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HONEY PRODUCTON FROM MANAGED FERAL BEE COLONIES

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Summary

Field trials using 100 queen bees from a queen bee breeding program (QBBP) and 10 naturally mated feral bees *Apis mellifera* were carried out on two different floral sites near Perth, Western Australia. The amount of honey (mean kg per hive) collected by the QBBP bees was significantly greater ($P<0.05$) than for managed feral colonies. The QBBP bees collected 22% more honey than the feral colonies on a light nectar flow and 17% more honey on a heavy nectar flow. Survival of the QBBP queen bees was lower than that of thee feral queen bees; 89% of QBBP queen bees survived a light nectar flow, 93% of QBBP queen bees survived a heavy nectar flow with all the feral queen bees surviving both flows.

Background

During the 1989-90 evaluation of the West Australian Queen Bee Breeding Program, ten feral queen bees were included to examine their potential as honey gatherers when compared to queens from the ten year breeding program conducted by the W.A. Department of Agriculture (WADA).

The choice of using naturally mated feral queens in the 1989 - 90 breeding program was made for two reasons:

- the dark colour of the queen bees indicated they had been feral for a number of generations and therefore they had not recently been selected or improved by man;
- they could be considered as a base line for honey production from which any improvement in honey production through selection could be quantified.

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Materials and Methods

One feral colony was collected near Stockyard Gully national Park and one in the township of Leeman both about 300km north of WADA., Western Australia.

Seven daughter queens from each feral colony were raised and naturally mated in September 1989 at Jandakot, 25km SE of WADA. (The Jandakot area was a suitable mating ground because of its large resident feral bee population and the location was at a convenient distant for management purposes). The percent of black body colour of daughter feral queens raised for this experiment averaged 59% whereas the QBBP queens were all uniformly yellow-orange in body colour.

WADA's breeding and evaluation program consisted of 120 hives. The program included 20 breeding lines from WADA's central breeding apiary (CBA) and 4 beekeeper-donated (Industry) hives from which 7 daughter queens were raised and artificially inseminated (AI) with semen from the CBA (the best of these contribute semen to the breeding program in the following year). Each of the 168 (20 CBA + 4 Industry x 7) daughter queens raised were artificially inseminated from semen homogenized from drones of the top performing parent beehives of each of the 20 lines and 4 donated industry (drone hives from the previous years trial (Allan and Carrick, 1988, 1989, Kuhnert *et al.* 1989). All queen bees were branded with a numbered disc and one wing was clipped.

Natural mating of the feral bees was carried out one week earlier than the AI program for the CBA and Industry queens. All of the CBA, Industry and feral queens' daughter queens were initially placed in four-frame (Langstroth) nucleus hives on the grounds of WADA. After a period of approximately one month, five daughter queens were selected from the seven daughter queens raised from each line and transferred into a single 10 frame Langstroth hives on a private apiary site near Tooyay, 94 km north-east of WADA in late October. The single ten frame hives were made up with two frames of honey, three 'dry' empty frames and the four frames of brood to standardize each beehive.

The beehives at this site worked a light to medium nectar and pollen flow of York Gum (*eucalyptus loxophleba B.*), and Paterson's Curse (*Echium plantagineum* L.). After beehive strength developed across the brood box, a nine frame Manley super was placed above a plastic queen excluder on each hive and moved to a light nectar flow of Summer Whitegum (*Eucalyptus wandoo* Blakely) and Jarrah (*Eucalyptus marginata* Sm.) 65 km east of WADA in early December. The nectar flow at this site started to decline in late January 1990 and the trial was subsequently moved to a heavier nectar flow from a Forest Redgum (*Eucalyptus calophylla* R. Br.) site near Collie, 200km south of WADA. In early March, the wind and rain from cyclone Vincent severely affected nectar production in the south-west region and the trial was relocated on a Redgum (*E. calophylla*) nectar flow at Dandaragan, 166km north of WADA. Honey production was measured by weighing each Manley super before placement on a beehive and after it had been filled with honey. As each super reached approximately 50% honey by weight, a second Manley super was placed on top eventually to be swapped around (undersupered) when the first super was full. When the second super was about half filled, the first was removed and replaced with a third empty super and the process repeated until the end of the trial. Sufficient space to store honey in the super was available to each beehive throughout the trial. The weight of the Manley supers were individually recorded (when both empty and full) on electronic scales connected to a data logger and downloaded to a specific computer program developed for the breeding trial to determine the net honey weight for each beehive. Phenol acid pads were used to clear the supers of bees prior to removal.

Frames of honey and pollen were removed and weighed when the brood nest became congested in December and January (Trial A) and March (Trial B). The frames were replaced with 'sticky' empty frames to maintain a similar brood nest size for all the hives in the trial apiary. The full frames were scored as percent (%) honey on the frame and multiplied by the net weight of an average full honey frame and added to the final super weight. For example, the 'sticky empty frames weighed 0.84kg (N=45) and the full frames weighed 3.1kg (N=41) and the average net honey weight was therefore 2.26kg/lLangstroth frame.

At the close of the Whitegum and Jarrah flow in January, thirteen queen excluders used in the trial were found to be defective and were subsequently removed and replaced. The trial (Trial A0 was terminated and all the supers on the trial beehives were reweighed and logged as empty weights. The trial (Trial B) recommenced in early February, on the Redgum and terminated in April 1990. All hives used in the trials were located together on each of the apiary sites.

