FINAL REPORT

Evaluation of the efficacy of PastureMasta for increased hay production in Lucerne cv. Q31

Virginia, South Australia, 2017-2019

Protocol Number:
Seasol-PastureMasta

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AGX17199

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EXECUTIVE SUMMARY

A field trial was conducted in a commercial lucerne paddock at Virginia, South Australia in two growing seasons across 2017-2019 to evaluate the effect of PastureMasta when used in conjunction with a growers' fertiliser program on the quality and yield of lucerne cv. QB31. The effect of PastureMasta (10 L/100L) was compared to the growers' standard program of Hi-Fert Lucerne mix applied once per season (100 kg/ha).

PastureMasta was applied on four occasions as soon as possible after hay cut using a Landcruiser mounted, motorised spray unit incorporating Agrotop AM 110-025 flat fan nozzles and a total spray volume of 100 L/ha. An additional application of PasstureMasta was applied in the second season.

In the first season, the initial applications of PastureMasta significantly increased crop biomass as measured by normalised difference vegetative index (NDVI) compared to the growers' Hi-Fert lucerne mix fertiliser program. The lucerne crop treated with PastureMasta appeared denser and greener in the paddock area treated with PastureMasta compared to other paddock areas. In the second season, crop biomass was equivalent between the treatments.

PastureMasta consistently improved hay crop yield over two seasons and dry matter production (kg/ha) significantly increased following four applications of PastureMasta compared to the growers' program. In terms of dry matter production per day, applications of PastureMasta resulted in numerically greater daily growth of the crop than the growers' program.

PastureMasta increased the number of bales of lucerne hay produced in the paddock compared to the growers' program at each hay cut timing. After the first application of PastureMasta, there were 15% more bales produced. The largest increase was recorded after the second application under ideal weather conditions with 54.2% more bales produced in the PastureMasta treated area compared to the growers' area in the 2017/2018 season. PastureMasta increased dry matter production by up to 11.9% in the 2017/2018 lucerne growing season and 7.8% in the second season. Bales were significantly heavier following the use of PastureMasta, with a 12% and 4% increase in weight, respectively across two seasons compared to other bales produced in growers' program paddock.

The quality of feed was highly dependent on seasonal weather conditions and irrigation. In the first season, feed quality was deemed high across all quality parameters. However, there were some significant differences between the treatments with PastureMasta reducing metabolic energy and digestibility compared to Lucerne hay from the growers' program.

High-yielding lucerne removes nutrients from the soil, but this was not evident in soil analysis of the trial area. In most instances, nutritional content of the soil improved from the initial soil sample collected prior to treatment application with little differences between PastureMasta and growers' program treated areas.

In terms of soil health, N-fixation was not detected in soil from the growers' program whereas PastureMasta soils had excellent N-fixation ability indicating a good population of nodule-forming bacteria to provide N to the plant. Soils under both treatments were equivalent with good levels of microbial activity, labile C and C:N.

Overall, this trial showed that PastureMasta significantly improved crop growth through increased dry matter production and improved yield through an increase in the number of bales.

OBJECTIVES

- Demonstrate the benefit of incorporating PastureMasta into an irrigated lucerne hay operation as a means of increasing both feed quality and productivity.

METHODS AND MATERIALS

Site details

Location	Virginia, South Australia, 5120
GPS co-ordinates	-34.65648, 138.60976
Soil texture	Loam
Crop and variety	Lucerne, cv. Q31
Irrigation type	Travelling irrigator
Trial design	Two-paired comparison
Total area treated (ha)	1.4 ha - Growers' program Hi-Fert Lucerne Mix (1 annual application) + PastureMasta (4 applications in the growing season) 4.7 ha - Growers' program Hi-Fert Lucerne Mix (1 annual application) Total trial area 6.1 ha.

Crop management

Sowing date	2014
Irrigation type	Travelling irrigator
Harvest dates (Hay cut)	27 Nov 2017 30 Dec 2017 24 Jan 2018 04 Mar 2018 04 Oct 2018 13 Nov 2018 17 Dec 2018 15 Jan 2019 14 Feb 2019 22 Mar 2019

Experimental design

Trial design	Two-paired comparison
Statistical analysis	Analysis of variance (ANOVA) test and Fisher's least significant difference (LSD) test were conducted using ARM18.
Replications	10
Plot size for bale production	10.9 m x 1.2 m

Treatments

Products

Product name	Primary nutritional status	Formulation	Batch number
Hi-Fert Lucerne Mix	N 7.6%, P 9.5%, K 9.6%	Water dispersible granules	17/11/2016
PastureMasta	N 9.5%, P 1.1%, K 6.2%	Soluble liquid	001PFS1701 1/5/2017

Treatment list

No.	Product	Application timing	Product rate
1	Hi-Fert Lucerne Mix (Grower Program)	One application in late January, immediately after hay cut or near as possible	100 kg/ha
2	PastureMasta	Immediately after hay cut or near as possible with 4 applications per season	10 L/100 L

Chronology of events: 2017-2018 season

Date	Days after application timing (DAA#)	Crop stage (BBCH)	Event
6 Oct 2017	-12DAAA	69	Pre-spray soil sample collection
13 Oct 2017	-5DAAA	69	Pre-spray crop harvest
17 Oct 2017	-1DAAA	69	Crop baled
18 Oct 2017	0DAAA	15	Application A of treatments 2
21 Nov 2017	34DAAA	65	Fresh weight recorded
22 Nov 2017	35DAAA	65	NDVI assessment
27 Nov 2017	30DAAA	69	Crop harvested
29 Nov 2017	42DAAA	69	Crop baled Dry weight recorded
30 Nov 2017	43DAAA	15	Application B of treatment 2
20 Dec 2017	20DAAB	67	Fresh weight recorded
21 Dec 2017	21DAAB	67	NDVI assessment Crop sampled for feed analysis
27 Dec 2017	27DAAB	69	Dry weight recorded
30 Dec 2017	30DAAB	69	Crop harvested
5 Jan 2017	36DAAB	69	Crop baled
08 Jan 2018	39DAAB	16	Application C of treatment 2
23 Jan 2018	15DAAC	60	NDVI assessment
24 Jan 2018	16DAAC	60	Fresh weight recorded
25 Jan 2018	17DAAC	69	Crop harvested
29 Jan 2018	21DAAC	69	Crop baled Dry weight recorded
31 Jan 2018	23DAAC	15	Application D of treatment 2
20 Feb 2018	20DAAD	67	Fresh weight recorded Crop sampled for feed analysis NDVI assessment Soil sample collection
23 Feb 2018	23DAAD	69	Crop harvested
27 Feb 2018	27DAAD	69	Crop baled
28 Feb 2018	28DAAD	69	Dry weight recorded

Date	Days after application timing (DAA#)	Crop stage (BBCH)	Event
04 Apr 2018	63DAAD	69	Bale weight assessment

Chronology of events: 2018-2019 season

Date	Days after application timing (DAA#)	Crop stage (BBCH)	Event
04 Oct 2018	-14DAAA	69	Crop harvested
10 Oct 2018	-8DAAA	69	Crop baled
18 Oct 2018	0DAAA	15	Soil sample collection Application A of treatments 1-2
02 Nov 2018	15DAAA	67	Fresh weight recorded NDVI assessment
12 Nov 2018	25DAAA	69	Dry weight recorded
13 Nov 2018	26DAAA	69	Crop harvested
19 Nov 2018	32DAAA	69	Crop baled
20 Nov 2018	33DAAA	15	Application B of treatment 2
17 Dec 2018	27DAAB	69	Fresh weight recorded Crop harvested
22 Dec 2018	32DAAB	69	Crop baled
31 Dec 2018	41DAAB	26	Application C of treatment 2
3 Jan 2019	34DAAB	69	Dry weight recorded
11 Jan 2019	11DAAC	67	Fresh weight recorded NDVI assessment
15 Jan 2019	15DAAC	69	Crop harvested Dry weight recorded
22 Jan 2019	22DAAC	69	Crop baled
01 Feb 2019	32DAAC	28	Application D of treatment 2
14 Feb 2019	13DAAD	69	Fresh weight recorded Crop sampled for feed analysis Crop harvested
20 Feb 2019	19DAAD	69	Crop baled
21 Feb 2019	20DAAD	16	Application E of treatment 2
27 Feb 2019	26DAAD	69	Dry weight recorded

Date	Days after application timing (DAA#)	Crop stage (BBCH)	Event
15 Mar 2019	22DAAE	67	Fresh weight recorded NDVI assessment Soil sample collection
22 Mar 2019	29DAAE	67	Dry weight recorded Crop harvested
30 Mar 2019	37DAAE	69	Crop baled

Application details: 2017-2018 season

Application equipment				
Method	Drive-on application of treatments			
Equipment	Landcruiser spray unit			
Nozzle type	Agrotop AM 110-025 flat fan			
Nozzle number	24 X 50 cm nozzle spacing			
Boom length	12 m			
Spray quality	Medium			
Spray volume (L/ha)	100			
Pressure (kPa)	300			
Ground speed	10-12 kmph			
Treatment applications				
Application timing	A	B	C	D
Date	18 Oct 2017	30 Nov 2017	08 Jan 2018	31 Jan 2018
Time	1030-1100	1550-1600	1120-1145	1630-1655
Treatments applied	1-2	2	2	2
Temperature (°C)	31.8	31.2	24.6	22.8
Relative humidity (%)	34.1	44	48.3	41.2
Cloud cover (%)	5	0	40	70
Wind direction	NNW	SW	SW	SSW
Wind speed (km/h)	18.2	6.9	2.5	16.8
Soil moisture	Dry	Dry	Dry	Dry
Leaf wetness	Dry	Dry	Dry	Dry
Crop stage (BBCH)	15	15	16	15

Application details: 2018-2019 season

Application equipment					
Method	Drive-on application of treatments				
Equipment	Landcruiser spray unit				
Nozzle type	Agrotop AM 110-025 flat fan				
Nozzle number	24 X 50 cm nozzle spacing				
Boom length	12 m				
Spray quality	Medium				
Spray volume (L/ha)	100				
Pressure (kPa)	300				
Ground speed	11-12 kmph				
Treatment applications					
Application timing	A	B	C	D	E
Date	18 Oct 2018	20 Nov 2018	31 Dec 2018	01 Feb 2019	21 Feb 2019
Time	1030-1050	1550-1615	1000-1020	1200-1300	0845-1000
Treatments applied	1-2	2	2	2	2
Temperature (°C)	18.3	21.6	23.4	26.6	22.0
Relative humidity (%)	66.9	44.8	46.7	50.3	68.9
Cloud cover (%)	90	90	0	0	60
Wind direction	NW	SW	SW	SE	NE
Wind speed (km/h)	2.3	2.0	4.0	2.0	2.0
Soil moisture	Moist	Moist	Moist	Moist	Moist
Leaf wetness	Wet	Dry	Wet	Dry	Dry
Crop stage (BBCH)	11	15	26	28	16

Assessments: 2017-2018 season

Crop biomass					
Dates	22 Nov 2017	21 Dec 2017	23 Jan 2018	20 Feb 2018	
Days after application timing	35DAAA	21DAAB	15DAAC	20DAAD	
Sample size	10 m section				
Method	Crop biomass and/or greenness was measured on the Normalised Difference Vegetative Index (NDVI) and determined using a GreenSeeker across 10 sections of the treatment area. The GreenSeeker was moved over the centre of 10 sections within each treatment area and average measurement taken over the entire length of the section. Records were recorded as mean NDVI in each treatment area.				
Crop yield					
Dates	13 Oct 2017	17 Nov 2017	30 Dec 2017	25 Jan 2018	23 Feb 2018
Days after application timing	-5DAAA	30DAAA	30DAAB	17DAAC	23DAAD
Sample size	Whole plot				
Method	Lucerne was harvested into rectangle bales by grower with commercial baler over lengths of 10.9 m X 1.2 m. Yield was measured as number of bales per area.				
Fresh weight					
Dates	21 Nov 2017	20 Dec 2017	24 Jan 2018	20 Feb 2018	
Days after application timing	34DAAA	20DAAB	16DAAC	20DAAD	
Sample size	50 cm X 50 cm quadrant	40 cm X 40 cm quadrant			
Method	A quadrat was randomly placed within 10 sections of each treatment area at random locations. Lucerne cut to above the growing tip with secateurs and removed within the boundaries of the quadrant. Samples were weighed and data converted and recorded as the mean fresh weight /m2.				
Dry weight					
Dates	29 Nov 2017	27 Dec 2017	29 Jan 2018	28 Feb 2018	
Days after application timing	42DAAA	27DAAB	21DAAC	28DAAD	
Sample size	Whole plot				
Method	Material collected from fresh cut samples was dried at >40ºC for 7-9 days until completely dried. Samples were weighed and data converted to the mean dry weight /m2. Data was recorded as total dry matter production (Kg DM/ha) and daily dry matter production (g DM/day/ha).				

Bale weight		
Date	04 Apr 2018	
Days after application timing	63DAAD	
Sample size	10 bales per treatment	
Method	Each bale was weighed and recorded as mean weight per bale (kg).	
Feed analysis		
Dates	21 Dec 2017	20 Feb 2018
Days after application timing	21DAAB	20DAAD
Sample size	40 cm X 40 cm quadrant	
Method	A quadrat was randomly placed within 10 random sections of each treatment area. Lucerne was cut to above the growing tip with secateurs and removed within the boundaries of the quadrant. Samples were dried at >40ºC for 7-9 days until completely dried then sent to the AgriFood Technology laboratory for analysis.	
Soil nutrient analysis		
Dates	6 Oct 2017	20 Feb 2018
Days after application timing	-12DAAA	20DAAD
Sample size	40 cm X 40 cm quadrant	
Method	Soil from 10 random locations per treatment area was collected days until completely dried then sent to the CSBP laboratory for analysis.	

Assessments: 2018-2019 season

NDVI					
Dates	02 Nov 2018	17 Nov 2018	11 Jan 2019	15 Mar 2019	
Days after application timing	15DAAA	30DAAA	11DAAC	22DAAE	
Sample size	Whole plot				
Method	Crop biomass and/or greenness was measured on the Normalised Difference Vegetative Index (NDVI) and determined using a GreenSeeker across 10 sections of the treatment area. The GreenSeeker was moved over the centre of 10 sections within each treatment area and average measurement taken over the entire length of the section. Records were recorded as mean NDVI in each treatment area.				
Crop yield					
Dates	04 Oct 2018	13 Nov 2018	17 Dec 2018	15 Jan 2019	14 Feb 2019
Days after application timing	-14DAAA	26DAAA	27DAAB	15DAAC	13DAAD
Sample size	Whole plot				
Method	Lucerne was harvested into rectangle bales by grower with commercial baler over lengths of 10.9 m X 1.2 m. Yield was measured as number of bales per area.				
Fresh weight					
Dates	02 Nov 2018	17 Dec 2018	11 Jan 2019	15 Feb 2019	15 Mar 2019
Days after application timing	15DAAA	27DAAB	11DAAC	14DAAD	22DAAE
Sample size	40 cm X 40 cm quadrant				
Method	A quadrat was randomly placed within each plot at random locations and the lucerne cut and removed within the boundaries of the quadrant. Samples were weighed and data converted and recorded as the mean fresh weight /m2.				
Dry weight					
Dates	12 Nov 2018	03 Jan 2019	15 Jan 2019	27 Feb 2019	22 Mar 2019
Days after application timing	25DAAA	34DAAB	15DAAC	6DAAE	29DAAE
Sample size	Whole plot				
Method	Material collected from fresh cut samples was dried at >40ºC for 7-9 days until completely dried. Samples were weighed and data converted to the mean dry weight /m2. Data was recorded as total dry matter production (Kg DM/ha) and daily dry matter production (g DM/day/ha).				

Bale weight		
Date	20 Feb 2019	22 Mar 2019
Days after application timing	19DAAD	29DAAE
Sample size	10 bales per treatment	
Method	Each bale was weighed and recorded as mean weight per bale (kg).	
Feed analysis		
Dates	24 Feb 2018	
Days after application timing	13DAAD	
Sample size	40 cm X 40 cm quadrant	
Method	A quadrat was randomly placed within 10 random sections of each treatment area. Lucerne was cut to above the growing tip with secateurs and removed within the boundaries of the quadrant. Samples were dried at >40ºC for 7-9 days until completely dried then sent to the AgriFood Technology laboratory for analysis.	
Soil health analysis		
Dates	20 Feb 2018	
Days after application timing	20DAAD	
Sample size	10 samples per treatment area	
Method	Ten soil samples (0-10 cm deep) were randomly collected from each treatment area and mixed to give one representative sample of 500 g. Samples were kept cool and transported to the Microbiology Laboratories Australia for soil health analysis.	
Soil nutrient analysis		
Dates	18 Oct 2018	15 Mar 2019
Days after application timing	0DAAA	22DAAE
Sample size	40 cm X 40 cm quadrant	
Method	Soil from 10 random locations per treatment area was collected days until completely dried then sent to the CSBP laboratory for analysis.	

RESULTS

Table 1. Crop biomass of lucerne cv. Q31 as measured by NDVI, Virginia 2017/18

No.	Treatment	Product rate	Crop biomass (mean NDVI)			
			35DAAA	21DAAB	15DAAC	20DAAD
1	Hi-Fert Lucerne Mix	100 kg/ha	0.80 b	0.82 b	0.78	0.84 b
2	PastureMasta	10 L/100 L	0.82 a	0.84 a	0.79	0.85 a
		P-value	0.0001	0.0025*	0.3707	0.0099
		CV	1.09	1.46	2.78	1.1
		LSD ($P \leq 0.05$)	0.008	0.011	NSD	0.009

DAA# = Days after application timing
* = Data failed Bartlett's test and cannot be transformed for homogeneity
Means followed by the same letter are not significantly different (P = 0.05, LSD)
NSD = No significant difference due to a P-value > 0.05

Table 2. Crop biomass of lucerne cv. Q31 as measured by NDVI, Virginia 2018/19

No.	Treatment	Product rate	Crop biomass (mean NDVI)			
			15DAAA	30DAAA	11DAAC	22DAAE
1	Hi-Fert Lucerne Mix	100 kg/ha	0.86	0.85	0.82	0.84
2	PastureMasta	10 L/100 L	0.86	0.85	0.82	0.84
		P-value	0.8664	0.6420	0.3433	0.4486
		CV	1.53*	0.62	1.12	0.69
		LSD ($P \leq 0.05$)	NSD	NSD	NSD	NSD

DAA# = Days after application timing
* = Data failed Bartlett's test and cannot be transformed for homogeneity
Means followed by the same letter are not significantly different (P = 0.05, LSD)
NSD = No significant difference due to a P-value > 0.05

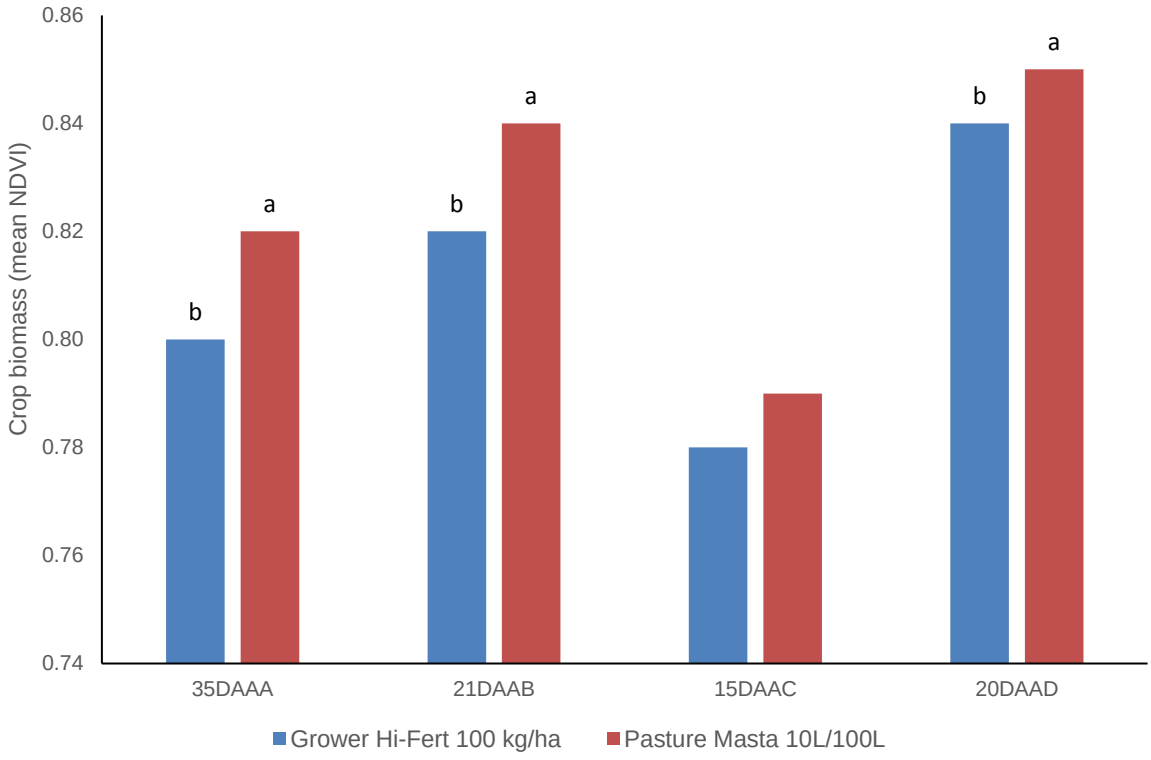

Figure 1. Crop biomass of lucerne cv. Q31, Virginia

Table 3. Fresh pasture production of lucerne cv. Q31, Virginia, 2017/18

No.	Treatment	Rate	Fresh pasture production (g/m2)			
			34DAAA	20DAAB	16DAAC	20DAAD
1	Hi-Fert Lucerne Mix	100 kg/ha	1772.0 b	2100.6	1646.9	1843.7
2	PastureMasta	10 L/100 L	2242.3 a	2271.3	1975.0	2121.3
Yield difference (%)			21	8	17	13
P-value			0.0147	0.5315	0.1024	0.0848
CV			19.42	27.36	23.54	17.17
LSD (*P* ≤ 0.05)			91.57	NSD	NSD	NSD

DAA# = Days after application timing
Means followed by the same letter are not significantly different (P = 0.05, LSD)
NSD = No significant difference due to a P-value > 0.05

Table 4. Fresh pasture production of lucerne cv. Q31, Virginia, 2018/19

No.	Treatment	Rate	Fresh pasture production (g/m2)				
			15DAAA	27DAAB	11DAAC	13DAAD	22DAAE
1	Hi-Fert Lucerne Mix	100 kg/ha	2426.3	2301.5	1661.8	1354.0	1910.9
2	PastureMasta	10 L/100 L	2365.0	2537.3	1750.6	1497.0	2141.4
Yield difference (%)			-3	9	5	10	11
P-value			0.8056	0.2698	0.6059	0.1570	0.1438
CV			22.89	19.14	22.17	15.19	16.64
LSD (*P* ≤ 0.05)			NSD	tL	NSD	NSD	NSD

DAA# = Days after application timing
Means followed by the same letter are not significantly different (P = 0.05, LSD)
NSD = No significant difference due to a P-value > 0.05
tL = Data transformed using x = Log (y + 1)

Table 5. Dry matter production of lucerne cv. Q31, Virginia, 2017/18

No.	Treatment	Rate	Dry matter production (kg DM/ha)				Total DM production from 4 hay cuts (t/ha)
			42DAAA	27DAAB	21DAAC	28DAAD	
1	Hi-Fert Lucerne Mix	100 kg/ha	4658.4	3843.8	3918.8	3128.4 b	15.5
2	PastureMasta	10 L/100 L	5342.4	3937.5	4581.3	3806.2 a	17.6
Yield difference (%)			12.8	2.4	14.5	17.8	11.9
P-value			0.0635	0.8345	0.1228	0.0272	-
CV			15.47	25.42	21.52	18.18	-
LSD ($P \leq 0.05$)			NSD	NSD	NSD	592.37	-

DAA# = Days after application timing
Means followed by the same letter are not significantly different (P = 0.05, LSD)
NSD = No significant difference due to a P-value > 0.05

Table 6. Dry matter production of lucerne cv. Q31, Virginia, 2018/19

No.	Treatment	Rate	Dry matter production (kg DM/ha)					Total DM production from 5 hay cuts (t/ha)
			25DAAA	34DAAB	15DAAC	26DAAD	29DAAE	
1	Hi-Fert Lucerne Mix	100 kg/ha	4306.3	4037.6	3330.2	3085.0	3109.8 b	17.8
2	PastureMasta	10 L/100 L	4468.8	4341.9	3392.9	3045.0	4023.4 a	19.3
Yield difference (%)			3.6	7.0	1.8	-1.3	22.7	7.8
P-value			0.7256	0.3917	0.8758	0.8390	0.0028	-
CV			23.23	2.02	26.32	14.15	16.57	-
LSD ($P \leq 0.05$)			NSD	tL	NSD	NSD	555.24	-

DAA# = Days after application timing
Means followed by the same letter are not significantly different (P = 0.05, LSD)
NSD = No significant difference due to a P-value > 0.05
tL = Data transformed using x = Log (y + 1)

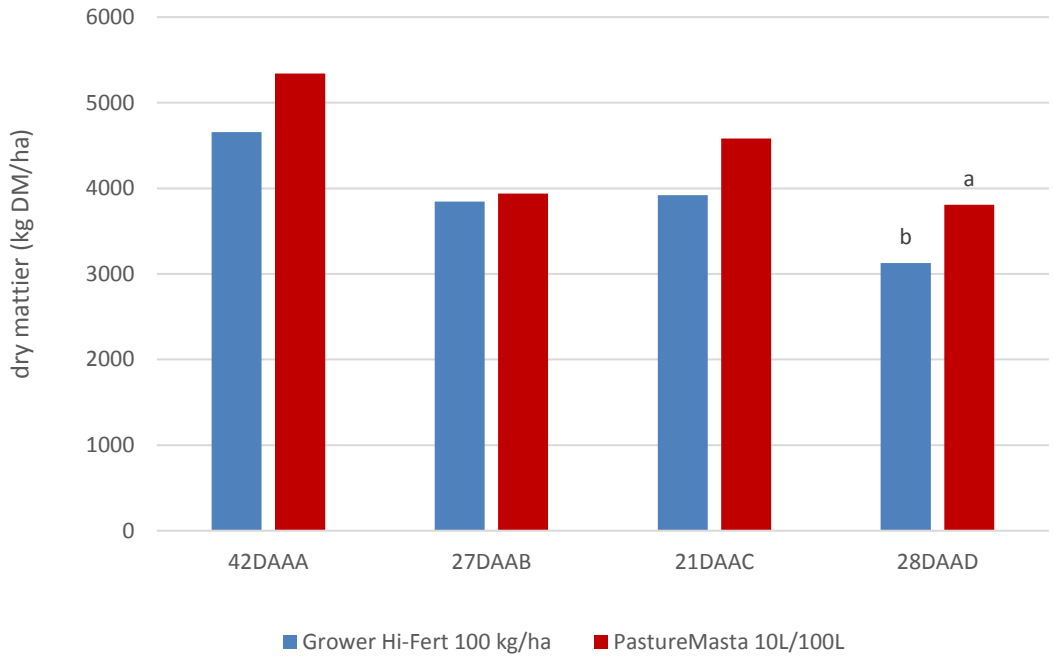

Figure 2. Dry matter production (kg/ha) of lucerne cv. Q31, Virginia, 2017-2018

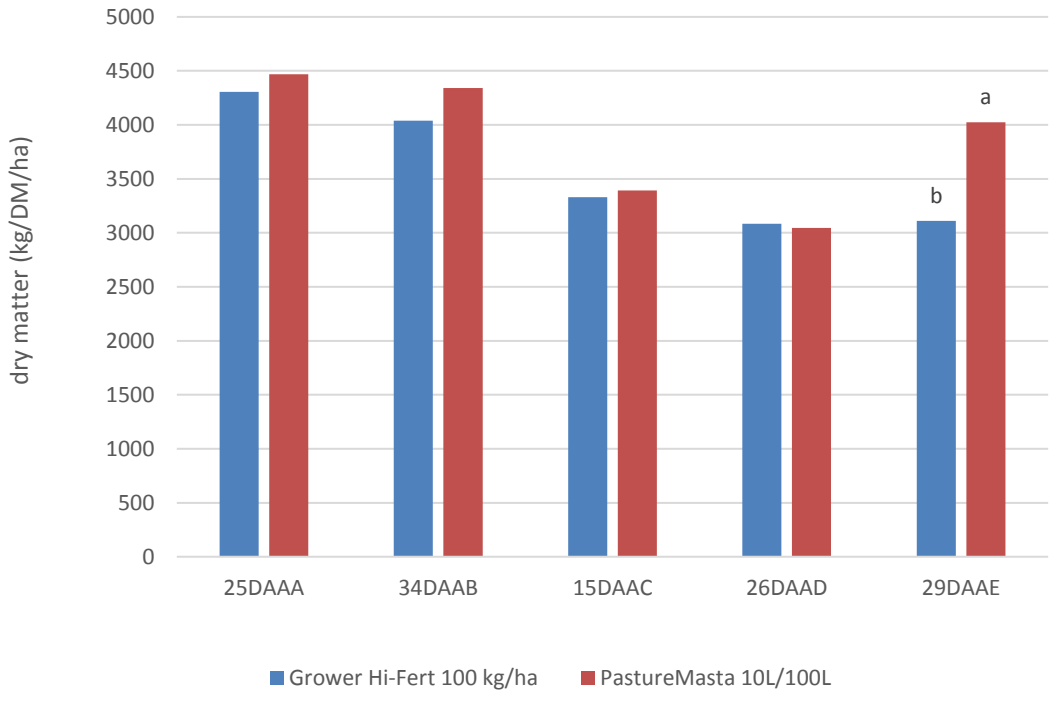

Figure 3. Dry matter production (kg/ha) of lucerne cv. Q31, Virginia, 2018-2019

Table 7. Daily dry matter production in lucerne cv. Q31, Virginia, 2017/18

No.	Treatment	Rate	Dry matter production (g DM/day/ha)			
			42DAAA	27DAAB	21DAAC	28DAAD
1	Hi-Fert Lucerne Mix	100 kg/ha	133.1	89.4	122.5	136.0 b
2	PastureMasta	10 L/100 L	152.6	91.6	143.2	165.5 a
		P-value	0.0635	0.8345	0.1228	0.0272
		CV	15.47	25.42	21.52	18.18
		LSD ($P \leq 0.05$)	NSD	NSD	NSD	4.12

