Northland Pastoral Extension:

Research Stocktake

NORTHLAND NATURALLY
FIRST REGION OF NEW ZEALAND

Sustainable Farming Fund

Sub Tropical Pasture Species

Contents

1.0 Comparison of ryegrass, paspalum and kikuyu pastures

Part 1: Pasture Production

Reference:

Comparison of ryegrass – white clover pastures with and without paspalum and kikuyu grass.

NZ Journal of Experimental Agriculture Vol 7, September 1979, Pages 295-302.

Author: JP Lambert, PJ Rumball and AF Boyd, Kaikohe

Overview:

Production and composition of 3 pasture types were measured under intensive sheep grazing for 7 years. This research stocktake (Pastures 1) covers the pasture production. Pastures 2 stocktake outlines the sheep production.

Trail Method:

- Trial located at Grasslands Station, Kaikohe on a gumland soil.
- Pastures were developed out of manuka during the 2 year period prior to the trial starting.

  Kikuyu was planted as stolons in October 1965.

  Paspalum was broadcast at 11 kg/ha in November 1965.

  In March 1967, Ariki ryegrass at 10kg/ha and Huia white clover at 1.9 kg/ha were drilled into the established paspalum and kikuyu areas plus into the remaining unsown area.
- Overall stocking rate in the first 4 years was 17.6 ewes/ha. Any feed surplus was harvested and then fed out later.
- Period 2, lasting 3 years, had a stocking rate at 19.8 ewes/ha and had no conservation of feed.
- Pasture measurements in Period 2 (last 3 years) were undertaken slightly differently than in Period 1, which gave slightly different results. Period 2 was a rate of growth method.

Results:

Pasture Growth:

- The range in annual pasture yield was small: the lowest was 9.0 tonne of DM/ha/year up to 12.5 tonne DM/ha/year.

  Average Seasonal and Annual DM Yield of the 3 Pasture Types for Period 2 (1973-1976)

	kgDM/ha			
	Ryegrass	*Paspalum*	*Kikuyu*	*Kikuyu Yield as % of Ryegrass Yield*
Winter	2490	2482	1975	79
Spring	4278	4478	3258	76
Summer	2751	2791	2979	108
Autumn	2811	2849	3143	112
Year	12330	12600	11355	92

- During the first 4 years, annual and summer yields of Rye pasture were lower than Paspalum (by 6% and 13% respectively).

  Paspalum and kikuyu pastures had similar average annual yields but kikuyu was more productive in autumn and winter but less productive in spring (by 6%).

- During period 2 (years 4 and 7) annual and seasonal growth of Rye and paspalum were similar and out produced kikuyu by 10%. Kikuyu pasture produced less than the Rye pastures in winter and spring (at just 78% of the production of the ryegrass) but produced more in the summer and autumn (at 110%).

Composition of the Pastures:

- Paspalum contribution to production was very low at 11% of the annual production in Period 1, decreasing to 6% of annual production in Period 2.

- Other grass species were very important contributors to annual yields, making up to 40 and 45% of total yearly production in Paspalum and Ryegrass respectively.

  These other species were Sweet vernal, poa trivialis, Yorkshire fog and brown top. In Period 2, poa annua became predominant.

- Rye Pasture

  Composition of Pastures By Year:

	Year 1		**Year 4**	**Year 7**	**Year 7**
	t DM/ha	*%*	*t DM/ha*	*t DM/ha*	*%*
Clover	6.0	52	3.0	3.9	35
Ryegrass	3.5	30	3.5	1.9	17
Other grass	2.0	18	5.0	5.5	48
Total	11.5		11.5	11.3	

Points regarding Rye pasture Composition:

- Clover dropped from a very high component in the first 2 years development stage, but still contributed a relatively high 35% of total dry matter in Year 7.
- Ryegrass contribution was highest at 6.5 tonnes of DM/ha/year in Year 3 (at 50%) but had dropped to just 17% of the annual production in Year 7 (Ariki is a hybrid ryegrass as opposed to a true perennial ryegrass).
- Other grasses were making up around 50% of the full annual yield for years 5 to 7.

- Paspalum Pasture: results were very similar to Rye pasture.

- Kikuyu Pasture Composition

	Year 1		*Year 4*	*Year 7*	
	t DM/ha	*%*	*t DM/ha*	*t DM/ha*	*%*
Clover	3.8	31	2.0	1.8	20
Ryegrass	4.3	35	2.0	0.9	10
Kikuyu	3.1	25	3.5	4.8	53
Other grass	1.1	10	3.5	1.5	17
Total	12.3		11.0	9.0	

Points regarding kikuyu Pasture Composition:

- Clover generally contributed just half of its amount of dry matter under kikuyu, compared to under Rye pasture. It was at 20% of the pasture in year 7.
- Ryegrass declined from 35% in year 1 to just 10% in year 7.
- Kikuyu increased from 25% in year 1 up to 53% in year 7.
- Other grasses although making up 17% of total yield in year 7, were at a far lower level than in ryegrass.

Effect of Paspalum:

- Although sown 16 months prior to and being well established at the start of the trial, it contributed only 10% of the annual dry matter yield during the first 4 years. It did increase summer and autumn production by 12% with no decrease in production in other seasons.

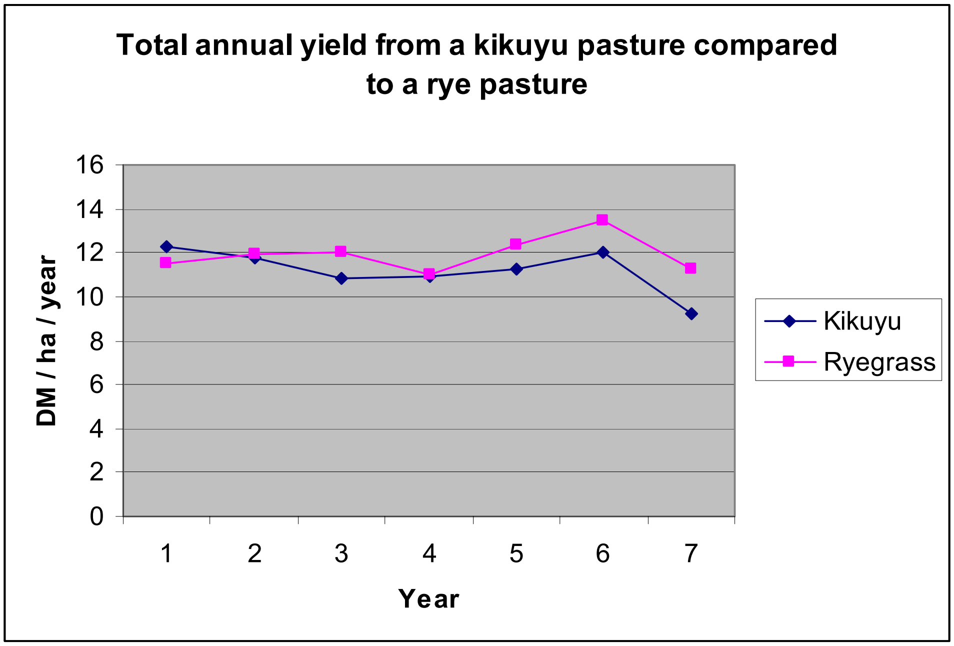
- Pastures containing paspalum also had the least variation in yield between years:

    - Major cause of poor paspalum production was due to lack of soil moisture over the summer due to restricted root depth (gumland soil). Other contributing factors could have been the very competitive white clover putting strain on the paspalum in early summer. Also, intensive grazing by sheep at a high to very high stocking rate would have put pressure on paspalum.
    - Other trial work has shown paspalum to contribute very high amounts of pasture to annual yields. On more favourable soils; Kaipara clay, paspalum provided 39% of a 12 year average annual yield of 17,160 kgDM/ha.

Effect of Kikuyu:

- Kikuyu established more rapidly than did paspalum and was considerably more aggressive towards all associated pasture species. Kikuyu rose from 20-25% of pasture in the first 2 years, to 53% in year 7.
- In the presence of kikuyu, both white clover and ryegrass produced less.
- The total annual yield from kikuyu pastures dropped away over time.

Year	*Yield of Kikuyu pasture relative to rye pastures - %*
1	+7
2	-1
5	-9
7	-19



Over the first 2 years there was a good balance of cool and warm seasons growing species.

Part of the reason for the falling production of kikuyu relative to other pastures may have been the severe suppression of white clover which would have caused much lower nitrogen fixation. White clover in year 2, produced almost 2,000 kgDM/ha/year in kikuyu compared to 4,000 in Rye and Paspalum.

The rapid increase in kikuyu in Year 4 to 7 followed the stopping of forage harvesting or rotary slashing of kikuyu, which prior to year 4 had restricted the build up of a mat of kikuyu stolon.

- Previous trials in this area had shown annual dry matter yield advantages to kikuyu, over ryegrass, varying between +2% to +42%. The +2% result was from mowing trials while +42% was under grazing and also with a higher soil fertility status.

- Measurements of pastures by cutting for estimating herbage available to stock, while accurate for ryegrass, are considerable less accurate with kikuyu.

2.0 Sheep production comparison of rye, paspalum and kikuyu pastures

Part 2: Sheep Production

Reference:

Comparison of ryegrass – white clover pastures with and without paspalum and kikuyu grass.

NZ Journal of Experimental Agriculture Vol 8, 1980, pages 21-26.

Author: PJ Rumball and AF Boyd, Kaikohe

Overview:

- Sheep production for the last 3 years of the 7 year trial, is discussed. This follows on from Stocktake Pastures 1 being the pasture production data for this trial.
- Sheep production differences were measured on the 3 pasture types.

Trial Method:

There were 2 sheep systems adopted:

- Ewe system with ewes stocked at 19.8 ewes/ha. Grazing management was set stocking at lambing, rotational grazing with daily shifts the balance of the year, with 10 day rotation in spring and 60 day rotation in late winter.
- Hogget system with variable numbers: a put-and-take system according to growth of pasture. Target growth rates were 60 gms/day which to ensure growth rates were not above this, required high pasture utilization.

Results:

- Ewe production:

  Lambs reared (post docking) per ewe carried ranged from 117 to 150%. Ewe weights varied slightly, between pasture types:

	Ewe Weights – kg/head		
	Lambing	*December*	*April*
Rye Pasture	55	50	49
Paspalum Pasture	54	49	50
Kikuyu Pasture	52	47	53

  Ewe weights dropped away the most from lambing, under kikuyu, but they also increased the most from December to April on kikuyu.

  Wool production was lowest from kikuyu pastures.

	Kg greasy fleece weight/ewe		
	Ryegrass	*Paspalum*	*Kikuyu*
Spring shear	2.03	1.89	1.71
Autumn shear	1.90	1.97	1.91
Total for year	3.97	3.86	3.62

Lamb production showed no statistical difference between pasture types:

	Lamb Production		
	Ryegrass	*Paspalum*	*Kikuyu*
Weaning weight kg (63 days)	17.3	16.9	16.7
Final weight (21 weeks)	25.7	25.4	26.1
Total lamb liveweight at 21 weeks kg/ha	645	669	669

- Hogget System Results

  Annual metabolisable energy intake by hoggets were higher for Ryegrass and Paspalum than on kikuyu, for the period May to November, (60% of the year) but lower than on kikuyu for January to March.

General Results:

- The poorer performance of ewes on kikuyu in spring compared with ewes on rye or paspalum corresponded to differences in pasture production. Pasture yield of kikuyu was 19% lower in winter and 24% lower in spring. This giving a greater feed deficient during ewe lactation. Because of the buffering effect of the ewes during lactation and preferential feeding gives to lambs after weaning, lamb production was a less sensitive measure of pasture production difference compared to ewe production.

- Metabolisable energy (ME) intake of paspalum was 7% higher than Ryegrass, in turn Ryegrass was 10% higher than kikuyu. Some 70% of this difference was due to the higher yield from Rye compared to kikuyu. In kikuyu, ME intake was relatively low from late summer to mid winter, corresponding to the peak of kikuyu dominance. In spring, when kikuyu component of kikuyu pasture was much lower, nutritive value of the kikuyu pasture was similar to Rye and Paspalum.

- The main limit to stock production at 19.8 ewes/ha was the unsuitable distribution pattern of pasture growth, rather than total supply of feed, especially with kikuyu.

