
PASTURE SPECIES AND MIXTURES FOR THE
AUCKLAND PROVINCE

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The Auckland Province can be divided into two main climatic regions :

- (1) The, Central Plateau
- (2) The Lower and Coastal Regions

The central plateau is characterised by fairly cold winters with severe frost at times, while the lower-lying and coastal regions lying to the north almost fall into the sub-tropical zone. This region, which includes the Waikato Basin, is reasonably suited to the growing of paspalum species and the frost-free areas suit kikuyu, a tropical grass. In parts of the central plateau the soils are so coarse in texture that in some seasons there is not sufficient moisture to support a high-producing sward of grasses and clovers. Here lucerne can, with advantage, replace much of the pasture for hay and for grazing. Apart from such small exceptions, the region is very well suited to the growth of red and white clover, cocksfoot, and ryegrass, provided the fertility is increased to the extent needed to support these pasture plants. Other grasses and clover may grow in association or in place of those generally desirable pasture plants. These include Yorkshire fog, ***Poa pratensis***, ***Poa trivialis***, ***Poa annua***, browntop, sweet vernal among the grasses and ***Lotus major*** (pedunculatus), subterranean clover, and suckling clover among the clovers.

In the lower-lying and northern regions one can add paspalum species, Indian doobj, and kikuyu grass as commonly or occasionally occurring.

The suitability of pasture species for production of meat and dairy produce has been almost entirely determined by noting how well they behave and what grazing they provide. The component of pastures on highly productive farms has been compared with that on less productive farms. Also, pastures on highly productive farms giving the greatest amount of grazing have been compared with those on the same farms giving less grazing. Therefore under our present farm management practices we have determined the pasture species compositions more likely to produce best under such conditions.

Clovers are of course of prime importance and the only clover that will persist and produce in a very high-producing sward is white clover. Therefore our management practices must always

study the well-being of this most valuable plant. For instance, it will not survive under very lax grazing which would be more suitable for several potentially high-producing grass plants which therefore cannot be considered. It appears that the value of any species must be studied in the way its growth harmonises with clover. Thus Yorkshire fog, which tends to form a mat excluding white clover, must not be permitted to do so. It can form a part of the sward, but must not be allowed to dominate it.

Because we must study the well-being of white clover our grazing cannot be too lax and if that suits certain grasses such as ryegrass and not others then we are confined to growing ryegrass and other species which produce better than others as companion plants to white clover.

Within this range we have examined the behaviour of pasture species and have come to place them in order of importance in regard to their potential production. We recognise that ryegrass, cocksfoot, and paspalum are highly productive, but if production goes up to a very high plane then the paspalum and cocksfoot cannot survive, either because their vigour is not high enough or because they cannot withstand the extra treading from stock. In either case they are out.

With this information as a base, we have laid down many observational trials to evaluate behaviour of species under existing farm management on farms throughout the province.

Observation Trials

Many observational trials were laid down in the thirties to demonstrate the value of strain in lines of ryegrass and white clover, showing the marked inferiority of many lines of seed before certification began to sweep them out of existence. There was no doubt about the difference in productive value in terms of yield of pasture and persistence, but the certified perennial ryegrass was criticised on account of its distinct lack of palatability, and recent trials with fat lambs have indicated the prime importance of palatability. This criticism undoubtedly helped to spark off the breeding of hybrid lines of ryegrass of greater palatability. Trials laid down immediately after the war sought to demonstrate the value of the first of these, short-rotation ryegrass, and a study was made also of seeding rates of grasses and clovers in common use on cultivated land.

Seeding rates of 10, 15, 25, and 45 lb of perennial ryegrass were made with 1 lb and 3 lb of white clover, with and without other species. Where conditions for establishment were poor up to 45 lb was needed, but with proper seed bed preparation under suitable climatic conditions, 25 lb produced a satisfactory cover in the first

year of life of the pasture and in the following year and years 15 lb and 10 lb rates were sufficient. Heavy rates of perennial ryegrass prevented the ingress of both desirable and undesirable companion plants. Thus it reduced markedly the establishment of browntop and flat weeds as well as cocksfoot, timothy, and paspalum. The rate of perennial ryegrass sown should be determined on:

1. How important the first winter's growth is to the farmer.
2. How important it is to suppress weed invasion (where optimum rates of fertiliser and lime are applied, this is of less importance).
3. How important it is to have an early, thick establishment of other valuable grasses such as cocksfoot and paspalum.

