6. PASTURE TRIALS

6.1 Response of Italian ryegrass to different fertilisers on a nutrient deficient soil - Dunkeld, Vic

Location:
Dunkeld Research Site.

Funding:
This was an Incitec Pivot Fertilisers funded trial.

Researchers:
Incitec Pivot Fertilisers

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Take home messages:

- Italian ryegrass dry matter response to different fertilisers was significant, and matched the nutrient deficiencies indicated in the soil test results.
- The site was clearly phosphorus deficient with marked responses to phosphorus (P) fertiliser addition with increases where other nutrients such as nitrogen (N) were also applied.
- The highest yielding fertiliser treatment had a balance of nutrients, including N, P, sulphur (S) and potassium (K) nutrients.
- The relatively wet year meant there was unexpectedly no affect on plant establishment by sowing seed with potassium fertiliser.
- The results also indicate the most cost effective method of getting a high yielding pasture is by addressing low nutrient soil status with an application of an appropriate mix of nutrients.

Background/Aim:
With farmers looking to diversify from cropping into pasture, or to improve existing pasture, there was a need to show effective fertiliser and placement methods to give a new pasture the best start. This trial was also designed to show the importance of soil testing, and linking this with applying the right nutrients.

Rainfall

Avg. Annual:	687
Avg. G.S.R.:	536
2009 Total:	562
2009 G.S.R.:	489

Treatments:
There were 20 different fertiliser treatments. They included fertiliser applied either side band drilled with the seed or broadcast (BR*) over the soil surface after drilling the seed. The rates of the different applied nutrients and the cost per hectare ($/ha) of the fertiliser treatments are listed in Table 1. After the first two harvests, the trial site received a blanket application of nitrogen (N) at a rate of approximately 100 kg/ha of urea fertiliser, or 46 kg N/ha.

Table 1. Fertiliser Treatments and estimated costs

Tr. no.	Fertiliser	Application rate (kg P/ha)	N kg/ha	P kg/ha	K kg/ha	S kg/ha	Cost $/ha**
1	Control nil fertiliser	0	0	0	0	0	0
2	Granulock® 15	30	35.75	30	0	26.25	164
3	Croplift® 13	30	23.22	30.4	0	13.19	127
4	PASTURE STARTER®	30	14.67	30.51	0	18.9	140
5	DAP	30	27	30	0	2.4	111
6	MAP	30	14	30.66	0	2.1	103
7	NPKS 19-8-10-6	30	72.77	30.4	38	25.23	262
8	NPKS 27-0-21-0	0	49.36	0	38.85	0	130
9	SuPerfect®	30	0	30.8	0	38.5	110
10	Triple superphosphate	30	0	30.02	0	1.45	101
11	Super/Potash 3&1	30	0	30.18	58.42	37.77	213
12	Super Cu0.5,Mo0.025	30	0	30.73	0	38.43	154
13	DAP	15	13.5	15	0	1.2	55
14	Triple superphosphate	15	0	15.11	0	0.73	51
15	DAP	60	54	60	0	4.8	222
16	Triple superphosphate	60	0	60.44	0	2.92	204
17	MAP-S	30	14	30.66	0	2.1	103
18	DAP – BR*	30	27	30	0	2.4	111
19	Single Superphosphate – BR*	30	0	30.8	0	38.5	110
20	Super/Potash 3&1–BR*	30	0	30.18	58.42	37.77	213

Source: Incitec Pivot Fertilisers, 2009. * BR treatment fertiliser was broadcast instead of being banded beside the seed. ** Cost is Incitec Pivot Fertilisers' recommended retail price (ex: GST) as of 12/01/2010 ex Portland and does not include application costs.

Plot size: 10m x 1.5m x 4 reps

Measurements:
Plant dry matter (DM) kg/ha

Variety: Sonik Italian ryegrass

Sowing rate: 20 kg/ha

Sowing date: May 27 2009

Soil Type: Brown sandy clay loam

Soil test (0 – 10 cm):
NH_4^- N = 10 mg/kg
Organic Carbon = 4%
PBI = 130
NO_3^- N = 3.3 mg/kg
Colwell P = 35 mg/kg
pH = 5 (1:5 H_20)
KCl-40 S = 17 mg/kg
K (Amm Acet) = 0.26 Meq/100 g

Herbicides:
Roundup Powermax at 4L/ha applied the day prior to sowing

Paddock History:
2007: Cropping, 2008: Cropping

Diseases:
Pasture fodder crop established well with no weed or disease pressure.

Results and discussion:
Some care needs to be taken when interpreting dry matter results from the first dry matter cut in this trial, as it had a high co-efficient of variance, which suggests a significant variation in dry matter recorded across the site regardless of treatments. Co-efficient of variation is reduced with subsequent cuts, which is generally seen in pasture trials.

