

# Nitrogen, Phosphorus and Potassium Application Contributed to the Growth and Yield of Teff Production

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## INTRODUCTION

Teff [*Eragrostis tef* (Zucc.) Trotter] is an annual small grain, panicle bearing C4 cereal crop native to Ethiopia. Substantial researches have been conducted in Ethiopia under rainfed condition and they reported that nitrogen (N) and phosphorus (P) are key limiting nutrients in teff production, however the response of teff to N, P and potassium (K) fertilization under irrigation is not well studied.

## OBJECTIVES

- Examine the effect of N, P and K nutrition on two teff genotypes growth and development under irrigation.
- Determine the optimum level of N, P and K concentrations for production of two teff genotypes under field condition.

## MATERIALS AND METHODS



**Figure 1.** Pot and field experimental layout from left to right, respectively. Both experiments share a similar experimental setup, comprising two genotypes (405B and 406W) planted in a randomized blocks design with 5 replicates.

Treatment code	Mineral concentrations in irrigation solution (ppm)			Treatment code	Mineral concentrations in irrigation solution (ppm)		
	Nitrogen (N)	Phosphorus (P)	Potassium (K)		Nitrogen (N)	Phosphorus (P)	Potassium (K)
T1	10	6	40	T1	0	6	40
T2	20	6	40	T2	30	6	40
T3	80	6	40	T3 (control)	60	6	40
T4	120	6	40	T4	120	6	40
T5	40	1	40	T5	60	1	40
T6	40	3	40	T6	60	3	40
T7	40	12	40	T7	60	12	40
T8	40	6	10	T8	60	6	0
T9	40	6	20	T9	60	6	80
T10	40	6	80				
T11 (control)	40	6	40				

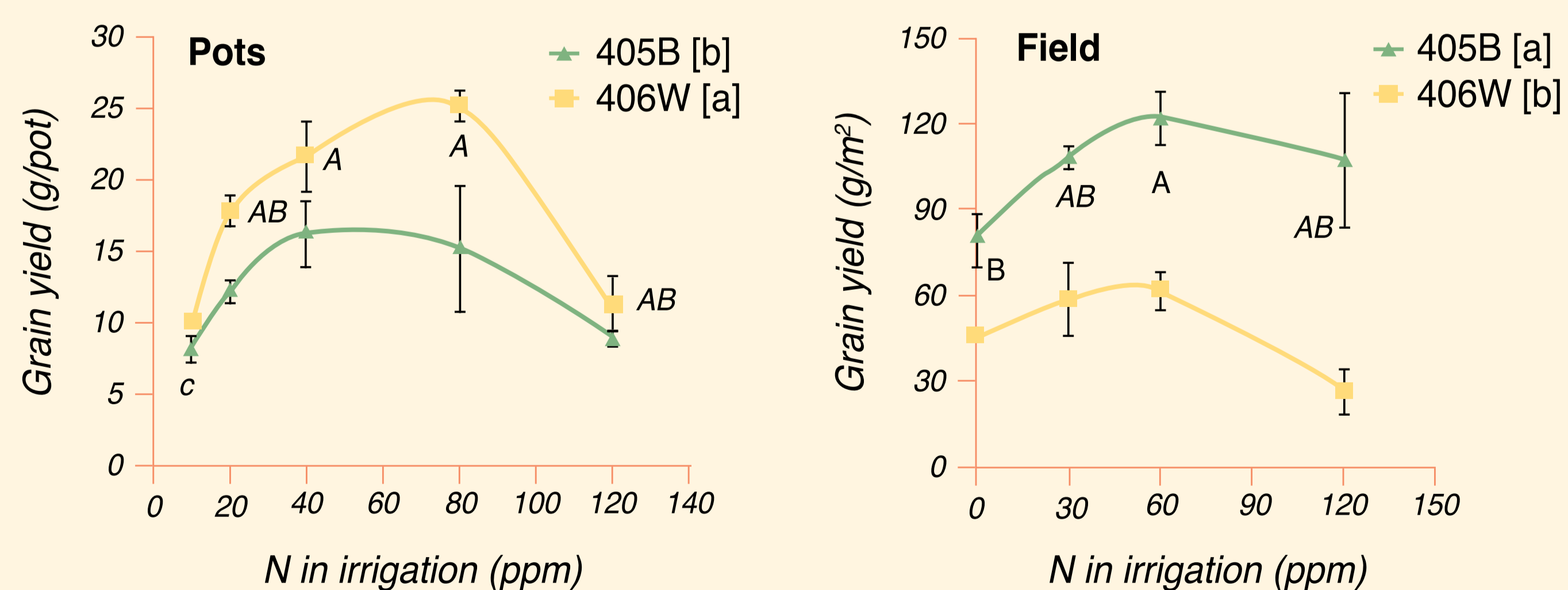
**Table 1.** Treatment and fertilizer combination used in the pot (left) and field (right) experiments.