DAA# = Days after application timing
Means followed by the same letter are not significantly different (P = 0.05, LSD)
NSD = No significant difference due to a P-value > 0.05

Table 8. Daily dry matter production in lucerne cv. Q31, Virginia, 2018/19

No.	Treatment	Rate	Dry matter production (g DM/day/ha)				
			25DAAA	34DAAB	15DAAC	26DAAD	29DAAE
1	Hi-Fert Lucerne Mix	100 kg/ha	107.7	118.8	114.8	102.83	107.2 b
2	PastureMasta	10 L/100 L	111.7	127.7	117.0	101.5	138.7 a
		P-value	0.7256	0.3915	0.8758	0.8390	0.0028
		CV	23.23	3.94	26.32	14.15	16.57
		LSD ($P \leq 0.05$)	NSD	tL	NSD	NSD	8.88

DAA# = Days after application timing
Means followed by the same letter are not significantly different (P = 0.05, LSD)
NSD = No significant difference due to a P-value > 0.05
tL = Data transformed using x = Log (y + 1)

Table 9. Number of bales produced and bale weight of lucerne cv. Q31, Virginia, 2017/18

No.	Treatment	Rate	Number of bales 2017/2018 (mean no./ha)						Bale weight (kg)
			-1DAAA	42DAAA	36DAAB	21DAAC	27DAAD	63DAAD	63DAAD
1	Hi-Fert Lucerne Mix	100 kg/ha	158	222	106	137	144	110	21.6 b
2	PastureMasta	10 L/100 L	168	256	163	158	159	116	23.5 a
P-value			1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0007
CV			0.00	0.00	0.00	0.00	0.00	0.00	4.64
LSD ($P \leq 0.05$)			-	-	-	-	-	-	0.98
Yield difference (%)			6.5	15.0	54.2	15.0	10.5	5.2	-
Actual yield difference (%)*			-	8.4	47.7	8.4	4.0	-1.3	-

DAA# = Days after application timing
Means followed by the same letter are not significantly different (P = 0.05, LSD)
* Taking into consideration 5% more yield in PastureMasta treated area of the paddock prior to commencement of the trial

Table 10. Number of bales produced and bale weight of lucerne cv. Q31, Virginia, 2018/19

No.	Treatment	Rate	Number of bales 2018/2019 (mean no./ha)					Bale weight (kg)	Bale weight (kg)
			32DAAA	32DAAB	22DAAC	19DAAD	37DAAE	20DAAD	37DAAE
1	Hi-Fert Lucerne Mix	100 kg/ha	202	216	160	174	154	21.1	19.4
2	PastureMasta	10 L/100 L	222	230	172	171	129	21.9	20.1
		P-value	1.0000	1.0000	1.0000	1.0000	1.0000	0.2794	0.1895
		CV	0.00	0.00	0.00	0.00	0.00	6.77	5.68
		LSD ($P \leq 0.05$)	-	-	-	-	-	NSD	NSD
		Yield difference (%)	9.9	6.5	7.3	-1.4	-16.3	-	-

DAA# = Days after application timing
Means followed by the same letter are not significantly different (P = 0.05, LSD)
NSD = No significant difference due to a P-value > 0.05

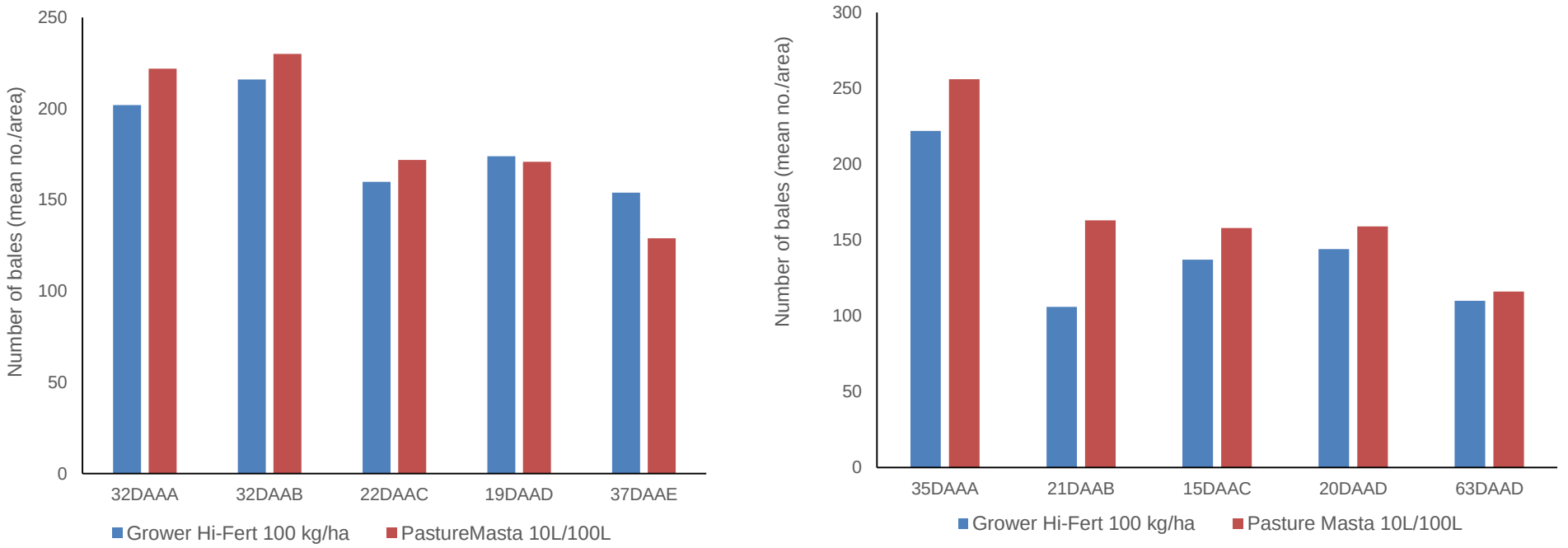

Figure 2. Number of bales produced in lucerne cv. Q31 in (a) season 1: 2017/2018 and (b) season 2: 2018/2019, Virginia, SA.

Table 11. Mean feed quality of lucerne cv. Q31, DAA, Virginia, 21DAAB and 20DAAD, 2017/2018

No.	Treatment	Dry matter (DM) (%)		Crude protein (% DM)		Digestibility (DMD) (% DM)		Metabolisable Energy (MJ/kg DM)		Acid Detergent Fibre (ADF) (% DM)		Neutral Detergent Fibre (NDF) (% DM)	
		21DAAB	20DAAD	21DAAB	20DAAD	21DAAB	20DAAD	21DAAB	20DAAD	21DAAB	20DAAD	21DAAB	20DAAD
1	Grower HiFert Lucerne Mix	91.7	82.0	28.3	32.3 a	75.2	77.6 a	11.3	11.7 a	27.5	22.4	29.6	29.7 b
2	PastureMasta	91.7	83.9	28.2	29.9 b	75.2	74.9 b	11.3	11.3 b	27.4	24.1	29.5	33.6 a
P-value		0.3528	0.2414	0.8622	0.0196	1.0000	0.0356	0.9154	0.0419	0.8893	0.1766	0.9394	0.0409
CV		0.14	2.83	2.53	4.47	2.25	2.37	2.58	2.68	4.87	7.91	4.14	8.45
LSD (*P* ≤ 0.05)		NSD	NSD	NSD	1.90	NSD	2.47	NSD	0.42	NSD	NSD	NSD	3.65

DAA# = Days after application timing
Means followed by the same letter are not significantly different (P = 0.05, LSD)
NSD = No significant difference due to a P-value > 0.05

Table 12. Mean feed quality of lucerne cv. Q31, Virginia, 13DAAD, 2018/2019

No.	Treatment	Dry matter (DM) (%)	Crude protein (% DM)	Digestibility (DMD) (% DM)	Metabolisable Energy (MJ/kg DM)	Acid Detergent Fibre (ADF) (% DM)	Neutral Detergent Fibre (NDF) (% DM)
1	Grower HiFert Lucerne Mix	92.8	23.3	64.4 a	9.5 a	32.5	37.7
2	PastureMasta	92.3	22.9	61.0 b	8.9 b	34.1	39.3
P-value		0.2700	0.6606	0.0300	0.0290	0.0912	0.2502
CV		0.71	6.39	3.5	4.22	4.37	5.6
LSD (*P* ≤ 0.05)		NSD	NSD	3.00	0.53	NSD	NSD

DAA# = Days after application timing
Means followed by the same letter are not significantly different (P = 0.05, LSD)
NSD = No significant difference due to a P-value > 0.05

Table 14. Soil microbial activity and Carbon – Grower

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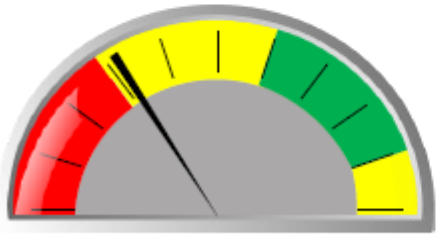
C WISE

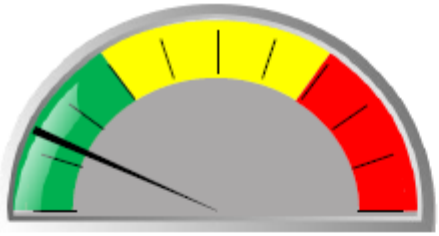
Customer name	AgXtra	**Date received**	2/04/2019
Client name	Belinda Rawnsley	**Agent**	Microbiology Laboratories A
Sample name	AgXtram Grower	**Advisor**	
Crop	Lucerne (alfalfa), for seed	**Authorised by**	Dr Maria Manjarrez
Date sampled	1/04/2019	**Analysis no.**	2175-2-CWSE

Indicators

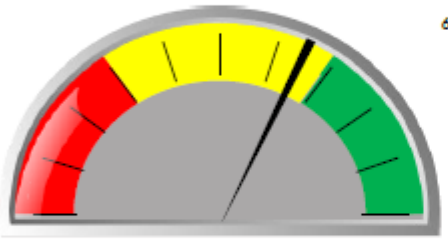
Potential Microbial Activity



Soil C:N Ratio



Soil Humus Building Potential



Key

Poor | Fair | Good

[1] Assumes a depth of 10 cm and a bulk density (BD) of 1.2 kg/L

Data

Soil Results

Analyte	Yours	Guide
Soil Basal Respiration (Potential) mg CO_2/kg soil/day	292.6	667.6
Soil Microbial Biomass C (Potential) mg C/kg soil	1801.5	4000.0
Labile C mg/kg	1015.9	5000.0
Resistant & Inert C %	2.718	4.500
Total Organic Carbon (TOC) %	2.820	5.000
Soil C:N ratio	9.8	12.0
Soil C : N : P : S ratio	1000 : 102 : 29 : 13	1000 : 83 : 20 : 14
Labile C:Soil Basal Respiration ratio	3.5	7.5
Water Stable Soil Aggregates (estimated) %	41.5	85.5

Soil Management Calculations

Calculation		Yours	
Additional N required to effectively break down residue without N tie-up kg/ha [1]	12:1 (optimal)	-625	
	22:1 (min)	-1906	
Additional nutrients required to OPTIMISE Resistant C formation (as humus) kg/ha [1]	N	-625	
	P	-294	
	S	50	

Table 15. Soil basal respiration carbon at different soil temperature and moisture contents - Grower

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C WISE

Name: **Belinda Rawnsley** Sample: **AgXtram Grower** Analysis no.: **2175-2-CWSE** Date: **1/04/19**

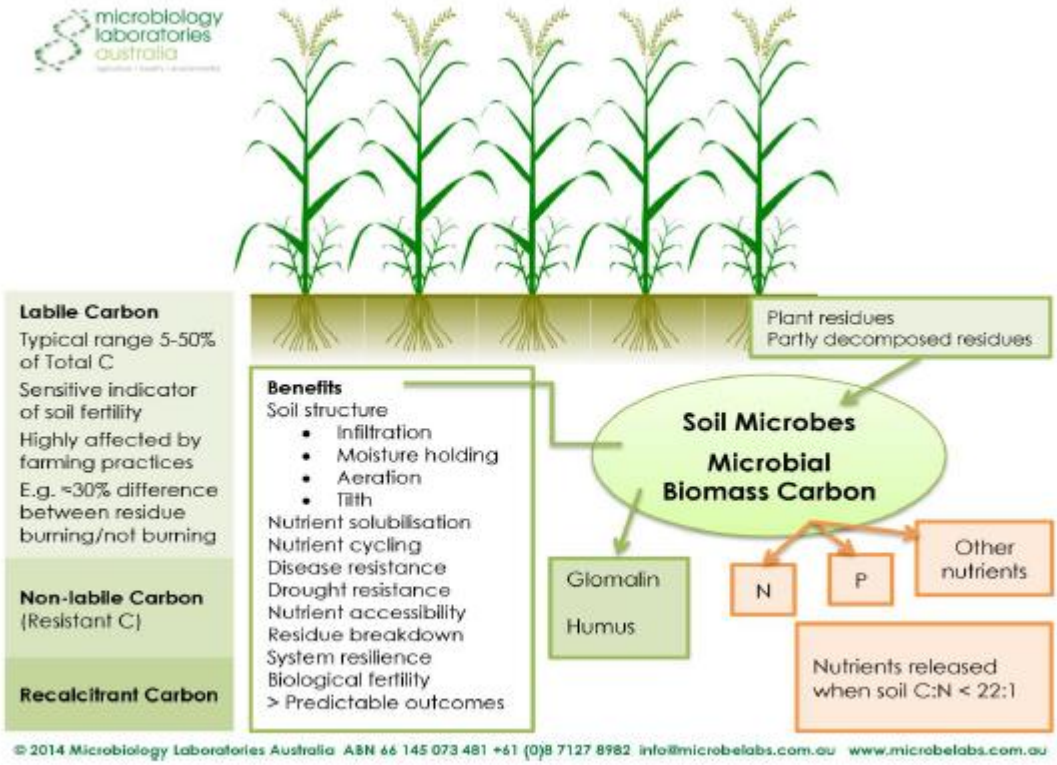
Ready Reckoner - SOIL BASAL RESPIRATION C

BASAL RESPIRATION at different soil temperatures and moisture contents (mg C/kg soil/day) [2]

Soil Temperature (°C)	Soil Moisture (% Water Holding Capacity, WHC)									
	< 10	10	20	30	35	40	45	50	55	> 55
< 10	< 8.3	< 8.3	< 36.2	< 49.4	< 56.0	< 62.6	< 69.2	< 75.8	< 82.4	< 82.4
10	< 8.3	< 8.3	36.2	49.4	56.0	62.6	69.2	75.8	82.4	< 82.4
15	< 8.3	8.3	35.4	62.5	76.0	89.6	103.1	116.7	130.2	< 130.2
20	< 19.7	19.7	60.7	101.7	122.1	142.6	163.1	183.6	204.1	< 204.1
25	< 57.2	57.2	112.0	166.9	194.4	221.8	249.2	292.6	304.1	< 304.1
28	< 92.2	92.2	155.4	218.6	250.2	281.8	313.4	345.0	376.7	< 376.7
30	< 120.7	120.7	189.5	258.3	292.7	327.1	361.4	395.8	430.2	< 430.2
35	< 210.4	210.4	293.1	375.7	417.1	458.4	499.7	541.1	582.4	< 582.4
> 35	< 210.4	< 210.4	< 293.1	< 375.7	< 417.1	< 458.4	< 499.7	< 541.1	< 582.4	< 582.4

[2] Soil temperature & moisture corrections from Rey *et al*. 2005, based on 0-10 cm depth.

Interactions Between Soil Carbon, Nutrients & Biology



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C WISE

Name: **Belinda Rawnsley** Sample: **AgXtra PastureMasta** Analysis no.: **2175-1-CWSE** Date: **1/04/19**

How To Read the Results

Soil Results

Soil Basal Respiration (Potential): This is the potential amount of carbon (C) in the carbon dioxide (CO_2) produced by soil microbes under standard ideal conditions (25°C and 50% Water Holding Capacity (WHC)). In general, basal respiration is positively related to soil health and fertility. However, when respiration is too high there is a risk that soil carbon stocks will be depleted. To build soil carbon, Labile Carbon should be good and Basal Respiration should not be too high. The ratio of Labile C to Soil Basal Respiration should approximate the guide level for maximum humus building potential. Note that humus formation also depends on having a good soil C:N:P:S ratio and good soil structure.

Soil Microbial Biomass C: This is the amount of carbon in the potential biomass of microbes in your soil under standard ideal conditions (25°C and 50% Water Holding Capacity (WHC)). Soil Microbial Biomass C (SMBC) is a frequently used, basic measure of the overall microbiological status of your soil. C Wise estimates SMBC by correlation from soil microbial respiration.

Labile C (Potential): This is the amount of 'active' or 'easily-available' carbon in your soil. Labile C includes such compounds as sugars, starches, and other forms of C that are easily available as a microbial food source. Labile C is the pool of soil C most easily influenced by soil management practices, and their effect on Labile C can be measured in a relatively short period of time. Labile C is the major origin of the C in humus, but can be quickly depleted if soil respiration is too high. A good Labile C to Soil Basal Respiration ratio, good soil C:N:P:S ratio and good soil structure are all required for maximum humus building potential.

Resistant and Inert C: This is the fraction of soil C that is resistant to further degradation or recalcitrant. Humus is a form of Resistant C, and charcoal is an example of Inert C. Resistant and Inert C together comprise the majority of total soil C.

Total Organic Carbon (TOC): A commonly-used measure of the total amount of carbon from organic sources in the soil.

Soil C:N: The ratio of Total Organic Carbon to Total Nitrogen in the soil. The soil C:N ratio has a large influence on the rate at which carbon and nitrogen are mineralised (released) from organic residues, and should ideally be around 12:1 and at a maximum 22:1 to avoid nitrogen tie-up in the microbial biomass.

Soil C:N:P:S: The ratio of total carbon to nitrogen to phosphorus to sulphur in the soil. Australian and international research has shown that this ratio has an important influence on the rate of soil humus formation.

Labile C:Soil Basal Respiration C: This ratio is an indicator of how much Labile C will potentially end up as humus C.

Water Stable Aggregates: Soil water-stable aggregates are a useful indicator of one of the main soil health processes, soil structure maintenance, and play an important role in carbon sequestration. Soil microbiology plays a major role in the formation of soil aggregates and arbuscular mycorrhizal fungi (VAM) are a key microbial group in this process, through physically binding soil particles together and the exudation of glomalin, a sticky carbon-rich protein that acts as a kind of soil particle glue. There is a strong correlation between soil glomalin and water stable aggregates, used as the basis for estimation here.

Soil Management Calculations

Additional N required to effectively break down residue without N tie-up : If the soil C:N ratio is too high, N will be immobilised (taken up by) in the soil microbial biomass before it can be accessed by plants, and organic residues may take a long time to break down. This result shows how much additional N (if any) is required for the optimal (12:1) and maximum desirable (22:1) soil C:N ratio.

Additional nutrients required to effectively build Resistant C (as humus): An incorrect C:N:P:S ratio may hinder soil humus formation. These results show how much additional nitrogen (N), phosphorus (P) and sulphur (S) (if any) are required for the optimal C:N:P:S ratio.

Indicators

Potential Microbial Activity: Based on soil respiration, this indicates the potential microbial activity of your soil under ideal conditions compared to a guide level for a typically healthy soil.

Soil C:N ratio: An at-a-glance indicator of the C:N ratio of your soil compares to the optimum of 12:1.

Soil Humus Building Potential: Based on the Labile C:Soil Basal respiration C ratio, the C:N:P:S ratio and Water Stable Aggregates in your soil compared to optimal guides for maximum humus building potential.

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Table 16. Soil microbial activity and Carbon – PastureMasta

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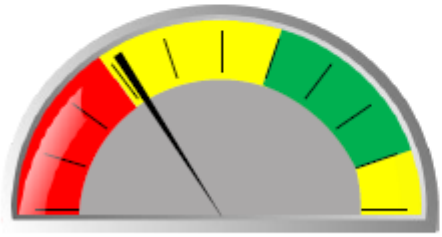
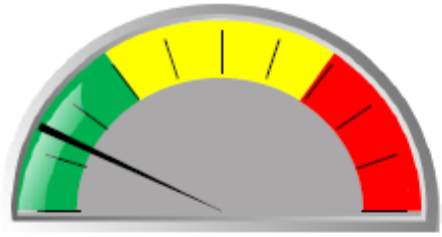
Customer name	AgXtra	**Date received**	2/04/2019
Client name	Belinda Rawnsley	**Agent**	Microbiology Laboratories A
Sample name	AgXtra PastureMasta	**Advisor**	
Crop	Lucerne (alfalfa), for seed	**Authorised by**	Dr Maria Manjarrez
Date sampled	1/04/2019	**Analysis no.**	2175-1-CWSE

Indicators

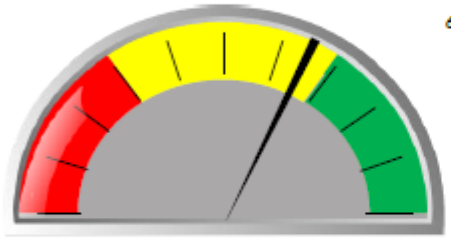
Potential Microbial Activity



Soil C:N Ratio



Soil Humus Building Potential



Key

Poor | Fair | Good

[1] Assumes a depth of 10 cm and a bulk density (BD) of 1.2 kg/L

Data

Soil Results

Analyte	Yours	Guide
Soil Basal Respiration (Potential) mg CO_2/kg soil/day	292.6	667.6
Soil Microbial Biomass C (Potential) mg C/kg soil	1801.5	4000.0
Labile C mg/kg	976.3	5000.0
Resistant & Inert C %	2.142	4.500
Total Organic Carbon (TOC) %	2.240	5.000
Soil C:N ratio	9.7	12.0
Soil C : N : P : S ratio	1000 : 103 : 27 : 12	1000 : 83 : 20 : 14
Labile C:Soil Basal Respiration ratio	3.3	7.5
Water Stable Soil Aggregates (estimated) %	44.4	85.5

Soil Management Calculations

Calculation		Yours	
Additional N required to effectively break down residue without N tie-up kg/ha [1]	12:1 (optimal)	-533	
	22:1 (min)	-1550	
Additional nutrients required to OPTIMISE Resistant C formation (as humus) kg/ha [1]	N	-533	
	P	-193	
	S	59	

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Table 17. Soil basal respiration carbon at different soil temperature and moisture contents- PastureMasta

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C WISE

Name: **Belinda Rawnsley** Sample: **AgXtra PastureMasta** Analysis no.: **2175-1-CWSE** Date: **1/04/19**

Ready Reckoner - SOIL BASAL RESPIRATION C

BASAL RESPIRATION at different soil temperatures and moisture contents (mg C/kg soil/day) [2]

Soil Temperature (°C)	Soil Moisture (% Water Holding Capacity, WHC)									
	< 10	10	20	30	35	40	45	50	55	> 55
< 10	< 8.3	< 8.3	< 36.2	< 49.4	< 56.0	< 62.6	< 69.2	< 75.8	< 82.4	< 82.4
10	< 8.3	< 8.3	36.2	49.4	56.0	62.6	69.2	75.8	82.4	< 82.4
15	< 8.3	8.3	35.4	62.5	76.0	89.6	103.1	116.7	130.2	< 130.2
20	< 19.7	19.7	60.7	101.7	122.1	142.6	163.1	183.6	204.1	< 204.1
25	< 57.2	57.2	112.0	166.9	194.4	221.8	249.2	292.6	304.1	< 304.1
28	< 92.2	92.2	155.4	218.6	250.2	281.8	313.4	345.0	376.7	< 376.7
30	< 120.7	120.7	189.5	258.3	292.7	327.1	361.4	395.8	430.2	< 430.2
35	< 210.4	210.4	293.1	375.7	417.1	458.4	499.7	541.1	582.4	< 582.4
> 35	< 210.4	< 210.4	< 293.1	< 375.7	< 417.1	< 458.4	< 499.7	< 541.1	< 582.4	< 582.4

[2] Soil temperature & moisture corrections from Rey *et al*. 2005, based on 0-10 cm depth.

Interactions Between Soil Carbon, Nutrients & Biology

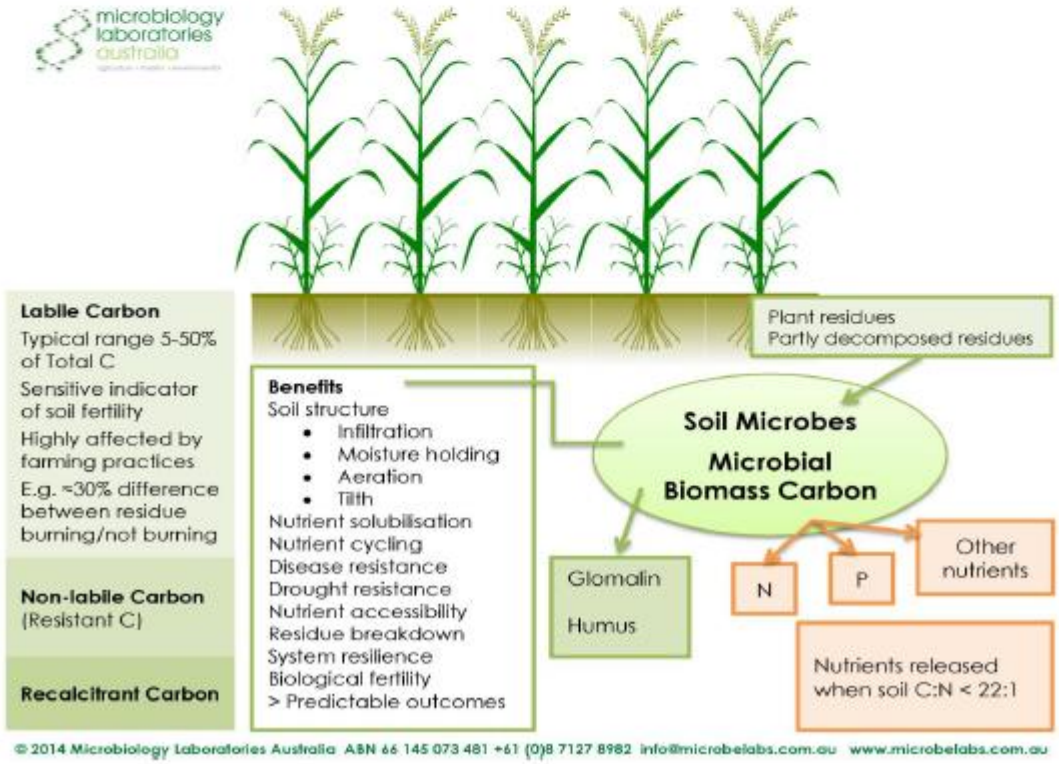

Table 18. P-Wise Phosphorus – Grower

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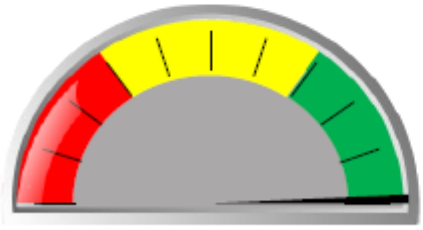
PWISE

Name: **AgXtra** Sample: **AgXtram Grower** Analysis no.: **2175-2-PWSE** Date: **2/04/2019**

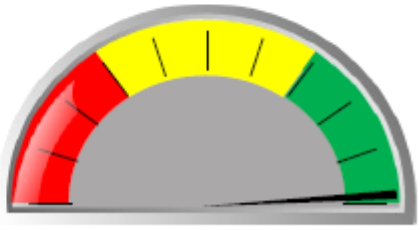
Customer name	AgXtra	**Date received**	2/04/2019
Client name	Belinda Rawnsley	**Agent**	Microbiology Laboratories Australia
Sample name	AgXtram Grower	**Advisor**	
Crop	Lucerne (alfalfa), for seed	**Authorised by**	Dr Maria Manjarrez (MLA)
Date sampled	1/04/2019	**Analysis no.**	2175-2-PWSE

Soil Phosphorus (P) Indicators

Net P Release



P Fertiliser Availability



Soil Phosphorus (P) Data

	Yours	Guide
Plant-available P (mg/kg)	52.2	
Total P (mg/kg)	809.0	
Net P release† (mg/kg/month) @ 28°C & 30% MC see reckoner p2 for other values	13.3	10.0
(kg/ha/month)*	15.9	25.7

	Yours	Guide
P fertiliser availability (%)	79.0	80.0%
P release from Total P (%)	1.6	0.4

Key: Poor — Fair — Good

† Net increase in plant-available P due to mineralisation (including by microbes) above any released P that became locked up again.

* Assumes a sampling depth of 10 cm and a bulk density (BD) of 1.2 kg/L. For other depths and densities use mg/kg × (depth (cm) ÷ 10) × BD (g/mL).

