SHORT COMMUNICATION

Role of Traditional Crops and Varieties to Mitigate Emerging Climate Change on Agriculture–A Case Study from Bhor Region, Maharashtra

PV Patil,* PB Kamble* and DK Kulkarni **

** Botany Department, AT College, Bhor, Pune*

***Division of Plant Science, Agharkar Research Institute, GG Agarkar Road, Pune-411 004, Maharashtra*

The biggest sources of biodiversity in tropical countries, the landraces, are threatened due to over exploitation, changing ecosystems and climatic conditions. India has great variation in climate and topography. In the present study, rural people from Bhor region cultivating traditional crops and varieties and their agricultural diversity for mitigating climatic change are presented.

Key Words: Cropland races, Bhor region, Global warming

Agricultural biodiversity in India consists not only of crops such as wheat, rice, bananas (species diversity) but also of immense variation within each of these crops (varietal diversity). India's rice possesses wide diversity in characters. They vary in crop duration from 60 to over 200 days and can grow in varied elevations, ranging from a meter below sea level to an altitude of 2,000 m. Traditional practice was propagated based on the intimate knowledge of the crop varieties and suitable for climatic conditions was prevalent in ancient India followed by the varietals choice (Sarawgi and Rastogi, 2000). In many parts of the country, varieties were and are still chosen for needs, definitely not for the yields alone. They were chosen for their ability to withstand droughts or floods, resistance to pests, susceptibility to disease, toleration of salinity, time of maturity, size of the grains, colour, aroma, taste, keeping qualities, nutritional values etc.

In recent agricultural practices, use of uniform varieties and hybrids, reduces genetic diversity in crop plants and causes them to be more susceptible to biological stresses such as drought, pest and diseases, water consumption etc. Many of these traditional crop varieties have gone out of cultivation and are lost forever. Genetic loss due to climate change appears to be beginning to have a drastic impact on the world's agriculture (Jackson and Lloyd, 1991).

Maharashtra state has rich diversity of traditional crop plants due to variation in soil, climate and choice of local people. Tribal regions are rich in many crops. Kulkarni *et al*. (1998) collected rice germplasm from Mahadeokoli tribe from western Maharashtra. Present paper deals with traditional agriculture in Bhor region of western Maharashtra and documentation of local traditional crops and their usefulness in changing climatic conditions.

Bhor is covering an area of 892.0 sq km and situated 54 km south of Pune and between 18º.45' N latitude and 73º -15' E longitude. Bhor region has 185 villages and total population is 1,54,903. Bhor area has average rainfall 643.5-800 mm from June to September. The mean daily maximum temperature is 38.10°C in summer. In the month of May, maximum temperature may reach to 41.09°C. December is the coldest month and minimum temperature is 8-9°C. The climate of the area is moist during rainy season and moderate in winter and summer season. The hilly area is of basalt rock formation. The soils of the area are alluvial along the banks of river and black cotton soil in eastern part while red and brown soils on western part. During the field visits, total 182 villages were recorded in Bhor region, out of which 60 villages were visited for data collection of traditional crops during the *kharif* and *rabi* season. A specially prepared questionnaire was used and characters like maturity of the crop, drought resistance, suitability of soils, keeping quality, nutritional value, fodder species, etc. were recorded by interviewing local people.

The main occupation of local people is agriculture. Majority of the people are depended on their farm produce. Agriculture fields are divided into two areas: Flat Land agriculture; and Shifting or *malkush shet* agriculture, collection of forest resources during scarcity of food.

Flat land agriculture: These people prepare agriculture land by operations like plowing, manuring, hoeing,

Author for Correspondence: *Dr. DK Kulkarni, Email:dilipkkulkarni@gmail.com*

sowing, transplanting, weeding, pests and diseases control, harvesting etc. Seedling production of rice is initiated with the onset of the monsoon showers. Cowdung, twigs of forest plants and grasses are arranged in layers over the seedbed and then burned. This practice is called *rabbing* method. It is not uniform in all the regions and changes according to the availability of the plant material. Fields are plowed a number of times in standing water. This *puddling* method is useful for soil facilitates easy transplanting of seedlings. Spacing is generally 22 cm between two spots and at each spot about four seedlings are transplanted. Following local traditional varieties are preferred:

***Oryza sativa* L.** (Rice): Farmers from this area are growing traditional rice varieties. In this region, *Kolamba* has early maturity and less water requirement. *Patani* is drought resistant and suitable in coarse sand or *murmad* soils where water holding capacity of soil is very less. *Kalbhat* is a scented type of rice and generally gown in the middle of the field due to destruction of crop before maturity by wild animals. The yield of rice is very low but has economic value. Some people prefer to grow jowar (barley) crop on coarse soil and drought prone areas.

