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Effect of irrigation schedule and planting geometry on growth and yield of stevia (*Stevia rebaudiana* Bertoni.)*

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Abstract: A field experiment was conducted in medium black, clayey soil under irrigated conditions to assess the response of stevia to irrigation schedules and planting geometry. Highest dry leaf yield of stevia (cumulative of five cuttings) was obtained with irrigation scheduled at 1.2 IW/CPE (10.54 t ha^{-1}) which was on par with irrigation scheduled at 1.0 IW/CPE (10.32 t ha^{-1}) and significantly lower dry leaf yield was with irrigation scheduled at 0.8 IW/CPE (9.36 t ha^{-1}). Planting geometry of 30 cm x 20 cm recorded the highest cumulative total dry leaf yield (11.12 t ha^{-1}) which was comparable with the dry leaf yield obtained with the planting geometry of 30 cm x 30 cm (10.89 t ha^{-1}). Significantly lower dry leaf yield was recorded with planting geometry of 45 cm x 30 cm (8.73 t ha^{-1}). Interaction effects of irrigation schedules and planting geometry on dry leaf yield of stevia were not significant. Consumptive use of water was highest with irrigation scheduled at 1.2 IW/CPE (2373.2 mm) closely followed by 1.0 IW/CPE (1903.8 mm). The study revealed that irrigation schedule at 1.0 IW/CPE *i.e.*, irrigation at 60 mm cumulative pan evaporation (CPE) with planting geometry of 30 cm x 30 cm (1,11,111 plants ha^{-1}) was found optimum for higher stevia dry leaf yield and higher water use efficiency. Based on the average daily evaporation the irrigation interval of 9-10 days during *kharif,* 5-6 days during *summer* and 7-8 days during *rabi* season can be recommended in similar soil and agro climatic conditions.

Key words: Consumptive use, Evapotranspiration, Geometry, Irrigation, Stevia

Introduction

Stevia (*Stevia rebaudiana* Bertoni.) is a herbaceous perennial small bush with carbohydrate based compounds in its leaves, which are many times sweeter than cane sugar and sugarbeet. Dry leaves are the economic part in stevia plant. Stevia leaves have a sweet taste which is 20-30 times that of cane sugar but importantly without any calories. Hence, stevia is a potential natural source of no calorie sweetner, alternative to the synthetic sweetening agents *viz.*, saccharine, aspartame, asulfam-K, sucralose that are available in the market to the diet conscious consumers and diabetics. Cultivation of stevia crop made significant impact in the countries like Japan, China, Korea, Mexico, USA, Thailand, Malaysia, Indonesia, Australia, Canada and Russia (Brandel and Rosa, 1992) and efforts were made to initiate research work in India. Studies conducted so far could suggest few management approaches for improving productivity. Since the production potential of stevia in India is 2-3 t ha^{-1} of dry leaves as against 1-2 t ha^{-1} in China, it has definite advantage over China (Chalapathi *et al*., 1997 b). Stevia can be cultivated profitably wherever irrigation facilities are available. Some research work on nutrient requirement and planting geometry for stevia was carried out in loamy soils at University of Agricultural Sciences, Bengaluru in Karnataka (Chalapathi *et al*., 1999) and at the Institute of Himalayan Bioresource Technology (IHBT), Palampur, Himachal Pradesh during 1996 and 2003, respectively (Megeji *et al.*, 2005 ; Ramesh *et al., 2006)*. In the absence of adequate information on the planting geometry, water requirement and optimum irrigation schedule to stevia in vertisols, the present investigation was undertaken to determine the optimum irrigation schedule and planting geometry for stevia to get higher dry leaf yield.

Material and methods

The experiment was conducted at Water Management Research Center (WMRC), Belavatagi, (Ta: Navalagund, Dist: Dharwad), during 2003-04 to 2005-06. It is located in semi-arid tract of Karnataka at 15^{o} 34' N latitude and 75^{o} 21' E longitude with an altitude of 578 m above mean sea level. The soil type of the experimental site was medium black soil (Vertisols) with soil depth of more than 1.5 m having high water holding capacity (78%) and low infiltration rate (0.25 cm hr^{-1}). The annual total rainfall received during the years 2004-05 and 2005-06 were 481, 492 and 443 mm respectively, which were 13.5, 11.5 and 20.3 per cent lower than the average annual rainfall of past 30 years (556.0 mm). The experiment consisted irrigation schedules *viz.*, I_1 (0.8 IW/CPE), I_2 (1.0 IW/CPE) and I_3 (1.2 IW/CPE) as main plots and planting geometries of D_1 (30 cm x 20 cm), D_2 (30 cm x 30 cm), D_3 (45 cm x 30 cm) and D_4 (60 cm x 20 cm) as sub plots. The experiment was laid out in split plot design with three replications. Two months old stevia seedlings were planted at respective spacing as per treatment on 23rd November, 2003. A common dose of FYM @ 10 t ha^{-1} was uniformly applied to the experimental plots. Nutrient dosage of 300:150:100 kg N, P_2O_5 and K_2O ha^{-1} was applied in equal splits for five cuttings in year *i.e.* 60: 30: 20 kg N, P_2O_5 and K_2O ha^{-1} per cutting. Common irrigation with 60 mm depth was given on the next day of planting. Gap filling with planting new seedling was undertaken after 30 days of planting up to 60 days to maintain required plant

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