



Cactus Pear (*Opuntia ficus-indica*) in India



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Evaluation of Cactus pear on farmers fields for growth and survival under arid conditions of Kachchh, Gujarat

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Cactus pear (*Opuntia ficus-indica*) has been commercially exploited as fruit, vegetable, forage, energy, medicinal and dye yielding crop in the arid and semi-arid areas of the world. Cactus is extensively used as an emergency livestock feed during times of extreme droughts, i.e. a kind of "drought insurance" (Le Houérou, 1994). Cactus pear meets the most important criteria (drought tolerance and palatability) for fodder crops in drought prone regions (Sharma, 2014; Soni *et al.* 2015.). Cactus pear can tolerate water-limited conditions (Felker *et al.*, 1997), high temperatures (Sudzuki, 1995) and poor soils (Gajendra *et al.*, 2014). Cactus pear possess crassulacean acid metabolism (CAM) pathways and hence capable of converting water to biomass fourfold more efficiently than either C₄ or C₃ plants (Han and Felker, 1997). They can be a source of water and dry matter in water-limited areas when fed to animals as green feed. It is a multi-purpose plant since it can be used for direct human consumption (fruit and vegetable) and raw material for various industries to prepare plywood, soap, dyes, adhesives, glue, serve as medicines and cosmetics such as shampoo, cream, body lotions (Barbera *et al.*, 1995; Pimienta, 1994). In India, cactus pear was first introduced in 1970s by the researchers at Central Arid Zone Research Institute, Jodhpur. In 1991, CSSRI, Karnal obtained five clones (fruits, forage and vegetable) from Dr. Peter Felkers collection from Texas, USA (1270, 1271, 1280, 1287 and 1308) and these accessions were introduced at CAZRI, Jodhpur during 1996. Currently, CAZRI, RRS Bhuj is maintaining 64 accessions of cactus pear received through ICARDA and local collections and are being evaluated for survival, growth and green fodder production at research farm. Due to extension efforts of CAZRI, RRS and KVK, Bhuj there is steady growing demand by the farmers for planting materials of cactus pear. Therefore, the most adapted cactus clone (CAZRI Botanical Garden) was selected to assess the growth and survival on farmers field of the regions.

Ten farmers were selected from two villages after focused discussions and group meeting in Kachchh region of Gujarat, each farmer was given 10 cladodes of CAZRI Botanical Garden obtained from 2-3 year old cactus garden of Regional Research Station, Kukma. Before planting, cladodes were dried in shade for a week for suberization to minimize the chance of microbial infection during planting. The provided cladodes were the same size/weight and age, as much as possible. The cladodes were planted vertically keeping half to one third portion in the soil at 1 x 1 m spacing in the farmer's field. In general, the soils of the experimental sites was alkaline (pH ranges from 7.88 to 8.70), non-saline (EC varies from 0.21 to 0.52 dS m⁻¹), sandy to gravelly in texture with low soil organic carbon, low available Nitrogen and Phosphorus and medium Potash. Their plantation was done in the month of June 2015 and observations were recorded on cactus pear survival and growth at monthly interval. The regeneration rate of cactus cladodes were calculated based on the number of new cladodes emerged from one mother cladode.

A significant differences (P=0.05) in the survival of cactus cladodes in different sites was observed (Table 1). Average plant survival was 86.04% after thirty days of planting and 75.16% after the 180 days of planting. The survival and regeneration rates ranged from 33.33% to 100% and 3 to 4.77 cladodes per one mother cladode. The maximum survival (100%) was recorded in two sites followed by 96.67% in one site. The decrease of survival over time was mainly due to lack of care after planting. On an average, 4.98 cladodes were regenerated from

one mother cladodes after 180 days of planting. Similar results were also reported by Tegegne (2001) in *Opuntia ficus-indica*. Moreover, Soni *et al.* (2015), found that the better management practices during initial stage increased the survival of newly planted cladodes.

Growth was assessed based on the plant height, number and diameter of cladodes produced after field planting and it was observed that plant growth increased significantly over time. The plant height increased from initial (11.72 cm) at 30 days to 33.11 cm after 180 day of planting (Table 2). The average cladodes diameter and numbers ranged from 3.64 to 6.19cm and 2.67 to 4.44 respectively. The cladodes diameter and plant height varied significantly mainly because of soil chemical properties and amount of care at initial stage. Cladodes planted in soil having higher soil pH was having poor growth compared to those planted in normal soils. Environmental stresses like temperature, drought and salinity influence the plant growth, development and yield of cactus pear as reported earlier by many workers (Le Houérou, 1994 and Han and Felker, 1997, Gajender, 2014). Singh(2003) also reported higher biomass production of CAZRI botanical garden accession in the Bikaner conditions.

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Table 1. Effect of planting sites on cactus pear survival and regeneration rate

Farmer site	Survival (%)			Mean	Regeneration rate (cladodes produced/one mother cladode)			Mean
	30 DAP	90 DAP	180 DAP		30 DAP	90 DAP	180 DAP	
S ₁	100	100	90	96.67	2.00	2.00	2.50	2.17
S ₂	100	100	100	100.00	2.00	2.50	5.00	3.17
S ₃	90	90	80	86.67	1.67	4.33	5.00	3.67
S ₄	100	100	100	100.00	2.50	4.33	6.33	4.39
S ₅	80	80	80	80.00	1.50	3.00	4.50	3.00
S ₆	80	70	60	70.00	2.00	3.00	4.00	3.00
S ₇	40	40	20	33.33	1.67	4.00	5.00	3.56
S ₈	98	93	71	87.67	2.23	4.57	7.50	4.77
Mean	86	84	75		1.95	3.47	4.98	
CD at 5%								
Treatment				3.44				0.66
Duration				2.11				0.40
T x D				5.96				1.14

Table 2. Effect of planting sites on cactus pear growth

Farmer site	Total cladodes			Mean	New cladode diameter (cm)			Mean	Plant height (cm)			Mean
	30 DAP	90 DAP	180 DAP		30 DAP	90 DAP	180 DAP		30 DAP	90 DAP	180 DAP	
S ₁	2.00	3.00	5.00	3.33	2.50	3.83	4.60	3.64	8.50	14.60	16.50	13.20
S ₂	2.00	3.00	5.00	3.33	3.50	4.50	5.17	4.39	8.33	12.57	16.73	12.54
S ₃	2.00	3.00	4.00	3.00	3.00	4.50	8.00	5.17	14.43	23.33	47.34	28.37
S ₄	3.00	4.00	5.00	4.00	3.17	4.17	6.50	4.61	12.33	20.00	37.33	23.22
S ₅	2.00	3.00	4.00	3.00	2.50	3.97	4.90	3.79	10.50	16.50	25.50	17.50
S ₆	2.00	3.00	4.00	3.00	2.50	4.00	5.00	3.83	11.00	15.60	27.17	17.92
S ₇	1.00	3.00	4.00	2.67	3.57	6.00	9.00	6.19	15.50	31.50	48.33	31.78
S ₈	1.67	3.67	8.00	4.44	3.67	4.17	6.00	4.61	13.17	28.33	46.00	29.17
Mean												
CD at 5%	1.96	3.21	4.88		3.05	4.39	6.15		11.72	20.30	33.11	
Treatment				0.92				0.65				0.98
Duration				0.56				0.40				0.60
T x D				1.58				1.13				1.69