

**Original Article****Importance of cucurbits for food cum nutritional security and climate resilience – a brief account****<sup>1</sup>Ritoban Pandit, <sup>2</sup>M. K. Pandit, <sup>2</sup>Sudipta Ghosh, <sup>2</sup>C. Karak and <sup>3</sup>S. Bairagi**<sup>1</sup>*Department of Agricultural Meteorology, Odisha University of Agriculture and Technology, Bhubaneswar, Odisha*<sup>2</sup>*Department of Vegetable Science, Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, Nadia, West Bengal*<sup>3</sup>*College of Agriculture, Sushunia campus, Bidhan Chandra Krishi Viswavidyalaya, Bankura, West Bengal***\*Corresponding author:** [mkumarpandit@yahoo.com](mailto:mkumarpandit@yahoo.com)

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**Introduction**

Cucurbits – the melon and gourd members of the Cucurbitaceae family are among the most important plant families supplying humans with edible products and useful fibers. Cucurbits are very similar in above ground development, but they have high genetic diversity for fruit shape and other fruit characteristics. They have contributed the world with a pack of diverse commodities and in particular, it has been a source of traditional food and medicine both to the native and rural folks. India is endowed with myriad genetic variability of cucurbits, comprising of 34 extant genera and 108 species of which 38 species are endemic (Bose and Som, 1986). Many cucurbits have their centres of diversity in this country. In different parts of India huge variability is present in cucurbits as a whole. Minor cucurbits like snap melon, chow-chow, snake gourd, ivy gourd, wax gourd, sponge gourd, ridge gourd, musk melon, sweet gourd, spine gourd etc play a vital nutritive role the daily diets of the rural poor. The cucurbits along with other groups of underexploited and traditional vegetables are of great significance in the household food and nutritional security (particularly through vitamin and mineral supplementations) and income generation to the small, marginal farmers and landless labourers. That's how cucurbits augment livelihood options for the rural communities.

Cucurbits constitute an appreciable share of our diet. Many of the cucurbits like, watermelon, bottle gourd, bitter gourd, pumpkin, squash, snake gourd, ash gourd, cucumber and pointed gourd are considered medicinally important and health supporting vegetables. Some of them are of global economic importance, some others are of regional importance Cucurbits prefer warm season, except Chowchow but many of them may be cultivated throughout the year. About 90% of the cucurbits are found in the tropical and subtropical parts of the world, mainly in Africa and Madagascar, South Asia, the Mesoamerican countries comprising Belize, El Salvador, Guatemala, Honduras, Costa Rica Southern México) and South America, and Southeast Asia.

**Diet and health:**

The millions of years of human evolution, principally by means of physical labour shaped the dynamics of gene-nutrient-environment interactions to regulate the genome content and the subsequent gene expression. Through the evolutionary journey humans became able to utilize a variety of foods, certain genetic adaptations and limitations have occurred in relation to diet. Genes control better health and susceptibility to disease, while environmental factors determine illness susceptible individuals. Diet is a contributory risk factor for chronic diseases. Traditional plant-based diets have been gradually replaced by high-fat, high-energy, somewhat synthetic diets with only an ounce of non-plant foods, making huge modifications in diets and lifestyles that took place due to industrialization, urbanization, socio-economic development and displacement, distress migrations and market globalization. The degenerative diseases due to aging and oxidative stress like cancer, cardiovascular disease, cataracts, brain and other bodily dysfunctions are increasing. Dietary antioxidants, like flavonoids, vitamin C and E and carotenoids, play a leading role in reducing such damages and a major part of the population, economically solvents and poor alike is receiving insufficient iota of such nutrients, causing health deterioration. The main source of dietary antioxidants is fruits and vegetables. People eating fewer servings of fruits and vegetables are prone to alarmingly higher rate of developing cancer in contrast to those who

eats more fruits and vegetables. Deficiency of antioxidants causes the same damage to DNA as radiation, while micronutrients are potent enough to impart protection against the damage. Lessened physical inactivity, now recognized as an increasingly important determinant of health, is the outcome of sedentary life-style patterns, in both the developed and developing countries. There are genetic variations among individuals, so, obviously changes in dietary patterns will have a differential impact on a genetically heterogeneous population.

