Northland Pasture Production Responses to Gibberellic Acid

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Summary

Single and repeat applications of gibberellic acid (Gibb) during winter and early spring were applied to plots to determine pasture production responses within a high nitrogen input context. Single applications of Gibb resulted in significant DM responses ranging from 409 kg DM/ha to 608 kg DM/ha during the first growth period following application. This provided very low cost feed at 2-3 c/kg DM plus application costs. However, most, or all, of this additional pasture growth was lost in following harvests due to 'post Gibb depression'. Repeat applications of Gibb generally provided no more DM production than a single application, however the second or third applications had the effect of delaying the inevitable 'post Gibb depression' until the final Gibb application had worn off.

This trial has confirmed that responses to gibberellic acid can occur from mid-winter through to early spring in Northland. Gibb is a tool that can be used to provide extra feed at critical times at low cost, however the 'post Gibb depression' is likely to occur. The timing of single or multiple applications of Gibb should be strategic to ensure the impact of the any 'post Gibb depression' is at a time when pasture production is naturally in a high growth period.

Introduction

Extra pasture production is of great value to farmers during winter and early spring when growth rates are low and feed demand usually exceeds feed supply. Some farmers use gibberellic acid (Gibb) to boost pasture production when a feed shortage is forecast, either on its own or in combination with nitrogen.

Gibberellic acid is a plant growth promotor which is sprayed onto the pasture causing an increase in tiller size through leaf and stem elongation. It is naturally produced by plants in warmer months, by applying it during cool weather pasture growth is increased.

In 2014, a field plot trial was conducted on the Northland Agricultural Research Farm (NARF) to determine the effects of single and multiple applications of Gibb with or without nitrogen on pasture production. A single application of Gibb (20 g/ha) plus nitrogen (37 kg/ha) in July produced 1066 kg DM/ha more than the control treatment, while nitrogen alone produced 539 kg DM/ha more than the control treatment. Repeat applications of Gibb without nitrogen showed

no greater pasture production than the control treatment, and suffered a significant 'post Gibb depression' after the second harvest. The trial showed that the best response to Gibb occurs when nitrogen is not limiting, and that repeat applications of Gibb were not reliable in providing additional pasture production. These results confirm findings from previous studies conducted in Canterbury and Manawatu (Matthew *et al.*, 2009; van Rossum *et al.*, 2012; Ball *et al.*, 2012).

Very little research has been done on the timing of Gibb plus nitrogen applications, however one study conducted in Canterbury found that when Gibb plus nitrogen was applied pasture production was 18-36% greater than the control in August and 26-51% greater than the control in September (Jiang *et al.*, 2011). It is thought that one way to prevent the 'post Gibb depression' is to apply nitrogen with Gibb as this would prevent the plant depleting soil nutrients. Trials at Lincoln University have found no negative effect of up to 10 consecutive applications of Gibb plus nitrogen (Miller, Bryant, Hague and Edwards unpublished), while van Rossum *et al.* (2012) also found no evidence of yield depression following successive Gibb plus nitrogen applications. These studies however did not do subsequent harvests in the months following application to find any carry over effects.

Very few studies on Gibb have been conducted in Northland. To further understanding of Gibb responses in Northland, a trial was conducted during 2015 which measured responses to Gibb applied at three different times including multiple applications within a high nitrogen context.

NARF trial

A trial was conducted over winter and spring of 2015 on the Northland Agricultural Research Farm in Dargaville. Nine treatments were replicated five times on plots measuring 4 m x 1.5 m. Plots were within 15 month old ryegrass pasture. The treatments were:

1. Control (no nitrogen or Gibb)
2. Nitrogen applied five times during July – October (+N)
3. July application of Gibb +N
4. August application of Gibb +N
5. September application of Gibb +N
6. July & August application of Gibb +N
7. July & September application of Gibb +N
8. August & September application of Gibb +N
9. July, August & September application of Gibb +N

All nitrogen was applied as Sustain granular at 30 kg N/ha immediately after harvest, resulting in all treatments receiving 150 kg nitrogen/ha from July to October, except the control treatment. ProGibb was applied at 20 grams/ha with surfactant 3-6 days after harvest, to ensure there was enough leaf to absorb the chemical.

