Western Mineral Fertilisers

Managing Risk, Creating a Positive Future in Farming

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Guest Speakers Extracts

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Preliminary Assessment of the effect on Biology of Pre-Emergent Herbicide Application to a WMF Mineral/Microbe Wheat Program

Richard Devlin and Rebecca Clarke (Living Farm Ag Research and Consultancy)

BACKGROUND:

Western Mineral Fertilisers (WMF) Biological Farming and cropping programs rely heavily upon beneficial soil bacteria and fungi. This current trial is a preliminary research study being conducted to examine a mineral fertiliser/microbe program and the *effects on soil Biology* of applying various pre-emergent herbicides.

OBJECTIVES:

- To evaluate soil mycorrhizal status (VAM), Yield and Quality - growing wheat with **Western Mineral's granular mineral fertiliser NPK Crop.**
- To compare the effects of application of various Herbicides – either individually or in combination.

TRIAL SUMMARY:

This trial was conducted at Pingelly during 2010, where seven commonly used pre-emergent herbicides (Logran^{TM}, Glean^{TM}, Sakura^{TM}, Diuron, Trifluralin, Boxer Gold^{TM} and Avadex^{TM}) were applied in a latin square arrangement - with every herbicide in every combination, as well as alone and at double rates. A "no herbicide" control was also included. Plots were then sown to wheat.

The trial generated a massive amount of information. It provided an agronomic „checkerboard" which not only showed up differences below the ground (the effect of these chemicals on Mychorriza), but was also a very visual trial above ground from a yield and weed control point of view.

TREATMENTS:

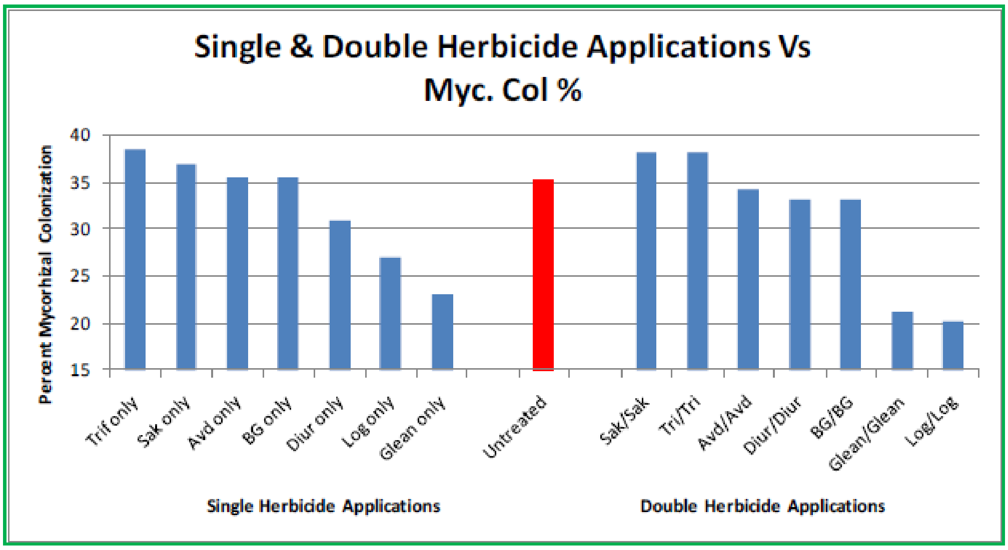
- Roundup (1.5l/ha) was sprayed over the whole site prior to seeding.
- Trial was sown on the 11/06/10. Pasture 2009, chemical fertiliser system.
- Basal Fertiliser: 75kg/ha WMF NPK Crop. 40kg Urea Gold @ 10 w.a.s.
- Wyalkatchem Wheat (non-pickled) at 75kg/ha. Seed was treated with 750g/t WMF Hort Microbes.
- Cloud Cover at application: 20-40%.
- Humidity: 94%(start) 54% (finish).
- Wind Speed: 6km/hr with gusts to 8km/hr.
- Wind Direction: ESE.
- Application Equipment: Ute Mounted Small Plot Boom (10m).
- Spray Volume: 50l/ha.
- Spray Pressure: 3 bar.
- Nozzle Type: Teejet 110015 Air Induction.
- Nozzle Spacing: 50cm.
- Temp Start: 1.7deg C (9.30am).
- Temp Finish: 13.7deg C (12pm).
- 100ml/ha dimethoate (RLEM) @ 10 w.a.s..
- Rainfall since seeding 106mm. (144mm growing season 2010).