### **Food Security**

Food security is when all people, at all times, have physical and economic access to sufficient safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life (FAO, World Food Summit, 1996)

The four main dimensions of food security are -

- Food availability refers food production, food stock and proper supply
- Economic and physical access to food: It is the guarantee of household level food security encompassing incomes, expenditure, markets and food prices.
- Food utilization: Sufficient energy and nutrient intake by individuals by means of feeding practices, food preparation, diet diversity and distribution of food in a family.
- Stability of the other three dimensions over time: Assurance of adequate intake without deterioration of nutritional status at individual level. Adverse weather conditions, political instability, or economic factors (unemployment, rising food prices) may have an impact on the stable food security status.

The present day production system should aim at food security in macro-sense to nutritional security at the individual level. It should put emphasis on combating hidden hunger and protein energy deficiency, equitable access to land, finance, market links, health and sanitation, quality education, information and capacity building.

### **Major points to ponder for food security**

- Soil & water conservation
- Organic manure application
- Sustainable nutrient, water and disease-pest Management
- Hands-on-training & skill development for small -holding farming communities
- Nutrition education & hygienic practices particularly for women and children
- Post-harvest technology & value addition – minimize post-harvest losses & food wastage
- Eco-geographic characterization of local food species including cucurbits
- On hand experience & development of skills for self-help groups, farmers' clubs/ societies, grower groups etc
- Drudgery reduction
- Homestead nutrition garden
- Geographical and Ecological Representativeness Score ex-situ and in-situ
- Biodiversity conservation of indigenous cucurbits

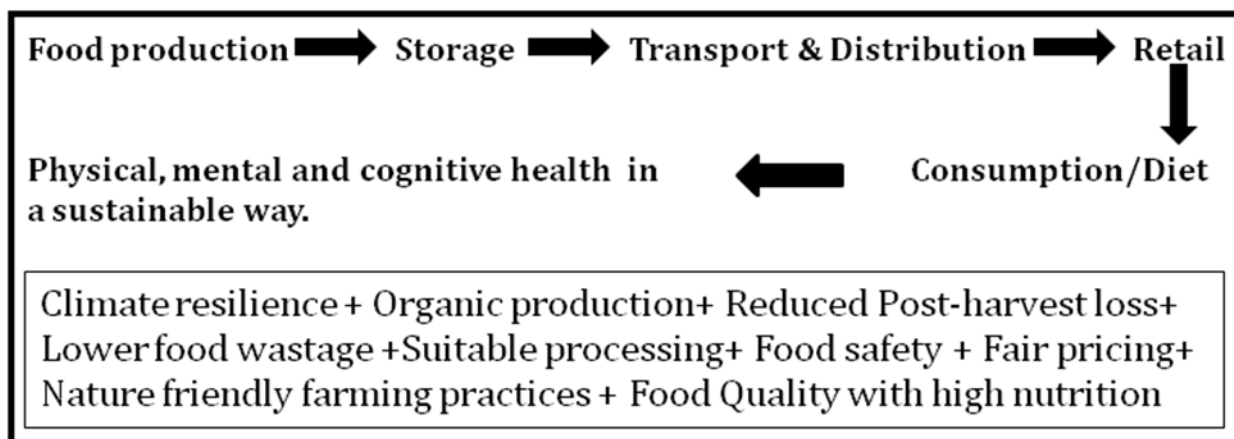
### **Why vegetables**

Vegetables are protective foods. Nutritional quality in diet enables humans combating malnutrition and diseases. Vegetables and play significant role in protecting people against oxidative stress. Minor cucurbits like snap melon, chow-chow, snake gourd, ivy gourd, wax gourd, sponge gourd, ridge gourd, musk melon, gherkin, sweet gourd, spine gourd etc., along with other groups of underexploited and traditional vegetables play a significant role in the household food and nutritional security. Cucurbits are the mainstay of major portion of the common vegetables - more than 15 kinds, consumed daily, as staple vegetables. Farm families have to depend largely on their very own valued physical labour, men, and women alike for the local food cycle to run sustainably.

