

REPORT ON OVERSEAS TRIP - CONTINENTAL SECTION - T. PALMER JONES

...As far as I could gather, diagnosis of bee diseases and their treatment is the main function of the Institute. I departed from Auckland, New Zealand, on 29 April and arrived in Rome, Italy, on 5 May, when I commenced fourteen days' annual leave. While in Rome I saw Conte Dr. Ezzi Recordati, who occupies much the same position in the Italian Department of Agriculture as does Mr Fawcett in New Zealand. The Count has a special interest in bees, having kept them himself, and is President of the Italian Government Beekeeping Association. The Count was most helpful and gave me a letter of introduction to the National Institute of Agriculture at Bologna, which is the centre of Italian beekeeping research. Adams and Victor. Eight strips

cost 2/6 In conversation the Count said that the food habits of the Italians are such that it is difficult to sell much honey in Italy. Insecticides are becoming a menace to bees and are being applied from the air. Acarine disease was introduced into Italy across the French and Austrian borders in 1940. It is now treated by burning strips of paper containing an insecticide inside the hive - these Folbex strips are sold by the Geigy Co. The Frow remedy is not used. The use of royal jelly in pharmaceutical preparations, and even toothpaste, is sweeping Italy and is an embarrassment to the Government, who do not recommend it.

Later, I visited the National Institute of Agriculture, directed by Dr. Ida Giavarini, assisted by Dr. Giulia Giordani. The Institute is well appointed, with an agricultural museum, chemistry and biology laboratories, and offices. Samples of bees are received from all over Italy for diagnosis of disease, routine dissection being carried out by a staff of eight girls. Acarine and Nosema diseases are common in Italy, and A.F.B. is

fairly widespread. As far as I could gather, diagnosis of bee diseases and their treatment is the main function of the Institute. Some research is carried out on academic subjects. ^{Already have}

Treatment of Acarine Disease: A mixture of methyl alcohol (96%) and essence of mustard (2%) is used to treat the affected bees inside the hive. A wick is placed in the bottle holding the mixture so that evaporation occurs more rapidly. One application is given in Autumn and two in Spring. None are given in Summer. This method is much faster in application than the Folbex one, in which strips impregnated with insecticide are burnt in the hive. One of the Folbex strips must be burnt each week for eight weeks, treatment being discontinued in Autumn and Winter. Eight strips cost 2/6 in Italy.

Treatment of Nosema: Fumagillin is used. I arrived in Rome, Queen Raising Apiaries under Supervision: When acarine disease reached Italy, many countries, such as England, ceased to import Italian queen bees. The Italian Government then took steps to ensure that queens were raised in certain apiaries supervised by the Institute, so that they could be guaranteed free from acarine disease, and the export trade revived. I inspected the largest of these apiaries, belonging to Gaetano Piano at Castel S. Pietro Dell' Emilia. All hives within 3 Kil. of this apiary must be inspected at intervals for acarine disease. Twice yearly, samples from all 500 nuclei in the apiary are collected and examined for acarine disease at the Agricultural Institute. If these tests prove negative, a Government Certificate is issued for export. The weakness of the scheme appears to me to be

that they have no staff with a practical knowledge of bees at the Institute, and apparently depend on the queen bee breeder himself to collect the samples. Countries that already have acarine disease and wish to import queens could rely on such measures, but they are completely unreliable for New Zealand, which is free.

Management of Queen Bee Raising Apiary: Two nuclei per box are used, with frames less than half Langstroth size. Both nuclei are covered with one roof. The Dolittle system of raising queen cells is employed, and apiary management is very efficient. The apiary site is most picturesque and the honey flow lasts six months from various sources. Alfalfa provides the main flow.

Visit to Research Centres in Switzerland: I arrived in Berne, Switzerland, on 19 May, and remained there at the Liebfeld-Berne Bee Research Station until 28 May. The Station is under the direction of Dr H.U. Gubler. The Swiss State runs a Federal Experimental Station at Berne, with branches at Wädenswil and Zurich. The beekeeping section, under Dr Gubler, is attached to the Dairy Research Station and has under its control, besides research, an advisory service run by part-time Apiary Instructors. These send samples of bees and combs for diagnosis of disease and give practical advice. There are no full-time Apiary Instructors. Little honey is eaten in Switzerland; crops are poor, and there are no commercial apiarists. Honey-dew from pine trees is a valuable crop. I spent sufficient time with each member of the staff to obtain full information on the work of the Station. The result of these talks and demonstrations is now set out:

Mr H. Schneider-Acarine Disease: Without treatment a hive suffering from acarine disease is certain to die in one to two years. The mites lay four to six eggs in the prothoracic tracheae only, where they take two to three weeks to become adults. Infested bees do not die through suffocation or through wing damage caused by the mites sucking their blood. Drones and queens can become infested.

