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Abstract

This project formed part of MLAs Pasture Variety Trial Network and sowed over 100 varieties of six pasture species in the Wangaratta area of north-east Victoria. As a result of the trial site, producers in the region benefited from this project by regular exposure to these trials, learning about the importance of such data and seeing firsthand how not all species and cultivars were equal – particularly with respect to persistence. Importantly producers were able to gain limited experience with, and exposure to, new plant genetics without taking a risk on sowing their own paddocks. These trials promoted the benefits and potential value of utilising improved plant genetics in livestock production systems and highlighted the significant opportunity for improvement.

The data has been provided to a central data analyst and the results will be published as part of MLAs Pasture Variety Trial Network. Therefore, this report contains only information about management of the trial site, rather than results.

Executive summary

A key problem limiting pasture improvement in Australia is that livestock producers do not have access to comprehensive, objective and independent information on the merit of pasture varieties. Meat and Livestock Australia (MLA), as a part of its Feedbase Investment Plan, is seeking to assist producers to make pasture investment decisions based on improved performance information. In order for producers to do this they need access to high quality trial data that addresses the fundamental questions of what grows best in their region.

Differences in conduct of trials and reporting standards for trial information do not readily enable a reliable comparison of trial data. Further, there is limited or no co-operation or co-ordination between the individual seed companies with regards to the location and content of trials and as a result, the development of trial data for end users is inefficient.

An opportunity exists for pasture based industries to create an extensive coordinated pasture trial program across Australia by accumulating the trials of all sources, including pasture seed companies, and utilizing protocols and processes that will ensure a high level of integrity and confidence in the trial data presented to producers.

The objectives of this project were to establish and manage trials of the 4 main temperate perennial grass species along with an annual legume. These trials were required to comply with the protocols and processes of the PVTN and deliver data on variety performance to MLA for extension to producers and others in the industry.

The following trials were established and managed according to the PVTN protocols.

- Cocksfoot (*Dactylis glomerata*) - 17 entries
- Perennial Ryegrass (*Lolium perenne*) - 37 entries
- Tall Fescue (*Fesctuca arundinacea*) of two types
  - Mediterranean in origin - 6 entries
  - Continental in origin (generally summer active) - 11 entries
- Phalaris (*Phalaris aquatica* plus hybrids) - 11 entries
- Sub clover (Trifolium subterraneum ssp subterranean, yannicum and brachycalycinum) - 20 entries

All the grass trials were sown in June 2011 while the sub clover trial was sown in May 2012.

All trials established satisfactorily however the poor spring of 2012 combined with an extended hot and dry summer in 2012-2013 resulted in massive death in the perennial ryegrass, cocksfoot and continental tall fescue trials and the termination of these specific trials in 2013. It is just as important to know about what does not survive such conditions as what does so this is not to be considered a failed trial.

At the conclusion of the project in May 2014, the phalaris and Mediterranean tall fescue grasses both looked promising while continued presence and good production of the black seeded subspecies of sub clover (ssp *subterranean*) suggests that they are well suited to the location. The tall fescue in particular showed impressive potential yield over the 3 year duration of this

project however the phalaris plots have continued to thicken with time. A 3 year timespan, particularly the first 3 years in what would be expected to be a 15-20 year minimum life for a permanent pasture, is perhaps too short for conclusive statements to be made about relative long term growth and persistence of species and cultivars.

During the lifespan of the trials approximately 180 producer visits occurred. Producers inspecting the trials showed great enthusiasm for both the project and the results that will come from it. Although the results were not provided at the time due to trial protocols, they are eagerly awaited by producers. In addition to the trial data however, the use of this site as a node to attract producers and stimulate discussion on a range of pasture topics was valuable.

Producers visiting this site also wanted to know about the performance of these species under grazing and when they are grown as part of a mixed pasture. This then would be an area to address with future research projects – taking the leading cultivars from such trials and helping producers to find ways to successfully use them on farm in a low risk manner for the producers.

Producers from the region will benefit from the publication of this work and promotion of the data. Producers from other similar regions who have acidic free draining soils, especially those with hot dry summers, will also benefit from this trial data. Such similar regions are likely to extend north along the western side of the dividing range from near Seymour into southern NSW and as such this project has significant value to many more producers than those found locally.

On a broader scale however this project, as part of the larger PVTN program, should help restore producer's confidence in trial data and help promote the adoption and use of improved plant genetics on farm in order to increase farm productivity and profitability.

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1 Background

A key problem limiting pasture improvement in Australia is that livestock producers do not have access to comprehensive, objective and independent information on the merit of pasture varieties. Meat and Livestock Australia (MLA), as a part of its Feedbase Investment Plan, is seeking to assist producers to make pasture investment decisions based on improved performance information. In order for producers to do this they need access to high quality trial data that addresses the fundamental questions of what grows best in their region.

Differences in conduct of trials and reporting standards for trial information do not readily enable a reliable comparison of trial data. Further, there is limited or no co-operation or co-ordination between the individual seed companies with regards to the location and content of trials and as a result, the development of trial data for end users is inefficient.

An opportunity exists for pasture based industries to create an extensive coordinated pasture trial program across Australia by accumulating the trials of all sources, including pasture seed companies, and utilizing protocols and processes that will ensure a high level of integrity and confidence in the trial data presented to producers.

The Pasture Variety Trial Network (PVTN) was launched comprising an auditing and accreditation program along with minimum trial protocols and standards. Any organisation can participate in the PVTN, including government organisations, private organisations and seed companies. An integral component of the PVTN is the need to have a suite of rolling series of independent regional trials which provide verification of other organisation's trials, particularly seed industry trials, as well as exploring the adaptation of species and cultivars in regions not currently well served by trials. Issues of independence, confidence and integrity underpinned the demand for such a program by producers (and indeed all sectors of the seed industry) and are critical to the future success of any variety evaluation program.

2 Project objectives

By 30 May 2014:

- to have established 6 small plot trials as negotiated with MLA
- managed and reported information according to required protocols as part of the Pasture Variety Trial Network (PVTN)
- from the trials deliver statistically sound data capable of showing significant differences between cultivars within a species - as a guide a CV of 15% or better is required.
- maintain operator and site accreditation

3 Methodology

3.1 General details

The trials were located at Bywatha near Wangaratta, Victoria (GPS: 36deg 15min 47sec South, 149deg 26min 12sec East) on a north west facing slope. The trial site was sprayed out in spring 2010 using glyphosate and fallowed over the summer of 2010-2011. Emerging weeds were

killed in autumn 2011 via the use of a knockdown herbicide (glyphosate) then the site was cultivated using a rotary hoe and rolled to achieve a fine, firm seedbed. Just prior to sowing a final knockdown herbicide was applied (glyphosate) to kill any emerging weeds and then after sowing the site was rolled with a tyre roller to ensure good seed-soil contact and an even germination.