Harvests occurred every 28 days through August and September, and every 21 days through October and November with the final harvest in early December. Plots were mown and the harvested material weighed wet with a subsample taken for DM analysis to calculate pasture DM responses.

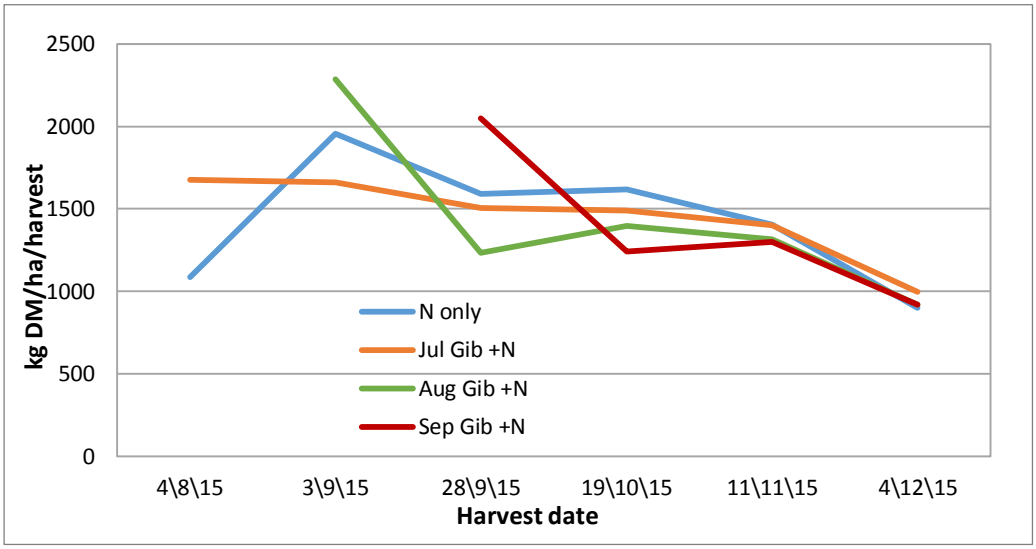
Trial Results

The nitrogen only treatment grew 2760 kg DM/ha more than the control treatments over the period of the trial, providing a pasture response of 18 kg DM/kg nitrogen applied. Given a total cost of applying nitrogen (Sustain) at $625/tonne, the pasture response to nitrogen cost an average of 7.5 c/kg DM plus application costs.

Single application of Gibb +N

Figure 1 shows the effect of single applications of Gibb +N on 6th July, 10th August and 9th September compared with nitrogen only. Each single Gibb application produced a significant DM response during the following growth period relative to nitrogen only. The July Gibb +N application produced an additional response of 608 kg DM/ha compared to the nitrogen only treatment. Based on Gibb plus wetter cost of $13/ha, this response cost 2c/kg DM plus application costs. The August Gibb +N application produced 409 kg DM/ha more than the nitrogen only treatment, at a cost of 3c/kg DM plus application costs. The September Gibb +N yielded an additional 458 kg DM/ha and a cost of 3c/kg DM plus application costs.

Figure 1: Harvested pasture (kg DM/ha) to nitrogen and single applications of gibberellic acid



All single applications of Gibb +N experienced reduced growth compared with the nitrogen only treatment in the second and subsequent harvests after Gibb application. As a result of this 'post Gibb depression', total DM produced over the trial period was similar to the nitrogen only treatment. Table 1 shows that overall of the monitored period the July application produced slightly more and the August and September applications slightly less total DM than nitrogen only treatment. Based on these results, single applications of Gibb +N can be used to fill a short term feed deficit, but may create a feed deficit following the response period.

