GIBBERELLIC ACID

What is gibberellic acid?

Gibberellic acid is a plant growth hormone that occurs naturally in many plants, including grasses, legumes and broadleaf weeds.

Why is gibberellic acid used?

Gibberellic acid is used as a short-term pasture management tool to increase the growth rate of pastures at key times of the year. Pastures treated with gibberellic acid can fill in a feed deficit at times when temperature and day length are limiting pasture growth (e.g. late winter / early spring).

Applying gibberellic acid to a portion of paddocks on the property, and keeping stock off those paddocks for three to four weeks, allows them to increase their DM production above normal levels. This extra feed can then be grazed while other paddocks build up a feed bank for later use.

When is gibberellic acid used?

Gibberellic acid can be used in late winter / early spring to bring forward the start of spring growth in a portion of paddocks (e.g. for set stocking). These paddocks can then be grazed as grass is starting to grow in other paddocks on the property. This allows a smoothing of the spring growth curve.

Plants will produce sufficient gibberellins of their own once the days get longer and temperatures start to rise. Therefore, applying gibberellic acid later in the spring or during the summer will not have such a notable effect on pasture growth.

How is gibberellic acid used?

For best results, graze the pasture prior to treatment and apply the gibberellic acid within five days of removing stock from the pasture. The period immediately following grazing is when the grass is growing fastest.

Generally, stock should be kept off the treated paddock for three to four weeks to get the full value from applying gibberellic acid. However, note that annual ryegrass is faster growing and should only take 2-3 weeks to reach its potential and be ready for grazing following treatment with gibberellic acid.

IMPORTANT POINTS TO NOTE:

- There needs to be sufficient residual pasture (1,000+ kg DM/ha) prior to treatment to allow effective absorption of gibberellic acid during application.

- If there are other factors limiting pasture growth (e.g. moisture, soil nutrient levels), the effect of gibberellic acid will be reduced.

- If soil moisture or nutrients are in low supply, the rate of regrowth following grazing may be slowed down. However, if there is adequate soil moisture and nutrients, the pasture should return to its normal rate of growth following grazing.

- Even though gibberellic acid boosts pasture growth at a time when temperatures are lower than normally required for the main spring growth period, the soil temperature still needs to be high enough for the grass to have started to grow. If the pasture is still dormant, there will be no effect from the gibberellic acid application.

- If sheep are coming off short feed onto lush green feed in spring, they may be less interested in eating the lush grass due to its low dry matter content. To increase dry matter content and feed utilisation, mow a few strips of the paddock prior to grazing.

NZM demonstration trials

During spring 2015, NZM undertook a series of paddock-scale trials across five sites to demonstrate the potential of gibberellic acid in a sheep production system.

ProGibb, a gibberellic acid product produced by Nufarm, was used in the demonstration trials. However, we note that there are other gibberellic acid products available on the market.

Trial sites

1. Cheviot (ryegrass and white clover)

2. Waipara (cocksfoot and white clover)

3. Coastal North Canterbury (ryegrass and white clover)

4. Hakataramea Valley (cocksfoot)

5. Lindis Pass (ryegrass and white clover – centre pivot irrigation)

Trial design

Each trial consisted of two treatments:

Treatment 1: ProGibb

Treatment 2: ProGibb + Urea

The treatments were compared against a control strip of untreated pasture (see figure 1).

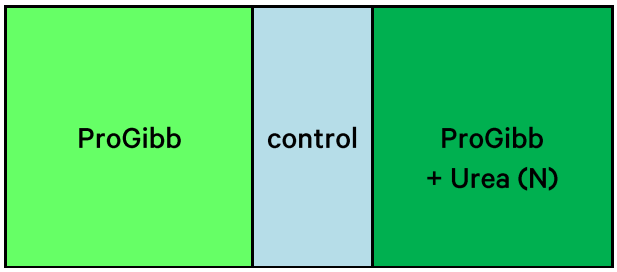

Figure 1: Diagram of the trial layout within a paddock

Application rates

The paddocks were grazed prior to application of the treatments.

ProGibb was applied as 20g ProGibb with 100-200 L water/ha and a non-ionic surfactant (Actiwett at 25ml/100L).

Urea was applied at a rate of 40 kilograms (18.4 units N) per hectare.

Application costs

Product	Application rate	Cost (excl. GST)
ProGibb SG (5kg container)	20g / ha	$11.70 / ha
Actiwett (10L container)	50 ml / ha	$1.19 / ha
Urea	40kg (18.4 units N) / ha	$22.48 / ha

Assessment of pasture mass

The pasture mass was calculated at both the start of the trial and the end of the trial (between 3 and 3.5 weeks after applying the treatments) to determine the amount of dry matter produced during the trial.

