The performance of pasture mixes containing 'Ceres Tonic' plantain *(Plantago lanceolata)* in Northland

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Abstract

Over the last 10-15 years 'Ceres Tonic' plantain (*Plantago lanceolata*) has been added to many ryegrass/white clover pastures in Northland. From 2001 to 2009, measurements were undertaken monthly in six locations throughout Northland to record the dry matter contribution of 'Tonic' plantain in mixes relative to perennial ryegrass-based pasture, using pasture cages in paired paddocks. Addition of plantain to pasture mixes provided significant dry matter production advantages which ranged from 6 t DM/ha in the first year to 1.2 t DM/ha by Year 3. Plantain contributed between 32-90% of the yield over the measurement periods. Differences between plantain-based pastures and perennial ryegrass-based pastures were significant in summer (1.8 t DM/ha) and autumn (0.9 t DM/ha), but there were no production differences in winter and spring. Adding 'Tonic' plantain to ryegrass/white clover pastures (even at low seeding rates) has potential to increase production levels and to improve dry matter distribution over time.

Keywords: pasture mixes, dry matter production, seasonal distribution of dry matter, persistence

Introduction

Northland's farmed pastures are dominated by grasses, primarily perennial ryegrass (*Lolium perenne*), kikuyu (*Pennisetum clandestinum*) and *Poa* species. Many of the longer-term perennial-based pastures contain standard endophyte which provides animal production challenges in Northland (Easton & Couchman 1999; Keogh & Blackwell 2001). This combined with heavy soils and a warm, wet climate means high quality pasture for feeding livestock becomes difficult to provide. Raising nutritive value by encouraging legumes such as white clover (*Trifolium repens*) has largely failed due to the competition from the grasses, high fertiliser nitrogen use, pugging damage, pests and diseases.

Recently, the sowing of mixed pastures with 'Tonic' plantain, clovers and low rates of ryegrass has become popular. 'Tonic' plantain has been shown to have a positive influence on animal production relative to perennial ryegrass (Moorhead *et al*. 2000; Hoskin *et al*. 2006; Judson 2008; Judson *et al.* 2009, this volume). This paper describes the annual yield, composition and seasonal distribution of dry matter production in such pastures.

Materials and Methods

Paddocks with pastures containing 'Tonic' plantain were compared with adjacent paddocks of predominantly ryegrass of varying age, (often older), using a cage technique. The on-farm sites were:

Hakuru/Kaiwaka - a sheep and cattle farm of rolling contour. A plantain mix was sown in autumn 2001 and this was compared with a ryegrass-dominant existing pasture. Sampling was monthly from July 2001 to June 2006.

TauhoaT/Wellsford - a dairy farm of rolling contour. A plantain mix was sown in autumn 2001 while the perennial ryegrass comparison was sown autumn 2000. Sampling was monthly from September 2001 to June 2006.

Ruawai - a dry stock flat farm. A plantain mix was sown in autumn 2003, and this was compared to a ryegrass-dominant existing pasture. Sampling was monthly from September 2003 to September 2006.

Mata/Ruakaka - a dairy farm. A plantain mix was sown on hilly/sloping land in autumn 2006, and this was compared to a ryegrass-dominant existing pasture. Sampling was monthly from May 2006 to June 2009.

Kerikeri - a dairy farm. A plantain mix was sown on sloping/hilly land in autumn 2007, and this was compared to a ryegrass-dominant existing pasture. Sampling was monthly from May 2007 to June 2009.

Umawera/Mangamuka - a hilly dairy farm. A plantain mix was sown in half a paddock with a ryegrass/white clover mix sown in the balance for comparison. Sowing was in autumn 2007 and sampling was approximately 6 weekly from May 2007 to June 2009.

Plantain-based pastures were established from a typical seeds mix of 2 kg plantain, 2 kg white clover, 3 kg red clover (*Trifolium pratense*) and 10 kg diploid perennial ryegrass drilled per hectare. 'Tonic' plantain was the only plantain cultivar used at all sites. The diploid perennial ryegrass cultivar varied over the different sowing years with Standard endophyte being used in 2001, AR1 in 2003 and 2006, and AR37 in 2007 sowings. Not all seed lines were the same as they were sourced commercially by each farmer in

Figure 1 Mean annual yields (kg DM/ha) of 'Tonic' plantain-based pastures and perennial ryegrass-based pastures from Northland monitor paddocks over consecutive years. Bars represent least significant difference (P<0.05).