The fundamental advantages of vegetables are -

- Higher crop capacity per unit area per unit time than the cereals.
- Offer more nutritional and food security even to the level of poorest section of the society.
- Vegetable enterprises can ensure good income to the rural youths and are able to create more man days.
- Post-harvest manipulation and value addition of vegetable crops extend consumption period by marketing a vast array of processed foods.
- Earn sizeable foreign exchange through export of value added horticultural produce.
- Organically grown crops fetch handsome premium price from the international markets.
- Suitable for most of the cropping systems and can increase total agri-space through succession, relay and multiple tier cropping.
- Marginal lands can effectively be utilized by cultivating locality-specific crops.

## The roadmap from farm to fork:



### Local food system

Local crop varieties—also referred as landraces or farmers’ varieties—are very useful for smallholder farmers and farming communities in rural and marginal areas for safeguarding their food, nutrition and economic security. The underutilized, minor or orphan crops including cucurbits are extremely diverse phenotypically, genetically and geographically; the local foods thus consumed, may be an immensely useful option for ensuring sustainable food supply as functional food that deliver additional or enhanced benefits over and above their basic nutritional needs. Understanding landrace diversity of important staple crops, especially in the rural settings, aids in deciphering domestication pathways and has applications in the conservation of genetic resources and their subsequent uses in crop improvement programmes.

Kinship seed exchange and seed security embraces a diverse range of physical, emotional, intellectual, biological and spiritual dimensions. Gene flow between domesticated plants and their wild relatives is one of the major evolutionary processes acting to shape their structure of genetic diversity. In small-scale farming systems, seed exchanges represent a key mechanism in the dynamics of crop genetic diversity maintenance by intricate social networks of non-commercial seed and organic input exchange among farmer communities. Gifts and feasting were usually a prerequisite to trade and exchange. Seeds are a gift of nature, of past generations and diverse cultures. As such it is our inherent duty and responsibility to protect them and to pass them on to future generations. Seeds are the first link in the food chain, and the embodiment of biological and cultural diversity, and the repository of life’s future evolution. Seed exchange takes place among kins, neighbours, local clans with different vocations and ritual festivities. The main emphatic factors are-

- To save crops and create diversity
- To adapt with climate change and ensure food security
- To cope with technological change and craft specialization
- To maintain relationships that entails reciprocity, gift-giving
- Redistribution of gifts and generosity
- To compete for status, exchanging rare and exotic goods and seeds
- To establish brotherhood and have skilled professionals under control of the elites

Every exchange like intermarriage of village elites, leader-followers, royal & religious nobles, enemies, clan heads, trade chief, kin-mode segmented minorities embodies some coefficient of sociability, not only in its material terms, but also to mutual perception and harmony.

The other important aspect is women’s gardening activities that are a profitable enterprise both in a way of positive impact on indigenous species biodiversity and on the family income being indicators of good family welfare. Women drive the homestead nutrition garden dynamics by deciding what to sow, when to sow, how much to sow, where to sow, how much to sell and how much to use in intra-family food needs. The nutrition and income from cucurbits have been a blessed synergy for the poor. Thus homesteads can come up as a natural in-situ food system, supported by family wisdom and praxis to rear and preserve biodiversity and valuable gene pool, traditional knowledge, child nutrition and education, mother care, age-old members’ recess and beyond that revisit the social capabilities, which could be elastic enough to absorb the jerk of impending climate change challenges. The traditional homestead gardens with monotypic species dominance need to be upgraded to the status of standard diversity garden which grows a wider range of seasonal vegetables in a cyclic manner for quality diet. In cucurbits, certain root stocks have been identified which possesses tolerance/resistance against such stresses. Grafting on these resistant/tolerant root stocks protects the crop from soil borne ill effects.

Homestead gardens are natural assets suitable for addressing such livelihood support issues along with gender equality and *in situ* sustainable conservation of diverse plant genetic resources. The ever-narrowing base of crop diversity and variability due to focusing on fewer major vegetable crops ought to have an impact on global food security and veritably impinges upon the rural peoples' access to the available natural resources and social logistics like land, water, credit and other infrastructural facilities, capacity building, market links, institutional supports etc.