Calculation Table to Help Optimise P Fertilisation

Variable		Formula	Result
Average soil temperature (°C)	*a*		
Average soil moisture content (%)	*b*		
P solubilised/°C/%MC (mg/kg/month)	*c*		0.016
P solubilised (kg/ha)* (10 cm depth & 1.2 BD)	*d*	*a* × *b* × *c* × 1.2 × *n*	
Plant-available P (mg/kg)	*e*		52.2
Crop P requirement (kg/ha)	*f*		
Surplus/deficit (kg/ha)	*g*	*f* − *e* − *d*	
P fertiliser availability (%)	*h*		79.0
P requirement from fertiliser (kg/ha)	*i*	*g* ÷ *h*	

Instructions

1. Write the average soil temperature and moisture content over the growth period of your crop next to cells *a* and *b*. 2. Write the result of the formula *d*, where *n* = the growth period in months. 3. Write the crop P requirement next to cell *f*. 4. Subtract the values for rows *d* and *e* from *f* and write the result at *g*. 5. Divide *g* by *h* and write the result at *i*. This is the amount of fertiliser P required for the crop.

Table 19. Phosphorus release at different soil temperature and moisture contents- Grower

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P WISE

Name: **AgXtra** Sample: **AgXtram Grower** Analysis no.: **2175-2-PWSE** Date: **2/04/2019**

Ready Reckoner

P release at different soil temperatures and moisture contents (mg/kg/month)

Soil Temperature (°C)	Soil Moisture (% w/w)							
	<5	5	10	15	20	25	30	>30
<10	limited	<0.8	<1.6	<2.4	<3.2	<4.0	<4.7	<4.7
10	limited	0.8	1.6	2.4	3.2	4.0	4.7	<4.7
15	limited	1.2	2.4	3.6	4.7	5.9	7.1	<7.1
20	limited	1.6	3.2	4.7	6.3	7.9	9.5	<9.5
25	limited	2.0	4.0	5.9	7.9	9.9	11.9	<11.9
28	limited	2.2	4.4	6.6	8.9	11.1	13.3	<13.3
30	limited	2.4	4.7	7.1	9.5	11.9	14.2	<14.2
35	limited	2.8	5.5	8.3	11.1	13.8	16.6	<16.6
>35	limited	<2.8	<5.5	<8.3	<11.1	<13.8	<16.6	<16.6

*To convert mg/kg/month to kg/ha/month use: mg/kg/month × (sampling depth (cm) ÷ 10) × soil bulk density (kg/L)

Comments

Plant available P was fair. P fertiliser availability was good. Net P release was also good. These results suggest that this soil will require low amount of P fertilisation to overcome crop P limitation. Management actions should aim at building soil P solubilisation through microbial action and the P solubilisation to lock-up ratio to at least the guide levels to help maximise P fertiliser efficiency. P fertiliser applications should be optimised (see Calculation Table).

Explanations

P Wise is a unique, advanced analysis that helps you manage P fertilisation better to get more out of your fertiliser dollar. It does this by taking into account P solubilisation (mineralisation) by soil microbes and P 'lock-up' (immobilisation) over time and under a simulated crop. This gives users the ability to optimise P fertility management to minimise inputs, maximise outputs and increase gross returns. **Net P release** is the net increase in plant-available P due to solubilisation by microbes above any solubilised P that became locked up again. **P fertiliser availability** is the percentage of soluble fertiliser P added in that remains available after one week, an advance on the PBI (Phosphorus Buffer Index) calculated in some tests. It is assumed that the field minimum is 5%. **P release from Total P** is the percentage of plant available P mineralised from total P per week. Use the **Calculation Table** to calculate the optimum rate of P fertilisation required for your crop. Use records or best estimations of soil temperatures and moisture contents for each month and enter them into the Calculation Table, along with the no. of days and crop P requirement (average if no specific data available) per month. Use the table formulas to arrive at the optimum P fertilisation per month. You can use this data to calculate how much fertiliser you will need to apply for a given no. of months. The **Ready Reckoner** helps you to calculate P solubilisation for a given set of soil temperature and moisture conditions at a glance. The **Calculation Table** and **Ready Reckoner** make the assumption that P solubilisation, soil temperature and soil moisture content are correlated linearly.

Disclaimer

Table 20. P-Wise Phosphorus - PastureMasta

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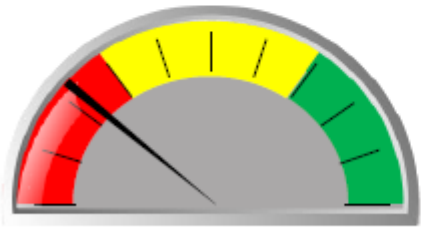
P WISE

Name: **AgXtra** Sample: **AgXtra PastureMasta** Analysis no.: **2175-1-PWSE** Date: **2/04/2019**

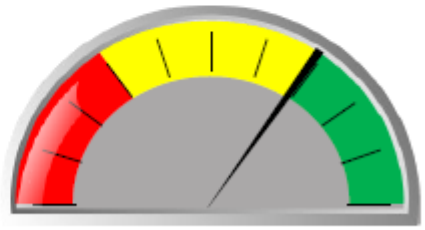
Customer name	AgXtra	**Date received**	2/04/2019
Client name	Belinda Rawnsley	**Agent**	Microbiology Laboratories Australia
Sample name	AgXtra PastureMasta	**Advisor**	
Crop	Lucerne (alfalfa), for seed	**Authorised by**	Dr Maria Manjarrez (MLA)
Date sampled	1/04/2019	**Analysis no.**	2175-1-PWSE

Soil Phosphorus (P) Indicators

Net P Release



P Fertiliser Availability



Soil Phosphorus (P) Data

	Yours	Guide
Plant-available P (mg/kg)	30.8	
Total P (mg/kg)	609.0	
Net P release† (mg/kg/month) @ 28°C & 30% MC see reckoner p2 for other values	2.1	10.0
(kg/ha/month)*	2.6	25.7

	Yours	Guide
P fertiliser availability (%)	56.0	80.0%
P release from Total P (%)	0.4	0.4

Key

Poor | Fair | Good

† Net increase in plant-available P due to mineralisation (including by microbes) above any released P that became locked up again.

* Assumes a sampling depth of 10 cm and a bulk density (BD) of 1.2 kg/L. For other depths and densities use mg/kg × (depth (cm) ÷ 10) × BD (g/mL).

Calculation Table to Help Optimise P Fertilisation

Variable		Formula	Result
Average soil temperature (°C)	*a*		
Average soil moisture content (%)	*b*		
P solubilised/°C/%MC (mg/kg/month)	*c*		0.003
P solubilised (kg/ha)* (10 cm depth & 1.2 BD)	*d*	*a* × *b* × *c* × 1.2 × *n*	
Plant-available P (mg/kg)	*e*		30.8
Crop P requirement (kg/ha)	*f*		
Surplus/deficit (kg/ha)	*g*	*f* − *e* − *d*	
P fertiliser availability (%)	*h*		56.0
P requirement from fertiliser (kg/ha)	*i*	*g* ÷ *h*	

Instructions

1. Write the average soil temperature and moisture content over the growth period of your crop next to cells *a* and *b*. 2. Write the result of the formula *d*, where *n* = the growth period in months. 3. Write the crop P requirement next to cell *f*. 4. Subtract the values for rows *d* and *e* from *f* and write the result at *g*. 5. Divide *g* by *h* and write the result at *i*. This is the amount of fertiliser P required for the crop.

Table 21. Phosphorus release at different soil temperature and moisture contents - PastureMasta

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PWISE

Name: **AgXtra** Sample: **AgXtra PastureMasta** Analysis no.: **2175-1-PWSE** Date: **2/04/2019**

Ready Reckoner

P release at different soil temperatures and moisture contents (mg/kg/month)

Soil Temperature (°C)	Soil Moisture (% w/w)							
	<5	5	10	15	20	25	30	>30
<10	limited	<0.1	<0.3	<0.4	<0.5	<0.6	<0.8	<0.8
10	limited	0.1	0.3	0.4	0.5	0.6	0.8	<0.8
15	limited	0.2	0.4	0.6	0.8	1.0	1.1	<1.1
20	limited	0.3	0.5	0.8	1.0	1.3	1.5	<1.5
25	limited	0.3	0.6	1.0	1.3	1.6	1.9	<1.9
28	limited	0.4	0.7	1.1	1.4	1.8	2.1	<2.1
30	limited	0.4	0.8	1.1	1.5	1.9	2.3	<2.3
35	limited	0.4	0.9	1.3	1.8	2.2	2.7	<2.7
>35	limited	<0.4	<0.9	<1.3	<1.8	<2.2	<2.7	<2.7

*To convert mg/kg/month to kg/ha/month use: mg/kg/month × (sampling depth (cm) ÷ 10) × soil bulk density (kg/L)

Comments

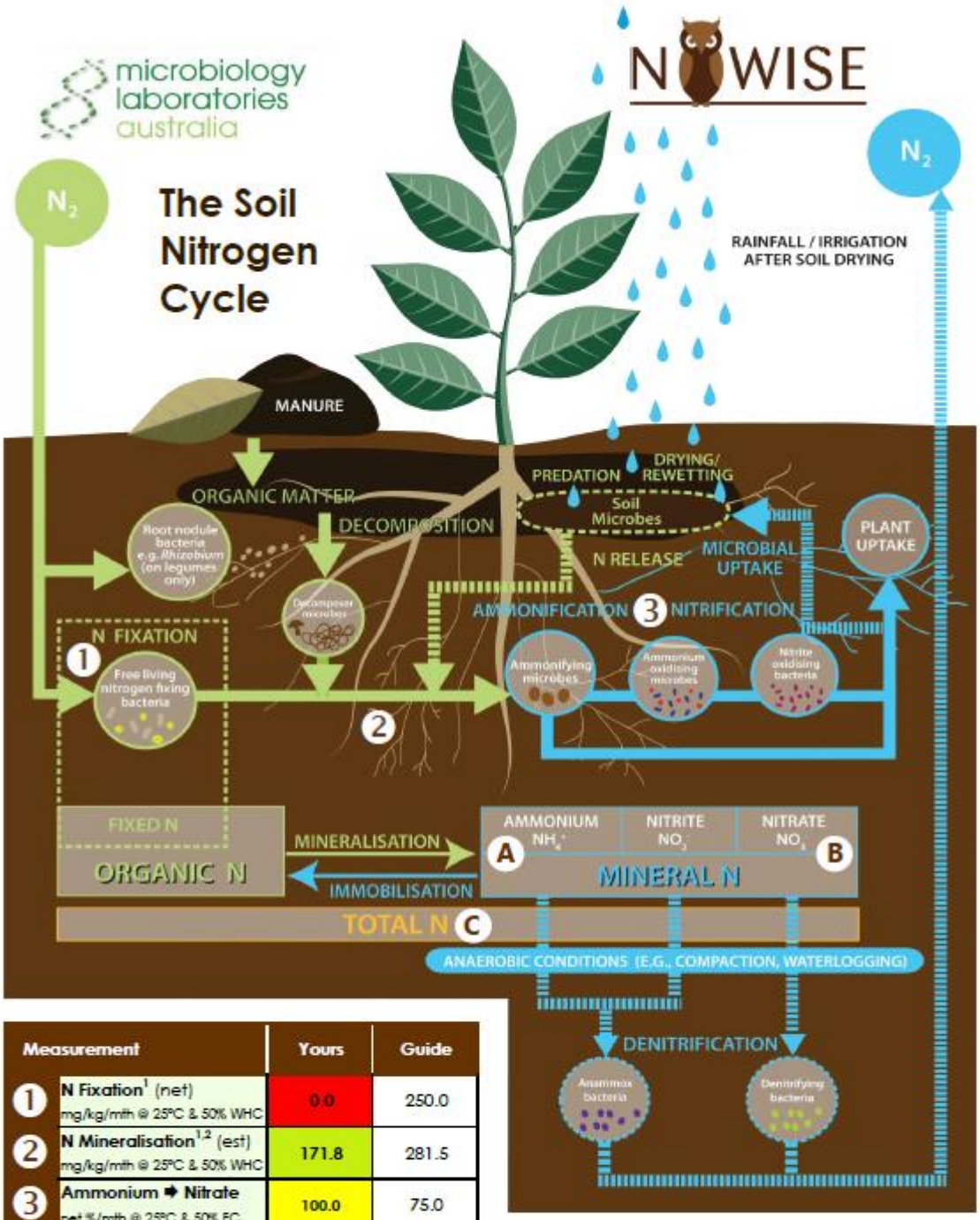
Plant available P was fair. P fertiliser availability was good. Net P release poor. These results suggest that this was a P-adsorbing soil that will require a moderate amount of P fertilisation to overcome crop P limitation. Management actions should aim at building soil P solubilisation through microbial action and the P solubilisation to lock-up ratio to at least the guide levels to help maximise P fertiliser efficiency. P fertiliser applications should be optimised (see Calculation Table).

Explanations

P Wise is a unique, advanced analysis that helps you manage P fertilisation better to get more out of your fertiliser dollar. It does this by taking into account P solubilisation (mineralisation) by soil microbes and P 'lock-up' (immobilisation) over time and under a simulated crop. This gives users the ability to optimise P fertility management to minimise inputs, maximise outputs and increase gross returns. **Net P release** is the net increase in plant-available P due to solubilisation by microbes above any solubilised P that became locked up again. **P fertiliser availability** is the percentage of soluble fertiliser P added in that remains available after one week, an advance on the PBI (Phosphorus Buffer Index) calculated in some tests. It is assumed that the field minimum is 5%. **P release from Total P** is the percentage of plant available P mineralised from total P per week. Use the **Calculation Table** to calculate the optimum rate of P fertilisation required for your crop. Use records or best estimations of soil temperatures and moisture contents for each month and enter them into the Calculation Table, along with the no. of days and crop P requirement (average if no specific data available) per month. Use the table formulas to arrive at the optimum P fertilisation per month. You can use this data to calculate how much fertiliser you will need to apply for a given no. of months. The **Ready Reckoner** helps you to calculate P solubilisation for a given set of soil temperature and moisture conditions at a glance. The **Calculation Table** and **Ready Reckoner** make the assumption that P solubilisation, soil temperature and soil moisture content are correlated linearly.

Disclaimer

Table 22. N-Wise Nitrogen - Grower



	Measurement	Yours	Guide
1	**N Fixation**[1] (net) mg/kg/mth @ 25°C & 50% WHC	0.0	250.0
2	**N Mineralisation**[1,2] (est) mg/kg/mth @ 25°C & 50% WHC	171.8	281.5
3	**Ammonium ➡ Nitrate** net %/mth @ 25°C & 50% FC	100.0	75.0
A	**Ammonium N** mg/kg	7.0	20.0
B	**Nitrate N** mg/kg	10.8	30.0
C	**Total N** mg/kg	2,870	2,350

[1] At standard temp. & moisture. Use ready reckoners to est. for your cond's.
[2] Result & Guide calculated from Schomberg et al (2009).

Customer	**Belinda Rawnsley**
Company	**AgXtra**
Sample name	**AgXtram Grower**
Crop	**Lucerne (alfalfa), for seed**
Date sampled	**1/04/19** Date received **2/04/19**
Agent	**Microbiology Laboratories Australia**
Advisor	Lab no. **2175-2-NWSE**

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Table 23. Soil Nitrogen indicators - Grower

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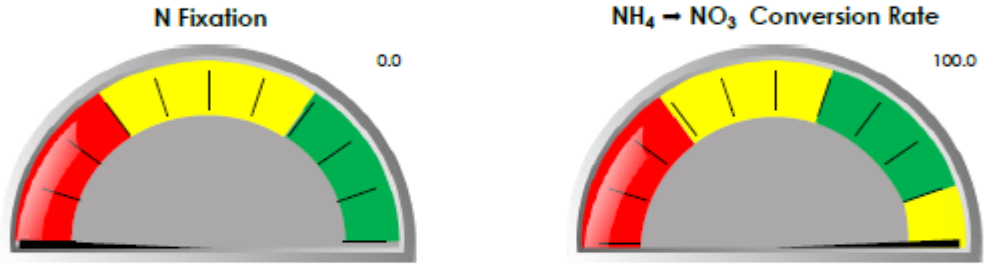
Name: **Belinda Rawnsley** Sample: **AgXtram Grower** Analysis no.: **2175-2-NWSE** Date: **1/04/19**

Soil Nitrogen (N) Indicators



Other useful data

Measurement	Yours	Guide
C:N ratio	9.8	12:1 (< 22:1)
Total C %	2.820	5.000
Total N %	0.287	0.235
Organic N (estimated) %	0.285	0.230
% Total N Mineralised [2] % of Total N mineralised/month	6.0	12.0

Measurement	Yours	Guide
N Fixation [1] (net) kg/ha/month @ 25°C & 50% FC [3]	0.0	300.0
N Mineralisation [1,2] (net) kg/ha/month @ 25°C & 50% FC [3]	206.1	337.8
Denitrification (net, estimated) kg/ha/month @ 25°C & 50% FC [3]	0.0	0.0
Ammonium N kg/ha [3]	8.4	24.0
Nitrate N kg/ha [3]	13.0	36.0

[1] At standard temp. & moisture. Use ready reckoners to estimate for your conditions. [2] Min Result & Guide calculated from Schomberg *et al* (2009)

[3] Assumes a sampling depth of 10 cm and a bulk density (BD) of 1.2 kg/L. For other depths and densities use mg/kg x (depth (cm) ÷ 10) x BD (kg/L).

How To Read the Results

Poor Fair Good

The Soil Nitrogen Cycle

The diagram on page 1 shows the main parts of the soil nitrogen (N) cycle and how specific microbiology drives each part of the cycle. Each part can be optimised to maximise natural N availability and optimise N fertiliser use.

❶ **N Fixation:** This is N fixed from air in the soil by Free Living Nitrogen Fixing Bacteria (FLNFB). This can occur in the root zone of all plants, not just legumes. It can make a substantial contribution to building soil N in all crops. ❷ **N Mineralisation:** This is N released from soil organic matter (including the microbial biomass) and converted into mineral N, which can be readily used by plants. It is a critical process in the soil N cycle because it determines how much organic N (including fixed N and urea) is converted to plant-available N. ❸ **Ammonium ➔ Nitrate:** This is the percentage of ammonium (NH_4^+) N that was converted to nitrate (NO_3^-) N. Ammonium N is more resistant to loss through leaching and denitrification than nitrate N, but nitrate N is often more readily absorbed by plants. Ideally, there should be a moderate amount of conversion to optimise the benefits of both of these forms of N. **A Ammonium N:** This is plant-available N converted from organic N to NH_4^+. **B Nitrate N:** This is plant-available N converted from NH_4^+ to NO_3^-. **C Total N:** This is the total amount of all N in the soil (organic + mineral).

Soil Nitrogen Indicators The two indicators on page 2 provide a quick display of N fixation and Ammonium ➔ Nitrate.

Other Useful Data

C:N Ratio: is the ratio of Total Carbon (C) to Total N in the soil. It has a large influence on how much N is mineralised (made plant-available) and immobilised (tied up in soil organic matter and the soil microbial biomass). As a guide, net mineralisation of organic N occurs when C:N < 22.; net immobilisation when C:N > 22:1. **Total C:** This is the total amount of all carbon (C) (Total Organic Carbon, TOC), expressed as a percentage. **Total N (%):** Total N expressed as a percentage. **Organic N (%) (estimated):** This is calculated by subtracting Ammonium N and Nitrate N from Total N. It is an estimate because Nitrite (NO_2^-) and other forms of mineral N that may be present are not easily measured. **Organic N Mineralised (%):** This is the percentage of Organic N that was mineralised . **N Fixation, N Mineralisation, Ammonium N &Nitrate N** are shown here in kg/ha ('units'). (They are shown in mg/kg on page 1.) **Denitrification:** N loss to the air can occur when the soil sample has anaerobic properties due to past waterlogging or compaction and a resultant population of anaerobic microbes.

Table 24. Nitrogen mineralisation at different soil temperature and moisture contents - Grower

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Name: **Belinda Rawnsley** Sample: **AgXtram Grower** Analysis no.: **2175-2-NWSE** Date: **1/04/19**

Calculation Table to Help Optimise N Fertilisation

Variable	Code	Calculation	Result	Instructions
No. of months of crop growth	**MCG**			1) Write the number of months of crop growth next to cell 'MCG'. 2) Write the average soil temperature during the crop growth period next to cell 'AST'. 3) Write the average soil moisture content during the crop growth period, expressed as the % of water holding capacity (WHC) (similar to field capacity) next to cell 'ASM'. 4) Look up the rate of N Mineralisation for your soil temp. and moisture using the Ready Reckoner - N Mineralisation and write it in the cell next to 'NMR'. 5) Calculate the total N mineralised in the crop growth period by multiplying MCG × NMR and write it in the cell next to 'TNM'. 6) Write the crop nitrogen requirement next to cell 'CNR'. 7) Calculate the additional N needed (e.g., as fertiliser) by subtracting 'TNM' - 'CNR' and write it next to 'Additional N needed'.
Average soil temperature	**AST**			
Average soil moisture (% Water Holding Capacity, WHC)	**ASM**			
N mineralisation under YOUR conditions **Use Ready Reckoner** (kg/ha/month)	**NMR**			
Total N mineralised in growth period (kg/ha)	**TNM**	**MCG × NMR**		
Crop N requirement (kg/ha)	**CNR**			
***Additional N needed** (eg, fertiliser) (kg/ha) How much you need above what's mineralised		**CNR – TNM**		

*Estimate only. Please consult a professional advisor and take N requirements of specific crop growth stages into account.

Ready Reckoner - N MINERALISATION

N MINERALISATION at different soil temperatures and moisture contents (kg/ha/month) [4]

Soil Temperature (°C) ('AST' in calculation table)	Soil Moisture (% Water Holding Capacity, WHC) ('ASM' in calculation table)									
	< 10	10	20	30	35	40	45	50	55	> 55
< 10	< 5.8	< 5.8	< 25.5	< 34.8	< 39.5	< 44.1	< 48.8	< 53.4	< 58.1	< 58.1
10	< 5.8	< 5.8	25.5	34.8	39.5	44.1	48.8	53.4	58.1	< 58.1
15	< 5.8	5.8	24.9	44.0	53.6	63.1	72.7	82.2	91.8	< 91.8
20	< 13.9	13.9	42.7	71.6	86.1	100.5	115.0	129.4	143.8	< 143.8
25	< 40.3	40.3	78.9	117.6	137.0	156.3	175.6	206.1	214.3	< 214.3
28	< 64.9	64.9	109.5	154.0	176.3	198.6	220.9	243.1	265.4	< 265.4
30	< 85.1	85.1	133.5	182.0	206.2	230.5	254.7	278.9	303.1	< 303.1
35	< 148.2	148.2	206.5	264.8	293.9	323.0	352.1	381.3	410.4	< 410.4
> 35	< 148.2	< 148.2	< 206.5	< 264.8	< 293.9	< 323.0	< 352.1	< 381.3	< 410.4	< 410.4

[4] Assumes a sampling depth of 10 cm and a bulk density (BD) of 1.2 kg/L. Soil temp. & moisture corrections from Gilmour & Mauromoustakos (2011).

Table 25. Nitrogen fixation and transformation at different soil temperature and moisture contents - Grower

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Name: **Belinda Rawnsley** Sample: **AgXtram Grower** Analysis no.: **2175-2-NWSE** Date: **1/04/19**

Ready Reckoner - N FIXATION

N FIXATION at different soil temperatures and moisture contents (kg/ha/month) [5]

Soil Temperature (°C)	Soil Moisture (% Water Holding Capacity, WHC)									
	< 10	10	20	30	35	40	45	50	55	> 55
< 10	< 0.0	< 0.0	< 0.0	< 0.0	< 0.0	< 0.0	< 0.0	< 0.0	< 0.0	< 0.0
10	< 0.0	< 0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	< 0.0
15	< 0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	< 0.0
20	< 0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	< 0.0
25	< 0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	< 0.0
30	< 0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	< 0.0
35	< 0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	< 0.0
> 35	< 0.0	< 0.0	< 0.0	< 0.0	< 0.0	< 0.0	< 0.0	< 0.0	< 0.0	< 0.0

[5] Assumes a sampling depth of 10 cm and a bulk density (BD) of 1.2 kg/L. Soil temp. & moisture corrections assume linear relationships (majority lit.).

Ready Reckoner - AMMONIUM ➡ NITRATE Transformation

Ammonium ➡ Nitrate at different soil temperatures and moisture contents (%/month) [6]

Soil Temperature (°C)	Soil Moisture (% Water Holding Capacity, WHC)									
	< 10	10	20	30	35	40	45	50	55	> 55
< 10	< 12.0	< 12.0	< 0.0	< 0.0	< 0.0	< 0.0	< 0.0	< 0.0	< 0.0	< 0.0
10	< 12.0	< 12.0	16.0	24.0	28.0	32.0	36.0	40.0	44.0	< 44.0
15	< 12.0	12.0	24.0	36.0	42.0	48.0	54.0	60.0	66.0	< 66.0
20	< 16.0	16.0	32.0	48.0	56.0	64.0	72.0	80.0	88.0	< 88.0
25	< 20.0	20.0	40.0	60.0	70.0	80.0	90.0	100.0	110.0	< 110.0
30	< 24.0	24.0	48.0	72.0	84.0	96.0	108.0	120.0	132.0	< 132.0
> 30	< 24.0	< 24.0	< 48.0	< 72.0	< 84.0	< 96.0	< 108.0	< 120.0	< 132.0	< 132.0

[6] Assumes a sampling depth of 10 cm and a bulk density (BD) of 1.2 kg/L. Soil temp. & moisture corrections from Kowalenko & Cameron (1976)

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Name: **Belinda Rawnsley** Sample: **AgXtram Grower** Analysis no.: **2175-2-NWSE** Date: **1/04/19**

Comments

N Fixation

N fixation was very low and should be improved as a priority. Low N fixation can commonly be caused by: 1) Excessive soluble fertiliser N (e.g., urea, ammonium N, nitrate N) - N fixing bacteria can sense the soil soluble N level and decrease the amount of N they fix as soluble N increases (level & rate depend on your soil); 2) Chemical residues - can inhibit N fixation by N fixing bacteria; 3) Low or absent N fixing bacteria - over time excessive N fertiliser and chemical residues can reduce populations of N fixing bacteria in the soil. Adjust these practices and consider inoculation with FLNFB.

N Mineralisation

N Mineralisation was fair, but could be further improved. Low N mineralisation can often be improved by: 1) Optimising the soil C:N ratio - as a general guide, N mineralisation can occur when the soil C:N ratio is less than 22:1; 2) Increasing soil organic N (N in organic matter, fixed N and N in soil microbial biomass); 3) Increasing soil microbial biomass or activity; 4) Ensuring biomasses of the specific microbe groups responsible for different parts of the mineralisation process are adequate. Test microbial activity and biomass, and adjust likely causes.

Ammonium ➡ Nitrate

One or more of the specific nitrifying microbe groups may be elevated due to low soluble N. Adjust practices.

Ammonium N	Low
Nitrate N	Low
Total N	Sufficient
C:N ratio	Low
Total C	Sufficient

Advice & Recommendations (if advice option selected)

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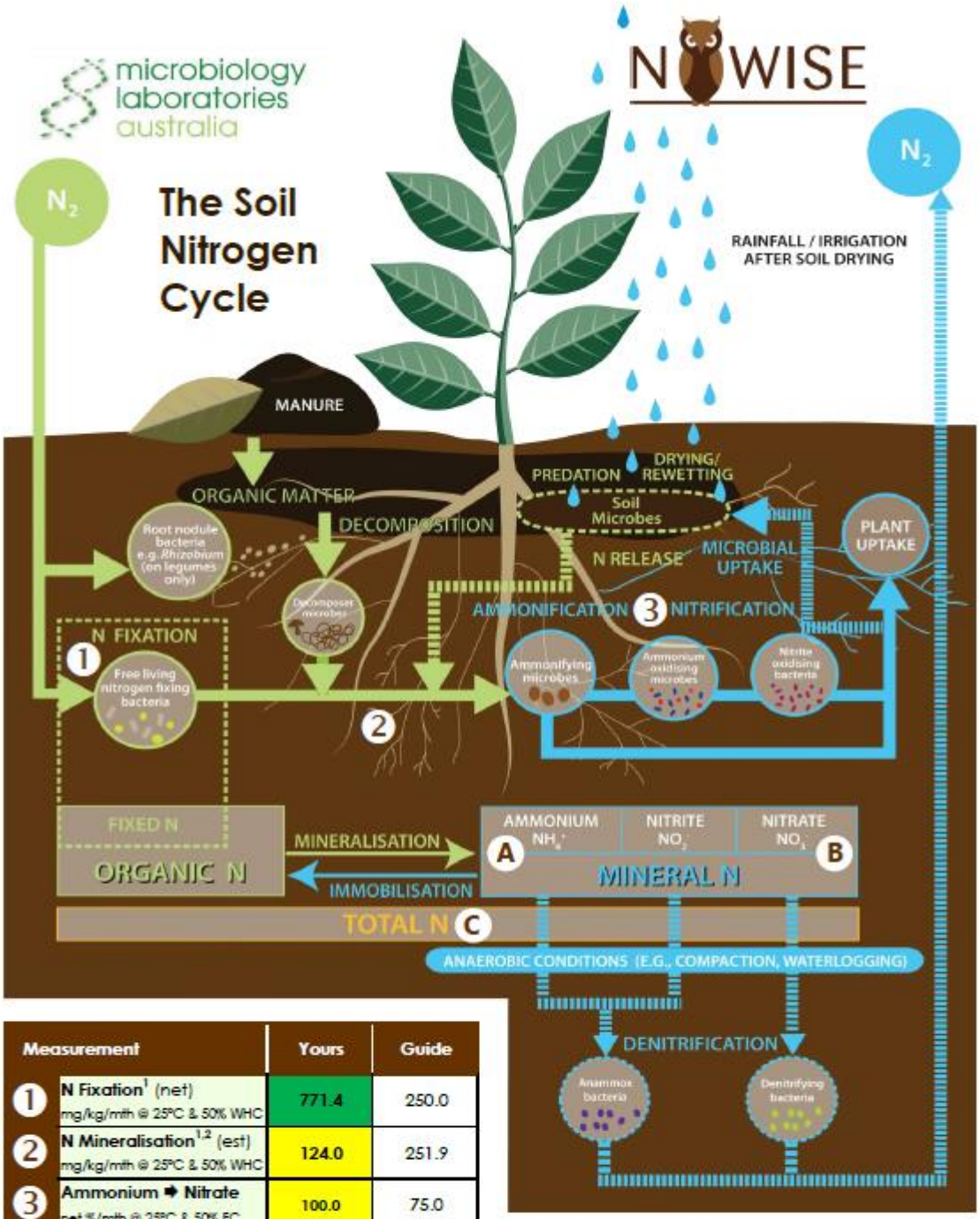
Table 26. N-Wise Nitrogen – PastureMasta



Measurement		Yours	Guide
1	N Fixation[1] (net) mg/kg/mth @ 25°C & 50% WHC	771.4	250.0
2	N Mineralisation[1,2] (est) mg/kg/mth @ 25°C & 50% WHC	124.0	251.9
3	Ammonium ➡ Nitrate net %/mth @ 25°C & 50% FC	100.0	75.0
A	Ammonium N mg/kg	6.8	20.0
B	Nitrate N mg/kg	18.9	30.0
C	Total N mg/kg	2,310	1,867

[1] At standard temp. & moisture. Use ready reckoners to est. for your cond's.
[2] Result & Guide calculated from Schomberg et al (2009).

