

THE PERFORMANCE OF, OVERSEAS RYEGRASS CULTIVARS IN NEW ZEALAND

W. RUMBALL and C. S. ARMSTRONG

Grasslands Division, DSIR, Palmerston North

Abstract

Results of comparisons between New Zealand and overseas bred ryegrass cultivars over the last thirty-five years are reported. **The** single plant data have involved a total of 2359 seasonal comparisons, and virtually all of them favour the New Zealand cultivars.

INTRODUCTION

AS PART OF the continuing plant breeding programmes carried out at Grasslands Division this past 40 years, a large research effort is, and has been, directed at examining a very wide range of overseas bred cultivars (= varieties) and naturally occurring populations of herbage plants. This material has been assessed for many different characters with the possibility of using it mainly in two ways: (a) widening gene pools of many cultivars for further plant improvement work, and (b) a search for cultivars that immediately have a place in New Zealand's agriculture without further plant improvement work required.

Results of this work have been methodically recorded and have been stored in a system where the performance of any of the, cultivars assessed over a wide range of characters is easily retrievable. Few of the data have been published but are frequently referred to when new plant breeding programmes are initiated. In other words, the results of this large-scale evaluation effort, over a very wide range of cultivars have been used almost only for plant breeding ends.

In New Zealand, in recent years there has been renewed interest in overseas cultivars. Much of this stems from the recently passed Plant Breeders' Rights legislation and the implications of such a scheme to commercialization of plant cultivars. It is in this light that the material included in this paper is presented. It should enable research workers, advisory officers and farmers to assess the possibilities of overseas cultivars in New Zealand agriculture.

This paper presents a summary of the data for ryegrasses only, the most widely used genus in New Zealand. It covers a wide range of cultivars from 15 countries, and includes 84 cultivars of perennial and long-rotation ryegrasses, and 59 of short-rotation, Italian, and Westerwolds ryegrasses.

METHODS

When initially received from overseas, a cultivar would normally be tested at Palmerston North and perhaps at Grasslands Division's regional stations (Kaikohe, Lincoln, and Gore). The method of testing would involve individual plants spaced 60 cm apart, as there would usually not be enough seed for sward comparisons. The overseas cultivar would be represented by at least 60 plants arranged in 5- or 10-plant rows replicated in a random arrangement with the New Zealand standard and any other introduced or experimental ryegrass lines of immediate interest. During each growth period all plants in the block would be scored for relative seasonal growth (on, say, a 0 to 5 scale), diseases, habit, heading behaviour, etc., before grazing.

Relative growth of any line for a given season would then be based on the average score of its 60 plants, and compared with that of the New Zealand standard. It is obvious that overseas cultivars which performed very poorly would be of no further interest, whereas a promising one might easily be entered in several experiments at different times and places. They would, of course, then be scored under different conditions of growth, climate, soil type, etc., and by different persons-but always relative to the same New Zealand standard in the same experiment-Ruanui for perennial ryegrasses, and Paroa for the annual ryegrasses.

To obtain the data presented below, for each overseas cultivar in turn, information was extracted from the plant breeding files (from 1939) to record its relative seasonal production in each experiment or experiments in which it appeared. For simpler presentation in the figures, all seasonal scores have been averaged (i.e., a cultivar value for any given season could thus be the mean of more than one scoring for that season, in more than one experiment at more than one site), as the data showed little evidence that the relative behaviour of these overseas cultivars varied much from one regional station to the next, or from one experiment to the next

RESULTS

PERENNIAL RYEGRASSES

. Spaced Plants

Results are given in Fig. 1 where 'Grassland Ruanui' is represented as a straight line at a constant score of 100. In general, overseas cultivars are lower than this score. They rise to a relative peak in their first spring (autumn planted), but then fade steadily to a level of about 35% from the next spring. This level is maintained through the following seasons, and data beyond 'the third winter have not therefore been presented. Much of this decline is due to a natural peak production in late spring/early summer and a relative winter dormancy. The failure to produce a similar peak in the second year **can** be attributed to the tendency of these overseas cultivars to die out. This early indication of poor persistence is characteristic of spaced plant trials, and no doubt reflects the greater exposure of plant growing points to severe grazing or other mismanagement.