Results (Industry donated hive data was excluded for the purposes of the comparison)

Honey Production:

Trial A:

The honey production from 110 beehives was measured over a 67 day period from November to January. During this period, 11 CBA beehives became queenless (89% survival). An additional 11 beehives were affected by defective queen bee excluders and the data collected from these beehives was excluded from the results. The affected beehives involved 10 CBA and one feral bee colony. The total mean (+/- standard error) honey production of the remaining 88 beehives for the two groups was: CBA (35.7kg +/- 1.24) and feral (27.7kg +/- 3.64) (see table 1). Total production of honey from the 88 beehives was approximately 2,594kg which was equivalent to 0.44kg honey per beehive per day.

Trial B:

After a nine day period, the 11 excluder affected hives were of similar condition to the rest of the trial beehives and the trial recommenced with 99 beehives. The honey production of these hives was measured over a 61 day period (February to April). The trial was 29 days at Collie and 32 days at Dandaragan. During the period, a further 6 CBA beehives became queenless (93% survival). The total mean honey production (+/- standard error) of the remaining 93 beehives for the two groups was: CBA (104.8kg +/- 2.13) and feral (87kg+/-9.91) (see table 1). Total production of honey from the 93 beehives was 9,644kg which was equivalent to 1.7kg honey per beehive per day.

The CBA beehives were significantly different (P, 0.05) in honey production from the feral honey bee colonies. (Table 2). The mean difference was 8kg on a light nectar flow and 17.8kg on a heavy nectar flow than the feral colonies

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The honey from the brood box increased the total mean honey production by 5.87kg for the CBA beehives and 5.90kg for feral beehives in Trial A. In Trial B, honey from the brood box increased the total mean honey production by 1.54kg for the CBA beehives and 1.56kg for feral beehives.

TABLE 1:
Comparison between honey production of the Central Breeding Apiary (CBA) honey bees and feral honey bees for Trials A and B.

BEEHIVE	Number of beehives	Mean (kg) per beehive	Std Error	Range (kg)
Trial A				
CBA	79	35.7	1.24	9.1 to 57.4
Feral	9	27.7	3.64	4.8 to 40.8
Trial B				
CBA	83	104.8	2.13	42.1 to 147.2
Feral	10	87.0	9.91	37.3 to 125.6

Brood Viability:

The brood viability of CBA beehives was 93% (n=85) compared with 94% (n=10) for feral colonies. February's examination of the brood boxes, showed supercedure queen cells in 40% of the feral colonies an 19% of CBA

TABLE 2:
An analysis of variance between CBA breeding stock and feral honey bees comparing honey production from Manley supers and honey removed from the brood box.

BEEHIVE	Mean difference (kg)	% difference	Fisher PLSD
Trial A			
CBA vs Feral	8.0	22.4	7.65*
Trial B			
CBA vs Feral	17.8	17.0	14.36*
* significant at 95%			

Discussion

Constant selection of the bees with high honey production (and yellow colour) in a breeding program showed that these bees were able to produce a significantly greater quantity of honey than feral strains of bees. The average production of feral bees from the two different sources was almost identical over two nectar flows. (25.7 and 27.5kg; 86.9 and 87.1kg respectively). The indication is that by using feral bees as a base line for honey production at the same time measuring the honey production of breeding stock could be a useful way of gauging improvements in breeding stock.

Estimates of the increase in honey production attributed to the unique way the WADA queen bee breeding program was structured and operated has been made by Carrick (1990). He estimated that the rate of genetic change in the WADA trials from 1986 to 1989 and predicted that the rate of improvement in honey production per year ranged from 6% to 12.8% and was most probably around 9.5% for the CBA group. There have been no controls in WADA's bee breeding program so it is difficult to say what the overall increase in honey production has been though the differences measured between the WADA and feral honey bees gives a positive indication that the theoretical estimates of the improvement in honey production are in the right direction and could reflect the actual increase.

In Western Australia, a large number of beehives do contain honey bees originating from feral stock. This has occurred through the lack of annual requeening of beehives with selected stock. (In 1991 survey Rhodes *et al.* suggest that only 29% of productive colonies are requeened each year), by having weak hives which have been invaded by feral swarms using queen bees from queen rearers who have mating areas in areas of high feral bee density. In all cases, beekeepers would not be maximising honey production from their apiaries.

Beekeepers choosing not to use bee breeding programs could also be disadvantaged, for example, 2.7% of beekeepers in a survey by Rhodes *et al.* (1991) showed a preference for feral honeybee hybrids. There are similar preferences for darker stock in Western Australia by some beekeepers. If hives dominated by feral bees were requeened with breeding stock each year, there would be a significant increase in the production of honey in apiaries across Australia.

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Author's Note: Critics of this paper have said that there were not enogh numbers of feral hives from different sources to make a valid comparison with honey bees from the queen bee breeding program. Nevertheless, I think by quantifying the honey production of the feral bee (*under managed conditions*) it shows there are significant differences between feral and managed bees in the context of the topic "honey bees in the environment" and for beekeepers who are not utilising stock from breeding programs, the results should be of interest.