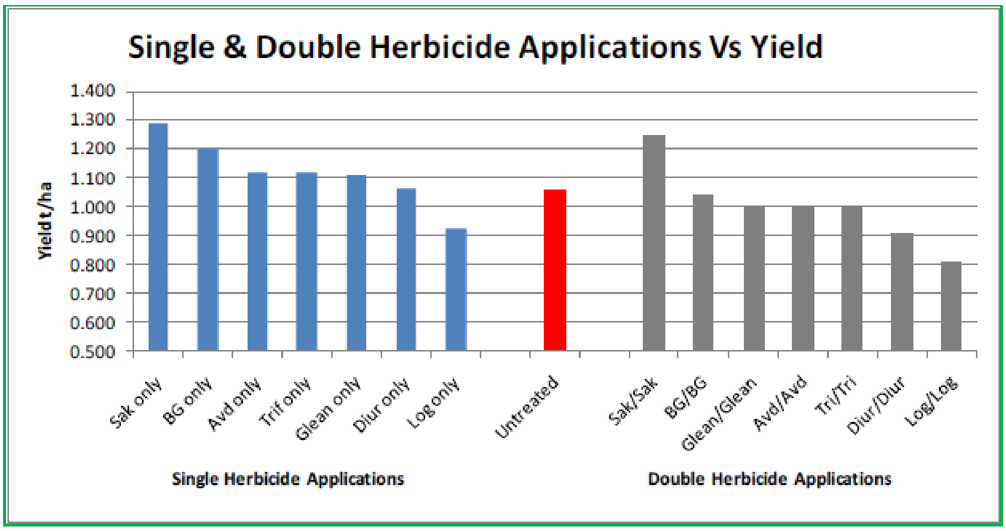
Fertiliser – Typical Nutrient Analysis (w/w%):

	N%	P%	K%	S%	Ca%	Mg%	Cu	Zn	Mn	TE
NPK Crop	7.0	7.5	5.0	8.0	7.5	1.2	0.056	0.048	0.390	+++
Urea Gold	46.0									

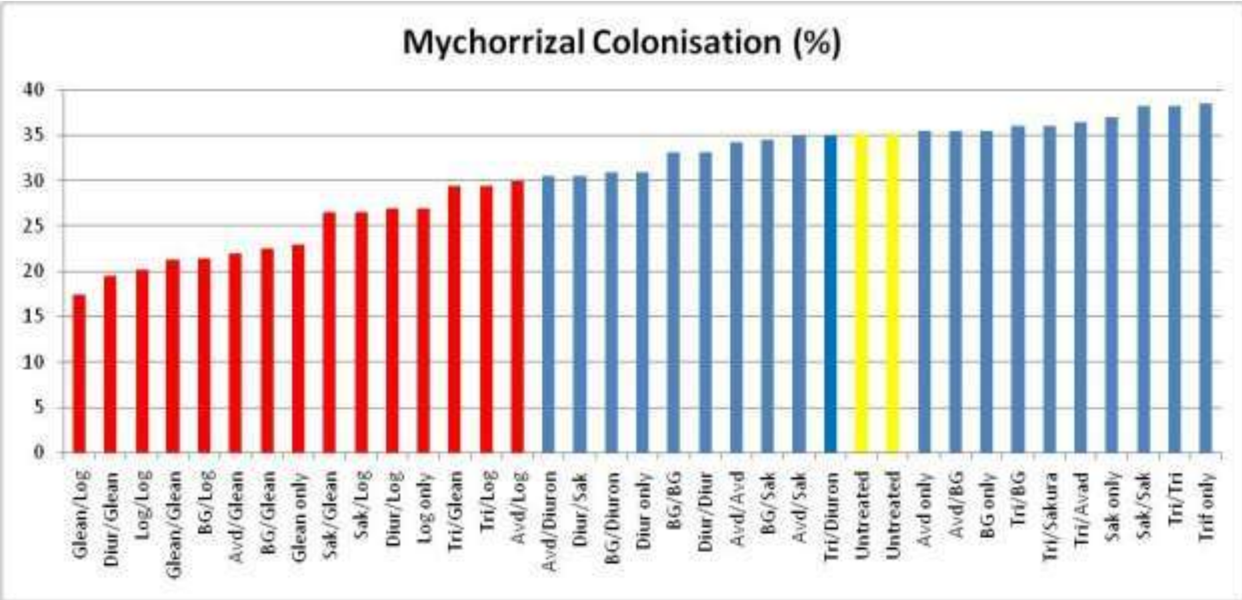
WMF Hort blend microbes	For broad acre cropping and pasture with over 25 strains of beneficial Microbes including Trichoderma, WA Mycorrhiza an VAM. Applied as a seed dressing at 750 grams/Tonne.