(ii) Dr Morgenthaler found that only young bees can become infested. He took bees that were 100% infested and mixed them with bees of varying ages. Infestation of bees older than five days was negligible, and bees older than nine days, which would be on field duties, did not become infested. Infestation cannot occur outside the hive.

Mites can enter the tracheae of old bees, but it is easier for them to enter those of young bees with less stiff bristles protecting the spiracles, and they prefer to parasitize these. When the infestation is fourteen days' old, young mites are continually leaving the spiracles, and in Winter, when no young bees are available to infest, they attack the roots of the bee's wings, where they suck its blood. They are driven out of the tracheae as these become hardened with dried blood and excretions. Although conditions at the wing bases are not as congenial as inside the prothoracic spiracles, the mites can develop fully in these places. Very badly infested bees may lose their wings, but others may only lose their use; such bees cannot fly in the Spring, and crawl out of the hives. After March, young bees are available for infestation and mites are not found at the wing bases. If more than 50% of the bees in a hive are infested in the Autumn, it dies, while if the infestation is less than 50%, it is weakened. Bees die only if the wing bases are infested,

and loss of honey production is due to lack of bees and not to the weakening of bees suffering from a tracheal infestation only. Exceptions to this are as follows:-

- (i) If a new hive is formed with bees, but no hatching brood, the mites will attack the wing bases of old bees because no young bees will be available for three weeks.
- (ii) If a hive is infested 70-100%, the mites may attack the wing bases because insufficient young bees are available.

It is only during the Spring inspection that the bee-keeper discovers hives infested with acarine disease. During the Winter months the bees may have starved to death through being too weakened to crawl to their honey stores, or many may be unable to fly when leaving the hive in the Spring. The agitation of bees by the mites causes the bees to breed much earlier than usual, and this is a symptom of the disease.

Schneider constructed an apparatus which could measure the weight required to tear the wing off a bee. 20 g. is required for healthy bees, but as Winter progresses it is found that increasing infestation lowers the weight required for diseased bees to 5 g. The hind wing is used as it is more infested at the base.

A hive with an 80% infestation showed no wing damage after Frow treatment. An infested hive treated with sulphur showed some damage.

By tearing a wing off a living bee, Schneider can tell if it has a wing base infection, but great experience is required before this method of diagnosis can be used accurately.

A very active queen will lay so many eggs that the acarine mites cannot infest a high proportion of the young bees and the hive can cope with the disease. In countries such as New Zealand, where the bees do not hibernate, the wing bases would not be infested and little mortality would be expected.

It has been shown that bees with tracheal damage only do not live a shorter time in an incubator than uninfested bees.

Infestation in Switzerland occurred prior to 1922, when work on acarine was commenced. A beekeeper in Geneva bought infested bees in France and sold them in Switzerland, so spreading the disease. The French-speaking part of Switzerland was more infested than the German part, which bought fewer of this beekeeper's hives. Now bees are not allowed into Switzerland from countries known to have acarine disease, and permission must be obtained to import them from acarine-free countries. The disease crosses the Swiss border, via swarms, from France, where control is not efficient. Attempts have been made to educate French beekeepers along the border in methods of treatment, but the position is hopeless.

Spread of Acarine: The disease is spread by young bees drifting from hive to hive and by swarms. Marked bees have been found more than one Kil. away from their parent hive. If one infested hive is found, all hives in apiaries within bee flight of it have been exposed to infestation. At first, when control measures for Acarine were applied in Switzerland, a cordon of 3-4 Kil. diameter was put round uninfested hives and all hives within this area were treated until free from disease. Later, it was found that infested hives were always found outside the cordon. Cordons are still applied, however, in spite of their limitations.

A good beekeeper can diagnose acarine disease, or at least suspect its presence, when 20% of the bees in a hive are diseased. Early diagnosis is most important. Beekeepers are obliged to inform the Research Institute when acarine is discovered. It was realized by now that all hives in the areas affected with

sciarine would require Frow treatment if the disease was to be eradicated. At first no treatment was available and infested hives were destroyed. Later it was found that other cases of disease always occurred nearby; so if a few mites were found in neighbouring hives, these hives, too, were destroyed. Destruction of diseased hives was carried further and further afield, but still the infestation was found effective in some mites survived its application.

