"GRASSLANDS 4707": A NEW TETRAPLOID WESTERN WOLTHS RYEGRASS

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WESTERN WOLTHS, the extreme annual form of Italian ryegrass (*Lolium multiflorum* Lam.), is a fodder grass which orginated in the Netherlands (De Haan, 1955). Thirty to forty years ago it was widely used in Canterbury but its use died out with the advent of the certification scheme and the availability of good perennial ryegrass-white clover pastures. Saxby (1956) states that the questionable value of Western Wolths ryegrass has not warranted its inclusion in the certification scheme, and that in 1956 genuine seed was practically non-existent on the New Zealand market.

In the late 1940s, L. Corkill (pers. comm.) bred at Grasslands Division a Western Wolths variety from New Zealand-collected and from introduced material. This variety was not released because it was not considered to be sufficiently superior to Grasslands new Italian ryegrass.

Western Wolths ryegrass is a diploid with 14 chromosomes in its somatic cells. Wit and Speckman (1955) have bred an induced tetraploid which has been marketed under seven names prefixed by Tewera, e.g., "Tewera Billion", as described in the Dutch 41st Descriptive List of Varieties of Field Crops 1966. Tests at Grasslands Division, principally with single-spaced plants, indicated that Tewera was not superior to "Grasslands Paroa" Italian ryegrass. It is not unusual for a variety bred for a very different climate to behave poorly in New Zealand and it was considered that an induced tetraploid produced from a New Zealand diploid Western Wolths would provide a good test of the merits of tetraploidy for New Zealand conditions.

A decision was made to treat with colchicine the diploid Western Wolths bred earlier by Corkill to produce a tetraploid and this paper presents an outline of the breeding scheme which led to the production of "Grasslands 4707",

a new tetraploid Western Wolths ryegrass. A description is given of its characteristics and results are presented on its performance.

Breeding

An outline of the breeding of "Grasslands 4707" is given in Fig. 1. Colchicine treatment of young seedlings of the Grasslands diploid bred earlier by Corkill resulted in 52 C_0 tetraploid plants which were pair crossed to produce a C_1 generation unaffected by plants chimaeral for diploid and tetraploid sectors. The tetraploid progenies were on