Those cultivars which outyielded Ruanui during the first spring/summer period did **not** tend to come from one country in particular.

After the first spring/summer period, very few cultivars appear above Ruanui, and it is not always the same ones that do. Some of the performances which appear to be reasonably spectacular are in fact misleading. They result from having to compare a solo result (because that cultivar has been tested only once) against a mean value for the standard. For example, it appears from the graph **that** one cultivar is better than Nui in the first spring, another better than Ariki in the first autumn, and another better than both Ariki and Nui in the same autumn. The explanation is that Nui was not present in that particular spring experiment, and that both Ariki and Nui surpassed both overseas cultivars in the particular autumn experiment. Ariki and Nui values for all autumn experiments, however, averaged out at a lower score. The three overseas cultivars concerned did not score **well in** other seasons in the same experiment but would probably justify further study.

The outstanding feature of Fig. 1 **is** the superiority of the other two New Zealand perennial ryegrasses. Ariki is consistently above Ruanui, by about 35%, and Nui is ahead of Ariki by a further margin of 20%.

The data summarized here involved 1778 seasonal comparisons between overseas cultivars and the New Zealand standards. In

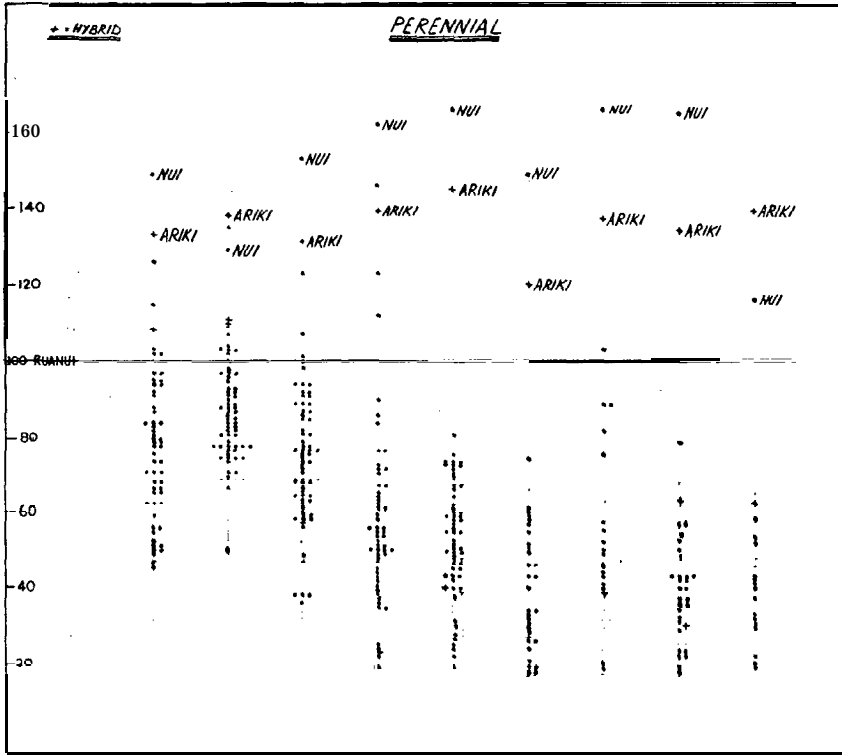


FIG. 1: Seasonal spaced-plant performance of overseas perennial ryegrasses, relative to 'Grasslands Ruanui' perennial ryegrass.

only four of these did an overseas cultivar surpass all the New Zealand ones, and in one of the four comparisons Nui was not present. These four exceptions all concerned growth in the first spring but involved four different overseas cultivars and three different regional stations.

Swards

It has been the experience at Grasslands Division that those cultivars which are superior, as spaced plants are also superior in swards, though often by a diminished margin. This decrease occurs because the more severe (but more realistic) mowing or grazing treatment does not allow the full potential of superior cultivars to be expressed. Where differences between cultivars are small as spaced plants, it is quite common to find them disappear or even reverse in swards.

There are much fewer data available from Grasslands Division on sward comparisons between New Zealand and overseas cultivars. This is partly because sward experiments are themselves less common, and partly because the available space in such experiments is usually filled with experimental lines more promising than overseas cultivars. This paper has therefore added to Grasslands Division data those found in reports by the Ministry of Agriculture and Fisheries. In general, such trials involved plots about 3 m X 1.5 m replicated four times for each cultivar, and broadcast with white clover. The plots were harvested when they reached sheep or cow grazing height, grass, clover and weed components were dissected out, and dry matter yields obtained for each. Concern here is with the grass component only.

