Mapleton Agri Biotec Pty Ltd

PastureN™ is a microbial biofertiliser for use in pastures. Dairy and beef producers use PastureN to grow more grass with moderate rates of nitrogen fertiliser or to make better use of nitrogen fertiliser at reduced rates (increased Nitrogen Use Efficiency). PastureN is Mapleton Agri Biotec's new product for 2019 and it has been developed to help farmers produce pastures of high quality in a more profitable and sustainable way.

PastureN has three main components:

1. **PastureN contains a glass vial of freeze-dried nitrogen fixing microbes.** This is the identical technology developed for our earlier product TwinN and, like TwinN, every batch of these microbes is tested by a NSW Government laboratory to guarantee we can supply all the microbe species at very high counts (>10^{11} counts per ha). These microbes act via several key mechanisms:

A. The microbes associate closely with the plants as endophytes - making their way into the plant. They also colonise close to, and on, the root surface. They fix nitrogen (N_2) from the atmosphere into plant available ammonium nitrogen ($\mathbf{N_2}$ + 8H → 2$\mathbf{NH_3}$ + H_2). This is the same mechanism used by the *Rhizobium*/legume symbiosis to fix N. Pasture plants release generous amounts of carbohydrate exudates into the zone close by their root surfaces specifically to feed beneficial microbes, including those supplied in PastureN. The NH_3 produced by the microbes is supplied either right by the root surface or within the root surfaces and root tissues, so it is captured very efficiently by the pasture plants.

B. The microbes produce plant growth factors (especially auxins) that enhance secondary root development and this increases the proportion of any applied nitrogen, or nitrogen mineralised from the soil, that is captured by the pasture plants (increased Nitrogen Use Efficiency) – particularly important in establishing crops. The combination of nitrogen fixation and better nitrogen capture results in better nitrogen nutrition.

2. **PastureN contains a tub of Bacillus microbes.** These are the same Bacillus that are included in the MAB inoculum, NitroGuard. The Bacillus species are valuable to help promote a healthy balanced soil microflora. Numerous studies have shown that different Bacillus species produce a range of compounds that inhibit the growth of pathogenic fungi and bacterial species. The Bacillus also produce beneficial plant growth factors and these add to the effect of the freeze-dried microbes in promoting strong root growth. They also stimulate Rhizobium nodulation in pasture legumes, enhancing their ability to fix nitrogen. This is of benefit to pasture if legumes are present and assists in maintaining legume persistence in mixed pastures.

3. **PastureN contains an alfoil bag of amino acids.** These are plant based amino acids which are widely used for their benefits as crop growth stimulants. Our trials show that they enhance the uptake of TwinN nitrogen fixing bacteria in pastures. Their inclusion in PastureN has allowed us to recommend application into a moist/wet grass sward as opposed to the standard application into the root zone, recommended for TwinN and NitroGuard. Amino acids are used as chelates, to assist plant stress recovery, and we have found they have good synergies with the microbial components of PastureN.

PastureN is used on a wide range of pasture types including Kikuyu, Italian ryegrass, lucerne crops and high quaility fodder crops.

PastureN trial in Kikuyu pasture, Nowra, NSW, 2019

Kikuyu pastures are widely used for dairy and beef production in Australia. With adequate nutrition the pastures can produce substantial yields, but management can be challenging and quality variable. This trial measured both production of DM and fodder quality with and without application of PastureN. Both were improved substantially by application of PastureN.

PastureN was applied to one paddock by boom spray into the moist kikuyu sward in February 2019 and the adjoining paddock was used as a control comparison. The pastures are situated in a fertile alluvial site and no urea had been applied during the current growing season. Pre-grazing measurements showed that the dry matter varied less than 4% between the two blocks, allowing for a good comparison. A rising plate meter was used to take six replicate readings (each were averages of around 50 individual readings) on 25/3/2019 to establish a baseline on both paddocks soon after grazing. Both treated and untreated paddocks went through a 15 day growth cycle. Six pre-grazing measurements were taken from each paddock on 9/4/2019 and repeated post-grazing 12/4.

About 100 handfuls of grass were taken between the dung and urine patches in each block, walking across them in a V – picking the grass as a cow would graze it. The grass samples sent off for fodder quality analysis consisted of the leaves to the end of the stalk (any rhizome stalks were discarded).

Total Dry Matter Production

Table 1 Total Dry Matter produced and grazed in PastureN and untreated paddocks

	Untreated (kg /ha)	**PastureN (kg /ha)**
Post-grazing measurements (baseline) 25/3/2019	3154	2638 (p =0.00006)
Average difference in residual grass	516	
Pre-grazing 9/4/2019	3644	4013 (p = 0.005)
Average grass grown in 15 days 25/3 to 9/4/2019	510	1375
Post-grazing 12/4/2019	2838	2565 (p = 0.016)
Average diff. residual grass	273	
Average grazed just before 12/4/2019	806	1447

The baseline measurements (25/3/2019) showed significantly less residual grass on the PastureN paddock, indicating much more palatable grass. Pre-grazing measurement on 9/4/2019 after a 15 day growth cycle showed a highly significant increase in the amount of grass DM produced on the PastureN block (1375 versus 510 kg/ha). The palatability of this grass grown and tight grazing meant that it was all consumed in that cycle (see Post-grazing 12/4/2019), providing the cattle with far better nourishment. In terms of production of DM and palatability of pasture the PastureN block was well ahead of the comparison block.