Because of its much greater palatability and much greater late winter and early spring production, much short-rotation ryegrass should be included if conditions suit it. The trials showed that this grass required a fertile soil moist in summer and yet reasonably well drained in winter and that grazing should not be severe, particularly in the late spring and early summer. They indicated that under ideal conditions it would be advisable to sow half and half of perennial and short-rotation ryegrasses with lower rates of the latter and higher of the former as conditions become more difficult. Probably even more so than perennial, short-rotation ryegrass suppresses the establishment of other species and low rates are advisable where it is important to establish cocksfoot or timothy.

Cocksfoot was sown in the trials at 5, 10, 15, and 20 lb with 15 lb of perennial ryegrass and 2 lb of white clover; and cocksfoot at 10 lb was also sown with 0, 5, 10, 20, and 40 lb rates of perennial ryegrass with 2 lb of white clover. Cocksfoot without ryegrass did not produce a satisfactory sward, because of the slow establishment. However, even with such low rates as 5 lb of perennial ryegrass, its establishment is suppressed. Where the soil is fertile or well topdressed, raising the seeding rates of cocksfoot did little to increase its prevalence in the sward because of the strong early competition of the ryegrass. More than 5 lb of cocksfoot in the mixture is not worth-while except on poor country and/or where the soil dries out. On a moist, fertile soil the, sowing of cocksfoot may not be justified and on an infertile soil reasonably supplied with moisture it is much better to spend money on fertiliser than on increasing rates of cocksfoot seed. With high prices obtaining for cocksfoot seed less than 5 lb is generally advised.

Timothy studied in the same way as cocksfoot gave the same trends; as good an establishment was obtained with 4 lb as with higher rates. However, the establishment was generally so small

that the inclusion of timothy appears not justified except in fairly damp soils or locations with very high rainfall, such as Waihi.

Similar trials with red clover with Italian ryegrass showed that for temporary pasture you should sow 5 or 6 lb of red clover. Higher rates of Italian ryegrass than 3.5 lb unduly suppressed the red clover. Similar results were noted with perennial ryegrass.

The trials established a rate of 2 or 3 lb for white clover and 3 lb of subterranean clover. Lesser rates would ultimately give a good cover by reseeding and stoloniferous growth of the white clover.

From those trials it was concluded that the following mixtures were generally suitable, subject of course to modification to suit special needs. On soils of reasonable fertility for dairying you would sow:

	lb per acre
Perennial ryegrass	20
Short-rotation ryegrass	10
Cocksfoot	5
White clover	2
Red clover	4
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On pastures for sheep and cattle you would sow:

	lb per acre
Perennial ryegrass	25
Short-rotation ryegrass	5
Cocksfoot	5
Crested dogstail	3
White clover	2
Red clover	3
Subterranean clover	3
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Subsequent work by Mr Allo has favoured lower rates and the general acceptance now is for 30 lb mixtures. These on well prepared seed beds sown on time have proved quite satisfactory and on virgin soils of low fertility where there are few weeds of importance and where it is important to have a good initial clover establishment there appears little doubt that low rates of grasses but not of clovers pay off, especially if the extra money is spent on fertiliser. The position, however, changes where weeds such as gorse or browntop are liable to come in and where there is likelihood of bloat. The price of seed has also to be considered, but never to the extent of completely eliminating a useful species.

Sow some of it even if it amounts to ounces per acre instead of pounds. Seeding rates are governed by many factors and no rule of thumb guides can be easily given. Consequently Farm Advisory Officers are frequently consulted on seed mixtures in the Auckland Province.

Mowing Trials

Three trials have been laid down since the war to determine the production in yield of **herbage** from various kinds of pasture under grazing.