Sorghum bicolor* (L.) Moench.** var. *bicolor* (*Jondhla*): There are some local strains like *Dukari* and *Kawali* in Bhor taluka. These strains are cultivated in *kharif* season. In case of *Dukari,* grain colour is yellow. Maturity is in September and cultivated in light soils. White grain is a special character of *Kawali,** cultivated in mixed cropping pattern. It has property of popcorn after proper drying. This popcorn sorghum is conserved for special occasions like marriages or social functions.

Pulses are playing major role in the diet of tribal communities. Tribal people from Bhor region were cultivating pulses on flat land as well as in shifting cultivation, like *Phaseolus vulgaris* L. (rajma)–green pods are boiled and consumed during food shortage, *Castanospermum australe* A. Cumn. (black gram), *Vigna unguiculata* (L.) Walp., subsp. *unguiculata* (Hulga, Kulith), subsp. *cylindrica* (L.) Van. (cowpea) in *kharif* season.

During the *rabi* season *Cicer arietinum* L. (*Harbhara*, pea) is sown as mixed crop in wheat or jowar. The green seeds in unripe stage were used as green vegetables to make curry. After harvesting, pulses are consumed as a supplementary food item. Mostly pulses are grown as mixed crop. This practice resulted into control of diseases and pests likely to be more evenly distributed as each crop has a different tolerance level. Due to mixed cropping pattern total output increases (Mishra *et al*., 2009).

***Malkush shet* or Shifting agriculture:** This practice of *malkush shet* is an old agriculture where forest land is cleared and burned in summer season. In monsoon season, crops are transplanted in heavy rains or thrown into prepared rows of the field. A fixed cropping pattern is followed by the local people. Rotation of cropping pattern is maintained for 3-5 years and later the land is kept fallow for regeneration of forest tree species. This controls soil erosion and helps forest development through coppicing. Finger millet are transplanted on ridges and furrows prepared by a tooth cultivator while other crops like *niger* (*Guizotia abyssinica* Cass) and pulses like pigeonpea (*Cajanus cajan* (L.) Millsp., cowpea (*Vigna unguiculata* (L.) Walp. subsp. *cylindrica* (L.) van Eseltine are broadcast in the field.

***Eleusine coracana* L.** (Nagali, Nachani, ragi): Bhor region is a part of Deccan Plateau or Sahyadri, the families are consuming ragi. Ragi is a very hardy crop as well as a grain of great nutritive value considered more sustaining to people doing hard physical work than any other grain. Generally, people grow this crop in shifting cultivation practices. It is also known as *Malkush sheti.* The tribal farmers grow this crop as traditional variety and it is generally harvested in September-October.

Kitchen garden: Tribal people are sowing seeds of cucurbits for their day to day needs in kitchen garden. Bhor region is rich in diversity of cucurbits like *Benincasia hispida* Cogn. (kohala, ash gourd), *Coccinia grandis* Voigt (ivy gourd, tondali), *Cucumis sativus* L. (Valuk), *Cucurbita maxima* Duch ex Lamk. (dangar, tamda bhopla), *Cucurbita pepo* L. (kashi bhopla), *C. moschata* Duch. ex Poir (kala bhopla), *Lagenaria siceraria* Standley (bottle gourd, dudhi bhopla), *Luffa acuntangula* Roxb. (dodka, shiral), *Luffa cylindrica* (L.) M.J. Roem. (ghosale), *Momordica charantia* L. (bitter gourd, karle), *Trichosanthes anguina* L. (padval). These land races of cucurbits have some medicinal properties, disease resistance, and high keeping quality. Some seeds of cucurbits have commercial values due to its nutritional potential. Some species of *Cucumis* included Valakya, Chivadya, Sendyana, Parosa, Khuhirya, Naringe etc. (Kulkarni and Kumbhojkar, 2004). *Colocasia esculenta* (L.) Schott is a tuber bearing herbaceous plant locally known as *Alu* (taro) and it is grown on waste water in kitchen garden. Leaves, stem and tubers are used as vegetable.