All grass trials were sown on the 16th of June 2011. Initially a sub clover trial was also sown however this trial emerged unevenly and it was re-sown in a slightly different location on the 24th May 2012. The site for the second sub clover trial had been maintained fallow throughout 2011 and was direct drilled after a knockdown herbicide application in autumn 2012.

Entries in the trials were sown at the following rates (as per the protocols manual supplied):

Species	Ploidy	(kg/Ha)
Perennial Ryegrass – Diploid	2N	15
Perennial Ryegrass – Tetraploid	4N	20
Tall Fescue		15
Phalaris		5
Cocksfoot		4
Sub Clover BARE		10

The sub clover was sown with a standard, commercially available granulated Group C inoculant purchased from BeckerUnderwood Pty Ltd. The granules were applied with the seed at sowing at a rate of 20kg/ha.

Soil test results for the site are as follows:

		Wangaratta Trial Site	
Sampling Date		1/05/2011	14/08/2011
Sample Depth From		0	0
Sample Depth To		10	60
pH (1:5 Water)		**4.8**	**5.8**
pH (1:5 CaCl2)		**4.3**	**4.6**
Elect. Conductivity	dS/m	0.2	0.05
Elec. Cond. (Sat. Ext.)	dS/m	2.3	0.6
Chloride	mg/kg	23	11
Nitrate Nitrogen (NO3)	mg/kg	98	5.5
Ammonium Nitrogen (KCl)	mg/kg	3.1	6.8
Phosphorus (Colwell)	**mg/kg**	**68**	**20**
Phosphorus (Olsen)	**mg/kg**	**27**	**10**
Phosphorus Buffer Index (PBI-Col)		49	45
Available Potassium	**mg/kg**	**190**	**75**
Calcium (Amm-acet.)	Meq/100g	2	0.95
Potassium (Amm-acet.)	Meq/100g	0.49	0.19
Magnesium (Amm-acet.)	Meq/100g	0.44	0.57
Sodium (Amm-acet.)	Meq/100g	0.1	0.16
Calcium/Magnesium Ratio		4.5	1.7
Aluminium (KCl)	Meq/100g	0.36	0.31
Cation Exch. Cap.	Meq/100g	3.39	2.18
Sodium % of Cations (ESP)	%	2.8	7.3
Aluminium Saturation	**%**	**11**	**14**
Copper (DTPA)	mg/kg	0.24	0.16
Iron (DTPA)	mg/kg	210	64
Manganese (DTPA)	mg/kg	17	15
Zinc (DTPA)	mg/kg	0.75	0.42
Boron (Hot CaCl2)	mg/kg	0.31	0.12
Sulfate Sulfur (KCl40)	**mg/kg**	**19**	**5.7**
Organic Carbon (OC)	%	1.6	0.52
Soil Colour		Brown	Brown
Soil Texture		Sandy Loam	Sandy Loam
Disp. Index, Loveday/Pyle		2	8
Slaking 2Hrs		Water Stable	Considerable
Aluminium (KCl)	mg/kg	32	28
Calcium (Amm-acet.)	%	59	44
Magnesium (Amm-acet.)	%	13	26
Potassium (Amm-acet.)	%	14	8.7
Potassium to Magnesium Ratio		1.1	0.3

For specific details on fertilizer use and weed control, plus brief notes on each trial, please refer to appendix 1.

3.2 Pasture yield

Trials were harvested using a small plot forage harvester manufactured by Kingaroy Engineering Workshop (Queensland). This machine uses a sickle bar to cut the forage (cut only once – not macerated like rotary blade or flail type mowers/harvesters) and then it is swept up a conveyor belt and into a large hopper where it is weighed. As the forage travels up the conveyor a sub-sample is randomly taken and placed in a labelled bag for weighing and then drying to determine dry matter (DM) percentage of the forage. The plots are completely removed during the harvest process and all material is transported off the trial. Cutting height is set at 50mm. Following harvest, and due to the large volume of material (and therefore nutrient) that is removed, fertilizer was applied to the plots in order to ensure continued growth free of nutrient limitation (apart from inherent site issues such as soil acidity and aluminium).

The decision to harvest was based on each trial reaching a mean target harvestable yield dry matter (DM) of approximately 2500 - 3000 kg DM/ha. However, this was influenced by weather conditions – with no harvest being possible during windy and wet conditions and also a final harvest being generally taken as pastures senesced at the end of the year.

3.3 Pasture presence

In spring of the first year and then each autumn thereafter, plots were assessed for the presence of the sown species. This is done using a template containing a 50 x 50mm grid. Edge rows and the ends of the plot were avoided in order to reduce any influence the edge effect may have.

This measure is designed to monitor the presence (or absence) of the pasture species sown. For pasture species that remain in rows for a long period of time, presence in the row is monitored (eg Mediterranean tall fescue can remain in rows for many years (that is, more than 3 years)). Other species (eg Phalaris) have a more spreading habit and in time will move into the gaps between rows – making it more appropriate to measure presence in an area rather than along a row.

4 Results and discussion

The following are commentary on the results results, without statistics, for each of the species sown at the trial site. MLA will publish the results once they have been statistically analysed.

The nearest weather station has been nominated as Springhurst. Its annual rainfall is measured at 607mm however the local producer indicated that the rainfall on site is lower and more like 550mm. Springhurst rainfall is presented below:

Table 1. Springhurst rainfall – from the Australian Bureau of Meteorology.

	Long Term Mean	2011	Variance	2012	Variance	2013	Variance	2014	Variance
January	39	68	29	65	26	6.6	-32.4	40	1
February	40.3	224.5	184.2	182	141.7	12	-28.3	21.2	-19.1
March	41.9	59.4	17.5	**170.8**	128.9	85	43.1	62	20.1
April	41.8	32.6	-9.2	22.5	-19.3	12.9	-28.9	100.9	59.1
May	53.8	25.5	-28.3	25.5	-28.3	53.3	-0.5		
June	61.8	32.5	-29.3	19.8	-42	100.2	38.4		
July	62.7	78.8	16.1	79	16.3	77.8	15.1		
August	61	61.6	0.6	62.9	1.9	76.7	15.7		
September	54	48	-6	14	-40	45.2	-8.8		
October	60.4	25.5	-34.9	**33.6**	-26.8	28.7	-31.7		
November	45.1	105.5	60.4	25.5	-19.6	11.7	-33.4		
December	45.7	19.4	-26.3	36.6	-9.1	63	17.3		
Mean Total	607.7	781.3	173.6	737.2	129.5	573.1	-34.6		

#Note – March 2012 and October 2012 data is from the Wangaratta Aero weather site due to the absence of data for that month at Springhurst. The trial site is located almost on a direct line between Springhurst and the Wangaratta Aero club, 20km NNE of the Aero club and 9km SSW of Springhurst.

