



AgGrow

AGRONOMY + RESEARCH



ZINC RESPONSE IN WHEAT

2013 & 2014

INDEPENDENT AGRONOMY ADVICE + CUTTING EDGE RESEARCH



Ag Grow Agronomy Zinc Trials

KEY POINTS

- * Zinc is one of the essential micronutrients required for optimum plant growth. Soil test results for the trial sites confirmed that zinc levels were well below the desired range, but there were no significant grain yield or protein responses to applying varying rates or forms of zinc.
- * Applying zinc at various rates did increase seed zinc levels from 13 to 19ppm.
- * Whilst applying extra zinc in these trials did not give any positive yield responses, this is in line with some industry experts who believe that positive responses to yield from zinc in low pH soils does not occur until zinc levels fall below 0.5 mg/kg.
- * Applying zinc as part of your fertiliser program, where soil levels are less than desired, needs to be carefully considered, and responses to yield may be questionable.

BACKGROUND

Zinc is an important trace element required by cereals. It is essential for normal crop development, although is particularly important in the very early stages of growth. Deficient levels of zinc often result in stunted crops with small leaves, figure 1.

Most soil tests conducted for clients by Ag Grow Agronomy and Research have shown zinc (Zn) levels (DTPA mg/kg) are well below the desired range in our region, with the desired level >5mg/kg, according to Phosyn.

This is not a new trend, however levels seem consistently lower than desired.

Paddocks with a history of Zn fertiliser have shown higher levels, indicating that we can increase soil Zn with fertiliser.

Responses to Zn can be affected by soil pH and limitations to root growth, such as disease and herbicide carryover.

TRIAL DETAILS

Zinc trials have been conducted by Ag-Grow Agronomy and Research for the past two seasons.

In 2013 a zinc rate and a zinc form trial were established to investigate the best ways to correct this deficiency in our environment.

In 2014 four zinc response and a zinc carryover trial were established to evaluate the importance of zinc in dryland and irrigated farming systems. They evaluated responses from various rates, application methods and forms of zinc with fertiliser at sowing.

2013 Trials:

The two trials were established 25km NE of Griffith NSW, in May 2013 at Michael Pfitzner's.

The soil Zn, P (Colwell) and pH (CaCl₂) levels for the site were:

| | |
|-----------|-----|
| Zn (ppm) | 0.3 |
| P (mg/kg) | 41 |
| pH | 4.9 |

Figure 1: Zinc deficiency in wheat - stunted plants with small leaves



The zinc rate demonstration trial consisted of five treatments using Zinc Sulfate Monohydrate (chystalline) 35% Zinc. The treatments were:

1. Nil
2. 570 g/ha ZnSO₄
3. 2.86 kg/ha ZnSO₄
4. 14.29 kg/ha ZnSO₄
5. 28.57 kg/ha ZnSO₄

The zinc form demonstration trial consisted of seven treatments. Each treatment applied an equivalent rate of 1 kg/ha of zinc. The seven treatments were:

1. Nil
2. Zinc Sulfate Heptahydrate (chrySTALLINE) 22% Zinc @ 4.5 kg/ha
3. Zinc Sulfate Monohydrate (chystalline) 35% Zinc @ 2.86 kg/ha
4. Zinc Chloride (crystalline) 48% Zinc @ 2.08kg/ha
5. Lig Zinc (chelate) 8% Zinc @ 12.5L/ha
6. Lig Seed Dress (chelate) 4% Zinc, 6% Phosphorous, 3% Manganese, 0.1% Copper, 0.1% Molybdenum, 0.1% Cobalt @ 8L/tonne grain.
7. Lig Grain (chelate) 9% Zinc, 0.5% Copper, 0.1% Molybdenum @ 8L/tonne grain.

In both trials, all treatments were liquid injected at sowing. They were replicated three times, with plot size 1.75m by 48m. Further management details are shown in table 1.

2014 Trials:

Four zinc response trials were established at

Rankins Springs (Michael Pfitzner's), Merriwagga (Jeffrey Muirhead's), Barellan (Jeff Savage's), and Hillston (Graeme Horneman's).

The zinc carryover trial was established at Rankins Springs (Michael Pfitzner's) only.

