

INTRODUCTION

- ❖ Copper (Cu) deficiency is the most common micronutrient deficiency on the prairies. Lack of zinc (Zn) can also be a factor in certain soils. Growers may consider applying both Cu and Zn in crop rotations (Kruger et al., 1985; Singh et al., 1987).
- ❖ Balancing Cu and Zn is important in soils that are deficient in both of these nutrient elements (Alloway, 2008).
- ❖ It is purported that insoluble precipitates [Zn₃(PO₄)₂] can form in soils with high P that can induce Zn deficiency (Loneragan and Webb, 1993).

HYPOTHESIS

- The response of grain yield in a wheat-pea rotation to the addition of Cu and Zn fertilizers will be related to soil phosphorus status.

OBJECTIVE

- ❖ To evaluate wheat and pea yield response to Cu and Zn fertilization in a highly phosphorus (P) deficient (< 3 ppm Olsen P) Saskatchewan soil, without and with P fertilizer added.

MATERIALS AND METHODS

Experimental set-up and management

- The experiment was conducted in the college phytotron facility using trays of soil in which treatments were applied (Photo 1).
- The soil used in this study was Tisdale Association Orthic Dark Gray Chernozem (Cu= 0.9; and Zn= 1.4 mg kg⁻¹)
- Micronutrient fertilizer solution (copper or zinc sulfate dissolved in water) was applied as a subsurface band.
- Wheat (HRSW var Waskada) was grown to maturity followed by yellow pea (var Meadow).

Treatments (Two Factors)

Phosphorus	Micronutrient
1) 0 kg ha ⁻¹ (Control)	1) control
2) 100 kg P ₂ O ₅ ha ⁻¹ (high-P)	2) Cu
	3) Zn
	4) Cu+Zn



Photo 1. Treatment set-up and crop growth in experimental units in the phytotron.