### **Value of local cucurbits**

- Can be grown throughout the year with more crop capacity per unit area
- Deeply embedded in food habit
- Low or no-cost production system and easy storage
- Potential biotic and abiotic stress tolerance
- Gender friendly
- Ethno-medicinal usage
- Load of phytonutrients and antioxidant property with free radical scavenging capacity
- Diversity of use
- Untapped area with high income possibilities

The ever-narrowing base of crop variability has an impact on global food security and actually encroaches upon the access of the rural people to the available natural resources. In cucurbits, generally fruits are eaten but in case of pumpkin, bottle gourd, pointed gourd tender twigs are also equally preferred.

Cucurbitaceae is the most genetically diverse family of plants in the form of landraces, traditional cultivars, wild edible form and related non-edible wild and weedy relatives, which can adapt to a wide range of tropical and subtropical climates including uplands, *diara* lands and riverbeds, arid regions and even undescript low lands. Riverbed cultivation is a type of vegetables forcing, denoting off season production. Income from river bed vegetable growing is primarily meant for their own household food security. Since ancient times, different parts of several cultivated as well as wild cucurbit plants have been used for medicinal purposes.

### **Climate and cucurbits**

Climate change is a happening reality but is always may not necessarily be harmful, but the extreme weather events with significant impact that are difficult to predict, is sure to affect agri-horticultural entrepreneurship and the consequent food supply.

Climate change has been found to have an impact on food safety, particularly on incidence and prevalence of food-borne diseases. Escalating climate variability with intense extremities is sure to affect the stability of food production, supply, access and utilization. The Indian monsoon is one of the most dominant weather parameters in the sub-continental climate systems. It is seasonal and extremely variable. A substantial increase in the surface temperature over the last five decades in India has been a result of global warming. At very high temperatures, there occur imbalances in plant cellular metabolism, resulting in a crippled photosynthetic process and the accumulation of toxic substances in different plant parts that retards plant growth and development. The thermotolerance in cucurbits, mainly due to the presence of robust and stable photosynthetic system, is a boon for a country like India having a predominantly hot and humid climate except for the higher altitudes. Under high-temperature stress, thermo-tolerant cucumbers can up-regulate the genes responsible for protein modification, DNA repair, macromolecule metabolism, involving the phenotypic and endogenous hormone pathways and biosynthesis of secondary metabolites. (Bingwei et al., 2022).

All of the cultivated cucurbits are frost-sensitive, but squash and chow chow do better than others in a cooler environment. Cucurbits are mostly warmth loving, but extreme heat induces maleness and hinders fruit maturity. Cucurbits grow well on almost any soil with good drainage. Compact and poorly aerated soils are unsuitable. A soil pH range of 6 to 7 is good to satisfactory growth of the cucurbits. A pH less than 5.5 makes it critical for cucurbits to grow. Liberal application of organic matter (preferably @ 20 t/ha) improves the water holding capacity and aeration of the soil, buffers pH changes, adds nutrients and promotes the growth of beneficial soil microorganisms. Cucurbits are somewhat drought tolerant. High temperature and low humidity during fruit ripening augment aroma and sweetness (Vishnu Swarup, 2006).

### **Conclusion**

Urbanization is changing agrifood systems with increased social stratification globally, in ways that can only be understood through a rural-urban continuum lens. The food security problems and solutions are not uniform throughout the entire world. The changing pattern of population agglomerations along a rural-urban continuum and its interface as a place of exchange in socioeconomic interactions, is reorganized and being reshaped by agrifood systems, implicating

the availability and affordability of healthy diets, and in turn, for food security and nutrition. It necessitates promoting farming systems that use climate-resilient techniques, and produce a more diverse mix of foods, to improve food systems' resilience, increase farm incomes and enable greater availability and affordability of nutrient-dense foods. Improving supply chains is a must to reduce post-harvest food losses, improve hygiene in food distribution channels linking production and consumption in a better way. Crop production techniques and a deep insightful analysis of global change factors is the key to curb malnutrition and food insecurity.

Daily food consumption pattern and livelihoods of marginal farmers in vegetable-based enterprises are mainly dependent on the successful harvesting of the cucurbits. So, cucurbits have to be given due weightage and concern they deserve to augment nutritional and income security of the distressed people, especially women and children vis-a vis biodiversity conservation and right to food for all.

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