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SHADE

AND

WATER

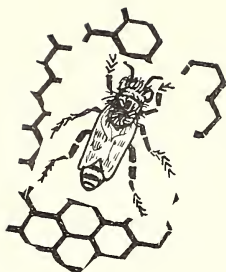
FOR

THE

HONEY BEE

COLONY





SHADE AND WATER FOR THE HONEY BEE COLONY

By Charles D. Owens, agricultural engineer, Agricultural Engineering Research Division, and S. E. McGregor, entomologist, Entomology Research Division, Agricultural Research Service

Honey bees, like other animals, require water for their normal body functions. They also use water to reduce the cluster temperature. If the outside temperature is high, they may stop collecting food and collect water to cool the cluster.

In areas of high temperature the beekeeper can get more honey from a colony if he protects it from heat and sees that a water supply is nearby.

ARTIFICIAL SHADES

The best way to protect a colony from heat is to place the hives on green grass in the shade of one or more good shade trees. In high-temperature areas having few shade trees, artificial shades are needed.

Tests made in Arizona show that a colony under solid shade produces 50 percent more honey than a colony exposed to the sun. Under partial shade the honey production is in proportion to the amount of shade.

The tests also show that unshaded colonies are more likely to be lost

as a result of insecticide poisoning than are shaded colonies. The reason probably is that after a part of the working force has been killed by insecticide, the remaining bees in the unshaded colonies cannot maintain broodnest temperatures.

Permanent Shades

In the lower valleys of southern Arizona and southern California, where temperatures above 100° are common, many beekeepers have built permanently located artificial shades (fig. 1).

These shades are usually about 7 feet high and 10 feet wide. Length depends on the number of colonies to be covered. A shade 50 feet long is sufficient for 50 colonies, which should be arranged back to back in two rows, with a 3- or 4-foot walkway between rows. The shades run east and west.

Many materials have been tested to learn their effectiveness as shades—the extent to which air



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Figure 1.—A permanent shade. The cover is made of boards.

temperature beneath them is reduced. Some of the materials tested are listed below, in descending order of effectiveness.¹

- HAY—6-inch layer.
- ALUMINUM—top, white; bottom, black.
- PLYWOOD— $\frac{1}{4}$ - to $\frac{1}{2}$ -inch.
- ALUMINUM—new, unpainted.
- HARDBOARD— $\frac{3}{8}$ -inch, plain (Masonite).²
- SNOW FENCE—double layer, no opening
- SARAN² SHADE CLOTH—type that produces 92-percent shade.
- SNOW FENCE—double layer, crisscrossed.
- SNOW FENCE—single layer.

¹ Source: Kelly, C. F., and Bond, T. E. EFFECTIVENESS OF ARTIFICIAL SHADE MATERIALS. Agricultural Engineering 39 (12): 758-759. 1958.

² Trade names are used in this publication solely for the purpose of providing specific information. Mention of a trade name does not constitute a guarantee or warranty of the product named and does not signify that this product is approved to the exclusion of other comparable products.

Portable Shades

Portable shades can be built to protect colonies placed in fields for pollination, where permanent shades cannot be used.

A portable shade, designed by USDA agricultural engineers at Tucson, Ariz., is shown in figure 2. This shade, which will cover 10 colonies, is 20 feet long, 6 feet wide, and 6 feet high. It folds to a 6- by 20-foot rectangle, 4 inches thick, for hauling. Two men can quickly set it up or take it down.

The following materials are needed to build it:

- 32 feet of steel tubing, 1½-inch (outside diameter), 16-gage wall.
- 36 feet of electrical metallic tubing, ¾-inch.
- 24 feet of electrical metallic tubing, ½-inch.
- Four ells, 1¼-inch.
- Four ells, ¾-inch.
- Eight conduit connectors, ¾-inch.

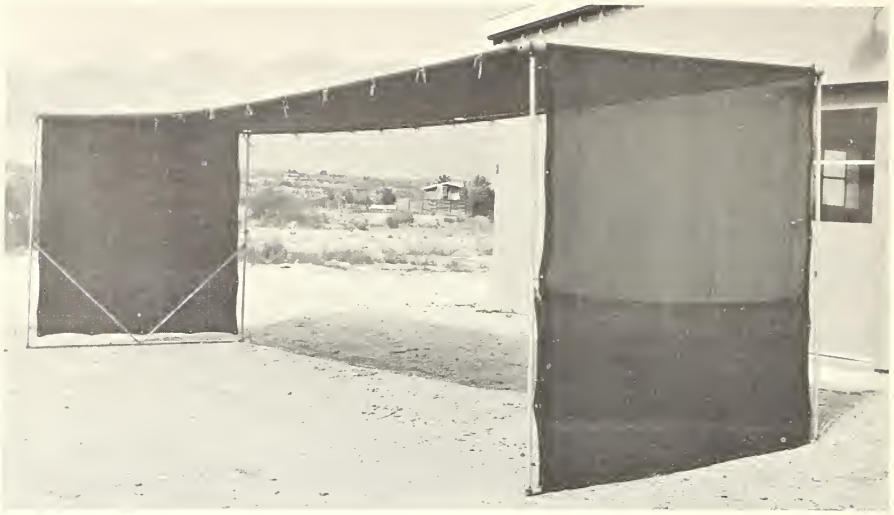


Figure 2.—A portable shade made of steel tubing and covered with shade cloth.