Soil Zn, P (Colwell) and pH (CaCl₂) levels for each of the sites were:

| | Zn (ppm) | P (mg/kg) | pH |
|-----------------|----------|-----------|-----|
| Barellan | 1.2 | 78 | 4.3 |
| Hillston | 1.3 | 28 | 7.8 |
| Merriwagga | 0.6 | 23 | 5.1 |
| Rankins Springs | 0.8 | 44 | 5.7 |

Plots sizes were 1.75m x 12m. The trials were sown with a Morris Contour Drill plot seeder with 25cm row spacings x 7 rows. Trials were replicated four times.

Zinc Response Trials

Each trial consisted of one variety by three Zn rates (as ZnSO₄ monohydrate) by 2 application methods (liquid injected and granule coated on starter fert).

The Zn rates for the trials were 0, 2 and 4kg Zn/ha.

Further details of the management of each of the trials is shown in table 2.

Zinc Carryover Trial

Sown using last years zinc rate trial seed, this trial consisted of one variety (Bolac) from 2013 seed that had 5 zinc rates applied (0, 0.2, 1, 5 & 10 kg Zn/ha).

It had similar management to the Rankins Springs zinc response trial, table 2.

Table1: 2013 Zn trial management details, Rankins Springs

| | |
|--------------------------|--|
| Pre-sow herbicides: | Roundup CT/Lontrel 19 th November, 2012 Gramoxone 30 th November, 2012 Roundup CT/Surpass/Garlon 23 rd November, 2012 Gramoxone 1 st February, 2013 |
| Pre-emergent herbicides: | 1.5L Glyphosate 450 + 100g Lontrel + 2.5L Boxer Gold |
| Variety: | Wheat - Bolac |
| Sowing date: | 3 rd May, 2013 |
| Sowing Rate: | 25 kg/ha |
| Phosphorous Fertiliser: | 60 kg/ha Triple single superphosphate |
| Post-em herbicides: | nil |
| Post-em fungicides: | nil |
| Post-em insecticide: | nil |
| Harvest Date: | 18 th November, 2013 |

Table 2: 2014 Zn response trials management details

| | <u>Merriwagga</u> | <u>Barellan</u> |
|----------------------|---|---|
| Previous Crop: | Wheat | Wheat |
| Pre-sow herbicides: | 1L Roundup UltraMax | 1L Roundup UltraMax |
| Pre-em herbicides: | 2.5L Boxer Gold + 50g Logran B | 118g Sakura + 50g Logran B |
| Variety: | Lancer | Merinda |
| Sowing date: | 1 st May, 2014 | 9 th May, 2014 |
| Sowing Rate: | 30 kg/ha | 40 kg/ha |
| Nitrogen Fertiliser: | 30 kg/ha urea | 30 kg/ha urea |
| Post-em herbicides: | 1L LVE MCPA 570 4 th August | 300mL Axial + 0.5% Adigor + 1L Precept 150 |
| Post-em fungicides: | 500mL Prosaro 4 th August | Amistar Xtra 750ml 9 th September |
| Harvest Date: | 5 th December, 2014 | 29 th November, 2014 |
| | <u>Rankins Springs</u> | <u>Hillston</u> |
| Previous Crop: | Fallow | Fallow |
| Pre-sow herbicides: | 2L Roundup UltraMax | 1L Roundup UltraMax |
| Pre-em herbicides: | 2.5L Boxer Gold | 2.5L Boxer Gold |
| Variety: | Livingston | Lancer |
| Sowing date: | 22 nd May, 2014 | 16 th May, 2014 |
| Sowing Rate: | 40 kg/ha | 100 kg/ha |
| Nitrogen Fertiliser: | 30 kg/ha urea | 30 kg/ha urea |
| Post-em herbicides: | 1.5L Precept 150 + 0.5%Adigor 30 th July | |
| Post-em fungicides: | 500mL Prosaro 30 th July 250ml Cogito 29 th Sept | Folicur 290ml by air 23 rd Aug Amistar Xtra 800ml 1 st Oct |
| Post-em insecticide: | | Pirimor 150g 1 st Oct |
| Harvest Date: | 20 th November, 2014 | 27 th November, 2014 |
| Irrigation: | N/A | 2 spring irrigations (3ML/ha) - Aug and Sept |

RESULTS AND DISCUSSION

2013:

No statistical analysis was carried out on the zinc rate and zinc form trials as there was no measured response to yield.

