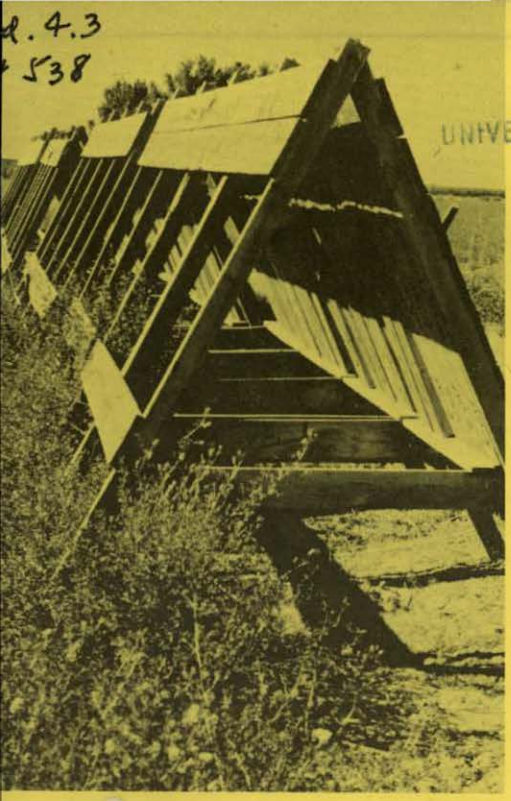

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Cooperative Extension Service

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College of Agriculture

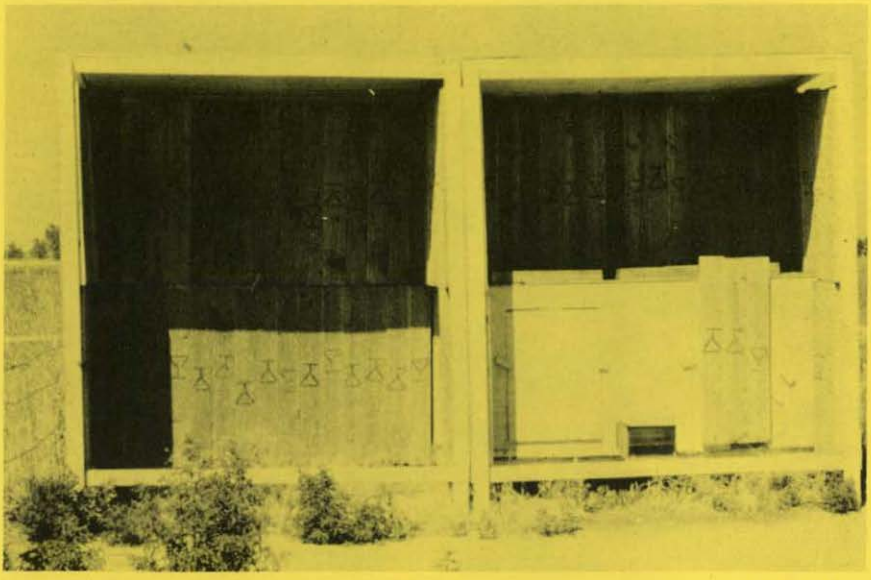

Fig. 1. A moderately large field shelter together with a combination field shelter-bee excluder. Note the owner's brand on the bee boards.

The cover photo shows another type of field shelter, an economical and practical A-frame designed for bee boards. Several of these can be grouped together to form a large station, as in this field.

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Raising Alfalfa Leafcutter Bees In Idaho

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"What should I do to raise better leafcutter bees?"

This is the one question asked most often by alfalfa seed producers who use the alfalfa leafcutter bee, *Megachile rotundata* (Fabricius), as a pollinator. The answer is there is no one "right way" to propogate this bee in Idaho. You must develop techniques that are best suited to your farm and your methods of operation.

This publication lists a number of techniques, methods and materials that have been used to rear bees in Idaho over the last 10 years. These are presented in 5 major sections: Spring Management, Summer Management, Fall Management, Winter Management, and Nesting Materials. Each section lists the tested practices or materials and presents the major advantages and disadvantages of each.

