap on side of base of box
- 4—
  - a. Dip box in melted wax to a depth of  $\frac{1}{2}$  inch.
  - b. Allow time for the wax to enter flap hole and 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). (Some growers find  $\frac{1}{4}$ -inch diameter straws seem to increase the number of female bees produced). Unwrapped straws provide more straws per box and are most easily waxed. Special order these through your distributor. Extra large malt straws will be used by the bees but acceptance is slower and use is not as efficient. Plastic straws are sometimes avoided by the bees and, in some areas, are noted to cause excessive moisture in the nests.