Zinc Rate trial

There was not a stepped response to increasing rates of zinc for grain yield and quality.

Grain yield for each treatment of the zinc rate trial is shown in figure 2. The average yield of the trial was 2.58 t/ha. The lowest yielding treatment was where 570 g/ha ZnSO₄ was applied, yielding 2.10 t/ha. The highest yielding treatment was where 2.86 kg/ha ZnSO₄ was applied, yielding 3.02 t/ha.

Grain quality analysis is shown in figure 3. Protein in the trial ranged from 9.87% where 2.86 kg/ha ZnSO₄ was applied to 10.20% where 28.57 kg/ha ZnSO₄ was applied. The average test weight for the trial was 71.47 kg/hl.

Seed from this trial was also analysed, figure 4. Applying zinc had an affect on the concentration of zinc in the seed.

The concentration of zinc in the seed increased as the rate of zinc applied increased. It ranged from 13ppm where no zinc was applied to 19ppm for where 28.57 kg zinc was applied.

The seed from this trial was then used to sow the zinc carryover trial at Rankins Springs in 2014.

Zinc Form trial

There was no difference in grain yield and protein between the different forms of zinc applied in this trial, figure 5.

The average grain yield for the zinc form trial was 3.84 t/ha. Yields ranged from 3.70 t/ha for the Lig Zn 12.5 L/ha treatment, to 3.95 t/ha for the ZnCl₂ 2.08 kg/ha treatment.

Grain protein ranged from 9.27% for the Lig seed dressing 8 L/t treatment to 9.67% for the ZnSO₄ monohydrate 2.86 kg/ha. figure 6. The average test weight for this trial was 70.86 kg/hl.