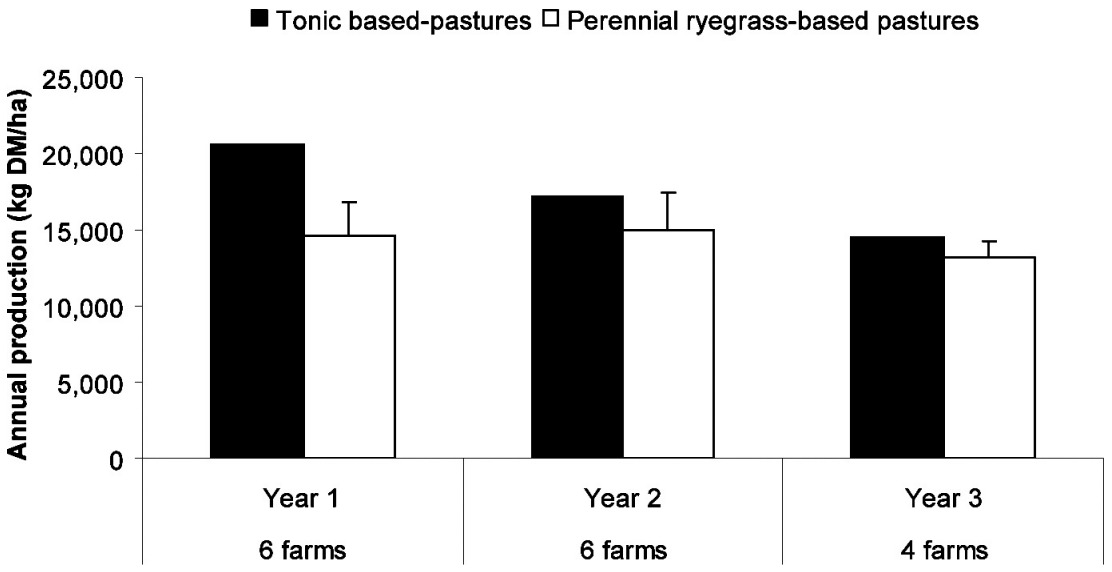

Figure 2 Mean seasonal distribution of dry matter production on four farms over 3 years from perennial ryegrass-based pastures and 'Tonic' plantain-based pastures in Northland. Bars represent least significant difference (P<0.05).