  For a spring lambing system, the peak demand in spring and early summer is 3 times maintenance demand in winter. This gives an energy demand of:

  - 65% of the annual energy demand in the 5 months of August to December.
  - The Ryegrass pasture supplied 55% of the annual ME intake in this period (a 15% shortfall).
  - The kikuyu supplied 48% of the annual ME intake (a 26% shortfall).

- Rates of lamb growth from birth to 21 weeks was 144 gms/day (at 133% lambing), and it was over 600 kg/ha.

- At the high stocking intensity (up to 1600 ewes/ha/day) pastures were susceptible to long term damage from treading during wet weather (gumland soil).

- Options for management changes to increase stock production:

  - Use Nitrogen to overcome the September feed deficient.
  - This nitrogen may allow lambing to begin early enough to use some of the winter feed surplus. This nitrogen will be less response on kikuyu pastures than Rye or Paspalum.
  - Early drafting of lambs will give more feed for the ewes during summer.
  - Some autumn lambing would fit feed supply better, especially with kikuyu, with its more uniform within year feed supply pattern.
  - Clover with the kikuyu, remained green through the summer in contrast to severely drying out in Rye and paspalum. Positive lamb growth rates would have been maintained longer into the summer on kikuyu. This may allow a 4 week delay to lambing and avoid the worst of the spring deficit, especially on kikuyu.
  - This delayed lambing may assist in easier control of kikuyu in the autumn. Even with 19 ewes/ha, the stocking rate is too low to prevent kikuyu suppression of white clover and too low to encourage early regeneration of cool season grasses such as ryegrass.

3.0 Establishment and production of paspalum

Reference:

The establishment and yield of paspalum in Northland.

Author: G.J. Piggot, Whangarei

Proceedings Agronomy Society of NZ, Vol 14, 1984 – Pages 111-115.

Overview:

Various methods and sowing dates and sowing rates of paspalum were measured. The yields for the various treatments were measured for 2 years: comparing the yield for mixed paspalum, rye and white clover swards.

Summary:

- Paspalum seed did not establish when broadcast onto temperate species pastures.

- Paspalum required the resident pasture to be removed, through spraying and/or cultivation; so to encourage seed establishment.

- Optimum sowing rate was 5-6 kg/ha of paspalum seed.

- Optimum sowing date was October.

- The presence of paspalum in mixed swards increased total yield in one year which had a dry summer, but it did not increase pasture yield in the other year.

Background:

- Paspalum was a common pasture component through Northland upto the 60's and 70's when its presence declined.

  Causes of this decline were considered to include:

  - Competition from ryegrass induced by changes in grazing management and fertiliser use,
  - Black beetle attack.
  - Overgrazing during the summer droughts of the early 1970's.

- Interest in paspalum was revived due to:

  - Release of a locally improved selection, being Raki paspalum,
  - Requirement for high quality herbage for late spring and summer,
  - Summer pasture production being higher than rye based pastures,
  - High levels of dairy production were being achieved on paspalum – based pastures in the Waikato.

Trial Method:

- Located at Otakanini Research area, Wellsford.

- The trial was laid out on 24th October 1975, with paspalum sown then. The mixed sward plots had rye and white clover seed oversown on 20th April 1976, followed by raking the seed in.

  25 kg/ha of nitrogen was applied plus black beetle control undertaken at the start of each season.

  Base fertiliser, P, K and S was applied annually (50 kg P/ha/yr).

  Raki paspalum seed was oversown following a spray with paraquat one month earlier, then soil was cultivated.

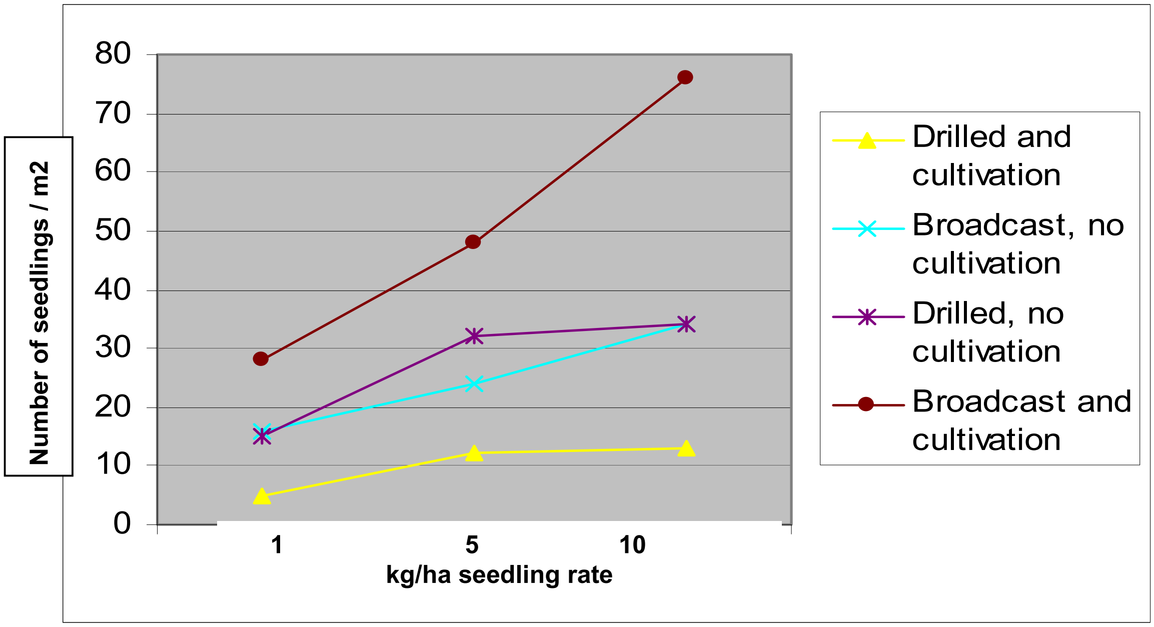
RESULTS

Establishment:

- The best establishment of paspalum was with – high rate of seed, 10 kg/ha being broadcast following cultivation: giving 76 seedlings / m2.

  This process gave double the seedling population compared to drilling or broadcasting onto none cultivated ground. The drilling following cultivation gave the poorest result, irrespective of using 10 kg or 5 kg/ha of seed, giving just 13 seedling / m2. Broadcasting onto cultivated ground at 1 kg/ha gave about twice the seedling establishment compared to drilling into cultivated ground and 10 kg/ha. No seed established in the non sprayed pasture.

Graph A: Paspalum seedlings establishment by method of establishment.



Date of Sowing:

Paspalum Seedlings established at 5 months after sowing in 1977	
Sowing Date	*Seedlings/m2*
March	2.1
May	0.3
August	2.2
October	6.7
November	4.6

Establishment was best from the October sowing. Seedlings were seen from early November onwards indicating that some of the autumn sown seed withstood over-wintering and remained viable.

Results – Dry matter Production:

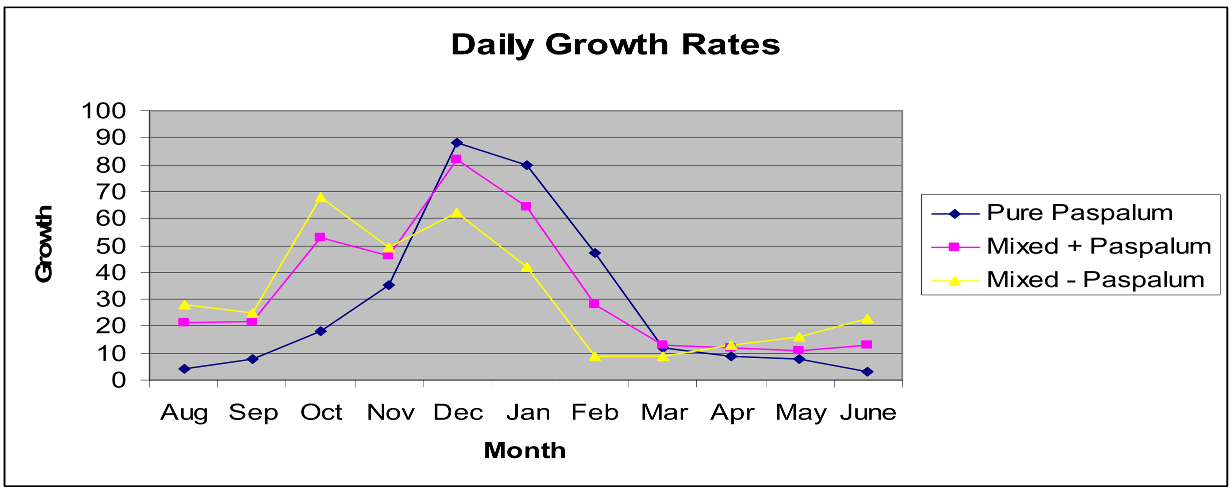
In the first year 1976-77, the pure paspalum sward yielded just 75% of the mixed swards with or without paspalum; at 9.4 tonnes DM/ha. In the second year it yielded the same as the mixed swards with paspalum, at 10.3 tonnes DM/ha, but produced 24% more than the mixed sward with no paspalum.

Table: Annual Dry Matter Production and Species Composition:

		Species by %			
	DM t/ha/yr	*Paspalum*	*Rye*	*Clover*	*Other*
1976-77					
Pure paspalum	9.4	93	0	6	1
Mixed + paspalum	12.3	42	32	24	2
Mixed – paspalum	12.6	0	69	28	3
1977-78					
Pure paspalum	10.3	98	0	1	1
Mixed + paspalum	10.1	52	24	6	18
Mixed – paspalum	8.3	0	50	19	31

Seasonal Production:

Graph 2: Seasonal growth of pure paspalum swards, ryegrass – white clover swards with or without paspalum (called mixed swards) measured over 2 years –



Points:

- Winter growth form pure paspalum was extremely low at just 3-4 kg DM/ha/day for July and August.
- The mixed sward with no paspalum had higher July and August production compared to the mixed sward that had paspalum present.
- Production from pure paspalum was hugely below that of the mixed swards for September and October.
- In February the pure paspalum at 47 kg/day was hugely above the mixed sward with no paspalum at just 9 kg/day.
- In March and April there was very little difference between all swards; all were low being between 9 and 16 kg DM/ha/day.

Table: Example Daily Growth Rates:

	Kg DM/ha/day			
	July	*October*	*February*	*April*
Paspalum pure	3	18	47	9
Mixed + paspalum	13	53	28	12
Mixed no paspalum	23	68	9	13

Ryegrass and Clover Effect:

The higher producing cultivars of Nui rye and Pitau white clover compared to Ruanui rye and Huia white clover gave significantly less paspalum production in spring (from more competion), and Nui also reduced the paspalum production in the summer (reducing pasaplum production by 22%).

DISCUSSION

- The presence of paspalum in mixed pastures, or own its own, increases early – mid summer production.
- The most critical period for supply of pasture is in the August – September period: pure paspalum had extremely low pasture growth at this time. The presence of paspalum in a rye based pasture, reduced the daily growth rates by 20% compared to rye, clover and no paspalum present. This restriction in late winter, early spring growth due to the presence of a summer growing sub tropical plant has been shown/recorded in other trial work.
- To maintain the presence of paspalum requires hard grazing during September and October which will result in low to very low animal production at that time.
- The gain from deliberately maintaining paspalum in rye, white clover pastures for the improved summer production, may not balance the very large loss in winter and spring pasture growth.
- Paspalum could be considered as a specialist perennial forage species, since this total dry matter production of pure sward compares favourably with mixed swards.
- Paspalum seed is small and light. Broadcasting has advantages over drilling – any drilling has to be very shallow.
- Drilling or broadcasting paspaulm seed into unsprayed residual pasture was totally unsuccessful.

4.0 Comparison of subtropical grasses in Northland hill pastures

Reference:

Performance of several subtropical grass in Northland hill pastures.

Author:

PJ Rumball.

NZ Journal of Agricultural Research 1991 Vol 34 pg 325-382

Overview:

Five C4 grasses (subtropical species), including kikuyu were evaluated as components of hill pastures.

Establishment and production over a 3 year period were compared.

Adaptation to hill country pastures is discussed.

Method:

Trial sites were hill country pastures near Kaikohe, Rawene and Mangonui.

