WESTERN MINERAL FERTILISERS
WM FERTILISERS
Update
February 2009
LEADERS IN BIOLOGY AND MINERAL FERTILISERS

When is No Extra Nitrogen - "too much" Nitrogen?

Hi everyone,

The face of agriculture is rapidly changing and needs to be sustainable, in terms of beneficial soil management practices, as well as input costs and the viable use of limited resources like Phosphate. One of the keys to Western Mineral Fertilisers growing success is based largely upon Research and Development of our products and our programs - both of which we are continually striving to improve.

Every year we conduct numerous fully independent verifiable trials comparing Western Mineral Fertilisers with conventional fertilisers & every year we end up on average with the highest yield and net $ return/ha and this year is no different. These results and the positive long term effect on soil health and viability will inevitably lead to the Mineral and Microbe program having a major influence in fertiliser usage in this state.

We have put together this special 2008 Trials newsletter as early as possible so the information can be used in planning for your farm fertiliser program. The 2008 season trials looked at both Western Mineral Fertiliser and biology program in comparison with the "standard practice" or "district average" acid fertiliser programs and also the results of various Nitrogen inputs.

Fertiliser price is falling at last after a year of price hikes and instability. The whole global economic situation led to high prices in most commodities which was unsustainable. Our fertiliser products are affected by the cost of Nitrogen, Phosphorus and Potash and with a falling market you will need to contact the office to get up to date pricing. Western Mineral Fertilisers products have always been a competitive choice and will remain so.

We have a flexable fully integrated manufacturing plant at Tenterden, using the most up to date technology. The plant went through extensive upgrades in 2008 and has again increased it's production capacity and quality of product. However please be aware that demand continues to outstrip production and booking space is essential.

All the best for the 2009 season.

Stephen Frost
Managing Director

Major upgrades have recently been completed at WMF's Tenterden manufacturing plant

NITROGEN AND WMF PROGRAMS:

By P.J. Storer (Microbiologist)

Introduction

Nitrogen (N_2) is the most abundant element (78.08%) in our atmosphere, (followed by Oxygen 20.95%), and yet *most* living organisms cannot use Nitrogen in this N_2 form…

Nitrogen plays a critical role in crop production; e.g. as proteins, hormones & nucleic acids. Plants must secure their Nitrogen in a ***"fixed"*** form incorporated in compounds that exists in the soil as either: 1). **Organic Nitrogen** – for example as amino acids, proteins, and Urea, (this includes Nitrogen within living organisms, and decaying animal and plant material); or 2). **Inorganic Nitrogen** - includes Nitrate ($N0_3$), nitrite ($N0_2$), Ammonium (NH_4^+), and ammonia gas (NH_3). Nitrogen is constantly being transformed in the soil between these various N forms through the Nitrogen cycle (a complex of physical, chemical, and biological reactions).

It is now becoming widely documented that the **excessive use of Nitrogenous fertilisers** in cropping can lead to decreases in yield and $ profit *(1,2)*, and may have detrimental environmental effects *(3,4)*. It can be *carbon retrograde* – depleting soil organic carbon and leading to shallow-rooted crops and pastures, increased soil acidity, soil nutrient imbalances, and weed proliferation *(5)*. In addition it may damage microbial communities *(3)* and destroy their capacity to release natural sources of Nitrogen stored in the soil "N bank".

WMF's Mineral and Microbe cropping programs have basically performed well on **relatively low** applications of Nitrogen. Over the last couple of seasons, an increasing amount of research has been conducted to examine the *rationale* and *value* of adding extra or top up N. There are many practices for applying N – for example, upfront, down the boot, post emergent and foliar. In addition, there are many forms of N applied (eg Urea, SOA, CAN, MAP, Liquid N, N_2 fixed by rhizobia etc).

The data collected to date shows trends against the use of Nitrogen ***in excess*** (note – this does not mean no Nitrogen!). In certain circumstances (eg see 2008 Hyden data), some Post emergent N may lift yield slightly. However, in conditions of the 2008 season, the economics and $ returns of this practice are questionable - particularly when the cost of fuel is also factored into the equation. As far as Liquid N is concerned, results in these and other trials (2007 and 2008 data) are **generally showing that *'down the boot'* application of Liquid N is not advisable *on WMF programs*.** Post emergent (foliar) application of Liquid N tends to show better yield results (though not significant) compared to down the boot application (eg 2008 Bruce Rock data). Other factors also need to be considered, such as the physical and financial cost of frost *(1)* on high N input crops?

Nitrogen fixing microbes show potential in wheat

The value and assimilation of fixed N_2 by rhizobia *(6,7)* in leguminous plants (such as lupins, peas, clovers etc) in the cropping rotation is well understood *(8,9)*. As Nitrogen fertilisation is a significant cost in cereal production, the development of a symbiosis between diazotrophic (N_2 fixing) bacteria and cereal would be of enormous economic value *(10,11)*. During 2008, field-trial research was conducted into the interaction between and benefits of diazotrophic bacteria and wheat. Preliminary data, on nutrient translocation (particularly amino acids as opposed to Nitrate), growth and yield, has demonstrated that wheat plants inoculated with these endophytic diazotrophs may have the potential of deriving their Nitrogen needs from atmospheric N_2.

Economic Value of WMF Mineral & Microbe Programs

Research and on farm trials over the past 6 years have consistently shown that Western Mineral Fertilisers mineral and microbe programs yield at least equally as well as those using acid based fertiliser programs. Statistical analysis may show "no significant differences" between "yield" – for example variance of plus or minus 60-200kg/ha. However, when one also considers other factors, such as the differences in cost of inputs between the WMF and the acid based programs, suddenly an equal yield in harvest can mean "significant" extra $ in the bank when using the WMF program.