Then, in 1928, Frow's remedy came at a time when a law was being framed which would have meant that all bees within flight range of a diseased hive must be destroyed. So Frow's remedy saved the industry. It was:-

Nitro-benzol	...	2 parts
Petrol	...	2 parts
Safrol	...	1 part

Two c.c. were put on a pad fitted with a handle, so that it could be inserted in the hive. Treatment was carried out for seven consecutive days and the pad then left in the hive for three more.

Many other ways of applying the treatment are known, but this official method is the best available. During the war methyl salicylate was used as a substitute for safrol, but it was not so good. Other combinations of drugs were also tried without improvement. The Frow remedy suffers from the disadvantage that it cannot be used during the breeding period, because it may kill the young larvae, so it can be used only in Winter. Sometimes, when fine weather comes in Winter, bees are able to fly from the hive, and as they have lost their sense of smell through the Frow remedy, robbing starts. The treatment

must be stopped at once in such cases. In 1945, although the 10,000 francs worth of damage was caused to bees by the Frow treatment, some beekeepers still considered it was satisfactory. It was realised by now that all hives in the areas affected with acarine would require Frow treatment if the disease was to be eradicated. It was difficult to carry out such a programme, although acarine is considered an epidemic disease in Switzerland and hence the Government had powers to order such general treatment. However, this would have involved much responsibility and the Frow treatment had been found to be not 100% effective as some mites survived its application. and the apiary instructor Then Renny in England discovered the sulphur treatment. Sulphur-impregnated paper is lit in a smoker and the SO₂ puffed into the hive. Schneider considers this treatment quite safe. Three puffs are given each hive for ten days, treatment is stopped for one week, and then the hives are treated as before for ten days. Mr Schneider considers this method most effective if it can be carried out longer than above, until the first young bees appear - say, every second day for two months. Although an easy and quick method, it is not always carried out properly.

The Folbex treatment has only recently been developed. It is now the official remedy. Remedies for the red mite were tried for acarine control at Liebfeld, being sent there by the Geigy Co. Chlorobenzene (chlorobenzilate) was found to be the best and was used to impregnate absorbent paper which could be burnt in an open space in the hive. The treatment should commence during the first week in April, when young bees are being reared. These remain free from acarine as the old bees die. One Folbex strip is burnt once a week for eight weeks.

Every beekeeper in Switzerland is ordered through the Government to attend an instructional course in the use of Folbex. There are severe penalties for non-compliance - a fine and destruction of all the beekeeper's hives. There are twenty-two Cantons, each with a part-time bee inspector who works with the local veterinarian, who is responsible for all animal and bee diseases; during his training he attends a course of a theoretical nature on bee diseases. Each Canton carries out its own programme of disease control and most have different methods of doing this. The Liebefeld laboratory supplies advice.

After each Folbex treatment the beekeeper and the apiary instructor both have to sign an official sheet (see copy). The sheet is retained by the apiary instructor. Experience has shown that eight sets of signatures are necessary to ensure that the treatment has been carried out. After the eight treatments, Liebefeld examines samples of bees from the treated hives. If properly applied, the treatment is 100% effective in eradicating the disease. Five treatments are not considered sufficient, and eight are necessary. Switzerland is now largely free from the disease, after the use of Folbex for eight years.

The correct time in the season to apply Folbex is all important. If used in New Zealand, careful consideration of this aspect would be necessary. The amount of Folbex required in New Zealand would be more than in Switzerland, on the basis of $\frac{1}{2}$ strip per five combs of bees. The disease appears is cordoned off and bees can Folbex must be applied at night, when all the bees are inside the hive. After lighting the strip, the hive is closed for half an hour. If the hive is opened before the half hour

In Dr Gubler's opinion, acarine disease would not be as severe in New Zealand as it is in Switzerland, because there closed more than the half hour, the bees will be distressed. The Folbex strip may be placed on a metal holder, which can be pushed inside a hive along the floor after ignition. This method could be used for treating Langstroth hives. A sample of the metal holder was obtained, together with a sheet of instructions for the use of Folbex strips.

The use of methyl alcohol and mustard oil (see notes on Italy) for the treatment of acarine is cheap and easy, but not 100% effective. It must be carried out permanently and causes robbing. It is not used in Switzerland.

