THE ESTABLISHMENT AND YIELD OF PASPALUM IN NORTHLAND

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ABSTRACT

In small-plot trials, paspalum (*Paspalum dilatatum*) seed did not establish when broadcast onto temperate species pastures and required de-vegetation, either chemically or by cultivation, to encourage seed establishment. Optimum seeding rates (of 5-6 kg/ha) and sowing dates (about October) were indicated. Paspalum dry matter yield in pure and mixed swards with ryegrass and white clover was evaluated in 2 years. The presence of paspalum in mixed swards increased total DM yield in 1 year which had a dry summer and not in the other year. In the dry year, the yield of the pure paspalum sward exceeded the yield of the mixed sward with or without paspalum. Details of sward components are presented. It is suggested that, in Northland, paspalum should be a specialist forage species rather than be sown in mixed pastures.

Additional Key Words: mixed pasture, growth pattern, forage

INTRODUCTION

Paspalum (*Paspalum dilatatum*) was considered a desirable pasture component for Northland (Arnold, 1953) but its presence declined during the 1960's and 1970's (Percival, 1977). Pastures in the region are now predominantly composed of temperate grasses with the only significant sub-tropical species being kikuyu grass (Percival, 1978). Possible causes of the loss of paspalum include competition from ryegrass induced by changes in grazing management and fertiliser use (Percival and McClintock, 1982), black beetle attack (Watson and Wrenn, 1979) and over-grazing during the summer droughts of the early 1970's (Reynolds and Langton, 1973). Such effects can be minimised by appropriate management and recently there has been interest by pastoral farmers in re-establishing paspalum. This interest has been influenced by the release of a locally improved selection of paspalum ('Grasslands Raki' — Percival and Couchman, 1979; Percival *et al.*, 1979) and a requirement for high quality herbage for feeding dairy cattle during late spring and summer (Coup and Dunlop, 1951). Summer pasture production by paspalum-based pastures is higher than ryegrass-based pasture (Lambert, 1967; Lambert *et al.*, 1979) and high levels of dairy production have been achieved on paspalum-based pastures in the Waikato (Bryant and Parker, 1971).

There was a lack of information on the growth pattern of paspalum in pure and mixed swards to assist consideration by farmers of the role for paspalum in the Northland pastoral scene. The seasonal influence of paspalum on the growth of other sward components was unclear. Recent evidence (Lambert *et al.*, 1979; Rumball and Boyd, 1980; Percival and McClintock, 1982) suggests that the extra management skill required to maintain paspalum as a significant summer growing component in otherwise temperate pastures may not be repaid by extra production. Also it was not known whether paspalum could be introduced into temperate species swards with minimum impact on total pasture yield and related animal production. Previous observers (Cockayne, 1918; Levy, 1926; Hamblyn, 1936; Allo, 1952) recommended establishment methods which were both expensive and involved loss of herbage yield for up to 9 months; i.e. cultivation in spring to establish paspalum, minimal summer grazing, and autumn establishment of temperate species. This paper reports small-plot investigations on establishment methods, seasonal growth patterns and annual yields of paspalum in pure and mixed swards.

MATERIALS AND METHODS

The trials were conducted at the Otakanini Research Area (Piggot *et al.*, 1978) using sites free of resident paspalum and all trials were laid out in randomised block designs.

Establishment

Effect of cultivation: A factorial (2 x 2 x 3) design in 4 replicates of either a rotary-hoed or non-cultivated seedbed x drilling or broadcast sowing x 3 seeding rates (1, 5, 10 kg/ha) was laid down on 24 October, 1975 in 1.5 x 10 m plots on bare ground. Plant counts were taken on 9 December 1975, 20 January 1976, and 1 February 1977 using 4 x 0.09 m^2 quadrats per plot. The site was occasionally and lightly grazed by sheep when necessary during 1976.

Seeding rates: Eight seeding rates (0, and 0.25 to 16 kg/ha in geometric progression) were laid out in 1 m^2 plots in 8 replicates and oversown in March and November (1977) onto either grazed pasture (4 replicates) or bare ground (4 replicates).

Time of sowing: On 5 sowing dates, paspalum was oversown on 1 m^2 plots at 8 kg/ha. Six replicates of cultivar G15 or 'Grassland Raki' (Percival *et al.*, 1979) were

sown on ground created by spraying with paraquat 1 month prior to each sowing.

In seeding rate and sowing date trials, a lawnmower was used to trim each site and plants counts were conducted using one 0.09 m^2 quadrat per plot.