RESULTS AND DISCUSSION

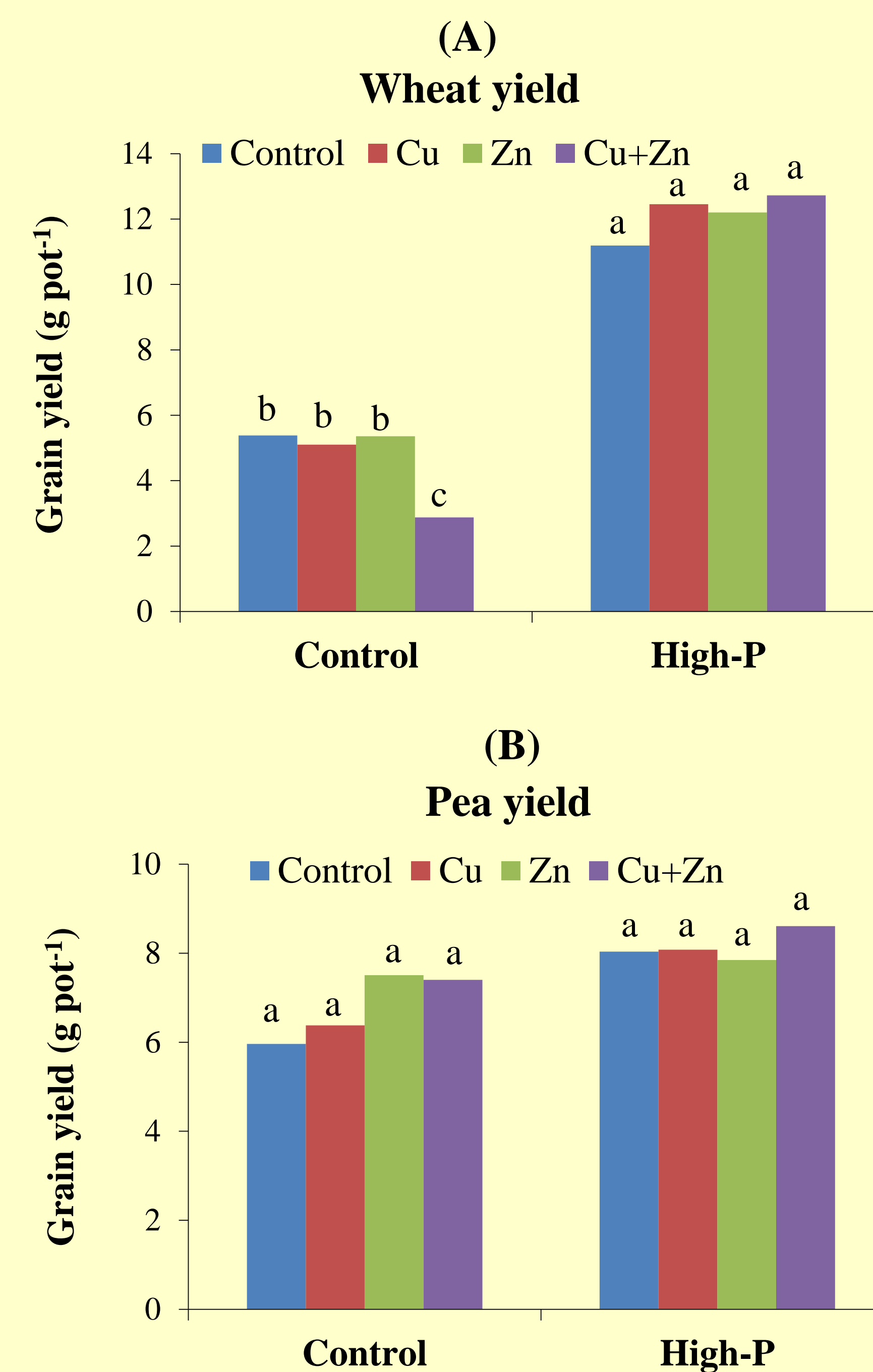


Fig. 1. Effect of phosphorus and micronutrient fertilization on grain yield of **wheat (A)** and the following **pea (B)**. For each crop, bars with the same letter are not significantly different ($p > 0.05$).

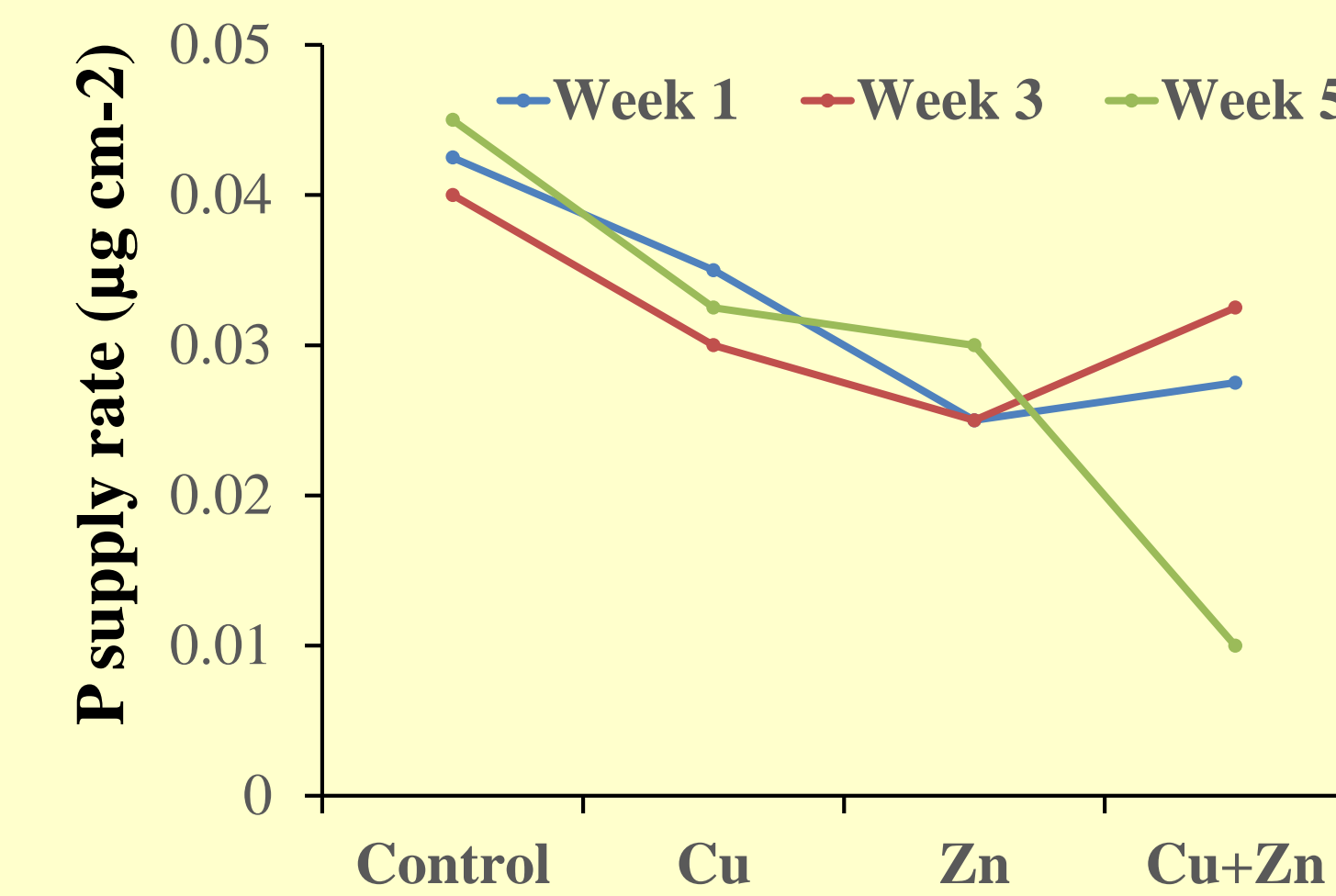


Fig. 2. Influence of micronutrient fertilization on P supply rate measured by 24 hour burial of PRSTM-probes in a P deficient Tisdale soil with no P fertilizer added (control).

