

Prevention of Residues in Honey: A Future Perspective

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Introduction

There are approximately 673,000 beehives registered in Australia, with commercial production of honey estimated to be about 30,000 tonnes annually (Gibbs & Muirhead, 1998). Most of this honey (80%) is produced from native floral species and between 9,000 (30%) and 12,000 (40%) tonnes is exported each year (Gibbs & Muirhead, 1998). The industry is fortunate to be free from parasitic mites, such as *Varroa*, with the primary disease problems being both American foulbrood (*Paenibacillus larvae* subsp. *larvae*) and European foulbrood (*Melissococcus pluton*).

Chemical usage by beekeepers in Australia is limited to the following: (i) the antibiotic, oxytetracycline hydrochloride (OTC) for control of European foulbrood in all States except Western Australia; (ii) the antibiotic, fumigillin, to treat protozoan infections only during commercial queen breeding and under strict permit use, and (iii) the fumigant, phosphine gas, to control wax moth (*Galleria mellonella*) and lesser wax moth (*Achroia grisella*) in stored honey combs. In mainland States, American foulbrood is a notifiable disease and treatment with therapeutic drugs is not permitted. Tasmania is the only State where the medication of American foulbrood is acceptable. For the removal of bees from honey boxes, there are no chemical bee repellents registered for use in the Australian industry.

The prophylactic medication of colonies is not a recommended practice within Australia. Whilst OTC is used by many beekeepers to control EFB, there are a significant number of beekeepers who do not use antibiotics at all. This is due to a number of factors: (i) EFB not being confirmed in Western Australia, (ii) a lower incidence of the disease in the warmer northern Australian States and, (iii) the sporadic seasonal nature of serious outbreaks from year to year. In commercial queen breeding, the use of fumigillin is also low, primarily due to the difficulties in obtaining import permits for this chemical. Both OTC and fumigillin are prescribed by veterinary surgeons.

Australian measures to prevent residues in honey

The Australian honey bee industry is a cohesive industry that prides itself on the production of a 'clean and green' product that is free of residues. The primary residue monitoring program is conducted by the Australian National Residue Survey (NRS) Program, a section of the Residues and Standards Branch, Department of Agriculture, Fisheries and Forestry - Australia (AFFA). The NRS program provides confidence in the environmental contaminant and chemical residue status of Australian domestic and export honeys. A total of 44 different compounds are monitored from groups of

substances that include sulphonamides, antibiotics, synthetic pyrethroids, organochlorines and organophosphates as well as chemical elements. In excess of 8,500 tests are carried out annually under the NRS program.

Consistent with Codex Alimentarius guidelines, Australia utilises a scientific and statistical risk-based approach to residue monitoring. All samples for the NRS monitoring programs are selected on a stratified randomised basis, with a complementary focus on high-risk producers or areas. Samples are collected at the producer or packer level with the cooperation of State Government Apiary Officers. All residue analytical data is stored in a database following comprehensive validation. In the case where a residue is detected, the cause of the problem is established and dealt with by a thorough investigation and traceback. If misuse is established, sanctions for non-compliance and/or commercial penalties may apply. A strict regulatory approach is practiced by Australian authorities in conjunction with beekeeper extension and educational programs aimed at promoting good beekeeping practice with respect to chemical use.

Recently, the Australian honey bee industry has established a company responsible for facilitating the industry adoption of quality assurance programs aimed at producing honey at the highest quality, which complies with government regulations. This company known as B-Qual, is promoting proven best practice in areas of hygiene, quality and freedom from residues through good management practice and the world recognised HACCP¹ system. The HACCP approach helps businesses identify their hazards and determine measures to control or eliminate them.

The B-Qual approved Supplier Program begins at the apiary sites and moves through the supply chain to packers and retailers. A primary component of the B-Qual program is the chemical and management standards that prevent the occurrence of residues in honey and honey products. Chemical standards address antibiotics, pesticides, herbicides and cleaning agents as well as banned substances and ensure correct withholding periods are upheld. Management strategies are established to maintain accepted industry best practice and are regularly reviewed to determine their adequacy and effective operation.

The B-Qual program also includes biosecurity standards that aim to reduce the risk of product contamination by honey bee pathogens. The standards also increase the preparedness of industry for honey bee disease outbreaks and spread caused by both endemic and exotic pathogens that have, or may have, a significant impact on production and/or trade. Such measures will reduce the capacity for exotic pathogens to become endemic in Australia, thereby avoiding the need for additional chemical usage in our industry. Education and training will improve beekeeper management and hopefully reduce the prevalence of endemic pathogens, as well as improving colony performance and profitability. A reduction in the incidence of endemic diseases such as European foulbrood, will have an accompanying reduction in antibiotic treatment and will help to further prevent residues in honey.

B-Qual has engaged a number of appropriately qualified auditors that will audit business enterprise operations and compliance with set industry standards. Business

¹ HACCP stands for Hazard Analysis Critical Control Point.

audits must take place annually to retain membership of B-Qual. A successful audit of an enterprise will result in the approval of Accredited Membership to the quality assurance program. Internal and external audits, review and customer feedback will enable B-Qual to provide increased assurances to markets about the safety and quality of Australian honey. The B-Qual program in conjunction with a comprehensive NRS residue testing program, will assist the Australian honey industry in their endeavours to prevent and eliminate residues in honey.