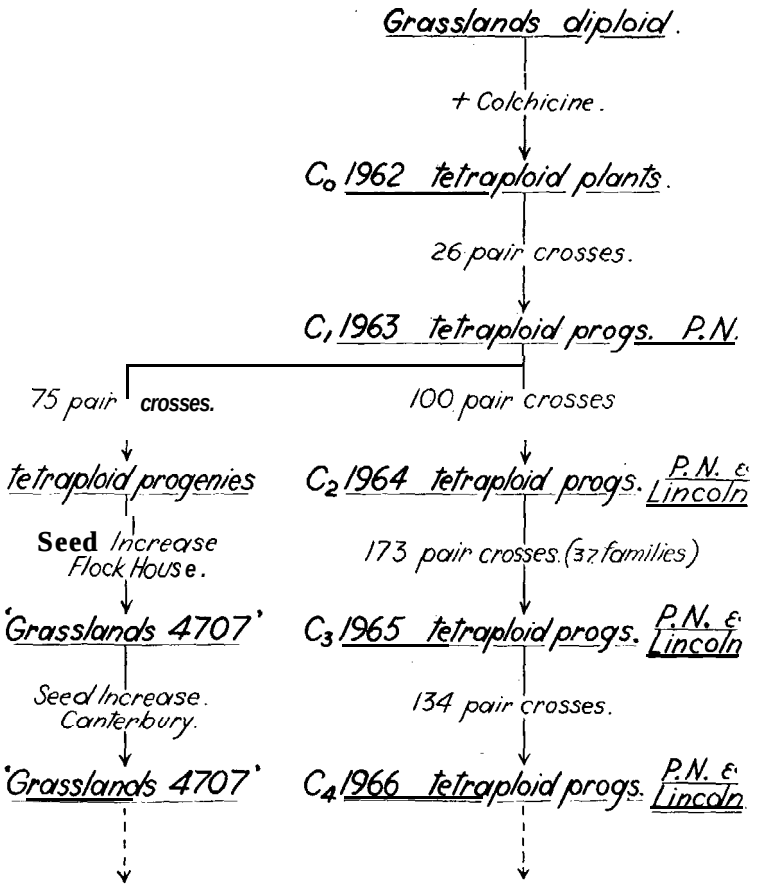

FIG. 1: *Breeding of tetraploid Western Wolths.*

TABLE 1: RYEGRASS SINGLE PLANT COMPARISONS
PALMERSTON NORTH, 1964
Relative Yields

Tetraploid Western Wolths (mean of 30 best progenies)	141
Diploid Western Wolths	123
"G. Paroa" Italian	100
Tewera Billion Tetraploid W.W.	80
"G. Manawa" short rotation	68

the average superior to the Grasslands diploid and to the Dutch "Tewera Billion". Pair crosses were made between superior plants and the resulting C_2 generation planted out as single-spaced plants at Palmerston North, Lincoln and at Flock House. Table 1 shows the relative yield of the mean of the best 30 tetraploid progenies compared with those for diploid Western Wolths, "Grasslands Paroa" Italian, "Tewera Billion" tetraploid Western Wolths and "Grasslands Manawa" (short rotation) ryegrasses. The New Zealand tetraploid certainly looked promising and it was decided to rogue the Flock House block of undesirable plants and progenies and to take a seed crop. This was released for trial purposes as "Grasslands 4707" and has been increased for a further generation in Canterbury by the Department of Agriculture (yield, 55 bushels per acre). Further selection and crossing have been continued each year with testing at both Palmerston North and at Lincoln.

General Description

"Grasslands 4707" tetraploid Western Wolths ryegrass has proved to be a very vigorous variety, broad in the leaf with very thick stems. Somewhat more open than diploid Western Wolths or Italian, it has a tendency to remain greener into the base of the sward. The leaves are soft and the dry matter percentages are significantly lower than those of any other ryegrass tested. Seeds are large (about double the weight of other diploid ryegrasses) and strongly awned. For drilling purposes it may be necessary to "polish" off the awns.

Palmerston North Green Feed Trial, 1965

A cutting trial was carried out comparing "Grasslands 4707" tetraploid Western Wolths, "Grasslands Paroa" Italian ryegrasses, Argentine II Barley and C.R.D. ryecorn