TRIAL LAYOUT – LATIN SQUARE:

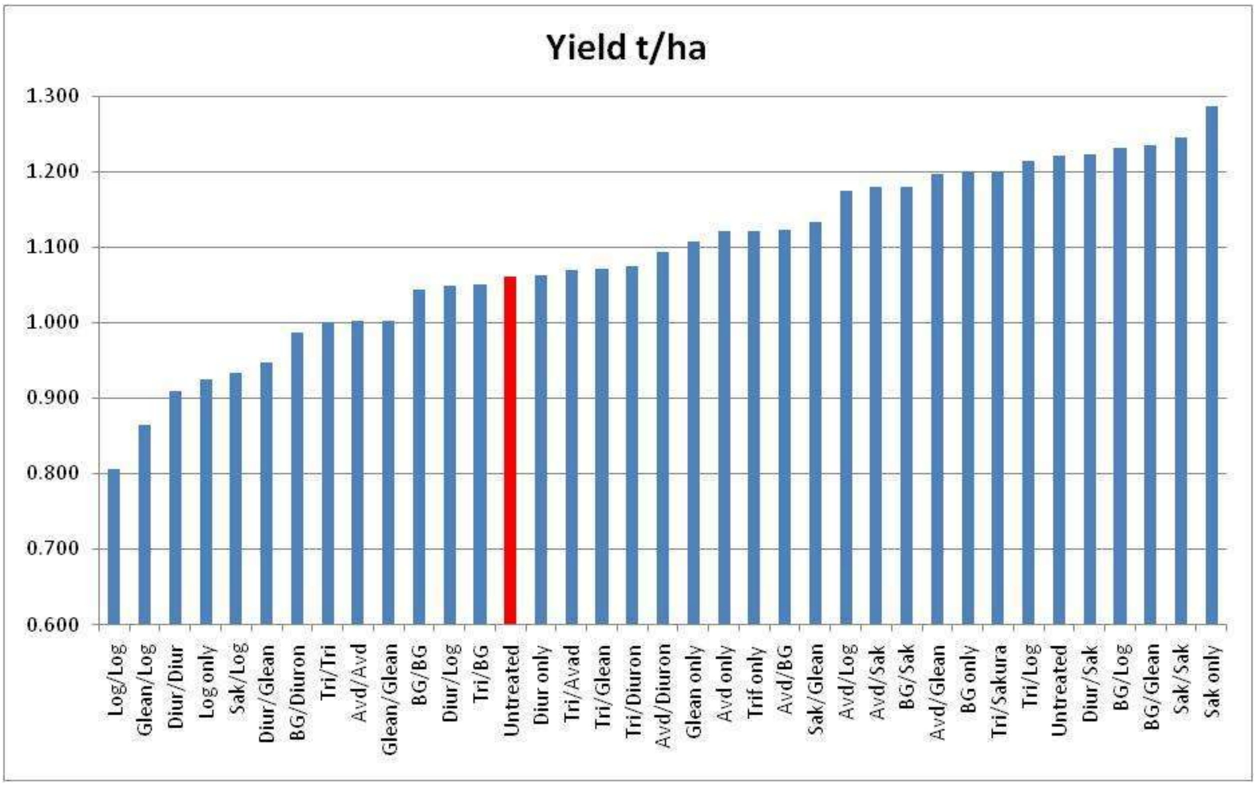




Results: % Myc. colonisation of all plots (inc. combinations)
Plots with SU's applied in Red



Results: Yields of all plots (inc. combinations)



CONCLUSION:

- Latin Square design: Excellent for generating a lot of data, but difficult to do stats on
- No single herbicide treatments appeared to reduce the yield when compared to UTC, except Logran (but this most likely due to soil type change in Logran plots, not Logran itself)
- Double applications of Logran and Diuron did look to reduce the yield
- Sakura and Boxer Gold have little affect on yield or mycorrhizal colonisation
- Trifluralin appeared to *increase* mycorrhizal populations
- SU"s did reduce mycorrhizal populations.
- Double applications of most products reduced the Mychorrizal colonies, with the exception of Sakura and Trifluralin.