Table 1: Harvested pasture (kg DM/ha) responses to gibberellic acid application relative to the nitrogen only treatment

Treatment	Harvest Date						Total compared to N only
	4/8/15	3/9/15	28/9/15	19/10/15	11/11/15	4/12/15	
July Gibb +N	608	-188	-88	-127	-4	97	**298**
Aug Gibb +N		409	-360	-221	-89	18	**-244**
Sept Gibb +N			458	-377	-108	18	**-10**
July & Aug Gibb +N	608	33	-449	-306	-104	-51	**-270**
July & Sept Gibb +N	675	-275	294	-220	-68	87	**493**
Aug & Sept Gibb +N		490	-97	-317	-61	41	**55**
Jul, Aug & Sept Gibb +N	557	21	20	-385	-175	-10	**-25**

Repeat applications of Gibb +N

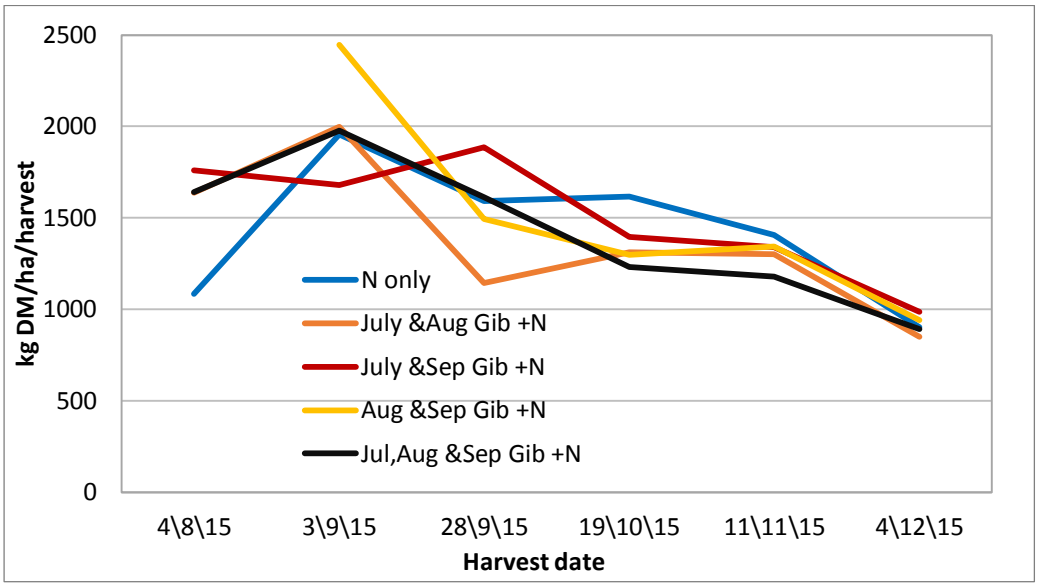
Figure 2 and Table 1 show the effect of repeat applications of Gibb +N compared with nitrogen only. A second application of Gibb +N in August prevented the post Gibb decline that occurred after the single July Gibb application. However, DM production was significantly lower than the nitrogen only treatment during September and October. Overall, total DM production for the July & August Gibb +N treatment was slightly lower than the nitrogen only treatment.

A third application of Gibb +N in September also delayed the post Gibb decline that would have occurred following the August Gibb application. The September DM response to the third application of Gibb was very similar to the nitrogen only response, however during October and November this treatment grew significantly less DM.

Gibb +N applications in July and September yielded very good DM responses immediately following application compared with the nitrogen only treatment at 675 kg DM/ha and 294 kg DM/ha respectively, however DM production was significantly lower following the immediate response period. Overall, this treatment produced the highest amount of DM at 493 kg DM/ha more than nitrogen only, a cost of 5c/kg DM plus application costs.

The August and September Gibb application +N treatment produced a similar amount of DM to the nitrogen only treatment over the whole monitored period.

Figure 2: Harvested pasture (kg DM/ha) from treatments with multiple applications of Gibb and nitrogen only.



Conclusions

A single Gibb +N application in July yielded the greatest response compared with August and September. This may be due to lower soil temperatures as at higher temperatures the plant starts to produce more gibberellins thereby reducing the effect of applied Gibb. Although the opposite was observed by Jiang *et al.* (2011), their trial was conducted in Canterbury at much lower temperatures.

Repeat applications of Gibb +N provided higher DM production following the first application and the following applications, then had the effect of delaying the post Gibb depression until after the final application had worn off. Previous studies (van Rossum *et al.*, 2013; Miller *et al.*, unpublished) also found that multiple applications produced greater responses than the control, however there was no evidence of yield depression which may be due to not doing subsequent harvests in the months following final application.

As evidenced in the trial results, if Gibb is used in late winter/early spring, repeat applications might be used to delay the 'post Gibb depression' until October and November as these months may naturally produce surplus pasture.

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