Forest resources: Local communities from Bhor region consume wild tubers, rhizomes and corms either in raw or baked or boiled or roasted form. These are *Dioscorea*

esculanta Burr. (kanake), *D. pentaphylla* L (chava, shend vel), *D. alata* L. (konphal), *D. sativa* L. (goda karanda), *D. tomentosa* Koen ex Spr. (lavati kand), *D. bulbifera* L. (kadu-kand) and *D. oppositifolia* L. (aniv). Tender shoots, flowering inflorescence, petioles, tubers are cooked before consumption. Similarly, Halunda (*Vigna vexillata* A. Rich) is supposed to stimulate the hunger (Nilegaonkar *et al*., 1985).

The conservation of crop landrace diversity has been hindered in part by the lack of an accepted definition to define the entity universally recognized as landraces. Crop species and the diversity between and within them has significant socio-economic as well as heritage value. Genetic diversity in domesticated species is located in traditional varieties maintained by traditional farming systems exist in tribal pockets. The existence of these traditional crop varieties are severely threatened by genetic extinction primarily due to their replacement by modern crop varieties. Considering importance to landraces it is necessary to prepare an inventory (Brush, 1991). Nene (2004) reported 300 diverse plant species belonging to 90 families utilized as food resources during famine. It includes herbs, flowering stalks, leaves, seeds, kernels, fruits, tubers, etc. Usually these wild species are not in cultivation. Germplasm of traditional crops and horticultural crop plants which are not properly documented. The reason behind this is changing food habits in rural areas. The age old varieties of crop plants and their technologies are not in use since long time. Ultimately our traditional systems got extinct. It is necessary to conserve our heritage of wild plants including wild relatives of crop plants (Kulkarni, 2006).

Local people from Bhor region are cultivating different crops on flat land agriculture, *malkush shet*, kitchen garden and diversity within one crop, mixed cropping ensures security in the event of monsoon failure and increases the returns from the land. Numerous crop combinations are found in small farmers' fields in hilly regions of Maharashtra State. These are frequently grown finger millet *ragi* (*Eleusine coracana* L.) and *niger* (*Guizotia abyssinica* Cass); *jowar* [(*Sorghum bicolor* (L.) Moench)], pigeon pea (*Cajanus cajan* (L.) Millsp., cowpea (*Vigna unguiculata* (L.) Walp. subsp. *cylindrica* (L.) van Eseltine on flat land and shifting cultivation. These crops serve to meet the needs of family consumption and they ensure a fairly balanced diet, the millets being used as a staple food, and the pulses provide proteins. *Ragi* is a very hardy crop as well its grains are of great nutritive value. They are considered more sustaining to people doing hard physical work than any other grain. *Jawar* can withstand considerable drought, and it gives good yields of grain and fodder. Land preparation is delayed due to late onset of monsoon in July, instead of June. It results into late sowing/transplanting of seedlings of rice. Similarly, due to early withdrawn of monsoon the yields of crops are adversely affected due to paucity of water in grain filling state. This is happening due to climatic change. Some insects like stem borer, aphids etc. are severely affecting crops and diseases like mildews, rusts, blights etc. are adversely infecting crops due to these changed climatic conditions. It results into search for alternative source of food material for tribals for their sustenance. They have to depend on forest resources for wild edible plants and tubers. The tribals consume them during the scarcity of food. Efforts were also made to explore the nutritive potential of wild edible tubers and rhizomes which supplement several nutrients (Table 1). Such unconventional wild edible plants are resources of fats, proteins, rich source of micro-nutrients and trace elements (Vartak and Kulkarni, 1987; Kulkarni *et al*., 2003).

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Table1. Proximate analysis of wild edible tubers, rhizomes, corms (g/100 g fresh samples)

Plant species	Edible portion	Moisture %	Protein	Ash %	Fat g%	Reducing sugar
Dioscorea pentaphylla	–	84	3.6	0.95	1.3	7.2
D. esculanta	–	82	1.7	1.3	0.6	12.2
D. oppositifolia	–	86.5	2.5	0.7	1.5	4.4
D. tomentosa	85	79.9	2.1	1.1	2.1	10.3
D. bulbifera	90	76	2.8	1.0	1.2	14.0
Vigna vexillata	82.4	88.3	1.5	1.0	1.2	7.0

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