Customer	Belinda Rawnsley
Company	AgXtra
Sample name	AgXtra PastureMasta
Crop	Lucerne (alfalfa), for seed
Date sampled	1/04/19 Date received 2/04/19
Agent	Microbiology Laboratories Australia
Advisor	Lab no. 2175-1-NWSE

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Table 27. Soil Nitrogen indicators - PastureMasta

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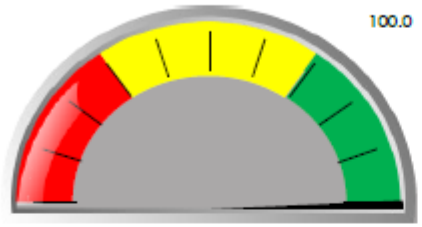
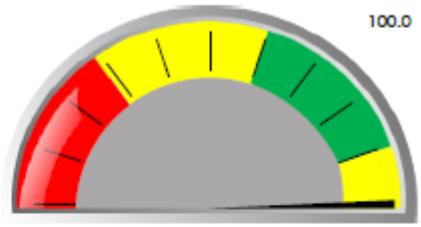
Name: **Belinda Rawnsley** Sample: **AgXtra PastureMasta** Analysis no.: **2175-1-NWSE** Date: **1/04/19**

Soil Nitrogen (N) Indicators

N Fixation



$NH_4 \rightarrow NO_3$ Conversion Rate



Other useful data

Measurement	Yours	Guide
C:N ratio	9.7	12:1 (< 22:1)
Total C %	2.240	5.000
Total N %	0.231	0.187
Organic N (estimated) %	0.228	0.182
% Total N Mineralised [2] % of Total N mineralised/month	5.4	13.5

Measurement	Yours	Guide
N Fixation [1] (net) kg/ha/month @ 25°C & 50% FC [3]	925.7	300.0
N Mineralisation [1,2] (net) kg/ha/month @ 25°C & 50% FC [3]	148.8	302.3
Denitrification (net, estimated) kg/ha/month @ 25°C & 50% FC [3]	0.0	0.0
Ammonium N kg/ha [3]	8.2	24.0
Nitrate N kg/ha [3]	22.7	36.0

[1] At standard temp. & moisture. Use ready reckoners to estimate for your conditions. [2] Min Result & Guide calculated from Schomberg et al (2009)

[3] Assumes a sampling depth of 10 cm and a bulk density (BD) of 1.2 kg/L. For other depths and densities use mg/kg × (depth (cm) ÷ 10) × BD (kg/L).

How To Read the Results

Poor Fair Good

The Soil Nitrogen Cycle
The diagram on page 1 shows the main parts of the soil nitrogen (N) cycle and how specific microbiology drives each part of the cycle. Each part can be optimised to maximise natural N availability and optimise N fertiliser use.
❶ **N Fixation:** This is N fixed from air in the soil by Free Living Nitrogen Fixing Bacteria (FLNFB). This can occur in the root zone of all plants, not just legumes. It can make a substantial contribution to building soil N in all crops. ❷ **N Mineralisation:** This is N released from soil organic matter (including the microbial biomass) and converted into mineral N, which can be readily used by plants. It is a critical process in the soil N cycle because it determines how much organic N (including fixed N and urea) is converted to plant-available N. ❸ **Ammonium ➔ Nitrate:** This is the percentage of ammonium (NH_4^+) N that was converted to nitrate (NO_3^-) N. Ammonium N is more resistant to loss through leaching and denitrification than nitrate N, but nitrate N is often more readily absorbed by plants. Ideally, there should be a moderate amount of conversion to optimise the benefits of both of these forms of N. **A Ammonium N:** This is plant-available N converted from organic N to NH_4^+. **B Nitrate N:** This is plant-available N converted from NH_4^+ to NO_3^-. **C Total N:** This is the total amount of all N in the soil (organic + mineral).
Soil Nitrogen Indicators The two indicators on page 2 provide a quick display of N fixation and Ammonium ➔ Nitrate.
Other Useful Data
C:N Ratio: is the ratio of Total Carbon (C) to Total N in the soil. It has a large influence on how much N is mineralised (made plant-available) and immobilised (tied up in soil organic matter and the soil microbial biomass). As a guide, net mineralisation of organic N occurs when C:N < 22.; net immobilisation when C:N > 22:1. **Total C:** This is the total amount of all carbon (C) (Total Organic Carbon, TOC), expressed as a percentage. **Total N (%):** Total N expressed as a percentage. **Organic N (%)** (estimated): This is calculated by subtracting Ammonium N and Nitrate N from Total N. It is an estimate because Nitrite (NO_2^-) and other forms of mineral N that may be present are not easily measured. **Organic N Mineralised (%):** This is the percentage of Organic N that was mineralised . **N Fixation, N Mineralisation, Ammonium N &Nitrate N** are shown here in kg/ha ('units'). (They are shown in mg/kg on page 1.) **Denitrification:** N loss to the air can occur when the soil sample has anaerobic properties due to past waterlogging or compaction and a resultant population of anaerobic microbes.

Table 28. Nitrogen mineralisation at different soil temperature and moisture contents - PastureMasta

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Name: **Belinda Rawnsley** Sample: **AgXtra PastureMasta** Analysis no.: **2175-1-NWSE** Date: **1/04/19**

Calculation Table to Help Optimise N Fertilisation

Variable	Code	Calculation	Result	Instructions
No. of months of crop growth	MCG			1) Write the number of months of crop growth next to cell 'MCG'. 2) Write the average soil temperature during the crop growth period next to cell 'AST'. 3) Write the average soil moisture content during the crop growth period, expressed as the % of water holding capacity (WHC) (similar to field capacity) next to cell 'ASM'. 4) Look up the rate of N Mineralisation for your soil temp. and moisture using the Ready Reckoner - N Mineralisation and write it in the cell next to 'NMR'. 5) Calculate the total N mineralised in the crop growth period by multiplying MCG × NMR and write it in the cell next to 'TNM'. 6) Write the crop nitrogen requirement next to cell 'CNR'. 7) Calculate the additional N needed (e.g., as fertiliser) by subtracting 'TNM' - 'CNR' and write it next to 'Additional N needed'.
Average soil temperature	AST			
Average soil moisture (% Water Holding Capacity, WHC)	ASM			
N mineralisation under YOUR conditions **Use Ready Reckoner** (kg/ha/month)	NMR			
Total N mineralised in growth period (kg/ha)	TNM	MCG × NMR		
Crop N requirement (kg/ha)	CNR			
***Additional N needed** (eg, fertiliser) (kg/ha) How much you need above what's mineralised		CNR – TNM		

*Estimate only. Please consult a professional advisor and take N requirements of specific crop growth stages into account.

Ready Reckoner - N MINERALISATION

N MINERALISATION at different soil temperatures and moisture contents (kg/ha/month) [4]

Soil Temperature (°C) ('AST' in calculation table)	Soil Moisture (% Water Holding Capacity, WHC) ('ASM' in calculation table)									
	< 10	10	20	30	35	40	45	50	55	> 55
< 10	< 4.2	< 4.2	< 18.4	< 25.1	< 28.5	< 31.8	< 35.2	< 38.6	< 41.9	< 41.9
10	< 4.2	< 4.2	18.4	25.1	28.5	31.8	35.2	38.6	41.9	< 41.9
15	< 4.2	4.2	18.0	31.8	38.7	45.6	52.4	59.3	66.2	< 66.2
20	< 10.0	10.0	30.9	51.7	62.1	72.6	83.0	93.4	103.8	< 103.8
25	< 29.1	29.1	57.0	84.9	98.9	112.8	126.8	148.8	154.7	< 154.7
28	< 46.9	46.9	79.0	111.2	127.3	143.3	159.4	175.5	191.6	< 191.6
30	< 61.4	61.4	96.4	131.4	148.9	166.3	183.8	201.3	218.8	< 218.8
35	< 107.0	107.0	149.1	191.1	212.1	233.2	254.2	275.2	296.2	< 296.2
> 35	< 107.0	< 107.0	< 149.1	< 191.1	< 212.1	< 233.2	< 254.2	< 275.2	< 296.2	< 296.2

[4] Assumes a sampling depth of 10 cm and a bulk density (BD) of 1.2 kg/L. Soil temp. & moisture corrections from Gilmour & Mauromoustakos (2011).

Table 29. Nitrogen fixation and transformation at different soil temperature and moisture contents - PastureMasta

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NWISE

Name: **Belinda Rawnsley** Sample: **AgXtra PastureMasta** Analysis no.: **2175-1-NWSE** Date: **1/04/19**

Ready Reckoner - N FIXATION

N FIXATION at different soil temperatures and moisture contents (kg/ha/month) [5]

Soil Temperature (°C)	Soil Moisture (% Water Holding Capacity, WHC)									
	< 10	10	20	30	35	40	45	50	55	> 55
< 10	< 111.1	< 111.1	< 114.6	< 156.3	< 177.2	< 198.1	< 219.0	< 239.8	< 260.7	< 260.7
10	< 111.1	< 111.1	148.1	222.2	259.2	296.2	333.3	370.3	407.3	< 407.3
15	< 111.1	111.1	222.2	333.3	388.8	444.3	499.9	555.4	611.0	< 611.0
20	< 148.1	148.1	296.2	444.3	518.4	592.5	666.5	740.6	814.6	< 814.6
25	< 185.1	185.1	370.3	555.4	648.0	740.6	833.1	925.7	1018.3	< 1018.3
30	< 222.2	222.2	444.3	666.5	777.6	888.7	999.8	1110.9	1221.9	< 1221.9
35	< 259.2	259.2	518.4	777.6	907.2	1036.8	1166.4	1296.0	1425.6	< 1425.6
> 35	< 259.2	< 259.2	< 518.4	< 777.6	< 907.2	< 1036.8	< 1166.4	< 1296.0	< 1425.6	< 1425.6

[5] Assumes a sampling depth of 10 cm and a bulk density (BD) of 1.2 kg/L. Soil temp. & moisture corrections assume linear relationships (majority lit.).

Ready Reckoner - AMMONIUM ➡ NITRATE Transformation

Ammonium ➡ Nitrate at different soil temperatures and moisture contents (%/month) [6]

Soil Temperature (°C)	Soil Moisture (% Water Holding Capacity, WHC)									
	< 10	10	20	30	35	40	45	50	55	> 55
< 10	< 12.0	< 12.0	< 114.6	< 156.3	< 177.2	< 198.1	< 219.0	< 239.8	< 260.7	< 260.7
10	< 12.0	< 12.0	16.0	24.0	28.0	32.0	36.0	40.0	44.0	< 44.0
15	< 12.0	12.0	24.0	36.0	42.0	48.0	54.0	60.0	66.0	< 66.0
20	< 16.0	16.0	32.0	48.0	56.0	64.0	72.0	80.0	88.0	< 88.0
25	< 20.0	20.0	40.0	60.0	70.0	80.0	90.0	100.0	110.0	< 110.0
30	< 24.0	24.0	48.0	72.0	84.0	96.0	108.0	120.0	132.0	< 132.0
> 30	< 24.0	< 24.0	< 48.0	< 72.0	< 84.0	< 96.0	< 108.0	< 120.0	< 132.0	< 132.0

[6] Assumes a sampling depth of 10 cm and a bulk density (BD) of 1.2 kg/L. Soil temp. & moisture corrections from Kowalenko & Cameron (1976)

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NWISE

Name: **Belinda Rawnsley** Sample: **AgXtra PastureMasta** Analysis no.: **2175-1-NWSE** Date: **1/04/19**

Comments

N Fixation

N fixation was good. These results indicate that soil soluble N applications (e.g., urea, ammonium N, nitrate N) are optimal for N fixation and populations of N fixing bacteria (FLNFB) in your soil are very good.

N Mineralisation

N Mineralisation was fair, but could be improved. Low N mineralisation can often be improved by: 1) Optimising the soil C:N ratio - as a general guide, N mineralisation can occur when the soil C:N ratio is less than 22:1; 2) Increasing soil organic N (N in organic matter, fixed N and N in soil microbial biomass); 3) Increasing soil microbial biomass or activity; 4) Ensuring biomasses of the specific microbe groups responsible for different parts of the mineralisation process are adequate. Test microbial activity and biomass, and adjust likely causes.

Ammonium ➡ Nitrate

One or more of the specific nitrifying microbe groups may be elevated due to low soluble N. Adjust practices.

Ammonium N	Low
Nitrate N	Low
Total N	Sufficient
C:N ratio	Low
Total C	Sufficient

Advice & Recommendations (if advice option selected)

Disclaimer **Authorised by** #REF!

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Photographs

Photograph 1. Application of PastureMasta and stage of crop growth at application, 18/10/2017

Photograph 2. Lucerne crop following application by (a) grower program and (b) PastureMasta, 21/11/2017

Photograph 3. Uniform crop growth of Lucerne, cv. Q31, 17/12/2018

Photograph 4. Fresh weight collection area of lucerne 3 days prior to hay cut to sample for dry matter production, 20/2/2018

Photograph 5. Lucerne at hay cut (a) grower program, (b) PastureMasta 27/11/2017

Photograph 6. Lucerne hay bales from (a) grower program and (b) PastureMasta, 5/3/2018

DISCUSSION

A field trial was conducted in a commercial lucerne paddock at Virginia, South Australia across two growing seasons across 2017-2019 to evaluate the effect of PastureMasta when used in conjunction with a growers' fertiliser program on the quality and yield of lucerne cv. QB31. The effect of PastureMasta was compared to the growers' standard program of Hi-Fert Lucerne mix applied once per season at 10 kg/ha.

The paddock was previously used for vegetable production and therefore had high quality friable soil with good nutritional status (see Appendix ii). The site was irrigated with a travelling irrigator as deemed necessary to maintain good crop growth and adequate soil moisture.

PastureMasta was applied on four occasions as soon as possible after hay cut using a Landcruiser mounted, motorised spray unit incorporating Agrotop AM 110-025 flat fan nozzles in a water volume of 100 L/ha (Photograph 1).

Weather conditions were considered dry and hot across both seasons with below average rainfall and above average maximum temperatures in summer (see Appendix v).

Crop biomass

After the initial application of PastureMasta in 2017, there was a significant increase in crop biomass as measured by normalised difference vegetative index (NDVI) compared to the growers' Hi-Fert program (Table 1, Photograph 2). At 21 days after application B (21DAAB), there were also significant differences in crop biomass and the lucerne crop appeared more dense and greener in the paddock area treated with PastureMasta compared to other areas. There was a numerical increase in crop biomass after three applications of PastureMasta at 15DAAC with the crop growth at this time restricted by hot, dry weather conditions and unforeseen restriction in irrigation by the grower (g*rower communication).* By 20DAAD, PastureMasta significantly increased the crop biomass of lucerne compared to the growers' fertiliser program (Figure 1).

In the following season, there was no significant difference in crop biomass between treatments (Table 2) and no notable differences in crop growth (Photograph 3).

Fresh pasture production

At each collection of fresh cutting in 2017/2018 (Photograph 4), the PastureMasta treated area yielded higher than the area treated with the growers' program only. There was a significant improvement in growth (21%) following the first application of PastureMasta compared to the grower program (Table 3). There was an increase of 8-21% in the PastureMasta treated section at each collection timing.

In comparison, the first cut of the second season showed equivalent fresh weight for both treatment areas, with no significant difference in fresh weight (Table 4). For subsequent cuts, PastureMasta resulted in a numerical increase in fresh yield (5-11%) but the differences were not as great as those recorded in the first season.

Dry matter production

Dry matter production (kg/ha) increased following the application of PastureMasta at all assessment timings in 2017/2018 when used in addition to the growers' program of Hi-Fert lucerne mix (Photograph 5). There was a statistically significant increase in dry matter production following the fourth application of PastureMasta (Table 5, Figure 2). After four applications of PastureMasta in the season, there was a significant increase (11.9%) in the total production of lucerne with 17.6 t/ha after four cuts compared to 15.5 t/ha without PastureMasta.

Similarly, there was a numerical increase in dry matter production in the PastureMasta treated area in the second season, with the exception of the cut following the fourth application (Table 6). The fourth application (D) was applied later than anticipated due to prolonged hot weather and subsequent irrigation events that restricted access to the paddock. High temperatures also occurred immediately after Application D (see Appendix v). By 29DAAE, there was a 22.7% increase in dry matter production in the PastureMasta treated area of the paddock (Figure 3). The application of PastureMasta in 2018/2019 resulted in an overall increase in dry matter production (19.3 t/ha) compared to the growers' program (17.8 t/ha).

In terms of dry matter production per day, applications of PastureMasta in the season resulted in ongoing improvement in daily growth of the crop compared to the growers' program (not significant).

At 28DAAD, PastureMasta caused a significant increase in growth between the treatment areas (Table 7).

In the second season, PastureMasta caused a numerical increase in dry matter production except at 26DAAD (Table 8). At 29DAAE there was a significant improvement in daily crop growth following the last application of PastureMasta.

Yield – bales

PastureMasta significantly increased the number of bales of lucerne hay produced per hectare compared to the growers' program at each hay cut timing (Table 9, Photograph 6). The number of bales per hectare varied between each hay cut, predominantly due to the influences of weather conditions and irrigation. The yield difference is reported as the difference in bale number per hectare between the PastureMasta treatment and the growers' program. The actual difference takes into consideration the pre-existing difference in paddock areas at the commencement of the trial (6.5%). After the first application of PastureMasta, there were 15% more bales produced. Application of PastureMasta resulted in a significant increase in the number of bales at each hay cut timing. The largest increase was recorded at 30DAAB, where 54.2% more bales were produced in the PastureMasta treated area compared to the growers' area (Figure 2). Overall, PastureMasta increased overall yield by 20% in the 2017/2018 growing season.

Bale weight was also significantly improved by the application of PastureMasta, with a 12% increase in weight compared to other bales in 2017/2018. In the first season, nearly all bales produced in the PastureMasta area were heavier than in the growers' program area (see raw data, Appendix iii).

In 2018/2019, the first three applications of PastureMasta resulted in an increase in the number of bales produced compared to the growers' area (Table 10). At 19DADD, bale number was equivalent yet by 37DAAE, there were a greater number of bales in the growers' area. A number of factors attributed to the decline observed compared to the ongoing trend. The travelling irrigator failed during very hot and dry weather conditions and fixed sprinkler lines were constructed. As the growers was trying to mitigate the effects of the hot weather, the growers' section received more water than the PastureMasta area of the paddock (*grower communication*).

Although the growing season was characterised by dry, hot conditions, bale weight was numerically greater (4% increase) following application of PastureMasta compared to the growers' program (data not significant).

Feed analysis

At 21DAAB and 20DAAD, feed tests were conducted by AgriFood Technology for analysis of Lucerne hay quality. There were no significant differences in feed quality at 21DAAB, with all feed attributes equivalent for the PastureMasta and grower's program treatments.

Dry matter was equivalent for both treatment areas, indicating a good direct comparison of feed quality between samples. Nitrogen content was measured and used to calculate the crude protein level which showed feed from both treatments contained similar protein levels earlier in the season. However by 20DAAD, the growers' program had significantly higher crude protein than that treated with PastureMasta. Digestibility of the feed was considered high at both times (industry standard >72% is deemed highly digestible, see Appendix ii). However, there was a significant difference at 20DAAD, with less digestibility in feed derived from the PastureMasta treated area. Similarly, both treatments attributed to feed of high metabolisable energy (industry standard for high quality is 11.3%), yet the PastureMasta again was significantly lower than the grower's program. Acid Detergent Fibre (ADF) is the poorly-digested and indigestible parts of the fibre (i.e. the cellulose and lignin). High quality feed has an ADF value of <25 % dry matter. The results indicate both treatments yielded high quality feed in terms of low ADF, with PastureMAsta samples having numerically greater ADF (not significant). The neutral detergent fibre (NDF) values reflect the amount of forage the animal can consume, whereby an NDF increase indicates animals will generally eat less due to the rising fibre content. PastureMasta feed recorded significantly higher NDF than the growers' program, but in terms of industry standards, was regarded as high-quality feed.

In 2018/2019, feed quality was affected by dry hot conditions with deterioration in nutritional condition compared to feed quality in the 2017/2018 growing season. Across all parameters, feed quality values were lower in the second season. Prolonged high temperatures in the growing season can cause protein damage and decreased digestibility (Borreani, G. *et al.*, 2018). Digestibility was significantly lower in the PastureMasta treated feed (61.0%) compared to the growers' program (64.4%) which

was much lower than the previous season (Table 12). Similarly, metabolic energy of feed was significantly less following PastureMasta applications than the growers' program. In terms of ADF and NDF, both parameters were equivalent for the two treated areas but indicated a decline in feed quality compared to the previous production season.

Soil health

Ten replicated soil samples were collected from each treatment area to provide a good comparison of soil health. Both treatments showed similar carbon parameters corelated to microbial activity (Tables 14-17). Both soils were considered healthy in terms of C:N. The growers' program showed slightly higher labile C and total organic carbon than the PastureMasta soils. The results indicate the soil across the paddock provides adequate food source to sustain microbial soil populations. Soil basal respiration and soil microbial biomass were equivalent between the treatments.

Plant-available Phosphorus (P) was considered fair in both treatments areas (Tables 18-22), however net release of P in the PastureMasta soils was deemed poor (Table 20). Typically there is a large amount of P in most soils yet it is relatively immobile in the soil. Although the results indicate P was held by the soil in PastureMasta treated soils, unavailable P can be released slowly.

In terms of the soil nitrogen cycle, there were very strong differences between the treatments, with no nitrogen fixation detected in the growers' program area (Tables 22-29). N fixation is required to convert N into a plant available form. The lack of nitrogen fixation may have been attributed to excess watering of the grower area which can impede N-fixing bacterial populations. In comparison, PastureMasta soils had excellent N-fixation ability indicating a good population of nodule-forming bacteria to provide N to the plant. N mineralisation is related to the process by which microbes convert organic N to ammonium. Although N mineralisation was slightly lower in the PastureMasta soils compared to the growers' program, PastaMasta soils had higher levels of nitrate which is the most plan available form of N. If Lucerne is grown under ideal conditions with enough compatible bacteria in the soil, adequate N is supplied to the plant.

Soil analysis

High-yielding lucerne removes nutrients from the soil, but this was not evident in soil analysis of the trial area (see Appendix ii). There were considerable increases in exchangeable Mg, K and Na in the growing season for both treatments. There were little differences in soil nutritional status between the treatments.

CONCLUSION

- Applications of PastureMasta significantly increased crop biomass as measured by normalised difference vegetative index (NDVI) following initial application of the product compared to the growers' Hi-Fert program. In the following season, crop biomass was equivalent between the treatment areas.
- PastureMasta consistently improved hay crop yield over two seasons and significantly increased dry matter production following four applications of PastureMasta (17.6 t/ha and 19.3 t/ha, respectively) compared to the growers' program (15.5 t/ha and 17.8 t/ha, respectively). In terms of dry matter production per day, applications of PastureMasta resulted in greater daily growth of the crop than the growers' program with numerical differences between the treated areas after four applications.
- PastureMasta significantly increased the number of bales of lucerne hay produced compared to the growers' program at each hay cut timing in the first season and early during the second season. Over 52% more bales were produced after the second application of PastureMasta compared to the growers' area under ideal weather conditions. Overall, four applications of PastureMasta increased overall yield as bale numbers by an average 20% in the 2017/2018 lucerne growing season and 6% in the following season.
- Bales were significantly heavier across two seasons following the use of PastureMasta, with a 12% (2017/2018) and 4% (2018/2019) increase in weight compared to other bales from the growers' program paddock area.
- The quality of feed was highly dependent on seasonal weather conditions and irrigation. In the first season, feed quality was deemed high across all quality parameters. However, there were some significant differences between the treatments with PastureMasta reducing metabolic energy and digestibility compared to Lucerne hay from the growers' program.
- In terms of soil health, N-fixation was not detected in soil from the growers' program whereas PastureMasta soils had excellent N-fixation ability indicating a good population of nodule-forming bacteria to provide N to the plant. Soils under both treatments were equivalent with good levels of labile C and C:N.

Reference:

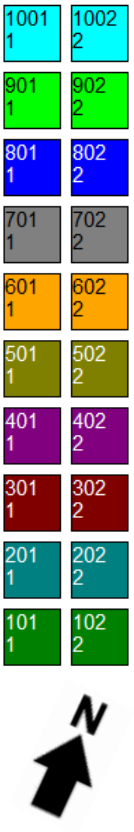
Borreani, G. Schmidt R.J., Holmes B.J., Muck R.E. (2018). *Silage review:* Factors affecting dry matter and quality losses in silages. *Journal of Dairy Science*, Vol. 101 (5): 3952-3979.

