Indian Farmer
Volume 13, Issue 06, 2026, Pp. 273-281
Available online at: www.indianfarmer.net
ISSN: 2394-1227 (Online)

Research Article

OPEN ACCESS

Crop Diversification: Multidimensional way for present and future food requirement

Mittu Katoch[1], Sandeep Manuja[2] and Pooja[3]

[1]Senior Research Fellow, [2] Principal Scientist and [3] Research Scholar

Department of Agronomy, CSKHPKV, Palampur

**Corresponding author: mitukatoch.katoch@gmail.com*

Received: 27/05/2026 *Published:02/06/2026*

INTRODUCTION:

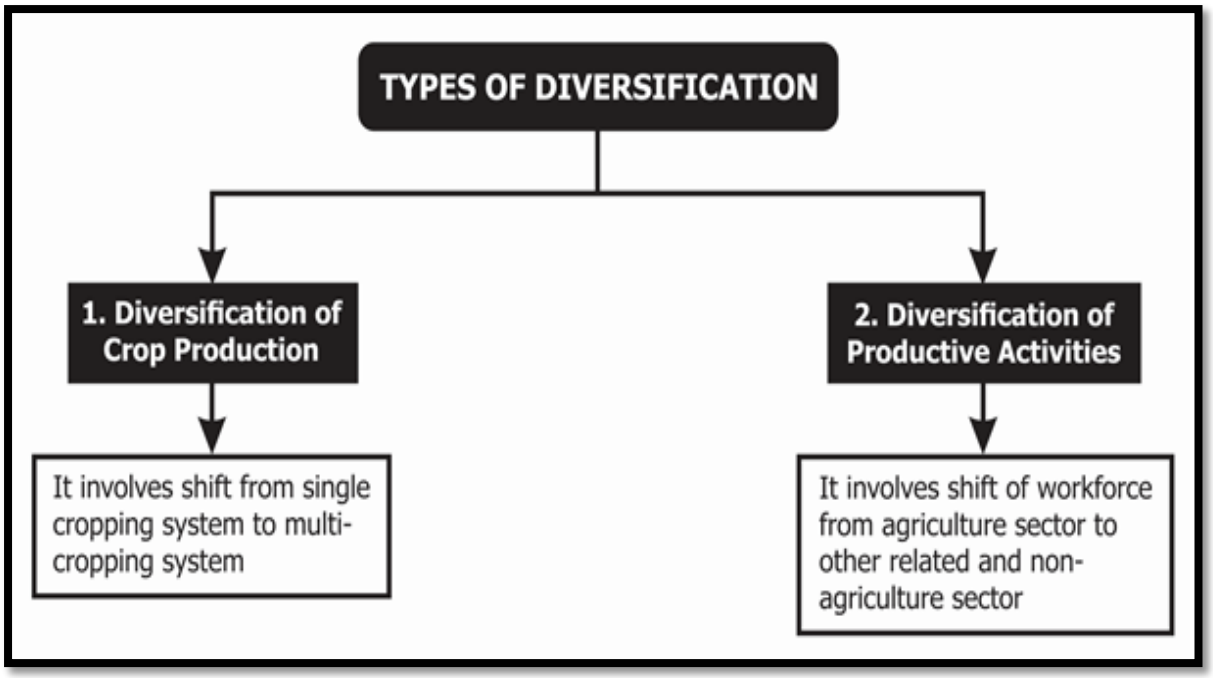
Agricultural intensification increased crop productivity but simplified production with lower diversity of cropping systems, higher genetic uniformity, and a higher uniformity of agricultural landscapes. Associated detrimental effects on the environment and biodiversity as well as the resilience and adaptability of cropping systems to climate change are of growing concern. Crop diversification may stabilize productivity of cropping systems and reduce negative environmental impacts and loss of biodiversity.

Food and nutrition security, income growth, poverty alleviation, employment generation, judicious use of land, water and other resources, sustainable agricultural development and environmental and ecological management/improvement have assumed high priority in the various countries of the region.

Crop diversification is the practice of growing more than one crop in an area, which can be done by adding new varieties or species of crops or by changing the current cropping system. It can help improve food security, increase farmer income, and promote sustainable agricultural practices.

It can also be defined as addition of new crops or cropping systems to agricultural production on a particular farm taking into account the different returns from value- added crops with complementary marketing opportunities.