All available data involved Belgian, Dutch, and British ryegrasses. The results were quite consistent, with Ruanui almost always superior in spring, and normally ahead in autumn, but usually inferior in summer. It was occasionally outyielded in this period by 50% (most trials did not record winter production separately). Because summer production in all cultivars was always a low proportion of their total yield, however, even the best overseas cultivars did not surpass Ruanui in yield averaged over all seasons and all trials. Its mean annual superiority ranged from 0 to 50%. Arikui was a further 6% ahead of Ruanui, mainly because of increased summer, autumn and winter yield. Nui was not present in any of these trials, although a precursor of it sown in one trial outyielded all other cultivars in all seasons (with one exception in summer), and surpassed Ruanui by 19% in mean annual yield.

In a grazing trial at Invermay, a late-heading cultivar (already on the Acceptable List) produced slightly-but not significantly—more carcass weight over the heading period. In another experiment in Southland, Ruanui produced 2% more lamb-weight gain over three years than did a late-heading cultivar.

SHORT-TERM AND ANNUAL RYEGRASSES

Spaced Plants

In this set of data, 'Grasslands Paroa' Italian ryegrass was treated as the New Zealand standard, and its productivity set as 100 for each season. There are, nevertheless, three different types of ryegrass to be considered, each with its place in the farming scene, and each with a New Zealand cultivar to be compared with overseas material. These three groups are, in order of

increasing longevity, Westerwolds ryegrass, Italian ryegrass (including tetraploid Italian), and short-rotation hybrids between Italian and perennial ryegrass. The respective New Zealand standards in each group are Tama, Paroa and an experimental

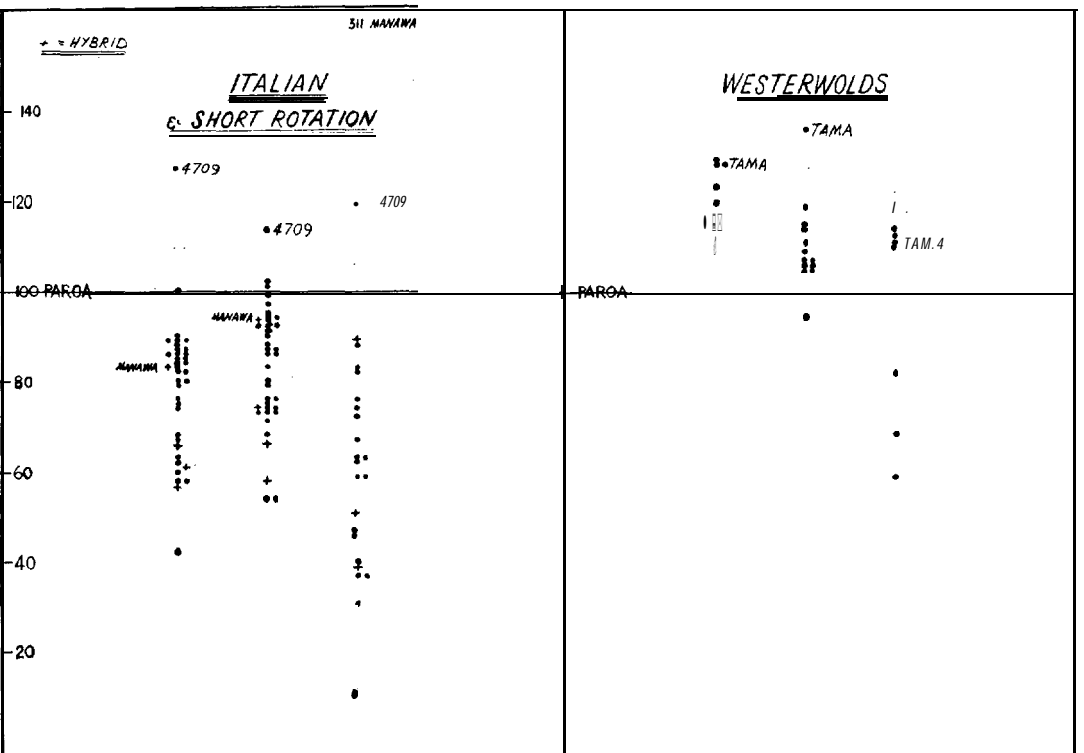


Fig. 2: Seasonal spaced-plant performance of evereas annual and short-term ryegrasses, relative to Grasslands Paroa Italian ryegrass.