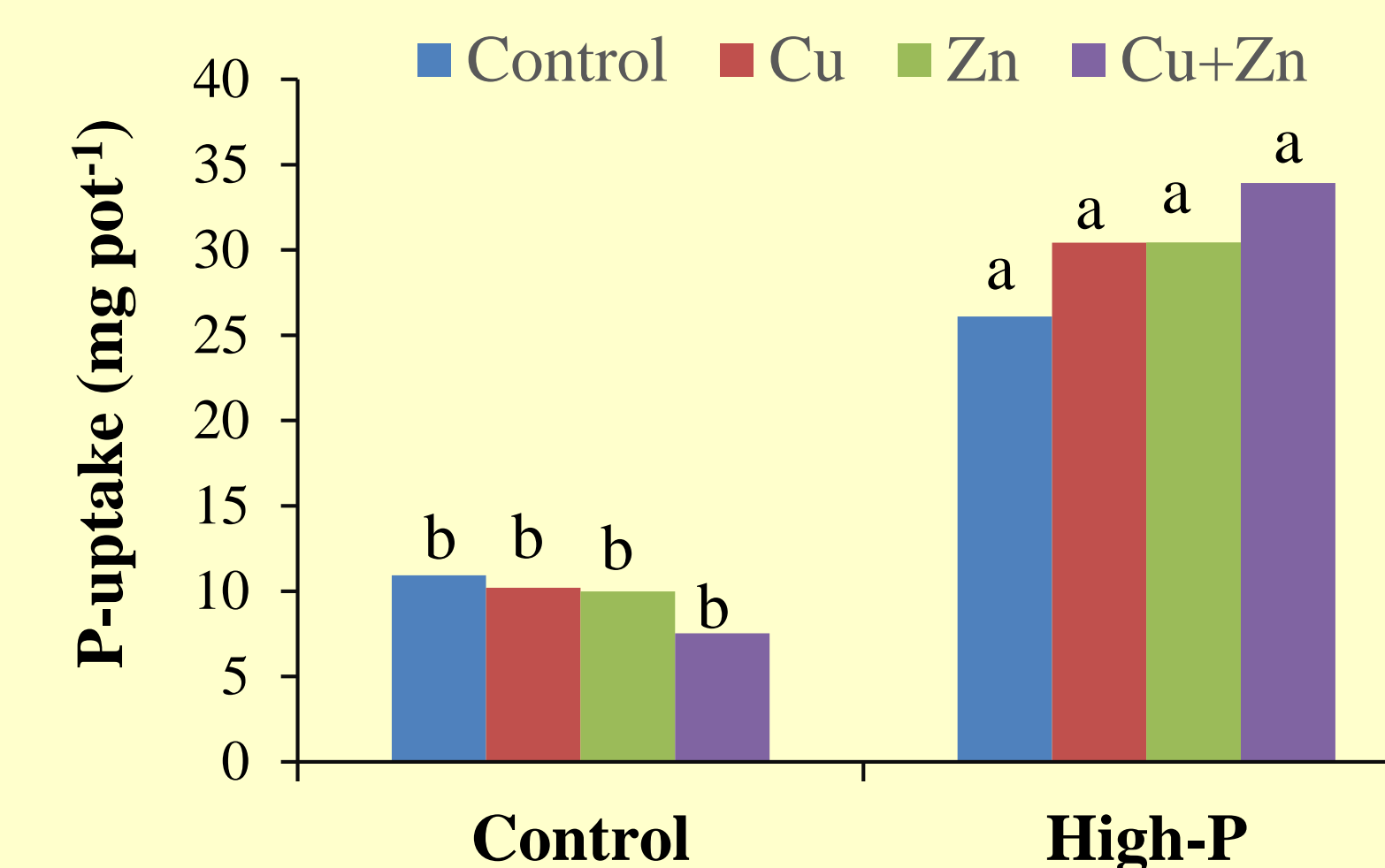


Fig. 3. Effect of phosphorus and micronutrient fertilization on P uptake by wheat grain. Bars with the same letter are not significantly different ($p > 0.05$).

