

Impact of Diversification of Cropping Patterns on Sustainable Development of Farm Sector of Uttar Pradesh: Theoretical Underpinnings

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ABSTRACT

Uttar Pradesh is one of the highly agrarian states of India where share of agriculture and allied sectors in the Gross State Domestic product (27% in 2014-15 at current prices) is much above national aggregate. Coupled with the challenge to provide food and nutritional security to such a massive population base and to ensure growth of other sectors as well, the sustainable growth of its farm sector is a prerequisite. It requires optimal utilization of resources with increased returns to the farmers. To combat the emerging challenges in agriculture, farming practices need to be revitalized. To achieve 4 % growth in the agriculture sector, the State Agriculture Policy of 2005 has identified seven thrust areas, called Sapt Kranti viz. extension, irrigation and water management, soil health and fertility, seed management, marketing, research and agricultural diversification. In the present State Agriculture Policy, 2013, in furtherance to aforesaid areas, promotion of agriculture based industries has been included as one of the strategies to achieve a growth rate of 5.1% in the agriculture sector. Within the given resource restraints, agricultural diversification is an effective strategy in this direction. Diversification of Cropping Patterns refers to bringing about a desirable change in the existing cropping patterns towards more balanced cropping system. This includes horizontal as well as vertical diversification of agriculture. For the purpose of the study only horizontal diversification has been considered which inclusion of more and varied crops in the cropping system, using multiple cropping techniques, rather than concentrating on repetition of few crops. Diversification can ensure judicious utilization of resources, synergy in the demand and supply of agricultural produce, remunerative returns to the farmers, strengthening agro-ecological system, providing hedge against adverse climatic conditions, providing economic hedge against price fluctuations, shifting additional burden from agriculture, development of allied sectors and sustainable development of farm sector. The present research paper explores the theoretical aspects of diversification of cropping patterns by reviewing the related literature. The determinants of diversification of cropping patterns and farmer's responsiveness to them have been assessed.

Keywords: Crop diversification, sustainable development, farm management, farmer's responsiveness.

INTRODUCTION:

As a natural consequence of growth, nature and structure of an economy transforms and its composition changes over time. The same has been true in the case of Indian agriculture. From the stage of food-grain deficiency to the self-reliance and further towards food-grain surplus; Indian agriculture has witnessed a paradigm shift. With advancements in technology and inception of scientific methods in farming, significant

changes have been observed in the way farming is done today. Commercial farming rather than subsistence farming is the face of modern agriculture. Selection of crops, input combinations, method of farming, choice of technology etc. is being predominantly governed by economic considerations than merely traditions and socio-cultural norms. Cropping pattern i.e., selection of different combinations of crops, *inter alia* is one of the prime determinants of the performance of agriculture sector. The erstwhile monocropping pattern which is highly concentrated has been replaced by other evolving and diversified cropping patterns e.g., multiple cropping, mixed cropping, crop rotation, sequential cropping, inter cropping, strip cropping, relay cropping, plantation cropping etc. Indian agriculture is facing multiple interrelated challenges, firstly to satiate the requirement of varied and nutritious food as per the changing food-habit of the large population, secondly increasing productivity under changing agro-ecological circumstances with shrinking and degrading natural resources, thirdly ensuring assured returns to the farmers and stimulating the growth of agriculture sector, and fourthly streamlining the growth of allied sectors. These challenges can be addressed by judicious agricultural practices and selection of cropping patterns which are in synergy with the emerging demand-supply scenario. Diversification of cropping pattern could be an effective strategy in this direction. 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. Uttar Pradesh, which is one of the highly agrarian states of India, where cropping pattern revolves around wheat and rice in cereals, and potato and sugarcane in non-cereals, opportunities as well as challenges for diversification are many.

REVIEW OF LITERATURE:

The following literature has been reviewed in order to get an insight into the area of research under consideration, and assess the study gaps.

International Practices of Diversification of Cropping Patterns:

Diversification of cropping patterns has been an internationally accepted and propagated practice due to multiple reasons including resilience to climatic changes, increasing farm yields and reduction of cultivation costs, enrichment of agro-biodiversity, effective farm management, and sustainable development of agriculture sector. The competing literature encompassing various aspects of diversification of cropping system spanning previous two decades has been considered for the purpose.

- i. (Papademetriou & Dent, 2001) have compiled the manuscripts of edited papers presented at the expert consultation on 'Crop Diversification in the Asia-Pacific Region', sponsored by the FAO Regional office for Asia and the Pacific. In the study, the status, issues, implications and opportunities of crop diversification practices in Bangladesh, China, India, Japan, Malaysia, Nepal, Phillipines, Sri Lanka, Thailand, and Vietnam have been assessed.
- ii. (Rosenzweig & Tubiello, 2007) have stressed upon the need for adaptation strategies in agriculture to be in tune with the objective of resistance to climate change.
- iii. (Akanda, 2010) opines that crop diversification must be guided by the changing climate conditions, availability of groundwater for irrigation and its sustainable use as well as changing food habit of the households.
- iv. (Mainuddin, Rahman, Islam, & Quasem, 2011) have found that diversification of cropping patterns in Bangladesh, which is predominantly rice-based, is affected mainly by the availability of surface and groundwater for irrigation.
- v. (Amujoyegbe & Alabl, 2013) in their study about the two agro-ecological zones of Nigeria, conclude that despite agro-ecological variations, socio-cultural settings also affect farming systems and cropping patterns.
- vi. (Sarker, Alam, Hossain, & Mannaf, 2014) have analyzed comparable margins and benefit-cost ratios of different cropping patterns in Bangladesh. High benefit-cost ratio is one of the factors inducing diversification of cropping patterns.
- vii. (Gorst, Groom, & Dehlavi, 2015) have found that farmers have benefitted from adaptation strategies in the form of increased productivity and better climatic resistance. Those who did not adapt, have potential to gain from adaptation, but resist due to resource bottlenecks.
- viii. (Vernooy, 2015) has analyzed the agro-ecological practices, policies and issues in Cambodia, Lao and Vietnam. He suggested that studies must be carried out to measure the agro-ecological and biodiversity benefits of crop diversification practices.