Types of Diversification



Diversification is categorized into different types according to its nature and their potential benefit

Table 1. Type of diversification according to nature and potential benefits

Type of diversification	Nature of diversification	Potential benefit
Improved structural diversity	Makes crops within field more structurally diverse	Pest suppression
Genetic diversification in monoculture	Cultivation of mixture of varieties of same species in a monoculture	Disease suppression, Increased production stability
Diversify field with fodder grasses	Growing fodder grasses alongside of food/pulse/oilseed/vegetables	Pest suppression, opportunity to livestock farming
Crop rotations	Temporal diversity through crop rotations	Disease suppression, Increased production
Polyculture	Spatial and temporal diversity of crops	Increased production stability
Agro-forestry	Growing crops and trees together	Soil sustainability, diversified income
Mixed landscapes	Development of larger-scale diversified landscapes with multiple ecosystems	Enhanced ecosystem resilience
Micro-watershed based diversification	Integration of crop with other farming components for year-round income and employment	Sustained soil health, continuous income

Scope of Crop Diversification

Crop diversification can be considered as an attempt to increase the diversity of crops through, e.g. crop rotation, multiple cropping or intercropping compared to specialized farming with the aim to improve the productivity, stability and delivery of ecosystem services. It can be one measure to develop more sustainable production systems, develop value-chains for minor crops and contribute to socio-economic benefits. Crop diversification practices can include higher crop diversity, more diverse crop rotations, mixed cropping, cultivation of grain legumes in otherwise cereal dominated systems, perennial leys or grassland and regionally adapted varieties or variety mixtures.

Crop diversification could be an effective strategy in this direction. Efforts, therefore, need to be made by governments to explore fully the potential and prospects of crop diversification to forge congruence of enhanced productivity, profitability and sustainability.

Crop diversification and/or additional diversification measures like variation of seeding time or changing cropping patterns have the potential to lead to higher and more stable yields, increase profitability and lead to greater resilience of agro-ecosystems in the long term These practices have the potential to make cropping systems more diverse in space, time and genetics. Consequences of diversification are temporal shifts and ranges of phenological stages (relevant for biodiversity and adaptation to climate change), more frequent or continuous soil cover and more diverse management strategies, i.e. 'tillage', 'sowing dates', 'fertilization', 'irrigation', 'harvesting' and also reducing labour peaks and economic risk.

Crop diversification can lead to greater genetic and/or structural diversity in time and/or space.

Crop diversification is an important instrument for economic growth. However, the ability of a country to diversify in order to attain various goals, will depend upon the opportunities for diversification and responsiveness of farmers to these opportunities. At the same time new problems, threats and challenges will have to be faced. Several of the commodity agreements, such as the International Natural Rubber Organization, have failed to the disadvantage of the majority of developing countries, even though rubber is an important commodity in the Region.

Need of Crop Diversification

New opportunities that would benefit crop diversification are technological breakthroughs, changes in demand pattern, changes in government policy, development of irrigation and other infrastructure, development of new trade arrangements, and others. Similarly, challenges and threats necessitating crop diversification result from :a) market and price risks; b) risk associated with existing crop management practices; c) adverse changes like degradation of natural resources and the environment; and d) socio-economic needs like employment generation, attaining self-sufficiency in some crops and earning foreign exchange from others.

The case of the green revolution in India presents a good example of the effects (positive and negative) of technology induced crop diversification. This technology created opportunities for raising agricultural productivity through diversification in favour of high yielding period- bound cultivars of wheat and rice in areas endowed with reliable irrigation. In this way, green revolution technology

resulted in spectacular growth in farm output, which enabled the country to attain food self-sufficiency. However, the green revolution technology has also led to substantial shifts in area in favour of rice and wheat and a high level of crop intensification which are said to be causing degradation of the ecology and natural resources like soil and water in various ways. For example, high crop intensity and intensive use of chemical fertilizers and irrigation are noted to be causing nitrate pollution, soil salinity and water logging; while burning of crop residues is contributing to air pollution.

To face these challenges and problems there is an urgent need to diversify the cropping patterns.