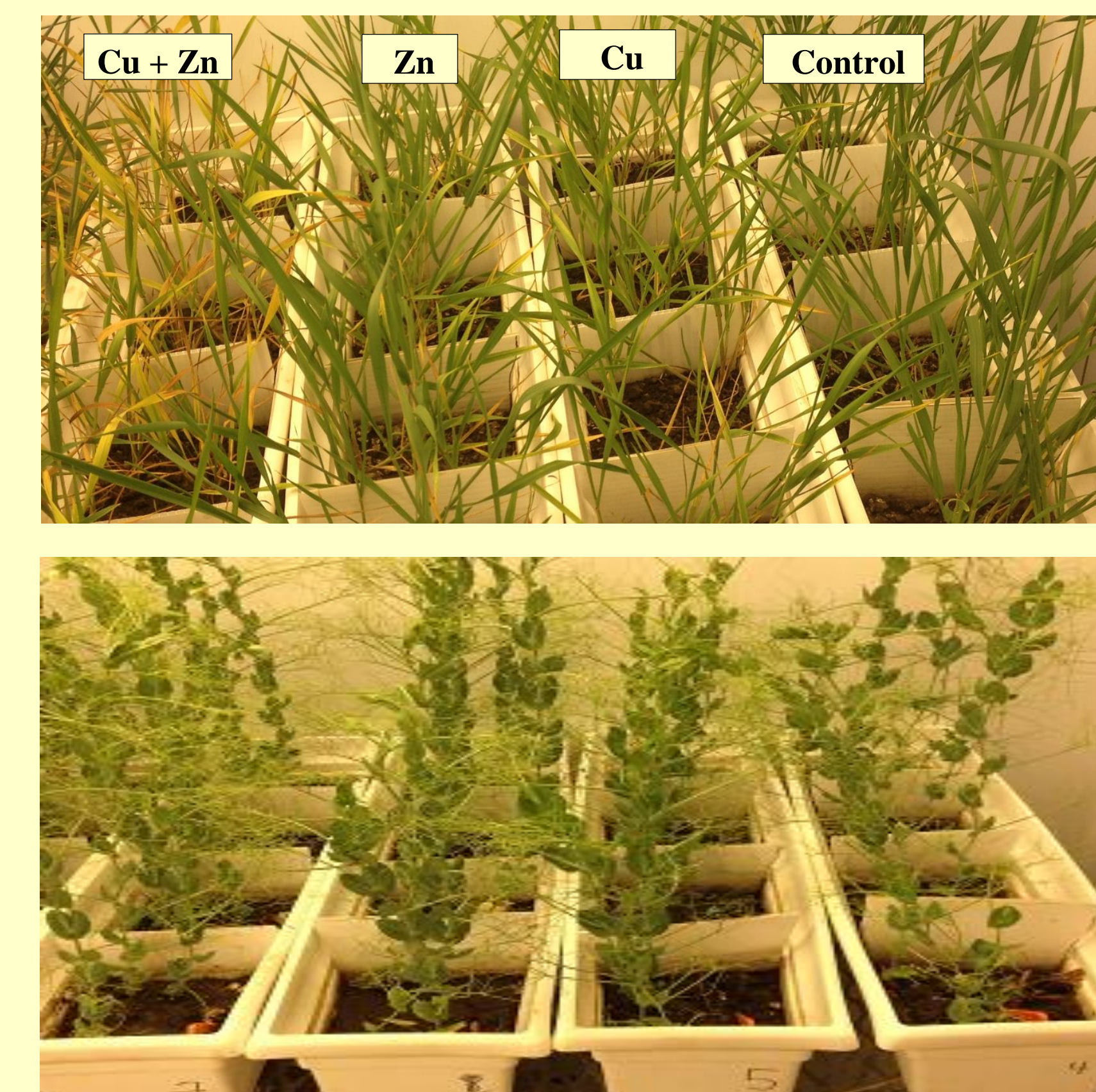


Photo 2. Antagonistic effect of Cu and Zn on wheat growth in P deficient soil (Top), and no visual effect evident in pea grown after wheat (Bottom).

✓ As expected, significantly higher grain yield of wheat was obtained with P fertilizer addition on the P deficient soil (Fig. 1A). Yield of pea following wheat (Fig. 1B) was not significantly affected by any of the treatments made at the beginning of the rotation. A large positive effect of Cu and Zn on yield was not expected as soil levels were above critical values.

✓ Interestingly, a strong antagonistic effect on the growth and yield of wheat (Fig. 1 A; Photo 2) was observed from the addition of both Cu and Zn when no P fertilizer was added on this P deficient soil.

✓ The soil P supply rate (Fig. 2) was negatively affected by micronutrient addition, especially for combination of Cu and Zn after three weeks, suggesting some interference of the combination with soil P availability and/or plant uptake.

CONCLUSION

Positive yield benefits from micronutrient fertilization were not observed without and with P fertilization. A negative response of wheat to combined addition of copper and zinc under highly P deficient conditions suggests that P limitations should be addressed first and foremost in wheat – pea rotations when addition of these micronutrients is considered. Future work will attempt to elucidate the mechanisms responsible.

REFERENCES

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