Examples of this from the 2008 Esperance trials show that the basic WMF program yielded 3548kg/ha, cost $105/ha for input, & returned $1048/ha; whereas the Standard Practice program yielded 3610kg/ha, cost $194/ha for input, and returned $979/ha (based on APW2 @ $325/t) = no significant yield difference but +***$69/ha more return on the WMF program***. In the RAIN 2007 fertiliser comparison trial (see WMF's August 2008 Research Update) the basic WMF program yielded an average 1952kg/ha, cost $69.66/ha for input, & returned an av. $518/ha; whereas the Standard Practice program yielded 1686kg/ha, cost $65.68/ha for input, and returned an average $433/ha (based on APW @ $419/t in '07) = no significant yield difference but +***$84.72/ha more return on the WMF program***. In some cases, the differences *are* significant. The 2007 Katanning trials showed that the basic WMF program yielded an av. 5138kg/ha, cost $79/ha for input, and returned an average $2093/ha; whereas the Standard Practice program yielded 3610kg/ha, cost $94/ha for input, & returned $1370/ha (based on APW @ $419/t in '07) = a significant yield difference & +***$723/ha more return on the WMF program***.

Seed coating with beneficial microbes is an efficient and cost effective way of precisely inoculating the root zone of plants (where these 'beneficials' are needed most) - at the point where the seed germinates in the ground *(12)*. This ensures that the beneficial bacteria, fungi and mycorrhiza are readily accessible to the root particularly at the critical "early germination" stages, facilitating early, healthy and rapid development, and improved uptake of plant nutrients. Seed inoculation of crops with WMF beneficial microbes has increased yields of WMF programs on average by 9.8%. For example in the 2008 Bruce Rock trial, WMF microbes increased a 1.92 t/ha wheat crop by 210kg/ha (up 10.9%) = "statistically not significant" but worth **an increase of $68.25/ha** (based on APW2 @ $325/t).

Finally, *Soil health* is all about utilizing farming practices that encourage the cycling of organic matter, increasing mineral nutrient status, multiplying beneficial biological and micro-biological activity, and improving water infiltration – leading to improving soil structure, which also improves crop root health. What economic and/or intrinsic value can be placed upon **the long term improvement of soil health, soil quality and sustainability due to the beneficial WMF mineral and microbe programs?**

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Summary of Research Trials (in this newsletter)

Western Mineral Fertilisers (WMF) has a progressive approach to R & D. Numerous independent & on-farm trials are conducted across WA in varying soil types and climatic conditions (from the adverse conditions in the North East, to the more fertile areas and consistent rainfall regions in the Southern wheatbelt). These trials are designed to enhance our understanding of, and develop and possibly improve WMF's mineral/microbe programs - thereby keeping WMF at the innovative cutting-edge of agriculture.

Assessment of WMF NPK Crop Plus and WMF Microbes on Wheat Yield & Quality

Western Mineral Fertilisers mineral and microbe programs have a reputation of performing well on relatively low inputs of Nitrogen – particularly at seeding. Anecdotal evidence has shown that the application of liquid-N down the boot may affect the potential of the mineral/microbe programs. This trial was set up to examine whether additional N (liquid-N down-the-boot or foliar applied) enhanced a **WMF mineral fertiliser** program as compared to a Standard Practice acid based fertiliser program. In addition, microbial inoculation with WMF microbes is reported to increase productivity and yield of these mineral programs by approximately 9-11%. This was also tested.

The wheat trial was conducted at Bruce Rock in 2008. No consistent differences in establishment, vigour or biomass were noted between the treatments. Results (based on APW2 @ $325/t) showed that: 1). the basic WMF mineral + microbe program with No extra N - yielded 1770kg/ha, cost $126/ha for input, and returned av. $449/ha; the basic Standard Practice program with No extra N - yielded 1800kg/ha, cost $148/ha for input, and returned av. $437/ha; 2). WMF plus 30l/ha Liq-N injected - yielded 1910kg/ha, cost $148/ha for input, & returned av. $472/ha; Std Practice plus 30l/ha Liq-N injected - yielded 2020kg/ha, cost $168/ha for input, and returned av. $489/ha; 3). WMF plus 30l/ha Liq-N post emergent foliar - yielded 2130kg/ha, cost $148/ha for input, and returned av. $544/ha; Std Practice plus 30l/ha Liq-N post emergent foliar - yielded 1850kg/ha, cost $168/ha for input, and returned av. $433/ha; and iv). Inoculation with WMF microbes increased yields on the WMF program by 210kg/ha (up 10.9%), cost $4.30, and returned **an extra of $68.25/ha.** Although the yields were not statistically significantly different, $ Returns were significant. Data trends in this trial indicate that Liq-N is better as a foliar (rather than down the boot) for WMF Program; and that inoculation with beneficial microbes increased yield by an average of 10.9%... *see Page 4:*

Comments and Observation on WMF Nitrogen Management 2008 Trial – Hyden and Esperance, WA

The objective of this trial was to evaluate different types of Nitrogen (solid, liquid or Microbial) 1). applied with seeding, 2). post seeding or 3). as a N_2 fixing microbial seed treatment.