In Belgium the P.K. treatment (material made in the U.S.A.) is used. It is similar to Folbex.

Dissection for Acarine Disease: The following solution is used to keep insects awaiting dissection:-

- (iv) No hives to be moved out of the area until a year after the disease.
- | | | |
|------------|-------------------------|-------------------------------|
| Oudemann's | Alcohol, 95% | 1000 c.c. |
| | Distilled water | 1400 c.c. |
| | Glacial acetic | |
| | The following facts are | acid blue 128 c.c. and such a |
| | Glycerine | 80 c.c. |

The complete tracheae must be dissected for a satisfactory diagnosis.

Steps to take if Acarine appeared in New Zealand:

The question of what steps to take if acarine appeared in New Zealand was fully discussed with Dr Gubler. In Switzerland the procedure may be summarised as follows:-

An area where the disease appears is cordoned off and bees cannot be moved out unless the whole area has been free from acarine for one year after a compulsory treatment of infested hives with Folbex strips.

In Dr Gubler's opinion, acarine disease would not be as severe in New Zealand as it is in Switzerland, because there is a long period, six months, in Switzerland during which no young bees are being raised. If acarine disease is found in New Zealand, destruction of the apiary where it appeared would be unlikely to eradicate it, according to Swiss experience - it would have already spread over a large area and outbreaks would flare up later.

It would appear that the best steps to take in dealing with an outbreak of acarine in New Zealand would be as follows:-

- (i) A cordon of a radius of 10 Kil. to be put round the infested apiary.
- (ii) Find all infested hives in the apiary.
- (iii) Destroy bees in badly infested hives and treat lightly infested ones with Folbex.
- (iv) No hives to be moved out of the area until a year after the disease completely eradicated.

The following facts are of value in planning such a campaign:-

- (a) Disease resistant bees are not known.
- (b) Acarapis dies within a day in a dead bee, and they are supplied with water from a piece of water-soaked blotting paper. One cricket is used, followed, if death occurs, by another. If no pollen but dead bees only are available, Aedes larvae are used. A poisoned bee is macerated in a test-tube of water and ten larvae added. Eggs of the larvae are able to fly, as they can do much of the year in our mild climate.
- (c) The Frow remedy would not be of much use in New Zealand because it causes robbing when bees are sprayed by the Tropical Institute. The larvae soon show signs

Dr Maurizio - Various Subjects. two functions (1) they secrete
brood food and Dr. Maurizio has worked on a variety of subjects.
She is noted for her work on pollen analysis, as from the bee.

Testing the Biological Value of Different Foods for Bees: Bees
not more than twelve hours old are caged and fed the test foods
in an incubator at 30°C. They are examined for Nosema, as this
would affect their metabolism. Control bees are fed on sugar
syrup only. After a minimum period of three weeks the pharyngeal
glands and fat bodies of the bees are removed and examined.
Their size and development are estimated compared with those of
the control bees. Hydrolysed casein (vitamin-free) plus vitamin-
free dextrose was being tested when I saw Dr. Maurizio. This
work would be of great use in evaluating pollen supplements.

Biological Tests for Bee Poisons: These were of great interest
to me, as I think they will be of increasing value in New Zealand.
Crickets are used for testing pollen from rape, which is often
sprayed with a solution of benzene hexachloride. The pollen is
removed from the bees' pollen baskets. A pollen trap could be
used in its collection. The crickets, two to three days old, are
left with the pollen in a plugged test-tube for twentyfour hours.
They are supplied with water from a piece of water-soaked blotting
paper. One cricket is used, followed, if death occurs, by another
as a check. If no pollen but dead bees only are available, *Aedes*
egypti larvae are used. A poisoned bee is macerated in a test-
tube of water and ten larvae added. Eggs of the larvae are
supplied by the Tropical Institute. The larvae soon show signs
of poisoning in a positive test. commercial beekeeping, and it is not

Pharyngeal glands: These have two functions (i) they secrete brood food and royal jelly and (ii) they secrete invertase. But invertase enters honey from the plant as well as from the bee. The glucose-fructose ratio varies in honey and the reasons for the variation are being investigated.

Dr Gubler - Nosema apis and Swiss Beekeeping.