APPENDICES

Appendix i. Trial details

Trial plan

3-digits = plot number
1-digit = treatment number
Colours represent replicate



Trial location map

Appendix ii. Analytical reports

Soil Analysis

Soil analysis report no.		4JS17025	RBS18007	RBS18008
Date		11 Oct 2017	16 Mar 2018	16 Mar 2018
Name		Lucerne	Grower	Seasol
Code		Pre-Spray,	Lucerne	Lucerne
Customer		Seasol International	AgXtra	AgXtra
Depth		0-10	0-10	0-10
Colour		Brown	Dark brown	Dark brown
Gravel	%	0	5	5
Texture		3.0	2.0	2.0
Ammonium Nitrogen	mg/Kg	8	2	2
Nitrate Nitrogen	mg/Kg	9	16	13
Phosphorus Colwell	mg/Kg	51	82	50
Potassium Colwell	mg/Kg	322	395	354
Sulphur	mg/Kg	3.6	38.7	30.6
Organic Carbon	%	0.82	0.86	0.75
Conductivity	dS/m	0.082	0.264	0.189
pH Level (CaCl2)	pH	6.4	6.6	6.7
pH Level (H2O)	pH	6.9	7.3	7.7
DTPA Copper	mg/Kg	2.19	4.01	2.50
DTPA Iron	mg/Kg	12.76	13.39	13.28
DTPA Manganese	mg/Kg	4.34	8.73	6.78
DTPA Zinc	mg/Kg	2.84	5.70	3.67
Exchangeable Aluminium	meq/100g	0.15	0.084	0.103
Exchangeable Calcium	meq/100g	5.86	4.94	4.74
Exchangeable Magnesium	meq/100g	1.85	2.33	2.07
Exchangeable Potassium	meq/100g	0.60	0.89	0.74
Exchangeable Sodium	meq/100g	0.38	1.28	1.08
Boron Hot CaCl2	mg/Kg	1.86	2.18	1.85

Soil analysis report no.		4IS18122	4IS18123
Date		07 Nov 2018	07 Nov 2018
Name		Seasol	Grower
Code		Lucerne	Lucerne
Customer		AgXtra	AgXtra
Depth		0-10	0-10
Colour		Brown/Red	Brown/Red
Gravel	%	0	0
Texture		3.0	3.0
Ammonium Nitrogen	mg/Kg	< 1	< 1
Nitrate Nitrogen	mg/Kg	40	30
Phosphorus Colwell	mg/Kg	55	77
Potassium Colwell	mg/Kg	300	354
Sulphur	mg/Kg	121.3	122.3
Organic Carbon	%	0.82	1.04
Conductivity	dS/m	0.314	0.294
pH Level (CaCl2)	pH	6.7	7.3
pH Level (H2O)	pH	7.2	7.9
DTPA Copper	mg/Kg	1.97	3.05
DTPA Iron	mg/Kg	10.31	11.66
DTPA Manganese	mg/Kg	4.86	4.22
DTPA Zinc	mg/Kg	3.43	4.60
Exchangeable Aluminium	meq/100g	0.063	0.087
Exchangeable Calcium	meq/100g	5.93	8.28
Exchangeable Magnesium	meq/100g	1.73	2.03
Exchangeable Potassium	meq/100g	0.53	0.67
Exchangeable Sodium	meq/100g	0.84	0.75
Boron Hot CaCl2	mg/Kg	1.98	2.51

Soil analysis report no.		SIS19134	SIS19133
Date		22 Mar 2019	22 Mar 2019
Name		Seasol	Grower
Code		Lucerne	Lucerne
Customer		AgXtra	AgXtra
Depth		0-10	0-10
Colour		Brown	Dark brown
Gravel	%	0	0
Texture		3	3
Ammonium Nitrogen	mg/Kg	3	2
Nitrate Nitrogen	mg/Kg	13	9
Phosphorus Colwell	mg/Kg	65	86
Potassium Colwell	mg/Kg	346	375
Sulphur	mg/Kg	22.6	23.1
Organic Carbon	%	1.15	0.93
Conductivity	dS/m	0.165	0.167
pH Level (CaCl2)	pH	6.6	6.9
pH Level (H2O)	pH	7.4	7.7
DTPA Copper	mg/Kg	1.96	4.25
DTPA Iron	mg/Kg	15.35	22.9
DTPA Manganese	mg/Kg	8.65	10.09
DTPA Zinc	mg/Kg	3.81	5.41
Exchangeable Aluminium	meq/100g	0.139	0.147
Exchangeable Calcium	meq/100g	5.05	8.08
Exchangeable Magnesium	meq/100g	1.74	2.27
Exchangeable Potassium	meq/100g	0.64	0.81
Exchangeable Sodium	meq/100g	0.69	0.86
Boron Hot CaCl2	mg/Kg	2.07	2.39

Feed Analysis

Range of ME, digestibility and fibre contents seen in Australian silages

Quality measure	Low quality	High quality
ME (MJ/kg DM)	6.7	11.3
Digestibility (%)	42	72
NDF (%)	72	32
ADF (%)	47	25

Source: https://futurebeef.com.au/knowledge-centre/hay-and-silage-analyses-what-do-they-mean/

January 2018 – Grower sample

Agrifood TECHNOLOGY

FEEDTEST
Under license from AVS

FEED ANALYSIS REPORT

AgXtra
6 Pattinson Rd
Newton SA 5074

ATTENTION Belinda Rawnsley
FAX NUMBER
PURCHASE ORDER SEASOL INTERNATIONAL
PROJECT NUMBER J1801-0195

DATE RECEIVED 04 January 2018
OUR SAMPLE NUMBER S2018-00620
YOUR REFERENCE GROWER REP 1
SAMPLE TYPE Pasture Fresh
DESCRIPTION
DATE SAMPLE COLLECTED 21 December 2017

TEST	Result
NIR Package (FT/003)	
Dry Matter (%)	91.5
Moisture (%)	8.5
Crude Protein (% of dry matter)	27.4
Acid Detergent Fibre (% of dry matter)	30.1
Neutral Detergent Fibre (% of dry matter)	30.5
Digestibility (DMD) (% of dry matter)	72.0
Digestibility (DOMD) (Calculated) (% of dry matter)	67.8
Est. Metabolisable Energy (Calculated) (MJ/kg DM)	10.8
Water Soluble Carbohydrates (% of dry matter)	2.3
Fat (% of dry matter)	4.2
Ash (% of dry matter)	11.2
Horse DE (TP/FT/008)	
Horse DE (MJ/kg DM)	11.8

Final Report

Report Number: 215548

Comments:

Metabolisable Energy has been calculated using the following equation:
ME = (0.203 x DOMD%) - 3.001

Joanne Warnes

Team Leader Quality, Milling & Feedtest Laboratory

09 January 2018

Report Number: **215548**
Issued: 09 Jan 2018

Australian Wool Testing Authority Ltd - Trading as Agrifood Technology Pty Ltd ABN 43 006 014 106
FEEDTEST, PO Box 728, Werribee Victoria 3030
0203/9/09 Telephone 1300 655 474 Facsimile 03 9742 3344 Email feed.test@agrifood.com.au

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Under license from AVS

FEED ANALYSIS REPORT

AgXtra
6 Pattinson Rd
Newton SA 5074

ATTENTION Belinda Rawnsley
FAX NUMBER

PURCHASE ORDER SEASOL INTERNATIONAL
PROJECT NUMBER J1801-0195

DATE RECEIVED 04 January 2018
OUR SAMPLE NUMBER S2018-00621
YOUR REFERENCE GROWER REP 2
SAMPLE TYPE Pasture Fresh
DESCRIPTION
DATE SAMPLE COLLECTED 21 December 2017

TEST	Result
NIR Package (FT/003)	
Dry Matter (%)	91.6
Moisture (%)	8.4
Crude Protein (% of dry matter)	27.3
Acid Detergent Fibre (% of dry matter)	28.3
Neutral Detergent Fibre (% of dry matter)	31.6
Digestibility (DMD) (% of dry matter)	73.8
Digestibility (DOMD) (Calculated) (% of dry matter)	69.3
Est. Metabolisable Energy (Calculated) (MJ/kg DM)	11.1
Water Soluble Carbohydrates (% of dry matter)	3.4
Fat (% of dry matter)	4.2
Ash (% of dry matter)	4.6
Horse DE (TP/FT/008)	
Horse DE (MJ/kg DM)	12.1

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- TP_DML Analysis conducted at Agrifood Technology, Victoria: Derrimut Site.
- OS Analysis is outsourced.

Final Report

Report Number: 215548

Comments:

Metabolisable Energy has been calculated using the following equation:
ME = (0.203 x DOMD%) - 3.001

Joanne Warnes

Team Leader Quality, Milling & Feedtest Laboratory

09 January 2018

Report Number: **215548**
Issued: 09 Jan 2018

Australian Wool Testing Authority Ltd - Trading as Agrifood Technology Pty Ltd ABN 43 006 014 106
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AgXtra
6 Pattinson Rd
Newton SA 5074

ATTENTION Belinda Rawnsley
FAX NUMBER
PURCHASE ORDER SEASOL INTERNATIONAL
PROJECT NUMBER J1801-0195

DATE RECEIVED 04 January 2018
OUR SAMPLE NUMBER S2018-00622
YOUR REFERENCE GROWER REP 3
SAMPLE TYPE Pasture Fresh
DESCRIPTION
DATE SAMPLE COLLECTED 21 December 2017

TEST	Result
NIR Package (FT/003)	
Dry Matter (%)	91.9
Moisture (%)	8.1
Crude Protein (% of dry matter)	28.3
Acid Detergent Fibre (% of dry matter)	27.4
Neutral Detergent Fibre (% of dry matter)	29.6
Digestibility (DMD) (% of dry matter)	74.8
Digestibility (DOMD) (Calculated) (% of dry matter)	70.2
Est. Metabolisable Energy (Calculated) (MJ/kg DM)	11.2
Water Soluble Carbohydrates (% of dry matter)	3.0
Fat (% of dry matter)	4.3
Ash (% of dry matter)	4.9
Horse DE (TP/FT/008)	
Horse DE (MJ/kg DM)	12.4

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Final Report

Report Number: 215548

Comments:

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Joanne Warnes

Team Leader Quality, Milling & Feedtest Laboratory

09 January 2018

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Issued: 09 Jan 2018

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ATTENTION Belinda Rawnsley
FAX NUMBER

PURCHASE ORDER SEASOL INTERNATIONAL
PROJECT NUMBER J1801-0195

DATE RECEIVED 04 January 2018
OUR SAMPLE NUMBER S2018-00623
YOUR REFERENCE GROWER REP 4
SAMPLE TYPE Pasture Fresh
DESCRIPTION
DATE SAMPLE COLLECTED 21 December 2017

TEST	Result
NIR Package (FT/003)	
Dry Matter (%)	91.5
Moisture (%)	8.5
Crude Protein (% of dry matter)	29.4
Acid Detergent Fibre (% of dry matter)	25.9
Neutral Detergent Fibre (% of dry matter)	27.8
Digestibility (DMD) (% of dry matter)	78.0
Digestibility (DOMD) (Calculated) (% of dry matter)	72.9
Est. Metabolisable Energy (Calculated) (MJ/kg DM)	11.8
Water Soluble Carbohydrates (% of dry matter)	4.1
Fat (% of dry matter)	4.4
Ash (% of dry matter)	4.1
Horse DE (TP/FT/008)	
Horse DE (MJ/kg DM)	12.9

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- TP_DML Analysis conducted at Agrifood Technology, Victoria: Derrimut Site.
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Final Report

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Comments:

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Joanne Warnes

Team Leader Quality, Milling & Feedtest Laboratory

09 January 2018

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PURCHASE ORDER SEASOL INTERNATIONAL
PROJECT NUMBER J1801-0195

DATE RECEIVED 04 January 2018
OUR SAMPLE NUMBER S2018-00624
YOUR REFERENCE GROWER REP 5
SAMPLE TYPE Pasture Fresh
DESCRIPTION
DATE SAMPLE COLLECTED 21 December 2017

TEST	Result
NIR Package (FT/003)	
Dry Matter (%)	91.8
Moisture (%)	8.2
Crude Protein (% of dry matter)	28.9
Acid Detergent Fibre (% of dry matter)	25.7
Neutral Detergent Fibre (% of dry matter)	28.4
Digestibility (DMD) (% of dry matter)	77.4
Digestibility (DOMD) (Calculated) (% of dry matter)	72.4
Est. Metabolisable Energy (Calculated) (MJ/kg DM)	11.7
Water Soluble Carbohydrates (% of dry matter)	3.5
Fat (% of dry matter)	4.4
Ash (% of dry matter)	4.5
Horse DE (TP/FT/008)	
Horse DE (MJ/kg DM)	12.8

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Final Report

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Comments:

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Team Leader Quality, Milling & Feedtest Laboratory

09 January 2018

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January 2018 – PastureMasta samples

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FAX NUMBER
PURCHASE ORDER SEASOL INTERNATIONAL
PROJECT NUMBER J1801-0195

DATE RECEIVED 04 January 2018
OUR SAMPLE NUMBER S2018-00625
YOUR REFERENCE SEASOL REP 1
SAMPLE TYPE Pasture Fresh
DESCRIPTION
DATE SAMPLE COLLECTED 21 December 2017

TEST	Result
NIR Package (FT/003)	
Dry Matter (%)	91.9
Moisture (%)	8.1
Crude Protein (% of dry matter)	27.0
Acid Detergent Fibre (% of dry matter)	29.8
Neutral Detergent Fibre (% of dry matter)	32.1
Digestibility (DMD) (% of dry matter)	72.4
Digestibility (DOMD) (Calculated) (% of dry matter)	68.1
Est. Metabolisable Energy (Calculated) (MJ/kg DM)	10.8
Water Soluble Carbohydrates (% of dry matter)	2.3
Fat (% of dry matter)	4.2
Ash (% of dry matter)	5.1
Horse DE (TP/FT/008)	
Horse DE (MJ/kg DM)	11.8

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TP_DML Analysis conducted at Agrifood Technology, Victoria: Derrimut Site.
OS Analysis is outsourced.

Final Report

Report Number: 215548

Comments:

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ME = (0.203 x DOMD%) - 3.001

Joanne Warnes

Team Leader Quality, Milling & Feedtest Laboratory

09 January 2018

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Issued: 09 Jan 2018

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PURCHASE ORDER SEASOL INTERNATIONAL
PROJECT NUMBER J1801-0195

DATE RECEIVED 04 January 2018
OUR SAMPLE NUMBER S2018-00626
YOUR REFERENCE SEASOL REP 2
SAMPLE TYPE Pasture Fresh
DESCRIPTION
DATE SAMPLE COLLECTED 21 December 2017

TEST	Result
NIR Package (FT/003)	
Dry Matter (%)	91.5
Moisture (%)	8.5
Crude Protein (% of dry matter)	27.5
Acid Detergent Fibre (% of dry matter)	27.9
Neutral Detergent Fibre (% of dry matter)	30.1
Digestibility (DMD) (% of dry matter)	74.7
Digestibility (DOMD) (Calculated) (% of dry matter)	70.1
Est. Metabolisable Energy (Calculated) (MJ/kg DM)	11.2
Water Soluble Carbohydrates (% of dry matter)	3.4
Fat (% of dry matter)	4.3
Ash (% of dry matter)	4.8
Horse DE (TP/FT/008)	
Horse DE (MJ/kg DM)	12.2

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Final Report

Report Number: 215548

Comments:

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ME = (0.203 x DOMD%) - 3.001

Joanne Warnes

Team Leader Quality, Milling & Feedtest Laboratory

09 January 2018

Report Number: **215548**
Issued: 09 Jan 2018

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ATTENTION Belinda Rawnsley
FAX NUMBER
PURCHASE ORDER SEASOL INTERNATIONAL
PROJECT NUMBER J1801-0195

DATE RECEIVED 04 January 2018
OUR SAMPLE NUMBER S2018-00627
YOUR REFERENCE SEASOL REP 3
SAMPLE TYPE Pasture Fresh
DESCRIPTION
DATE SAMPLE COLLECTED 21 December 2017

TEST	Result
NIR Package (FT/003)	
Dry Matter (%)	91.7
Moisture (%)	8.3
Crude Protein (% of dry matter)	29.2
Acid Detergent Fibre (% of dry matter)	25.6
Neutral Detergent Fibre (% of dry matter)	28.8
Digestibility (DMD) (% of dry matter)	76.5
Digestibility (DOMD) (Calculated) (% of dry matter)	71.6
Est. Metabolisable Energy (Calculated) (MJ/kg DM)	11.5
Water Soluble Carbohydrates (% of dry matter)	3.1
Fat (% of dry matter)	4.4
Ash (% of dry matter)	4.4
Horse DE (TP/FT/008)	
Horse DE (MJ/kg DM)	12.9

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Final Report

Report Number: 215548

Comments:

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Joanne Warnes

Team Leader Quality, Milling & Feedtest Laboratory

09 January 2018

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ATTENTION Belinda Rawnsley
FAX NUMBER
PURCHASE ORDER SEASOL INTERNATIONAL
PROJECT NUMBER J1801-0195

DATE RECEIVED 04 January 2018
OUR SAMPLE NUMBER S2018-00628
YOUR REFERENCE SEASOL REP 4
SAMPLE TYPE Pasture Fresh
DESCRIPTION
DATE SAMPLE COLLECTED 21 December 2017

TEST	Result
NIR Package (FT/003)	
Dry Matter (%)	91.8
Moisture (%)	8.2
Crude Protein (% of dry matter)	28.7
Acid Detergent Fibre (% of dry matter)	26.4
Neutral Detergent Fibre (% of dry matter)	29.1
Digestibility (DMD) (% of dry matter)	76.7
Digestibility (DOMD) (Calculated) (% of dry matter)	71.8
Est. Metabolisable Energy (Calculated) (MJ/kg DM)	11.6
Water Soluble Carbohydrates (% of dry matter)	2.9
Fat (% of dry matter)	4.4
Ash (% of dry matter)	4.4
Horse DE (TP/FT/008)	
Horse DE (MJ/kg DM)	12.7

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Final Report

Report Number: 215548

Comments:

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Joanne Warnes

Team Leader Quality, Milling & Feedtest Laboratory

09 January 2018

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Issued: 09 Jan 2018

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ATTENTION Belinda Rawnsley
FAX NUMBER

PURCHASE ORDER SEASOL INTERNATIONAL
PROJECT NUMBER J1801-0195

DATE RECEIVED 04 January 2018
OUR SAMPLE NUMBER S2018-00629
YOUR REFERENCE SEASOL REP 5
SAMPLE TYPE Pasture Fresh
DESCRIPTION
DATE SAMPLE COLLECTED 21 December 2017

TEST	Result
NIR Package (FT/003)	
Dry Matter (%)	91.8
Moisture (%)	8.2
Crude Protein (% of dry matter)	28.5
Acid Detergent Fibre (% of dry matter)	27.5
Neutral Detergent Fibre (% of dry matter)	29.7
Digestibility (DMD) (% of dry matter)	75.7
Digestibility (DOMD) (Calculated) (% of dry matter)	70.9
Est. Metabolisable Energy (Calculated) (MJ/kg DM)	11.4
Water Soluble Carbohydrates (% of dry matter)	2.9
Fat (% of dry matter)	4.3
Ash (% of dry matter)	10.8
Horse DE (TP/FT/008)	
Horse DE (MJ/kg DM)	12.4

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Final Report

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Comments:

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Joanne Warnes

Team Leader Quality, Milling & Feedtest Laboratory

09 January 2018

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March 2018 – Grower samples

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FEED ANALYSIS REPORT

Seasol International
PO Box 160
Bayswater VIC 3153

ATTENTION Peter Brown
FAX NUMBER 03 9720 4792
PURCHASE ORDER None
PROJECT NUMBER J1803-0267

DATE RECEIVED 05 March 2018
OUR SAMPLE NUMBER S2018-11311
YOUR REFERENCE Grower Rep 1
SAMPLE TYPE Pasture Fresh
DESCRIPTION
DATE SAMPLE COLLECTED 28 February 2018

TEST	Result
NIR Package (FT/003)	
Dry Matter (%)	81.7
Moisture (%)	18.3
Crude Protein (% of dry matter)	32.4
Digestibility (DMD) (% of dry matter)	77.3
Digestibility (DOMD) (Calculated) (% of dry matter)	72.3
Est. Metabolisable Energy (Calculated) (MJ/kg DM)	11.7
Fat (% of dry matter)	4.3
Ash (% of dry matter)	11.0
Horse DE (TP/FT/008)	
Horse DE (MJ/kg DM)	13.9
Acid Detergent Fibre (FT005)	
Acid Detergent Fibre (% of dry matter)	23.1
Neutral Detergent Fibre (FT/006)	
Neutral Detergent Fibre (% of dry matter)	29.7

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- TP_WA Analysis conducted at Agrifood Technology, Western Australia: Bibra Lake Site.
- TP_DML Analysis conducted at Agrifood Technology, Victoria: Derrimut Site.
- OS Analysis is outsourced.

Final Report

Report Number: 223348

Comments:

Metabolisable Energy has been calculated using the following equation:
ME = (0.203 x DOMD%) - 3.001

Report Number: 223348
Issued: 22 Mar 2018

Australian Wool Testing Authority Ltd - Trading as Agrifood Technology Pty Ltd ABN 43 006 014 106
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Seasol International
PO Box 160
Bayswater VIC 3153

ATTENTION Peter Brown
FAX NUMBER 03 9720 4792

PURCHASE ORDER None
PROJECT NUMBER J1803-0267

DATE RECEIVED 05 March 2018
OUR SAMPLE NUMBER S2018-11312
YOUR REFERENCE Grower Rep 2
SAMPLE TYPE Pasture Fresh
DESCRIPTION
DATE SAMPLE COLLECTED 28 February 2018

TEST	Result
NIR Package (FT/003)	
Dry Matter (%)	84.9
Moisture (%)	15.1
Crude Protein (% of dry matter)	34.4
Digestibility (DMD) (% of dry matter)	80.6
Digestibility (DOMD) (Calculated) (% of dry matter)	75.1
Est. Metabolisable Energy (Calculated) (MJ/kg DM)	12.2
Fat (% of dry matter)	4.4
Ash (% of dry matter)	11.1
Horse DE (TP/FT/008)	
Horse DE (MJ/kg DM)	14.9
Acid Detergent Fibre (FT005)	
Acid Detergent Fibre (% of dry matter)	20.4
Neutral Detergent Fibre (FT/006)	
Neutral Detergent Fibre (% of dry matter)	27.6

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Final Report

Report Number: 223348

Comments:

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ATTENTION Peter Brown
FAX NUMBER 03 9720 4792

PURCHASE ORDER None
PROJECT NUMBER J1803-0267

DATE RECEIVED 05 March 2018
OUR SAMPLE NUMBER S2018-11313
YOUR REFERENCE Grower Rep 3
SAMPLE TYPE Pasture Fresh
DESCRIPTION
DATE SAMPLE COLLECTED 28 February 2018

TEST	Result
NIR Package (FT/003)	
Dry Matter (%)	83.5
Moisture (%)	16.5
Crude Protein (% of dry matter)	33.7
Digestibility (DMD) (% of dry matter)	78.8
Digestibility (DOMD) (Calculated) (% of dry matter)	73.6
Est. Metabolisable Energy (Calculated) (MJ/kg DM)	11.9
Fat (% of dry matter)	4.3
Ash (% of dry matter)	11.0
Horse DE (TP/FT/008)	
Horse DE (MJ/kg DM)	14.9
Acid Detergent Fibre (FT005)	
Acid Detergent Fibre (% of dry matter)	20.3
Neutral Detergent Fibre (FT/006)	
Neutral Detergent Fibre (% of dry matter)	26.1

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ATTENTION Peter Brown
FAX NUMBER 03 9720 4792

PURCHASE ORDER None
PROJECT NUMBER J1803-0267

DATE RECEIVED 05 March 2018
OUR SAMPLE NUMBER S2018-11314
YOUR REFERENCE Grower Rep 4
SAMPLE TYPE Pasture Fresh
DESCRIPTION
DATE SAMPLE COLLECTED 28 February 2018

TEST	Result
NIR Package (FT/003)	
Dry Matter (%)	78.4
Moisture (%)	21.6
Crude Protein (% of dry matter)	29.6
Digestibility (DMD) (% of dry matter)	74.9
Digestibility (DOMD) (Calculated) (% of dry matter)	70.3
Est. Metabolisable Energy (Calculated) (MJ/kg DM)	11.3
Fat (% of dry matter)	4.2
Ash (% of dry matter)	10.8
Horse DE (TP/FT/008)	
Horse DE (MJ/kg DM)	12.9
Acid Detergent Fibre (FT005)	
Acid Detergent Fibre (% of dry matter)	25.9
Neutral Detergent Fibre (FT/006)	
Neutral Detergent Fibre (% of dry matter)	34.7

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ATTENTION Peter Brown
FAX NUMBER 03 9720 4792

PURCHASE ORDER None
PROJECT NUMBER J1803-0267

DATE RECEIVED 05 March 2018
OUR SAMPLE NUMBER S2018-11315
YOUR REFERENCE Grower Rep 5
SAMPLE TYPE Pasture Fresh
DESCRIPTION
DATE SAMPLE COLLECTED 28 February 2018

TEST	Result
NIR Package (FT/003)	
Dry Matter (%)	81.7
Moisture (%)	18.3
Crude Protein (% of dry matter)	31.3
Digestibility (DMD) (% of dry matter)	76.3
Digestibility (DOMD) (Calculated) (% of dry matter)	71.5
Est. Metabolisable Energy (Calculated) (MJ/kg DM)	11.5
Fat (% of dry matter)	4.3
Ash (% of dry matter)	10.7
Horse DE (TP/FT/008)	
Horse DE (MJ/kg DM)	14.0
Acid Detergent Fibre (FT005)	
Acid Detergent Fibre (% of dry matter)	22.3
Neutral Detergent Fibre (FT/006)	
Neutral Detergent Fibre (% of dry matter)	30.5

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- TP_DML Analysis conducted at Agrifood Technology, Victoria: Derrimut Site.
- OS Analysis is outsourced.

Final Report

Report Number: 223348

Comments:

Metabolisable Energy has been calculated using the following equation:
ME = (0.203 x DOMD%) - 3.001

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March 2018 – PastureMasta samples

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Seasol International
PO Box 160
Bayswater VIC 3153

ATTENTION Peter Brown
FAX NUMBER 03 9720 4792

PURCHASE ORDER None
PROJECT NUMBER J1803-0267

DATE RECEIVED 05 March 2018
OUR SAMPLE NUMBER S2018-11306
YOUR REFERENCE Seasol Rep 1
SAMPLE TYPE Pasture Fresh
DESCRIPTION
DATE SAMPLE COLLECTED 28 February 2018

TEST	Result
NIR Package (FT/003)	
Dry Matter (%)	84.5
Moisture (%)	15.5
Crude Protein (% of dry matter)	31.8
Digestibility (DMD) (% of dry matter)	77.2
Digestibility (DOMD) (Calculated) (% of dry matter)	72.2
Est. Metabolisable Energy (Calculated) (MJ/kg DM)	11.7
Fat (% of dry matter)	4.3
Ash (% of dry matter)	10.9
Horse DE (TP/FT/008)	
Horse DE (MJ/kg DM)	14.4
Acid Detergent Fibre (FT005)	
Acid Detergent Fibre (% of dry matter)	21.1
Neutral Detergent Fibre (FT/006)	
Neutral Detergent Fibre (% of dry matter)	29.6

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Final Report

Report Number: 223348

Comments:

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Report Number: 223348
Issued: 22 Mar 2018

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FAX NUMBER 03 9720 4792

PURCHASE ORDER None
PROJECT NUMBER J1803-0267

DATE RECEIVED 05 March 2018
OUR SAMPLE NUMBER S2018-11307
YOUR REFERENCE Seasol Rep 2
SAMPLE TYPE Pasture Fresh
DESCRIPTION
DATE SAMPLE COLLECTED 28 February 2018

TEST	Result
NIR Package (FT/003)	
Dry Matter (%)	77.8
Moisture (%)	22.2
Crude Protein (% of dry matter)	27.4
Digestibility (DMD) (% of dry matter)	71.2
Digestibility (DOMD) (Calculated) (% of dry matter)	67.2
Est. Metabolisable Energy (Calculated) (MJ/kg DM)	10.6
Fat (% of dry matter)	4.1
Ash (% of dry matter)	4.8
Horse DE (TP/FT/008)	
Horse DE (MJ/kg DM)	12.3
Acid Detergent Fibre (FT005)	
Acid Detergent Fibre (% of dry matter)	27.3
Neutral Detergent Fibre (FT/006)	
Neutral Detergent Fibre (% of dry matter)	37.5

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Final Report

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PURCHASE ORDER None
PROJECT NUMBER J1803-0267

DATE RECEIVED 05 March 2018
OUR SAMPLE NUMBER S2018-11308
YOUR REFERENCE Seasol Rep 3
SAMPLE TYPE Pasture Fresh
DESCRIPTION
DATE SAMPLE COLLECTED 28 February 2018

TEST	Result
NIR Package (FT/003)	
Dry Matter (%)	85.1
Moisture (%)	14.9
Crude Protein (% of dry matter)	30.2
Digestibility (DMD) (% of dry matter)	76.8
Digestibility (DOMD) (Calculated) (% of dry matter)	71.8
Est. Metabolisable Energy (Calculated) (MJ/kg DM)	11.6
Fat (% of dry matter)	4.3
Ash (% of dry matter)	10.5
Horse DE (TP/FT/008)	
Horse DE (MJ/kg DM)	13.8
Acid Detergent Fibre (FT005)	
Acid Detergent Fibre (% of dry matter)	22.6
Neutral Detergent Fibre (FT/006)	
Neutral Detergent Fibre (% of dry matter)	30.7

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Final Report

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FAX NUMBER 03 9720 4792

PURCHASE ORDER None
PROJECT NUMBER J1803-0267

DATE RECEIVED 05 March 2018
OUR SAMPLE NUMBER S2018-11309
YOUR REFERENCE Seasol Rep 4
SAMPLE TYPE Pasture Fresh
DESCRIPTION
DATE SAMPLE COLLECTED 28 February 2018

TEST	Result
NIR Package (FT/003)	
Dry Matter (%)	85.6
Moisture (%)	14.4
Crude Protein (% of dry matter)	29.7
Digestibility (DMD) (% of dry matter)	75.0
Digestibility (DOMD) (Calculated) (% of dry matter)	70.3
Est. Metabolisable Energy (Calculated) (MJ/kg DM)	11.3
Fat (% of dry matter)	4.3
Ash (% of dry matter)	10.5
Horse DE (TP/FT/008)	
Horse DE (MJ/kg DM)	13.1
Acid Detergent Fibre (FT005)	
Acid Detergent Fibre (% of dry matter)	25.2
Neutral Detergent Fibre (FT/006)	
Neutral Detergent Fibre (% of dry matter)	36.8

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FAX NUMBER 03 9720 4792

PURCHASE ORDER None
PROJECT NUMBER J1803-0267

DATE RECEIVED 05 March 2018
OUR SAMPLE NUMBER S2018-11310
YOUR REFERENCE Seasol Rep 5
SAMPLE TYPE Pasture Fresh
DESCRIPTION
DATE SAMPLE COLLECTED 28 February 2018

TEST	Result
NIR Package (FT/003)	
Dry Matter (%)	86.3
Moisture (%)	13.7
Crude Protein (% of dry matter)	30.6
Digestibility (DMD) (% of dry matter)	74.3
Digestibility (DOMD) (Calculated) (% of dry matter)	69.8
Est. Metabolisable Energy (Calculated) (MJ/kg DM)	11.2
Fat (% of dry matter)	4.3
Ash (% of dry matter)	10.7
Horse DE (TP/FT/008)	
Horse DE (MJ/kg DM)	13.5
Acid Detergent Fibre (FT005)	
Acid Detergent Fibre (% of dry matter)	24.1
Neutral Detergent Fibre (FT/006)	
Neutral Detergent Fibre (% of dry matter)	33.2

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ATTENTION Belinda Rawnsley
FAX NUMBER
PURCHASE ORDER None
PROJECT NUMBER J1903-0377

DATE RECEIVED 05 March 2019
OUR SAMPLE NUMBER S2019-12047
YOUR REFERENCE Grower Rep 1
SAMPLE TYPE Pasture Fresh
DESCRIPTION
DATE SAMPLE COLLECTED 28 February 2019

TEST	Result
NIR Package (FT/003)	
Dry Matter (%)	91.7
Moisture (%)	8.3
Crude Protein (% of dry matter)	22.5
Acid Detergent Fibre (% of dry matter)	31.7
Neutral Detergent Fibre (% of dry matter)	38.6
Digestibility (DMD) (% of dry matter)	65.0
Digestibility (DOMD) (Calculated) (% of dry matter)	61.9
Est. Metabolisable Energy (Calculated) (MJ/kg DM)	9.6
Fat (% of dry matter)	3.8
Ash (% of dry matter)	3.3

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TP_DML Analysis conducted at Agrifood Technology, Victoria: Derrimut Site.
OS Analysis is outsourced.

