

LOW~COST FOUNDATION

by K S Aidoo and R J Paxton.

Embossed wax foundation is a thin sheet of beeswax with the pattern of hexagonal cell bases embossed on each side of it. It is used in frame hive beekeeping to encourage bees to build comb in the way that is most convenient for the beekeeper

Foundation provides these advantages:

- a) it encourages bees to build straight combs within wooden frames. This allows easy and rapid manipulation of honey bee colonies;
- b) it saves bees' resources and labour in the construction of combs thereby allowing increased honey production;
- c) it facilitates honey extraction since combs in frames can be strengthened by reinforcement with wire.

Colonies provided with foundation are therefore able to develop their nest and commence brood rearing quickly, and can store more surplus honey than colonies given either no foundation or just starter strips of wax.

Foundation has not been universally adopted by beekeepers in rural areas of developing countries because of its prohibitive cost or unavailability. Also, equipment used to make foundation has been designed mainly for European honey bees and not for other races or species of bees with different cell sizes. Equipment for the large-scale manufacture of foundation is expensive. This means that many beekeepers in rural communities are unable to benefit from the advantages of using foundation.

It is against this background that a study was conducted at the University of Wales College Cardiff, UK, to find out if honey bees will readily accept plain wax sheets as alternatives to embossed wax foundation.

Method

Four European honey bee (*Apis mellifera*) colonies were used in the study. Each colony was provided with the following frames:

- a) two frames with one half of thick (1.19 mm) non-embossed wax sheet, the other half a thin (0.72 mm) non-embossed wax sheet (see preparation of non-embossed wax sheet below);
- b) a frame with embossed foundation (thickness 0.76 mm);
- c) a frame with a narrow (3.0 cm) starter strip of embossed foundation (thickness 0.76 mm).

An equal number of these three sets of frames were arranged on both sides of a comb full of young brood and the queen. The set-up was completed with two super boxes; one with a set of the experimental frames, the other full of honey.

At the end of four weeks of colony development during an early summer nectar flow, when bees typically build new combs, all experimental frames were removed from the colonies for the measurement of comb characteristics.

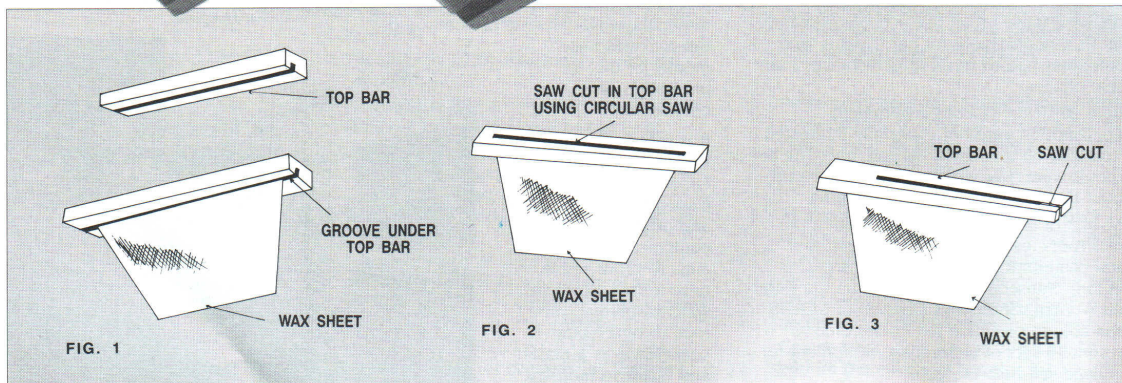
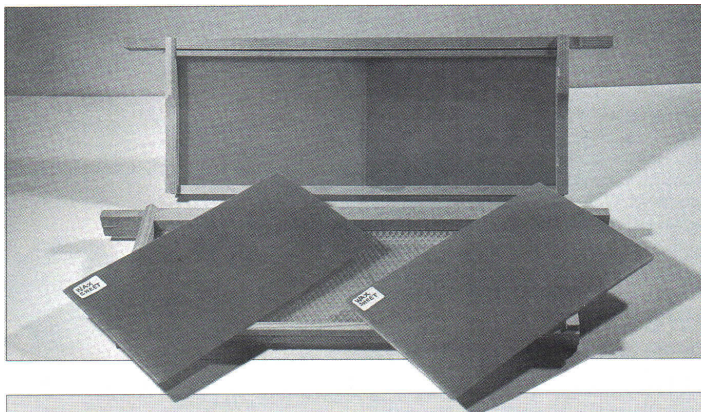
Results

The study indicated few statistical differences between comb built from the experimental frames. Cell diameter, cell size and angle at which cells are held to the horizontal were similar for combs developed from the plain non-embossed wax sheets, embossed foundation and the starter strips. The thickness of midribs of combs developed from all experimental frames were not significantly different, ranging from 0.23 mm to 0.27 mm. Therefore no matter how thick the original wax sheet, the resultant comb had a consistently thin midrib. A comparison of the amount of wax added to a unit area of foundation indicated highest fresh

wax production using the thin non-embossed wax sheets. The starter strip, the thick non-embossed wax sheets and the embossed foundations followed in descending order, in terms of amount of wax added to the resultant combs.