Major weather events during the trial period include:

1. February 2011 had significant rainfall – however drier than average conditions in April, May and June, combined with the sandy-loam soil texture and a north-west aspect meant that the site was not wet at sowing and soil moisture at sowing was likely most influenced by the 18mm of rain that fell in June just prior to sowing.

2. November 2011 was much wetter than average (105.5mm recorded against an average of 45.1mm, or more than double the monthly rainfall).

3. February and March 2012 was much wetter than average (with a total of 353 mm rainfall against an annual average of 82mm)

4. The spring (September – December) of 2012 was dry (with 95.7mm compared with an average of 159.5mm, which equates to 60% of normal rainfall)
5. Hot and drier than average 2012-2013 Summer as demonstrated by the temperature measurements (in degrees Celcius) at the Rutherglen research station which were as follows:
    a. November 2012 – Actual 28.0, Mean 25.3
    b. December 2012 - Actual 29.9, Mean 29.1
    c. January 2013 - Actual 34.4, Mean 31.3
    d. February 2013 – Actual 33.0, Mean 30.7
    e. March 2013 - Actual 28.4, Mean 27.3
    f. In January 2013, there were 13 days with a maximum temperature greater than 35C and 5 days (4 consecutive) with a temperature greater than 40C
6. Spring 2013 was drier than average with actual rainfall 54% of average, particularly worse in October and November (48% and 26%, respectively).

The perennial ryegrass, cocksfoot and continental tall fescues trials failed to persist through the dry spring of 2012 and very hot and dry summer of 2012-2013, leading to large scale death and eventual abandonment of these trials. The abandonment or termination of trials was based on measurements of plant presence in autumn/early winter, following the autumn break. If plant recovery was low (typically less than 15%) for the vast majority or all of the entries in a trial then it was considered that the plots would have insufficient plant density (of the sown species) to resist weed invasion and that the sown plants would contribute little yield per unit area.

The phalaris, Mediterranean tall fescue and sub clover trials however did persist through this period, although there were fewer plants.

4.1 Cocksfoot 2011 trial

Prior to the summer of 2012/13, the highest yielding cultivars were Gobar, Greenly, Howlong, Porto and Lazuly. The most persistent cultivar after the summer of 2012/13 was Uplands, a ssp. *hispanica* type which displays moderate summer dormancy, more than any other cocksfoot cultivar in this trial. As a result of the dry spring of 2012 and then the hot, dry summer of 2012/13, most cultivars in this trial fell to less than 10% presence and after consultation with MLA this trial was terminated.

The data has been submitted to MLA and will form part of the reporting for the whole of the PVTN once appropriate protocols for data analysis have been developed.

4.2 Tall Fescue 2011 trial

Prior to the summer of 2012/13, the highest yielding commercial cultivars were Dovey, Royale Q-100, Quantum MaxP and Martin 2 (plus 2 experimental lines). Interestingly, at least two of those cultivars would be described as being early in maturity (Dovey and Quantum MaxP). Despite establishing well, none of these fescues persisted well after the summer of 2012/13. Jesup MaxP was slightly ahead of the others however it has a more prostrate habit than many so this

may well have influenced the presence scoring slightly. Due to the poor presence after the dry spring of 2012 and hot, dry summer of 2012/13, all cultivars in this trial fell to less than 10% presence and after consultation with MLA this trial was terminated.

4.3 Perennial Ryegrass 2011 trial

Prior to the summer of 2012/13, the highest yielding cultivars were Arrow AR1, Base AR37 and Valley (plus one of the experimental lines). Interestingly, these cultivars span a large range in maturity of approximately from -17 to +21 as well as including both ploidy types (diploid and tetraploid). Despite establishing well, none of these ryegrasses persisted well after the summer of 2012/13 however it was interesting that the three most persistent cultivars were all tetraploids with a similar genetic background (Bealey, Base and Halo). Due to the poor presence after the dry spring of 2012 and hot, dry summer of 2012/13, most cultivars in this trial fell to less than 10% presence and after consultation with MLA this trial was terminated.

The endophtye infection level of the varieties in this trial varied from 0% to 96%. Some varieties infected with novel endophytes appeared to have low infection rates – at times below 50%.

4.4 Mediterranean Tall Fescue 2011 trial

This species established and held on over the hot dry summer of 2012/13 better than all other grass species at this location. At the end of 2012, the leading cultivars in this species had a similar total yield as the leading perennial ryegrasses and a higher yield than all other grasses. Over the entire trial period the better cultivars in this species yielded nearly 25,000 kg DM/ha. Compared to the only other perennial grass to substantially survive the summer of 2012/13, phalaris, this was almost 6000 kg DM/ha higher or an average of approximately 2000kg DM/ha per year better.

Given that this species group is relatively new, has had limited development and comprises just a few options, it is perhaps not surprising that they are relatively similar in yield. Prosper and Flecha MaxP maintained greater than 50% presence in the rows throughout the trial while other varieties fell below 50% presence. The erect and relatively non spreading habit of this species combined with the lack of legume between the rows (by design) may result in potential weed invasion problems in the future – certainly some broad leaf weed control was required during the trial period (as it was for all grass trials). This may particularly be a problem for those cultivars with plant presence figures of approximately 50% or lower (Medallion, Resolute, Fraydo and Origin). It is worth noting that despite a range of ~30 to 70% in presence, total yields from the plots appear to have been less affected. It is also worth noting that these results are for 3 years only.

4.5 Phalaris 2011 trial

This species established reasonably well and continued to thicken over the first 12 month period however were then knocked back significantly as a result of the dry spring in 2012 and the hot and dry summer of 2012/13. The highest yielding cultivars in this trial were Lawson, Advanced AT, Atlas PG and Sirosa – all winter active cultivars. The industry standard cultivar, Australian (less winter active), produced approximately 1500 kg DM/ha less biomass than these in total over the duration of the trial however it has finished the trial with the highest presence compared to all other phalaris cultivars.

The improvement in plant presence from 2013 to 2014, combined with the typical spreading habit of phalaris suggests that over time these plots may continue to thicken and improve in density.