For more than five decades, farmers have been using the common government-promoted Green Revolution cropping pattern — rice-wheat-rice for a longer time to enhance productivity. Unilaterally, following the same cropping pattern for a longer period of time has resulted in

– Extraction of specific nutrients from the soil, resulting in soil deficiency in those nutrients,

– Declining population of microfauna in the soil: The microfaunal population is responsible for the mobilisation and absorption of particular nutrients in the crop rhizosphere. Without microfaunal activities, the soil is lost to self-perpetuate and its ecology for crop production.

– Reduced resource-use efficiency: After the Green Revolution, Indian agriculture has been facing severe problems related to an increase in input cost to increase productivity. The direct increase in productivity in proportion to increase in input is limited to a certain extent and plateaus and then decreases with further increase in inputs. In India, productivity has plateaued in most regions.

– Mono-cropping patterns have more chances to be attacked by the same types of insects and pests, which in turn are controlled by pumping the insecticides and pesticides. This accumulates the residue of these chemicals in soil which pollutes the soil, crop and environment.

The introduction of diverse crops and cropping patterns help in a) Reviving soil health, b) Increasing the population of microfauna, c) Increasing resource-use efficiency, d) Preventing change in soil's chemical and biological properties, e) Reducing the application of weedicides or herbicides, etc.

Therefore, there is an urgent need to change the crops and cropping pattern, that is crop diversification.

Crop Diversification in the Indian Perspective

During the period of the Green Revolution in the late sixties and early seventies, there is a continuous surge for diversified agriculture in terms of crops, primarily on economic considerations. The crop pattern changes, however, are the outcome of the interactive effect of many factors which can be broadly categorized into the following five groups:

- Resource related factors covering irrigation, rainfall and soil fertility.
- Technology related factors covering not only seed, fertilizer, and water technologies but also those related to marketing, storage and processing.
- Household related factors covering food and fodder self-sufficiency requirement as well as investment capacity.

- Price related factors covering output and input prices as well as trade policies and other economic policies that affect these prices either directly or indirectly.
- Institutional and infrastructure related factors covering farm size and tenancy arrangements, research, extension and marketing systems and government regulatory policies.

The evaluation of crop pattern changes and their implications for crop diversification and area composition cannot be completed without considering their output and productivity effects. The production and productivity effects of area shifts can be evaluated by considering both the growth rates of output, area, and yield of various crop groups as well as the crop group specific patterns evident in the relative contributions of area and yield to overall output growth. The growth rates and sources of growth for the major crop groups at the all India level for the three periods, i.e., 1966-76, 1976-86 and 1987-97. The shift of area from cereals (especially coarse cereals) has not led to any decline in their output thanks to an impressive performance of their yield levels. The productivity improvement in cereals has been such that it compensates even for the area loss of cereals occurred during 1986-97.Notably, in the case of coarse cereals that have suffered a heavy area loss ever since 1976, yield improvement has been substantial especially in the last period. As a result their output growth, which was only marginal during 1976-86, has jumped to 1.14 percent during 1986-97. For pulses, on the other hand, even though area growth has increased from 0.21 to 0.32 percent between the last two periods, their output growth turns out to be negative due to a fall in their yield levels.

Food grains showing a steady rise in their output growth have a story similar to that of cereals as the contributions of their yield growth is increasing; whereas, those of their area growth are declining even to become negative in the recent period. Turning to the growth rates and growth sources of oilseeds, it is useful to distinguish the trend observed for the three oilseeds, i.e., rapeseed and mustard, sunflower and soybean from that observed for the oilseeds as a whole. This is because of the fact that the area shares of these three oilseeds have grown tremendously since 1976. Due to their faster expansion, their combined area share of 6.85 percent observed at present is higher than the combined share of both groundnut and sesamum, which dominated the oilseed sector in the pre-Green Revolution era. While the output growth of nine oilseeds has been impressive as compared to that of other crop groups, it is not as impressive as the combined output growth of the three fast growing oilseeds. However, there is a marked difference in the sources of output growth between the nine oilseeds and its sub-group. Although the contribution of area growth dominates that of yield growth in both cases, the contributions of area growth are far higher in the case of the three oilseeds as compared to that in the case of nine oilseeds. It should be noted that it is the higher area growth observed in the case of the three oilseeds, which has also compensated for the declining area share of some of the traditional oilseeds such as sesamum, linseed and nigerseed. Since the yield growth of the three oilseeds is also higher than that obtained for the nine oilseeds, the productivity improvement in the case of former is also relatively higher than that of the traditional oilseeds. There is also a notable shift in the sources of output growth among the commercial crops (i.e., crops other than cereals, pulses, and oilseeds) as yield growth that dominated over the area growth during

1966-1986 becomes dominated in turn by a area growth during 1986-97.