Comments and Observation on WMF Nitrogen management trials conducted in the Esperance district over the past 3 years

HF De Wet (Meag Soil Consultancy)

BACKGROUND:

For the past three years, comprehensive Nitrogen management trials in the wheat-growing region of Western Australia's Esperance district.

High inputs of agricultural fertilisers containing nitrogen and phosphorus have significantly increased crop yields over the past 20-30 years however, it's 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.

Below, the results of WMF's four trials are summarized.

TRIAL CONCLUSIONS:

The trials reveal that encouraging the mineralisation of nitrogen through biological activity is the cheapest and most effective way to supply nitrogen, confirming the importance of a fertiliser program that supports the biological system.

Nitrogen management is a factor and is influenced by variable parameters ie. the soil's moisture content and temperature is critical in managing nitrogen. A significant benefit could be seen by top- dressing nitrogen later in the season if we get extended rainfall events into spring.

The source of nitrogen is important, as is the time of application and the soil condition. Specific soil parameters like C/N ratio, organic carbon, clay content, cation exchange capacity (CEC), sulphate and pH will determine the source of N to be used. It was evident in the 2010 trials that a nitrate base nitrogen source was most effective in a soil with high CEC and clay content.

DISCUSSION:

The trials prove that nitrogen management practices play an important role in optimum grain production. Although crops usually respond to N fertiliser, this is not always the case as response to N depends on:

- physical and chemical soil conditions
- soil moisture and temperature
- the particular crop; and
- the plant nutrient supply in general

As far as soils are concerned, N response is generally correlated to the release of nitrogen by microbial decomposition of soil organic matter. Thus, a fertiliser program stimulating microbial activity requires specific N management, ensuring optimum economic returns.

Nitrogen is mainly absorbed in the nitrate form by most of the cereal crops grown in WA's 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. The different sources of N used in these trials were Urea, Ammonium Sulphate, Ammonium Nitrate Sulphate, UAN and N-fixing bacteria. The seeding fertiliser used was the WMF product called NPK Crop Plus. In addition, the seed was treated with a microbial seed treatment – Hort Blend. All the treatments were compared with a farmer's practice that normally consist of a MAP or DAP base fertiliser with no treatment on the seed.

YEAR-BY-YEAR RESULTS:

2008:

- 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 N, the trials showed yields were not driven by application of excessive amounts of N. Yields compared favorably with the farmer's practice.

Visual inspection of all trial crops during the growing season showed no observable N 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 N or that had N-fixing bacteria applied (either to the seed, or as post emergent foliar). On the other hand, the plants that were treated with these N-fixing bacteria had the highest levels of translocated amino acids.

UAN appeared not to perform as well as Urea, ASN or Sulphate of Ammonia. WMF's NPK Crop Plus and seed dressing microbes with no additional N treatment yielded significantly higher than the UAN treatment.

In 2009, treatments were designed to address four objectives:

1) to demonstrate the role of UAN, applied via liquid injection at seeding, in grain production and quality
2) to evaluate the application of UAN as a foliar, post seeding
3) to evaluate the role of microbes applied on the seed at seeding; and
4) to compare normal DAP as a phosphate source with a mineral fertiliser

There was no significant difference in the treatments where UAN was applied as a nitrogen source. In comparison, there was a yield decrease of 17.3% between NPK Crop Plus with microbes and the same treatment, but with the injection of 30 L/ha UAN. No difference between where UAN was applied as a foliar post seeding and where UAN was injected with seeding.

There was no specific trend as regards to the ratio between nitrate and ammonium in the separate crop stages though, as the crop matured, the NO_3/NH_4 ratio decreased because of the reduction of nitrate in the process of building carbohydrates.

There was a positive response to treating the seed with a microbial seed treatment. The treatment with the microbes on the seed (with 600 g/ton Hort Blend) yielded 2828 kg/ha. Where the seed wasn't treated, the yield was 2136 kg/ha. The use of 600 g/ton HortBlend resulted in a 24.5% yield increase.