DM Production

Plots (2 x 3 m) were laid out, with surrounding buffers of 50 cm, in 4 replicates of 5 treatments. Swards were two pure paspalumn lines or mixed (G 15 and an unnamed commerical line ex. Australia) or each mixed with ryegrass and white clover with the fifth treatment being a mixed ryegrass-white clover sward without paspalum. Both paspalum lines were oversown onto cultivated land on 25 October 1975. The mixed sward plots were oversown with ryegrass and white clover on 20 April 1976 and vigorously raked; each replicate being oversown with 1 ryegrass-white clover combination of 'Grasslands Nui' or 'Ruanui' ryegrass, and 'Huia' or 'Pitau' white clover. Nitrogen at 25 kg/ha as nitrolime and ethoprophos for black beetle control were applied at the start of each season. Phosphorus (50 kg/ha) and potassium (30 kg/ha) were applied annually as potassic superphosphate. The pure paspalum plots were weeded when necessary by spraying bromacil or simazine. The paspalum swards were trimmed to a standard height of 3 cm using a rotary lawnmower twice over summer 1975-76 and all plots were trimmed on 25 August 1976 prior to starting yield cuts. Plots were cut for yield at the end of each season or when paspalum reached 15 cm in summer and autumn and when ryegrass reached 10 cm during the other seasons in 1976-77. In 1977-78, the plots were cut on or about the same date as for the previous year. The pure paspalum plots were not cut during winter in both years because of poor growth.

RESULTS

Establishment

The advantage to cultivation where seed was oversown is shown in Fig. 1, which gives the mean of the 3 assessment dates since the results of plant counts were virtually identical at each date. On the non-cultivated bare ground, both drilling (D-NC) and oversowing (B-NC) gave similar results establishing about half the plants of the cultivated and broadcast treatment (B-C). Seed drilled into cultivated ground (D-C) established fewest plants at any seeding rate.

No seed established in the non-sprayed pasture of the seeding rate trial. For the bare ground plots, a curve was formed by fitting a general linear model relating the log of plant counts to the rate of seed and assuming a Poison error because some plots had zero plants at the lower seeding rate treatments. Response curves for a selection of seeding rates tested indicate a marked fall off in the efficiency of establishment at the higher seeding rates particularly for the autumn sowing (Fig. 2).

With the sowing date trial, the results were analysed similarly to the seeding rate trial and establishment was best for the October sowing (Table 1). Seedlings were only observed on plots from early November onwards indicating that at least a proportion of the autumn and winter-sown seed withstood over-wintering and still remained viable.

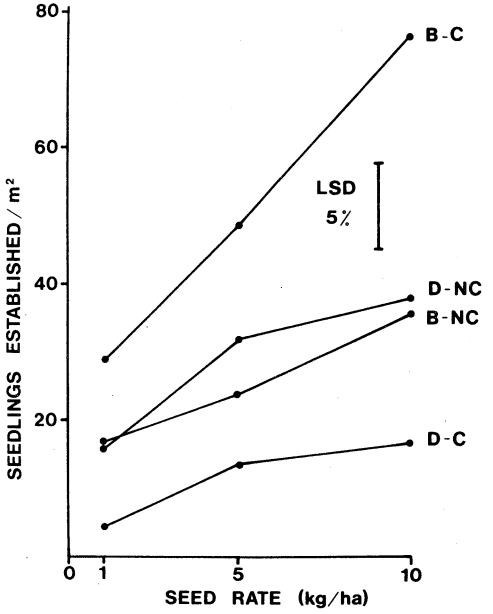

Figure 1: Paspalum seedling establishment following drilling (D) or broadcasting (B) onto a cultivated (C) or non-cultivated (NC) seedbed; as the mean of 3 assessment dates.

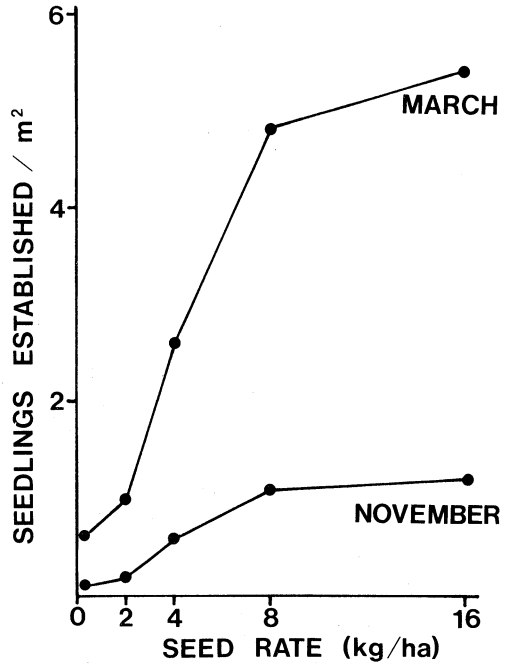

Figure 2: Seedlings established following oversowing at seeding rates from 0.25 to 16 kg/ha in 2 months.