Figure 2: Average yield (kg/ha) for each treatment of the Zinc Rate trial

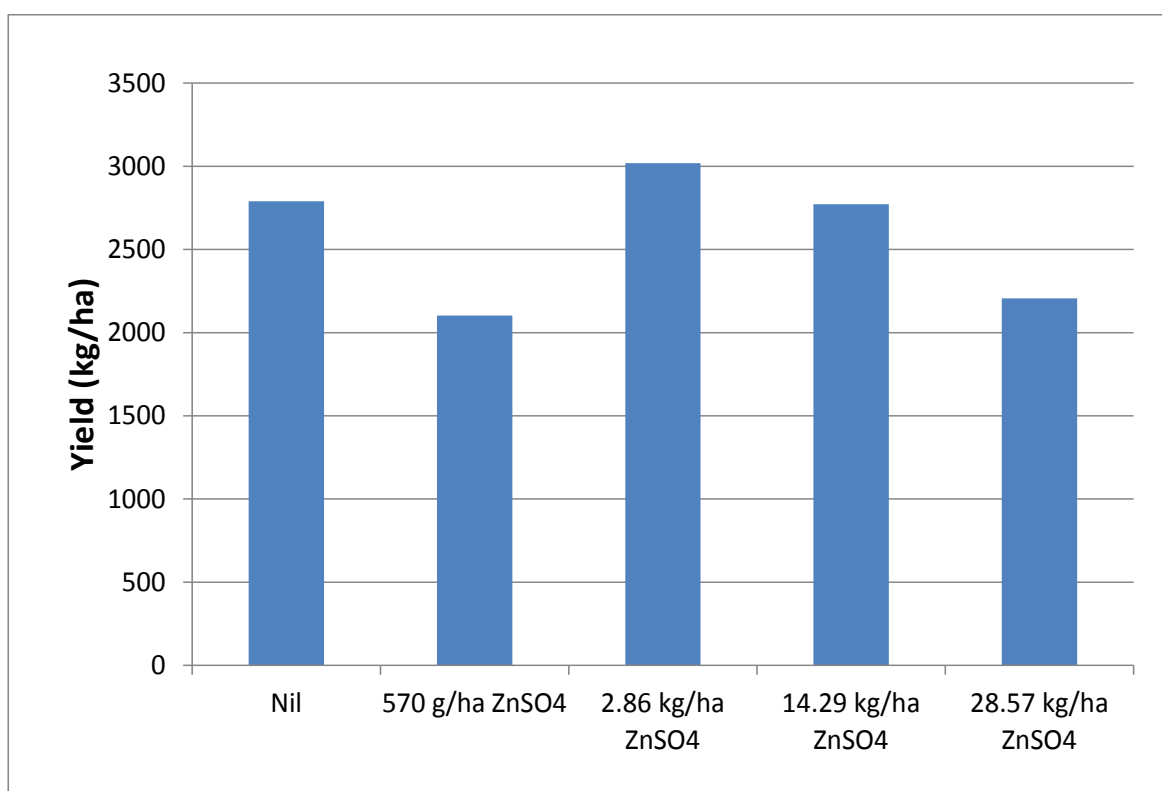


Figure 3: Average grain quality for each treatment of the Zinc Rate trial



Figure 4: Average Seed Analysis for each treatment of the Zinc Rate Trial