The implications are clear that area shifts from crops need not be a problem as long as their productivity levels are increasing faster to compensate for their declining area share. This is what has happened especially in the case of coarse cereals that have been a net donor of area to oilseeds and other commercial crops. Despite their negative area growth of -4.36 percent, they managed to maintain a positive output growth of 1.14 percent thanks to an impressive yield growth of 5.51 percent. Since this pattern is more or less repeated in the case of cereals as a whole, it is reasonable to say that the area shift has not affected food security. On the other hand, since the area shifts were from low-value coarse cereals to high- value oilseeds and since such shifts were accompanied by yield improvements within the oilseed sector, the area shifts have not only increased the overall output of edible oils but also contributed to an enhancement of the income level of farmers. In this sense, the area shifts have actually contributed to broaden the foundation of food security.

Benefits of Crop Diversification

Crop diversification can have many benefits, including:

- Food security: Crop diversification can improve food security by increasing the variety and quantity of food stocks.
- Increased income: Crop diversification can increase income by reducing the risk of crop failure and by creating opportunities to sell a variety of crops.
- Reduced risk: Crop diversification can reduce the risk of financial loss due to bad weather conditions or market swings.
- Environmental benefits: Crop diversification can make farms more environmentally friendly by reducing the need for excessive fertilizer and pesticides.
- Improved soil health: Crop diversification can improve soil health by reducing the incidence of disease and pests.
- Increased profits: Crop diversification can increase profits by reducing production costs.
- More varied food: Crop diversification can provide more varied and healthful food for both humans and livestock.
- Enhanced pollinator populations: Crop diversification can enhance beneficial pollinator populations.
- Increased employment opportunities: Crop diversification can increase employment opportunities.

Crop diversification has many benefits, including:

Increases Farmers' income: Crop diversification can act as an important stress-relieving factor for the economic growth of the farming community and provide economic stability.

Increases natural biodiversity and productivity: Crop diversification can increase natural biodiversity, strengthening the ability of the agroecosystem to respond to climatic and environmental stresses.

Reduces the risk of crop failure: As different crops will respond to climate scenarios in different ways, crop diversification will significantly reduce the risk of total crop failure. Further, diversification will also help in **mitigating natural calamities.**

Ensure Food and nutritional security: Crop diversification enables farmers to grow surplus products for sale at the market. Thus facilitating both food and nutritional security.

Access to national and international markets: It can enable farmers to gain access to national and international markets with new products, food and medicinal plants.

Environmental Conservation: Adoption of crop diversification helps in the conservation of natural resources like the introduction of legumes in the rice-wheat cropping system, which has the ability to fix atmospheric Nitrogen to help sustain soil fertility.

- Improved crop yields: Crop diversification can improve crop yields and quality.
- Increased biodiversity: Crop diversification increases agricultural biodiversity by increasing the variety of plants, animals, and soil-borne organisms.
- Reduced risk of pests and diseases: Crop diversification can help break the cycles of insects and diseases, which can reduce the risk of pests and diseases.
- Reduced soil erosion and weeds: Crop diversification can reduce soil erosion and weeds.
- Improved soil moisture conservation: Crop diversification can help conserve soil moisture.
- Adaptation to climate change: Crop diversification can help smallholders adapt to the adverse effects of climate change.

Challenges faced in crop diversification

Dependence on Monsoon: Around 55% of India's Cultivable Land is Rain-fed with heavy dependence on monsoon. Hence, some crops may not be able to survive in the prevailing environmental conditions.

Fragmented land holding: It makes it difficult to use efficient modern technology on large scale, raises the cost of land boundary management, land disputes etc.

The shift from Food crops to Commercial Crops: This especially includes Cotton in the Deccan belt; and Sugarcane in the Green revolution belt and Krishna-Godavari basin.

Inadequate infrastructure: Poor basic infrastructure like rural roads, power, transport, communications etc is major impediments for diversification.

Lack of Knowledge and Training: Indian farmers are inadequately trained. Further, there is persistent and large scale illiteracy amongst farmers.

