

Effect of planting date and plant density on morphological traits, yield and yield components of *Cannabis sativa* L.

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Extended Abstract

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Introduction: Cannabis has long been used for hemp fibre, hemp oils, medicinal purposes, and also as a recreational drug. Given the importance of maximum utilization of environmental parameters during growth period, it is crucially important to choose an appropriate sowing date and plant density for crops cultivation. Hence, the objective of the present study was to evaluate the effect of sowing date and plant density on morphological and yield traits of cannabis.

Materials and Methods: This experiment was carried out as a split-plot based on randomized complete block design with three replications at the field of agricultural research center of Birjand, Iran in 2013 cropping season. The main plots consisted of three sowing dates of May 12, May 27 and June 11 and the sub-plots were plant densities at four levels of 7.4, 11.1 and 22.2 plants m⁻². The measured traits were as follows: plant height, stem diameter, branch number of main stem, seed number per plant and m², 1000-seed weight, seed yield, biological yield, harvest index and seed and biomass yields of single plant. The texture of the soil at the research farm was loamy with a pH of 8.28, electrical conductivity of 2.23 mmhos/cm and organic carbon, total N, P, and K content were 0.18%,

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0.035%, 6.04.4 ppm and 231 ppm at the soil depth of 0-30 cm, respectively. All the data obtained from the experiment were analyzed by MSTAT-C statistical software and means were compared by Duncan multiple range test at 5% probability level.

Results and Discussion: The results showed that all the traits were significantly affected by sowing date and plant density. Also, the interaction effects of planting date and plant density significantly affected plant height, seed number per m² and seed yield of cannabis. The delay in sowing from May 12 to June 11 significantly decreased stem diameter, branch number in main stem, plant height, seed number per single plant and m², seed and biological yields per single plant and m² and harvest index by 20.2, 22.2, 20.3, 49.2, 43.2, 53, 36.9, 48, 36.9 and 32%, respectively. It can be said that delaying of sowing date from May 12 to June 11 was associated with increased temperature and shortened days and as a consequence, the plants did not have enough time for vegetative growth and production of branches (Shafaroodi *et al.*, 2012). This led to decreased number of seed per plant and m², which ultimately reduced seed and biological yields. Also means comparison showed that with decrease in density from 22.2 to 7.4 plants/m², the traits including seed number, seed and biological yields per m² decreased by 37.2, 13.7 and 19.5%, respectively. In contrast, the traits including stem diameter, branch number in main stem, seed number, seed and biological yields per single plant and 1000-seed weight increased by 40.7, 22.7, 72.7, 112.3, 141.4 and 32%, respectively. It appears that the increase in seed yield with the increase in plant density was a result of higher leaf area, effective utilization of solar radiation during growth period (Niroomand Tomaj *et al.*, 2012; Delarami & Moosavi, 2016) and enhanced photosynthetic capacity and production of more pods per unit area.

Conclusions: The results of this study showed that longer growth period and production of more assimilates at earlier sowing dates can be a main reason for better yield of cannabis. Moreover, higher plant density allowed maximum utilization of solar radiation by the plant, which resulted in increased photosynthetic capacity. Also, the higher yield at the first sowing date under density of 22.2 plants m⁻² was due to the effective utilization of solar radiation by increasing leaf area. In total, sowing date of May 12 with the density of 22.2 plants m⁻² produced the highest average seed yield of 356.60 g m⁻².

Keywords: Medicinal plant, sowing time, plant number, harvest index, seed number, plant height.

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