

Original Research Article

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Establishment and Performance of Cactus (*Opuntia ficus-indica*) Accessions at Initial Stages under Shed Net in Semi-Arid Region of Rajasthan

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ABSTRACT

Cactus (*Opuntia ficus-indica*), commonly known as prickly pear, belongs to the family Cactaceae. It has high water-use efficiency, drought tolerant, survive under erratic and low rainfall and highly useful in arid and semiarid environments, particularly during prolonged dry spells or failure of the monsoon. Cactus is considered as one of the important sources of food and fodder to cattle under arid condition. The study has been carried out to estimate the initial survival rate and establishment of cactus accessions under shed net condition at ICAR-CAZRI, Regional Research Station, Pali-Marwar. It has shown good survival rate before rainfall (March-June). But after commencement rainfall (July-August) it was showing decreasing trend in survival percentage. The survival rate of cladodes before rainfall ranged between 100% and 40% whereas it was decreased as 80% to 31.4% after commencement of rainfall. The highest survival percentage of cladodes before rainfall was recorded in Trunzara Red San Cono, ARL Spineless, Roso Castle Sardo and Algerian (100%). Out of fifteen accessions, seven were sprouted in 28 to 49 days and others sprouted after over 50 days. Therefore, waterlogging and saline condition of water may reduce the survival rate and establishment at initial stage of cactus by causing root rot under shed net condition.

Keywords

Cactus, Accessions, Survival rate, Semi-Arid region

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Introduction

Opuntia ficus-indica (Cactus), commonly known as prickly pear and belongs to the order Caryophyllales and the family Cactaceae. Locally cactus is called nagphani or dandathohar. *Chapathikalliis* the common

name of plant used in Tamil Nadu. It is reported to contain about 130 genera and nearly 1500 species, which is a new crop in India although its spiny type, bearing very small fruits (locally called nagphani) and it is found wild in arid and semiarid plateau regions. Owing to its xerophytic

characteristics and capability for greater conversion of water to dry matter than by either C₃ or C₄ plants through a specialized photosynthetic mechanism called Crassulacean acid metabolism (Felker *et al.*, 1997; Mizrahi *et al.*, 1997), it was considered as a potential crop species for the water-scarce arid parts of India.

It has a marked capacity to withstand prolonged drought (Nobel, 1995; Felker *et al.*, 1997), extreme heat (Sudzuki, 1995), highly efficient in water use (Nobel, 1995; Snyman, 2004; Snyman, 2005), moderately tolerant to salinity (Gajendra *et al.*, 2014) and are considered as an important potential source of food and fodder (Mishra *et al.*, 2006; Mathur *et al.*, 2009) in many desert areas of the world. It is considered as a natural reservoir of water and may reduce the water requirement of cattle (Flores-Hernández *et al.*, 2004). Many species of cactus are found growing as wild plants in arid (less than 250 mm annual precipitation) and semi-arid (250-450 mm annual precipitation) regions of India. In addition to its remarkable value as cattle and human food, it can act as biological barrier to prevent and control top-soil loss (Nefzaoui and El Mourid, 2009) and increase fodder availability for animals (Alary *et al.*, 2007). Opuntias are also important as cover in arid and semi-arid areas because they can survive and spread under conditions of scarce and erratic rainfall and high temperatures and can play an important role in the protection of local fauna.

Also, cactus pear has multiple uses. It produces sweet, nutritionally rich edible fruits, its tender cladodes are used as fresh green vegetable and salad, mature cladodes or cactus stems are used as nutritive fodder for milch animals (Vishal Nath *et al.*, 1999). The fruit, as well as cactus stem are used to prepare value-added products, such as jam, squash, wine, pickle, body lotions, shampoo, creams,

etc. It also has several medicinal and industrial uses (Singh and Felker, 1998). The fruit is a fleshy berry, varying in shape, size, and colour and has a consistent number of hard seeds. The fairly high sugar content and low acidity of the fruit make it very sweet and delicious. Cacti, and specifically *Opuntia* spp., have been extremely useful livestock forage in times of drought, primarily by providing digestible energy, water and vitamins. Although mainly used for cattle, opuntia has also been used as forage for pigs.