Fig 1: Esperance - Yield response

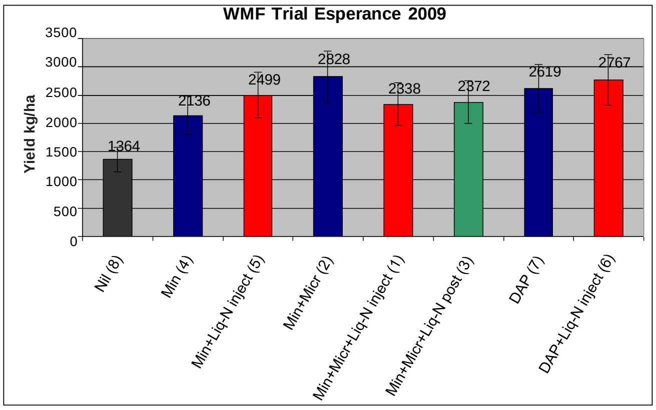
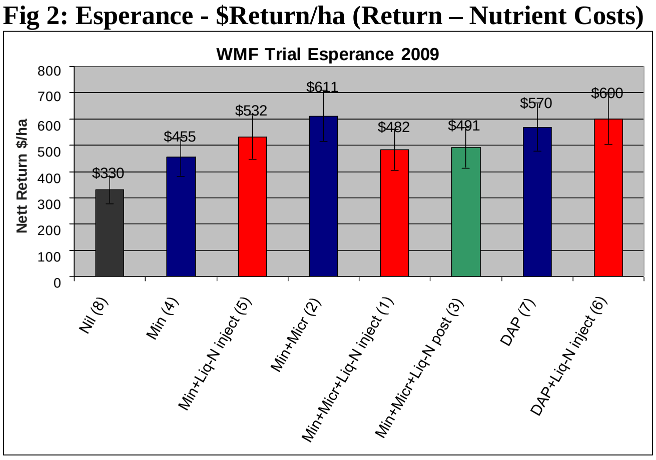


Fig 2: Esperance - $Return/ha (Return – Nutrient Costs)



- based on $246 APW2 (10% protein, 5% screenings)

Trials in 2010 were conducted on two different sites:

The first trial was in the Neridup area, closer to the coast on a lighter soil. The main objectives were nitrogen management by using different rates of Ammonium Sulphate banded at seeding, comparing that with UAN, also banded at seeding. The nitrogen program used by the farmer was evaluated and compared against the other treatments.

The second 2010 trial was in the Scaddan area, in Esperance's north-west, on a heavier soil and was designed to look at N management by using different sources of nitrogen banded at seeding. The nitrogen source called WMF-N is a product containing 26% N where 50% of that is in the ammonium form and the rest in the nitrate form. A nil treatment was also included where no fertiliser at seeding and no additional N was applied. The nitrogen program used by the farmer was evaluated and compared against the other treatments.

With the trial at Neridup, the treatment with 100kg/ha NPK Crop Plus, 40 liter/ha UAN at seeding and additional N top-dressed yielded the highest at 2955 kg/ha. The treatment with the same N regime, except the seeding fertiliser was MAP base, yielded insignificantly lower at 2904 kg/ha. All treatments where additional N was top dressed had a significantly higher yield than the rest of the treatments.

Where 80kg/ha of Ammonium Sulphate was banded, the yield was 2424kg/ha, where 50 kg/ha of Ammonium Sulphate was applied, the yield was 2388kg/ha. What's interesting is where no additional N was applied, the yield was 2383 kg/ha, very close to the same yield where 50 kg/ha of Ammonium Sulphate was banded. Considering the price of Granulated Ammonium Sulphate, this trial showed even the application of 80 kg/ha Ammonium Sulphate didn't have a significant increase in yield to justify the cost of the additional N under these specific conditions.

A significant increase in yield occurred when additional N and sulphur was top-dressed, in this case 39.4kg of nitrogen and 5.4kg of sulphur. Due to the character of the soil and the amount of moisture during the growing season, a later application of N was essential. The main reason is the lack of mineralisation and nutrient recycling to support a nearly 3 ton/ha crop.

The Scaddan trial showed using the ammonium nitrate base product (WMF-N) as a nitrogen source had a significant yield increase over using Urea or not using any N at all.

Although there was a yield increase of 283kg/ha between using 80kg/ha NPK Crop Plus and not using any fertiliser, it wasn't significant according to the statistical analysis. There was a significant difference of 693kg/ha between using 80kg/ha of NPK Crop Plus and 40kg/ha WMF-N and no fertiliser.