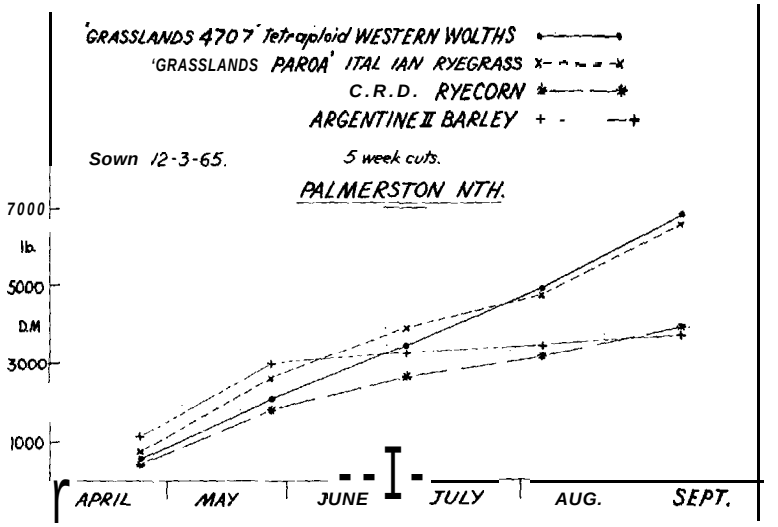

FIG. *2: Comparison cutting trial: results for S-week cuts.*

at 3-week, S-week and 7-week cuts. The results for S-week cuts are shown in Fig. 2. The barley was ahead on the first two cuts but rapidly faded out. "Grasslands 4707" lagged behind "Grasslands Paroa" to start with owing, it was discovered, to a dormant condition of the seed resulting in slow establishment, but eventually caught up and passed the Italian. C.R.D. ryecorn was comparatively slow in production. The actual production for the S-week period July 1 to August 5, 1965 is shown in Table 2, together with the data for 3-week cutting, cut August 5, 1965, and 7-week cutting, cut July 30 1965. In all cases,

TABLE 2: PALMERSTON NORTH CUTTING TRIAL SOWN MARCH 12, 1965
(lb D.M./Acre)

Variety	Cutting Interval 3-week cut 5/8	5-week cut 5/8	'I-week cut 30/7
"Grasslands Paroa" Italian Ryegrass	244b (100)	811b (100)	1517b (100)
"Grasslands 4707" tetraploid W. Wolths	375a (154)	1423a (175)	1830a (121)
C.R.D. Ryecora	92c (38)	496b (61)	980c (65)
d.05	123	416	176

"Grasslands 4707" is highly significantly better than "Grasslands Paroa", the increases being 54% for the 3-week cut, 75% for the 5-week cut and 20% for the 7-week cut.

Lincoln Grazing Trials, 1965 and 1966

In Canterbury, a main. use of greenfeed is to provide high quality in ***situ*** grazing for ewes during late pregnancy and after lambing. "Grasslands Paroa" Italian ryegrass, with or without turnips, and greenfeed cereals such as oats, barley or ryecorn are commonly used for this purpose. During the past two winters, on cultivated high fertility Wakanui silt loam at Lincoln, "Grasslands 4707" tetraploid Western Wolths ryegrass has been compared under grazing with "Grasslands Paroa" Italian ryegrass, C.R.D. ryecorn and Amuri oats. These were sown in February at seeding rates of 30 lb, 20 lb, 2½ bushels and 2 bushels per acre respectively with 1 cwt per acre of nitrolime and 1 cwt of superphosphate. Over the period from April to October, paired comparisons of the Western Wolths with these greenfeeds were mob grazed at varying intervals, with stocking rates of at least 500 sheep per acre.

Figure 3 shows the comparison between the Western Wolths and the ryecorn, with variable grazing intervals in

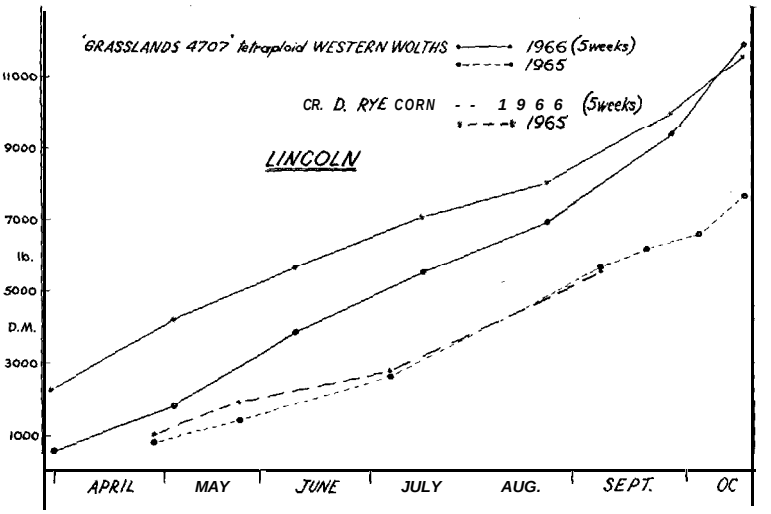

FIG. ***3: Results of comparison trial between Western Wolths*** and ***C.R.D.*** *ryecorn.*