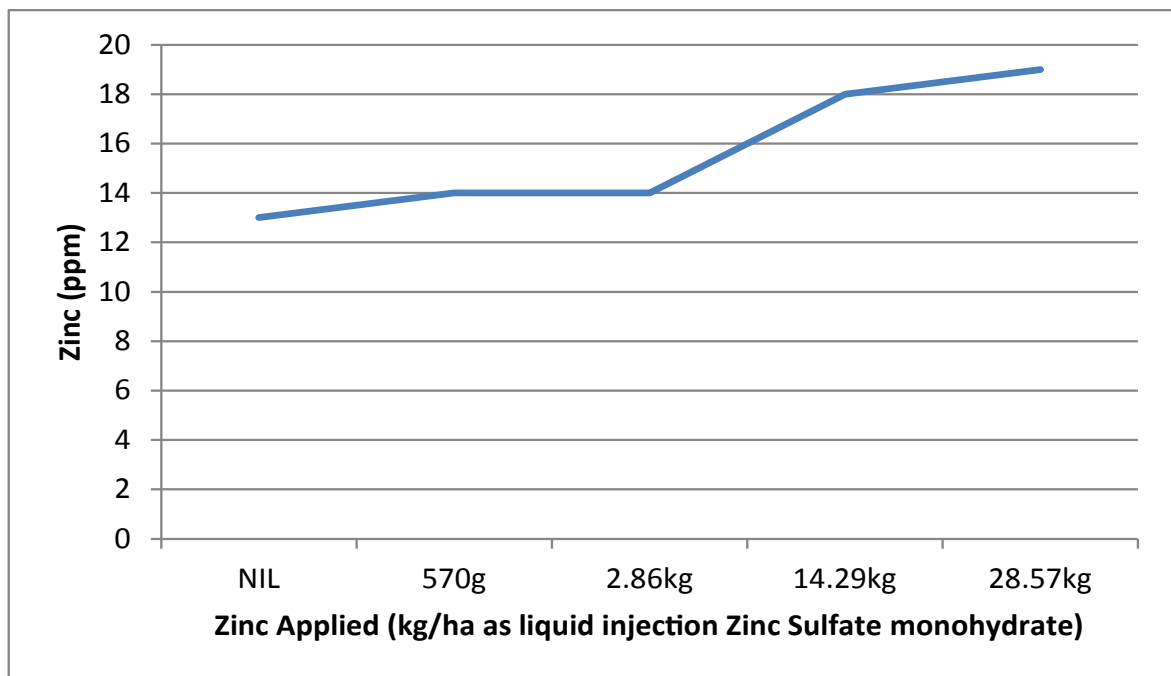


Figure 5: Average yield (kg/ha) for each treatment of the Zinc Form trial

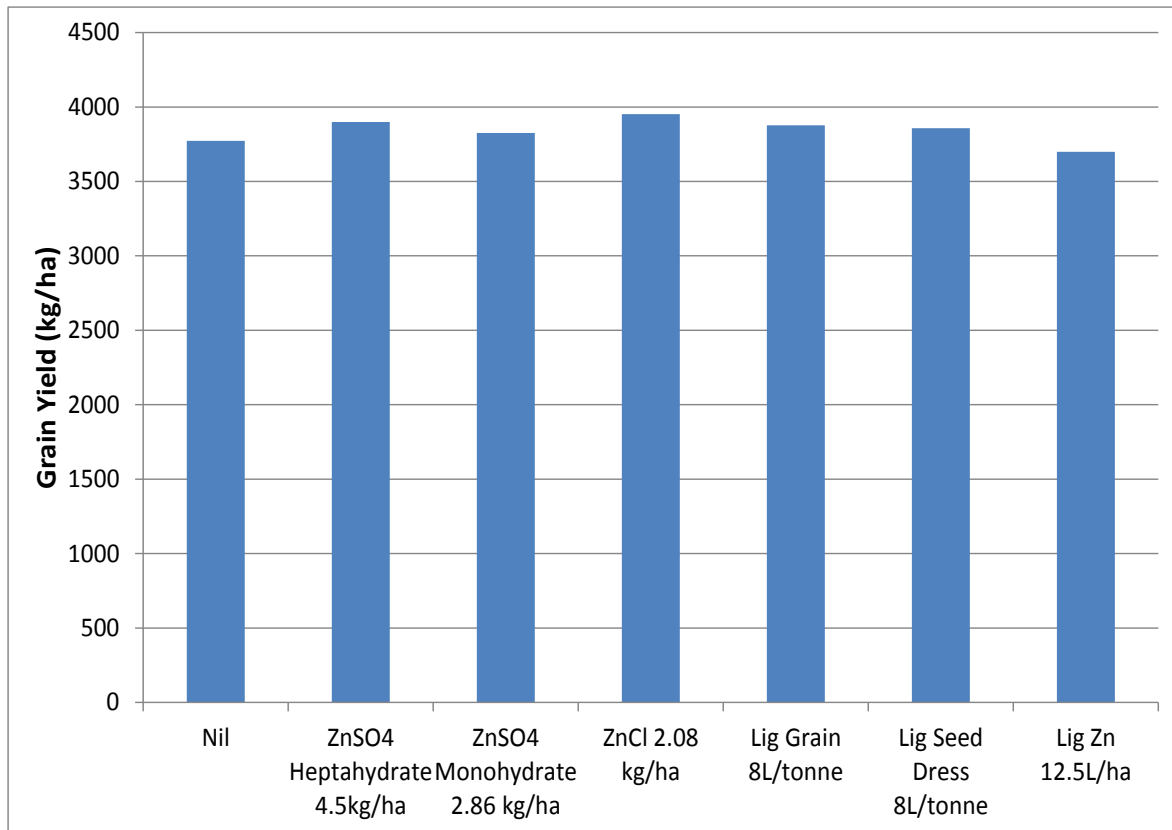
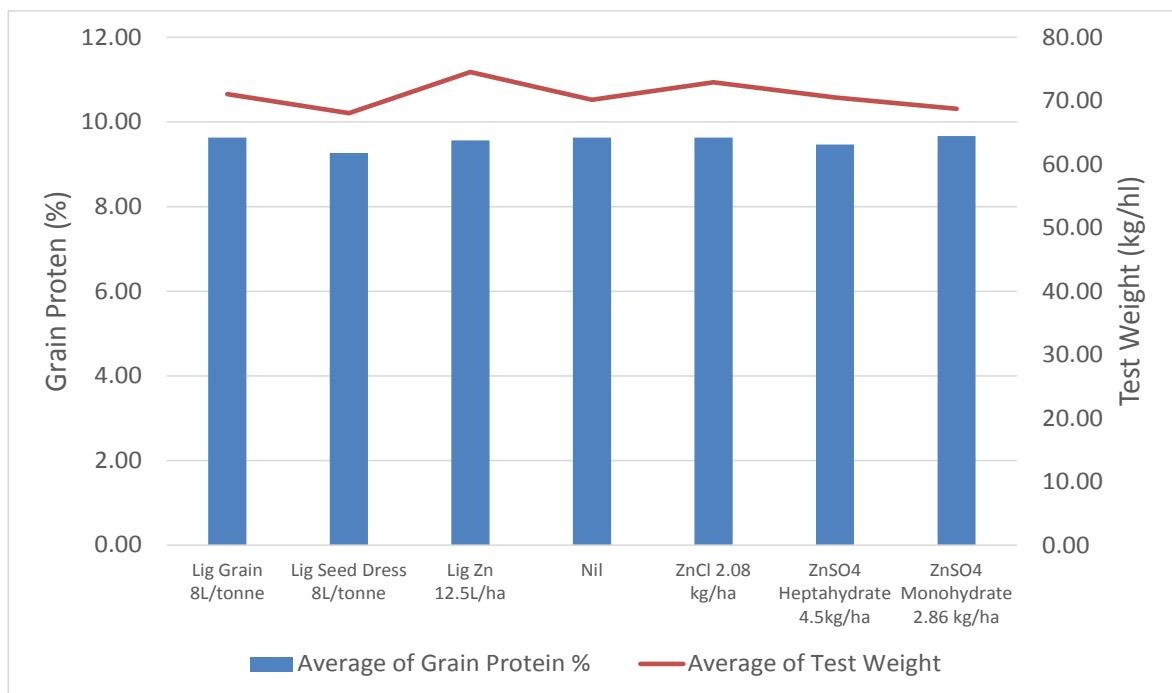


