

Current Status And Prospects Of Arid Fruit Crops In India

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Indian arid zone is characterized by high temperature and low and variable precipitation, which limit the scope for high crop productivity. However, these conditions greatly favor the development of high quality produce in a number of fruit crops such as date palm, ber, aonla, pomegranate, kinnow, lasoda and *annona*. The existing low productivity could be increased by following improved new technologies and inputs. It is now realized that there is a limited scope for quantum jump in fruit production in the traditional production areas. The amelioration of the extreme conditions is also considered vital for life support to the inhabitants of this area. The recent awareness regarding the potential of these ecologically fragile lands for production of quality produce has not only opened up scope for providing nutritional sustainability for the people of this region, but also for bringing in new areas to increase horticultural production (More *et al.*, 2012). The area and yield potential of arid horticultural crops has increased many-fold because of the development of new varieties and agro-techniques in arid region.

Constraints in Arid Region

The soils of arid region are very poor in availability of nutrients, water holding capacity, etc. Most of arid areas (about 64.6%) are dunny, where the soils often contain only about 3.2-4.0% clay and 1.4-1.8% silt. Besides this, about 5.9% area is covered by soils having hard pan, 5.6% is under hills and pediments, 6.8% area is alluvial dunes and 1.6% is sierozems extending from the soils of Haryana and the Punjab. In the peninsular India, a considerable part of arid region has red sandy soil and some parts have mixed black soils. The soils are poor in organic matter having 0.03% OC in bare sand dunes to 0.1% in the stabilized dunes. Soils are generally rich in total potassium and boron, but are low in nitrogen, phosphorus and micronutrients such as copper, zinc and iron. The soils often have high salinity. The ground water is not only limited owing to poor surface and sub-surface drainage, but is also saline in quality. The irrigation water resources in the region are seasonal rivers and rivulets, surface wells and some runoff water storage devices and canal irrigation in arid region. Thus, the water resources in arid region are limited and can irrigate hardly 4% of the area.

The average annual rainfall in the arid regions is very low, erratic and varies from 100 mm in north-western sector of Jaisalmer to 450 mm in the eastern boundary or arid zone of Rajasthan. Most of the precipitation in north-western arid region occurs during July-September in about 19-21 rain spells. Due to low and erratic rainfall pattern in arid region, appropriate technology is needed to increase productivity. Water is precious input in hot arid region of the country therefore, adoption of micro-irrigation system is desirable to save water and enhance productivity. For arid climatic conditions, the variety is needed which is resistant to biotic and abiotic stresses for sustainable production. In some parts of arid region, occurrence of frost is also a common feature during winter season, which affects vegetative growth of plants as well as productivity, quality of fruits especially in ber, lasoda and aonla. There is no heat tolerant variety among arid horticultural crops, which should be developed to achieve higher production.

Prospects of Arid Fruit Crops

There is a much scope in expansion of fruit crops in arid region and it has vast potential for changing scenario of horticulture of the country. Vast land resource, surplus family labors, increasing canal irrigated area, developing infrastructural facilities, plenty of solar and wind energy, etc. are the strength in the region for research and development of arid fruit crops. Further, low incidence of diseases/insects in the region provides good scope for production of quality seed and planting material of horticultural crops. Ber is commercially grown in more than 52,000 ha area with production of 0.5 Mt under semi-arid and arid regions of the country. More efforts are needed for value addition. Pomegranate area 2,61,000 and production (2.31 Mt) is increasing very fast in dry parts of the country as there is vast scope for export of this crop from semi-arid and arid regions of the country. Pomegranate worth Rs. 92 million is being exported to Middle East, UK, Germany, UAE, The Netherlands, Bahrain, Kuwait and Egypt. The crops like fig, custard apple, tamarind are also coming very well under dryland conditions. At present, fig is cultivated in more than 3,000 ha area in Maharashtra, Karnataka. Likewise, custard apple is grown in the states of Maharashtra, Andhra Pradesh, Karnataka, Rajasthan and Tamil Nadu. In foot hills of Arawali, custard apple is grown naturally and its potential should be exploited. Aonla is a medicinal fruit plant and cultivated in over 55,000 ha area with production of 150 Mt fruits per year.

Date palm is most suitable fruit tree of dry hot arid region and it is grown in Rajasthan, Gujarat, Punjab and Haryana. The area under date palm in Gujarat has increased from 12,493 (2004-05) to 16,688 ha in 2009-10 with production of 1,23,490 t fresh fruit. However, date is imported from Gulf countries due to its meager production in the country. In Kachchh region of Gujarat plants of cultivar Barhee raised through tissue culture have been planted in about 1000 acre (Muralidharan *et al.*, 2008). There is considerable increase in area and production of date palm in Kachchh region and estimated income from dates is around 17 crores. In recent years, imported plants of cvs. Barhee, Khalas, Khunezi, Medjool, Khadrawy, Zamli and Saggai have been planted in districts of western Rajasthan. The planting of male palms are also essential for pollination and male cvs. Ghanami and Al-in-city have been planted for this purpose. Looking to potential of date palm in hot arid region, area is being increased. In Bikaner district alone, date palm cultivars raised through tissue culture have been planted on about 250 ha area. Out of these, maximum plantation is under vegetative growth stage. In Tamil Nadu state also, date palm have been planted by the farmers on about 100 ha area. Bael is also an important fruit crop of semi-arid and arid regions. Earlier there were no systematic orchards of bael. Now, looking to its nutritional and medicinal value, attention is being given on its commercial production.

