

AGROBIODIVERSITY IS THE KEY TO FOOD AND NUTRITION SECURITY: A REVIEW

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Abstract: Almost all of 2020 has been spent grappling with the Covid 19 crisis and we don't know how much longer we will be restrained by the pandemic. But eventually it will be brought under control and the virus will be tamed either by a vaccine or by appropriate drugs. The other crisis however that is looming over our heads is far bigger than Covid 19 and it is not likely that we will be able to reverse it or get it under control. The only option we seem to have is to adapt to it and do the best we can. I speak of climate change.

Key words: Agrobiodiversity, Climate change

Of the many ravages that will be caused by Climate Change , the most alarming to me is the threat to our food and nutrition security. In a country that has the largest number of hungry people and the highest figures for undernourished and malnourished people, Climate Change poses a serious challenge to our very survival. So how do we make our agriculture and food production more climate resilient? Fortunately, we have a resource that can help us to a large extent if we deploy it wisely. This resource is Agrobiodiversity.

Agrobiodiversity is broadly speaking, the genetic diversity found in agriculture. Agricultural biodiversity, also known as Agrobiodiversity or the genetic resources for food and agriculture, includes crop varieties, livestock breeds, fish species and wild or undomesticated species found in fields, forests, grasslands, rivers, ponds, marshes and other aquatic ecosystems. It also includes allied species within agriculture production ecosystems that support the production of food, like soil micro-biota, pollinators and so on [1].



Dr. Suman Sahai, trained in genetics, is a recipient of the Padma Shri , the Borlaug Award, Outstanding Woman Achiever awards and the Order of the Golden Ark of the Netherlands. She chaired the Planning Commission Task Force on 'Agro biodiversity and Genetically Engineered Organisms', for the XIth Plan and has served on the Research Advisory Committees of national scientific institutions

I have had the pleasure to work with Dr.P.D. Gupta when I was a junior colleague at the All India Institute of Medical Sciences, New Delhi. This article is contributed in this issue to commemorate the scientific achievements of Dr. Gupta who has had a distinguished and prolific scientific career. Dr Gupta is a tireless crusader for science and scientific research and is an inspiration to his many students who have learnt much from him.

The genetic diversity in agricultural systems is not a gift of nature but the result of the careful selection and innovations of farmers, pastoralists and fisher folk, over millennia. It is the outcome of human endeavor. Put differently, the genetic diversity in agriculture is a result of the interaction between the environment, genetic resources and the management systems that farmers use, relating to crops, animals, even fish. This diversity is influenced by practices used by culturally diverse peoples resulting in the different ways land and water resources are used for production. It thus encompasses the vast variability found in animals, plants and micro-organisms which are necessary to sustain key functions of the agro-ecosystem which is necessary to support food production and aim for food and nutrition security of the global population [2].

After years of neglect and a deliberate putting down by the Life Sciences industry promoting technofixes like GM crops, Agro biodiversity is finally acknowledged internationally as the foundation on which food, livelihoods and income security is based. Unfortunately this is not yet internalized at the national level. India has a particularly bad record of agro biodiversity conservation and use. Whereas government systems have elaborate plans to make available high yielding and hybrid seeds, and plans to conserve them, there is little attention paid to the conservation of traditional germplasm. Conserving agro biodiversity means conserving the gene pool and those genes that may come in useful for traits required by crops and animal breeds under challenging farming conditions. There is an urgent need to save this diversity since it is the foundation for ensuring long term sustainability in agriculture and food production.

Agrobiodiversity supports food and nutrition in a variety of ways. Farming communities rely on it to increase agriculture productivity, improve food security, and boost farm incomes. Agro biodiversity facilitates agriculture and food production in fragile areas and makes farming systems more sustainable and stable by improving soil health and providing more effective pest and disease control. Farmers having access to genetic diversity are more self-reliant because they can reduce external dependence. Genetic diversity helps to maintain the integrity of local ecosystems and makes available dietary diversity and therefore better nutritional intake [3].

Genetic diversity is the farmers' biggest insurance

policy. It enables them to find solutions for the most diverse kinds of challenges. Having access to a repertoire of crop varieties to choose from, means the farmer will almost always find a variety for a particular situation. If the rains are late, she/he can cultivate a short duration variety of rice which will mature in time before winter sets in. If the monsoons come on time, she/he can cultivate a longer duration variety which may give more time to pursue some other economic activity. If there is a disease outbreak, the collection of traditional varieties will contain a disease resistant variety that can be planted. Traditional varieties will also offer options to cope with seasons when there is low rainfall and drought like conditions or too much rainfall and flood like conditions [4].

Farming communities have faced all kinds of challenges to their agriculture in the past and have wisely conserved those varieties that have helped them to overcome those challenges. Therefore, farm men and women across the world have created a vast repertoire of crop varieties with diverse traits. Today this resource is available to fight new and current challenges to agriculture and therefore, to ensure food security.