TABLE 1: Paspalum seedlings established after over-sowing in 5 months in 1977.

Sowing date	Seedlings/m²
March	2.1
May	0.3
August	2.2
October	6.7
November	4.6
S.E.	0.6

DM Production

The growth pattern of the 3 sward types meaned over both years is displayed in Fig. 3. The presence of paspalum resulted in high growth rates in summer but the ryegrass-white clover treatment was superior from April to November. In 1976-77, the mixed swards without paspalum outyielded those with paspalum while in 1977-78 this difference was reversed (Table 2). Also, the pure paspalum sward yielded as well as the mixed sward with paspalum in 1977-78, while, in 1976-77, it was 75% of both mixed sward yields. Changes occurred in sward composition between years as other species, particularly Yorkshire Fog, progressively invaded the trial. There was a small significant ($P<0.05$) advantage to the 'commercial' line of 3% in mixed swards and 8% in pure swards meaned over the trial. There was also an effect of companion ryegrass or white clover cultivar on paspalum yield in the mixed swards (Table 3). Both 'Nui' and 'Pitau' presence resulted in significantly less paspalum production in spring, and 'Nui' reduced production in summer.

TABLE 2: Annual DM production (t/ha) and species composition (%) for mixed swards with or without paspalum. Differing lettering indicating significant differences ($P<0.05$) is comparable within years only.

	DM	Species			
		Pasp.	Ryegrass	Clover	Other
1976-77					
Pure paspalum	9.4 c	93	0	6	1
Mixed + paspalum	12.3 b	42	32	24	2
Mixed – paspalum	12.6 a	0	69	28	3
S.E.	0.2				
1977-78					
Pure paspalum	10.3 a	98	0	1	1
Mixed + paspalum	10.1 a	52	24	6	18
Mixed – paspalum	8.3 b	0	50	19	31
S.E.	0.3				

TABLE 3: Effect of companion ryegrass or white clover variety on paspalum (t DM/ha)

	Paspalum yield			
	Spring	Summer	Autumn	S-S-A Total
Nui	1.00	2.53	0.57	4.10
Ruanui	1.24	3.32	0.68	5.24
	*	**	NS	**
Pitau	1.00	2.48	0.60	4.08
Huia	1.25	2.69	0.65	5.25
	*	NS	NS	**

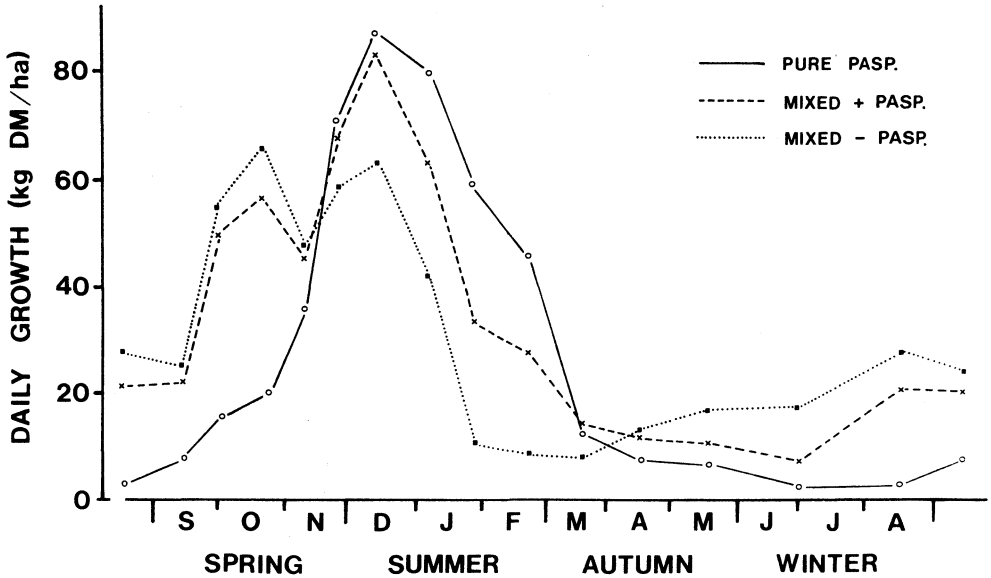

Figure 3: Seasonal pattern or growth of pure paspalum swards, and ryegrass-white clover swards with or without paspalum meaned over two years. (Average C.V. = 9%).