Italian ryegrass dry matter responses in Table 2 show that different fertilisers gave significant yield increases over three harvests compared to the control plots. This was no surprise given the low nutrient status of the trial site, as the soil test analysis showed that a range of nutrients were either deficient, low or marginal. The cost of extra dry matter grown above the control also reflected this, with the highest yielding treatments being among the cheapest extra dry matter grown (Table 2).

The most impressive results were from the treatments which had a balanced nutrient approach. This included phosphorus added in combination with nitrogen, potassium and sulphur. This can be seen by comparing the yields of treatments in Table 2 with others applying the same phosphorus rate which included the extra nutrient combinations of N, K and S.

For example, one striking difference was the response between triple superphosphate (TSP) and DAP at 15 kg P/ha. This shows that for the same amount of applied phosphorus, the addition of nitrogen from the DAP boosted initial yields and helped the pasture to a better start (Table 2). It should also be noted that from these two treatments, there were no differences from the second and final harvests.

Even though the best yielding treatment involved banding potassium in the soil near the seed, this is generally not regarded as good practice. This is due to a 'salting' effect that can occur, resulting in burning of seed and reduced germination. However, this was not seen in this trial, possibly due to the wet period experienced during establishment of the trial.

The underlying key nutrient required appeared to be phosphorus with marked responses to phosphorus fertilisers. Treatment 8 (table 1), where nitrogen and potassium was applied in the absence of phosphorus, failed to generate a significant dry matter response compared to the control or 'nil' fertiliser treatment. All other treatments where phosphorus was applied banded at 30 kg P/ha or higher, yielded significantly better than the control.

There were two fertiliser treatments which had phosphorus applied and did not perform significantly better than the control. These were TSP at a rate of 15 kg P/ha, and SSP broadcast over the surface at 30 kg P/ha. It is possible that in both treatments, the phosphorus available was not sufficient to increase the dry matter yields. This is backed by increased dry matter yields when SuPerfect was banded or TSP was applied at higher rates.

Table 2. Italian Ryegrass Yield responses over three harvests to different fertilisers applied at sowing and the respective cost of extra dry matter grown above the control

Fertiliser	Application rate (kg P/ha)	Harvest 1 kg/ha 19.10.09	Harvest 2 kg/ha 19.11.09	Harvest 3 kg/ha 18.12.09	Total DM kg/ha	DM kg/ha above control	Cost of extra DM c/kg
Control nil fertiliser	0	1782	1129	659.4	3570	0	0
Granulock®15	30	4897	1659	1146.6	7702	4132	4.0
Croplift® 13	30	4140	1074	1044.3	6258	2688	4.7
PASTURE STARTER®	30	3713	1384	986.7	6084	2514	5.6
DAP	30	3610	1357	1031.2	5999	2429	4.6
MAP	30	5547	1720	1067.6	8335	4765	2.2
NPKS 19-8-10-6	30	6219	1492	1159.1	8870	5300	4.9
NPKS 27-0-21-0	0	2112	1606	522.1	4240	670	19.3
SuPerfect®	30	4660	1347	978.3	6985	3415	3.2
Triple Superphosphate	30	2555	1940	1094.7	5590	2020	5.0
Super/Potash 3&1	30	4187	1435	1089.5	6712	3142	6.8
Super Cu 0.5,Mo 0.025	30	5016	1208	1057.1	7282	3712	4.2
DAP	15	4701	1824	951.7	7477	3907	1.4
Triple Superphosphate	15	2336	1873	825.3	5035	1465	3.5
DAP	60	5042	1515	1152.7	7709	4139	5.4
Triple Superphosphate	60	4102	1500	1027.7	6630	3060	6.7
MAP-S	30	4118	1612	874	6604	3034	3.4
DAP – BR*	30	3698	1105	962.1	5766	2196	5.1
Single Superphosphate – BR*	30	2607	1445	1045.7	5098	1528	7.2
Super/Potash 3&1 - BR*	30	4839	1107	934.3	6880	3310	6.4
l.s.d.		**1465**	**155.1**	**50.16**	**1807.8**		
F pr.		**<.001**	**<.001**	**<.001**	**<.001**		
c.v.		**43.5**	**38.18**	**18.27**	**24.5**		

Source: Incitec Pivot Fertilisers, 2009

Summary:
These results suggest that a balanced fertiliser approach is suited where a soil tests low for multiple nutrients. The Italian ryegrass responded well to phosphorus additions in the range of 15-60 kg P/ha and required the higher rates to be applied unless nitrogen, potassium and sulphur were also included. In regard to the addition of potassium, the relatively wet year meant there was unexpectedly no negative affect on plant establishment by banding potassium fertiliser in the soil at sowing which is generally not recommended.