Trial 1: C4 4 grasses were planted into resident pastures in October 79. Species were: kikuyu, Coastcross 1 (Cynodon dactylon), pangola (digitaria eriantha), CQ911 (D. eriantha) and Narok (setaria sphacelata). All but Narok have prostrate growth form. Details of method of establishment are given: grasses were transplanted into pre-planted sprayed out plots. Soils were moist and NPK (14:14:8) applied at 350 kg/ha.

Trial 2: The same grasses as Trial 1, were established at Rawene site only. The unmodified pasture present was used as the control treatment. Sward production with and without nitrogen, applied over summer, was measured.

At 4-6 week intervals botanical composition and dry matter yields were measured; under a mowing regime.

After 2 years of this mowing, the impact of grazing was measured for further 2 year period, with data recorded in autumn and mid spring only.

Results:

Trial 1

Table: sward dominance (% of total DM within the areas occupied) at the end of the fourth growing season.

Sward Dominance - %					
Location	*Kikuyu*	*Coast Cross 1*	*Pangola*	*CQ911*	*Narok*
Kaikohe	85	43	0	64	0
Rawene	93	40	50	66	20
Mangonui	73	78	22	81	0
Mean	84	54	24	77	7
Herbage Mass gm DM within area occupied					
	Kikuyu	*Coast Cross 1*	*Pangol*	*CQ911*	*Narok*
Kaikohe	560	20	0	50	0
Rawene	2010	340	380	240	40
Mangonui	430	240	30	70	0

Performance of plants was variable:

- Highest at Rawene
- Lowest at Kaikohe
- Kikuyu covered a greater area, dominated the sward more and produced a higher yield than all other C4 plots
- Narok was the poorest for spreading, production and survival, of all grasses.

Trial 2

All plants established very well.

Table: Herbage yields (tDM/ha) at Rawene:

	Control (Browntop, Rye, clover)	*Kikuyu*	*Coast Cross 1*	*Pangola*	*Narok*
Mowing – 12 month yield, mean of 2 years					
No N	7.8	10.8	10.0	9.0	8.0
200 kg N	10.1	14.5	13.8	13.7	15.5
Grazing					
April 84	0.77	2.33	2.7	1.6	1.4
Nov 84	1.13	1.4	1.3	1.0	0.9
Combination of Autumn and Spring yields for 2 year period	3.8	8.4	6.4	6.1	4.5

Yields

Under mowing, N at 200 kg/ha over summer substantially increased average warm season yields over 2 years at 68 and 63%.

There was a significant carry over into the first but not the second cool season (cool season started May). Swards with C4 grass averaged 20% higher yield than control, mainly in the warm season (+32% warm and +5% in cool).

Under 200 kg N, the average gain for the C4 grasses over the control swards increased to 41% (range being from 35 to 51%), almost all being in the season of application.

Under grazing, kikuyu yield was the highest in autumn. All C4 plants, except Narok, were above control in both years. There was no significant difference in spring yields between swards.

Sward Composition

With no N, all C4 grasses dominated warm season yields. The C4 grasses suppressed other species more than they suppressed legumes. In C4 swards N at 200 kg/ha had no marked effect on legumes.

Growth rates

Minimum growth rate of 5-12 kgDM/ha/day occurred in mid winter for all swards and mid summer for the control.

Maximum growth occurred after soaking rain in summer for both no N and 200 kgN.

Sward Quality	*Warm Season*		*Sward Mean*	
	Digestibility %	*Nitrogen %*	*Digestibility %*	*Nitrogen %*
Control no N	58	2.5		
Control 200 N	57	3.1	61.3	3.0
Kikuyu no N	50	1.55		
Kikuyu 200 N	52	2.0	54.8	1.9

The digestibility and nitrogen levels were higher in the control sward in the warm season, but similar to the C4 grasses in the cool season.

Discussion

The poor performance of C4 grasses at Kaikohe and Mangonui were attributed to:

- Steep contour
- Shady aspect
- Intensive grazing by sheep
- Drought prone (especially Mangonui site)

Rawene was the most favoured site:

- The least steep
- Westerly aspect
- Grazed by cattle
- No higher base soil fertility than Kaikohe or Mangonui.

The performance of the C4 grasses reflected the variability of hill soils: expansion of the grasses occurred on the best sites e.g. high fertility areas, whereas on the more harsh sites (steep slopes) growth was poor and population of C4 plants declined. Intermediate slopes contained the best mix of planted and resident species.

Kikuyu was the most competitive of the C4 species having 2.5 and 5 times greater occupied area and herbage mass after 4 years, than the second best C4 grass (Coastcross 1).

The gain in herbage yield from the inclusive of C4 grass was in the stem/stolon material. Because this material had lower quality, the gain in increased digestible dry matter and crude protein was less than the gain in the absolute dry matter yield.

e.g. kikuyu 41% yield advantage over control pasture in total yield reduced to 27% and 22% gain for digestible dry matter and crude protein yields.

N response; the control sward was much less responsive to N at 12 kgDM/kgN compared to kikuyu at 18 kgDM/kg N and the other C4 grasses at 27.

The grasses in the control sward were more limited by lack of moisture during summer, than the lack of N. One of the main reasons for the strong competitiveness off kikuyu, paspalum and carpet grass in Northland hill pastures, is their superior ability to exploit low soil moistures.

In favourable sites, paspalum and kikuyu form stable and productive mixes with rye and clover. The main result is a re-distribution of seasonal growth and livestock production, rather than a net gain in production.

Summary:

- Following transplanting, all C4 grasses established well.
- Apart from kikuyu, it was difficult to have C4 swards surviving and producing well after 3-4 years.
- Kikuyu was the best adapted of C4 plants and was the easiest to established.
- Summer growth of the C4 plants was severely limited by nitrogen as well as moisture.
- Once established, the main contribution from C4 grasses occurs after late summer/autumn rain, rather than during summer.
- Kikuyu had a 41% advantage over the control sward for yield. With lower feed quality attributes, the digestible dry matter and crude protein yield advantages reduced to 27 and 22% respectively.
- The major impact from C4 swards is the re-distribution of seasonal growth compared to non C4 swards, rather than nett gain in yield.

5.0 Evaluation of the subtropical grass hermarthria altissima, and comparison with Wana Cocksfoot

Reference:

Evaluation of five introductions of the subtropical grass Hemarthria altissima at a frost prone site in Northland.

Author:

LJ Davis and BJ Hunt.

NZ Journal of Agricultural Research, 1989, Vol 32 pages 469-476.

Overview:

A subtropical grass, hemarthria altissima commonly called limpograss, was introduced. Annual dry matter production was recorded and compared to Wana Cocksfoot. Persistence, related to frost damage, was recorded for the various lines of limpograss.

Background:

Previous studies showed limpograss as having good potential as a summer pasture species in Northland. It is well adapted to moist sites, such as river floodplains. Yield of greater than 20 tonnes DM/ha/year have been achieved under mowing and grazing. Frost damage poses a threat to production and to persistence: frosts in Northland have caused it to fail to persist.

Trial Method:

Trial site was a valley floor at Kauri, being a former swamp but now extensively drained.

Soil type was Wairua clay.

Soil fertility: pH 4.8, Ca 5, P25, K5 and Mg15 as MAF Quick test units. Before cultivation the dairy pasture was rye, paspalum and white clover.

The limpograss cultivars used were stoloniferous perennials which have to be propagated vegetatively, not via seed.

Planting: the five cultivars of limpograss had been established in 1981. On 31 October 1982 stems (runners) which were over 6 months of age, were pulled by hand, cut into 50 cm lengths, planted at 65 stem pieces per plot, being 3 x 3 metres. Wana cocksfoot seed was broadcast at 6 kg/ha and raked in: following a deep rotary hoe cultivation.

Trial area was irrigated at planting and this repeated at 5 days and again in December. Some plants failed to establish: these plots were replanted in October 1983 for limpograss and April 1983 for cocksfoot.

Fertiliser – nil for first 12 months, then 300 kg/ha of nitrogen as urea plus 600 kg/ha of 30% potash. Nitrogen applied at 100 kg/ha in October, December and March.

RESULTS

Plant Establishment

Summer annual grass species severely impeded establishment of all the limpograss cultivars and the cocksfoot.

In March 1983, all the cocksfoot plants were sprayed out and in April they were re-cultivated and resown. Cocksfoot established successfully over the winter.

For all limpograss cultivars, most of the above ground parts of the stem pieces died back to soil level within 3 weeks: new shoots emerged within 1-2 months from nodes at or below soil level.

By June 1983 the more weed free plots were almost completely covered by limpograss. The worst 3 plots had less than 50% cover. By December 1984, 2 years after the initial planting and 12 months after the replanting of some plots, all limpograss plots were completely covered by limpograss vegetation.

Herbage Production:

Limpograss was dominant for the four months May until August.

Wana cocksfoot peaked at 110-120 kgDM/ha/day. Its low growth period was winter at 20-25 kgDM/ha/day.

Cutting height: data indicated that significantly more herbage was harvested by mowing at 3cm compared to mowing at 8cm high. Over the first 12 months the 3cm harvest height gave an extra 4 to 5 tonnes of DM/ha/year.

Annual dry matter production declined over the three year.

Dry Matter Yield over time – tDM/ha/yr To a 3cm mowing height				
Line	Year 1	Year 3	3 year mean	Year 3 as % of Year 1
Bigalta	18.96	4.75	13.0	25
Floralta	21.1	12.62	16.9	60
PI 349753	19.04	3.59	11.9	20
PI 364884	20.93	19.72	19.1	94
Wana Cocksfoot	16.12	18.24	17.4	113

Some lines of limpograss decreased production over time dramatically: this largely due to frost damage; e.g. -4.0^{o}C and -5.5^{o}C frosts occurred in winter 86 to give severe frost damage on some lines.

The finer stems lines such as PI 364884 had higher stem tissue survival over winter because they were less frost damaged. The coarser stemmed lines were eliminated by frost in the 3 winters, under the 3 cm mowing treatment: the frost damage under the 10 cm mowing treatment was less severe and gave rise to improved spring growth.

The spread of limpograss was greatest under the 10 cm mowing height.

The lack of persistence is shown by the table below: giving the percentage ground clover in the third spring.

% Ground cover: 1987

	% Ground Cover	
Line	*3cm*	*10cm*
Bigalta	3	10
Floralta	7	23
PI 349753	3	20
PI 364884	27	90
Wana Cocksfoot	93	97

Wana cocksfoot was not frost-damaged at any stage. Annual yields of cocksfoot were comparable with those of the fine stem limpograss lines in all years, but its seasonal growth pattern differed. Wana grew throughout the year with a spring peak. It did not have the extreme summer peaks and winter troughs for growth.

DISCUSSION

The course stemmed lines e.g. Bigalta, Floralta established successfully, but it took 12 months.

Large scale planting of Bigalta in Florida is by broadcasting mature stems on cultivated soil followed by moderate discing and soil packing. This process has been successful in Northland on soils with good summer moisture, but it has failed on free draining soils with low summer rainfall. The fine stemmed lines were more difficult to establish, especially under the weedy conditions of this trial. The probable main reason is the poor sprouting ability of the thin stems. To sprout, the stem is dependant on food reserves which will be smaller in these fine stemmed lines. Even under weed-free conditions, the fine stemmed lines will take longer than 12 months to establish.

To compensate for this slow/lower establishment, a higher shoot density may have to be sown at establishment.

Bigalta has failed to persist at other frost-prone sites in Northland, as it did at Kauri. Frost temperatures below -2.5^{o}C will kill leaves of Bigalta.

The fine stemmed lines are more frost hardy. This from slightly higher frost tolerance plus having denser swards and more plant material at the soil surface which can escape frost damage.

Other limpograss lines, not trialled in Northland, have shown more winter hardiness, e.g. lines from high elevations in Natal, South Africa appear to be especially cold-tolerant.

6.0 Persistance of Limpograss

Reference:

Variation and adaptation in Limpograss (hemarthria altissima).

Proceedings of the NZ Grassland Association 57: Pages 49-53, 1996.

Author:

PW Woods, JN Couchman and HA Barlow

Overview:

A study was undertaken of abandoned research sites to assess long term persistence and adaptation.

New trials were established to assess morphological variation and plant survival.

Method:

Abandoned trial sites of limpograss were re-visited in September 1992.

