EFFECT OF GENOTYPE AND PHOSPHORUS FERTILIZER RATES ON WATER USE AND YIELD OF CHICKPEA

BY

THENDO MADZIVHANDILA
STUDENT NO: 11511824

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SUPERVISOR: Prof. J.B.O Ogola
CO-SUPERVISOR: Prof. J.J.O Odhiambo

ABSTRACT

Production of chickpea in South Africa is currently insignificant but local demand is high. There are no recommendations on suitable genotypes of chickpea and agronomic practices at present. This study aimed at evaluating the effect of genotype and phosphorus (P) fertilizer rates on water use and yield of four chickpea genotypes. A field experiment was undertaken, in winter 2009 and summer 2010, using a factorial arrangement of 3 P fertilizer rates (0, 45 and 90 kg P ha^{-1}) and 4 chickpea genotypes (ICCV92944, ICCV3110, ICCV4306 and ICCV7307) laid in a randomized complete block design and replicated 3 times. Total crop biomass was determined at vegetative, 50% flowering, and harvest maturity (HM) stages and number of pods per plant, seeds per pod, 100 seed weight, grain yield and harvest index (HI) were determined at harvest maturity. Water use (ET) was determined by measuring soil moisture content at week intervals. Neutron probe was used to measure soil moisture content every week after emergence until physiological maturity. Soil moisture value was used to determine crop water use. Water use efficiency was determined as the ratio of crop biomass or grain yield to water use (ET). Genotype and P fertilizer rates affected the crop biomass at vegetative and 50% flowering stage in season I and season II. Desi genotypes had greater crop biomass compared with kabuli genotypes in winter and summer season. Genotype did not affect crop biomass at harvest maturity in both winter and summer season but the application of phosphorus fertilizer rate significantly ($P<0.01$) affected crop biomass at harvest maturity in summer season. Genotype significantly affected grain yield in winter ($P<0.05$) and summer ($P<0.01$) se ason. The desi types significantly had greater grain yield (1464 and 979 kg ha^{-1}) compared with kabuli types (680 and 274 kg ha^{-1}) in season I.

In contrast, the kabuli types significantly had greater grain yield (1538 and 1396 kg ha^{-1}) compared with desi types (1196 and 983 kg ha^{-1}) in season II. Application of phosphorus fertilizer rates did not affect grain yield in season I probably due to water deficits in winter season. In contrast, P fertilizer application rates significantly ($P<0.01$) af fected grain yield in season II. Phosphoru s fertilizer at the rate of 90 kg P ha^{-1} produced significantly greater grain yield (1585.0 kg ha^{-1}) followed by 45 kg P ha^{-1} (1313.0 kg ha^{-1}) and 0 kg P ha^{-1} (935.0 kg ha^{-1}) in season II. Genotype and did not affect water use (ET) in season I (average 221.3 mm) and season II (average 314.2 mm). Phosphorus application also did not affect water use (ET) in season I (average 221.3 mm) and season II (average 314.2 mm). The desi types significantly had greater water use efficiency of grain yield (WUE_g) (6.36 and 4.41 kg ha^{-1} mm^{-1}) compared with kabuli types (2.69 and 1.33 kg ha^{-1} mm^{-1}) in season I. In contrast, the kabuli types significantly had greater water use efficiency of grain yield (WUE_g) (4.90 and 4.40 kg ha^{-1} mm^{-1}) compared with desi types (3.41 and 3.12 kg ha^{-1} mm^{-1}) in season II. Application of phosphorus fertilizer rates significantly ($P<0.05$) affected water use efficiency of grain yield (WUE_g) in season I and season II. Application of phosphorus fertilizer at the rate of 90 kg P ha^{-1} produced significantly greater water use efficiency of grain yield (WUE_g) compared with 45, 0 kg P ha^{-1}. Therefore desi genotypes may be more favourable in winter season. In contrast, kabuli appears to be more suitable in summer season while 45 and 90 kg P ha^{-1} phosphorus fertilizer rates may increase chickpea yield for the site of current study in both season and season II.