Figure 6: Average grain quality for each treatment of the Zinc Form trial



2014:

Statistical analysis was carried out on grain yield and quality for the zinc response and zinc carryover trials.

No significant effect of Zn treatment was found, in any of the Zn response trials. There was also no response of grain yield to Zn application.

For the Zn carryover trial no significant grain yield or grain N effect were found.

Zinc Response Trials

Whilst there were no significant differences in the trials, they differed in yield and grain quality.

Grain yield is shown in figure 7 and protein is shown in figure 9.

The average yield for Hillston was 8.71 t/ha, ranging from 8.06 t/ha for the 4kg Zn granular treatment to 9.20 t/ha for the 4kg Zn liquid injected treatment. The average protein was 13.37%.

For Merriwagga and Rankins Springs the yields across the treatments did not vary greatly. The average yield for Merriwagga was 2.01 t/ha, ranging from 1.94 t/ha for the 2kg Zn granular treatment to 2.07 t/ha for where no Zn was applied. The average protein was 9.54%.

For Rankins Springs the average yield was 3.58 t/ha, ranging from 3.41 t/ha for the 2kg Zn granular treatment to 3.75 t/ha for where no Zn was applied. The average protein was 11.41%.

Comparing zinc treatments across all sites, there was very little difference between applying 0kg, 2kg and 4kg/ha of zinc, figure 8.

Zinc Carryover Trial

Using seed, from varying rates of zinc applied to zinc trials in 2013 did not show any advantages. There were no differences in early crop vigour or grain yield between any of the zinc carryover treatments in this trial, figure 10.

Figure 7: Grain yield of the Zn response trials. Note the Barellan trial was not harvested.

