Farm Production & Practice

Ministry of Agriculture and Fisheries

Beekeeping
Pollen Production
Collecting and Processing

Pollen grains from seed plants are used by a wide range of animals as a source of protein, vitamins, fats and minerals. Honey bees, in particular, consume vast amounts of pollen each year in order to feed developing larvae, the queen and young adult bees.

As a product of the hive, beekeepers can harvest this pollen, and either feed it back to the bees in times of pollen shortages, or sell it to the ever-growing health food industry for human consumption.

Composition of Pollen

Pollen is very rich in fats and proteins, and although the proportion of protein varies according to the plant source, it ranges from 7% to 40%. On average, bee-collected pollen compares favourably in protein content with that of beans, peas, lentils, meat and milk. Pollen also contains amino-acids, carbohydrates, fats, minerals, vitamins, enzymes, pigments and sterols.

This AgLink examines pollen and its collection, drying, cleaning, sorting and marketing. AgLink FPP 533 discusses the design of the pollen trap.

Bee Collection of Pollen

Honey bees are highly adapted for collecting pollen on their hairy bodies. They scramble around on flowers actively brushing pollen onto their body hairs. From here they pack the pollen onto a special flat receptacle, called a corbicula or "pollen basket" on their hind legs. The millions of tiny pollen grains are stuck together into a kidney-shaped ball, using nectar gathered directly from the flower or honey brought from the hive. These balls or pellets of pollen vary in size between 1–5 mm long and 1–3 mm wide.

Honey bees do not normally collect pollen from non-flowering plants or trees such as maize or pines.

Trapping Pollen

Beekeepers collect pollen by forcing the worker bees to squeeze through narrow apertures which dislodge the pollen pellets from their hind legs. The pollen falls through a horizontal set of apertures, through which bees cannot pass, and the pollen is held in a collecting tray.

There are two basic designs of pollen trap; one fitting under the hive, and the other fitting outside and onto the entrance of the hive. There are many variations of these basic designs. AgLink FPP 533 discusses the design of the pollen trap and includes a plan of a MAF-recommended trap.

Regardless of the type of pollen trap used, the rest of the hive boxes must be completely bee-tight. If they are not, bees will use the alternative entrance rather than go through the pollen trap.

When to Trap

In most areas there are two main pollen flows, one in spring and the other in autumn. The spring flow usually starts with willows and five finger. A surplus of about 2 kg per hive can be expected during this time. Other spring sources such as gorse, dandelion, broom, tree lucerne, lupins and native fuchsia could add considerably to this quantity of pollen collected. Six kilograms/hive/year have been recorded in some districts.

Bees may take several days to become accustomed to the pollen trap and in hot weather may cluster on the front of the hives if traps are left on during the honey flow.

It is debatable whether the traps should be permanently engaged during the honey flow. The MAF-designed trap (see FPP 533) has the advantage over other traps in that by removing the entrance fillet some pollen will still be trapped by bees accustomed to using the lower entrance. The main force of bees and the drones will use the top entrance. Pollen traps could probably be engaged in most districts from mid-September to early December and from late January to mid-March.

When Not to Trap

Pollen should not be collected in a pollen-deficient area. An expanding colony should have at least 2-3 full-depth frames (or equivalent) of pollen to sustain it. If there is less pollen than this, and pollen-bearing sources are not yielding well, the traps should not be engaged. It is advisable to wait until there are at least four frames of brood in the hive and hive strength is increasing before engaging pollen traps in the spring. It appears that hives with abundant young brood are often good pollen gatherers.

If a colony is not collecting much pollen the trap should be removed and put on another hive, after first checking the brood nest for American Brood Disease. Some colonies seem unable to collect a pollen surplus although they may be excellent honey producers. There is plenty of scope for breeding bee stocks for increased pollen collection. Some hives have been found that collect 5-10 times as much as the average, even in a yard where the colonies are of even strength.

Pollen traps should not be engaged when the hives are united with newspaper or the pollen will be contaminated with finely chewed fibres of paper. Similarly, when putting out freshly extracted combs on hives or feeding dry sugar, the traps should be disengaged or else a large quantity of wax particles or sugar crystals will be found amongst the pollen. Wooden inner covers are preferable to hive mats made from sacking (especially sugar bags) for the same reason.

When putting out cells for requeening, the traps should be disengaged. Virgin queens may not be able to pass through the screen or they may become damaged on their return to the hive.

Traps should be disengaged, or removed completely, in the autumn before drones are evicted, or else the trapping screen may become blocked with drones, which could lead to suffocation of the colony.

Effect on Hives

The reported effects of pollen traps on brood rearing, the queen and honey production are often contradictory. The efficiency rate claimed for different pollen trap designs ranges from 10% to 77%. The MAF model (AgLink FPP 533) probably traps about 5-20% of the total pollen coming into the hive. Bees forced to go through a pollen trap learn to bring home smaller loads which will fit through the trapping screen. They also tuck their legs under their abdomens, or with wire mesh screens they may squeeze through diagonally to get their pollen loads into the hive. A number of bees may also bring in pollen through the drone escape holes.