One at Whangarei and the subject of a paper by C. E. Ballinger at the Whangarei conference showed that not much difference in production would be expected between a kikuyu grass dominant sward with clovers and a perennial ryegrass-white clover-*Paspalum dilatatum* sward. Kikuyu grass suffers severely from frosts but grows quite well under cool temperatures; in frost-free areas it can be shut up in the autumn to provide winter feed which, incidentally, is less likely to spoil than autumn-saved ryegrass, cocksfoot, and Yorkshire fog. Also, incidentally, it is reported that it is probably a safe feed against facial eczema. *Paspalum*, on the other hand, does not suffer nearly so much from frost, but will not grow under cool temperatures. Kikuyu grass, besides suffering severely from frost, has another disadvantage in that where it grows the land surface is made more moist and more liable to pugging. It appears, therefore, that kikuyu grass should be confined to light sandy soils subject to only light frosts. It is an exceptionally good coloniser of raw sand country. Raw sand is extremely liable to dry out in summer, to such an extent that normally only annual clovers will survive. Colonised by kikuyu and especially if top-dressed, white clover grasses grow well on raw sand because the kikuyu grass has increased the moisture content of the top layer of the sand.

The value of *Paspalum dilatatum* has been examined in a trial at Rukuhia and reported by Karlovsky in the "Journal of Agriculture" for June 1959. This trial was carried out on a fertile, moist meadow soil and showed that under the conditions pertaining to the trial the addition of *paspalum* to the standard perennial ryegrass-short-rotation ryegrass-white clover mixture would increase production of **herbage**. The greatest benefit from the *paspalum* was from summer and early autumn growth and there was little lowering in winter production if the **ryegrass** content of the sward was maintained.

Paspalum will not stand treading to the same extent as ryegrass. As a matter of fact there are few perennial pasture plants that will compete with perennial **ryegrass** in this respect. Hence under very

high fertility and consequently very high carrying capacity and production, paspalum with many other grasses disappears and is replaced by ryegrass. The ultimate sward with extremely high production appears to be willy-nilly a dominant **ryegrass** one. Where paspalum is dominant and there is very little **ryegrass** in the sward, the position can be changed by improving the fertility of the sward, destroying insects which may be attacking the **ryegrass**, and keeping the paspalum well grazed in the summer and autumn. There are far too many paspalum dominant fields in the Auckland Province which reveal by their sickly and yellow appearance in winter the need for their rejuvenation by some means. Farm Advisory Officers are very well equipped to deal with this problem. There is so much paspalum about that the question of its introduction rarely arises. It should be included in new sowings on virgin soils in northern and coastal regions.

Phalaris tuberosa, introduced into the Matamata district about 10 years ago, showed considerable promise on a few farms, giving high winter production apparently comparable with that of **short-rotation ryegrass** and yet not suffering from and being eliminated by dry summers. It has been introduced into pastures in other districts by the Department of Agriculture but on the whole its behaviour has been most erratic. This might have been due in some measure to the idea, probably mistaken, that it should not be grazed for the first nine months. It is slow to establish and cannot compete at all with **ryegrass** in the year of establishment. It can be sown with **clovers** or other slowly establishing grass species such as cocksfoot.

A trial was laid down at Mangateparu just north of Morrinsville in the autumn of 1959 to compare the production of **Phalaris tuberosa**, prairie grass, and ryegrass, all sown with cocksfoot, and white and red clover in three separate and fenced-off portions of one fairly fertile field. The **ryegrass** sown was 12 lb of perennial and 9 lb of short-rotation per acre. The fields were subjected to normal grazing by dairy cattle and measurements were made from cages. The following table shows the production in dry matter from the different seed mixtures in the first two years of the trial.

