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Studies on Growth Enhancement of Khejri (*Prosopis cineraria* (L.) Druce) Seedlings and *in situ* Budded Plants

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Abstract: Studies were conducted on the growth vigor of khejri seedlings as affected by environment (in open and under shade net), irrigation method (rose can and mini-sprinkler), growth regulator treatment (50 ppm GA, 50 ppm GA + 2% urea, 1000 ppm MH and B-9) and on the growth of the *in situ* budded plants as affected by black polyethylene mulch and application of 1 L urea (2%) per plant under irrigated and rainfed conditions. Seedling height after 6 months was 34.33 cm in plants treated with 50 ppm GA when planted under open with rose can irrigation compared to 29.6 cm in the control. Linear growth of budded plants was 138.31 cm under rainfed conditions when mulched with black polyethylene compared to 76.98 cm in the control.

Key words: Khejri, *Prosopis cineraria*, growth regulator, irrigation, growth enhancement, polyethylene mulch.

Khejri (*Prosopis cineraria* (L.) Druce) is an important component of the flora of Thar Desert. This versatile tree species not only fixes atmospheric nitrogen (Singh, 1998), but also provides protein-rich pods even during the extremely warm summer months of April-May. It readily perpetuates itself from the dispersed seeds, giving rise to a wide range of variability with respect to pod quality traits in the natural stands of *P. cineraria* in north-west Rajasthan (Pareek and Nath, 1997). Elite trees that produce good quality pods have been identified from this biodiversity. Since vegetative propagation technique of khejri by patch budding has been developed (Pareek and Purohit, 2002), true-to-type plant material of these elite trees can now be multiplied. The success in budding and subsequent rate of sprouting, however, depends on the vigor of rootstock. The desirable thickness (vigor) of rootstock is hard to achieve in this slow-growing species in nursery as well as after planting in the field. Favorable effects on growth of khejri seedlings have been reported by application of watering and manuring (Gupta and Sharma, 1998), soil management practices (Puri and Kumar, 1992), fertilizer application (Gupta *et al.*, 1996), and mulching (Gupta *et al.*, 1997). Growth regulators are also known to influence the growth and vigor of plants. Attempts were, therefore, made to increase vigor of khejri seedlings and *in situ* budded plants by application of nutrients, irrigation, plant growth regulators and by soil mulching.

Material and Methods

Khejri seeds were sown in October 2001 in polyethylene tubes (30 x 10 cm) filled with mixture of FYM and sand in 1:1 ratio in the nursery. After three months, khejri seedlings of uniform height and diameter were selected and kept under open as well as under shade net (Agro Shade Net HDPE; 75% shade, green color polynet).

The seedlings under both conditions were irrigated by two methods, i.e. by rose can and by mini sprinkler (operating for 30 minutes), so as to supply 24 L m^{-2} area by each method. In each of these four sets, 50 ppm GA, 1000 ppm MH, 1000 ppm B-9 and 50 ppm GA+ 2% urea were applied as foliar spray. Observations on seedling height, collar diameter and stem diameter were recorded 3 and 6 months after imposing the treatments.

Another experiment was conducted to enhance the vigor of the budded plants raised through *in situ* budding in September 2001 on the seedlings planted in the field in August 2000 at 4 x 4 m spacing. This study was also done under both irrigated and rainfed conditions. 20 L of water was applied to each plant at an interval of 15 days. Under both rainfed and irrigated conditions, treatments consisted of (i) mulch (spreading a 50 x 50 cm sheet of black polyethylene around each plant), (ii) 1L urea solution (2%) applied in each basin in the month of October, 2001, and (iii) mulch + urea. The treatments had three replications. Observations on length and diameter of scion sprout and linear growth were recorded 6 months after the treatments.