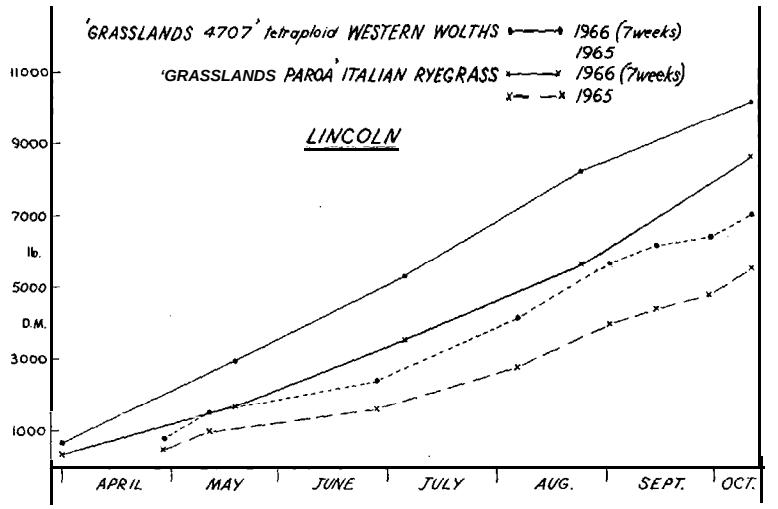

FIG. 4: ***Results*** of ***comparison trial between Western Wolths und "Grasslands Paroa" Italian*** ryegrass.

1965 and 5-week intervals in 1966. There was little between the two feeds in 1965, although the ryegrass provided palatable feed for a longer period. In 1966 the C.R.D. ryecorn showed an early winter advantage in production, but the ryegrass was far superior over the last three periods and ultimately yielded slightly more in total.

Figure 4 shows the comparison between the Western Wolths and "Grasslands Paroa" Italian ryegrass, with variable grazing intervals in 1965 and 7-week intervals in 1966. In 1965 the Western Wolths outyielded "Grasslands Paroa" by 27% and in 1966 by 41%. The levels of production were considerably higher in 1966 than in 1965.

Figure 5 shows the comparison between the Western Wolths and Amuri oats. Production of oats was low in both years, in 1965 owing to severe infection with barley yellow dwarf virus.

Overdrilling into Legume-dominant Swards

Experiments in which "Grasslands 4707" was overdrilled into legume-dominant swards were carried out at Lincoln substation of the Grasslands Division in 1965, on the "Ashley Dene"' light land property of Lincoln College in 1966, and also on a town supply dairy farm on heavy land at Ladbrooks near Lincoln.

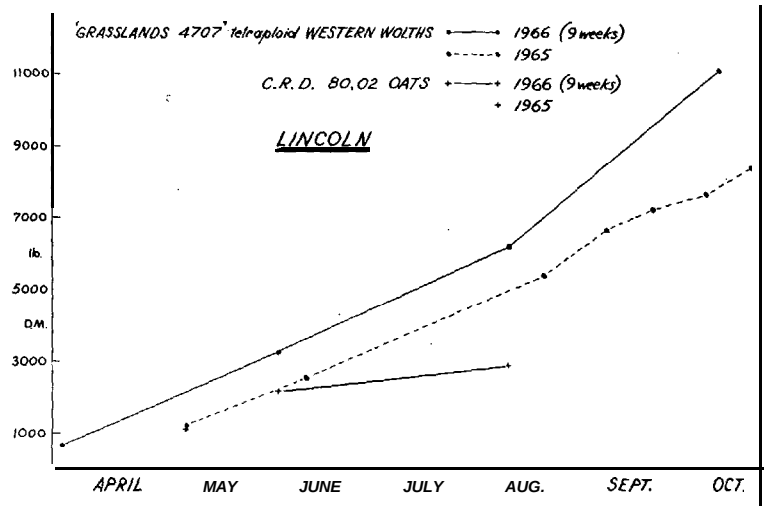

FIG. 5: *Results of comparison trial between Western Wolths and Amuri oats.*

At the substation, "Grasslands 4707" was overdrilled into a white clover-dominant sward which contained a low proportion of "Grasslands Ariki" ryegrass. Under mob stocking with seven grazings, the overdrilled treatment produced 6,800 lb dry matter per acre in the period April to mid-November compared with 3,900 lb dry matter from the existing sward which was grazed five times.