SPRING MANAGEMENT

I. Incubation of bee nests at 85°F., following refrigerated storage.

Advantages:

1. You can predict bee emergence. After 19 days at 85°F. and 50 to 70% relative humidity, male bees appear. Female bees start emerging 2 days later.
2. Increases management options. You can extend the incubation period by lowering temperatures to between 50 and 60 degrees for the first half of the incubation period. And in the last half of the incubation period, you can delay putting bees in the field an additional 7 to 10 days by reducing the incubation room temperature to between 65 and 67 degrees. These techniques will permit you to hold back bee emergence safely, so that the bees can be placed in the field just before full bloom. This can be important when extended cold delays alfalfa bloom.
3. Most incubated bees emerge within 2 weeks after being placed in field shelters.

Disadvantages:

1. Bees require daily attention during the incubation period.
2. Cost of incubator and operation.
3. Controls can malfunction. Excessively high temperature or relative humidity will kill bees.

II. Use of lights over water pans in incubation room.

Advantages:

1. A combination of incandescent and fluorescent "black lights" attracts many nest-destroying insects and parasites emerging during incubation. Many of these emerge from nests earlier than bees and are easily destroyed in water-filled pans positioned under lights.

Disadvantages:

1. Extra labor for daily maintenance.
2. Cost of light fixtures.
3. The lightproof room must have temperature and relative humidity controls.
4. Leafcutter bees are also attracted to these lights. Early emergence or unexpected delay in placing bees into field shelters can lead to many bee deaths.

III. Phasing-out old or contaminated nest materials.

Advantages:

1. Nest material from the field always contains some living bees. They can be salvaged by a phasing-out process.
2. A properly constructed phase-out structure will retain or kill nest-destroying insects while allowing the bees to emerge safely. This is particularly recommended following incubation where early-emerging parasites and nest destroyers have already been eliminated by the use of lights over water pans. After the bees have finished emerging, burn nest materials and spray the inside of the phase-out structure with a short residual insecticide.
3. Use nest materials for only 2 or 3 years in the field and have a regular phase-out program. These two practices will drastically reduce or eliminate populations of most parasites and nest destroyers.

Disadvantages:

1. Cost of phase-out structures.
2. Labor to move nest materials two additional times (in, then out to burn).
3. Excess heat inside poorly located phase-out structures can kill bees.
4. Bee losses can be excessive in poorly constructed phase-out structures that do not let bees escape easily.

SUMMER MANAGEMENT

I. Field Shelters: small size, 5-to-20-board capacity.

Advantages:

1. Low cost per unit for construction and labor.

Disadvantages:

1. Bees seem to work less efficiently in small groups.
2. Small shelters increase tendency of bees to drift, leaving some shelters relatively empty and others crowded.

II. Field Shelters: large size, 50-to-200-board capacity.

Advantages:

1. Bees work better and drift less in large, well-populated shelters.
2. Bees from each well-populated field shelter can pollinate up to 20 or more acres.
3. Inspection and care for a few large shelters is easier than for many small ones.
4. In general, larger shelters must be better constructed than smaller ones.
5. Large shelters can be mounted on wheels for mobility and, eventually, reduced labor costs.

Disadvantages:

1. High cost per unit for building large, well-constructed shelters.
2. Bee thieves can steal easily.

III. Place bee shelters around rather than inside alfalfa seed fields.

Advantages:

1. Adult bees are less subject to direct contact with insecticides applied to fields at night.
2. Bees have more opportunity to construct nest cells with leaves from plants other than alfalfa.
3. Bees have more opportunity to use leaves from plants that have not been treated with insecticides.
4. Shelters interfere less with farming operations.
5. Shelters are usually more available for inspection and care.

Disadvantages:

1. Center of field may not be adequately pollinated if there are not enough bees.
2. Edges of seed fields may have double applications of insecticides in spots, and this can be fatal for bees.
3. Convenient for bee thieves.

