

examination of the ram flock and culling of the rams with palpable abnormalities of the genitalia, the incidence and spread of the disease have been substantially reduced on many properties.

Spread of infection may be further reduced by rigid isolation of the younger clean rams from the older rams. Infection can develop in ram hoggets and virgin 2-tooth rams after contact with older infected rams and every effort should be made to avoid such contact. Also young rams have been protected from contact with heavy infection during the tupping season by ensuring their segregation from the older rams or by confining their mating to ewes of their own age.

As soon as the infective nature of this disease was established research was undertaken to develop methods of conferring immunity or resistance on sheep against the disease to supplement other methods of control.

Development of Vaccines

In experiments at Wallaceville extending over the past 4 years attention has been directed at the development of vaccination procedures which would confer a high degree of immunity against controlled experimental infection. In a preliminary trial rams and ewes were inoculated with a variety of vaccines either singly or in various combinations. Vaccinated and non-vaccinated animals in the various groups were later exposed to severe infection by the intravenous inoculation of virulent *Br. ovis* organisms.

The only procedure which consistently conferred significant protection was the simultaneous inoculation of *Br. abortus* Strain 19 and a special vaccine prepared from killed *Br. ovis* organisms. Strain 19 is the vaccine used for the protection of cows against contagious abortion and is a suspension of living but non-virulent organisms. This vaccine was shown to be incapable of causing active disease in rams or ewes. The special *Br. ovis* vaccine contains chemically treated and killed organisms in an emulsion prepared from mineral oil. This method of preparation of the vaccine greatly improves its efficiency, so consequently this type of product has been called an "adjuvant vaccine".

Subsequent work has involved the use of larger groups of rams immunised at different ages with a variety of procedures. Again in the later trials Strain 19 with the adjuvant vaccine conferred a high degree of protection on rams against experimental infection.

Field Trials

In the first field trial, initiated on two properties in 1955, approximately half the 2-tooth rams were immunised with Strain 19 and the adjuvant

vaccine and the remainder left untreated. The results after two examinations at the end of the 1956 tupping season are summarised in Table 1.

TABLE 1—RAM VACCINATION FIELD TRIAL, 1956

Infection in rams after first tupping season		
2-tooth rams		Older rams
Vaccinated	Non-vaccinated	Non-vaccinated
per cent.		per cent.
0/31	8/32	25
		29/121
		24

In this trial the vaccination procedure had obviously conferred a high degree of protection on the 2-tooth rams against heavy infection during their first tupping season.

The results from this trial and from more intensive experiments running concurrently at Wallaceville led to the decision in September last year to proceed immediately to a more extensive field trial. Through the collaboration of the Department of Lands and Survey the main part of the trial was located in the Rotorua district. Two different vaccination procedures were to be compared, Strain 19 plus the adjuvant vaccine and the adjuvant vaccine used alone. The latter procedure was included, as results from laboratory controlled experiments had indicated that an adjuvant vaccine used alone did confer some degree of protection. Vaccination was confined to the recently purchased 2-tooth rams and a number of these on every block were left untreated as controls. To ensure that the 2-tooth rams were exposed to severe infection during their first tupping season infected older rams were intentionally retained in the flocks and rams of all age groups were run together during tupping. Results are available from the first clinical examination conducted on the experimental 2-tooth rams after tupping.

Table 2 summarises the results from the blocks where groups of 2-tooth rams were vaccinated with Strain 19 plus adjuvant vaccine as well as with adjuvant vaccine alone. The results confirm the efficiency of the double vaccination procedure and demonstrate clearly that the adjuvant vaccine used alone did not confer adequate protection.

Table 3 summarises the available results from the flocks where the only treatment given was the adjuvant vaccine inoculated alone. Again on these blocks this procedure did not confer satisfactory protection.

TABLE 2—RAM VACCINATION FIELD TRIAL, 1957

Department of Lands and Survey, Rotorua district			
2-tooth rams	Number	Cases	Per cent.
Adjuvant vaccine	159	8	5
Strain 19 plus adjuvant vaccine	174	1	0.6
Non-vaccinated	210	21	10

TABLE 3—RAM VACCINATION FIELD TRIAL, 1957

Department of Lands and Survey, Rotorua district			
2-tooth rams	Number	Cases	Per cent.
Adjuvant vaccine	282	18	6.4
Non-vaccinated	341	37	10.9

Vaccination studies have been primarily concentrated on rams in view of the importance of the male as regards susceptibility and transmission in ovine brucellosis. The economic importance of *Br. ovis* infection in ewes is not yet so clearly established. As infection in ewes might originate exclusively from the use of infected rams, lamb losses through infection of the ewe might be most conveniently and economically controlled by confining vaccination to rams. Experiments are still in progress to determine whether vaccination of the ewe will confer protection against infection presented by the use of infected rams for tupping.

Vaccination Procedures

Vaccination procedures should be applied as follows for effective control of the disease:—

1. Ram lambs after weaning should be kept in strict isolation from older sheep.
2. Young rams may be vaccinated at any age from 4 months until 2 months before their first tupping season. Vaccination as yearlings rather than at an earlier age will result in the development of better protection, and vaccination should therefore be left as late as possible.
3. Older rams should be examined by a veterinary surgeon and rams with clinical lesions of the disease should be culled from the flock. The remainder of the rams may be vaccinated either immediately or at any time until 2 months before the next tupping season.
4. Vaccination of ewes is not recommended at present, as it is not known if this would be effective.

The vaccines are now being prepared in a commercial laboratory and are available for use by veterinary surgeons. Farmers wishing to arrange for the vaccination of ram hoggets and older rams are advised to consult their veterinary surgeon.

Though the vaccination field trials are incomplete at present, the available results indicate that the double vaccination procedure confers a high degree of immunity in rams against experimental and natural infection and will provide a formidable weapon for more effective control of the disease in the near future.