## RESULTS

**Effect of Nitrogen:** High nitrogen fertilization resulted in decreased in days to flowering and enhanced leaf development.

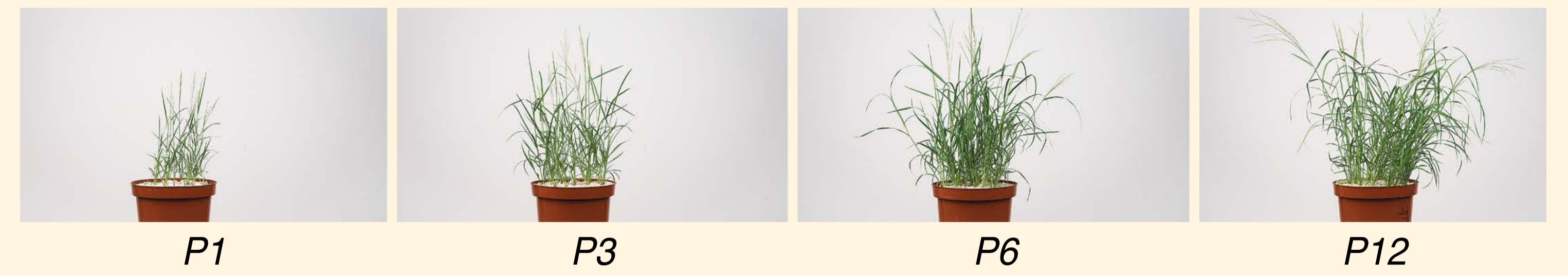


**Figure 2.** Response of teff growth to different N nutrient levels. N10-N120 indicates the concentration of N in irrigation solution.

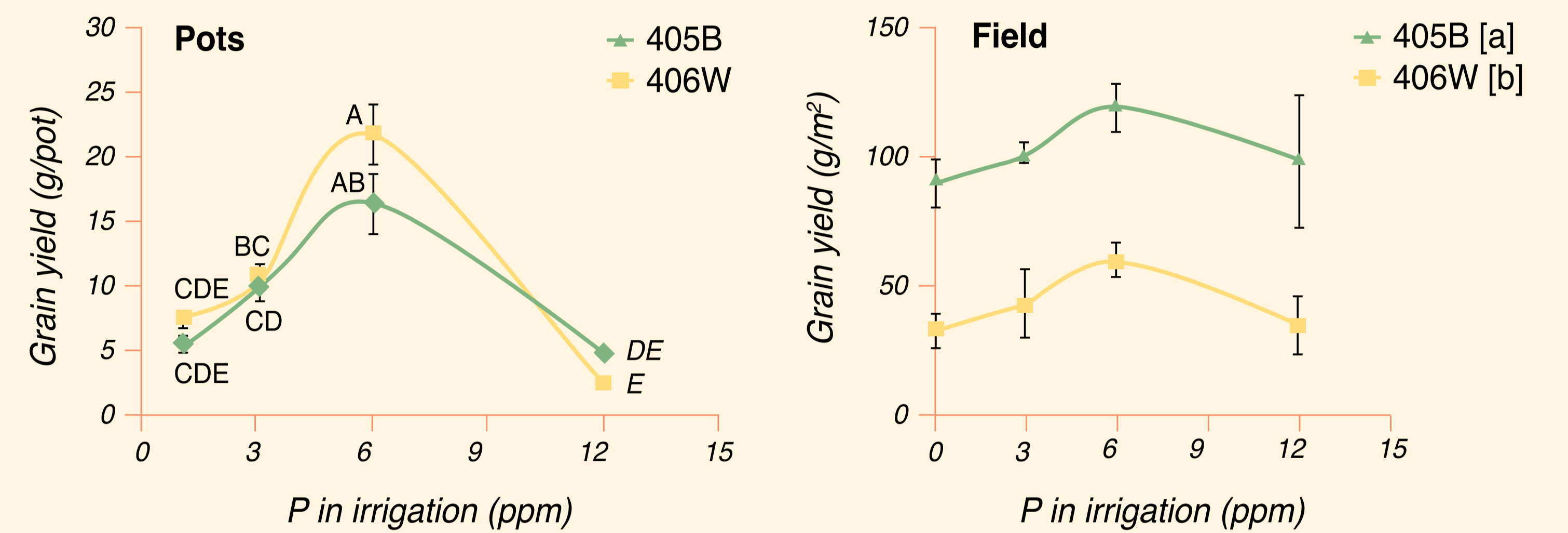


**Figure 3.** The main effect of N on grain yield in two teff genotypes in the pots (left) and field (right) experiments. Vertical bars indicate SE(n=5). [a], [b]- indicate significance difference between genotypes. A, B, C - main effects of treatments, different letter indicate significantly different treatment means ( $p < 0.05$ , Tukey HSD test).