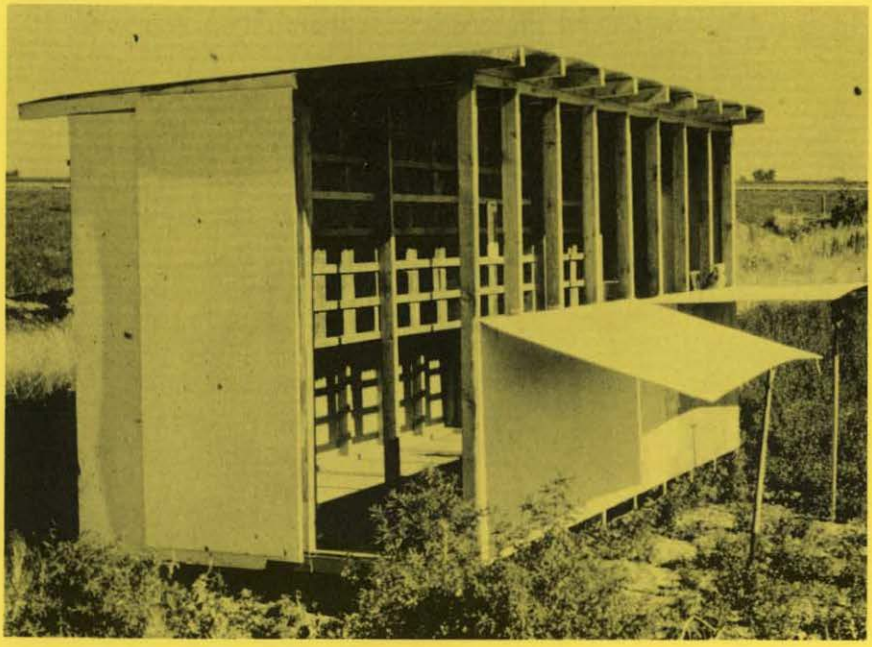

Fig. 2. An elaborate, large bee field shelter. This stationary shelter can be heated if the owner desires.

IV. Inspect leafcutter bees at least once each week.

Advantages:

1. You can follow changes in populations of bee parasites and nest destroyers and deal with these as needed.
2. You can regularly remove dropped pollen, fallen leaf pieces and dead bees, which attract and provide food for nest-destroying insects.
3. You can take immediate steps to secure additional pollinators in case of a bee kill.
4. You can observe when bees stop work in the field at night. This will help you time insecticide applications to avoid bee kills.

Disadvantages:

1. Time required to inspect and care for bees.

V. Protect bees from sun, rain and wind and provide shade for nests after 9 a.m.

Advantages:

1. Bee larvae develop best between 70° and 95°F.
2. Direct sun on the face of bee nests before 9 a.m. stimulates female alfalfa leafcutter bees to begin work earlier in the day.

3. Shade protects developing bees. Under test conditions all developing immature bees died when nests were exposed to direct, hot afternoon sun for more than 30 minutes.
4. Shelters designed to provide proper shade generally also provide adequate rain and wind protection.

Disadvantages:

1. Cost of more elaborate field shelters.

VI. Brand or mark bee boards and other nesting materials.

Advantages:

1. Marks and brands discourage thieves.
2. Marks and brands on the face of nests serve as points of orientation for nesting females.

Disadvantages:

1. Cost of labor and materials to mark nests.

FALL MANAGEMENT

I. Move nest materials into winter storage in August or early September.

Advantages:

1. Clearing shelters from seed fields aids harvesting operations.

Disadvantages:

1. Early storage prevents the second generation bees from emerging. Unfortunately, bees that are prevented from emerging usually do not emerge the following year because they are not physiologically prepared for the long overwinter storage period.
2. The move disturbs and kills some developing larvae.
3. Frequently, the move eliminates substantial late season bee nesting activity.

II. Move nest materials to winter storage after October 15 or following a killing frost.

Advantages:

1. Maximum bee nesting activity is accomplished by this time.
2. All bee larvae will have ample time to develop to the overwintering prepupal stage.
3. You can take more time and use more care to gather, grade and store nest material.

Disadvantages:

1. Bee shelters inside the field during harvest interfere with operations.
2. Nests have a longer exposure to the elements.
3. Bee thieves have greater opportunity to operate.

