

The German Bee Breeding Programme

- Des Cannon







My Experience with the system

- 1. First met German Queen breeder Andreas Hähnle in 2009 at the Qld Conference in Cairns
- 2. 2010 Cycling trip to Germany/France. First two weeks evolved into a study tour
- 3. Subsequent cycling trips in 2012, 2014 and 2019 all involved staying with Andreas and learning more about their system, with a new experience each time
- 4. Andreas and Christiane spent three weeks with us in Australia, looking at beekeeping in Australia, and helping me to set up a small-sale breeding operation



The German System

- Evolved in the 1950s
- Germany today has some 80,000 beekeepers, with some at a commercial level similar to Australia, but mostly less than 10 hives
- The small hive numbers/beekeeper should not be allowed to mislead you
- Each State has a Beekeeping institute, and while each specialize in different areas, they work together to ensure even results and a standard across the country. This includes research into beekeeping diseases and problems, bee breeding, organizing courses and apprenticeships etc.
- Hesse = Kirchhain and Oberursel; Hohen Neuendorf (LIB) is a research facility jointly supported by the five German federal states of Brandenburg, Saxony-Anhalt, Saxony, Thuringia and Berlin; Baden-Württemberg = Hohenheim; Lower Saxony = Celle
- Main criterion has always been GENTLENESS
- Why?
- What other factors do they look at?



The German Criteria

- Programme started in the mid-1950s
- Set criteria – 20 characteristics
- No.1 – Gentility and calmness
- No. 2 Varroa resistance (tolerance, sensitivity, whatever)
- Honey productivity
- Swarming behaviour
- Hygienic behaviour
- Disease resistance
- Colony development
- Overwintering ability
- Bee population
- Brood area



Evaluation of the System

- Kirchhain plays a leading role in the German bee breeding programme, and Dr Büchler explained the programme in some detail. There are over 130 Queen breeders involved in selection, breeding and evaluation of stock. The initial programme was started by Professor Freidrich Ruttner from Oberursel Bee Institute some 60 years ago
- Is done via the internet, any purchaser can make comments in relation to their own (supplied) queens, but on the net the queen breeder is only shown by a code
- Registered queen breeders can access information at a higher level, in order to raise the quality of their own stock by importing genes (by purchasing queens from another breeder)
- Just imagine the feedback you could get from 80,000 passionate beekeepers!

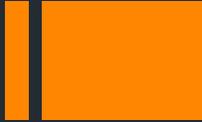
No.1 has Criterion always been:
Gentleness = Carniolans
(also a good cold climate bee)



- Scoring Criteria – Colony Defensiveness

Points	Gentleness
4	No use of smoke, no protective clothing needed to avoid stings whilst working bees
3	Colonies can be easily worked without stings, using some smoke
2	Single bees attack and sting, even if smoke is used intensively
1	Despite smoke, the colony shows a strong defence reaction when handled, or even attack without being disturbed





- Scoring criteria – Colony Calmness

Points	Calmness
4	Bees stick to combs 'like fur' without any notable reaction when being worked
3	Bees are moving, but do not leave combs during handling
2	Bees partly leave their combs and cluster in the edges of frames and supers
1	Bees nervously leave their combs, 'run' during handling, and cluster inside or outside the hive

- Scoring criteria – Swarming behaviour

Points	Symptoms of swarming behaviour
4	The colony shows no tendency to swarm – no swarm cells with eggs, larvae or pupae
3	Low swarming tendency. Cells may be present, with brood, but the colony shows no swarming activities. Swarming is prevented by destroying the swarm cells and offering space
2	Strong swarming tendency. Repeated construction of queen cells, advanced preparation activities (reduction in open brood, emaciated queen, limited com production)
1	Active swarming. Only prevented by extensive intervention (making splits etc)





The Varroa Tolerance programme

The steps in the breeding programme are (broadly):

1. Selection (in early Spring) of stock for gentleness, Varroa-tolerance, resistance to other diseases etc
2. Breeding from selected stock – grafting, raising, mating
3. Introduction of selected stock to hives in July
4. Re-evaluation of stock after winter
5. Repetition of the process with the survivors
6. All the results are tabulated fed into www.beebreed.eu on the .internet, to enable queen breeders to apply selection criteria to drone selection. (This means the queen breeders can compare their stock to that of other queen breeders, see how they are performing, and use the information to make improvements to their own stock and breeding programme. Some of the results are also available to ‘normal’ beekeepers, to use in their choice of queen breeder.) [A similar programme exists in the Pork Industry in Australia, but here the results are anonymous, and are only useful for bench-marking.]
7. A Varroa-vitality test is applied to these survivors with no treatment for Varroa in the 2nd winter. The number of bees in each hive is measured in autumn, and again in winter, to evaluate which bees (queens) display the highest level of vitality against Varroa.
8. The same tests (as in 7. Above) are applied to Varroa levels in the hive.
9. This 2-stage selection-propagation-selection process is continued.