Final Report

Report Number: 262794

Comments:

Metabolisable Energy has been calculated using the following equation:
ME = (0.203 x DOMD%) - 3.001

Joanne Warnes

Team Leader Quality, Milling & Feedtest Laboratory

07 March 2019

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FAX NUMBER

PURCHASE ORDER None
PROJECT NUMBER J1903-0377

DATE RECEIVED 05 March 2019
OUR SAMPLE NUMBER S2019-12048
YOUR REFERENCE Grower Rep 2
SAMPLE TYPE Pasture Fresh
DESCRIPTION
DATE SAMPLE COLLECTED 28 February 2019

TEST	Result
NIR Package (FT/003)	
Dry Matter (%)	92.2
Moisture (%)	7.8
Crude Protein (% of dry matter)	23.8
Acid Detergent Fibre (% of dry matter)	32.7
Neutral Detergent Fibre (% of dry matter)	37.3
Digestibility (DMD) (% of dry matter)	63.3
Digestibility (DOMD) (Calculated) (% of dry matter)	60.5
Est. Metabolisable Energy (Calculated) (MJ/kg DM)	9.3
Fat (% of dry matter)	3.8
Ash (% of dry matter)	9.7

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Joanne Warnes

Team Leader Quality, Milling & Feedtest Laboratory

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PROJECT NUMBER J1903-0377

DATE RECEIVED 05 March 2019
OUR SAMPLE NUMBER S2019-12049
YOUR REFERENCE Grower Rep 3
SAMPLE TYPE Pasture Fresh
DESCRIPTION
DATE SAMPLE COLLECTED 28 February 2019

TEST	Result
NIR Package (FT/003)	
Dry Matter (%)	92.4
Moisture (%)	7.6
Crude Protein (% of dry matter)	22.9
Acid Detergent Fibre (% of dry matter)	34.1
Neutral Detergent Fibre (% of dry matter)	39.2
Digestibility (DMD) (% of dry matter)	63.5
Digestibility (DOMD) (Calculated) (% of dry matter)	60.7
Est. Metabolisable Energy (Calculated) (MJ/kg DM)	9.3
Fat (% of dry matter)	3.8
Ash (% of dry matter)	9.8

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Final Report

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Comments:

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Joanne Warnes

Team Leader Quality, Milling & Feedtest Laboratory

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PURCHASE ORDER None
PROJECT NUMBER J1903-0377

DATE RECEIVED 05 March 2019
OUR SAMPLE NUMBER S2019-12050
YOUR REFERENCE Grower Rep 4
SAMPLE TYPE Pasture Fresh
DESCRIPTION
DATE SAMPLE COLLECTED 28 February 2019

TEST	Result
NIR Package (FT/003)	
Dry Matter (%)	91.7
Moisture (%)	8.3
Crude Protein (% of dry matter)	27.1
Acid Detergent Fibre (% of dry matter)	28.8
Neutral Detergent Fibre (% of dry matter)	32.0
Digestibility (DMD) (% of dry matter)	69.7
Digestibility (DOMD) (Calculated) (% of dry matter)	65.9
Est. Metabolisable Energy (Calculated) (MJ/kg DM)	10.4
Fat (% of dry matter)	4.1
Ash (% of dry matter)	10.0

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Final Report

Report Number: 262794

Comments:

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Joanne Warnes

Team Leader Quality, Milling & Feedtest Laboratory

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PURCHASE ORDER None
PROJECT NUMBER J1903-0377

DATE RECEIVED 05 March 2019
OUR SAMPLE NUMBER S2019-12051
YOUR REFERENCE Grower Rep 5
SAMPLE TYPE Pasture Fresh
DESCRIPTION
DATE SAMPLE COLLECTED 28 February 2019

TEST	Result
NIR Package (FT/003)	
Dry Matter (%)	92.8
Moisture (%)	7.2
Crude Protein (% of dry matter)	20.4
Acid Detergent Fibre (% of dry matter)	35.0
Neutral Detergent Fibre (% of dry matter)	41.3
Digestibility (DMD) (% of dry matter)	60.2
Digestibility (DOMD) (Calculated) (% of dry matter)	57.8
Est. Metabolisable Energy (Calculated) (MJ/kg DM)	8.7
Fat (% of dry matter)	3.6
Ash (% of dry matter)	4.6

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Final Report

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Team Leader Quality, Milling & Feedtest Laboratory

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PURCHASE ORDER None
PROJECT NUMBER J1903-0377

DATE RECEIVED 05 March 2019
OUR SAMPLE NUMBER S2019-12042
YOUR REFERENCE Seasol Rep 1
SAMPLE TYPE Pasture Fresh
DESCRIPTION
DATE SAMPLE COLLECTED 28 February 2019

TEST	Result
NIR Package (FT/003)	
Dry Matter (%)	92.2
Moisture (%)	7.8
Crude Protein (% of dry matter)	23.0
Acid Detergent Fibre (% of dry matter)	33.4
Neutral Detergent Fibre (% of dry matter)	39.5
Digestibility (DMD) (% of dry matter)	61.9
Digestibility (DOMD) (Calculated) (% of dry matter)	59.2
Est. Metabolisable Energy (Calculated) (MJ/kg DM)	9.0
Fat (% of dry matter)	3.8
Ash (% of dry matter)	9.9

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PURCHASE ORDER None
PROJECT NUMBER J1903-0377

DATE RECEIVED 05 March 2019
OUR SAMPLE NUMBER S2019-12043
YOUR REFERENCE Seasol Rep 2
SAMPLE TYPE Pasture Fresh
DESCRIPTION
DATE SAMPLE COLLECTED 28 February 2019

TEST	Result
NIR Package (FT/003)	
Dry Matter (%)	92.1
Moisture (%)	7.9
Crude Protein (% of dry matter)	21.8
Acid Detergent Fibre (% of dry matter)	35.1
Neutral Detergent Fibre (% of dry matter)	40.9
Digestibility (DMD) (% of dry matter)	59.0
Digestibility (DOMD) (Calculated) (% of dry matter)	56.8
Est. Metabolisable Energy (Calculated) (MJ/kg DM)	8.5
Fat (% of dry matter)	3.6
Ash (% of dry matter)	9.5

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Joanne Warnes

Team Leader Quality, Milling & Feedtest Laboratory

07 March 2019

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PURCHASE ORDER None
PROJECT NUMBER J1903-0377

DATE RECEIVED 05 March 2019
OUR SAMPLE NUMBER S2019-12044
YOUR REFERENCE Seasol Rep 3
SAMPLE TYPE Pasture Fresh
DESCRIPTION
DATE SAMPLE COLLECTED 28 February 2019

TEST	Result
NIR Package (FT/003)	
Dry Matter (%)	92.0
Moisture (%)	8.0
Crude Protein (% of dry matter)	24.5
Acid Detergent Fibre (% of dry matter)	32.8
Neutral Detergent Fibre (% of dry matter)	36.6
Digestibility (DMD) (% of dry matter)	63.6
Digestibility (DOMD) (Calculated) (% of dry matter)	60.7
Est. Metabolisable Energy (Calculated) (MJ/kg DM)	9.3
Fat (% of dry matter)	3.9
Ash (% of dry matter)	10.0

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Under license from AVS

FEED ANALYSIS REPORT

Seasol International
PO Box 160
Bayswater VIC 3153

ATTENTION Belinda Rawnsley
FAX NUMBER

PURCHASE ORDER None
PROJECT NUMBER J1903-0377

DATE RECEIVED 05 March 2019
OUR SAMPLE NUMBER S2019-12045
YOUR REFERENCE Seasol Rep 4
SAMPLE TYPE Pasture Fresh
DESCRIPTION
DATE SAMPLE COLLECTED 28 February 2019

TEST	Result
NIR Package (FT/003)	
Dry Matter (%)	92.7
Moisture (%)	7.3
Crude Protein (% of dry matter)	22.1
Acid Detergent Fibre (% of dry matter)	35.2
Neutral Detergent Fibre (% of dry matter)	40.6
Digestibility (DMD) (% of dry matter)	59.2
Digestibility (DOMD) (Calculated) (% of dry matter)	57.0
Est. Metabolisable Energy (Calculated) (MJ/kg DM)	8.6
Fat (% of dry matter)	3.7
Ash (% of dry matter)	9.8

Note: **This report is not to be reproduced except in full.**

If test method is prefaced by:
- TP or FT Analysis conducted at Agrifood Technology, Victoria: Werribee Site.
- TP_WA Analysis conducted at Agrifood Technology, Western Australia: Bibra Lake Site.
- TP_DML Analysis conducted at Agrifood Technology, Victoria: Derrimut Site.
- OS Analysis is outsourced.

Final Report

Report Number: 262794

Comments:

Metabolisable Energy has been calculated using the following equation:
ME = (0.203 x DOMD%) - 3.001

Joanne Warnes

Team Leader Quality, Milling & Feedtest Laboratory

07 March 2019

Australian Wool Testing Authority Ltd - Trading as Agrifood Technology Pty Ltd ABN 43 006 014 106
FEEDTEST, PO Box 728, Werribee Victoria 3030
0203/9/09 Telephone 1300 655 474 Facsimile 03 9742 3344 Email feed.test@agrifood.com.au

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FEED ANALYSIS REPORT

Seasol International
PO Box 160
Bayswater VIC 3153

ATTENTION Belinda Rawnsley
FAX NUMBER

PURCHASE ORDER None
PROJECT NUMBER J1903-0377

DATE RECEIVED 05 March 2019
OUR SAMPLE NUMBER S2019-12046
YOUR REFERENCE Seasol Rep 5
SAMPLE TYPE Pasture Fresh
DESCRIPTION
DATE SAMPLE COLLECTED 28 February 2019

TEST	Result
NIR Package (FT/003)	
Dry Matter (%)	92.4
Moisture (%)	7.6
Crude Protein (% of dry matter)	23.2
Acid Detergent Fibre (% of dry matter)	34.2
Neutral Detergent Fibre (% of dry matter)	39.0
Digestibility (DMD) (% of dry matter)	61.3
Digestibility (DOMD) (Calculated) (% of dry matter)	58.8
Est. Metabolisable Energy (Calculated) (MJ/kg DM)	8.9
Fat (% of dry matter)	3.8
Ash (% of dry matter)	9.7

If test method is prefaced by:

TP or FT	Analysis conducted at Agrifood Technology, Victoria: Werribee Site.
TP_WA	Analysis conducted at Agrifood Technology, Western Australia: Bibra Lake Site.
TP_DML	Analysis conducted at Agrifood Technology, Victoria: Derrimut Site.
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Appendix iii. Statistical analysis

2017-2018 Season

Crop Name				Alfalfa	Alfalfa	Alfalfa	Alfalfa	Alfalfa
Crop Variety				Q31	Q31	Q31	Q31	Q31
Description				GreenSeeker	GreenSeeker	GreenSeeker	GreenSeeker	Fresh Wt
Rating Date				22/11/2017	21/12/2017	23/1/2018	20/2/2018	21/11/2017
Rating Type				NDVI	NDVI	NDVI	NDVI	WEIFRE
Rating Unit				INDEX	INDEX	INDEX	INDEX	g
Sample Size				1.0 PLOT	1.0 PLOT	1.0 PLOT	1.0 PLOT	1.0 m2
Number of Subsamples				1	1	1	1	1
Days After First/Last Applic.				35 35	64 21	97 15	125 20	34 34
ARM Action Codes								T1
Trt No.	Treatment Name	Rate	Rate Unit / Appl Code	29	30	31	32	3
1	Hi-Fert Lucerne Mix	100	kg/ha A	0.80b	0.82b	0.78-	0.84b	1772.0b
2	Pasture Masta	10	L/100 L ABCD	0.82a	0.84a	0.79-	0.85a	2242.3a
LSD P=.05				0.008	0.011	0.021	0.009	366.29
Standard Deviation				0.009	0.012	0.022	0.009	389.85
CV				1.09	1.46	2.78	1.1	19.42
Bartlett's X2				1.722	10.784	2.316	2.998	0.464
P(Bartlett's X2)				0.189	0.001*	0.128	0.083	0.496
Skewness				-0.4678	-1.0528*	-0.1921	-0.6833	0.4583
Kurtosis				-0.7621	0.356	-0.7586	0.2245	-1.12
Treatment F				25.352	12.260	0.843	8.308	7.276
Treatment Prob(F)				0.0001	0.0025	0.3707	0.0099	0.0147

Means followed by same letter or symbol do not significantly differ (P=.05, LSD).
Mean comparisons performed only when AOV Treatment P(F) is significant at mean comparison OSL.

Column 3: T1 = [C1]/(0.5*0.5)
Column 10: T3 = [C8]/(0.4*0.4)
Column 17: T5 = [C15]/(0.4*0.4)
Column 24: T7 = [C22]/(0.4*0.4)
Column 4: T2 = [C2]/(0.5*0.5)
Column 11: T4 = [C9]/(0.4*0.4)
Column 18: T6 = [C16]/(0.4*0.4)
Column 25: T8 = [C23]/(0.4*0.4)
Column 5: T13 = [C4]*10
Column 12: T15 = [C11]*10
Column 19: T17 = [C18]*10
Column 26: T20 = [C25]*10
Column 7: T14 = [C6]*10
Column 14: T16 = [C13]*10
Column 21: T19 = [C20]*10
Column 28: T21 = [C27]*10

Could not calculate LSD (% mean diff) for columns 34,35,36,37,38,39 because error mean square = 0.

Crop Name				Alfalfa	Alfalfa	Alfalfa	Alfalfa	Alfalfa	Alfalfa
Crop Variety				Q31	Q31	Q31	Q31	Q31	Q31
Description				Fresh Wt	Fresh Wt	Fresh Wt	Dry Wt	Dry Wt	Dry Wt
Rating Date				20/12/2017	24/1/2018	20/2/2018	29/11/2017	27/12/2017	29/1/2018
Rating Type				WEIFRE	WEIFRE	WEIFRE	WEIDRY	WEIDRY	WEIDRY
Rating Unit				g	g	g	g	g	g
Sample Size				1.0 m2	1.0 m2	1.0 m2	1.0 m2	1.0 m2	1.0 m2
Number of Subsamples				1	1	1	1	1	1
Days After First/Last Applic.				63 20	98 16	125 20	42 42	70 27	103 21
ARM Action Codes				T3	T5	T7	T2	T4	T6
Trt No.	Treatment Name	Rate	Rate Unit / Appl Code						
				10	17	24	4	11	18
1	Hi-Fert Lucerne Mix	100	kg/ha A	2100.6-	1646.9-	1843.7-	465.8-	384.4-	391.9-
2	Pasture Masta	10	L/100 L ABCD	2271.3-	1975.0-	2121.3-	534.2-	393.8-	458.1-
LSD P=.05				561.85	400.56	319.74	72.67	92.94	85.95
Standard Deviation				598.00	426.33	340.31	77.35	98.91	91.48
CV				27.36	23.54	17.17	15.47	25.42	21.52
Bartlett's X2				1.647	2.89	0.01	0.015	0.456	1.70
P(Bartlett's X2)				0.199	0.089	0.922	0.902	0.50	0.192
Skewness				0.4938	0.4932	0.9422	0.2986	0.4114	0.5014
Kurtosis				0.5519	-1.0876	0.6061	-1.5612	0.4198	-0.8103
Treatment F				0.407	2.962	3.327	3.910	0.045	2.622
Treatment Prob(F)				0.5315	0.1024	0.0848	0.0635	0.8345	0.1228

Crop Name				Alfalfa	Alfalfa	Alfalfa	Alfalfa	Alfalfa	Alfalfa
Crop Variety				Q31	Q31	Q31	Q31	Q31	Q31
Description				Dry Wt	Dry Wt	Dry Wt	Dry Wt	Dry Wt	DM Production
Rating Date				28/2/2018	29/11/2017	27/12/2017	29/1/2018	28/2/2018	29/11/2018
Rating Type				WEIDRY	WEIDRY	WEIDRY	WEIDRY	WEIDRY	WEIDRY
Rating Unit				g	kg DM/ha	kg DM/ha	kg DM/ha	kg DM/ha	g/day
Sample Size				1.0 m2	1 ha	1 ha	1 ha	1 ha	1 ha
Number of Subsamples				1	1	1	1	1	1
Days After First/Last Applic.				133 28	42 42	70 27	103 21	133 28	407 9
ARM Action Codes				T8	T13	T15	T17	T20	T14
Trt No.	Treatment Name	Rate	Rate Unit / Appl Code						
				25	5	12	19	26	7
1	Hi-Fert Lucerne Mix	100	kg/ha A	312.84b	4658.4-	3843.8-	3918.8-	3128.4b	133.10-
2	Pasture Masta	10	L/100 L ABCD	380.62a	5342.4-	3937.5-	4581.3-	3806.2a	152.64-
LSD P=.05				59.237	726.74	929.36	859.51	592.37	20.764
Standard Deviation				63.047	773.49	989.14	914.79	630.47	22.100
CV				18.18	15.47	25.42	21.52	18.18	15.47
Bartlett's X2				0.004	0.015	0.456	1.70	0.004	0.015
P(Bartlett's X2)				0.95	0.902	0.50	0.192	0.95	0.902
Skewness				0.7062	0.2986	0.4114	0.5014	0.7062	0.2986
Kurtosis				0.11	-1.5612	0.4198	-0.8103	0.11	-1.5612
Treatment F				5.779	3.910	0.045	2.622	5.779	3.910
Treatment Prob(F)				0.0272	0.0635	0.8345	0.1228	0.0272	0.0635

Crop Name				Alfalfa	Alfalfa	Alfalfa	Alfalfa
Crop Variety				Q31	Q31	Q31	Q31
Description				DM Production	DM Production	DM Production	No. Bales (prespray)
Rating Date				27/12/2018	29/1/2018	28/2/2018	13/10/2017
Rating Type				WEIDRY	WEIDRY	WEIDRY	Per hectare
Rating Unit				g/day	g/day	g/day	NUMBER
Sample Size				1 ha	1 ha	1 ha	1 AREA
Number of Subsamples				1	1	1	1
Days After First/Last Applic.				435 37	103 21	133 28	-5 -5
ARM Action Codes				T16	T19	T21	
Trt No.	Treatment Name	Rate	Rate Unit	Appl Code	14	21	28	34
1	Hi-Fert Lucerne Mix	100	kg/ha	A	89.4-	122.5-	136.0b	158b
2	Pasture Masta	10	L/100 L	ABCD	91.6-	143.2-	165.5a	168a
LSD P=.05					21.61	26.86	25.76	.
Standard Deviation					23.00	28.59	27.41	0.0
CV					25.42	21.52	18.18	0.0
Bartlett's X2					0.456	1.70	0.004	0.00
P(Bartlett's X2)					0.50	0.192	0.95	.
Skewness					0.4114	0.5014	0.7062	.
Kurtosis					0.4198	-0.8103	0.11	.
Treatment F					0.045	2.622	5.779	0.000
Treatment Prob(F)					0.8345	0.1228	0.0272	1.0000

Crop Name				Alfalfa	Alfalfa	Alfalfa	Alfalfa	Alfalfa	Alfalfa
Crop Variety				Q31	Q31	Q31	Q31	Q31	Q31
Description				No. Bales	No Bales	No. Bales	No. Bales	No. Bales	Bale weight
Rating Date				17/11/2017	30/12/2017	31/1/2018	28/2/2018	4/4/2018	4/3/2018
Rating Type				Per hectare	Per hectare	Per hectare	Per hectare	Per hectare	Per hectare
Rating Unit				NUMBER	NUMBER	NUMBER	NUMBER	NUMBER	NUMBER
Sample Size				1 AREA	1 AREA	1 AREA	1 AREA	1 AREA	1 AREA
Number of Subsamples				1	1	1	1	1	1
Days After First/Last Applic.				30 30	73 30	105 23	133 28	168 63	137 32
ARM Action Codes									
Trt No.	Treatment Name	Rate	Rate Unit	Appl Code	35	36	37	38	39	33
1	Hi-Fert Lucerne Mix	100	kg/ha	A	222b	106b	137b	144b	110b	21.6b
2	Pasture Masta	10	L/100 L	ABCD	256a	163a	158a	159a	116a	23.5a
LSD P=.05					.	.	.	.	.	0.98
Standard Deviation					0.0	0.0	0.0	0.0	0.0	1.05
CV					0.0	0.0	0.0	0.0	0.0	4.64
Bartlett's X2					0.00	0.00	0.00	0.00	0.00	0.089
P(Bartlett's X2)					.	.	.	.	.	0.765
Skewness					.	.	.	.	.	-0.1083
Kurtosis					.	.	.	.	.	-0.9872
Treatment F					0.000	0.000	0.000	0.000	0.000	16.511
Treatment Prob(F)					1.0000	1.0000	1.0000	1.0000	1.0000	0.0007

Crop Name				Alfalfa	Alfalfa	Alfalfa	Alfalfa	Alfalfa	Alfalfa
Crop Variety				Q31	Q31	Q31	Q31	Q31	Q31
Description				Dry matter	Dry matter	Crude protein	Crude protein	Digestibility	Digestibility
Rating Date				4/1/2018	5/3/2018	4/1/2018	5/3/2018	4/1/2018	5/3/2018
Rating Type				Dry matter	Dry matter	Crude prote	Crude prote	Digestibili	Digestibili
Rating Unit				%	%	%DM	%DM	%DM	%DM
Sample Size									
Number of Subsamples				1	1	1	1	1	1
Days After First/Last Applic.				78 35	138 33	78 35	138 33	78 35	138 33
ARM Action Codes									
Trt No.	Treatment Name	Rate	Rate Unit	Appl Code	101	107	102	108	103	109
1	Hi-Fert Lucerne Mix	100	kg/ha	A	91.7-	82.0-	28.3-	32.3a	75.2-	77.6a
2	Pasture Masta	10	L/100 L	ABCD	91.7-	83.9-	28.2-	29.9b	75.2-	74.9b
LSD P=.05					0.18	3.20	0.98	1.90	2.32	2.47
Standard Deviation					0.13	2.34	0.71	1.39	1.69	1.81
CV					0.14	2.83	2.53	4.47	2.25	2.37
Bartlett's X2					0.122	0.445	0.001	0.106	0.468	0.025
P(Bartlett's X2)					0.727	0.505	0.976	0.744	0.494	0.874
Skewness					-0.1914	-0.8284	-0.1064	-0.0423	-0.3184	-0.3012
Kurtosis					-1.7612	-0.5737	-1.631	-0.0652	-0.9994	0.8491
Treatment F					0.929	1.507	0.031	7.079	0.000	5.497
Treatment Prob(F)					0.3528	0.2414	0.8622	0.0196	1.0000	0.0356

Crop Name				Alfalfa	Alfalfa	Alfalfa	Alfalfa	Alfalfa	Alfalfa
Crop Variety				Q31	Q31	Q31	Q31	Q31	Q31
Description				Metabolic Energy	Metabolic Energy	ADF	ADF	NDF	NDF
Rating Date				4/1/2018	5/3/2018	4/1/2018	5/3/2018	4/1/2018	5/3/2018
Rating Type				Metabolic E	Metabolic E	CHO	ADF		NDF
Rating Unit				MJ/kg DM	MJ/kg DM	%DM	%DM	%DM	%DM
Sample Size									
Number of Subsamples				1	1	1	1	1	1
Days After First/Last Applic.				78 35	138 33	78 35	138 33	78 35	138 33
ARM Action Codes									
Trt No.	Treatment Name	Rate	Rate Unit	Appl Code	104	110	105	111	106	112
1	Hi-Fert Lucerne Mix	100	kg/ha	A	11.3-	11.7a	27.5-	22.4-	29.6-	29.7b
2	Pasture Masta	10	L/100 L	ABCD	11.3-	11.3b	27.4-	24.1-	29.5-	33.6a
LSD P=.05					0.40	0.42	1.83	2.51	1.67	3.65
Standard Deviation					0.29	0.31	1.34	1.84	1.22	2.67
CV					2.58	2.68	4.87	7.91	4.14	8.45
Bartlett's X2					0.303	0.17	0.072	0.005	0.003	0.021
P(Bartlett's X2)					0.582	0.68	0.788	0.946	0.959	0.884
Skewness					-0.2192	-0.5785	0.5926	0.3758	0.6169	0.2964
Kurtosis					-1.0797	1.2564	-0.7301	-0.9048	-0.6378	-0.9607
Treatment F					0.012	5.091	0.020	2.042	0.006	5.152
Treatment Prob(F)					0.9154	0.0419	0.8893	0.1766	0.9394	0.0409

2018-2019 Season

Crop Name				Alfalfa	Alfalfa	Alfalfa	Alfalfa	Alfalfa	Alfalfa
Crop Variety				Q31	Q31	Q31	Q31	Q31	Q31
Description				GreenSeeker	GreenSeeker	GreenSeeker	GreenSeeker	Fresh Wt	Fresh Wt
Rating Date				2/11/2018	17/11/2018	11/1/2019	15/3/2019	2/11/2018	17/12/2018
Rating Type				NDVI	NDVI	NDVI	NDVI	WEIFRE	WEIFRE
Rating Unit				INDEX	INDEX	INDEX	INDEX	g	g
Sample Size				1 PLOT	1 PLOT	1 PLOT	1 PLOT	0.16 m2	0.16 m2
Number of Subsamples				1	1	1	1	1	1
Days After First/Last Applic.				380 15	395 30	450 11	513 22	380 15	425 27
ARM Action Codes									
Trt No.	Treatment Name	Rate	Rate Unit	Appl Code							
					87	88	89	90	49	56
1	Hi-Fert Lucerne Mix	100	kg/ha	A	0.9-	0.8-	0.8-	0.8-	388.2-	368.2-
2	Pasture Masta	10	L/100 L	ABCD	0.9-	0.8-	0.8-	0.8-	378.4-	406.0-
LSD P=.05					0.01	0.01	0.01	0.01	82.42	69.62
Standard Deviation					0.01	0.00	0.01	0.01	87.72	74.10
CV					1.53	0.58	1.12	0.69	22.89	19.14
Bartlett's X2					6.274	0.007	0.00	0.357	0.013	2.076
P(Bartlett's X2)					0.012*	0.933	.	0.55	0.91	0.15
Skewness					-1.3894*	-0.2788	-0.9081	0.0376	0.5424	2.0985*
Kurtosis					2.441*	-2.2187*	0.5355	-0.3954	-0.9777	6.9968*
Treatment F					0.029	0.258	0.947	0.600	0.062	1.296
Treatment Prob(F)					0.8664	0.6184	0.3433	0.4486	0.8056	0.2698

Means followed by same letter or symbol do not significantly differ (P=.05, LSD).
Mean comparisons performed only when AOV Treatment P(F) is significant at mean comparison OSL.

Column 58: TL[57] = LOG([57]+ 1)
Column 53: T25 = [C52]*10
Column 61: T27 = [C60]*10
Column 62: TL[61] = LOG([61]+ 1)
Column 69: T30 = [C68]*10
Column 75: T31 = [C74]*10
Column 82: T47 = [C81]*10
Column 55: T33 = [C54]*10
Column 64: T36 = [C63]*10
Column 71: T38 = [C70]*10
Column 77: T46 = [C76]*10
Column 84: T49 = [C83]*10

Could not calculate LSD (% mean diff) for columns 91,92,93,94,95,96 because error mean square = 0.