Biological Farming and Nutrient Use Efficiency (NUE)

Paul Storer (Western Mineral Fertilisers)

BACKGROUND:

University and CSIRO research has shown that the efficiency (plant usage) of **applied soluble chemical fertilisers** can be as **low as 10 to 30 percent**, particularly for phosphorus and nitrogen.

Biological farming methods present a viable way of increasing nutrient use efficiency (NUE) while at the same time lowering production costs, improving yields, and reducing degradation and pollution of the environment by shifting to sustainable and less chemical dependent practices.

The main issue in applying fertiliser is not the **actual analysis** but how **bio-available** and how **well utilized** it is - this is why beneficial soil biology is so critical. Western Mineral Fertilisers (WMF) Biological Farming and cropping programs rely heavily upon beneficial soil bacteria and fungi.

TRIAL CONCLUSIONS:

Trial Data will be presented that shows that Biological farming practices that support good soil biology (including Mycorrhizal fungi and beneficial soil bacteria) can help improve nutrient use efficiency up to 50 to 70%. Therefore It is not necessary to apply high units of N or P in order to achieve a yield. Application of pickle can be detrimental to the developmental physiology and ultimately root biomass of the cereal, as well as damaging the beneficial microbiology.

DISCUSSION:

Table 1: Soil fertility requirements - Nutrients removed (kg) per tonne of production:

Species	Grain moisture	P	K	S	Ca	Mg
CEREALS						
Barley	11	2.7	4.3	1.2	0.37	1.0
Cereal rye	11	3.4	4.6	0.9	0.62	1.2
Maize	10	2.3	2.7	1.1	0.11	1.2
Millet/Canary seed	11	3.3	3.9	1.3	1.20	3.8
Oats	11	2.7	4.0	1.4	0.60	1.2
Triticale	11	2.4	4.4	1.0	0.31	1.0
Wheat	11	2.6	3.6	1.4	0.38	1.2
GRAIN LEGUMES						
Chickpea	10	3.8	9.1	1.8	1.5	1.4
Faba bean	10	3.6	9.7	1.6	1.1	1.1
Field pea	10	3.6	9.0	2.1	0.8	1.5
Lentil	10	3.3	8.2	1.4	0.9	1.4
Lupin (sweet)	9	3.2	8.3	2.6	2.3	1.8
Lupin (Albus)	9	3.0	8.8	2.4	2.0	1.5
Mung bean	9	7.7	4.7	1.9	1.0	1.8
Vetch	10	4.2	9.0	1.9	0.8	1.1
OILSEED CROPS						
Canola	8.5	5.1	7.4	5.0	3.9	2.8

Source: National Land and Water Resources Audit Final Report September 2001 APPENDIX 6

Nutrients must be replaced as they are removed from soils when grain is harvested and paddocks are grazed (see Table 1). **Soil nutrient availability** to plants is not necessarily determined by the amount of the nutrient that is present in the soil (unless it is deficient), *but* more by how the nutrients *are released* by the soil to the plant. Farm management practices and biological approaches offer improvements in **NUE** and the recovery of N, P + other minerals, and are typically associated with higher grain yield & protein levels.

Microorganism mediated processes (such as by Mycorrhizal fungi) can enhance the release of essential nutrients tied-up in the soil. In addition, the VA Mycorrhiza form an extensive filament system within the soil that is many times larger than the plant root system, and therefore can **bypass nutrient depletion zones** (see Fig A) and access nutrients and water that may not normally be accessible by a smaller root system.

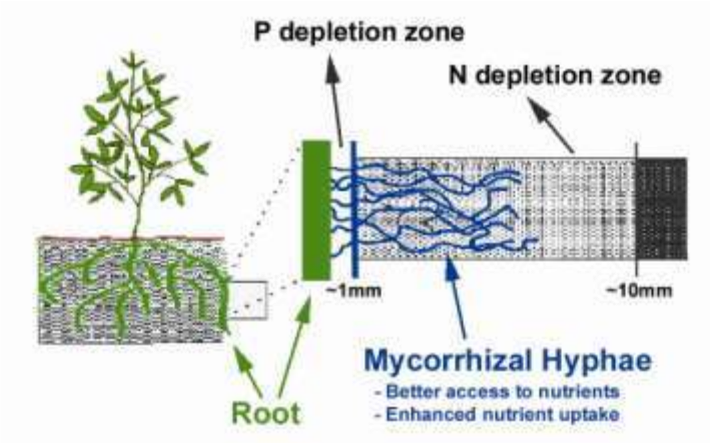


Fig A - the nutrient depletion zone