tetraploid Italian cultivar labelled G4709, and Manawa. Figure 2 shows the relative production periods of these four groups. The Westerwolds ryegrasses are usually sown early enough to provide autumn forage and increase their productivity through winter to a spring peak, then fade rapidly enough to be ploughed in time for a summer crop. Italian ryegrass may often be slower to grow in the autumn but persists longer into the summer, and this possibility of providing summer forage through to an autumn ploughing is even greater in the tetraploid Italians.

The hybrid ("short-rotation") ryegrasses tend to produce even less forage in the first winter but grow vigorously through the spring and have the persistence to produce through two growing seasons in dry areas and much longer in moist areas.

Westerwolds Ryegrass: Tama is equal to the best overseas cultivars in autumn and clearly superior in winter. It is only about average in spring production but persists better into the summer (data not shown).

Italian Ryegrass: Two cultivars (both from U.S.A.) are ahead of Paroa in the first winter but fade rapidly thereafter. Three different cultivars were slightly superior in spring and summer, but most were considerably inferior, and less persistent. In all three growth seasons, G4709 was clearly superior to all other cultivars.

Short-rotation Hybrid Ryegrasses: Three French cultivars were tested against Manawa. They were clearly inferior at all seasons.

Swards

Again sward data tend to support the spaced plant comparisons, though diminishing their differences and occasionally reversing the results. Tama has been outyielded by overseas Westerwolds ryegrasses by up to 15%, particularly in the early part of the season. It is now obvious that Tama must be sown early in dry southern areas if it is to provide much autumn feed, and this requirement may conflict with the farming programme.

The meagre data on the Italian group show no overseas cultivar to be equal to the New Zealand counterpart in the early part of the season, but in one trial Paroa was outyielded by 8% over the whole test period (March to December). G4709 was not present in that trial.

DISCUSSION

The available evidence on the perennial ryegrasses shows that overseas cultivars may outyield Ruanui in the first summer, but are

inferior in other seasons, in total annual yield, and in persistence. This summer superiority is probably linked with later heading. It is because of their value in providing late-season feed that two overseas late-heading ryegrasses were recommended by Grasslands Division to be placed on the Acceptable List-S23 and RvP Melle. It would be an improvement if this late-season production could be combined with better productivity in the remaining seasons, and such a breeding programme is already under way. The main problem will be whether such a late-heading ryegrass will give adequate seed yields. Late-heading overseas cultivars are usually poor seed yielders in this country, and consequently not attractive as a commercial proposition. The answer to the problem of obtaining late season production without resorting to extreme late heading may well lie within Nui.

Among Westerwolds and diploid Italian ryegrasses, New Zealand cultivars are again more persistent and usually more productive over the total growing season. However, there are a few overseas cultivars that appear to be equally or more productive in the autumn and early winter periods, and it would be useful to have more sward data available.

Among the short-rotation and tetraploid Italian ryegrasses, sward data are again meagre, but the total evidence presented here suggests that the overseas cultivars studied are inferior to their New Zealand counterparts.

Exactly 40 years ago, at the Third New Zealand Grassland Conference, Saxby (1934) reported on his experiments comparing overseas perennial, Italian, and Westerwolds ryegrasses with the commercial New Zealand lines available at that time. His study was complicated by the diversity among New Zealand lines but, taking the best as standards, his conclusions were remarkably similar to those given here. The numbers of cultivars available have increased since then and so have the testing sites, but the existing evidence—except for early season annuals—still greatly favours New Zealand cultivars for New Zealand farmers.

ACKNOWLEDGEMENTS

Grateful thanks are offered to those past and present officers of DSIR and MAF whose data have been included in the summarized presentation of this paper.

REFERENCES

- Saxby, S. H., 1934. *Proc. N.Z. Grassld Ass.*, 3: 77-83.
-