Fumagillin has been found effective against Nosema. Sugar syrup containing 35 mg. per litre is fed for three weeks, the volume given being 4-5 l. - 9035 mg. per c.cm. The dosage of fumagillin is affected by the way in which bees winter. In Switzerland, where the bees hibernate in Winter, the dose would be different from that given in New Zealand, where they breed throughout the Winter.

When no honey is coming into a hive, few young bees are raised and the old bees would live longer and be more affected with Nosema. This situation has applied recently in Switzerland, which has experienced several severe seasons. The climate of the Winter preceding an outbreak of Nosema is usually severe, according to Ruth Lottmar.

It would be expected that the Winter preceding the New Zealand epidemic of Nosema in 1946-1947 would be severe (February, March, April severe?). This would mean that no young bees would be coming on and the old ones would be heavily infested.

Types of Swiss Hive: The Swiss have developed a special hive, which is used mainly in bee-houses. The combs are large, being 35 cm by 27 cm. This type of hive and the bee-houses themselves are completely unsuitable for commercial beekeeping, and it is not surprising to find there are no commercial beekeepers in Switzerland.

In the French part of Switzerland, Dadant hives are used in bee-houses, or they may be kept in the open and wintered without packing. Not long ago from 14-16 lbs of honey was collected by a hive in Switzerland, but now the crop is only 8-10 lbs. The climate has become worse, more shrubs and flowers are destroyed so that the ground can be used, and insecticides are employed on an increasing scale. D. Baumgartner - Diagnosis of Disease.

E.F.B. This is caused by Strep. pluton, usually with B. alvei as a secondary invader. Yellow brood appears in the cells of the brood combs. This brood breaks up if it is removed. Strep. pluton is expelled orally by the larvae, and it can be found on the cappings. Strep. pluton is also excreted by the larvae. In diagnosis bacteria are removed in scrapings from the inside of the cappings and examined, nigrosin being used as a background stain. They can also be found in the yellow parts of the larvae. Bac. orpheus sometimes accompanies Strep. pluton, which must be found for a positive diagnosis. The presence of B. alvei and Bac. orpheus alone is not conclusive. Nigrosin stain is used to provide a background for the three organisms, which are examined with a X950 oil immersion. Strep. pluton can be recognized by its characteristic appearance. (See specimen slides).

E.F.B. is treated with terramycin, although this does not always effect a cure. In some parts of Switzerland the bees and combs are burnt, as in the case of A.F.B. The disease is regarded as less dangerous than A.F.B. Combs should be burnt immediately the disease is found, as they are infectious for about a year.

Herr A. Brugger - Effect of Climate and Temperature on Nosema.

A Nosema infection itself may be relatively harmless, but when allied to other factors heavy mortality may occur. Swiss beekeepers think the pollen collected may be connected with increased mortality, but this is doubtful.

Mr Brugger's views apply probably only to Switzerland, where they have been so far worked out only for a restricted area. When the Swiss winter finishes in March, the bees become active, except in areas with a high altitude, where they are retarded. If such active bees are fed sugar water, they will be stimulated to fly, and if infected with Nosema, they will be unable to regain their hive, the brood will be uncared for, and the hive will die out. It would have been better to leave the hive to collect nectar supplied by Nature. If hives are short of stores, sugar should be fed in Winter, not Spring.

If the Summer, including July and August, is fine, there is practically no Nosema the following Summer. 1947 was the best Summer of the century. 1948 was the contrary, with much rain and cold. 1949 was a fine Summer, very hot and dry; but there was a very great outbreak of Nosema in the less high areas of Switzerland. Here the rainfall was about twice that which fell in the more mountainous areas during 1948. If breeding bees are fed with sugar syrup before July, they can resist Nosema, but if fed after July, they die because they are stimulated at the wrong time.

Herr W. Fyg - Queen Bees.

Herr Fyg is the leading expert on diseases and abnormalities of the queen bee, and receives specimens from all over the world.

He said that there are 68 different types of disease and abnormality which can afflict queen bees' reproductive organs.

Queen bees sent to him are given a number and all particulars are entered on a special form. (See specimen). So far he has dissected 4,000 queen bees, all of which are preserved for reference. Abnormalities in organs other than the reproductive organs can cause sterility or malfunction.

Von Leeuwen's Fixative for Bees

1% picric acid in absolute alcohol 12 T. Parts by vol.
40% formalin 2 T. " " "
CHCl₃ 2 T. " " "
Conc. Acetic acid 1 T. " " "
Wash after soaking in above and keep in 70% alcohol.