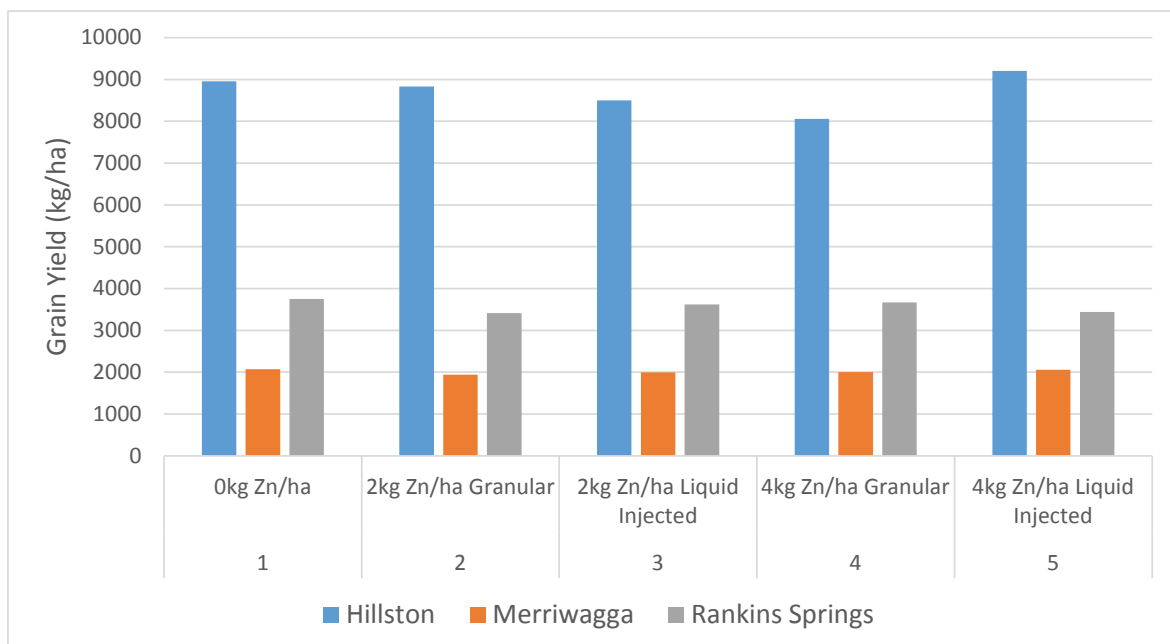


Figure 8: Average grain yield by rate and method of zinc application,

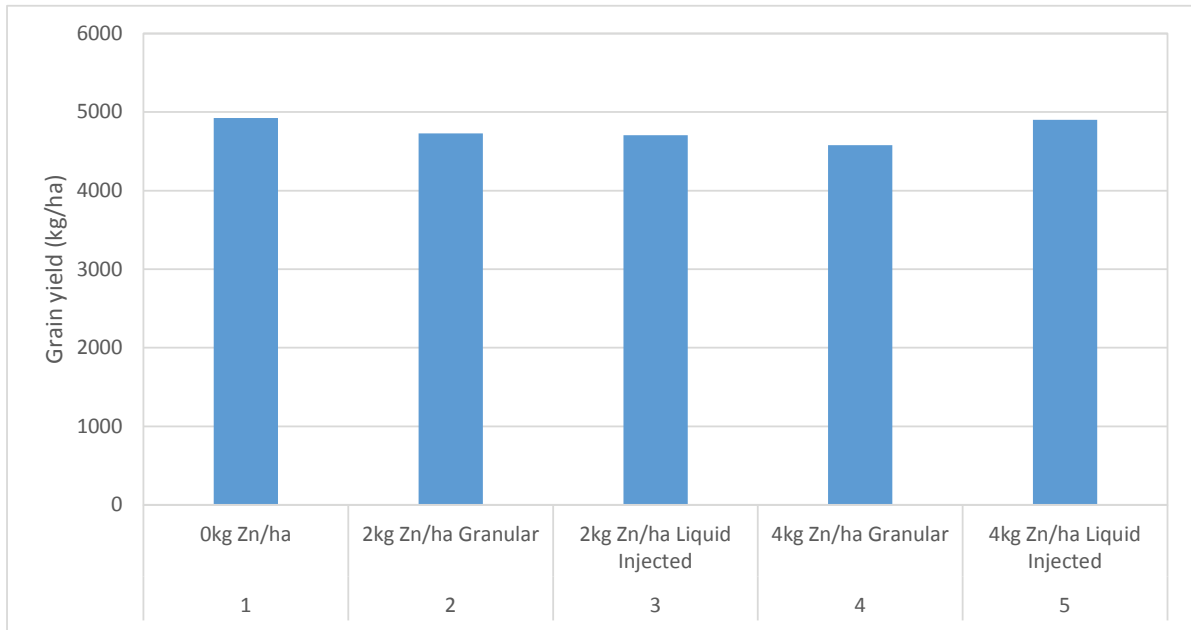


Figure 9: Average grain protein by rate and method of zinc application for each site.