Data is presented on wheat trials conducted at Esperance and Hyden. Parameters such as crop vigour showed no significant differences between any of the treatments. Nitrate, Ammonium and Amino Acids translocated through the saps showed definite trends. Highest Nitrates (and lowest Amino Acids) in the WMF mineral/microbe program were generally seen where N was applied post emergent - with very much higher levels of Nitrate in the Standard Practice program applied with foliar Liq-N. The N_2 fixing microbe treatments generally showed lower levels of Nitrate, but increased levels of Ammonium, and very high levels of translocated Amino Acids. Ultimately, there was no real significant yield differences between treatments; however there was significant $ return differences. The N_2 fixing microbe treatments showed comparable yields to those where additional N was applied… *see Page 7:*

PASTURE RENOVATION *Page 3*

This long term pasture program has been conducted at Narrikup over 12 years using a combination of mineral fertiliser and beneficial microbes. This 2008 assessment was to renovate pasture to introduce better Rye (Perennial and Annual) and legume pasture (other than Clover), cut Hay or Haylage early enough to ensure good seed set. Contractors results were excellent - 12.5 large rolls/acre or 30.5 rolls/ha. Rye seeds were harvested from strong regrowth in January 2009… *see Page 8:*

RECENT & ON-GOING RESEARCH TRIALS

Reports to be presented in the next Research Update

- Mineral / Mycorrhizal trials and Biochar (UWA).
- Assessment of Mineral / Microbes, Biochar (DAFWA).
- In addition, data from 2008 Cereal Trials with the RAIN Group and FACEY Group, and also from Goomalling are still being analysed.

Wheat harvested from 2008 Trial Plots at Tincurrin being loaded into Weigh Trailer.

Soil Testing

APAL Soil testing Kits are availble from WMF Administration, Ph: (08)-9851-7222.

Trial Results again show the excellent performance of the basic WMF Mineral and Microbe programs.

There are many new "stand alone" Biological products coming onto the market – ask for the independent scientific research and data that validates any claims made.

IF YOU ARE USING WMF MINERALS & MICROBES - AND YOU PLAN TO USE ANY OTHER SEED DRESSING or DOWN THE BOOT TREATMENTS *including Nitrogen* – CONTACT WMF OFFICE and CHECK FOR COMPATABILITY.

living farm

Assessment of WMF NPK Crop Plus & WMF Microbes on Wheat Yield & Quality

CROPPING – Bruce Rock Region

by Richard Devlin (BSc NRM Hons)

AIM:

To investigate the effect on wheat yield and quality of using 100kg/ha of WMF's NPK Crop Plus with and without WMF's Microbe seed treatment, and with two different methods of Nitrogen application.

EXPERIMENTAL DETAILS:

This trial was conducted at Ian Dolton's farm, 15km NE of Bruce Rock on a gravely loam site, pH 4.7. Arrino wheat @ 70kg/ha was seeded on 27 May 2008 using a dedicated small plot seeder with knife points and press wheels. Fertiliser was banded at the bottom of the furrow approximately 3-4cm from the seed. Liq-N applied at seeding was applied via a Liquid Systems Stacker Manifold and injected at approximately the same depth as the fertiliser. Foliar Nitrogen was applied on 16 July 08 with a hand held small plot trials sprayer.

Plots were checked for visual differences in establishment, vigour and biomass throughout the season. A composite sample of whole plant tops was taken from each treatment for tissue testing on 16 July 2008 (crop growth stage Z20-Z23) prior to the application of the foliar Nitrogen treatments. Another composite sample of whole plant tops was taken on 4 September 2008 (crop growth stage Z30-Z32). All plots were harvested with a Hege 125C small plot combine. Individual grain weight was taken from each plot.

RESULTS AND DISCUSSION:

Visual Differences

Plots were checked on 11/06/08, 20/06/08, 16/07/08, 06/08/08, 02/09/08, 16/09/08, 22/09/08, 8/10/08 and again prior to harvest. No consistent differences in establishment, vigour or biomass were noted between the treatments.

Tissue Tests

Tissue tests taken on the 16th of July 2008 (prior to the foliar application of Nitrogen) show the high Nitrate levels in treatments 2 and 5 which are those that had Liq-N injected at seeding (see Figure 2).

The WMF NPK Crop Plus contains a different trace element mix to the Standard Practice fertiliser (Table 3). These differences in trace elements were not reflected in the whole top analysis from the 16th of July 2008.

Analysis of tissue samples taken on the 4th of September 2008 showed few differences between any of the treatments (data not shown). Nitrate levels had settled and dropped significantly from the July test and there was little difference in trace element levels between any of the treatments.

Grain Yield

There was an increase in average yield of 210kg/ha in the WMF NPK package with the addition of microbes (see Figure 1), although this was not statistically significant at p=0.05 or p=0.1.

Whilst there is no statistical significance (p=0.05) in yield between treatments there are some interesting trends. Lowest yields were seen in the treatments 1 and 4 which were those that did not receive any additional Nitrogen (apart from that contained in the starter compound fertiliser).

The WMF package yielded more where the Nitrogen was applied as a foliar spray rather than being injected at seeding. The Standard package showed the opposite of this, returning a higher yield where the Nitrogen was injected at seeding. Again, these results were not statistically significant.