A series of field trial were established in December 1993 with 8 lines of limpograss planted at Kaitaia, Dargaville, Hamilton and Te Puke. Establishment method detail is outlined:

- Plants were transplanted at 10 plants per 1 x 1 metre plots.
- Morphological features were recorded.

Results:

Abandoned Sites:

Of the sites that had Bigalta established 10-13 years earlier, in the greater Kaitaia district, this line of limpograss had disappeared from three out of the four sites. The one site where it remained as a strong plant was in a frost free site, soil was Takahiwi clay (very heavy clay), grazed by cattle and taken for hay each year.

At the Kauri site, where limpograss had been established 6 years earlier, Bigalta and PI 349753 had failed to persist. Floralta plus two other lines were present but at low density. But with favourable management these three lines quickly dominated.

Current Field Trial Results:

Data covering various morpholoical features is given in detail: e.g. leaf %, stolon %, number of basal stolons and aerial stolons per plant, plus other data.

Discussion:

Yield and persistence will affect the success of limpograss. Bigalta, Floralta and two other lines had the highest yield of both leaf and stolon materiel. Stolon forms the largest component of harvested plant material: this under cutting plus under grazing. Limpograss may spread by seedling, long stolons and rooting from nodes.

Under grazing, Bigalta and Floratla formed large plants with distinct crowns and minimal rooting from stolon nodes. This means there is minimal scope for secondary plants to establish.

It is almost impossible to obtain viable seed set from limpograss: flowers were not observed at all on Bigalta and only rarely on Floralta. While little or no flowering has advantages in terms of maintaining forage quality, it does not assist the long term persistence of a stand of limpograss.

General Discussion:

Limpograss has potential to be used as a special purpose perennial summer forage in Northland dairy and beef cattle systems.

Limpograss is most likely to flourish on sites with:

- Fertile, moisture retentive soils
- Low frost occurrences (limit at $6^{o}C$)
- Supplemented by 200-300 kg N/ha from November to March
- Perhaps with irrigation

Stands require vegetative establishment – a major problem.

Growth rates from January to March exceed 100 kgDM/ha/day but it is dormant in winter.

It has digestibility of 68-72% and protein content of 12-13%.

Bigalta and Floralta cultivars are tetraploid giving them superior digestibility.

During the late 1970's material was imported to NZ. Establishment, productivity, persistence and frost tolerance were evaluated. Points from this work:

- 80% of stolon cuttings from coarse-stem lines established compared to only 40-50% of stolon cuttings from fine stemmed lines.

- Initially tetraploid cultivars performed better than other lines, but subsequent yields were directly related to shoot tissue survival through winter. Fine stemmed lines were less damaged by frost than coarser tetraploid.

- Floralta was intermediate in frost tolerance, yield and persistence. Bigalta was more susceptible to frost than Floralta.

- Digestibility and crude protein content were highest in Bigalta (77% and 12.8%) with Floralta slightly less.

- Limpograss retains many of the benefits of both annual crops and subtropical grass components of pasture: it offers advantages of perennials and flexibility of use. Limpograss is best suited to development as a standing feed bank for feeding of cattle during summer. It may take 2-4 months for sufficient feed to grow but this is similar to traditional summer crops. Limpograss would not need annual re-establishment, but compatible cool season species would be needed for winter production. Large scale plantings in Northland, of Bigalta which established and produced well, failed to persist. Floralta seems to be better suited to Northland conditions.

Feed conservation technique may increase flexibility of forage use options:

- Fine stemmed limpograss for hay,
- Ensiling surplus feed, especially with the potential of additives used to improved feed quality.
- Forage crop under irrigation or cowshed effluent disposal.

Limpograss can tolerate wet soils and intermittent flooding during warm conditions.

7.0 Milk Production from Limpograss

Reference:

Dairy cow performance on Limpograss (hermarthria altissima).

Author: *PW Woods, JN Couchman, DA Clark*

Publised approximately 1996.

Overview

Milk production from cows fed Limpograss for short periods, dry matter production and feed quality assessments were measured.

Trial method:

- Trial located at Kaikohe research station and neighbouring Northland college farm.
- Floralta and Bigalta limpograss were vegetatively established in January 1992 – 1993.
- In October of each year, 700 kg/ha of 30% potash was applied. From late October, urea was applied at 100 kg nitrogen per hectare fortnightly.
- During March 1994, two groups of six Friesian cows were stall fed diets of freshly harvested limpograss or temperate pasture of equal intakes of 13 kgDM/cow/day.
- In March 1995 a grazing trial had 10 Friesian cows grazing limpograss or temperate pasture.
- Milk production, liveweight changes, rectal temperature, fed intake and feed quality were measured.

Results:

TABLE 1 – Stall Fed Results

Overmeans for cows fed limpograss or temperate grass during March 1994.

	Limpograss	***Temperate***
Milk volume (litres/c/day	7.8	8.5
Milkfat kg/cow/day	0.35	0.41
Protein kg/cow/day	0.27	0.31
Milksolids kg/cow/day	0.62	0.72
Rectal Temperature ^{o}C	39.0	40.0
Final liveweight – kg	522	498
Intake – kgDM/cow/day	13.1	13.5

Points:

- Heat stress and ryegrass staggers were observed in cows fed the temperate pasture. Although not commented on in this paper, this would have been due to the endophyte presence in the temperate grass species, which would have also caused the difference in rectal temperatures.

- Milk solids production from the limpograss were slightly lower than from the temperate pasture.

TABLE 2 – Grazing Trial

	Limpograss	***Temperate***
Milk volume (litres/c/day	13.3	12.6
Milk solids kgMS/c/day	1.03	1.08
Rectal temperature ^{O}C	38.3	38.3
Final liveweight – kg	491	483
Intake kgDM/c/day	13.4	15.1

Points:

- Milk production was not significantly different.
- Intake was slightly lower on the limpograss but this was not significantly different.
- There were no animal health issues.

Other Results:

- With 300 kg nitrogen/hectare, between November and April, yields were 14-15 t DM/ha for mixed pasture and up to 34 t DM/ha for pure strands of limpograss, without irrigation.
- Digestibility of the leaf and stolon of limpograss were similar: ranging from 66-77% digestibility, and crude protein of 12-13% (low to very low).

Conclusions:

- Limpograss is a perennial subtropical grass with the potential to produce a substantial bulk of feed for cattle during summer.
- It has been developed for beef cattle in Florida, where mineral and protein supplement is required for cattle being fed 2-3 month old limpograss.

8.0 Autumn under sowing of kikuyu

Reference:

Autumn under sowing of grazed kikuyu grass (Pennisetem clandestinum) pasture.

NZ Journal of Experimental Agriculture – Vol 12 (1984) page 269

Author: *G. Piggot*

Overview – Summary

- Under sowing of pastures with some kikuyu present (kikuyu making up to 30% of the pasture in February) gave either nil response, or an 8% increase in pasture production.
- This 8% increase did not produce any increase in meat production, under a system with high liveweight gain per hectare (1100 kg liveweight/ha/year).
- Cereals and Tama do give a strong visual response, but this does not always convert into increased dry matter production.

Introduction

Kikuyu dominant pastures display a winter trough of poor/very poor grass growth: severe feed shortages develop in August or September. One action to overcome this trough is to sow winter and spring active species.

Method

Dargaville research area on Te Kopuru soil. Under sowing of Tama annual ryegrass or green feed cereals on 16th April 1979 and 7th April 1980 (it was mown before drilling in 1980 but just severely grazed in 1979).

Cereals were sown at 50 kg of Oats plus 50 kg/ha of barley. Tama shown at 15 kg/ha.

Trial stocked at 6.3 head of a six month old steers (190 kg live weight per head and 1200 kg/ha).

Rotation length:

28 days up to early September
14 days from September to late December
21 days from December until April

Grazing duration: 3 ½ days per shift up to late December and 7 days there after.

Nitrogen applied (urea) after each grazing:

June to October inclusive at 20 kg N/ha/month
Additional 20 kg N/ha/month in August and September
Total of 140 kg N/ha/year

Results

- Under sown species gave a strong visual impact (considered a typical response to under sowing).
- 1979-80 there was no difference in dry matter production – the area that was not under sown produced 2% more dry matter.

- 1980-81 there was an advantage of 8% to the under sowing; a result of Tama growth. The sown cereal had little impact: gave an extra 3% (190 and 160 kg DM/ha in 1979 and 1980) dry matter by August before being grazed out. This cereal established well with 65 and 73 plants per square metre establishing.

- TABLE 1: Pasture composition – Trial Year

Species	*Composition of Pasture*			
	1979 – 1980		*1980 – 1981*	
	Not Under Sown	*Under Sown*	*Not Under Sown*	*Under Sown*
Rye - %				
- For the full trial year	39	39	32	35
- June to mid Dec	46	45	32	38
Kikuyu - %	17	17	11	11
Clover - %	16	16	17	16
Other Grasses - %	28	28	41	38

Other grasses: poa, Yorkshire fog, sweet vernal, prairie grass and brown top.

- Total dry matter production of 10,600 kg DM/ha.

Comments

- These pastures were not kikuyu dominant: eg kikuyu presence made up 11 and 17% of the pasture composition in the 2 years.
- Perennial ryegrass made up 30 to 40 of the pasture composition over the 2 years.
- Other grass species were a high component in both years.

Animal Production

- The increase in pasture from the under sowing of Tama in 1980 did not produce any more cattle liveweight.

- TABLE 2: Animal Production – Trial year

Liveweight Gain	*1979 – 1980*	*1980 – 1981*
Per Animal	171	151
Per Hectare	1100	1090

- Supplements were used: 30 kg DM per head of hay was fed out in August.
- Lack of pasture on hand in summer 1980-81 forced a reduction to 5.5 steers/ha for the February and March period.
- Overall: production of 1 kg liveweight gain per 10 kg of dry matter grown.
- Cattle growth rates:
    - 1.3 kg/day in October with Kikuyu at 3% of pre graze pasture
    - 0.5 kg/day in February with Kikuyu at 30% of pre graze pasture.

9.0 Pasture species for Northland

Reference:

Pasture species for Northland

Proceedings of the NZ Grassland Association 1967, Vol 29, Pages 78-87.

Author: Lambert JP.

Overview:

Seasonal yields of a number of grass species were measured on two soil types over a four year period.

Trial Method:

- Trial located at Grasslands Station, Kaikohe on 2 soil types:
    - Wairoro clay loam, an alluvial soil
    - Waiotu clay, semi volcanic soil
- Sites subject to frost
- Simple mixtures of one grass plus red and white clover.
- On the alluvial soil species were sown in both plots for mowing yields and in grazing paddocks. The results for the mowing yields are not discussed in depth in this Research Stocktake.
- Grazing paddocks were sown on the volcanic soils.
- Grazing was rotational with dry sheep, over six paddocks of each species.

Results:

- Seasonal pattern of production was similar in each of the 3 trials.
- The major difference between the mowing only and the grazing yields was the major reduction in paspalum under grazing and a corresponding increase in other species, being Yorkshire fog and browntop. Paspalum yield decreased from 5200 kgDM/ha to 2000 kgDM/ha.

- The winter yield of the sown grass component was higher than the summer yield in the case of the true perennial ryegrass in each trial (Ruanui rye). The winter yield of paspalum and kikuyu was very low in each trial; but the growth from other species was high enough to give similar yield for the pasture mix for paspalum compared to the ryegrasses, at 20 kgDM/ha/day for the alluvial site. The paspalum sward yield for winter was lower than the ryegrasses on the semi volcanic soil at 14 kgDM/ha/day compared to 20 for the rye swards. The kikuyu sward grew at 11 kg/day on the semi-volcanic but at 15kg/day on the alluvial.

- The production of the sown grass was about 100% higher on the semi volcanic soil compared to the alluvial soil for all species. Soil fertility levels were not given but it was stated that the semi volcanic soil was the more fertile one. The yields obtained from each swards were 25% greater on the semi volcanic soil compared to the alluvial soil.

  Grass Component Species being:

Yield – mean of 4 years 1961-65 kgDM/ha/year		
	Alluvial Soil	*Semi Volcanic Soil*
Ruanui Perennial ryegrass	8,200	10,700
Manawa rye short rotation	8,500	10,600
Ariki rye (Ariki is a Manawa + Ruanui cross rye)	8,350	11,800
Apanui cockfoot	8,400	10,800
Paspalum	11,000	11,400
Kikuyu	11,100	14,800
Tall Fescue	10,500	12,100
Group mean	9,436	11,743

- The pasture production of the species used in this trial illustrate that in general field production does not approach the potential production.