Owing to this importance, it may be considered as a potential crop species for the water-scarce arid parts of India. In recent years, an attention of growing spineless cactus pear in the drier areas of India in terms of fruit, fodder and vegetable production is increasing (Singh and Singh, 2003; Pareek *et al.*, 2003; Singh, 2006). Therefore, present investigation has been carried out to estimate survival rate and initial establishment of cactus populations (before and after rainfall) which is collected from different region of arid zone of India under semi-arid condition of Rajasthan.

Materials and Methods

The study was conducted on fifteen accessions of cactus in shade net house condition in Central Arid Zone Research Institute (CAZRI), Regional Research Station, Pali-Marwar, Rajasthan situated at 25°46'N longitude and 73°50'E latitude at 225 msl during the year 2016. The soil is fine sandy clay loam with high silica content in texture and alkaline with pH 8.5. Fifteen accessions of cactus were collected from different region of arid zones of India and efforts were made to multiply these accessions in pots. The planting materials were consisted of two cladodes or two pieces of a cladode from each clone and it was weighed prior to planting (200 g to 400 g). The cladodes were dried under partial

shade and treated with Bavistin (0.2%). Planting was done in cement pots which were filled with a mixture of farmyard manure and soil in the month of March. The planting was done at the depth of 5 cm (1/3rd portion of cladode) in pots as suggested by Pareek *et al.*, (2002). Survival rate and growth of cladodes were measured before (March to May, 2016) and after rain fall (July to August, 2016). Survival Percentage (%) (before and after rainfall), number of cladodes, days to sprouting were measured and observations were recorded.

Results and Discussion

Survival percentage (%) before and after rainfall

Differences among the accessions were observed in survival rate of cladodes before and after rainfall (Table 1). The survival rate of cladodes before rainfall ranged between 100% and 40%. The highest survival percentage of cladodes before rainfall was recorded in Trunzara Red San Cono, ARL Spineless, Roso Castle Sardo and Algerian (100%). The accessions from 1271 (40%) and Bianca Macromer (40%) followed by Piantra-25 (67%) and Trunzara Red Bronte (67%) had lowest survival percentage before rainfall. But after rainfall the survival percentage was decreased and it ranged from 80% to 31.4%. The highest survival rate of the cladodes was observed in ARL Spineless (80%), Roso San Cono (80%) and Algerian (80%) whereas lowest was 1271(31.4%) followed by Bianca Macromer (37) and 1308 (50%) after rainfall (Table 1).

Survival rate before rain (March to June-2016) is better as compare to after commencement of rain (from July-2016). Because of heavy rainfall the rotting of cladodes is more. It may be due to water logging condition in pots. The infestation of fungus *Phytophthora nicotiana*

may be more because of favorable climatic condition. Nallathambi *et al.*, (2005) also reported that foot rot caused by *Phytophthora nicotiana* has been observed as a major disease in the establishment of cactus pear (*Opuntia spp.*) under arid conditions. Foot rot incidence was prevalent in 23.5% of the germplasm collections during the months of August and November. Guvera (2001) suggested that the cactus and other drought-tolerant and water-efficient fodder shrubs are better growing in deep sandy soils under low rainfall condition (100-150 mm). Gajendra *et al.*, (2014) also reported that cactus has lower tolerance to salinity at establishment and survival stage.