While industry comprehensively works to ensure that there are no residues in honey, the Australian Rural Industries Research and Development Corporation (RIRDC) has devoted considerable research funding to projects that investigate the prevention and elimination of residues in honey. Current research projects are designed to establish best practice use of antibiotics (OTC) and identify the potential of other antibiotics for control of European foulbrood, without honey residues. In addition, research is focussed upon further characterisation of pathogens and finding non-antibiotic control measures for honey bee diseases. Results from these studies are expected to become available late in 2003, and will be published in international apicultural journals.

Agricultural veterinary chemicals, honey bee colonies, and the future

There is an ever-increasing international honey trade, and this global market requires universal standards for the protection of consumers. To a certain extent, these global standards are provided by the Codex Alimentarius system. However this system is lacking, as it does not address natural toxins or chemical residues in honey. Legitimising the use of appropriate chemicals in honey production is necessary to ensure consumer protection and confidence is maintained, while bringing about conformity to the market.

Recently, Australia introduced a temporary maximum residue limit (MRL) of 0.3 ppm for OTC in honey produced at the farm gate. This was due to an increased detection of OTC in honey as a direct result of heightened sensitivity levels in analytical methods. However, the establishment of this MRL has not effected Australia's capacity to export honey that has zero contamination with OTC following sufficient withholding and processing by honey packers. Great care is taken in the blending and testing of honey to limit contamination. Australia is first to recognise the necessity for therapeutic drug treatment of honey bee colonies to control diseases and maintain productivity. We are one of many countries establishing MRLs for veterinary chemicals in beekeeping.

Agreed MRLs are required for legitimate chemicals that are paramount in disease and parasite control. Although bees in Australia are free of parasitic mites, we understand the necessity for their control using chemicals. Such legitimate chemical control must be based on established best practice use accompanied by set standards for residues in honey, to which exporting and importing countries can comply. At present, common chemicals used in apiculture for disease control are not accounted for under Codex standards. These chemicals include the acaricides Folbex VA (bromopropylate), Perizin (coumaphos), Apistan (Fluvalinate), Bayvarol (flumethrine), and antibiotics

OTC, tylosin and streptomycin. However, MRLs have been established for both of the antibiotics OTC and streptomycin under Codex Standards in other primary industries.

While embracing legitimate chemical use, agreement for zero tolerance (or zero MRL) needs to be agreed upon by the world honey industry for inappropriate chemicals that lead to harmful or unacceptable contamination of honey. Classification of inappropriate chemical usage in beekeeping must be addressed considering the scientific evidence for the potential for honey contamination, human health implications and market perceptions. Contamination of honey with chemicals such as chloramphenicol, DDT and phenols has the potential to do irreparable damage to the consumer image of honey and should not be tolerated.

Another threat to consumer perception is the presence of natural toxins in honey, such as pyrrolizidine alkaloids (PAs) (Edgar *et al.* 2002). The reality may be that PAs in honey pose no threat to human health, however, the perception of their contamination of honey may influence consumer demand and confidence in the product. Acute human poisoning resulting in high mortality has already been attributed to PA contamination of grain (Edgar *et al.* 2002). One case of infant death has also been reported due to the mother drinking herbal tea high in PAs while pregnant (Roulet *et al.* 1998). This is potentially bad exposure for the honey industry. A 1988 World Health Organisation (WHO) report, notes that PAs can cause mutations, damage genes, and have been shown to trigger cancer in rats. The hepatotoxic PAs responsible for human health concerns should be addressed by establishing MRLs consistent with a developed world market standard. Such a measure will help to protect the world honey industry and eliminate consumer health concerns regarding this issue. Industry can address the problems associated with the occurrence of high PAs in honey by blending honey to form a product that would meet the proposed MRL requirements.

In Australia, it is becoming increasingly apparent that analytical techniques for the detection of chemical residues are not standardised and often produce differing results in terms of the concentration of contaminants in honey. This may be due to the qualitative nature of many analytical methods. This issue, directly influences scientific research aimed at determining best practice use of therapeutic drugs in beekeeping. The world honey industry requires a set of standardised analytical methods for determining the levels of chemical residues in honey. This requirement is essential, especially as many countries are establishing MRLs for residue limits in their honey. Consumers and trading partners need to be assured that a high standard of replicable chemical analysis is being conducted on honey by the country of origin.

Recommendations and conclusions

The future use of veterinary chemicals in apiculture is required to continue productivity and profitability. However, increasingly sensitive analytical methods places the use of therapeutic drugs in jeopardy without compliance standards for exporting countries. The establishment of a worldwide consensus on legitimate best practice veterinary chemical usage in beekeeping, and a determination of appropriate MRLs for these and natural toxin contaminants in honey should be pursued. Standardised and updateable analytical protocols need to be established to determine contamination of honey from

legitimate chemical usage. Thereafter, the Pesticides Residues Committee and/or the Residues of Veterinary Drugs in Food Committee of Codex can be approached for the implementation of suitable standards for honey. It should be noted that significant scientific evidence might be required to support claims for an MRL for some chemicals.

Australia believes a worldwide concerted effort is required to uphold the all-natural, wholesome and 'clean and green' image of honey. Australia is prepared to devote considerable effort at both government and industry levels to assist in achieving these aims. However, international support and effort is required to accomplish the suggestions outlined in this paper.

References

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