

SOME OBSERVATIONS ON STRAIN IN CLOVERS.

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Recent research on grassland problems has made prominent the importance of strain in pasture species. The strains of grasses and clovers sown determine to a very large extent for what purpose the pasture is most suited, what its carrying capacity will be, and also the extent of its useful life. Most of the pasture species when studied show some strain difference, and so it is the object of this paper to deal with the strain differences which occur in the Leguminous species which have been studied at the Plant Research Station.

Strain studies on White clover were commenced six years ago when 104 samples of commercial seed were sown in small broadcast plots on the Research Area. These plots gave promising results so in the following spring these, and another 525 lines, were sown. The technique was changed to permit sowing the clover in rows. This allowed better establishment, and made possible the control of unwanted volunteer clover till such time as adjacent pairs of rows could grow over quickly and give the equivalent of a broadcast plot. Of the total 629 lines sown 587 were New Zealand commercial samples, 15 were of Kentish origin, and the remaining 27 were mostly Dutch. Within a year these plots showed remarkable differences. From observations, together with data from single plant trials being conducted simultaneously, a suitable type classification was worked out. Each sample tested came within one or other of the six types which were as follows:

- Type 1: New Zealand No. 1 - A large-leaved, widely spreading, stout stoloned, highly productive and persistent type.
- Type 2: New Zealand No. 2 - Leaves smaller than the Type 1 group, stolons more slender, plants dense, but less productive than Type 1.
- Type 3: Ordinary New Zealand - Leaves medium sized, comparatively low producing, and low persistency after two years.
- Type 4: European and New Zealand Dutch - Leaves small, production very low after the first six months; a free-seeding, short-lived type.
- Type 5: Kentish Wild White - A small-leaved dense type of plant never highly productive but quite persistent when competition from tall growing plants is not excessive.
- Type 6: Ladino - A very large leaved tall form, good hay production but poor persistency under closer management,

At the end of the second year the economic differences between types were even more marked. It was quite apparent that again a pasture did not indicate type differences, so seed certification relative to type and not to age was then decided on.

The New Zealand No. 1 was proving exceptionally good for high production, for recovery from cutting, for making winter growth, and for early spring growth. It was also able to withstand competition, so lines dominantly of this type were considered suitable for "Mother seed" lines. Subsequent tests have proved that this type will grow and persist better than any other New Zealand type.

Samples dominantly New Zealand No, 2, but also containing some New Zealand No, 1 proved suitable for maintaining quite, a good percentage of clover in a pasture so these were deemed certifiable as "Permanent Pasture" lines. Any of the seed lines certified are greatly superior to the types which are excluded from certification.

The rejected lines belong to Types 3 and 4. Evtm so the Ordinary New Zealand type is more useful than either the European or New Zealand Dutch type.

Since the strain differences have been established and their importance realised there has been a steady increase in the number of samples submitted for trial with a view to certification, The following table shows the number of samples, sown in the spring of each year:

<u>Year</u>	<u>No. of lines.</u>	<u>No. of plots (including control plots),</u>
1929	630	800
1930	267	334
1932	312	393
1933	<u>703</u>	<u>979</u>

Total 2265 3039

Certification on type actually commenced on the lines sown in 1930. During the last two years chemical tests as well as plot trials have been used as an aid to an early determination of type.

The one method consists in quantitatively analysing the growing herbage and measuring the percentage of Hydrocyanic acid which can be distilled off, This method has been perfected, and the percentages of Hydrocyanic acid correlated with plant types by the Station's analytical chemist, In the other method the seed sample is used, Its reaction also depends on the presence of Hydrocyanic acid in germinating seedlings.,

Type has been decided for **1626** lines and these have been classified as follows:

<u>Number of lines finalised.</u>	<u>Number up to Mother /Seed Standard.</u>	<u>Number up to Perm. Pasture standard.</u>	<u>Number rejected from certification.</u>
1626	217	480	929
Percentage in each Class:	13.4%	29.5%	57.1%

The above table shows that of the white clover available commercially a small percentage is of the highest standard and only 435 of the total tested is sufficiently good to come within certification,

The acreages of white clover which have come into certification have shown marked annual increases since type was made the basis of the test. The actual figures for each year are as follows:

Acreage of white clover seed-inspected.

<u>1931-32.</u>	<u>1932-33.</u>	<u>1933-34.</u>
31	161	929

The natural occurrence of the New Zealand types is very interesting ecologically. The types, as described, seem to have undergone a rapid process of natural selection to suit a series of eco-habitats ranging from a very fertile soil type, allowing strongly competitive growth, down to a much poorer soil type where annual crops have to be grown or where the sward opens up in the summer and allows re-establishment from shed seed. It is on the former soil type that most of the New Zealand No. 1 is found, and as conditions change to being slightly less fertile the New Zealand No. 2 is the dominant type. The ordinary New Zealand is found under a wider range of soil types and conditions, being mainly on soils holding white clover but capable of improvement by phosphatic topdressing. The New Zealand Dutch types occur where arable farming is largely practised.

The quantities of the different types available commercially have been dependent on the extent to which these eco-habitats are occurring in the seed-producing areas of New Zealand. Actually the acreage occupied by the New Zealand No. 1 ecotype is comparatively small, that of the New Zealand No. 2 is more extensive; the Ordinary New Zealand occurs quite widely, but the New Zealand Dutch occupies quite a small area only.