In my experience, the performance of Holdfast in this trial is atypical. I have no explanation for this result and it must be balanced out by its performance across other sites. I know of no reason why it should have lower establishment figures than the other erect, winter active phalaris lines and a lower level of "thickening up" – although by the end of this trial period it has similar plant numbers as some other winter active lines (e.g. Sirosa) so perhaps in time this yield and presence difference may disappear.

In this region winter feed is often in short supply and therefore particularly valuable while summer feed can often be available from crop residues and dried off surplus spring fodder (standing hay). For this reason, it is possible that measures of total annual yield alone are inadequate at highlighting the forages value to producers.

4.6 Subterranean Clover 2011 trial

The higher yielding cultivars in this trial were SF Narrikup, Urana, Monti, Leura and Goulburn – with Bindoon and Campeda only just behind these ones. This is an interesting mix as it includes the following attributes:

- Urana Black seeded, early season, high hard seed
- Goulburn Black seeded, mid-late season, moderate hard seed
- Leura Black seeded, very late season, low hard seed
- Monti Yellow seeded, early-mid season, low hard seed
- SF Narrikup Black seeded, mid season, low hard seed
- Bindoon Black seeded, early-mid season, low hard seed
- Campeda Black seeded, mid maturity, high hard seed

The odd one in this mix is Monti. The site is an acidic, free draining sandy loam soil which would traditionally be most suited to the black seeded sub species (ssp. *subterranean*). Monti is one of the earliest maturity (flowering) yellow (ssp. *yannicum*) cultivars and perhaps this early maturity trait has assisted in its survival to date.

The other interesting point concerning these leading cultivars is that they include a reasonable range in maturity – particularly with respect to the difference between Urana and Leura (~103 vs 150 days to flowering in Perth). Such trials probably need to be run for a longer period in order to smooth out year to year climatic variation and exhaust any opportunistic seed bank development that might occur for instance if year one happens to be a "good" year with a long spring. Modelling to predict fit of sub clover maturity or flowering time to region (e.g. Archer *et al* (1987), Evans *et al* (1992)), with the addition of sensitivity analysis that accounts for increased climate variability and allows producer to make selections for their own situation and risk profile, would be of value.

Overall for sub clover, it needs to be remembered that the soil type (suited to black seeded subs) is very acidic (4.3 pH in calcium chloride) and had 11% Aluminium. This was not an ideal

situation for legumes and may have influenced the results. There is limited or no comparative data on the combining ability and effectiveness of the commercial rhizobia strain with each of the cultivars, in such situations.

4.7 General discussion on trials

With respect to the trial results, a number of issues were hinted at in this suite of trials. One of particular interest concerned sowing rate which although appropriately standardized in the Trial Protocols document, may have contributed to reduced persistence and/or poor plant numbers. The final presence score of ~15% for some of the leading perennial ryegrass lines and observations (not reported – trial was terminated) that this appeared to remain stable over time, plus what would appear to be a relatively stable end presence for the Mediterranean tall fescues (admittedly only a short period is still involved) hints at an opportunity for the successful use of lower seeding rates in perennial ryegrass and tall fescue - in this environment. Further, some of the lower presence Mediterranean fescues still appeared to yield reasonably well. In contrast, phalaris appeared to have relatively lower presence at the beginning but has “thickened up” over time. None of this is particularly surprising however it does help to highlight the lack of sowing rate X environment trial data which has also been outlined in a recent review of pasture establishment (Unpublished, G Sandral & S Kemp, personal comm.).

Another issue is that as valuable as these trials are – and producers appear to really appreciate them, the use of pure swards is a little abstract compared to the typical pasture scenario. Producers utilize a mixed sward to feed their livestock and generally in this region this comprises a grass plus sub clover. There remains very little evidence to support the proposition that the best grass combined with the best legume is the most productive combination long term. On the face of it, logic might suggest that this is the case however unlike in other species, typically none of the major perennial grasses nor the sub clover are co-selected for their ability to combine and produce the greatest combined yield/animal production. It is perhaps a level of finesse that some producers are not ready to utilize however neither is it a level of development that is currently being implemented. An example of where this co-selection is viewed as critical, for one part of the “mix” at least is white clover. All the leading white clovers on the market today were developed in programs that included multiple selection cycles from within a grass sward.

5 Success in achieving objectives

5.1 Establish and manage pasture variety trials

Six pasture trials were established and managed. The trials and species concerned were:

- Cocksfoot (*Dactylis glomerata*) - 17 entries
- Perennial Ryegrass (*Lolium perenne*) - 37 entries
- Tall Fescue (*Fesctuca arundinacea*) of two types
    - Mediterranean in origin (vary in summer dormancy) - 6 entries
    - Continental in origin (generally summer active) - 11 entries
- Phalaris (*Phalaris aquatica* plus hybrids) - 11 entries

- Sub clover (*Trifolium subterraneum* ssp *subterraneum, yannicum* and *brachycalycinum*) - 20 entries

Of these trials, the cocksfoot, perennial ryegrass and continental tall fescue trials did not survive the combination of a cut off spring in 2012 and a hot, dry summer of 2012/13 and on the approval of MLA were subsequently terminated. The death of cultivars and the termination of trials was a reflection of the environment that they were grown in and not trial management – and this information is just as or more useful to producers than data from the trials that remained.

The remaining trials (phalaris and sub-clover) continued through until the end of autumn 2014.

Ongoing "live" trials have been inspected and passed by the MLA appointed auditor in 2012 and 2013. In addition, the trials were inspected approximately 9-10 times by producer groups over the duration of the trials with plenty of interest and positive feedback. Group sizes ranged from 8 to approximately 80 and of during the period 2011 to 2013 (inclusive) about 180 producers visited the site. It should be noted however that of the 180 producer visits being counted, there would be a reasonable proportion of producers, perhaps 40, that visited the site more than once.

5.2 Manage and report the trial information according to required protocol as part of the PVTN

Throughout the duration of the trials all trial information has been reported to MLA and the PVTN manager according to the established protocols and in line with the contractual obligations. One of the challenges has been the format of the data however in order to allow statistical analysis trial data has been submitted with a trial plan (which was also submitted on trial registration) and included row and column identifying information in addition to the required replicate, variety name and harvest date information. This level of information allows efficient and robust statistical analysis and exceeded the stated requirements of the program. It is noted in the contract for this project that data was expected to be submitted "to the PVTN in an electronic format – this is expected to occur directly into the PVTN nominated database system".