At "Ashley Dene", "Grasslands 4707" was overdrilled into a six-year-old grazing stand of lucerne on February 28 at 30 lb per acre, compared with "Grasslands Paroa" at 20 lb and a mixture of 30 lb "Grasslands 4707" plus a bushel of Amuri oats. One hundredweight per acre of nitrolime and of ,superphosphate was applied. The production at a first cut after 8 weeks and the total production of three cuts up to September 5 are shown in Table 3. At the first cut, the mixture is highly significantly better than Western Wolths (largely from the oat contribution), which is highly significantly better than Paroa. The next two cuts are not shown but the differences were not significant. The total production of the mixture does not differ from the Western Wolths which is greater at the 10% level than Paroa.

At Ladbrooks, "Grasslands 4707", "Grasslands Paroa" and "Grasslands Manawa" ryegrasses were overdrilled into a first-year stand of lucerne at seeding rates of 25, 20 and

I8 lb per acre. Two hundredweight of ammoniated superphosphate was applied. The results are tabulated in Table 4. Whereas "Grasslands 4707" and "Grasslands Manawa" were better than "Grasslands Paroa" on the first cut, "Grasslands 4707" was much better than the other two grasses on the second cut.

Canterbury Farm Trials

An evaluation of "Grasslands 4707" under farm practice, sown on a cultivated seedbed, was obtained in 1966. With the co-operation of officers of the Farm Advisory Division of the Department of Agriculture at Christchurch and at Ashburton, half-acre strips of "Grasslands 4707" were sown on a" number of farms to provide a comparison with their normal greenfeed mixtures. The trials included a wide range of soil types of varying fertility status. Results are presented in Table 5 from a sampling taken in mid-June for comparisons of "Grasslands 4707" and "Grasslands Paroa". "Grasslands 4707" outyielded "Grasslands Paroa" in five out of the six trials though production from both grasses was poor at low fertility.

Gore Substation Mowing Trial

A comparison of "Grasslands 4707" tetraploid Western Wolths and "Grasslands Paroa" Italian ryegrass was sown at Gore on April 6, 1966 and the results for two harvests and for total production to date are shown in Table 6. "Grasslands 4707" was highly significantly better than "Grasslands Paroa" at the first cut, being 22% ahead; "Grasslands 4707" was ahead but not significant on the second cut: "Grasslands 4707" was highly significantly ahead of "Grasslands Paroa" in total production.

Department of Agriculture Trials

Seed of "Grasslands 4707" tetraploid Western Wolths has been released to the Superintendent, Field Research, for field trials in areas where this grass may play a role. Trials have been laid down in the Waikato, Manawatu/Rangitikei, Hawke's Bay, Canterbury and South Canterbury. Results to hand indicate that, in general, "Grasslands 4707" is not a substitute for greenfeed cereals

TABLE 3: COMPARISON TRIAL: "GRASSLANDS PAROA" ITALIAN RYEGRASS, "GRASSLANDS 4707" TETRAPLOID WESTERN WOLTHS RYEGRASS, AND "G. 4707" W. WOLTHS PLUS "AMLJRI OATS", OVERDRILLED ON FEBRUARY 28, 1966, INTO 6-YEAR-OLD LUCERNE
(lb D.M./Acre)

	1st cut, 8 wk	Total of 3 cuts
Paroa	109	1,070
W. Wolths	576	2,100
W. Wolths plus Oats	1,250	2,360
(W. Wolths)	(141)	(1,180)
d.05	337	1,180

TABLE 4: RYEGRASS COMPARISONS: OVERSOWING INTO LUCERNE ON DAIRY FARM AT LADBROOKS
(lb D.M./Acre)