III. Treat nest materials with insecticide before storage to reduce nest-destroyer populations.

The recommendation is to spray the face of the nest in the field shelter with a ½% solution of naled (Dibron[1]). Spray lightly. Use 1 pint of 8-pounds-per-gallon material in 25 gallons of water, or 4 teaspoons in 1 gallon of water. Wait 2 to 10 days and repeat if desired. When the nests are completely dry, they may be placed in storage.

Advantages:

1. This treatment may eliminate from 5 to 20% of the total nest-destroying beetle population.

Disadvantages:

1. Cost of material and labor to apply sprays.
2. Bee loss is possible if spray directions are not followed carefully.

IV. Evaluate and grade bee nests as they are gathered for winter storage.

Advantages:

1. You can mark poor nest material for segregated winter storage and phasing-out next year.
2. By marking the face of a selected number of nests very lightly now with spray paint, you can evaluate nest materials next summer for bee emergence, etc.
3. Evaluating bee and pest populations now can help you plan: Buy more bees? Sell excess bees? Need additional phase-out structures or field shelters?

Disadvantages:

1. Cost of labor and materials.

WINTER MANAGEMENT

I. Overwinter storage: leave bees in place in the field.

Advantages:

1. Saves the cost of moving bees twice and saves storage expenses.
2. Bees will overwinter in most areas if protected from direct exposure to the elements.
3. Bees will begin emerging about the time alfalfa normally starts to bloom in the spring.

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[1]Trade name for material manufactured by Chevron Chemical Co., Ortho Div., San Francisco, Calif.

Disadvantages:

1. Several hours exposure at −20°F. will kill bees.
2. Bee emergence will not coincide with alfalfa bloom when bloom is delayed by cultural practices or when a hay crop is removed first.
3. Bees overwintered this way normally emerge over an extended period of time—from June into August. Too few bees may be working when maximum bloom is present.
4. Lack of temperature control gives an advantage to nest-destroying insects which are active at temperatures above 40°F.

II. Overwinter storage: move bees to shed or barn.

Advantages:

1. Bees begin emerging about the time alfalfa normally starts to bloom if they are placed in field shelters 40 or more days before bloom.
2. You can inspect nest material for nest-destroying pests, dead cells, etc., and determine which nests are to be phased out or replaced.

Disadvantages:

1. All disadvantages listed above under I.
2. Cost of moving bees twice and storing them.
3. Nest materials are concentrated, so noninfested nests can be contaminated easily by nest-destroying insects from infested nests when temperatures are above 40°F.
4. Increased possibility of loss from fire or theft.

III. Overwinter storage: place bees in refrigerated cold storage room.

Advantages:

1. Temperatures maintained at about 35°F. prevent damage from nest-destroying insects.
2. You can inspect nest materials for nest-destroying pests, dead cells, etc., and determine which are to be replaced or phased out.
3. Precise timing of emergence is possible by incubating after cold storage. This makes bees available near the beginning of full bloom even when bloom is delayed.

Disadvantages:

1. Cost of moving bees twice.
2. High storage cost.
3. Mechanical failure can allow relative humidity to climb above the safe limit (70%) which would stimulate mold growth and cause bee mortality.

IV. Use dichlorvos (Vapona[2] pest strips) in closed storage rooms.

Advantages:

1. Kills many nest-destroying insects quickly. Dichlorvos can be used in closed storage and incubation rooms after bees have been removed in the spring to eliminate all remaining pests.

Disadvantages:

1. Can kill bees in closed storage rooms. Although some growers continue to use this insecticide, research results definitely indicate that dichlorvos vapor is capable of killing all bees.

NESTING MATERIALS

Five primary types of nesting materials are commercially available. These are discussed below in order of preference:

I. Paper soda straws.

Advantages:

1. Lightly waxed, paper-base soda straws have given consistently better bee reproduction over the past 10 years than any other nesting material. Under test conditions, production ranged between a 2- and 4-fold increase yearly.
2. Straws are lowest in cost, so they can be phased-out with small monetary loss.
3. Bees in straws can be stored overwinter using much less space than standard bee boards require.
4. Field shelters using soda straws will have more nest holes than shelters with other nest materials.