Results and Discussion

Growth of khejri seedlings

The seedlings raised under open condition were more stocky with better height, collar and stem diameter than those under the shade net (Table 1). Choudhary (2001) reported the shade-intolerant nature of khejri seedling. This may be one of the reasons for better growth of plants in the open than under shade. Irrigation by rose can was better than by mini sprinklers. The soil moisture data indicate that vertical penetration of moisture was more when watered with a rose can and this may have

Table 1. Effect of environment, irrigation methods and plant growth regulators on growth of khejri seedlings

Treatment	Seedling height (cm)		Collar diameter (cm)		Stem diameter (cm)	
	3 month	6 month	3 month	6 month	3 month	6 month
Environment						
Open	20.28	29.31	0.290	0.428	0.192	0.319
Under shade net	19.58	26.78	0.263	0.371	0.178	0.282
CD at 5%	NS	1.8619	0.012	0.01425	NS	0.024
Irrigation method						
Rose can	20.25	28.66	0.270	0.415	0.188	0.314
Mini-sprinkler	19.61	27.43	0.283	0.384	0.181	0.287
CD at 5%	NS	NS	NS	0.0142	NS	0.024
Growth regulator						
Control	19.82	27.61	0.247	0.342	0.155	0.266
GA 50 ppm	21.21	31.74	0.285	0.460	0.210	0.336
GA 50 ppm + 2% urea	20.72	29.41	0.297	0.412	0.203	0.318
MH 1000 ppm	19.00	25.32	0.275	0.382	0.178	0.287
B-9 1000 ppm	18.89	26.13	0.279	0.400	0.177	0.295
CD at 5%	NS	2.944	0.0191	0.0225	0.030	0.0385

Table 2. Effect of environment, irrigation methods and plant growth regulators interactions on growth of khejri seedlings

Treatment	Seedling height (cm)		Collar diameter (cm)		Stem diameter (cm)	
	3 month	6 month	3 month	6 month	3 month	6 month
ORT1	20.39	29.60	0.24	0.36	0.16	0.29
ORT2	21.40	34.33	0.34	0.65	0.26	0.44
ORT3	21.38	30.32	0.31	0.48	0.20	0.35
ORT4	19.77	27.65	0.30	0.42	0.18	0.32
ORT5	19.89	28.12	0.31	0.45	0.18	0.35
OST1	19.95	28.64	0.27	0.35	0.15	0.26
OST2	21.12	30.62	0.27	0.42	0.20	0.32
OST3	20.92	30.40	0.29	0.38	0.19	0.31
OST4	19.10	26.27	0.28	0.37	0.17	0.25
OST5	18.90	27.18	0.29	0.40	0.17	0.26
ShRT1	19.87	26.19	0.21	0.31	0.15	0.25
ShRT2	21.40	32.26	0.24	0.37	0.18	0.27
ShRT3	20.54	29.91	0.28	0.39	0.20	0.29
ShRT4	19.03	23.92	0.23	0.36	0.17	0.26
ShRT5	18.83	24.31	0.23	0.36	0.17	0.27
ShST1	19.10	26.01	0.27	0.35	0.15	0.24
ShST2	20.93	29.78	0.29	0.40	0.18	0.29
ShST3	20.05	27.04	0.31	0.40	0.21	0.31
ShST4	18.10	23.47	0.28	0.38	0.18	0.30
ShST5	17.95	24.93	0.28	0.39	0.18	0.29
CD at 5%	3.438	4.163	0.027	0.0318	0.0425	0.0545

O- Open; Sh- Shade; R- Rose can; S- Mini sprinkler; T1- Control; T2- GA50 ppm; T3- GA50 ppm + Urea 2%; T4- MH1000 ppm; T5- B-9 1000 ppm.

resulted in better growth of plants. Spray of 50 ppm GA significantly increased the height, collar diameter and stem diameter of the seedlings in the nursery (Table 1). Gibberellic acid is well known to stimulate elongation of cells due to increased enzymatic activities, permeability of cell wall and formation of energy-rich phosphates. Also the gibberellic acid treatment might have increased osmotic uptake of water and nutrients (Salisbury and Ross, 1992). Thus the studies indicate that the best treatment combination is to raise plants under open condition giving 50 ppm GA spray and irrigation with a rose can (Table 3).