However, the presence of a trap on a hive does appear to cause early supersedure of old queens, and such hives usually end up queenless. It is best to put traps on hives with young queens.

The presence of a pollen trap does not inhibit swarming. The bees may in fact swarm out through the drone escape holes.

In hot weather drones and workers will congregate at the back of the hive under the trapping screen. They may also cluster up the front of the hive but this will not cause any harm. If the trap is engaged during the honey flow, bee-proof ventilation under the lid may be necessary. Honey boxes should not be staggered for ventilation as the bees will use this gap as an entrance and abandon the pollen trap. Rain can also enter the hive through such a gap.

Honey Bee Diseases and Pollen Trapping

American Brood Disease, caused by the bacterium, ***Bacillus larvae,*** is transmitted in bee-collected pollen through the nectar or honey which is mixed with the pollen in the formation of the pollen pellet. For this reason it is essential that only colonies free of American Brood Disease are used to trap pollen. It is also recommended that the brood nest be checked for Amercian Brood Disease each time pollen is removed from a trap, especially if the pollen is to be used for feeding to honey bees.

Other serious bee diseases, such as European Brood Disease ***Streptococcus pluton*** and chalkbrood ***Ascophaera apis,*** which are currently not found in New Zealand, could be brought into the country with imported pollen. The Apiaries Act 1969 and its Amendments prohibits the importation of pollen and other bee products without special permission from the Minister of Agriculture (see AgLink FPP 428).

Harvesting

In wet weather, pollen which becomes damp may start to grow mould and rot after 4-5 days. This pollen will never be fit for human consumption. Ideally traps should be emptied every 2-5 days, and this should be taken into consideration when deciding which apiaries are to be used for trapping pollen. Pollen can be collected from the trays into large plastic bags but should never be stored in these for any length of time before drying or placing in a freezer. This is especially important if the pollen is wet. If plastic bags are used to collect pollen, they should be kept out of the sun, or else the pollen will "sweat" and the pellets may clump together.

Wax moths will rapidly infest pollen if left in the traps too long.

Three quarter-depth (185 mm) honey supers can be adapted for collecting, transporting and drying pollen. To do this a wire mesh screen, similar to the mesh used in the pollen tray should be stapled to the bottom of the super. Strips of wood about 6 mm thick should be tacked around the base to cover the edges of the wire.

Four battens, 20 x 50 mm are then nailed to the sides and ends of the super so that 20 mm is projecting below the base of the super. This "lip" serves to locate and interlock the top of another super when stacked together. Five or six of these units can be stacked on top of each other and held together with a strap or rope. A covering plate or hive lid should be put on to keep dust or rain out of the pollen. If the bottom unit is placed on a pallet the whole stack can be wheeled around on a trolley.

Pollen can be emptied into each of these units to a depth of about 130 mm.

Preserving Pollen

All fresh pollen must be presumed to contain wax moth eggs. To kill these the pollen should be frozen for at least two days after collecting. A longer freezing time does no harm and the pellets remain "free flow" after freezing.

Commerical beekeepers could consider fumigating with methyl bromide. This gas is highly toxic and strict precautions must be observed when using it. Further information on the use of methyl bromide as a fumigant is available from MAF.

Para-dichlorobenzene (P.D.B. or wax moth crystals) or naphthalene (moth balls) should not be used to control wax moths in pollen.

Whatever method is used to destroy the wax moths, care must be taken to prevent reinfestation.

Drying

Pollen should be dried as soon as possible after freezing to reduce shattering of the pellets especially with soft pollen like willow. Fresh pollen can contain over 20% moisture and buyers require this to be reduced to 8-10%. As a rough guide, this is when the pollen pellets are crunchy between the teeth. If they can be cracked between the thumb nails without powdering, the moisture content will be about 5%.

In some countries air drying alone will achieve this reduction. In New Zealand some secondary drying is usually required. Pollen should not be left in full sunlight too long or it will be bleached, nor should pollen be left outside unattended. If it gets wet it cannot be marketed.

Drying times will vary according to the pollen type, the efficiency of the drier, and the relative humidity of the air. Freshly collected pollen may take up to 24 hours to dry properly or 4-6 hours if partially dried outside.

Pollen is easily burnt, so drying temperature should not exceed 50^{o}C. A temperature of 45^{o}C is ideal. Pellets should

be spread thinly in layers (no more than 10-12 mm deep) on ventilated screens and stirred occasionally. Beekeepers' hot rooms, egg incubators, and cabinet clothes driers have all been used to dry pollen. It may be possible to use silica gel to reduce the humidity in a pollen drier if necessary. This material can be dried out in an oven and reused repeatedly. Whatever type of drying cabinet is used, movement of the warm air by a fan is essential, as is venting of the moist air.

Pollen that has been collected into the ventilated interlocking supers previously described, can also be dried in these units, if they are stacked above a baffled air-inlet box. Hot air can be introduced by a fan heater or a vacuum cleaner. A protective cover with a 50 mm diameter screened vent should be placed on top of the stack.