At the same time, PCR testing for Nosema levels is carried out, honey-testing for AFB is conducted, and Queen Insemination facilities are used by the Institute staff to

- Produce AI queens for sale
- Conduct the Institute’s own research
- Propagate the VT programme



This whole Varroa tolerance breeding programme cost 600,000€ to set up over a 3 year period

Dr Büchler re-iterated the words of Dr Robin Moritz (from the University of Halle), in stating

- 1) that use of chemicals to control Varroa only props up those colonies (queens) that are susceptible to Varroa, and encourages development of resistance in the Varroa population
- 2) it will not be simply a case of transferring tolerant stock from one area to another. Yves Le Conte bred Varroa tolerant stock in Avignon in France, but it was found to not have the same level of tolerance when transferred to northern Germany, but was again effective when taken back to Avignon.

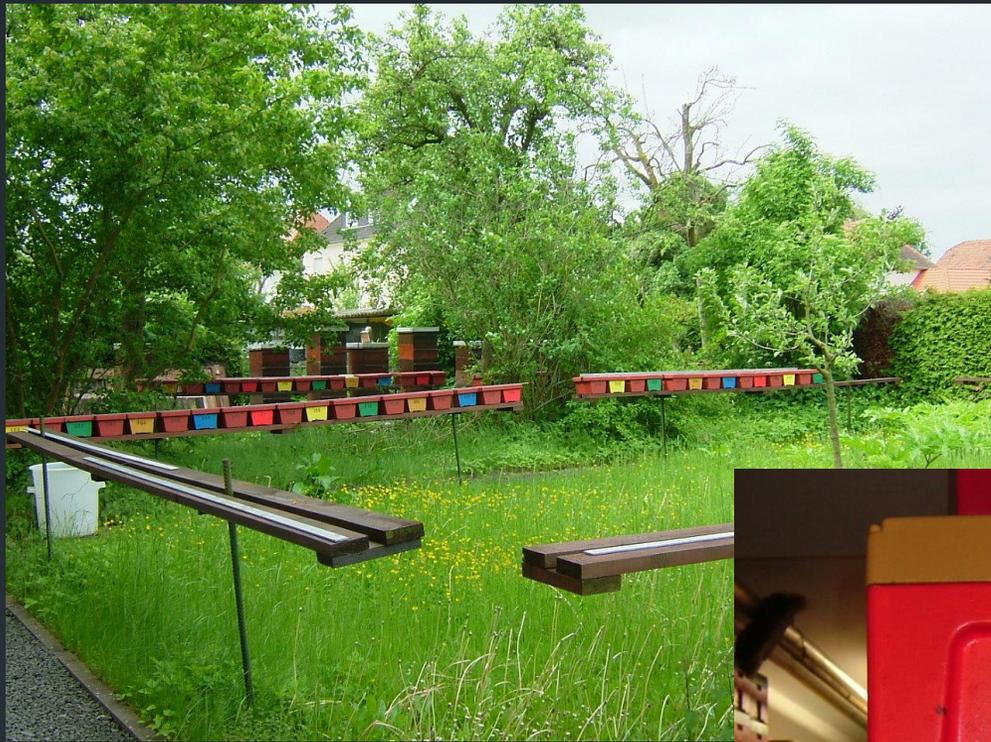
Disseminating the Desired Genetics

Island mating

- Island mating is carried out on Nordenay Island in the North Sea
- The island is flooded with drones from selected drone mothers

The drone mothers are selected by Kirchhain Bee Institute working together with Hohen Neuendorf Bee Institute. Dr Ralph Büchler, Director of Kirchhain , designed the AGT (Varroa-tolerance) program and verified the selection procedures, and he works with bee geneticist and computer whiz Prof. Dr Kasparov Bienefeld, Leader of the Dept of Selection and Genetics at Hohen Neuenfeld Institute, to evaluate the stock in the entire German breeding programme and select the queen mothers, and drone mothers. No fee is charged to the beekeepers for this service.

- Mini nucs are used to house and transport the virgin queens and the nuc colony
- The mini nucs are inspected and rejected if drones are found in the colony
- Cost to the beekeeper (2012) was 5€ per queen
- Mating success can sometimes be adversely affected if cold weather persists



- *Isolated mating in forest in Thuringia*





- First (and thus oldest) 'Belegstelle' (mating station in the world) – 1911
- Has operated continuously in present position since 1912
- Operated by the Arnstadt Beekeeping Club (1838) as part of the Varroa tolerance breeding programme since 2005
- Club volunteers place >50 drone mother colonies in a 'circle' 500-1500m around the mating station. 2014 = 5 lines of 15 colonies for each line = 75 colonies
- Set in high alpine Gehlberg forest, by Thuringen State law, no other colonies can be placed within 10km of the Belegstelle
- The Schneetiegel (alpine meadow) is snow-bound in winter, in the old DDR