Thoughout the duration of this project there has been no issues raised by MLA or the PVTN staff concerning the trial data submitted therefore it has been assumed to be acceptable.

5.3 Deliver data capable of showing differences between cultivars within a species

The brief and scope of this project did not include statistical analysis and it was expected that this service would be provided to the project and include regular feedback to trial operators in order to assist them to monitor their own performance. This service was not implemented in the desired time-frame and as a result there has been no feedback concerning the statistical analysis of the trials in this project.

In most of the trials managed by this project, there was a spread of 30% difference in production between the highest and lowest producing varieties of each species. Appropriate statistical analysis will be conducted using the data supplied to the PVTN analyst to determine the extent to which these are real or and reproducible.

It is also worth noting that the Mediterranean tall fescue group has fewer cultivars, a relatively recent history, are relatively less well developed and perhaps target a more specific market segment than say perennial ryegrass. This has tended to mean that the few cultivars are more

similar with a range of approximately 10% between the cultivars, which was lower than for other species.

5.4 Maintain operator and site accreditation and therefore compliance with PVTN

The Trial Operator has attended all meetings and facilitated all trial site inspections. Operator and site accreditation was maintained.

6 Impact on meat and livestock industry – Now and in five years' time

6.1 Impact on meat and livestock industry – now

Over the duration of this project there have been approximately 9-10 farmer group visits, with some groups visiting more than once. This inspection has often been part of a larger tour and formed part of a larger pasture discussion that included topics such as species and cultivar selection, grazing management, nutrient use, use of plant growth stimulants, use of robust scientific data, improved cultivars etc. It must be said however that often the greatest interest from producers was for sections of the tour that included this site and allowed them to walk through the trials and "kick the clods" so to speak. Throughout producers have done this without being provided with any trial data however by repeatedly visiting the site over a number of years, they have been able to gain an appreciation of the trials. Although no site visits have been conducted to date in 2014, throughout 2013 and earlier there were at least 3 visits to the site per year. Earlier field days included as many as 80 producers per day from the local region (2011) while later site visits included visitors from Beef and Sheep groups who travelled from 100km away.

The important aspect of field days at this site is that, the site and diversity of options helped to facilitate broader and important discussions on various topics. There trials were a way of focussing the attention of producers on pasture issues which experienced agronomists and consultants were then able to address.

Many of the producers who visited the site commented highly favourably on issues such as:

- independent trials – free from seed company bias
- relatively comprehensive trials – large range and no bias towards a particular company
- location – not the best paddock on the farm but a rather more challenging site
- location – in their region and not on a research farm

Having brought the local producers along on the "trial journey" it would be fantastic to be able to present to them some actual trial results. In the last 6-12 months, the lack of data and new trials at the site has contributed to a decline in interest in the site. In 2011, 30 producers attending a field day were polled on what they would like to see developed at the site in order to enhance the value to them and ensure ongoing interest. The 4 top items included short term forage options, pasture mixes, sowing rates and performance under grazing. One of these areas was partially

addressed in subsequent years via additional trials (not funded by MLA) and this engagement with and participation by the local producers was useful in maintaining interest during 2012.

The impact on producers who attended the site has been positive – as demonstrated by the continued interest in the site over time, repeat visits by producers and farmer groups and for example a requested visit in July 2014. There is a greater awareness about the value of looking for data from well-run trials adhering to a set of published protocols, the value of selecting improved cultivars that suit their production system and the range of options available.

Further immediate impact from this work will be realised when the trial data is analysed and made available to producers in the region.

6.2 Impact on meat and livestock industry – five years' time

At the inception of the PVTN program one of the opportunities foreseen for sites such was their use as nodes around which additional, ongoing research could be built. This site still provides the opportunity to facilitate other research to broaden the scope of this trial. Limitations on the availability of funding are likely to reduce some of these opportunities.

Nonetheless, the impact of this project on producers in 5 years' time will be in the form of improved pastures that were sown using information gained either directly from the trials (e.g. using trial data) or were sown as a result of the broader pasture discussion that occurred as a result of producers attending a site visit. Further, data from this project will contribute to a greater overall data set that will be published by MLA in various forms. In this way producers will be able to continue to find objective, independent data on cultivar performance in tougher settings than say on a research farm and hopefully use it as part of their decision making process on cultivars for use on their property.

Finally, a number of the cultivars in this project were experimental lines provided by seed companies – therefore there is the prospect that they will be commercialized and producers will be able to reference these independent trials in their decision making on those new cultivars. This will provide greater confidence in the performance of these cultivars which traditionally at release would only have limited seed company data to support them.

7 Conclusions and recommendations - section

7.1 Issues and suggestions to MLA about conduct of trials

No issues are raised concerning the conduct of the trials.

It is noted that at the commencement of this project, trial auditing guidelines were provided by MLA that outlined the types and timing of audits. Unfortunately the auditing process has not followed this process and it would be fair to suggest that at times it has been conducted at times of the year when it would be difficult to do more than ascertain that a trial existed.

7.2 Trials recommended for further monitoring

In November 2013 it was recommended that at the conclusion of this project, the remaining trials at this site begin to be grazed by sheep with persistence over time, under grazing, to be monitored. This recommendation appeared to be favourably accepted however there were

concerns from MLA regarding the limited funding at their disposal. The absence of any further communication on this subject suggests that there is no funding for this work therefore I suggest two possible courses of action:

1. Finish this project and terminate these trials. This would allow PastureWise to either return the land to the farmer or use the area for new projects.

2. Finish this project and allow PastureWise to assume full responsibility for the remaining trials – with MLA having no further responsibility or liability for the trials or the site. PastureWise will undertake to protect the integrity of the trials with respect to not allowing material to be removed (unless it is by the owner – however unlikely). At its discretion PastureWise may elect to maintain the trials, develop new projects alongside the trials, terminate the trials in order to free up land for new projects or return the land to the farmer. Initially at least the trials are likely to be maintained and grazed for the benefit of local producers.

A prompt decision is required for these trials so that site leases can be appropriately reviewed.

7.3 General conclusions and recommendations

Overall, this project has been of value to producers in this region (180 producer visits including repeat visits). It has helped stimulate interest in improved species and cultivars as well as promoted greater discussion and engagement pf producers focussed on pastures. It is recommended that this kind of work be continued and in the future should include additional species plus supporting research.

A number of areas of further research exist in the area of cultivar evaluation which if addressed would add significant value to the PVTN and greatly improve the confidence of producers in small plot trial work.

1. Grazing interactions – how does the performance of cultivars in pure sward, small plot trials harvested mechanically relate to their performance under grazing?