Growth parameters of cactus accessions

Days to sprouting was higher in Piantra-25 (72 days) followed by Roso Castle Sardo (70 days), ARL Spineless and Algerian (69 days) lower in Trunzara Red San Cono (28 days) followed by Bianca Macromer (30 days). Seven accessions sprouted in 28 to 49 days and others sprouted after over 50 days (Table 1). Under the semiarid conditions of Karnal (India), the cladodes sprouted after 57 to 100 days after planting (Singh and Felker, 1998). But, earlier sprouting was occurred at RRS, Pali-Marwar seems to be related to the warmer conditions during the month of March. Number of cladodes per plants ranged between 6 and 2. Maximum number of cladodes per plant was observed in 1270 and 1308 (6) followed by Trunzara Red San Cono (5) whereas minimum was in White San Cono (2). Singh (2003) and Soni *et al.*, (2015) also reported higher number of cladodes in accessions 1270 and 1271. Maximum plant height was recorded in 1308 (71.8 cm) followed by 1271 (64.0 cm) and Trunzara Red San Cono (59.0cm) whereas minimum was Bianca Macromer (20.5 cm) (Table 2). The cladodes length of plant varied in different accessions.

Table.1 Survival percentage and days for sprouting of different cactus accessions

S.No.	Cactus Accessions	Survival Percentage (%) (Before Rain)	Survival Percentage (%) (After Rain)	Days for sprouting	Number of cladodes per plant
1.	1270	80	60	45	6
2.	1271	40	31.4	45	3
3.	CAZRI BOT Garden	80	55	46	3
4.	1308	80	50	66	6
5.	Bianca Macromer	40	37	30	3
6.	Trunzara Red San Cono	100	60	28	5
7.	Piantra-25	67	55	72	3
8.	ARL Spineless	100	80	69	3
9.	Red San Cono	85.8	57.1	50	4
10.	Roso Castle Sardo	100	75	70	4
11.	Roso San Cono	80	80	48	3
12.	Algerian	100	80	69	3
13.	Trunzara Red Bronte	67	55	66	3
14.	Yellow Rocca Palumba	80	66	66	3
15.	White San Cono	80	66	49	2

Table.2 Growth parameters of different cactus accessions

S.No.	Cactus Accessions	Number of cladodes per plant	Plant Height (cm)	Cladode Length (cm)	Cladode Width (cm)	Cladode Thickness (cm)
1.	1270	6	39.5	22.20	17.0	1.32
2.	1271	3	64.0	22.80	6.25	0.65
3.	CAZRI BOT Garden	3	39.5	25.60	8.85	0.90
4.	1308	6	71.8	19.06	4.03	0.90
5.	Bianca Macromer	3	20.5	17.50	5.20	0.50
6.	Trunzara Red San Cono	5	59.0	18.70	6.76	0.56
7.	Piantra-25	3	54.5	26.00	7.36	0.86
8.	ARL Spineless	3	40.0	20.20	6.13	0.60
9.	Red San Cono	4	46.0	18.40	5.10	0.40
10.	Roso Castle Sardo	4	36.0	13.25	6.65	0.40
11.	Roso San Cono	3	53.3	23.15	4.85	0.55
12.	Algerian	3	51.0	13.00	4.63	0.63
13.	Trunzara Red Bronte	3	51.0	20.00	6.25	0.65
14.	Yellow Rocca Palumba	3	31.0	20.25	5.40	0.55
15.	White San Cono	2	47.0	16.50	4.70	0.50

The accession Piantra-25 recorded the maximum (26.0 cm) length followed by the accession CAZRI BOT Garden (25.60 cm). The Length of cladodes was minimum in accession Algerian (13.0 cm) followed by Roso Castle Sardo (13.25 cm) (Table 2). Maximum width of cladode (17.0 cm) was attained by the accession 1270 followed by CAZRI BOT Garden (8.85 cm). Minimum cladode width (4.03 cm) was recorded in accession 1308 (Table 2). Regarding cladodes thickness, it was observed that the accession 1270, CAZRI BOT Garden and 1270 had the largest cladode thickness of 1.32 cm, 0.90 cm and 0.90 cm., respectively (Table 2). The lowest cladode thickness (4.9 cm) was observed in the accession Red San Cono (0.40 cm) followed by Roso Castle Sardo (0.40 cm). Such variation in size of cladodes has also been reported from Phaltan in southern India (Anon., 1993), CAZRI, RRS, Bikaner (Soniet *al.*, 2015) and Agra in central India (Singh, 2000).

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