Table 1: Grain Yield and Statistical Analysis

Tmt	Base Fertiliser	Additional Treatment	Liq-N	Yield (t/ha)
1.	100kg/ha WMF NPK Crop Plus	750g/ton WMF Microbes	None	**1.77**
2.	100kg/ha WMF NPK Crop Plus	750g/ton WMF Microbes	30L/ha Injected at seeding	**1.91**
3.	100kg/ha WMF NPK Crop Plus	750g/ton WMF Microbes	30L/ha post	**2.13**
4.	100kg/ha Standard Practice fertiliser	400ml/ha Impact-in-Furrow	None	**1.80**
5.	100kg/ha Standard Practice fertiliser	400ml/ha Impact-in-Furrow	30L/ha Injected at seeding	**2.02**
6.	100kg/ha Standard Practice fertiliser	400ml/ha Impact-in-Furrow	30L/ha post	**1.85**
7.	100kg/ha WMF NPK Crop Plus	None	30L/ha post	**1.92**
			Mean	1.92
			CV%	8.4
			Significance	ns
			LSD 5%	na

Fig 1: Effect of Microbes on Wheat Yield

Treatment 100kg/ha NPK Crop Plus *and* 30l/ha Liq-N Foliar

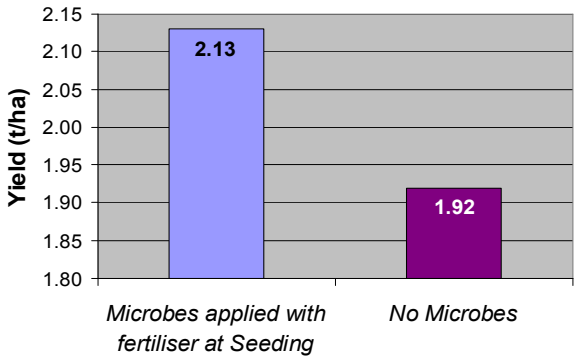


Table 2: Grain Quality

Tmt	Protein	Screenings	Hectolitre Weight
1.	12.9	1.98	80.8
2.	12.3	1.96	81.8
3.	12.8	1.88	80.6
4.	12.4	1.87	80.4
5.	12.5	1.27	81.9
6.	12.8	1.78	80.0
7.	12.8	1.75	80.7

Protein levels were similar for all treatments, however it is interesting to note that Treatment 1, which received no extra Nitrogen also returned the highest protein levels. Screenings were extremely low for all treatments which is likely due to the extremely soft finish to the season. Hectolitre weights did not vary greatly, although it is worth noting that highest weights were achieved by the two treatments which had Liq-N injected at seeding.

(samples collected 16 July 2008)

