NOTES

EFFECTS OF SPACING AND IRRIGATION LEVELS ON GROWTH AND BIOMASS PRODUCTION IN *SALVADORA PERSICA*

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Salvadora persica (family Salvadoraceae), popularly known as "Khara Jhal/Pilu", is a perennial shrub/tree found in the Indian desert. Its green branches and roots are used as chewing sticks, known as meswak. The whole plant is used for the preparation of medicines in ayurveda, homeopathy and unani systems of medication. Under soil-water stress conditions, the growth of this plant is very much restricted. Soil profile from different plant communities associated with *Salvadora* show that it prefers medium- and fine-textured soil, particularly sandy loams, sandy clay loams and light clays of good depth (Gupta & Saxena 1968). Plant density is yet another important factor which affects plant growth characteristics. Competitive ability of plants in a community varies greatly and depends upon the density of plants per unit area. High plant densities, in general, adversely affect the plant growth and development. Nutrient uptake is affected by fertiliser application and plant density in a unit area. Plant growth and development in arid regions are dependent entirely on the availability of soil moisture, which is highly unpredictable. Application of fertilisers and maintaining optimum plant populations assume great importance in yield maximisation. These requirements may vary according to cultivar, soil fertility, soil condition as well as agroclimate of the region. With increasing demand for fodder, fuel and timber, tree-planting activities have been accorded the highest priority in desert development programmes. The studies of tree crop interaction under varying spacing regimes are required in order to improve productivity of agroforestry systems (Gupta *et al.* 1998). In arid regions, irrigation is a costly input in crop production and has not received adequate attention from Indian researchers working in medicinal and aromatic plants (Gupta & Chadha 1995). In view of the harsh climatic conditions of the arid region, it is essential to study the optimum water requirements of the desirable plants to obtain maximum production potential under constraints of various resources, so as to optimise the available resources. Keeping this in view, the present studies were conducted to find out the optimum spacing level and water requirement of *S. persica* to achieve maximum plant growth and biomass production under arid zone conditions.

The experiments were conducted at the experimental field of the Botany Department, J. N. Vyas University, Jodhpur (26° N, 73° E and 254 m above mean sea level) during hot summer (30–46 °C) and cool winter (10–20 °C) seasons in 1999–2001. The soil at the experimental site has a pH of 8.06–8.69, organic carbon 0.34–0.63%, total N 0.024–0.05% and phosphorus 0.0031–0.0074%. One-month-old seedlings were transplanted from nursery to the experimental plot in July–August 1999. The experiments were conducted

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in randomised block design (RBD) each with three levels of spacing, namely, 3 × 3, 4 × 4 and 5 × 5 m and irrigation, namely, control (no irrigation), fortnightly (15 days) and monthly (30 days). Irrigation was provided according to the requirement of the plants until their final establishment in field conditions. After the rainy season, 8 litres of water per plant were used every fortnightly and monthly accordingly. Each treatment consisted of nine replicates. Observations on plant height and collar diameter were recorded three, 12 and 18 months after transplantation of seedlings in the plots. Plants were uprooted after 12 months of growth for the estimation of plant biomass. The experimental data were subjected to analysis of variance as suggested by Gomez and Gomez (1984).

The data on effects of different spacing levels on plant growth parameters during various months are given in Table 1. Results revealed that 5 × 5 m spacing favourably increased the plant height and collar diameter compared with spacings of 3 × 3 and 4 × 4 m. At the end of the 18 months, maximum values for plant height and collar diameter were observed in 5 × 5 m spacing (p = 0.01) and minimum in 3 × 3 m spacing (p = 0.01). Kasera and Chawan (2000a, b) reported that 3 × 3 and 4 × 4 m spacings in *Prosopis cineraria* and 1 × 1 to 3 × 3 m in *Commiphora wightii* were favourable for harvesting maximum number of plants per unit area. Tiwari and Pandey (2000) observed maximum plant height and collar diameter in 3 × 3 m spacing under irrigated conditions for *P. cineraria*. Singh (1998) recorded that *P. juliflora* planted at 1 × 1 and 1 × 2 m spacings under irrigated conditions produced 39 and 32 kg tree^{-1} aboveground biomass respectively after seven years' growth. The author further suggested that plant growth could be improved by planting at closer spacing. In the present study, maximum plant height and collar diameter of *S. persica* were observed in 5 × 5 m spacing experiments, which ensured lower competition for light, moisture and nutrient uptake than the other two spacing levels studied.

The effects of irrigation levels on plant growth and biomass are presented in Table 2. Readings at the end of this experiment showed that fortnightly irrigation level increased plant height and collar diameter significantly (p = 0.01) compared with control and monthly irrigation. Above- and belowground biomass production increased significantly (p = 0.01) with fortnightly irrigation compared with monthly irrigation and control. High values for above- and belowground biomass (795.2 and 335.3 g plant^{-1} dry weight respectively) were recorded in fortnightly irrigation and minimum in control (377.0 and 135.1 g plant^{-1} dry weight respectively).

Table 1 Effects of different spacing levels on the growth measurements of *Salvadora persica* during different months

Month / Spacing	Plant height (cm)			Collar diameter (cm)		
	3	12	18	3	12	18
3 × 3	49.00	107.00	122.8	0.54	2.06	2.54
4 × 4	46.83	109.00	124.2	0.45	1.52	2.61
5 × 5	45.66	117.75	128.4	0.64	1.39	3.14
CD	0.90**	8.172*	2.297**	0.111*	0.205**	0.226**

*p = 0.05, **p = 0.01

Table 2 Effects of different irrigation levels on the growth measurements and biomass production of *Salvadora persica* during different months

Month / Irrigation level	Plant height (cm)			Collar diameter (cm)			Biomass after12 months (g plant^{-1} dry weight)	
	3	12	18	3	12	18	Above-ground	Below-ground
Control	70.00	88.00	130.80	1.09	1.80	2.92	377.0	135.1
Fortnightly	69.50	142.25	162.20	1.02	2.55	3.56	795.2	335.3
Monthly	75.83	134.50	153.20	1.02	2.78	3.26	518.2	190.4
CD	3.58*	12.62**	16.52**	ns	0.43**	0.16**	11.332**	13.086**

ns = Non-significant, *p = 0.05, **p = 0.01

Shukla (2001) observed that monthly irrigation was suitable for *P. cineraria* under field conditions for increasing growth parameters and biomass production. Irrigated *P. cineraria* plants exhibited better growth performance as compared with non-irrigated plants (Tiwari & Pandey 2000). It has been reported that water harvesting helps in early growth and establishment of tree seedlings (Gupta & Sharma 1998). Singh *et al.* (2000) reported beneficial effects of different irrigation levels on growth and biomass potentials of *Leucaena leucocephala.* The high biomass and growth of *S. persica* under fortnightly-irrigated plants observed in this study may be due to optimum soil temperature, moisture and adequate aeration prevalent in light textured soil, as confirmed by Charaya *et al.* (1989).

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