

Phosphorus use efficiency of safflower (*Carthamus tinctorius* L.) and sunflower (*Helianthus annuus* L.)

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Abstract:

Safflower represents an oil crop believed to have putatively low nutrient requirement and high nutrient efficiency, but current knowledge regarding its nutrient use efficiency (NUE) as compared to similar oil crops is limited. It was thus the aim of this study to determine NUE of safflower as compared to sunflower with respect to P supply in pot experiments. Safflower and sunflower were cultivated with increasing P supply in a mixture of equal volumes of sand, nutrient-poor limed soil, and perlite in 6 L Mitscherlich pots. Sunflower accumulated much more P (mg / pot) than safflower at all equivalent P supplies especially at low levels, but both accumulated the same P amounts at their individual optimal supplies. Uptake efficiency (mg P accumulated (mg P provided)⁻¹) was higher in sunflower than safflower at all equivalent P supplies including their optimal levels. Sunflower contained higher P concentration (mg P (g DM)⁻¹) than safflower at low P supplies only; while safflower needed more P concentration in their tissues at optimal levels. Agronomic efficiency interpreted as g P required to produce fixed amount of achenes was higher in safflower than sunflower at optimal and suboptimal P supply indicating the superiority of sunflower in term of the efficiency to use external P supply to produce achenes than safflower. Sunflower was much more efficient at their optimal P supplies to utilize absorbed P than safflower in term of efficiency ratio (g achene (g P accumulated)⁻¹) and utilization index (g achene / (g P (g DM)⁻¹)). Safflower showed higher efficiency in utilizing P at the very severe P deficiency than sunflower in term of efficiency ratio but it was a dilution effect not efficiency itself when interpreted in term of utilization index, while sunflower was found better P utilizer than safflower under moderate P deficiency interpreting utilization efficiency in term of efficiency ratio and utilization index. Harvest Index in sunflower out-yielded that of safflower at low and optimal P supplies. It can be concluded that safflower has a high requirement for P with respect to growth and yield; sunflower is more efficient than safflower in term of uptake and utilization of P at optimal and sub-optimal P supplies indicating that safflower failed to be a low nutrient input crop in term of phosphorus.

Key words: Phosphorous, Utilization Efficiency, Safflower, Sunflower