Over-use of resources like land and water resources: Crop diversification might amplify resource consumption, thereby creating a negative impact on the environment and sustainability of agriculture. For instance, Animal agriculture is the second-largest contributor to human-made Greenhouse Gas (GHG) emissions after fossil fuels.

Suitability for some crops: The majority of cropped area in the country is completely dependent on rainfall therefore some crops may not be able to survive

Overuse of Resources: Over-use land and water resources, causing a negative impact on the environment and sustainability of agriculture.

Government Policies And Strategies For Crop Diversification

The government of India have taken several initiatives for agricultural development in general and crop diversification in particular. These initiatives are as follows:

- **Launching a Technology Mission for the Integrated Development of Horticulture in the Northeastern Region**: The programme will establish effective linkages between research, production, extension, post-harvest management, processing, marketing and exports and bring about the rapid development of agriculture in the region.
- **Implementing National Agriculture Insurance Scheme:** The scheme will cover food crops, oilseeds, annual commercial and horticulture crops. Small and marginal farmers are eligible for 50 per cent subsidy under the Scheme.
- **Operationalizing Technology Mission on Cotton**: The Technology Mission will have separate Mini-Missions on technology generation, product support and extension.
- **Creation of Watershed Development Fund**: At the National level for the development of Rainfed lands.
- **Strengthening Agricultural Marketing**: Greater attention to be paid to the development of a comprehensive, efficient and responsive marketing system for domestic marketing as well as exports by ensuring proper quality control and standardization.
- **Seed Crop Insurance:** A pilot scheme on Seed Crop Insurance has been launched which will cover the risk factor involved in the production of seeds.

Ways for improvement in crop diversification in India

India needs to identify crops and varieties that may suit a range of environments and farmers' preferences.

a) India needs to frame adequate skill development policies to promote the crops and varieties amongst rural livelihoods,

b) Research institutes such as ICAR should conduct research on further crop diversification,

c) The government should procure crops produced other than wheat and rice at a Minimum Support Price**.**

d) Reduce agricultural emissions through smarter livestock handling, technology-enabled monitoring of fertilizer application and more efficient agricultural techniques.

Although there are challenges that need to be addressed, crop diversification provides an opportunity to double farmers income and create food and nutritional security for the nation.

REFERENCES:

Hondrade RF, Hondrade E, Zheng L, Elazegui F, Duque JALJE, Mundt CC, Vera Cruz CM, Garrett KA (2017) Cropping system diversification for food production in Mindanao rubber plantations: a rice cultivar mixture and rice intercropped with mungbean. PeerJ 2017(2). https://doi.org/10.7717/peerj.2975

Hufnagel,J.,Reckling, M. & Ewert, F. Diverse approaches to crop diversification in agricultural research. A review. *Agron. Sustain. Dev.* **40**, 14 (2020). https://doi.org/10.1007/s13593-020-00617-4

Kumar R, Shambhavi S, Beura K, Kumar S, Singh RG (2017) Soil microbial budgeting as influenced by contrasting tillage and crop diversification under rice based cropping systems in Inseptisol of Bihar. J Pure Appl Microbiol 11(1):539–547. https://doi.org/10.22207/JPAM.11.1.71

Kachroo D,Thakur NP,Kour M,Kumar P,Sharma R,Khajuria V(2014) Diversification of rice(Oryza sativa)-based cropping system for enhancing productivity and employment. Indian J Agron 59(1):21–25

Kumar R, Saurabh K, Kumar S, Dubey AK, Tamta M and Hans H.2018. Diversification of rice–wheat system through climate resilient cropping in Eastern India. Mishra JS, Bhatt BP, Kumar Rakesh and Koteswara Rao K (eds).Conservation Agriculture: Mitigating Climate Change Effects & Doubling Farmers Income, 269 p. ICAR Research Complex for Eastern Region, Patna, pp: 80–84.

Reckling M, Albertsson J, Topp CFE, Vermue A, Carlsson G, Watson C, Justes E, Bergkvist G, Jensen ES (2019) Does cropping system diversification with legumes lead to higher yield stability? Diverging evidence from long-term experiments across Europe. European Conference on Crop Diversification September 18–21 September 2019, Budapest, Hungary

Singh R, Babu S, Avasthe RK and Yadav GS 2018. Crop diversification and intensification for enhancing livelihood security in Sikkim. Published by ICAR-National Organic Farming Research Institute, Tadong, Gangtok, Sikkim, India. 36 p.