Four hinges of the type shown in figure 6.
 Two turnbuckles, $\frac{5}{16}$ -inch.
 44 feet of wire, 9-gage, smooth galvanized.
 7 feet of reinforcing rod, $\frac{5}{8}$ -inch.
 One piece of Saran shade cloth (90-percent solid), 6 by 32 feet.

A diagram of the portable shade is shown in figure 3. The top frame is made of steel tubing having an outside diameter of $1\frac{1}{2}$ inches with a 16-gage wall thickness. The end frame is made of $\frac{3}{4}$ -inch steel conduit.

The ends are made in a U shape and hinged at the top (figs. 4 and 5). The top corners are $1\frac{1}{4}$ -inch pipe elbows and the end corners are $\frac{3}{4}$ -inch pipe elbows and conduit connectors.

To keep the shade standing square, one side of the frame has diagonal wires across it. Turnbuckles (fig. 5) are used to tighten the wires.

Figure 6 shows the dimensions of the hinges. The top part is welded into a $\frac{1}{2}$ -inch hole that is bored in the $1\frac{1}{4}$ -inch pipe elbow. The

other end is welded or pinned in the conduit. Bracing is welded on each end for rigidity and a brace is welded across the center of the top. The bracing is $\frac{1}{2}$ -inch conduit.

The frame is covered with Saran shade cloth that gives 90-percent shade. The shade cloth has a 2-inch hem on all edges with eyelets every 18 inches for tying it to the frame. The stakes are $\frac{5}{8}$ -inch rein-

Protection From Radiation

Shades protect bee hives from direct rays of the sun. The hives should also be protected from heat radiating from the ground. This can be done by placing the hives on green grass or other vegetation.

Keeping the hives covered with a good coat of white or other reflective paint also provides heat protection. The paint reduces the amount of heat the hives will absorb.

PORTABLE SHADE
NOTE: WELD ALL
TOP JOINTS AND
END BRACES.

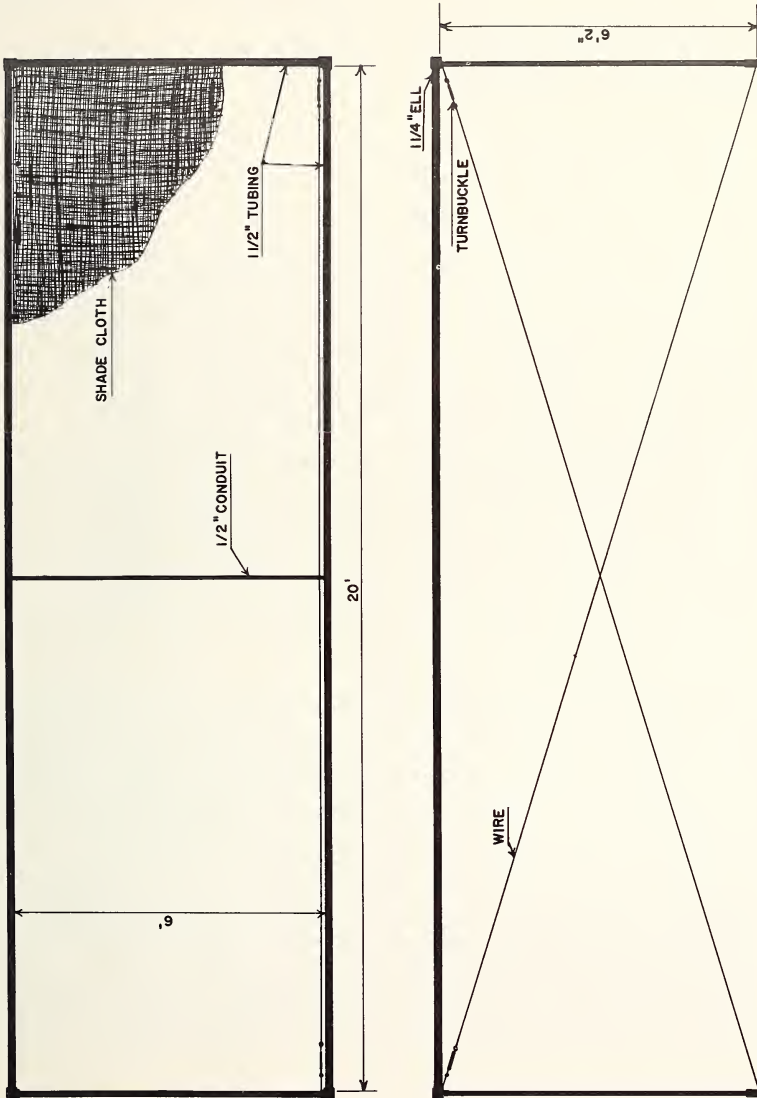
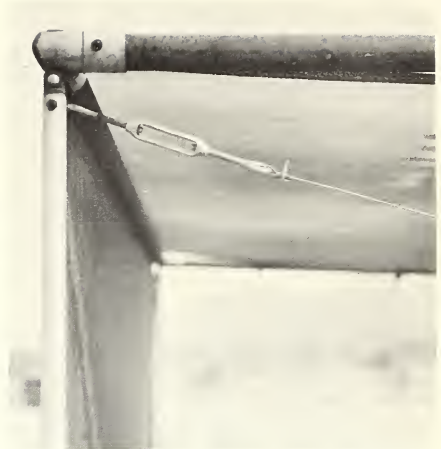