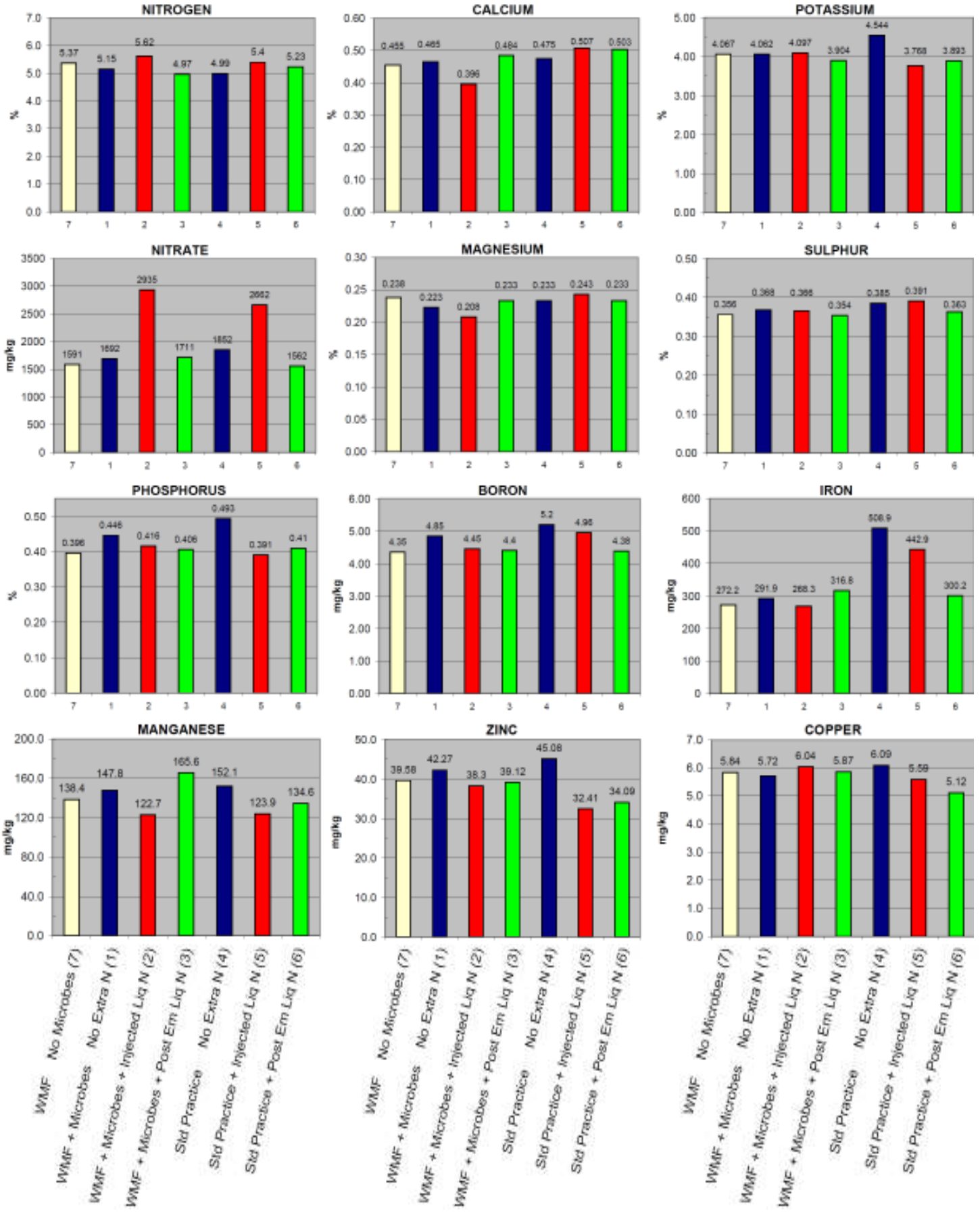


Table 3: Fertiliser Macro-Nutrient Analysis

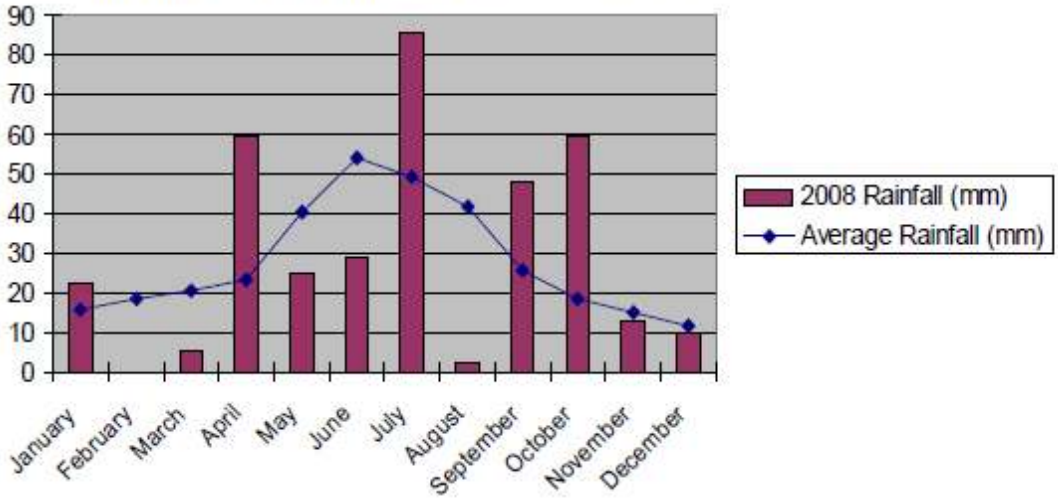
FERTILISER	N	P	K	S	Mg	Fe
WMF NPK Crop Plus	8	9	4.5	7.6	1.3	2
Std Practice fertiliser	9.7	11.2	11.2	10.2	-	-
Liq-N	42 units of Nitrogen (w/v%) in the nitrate, ammonium and urea forms					

Example of Trial Site plots:
No consistent differences in establishment, vigour or biomass were noted between the different treatments.

16/07/08: Plot 101, Treatment 1.
100kg/ha NPK Crop Plus
+ Microbes (No extra N)

16/07/08: Plot 106, Treatment 6.
100kg/ha Standard Practice fertiliser
+ Impact + 30L Liq-N Post

2008 Monthly & Av Rainfall Data – Bruce Rock, W.A.



CONCLUSIONS:

Despite the lower analysis of Western Mineral Fertiliser's NPK Crop Plus there was little difference in establishment, biomass or vigour when compared to an equivalent rate of Standard Practice fertiliser.

Tissue tests taken 50 days after seeding showed high Nitrate levels in those plots that had received Nitrogen injection, regardless of the starter fertiliser treatment.

There was no statistically significant difference (p=0.5) in yield between any of the treatments, however the lowest yielding plots were those that did not receive the additional 30l/ha of liquid Nitrogen.

While not statistically significant (p=0.5) the addition of microbes to the WMF cropping package increased yield by an average of 210kg/ha.

There was very little difference in quality between any of the treatments. Protein was similar for all treatments with timing or application method of Nitrogen (foliar or injected) having little effect in this trial. Screenings were extremely low for all treatments, most likely due to high rainfall during grain filling. Hectolitre weights also varied little between treatments and showed no trends.

MEAG Soil Consultancy

Comments and Observation on WMF Nitrogen Management 2008 Trial – Esperance & Hyden, WA

By H.F. De Wet (MSc Soil Chemistry)

BACKGROUND:

High inputs of agricultural fertilisers containing Nitrogen and Phosphorus have significantly increased crop yields over the last 20-30 years. However, it is becoming increasingly evident that this intensive cropping is no longer sustainable, both in terms of soil management and increased input costs. In addition, there is growing evidence that increasing root colonization by beneficial microbes may give crops better access to soil nutrition.

OBJECTIVES:

The objective of this trial was to evaluate different sources of Nitrogen 1). applied with seeding, 2). post seeding and 3). as a microbial seed treatment. The sources of Nitrogen used were:

- Urea (46% N) – A granular amine form of Nitrogen that needs to be converted to Ammonium and eventually Nitrate to be absorbed by the plant.
- UAN (32% N) – A liquid form of N (Urea-Ammonium-Nitrate) that is very flexible in use because it can be applied on the soil pre-seeding, close with the seed at seeding or as a foliar post-seeding.
- ASN (26% N) – A granular form of Nitrogen containing Sulphur, very effective to apply post-seeding.
- Sulphate of Ammonia (21% N) – A Nitrogen source predominantly in the Ammonium form. This form of Nitrogen is not volatile under normal soil conditions and because of its positive charge in solution, leaching is not a problem.
- Twin N – Endophytic Nitrogen fixing bacteria that is sprayed on the leaf of the crop.
- PSN – Nitrogen fixing bacteria used as a seed treatment with seeding.

