

- (2) Orange-coloured butt is partially dominant to white butt. The result is that a hybrid between a white-butted and an orange-butted variety will be intermediate in butt colour. This hybrid if self-pollinated will give amongst its seedlings some with white butts, some with the full orange colour, and others with intermediate colour.
- (3) Bronze or purplish colour of the leaf is dominant to green colour. Therefore most bronze plants give rise to some green seedlings which breed true for green colour.

Knowledge of the dominance of these characters is of great use in breeding-work, for it is thus possible to judge whether by inbreeding any particular type we may expect to obtain some plants of another and desirable type. In addition, in many cases, such knowledge allows us to judge if supposed hybrid seedlings are or are not really hybrids. This enables culling at a very early age. The cross between Ngaro and S.S. is a good example. If S.S. is used as the seed parent, any pods of seed that have been crossed by Ngaro will show bronze seedlings. All others can be thrown away at once. The bronze character is shown at a very early age after germination, and therefore is most useful in permitting early culling.

Thanks are again due to the various millers and growers who have helped the work during the past year. The presence of our Chairman in Palmerston North has proved a great boon in these rather difficult times.

## MINERAL CONTENT OF PASTURES INVESTIGATIONS.

### BUSH SICKNESS.

The value of the work on the chemistry of bush sickness commenced in New Zealand by the writer in the year 1900, and extended and supported by means of the Empire Marketing Board's grant for research on mineral content of pastures in 1926, cannot be estimated by the actual results in this country. Similar conditions attending any given deficiency disease doubtless occur in other parts of the world, possibly over greater areas than those in New Zealand, and any fundamental work in field or laboratory cannot fail to be of value in combating these conditions and applying the correct curative and preventive treatment found efficacious here. All results as soon as they were obtained were published each year in either the annual report to the Government, to which at the time the writer was attached, or in the *Journal* of the Department of Agriculture. As a result of this publicity it was discovered that similar diseases occurred in other parts of the Empire, notably in Scotland, Kenya, Tasmania, and possibly in South Australia. In each country the disease had received recognition and a local name—"pining" in sheep in Scotland, "Nakuritus" in cattle in Kenya, and "coast disease" in cattle in Tasmania. There is little doubt that all these three diseases are identical with bush sickness. In the case of Kenya the trouble has been effectually and cheaply cured by the same remedy that has been found efficacious in New Zealand, iron compounds given to the animal as a drench or lick. At first the treatment tried in New Zealand was by means of drenching. This method was quite successful, but laborious, expensive, and not regarded as a feeding, but as a medicinal treatment, and therefore used as a curative rather than a preventive.

For years the writer has been endeavouring to introduce some way of automatically giving ruminants additional iron *as a food*, and therefore as a preventive against bush sickness. The author's theory that this was iron starvation, caused by a direct deficiency of iron in the food, may still be considered the best yet advanced. The double citrate of ammonium and iron introduced by him in 1918 as a drench had at once supplanted the cumbersome and expensive syrup of phosphate of iron. Both of these remedies, however, were expensive, compared with crude iron-ores now being used. The citrate is now being imported by the ton (last year 2½ tons were imported), to be used in small quantities sold to the farmer at cost price. A duty of £50 per ton recently imposed, unfortunately, has increased the amount charged to 3s. per pound. Used as a 6-per-cent. solution and given in 2 oz. doses twice daily to cattle, this compound can be relied upon to effect a cure on a sick animal, provided it can be kept alive for a fortnight after the treatment commences. The cost of this treatment as a preventive would be 3s. per year using 1 lb. of the material per cattle beast.

Varying success attended the attempts to make a compound lick which could be automatically given to cattle. Bricks weighing about 8 lb., made in a hand-press brick-machine, supplied various mixtures containing iron and salt or iron and sugar in which the citrate of ammonium was used as the iron salt, which for many months were experimented with on young and mature cattle. Sheep were not experimented with at this stage.

In 1926 the Empire Marketing Board provided a yearly grant of £2,000 for two years to the New Zealand Government for work in connection with the mineral content of pastures (history of the vote and the conditions were given in the 1929 annual report of the Department of Scientific and Industrial Research, p. 20). In 1927 the currency of the grant was increased from two to five years.

The visit of Dr. Orr, the Director of the Rowett Research Institute of Animal Nutrition, Aberdeen, and member of the Mineral Content of Pastures Committee of the Privy Council, to the bush-sick districts in June, 1927, put new life into the investigation by his personal interest and valuable suggestions. One of these was based on the fact that, following the results of the New Zealand work in bush sickness and preliminary report from Kenya Colony that there was a similar disease on similar volcanic soil there, he had tried a ground Scotch bog-iron on some cattle, and the experiment had been extraordinarily successful. (A report recently to hand contains the result of confirmatory work in that colony by Dr. J. B. Orr and Mr. A. Holm, Director of Agriculture in Kenya. (See Sixth Report on the Mineral Contents of National Pastures, published by the Economic Advisory Council, London, 1931.) This information encouraged the writer in his use of ground-up iron-ore, begun in 1925, instead of the costly pharmaceutical iron preparation already found efficacious. A local iron-ore that was to be found in many parts of New Zealand was mixed with salt as a lick, tried, and found successful