Figure 3.—Diagram of the portable shade.



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Figure 4.—End construction of the portable shade.



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Figure 5.—Corner construction of the portable shade.

forcing rod, 18 inches long, with a 3-inch piece welded on the end that hooks over the bottom conduit.

WATER SUPPLY

On a hot day a colony may use as much as a gallon of water. Some water is obtained from nectar, but a colony unable to collect water will die within a day or so.

Beekeepers usually locate their colonies as near a source of fresh water as possible. If this is not done, the bees must carry water when they should be collecting nectar. If a colony is more than a mile from water, it should be moved closer, or water should be provided. Full efficiency is possible only if cool, fresh water is within a few rods of the colony.

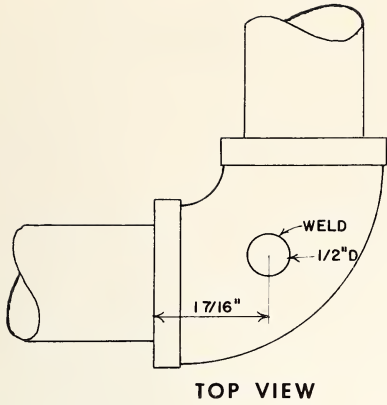
Bees kept in a residential area may become a nuisance if they seek water near the homes of the beekeeper's neighbors. The beekeeper can reduce the nuisance by making water available near the colony.

If large numbers of bees need water for a considerable period of time, it should be furnished in barrels, in a tank, or directly from a pressure water system into a watering device (figs. 7 and 8).

A trough filled with coarse gravel makes a good watering device (fig. 8). Uniform water distribution can be obtained with a perforated tube in the bottom of the trough.

A cellulose sponge 1 to 2 inches thick can be floated in water in a pan or trough. The pan or trough should be about 2 inches deeper than the thickness of the sponge. A float on the end of a water supply line (similar to the line shown in fig. 8) will maintain the desired water level in the pan or trough.

Watering units should be thoroughly cleaned every 2 weeks to reduce the spreading of bee diseases. A cover, such as a low shade, over the watering unit will help to keep it clean.



DETAIL OF HINGE

MADE FROM 7/8-INCH COLD ROLL.

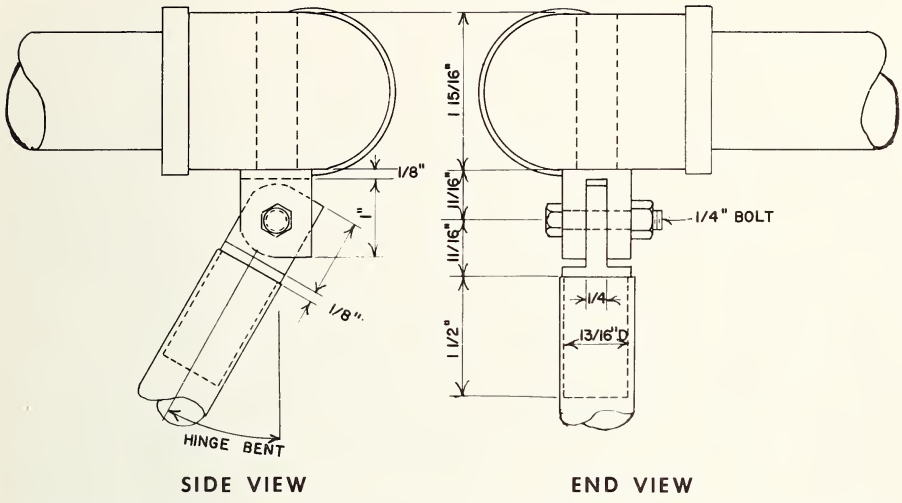


Figure 6.—Views of a hinge. Four hinges of the type shown are used in the portable shade.



Figure 7.—Watering troughs supplied with water from a barrel.

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Figure 8.—Four-inch eaves trough filled with coarse gravel and equipped with a float water-level control.

Washington, D.C.

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