An Australian researcher has built a tumble drier that dries 15 kg of pollen in 5 hours. A 16 mesh fibreglass screened barrel is housed in a wooden cabinet that measures 188 cm high by 123 cm wide by 94 cm deep. Hinged doors give access through the cabinet and into the barrel.

A 65 cm pulley wheel is attached to the 5 cm diameter horizontal spindle while a V-belt connects the drum spindle to a 5 cm drive pulley on an electric motor. A gear box provides about 5 revolutions of the barrel per hour.

A domestic fan heater thermostatically set to 45°C provides hot air for drying. Two adjustable 6 cm draught escapes are fixed in the ceiling of the cabinet.

Pollen that has been properly dried should retain its nutritive value for at least 6-12 months if stored in air-tight containers.

Cleaning

Dried pollen is much less fragile than the fresh material and cleaning cannot be carried out until after drying. Producers need to consider very seriously the quality of material used for human consumption. One of the authors has received a sting on the tongue from a sample of poorly cleaned pollen. Mice occasionally frequent pollen traps and droppings in pollen are impossible to dress out. Mice seem to be less prone to inhabit traps that are visited at least weekly.

Small quantities of pollen can be picked over by hand or winnowed by dropping the pollen through a gentle air current created by a low speed air fan. A simple birdseed cleaning unit which uses a vacuum cleaner for the air supply may be suitable for cleaning small quantities of pollen. Simple sieves can also be used, beginning with a fine mesh screen followed by a 6 mesh to the inch sieve. Component parts of the pollen trap can be used for this.

Large quantities will need to be processed in a commercial seed-cleaning machine. These contain vibrating riddles or screens which sift out the pollen into different sizes. They also have an air current to remove the dust and fine debris.

Storing

Methods used for storing pollen depend on whether it is to be used for bee feed or human consumption.

Bee Feed: Pollen can be stored in a deep freeze, either before or after drying, for up to two years without any serious deterioration in its nutritional value. However, it should be used as soon as possible once it is removed from the freezer.

Pollen can also be stored at room temperature in any air-and-moisture-proof container, provided the pollen has been dried first. Pollen stored in this manner retains most of its nutritional value for one year, but after two years its value to honey bees at least, declines markedly. The nutritional value is measured by the ability of bees to rear brood when restricted to the test pollen as their only source of protein. As dried pollen pellets are quite hard, they should be soaked in warm water for several hours before use.

During the drying process it is possible for wax moths to reinfest the pollen so it should be treated by one of the following methods:

- deep freeze for at least 48 hours
- fumigate with methyl bromide
- displace the air in the container with food-grade carbon dioxide. The pollen must be thoroughly dry if carbon dioxide is to be used.

An alternative storage method tested at the University of Guelph involved mixing fresh pollen with half its weight of white sugar and tamping the mixture down tightly into containers with an air-tight lid. A 12 mm layer of sugar should be sprinkled on top of the pollen-sugar to prevent surface mould growing. The containers can be stored at room temperature.

Pollen stored this way retained its nutritional value for two years.

Human Consumption: Pollen intended for human consumption should be stored in a deep freeze or as dried pellets in air tight containers at room temperature.

Blending

Pollen from different sources varies in appearance and flavour. Producers who supply direct to health food shops could be wise to collect each month's pollen and mix it thoroughly to avoid rapid changes in the appearance of the product.

Unfortunately, some of the nicest tasting pollens are very bland in appearance, for example willow pollen. A mixture of pollens, while more colourful, may not be so agreeable to the taste. Trial and error is needed to find a blend that is appealing both to the eye and palate.

Marketing

Currently the demand for pollen by manufacturers of health foods is very good. Pollen may also be sold directly to local health food shops, which gives a better return to beekeepers. For the beekeeper with his own honey shop, attractive packets of multi-floral pollen of good quality can be displayed in clear cellophane bags and sealed with cellotape. Bags containing 100 g to 250 g are a useful size. A small label with the name and address of the producer or packer and the weight is also required.

Nobody can be sure of the future prospects for the pollen market, but at present there is a sound and growing home base and export possibilities do exist. Only time will tell if pollen will become another suitable export product to supplement honey and wax.

Note: Pollen pellets are a very concentrated source of pollen. Some sufferers of hayfever and asthma claim relief from eating pollen. Prospective consumers should be cautioned not to eat too much pollen at any one time in case an allergic reaction is initiated. Label warnings may be required.

Pollen collected from traps under beehives also contains a significant amount of propolis. This may also cause a reaction in people allergic to propolis.

References

Chambers, S.R. (1977) A Rotary Pollen Dryer. Apiacta XII (2) : 69-70

McLellan, A.R. (1974) Some Effects of Pollen Traps on Honeybees. Journal of Apicultural Research 13 (2) : 143–148

Smith, M.V. (1963) The O.A.C. Pollen Trap. Canadian Bee Journal (74 (4) : 4)

Further Reading

FPP 533 : Pollen Trap Design

G.M. Reid
Apicultural Advisory Officer
MAF Advisory Services
Hamilton

K.W. Simpson
Apicultural Advisory Officer
Advisory Services Division
Oamaru