**Effect of Phosphorus:** Phosphorus deficiency resulted in stunted growth.



**Figure 4.** Response of teff growth to different P nutrient levels. P1-P12 indicates the concentration of P in irrigation solution.

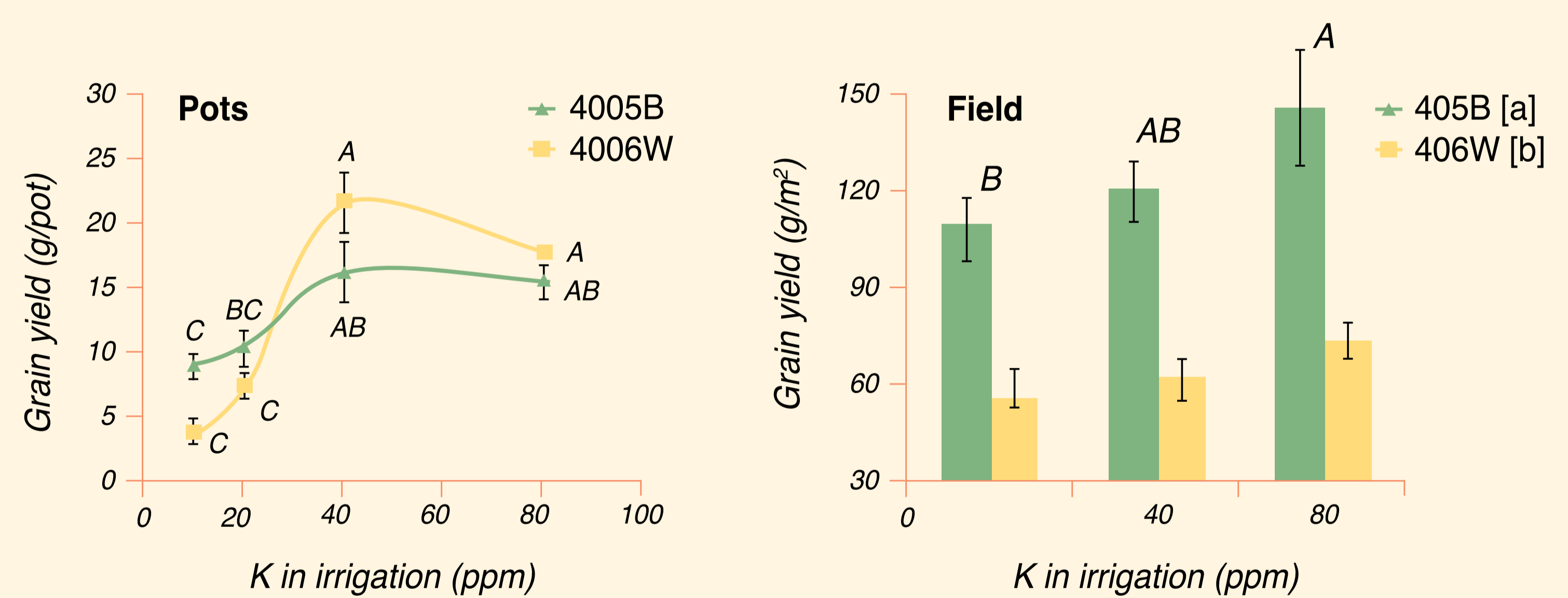


**Figure 5.** The main effect of P on grain yield in two teff genotypes in the pots (left) and field (right) experiments. Vertical bars indicate SE(n=5). [a], [b]-indicate significant differences between genotypes. A, B, C, D, E-main effect of treatments, different letters indicate significantly different treatment means ( $p < 0.05$ , Tukey HSD test).

**Effect of Potassium:** Teff plant leaves did not show any visible symptoms in response to different level of K fertigation.



**Figure 6.** Response of teff growth to different K nutrient levels. K10-K80 indicates the concentration of K in irrigation solution.



**Figure 7.** The main effect of K on grain yield in two teff genotypes in the pots (left) and field (right) experiments. Vertical bars indicate SE(n=5). [a], [b]-indicate significant differences between genotypes. A, B, C-main effect of treatments, different letters indicate significantly different treatment means ( $p < 0.05$ , Tukey HSD test).

## CONCLUSIONS

- Under irrigation, teff grain yield respond positively to N, P and K fertilization but over fertilization causes grain yield reduction as a result of less grain set.
- The two genotypes differed in their flowering time, shoot and root DM, tiller and grain yield production.
- Our results indicate that 60 ppm N, 6 ppm P and 80 ppm K in the irrigation solution seems optimal in the genotypes studied. However, any recommendation should consider also the exact status of the nutrients in the soil and water.

## ACKNOWLEDGEMENTS

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