

Winter Feeding

We are getting to that time of the year when we should begin preparing our colonies for winter. Honey bees collect nectar in the warm months and put it into long-term storage as honey in order to have stores for the winter. These stores are used both to survive on, as food, and as fuel for keeping the colony warm as it clusters to pass the cold winter months. Bees eat the diluted honey and use their powerful wing muscles to generate heat thus converting the sugars into energy and keeping the winter cluster warm. It is imperative therefore that we, as beekeepers managing colonies for our own use, ensure that each colony has sufficient honey to last until next spring when the bees can begin to collect fresh nectar again.

What is considered to be 'enough' honey stores in our northern temperate climate?

As in all things to do with bees, the answer is, it depends. Some races of bees are frugal but others eat lots in the winter. For the average colony, around 20 kg (45 lbs) of stores are required although larger colonies of more prolific races such as the Italian bee, *Apis mellifera ligustica*, may need more and our native black bee, *Apis mellifera mellifera*, will consume less. Go by how much space the colony needs during the summer; take 20Kg (45 lbs) of stores as an average requirement for a colony which is comfortable with the queen laying in a single brood box, but allow 25 kg (55 lbs) if the colony is on brood and a half.

To assess the amount of stores in a colony going into winter, it is useful to know that a British Standard brood frame holds just over 2 kg or around 5 lbs, so nine full frames of honey will be needed. For a Langstroth, this comes out at around 3 kg per frame, so assess accordingly. It now depends mainly on the beekeeper. If it has been a bad year for the honey crop and a colony does not have sufficient stores according to assessment, or if the beekeeper takes as much honey as possible leaving insufficient for the bees, then they must be given a supplement. Of course commercial honey farmers have to maximise their yields in order to make a living, but for the amateur beekeeper, consider leaving a super of the colony's own honey, which one feels instinctively must be best. Remove the queen excluder until spring so that the cluster can move into the super easily as it will not leave the queen behind. There is a view that putting the super below the brood box is the best way; both options have their merits.

The substitute or top-up that we give our bees is sugar syrup. Feeding honey should be avoided as there is a risk of spreading disease and the odour of honey increases the likelihood of robbing. Syrup is odourless. Ready prepared feed is available commercially and very convenient for bee farmers, but most of us make up our own feed from white granulated sugar, which is pure sucrose and one of the three main component sugars of nectar. Never use raw or brown sugar. This may sound counter-intuitive when we consider that these less processed (usually) sugars may be thought to be more natural than the white stuff, but the impurities in it are harmful to bees. Icing sugar often contains additives as well as being more expensive than granulated sugar.

Before going into the detail of how to make up the syrup some issues need to be addressed. The strength of syrup is often quoted as 'light syrup, spring feed, 1:1' or 'heavy syrup, winter feed, 2:1' which without units is meaningless. In the days when we in the UK used

mainly Imperial measures, these proportions meant respectively 1 lb of sugar to 1 pint of water, and 2 lbs to 1 pint. However, now that we have moved to metric measures, we need to understand exactly what these figures mean as they do not translate to 1 kg sugar in 1 litre of water, etc. So, here follows the maths.

Sugar should be fed as syrup expressed as a percentage, and for winter feed this is a little over 60%. Research at Rothamsted has shown that the optimum concentration for bees to process syrup fastest and store most is 60%, with greater concentrations becoming progressively less interesting to bees. Take our 2 lb of sugar to a pint of water as an example:

2 lb of sugar weighs 2×16 ounces i.e. 32 oz.

1 pint of water is 20 fluid oz.

The total weight of this mixture is then $32 + 20 = 52$ oz.

The percentage of sugar it contains is $32/52 \times 100\% = 61.5\%$.

Since 1 litre of water weighs 1 kg, if we metricate our '2:1' example for 2 kg sugar dissolved in 1 litre of water we get:

Total weight of mixture = $2 + 1 = 3$ kg.

The percentage of sugar it contains is $2/3 \times 100\% = 66.6\%$.

However, for 2 kg sugar dissolved in 1.25 litres of water:

Total weight of mixture = $2 + 1.25 = 3.25$ kg.

The percentage of sugar it contains is $2/3.25 \times 100\% = 61.5\%$

Halve these numbers and you get 1 kg sugar in 625 ml of water. Although here we are not concerned with light syrup, similar calculations will give 1 lb sugar in 1 pint of water as 44% but 1 kg sugar in 1 litre of water is 50%. To make up 44% in metric measures, we need 1 kg sugar in 1.25 litres of water ($1/2.25 \times 100 = 44\%$). Therefore do be careful when quoting 1:1 or 2:1!

Now to calculate the amount of syrup to offer. In approximate terms, 10 kg of sugar made into heavy syrup gives a volume of about 25 litres and weighs about 16 kg, providing 15kg of stores and being equivalent to 12 kg of honey (16 lbs of sugar made into heavy syrup gives about 23–24 lbs of stores and is equivalent to 20 lbs of honey). To make up the syrup, mix the required amount of sugar with hot water and mix as quickly as possible until all the sugar has dissolved to give a clear solution, which has a pale cream tint. Do not boil the mixture in an attempt to dissolve it all because this can break down the sugar and produce the organic molecule hydroxymethylfurfural (HMF) which is toxic to bees. Cool it down before adding to the feeder. At this strength the syrup can be stored, but keeps best if a little thymol is dissolved in surgical spirit and mixed with the sugar solution.

Note:

Thymol crystals are hardly soluble in water but dissolve easily in alcohol, so according to a recipe adapted from Rob Manley's original:

- Careful handling of thymol crystals is essential, as they are harmful to the skin.
- Dissolve 30 g thymol in 150 ml surgical spirit (1 tsp in 5 fl oz) to make a stock solution.
- Add 5 ml stock solution to 13.5 litres syrup (1 tsp to 3 gallons).