DRY MATTER YIELDS (lb PER ACRE)				
Year	Season	Rye	Prairie	Phalaris
1959	Winter	2,360	1,150	450
	Spring ----	4,000	3,910	4,390
	Summer	2,700	4,190	3,260
1960	Autumn	1,580	2,120	2,430
1959-60 first year total		<u>10,640</u>	<u>11,370</u>	<u>10,530</u>

DRY MATTER YIELDS (lb PER ACRE)-Continued						
	Winter	1,450	1,430	2,100
	Spring		4,810	4,430	4,940
1961	Summer			2,990	2,450	2,900
	Autumn		—	2,330	2,740	2,300
	1960-61 second year	total		11,580	11,050	12,240

The Prairie Grass Field-Despite a fairly high production of eleven or twelve thousand pounds of dry matter, the fertility has not been sufficiently high for the well-being of prairie grass, which has not been very happy and has produced only about a quarter of the total production despite a quite reasonable establishment of plant numbers. Prairie grass was dominant in the first spring, but the running was taken over in the summer by red clover followed by cocksfoot in the next year. Volunteer ryegrass is now taking up the running and the sward is now a ryegrass-cocksfoot-prairie grass one and unless the fertility is markedly improved it will soon have about the same composition as the ryegrass field.

The Ryegrass Field-In the first winter this greatly outproduced and other two fields. At present the sward appears virile and promising. The farmer wintered his herd on the ryegrass field in 1960 and on the phalaris field in 1961, and the ryegrass field appears to have stood up to this treatment better than the phalaris field. Besides, white clover appears to knit in better with the ryegrass-cocksfoot mixture than with the phalaris-cocksfoot combination. The ryegrass field was clover dominant in the summer and ryegrass dominant at all other times.

The Phalaris Field-As is commonly experienced, the production was very poor in the first winter because of the absence of ryegrass. Thereafter production has been on the **whole** ahead of the other two fields, but recently little difference has been apparent. The real test will be how the field recovers from the recent hard stocking received last winter. In the last year the field was phalaris dominant in the autumn, winter, and spring and cocksfoot dominant in the summer. Under lax grazing or no grazing at all **Phalaris tuberosa** is a very vigorous grass growing taller than tall fescue and easily smothering it out on roadsides and waste places. It can be used to combat tall fescue under grazing.

General Conclusions-The fertility level of the field was not high enough to test the value of prairie grass, which may yet shine if the fertility of the field can be improved sufficiently. It would appear that fertility of a level to produce eleven or twelve thousand pounds of dry matter in this district is not high enough for prairie grass. **Phalaris tuberosa** has demonstrated its potentiality to produce about as well as ryegrass, but the test will be whether

it can recover from winter treading as well as ryegrass. It has been situated at the more fertile end of the original field and this advantage may or may not be offset by the present plan to topdress the whole area with extremely heavy rates of fertiliser.

All in all I should say there is not much advantage to be gained by making changes in our normal mixtures of ryegrass, cocksfoot, and red and white clover, for fairly fertile cultivated ground.

Swamp Pastures

So far this paper has dealt with pastures of cultivated land, generally well drained and with a reasonable supply of moisture. Some of our land lies wet in the winter and there are areas alongside rivers and streams that flood every winter and yet dry out sufficiently in summer to support grazing animals. Little attempt has been made to colonise such areas with grasses such as ***Glyceria maxima***, ***Phalaris arundinacea***, or ***Paspalum distichum***, despite the fact that many such areas are difficult and uneconomical to drain. In fact it might perhaps be said that if the money and time spent in draining such areas had been expended much more widely on establishing swamp grasses, we would be better off. These grasses are capable of high carrying capacity in summer on fertile soils. They will not grow on poor soils or on acid peat swamps; they thrive best on alluvial soils.

Glyceria maxima (commonly called ***Poa aquatica***) begins growth very early in the spring and often gets away towards an unpalatable stage before the water level is low enough for the swamp to support grazing animals. If the water in such swamps could be controlled and the areas dewatered earlier, it would provide feed of good quality and for much longer than it normally does. ***Paspalum distichum*** being sub-tropical does not begin growth until about November. There used to be hundreds of acres of this grass in the lower reaches of the Waikato River, but it has almost disappeared from there because it has been drowned out by summer flooding that has occurred since the silting up of the bed of the river. In its heyday, because it could be stocked with sufficient numbers of sheep and cattle at an early stage of growth and therefore could more easily be kept at a young, palatable stage, it achieved a better reputation as a fodder than ***Glyceria maxima***. It was used at times for finishing off lambs. It does not matter how deep the water is in winter, the ***Paspalum distichum*** will thrive, but it must get its head above water in the summer, which is its growing period. The ***Glyceria maxima***, being much taller, will survive a considerable amount of summer flooding, but the depth of water in winter limits its range. ***Phalaris arundinacea***