A closer study of the New Zealand samples is showing that the types already mentioned can be subdivided further into definite ecotypes and in order to understand better their significance these ecotypes and their respective eco-habitats are being studied closely. Quite marked differences have been observed to occur within quite small geographical boundaries.

Of the overseas types mention has been made of the Kentish, the Dutch, and the Ladino types. The Kentish type, in our trials, has proved relatively low in production, but it is a permanent species which may prove very useful where relatively poor soil conditions occur. The Dutch types tested have been short lived, low-producing types, poorer than any New Zealand Dutch lines. The Ladino is a highly producing type suitable for hay conditions only. A more recent overseas type tested here is the Danish Morso. It was said to be a small-leaved type approaching Kentish Wild White in appearance and persistency, but we find it resembles the Ordinary New Zealand in growth form but is actually poorer in production and less persistent than the New Zealand type.

During the last two years herbage yields have been measured on plots originally sown down as certification trials. Green weights only were recorded. The outstanding features of these recordings were:

1. The high total production of green herbage from the New Zealand No. 1 type represented by Mother seed lines.
2. The marked superiority of a selection from the No. 1 type.
3. The long growth range of the New Zealand No. 1 type and selections.
4. The relatively high amount of late autumn and winter growth made by the selected line.

Although these weights were recorded on pure swards of white clover similar types sown in mixtures are being tested at Marton under the Crop Experimentalist's system of alternate mowing and grazing. There the types are producing yields relatively in the same order as in the pure sowings, but the actual differences in yield are not so great because the ryegrass in the plots is able to make up for some of the lack of production of the poorer clovers. The clover types were sown at the same rate in each

plot so a botanical analysis of the herbage now being produced gives a measure of the relative values of the clover types sown. Such an analysis made 1 year 8 months after sowing is as follows:

White Clover strain trials at Marton. Sown January, 4 1933.

Botanical analysis of herbage. Date 29.8.34.

	Now Zealand No. 1.	New Zealand No. 2.	Kentish Wild White.	Imported Dutch.	New Zealand Ordinary,
	1	2	3	4	5
White clover	67.9	75.3	80.3	95.4	17.8 82.2

Balance of suitable species in a pasture is important and the above table shows clearly a good balance of ryegrass and clover if a good clover is also present, but a bad balance with a poorly producing, non-persistent type of clover.

When the strain work was commenced 3000 spaced single plants from commercial lines were studied. This helped in differentiating the types of plants, as well as giving a measure of single plant performance. After two and a half years the 10 best plants were selected and planted in a block for seeding and further increase growing as a pedigree line,

More recently further single plants have been grown. The best plants have been selected and tested in "tiller rows" as well as being progeny tested. The 10 best plants obtained by these methods have been control pollinated within a glasshouse, and the seed obtained has been planted out in a three-quarter acre block for increase growing. Within three years this improved "pedigree" seed should be available commercially.

Strain investigations with Red clover (Trifolium pratense) have shown that there are five different groups, but of those only the Broad red and Extra late-flowering suit New-Zealand conditions, the former as a hay type and the latter as a permanent pasture species,

An intermediate "ordinary late flowering" group is useful in colder countries as a dense hay type, but in New Zealand it is badly affected by frosts and has a long 'winter dormant period,

All the New Zealand lines tested have been Broad red in type. Supplies of the Montgomery type have been imported from Great Britain and these are being "once grown" in New Zealand.

A certification scheme is in operation for red clover but only the Montgomery type is being certified to. The progress of this certification is shown by the following figures:

Acres Montgomery Red Clover inspected.

Year, . . . . .	<u>1931-32.</u>	<u>1932-33.</u>	<u>1933-34.</u>
Number of acres,	9	71	183

Some herbage yield figures recorded on pure sowings of the red clover types have shown:

1. That red clover is capable of a very high total production,
2. The Broad red produces more than the **Montgomery** in the first year after establishment,
3. By the end of the second year the commercial **Montgomery** has produced a total weight not far below that of the total for the Broad red, and a **Montgomery** selection has exceeded the total Broad red yield,

Improvement work with red clover has consisted of mass selections from single plants originally from **Montgomery** "mother seed" lines. The plants selected for 1933-34 harvest were control pollinated in a glasshouse. Seed from this is being increase grown in a half-acre block as a step towards producing commercial supplies of an improved red clover strain.

Other species under study are *Lotus major* and Subterranean clover, *Lotus major* has shown extensive differences in single plant trials. Most commercial lines are very heterogeneous so work is in hand aiming to build up a line superior to commercial both in type and in performance,

Practically all Subterranean samples tested have been sent us from **Australia**. Our tests confirm the Australian reports that important strain differences occur in this species,

All our tests have shown that in each of the species dealt with strain differences are to be found. The use of the best strains where these can be grown, either naturally or with the aid of topdressing, must lead to the maintaining of better pastures such as the **better** and more progressive farmers will wish to have always. Both the buyer and the seller of seed must rely on certification to give them the guarantee of type, The strain ecologist must study the performance of all available strains and pedigree lines in order to be able to advise the grower which species and which strains he should use.

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