The bodies of the bees should be opened.

Melanosia: Caused by a yeast-like organism or by a bacterium.

Calculi: Calculi form in the rectum and cause injury because the queen cannot excrete and may become distended. The enlarged rectum constricts the oviducts and prevents the queen laying.

Nosema: Many package queens in the U.S.A. are affected.

Amoeba disease: This never affects queens.

Virus disease: A very common disease of queens. A very young queen will be found laying only drone eggs, due to defective sperms. The virus affects the sperms in the spermatheca and enters other organs also. The sperms develop characteristic curls. Herr Fyq discovered the cause of the disease in 1947. The virus is found in the fore intestine, ectoderm, and reproductive organs. No other type of bee, or even queen larvae, have been found with the disease.

Endocrine Glands: These suffer from disturbances about which little is known; from the corpora allata come hormones which stimulate egg laying; the corpora cardiacum secretes hormones; there is a prothoracic gland.

Practical Beekeeping.

On 25 May, I went for a drive with Dr Gubler through Mattstetten, Murzelen (where the schoolmaster keeps bees), and Sarisvil, to inspect bee-houses and see the Swiss way of keeping bees. The bee-houses and hives are very expensive and complicated, and appeared to me to be uneconomic, even when allowance was made for local conditions.

I saw a bee-house on wheels, which is towed up to the woods for a month every year so that the bees can collect honey-dew from the pines. The Owner (Mrs Staehli) mixes this with flower honey and sells it for a good price.

It appears likely to me that ordinary, double-walled hives, or single-walled hives with some insulation or winter packing, would be far more efficient and economical than the hives kept in bee-houses. The only advantage appears to be that the bees are easier to handle.

After leaving Berne, I followed an itinerary arranged by Dr Gubler and attended the Seventh International Congress of Comparative Pathology at Lausanne. One of the papers delivered dealt with the effect of industrial wastes on bees.

I then spent a day at Val Mont, Montreux, with Mr Frankhauser, who is secretary of the local beekeepers' association. I particularly wished to see something of the beekeeping in this French-speaking area of Switzerland, as Dadant hives are used here without bee-houses. These hives resemble Langstroth ones, but have deeper frames.

Mr Frankhauser's hives are kept in the open, without bee-houses or special shelter, in an apiary at an altitude of 700 metres. He considered the bee-houses were unnecessary. At greater heights he winters hives in a box-like structure which accords some protection. Usually one super only is used in Switzerland for brood, but the combs are bigger than in our Langstroth hives.

In Zurich, I visited Professor Bovey at the Entomological Institute, where he teaches apiculture. Recently, he has been forced to spend his time dealing with a disease affecting larch trees. This is being combated by spraying affected trees with a virus which attacks the caterpillars causing the disease. He would be interested in the work of our Forestry Department.

I also visited Dr Horber at the Oerlikon Research Station. He has been carrying out interesting work on acclimatising bumble-bees to new sites. The nesting boxes for the bumble-bees are first used as homes for mice, so that the nest material can acquire the authentic mousey smell which attracts bumble-bees. Dr Horber is also making migration studies on wire-worms, which are marked with radioactive wires attached to their bodies. Radioactive D.D.T. is being fed to the Colorado beetle so that acquired resistance to D.D.T. can be studied. Dr Horber specializes in studying the effect of wire-worms on field crops.

Some Conclusions.

The value of the Swiss honey crop is about the same as that of New Zealand, but much less honey is produced, its price being artificially kept up by a duty on imported honey. The value of the bees as pollinators in Switzerland is considered, as it should be in New Zealand, to be about ten times the honey

1953 I visited Masaro, Kington Bros, and spent the day with Mr Paul Bayner who is in charge of their marketing crop. However, although both New Zealand and Switzerland have beekeeping industries of approximately equal value, far more is spent in Switzerland on beekeeping research. The Laboratory at Liebefeld has a staff of eight, three of whom have degrees, while the remaining ones are highly qualified technicians. The equipment and library is very good. I should estimate the Swiss expenditure on beekeeping research as at least five times that of New Zealand.

The Swiss have probably concentrated more than any other country on the prevention and treatment of bee diseases, and the information obtained from them will be of great value in New Zealand, particularly if we have an outbreak of acarine disease.

NOTE: A very useful type of hive balance was inspected - the Meier Kuntzen Bienartikel (400 F.).

A large collection of scientific papers was obtained from the Liebefeld staff.