Results

Dry matter production

The overall dry matter production varied considerably between the five trial sites:

	Cheviot			Waipara			Coastal North Canterbury			Hakataramea Valley			Lindis Pass		
	start yield	end yield	**actual growth**	start yield	end yield	**actual growth**	start yield	end yield	**actual growth**	start yield	end yield	**actual growth**	start yield	end yield	**actual growth**
ProGibb	680	2870	**2190**	829	1186	**357**	739	755	**16**	1050	1130	**80**	1439	3380	**1941**
ProGibb + N	790	2860	**2070**	821	1168	**347**	541	835	**294**	1120	1350	**230**	1407	3448	**2041**
Control	730	1910	**1180**	858	1025	**167**	495	501	**6**	895	900	**5**	1355	3265	**1910**

Figure 2: Dry matter production (kg DM / ha)

There was also variation across the five trial sites in terms of dry matter production per hectare when **comparing the treated areas to the control** (see Figure 3 below). For instance, the area treated with ProGibb at the Cheviot site produced an extra tonne of dry matter per hectare; while the ProGibb treated site at the Coastal North Canterbury property only produced an extra 10 kilograms of dry matter per hectare.

	Cheviot	Waipara	Coastal North Canterbury	Hakataramea Valley	Lindis Pass
ProGibb	1010	190	10	75	30
ProGibb + N	890	180	288	225	130

*Figure 3: Dry matter production for each treatment in **comparison to the control** (kg DM / ha)*

Growth per day

The following table shows the additional growth per hectare **per day** for the two treatments (when compared to the control):

	Cheviot	Waipara	Coastal North Canterbury	Hakataramea Valley	Lindis Pass
ProGibb	42	9	0.5	3	1.2
ProGibb + N	37	9	15.2	9	5.2

Figure 4: Dry matter production per day in comparison to the control (kg DM / ha / day)

Yield

The following table shows the **increase in yield** as a percentage:

	Cheviot	Waipara	Coastal North Canterbury	Hakataramea Valley	Lindis Pass
ProGibb	46	53	63	7	2
ProGibb + N	43	52	98	17	6

Figure 5: Increase in yield in comparison to the control (%)

Cost of application

The following table shows the cost of application per extra kilogram of dry matter produced per hectare (i.e. compared to the control), including a spray contractor at $30/ha:

	Cheviot	Waipara	Coastal North Canterbury	Hakataramea Valley	Lindis Pass
ProGibb	0.04	0.23	4.29	0.57	1.43
ProGibb + N	0.07	0.36	0.23	0.29	0.50

Figure 6: Cost of application, including products and spray contractor ($ / kg DM / ha)

Extra days grazing

The next table shows the number of extra days grazing for ewes with a lamb at foot at a stocking rate of 13 ewes per hectare, assuming that each ewe eats 2.2 kilograms of dry matter per day:

	Cheviot	Waipara	Coastal North Canterbury	Hakataramea Valley	Lindis Pass
ProGibb	35 days	7 days	0 days	3 days	1 day
ProGibb + N	31 days	6 days	10 days	8 days	5 days

Figure 7: Number of extra days grazing for ewes with a lamb at foot

Value of additional dry matter

The final table shows the value of the extra feed produced, based on a price of $0.22 per kilogram of dry matter:

	Cheviot	Waipara	Coastal North Canterbury	Hakataramea Valley	Lindis Pass
ProGibb	$222.20	$41.80	$2.20	$16.50	$6.60
PG + N	$195.80	$39.60	$63.36	$49.50	$28.60

Figure 8: Value of the extra feed produced

Cheviot site

This site demonstrated the largest difference in dry matter production between the treatments and the control. There was adequate soil moisture when the treatments were applied, and there was significant rain during the trial (therefore, soil moisture was not a limiting factor).

The soil temperature during the 24 day trial period ranged between 8-12 ^{o}C during the daytime most days. The optimum soil temperature for ryegrass growth is 14-18 ^{o}C. Therefore, the soil was sufficiently warm to enable some growth of the pasture, but temperature was a limiting factor to some extent for the control area, which allowed the gibberellic acid to show an effect on the treated areas.

Figure 9: Cheviot site at 2.7 weeks. ProGibb only (left); control (centre); ProGibb + N (right)

Figure 10: Cheviot site at 3.5 weeks. ProGibb only (left); control (centre); ProGibb + N (right)

Notes regarding the other trial sites

Soil moisture has been an issue during the spring of 2015, and this has significantly impacted the potential growth at two of the trial sites ((1) Coastal North Canterbury and (2) Hakataramea Valley). Both sites had little to no rain during the trial period.

The Lindis Pass site was a ryegrass and white clover under a pivot. There were no limiting factors (i.e. moisture, soil temperature), but the pasture was left too long before it was reassessed and the regular pasture production (i.e. the control area) had caught up due to the favourable growth conditions and the fast-growing nature of the ryegrass. In addition, the pasture had not been grazed recently, so it was not in its most vigorous growth stage, which reduced the impact of the gibberellic acid applied to it.