Improving Zinc and Manganese Uptake in Wheat on Calcareous Soils with Fluid Suspension Fertilisers

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INTRODUCTION

Research over 10 years on highly calcareous soils on Eyre Peninsula in South Australia (SA) has shown that combined clear liquid fertilisers containing N, P and Zn are much more effective than standard commercial granular fertilisers (e.g., Holloway et al. 2001). Clear liquids are also more expensive in SA due to the lack of infrastructure. Suspension-fluid fertilisers are made from the same materials as granular, and more cheaply than clear liquids. It is also easier to mix a wider range of nutrients in this form. Few studies have been reported concerning the relative abilities of granular and fluid suspension fertilisers to provide micronutrients to wheat on highly calcareous soils.

METHODS

An initial experiment was conducted at Cungena in SA in 2004 to compare the performance of six granular fertilisers with the same fertilisers converted to fluid-suspensions. In all of the treatments, extra N, Mn and Zn were added as needed to balance the nutrients across the trial but they were all added as granular products: granular urea 2.5% Zn, granular $ZnSO_4$ or granular $MnSO_4$.

Because the highest yielding treatment, 18:16 Zn 2%, Mn 2%, had Zn and Mn in the fluid-suspension form, the inclusion of the micronutrients in the suspension may have had a major effect on the result but this could not be clearly concluded from the results.

In 2005, experiments were conducted on highly calcareous soils at two sites, Port Kenny and Cungena, to clearly define the role of the micronutrients. Products applied at sowing with Yitpi wheat are presented in Table 1.

Table 1. Products applied at sowing with Yitpi wheat.

FERTILISER	MICRONUTRIENT APPLICATION	PRODUCT
Granular	Nil	DAP
Granular	Dry Blend	DAP with Zn/Mn sulphate granules
Granular	Coated	19:13 Zn 1.2 Mn 3.3
Suspension	Nil	DAP into suspension
Suspension	Sep Granular	DAP into suspension with Zn/Mn sulphate granules applied separately
Suspension	Sep Fluid	DAP into suspension with Zn/Mn sulphate clear liquid solution applied separately
Suspension	Added	DAP with Zn/Mn sulphate granules mixed into suspension
Suspension	Coated	19:13 Zn 1.2 Mn 3.3 (coated granular product) into suspension
Nil fertiliser		

At Cungena, the rates of application for P, N, Zn and Mn were 10, 15, 1 and 2.5 kg ha^{-1}, respectively. The application rates at Port Kenny were the same except for N, which was applied at 25 kg ha^{-1}.

RESULTS AND DISCUSSION

At Cungena, the relative shoot growth response to micronutrients was 40% greater when they were added to the suspension than when applied as a granular coating. The overall combined increase in shoot growth with suspension plus micronutrients, compared with micronutrient-coated granules, was 39%. At Port Kenny, the relative response to micronutrients was 81% greater when they were mixed with the suspension or applied as a separate solution in combination with the suspension than when applied as a granular coating. At both sites, adding micronutrients separately to the soil in granular form was ineffective in promoting shoot growth.

At Cungena, there was no significant increase in grain yield with the base suspension compared with the base granular fertiliser. Adding micronutrients to the granular fertiliser separately or by coating produced no grain yield response. Including micronutrients in the suspension increased grain yield by 11% above the base suspension. There was a 17% difference in grain yield between the suspension mixed with micronutrients and the coated granular treatments.

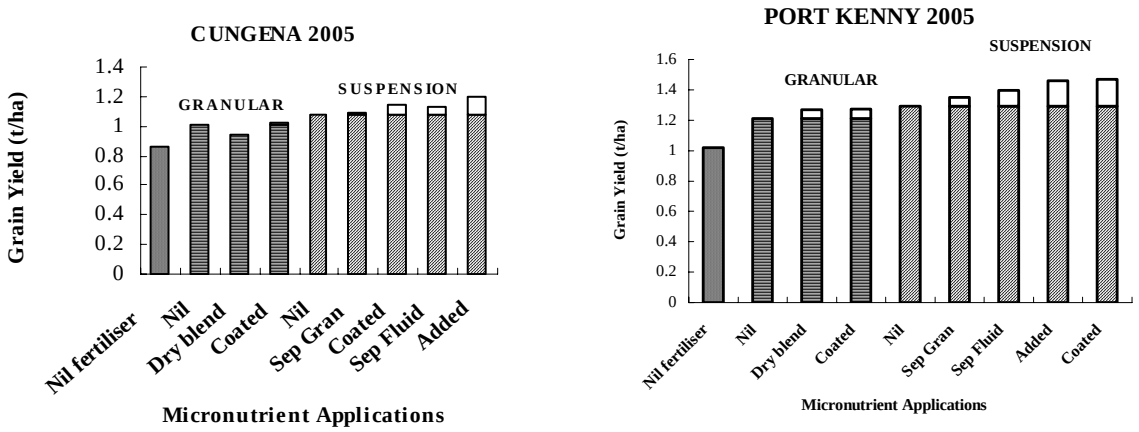

Fig.1. Response of grain yield of Yitpi wheat to applications of dry granular and suspension fertilisers with and without added micronutrients at Cungena (L) and Port Kenny (R), 2005. The hatched bars show the response in grain yield to granular and suspension fertiliser with the micronutrient response added as the clear top portion of the bar.

At Port Kenny, the application of coated granules did not increase grain yield above the non-micronutrient granular treatment. In the suspension group, the addition of micronutrients as coated granules (converted to suspension), increased grain yield above the basal (non-micronutrient) suspension by 14%. The overall grain yield response between the best suspension and granular treatments was 15%. The results are interesting in that the sites would have been considered non responsive to micronutrients if the experiment had been carried out with the granular forms of micronutrients only.

REFERENCES

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