DISCUSSION

The presence of paspalum in ryegrass-white clover pastures influenced the production of the temperate components principally by seasonal effects on species competition (Harris and Lazenby, 1974). Conversely, the more competitive ryegrass (Nui) and white clover (Pitau) depressed paspalum production. The presence of paspalum did not improve total DM production in the climatically normal year (1976-77), at a total annual production similar to the long term pasture yield expectation for ryegrass-white clover pasture at this site (12.76 t DM/ha — Piggot *et al.,* 1978). In 1977-78, the presence of paspalum in the mixed sward provided a yield advantage and the effect was mainly caused by the dry period from January to March 1978 providing a pronounced depression in ryegrass yield. The mowing management and ingress of Yorkshire Fog also probably disadvantaged ryegrass in this trial (Lambert, 1967). While trials in the Waikato have supported the encouragement of paspalum into ryegrass-white clover pastures (Karlovsky, 1959; Baars *et al.,* 1976), the results from Table 2 and species comparisons of Lambert (1967) and Percival *et al.* (1979) do not suggest such a conclusive advantage to including paspalum in mixed pastures in Northland during climatically normal years.

The presence of paspalum in mixed pasture clearly increased the summer and autumn production which would be of some value in pastoral farming. However, the most critical feed shortage period in pastoral farming in Northland is usually during August and September when low pasture growth rates coincide with the high animal requirements of early lactation in dairying and sheep farming. In this trial, the presence of paspalum suppressed total DM yield of mixed pastures during this period. The yield of the mixed swards with paspalum during August and September of both years averaged 2,150 kg DM/ha and this was 16% less than the yield for the mixed swards without paspalum. This difference was statistically highly significant ($P<0.01$) and the same effect is indicated from 'winter' yields of other trials (Karlovsky, 1959; Lambert, 1967; Harris and Lazenby, 1974; Baars *et al.,* 1976; Percival *et al.,* 1979). Animal production from dairying or lamb production could be less if paspalum was present in ryegrass-white clover pastures. Also, the grazing management needed to maintain paspalum presence, such as hard grazing during September and October (Baars *et al.,* 1979; Percival and McClintock, 1982) is contrary to current dairy or sheep farming practice. Therefore it is doubtful whether a policy of deliberately maintaining paspalum in ryegrass-white clover pasture is justified in conventional grazing systems in Northland because the loss of spring feed is of greater significance than any gain in summer feed quantity or quality.

Paspalum should perhaps be used as a specialist perennial forage species since the total DM production of the pure sward compared favourably with the mixed swards in this trial (Table 2, Fig. 3). Such a role would involve growing paspalum on a small proportion of the farm and grazing regularly in summer to minimise seedhead production and to prevent the sward becoming sod-bound. The seasonal spread of production could possibly be improved by overdrilling an annual winter-active species as occurs in Australia (Murtagh, 1971). To a degree the paspalum-*Poa* association of the high producing Number 5 Dairy farm at Ruakura (Bryant and Parker, 1971) is exploiting the complementary growth of such distinctly seasonal species.

The establishment of paspalum in pure swards would not present the problems that introduction into mixed swards would incur. It appears from this work that the introduction of paspalum into mixed temperate swards with minimal disturbance will not be successful unless radical or long-term methods are used; e.g. seeding through dung dispersal (Levy, 1926; Allo, 1952). To establish a pure sward, seed at 5-8 kg/ha could be broadcast onto cultivated ground or drilled into chemically de-vegetated land in mid-late spring. The advantages of surface sowing probably relates to the small, light nature of the seed; the effect is noted with other small grass seeds (Cullen, 1966). For direct drilling establishment, residual herbicides would probably be required in addition to the initial de-vegetation but paspalum seedlings are tolerant of a range of effective residual herbicides (Evers, 1981).

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REFERENCES

Allo, A.V. 1952. Paspalum in Bay of Plenty district. *N.Z. Journal of Agriculture 85:* 58-59.

Arnold, E.H. 1953. Some sub-tropical and other grasses in Northland. *Proceedings N.Z. Grasslands Association 15:* 79-89.