Having access to a range of crop varieties allows farmers to minimize the risks to their crop production and enables them to ride out episodes of biotic and abiotic stress in a more assured manner than if there were a monoculture crop system. The vulnerability caused by monocultures and genetic uniformity have been highlighted by events of crop failures in the past. The Irish famine in 1846 caused by the potato blight *Phytophthora infestans* which wiped out potato fields planted with just one or two varieties is well known. The US corn crop suffered a 15% reduction in yield and losses of up to US \$1 billion in 1970, when a leaf fungus spread rapidly through the genetically uniform crop, causing severe destruction. Other instances of the vulnerability caused from a narrow genetic base are also known, for instance the outbreak of citrus canker in 1984 in Florida that resulted from reduction in genetic diversity in their plantations.

If we are to deploy agrobiodiversity as an adaptive tool to cope with climate change and make our food production systems more robust, we need to understand how farmers today perceive agrobiodiversity. To this end, Gene Campaign had conducted a study some years ago in Bihar and Jharkhand [5], to get a

sense of how farmers perceive agro biodiversity and their views on its conservation. The highlights of the study were as follows:

- Farmers by and large regretted that traditional varieties are now lost and have been replaced by the high yielding varieties (HYVs).
- Farmers felt that there was an urgent need for local seed banks, offering both traditional seeds and HYVs.
- In irrigated areas where HYVs are cultivated, farmers said the biggest drawback of traditional varieties was its low yield and that seed is not easily available.
- In rainfed areas where hardly any HYVs were cultivated, farmers recognize that traditional varieties do better under those conditions. They also complained about the difficulty of accessing seeds of these varieties since neither seed stores nor government agencies provide such seeds.
- Most farmers felt that the loss of traditional varieties is a negative development for agriculture.
- However, a section of younger farmers are not sure if this loss is a negative development or it has actually been a positive development for the farming community, resulting in the overall development of agriculture.
- Farmers acknowledged that HYVs fare better in terms of yield and marketability but traditional varieties are better in terms of characteristics like amount and quality of straw and resistance to pests and disease. The traditional varieties were said to be better tasting and were valued for festivals, ceremonies and rituals.
- Most farmers are open to cultivating traditional varieties of crops, at least on a portion of their land. The main impediment to this is lack of seeds.
- Farmers were interested in increasing the cultivation of traditional varieties but wanted incentives to offset the loss of yield compared to HYVs. Some of the desired incentives were assured availability of water, link roads, assured supply of good quality seeds, fertilizers and

pesticides and marketing facilities with price support.

So how do we set about conserving this valuable resource and using it judiciously?: Research programs and government policies must respond urgently to arrest the further loss of genetic diversity and bring in proactive programs to restore what is lost. The apparent conflict between productive agriculture and biodiverse production systems must be resolved because it is possible to do so. Increasing the genetic base in agriculture will only increase productivity, not decrease it. The farming community has a natural advantage with biodiverse agriculture because they have sophisticated knowledge of the flora, fauna and soil of their region. This enables them to do their own problem solving and remain viable.

Technology moguls who currently dominate the direction of agricultural policy across the world, hold the view that the genetic diversity of crops have no role to play in ensuring food security. Many, who promote GM crops as the answer to all the world's problems from climate change to biofuels to banishing hunger, refer to traditional crop varieties as unproductive trash that does not need to be conserved. According to them genetic manipulation will provide all the variability required to breed new varieties of plants and animals and there is no need to maintain collections of low yielding genetic resources. The fact is that the food security of communities and nations cannot be guaranteed without taking recourse from time to time to the repertoire of genes that are contained in the collection of traditional crop varieties and animal breeds.

The collection, characterization and conservation of agrobiodiversity must receive policy and resource support from government so that the genetic wealth of crop, livestock and fish can be actively maintained. The biased economic incentives that favour high yield alone must be reviewed and biodiversity rich farming systems must be promoted and incentivized.

The enormous contribution of rural communities to the development, refinement and conservation of large and diverse gene pools must be recognized and rewarded. It's a pity that after much wrangling on international platforms, the concept of farmers rights was adopted by FAO but was not enforced. Implementation of farmers rights was not made binding (like

the intellectual property rights in the WTO) and was left to the decisions of individual countries who have largely abdicated responsibility in this regard. India is the only country in the world that has enacted a law granting Farmers Rights (Protection of Plant Variety & Farmers Rights Act 2001).

The use of agrochemicals should be curbed and replaced to the extent possible with biological substitutes that will improve soil micro flora and therefore soil health and soil fertility.

Conservation of ecosystems and biodiversity rich areas where wild foods are found, should be incorporated into the development programs from the start, so that there is a mandate to protect them. Plant and livestock breeding should be done in participatory mode together with farmers in different locations, so that crop varieties and animal breeds are produced

that have a broad genetic base, are adapted to local conditions and can be easily accessed by farmers.

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