SETUP:

The trial was conducted at three locations in the wheat belt, Esperance, Hyden & Goomalling using Western Mineral Fertiliser NPK Crop Plus (8%N, 9%P, 4.5%K, 7.6%S, 1.3%Mg, 2% Fe + TE) as seeding fertiliser with Ag Blend microbial seed treatment, except on the treatment where PSN Microbes were used on the seed. A Standard Practice fertiliser (9.7%N, 11.2%P, 11.2%K, 10.2%S) was also included in the trials at Esperance and Goomalling. The Hyden farm doesn't use any acid based down-the-boot fertilisers. All treatments were replicated 3 times and randomised. Carnamah was used at a rate of 70kg/ha in Esperance & Wyalkatchem wheat in Hyden at 65kg/ha. Data from Goomalling is not complete at the time of writing, so discussion will only be made of the results from Esperance and Hyden.

The parameters tested during the growing season was Nitrogen ratios, Yield and Quality. All trials were done using the farmers equipment and in paddocks between 80ha and 120ha in size. Plots were checked for visual growth differences throughout the season. Saps were analysed for Nitrate and Ammonium using a Horiba hand held analyzer on three occasions in June, July and August. With the August sap analysis, another composite sap sample (whole plant tops) was taken & analysed for total amino acid analysis. All plots at Esperance were harvested on the 15th of December 2008 & at Hyden on the 30th of December 2008. Individual grain yield from each plot was made using a weigh trailer.

Esperance Soil Analysis:

The soil at the Esperance trial site is loamy gravel with a low organic fraction. Because of the low organic matter the holding capacity of this soil isn't high, thus the potential Nitrogen mineralisation is low. The soil level of Phosphorus is significant with low levels of Potassium and Sulphur deficient. All the trace elements are low.

Hyden Soil Analysis:

The soil at the Hyden trial site is typical sand over clay with reasonable organic matter. The pH of the soil might be low in some areas, but because of the higher nutrition level, acid cations like aluminium and reactive iron shouldn't be a problem. The holding capacity of this soil is high, thus this soil has the potential to mineralise Nitrogen if conditions are good. The soil level of Phosphorus is significant with higher levels of Potassium and Sulphur. All the trace elements are low.

Esperance Treatments: *2008 Nutrient Input Cost/ha*

(A)	E 1 - NPK Crop Plus @ 80kg/ha + Microbes + No Nitrogen (With Seeding)	$105.10
(B)	E 2 - NPK Crop Plus @ 80kg/ha + PSN Microbes on seed (With Seeding)	$107.60
(C)	E 7 - NPK Crop Plus @ 80kg/ha + Microbes + Twin N (Post Seeding)	$130.10
(D)	E 3 - NPK Crop Plus @ 80kg/ha + Microbes + UAN @ 25l/ha (With Seeding)	$120.10
(E)	E 4 - NPK Crop Plus @ 80kg/ha + Microbes + Urea @ 25kg/ha (Post Seeding)	$126.85
(F)	E 8 - NPK Crop Plus @ 80kg/ha + Microbes + UAN @ 25l/ha (Post Seeding)	$120.10
(G)	E 5 - NPK Crop Plus @ 80kg/ha + Microbes + ASN @ 40kg/ha (Post Seeding)	$137.10
(H)	E 6 - NPK Crop Plus @ 80kg/ha + Microbes + SOA @ 55kg/ha (Post Seeding)	$127.10
(S)	E 9 – Standard Practice fertiliser @ 100kg/ha + UAN @ 40l/ha (Post Seeding)	$194.20

*Unfortunately **(D)** E 3 wasn't seeded due to a mechanical problem.*

Hyden Treatments:

(A)	H 1 - NPK Crop Plus @ 80kg/ha + Microbes + No Nitrogen (With Seeding)	$105.10
(B)	H 2 - NPK Crop Plus @ 80kg/ha + PSN Microbes on seed (With Seeding)	$107.60
(C)	H 5 - NPK Crop Plus @ 80kg/ha + Microbes + Twin N (Post Seeding)	$130.10
(D)	H 3 - NPK Crop Plus @ 80kg/ha + Microbes + Urea @ 25kg/ha (With Seeding)	$126.85
(E)	H 8 - NPK Crop Plus @ 80kg/ha + Microbes + Urea @ 25kg/ha (Post Seeding)	$126.85
(F)	H 4 - NPK Crop Plus @ 80kg/ha + Microbes + UAN @ 25l/ha (Post Seeding)	$120.10
(G)	H 6 - NPK Crop Plus @ 80kg/ha + Microbes + ASN @ 40kg/ha (Post Seeding)	$137.10
(H)	H 7 - NPK Crop Plus @ 80kg/ha + Microbes + SOA @ 55kg/ha (Post Seeding)	$127.10

Nitrogen:

Nitrogen is mainly absorbed in the Nitrate form by most of the cereal crops grown in the wheat belt. This form of Nitrogen needs to be reduced or changed to an amine form of Nitrogen that is the building blocks for amino-acids. The amino-acids are in turn the building blocks for protein, a very important quality parameter. Therefore it is standard practice to optimise the ratio between Nitrate N and Ammonium N. The optimum Nitrate to Ammonium ratio in the sap of a cereal plant is generally considered to be between 10 and 18, depending on the soil conditions, soil moisture, the availability of nutrients and soil biological activity.