Feed Quality

Grass analysis was done by Feed Test, Agrifood Technology and the results are shown below. The first samples (1) were taken on 24th March, just before grazing in the previous cycle. The second sample (2) just from the PastureN block, was taken on 10th April, prior to grazing. Analysis results are tabled below.

Comparing the first samples taken on 24th March, crude protein was 22.9 % in the PastureN paddock compared with 17.7% in the control. This higher protein level was not associated with increased nitrate levels – one would expect these to be 1000 ppm or above for grass grown with urea, or other high N fertilizers. High nitrate levels are detrimental to pasture digestibility and may even cause 'nitrate poisoning'. Nitrogen fixing microbes in PastureN supply nitrogen in ammonium form rather than nitrate which allows high leaf protein levels without the negative of high nitrate levels.

PastureN grass showed an estimated Metabolizable Energy (ME) of 10.5 MJ/kg DM compared with 10.0 in the untreated control block. The second measurement for the PastureN block showed a very high ME of 11.8 MJ/kg DM. This indicates an extremely high feed quality. Improved nitrogen status from use of PastureN allows high levels of both Crude Protein and ME in the grass grown. This leads on to greater intake of quality feed, making more milk and beef production possible at a very economical cost.

Another measure of feed quality, Neutral Detergent Fibre (NDF) showed lower percentages in the PastureN treated grass compared with control. All these factors explain the improved palatability and intake, that resulted in lower pasture residue readings. This is of significance when managing Kikuyu grass pastures, reducing or even eliminating the need for slashing and mulching paddocks, saving both time and money.

TEST	Result
NIR Package (FT/003) PastureN 1	
Dry Matter (%)	10.4
Moisture (%)	89.6
Crude Protein (% of dry matter)	22.9
Acid Detergent Fibre (% of dry matter)	34.8
Neutral Detergent Fibre (% of dry matter)	55.4
Digestibility (DMD) (% of dry matter)	70.5
Digestibility (DOMD) (Calculated) (% of dry matter)	66.6
Est. Metabolisable Energy (Calculated) (MJ/kg DM)	10.5
Fat (% of dry matter)	4.3
Ash (% of dry matter)	14.1
Nitrate (FT009)	
Nitrate (mg/kg of dry matter)	<0.4

TEST	Result
NIR Package (FT/003) Control 1	
Dry Matter (%)	14.9
Moisture (%)	85.1
Crude Protein (% of dry matter)	17.7
Acid Detergent Fibre (% of dry matter)	34.6
Neutral Detergent Fibre (% of dry matter)	64.2
Digestibility (DMD) (% of dry matter)	67.5
Digestibility (DOMD) (Calculated) (% of dry matter)	64.0
Est. Metabolisable Energy (Calculated) (MJ/kg DM)	10.0
Fat (% of dry matter)	3.6
Ash (% of dry matter)	10.6
Nitrate (FT009)	
Nitrate (mg/kg of dry matter)	<0.4

TEST	Result
NIR Package (FT/003) PastureN 2	
Dry Matter (%)	18.6
Moisture (%)	81.4
Crude Protein (% of dry matter)	21.3
Acid Detergent Fibre (% of dry matter)	22.9
Neutral Detergent Fibre (% of dry matter)	48.8
Digestibility (DMD) (% of dry matter)	78.0
Digestibility (DOMD) (Calculated) (% of dry matter)	72.9
Est. Metabolisable Energy (Calculated) (MJ/kg DM)	11.8
Fat (% of dry matter)	3.9
Ash (% of dry matter)	8.8

CONCLUSION

PastureN is a valuable tool for dairy and beef farmers who grow Kikuyu pastures. It allows increased dry matter production when used on fertile soils where farmers use little or no nitrogen fertiliser, as was the case in the trial shown here. PastureN also allows high productivity with reduced nitrogen rates in other situations. Because milk and beef production is often limited by feed quality in Kikuyu pastures the improvement in quality shown here in the PastureN treated block is very significant. The capacity to produce feed with good Metabolisable Energy and protein, but without associated high nitrate levels, by inoculating with PastureN, will be useful to farmers whether used on Kikuyu grass over the summer, or on Italian ryegrass with moderate urea applications over the winter.

Mix PastureN as per instructions

Application to the pasture

Apply PastureN with a boom sprayer with very coarse nozzles, **well into the moist grass sward.** Centre pivot delivery is also effective.

Do not apply in windy, drying conditions. Do not apply into a dry pasture. Apply in as much water as possible and practical, but a to a minimum of 100 litres/ha.

Do not apply less than one week after or before grazing or cutting

Once the tank mix is fully prepared apply immediately or within 24 hours (do not allow mix to get hotter than 30^{O}C if storing for longer than an hour).

Application schedule and reducing nitrogen fertiliser rates

A. For high production intensity pastures apply PastureN at the start of the main growing season and then every 3 months while pastures are actively growing. Reduce N fertiliser by up to 25% to a maximum of 40 U of N or use smaller reductions and target higher yields.
B. For intermediate production intensity pastures use two applications during the growing season. Reduce N fertiliser by up to 15%.
C. For organic pastures apply every 3 months and do not reduce any other sources of organic nutrients.

General instructions

1. Do not reduce other nutrients eg P, K, etc while reducing N.
2. Ensure **molybdenum** levels in soils are adequate as Mo is necessary for effective N fixation by microbes.
3. Do not make cuts to N fertilizer until at least 2 weeks after application of PastureN, to allow microbes time to colonise and start N fixation. In intensive pastures keep the first application of N of the season at standard rate.
4. Make cuts to N evenly across the season if possible.

For any enquiries and individual advice contact TwinN@mabiotec.com,
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