Discussion regarding Species:

- The most consistent producers, between seasons and between years, were Ariki ryegrass and the tall fescue.

- Summer growth of paspalum and kikuyu was impressive, as was kikuyu in the autumn.

- The perennial ryegrass was one of the best for inclusion in pasture mixes. While it has summer weaknesses, it survives under many different systems of management.

- Ariki ryegrass appears to be persistent under hard grazing but it did have a tendency to suppress the clover.

- Manawa short rotation ryegrass persisted well, but was generally surpassed by Ariki for any seasonal production yield; except in establishment (first 1-2 years) when it was superior to other ryegrasses.

- Apanui cocksfoot produced similarly to the ryegrasses. In another study, in a pasture in its tenth year, cocksfoot provided 21% of the herbage over years 9 and 10. Apanui cocksfoot will persist under hard grazing; especially in drier soils.

- Paspalum showed better growth in dry weather as does the associated clover. But increased stocking brings a decrease in paspalum population. If paspalum is sown in a pasture mix, and conditions for establishment and maintenance of a vigorous pasture exist, there seems little chance of paspalum contributing much.

- Kikuyu pastures have been the highest producing pastures in these Kaikohe trials. But it shows different seasonal production compared to ryegrasses.

- Tall fescue showed similar seasonal and annual production to Ariki ryegrass. Poor palatability was a problem in spring and summer. When subjected to harder grazing than in this trial, tall fescue weakens more than cocksfoot.

10.0 Performance of paspalum under grazing

Reference:

Evaluation of paspalum (Paspalum dilatatum Poir) selections. II Productivity under grazing.

Author:

NS Percival, JP Lambert, ARJ Christie and McClintock.

NZ Journal of Experimental Agriculture 7 (1979) 65-69

Overview:

NZ paspalum selections were compared with commercially available lines in mixed pasture, under sheep grazing. Yield, persistence, herbage digestibility were assessed. All pastures containing paspalum produced more than those sown with ryegrass alone.

Method:

Trial 1: 3 selections were compared for yield and persistence under sheep grazing with an overseas line and a control not containing paspalum.

Trial laid down at Kaikohe in November 1969 with paspalum tillers planted, followed by 20 kg/ha of Ariki ryegrass. Yields for spring and summer were recorded.

Trial 2: A similar but larger scale trial with mixes used: site cultivated autumn 1973:

- 2 NZ selections of paspalum at 12 kg/ha, Nui ryegrass at 15 kg/ha and Pitau w/c at 3 kg/ha. The paspalum was broadcast 10th October 1973 while the rye and w/c undersown 19th April the following year.
- Commercial line of paspalum with Nui and Pitau w/c: same dates and seed rates as above.
- Control of Nui rye and Pitau w/c only.

Fertiliser: before sowing 3.75 t/ha of lime, 500 kg/ha of 30% potash super. Plus urea at 60 kg/ha on 3 occasions.

Thereafter, annual application of 800 kg/ha of 30% potassic super plus 2.5 t/ha of lime in March 1977. Grazing with mature wethers with shifts every 16-24 hours.

Results:

Trial 1:
Dry matter yields were similar for all treatments in spring; but in summer substantially greater yields in all treatments containing paspalum (by 34%). During the spring and summer, yields of the NZ Selections of paspalum (NZ P) were on average, double that of the commercial line.

Trial 2:
Establishment: at 6 weeks post sowing, establishment was very similar, with 263 seedlings/m2 for NZ-P.

Yields:
Table: Seasonal and annual DM yields average over 3 years:

kgDM/ha

	Treatment	*Spring*	*Summer*	*Autumn*	*Winter*	*Annual*
Whole sward	NZ-P	5533	4512	3064	2574	15683
	Control Rye	5377	3100	2701	2727	13905
Paspalum Component	NZ-P	709	2140	524	30	3403
Rye Component	NZ-P	2355	1163	1192	1253	5963
	Control Rye	1858	962	830	802	4452
White clover						
	NZ-P	644	472	690	358	2164
Component	Control Rye	646	544	832	464	2486
Other grasses Component	NZ-P	1585	532	515	762	3394
	Control Rye	2362	1234	993	1300	5889

Yield:

- DM yield for the NZ-P was 13% higher yielding than control with rye and clover only, for annual production.
- There was no statistical difference in spring production between the swards.
- Summer production for NZ-P was 45% greater than the rye control, 13% greater for NZ-P for autumn, but 6% less in winter.

Components:

- The paspalum component of the NZ-P sward was:
  - 13% in the spring
  - 47% in the summer
  - 17% in the autumn
  - 1% in the winter
  - 22% for the whole year
- The ryegrass component was:

NZ-P sward	Control sward
43%	35% in spring
26%	21% in summer
39%	31% in autumn
49%	29% in winter
38%	32% for the whole year

Note that the ryegrass component was higher in each season, in the sward containing paspalum, than in the sward with no paspalum.

- White clover content was reasonably similar for most seasons and being 14% of the whole years yield for the paspalum treatment compared to 18% for the ryegrass sward.

- Other grasses made up an important component of annual yield, especially for the ryegrass swards: 22% of the annual yield for the paspalum sward and 42% for the rye sward.

Herbage Digestibility

Organic matter digestibility in mid summer 1976:

	NZ Paspalum Mix	***Control (Rye + w/c)***
Digestibility	67.5%	69.7%
Sward Makeup: Paspalum Rye White Clover Volunteer grasses	 73% 8% 10% 	 0% 15% 28% 46%

Discussion:

- All pasture mixtures containing paspalum produced substantially more DM during summer and on an annual basis.
- The performance of paspalum could have been affected by the grazing management. Other studies have shown that the summer production of paspalum was largely determined by the grazing intensity in spring: grazing had to be to low residuals to maximize paspalum growth.
- In other studies the presence of paspalum reduced the winter pasture growth. While there was some indication of this here, data for the whole winter and spring periods showed no statistical difference. Note that the paspalum content during winter and spring as a percentage of the total sward, was just 1 and 13% respectively.
- The NZ Paspalum mix had a greater ryegrass component than the control swards: for each season and for the annual yield.

11.0 Comparing rye and kikuyu

Reference:

Comparison of ryegrass and kikuyu grass pastures under mowing.

NZ Journal of Experimental Agriculture vol, Number 1, 5 pg 71-77, 1977

Author: JP Lambert, PJ Rumball and AR Christie

Overview:

Trials at Kaikohe compared the performance of perennial ryegrass and kikuyu based swards separately and in combination over 4 years.

This was a mowing only trial. The combination of ryegrass and kikuyu produced higher yields and more uniform seasonal distribution.

Method:

Trial site was at Kaikohe in a frost pocket. Treatments were sown with:

- RC being 5.6 kg/ha of Ariki ryegrass and 2.2 kg/ha of Pitau white clover
- RKC being Ariki rye, kikuyu and Pitau white clover.
- KC being kikuyu and Pitau white clover.

Trial laid out 30 Oct 1968 with Kikuyu established vegetatively.

A high fertiliser input. First cut early July 1969 (9 months post establishment).

Pasture cuts taken every 3 weeks apart from during droughts when it was 6 weeks.

Results:

Herbage Yield – kg DM/ha – pasture treatments			
	Rye Clover	Rye Kikuyu Clover	Kikuyu + Clover
Spring	4071	4115	3798
Summer	2545	3001	3025
Autumn	1870	2117	2104
Winter	1334	1131	1020
Annual	9820	10365	9947

Seasonal yield (% of yield)			
	Rye Clover	Rye Kikuyu Clover	Kikuyu + Clover
Spring	41	40	38
Summer	26	29	31
Autumn	19	20	21
Winter	14	11	10

The pasture mix RKC significantly out yielded mixture KC and RC by 4 and 6% respectively.

Seasonal differences were significant:

- Kikuyu clover growth was less than the other 2 mixes in spring by 8%
- Rye clover was lowest in summer and autumn but highest over winter.
- RKC produced more in summer and autumn.

Composition:

Table: Composition % - Pasture Treatments

	RC	*RKC*	*KC*
Ryegrass	41	41	
Kikuyu		18	24
White clover	27	17	26
Volunteer species	32	24	50

As a component of the sward over the 4 year period, volunteer species made up 50% of the kikuyu sward, compared to kikuyu itself making up just 24% in the KC treatment.

Ryegrass content declined significantly over the 4 years: from 47% to 32% in the RC treatment.

Growth Rate – response to environment.
The treatments showed similar responses to seasonal weather variation.
Maximum growth rates of 87-95 kgDM/ha/day for the 3 treatment occurred in early December 1969 after a dry mid spring and a moist late spring. Dry weather set in and growth rates dropped.

Growth Rates:	early Dec	87-95 kg/day
	end Dec	30 kg/day
	end Jan	0 kg/day
	end Feb	1-2 kg/day

In 3 out of the 4 years, dry spells in October and November severely restricted growth rates. For summer and autumn, growth of all treatments were strongly related to rainfall patterns.

The most striking change in composition was the increase in kikuyu and the accompanying decreased contribution from white clover and more particular the volunteer species. This gave an increase in warm season growth and a decrease in cold season growth: These differences became more pronounced in the last 2 years of the 4 year trial.

Discussion and Summary:

- Pastures containing both rye and kikuyu out yielded those containing either species on its own, by 5-6%.

- Rye growth peaked in mid-late spring while kikuyu peaked anywhere between mid summer and mid autumn. There was little suppression of ryegrass by kikuyu: during this 4 year period.

- Even with high fertiliser inputs, including N, there were large to very large contributions from volunteer species: making up 24% of the sward in the RKC mix, 31% in RC mix and 50% of the kikuyu clover sward. In kikuyu, poa annual was prevalent. In RC, browntop and crabgrass (warm season grasses) were prevalent.

- The author suggested that this site may be biased against kikuyu due to:

  - Frosts being more frequent and severe restricting the seasonal growth of kikuyu
  - Regular mowing to 4 cm, not allowing the build up of stoloniferous mat which suppresses companion species (this should be seen as a positive effect).

- The average yield of kikuyu was low because of its slow initial buildup and the trial running for just 4 years. This was not long enough for kikuyu to reach its usual degree of dominance.

- This trial indicated that even with high use through good management of kikuyu, there is a consistent growth lag in spring in swards containing kikuyu. The authors suggested that under intensive management it would be worthwhile to establish ryegrass into a kikuyu dominant sward.

12.0 Comparison of pasture species

Reference:

Effects of white fringed weevil and black beetle populations on pasture species.

NZ Journal of Agricultural Research 1982 Vol 25 pages 405-414

Author: PD King, JS Meekings and CF Mercer

Overview:

Short term, one to two years, pasture production data from various pasture species and mixes are given. Note: data and discussion regarding the black beetle populations is given in the Research Stocktake – Insect Pests.

Trial Method:

- Trials sited at Otakanini Research Area, close to Helensville on Red Hill – Tangitiki sandy clay.
- Trial 1 – 2 years data not covered in this Research stocktake. Similar species used as in Trial 2.
- Trial 2 – species sown or transplanted (paspalum and kikuyu) in spring 1976.
- Data shown below is for Year 2 being 1978.

TABLE: Seeding rates for cultivars sown by annual dry matter production for 1978: for untreated plots (against white fringed weevil and/or black beetle).

Treatment	*Sowing rate kg/ha*	*12 month yield kgDM/ha*
Paspalum		13,150
Phalaris	20	8,200
Kikuyu		8,650
Matua prairie grass	30	8,950
Roa tall fescue	20	8,100
Paspalum + ryegrass + white clover	15 + 5	9,550
Paspalum, phalaris, rye + clover		9,950
Kikuyu, rye + white clover		9,150
Kikuyu, phalaris, rye + white clover		11,100

Sowing rate for ryegrass was 15 kg/ha of viable seed for each treatment that had rye sown; the white clover sown, at 5 kg/ha for each treatment that included clover.

TABLE 2: Seasonal Production by Treatment: Average daily growth rates per season: kgDM/ha/day.