Crop Name				Alfalfa	Alfalfa	Alfalfa	Alfalfa	Alfalfa	Alfalfa	Alfalfa
Crop Variety				Q31	Q31	Q31	Q31	Q31	Q31	Q31
Description				Fresh Wt	Fresh Wt	Fresh Wt	Dry Wt	Dry Wt	Dry Wt	Dry Wt
Rating Date				11/1/2019	14/2/2019	15/3/2019	12/11/2018	3/1/2019	3/1/2019	15/1/2019
Rating Type				WEIFRE	WEIFRE	WEIFRE	WEIDRY	WEIDRY	WEIDRY	WEIDRY
Rating Unit				g	g	g	g	g	g	g
Sample Size				0.16 m2	1.0 m2	0.16 m2	0.16 m2	0.16 m2	0.16 m2	0.16 m2
Number of Subsamples				1	1	1	1	1	1	1
Days After First/Last Applic.				450 11	484 13	513 22	390 25	442 3	442 3	454 15
ARM Action Codes									TL[57]	
Trt No.	Treatment Name	Rate	Rate Unit / Appl Code							
				65	73	78	50	57	58	66
1	Hi-Fert Lucerne Mix	100kg/ha	A	265.9-	1354.0-	305.8-	68.9-	64.6-	1.81-	53.3-
2	Pasture Masta	10L/100 L	ABCD	280.1-	1497.0-	342.6-	71.5-	69.5-	1.84-	54.3-
LSD P=.05				56.87	203.45	50.68	15.32	11.32	0.068	13.30
Standard Deviation				60.52	216.54	53.94	16.31	12.05	0.072	14.16
CV				22.17	15.19	16.64	23.23	17.97	3.94	26.32
Bartlett's X2				2.065	3.831	0.92	0.348	1.338	0.478	1.755
P(Bartlett's X2)				0.151	0.05	0.338	0.555	0.247	0.489	0.185
Skewness				0.3373	0.2025	0.5944	0.4878	1.4619*	0.7582	0.6096
Kurtosis				-0.2019	-0.0316	0.062	-0.2059	3.9069*	1.7574	0.6954
Treatment F				0.276	2.181	2.336	0.127	0.817	0.771	0.025
Treatment Prob(F)				0.6059	0.1570	0.1438	0.7256	0.3780	0.3915	0.8758

Crop Name				Alfalfa	Alfalfa	Alfalfa	Alfalfa	Alfalfa	Alfalfa	Alfalfa
Crop Variety				Q31	Q31	Q31	Q31	Q31	Q31	Q31
Description				Dry Wt	Dry Wt	Dry Wt	Dry Wt	Dry Wt	Dry Wt	Dry Wt
Rating Date				27/2/2019	22/3/2019	12/11/2018	3/1/2019	3/1/2019	15/1/2019	27/2/2019
Rating Type				WEIDRY	WEIDRY	WEIDRY	WEIDRY	WEIDRY	WEIDRY	WEIDRY
Rating Unit				g	g	kg DM/ha	kg DM/ha	kg DM/ha	kg DM/ha	kg DM/ha
Sample Size				1.0 m2	0.16 m2	1 ha	1 ha	1 ha	1 ha	1 ha
Number of Subsamples				1	1	1	1	1	1	1
Days After First/Last Applic.				497 6	520 29	390 25	442 3	442 3	454 15	497 6
ARM Action Codes						T25	T27	TL[61]	T30	T31
Trt No.	Treatment Name	Rate	Rate Unit / Appl Code							
				74	79	53	61	62	69	75
1	Hi-Fert Lucerne Mix	100kg/ha	A	308.5-	49.8b	4306.3-	4037.6-	3.60-	3330.2-	3085.0-
2	Pasture Masta	10L/100 L	ABCD	304.5-	64.4a	4468.8-	4341.9-	3.63-	3392.9-	3045.0-
LSD P=.05				40.76	8.88	957.48	707.47	0.069	831.26	407.59
Standard Deviation				43.38	9.46	1019.07	752.98	0.073	884.73	433.81
CV				14.15	16.57	23.23	17.97	2.02	26.32	14.15
Bartlett's X2				3.17	3.251	0.348	1.338	0.47	1.755	3.17
P(Bartlett's X2)				0.075	0.071	0.555	0.247	0.493	0.185	0.075
Skewness				-0.332	0.8524	0.4878	1.4619*	0.7489	0.6096	-0.332
Kurtosis				-0.2875	-0.1017	-0.2059	3.9069*	1.7359	0.6954	-0.2875
Treatment F				0.043	11.949	0.127	0.817	0.770	0.025	0.043
Treatment Prob(F)				0.8390	0.0028	0.7256	0.3780	0.3917	0.8758	0.8390

Crop Name				Alfalfa	Alfalfa	Alfalfa	Alfalfa	Alfalfa
Crop Variety				Q31	Q31	Q31	Q31	Q31
Description				Dry Wt	DM Production	DM Production	DM Production	DM Production
Rating Date				22/3/2018	12/11/2018	3/1/2019	15/1/2019	27/2/2019
Rating Type				WEIDRY	WEIDRY	WEIDRY	WEIDRY	WEIDRY
Rating Unit				kg DM/ha	g/day	g/day	g/day	g/day
Sample Size				1 ha	1 ha	1 ha	1 ha	1 ha
Number of Subsamples				1	1	1	1	1
Days After First/Last Applic.				155 50	390 25	442 3	454 15	497 6
ARM Action Codes				T47	T33	T36	T38	T46
Trt No.	Treatment Name	Rate	Rate Unit	Appl Code	82	55	64	71	77
1	Hi-Fert Lucerne Mix	100	kg/ha	A	3109.8b	107.7-	118.8-	114.8-	102.8-
2	Pasture Masta	10	L/100 L	ABCD	4023.4a	111.7-	127.7-	117.0-	101.5-
LSD P=.05					555.24	23.94	20.81	28.66	13.59
Standard Deviation					590.96	25.48	22.15	30.51	14.46
CV					16.57	23.23	17.97	26.32	14.15
Bartlett's X2					3.251	0.348	1.338	1.755	3.17
P(Bartlett's X2)					0.071	0.555	0.247	0.185	0.075
Skewness					0.8524	0.4878	1.4619*	0.6096	-0.332
Kurtosis					-0.1017	-0.2059	3.9069*	0.6954	-0.2875
Treatment F					11.949	0.127	0.817	0.025	0.043
Treatment Prob(F)					0.0028	0.7256	0.3780	0.8758	0.8390

Crop Name				Alfalfa	Alfalfa	Alfalfa	Alfalfa	Alfalfa	Alfalfa
Crop Variety				Q31	Q31	Q31	Q31	Q31	Q31
Description				DM Production	No. Bales	No. Bales	No. Bales	No. Bales	No. Bales
Rating Date				22/3/2018	19/11/2018	22/12/2017	22/1/2019	20/2/2019	22/3/2019
Rating Type				WEIDRY	Per hectare	Per hectare	Per hectare	Per hectare	Per hectare
Rating Unit				g/day	NUMBER	NUMBER	NUMBER	NUMBER	NUMBER
Sample Size				1 ha	1 AREA	1 AREA	1 AREA	1 AREA	1 AREA
Number of Subsamples				1	1	1	1	1	1
Days After First/Last Applic.				155 50	397 32	65 22	461 22	490 19	520 29
ARM Action Codes				T49					
Trt No.	Treatment Name	Rate	Rate Unit	Appl Code	84	91	92	93	94	95
1	Hi-Fert Lucerne Mix	100	kg/ha	A	107.2b	222.4b	216.6b	159.8b	173.9a	153.7a
2	Pasture Masta	10	L/100 L	ABCD	138.7a	255.7a	230.7a	171.4a	171.4b	128.6b
LSD P=.05					19.15	.	.	.	.	.
Standard Deviation					20.38	0.00	0.00	0.00	0.00	0.00
CV					16.57	0.0	0.0	0.0	0.0	0.0
Bartlett's X2					3.251	0.00	0.00	0.00	0.00	0.00
P(Bartlett's X2)					0.071	.	.	.	.	.
Skewness					0.8524	.	.	.	.	.
Kurtosis					-0.1017	.	.	.	.	.
Treatment F					11.949	0.000	0.000	0.000	0.000	0.000
Treatment Prob(F)					0.0028	1.0000	1.0000	1.0000	1.0000	1.0000

Crop Name				Alfalfa	Alfalfa		Alfalfa		Alfalfa	Alfalfa	Alfalfa	Alfalfa
Crop Variety				Q31	Q31		Q31		Q31	Q31	Q31	Q31
Description				Yield difference	Bale Weight		Bale Weight		Dry matter	Crude protein	Digestibility	
Rating Date				13/11/2018	20/2/2019		22/3/2019		5/3/2019	5/3/2019	5/3/2019	
Rating Type					kg		kg		Dry matter	Crude prote	Digestibili	
Rating Unit				%	kg		kg		%	%DM	%DM	
Sample Size					1	AREA	1	AREA				
Number of Subsamples				1	1		1		1	1	1	
Days After First/Last Applic.				391 26	490 19		520 29		503 12	503 12	503 12	
ARM Action Codes												
Trt No.	Treatment Name	Rate	Rate Unit	Appl Code								
					96		85		86	113	114	115
1	Hi-Fert Lucerne Mix	100	kg/ha	A	15.0		21.2-		19.4-	92.8-	23.3-	64.4a
2	Pasture Masta	10	L/100 L	ABCD	.		21.9-		20.1-	92.3-	22.9-	61.0b
LSD P=.05					.		1.37		1.05	0.90	2.02	3.00
Standard Deviation					.		1.46		1.12	0.66	1.48	2.19
CV					.		6.77		5.68	0.71	6.39	3.5
Bartlett's X2					.		1.976		1.201	5.938	2.361	1.209
P(Bartlett's X2)					.		0.16		0.273	0.015*	0.124	0.272
Skewness					.		-0.4441		0.3663	2.3115*	1.002	1.0651
Kurtosis					.		-0.3875		-0.2916	6.2619*	2.2937	1.661
Treatment F							1.244		1.895	1.328	0.202	5.930
Treatment Prob(F)							0.2794		0.1855	0.2700	0.6606	0.0300

Crop Name				Alfalfa	Alfalfa	Alfalfa	
Crop Variety				Q31	Q31	Q31	
Description				Metabolic Energy	ADF	NDF	
Rating Date				5/3/2019	5/3/2019	5/3/2019	
Rating Type				Metabolic E	ADF	NDF	
Rating Unit				MJ/kg DM	%DM	%DM	
Sample Size							
Number of Subsamples				1	1	1	
Days After First/Last Applic.				503 12	503 12	503 12	
ARM Action Codes							
Trt No.	Treatment Name	Rate	Rate Unit	Appl Code			
					116	117	118
1	Hi-Fert Lucerne Mix	100	kg/ha	A	9.5a	32.5-	37.7-
2	Pasture Masta	10	L/100 L	ABCD	8.9b	34.1-	39.3-
LSD P=.05					0.53	1.99	2.94
Standard Deviation					0.39	1.46	2.15
CV					4.22	4.37	5.6
Bartlett's X2					1.519	2.349	1.776
P(Bartlett's X2)					0.218	0.125	0.183
Skewness					1.1086	-1.4123*	-1.6164*
Kurtosis					1.6515	2.2946	3.1911*
Treatment F					6.019	3.328	1.449
Treatment Prob(F)					0.0290	0.0912	0.2502

Appendix iv. Raw data

2017-2018 Season

Crop Name					Alfalfa	Alfalfa	Alfalfa	Alfalfa	Alfalfa
Crop Variety					Q31	Q31	Q31	Q31	Q31
Description					GreenSeeker	GreenSeeker	GreenSeeker	GreenSeeker	Fresh Wt
Rating Date					22/11/2017	21/12/2017	23/1/2018	20/2/2018	21/11/2017
Rating Type					NDVI	NDVI	NDVI	NDVI	WEIFRE
Rating Unit					INDEX	INDEX	INDEX	INDEX	g
Sample Size					1.0 PLOT	1.0 PLOT	1.0 PLOT	1.0 PLOT	1.0 m2
Number of Subsamples					1	1	1	1	1
Days After First/Last Applic.					35 35	64 21	97 15	125 20	34 34
ARM Action Codes									T1
Trt No.	Treatment Name	Rate	Rate Unit	Appl Code	Plot	29	30	31	32	3
1	Hi-Fert Lucerne Mix	100	kg/ha	A	101	0.82	0.85	0.76	0.86	1824.8
					201	0.81	0.80	0.80	0.84	2248.0
					301	0.81	0.84	0.78	0.84	1569.2
					401	0.79	0.84	0.79	0.85	1566.0
					501	0.81	0.82	0.77	0.85	1664.4
					601	0.79	0.83	0.78	0.84	1426.0
					701	0.80	0.82	0.78	0.83	1438.0
					801	0.79	0.82	0.81	0.84	2061.2
					901	0.80	0.82	0.77	0.83	2377.2
					1001	0.81	0.80	0.80	0.82	1545.2
					Mean =	0.80	0.82	0.78	0.84	1772.0
2	Pasture Masta	10	L/100 L	ABCD	102	0.83	0.84	0.75	0.84	1940.0
					202	0.82	0.85	0.79	0.86	1992.8
					302	0.82	0.84	0.78	0.85	2794.4
					402	0.83	0.85	0.75	0.85	1723.6
					502	0.82	0.84	0.81	0.86	2772.4
					602	0.83	0.84	0.82	0.85	2502.4
					702	0.81	0.84	0.79	0.85	2470.4
					802	0.83	0.84	0.82	0.85	2624.8
					902	0.82	0.85	0.80	0.86	1886.4
					1002	0.82	0.84	0.82	0.85	1715.6
					Mean =	0.82	0.84	0.79	0.85	2242.3

Column 3: T1 = [C1]/(0.5*0.5)
Column 10: T3 = [C8]/(0.4*0.4)
Column 17: T5 = [C15]/(0.4*0.4)
Column 24: T7 = [C22]/(0.4*0.4)
Column 4: T2 = [C2]/(0.5*0.5)
Column 11: T4 = [C9]/(0.4*0.4)
Column 18: T6 = [C16]/(0.4*0.4)
Column 25: T8 = [C23]/(0.4*0.4)
Column 5: T13 = [C4]*10
Column 12: T15 = [C11]*10
Column 19: T17 = [C18]*10
Column 26: T20 = [C25]*10
Column 7: T14 = [C6]*10
Column 14: T16 = [C13]*10
Column 21: T19 = [C20]*10
Column 28: T21 = [C27]*10

Crop Name					Alfalfa	Alfalfa	Alfalfa	Alfalfa	Alfalfa	Alfalfa
Crop Variety					Q31	Q31	Q31	Q31	Q31	Q31
Description					Fresh Wt	Fresh Wt	Fresh Wt	Dry Wt	Dry Wt	Dry Wt
Rating Date					20/12/2017	24/1/2018	20/2/2018	29/11/2017	27/12/2017	29/1/2018
Rating Type					WEIFRE	WEIFRE	WEIFRE	WEIDRY	WEIDRY	WEIDRY
Rating Unit					g	g	g	g	g	g
Sample Size					1.0 m2	1.0 m2	1.0 m2	1.0 m2	1.0 m2	1.0 m2
Number of Subsamples					1	1	1	1	1	1
Days After First/Last Applic.					63 20	98 16	125 20	42 42	70 27	103 21
ARM Action Codes					T3	T5	T7	T2	T4	T6
Trt No.	Treatment Name	Rate	Rate Unit	Appl Code	Plot	10	17	24	4	11	18
1	Hi-Fert Lucerne Mix	100	kg/ha	A	101	1956.3	1643.8	1893.8	440.4	337.5	418.8
					201	2406.3	2250.0	1647.9	570.4	443.8	543.8
					301	2612.5	1912.5	1848.9	425.6	481.3	431.3
					401	1168.8	1393.8	1570.1	432.4	218.8	325.0
					501	2187.5	1375.0	1754.9	437.6	387.5	350.0
					601	1637.5	1550.0	1611.4	394.4	306.3	381.3
					701	2587.5	1418.8	2158.8	387.2	487.5	356.3
					801	1812.5	1818.8	1764.0	531.6	325.0	425.0
					901	2362.5	1762.5	2671.8	606.4	456.3	393.8
					1001	2275.0	1343.8	1515.1	432.4	400.0	293.8
					Mean =	2100.6	1646.9	1843.7	465.8	384.4	391.9
2	Pasture Masta	10	L/100 L	ABCD	102	2775.0	2543.8	2195.3	624.4	443.8	606.3
					202	2543.8	2525.0	1629.8	464.4	443.8	568.8
					302	3637.5	1875.0	1994.8	621.6	625.0	406.3
					402	2956.3	2587.5	2119.5	448.4	475.0	550.0
					502	1506.3	2187.5	2075.0	554.4	287.5	468.8
					602	2037.5	1250.0	2002.4	569.6	362.5	287.5
					702	1668.8	2293.8	2419.0	558.4	293.8	556.3
					802	1431.3	1781.3	2852.8	620.8	262.5	431.3
					902	1850.0	1287.5	2126.4	422.0	337.5	356.3
					1002	2306.3	1418.8	1797.7	458.4	406.3	350.0
					Mean =	2271.3	1975.0	2121.3	534.2	393.8	458.1

Crop Name					Alfalfa	Alfalfa	Alfalfa	Alfalfa	Alfalfa
Crop Variety					Q31	Q31	Q31	Q31	Q31
Description					Dry Wt	Dry Wt	Dry Wt	Dry Wt	Dry Wt
Rating Date					28/2/2018	29/11/2017	27/12/2017	29/1/2018	28/2/2018
Rating Type					WEIDRY	WEIDRY	WEIDRY	WEIDRY	WEIDRY
Rating Unit					g	kg DM/ha	kg DM/ha	kg DM/ha	kg DM/ha
Sample Size					1.0 m2	1 ha	1 ha	1 ha	1 ha
Number of Subsamples					1	1	1	1	1
Days After First/Last Applic.					133 28	42 42	70 27	103 21	133 28
ARM Action Codes					T8	T13	T15	T17	T20
Trt No.	Treatment Name	Rate	Rate Unit	Appl Code	Plot	25	5	12	19	26
1	Hi-Fert Lucerne Mix	100	kg/ha	A	101	310.31	4404.0	3375.0	4187.5	3103.1
					201	298.81	5704.0	4437.5	5437.5	2988.1
					301	315.25	4256.0	4812.5	4312.5	3152.5
					401	250.75	4324.0	2187.5	3250.0	2507.5
					501	293.50	4376.0	3875.0	3500.0	2935.0
					601	258.25	3944.0	3062.5	3812.5	2582.5
					701	377.69	3872.0	4875.0	3562.5	3776.9
					801	301.56	5316.0	3250.0	4250.0	3015.6
					901	461.44	6064.0	4562.5	3937.5	4614.4
					1001	260.81	4324.0	4000.0	2937.5	2608.1
					Mean =	312.84	4658.4	3843.8	3918.8	3128.4
2	Pasture Masta	10	L/100 L	ABCD	102	378.94	6244.0	4437.5	6062.5	3789.4
					202	280.75	4644.0	4437.5	5687.5	2807.5
					302	368.25	6216.0	6250.0	4062.5	3682.5
					402	403.88	4484.0	4750.0	5500.0	4038.8
					502	358.88	5544.0	2875.0	4687.5	3588.8
					602	341.38	5696.0	3625.0	2875.0	3413.8
					702	443.88	5584.0	2937.5	5562.5	4438.8
					802	511.38	6208.0	2625.0	4312.5	5113.8
					902	372.31	4220.0	3375.0	3562.5	3723.1
					1002	346.56	4584.0	4062.5	3500.0	3465.6
					Mean =	380.62	5342.4	3937.5	4581.3	3806.2

Crop Name					Alfalfa	Alfalfa	Alfalfa	Alfalfa
Crop Variety					Q31	Q31	Q31	Q31
Description					DM Production	DM Production	DM Production	DM Production
Rating Date					29/11/2018	27/12/2018	29/1/2018	28/2/2018
Rating Type					WEIDRY	WEIDRY	WEIDRY	WEIDRY
Rating Unit					g/day	g/day	g/day	g/day
Sample Size					1 ha	1 ha	1 ha	1 ha
Number of Subsamples					1	1	1	1
Days After First/Last Applic.					407 9	435 37	103 21	133 28
ARM Action Codes					T14	T16	T19	T21
Trt No.	Treatment Name	Rate	Rate Unit	Appl Code	Plot	7	14	21	28
1	Hi-Fert Lucerne Mix	100	kg/ha	A	101	125.83	78.5	130.9	134.9
					201	162.97	103.2	169.9	129.9
					301	121.60	111.9	134.8	137.1
					401	123.54	50.9	101.6	109.0
					501	125.03	90.1	109.4	127.6
					601	112.69	71.2	119.1	112.3
					701	110.63	113.4	111.3	164.2
					801	151.89	75.6	132.8	131.1
					901	173.26	106.1	123.0	200.6
					1001	123.54	93.0	91.8	113.4
					Mean =	133.10	89.4	122.5	136.0
2	Pasture Masta	10	L/100 L	ABCD	102	178.40	103.2	189.5	164.8
					202	132.69	103.2	177.7	122.1
					302	177.60	145.3	127.0	160.1
					402	128.11	110.5	171.9	175.6
					502	158.40	66.9	146.5	156.0
					602	162.74	84.3	89.8	148.4
					702	159.54	68.3	173.8	193.0
					802	177.37	61.0	134.8	222.3
					902	120.57	78.5	111.3	161.9
					1002	130.97	94.5	109.4	150.7
					Mean =	152.64	91.6	143.2	165.5

Crop Name					Alfalfa	Alfalfa	Alfalfa	Alfalfa	Alfalfa
Crop Variety					Q31	Q31	Q31	Q31	Q31
Description					No. Bales (prespray)	No. Bales	No Bales	No. Bales	No. Bales
Rating Date					13/10/2017	17/11/2017	30/12/2017	31/1/2018	28/2/2018
Rating Type					Per hectare	Per hectare	Per hectare	Per hectare	Per hectare
Rating Unit					NUMBER	NUMBER	NUMBER	NUMBER	NUMBER
Sample Size					1 AREA	1 AREA	1 AREA	1 AREA	1 AREA
Number of Subsamples					1	1	1	1	1
Days After First/Last Applic.					-5 -5	30 30	73 30	105 23	133 28
ARM Action Codes									
Trt No.	Treatment Name	Rate	Rate Unit	Appl Code	Plot	34	35	36	37	38
1	Hi-Fert Lucerne Mix	100	kg/ha	A	101	158	222	106	137	144
					201					
					301					
					401					
					501					
					601					
					701					
					801					
					901					
					1001					
					Mean =	158	222	106	137	144
2	Pasture Masta	10	L/100 L	ABCD	102	168	256	163	158	159
					202					
					302					
					402					
					502					
					602					
					702					
					802					
					902					
					1002					
					Mean =	168	256	163	158	159

Crop Name					Alfalfa		Alfalfa		Alfalfa		Alfalfa		Alfalfa		
Crop Variety					Q31		Q31		Q31		Q31		Q31		
Description					No. Bales		Bale weight		Dry matter		Dry matter		Crude protein		
Rating Date					4/4/2018		4/3/2018		4/1/2018		5/3/2018		4/1/2018		
Rating Type					Per hectare		Per hectare		Dry matter		Dry matter		Crude prote		
Rating Unit					NUMBER		NUMBER		%		%		%DM		
Sample Size					1	AREA	1	AREA							
Number of Subsamples					1		1		1		1		1		
Days After First/Last Applic.					168	63	137	32	78	35	138	33	78	35	
ARM Action Codes															
Trt No.	Treatment Name	Rate	Rate Unit	Appl Code	Plot	39		33		101		107		102	
1	Hi-Fert Lucerne Mix	100	kg/ha	A	101	110		20.7		91.5		81.7		27.4	
					201			21.7		91.6		84.9		27.3	
					301			20.3		91.9		83.5		28.3	
					401			22.1		91.5		78.4		29.4	
					501			21.9		91.8		81.7		28.9	
					601			23.0							
					701			23.4							
					801			20.6							
					901			21.9							
					1001			20.3							
					Mean =	110		21.6		91.7		82.0		28.3	
2	Pasture Masta	10	L/100 L	ABCD	102	116		24.1		91.9		84.5		27.0	
					202			24.9		91.5		77.8		27.5	
					302			24.5		91.7		85.1		29.2	
					402			23.0		91.8		85.6		28.7	
					502			22.0		91.8		86.3		28.5	
					602			22.0							
					702			23.4							
					802			23.9							
					902			24.1							
					1002			23.0							
					Mean =	116		23.5		91.7		83.9		28.2	

Crop Name					Alfalfa		Alfalfa		Alfalfa		Alfalfa		Alfalfa		
Crop Variety					Q31		Q31		Q31		Q31		Q31		
Description					Crude protein		Digestibility		Digestibility		Metabolic Energy				
Rating Date					5/3/2018		4/1/2018		5/3/2018		4/1/2018				
Rating Type					Crude prote		Digestibili		Digestibili		Metabolic E				
Rating Unit					%DM		%DM		%DM		MJ/kg DM				
Sample Size															
Number of Subsamples					1		1		1		1				
Days After First/Last Applic.					138	33	78	35	138	33	78	35			
ARM Action Codes															
Trt No.	Treatment Name	Rate	Rate Unit	Appl Code	Plot	108		103		109		104			
1	Hi-Fert Lucerne Mix	100	kg/ha	A	101	32.4		72.0		77.3		10.8			
					201	34.4		73.8		80.6		11.1			
					301	33.7		74.8		78.8		11.2			
					401	29.6		78.0		74.9		11.8			
					501	31.3		77.4		76.3		11.7			
					601										
					701										
					801										
					901										
					1001										
					Mean =	32.3		75.2		77.6		11.3			
2	Pasture Masta	10	L/100 L	ABCD	102	31.8		72.4		77.2		10.8			
					202	27.4		74.7		71.2		11.2			
					302	30.2		76.5		76.8		11.5			
					402	29.7		76.7		75.0		11.6			
					502	30.6		75.7		74.3		11.4			
					602										
					702										
					802										
					902										
					1002										
					Mean =	29.9		75.2		74.9		11.3			

Crop Name					Alfalfa	Alfalfa	Alfalfa	Alfalfa	Alfalfa
Crop Variety					Q31	Q31	Q31	Q31	Q31
Description					Metabolic Energy	ADF	ADF	NDF	NDF
Rating Date					5/3/2018	4/1/2018	5/3/2018	4/1/2018	5/3/2018
Rating Type					Metabolic E	CHO	ADF		NDF
Rating Unit					MJ/kg DM	%DM	%DM	%DM	%DM
Sample Size									
Number of Subsamples					1	1	1	1	1
Days After First/Last Applic.					138 33	78 35	138 33	78 35	138 33
ARM Action Codes									
Trt No.	Treatment Name	Rate	Rate Unit	Appl Code	Plot	110	105	111	106	112
1	Hi-Fert Lucerne Mix	100	kg/ha	A	101	11.7	30.1	23.1	30.5	29.7
					201	12.2	28.3	20.4	31.6	27.6
					301	11.9	27.4	20.3	29.6	26.1
					401	11.3	25.9	25.9	27.8	34.7
					501	11.5	25.7	22.3	28.4	30.5
					601					
					701					
					801					
					901					
					1001					
					Mean =	11.7	27.5	22.4	29.6	29.7
2	Pasture Masta	10	L/100 L	ABCD	102	11.7	29.8	21.1	32.1	29.6
					202	10.6	27.5	27.3	27.9	37.5
					302	11.6	25.6	22.6	28.8	30.7
					402	11.3	26.4	25.2	29.1	36.8
					502	11.2	27.5	24.1	29.7	33.2
					602					
					702					
					802					
					902					
					1002					
					Mean =	11.3	27.4	24.1	29.5	33.6

2018-2019 Season

Trt No.	Treatment Name	Rate	Rate Unit	Appl Code	Plot	87	88	89	90	49
	Crop Name					Alfalfa	Alfalfa	Alfalfa	Alfalfa	Alfalfa
	Crop Variety					Q31	Q31	Q31	Q31	Q31
	Description					GreenSeeker	GreenSeeker	GreenSeeker	GreenSeeker	Fresh Wt
	Rating Date					2/11/2018	17/11/2018	11/1/2019	15/3/2019	2/11/2018
	Rating Type					NDVI	NDVI	NDVI	NDVI	WEIFRE
	Rating Unit					INDEX	INDEX	INDEX	INDEX	g
	Sample Size					1 PLOT	1 PLOT	1 PLOT	1 PLOT	0.16 m2
	Number of Subsamples					1	1	1	1	1
	Days After First/Last Applic.					380 15	395 30	450 11	513 22	380 15
	ARM Action Codes									
1	Hi-Fert Lucerne Mix	100	kg/ha	A	101	0.9	0.9	0.8	0.8	537.0
					201	0.8	0.9	0.8	0.8	486.0
					301	0.9	0.9	0.8	0.8	465.0
					401	0.9	0.8	0.8	0.8	295.0
					501	0.9	0.9	0.8	0.8	374.0
					601	0.9	0.8	0.8	0.8	320.0
					701	0.9	0.8	0.8	0.8	264.0
					801	0.9	0.9	0.8	0.8	323.0
					901	0.9		0.8	0.8	399.0
					1001	0.8		0.8	0.8	419.0
					Mean =	0.9	0.8	0.8	0.8	388.2
2	Pasture Masta	10	L/100 L	ABCD	102	0.9	0.8	0.8	0.8	358.0
					202	0.9	0.8	0.8	0.8	325.0
					302	0.9	0.9	0.8	0.8	289.0
					402	0.9	0.9	0.8	0.8	539.0
					502	0.9	0.8	0.8	0.8	320.0
					602	0.9	0.8	0.8	0.9	462.0
					702	0.9	0.9	0.8	0.8	335.0
					802	0.9	0.9	0.8	0.8	485.0
					902	0.9		0.8	0.8	369.0
					1002	0.9		0.8	0.8	302.0
					Mean =	0.9	0.8	0.8	0.8	378.4

Column 58: TL[57] = LOG([57]+ 1)
Column 53: T25 = [C52]*10
Column 61: T27 = [C60]*10
Column 62: TL[61] = LOG([61]+ 1)
Column 69: T30 = [C68]*10
Column 75: T31 = [C74]*10
Column 82: T47 = [C81]*10
Column 55: T33 = [C54]*10
Column 64: T36 = [C63]*10
Column 71: T38 = [C70]*10
Column 77: T46 = [C76]*10
Column 84: T49 = [C83]*10

Crop Name					Alfalfa	Alfalfa	Alfalfa	Alfalfa	Alfalfa	Alfalfa
Crop Variety					Q31	Q31	Q31	Q31	Q31	Q31
Description					Fresh Wt	Fresh Wt	Fresh Wt	Fresh Wt	Dry Wt	Dry Wt
Rating Date					17/12/2018	11/1/2019	14/2/2019	15/3/2019	12/11/2018	3/1/2019
Rating Type					WEIFRE	WEIFRE	WEIFRE	WEIFRE	WEIDRY	WEIDRY
Rating Unit					g	g	g	g	g	g
Sample Size					0.16 m2	0.16 m2	1.0 m2	0.16 m2	0.16 m2	0.16 m2
Number of Subsamples					1	1	1	1	1	1
Days After First/Last Applic.					425 27	450 11	484 13	513 22	390 25	442 3
ARM Action Codes										
Trt No.	Treatment Name	Rate	Rate Unit	Appl Code	Plot	56	65	73	78	50	57
1	Hi-Fert Lucerne Mix	100	kg/ha	A	101	415.5	224.5	1325.0	295.7	100.0	76.4
					201	441.8	287.9	1130.0	336.2	85.0	73.7
					301	377.6	319.3	1470.0	367.4	86.0	67.9
					401	339.3	164.4	1480.0	292.5	53.0	57.1
					501	374.5	401.7	1330.0	240.4	66.0	64.8
					601	327.5	223.9	1565.0	265.1	58.0	58.6
					701	324.0	236.3	1350.0	314.7	41.0	55.8
					801	369.5	354.0	1230.0	315.4	56.0	62.3
					901	440.7	212.2	1210.0	257.5	73.0	78.9
					1001	272.1	234.6	1450.0	372.7	71.0	50.4
					Mean =	368.2	265.9	1354.0	305.8	68.9	64.6
2	Pasture Masta	10	L/100 L	ABCD	102	351.6	287.1	1435.0	284.6	66.0	68.1
					202	362.4	266.9	990.0	253.5	64.0	62.8
					302	342.5	323.1	1285.0	335.0	61.0	60.9
					402	342.0	301.4	1580.0	287.9	84.0	50.8
					502	389.8	356.3	1790.0	323.3	58.0	66.5
					602	439.4	216.8	1695.0	454.2	87.0	74.8
					702	422.4	283.5	1550.0	345.4	68.0	76.3
					802	395.1	291.2	1220.0	336.9	102.0	64.3
					902	371.6	207.9	1890.0	402.2	67.0	66.0
					1002	643.0	266.7	1535.0	403.3	58.0	104.2
					Mean =	406.0	280.1	1497.0	342.6	71.5	69.5