2. Sowing Rate and mixes – the MLA review into the establishment of the major perennial grass species (Sandral & Kemp, 2014) highlighted the lack of sowing rate x environment research and clearly it is important to be able to relate data from pure sward experiments to the likely performance as part of a mix, particularly with respect to grass-legume mixes.

3. Trial Methodologies – until harvesting methods are directly compared in a scientifically robust manner by an independent organisation, there will continue to be question marks raised in this area. There is no recent research comparing modern capacitance probes, rising plate meters and whole plot cut and dry approaches across a broad range of cultivars within a species.

4. A recognized methodology exists for testing grazing tolerance in lucerne which although not uniformly adopted across the major development companies, is sufficiently similar that a well versed and appropriate person would be able to bring them into alignment. This grazing tolerance assessment is used as a surrogate for “persistence” under grazing and is reasonably well accepted however of course it only applies to lucerne which is not generally considered a permanent pasture.

There is merit in considering the development of an accelerated aging methodology for testing persistence of pastures. It is unlikely that there will be funding from any organisation to run trials for greater than 3-5 years across multiple sites and with a reasonable range of cultivars within a species – and in any event, current product lifecycles are likely to be nearing their end by the time this data becomes available. This therefore points towards a need to find a more rapid method of determining likely persistence – an index perhaps that is relative to known standards. Currently numerous public and private organisations are undertaking research into pasture persistence – either at a fairly macro level (in the field) and/or at the molecular (and various "omic") level(s). This research may be of value in devising potential rapid aging methods and defining the assessment of such methods. In at least one instance there is a rapid aging methodology being tested in the field however greater focus on the area and increased collaboration between the relevant research groups (including those overseas) may improve progress in this space. I am happy to discuss this further should there be interest.

8 Bibliography

Archer KA, Wolfe EC and Cullis BR (1987) Flowering time of cultivars of subterranean clover in New South Wales, *Australian Journal of Experimental Agriculture* **27(6)** 791 – 797.

Evans PM, Lawn RJ and Watkinson AR (1992) Use of linear models to predict the date of flowering in cultivars of subterranean clover (*Trifolium subterraneum* L.), *Australian Journal of Agricultural Research* **43(7)** 1547 - 1548

Trial Protocols Manual March 2011, MLA.

9 Appendices

Appendix 1 - Wangaratta, Victoria: Trials

Trial information: Perennial Ryegrass Lp11143677

Measurement dates

Yield	23/09/2011
Yield	23/11/2011
Presence	25/11/2011
Yield	26/03/2012
Presence	3/04/2012
Yield	17/05/2012
Yield	8/08/2012
Yield	13/09/2012
Yield	26/10/2012
Presence	21/05/2013

As a result of the dry spring of 2012 and then the hot, dry summer of 2012/13, most cultivars in this trial fell to less than 10% presence and this trial was terminated.

Weed Control

DATE	HERBICIDE APPLIED (COMMERICAL NAME)	HERBICIDE APPLIED (ACTIVE INGREDIENT)	APPLICATION RATE (x/ha)	TARGET WEED (s)
2/09/2011	Agtryne MA	275g/L Terbutryn + 160g/L MCPA	1.5 L/ha	Capeweed (minor erodium)
27/06/2012	Agritone + Dicamba	750g/L MCPA (Agritone) + 500g/L Dicamba	1.5 L/ha + 0.5L/ha	Range of broad leaf weeds – capeweed, erodium, sorrel.

Fertiliser Application

DATE	FERTILIZER APPLIED	METHOD OF APPLICATION	RATE OF APPLICATION (x/ha)	TARGE NUTRIENT (s)
16/06/2011	DAP	Broadcast	120kg/ha	Sowing. N (18): P (20): S (1.6)
23/09/2011	Croplift 400	Broadcast	300kg/ha	N (21.9): P (4.7): K (7.6): S(9.1)
23/11/2011	Croplift 400	Broadcast	250kg/ha	N (21.9): P (4.7): K (7.6): S(9.1)
26/03/2012	Croplift 400 + Urea	Broadcast	180kg/ha + 160kg/ha	N (21.9): P (4.7): K (7.6): S(9.1) + N (46)
17/05/2012	Urea	Broadcast	160kg/ha	N (46)
8/08/2012	Urea	Broadcast	120kg/ha	N (46)
13/09/2012	Croplift 900 + Urea	Broadcast	120kg/ha + 115kg/ha	N (15.7): P (7.6): K (9): S (11.2) + N (46)
26/10/2012	Urea	Broadcast	150kg/ha	N (46)

Insect Control

None required during life of trial.

Research notes

November 2012

This trial is progressing well with 5 harvests this calendar year. Plots have been well maintained and are clearly distinguishable from each other. There have been no fertility constraints apparent. There has been some plant deaths in this trial over the first summer however this is expected for this region. Plant persistence will be tested and highlighted.

2013

Due to the poor presence after the dry spring of 2012 and hot, dry summer of 2012/13, most cultivars in this trial fell to less than 10% presence and after consultation with MLA this trial was terminated.

Trial information: Cocksfoot Dg11143677

Measurement dates

Yield	23/11/2011
Presence	25/11/2011
Yield	26/03/2012
Presence	3/04/2012
Yield	17/05/2012
Yield	8/08/2012
Yield	13/09/2012
Yield	26/10/2012
Presence	21/05/2013

As a result of the dry spring of 2012 and then the hot, dry summer of 2012/13, most cultivars in this trial fell to less than 10% presence and this trial was terminated.

Weed Control

DATE	HERBICIDE APPLIED (COMMERICAL NAME)	HERBICIDE APPLIED (ACTIVE INGREDIENT)	APPLICATION RATE (x/ha)	TARGET WEED (s)
2/09/2011	Agtryne MA	275g/L Terbutryn + 160g/L MCPA	1.5 L/ha	Capeweed (minor erodium)
27/06/2012	Agritone + Dicamba	750g/L MCPA (Agritone) + 500g/L Dicamba	1.5 L/ha + 0.5L/ha	Range of broad leaf weeds – capeweed, erodium, sorrel.