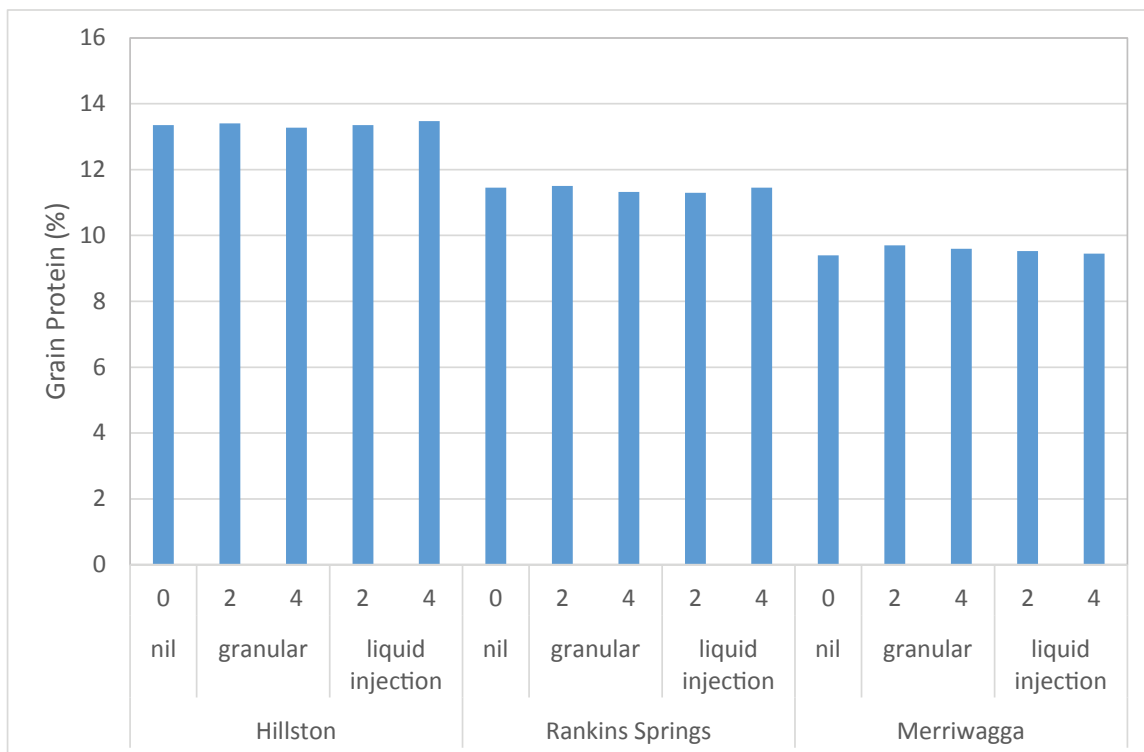
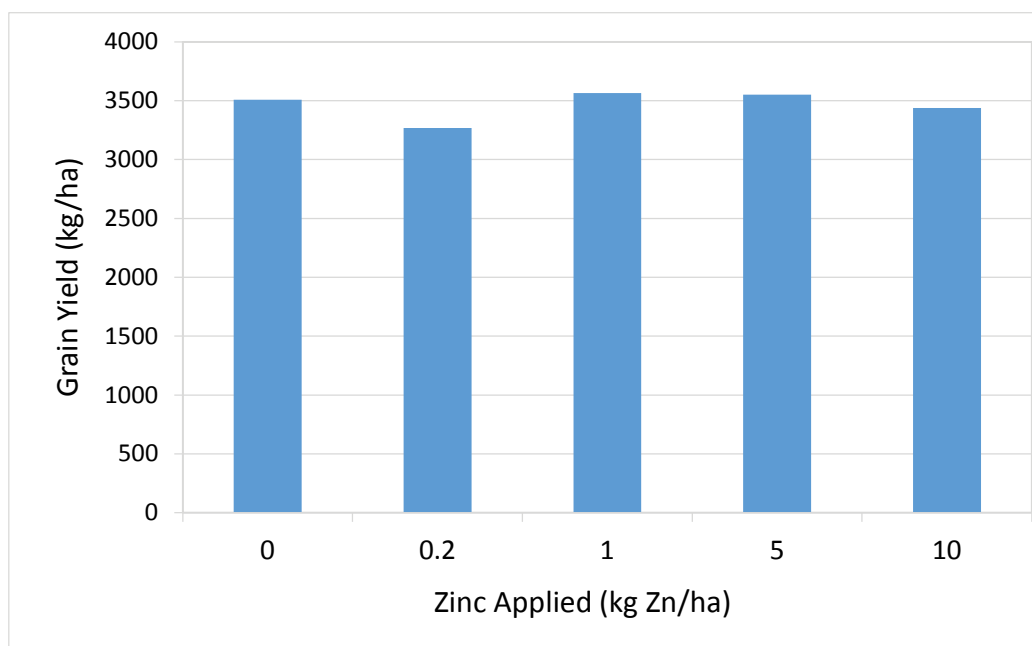


Figure 10: Average grain yield for each zinc rate of the zinc carryover trial



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