Disadvantages:

1. Bees in straws are vulnerable to wasp parasites, such as *Monodontomerus obscurus* and *Leucopsis affinis*. Cold storage, incubation and phasing-out after 2 years will keep bee losses at a minimum.
2. Changing over to soda straws is difficult because bees that emerge from other nest materials, such as wooden boards, do not adapt readily to soda straws.
3. Cost of labor in preparing straws for field use.
4. Filled straws are susceptible to damage from sparrows, magpies, field mice and even cows. They require extra protection.
5. Heavily waxed or plastic soda straws hold in leaf moisture. Mold then develops and kills immature bees. Avoid straws of these types.

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[2]Trade name for active ingredient in resin or pest strips which works by fumigation. Strips are sold under numerous company names.

II. Holes drilled in boards—commonly known as bee boards.

Advantages:

1. Most readily accepted by bees as nest sites.
2. Damage from wasp parasites is greatly reduced.
3. Standard 4-foot-long bee boards are convenient to install in field shelters, to store overwinter and to sell on the open market.
4. Insect enemies can enter only through the open end of the nest hole.
5. Wood readily absorbs and holds moisture from leaves used in cell construction, thereby creating a favorable micro-environment.
6. Wood provides insulation, reducing rapid temperature changes.
7. Wood may be easily marked with paint or a hot branding iron.

Disadvantages:

1. Initial and replacement costs are higher than for straws.
2. Storage bulk for an equal number of bees is much greater than with straws.
3. Transportation weight for an equal number of bees is much higher than for straws.
4. Boards with a single entrance hole are difficult to sample for bee development and survival.

III. Drilled boards with removable backs.

Advantages:

1. These have all the advantages listed for bee boards.
2. You can re-use boards by removing backs and punching out cells containing bee larvae, instead of phasing-out and burning.

Disadvantages:

1. Initially these boards are quite expensive. Re-use lowers long-term costs.
2. Bulk of boards stored overwinter equals that of standard bee boards.
3. The punching-out process, provided by the manufacturer for a fee, may cause 25% or higher mortality of overwintering bee larvae.
4. Punched-out bee cells require special handling and care over winter and during incubation in the spring.
5. Transportation and handling weight are equal to standard boards.

IV. Laminated (grooved or take-apart) boards.

Advantages:

1. Bees readily accept these nest sites.
2. The boards absorb moisture and provide the same insulation quality as standard bee boards.
3. They can be taken apart to remove bee cells, then re-used to lower cost.

4. Removed bee cells require smallest amount of winter storage space.

Disadvantages:

1. Initial cost is high.
2. Boards tend to warp and crack.
3. Sealing the back of holes to prevent access by parasites and nest destroyers is difficult.
4. Labor needs are high to remove overwintering bee larvae in order to re-use boards.
5. Removed bee cells require special handling and care over winter and during incubation in the spring.
6. Weight equals or exceeds standard bee boards.

V. Laminated (grooved or take-apart), molded plastic sheets. Not recommended in Idaho.

Advantages:

1. Bees accept these as nest sites.
2. Insulation quality is superior to all other nest materials.
3. They can be taken apart to remove bee cells, then re-used to lower cost.
4. Handling weight is less than standard bee boards.

Disadvantages:

1. The back of nest holes cannot be readily sealed to exclude parasites and predators.
2. Initial cost is high, but re-use lowers long-term cost.
3. Leaf moisture dissipates slowly which often results in mold development and bee mortality.
4. Precision equipment required to remove large numbers of bee cells is not available commercially.
5. Labor needs are high to remove overwintering bee larvae.
6. Removed bee cells require special handling and care over winter and during incubation in the spring.
7. These sheets are susceptible to mouse and woodpecker damage.

Additional Information

Alfalfa Leafcutter Bee Excluder—Beetle Trap. Idaho C.I.S. 97, Dec. 1968.

Alfalfa Pollinators. Idaho C.I.S. 106, May 1969.

Lights and Water Traps for Alfalfa Leafcutter Bee Incubators, Idaho C.I.S. 120, Mar. 1970.

Insect Enemies of the Alfalfa Leafcutter Bee and Their Control. Idaho C.I.S. 163, May 1971.