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Climate change and post harvest loss in North East India

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Abstract:

Global climate change is one of the most serious environmental threats facing mankind. Agriculture based livelihood systems are especially vulnerable to the adverse effects of climate change. There has been little discussion of the impacts of climate change on the post harvest handling. This article focus on the post harvest agriculture under changing climatic scenario of North East India. A proper climate resilient post harvest handling system needs to encompass the delivery of a crop from the time and place of harvest to the time and place of consumption with minimum loss, maximum efficiency and maximum return for all aspects involved.

Key words: Climate change, Post harvest loss, Adaptation, Mitigation

Introduction

Climate change is one of the most serious environmental threats facing mankind worldwide. Agriculture based livelihood systems are especially vulnerable to the adverse effects of climate change. Climate change will directly and indirectly affect all the stages of the food chain and impose a threat to food security. Its impacts will be felt in the short term, resulting from shifts in rainfall patterns and more frequent and intense extreme weather events and in the long term caused by changing temperatures and precipitation patterns. Until recently, most assessments of the impact of climate change on food systems and the agriculture sector have focused on the implications for production and global supply of food, with less consideration on the postharvest value chain issues such as harvesting and drying, primary and secondary processing, storage, processing and marketing [1]. India's North Eastern region consists of eight states–Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, and Tripura–occupying 2,62,179 square kilometres and with a population of over 45.58 million (Census 2011) which is 3.77% of India's population. The North Eastern Region is socially, culturally and politically very complex and contains great environmental and natural resource diversity. The region falls under high rainfall zone (>2000 mm annual rainfall) and is characterized by having difficult terrain, wide range of slopes and elevations, varied land tenure system, ethnic diversity, diverse food habit and cultural practices. Agriculture is the mainstay of the economy of northeast India, where more than 80% of the total population is rural. With rapid increase in human and livestock population and the rising demand of food, feed, fuel, fodder, fibre, timber and the other developmental activities. Climate change is expected to have a profound impact on agricultural productivity, post harvest losses and value chains. Climate change affects agricultural productivity both directly, by introducing changes in agro-ecological conditions (e.g. drought, variable precipitation, extreme weather events) and indirectly, by giving rise to new diseases and pests. Rapid climate change and climatic variability is now a reality. Climate change refers to the variation in the earth's global climate or regional climate over time. It describes changes in the variability or average state of the atmosphere over time scales ranging from decades to millions of years. Global warming, caused by the increase concentration of green house gases (GHG) has emerged as the most prominent environmental issue all over the world. Amongst various GHGs that contribute to global warming, carbon dioxide is released from agriculture by way of burning of fossil fuel for agricultural operations; methane is emitted through agricultural practices like inundated paddy fields, nitrous oxide through fertilizers, combustion of fossil fuels etc. Nitrous oxide has a global warming potential 296 times greater than CO_2, As per estimate, in India, 28% of the GHG emissions are from agriculture, about 78% of the methane and nitrous oxide emissions are also estimated to be from agriculture. Agriculture is the most vulnerable sector to climate change as it is very much sensitive to climate variability particularly rainfall and temperature aberrations threatening food security and livelihood. Agriculture in the North East is facing multifarious challenges like degradation of natural resources especially land degradation with jhum cultivation, fragmentation of land, occurrence of dry spells in undulating hill topography, securing food for increasing population and low crop productivity. The shift in the climatic scenario, low availability of resources and lack of mitigation strategies with the farmers makes the challenges in North Eastern agriculture further complex. In the climate change front, average temperature is projected to rise by another 3-5°C in this region of India during the latter third of this century [2]. Results of the recent study [3] indicates that majority of the districts in North East India are subject to climate induced vulnerability presently and in the near future. The erratic pattern of rainfall, higher frequency of extreme rainfall events, less rain in June-August, and more in September and October, and frequent flash floods and longer dry periods in various parts of the region manifests the impact of climate change. It is now well understood that climate variability and climate change are reality. Climate change is already putting food security at risk. Rising temperature and extreme events such as sudden drought and flood made it harder to meet the growing demand for food, fiber and fuel. Unless immediate action is taken up by policy maker, the impact on livelihood will increase over long run.

The impact of climate change on Post harvest losses

Post harvest losses (PHL) are defined as measurable quantitative and qualitative food loss from the time of harvest to the time the food reaches the end consumers [4, 5]. The chain comprises interconnected activities such as harvesting, threshing, shelling, drying, processing, storage, packaging, transportation, milling, marketing and consumption. Post harvest losses can be quantitative or qualitative. Quantitative PHL is defined as reduction in physical weight of food available for human consumption and other utilization. Quantitative loss can be caused by spillage, broken grain, rodent and pest damage and spoilage due to temperature changes, chemical changes and humidity content. The reduction in weight due to shrinkage of food grain after drying to allow for their storage for a longer period is not counted as a loss because it does not involve any food loss. Qualitative PHL refers to loss in the nutritional value, edibility, caloric value, acceptability or other intrinsic feature of the food. Qualitative losses can be due to factors such as contamination by microorganisms, pest and rodents attacks, humidity content, chemical changes, broken grain, contamination by mycotoxin, and pesticides residues [6]. According to FAO, an estimated 25% of the world's food crops are affected by mycotoxins (aflatoxins) produced by mould during storage, resulting in billions of dollars in losses. This happens due to irregular weather pattern. If qualitative deterioration of food makes it unfit for human consumption, leading to eventual rejection, this will be counted as a quantitative loss. According to a World Bank study, the post harvest losses of food grains in India are 7-10% of the total production from farm to market level and 4-5 % at market and distribution level. With the given per capita cereal consumption requirement for India, the above quantity of grains lost would be sufficient to feed >10 crore people. Cereal grains are the basis of staple food in most of the developing nations, and account for the maximum postharvest losses on a calorific basis among all agricultural commodities. As much as 50–60% cereal grains can be lost during the storage due to the lack of technical inefficiency [7].

There has been little discussion of the impacts of climate change on the postharvest agricultural sectors. After harvesting, smallholder farmers typically dry then store their staple crops to provide food until the next harvest. Cash demands force some farmers to sell part of their food stocks, while others strategically sell their surplus. The produce is sold through a variety of marketing chains within which factors operate with very different levels of capital, technology and influence. During these processes, there are significant losses due to insects and other pests, spoilage, damage during transportation, and market weaknesses. These post harvest aspects of agriculture are diverse, complex and multi-faceted and of key importance to the livelihoods of farmers; they are influenced in many different ways by variability in the climate and increasingly by climate change. The impacts of climate change on the storage, processing and marketing of agricultural commodities will be felt at household, national, regional and global levels. Assessing the effects of climate change through a post harvest systems offers new and important insights into food security and food safety.

Conclusion

To optimize harvest and post harvest processing and storage techniques, each step in existing post harvest systems needs to be analyzed with regards to climate related impacts and resilience. During the harvesting and post harvesting time, extreme climate conditions and inferior storage systems combined with anthropogenic effects result in deterioration and collapse of harvested grain. In traditional practices of post harvest handling and storage, about 3-20% of yields are wasted. A properly considered, resilient post harvest system needs to encompass the delivery of a crop from the time and place of harvest to the time and place of consumption with minimum loss, maximum efficiency and maximum return for all aspects involved. For climate change adaptation purposes, the focus will be on the improvement of steps during post harvest handling.

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Popularization climate resilient technology help to reduce the climate induced post harvest losses of this region.

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