Observations made during the study indicated a preference by the bees to use thin non-embossed wax sheets to make new combs rather than thick non-embossed wax sheets or embossed foundation. Cells built on combs from non-embossed wax sheets were, however, irregularly arranged as compared to the regular, orderly arrangement of cells on combs developed from the embossed foundation. Beekeepers can therefore reduce costs and make good gains in colony development and production through the use of plain non-embossed wax sheets. European bees readily use them and construct good combs within frames; a repetition of this experiment with African and other bees will show whether or not they do the same.

Frame fitted with dyed thin and thick non-embossed wax sheets. In the foreground are dyed and plain wax sheets placed on a frame fitted with embossed foundation.



Preparation of plain, non-embossed wax sheets

A narrow, deep container should be used for melting the beeswax.

The length and depth of this container should be about 10-15 cm greater than the required size of brood frame or top-bar comb. Pieces of clean beeswax are put into the container and heated in a water bath to 68°-72°C. Beeswax should be added to the container until it is filled to about 5.0 cm of the brim. A long glass sheet of width a little narrower than the melting container is dipped into the molten wax for about three seconds and then lifted out to cool. Thin sheets of wax formed on each side of the glass are peeled off and placed on a flat surface to harden. Alternatively, a thin, smooth piece of wood or plywood can be used in place of the glass sheet. This should however be soaked in water for 24 hours before use. To facilitate the removal of the wax sheets from glass or wood, a weak solution of liquid washing soap is applied before dipping in the wax

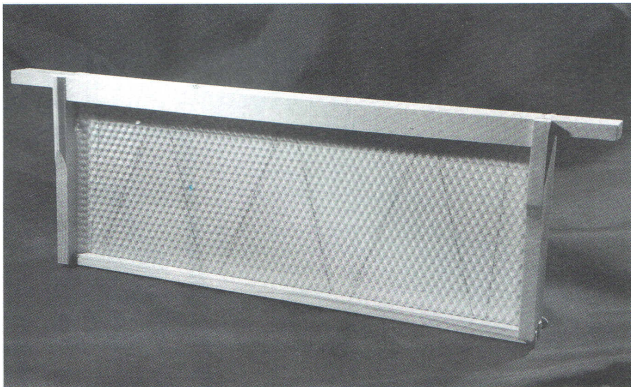
The plain wax sheet is then trimmed to size and **fitted** into brood or super frames. These sheets can also be placed in wired frames or the sheets themselves can be wired for extra strength.

Fixing non-embossed wax sheets in top-bar hives

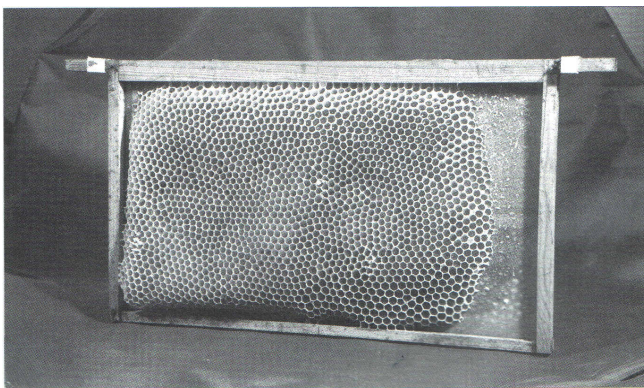
The adoption of non-embossed wax sheets in the management of honey bee colonies in top-bar hives could improve productivity.

Firstly they will force bees to construct combs parallel to one another, suspended directly beneath each top-bar, facilitating their removal during inspection and harvest. Secondly they should improve honey and wax production. There are a number of ways by which wax sheets could be fitted on to top-bars. The method used will depend upon the type of woodworking tools available. Some methods we have used are:

- a) make a narrow, deep groove (lengthways) in the middle of the underside of the top-bar Place the wax sheet into the groove and apply some molten wax to the line of attachment using a spoon. The wax sheet will be held in place when the molten wax has cooled (Figure 1);
- b) make a saw cut along the centre (lengthways) of the top-bar This should cut through the entire length leaving about 5 cm uncut at both ends. Push the wax sheet through the opening in the top-bar from the underside and apply molten wax to help hold the wax sheet in place (Figure 2);
- c) make a cut through the middle (lengthways) of the top-bar from one end using an ordinary hand saw. This cut should go up to about two thirds of the length of the top-bar. Push the wax sheet into the saw cut and hold it in place with molten wax as above. Alternatively the wax sheet can be held in place by nails through the sides of the top-bar (Figure 3).



A wooden frame fitted with embossed wax foundation



A frame with drawn comb based on dyed, non-embossed wax sheets.