	Summer	*Autumn*	*Winter*	*Spring*	Annual Yield kgDM/ha
Paspalum	76	18	12	38	13,150
Phalaris	26	21	18	25	8,200
Kikuyu	54	29	3	21	8,650
Prairie	33	19	24	22	8,950
Tall fescue	21	17	24	27	8,100
Paspalum, rye mix	31	14	20	40	9,550
Paspalum, phalaris, rye mix	32	14	24	40	9,950
Kikuyu, rye mix	27	23	14	36	9,150
Kikuyu, phalaris, rye mix	37	26	20	38	11,100

Discussion:

- Results were from mowing only: other studies have shown paspalum production to show a substantial reduction under grazing trials.
- Paspalum showing the highest summer production by a very big margin.
- Apart from kikuyu, which was the second highest producing treatment in the summer, all other treatments were quite similar for summer growth.
- Kikuyu plus the kikuyu mixes had the highest autumn growth.
- Kikuyu on it own, had extremely low growth in the winter. The addition of ryegrass and especially phalaris and rye improved the winter production greatly. This improvement carried onto the annual yield figure.
- Spring growth rates were moderately similar across all treatments.

TABLE 3: Seasonal Production by Treatment: Each seasons production as percentage of annual yield by treatment.

	Summer	Autumn	Winter	Spring	Annual Yield kgDM/ha
Paspalum	53	12	8	27	13,150
Phalaris	30	23	20	25	8,200
Kikuyu	57	31	3	9	8,650
Prairie	34	20	25	22	8,950
Tall fescue	23	19	27	31	8,100
Paspalum, rye mix	29	13	20	38	9,550
Paspalum, phalaris, rye mix	29	13	22	36	9,950
Kikuyu, rye mix	27	23	14	36	9,150
Kikuyu, phalaris, rye mix	31	21	17	31	11,100

Discussion:

Data in Table 3 reflects the same “story” as in Table 2, e.g.:

- Low winter production from paspalum and extremely low winter production from kikuyu.

13.0 Pasture yields with or without kikuyu

Reference:

Yield of temperate pastures on north facing slopes with or without kikuyu grass.

Second edition of kikuyu grass farming for high production. Published by Northland Pasture, P O Box 1590, Whangarei.

Author: G Piggot

Overview:

The effect on dry matter yield of kikuyu presence in well managed temperate pastures on north facing slopes was studied at two sites.

Pastures with kikuyu outyield those without, in all seasons except winter.

The presence of kikuyu boosted average annual yield by 45%.

Kikuyu produced 46% of the annual yield.

Trial method:

- This trial provides yield data relevant to well developed hill country farms in the drier areas of Northland.

  Sites were on 15 degree slopes of a northern aspect.

	Moist Farm Maungaturoto	Dry Farm Tinopai
Normal rain mm/yr	1500	1200
Soil test pH and Ca	6.4 and 18	5.9 and 16
K,P, Mg	8, 25 35	15, 27, 60+
Soil Type	Clay loam	Sandy loam

  Pasture data recorded 1985 to 1988.

- Climatic data is provided in the paper.

- Pasture yield data shows the presence of kikuyu grass improved annual yield by increasing summer and autumn production.

TABLE 1: Yield as tonnes dry matter / ha averaged over seasons.

	Tones DM/ha/year	
	No kikuyu Present in Pasture	***Kikuyu Present in Pasture***
Moist Site		
Winter	3.4	2.7
Spring	7.1	8.1
Summer	3.2	8.8
Autumn	2.7	6.0
Year	16.5	25.7
Dry Site		
Winter	3.7	3.4
Spring	6.7	7.0
Summer	3.4	6.1
Autumn	2.9	5.3
Year	16.6	22.3
Year Totals		
Moist Site		
1985/86	18.7	31.2
1986/87	13.4	20.2
1987/88	17.3	25.6
Dry site		
1985/86	19.6	26.7
1986/87	14.4	18.2
1987/88	15.7	21.9

Points:

- A clear advantage in yield to the presence of kikuyu in temperate pastures.

Pasture Composition:
Kikuyu and ryegrass proportions were higher at the moist site.

TABLE2: composition of pastures as percentage of dry matter, meaned over all cuts.

	1985/86		***1986/87***		***1987/88***	
	No K	***+K***	***No K***	***+ K***	***No K***	***+ K***
Moist Site						
Kikuyu	0	63	0	51	0	49
Ryegrass	53	17	67	21	70	22
Other grasses	23	12	19	18	18	19
Legumes	7	5	4	6	3	6
Weed	7	1	3	0	3	1
Dead matter	10	3	7	4	6	3
Dry Site						
Kikuyu	0	50	0	35	0	28
Rye	50	22	57	20	54	36
Other grasses	26	15	22	26	27	20
Legumes	12	10	13	16	11	13
Weed	2	0	2	1	2	0
Dead matter	10	3	7	2	6	3

Discussion:

- Yields from kikuyu are considerably higher than recorded in other studies. Issues contributing to this difference are:
    - Of the 9 comparisons with temperate pastures with or without kikuyu,
        - 4 with kikuyu were at Kaikohe which is a wetter and cooler district than much of Northland.
        - Ungrazed small plots were used in 2 studies which limits there applicability.
        - Other studies compared data from different sites.
    - Pasture cutting techniques used in majority of previous studies have probably depressed the assessed production from kikuyu.

- A complicating factor in this trial was that livestock probably returned higher rates of potash and nitrogen via dung and urine, to the cage sites: this may have elevated the dry matter yields for both no kikuyu and plus kikuyu data.

14.0 Pasture quality

Reference: Quality of grazed pastures.

Reference publication: Kikuyu grass farming for high production.

Published by Gallagher Electronics Ltd, Hamilton. 1985.

Author: K Betteridge. Also Reid, Stevenson and Piggot

Part 1: Author, Betteridge

Quality is defined as the animal performance per unit of feed consumed.

The first study discussed involved sheep being fed kikuyu, in an indoor feeding trial at Ruakura lasting 72 days. Kikuyu was harvested near Dargaville, frozen and then thawed as required. This compared to a high quality ration of pelleted grass meal and barley meal.

Sheep lost weight on the adlib kikuyu diet (-45 gms/day) but gained weight on the pelleted diet (+63 gm/day).

The digestibility of the diets was similar, but the intake of the kikuyu was only 73% of that of the pellets.

The second study at Kaikohe looked at pasture feed quality.

TABLE 1: Botanical composition, digestibility, nitrogen and carbohydrate content of pastures: % DM basis:

	Spring		***Autumn***	
Pasture Type	*Kikuyu*	*Rye*	*Kikuyu*	*Rye*
White clover content	15	17	20	45
Kikuyu content	24		71	
Digestibility %	78.2	79.6	73.8	76.1
Nitrogen %	3.1	3.3	3.1	4.2
Structural carbohydrate	42.6	38.0	51.8	33.4
Soluble carbohydrate	16.7	16.7	6.4	9.0

In spring there was no significant difference in nutritive value between the pasture types. In autumn the ryegrass pasture had a nutritive value three times greater than that of kikuyu pasture: feed intake was similar on both pastures within each of the two seasons.

TABLE 2: Animal data and nutritive value of pastures in a spring and autumn grazing trial with 35-40 kg sheep.

Nutritive value = liveweight gain divided by digestibility organic matter intake multiplied by 100%.

	Spring		Autumn	
Pasture Type	Kikuyu	Rye	Kikuyu	Rye
Liveweight gain (gm/day)	80	114	48	117
DOM intake (gm/day)	935	977	839	823
Nutritive value	8.4	11.9	4.7	14.8

Discussion:

- Quality of kikuyu grass dominated pasture is lower than that of temperate pasture.

- High sheep performance cannot be expected from pure kikuyu. If pastures containing kikuyu are well managed so temperate grasses and legumes are encouraged, the nutritive value of the pasture will improve.

  Good management involves hard grazing kikuyu in summer and autumn to prevent a mat building up that would smother other grasses and legumes. If this hard grazing is impossible then mechanical removal would be useful.

Part 2: Authors being Reid, Stevensan and Piggot

Overview:

Analysis of pastures in autumn has shown digestibility and energy content (ME) of kikuyu grass to be lower than for other species component, being mainly ryegrass and white clover.

Trial Method:

Cattle grazed pasture was harvested from within cages for May 1983, for a year. Kikuyu was separated out and both the kikuyu and the remaining portion were analysed for digestibility and organic matter.

Results:

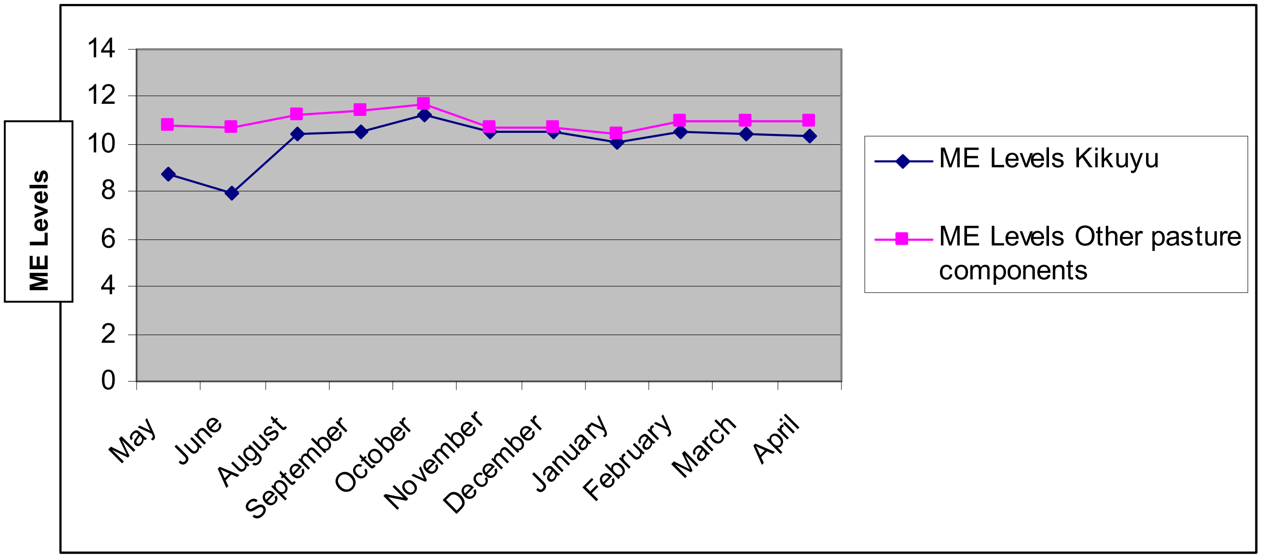
- The proportion of kikuyu grass in pastures ranged from 73% in May to 3% in October; being 30-55% in summer.

  Ryegrass varied from 12-16%
  White clover 2-37%
  Maximum dead matter at 17%
  Standing dry matter ranged from 830 up to 3150 kgDM/ha.

TABLE: Metabolisable energy levels of kikuyu verse other pasture components.

	ME Levels	
	Kikuyu	***Other pasture components***
May	8.7	10.8
June	7.9	10.7
August	10.4	11.2
September	10.5	11.4
October	11.2	11.7
November	10.5	10.7
December	10.5	10.7
January	10.1	10.4
February	10.5	11.0
March	10.4	11.0
April	10.3	11.0

METABOLISABE ENERGY (ME) LEVELS



Discussion Points:

- On all occasions kikuyu had lower ME levels: statistically lower for all occasions except October and January. The large drop in ME in June was associated with frost damage.
  The rapid decline in January followed 3 weeks of little rain.
  Kikuyu was less affected by this dry whether than the other pasture components.
  That is, its drop in ME was less than the other components. Conversely, the recovering in ME following 60 mm rain was far more rapid for the other pasture components than for kikuyu.
- Total ME production
  The contribution of kikuyu to the total ME production reflects the proportion that kikuyu makes up in the pasture and its lower ME content. The overall contribution to ME present was highest in May at 70%, and lowest in October at 3% due to the very small proportion of kikuyu present, and its low ME content.
- Kikuyu has lower nutritive value than other pasture components throughout the year. But from its presence in large amounts over summer, it contributes substantially to the total amount of energy available to the grazing animal.

15.0 Sowing ryegrass into kikuyu pastures

Reference: Introducing temperate grasses into resident sward.