	1st cut, June 30		2nd cut, Aug. 31	
	Grass	Lucerne	Grass	Lucerne
"G. 4707" tetraploid W. Wolths	1,700	600	1,400	300
"G. Paroa" Italian	1,100	1,000	700	600
"G. Manawa" short rotation	1,700	600	600	400

TABLE 5: CANTERBURY FARM TRIALS, 1966: "GRASSLANDS 4707" TETRAPLOID WESTERN WOLTHS AND "GRASSLANDS PAROA" ITALIAN RYEGRASS: RESULTS TO MID-JUNE
(lb D.M./Acre)

	Fertility				
	High		Medium	Low	
W. Wolths	3,400	4,000	2,200	1,300	600
Paroa	2,200	3,200	2,400	500	400

TABLE 6: PLOT MOWING TRIAL: "GRASSLANDS 4707" TETRAPLOID WESTERN WOLTHS AND "GRASSLANDS PAROA" ITALIAN RYEGRASS, CORE (SOWN APRIL 6, 1966)
(lb D.M./Acre)

	W.Wolths	Paroa	S.E. (Plus or Minus)
17-S-66	1,682	1,377	51
21-9-66	1,508	1,405	51
Totals	3,190	2,782	78

insofar as autumn and early winter production is concerned, but has in many cases outyielded Italian ryegrass although this superiority has not shown in all trials, Italian sometimes being equal or better. Surprisingly enough, Dutch "Tewera Barenza" tetraploid has performed better than "Grasslands 4707" in one trial. In more than one trial difficulty was experienced in drilling the large awned seed.

Animal Performance

The quality of "Grasslands 4707" as a feed for cows was compared with "Grasslands Paroa" and "Grasslands Ruanui" ryegrasses in short-term experiments carried out by G. F. Wilson at Massey University during winter and spring of 1966.

The three ryegrasses were fed to groups of six Friesians (autumn calvers) for a period of 3 weeks in the June-July period. Pure stands were used and the objective in management was to ensure that the cows in the different groups were offered pasture at approximately the same stage of growth (9 to 14 in.) and in sufficient quantity to ensure full feeding. This was achieved by providing the cows with a fresh break of grass each day using an electric fence.

A similar management method was used for a further 3-week period in October, using twelve sets of identical twins (spring calvers) in a balanced incomplete block design.

Results available indicated that milk yields produced from the Western Wolths and Italian were similar, but higher than from the perennial ryegrass. The butterfat percentages of the milks in decreasing order were Perennial > Italian > Western Wolths; and the solids-not-fat percentage, Western Wolths = Italian > Perennial.

The low fat percentage from the Western Wolths is unlikely to be economically important to town milk farmers while relatively high solids-not-fat percentages are sought.

It was considered likely that the changes in milk composition obtained may be related to the relatively high soluble carbohydrate content of Western Wolths (Western Wolths 23.5%, Italian 20.6%, Perennial 18.0%).

Evaluation

Results to date indicate that "Grasslands 4707" tetraploid Western Wolths ryegrass is a new variety of distinct promise in districts where its annual habit fits in with farming practice. In Canterbury, in particular, it has been highly productive under both favourable and unfavourable winter conditions and has withstood heavy grazing. It is certainly a probable substitute for Italian ryegrass, and with its clear-cut mid-winter and spring advantage may well be used instead of cereals, especially under highly fertile conditions. Evidence has been presented to indicate its potential when overdrilled into legume-dominant swards on town supply dairy farms, and into grazed lucerne stands on light-land sheep farms. The quality of the grass for dairy purposes is under investigation at Massey University and results to date indicate that it is likely to be particularly valuable for town milk purposes. With its high soluble carbohydrates it may have good quality for weight gain in sheep, and this should be tested. Certain cases of failure of this grass can be attributed to difficulty in drilling the large awned seed, or to sowing too late.

Acknowledgements

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