will withstand winter floods up to the height of fences. It has a reputation for better palatability than *Glyceria maxima* and *Paspalum distichum*. This is probably only partly due to the areas it invades being dewatered earlier. Only a few acres of it remained a few years ago on the Waikato flood plain. There have never been large areas of *Glyceria fluitans* in the Auckland Province, because this grass is not vigorous enough to withstand the competition of the three swamp grasses already mentioned.

Glyceria fluitans is very palatable, but not highly productive when compared with other swamp grasses. Its production has been fortuitously compared with that of a normal dryland sward of ryegrass, white clover, and other species on the Hauraki Plains. This was a drainage trial where the wet, poorly drained area comprising much *Glyceria fluitans* out-produced in winter the area drained thoroughly with tiles and moles. Unfortunately the wet area was not poorly enough drained to show to advantage in the summer. Unfortunately there is no companion legume plant that can be used to accompany these swamp grasses and so they can only exploit existing fertility and are useful only in fertile soils. If the water level of the swamp could be controlled, they could be better utilised at right stages of growth.

Paspalum distichum and *Glyceria maxima* form rafts so that cattle can invade swamps without much fear of becoming bogged. They probably accumulate soil and gradually raise the level of swamps.

Pastures for Sea Mud

On the seashore spartina grass serves a like purpose to that of the swamp grasses. Our seashore climate seems to be too mild for *Spartina townsendii* and another species, *S. alterniflora*, recently introduced by the Department of Agriculture from America, is growing much faster and providing much more winter growth. These species should colonise our sea mud and help to reclaim them, in the meantime providing fodder for stock.

Wet Land Pastures

In between the extremes of dry ploughable land and winter flooded land and sea mud covered by the tides there do not appear to be any worthwhile plant associations that can be used. You do not see worthwhile pastures of meadow foxtail, and better drainage to suit such areas for growth of dry land species seems the best plan.

Hill Country

At the other end of the scale lies our hill country where there are scrub areas which can be cut, burnt, and sown to pasture with mixtures such as:

	lb per acre
Perennial ryegrass ...	10
White clover	2
Subterranean clover	3
Lotus major (<i>pedunculatus</i>)	½
Crested dogstail	2
Cocksfoot	2
	19½

Browntop should be included at 2 lb if the area is not going to be well treated with fertiliser. Hill country pastures should be **oversown** with white clover, subterranean clover, and *Lotus major* where no clovers are present. The rates sown should be about the same as mentioned for the bum, but some farmers adopt a practice, which is quite a good one, of sowing a few ounces every year until the species are well established. The introduction of better grass species awaits more work on chemical ploughing. Their introduction is very difficult without some such aid, as many trials with oversowing on hill country have indicated. It is possible, however, that introduction of grasses could be made satisfactorily by concentrating all available stock on a small paddock to eat out all growth to ground level, apply the seed, and continue to concentrate the stock to tramp the seed into the bare ground. Stock should then be removed until the new species establish. In all such establishments insect attack should be guarded against.

DISCUSSION

- Q. (E. Madden): Has any consideration been given to the introduction of some of the sub-tropical grasses for trial on the difficult hill country.
- A. Kikuyu has been tried. There was a place for this grass in the hill country, but not on the wet flats. Mr Halliwell has tried some further sub-tropical grasses at Kaitaia.
- Q. (G. Jensen): Has Kikuyu grass production been compared with Italian ryegrass in the Bay of Plenty district?
- A. There is a definite place for Kikuyu grass on the sandy soils in this area but it should be confined to this soil type.
- Q. (Clarke): Mr Bell has mentioned cocksfoot in his paper, was this the old type of cocksfoot or was it the new Grasslands Strain.
- A. The cocksfoot referred to was the old type. On the Central plateau up to 5 lb of cocksfoot, depending on price, would be advocated in all seed mixtures, but cocksfoot will not stand the treading or close grazing that ryegrass will.