Published by Gallagher Electronics Ltd, Hamilton, 1985

Author: K Betteridge

Introduction

The autumn flush of kikuyu suppresses the new season's growth of temperate species. Controlling the growth of kikuyu grass and sowing temperate grasses improves the growth in winter and spring.

Results:

- When sowing new species in autumn, the bulk of stolon and leaf material of the kikuyu must first be removed: mob stocking with cattle or a forage harvestor can be used.

- Sowing dates:

Table: Tiller density counts of Tama ryegrass in kikuyu grass direct drilled without herbicide: tiller counts as numbers/m2.

	Tiller Counts : /m2	
	Counting Date	
	30 June 05	***2 September***
Sowing Date		
25 March	8,600	7,500
22 April	14,000	10,400
11 May	5,100	8,300

The best establishment followed an April sowing. The May sown treatment never reached the higher tiller density of the April sowing because it was too late to allow good tillering.
Because of the ability of kikuyu to become dominant or rank in autumn, a spraying out of kikuyu will improve the establishment of seedlings.

TABLE: Tiller density of Tama after an April sowing into kikuyu dominant pasture (tiller counts as numbers /m2

Time from sowing treatment	+ 7 weeks	+ 18 weeks
No spray – oversown	3,400	14,600
Spray – oversown	9,300	26,100
No spray – direct drill	15,100	40,000
Spray – direct drill	26,000	49,000

Tama was sown at 20 kg/ha. Plots were rolled after sowing.
At 18 weeks the no spray oversown Tama had just 30% of the tiller count that the spray direct drill had.

Pasture Growth:

TABLE: Daily growth rates (kgDM/ha/day) and % contribution from Tama (in brackets):

Growth Period	***May – June***	***Aug – Mid Oct***	***Mid Oct – Dec***
Treatments			
No spray – unsown	16	34	66
Spray – unsown	12	37	55
No spray – oversown	15 (15)	39 (76)	44 (69)
Spray – oversown	15 (52)	51 (87)	43 (81)
No spray – direct drilled	25 (48)	46 (91)	45 (79)
Spray – direct drilled	23 (72)	56 (97)	48 (82)

Tama sown at 20 kg/ha. Spray was 2.2 kg active ingredients/ ha of paraquat.

In winter, direct drilled plots grew fastest. Tama content was higher in sprayed than upsprayed, and in direct drilled than in over sown treatments.

Perennial Grasses:
TABLE: Seasonal daily growth rates (kgDM/ha/day) and annual production (t DM/ha) of kikuyu unsown or sown (mean of over drilled and oversown) with annual or perennial grasses over two years:

	Daily Growth Rates – kgDM/ha/day				***Total Annual***
Period	***Winter***	***Spring***	***Summer***	***Autumn***	
Sowing Treatment					
Unsown	9	48	62	43	13.9
Tama rye	14	46	62	38	14.6
Nui rye	19	60	63	35	15.1
Matua prairie	16	53	65	49	15.8

Mature prairie increased annual production by 14%: it also increased autumn and winter growth.

Nui rye gave the most useful shift in pasture growth patterns with its high winter and spring growth, but it did have an autumn depression in growth.

Summary:

Seasonal pasture production of kikuyu dominant pastures can be shifted towards better spring growth by sowing template species, preferably perennial.

This require suitable timing of sowing combined with the suppression of autumn growth of kikuyu either by mob stocking or forage harvesting in conjunction with herbicide suppression.

For successful establishment into kikuyu, the dense kikuyu mat must be removed. For ongoing maximum growth for resident temperate species during winter and spring, any kikuyu mat must be removed each autumn by mob stocking or mechanically.

16.0 Feed quality in subtropical grasses

Reference: Nutritive value of subtropical grasses invading Northland Island pastures.

Proceedings of the NZ Grassland Association Vol 57, pages 203-206, 1996

Author: FS Jackson and others

Overview:

- A study was undertaken to ascertain nutritional impact of subtropical grass invasion into pastures.

- Leaves from subtropical grasses and perennial ryegrass were analysed for quality.

- Relative to perennial rye the subtropical species showed:

    - Increased levels of fibre NDF 57.5% versus 38.4% for the perennial rye
    - Reduced levels of total protein 13.2% versus 23.2% for the rye
    - Reduced levels of soluble sugar, 5.9% versus 11.7%
    - Reduced organic matter digestibility 66.6% compared to 84%

- Results indicate that subtropical grasses are of considerably lower nutritive value than perennial ryegrass. Their continued spreading will substantially decrease the nutritive value of pastures.

Trial Method:

Leaves from 5 subtropical grasses and perennial ryegrass were harvested during mid summer from grassland in Manuwatu, Waikato and Northland.

Chemical analysis was undertaken on this material. In vitro rumen tests were undertake with sheep.

- Plants grown in Northland were consistently poorer quality feed than those grown in Manawatu – Waikato.

TABLE 1

	Species	***Northland***	***Waikato***	***Manawatu***
Digestibility	Kikuyu	65.4	69.5	66.3
	Paspalum	58.3	64.7	67.8
	Ryegrass	81.7	86.2	
Soluble Sugars	Kikuyu	4.3	5.1	6.6
	Paspalum	8.8	7.9	6.4
	Ryegrass	12.1	11.3	

Results: TABLE 2: Chemical composition of the leaves of subtropical grasses compared with perennial ryegrass levels (samples were analysed in duplicate)

Area	*Species*	*Crude protein (%DM)*	*Total condensed tannia (%DM)*	*Soluble sugar (%DM)*	*NDF (%DM)*	*OMD (%DM)*
Northland	Ryegrass	24.2	0.30	12.1	40.3	81.7
	Kikuyu	17.5	0.10	4.3	58.8	65.4
	Paspalum	15.7	0.25	8.8	58.2	58.3
	Crowfoot	6.6	0.13	3.8	67.0	52.2
Waikato	Ryegrass	21.8	0.07	11.3	36.5	86.2
	Kikuyu	15.6	0.03	5.1	59.4	59.5
	Paspalum	15.8	0.18	7.9	63.0	64.7
	Witchgrass	13.3	0.12	8.5	53.6	63.7
	Summer grass	19.2	0.20	5.7	44.2	71.2
	Crowfoot	8.9	0.04	8.8	62.8	64.0
Mean Values	Ryegrass	23.8	0.19	11.7	36.4	84.0
	Kikuyu	16.6	0.09	5.3	58.1	67.1
	Paspalum	15.6	0.17	7.7	61.5	63.6
	Witchgrass	9.9	0.17	9.1	55.8	67.5
	Summer grass	15.6	0.16	6.0	48.3	73.5
	Crowfoot	8.1	0.06	1.3	64.0	61.2

NDF is neutral detergent fibre, measuring the total cell wall content.
OMD is organic matter digestibility.

- The digestibility crude protein and soluble sugars of all subtropical grasses were lower than for perennial ryegrass.

Discussion:

- Study data indicates that the invasion of rye white clover pastures by subtropical grasses will considerably reduce nutritive value. This decrease in quality would be great enough to lower the voluntary feed intake of animals. This in combination with the lower digestibility would be likely to decrease animal production.
- The condensed tanins in the grasses were at very low levels: too low to be effective in reducing net degradation of plant nitrogen (protein) to ammonia.
- Without effective pasture management, the continued invasion by subtropical grasses will lower the quality perennial rye white clover pastures. Management such as is spraying, resowing, specific grazing management e.g. harsh in the autumn, may limit the spread of the subtropical grasses.

  Conversely a supplementing feed strategy could be used. These supplements would have high concentrations of sugars and contain rumen under-gradable protein.

17.0 Kikuyu management: Nitrogen responses and cutting interval

Reference: Effect of Nitrogen – cutting interval on production of grass species swards in Northland, NZ

I. kikuyu dominant swards.
NZ Journal of Experimental Agriculture 1979: 353-359

Author: G I Goold

Overview – Summary

- The effects of 2, 4 and 6 weekly cutting intervals – 4 rates of nitrogen (0, 120, 240 and 480 kgN/ha/year) were examined on kikuyu dominant swards.
- Pasture production was highest in autumn when moisture was adequate and mean temperatures were high.
- At other times low temperature and/or moisture stress limited pasture growth.
- Nitrogen increased annual dry matter yield; the response general being linear.
- Nitrogen response greatest during winter and spring when poa made a large contribution, and autumn with kikuyu dominance.
- Extending the cutting interval increased pasture growth: effect being greatest in late spring and summer and least in winter.
- Clover cover decreased with increased nitrogen use, and increased with extended cutting interval.

Trial Method

- Site 1 – Peria (Kaitaia) on Mangakahia silt (very good soil)
- Site 2 – Dargaville research farm on Te Kopuru sand (very poor soil)
- Site 3 – Matakohe on limestone (very difficult soil)
- From the end of spring until the middle of winter, all swards were kikuyu dominant.

Measurements collected for a 2 year period, from January 1971 to December 1972.

Results:

TABLE 1 – Overall Results

Effects of N and cutting interval on mean annual herbage yields at three sites (kg DM/ha).

Site	*Cutting Intervals (weeks)*	*Kilograms of dry matter per hectare per year* *Annual rate of applied N (kg/ha*				
		0	*120*	*240*	*480*	*Mean*
Peria	2	5060	5970	7490	8930	6860
	4	7420	8800	10740	12800	9940
	6	9020	10760	12360	14650	11700
	Mean	7170	8510	10200	12130	9500
Dargaville	2	4760	4850	5430	6880	5480
	4	6500	6840	7320	8470	7280
	6	7460	8090	8480	9360	8350
	Mean	6240	6590	7080	8230	7040
Matakohe	2	6590	6830	7300	9460	7550
	4	9480	9270	9390	11520	9910
	6	10800	11860	12250	12960	11970
	Mean	8960	9320	9650	11310	9810

TABLE 2

Pasture growth responses to Nitrogen applied: (kg DM growth per kg Nitrogen applied) Annual rate of applied N (kg/ha).

Pasture Growth KgDM per Kg Nitrogen applied:

		Kg/ha of Nitrogen		
	Rate Cutting Interval - Week	*120*	*240*	*480*
Peria	2	7.5	10.1	8.1
	4	11.5	13.8	11.2
	6	14.5	13.9	11.7
Dargaville	2	0.8	2.8	4.4
	4	2.8	3.4	4.1
	6	5.3	4.3	4.0
Matakohe	2	2.0	3.0	6.0
	4	-1.8	-0.4	4.3
	6	8.8	6.1	4.5

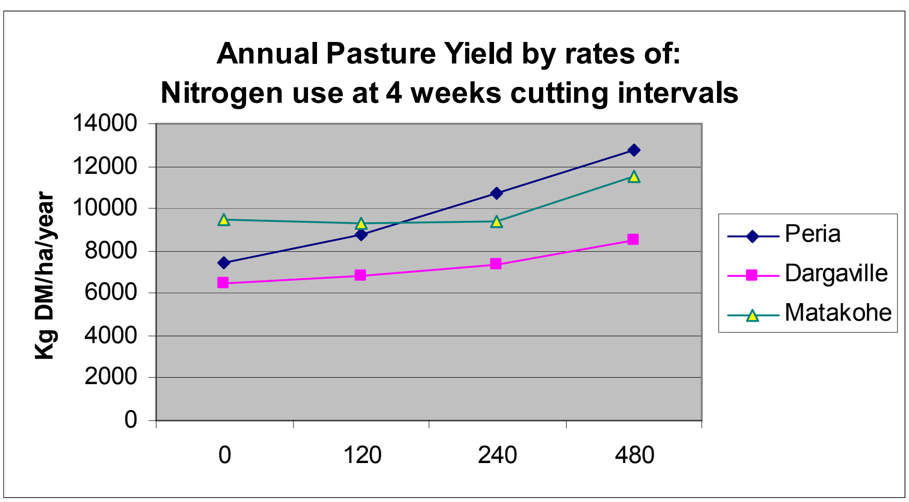
Discussion

- Nitrogen Response
    - Pasture growth rates were highest during February and March at Peria and Matakohe – kikuyu growth, but a November peak in Dargaville.

