

weeks afterward. The weight of the liver can be measured after slaughtering the animal at the end of an experiment or can be calculated with sufficient accuracy from the body-weight. The concentration of copper in the liver can be measured at any time by analysing small pieces removed surgically.

Using these methods it was found that 400 mg. of copper glycinate is a satisfactory dose for cattle. This dose of glycinate contains 120 mg. of copper and of this about 100 mg. reaches the liver 2 to 4 weeks after dosing. That quantity will raise the concentration of copper by about 100 parts per million of dry liver and bring the level to that found in normal, healthy animals.

For tests on the control of greying made under practical farming conditions 400 mg. of copper glycinate was the dose finally decided on.

### Times of Dosing

The times at which doses should be administered had also to be decided. Access to run calves is governed to a large extent by the problem of mustering, but there are at least two essential musters on any station, one for marking and one for weaning. The suitability of these two muster periods for preventive injections was therefore studied by treating some animals and comparing their progress with that of untreated animals in the same herd. This comparison in the same herd was made possible by treating heifer calves and leaving steers untreated. The effectiveness of a treatment was measured by its success in bringing animals through to 15 months of age in a thrifty condition without greying of the coat.

It was found that young calves, 2 to 3 months old, could safely be injected

with 400 mg. of the cerate at marking time in November. By the next (weaning) muster in the following May treated animals were found to be in better condition than the untreated ones. In some years there were a few treated heifers showing grey round the eyes and in other years some even showed a mottled coat, but stunted and severely greyed animals did not occur. Among untreated steers on the other hand there were in some years as many as 25 per cent. which showed severe greying at weaning.

### Results of Treatment

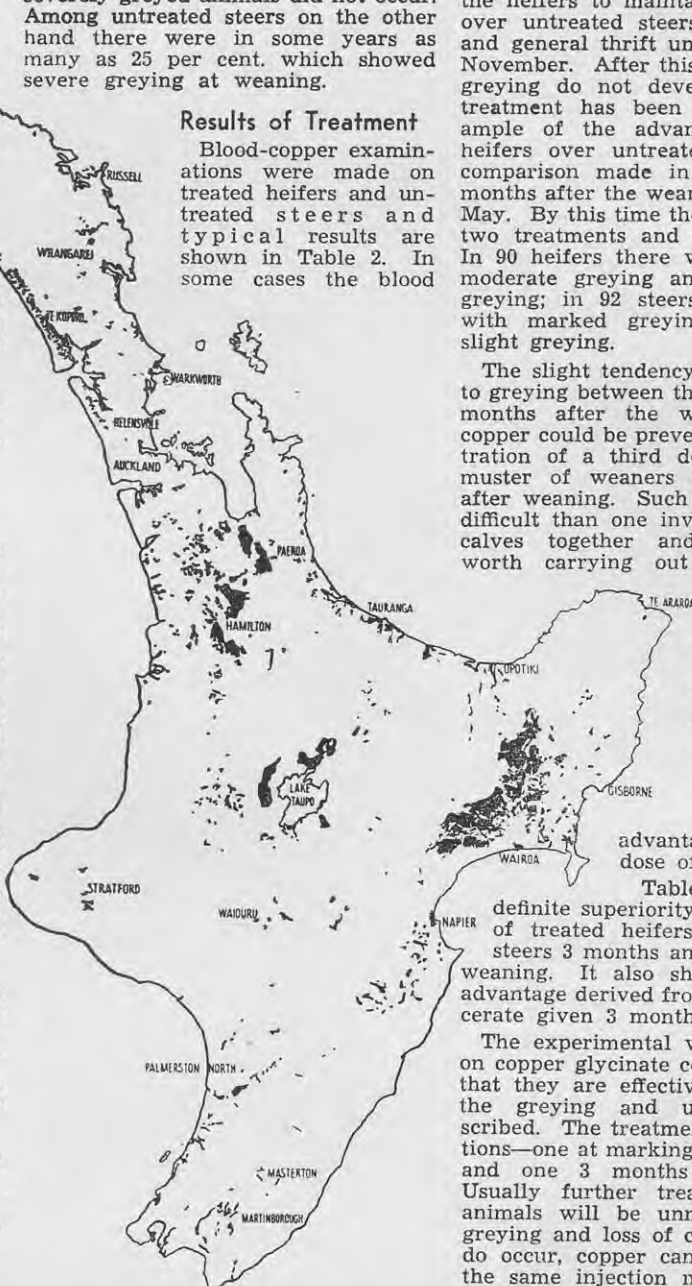
Blood-copper examinations were made on treated heifers and untreated steers and typical results are shown in Table 2. In some cases the blood

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in good condition at weaning despite low blood copper, and there was therefore no justification for the expense of an extra muster between marking and weaning.

A second dose to the heifers given at the weaning muster in May enabled the heifers to maintain an advantage over untreated steers in coat colour and general thrift until the following November. After this further cases of greying do not develop, even if no treatment has been given. An example of the advantage to treated heifers over untreated steers is the comparison made in August 1955, 3 months after the weaning treatment in May. By this time the heifers had had two treatments and the steers none. In 90 heifers there was one showing moderate greying and 9 with slight greying; in 92 steers there were 21 with marked greying and 22 with slight greying.

The slight tendency in some heifers to greying between the third and sixth months after the weaning dose of copper could be prevented by administration of a third dose at a special muster of weaners made 3 months after weaning. Such a muster is less difficult than one involving cows and calves together and is considered worth carrying out to obtain the



← The black areas are the soils listed in Table 3, where high-molybdenum pastures occur.

advantage of the extra dose of copper.

Table 2 shows the definite superiority in blood copper of treated heifers over untreated steers 3 months and 6 months after weaning. It also shows the further advantage derived from a third dose of cerate given 3 months after weaning.

The experimental work carried out on copper glycinate cerates has shown that they are effective for control of the greying and unthriftiness described. The treatment is three injections—one at marking, one at weaning, and one 3 months after weaning. Usually further treatment of older animals will be unnecessary, but if greying and loss of condition in cows do occur, copper can be supplied by the same injection method. Because of variation between years and farms, it is not possible to lay down any rule for treatment of adult animals. A cerate should be injected if there are signs of greying or loss of condition.

### Injection Procedure

Injection in the beef animal is best made subcutaneously. With intra-

TABLE 2—AVERAGE BLOOD COPPER IN TREATED HEIFERS AND UNTREATED STEERS

	Weaning Mg. per 100 ml. of blood	3 months after wean- ing	6 months after wean- ing
1955:			
Heifers treated at marking and weaning .. ..	0.052		
Steers untreated .. ..	0.040		
1956:			
Heifers treated at marking and weaning only .. ..	0.039	0.083	0.065
Heifers treated at marking, weaning, and 3 months after .. ..	0.039	0.085	0.083
Steers untreated .. ..	0.048	0.055	0.050

copper of heifers was as low as that of steers at weaning time. This indicated that the dosing rate was borderline and suggested that an additional dose of cerate between marking and weaning would have been an advantage. In the several years of observations heifers treated at marking were