

Development of khejri based crop production sites

The traditional cropping systems have provided sustenance to the desert dwellers. In vast arid farm lands, cultivation of pearl millet, cluster bean, moth bean, sesame and native cucurbits is done as component crops between the natural plantations of khejri, and in addition some native trees/shrubs/grasses (jharber, bordi, lasora, pilu, ker, phog, sewan, etc) are the part of traditional agri-horti-silvi-pastoral system prevalent under rainfed situations in the hot arid region of India. This system of harvesting of agricultural produce can provide sound farm economy, improved nutrition and health standards of the livelihood and stability when the monsoon rains is good during the kharif season.

Under the changed scenario, now the focus has shifted from sustenance to remunerative farming but the mono-cropping is much risky for the development of desert horticulture. This is because of scanty, uneven and regular failure of monsoon rains and also environmental restrictions prevailing in the hot arid region. Therefore, the traditional farming systems of arid region pre-dominantly mixed cropping needs multi-dimensional exploitation through interventions between the native crop species and newer technological advancements, and this can now potentially be exploited under the concept - Horticulture Based Crop Production Site Management Approach (HBCPSMA) as an innovative tool for breaking up the yield gaps.

Based on SWOT analysis for desert horticulture, some principles have been recommended under the concept (HBCPSMA) for the development and management of crop production sites. The production sites should be developed in accordance to the topography of sand-dune landscape and soil conditions. Fencing of production site and development

of multi-tier rows of seedling plantation of native species such as khejri, lasora, rohida and bordi with desert shrub florals all-around the field blocks is the prime consideration for the creation of favourable micro-climate which is must for the protection of crop production site.

The innovative technologies under HBCPSMA includes selection and development of khejri based crop production sites, preparation and maintenance of production sites for *in situ* rain water harvesting and soil moisture conservation, and crop cultivation. Keeping of crop fields fallow for 1- 2 months from April - June or October - November, and is an important practice for soil health security and development.

Adoption of pre-monsoon field ploughing during June prior to rainy season crop sowing and post monsoon field ploughing during November after crop harvest as techniques resulted into more *in situ* rain water harvesting, moisture conservation and weed free field in the production site. Besides, seed selection, sowing time and techniques, maintenance of plant population and crop protection measures are good management practices for improving marketable yield of crops and productivity of resources.

On the basis of crop potentialities and diversification, two horticultural crop combinations have been recommended for better resource utilization and regular income to the farmers. These rainfed cropping systems are (i) organic Panchkuta (khejri, ker, lasora, kumat and kachri) production and (ii) vegetable (mateera, kachri, snap melon, round melon and cluster bean) production with wide spacing khejri planting models (paired row of 4mx4m khejri plantation at 24m or 48m distances).



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Grow with innovative technological advancement



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Mateera : Thar Manak

Grow with innovative technological advancement

Kachri, snap melon, mateera and round melon are grown as components of mixed crop in the traditional production system under rainfed conditions in hot arid region of Rajasthan. The choice of vegetable crops is very limited, and this is primarily due to unavailability of crop genotypes suited to the prevailing stressed conditions of the arid agro-climate. Realizing the potentialities of mateera, concerted research efforts were initiated from 1994 at CIAH and resulted to the development of varieties and production technologies at the institute for commercialization of the crop.

The mateera

Mateera is an indigenous type of drought hardy watermelon (*Citrullus lanatus*) and it is extensively grown with mixed cropping on sand-dunes landscape during the rainy season in Thar Desert. The mouth appeal of the mateera fruits is attributed to sweet and refreshing edible flesh (pulp), and consumed fresh as dessert and have juicy properties. Besides, the tender fruits (loiya) weighing 80-150 g are nutrition rich and are used extensively as fresh vegetable for making rayta and curries. The seeds are protein rich (25-32 %) and are roasted and eaten as snacks. The seeds also yield very nutritive oil (30-40 %). Seed kernels (magaz) are extracted on large scale and are used in sweets, bakery and ice creams. The rind of ripen fruits is pickled or turned in to sugar candy (tuty fruity) and is also a good animal feed.

Why mateera cultivation in arid region?

For production of mateera in the rainy season, farmers broadcast its seeds alongwith bajra and

legumes as mixed crop with the advent of monsoon rains in July. During good rainy years, the farmers collected mateera fruits in the months of October - November i.e. at the time of harvesting of rainfed crops. Now, its systematic cultivation is becoming popular both as sole and mixed crop due to high economic benefits and easiness in cultivation. With limited irrigation facilities, it is also grown as summer season crop even when the temperature is very high (42-48°C) and abiotic stress conditions are not much conducive during the months of May and June.

Prior to the development and recommendations of varieties in drought hardy mateera from CIAH, farmers of this region were compelled to use heterogeneous and mixed seeds collected from open pollinated crop only on the basis of fruit sweetness. Obviously, this results into poor yields and no assurance of fruit quality to the consumers. The results of intensive studies conducted during 1994 and 1995 at Bikaner revealed that hardly 10 per cent fruits were of better quality and it could be known only after cutting the fruit. The non-availability of varieties in drought hardy mateera resulted to highly variable and poor quality yields, and consequently it fetches low market price resulting to poor returns to the growers. The commercial varieties and hybrids of watermelon such as Durgapura Meetha, Arka Manik, Sugar Baby, Charleston, Arka Jyoti, etc. suffer from severe fruit cracking, exhibited low marketable yield potential and did not performed well under extremes of high temperature conditions and also required high numbers of irrigation (20 - 25) as summer season crop. In addition, these varieties failed to express their potentialities as rainy season crop in the arid agro-climate.

