

EFFECTS OF TILLAGE METHOD AND SOWING TIME ON GROWTH, WATER USE AND YIELD OF CHICKPEA (*Cicer arietinum* L.) IN KENYAN DRY HIGHLANDS

**ABSTRACT**

The need to provide sufficient protein food for an increasing population that is mainly resource poor requires opening up of marginal land for growing appropriate pulses such as chickpea. An experiment was carried out at KARI-Naivasha situated at an altitude of 1900 m, characterized with clayey to sandy loam soils in a split plot of randomized complete block design over two seasons (December 29, 2004 to May 26, 2005 and June 21 to November 15, 2007). The objective was to investigate the production of kabuli chickpea in Kenya as affected by tillage methods (main plots) and sowing times (subplots) and the effects of these factors on water use and yield of the crop. The overall mean height ranged from 39.7 to 47.7 cm under tillage methods with strip tillage resulting in relatively taller plants than the other tillage methods. Sowing times gave plant heights of 41.5 – 46.4 cm with early sown crops being relatively taller than late sown crop in both seasons. The leaf area index ranged from 2.50 to 3.31 and 4.22 to 5.44 under tillage methods in Season I and II, respectively. The corresponding values of LAI in the respective two seasons under sowing times were 2.80 to 3.20 and 3.59 to 5.69. The crop took 32.5 to 35.5 days to first flower and 61.8 to 61.4 days to 50% flowering in Season I and II, respectively. The mean time to physiological maturity was 120 days showed significant differences among tillage methods in both seasons. The time to first flower and 50% flowering however had non-significant differences ( $P < 0.05$ ) under both tillage method and sowing time treatments. The aboveground biomass yield of the chickpea varied from 3242.1 to 4231.3 kg ha<sup>-1</sup> in Season I and 3035.8 to 4556.1 kg ha<sup>-1</sup> in Season II under varying tillage treatments. The sowing time effects on biomass yield showed significant differences in biomass yields ranging between 3784.3 to 4095.0 kg ha<sup>-1</sup> and 2938.1 to 4263.2 kg ha<sup>-1</sup> in Season I and II, respectively. The grain yields obtained were significantly different ( $P < 0.05$ ) ranging from 1430.6 to 2544.9 kg ha<sup>-1</sup> under tillage method effects and 1573.8 to 2235.3 kg ha<sup>-1</sup> under sowing time treatment effects in both seasons. Tillage and sowing time effects on grain yield of chickpea were significantly different ( $P < 0.05$ ) only in the second season. In Season I, rains received in the post anthesis period of the chickpea thus causing it to exhibit indeterminate growth habit which resulted in additional yield increments of between 26.2 to 29.8% and 23.3 to 35.0% under various tillage and sowing time treatments, respectively. This gave a final overall mean grain yield of 2058.4 kg ha<sup>-1</sup>. The 100-grain weight of the chickpea varied between 36.7 to 40.2 g in both seasons and showed non-significant differences under both factors of study. Infiltration rates were not significant under tillage and sowing times but affected the storage capacity ranging between 450.3 mm for first sowing time in Season II to 488.1 mm for conventional tillage in Season I. The mean seasonal evapotranspiration varied between 300.1 mm to 326.1 mm and showed interaction effects between tillage and sowing times in Season II. The mean biomass based water use efficiency (WUE<sub>b</sub>) and grain based water use efficiency (WUE<sub>g</sub>) ranged from 12.09 to 12.21 kg ha-mm<sup>-1</sup> and 4.93 to 6.31 kg ha-mm<sup>-1</sup> in Season I and II, respectively. The moisture use rate was non-significant with ranges of 2.23 to 2.58 and 2.18 to 2.56 mm/day in Seasons I and II, respectively.