Fertiliser Application

DATE	FERTILIZER APPLIED	METHOD OF APPLICATION	RATE OF APPLICATION (x/ha)	TARGE NUTRIENT (s)
16/06/2011	DAP	Broadcast	120kg/ha	Sowing. N (18): P (20): S (1.6)
23/11/2011	Croplift 400	Broadcast	250kg/ha	N (21.9): P (4.7): K (7.6): S(9.1)
26/03/2012	Croplift 400 + Urea	Broadcast	180kg/ha + 160kg/ha	N (21.9): P (4.7): K (7.6): S(9.1) + N (46)
17/05/2012	Urea	Broadcast	160kg/ha	N (46)
8/08/2012	Urea	Broadcast	120kg/ha	N (46)
13/09/2012	Croplift 900 + Urea	Broadcast	120kg/ha + 115kg/ha	N (15.7): P (7.6): K (9): S (11.2) + N (46)
26/10/2012	Urea	Broadcast	150kg/ha	N (46)

Research notes

November 2012

This trial was slow to establish in 2011 and as can be the case with slow establishing perennial grasses the plots appeared “thin” when compared to the ryegrasses – however cocksfoot typically will thicken up over time and the plots have improved across this year. They now look quite reasonable.

2013

As a result of the dry spring of 2012 and then the hot, dry summer of 2012/13, most cultivars in this trial fell to less than 10% presence and this trial was terminated.

Trial information: Phalaris Pa11143677

Measurement dates

Yield	23/11/2011
Presence	25/11/2011
Yield	26/03/2012
Presence	3/04/2012
Yield	17/05/2012
Yield	7/08/2012
Yield	12/09/2012
Yield	26/10/2012
Presence	21/05/2013
Yield	3/07/2013
Yield	4/09/2013
Yield	18/10/2013
Yield	21/05/2014
Presence	21/05/2014

Weed Control

DATE	HERBICIDE APPLIED (COMMERICAL NAME)	HERBICIDE APPLIED (ACTIVE INGREDIENT)	APPLICATION RATE (x/ha)	TARGET WEED (s)
2/09/2011	Agtryne MA	275g/L Terbutryn + 160g/L MCPA	1.5 L/ha	Capeweed (minor erodium)
27/06/2012	Agritone + Dicamba	750g/L MCPA (Agritone) + 500g/L Dicamba	1.5 L/ha + 0.5L/ha	Range of broad leaf weeds – capeweed, erodium, sorrel.
18/6/2013	Agtryne MA	275g/L Terbutryn + 160g/L MCPA	1.5 L/ha	Capeweed (minor erodium)
07/11/2013	2,4 D Ester	680g/L 2,4D Ester	4.0L/ha	Capeweed, milk thistle, clover, erodium, flatweed/dandelions, sorrel

Fertiliser Application

DATE	FERTILIZER APPLIED	METHOD OF APPLICATION	RATE OF APPLICATION (x/ha)	TARGE NUTRIENT (s)
16/06/2011	DAP	Broadcast	120kg/ha	Sowing. N (18): P (20): S (1.6)
23/11/2011	Croplift 400	Broadcast	250kg/ha	N (21.9): P (4.7): K (7.6): S(9.1)
26/03/2012	Croplift 400 + Urea	Broadcast	180kg/ha + 160kg/ha	N (21.9): P (4.7): K (7.6): S(9.1) + N (46)
17/05/2012	Urea	Broadcast	160kg/ha	N (46)
8/08/2012	Urea	Broadcast	120kg/ha	N (46)
13/09/2012	Croplift 900 + Urea	Broadcast	120kg/ha + 115kg/ha	N (15.7): P (7.6): K (9): S (11.2) + N (46)
26/10/2012	Urea	Broadcast	150kg/ha	N (46)
03/07/2013	Urea	broadcast	100kg/ha	N (46)
4/9/2013	Croplift 900	broadcast	200kg/ha	N (15.7):P (7.6):K (9): S (11.2)
7/11/2013	Croplift 900	broadcast	250kg/ha	N (15.7):P (7.6):K (9): S (11.2)

Insect Control

None required during the life of the trial.

Research notes

2011

Plots were slow to establish however later in spring growth was good.

2011-2012 Summer

Plants appeared to respond and do well with the unusual summer rain however the large tillers and big broad leaves can be deceptive with respect to yield. Appeared to produce similar growth as per the Mediterranean tall fescues.

November 2012

This trial established reasonably well however it was slow and the plants remained small (and a little sparse) for quite some time. The site is reasonably acidic with moderate levels of aluminium (11%) and shallow sandy soils therefore it is quite a test for this species. Unseasonal rain over the summer of 2011-2012 helped maintain these plants and across the 2012 year these plants

have begun to thicken up to the point where once well defined plot rows are now merging with each other.

May 2014

The improvement in plant presence from 2013 to 2014, combined with the typical spreading habit of phalaris suggests that over time these plots may continue to thicken and improve in density. Good survival and good growth to date.

Trial information: Tall fescue – Continental FaC11143677

Measurement dates

Yield	23/11/2011
Presence	25/11/2011
Yield	26/03/2012
Presence	3/04/2012
Yield	17/05/2012
Yield	8/08/2012
Yield	13/09/2012
Yield	26/10/2012
Presence	21/05/2013

As a result of the dry spring of 2012 and then the hot, dry summer of 2012/13, most cultivars in this trial fell to less than 10% presence and this trial was terminated.

Weed Control

DATE	HERBICIDE APPLIED (COMMERICAL NAME)	HERBICIDE APPLIED (ACTIVE INGREDIENT)	APPLICATION RATE (x/ha)	TARGET WEED (s)
2/09/2011	Agtryne MA	275g/L Terbutryn + 160g/L MCPA	1.5 L/ha	Capeweed (minor erodium)
27/06/2012	Agritone + Dicamba	750g/L MCPA (Agritone) + 500g/L Dicamba	1.5 L/ha + 0.5L/ha	Range of broad leaf weeds – capeweed, erodium, sorrel.

Fertiliser Application

DATE	FERTILIZER APPLIED	METHOD OF APPLICATION	RATE OF APPLICATION (x/ha)	TARGE NUTRIENT (s)
16/06/2011	DAP	Broadcast	120kg/ha	Sowing. N (18): P (20): S (1.6)
23/11/2011	Croplift 400	Broadcast	250kg/ha	N (21.9): P (4.7): K (7.6): S(9.1)
26/03/2012	Croplift 400 + Urea	Broadcast	180kg/ha + 160kg/ha	N (21.9): P (4.7): K (7.6): S(9.1) + N (46)
17/05/2012	Urea	Broadcast	160kg/ha	N (46)
8/08/2012	Urea	Broadcast	120kg/ha	N (46)
13/09/2012	Croplift 900 + Urea	Broadcast	120kg/ha + 115kg/ha	N (15.7): P (7.6): K (9): S (11.2) + N (46)
26/10/2012	Urea	Broadcast	150kg/ha	N (46)

Insect Control

Not required during life of trial.