Recognised queen breeders tend to use the mating nucs designed by Kirchhain, but other beekeepers must use a standard sized nuc box with glass sides to allow for visual inspection to ensure no drones are present, and two of these nucs fit into the permanent two-way nucs set up on stands and dotted throughout the station



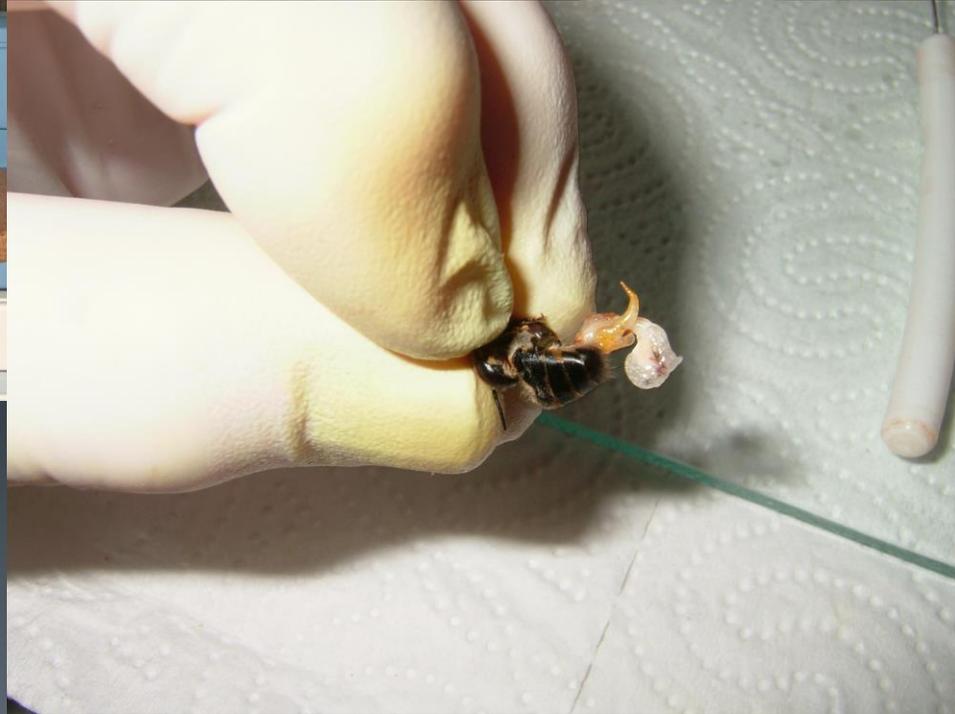
- Opens last day in May, every Wednesday night. Last hives (nucs) on July 16th, Belegstelle closes on 31st July. Possible to put 6 lots of virgins a year through the facility
- Beekeepers pay 4€/virgin. 2005 = 293, 2011 = 1173. 2012 = 71.8 % success rate
- All colonies are inspected before admittance for presence (absence) of drones. All the queens are Carniolan – virgins and drone mothers



AI program

- Carried out by Frau Christa Winkler and her husband.
- Road trip with caravan through all the bee Institutes in Germany (plus, in 2012, part of France, Luxembourg and Belgium).
- The different Bienen Institutes co-ordinate supply of drones from selected drone mothers
- Frau Winkler would inseminate the virgins for 14,50€ (about \$19.00 AUD) each
- There were only two catches to this offer:
 - The queens to be inseminated had to have a pedigree, going back at least two generations, giving them status within the German/French breeding programme (aimed at gentility, Varroa-tolerance etc)
 - And sexually-mature drones with a similar pedigree have to be available at each destination. This is solved by co-ordinating the whole trip with the German Bee Institutes, who raise the drones and have them available at each stop.







- Andreas had 25 queens inseminated, and a total of 130 queens were inseminated over the two days. *I never saw a smoker used in the whole exercise*
- Winklers and the German Bee Breeding programme have a low-cost, co-ordinated mechanism whereby they can disseminate the required genetic pool around the country. Not only is each beekeeper given a signed certificate authenticating the parentage of each queen, but at the end of the road trip, Frau Winkler spends another month completing all the paperwork

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- Three aspects of the exercise struck me:
 - The sheer logistics of the whole exercise, with each successive venue having to have available the sexually mature drones, and with the whole process being documented and evaluated afterwards
 - The co-operation needed between the researchers and the beekeepers to ensure the even dissemination of the genetics developed by the Varroa-resistance breeding programme throughout the larger area of Northern Europe
 - The willingness of the Winklers to use their technical expertise for the betterment of the honeybee 'industry' in Europe. The price charged for the insemination of each queen was, after all, really only a pittance – *but was affordable enough to ensure that a large number of queens were inseminated*, thus ensuring the viability of the whole programme

Questions?