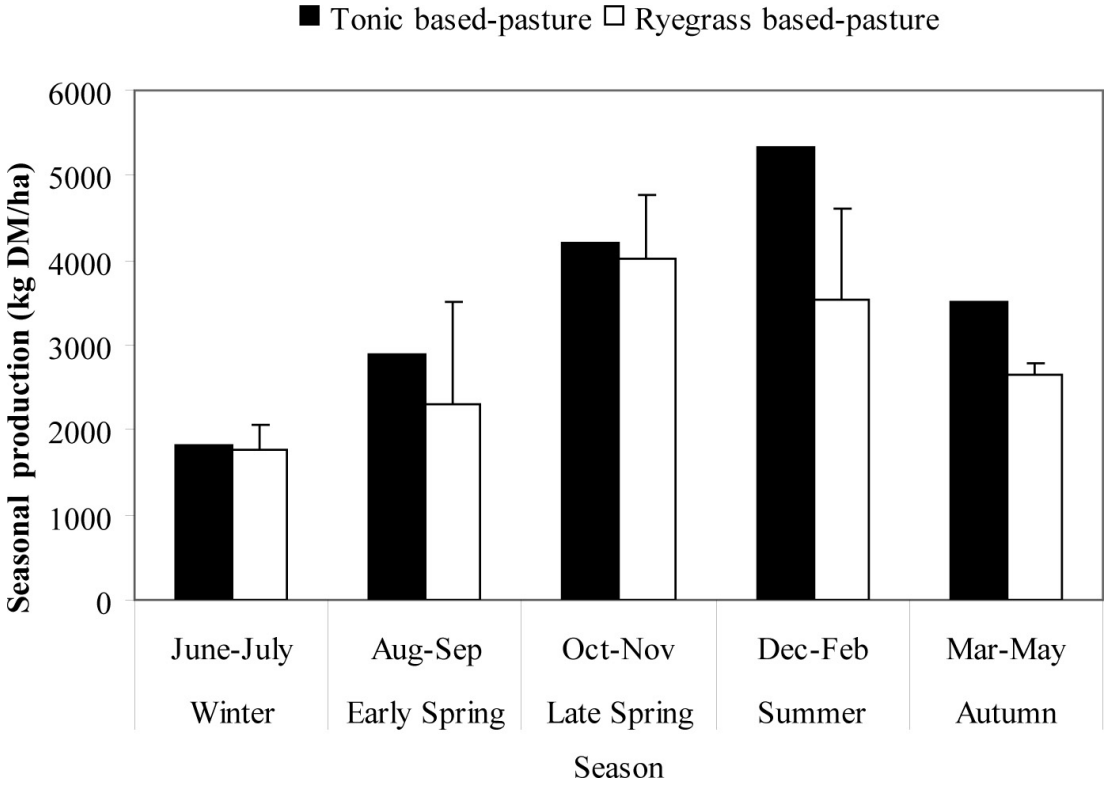

Table 1 Annual yields (t DM/ha) of perennial ryegrass-based pastures and 'Tonic' plantain-based pastures from Northland monitor paddocks.

Location, farm type, start and finish date for each year	Year	Perennial ryegrass-based pasture (t DM/ha)	Tonic plantain-based pasture (t DM/ha)
Hakuru – Sheep/Beef	2001/02	14.5	19.9
Aug-July	2002/03	13.1	15.8
	2003-04	11.9	13.1
	2004/05*	9.8	11.6
Mean of completed years		13.2	16.3
Tauhoa - Dairy	2001/02	13.1	19.7
Sept-Oct	2002/03	14.7	14.4
	2003/04	12.6	12.9
	2004/05*	7.5	8.7
Mean of completed years		13.5	15.7
Ruawai – Dry stock/ beef	2003/04	15.9	21.4
Aug-Sept	2004/05	16.0	22.2
	2005/06	18.3	20.6
Mean		16.7	21.4
Mata - Dairy	2006/07	13.8	22.3
May-June	2007/08	16.6	19.2
	2008/09**	9.9	10.6
Mean		13.4	17.4
Kerikeri - Dairy	2007/08	16	18.5
May-June	2008/09	18.1	18.5
Mean		17.1	18.5
Umawera – Dairy	2007/08	14.4	22.2
May-June	2008/09	11.5	12.9
Mean		13.0	17.6
Mean annual production t DM/ha		14.3	17.6
LSD (P<0.05)		1.40	

* Part year only; **10 Months, measured to April

the year sown. Sowing techniques varied with farm type and topography. All monitored paddocks where subjected to individual farmers fertiliser and grazing management practices.

The ryegrass and plantain-based paddocks were assessed simultaneously and at monthly intervals for DM yield, using the pre-trimming cage technique of Piggot (1997). The method involved a pre-trim of paired cage sites to a standard cutting height of about 1 cm by rotary mower to ensure the pasture exceeded 1 cm before another trim, and then yield sampling at the subsequent monthly visit. Yield samples were then cut to a 1 cm stubble using hand-shears, off one 0.25 m^2 quadrat per cage. Weighing and sub-sampling was done in the field, and a 100 g sub-sample of herbage was dried in a forced-draft oven at about 85°C for dry matter content determination. Botanical composition was assessed from dissection of a 200-300 piece herbage sample from the field sub-sample. The components were plantain, legume (mainly white clover), kikuyu, other grasses (mainly perennial ryegrass), weeds, and dead material.

At the Hakuru, Tauhoa and Ruawai sites a second series of paired cages were placed onto untrimmed pasture and sampled at the next visit. A herbage sample to a 1 cm stubble height was cut at each visit to allow growth to be calculated from the difference in herbage mass between consecutive visits. These data are not presented here but are available on request.

Farms were used as replicates and treatments were analysed using ANOVA.

Results

Dry matter production

Annual dry matter production on perennial ryegrass-based pastures on the Northland farms were variable and ranged from 13.1-16 t DM/ha in the Year 1 and 11.9-18.3 t DM/ha in the Year 3 of measurements with no distinctive trend between years within farms. Average annual production over all farms combined showed a significant advantage to plantain-based pastures (17.6 t DM/ha) over perennial ryegrass-based pastures (14.3 t DM/ha) (Table 1). Plantain-based pasture annual yields ranged from 18.5-22.3 and 10.6-20.6 t DM/ha for the first and third years, respectively. There was a significant (+6 t DM/ha) advantage to plantain-based pastures over those based on perennial ryegrass in Year 1. Comparable differences declined in Year 2 (non-significant) and again in Year 3 (significant) (Fig. 1).