Crop Name					Alfalfa	Alfalfa	Alfalfa	Alfalfa	Alfalfa	Alfalfa
Crop Variety					Q31	Q31	Q31	Q31	Q31	Q31
Description					Dry Wt	Dry Wt	Dry Wt	Dry Wt	Dry Wt	Dry Wt
Rating Date					3/1/2019	15/1/2019	27/2/2019	22/3/2019	12/11/2018	3/1/2019
Rating Type					WEIDRY	WEIDRY	WEIDRY	WEIDRY	WEIDRY	WEIDRY
Rating Unit					g	g	g	g	kg DM/ha	kg DM/ha
Sample Size					0.16 m2	0.16 m2	1.0 m2	0.16 m2	1 ha	1 ha
Number of Subsamples					1	1	1	1	1	1
Days After First/Last Applic.					442 3	454 15	497 6	520 29	390 25	442 3
ARM Action Codes					TL[57]				T25	T27
Trt No.	Treatment Name	Rate	Rate Unit	Appl Code	Plot	58	66	74	79	53	61
1	Hi-Fert Lucerne Mix	100	kg/ha	A	101	1.89	40.9	305.0	45.3	6250.0	4775.6
					201	1.87	56.6	260.0	47.6	5312.5	4605.6
					301	1.84	64.0	330.0	51.4	5375.0	4244.4
					401	1.76	29.7	335.0	42.7	3312.5	3570.0
					501	1.82	87.7	300.0	45.2	4125.0	4051.9
					601	1.78	45.7	345.0	45.1	3625.0	3665.0
					701	1.75	44.5	320.0	51.4	2562.5	3487.5
					801	1.80	71.2	295.0	55.7	3500.0	3893.1
					901	1.90	47.0	265.0	49.6	4562.5	4933.1
					1001	1.71	45.7	330.0	63.8	4437.5	3149.4
					Mean =	1.81	53.3	308.5	49.8	4306.3	4037.6
2	Pasture Masta	10	L/100 L	ABCD	102	1.84	60.1	285.0	52.9	4125.0	4258.8
					202	1.80	54.5	240.0	45.8	4000.0	3924.4
					302	1.79	59.9	220.0	59.7	3812.5	3808.1
					402	1.71	56.0	310.0	56.4	5250.0	3173.1
					502	1.83	74.0	360.0	72.3	3625.0	4158.1
					602	1.88	38.2	350.0	81.0	5437.5	4671.9
					702	1.89	55.5	320.0	60.2	4250.0	4769.4
					802	1.82	56.8	255.0	66.9	6375.0	4020.0
					902	1.83	37.0	385.0	66.2	4187.5	4122.5
					1002	2.02	50.9	320.0	82.4	3625.0	6513.1
					Mean =	1.84	54.3	304.5	64.4	4468.8	4341.9

Crop Name					Alfalfa	Alfalfa	Alfalfa	Alfalfa	Alfalfa
Crop Variety					Q31	Q31	Q31	Q31	Q31
Description					Dry Wt	Dry Wt	Dry Wt	Dry Wt	DM Production
Rating Date					3/1/2019	15/1/2019	27/2/2019	22/3/2018	12/11/2018
Rating Type					WEIDRY	WEIDRY	WEIDRY	WEIDRY	WEIDRY
Rating Unit					kg DM/ha	kg DM/ha	kg DM/ha	kg DM/ha	g/day
Sample Size					1 ha	1 ha	1 ha	1 ha	1 ha
Number of Subsamples					1	1	1	1	1
Days After First/Last Applic.					442 3	454 15	497 6	155 50	390 25
ARM Action Codes					TL[61]	T30	T31	T47	T33
Trt No.	Treatment Name	Rate	Rate Unit	Appl Code	Plot	62	69	75	82	55
1	Hi-Fert Lucerne Mix	100	kg/ha	A	101	3.68	2556.3	3050.0	2828.8	156.3
					201	3.66	3535.0	2600.0	2971.9	132.8
					301	3.63	3996.9	3300.0	3210.6	134.4
					401	3.55	1856.3	3350.0	2666.3	82.8
					501	3.61	5481.9	3000.0	2824.4	103.1
					601	3.56	2853.1	3450.0	2816.3	90.6
					701	3.54	2781.3	3200.0	3212.5	64.1
					801	3.59	4448.8	2950.0	3480.0	87.5
					901	3.69	2934.4	2650.0	3098.8	114.1
					1001	3.50	2858.1	3300.0	3988.8	110.9
					Mean =	3.60	3330.2	3085.0	3109.8	107.7
2	Pasture Masta	10	L/100 L	ABCD	102	3.63	3755.6	2850.0	3304.4	103.1
					202	3.59	3407.5	2400.0	2865.0	100.0
					302	3.58	3742.5	2200.0	3731.9	95.3
					402	3.50	3500.0	3100.0	3525.0	131.3
					502	3.62	4625.6	3600.0	4518.1	90.6
					602	3.67	2385.0	3500.0	5063.1	135.9
					702	3.68	3468.1	3200.0	3759.4	106.3
					802	3.60	3550.6	2550.0	4182.5	159.4
					902	3.62	2313.1	3850.0	4135.0	104.7
					1002	3.81	3181.3	3200.0	5149.4	90.6
					Mean =	3.63	3392.9	3045.0	4023.4	111.7

Crop Name					Alfalfa	Alfalfa	Alfalfa	Alfalfa
Crop Variety					Q31	Q31	Q31	Q31
Description					DM Production	DM Production	DM Production	DM Production
Rating Date					3/1/2019	15/1/2019	27/2/2019	22/3/2018
Rating Type					WEIDRY	WEIDRY	WEIDRY	WEIDRY
Rating Unit					g/day	g/day	g/day	g/day
Sample Size					1 ha	1 ha	1 ha	1 ha
Number of Subsamples					1	1	1	1
Days After First/Last Applic.					442 3	454 15	497 6	155 50
ARM Action Codes					T36	T38	T46	T49
Trt No.	Treatment Name	Rate	Rate Unit	Appl Code	Plot	64	71	77	84
1	Hi-Fert Lucerne Mix	100	kg/ha	A	101	140.5	88.1	101.7	97.5
					201	135.5	121.9	86.7	102.5
					301	124.8	137.8	110.0	110.7
					401	105.0	64.0	111.7	91.9
					501	119.2	189.0	100.0	97.4
					601	107.8	98.4	115.0	97.1
					701	102.6	95.9	106.7	110.8
					801	114.5	153.4	98.3	120.0
					901	145.1	101.2	88.3	106.9
					1001	92.6	98.6	110.0	137.5
					Mean =	118.8	114.8	102.8	107.2
2	Pasture Masta	10	L/100 L	ABCD	102	125.3	129.5	95.0	113.9
					202	115.4	117.5	80.0	98.8
					302	112.0	129.1	73.3	128.7
					402	93.3	120.7	103.3	121.6
					502	122.3	159.5	120.0	155.8
					602	137.4	82.2	116.7	174.6
					702	140.3	119.6	106.7	129.6
					802	118.2	122.4	85.0	144.2
					902	121.3	79.8	128.3	142.6
					1002	191.6	109.7	106.7	177.6
					Mean =	127.7	117.0	101.5	138.7

Crop Name					Alfalfa	Alfalfa	Alfalfa	Alfalfa	Alfalfa
Crop Variety					Q31	Q31	Q31	Q31	Q31
Description					No. Bales	No. Bales	No. Bales	No. Bales	No. Bales
Rating Date					19/11/2018	22/12/2017	22/1/2019	20/2/2019	22/3/2019
Rating Type					Per hectare	Per hectare	Per hectare	Per hectare	Per hectare
Rating Unit					NUMBER	NUMBER	NUMBER	NUMBER	NUMBER
Sample Size					1 AREA	1 AREA	1 AREA	1 AREA	1 AREA
Number of Subsamples					1	1	1	1	1
Days After First/Last Applic.					397 32	65 22	461 22	490 19	520 29
ARM Action Codes									
Trt No.	Treatment Name	Rate	Rate Unit	Appl Code	Plot	91	92	93	94	95
1	Hi-Fert Lucerne Mix	100	kg/ha	A	101	222.4	216.6	159.8	173.9	153.7
					201					
					301					
					401					
					501					
					601					
					701					
					801					
					901					
					1001					
					Mean =	222.4	216.6	159.8	173.9	153.7
2	Pasture Masta	10	L/100 L	ABCD	102	255.7	230.7	171.4	171.4	128.6
					202					
					302					
					402					
					502					
					602					
					702					
					802					
					902					
					1002					
					Mean =	255.7	230.7	171.4	171.4	128.6

Crop Name					Alfalfa	Alfalfa	Alfalfa	Alfalfa	Alfalfa
Crop Variety					Q31	Q31	Q31	Q31	Q31
Description					Yield difference	Bale Weight	Bale Weight	Dry matter	Crude protein
Rating Date					13/11/2018	20/2/2019	22/3/2019	5/3/2019	5/3/2019
Rating Type						kg	kg	Dry matter	Crude prote
Rating Unit					%	kg	kg	%	%DM
Sample Size						1 AREA	1 AREA		
Number of Subsamples					1	1	1	1	1
Days After First/Last Applic.					391 26	490 19	520 29	503 12	503 12
ARM Action Codes									
Trt No.	Treatment Name	Rate	Rate Unit	Appl Code	Plot	96	85	86	113	114
1	Hi-Fert Lucerne Mix	100	kg/ha	A	101	15.0	19.8	19.5	94.7	22.5
					201		20.1	18.8	92.2	23.8
					301		18.3	21.1	92.4	22.9
					401		21.8	19.3	91.7	27.1
					501		19.6	17.7	92.8	20.4
					601		22.7	19.3		
					701		23.9	19.2		
					801		21.9	19.8		
					901		20.9	20.3		
					1001		23.1	19.2		
					Mean =	15.0	21.2	19.4	92.8	23.3
2	Pasture Masta	10	L/100 L	ABCD	102		21.8	21.6	92.2	23.0
					202		20.8	20.5	92.1	21.8
					302		23.2	20.9	92.0	24.5
					402		22.9	22.1	92.7	22.1
					502		22.9	20.0	92.4	23.2
					602		21.7	18.7		
					702		21.4	19.5		
					802		20.1	18.3		
					902		23.2	18.7		
					1002		21.3	20.6		
					Mean =	.	21.9	20.1	92.3	22.9

Crop Name					Alfalfa	Alfalfa	Alfalfa	Alfalfa
Crop Variety					Q31	Q31	Q31	Q31
Description					Digestibility	Metabolic Energy	ADF	NDF
Rating Date					5/3/2019	5/3/2019	5/3/2019	5/3/2019
Rating Type					Digestibili	Metabolic E	ADF	NDF
Rating Unit					%DM	MJ/kg DM	%DM	%DM
Sample Size								
Number of Subsamples					1	1	1	1
Days After First/Last Applic.					503 12	503 12	503 12	503 12
ARM Action Codes								
Trt No.	Treatment Name	Rate	Rate Unit	Appl Code	Plot	115	116	117	118
1	Hi-Fert Lucerne Mix	100	kg/ha	A	101	65.0	9.6	31.7	38.6
					201	63.5	9.3	32.7	37.3
					301	63.5	9.3	34.1	39.2
					401	69.7	10.4	28.8	32.0
					501	60.2	8.7	35.0	41.3
					601				
					701				
					801				
					901				
					1001				
					Mean =	64.4	9.5	32.5	37.7
2	Pasture Masta	10	L/100 L	ABCD	102	61.9	9.0	33.4	39.5
					202	59.0	8.5	35.1	40.9
					302	63.6	9.3	32.8	36.6
					402	59.2	8.6	35.2	40.6
					502	61.3	8.9	34.2	39.0
					602				
					702				
					802				
					902				
					1002				
					Mean =	61.0	8.9	34.1	39.3

Appendix v. Meteorological details

Temperature & Rainfall

	October 2017			November 2017			December 2017			January 2018		
	Min ºC	Max ºC	mm	Min ºC	Max ºC	mm	Min ºC	Max ºC	mm	Min ºC	Max ºC	mm
1	4.4	17.2	0.0	7.5	20.7	0.0	14.0	19.7	0.0	15.8	25.6	0.0
2	4.7	22.3	0.0	8.5	21.9	0.0	12.4	20.2	0.2	14.7	24.2	0.2
3	6.0	27.4	0.0	12.4	19.1	0.0	13.3	22.0	0.0	16.9	25.1	0.0
4	14.1	31.0	0.0	9.1	22.0	0.0	8.6	22.2	0.0	12.2	31.5	0.0
5	13.6	19.2	2.8	12.0	25.9	0.0	12.3	23.4	0.0	14.8	37.6	0.0
6	5.4	19.5	0.0	11.4	21.1	0.8	10.1	20.0	0.0	25.3	43.3	0.0
7	11.4	29.3	1.4	12.0	21.5	0.0	11.5	21.2	0.4	18.0	28.5	0.0
8	12.8	27.3	0.2	11.3	25.6	0.0	9.8	24.7	0.0	17.1	27.3	0.0
9	9.4	19.0	0.0	10.5	31.2	0.0	11.1	29.9	0.0	12.6	27.8	0.0
10	5.6	26.4	0.0	22.3	34.3	0.0	11.9	30.4	0.0	13.5	29.1	0.0
11	14.7	25.7	0.0	25.9	32.1	0.0	11.5	38.0	0.0	17.3	36.4	0.0
12	10.9	18.4	8.6	17.7	35.3	0.0	25.7	42.6	0.0	22.2	22.9	5.0
13	8.3	19.4	0.0	22.2	36.3	0.0	18.4	24.4	0.0	17.2	23.3	0.6
14	6.2	21.6	0.0	18.4	36.6	0.0	11.8	26.9	0.0	14.2	27.0	1.0
15	8.6	25.0	0.0	18.2	20.0	2.4	11.9	26.7	0.0	14.0	30.4	0.0
16	10.1	32.7	0.0	13.0	19.5	4.2	13.6	34.6	0.0	16.1	31.8	0.0
17	20.3	33.6	0.0	13.2	17.7	1.0	25.4	35.5	0.0	15.2	38.8	0.0
18	22.0	34.4	0.0	12.5	23.9	4.6	21.0	28.9	8.2	21.4	41.8	0.0
19	16.9	19.7	1.2	11.8	32.4	0.0	16.2	23.2	0.2	21.2	44.2	0.0
20	7.9	21.0	0.0	23.6	35.4	0.0	10.9	24.7	0.0	22.6	39.5	0.0
21	7.3	19.3	0.0	25.0	36.7	0.0	12.3	32.6	0.0	22.0	38.5	0.0
22	9.7	19.1	0.0	24.6	35.8	0.0	14.2	38.9	0.0	21.8	30.9	0.6
23	7.2	25.5	0.0	17.5	25.8	3.8	16.8	26.1	0.0	13.3	31.8	0.0
24	12.1	26.5	0.0	15.3	27.9	1.0	13.9	30.6	0.0	12.4	32.9	0.0
25	13.4	23.2	5.0	15.5	27.0	0.4	17.7	34.8	0.0	15.6	34.2	0.0
26	14.0	20.7	0.2	15.1	23.8	0.0	25.0	40.1	0.0	18.3	33.1	0.0
27	9.4	34.4	0.2	12.0	28.9	0.0	21.6	27.5	0.0	19.6	39.2	0.2
28	8.8	23.6	0.0	13.7	35.6	0.0	19.3	24.8	0.0	24.5	43.6	0.0
29	11.4	30.2	0.0	19.8	39.3	0.0	17.0	24.7	0.0	24.0	28.2	0.0
30	8.2	17.3	2.0	20.7	34.4	0.0	12.7	25.2	0.0	16.8	22.8	3.2
31	5.7	20.1	4.0				12.7	25.2	0.0	14.7	22.4	0.0
Total			**25.6**			**18.2**			**9.0**			**10.8**

The trial site was situated at Virginia, approximately 6.03 km from Edinburgh AWS weather station, BOM Station No. 023083.

	February 2018			March 2018			April 2018			May 2018		
	Min ºC	Max ºC	mm	Min ºC	Max ºC	mm	Min ºC	Max ºC	mm	Min ºC	Max ºC	mm
1	14.1	25.6	0.0	14.8	29.9	0.0	12.8	27.8	0.0	9.7	24.5	0.0
2	15.8	30.8	0.0	18.2	33.0	0.0	13.8	22.5	0.0	11.4	28.0	0.0
3	19.4	33.7	0.0	14.9	26.8	0.0	10.8	23.3	0.0	16.2	17.2	3.0
4	18.0	35.6	0.0	12.8	24.3	0.0	8.3	26.6	0.0	9.3	18.8	14.8
5	18.7	37.0	0.0	10.3	24.5	0.0	8.8	24.1	0.0	9.7	20.0	0.0
6	21.5	36.2	0.0	13.7	27.1	0.0	8.0	26.4	0.0	8.5	22.9	0.0
7	22.6	0.0	0.0	16.9	34.8	0.0	11.4	31.7	0.0	11.3	22.5	0.0
8	22.1	39.9	0.0	21.6	34.6	0.0	15.5	36.5	0.0	7.2	19.2	0.2
9	28.1	41.0	0.0	22.8	36.1	0.0	18.9	37.9	0.0	7.2	18.2	0.0
10	24.8	33.1	0.0	19.3	36.1	0.0	19.1	37.6	0.0	9.3	16.2	5.4
11	13.9	24.8	0.0	16.5	33.6	0.0	17.4	38.2	0.0	8.2	16.3	1.6
12	13.2	24.6	0.0	13.5	26.9	0.0	15.5	24.3	0.0	7.6	18.0	0.0
13	11.7	29.7	0.0	9.8	25.8	0.0	11.3	25.0	0.0	8.3	19.4	0.0
14	18.3	25.0	0.0	10.7	25.3	0.0	14.3	19.0	3.2	3.6	16.1	0.0
15	10.9	24.1	0.0	10.7	24.5	0.0	15.0	19.8	2.8	9.9	17.7	0.0
16	15.5	25.7	0.0	13.0	27.4	0.0	16.7	19.8	1.4	2.7	16.7	0.0
17	13.3	28.7	0.0	17.7	33.0	4.2	11.9	22.0	0.0	8.4	15.2	0.2
18	17.1	28.4	0.0	16.0	21.7	1.0	13.3	27.0	0.0	12.3	17.8	4.2
19	17.7	30.1	1.8	13.3	23.3	0.0	14.7	30.7	0.0	11.2	18.1	11.0
20	18.9	35.1	0.2	15.7	23.1	0.0	18.9	31.8	0.0	8.2	15.9	0.2
21	23.2	32.8	0.0	11.5	22.7	0.0	17.4	31.0	1.6	11.0	16.1	0.0
22	22.9	32.9	0.0	11.6	30.0	0.0	12.4	32.2	0.0	12.7	16.7	0.0
23	24.6	36.8	0.0	18.3	33.7	0.0	16.5	33.4	0.0	12.5	16.4	0.0
24	19.9	26.4	0.0	20.2	36.0	0.0	18.7	22.8	0.0	10.0	15.4	0.2
25	16.8	24.9	0.2	17.2	23.4	0.6	12.0	23.1	1.0	10.2	19.9	0.0
26	8.9	26.0	0.0	12.6	20.0	0.4	10.4	21.7	0.0	13.8	25.2	0.0
27	13.1	35.9	0.0	10.9	30.4	0.0	8.6	24.7	0.0	15.0	19.1	0.0
28	18.3	25.1	0.0	15.6	23.4	0.0	7.4	23.8	0.0	13.3	23.7	0.8
29				12.0	23.5	0.0	11.3	23.3	0.0	11.0	16.4	1.0
30				12.6	23.0	0.0	6.8	24.9	0.0	5.0	17.2	2.4
31				9.6	0.0	0.0				7.1	18.8	0.0
Total			**2.2**			**6.2**			**10.0**			**45.0**

	June 2018			July 2018			August 2018			September 2018		
	Min ºC	Max ºC	mm	Min ºC	Max ºC	mm	Min ºC	Max ºC	mm	Min ºC	Max ºC	mm
1	2.9	18.8	0.0	1.6	15.3	0.0	8.9	17.7	0.2	10.3	15.8	6.2
2	5.6	19.2	0.0	3.2	16.4	0.0	9.1	23.8	0.2	6.9	15.1	0.4
3	2.1	18.2	0.0	6.6	19.3	0.0	9.0	13.8	15.8	1.4	15.5	0.0
4	7.0	16.2	0.0	8.0	19.1	0.0	9.0	18.9	4.0	0.5	17.8	0.0
5	2.1	17.8	0.0	13.2	20.3	0.2	9.9	16.3	0.0	5.2	21.6	0.0
6	2.8	19.0	0.0	8.4	14.5	6.2	7.7	13.1	9.4	8.8	16.5	0.0
7	10.2	19.4	0.0	8.3	14.2	3.2	5.0	14.6	2.6	3.6	16.1	0.0
8	11.4	14.5	1.8	11.0	15.6	0.0	9.0	15.9	2.0	5.7	18.9	0.0
9	9.2	18.6	0.2	6.9	13.3	0.0	8.0	19.5	0.0	6.1	20.1	0.0
10	5.6	19.3	0.0	2.5	14.6	0.0	11.0	18.5	0.0	5.4	26.2	0.0
11	13.2	22.3	0.0	2.3	14.3	0.4	6.1	12.4	10.6	11.9	26.1	0.0
12	12.1	16.4	1.2	6.9	14.4	2.6	5.0	15.0	1.2	5.6	16.6	0.8
13	8.4	16.2	1.4	4.8	14.5	0.0	8.7	14.9	0.6	5.3	20.2	0.0
14	8.8	16.6	4.2	3.7	17.3	0.2	6.0	18.3	0.0	9.5	29.3	0.0
15	9.9	15.1	2.4	5.1	17.3	0.0	10.3	17.5	0.2	7.2	14.5	3.4
16	8.7	13.7	2.6	8.6	17.1	0.2	4.4	14.3	0.2	2.8	15.7	1.2
17	5.7	14.1	10.8	9.1	15.3	0.0	5.3	17.1	0.2	4.2	23.1	0.0
18	3.6	12.6	0.2	5.2	18.1	1.8	7.2	14.1	5.8	8.6	18.1	0.0
19	4.7	13.3	0.0	6.4	12.1	0.0	8.4	14.3	0.2	6.3	15.3	1.6
20	6.0	15.2	0.0	4.3	13.3	5.8	3.6	12.4	0.0	8.8	16.7	6.2
21	2.4	16.0	0.0	5.6	15.3	0.0	6.1	15.2	0.0	6.2	20.0	0.0
22	2.1	16.0	0.0	7.4	17.9	0.0	5.4	20.9	0.0	7.5	22.8	0.2
23	2.5	16.1	0.0	10.8	20.2	0.0	12.4	19.1	0.0	5.0	20.5	0.0
24	3.5	14.5	0.0	9.1	18.6	2.2	13.7	20.2	0.0	7.9	18.2	0.0
25	3.8	13.5	0.0	10.0	16.9	0.8	2.5	18.6	0.0	4.1	19.0	0.0
26	-0.2	13.0	0.0	7.8	20.3	0.2	2.6	16.2	0.0	9.1	26.1	0.0
27	1.1	13.0	0.0	12.3	21.5	0.0	5.4	16.1	0.0	7.5	18.9	0.0
28	0.3	15.1	0.0	5.0	17.5	0.0	8.9	19.4	0.0	8.6	16.7	0.6
29	5.7	15.3	0.0	9.0	14.6	0.4	12.8	26.1	0.0	1.9	16.6	0.0
30	4.4	14.5	1.4	6.4	17.5	0.0	16.1	20.0	0.0	3.7		0.0
31				8.9		0.6	8.7	15.8	4.6			
Total			**26.2**			**24.8**			**57.8**			**20.6**

	October 2018			November 2018			December 2018		
	Min ºC	Max ºC	mm	Min ºC	Max ºC	mm	Min ºC	Max ºC	mm
1	14.4	26.5		24.4	35.7	0.0	17.3	35.0	0.0
2	14.9	31.9	0.0	19.5	25.9	3.6	13.6	20.9	1.4
3	13.8	19.4	4.6	14.4	21.6	0.2	14.5	22.8	0.0
4	11.4	17.3	0.0	11.5	29.7	0.0	12.0	28.4	0.0
5	8.6	18.9	0.0	16.9	26.2	4.6	15.7	34.7	0.0
6	7.1	23.9	0.0	16.1	20.6	3.6	21.6	39.2	0.0
7	12.0	30.2	0.0	9.4	17.9	2.4	23.9	41.3	0.0
8	18.1	30.2	0.0	7.1	19.8	0.6	19.2	24.9	0.0
9	12.8	17.0	0.0	7.6	24.6	0.0	16.0	30.5	0.2
10	9.5	19.3	0.4	8.4	26.5	0.0	12.1	29.5	0.0
11	5.8	22.9	0.0	10.3	32.0	0.0	13.9	35.0	0.0
12	13.6	26.7	0.0	21.6	36.0	0.0	19.7	34.2	0.0
13	14.3	30.1	0.0	19.3	24.3	0.0	14.2	18.2	4.0
14	19.3	31.4	0.0	15.6	22.9	0.0	11.9	24.1	5.6
15	18.6	27.3	5.0	10.9	23.1	0.0	13.8	25.5	0.2
16	13.5	18.9	0.2	8.4	23.4	0.0	16.8	23.7	1.4
17	12.4	15.6	5.2	10.8	26.7	0.0	16.1	29.2	0.0
18	11.5	21.5	1.4	14.1	32.0	0.0	19.5	30.1	0.0
19	12.0	30.4	0.2	21.6	37.3	0.0	22.4	36.9	0.0
20	12.2	19.1	0.6	15.5	19.8	0.0	17.6	26.7	0.0
21	6.4	24.0	0.0	11.6	17.5	8.8	13.8	23.1	0.0
22	14.0	30.9	0.0	9.7	17.8	13.2	10.1	23.9	0.0
23	11.4	19.7	0.0	10.4	19.0	1.0	8.8	30.4	0.0
24	6.5	23.4	0.0	6.7	20.7	0.0	14.0	36.4	0.0
25	8.9	24.6	0.0	10.4	23.0	9.4	15.3	37.5	0.0
26	6.7	24.2	0.0	8.7	23.9	0.0	16.6	40.1	0.0
27	7.4	24.2	0.0	13.3	19.6	1.2	18.7	43.9	0.0
28	12.5	22.7	0.0	13.5	21.2	1.6	25.2	36.7	0.0
29	5.8	24.6	0.0	8.9	22.3	0.0	21.4	30.8	0.4
30	7.3	29.2	0.0	9.1	30.2	0.0	18.3	30.2	0.0
31	11.3	36.0	0.0				15.5	30.1	0.0
Total			**17.6**			**50.2**			**13.2**

	January 2019			February 2019			March 2019		
	Min ºC	Max ºC	mm	Min ºC	Max ºC	mm	Min ºC	Max ºC	mm
1	12.3	32.9	0.0	14.2	30.8	0.0	20.2	42.3	0.0
2	15.0	34.7	0.0	13.1	38.4	0.0	27.5	40.5	0.0
3	18.4	41.8	0.0	21.3	40.9	0.0	19.8	33.1	0.0
4	25.7	27.2	0.0	18.8	28.5	0.0	17.6	32.2	0.0
5	17.0	24.0	0.0	16.1	32.2	0.0	15.7	24.6	0.0
6	12.0	26.7	0.0	18.8	31.6	0.4	15.6	21.9	0.2
7	12.1	29.1	0.0	18.5	32.1	0.4	9.9	26.5	0.0
8	12.5	25.4	0.0	18.3	24.7	0.0	14.7	29.4	0.0
9	13.9	26.8	0.0	16.8	23.5	0.0	17.7	28.9	0.0
10	14.1	31.7	0.0	14.6	23.8	0.8	17.0	26.9	0.0
11	15.6	38.9	0.0	17.3	26.5	0.0	19.0	25.0	0.0
12	23.1	36.0	0.0	16.9	21.6	0.0	17.4	22.1	0.0
13	12.9	34.6	0.0	13.4	22.8	0.2	11.9	23.1	3.6
14	15.6	40.7	0.0	11.8	24.5	0.2	9.2	25.4	0.0
15	19.4	41.6	0.0	11.4	30.8	0.0	10.9	26.7	0.0
16	19.3	40.6	0.0	13.9	31.2	0.0	12.5	30.0	0.0
17	24.3	40.4	0.0	15.4	36.1	0.0	13.3	31.3	0.0
18	22.3	26.4	0.0	20.5	25.0	0.0	14.1	31.6	0.0
19	17.1	30.7	0.0	16.3	23.7	0.0	15.3	30.0	0.0
20	16.1	32.5	0.0	13.2	23.7	0.0	15.9	28.7	0.0
21	18.8	36.8	0.0	14.0	26.4	0.0	17.2	29.8	0.0
22	20.9	40.3		11.8	31.1	0.0	15.9	35.0	0.0
23	23.1	42.0		20.1	34.0	0.0	19.5	26.1	0.0
24	30.7	47.5	0.0	15.8	37.7	0.0	17.5	26.3	0.0
25	24.1	30.1	0.0	20.2	37.9	0.0	15.2	20.5	3.2
26	20.2	27.1	0.0	18.1	37.1	0.0	14.7	21.3	0.0
27	17.0	26.6	0.0	18.8	38.6	0.0	9.7	24.9	0.0
28	14.0	30.2	0.0	19.0	38.0	0.0	11.8	30.0	0.0
29	15.4	33.4	0.0				18.0	21.7	0.0
30	16.2	40.3	0.0				10.2	17.9	0.2
31	17.2	26.9	0.0				11.1	21.1	4.6
Total			**0.0**			**2.0**			**11.8**