Treatments at Esperance (see Figure 2. v) where the Nitrate levels are in balance with the Ammonium are **A** (No additional N), **E** (Post Urea), **G** (Post ASN) and **H** (Post Sulphate of Ammonia). Likewise at Hyden (see Figure 2. vi), a similar pattern is seen for **D** (Urea at seeding), **E** (Post Urea), **G** (Post ASN) and **H** (Post Sulphate of Ammonia).

At Esperance, treatment **F** (UAN was sprayed on the crop as a foliar) and treatment **S** (Std Practice with UAN as a foliar) had a very high Nitrate to Ammonium ratio. Similarly, at Hyden, the two treatments with the very high Nitrate to Ammonium ratios were **A** (No additional Nitrogen) and **F** (UAN as a foliar). These treatments all specifically had quite low Ammonium levels.

It is obvious at both Esperance and Hyden that the two treatments (B and C - see Figure 2. v and vi) where Nitrogen fixing bacteria were used as the only additional source of N - had the lowest Nitrate to Ammonium ratio. Initially, this might indicate that additional Nitrogen could be applied to achieve the optimum ratio. However when one observes the levels of amino acid (treatments B and C - see Figure 2. vii and viii), it becomes apparent that adequate Nitrogen *is being* translocated in these plants. In addition, field observations at various stages of the growth of these plants indicated that there were no visible signs of Nitrogen deficiency. In comparison, the amino acid levels were much lower in the treatments (including the Standard Practice) where N fixing bacteria were not applied.

Yield:

The WMF treatment with the highest yield at Esperance is **A** (**3.55 t/ha**) where no additional N was applied to the Nitrogen in the seeding fertiliser (see Figure 2 ix.) – this compares favourably with the Standard Practice treatment **S**. No significant difference in the rest of the treatments, except **F** (**2.80 t/ha**) that is on average about half a ton lower in yield. Interesting to note that **F** is the only WMF treatment where the Nitrate to Ammonium ratio is very high at 29.2 in this Esperance trial.

The Esperance data and yields of treatments **B** and **C** (**3.3** and **3.36t/ha** respectively) indicates that the wheat treated with the N_2 fixing microbes showed a low Nitrate to Ammonium ratio; BUT this did not relate to a yield problem. One may postulate that the increase in translocated Amino Acids in these two treatments bypassed conventional understanding of the Nitrate : Ammonium ratio. This result is interesting and warrants further investigation.

At Hyden (see Fig 2 x.), the two treatments with the highest yield is **D** (2.26t/ha) where Urea was banded close to the seed at seeding & **G** (2.27t/ha) where ASN was used as a N source post-seeding. The yields of N_2 fixing microbes treatments **B** & **C** are measuring up to the control where no additional Nitrogen was applied.

CONCLUSIONS:

2008 was a non-typical year as far as rainfall patterns, a major frost event and a very long and soft finish. Although each treatment had varying types and amounts of applied Nitrogen, trials both at Esperance and Hyden showed that there was generally little significant yield difference when using Western Mineral Fertilisers NPK Crop Plus and seed dressing microbes – indicating that yields in these 2008 trials were not driven by application of excessive amounts of N. Yields compared favourably with the Standard Practice treatment at Esperance.

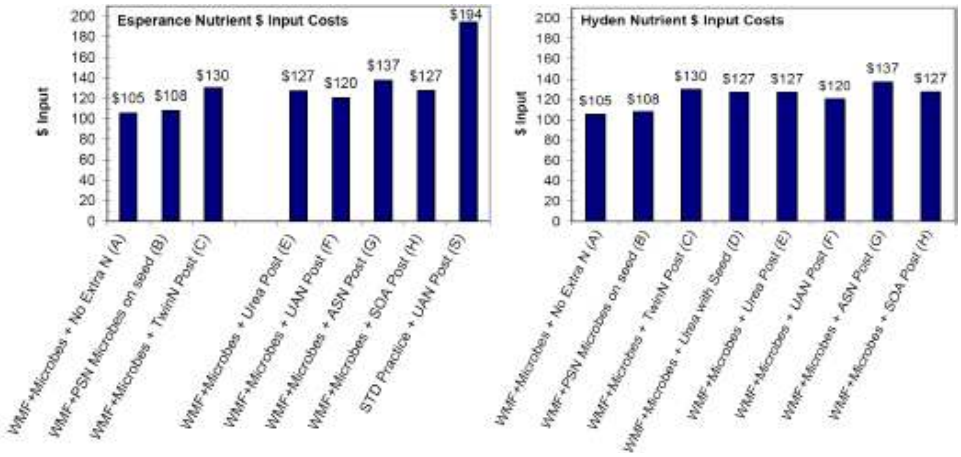
Visual inspection of all trial crops during the growing season showed no observable Nitrogen Deficiencies.