Breeding for fruit quality in drought hardy mateera

The quality of fruit (sweetness, firmness and colour of pulp, and seed size and quantity) is the important aspect of consumer's preferences and its wider acceptability. Realizing the importance of drought hardy mateera in the Indian desert, potentiality of crop to have extended period of fruit availability (April - November), market demand and diversified uses (tender fruits as vegetable, ripen fruit pulp as dessert for thrust quenching and refreshing, edible oil rich seeds for roasting and magaz, besides non-edible rind for processing and animal feed) call for concerted research efforts for its commercial exploitation. Looking to the all facts, the research work on mateera improvement was taken up since 1994 at CIAH, Bikaner.

The systematic germplasm collection and evaluation (217) followed by utilization in selection breeding resulted to development of two varieties namely AHW-19 and AHW-65 and released in 1998 for the immediate gains in drought hardy mateera. These recommended varieties have been adopted by the growers for uniform and assured quality fruit yield. However, these varieties have some limitations like medium sweetness and less eye appealing flesh quality. Therefore, intensive hybridization work was taken-up in 1998 involving developed lines of mateera and varieties of watermelon in breeding programme to overcome the problems of fruit quality and at the same time to retain the drought hardy characteristics.

As a result of hybridization followed by selection breeding, the progenies of cross combination Mateera AHW-19 x Sugar Baby exhibited desirable characters to full-fill the objectives and identified in 2005 for large scale testing over the seasons. The developed line (Mateera-F6/a) was released in 2007 under the

name Thar Manak for commercial cultivation. This high yielding variety is devoid of fruit cracking and produces high quality fruits under extremes of arid conditions.

Thar Manak

The variety is much suitable for cultivation both as summer and rainy season crop with a fruit yield potential of 50 - 80 tonnes/ha under hot arid agro-climate. The fruits weighing 2.65 - 4.21 kg are ready for first marketable harvesting in 70 - 80 days from crop sowing. The plants are medium in growth habit having an average vine length of 2.65 - 3.12 m with 5.2 - 6.5 branches. The opening of first male and female flower starts after 30 - 35 and 35 - 38 days from sowing at 4.2 - 6.2 and 9.5 - 14.5 numbers node, respectively. On an average, number of marketable fruits/plant ranged from 2.59 - 4.22 with yield potential of 10 - 14 kg/plant with varying seasons and production situations.

The fruits are free from cracking under extremes of high temperature and aridity conditions. The fruits are oblong-round having dark green-green stripes on the smooth rind. The fruit is 20 - 22 cm in length and 58 - 62 cm in girth. In a fruit, edible and non-edible flesh thickness is 14.2 - 16.5 cm and 1.35 - 1.62 cm, respectively. The flesh is red, solid (firm) and granular and has good taste and sweetness (9.5 - 11.2 % TSS). Low in seed quantity and the number of seeds in a fruit ranged from 160 - 266. The seeds are very big, bold and blackish in colour.

Production techniques

In the arid region, the mateera variety Thar Manak is successfully cultivated by sowing in July for rainy and February for summer season crop. On-set of the monsoon rains is the ideal sowing time for rainfed crop.

The selected fields in production site should be developed as per topography of sand-dune landscape for crop cultivation adopting channel (deep or light furrows) technology either rainfed or with limited irrigation through flood only in the channels and drip system. In the thoroughly developed and lay-out field, channels of 50 - 60 cm wide are prepared at 2.0 m apart, or with drip technology (lateral lines at 2 m apart), which are of about 25 m in length on one-side of main water supply line. The channels of a hectare area should be fertilized with FYM (50 q), vermin-compost (5 q), DAP (100 kg), SSP (100 kg), urea (50 kg), MOP (50 kg) and 10 kg methyl parathion (2 % dust) as a basal dose and mixed thoroughly prior to the crop sowing.

About two kg seed is enough for raising a hectare crop. Prior to sowing, seeds should be soaked in water for 5 - 6 hours and also treated with fungicide. Seeds should be sown at 50 cm distances at inner down slope of the channels or near to the drippers of lateral lines. At each sowing point, 3 - 4 seeds should be sown and 1 or 2 healthy plants are allowed. Thinning out of seedling plants is done at 18 - 21 days from sowing or when they attained 2 - 4 true leaves stage. The crop should be irrigated at 6 - 8 days intervals by flood method only in the channels or at 2 - 3 days intervals for 1.5 - 2.0 hours with drip technology (laterals 14 - 16 mm and 4 lph in-line emitters) under sandy soils of the arid agro-climate. Manual hoeing and weeding operations should be done at 18 - 21, 28 - 30 and 40 - 45 days from sowing in the channels and at this time also apply urea (@ 50 kg/ha) in 2 - 3 split doses. Weeds between the channels (in vine spread area) are controlled with spades manually or by cultivating the

area with rotavator as attachment on mini-tractor or power tiller.

Spraying of insecticides such as imidachloropid (0.3 ml/litre of water), rogor, malathion or endosulfan (@ 1.0 - 1.5 ml/litre of water) to control aphids, thrips and other minor insect-pests is recommended at very early plant growth, flowering and fruit setting stages. An integration of interculture operations and spraying of insecticide can be done for effective management at 18 - 21, 28 - 30 and 40 - 45 days after sowing as critical stages of crop growth. Due crop protection measures from birds and wild animals is also required.



Channel technology of mateera cultivation



Drip technology of mateera cultivation