Seasonal distribution of dry matter production

Seasonal dry matter production was analysed for the four farms which had a 3 year history of measurements. Annual dry matter production was split into the key periods of winter (June-July), early spring (August-September) and late spring (October-November), summer (December-February) and autumn (March-May). Plantain-based pasture dry matter production was not significantly different from the ryegrass-based pasture for winter, early spring and late spring. In summer and autumn, however, plantain-based pasture significantly outyielded ryegrass-based pasture by 1.8 t DM/ha ($P<0.05$) and 0.9 t DM/ha ($P<0.01$), respectively (Fig. 2).

Table 2 Botanical composition (% of DM) of perennial ryegrass-based pastures compared with 'Tonic' plantain-based pastures (the balance was dead material or weeds) from different farm types over different years in Northland.

Location, farm type, start and finish date for each year	Year	Composition of perennial ryegrass-based pastures			Composition of plantain-based pastures	
		Perennial ryegrass	White + red clover	Plantain	Perennial ryegrass	White + red clover
Hakuru	2001/02	86	11	90	2	8
(Aug-July)	2002/03	76	20	78	12	9
Sheep/Beef	2003/04	75	18	40	47	11
	2004/05*	74	16	59	23	17
Tauhoa	2001/02	78	20	66	20	12
(Sept-Oct)	2002/03	88	9	63	27	7
Dairy	2003/04	90	6	46	39	13
	2004/05*	71	18	52	26	20
Ruawai	2003/04	93	6	58	19	22
(Aug-Sept)	2004/05	78	20	68	16	16
Dry stock/Beef	2005/06	79	18	60	29	10
Mata	2006/07	89	7	56	33	10
(May-June)	2007/08	89	7	65	20	13
Dairy	2008/09	69 (24)**	3	29	50 (12)**	6
Kerikeri -Dairy	2007/08	92	6	54	30	14
(May-June)	2008/09	95	3	38	52	6
Umawera - Dairy	2007/08	83	13	84	7	8
(May-June)	2008/09	86	10	42	32	24

* Part year only ( ) ** kikuyu

Botanical composition

Perennial ryegrass-based pastures contained 78-93% and 75-90% ryegrass over Year 1 and Year 3, respectively. Comparable data for white and red clover contents of perennial ryegrass-based pasture were 6-20% and 3-18%, respectively (Table 2). Plantain based-pastures contained 54-90% and 29-60% plantain in Year 1 and Year 3, respectively. Ryegrass content of plantain-based pastures was 2-30% in Year 1, increasing to 29-47% of DM by Year 3. White and red clover contents in the plantain-based pasture were 8-22% in Year 1 and 8-13% of DM in Year 3, respectively.

Discussion

Plantain-based pastures were consistently higher yielding than ryegrass-based in the Year 1, with plantain contributing the highest proportion of the dry matter in all of the measured pastures. Although the plantain content declined over time it was still on average the major plant species in the monitored pastures.

It is difficult to be certain if higher pasture yields resulted from the inclusion of plantain in the seed mix or simply reflected an advantage of new pasture over older ones. The yield of new pastures tended to decline over time even though plantain remained the major sward component at most sites (Table 2). Previous research has shown that new pasture is more productive than older ones but that the advantage may be short-lived (Thom *et al*. 1993). However, where plantain-based pasture and perennial ryegrass was sown at the same time in the same paddock (Umawera), the plantain-based pasture showed greater production in Year 1. Although the difference declined over time there was still a real advantage to plantain-based pastures by Year 3.

Northland is a difficult environment to maintain pasture quality and productivity at key times of the year, namely winter, summer and autumn. The seasonal distribution of dry matter showed an advantage to the plantain-based pastures in summer and autumn which

reflects the warm-season growth potential of 'Tonic' plantain. The yield advantage in summer is potentially the most useful finding because at this time the forage quality of both perennial ryegrass and kikuyu limits animal performance. The summer growth potential of 'Tonic' plantain in Northland is consistent with other plot trial data (Agricom regional trial, Northland 2006-09). Low numbers of farms and the variations in local climate may have contributed to the lack of statistical significance in other seasons. The results do, however, highlight how uniform the summer and autumn growth potential of 'Tonic' plantain-based pastures are in the Northland environment.

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