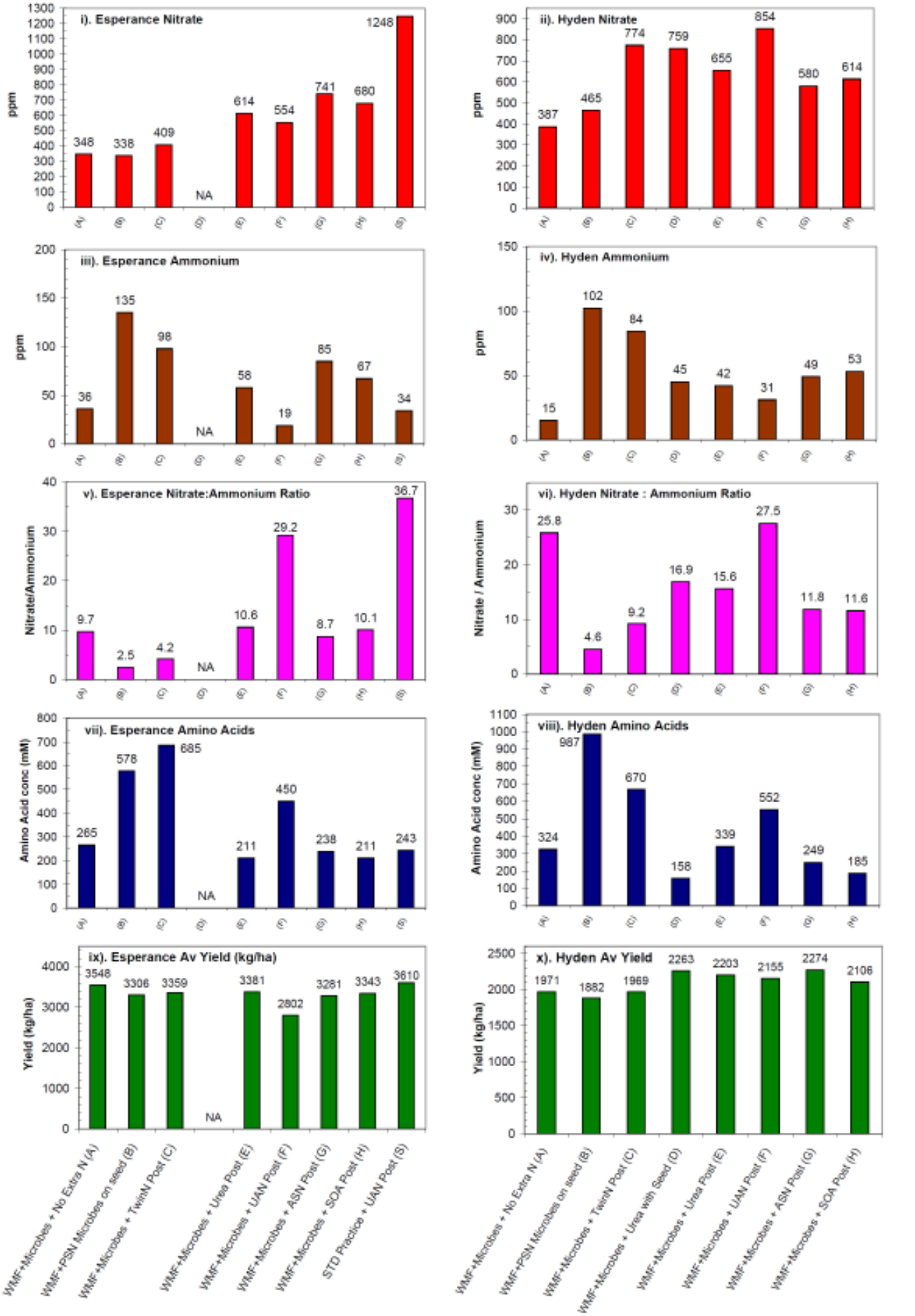
Sap tests collected showed large variability in the Nitrate : Ammonium ratios, with the highest generally being detected in the treatments that had extra N applied, and the lowest generally in those plots that had received no extra Nitrogen, or that had Nitrogen fixing microbes applied (either to the seed, or as post emergent foliar). On the other hand, the plants that were treated with these N fixing microbes had the highest levels of translocated amino acids. Yield data showed that there was no significant yield penalty (particularly on the relatively high yielding 3.3t crops at Esperance), and that the Nitrogen fixing microorganisms are well worth further investigation.

Of the soluble Nitrogen's applied to the WMF treatments - UAN appeared not to perform as well as either Urea, ASN or Sulphate of Ammonia. At Esperance the Western Mineral Fertiliser's NPK Crop Plus and seed dressing microbes with no additional Nitrogen treatment yielded 3.5t/ha, which was significantly higher than the UAN treatment (2.8t/ha).

Given that the yields were comparable between the WMF treatments (and with the Standard Practice treatment at Esperance), it will be interesting to see the Grain quality data to see if there are any differences in the Protein levels, screening etc. and so that $ Returns per treatment can be calculated. This will be important - particularly based upon the variability of inputs cost per ha in 2008, where the WMF treatments ranged from $105 to a maximum of $137/ha, compared to the similarly yielding Standard Practice treatment at $197/ha. Based on equal grain quality this would show a $68/ha higher return on the WMF basic mineral microbe program compared to Standard Practice.

Figure 1:
Input Costs





FOCUS:

To renovate pasture to introduce better Rye (Perennial and Annual) and legume pasture (other than Clover), cut Hay or Haylage early enough to ensure good seed set.

LOCATION:

Stephen and Kerry Frost's property, The Pass Road, West Narrikup.

HISTORY:

12 years of Mineral fertiliser application, with predominant Clover base pasture for sheep grazing (@ 8.6 wet/ha). Renovated and cut for Hay in 2002. Gravel sand over clay, pH 5.6 (in H_2O).

SEEDING:

- Seeded 21 May 2008. Seeds coated with WMF Hort blend microbes @ 100g/ha.
- 60kg/ha WMF NPK Crop mixed with :
  - Everlast Perennial Rye 10kg/ha
  - Rocket Annual Rye 4kg/ha
  - Massive Oats 15kg/ha
  - Sao Oats 5kg/ha
  - Sundry pasture legumes
- Top dressed 180kg/ha Mineral PK fertiliser.