Peria	- Peak growth after high autumn rainfall. These growth rates being no N at 70 kg DM/ha/day and the plus 480 kg N/ha at 110kg DM/ha/day
Matakohe	- Peak growth No N at 70 kgDM/ha/day and the plus N at 80 kg DM/ha/day
Dargaville	- Peak growth no N at 50 kgDM/ha/day and the plus 480 kg N/ha at 60 (Nov)

- At Peria – responses from N were consistent and generally linear throughout the year.
- At Dargaville and Matakohe sites N responses were significant and linear during winter and early spring. During periods of moisture stress or low temperatures, N responses were minimal and sometimes negative.
-

	Kg DM/ha/year		
Kg N/ha/yr	Peria	Dargaville	Matakohe
0	7420	6500	9480
120	8800	6840	9270
240	10740	7320	9390
480	12800	8470	11520



Cutting Interval

- Longer regrowth interval resulted in greater pasture growth at each site; but the seasonal pattern was not altered.
- Responses to longer regrowth intervals were greatest in spring and autumn (periods of highest growth) and least during summer (high growth) and winter (low growth).
- The effect of cutting interval on pasture growth was greater than the effect of N at Dargaville and Matakohe, and had a similar effect at Peria eg; kikuyu swards cut

every 6 weeks compared to 2 weeks were 71, 52 and 59% higher yielding at Peria, Dargavllie and Matakohe respectively.

- N – cutting interval effect on pasture cover:
  - White clover cover markedly decreased with increasing nitrogen and increased with extended cutting interval.
  - Kikuyu cover was significantly reduced with longer regrowth intervals but was not influenced by N. Note the halving of kikuyu present in the pasture in August, by going for 2 weeks to 6 weeks cutting interal at Dargaville.

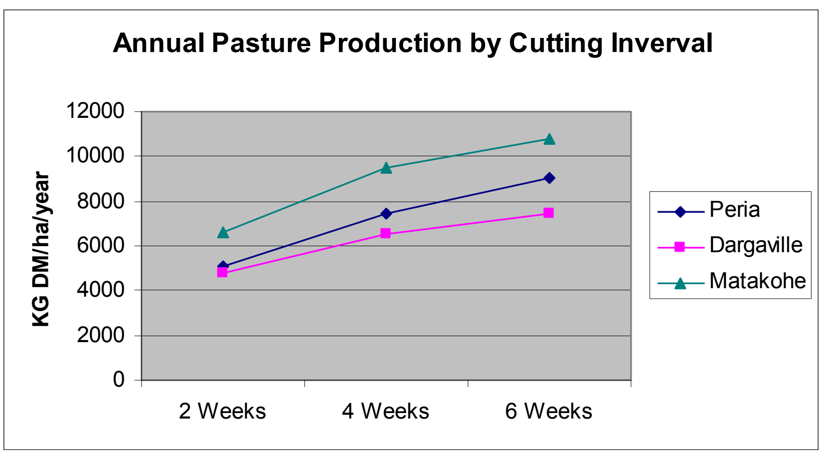
TABLE 3

Effect of N and cutting interval on botanical composition in August 1972 (% of cover hits in the second winter)

	Kikuyu %		Clover %	
	Dargaville	*Matakohe*	*Dargaville*	*Matakohe*
Cutting Interval				
2 weeks	36	37	6	7
4 weeks	25	33	4	10
6 weeks	14	25	10	16
N applied / ha / year				
0	24	33	15	19
120	27	32	9	12
240	24	30	4	8
480	23	31	2	5

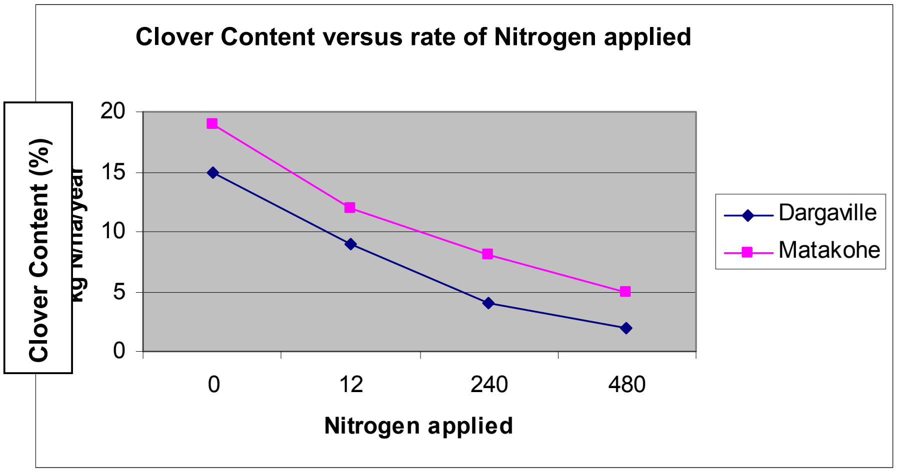
Effect of Cutting Interval on DM production:

	Kg DM/ha/year		
	2 Weeks	4 Weeks	6 Weeks
Peria	5060	7420	9020
Dargaville	4760	6500	7460
Matakohe	6590	9480	10800



Clover content by N application:

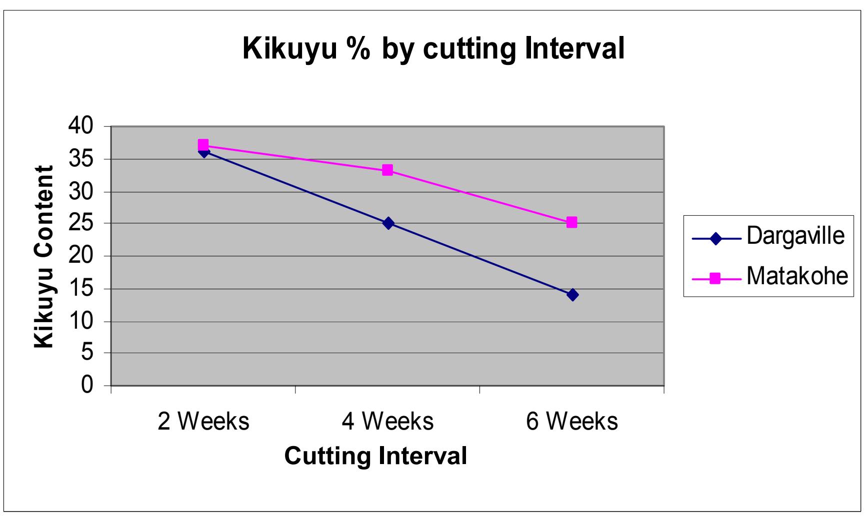
N applied: kgN/ha	Dargaville clover %	Matakohe clover %
0	15	19
12	9	12
240	4	8
480	2	5



Comment: Almost a straight line for decreasing clover content from increasing Nitrogen application.

Effect of cutting interval on kikuyu content of the pasture:

	Kikuyu % In August		
	2 Weeks	4 Weeks	6 Weeks
Dargaville	36	25	14
Matakohe	37	33	25



Comment: at Dargavile, for every 2 week increase in cutting interval, a 10% decrease in kikuyu content in August; e.g. kikuyu content being 36% with 2 week cutting interval compared to 25% with a 4 week cutting period.

Response to Nitrogen – influenced by the cutting interval:

Peria Site:

	Applied N – Kg /ha/year + increases in DM/ha/year			
Cutting Interval	0 kgN/ha	120 kgN	240 kgN	480 kgN
Week 2	5060 kgDM/ha Grown			
	Increase in DM	+910	+2430	+3870
	Increase as %	18	48	76
	Response (kgDM/kgN)	7.6	10.1	8.1
Week 4	7420 kgDm/ha Grown			
	Increase in DM	+380	+3320	+5380
	Increase as %	19	45	73
	Response (kgDM/kgN)	11.5	13.8	11.2
Week 6	9020 kg/DM/ha Grown			
	Increase in DM	+1740	+3340	+5630
	Increase as %	19	37	62
	Response (kgDM/kgN)	14.5	13.9	11.7
Mean	7170 kgDM/ha Grown			
	Increase in DM	+1340	+3030	+4960
	Increase as %	19	42	69
	Response (kgDM/kgN)	11.2	12.7	10.3

Comment:

- Strong nitrogen responses.
- Nitrogen responses at a maximum with an input of 240 kg N/ha.
- Best nitrogen responses with a rotation length (cutting interval) of 4 or 6 weeks.
- Overall result for nitrogen response at 11.5 kg DM/ha per kilogram of nitrogen applied.

Dargaville Site:

Cutting Interval	*Applied N – Kg /ha/year + increases in DM/ha/year*			
N➔	0 kgN/ha	120 kgN	240 kgN	480 kgN
Week 2	4760 kgDM/ha Grown			
	Increase in DM KG	+90	+670	+2120
	Increase as %	2	14	45
	Response (kgDM/kgN)	0.8	2.8	4.4
Week 4	6500 kgDM/ha			
	Increase in DM kg	+340	+820	+1970
	Increase as %	5.3	12.6	30
	Response (kgDM/kgN)	2.8	3.4	4.1
Week 6	7460 kgDM/ha			
	Increase in DM kg	+630	+1020	+1900
	Increase as %	8.5	13.7	25
	Response (kgDM/kgN)	5.3	4.3	4.0
Mean	6240 kgDM/ha			
	Increase in DM kg	+350	+840	+1990
	Increase as %	5.6	13.5	32
	Response (kgDM/kgN)	3.0	3.5	4.1

Comment:

- Very small responses to nitrogen. Overall average at 3.5 kg DM per kg of nitrogen applied.
- Site was moderately kikuyu dominant, averaging 25% kikuyu as component of pasture in August.

Conclusion:

Limitations to this trial are:

- This 2 year collection of data covers mowing trials only. No animal effects are included.
- No data on pasture quality is provided either.
- What flow on effects there may have been are unknown.

- The positive result of this trial is that it gives some very useful detail covering kikuyu dominant swards:

    - Dry matter production
    - Nitrogen responses for three rates of N and at various application intervals; following each pasture cut being,
        - 24 applications for 2 weekly cutting
        - 12 applications for 4 weekly cutting
        - 8 applications for 6 weekly cutting

    These nitrogen responses as total dry matter growth throughout the year plus DM responses per kilogram of N applied.

    - Pasture growth charges from changing the cutting interval
    - Clover population changes due to nitrogen application.

Discussion Points

- Seasonal growth was highest in February and March for swards with greatest kikuyu dominance e.g. at Matakohe under 2 weekly cutting interval.

Daily Growth Rates (kgDM/ha/day) – Average of 2 years:

February – March	November
Seasons Peak	
64	30

Spring growth was considerably slower than the mid late summer peak growths. Winter growth rates at Matakohe and Dargaville were under 10 kg DM/ha/day for periods, with no nitrogen applied. And especially under a 2 week cutting interval.

- Frequent cutting substantially reduced sward yields: swards with 2 week regrowth period were 41% lover yielding than those with a 6 week regrowth period at Peria, 34% at Matakohe.

    Question: Do we limit our kikuyu growth with quick rotations in the autumn currently? Extrapolating these mowing results into current day grazing management should be considered with care.

- Nitrogen increased growth rates and yields at each site although there were seasonal and site differences.

At the highest rate of nitrogen (480 kg/ha/year) the increase in mean annual pasture yield was:

69% at Peria
32% at Dargaville
26% at Matakohe

Compared to the no nitrogen yield – nitrogen responses as kg Dm growth per kg N applied varied:

Mean result over all cutting intervals.

	Nitrogen Response: kgDM grown per kg N applied	
Rate of n (kg/ha/applied)	Peria	Dargaville and Matakohe Average
120	11.2	3.0
240	12.6	3.3
480	10.3	4.5

- Clover presence was increased by increasing the cutting interval and decreased by increasing the nitrogen application.
- Kikuyu content decreased by increasing the cutting interval.
- Feed quality should be improved by increasing the cutting interval because of the increased clover content and the decreased kikuyu content.

18.0 Potential yields of kikuyu

Reference: NZ Journal of Experimental Agriculture 1979: 353-359

Author: G I Goold

Notes from his Discussion regarding Potential Growth Kikuyu

- Taylor recorded growth of 245 kg DM/ha/day near Kaitaia under irrigation.
- Colman (1966), Australia reported that kikuyu swards were able to continue growing at a high rate despite very dry conditions, provided adequate Nitrogen was applied.
- Whitney (1974) NSW applied 800 kg N/ha and irrigate kikuyu and obtained yields of 30,000 kg DM/ha/year.
- Kemp (1976) NSW, yields of 21,370 kg DM/ha/year when he applied 950 kg N/ha.

GAVIN USSHER

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