Selection of Fruit Crops

The environmental conditions of arid region are very harsh for sustainability of plants hence; selection of a plant species for such region is important for growth and production. While selecting the fruit species for dry land horticulture, one of the basic requirements is that those crops, which complete their vegetative growth and reproductive phase during the period of maximum moisture availability, should be selected. The fruits such as ber, pomegranate, custard apple, aonla and sour lime, conform to this prerequisite. The crops must have xeric characters such as deep root system (e.g. aonla, ber), summer dormancy (e.g. ber), high 'bound water' in the tissues (e.g. cactus pear, fig), reduced leaf area (e.g. Indian gooseberry, tamarind), leaf surface having sunken stomata, thick cuticle, wax coating and pubescence (fig, ber, phalsa, tamarind), and ability to adapt to shallow soils, rocky, gravelly, and undulating wastelands (pomegranate, aonla, bael) (Pareek and Sharma, 1991).

Fruit Based Farming Systems

Monoculture in arid zone is highly risk due to crop failures, hence a suitable tree crop combination is essential for risk alleviation, income generation, improved productivity as a result of efficient use of natural resources and inputs, and ameliorate and improve adverse agro-climate. Agri-horticultural combinations with legume intercrops such as mung bean, moth bean, clusterbean, and cowpea are beneficial. In the rainfed orchards of guava and ber, clusterbean okra, and cowpea in kharif (rainy season) proved good in the medium rainfall region of Gujarat (Raturi and Hiwale, 1988). Under South Indian conditions of Hyderabad; cowpea, green gram, clusterbean and horse gram in ber orchards and bitter gourd, tomato and okra in acid lime orchards have been grown as intercrops.

In areas with large livestock population, horti-pastoral system would be beneficial. In the arid areas, the system could have combinations such as khejri (*Prosopis cineraria*) + ber + dhaman (*Cenchrus ciliaris*, *C. setigerus*) or sewan (*Laisurus sindicus*). In semi-arid areas, perennial trees (mango, tamarind, sapota, jackfruit and palmyrah palm) could be grown with fodder crops.

Fruit trees can also be planted in association with forest trees, and they yield wood for packaging and fuel. Multistorey combinations incorporating large trees, small trees, and ground crops can be used. In low rainfall (300-500 mm) zone, combinations such as khejri or ber + ber or drumstick + vegetables (legumes and cucurbits); in 500-700 mm rainfall zone, combination of mango or ber or aonla or guava + pomegranate or sour lime or lemon or drumstick + solanaceous or leguminous or cucurbitaceous vegetables; and in 700-1000 mm rainfall zone, combination of mango or jackfruit or mahua or palmyrah palm or tamarind or guava + sour lime or lemon or pomegranate or aonla + vegetables can be adopted.

In arid ecosystem, attempts have been made to develop models for crop diversification. Keeping in view the traditional over storey crops as ber and new introduction aonla, the cropping models have been developed. It has been demonstrated that in ber-based farming system cultivation of Indian aloe can be taken up as a remunerative model (Dhandar *et al.*, 2004). Similarly, in aonla-based cropping system, it has been demonstrated that model consisting of aonla + ber along with moth bean or fenugreek can be adopted as a sustainable model for nutritional and income security of the inhabitants (Awasthi *et al.*, 2007).

Mono cropping of either fruit or seasonal crops is highly risk prone in arid areas, hence to mitigate the effect of total crop failures, fruit-based multistorey cropping system, such as aonla-ber-brinjal-moth bean, aonla-drumstick-senna-moth, bean-cumin can be profitably adopted by the farmers of arid region for better cash flow, nutritional and environmental security and sustainable livelihood. In areas where frost is severe aonla-khejri-suaeda-moth bean and mustard can be another lucrative option (Awasthi *et al.*, 2007).

Crop diversification studies in ber and aonla based cropping led to the recommendations that in pre-establishment phase of ber orchard, Indian aloe (*Aloe barbedensis*) and clusterbean (*Cyamopsis tetragonoloba*) are the low input and high-return crops in arid region. In aonla-based multi storey cropping system, the model with crop combination of aonla-drumstick-senna-moth bean-cumin recorded highest net return followed by cropping model aonla-ber-brinjal-mothbean-fenugreek has been recommended for sustainable and remunerative under arid ecosystem. Under semi-arid conditions of

Godhra, Gujarat, fruit-based farming system like aonla/ber + okra/brinjal/cowpea have been recommended to the farming community for sustainable production. In date palm plantations at Abohar, Punjab, growing of turmeric and ginger was found suitable as inter crops. However, under hot arid conditions, Taramira, an oil seed crop, can be grown as dryland inter crop in interspaces of date palm plantations.

Conclusion

It can be concluded that much efforts have been made to develop technology compatible for commercial production of fruit crops. A number of varieties and agro-techniques suitable for arid region have been developed to increase production. However, there is a need to address various issues for further refinement of technology, improvement in socio-economic status of peoples of arid region and development of sustainable agro-horti-system. The major issues are utilization of plant genetic resources, exploitation of biotechnology in arid horticultural crops, protected cultivation and off season production, hi-tech crop production, efficient utilization of water resources, rehabilitation of degraded lands, diversified cropping systems and organic farming, use of solar and wind energy, post harvest management, marketing and export, transfer of technology and human resource development.

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