Growth of budded plants

Although effects of either irrigation, mulching or urea applications were not significant even after 6 months of the treatments, the results indicate that the plants raised under rainfed conditions had better growth as compared to the plants under irrigation (Table 3). This may be because the plants under rainfed condition developed deeper roots due to stress as suggested by the studies of Kaarakka *et al.* (1992)

Table 3. Effect of irrigation, mulching and urea application on growth of in situ budded khejri plants after 6 months

Treatment	Length of main scion sprout (cm)			Diameter of main scion sprout (cm)			Linear growth of scion (cm)		
	Irrigated	Rainfed	Mean	Irrigated	Rainfed	Mean	Irrigated	Rainfed	Mean
Control	24.75	23.46	24.10	0.503	0.426	0.465	108.50	76.98	92.74
Mulch	23.99	28.57	26.28	0.463	0.64	0.551	74.16	138.31	106.24
Urea (2%)	25.45	25.72	25.58	0.573	0.546	0.560	126.57	98.23	112.40
Mulch + Urea	17.76	27.42	21.59	0.34	0.52	0.43	51.63	107.96	79.79
Mean	22.49	26.29		0.47	0.533		90.21	105.37	
	I	M	IM	I	M	IM	I	M	IM
SEm±	1.177	1.664	2.354	0.037	0.052	0.074	10.806	15.283	21.613
CD at 5%	3.570	NS	7.141	NS	NS	0.225	NS	NS	65.558

I = Irrigation; M = Management (mulching and urea application).

who observed that khejri plants did not require irrigation to enhance growth. Soil moisture data indicated that water applied by the limited irrigation in this study (20 L) did not change the moisture content of soil profile below 40 cm depth. The studies have also indicated that black polyethylene mulch under rainfed condition slightly enhanced the growth of plants, perhaps due to better maintenance of temperature, moisture and colloidal state of soil (Gupta *et al.*, 1997).

Seedling growth in the nursery was better in the open than under the Agro Shade Net (75%) when sprayed with 50 ppm gibberellic acid and irrigated with a rose can. The growth of budded plants was slightly better when black polyethylene mulch was used under rainfed conditions.

References

Choudhary, A.K. 2001. Effect of shade on growth performance of four tree species: Nursery stage. *Pakistan Journal of Agricultural Sciences* 38: 69-72.

Gupta, G.N., Kuppusamy, V., Choudhary, K.R., Bohra, N.K., Singh, Neelu and Kusum Lata 1996. Effect of fertilizers on early growth of desert species *Prosopis cineraria* and *Tecomella undulata*. *Annals of Forestry* 4: 29-33.

Gupta, G.N., Singh, B. and Singh, G. 1997. Relative performance of different species on a sand dune in Thar Desert. *Indian Forester* 123: 206-210.

Gupta, J.P. and Sharma, A.K. 1998. Integrated effect of water harvesting and manuring on growth and establishment of *Prosopis cineraria* (khejri) in hot-arid region of Rajasthan. *Indian Forester* 124: 54-58.

Kaarakka, V., Johansson, S., Johansson, S.G. and Kaarakka, V.J. 1992. Yield and water use efficiency of 32 two-year-old *Prosopis* provenances under irrigation in Bura, eastern Kenya. *Nitrogen Fixing Tree Research Reports* 10: 182-185.

Pareek, O.P. and Nath, V. 1997. Variability in horticultural traits of khejri in Thar desert. *International Plant Genetic Resources Institute Newsletter for Asia, the Pacific and Oceania*. No. 24, December 1997, pp. 23-25.

Pareek, O.P. and Purohit, A.K. 2002. Patch budding in khejri (*Prosopis cineraria*). *Indian Journal of Horticulture* 59: 89-94.

Puri, S. and Kumar, A. 1992. Management and establishment of *Prosopis cineraria* in hot desert of India. In *Integrated Land Use Management*

for Tropical Agriculture: Proceedings Second International Symposium Queensland 15-25 September, 1992. Module 2, 46.1-46.9, Conference and Workshop Series. QC 2009.

Salisbury, F.B. and Ross, C.W. 1992. *Plant Physiology.* Wadsworth Blemont, CA.

Singh, R.R. 1998. Germination, growth and nodulation studies in three important nitrogen fixing tree species. *Indian Journal of Forestry* 21:128-130.