Baars, J.A., Douglas, J.A., Thomsen, E.J. 1976. An evaluation of 'Grasslands Nui' perennial ryegrass in the Waikato. *Proceedings Ruakura Farmers Conference Week:* 62-64.

Baars, J.A., Percival, N.S., Goold, G.J., Weeda, W.C. 1979. The use of grazing pressure to manipulate the balance of paspalum/ryegrass based pasture. *Proceedings N.Z. Grassland Association 41:* 89-95.

Bryant, A.M., Parker, O.F. 1971. Optimum grazing interval at high stocking rate. *Proceedings Ruakura Farmers Conference Week:* 110-120.

Cockayne, A.H. 1918. Paspalum in New Zealand. *N.Z. Journal of Agriculture 16:* 87-91.

Coup, M.R., Dunlop, A.A. 1951. Digestibility trials with *Paspalum dilatatum. N.Z. Journal of Science and Technology 33A:* 1-16.

Cullen, N.A. 1966. Invermay trials show importance of competition between pasture species. *N.Z. Journal of Agriculture 112 (2):* 31-32.

Evers, G.W. 1981. Herbicidal enhancement of Dallisgrass establishment. *Agronomy Journal 73:* 347-349.

Hamblyn, C.J. 1936. Paspalum as a pasture grass. *Proceedings N.Z. Grassland Association 5:* 59-66.

Harris, W., Lazenby, A. 1974. Competitive interactions of grasses with contrasting temperature responses and water stress tolerances. *Australian Journal of Agricultural Research 25:* 227-246.

Karlovsky, J. 1959. Place of paspalum in Waikato pastures. *N.Z. Journal of Agriculture 98:* 574.

Lambert, J.P. 1967. Pasture species for Northland. *Proceedings N.Z. Grassland Association 29:* 78-87.

Lambert, J.P., Rumball, P.J., Boyd, A.F. 1979. Comparison of ryegrass-white clover pastures with and without paspalum and kikuyu grass. 1. Pasture production. *N.Z. Journal of Experimental Agriculture 7:* 295-302

Levy, E.B. 1926. The grasslands of New Zealand. Series 2. North Island hill country. Grasses and clovers for hill country — continued. 5. Paspalum. *N.Z. Journal of Agriculture 33:* 361-378.

Murtagh, G.J. 1971. Chemical seedbed preparation and the efficiency of nitrogen utilization by sod-sown oats. 1. Comparison of seedbeds. *Australian Journal of Experimental Agriculture and Animal Husbandry 11:* 299-312.

Percival, N.S. 1977. Survey of paspalum in New Zealand pastures. *N.Z. Journal of Experimental Agriculture 5:* 219-226.

Percival, N.S. 1978. Survey of kikuyu grass (*Pennisetum clandestinum* Hochst.) in New Zealand pastures. *N.Z. Journal of Experimental Agriculture 6:* 19-21.

Percival, N.S., Couchman, J.N. 1979. Evaluation of paspalum (*Paspalum dilatatum* Poir) selections. 1. Variation among populations. *N.Z. Journal of Experimental Agriculture 7:* 59-64.

Percival, N.S., Lambert, J.P., Christie, A.R.J., McClintock, M.B. 1979. Evaluation of paspalum (*Paspalum dilatatum* Poir) selections. 2. Productivity under grazing. *N.Z. Journal of Experimental Agriculture 7:* 65-69.

Percival, N.S., McClintock, M.B. 1982. Role of grazing management in manipulating the balance of ryegrass and paspalum in pastures. *N.Z. Journal of Experimental Agriculture 10:* 365-370.

Piggot, G.J., Baars, J.A.,, Cumberland, G.L.B., Honore, E.N. 1978. Seasonal distribution of pasture production in New Zealand. 13. South Kaipara, Northland. *N.Z. Journal of Experimental Agriculture 6:* 43-46.

Reynolds, D.G., Langton, A.C.F. 1973. Black beetle and crickets in Northland. *Proceedings 26th N.Z. Weed and Pest Control Conference:* 182-183.

Rumball, P.J., Boyd, A.F. 1980. Comparison of ryegrass-white clover pastures with and without paspalum and kikuyu grass. 2. Sheep production. *N.Z. Journal of Experimental Agriculture 8:* 21-26.

Watson, R.N., Wrenn, N.R. 1979. An association between *Paspalum dilatatum* and black beetle in pasture. *Proceedings N.Z. Grassland Association 41:* 96-103.