Research notes

2011-2012

Trials established slowly – typical for this species however by the end of 2011 the plots were well established with near to full rows in every plot. Plots continued to look good however plant numbers did decline a little from 2011 to 2012. Thoughtout 2012 plots grew well however the early finish to the season in spring 2012 when the plants appeared to still want to grow did negatively impact on these plots.

2013

Due to the poor presence after the dry spring of 2012 and hot, dry summer of 2012/13, all cultivars in this trial fell to less than 10% presence and MLA agreed for this trial to be terminated.

Trial information: Tall fescue – Mediterranean FaM11143677

Measurement dates

Yield	23/11/2011
Presence	25/11/2011
Yield	26/03/2012
Presence	3/04/2012
Yield	17/05/2012
Yield	7/08/2012
Yield	12/09/2012
Yield	26/10/2012
Presence	21/05/2013
Yield	3/07/2013
Yield	4/09/2013
Yield	18/10/2013
Yield	21/05/2014
Presence	21/05/2014

Weed Control

DATE	HERBICIDE APPLIED (COMMERICAL NAME)	HERBICIDE APPLIED (ACTIVE INGREDIENT)	APPLICATION RATE (x/ha)	TARGET WEED (s)
2/09/2011	Agtryne MA	275g/L Terbutryn + 160g/L MCPA	1.5 L/ha	Capeweed (minor erodium)
27/06/2012	Agritone + Dicamba	750g/L MCPA (Agritone) + 500g/L Dicamba	1.5 L/ha + 0.5L/ha	Range of broad leaf weeds – capeweed, erodium, sorrel.
18/6/2013	Agtryne MA	275g/L Terbutryn + 160g/L MCPA	1.5 L/ha	Capeweed (minor erodium)
07/11/2013	2,4 D Ester	680g/L 2,4D Ester	4.0L/ha	Capeweed, milk thistle, clover, erodium, flatweed/dandelions, sorrel

Fertiliser Application

DATE	FERTILIZER APPLIED	METHOD OF APPLICATION	RATE OF APPLICATION (x/ha)	TARGE NUTRIENT (s)
16/06/2011	DAP	Broadcast	120kg/ha	Sowing. N (18): P (20): S (1.6)
23/11/2011	Croplift 400	Broadcast	250kg/ha	N (21.9): P (4.7): K (7.6): S(9.1)
26/03/2012	Croplift 400 + Urea	Broadcast	180kg/ha + 160kg/ha	N (21.9): P (4.7): K (7.6): S(9.1) + N (46)
17/05/2012	Urea	Broadcast	160kg/ha	N (46)
8/08/2012	Urea	Broadcast	120kg/ha	N (46)
13/09/2012	Croplift 900 + Urea	Broadcast	120kg/ha + 115kg/ha	N (15.7): P (7.6): K (9): S (11.2) + N (46)
26/10/2012	Urea	Broadcast	150kg/ha	N (46)
03/07/2013	Urea	broadcast	100kg/ha	N (46)
4/9/2013	Croplift 900	broadcast	200kg/ha	N (15.7):P (7.6):K (9): S (11.2)
7/11/2013	Croplift 900	broadcast	250kg/ha	N (15.7):P (7.6):K (9): S (11.2)

Insect Control

Not required during the life of this trial.

Research notes

2011

These trials established well and appeared to grow faster than all the other perennial grasses – with the exception of perennial ryegrass. Clear, strong rows and plots of fescue were established.

2011-2012 Summer

Due to the summer rain and milder conditions, the fescue tended to stay green over summer – not unusual for first year Mediterranean tall fescue in a mild, wet summer. Growth tended to be only moderate at best.

November 2012

This trial established quite well and has been performing well. As a group, mediterranean tall fescues are relatively new (excluding Melik) in Australia with only a few cultivars being available with all of them having a more similar “type” in comparison to other species such as phalaris or cocksfoot. These trials are sound, relatively weed free and the plots are easily distinguished from each other.

2013

Plots survived the summer of 2012-2013 very well and have continued to perform well. Rows seem to be fairly resiliant. Plants are tending to stay fairly narrow and in the rows (esp in comparison with phalaris). Appears to be very productive.

2014

Good survival at the end of this trial. Impressive growth.

Trial information: Subclover Ts12143678

Sowing notes

24/05/2012

Measurement dates

Presence	21/05/2013
Yield	4/09/2013
Yield	18/10/2013
Yield	21/05/2014
Presence	21/05/2014

Weed Control

DATE	HERBICIDE APPLIED (COMMERICAL NAME)	HERBICIDE APPLIED (ACTIVE INGREDIENT)	APPLICATION RATE (x/ha)	TARGET WEED (s)
18/6/2013	Agtryne MA	275g/L Terbutryn + 160g/L MCPA	1.5 L/ha	Capeweed (minor erodium)

Fertiliser Application

DATE	FERTILIZER APPLIED	METHOD OF APPLICATION	RATE OF APPLICATION (x/ha)	TARGE NUTRIENT (s)
24/05/2012	DAP	Broadcast	120kg/ha	Sowing. N (18): P (20): S (1.6)
28/08/2012	Molybdenum	Spray	150g/ha	Mo (39%) was applied in 150L/ha of water in order to achieve a net application of 58.5g/ha (39% x 150g/ha)
4/9/2013	Croplift 900	broadcast	150kg/ha	N (15.7):P (7.6):K (9): S (11.2)
7/11/2013	Croplift 900	broadcast	200kg/ha	N (15.7):P (7.6):K (9): S (11.2)

Insect Control

Not required during trial life.

Research notes

November 2012

Trial was sown in autumn 2012 (24th May 2012). The trial established slowly after the late May sowing and the dry September/October period restricted growth and in order to enable the legumes to set seed and produce a viable plot in 2013 it was decided to refrain from harvesting until after seeding – if it is possible at that time. At this point in time the plots were clean and contained complete rows of plants (100% presence) which it was hoped would set seed for future years.

2013

In 2013 there was an early “partial break” with rain in late March, then a prolonged warm dry period which influenced the presence measurements in late May. There may well have been more plants emerge following from this measure since the DM yields of the plots in spring do not seem to correlate well with the measure of plant presence in autumn/winter. There were some challenges with broad leaf weeds in this year however the variety in sub species (ssp

subterranean, yannicum and *brachycalicinum*) combined with potentially variable and uncertain responses of cultivars with each species make control challenging and risky.

May 2014

The autumn of 2014, following from a very hot summer, has been a particularly good start for sub clover and so it would be expected that sub clover presence improve on last year (Figure 12).