Indian Experience of Diversification of Cropping Patterns:

Some of the pioneer works in the early seventies and recent developments in the previous decade have been considered for the review purpose.

- i. (Singh H. S., 1962) has provided a historical count of the factors inducing shifts in cropping patterns. He stressed that farmers must take into consideration account some of the economic criteria like opportunity cost of shifted crops, and the comparative advantage.
- ii. (Bhatia, 1965) has provided two indices for measurement of the degree of concentration and diversification of cropping pattern for identifying the areas with differing degrees of diversification so that the untapped potential of the areas with low degree may be unleashed.
- iii. (Srivastava & Mukhopadhyay, 1997) have pointed out the causes for stagnation of yields from wheat-rice intensification e.g., degradation of natural resources, decline in soil fertility, issues in water management, pest and disease problems due to intensive monocropping. The researchers further suggest that possible solution might be found in diversification of cropping patterns.
- iv. (Kar, Singh, & Verma, 2003) have concluded in their experimental research that crop diversification might result in increased productivity and efficient rainwater management in rain-fed areas. Crop diversification towards short duration, low duty crops results in assured returns to the farmers even under rainfall deficit situations.
- v. (Reserve Bank of India, 2007) has identified the major cropping patterns in India and categorized the factors inducing diversification of cropping patterns which include various factors related with availability of resources, technology, institutional arrangements, infrastructure and pricing and market related factors.
- vi. (Singh, Ali, & Venkatesh, 2009) have identified the niche cropping patterns with sequential and mixed intercropping which include pulses as one of the crop. Researchers have stressed the need to diversify crop systems toward pulses-rich patterns for increased yields and efficient farm management.
- vii. (Jha, Kumar, & mohanty, 2009) have analyzed the potential of horticulture-based and livestock-led diversification. Such diversification may lead to high value to the farmers because of high income elasticity of demand for fruits and vegetables.
- viii. (De & Chattopadhyay, October 2010) have concluded in their study that small scale farmers have diversified cropping patterns more intensely provided adequate infrastructural facilities are made available.
- ix. (Haque, Bhattacharya, Sinha, Kalra, & Thomas, 2010) have found that small farmers have been diversifying cropping patterns horizontally while at the same time they are facing some restraints in vertical diversification e.g., lack of technological access and less capital intensity.
- x. (Manjunath, Kundu, Ray, Panigrahy, & Parihar, 2011) have obtained and analyzed crop data using geospatial remote sensing technique and concluded that crop rotation and intra-crop variety variations are more predominant characteristics of diversification in West Bengal than inter-crop and inter sector variations.
- xi. (Singh G., 2012) has concluded that there is a significant relationship between socio-economic status of farmers and their responsiveness to the crop diversification.
- xii. (Mandal & Bezbaruah, 2013) in their study using econometric modeling for variables affecting diversification patterns, concluded that in flood-prone areas index for diversification is high whereas in flood-free areas, this is low. Access to irrigation and institutional credit and other arrangements positively influence crop diversification.
- xiii. (Aggarwal, 2013) have concluded that although pattern of rainfall has highly been oscillating, yields have not fluctuated in the same manner due to diversification of crops and alternate sources of irrigation.
- xiv. (Koshal, 2014) has analyzed remote sensing data and found good correlation between yields and areas under wheat and rice. While rainfall has good correlation with rice yields, this is not so in case of wheat. He opines that remote sensing and GIS technologies can be helpful in management of problematic areas.
- xv. (Akhter & Acharya, 2015) in their study revealed that availability of irrigation facilities is the prime determinant of the extent of diversification of cropping patterns.

Thus there arises a need to revisit the emerging scenario of cropping patterns in U. P. and opportunities and challenges for diversification of cropping patterns and responsiveness of farmers thereto.

NEED OF THE STUDY:

To combat the emerging challenges in agriculture, farming practices need to be revitalized. To achieve 4 % growth in the agriculture sector, the State Agriculture Policy of 2005 has identified seven thrust areas, called Sapt Kranti viz. extension, irrigation and water management, soil health and fertility, seed management, marketing, research and agricultural diversification. In the present State Agriculture Policy, 2013, in furtherance

to aforesaid areas, promotion of agriculture based industries has been included as one of the strategies to achieve a growth rate of 5.1% in the agriculture sector. Within the given resource restraints, agricultural diversification is an effective strategy in this direction. Thus there is a need to assess the restraints, challenges, policy initiatives and imperatives of crop diversification in Uttar Pradesh.

OBJECTIVES OF THE STUDY:

- (i) To elaborate the concept of Diversification of agriculture in general and Diversification of cropping patterns in specific.
- (ii) To assess the major factors and key drivers of crop diversification in U. P.
- (iii) To analyze the implications of crop diversification practices for sustainable development of farm sector of U. P.
- (iv) To review the related literature on national and international experiences of crop diversification.
- (v) To assess the policy constraints and challenges in diversification of cropping patterns.

RESEARCH METHODOLOGY:

Research paper basically aims at providing a theoretical perspective to the concept of diversification of cropping patterns and its various dimensions. For this purpose, available literature has been reviewed and summary findings have been presented.

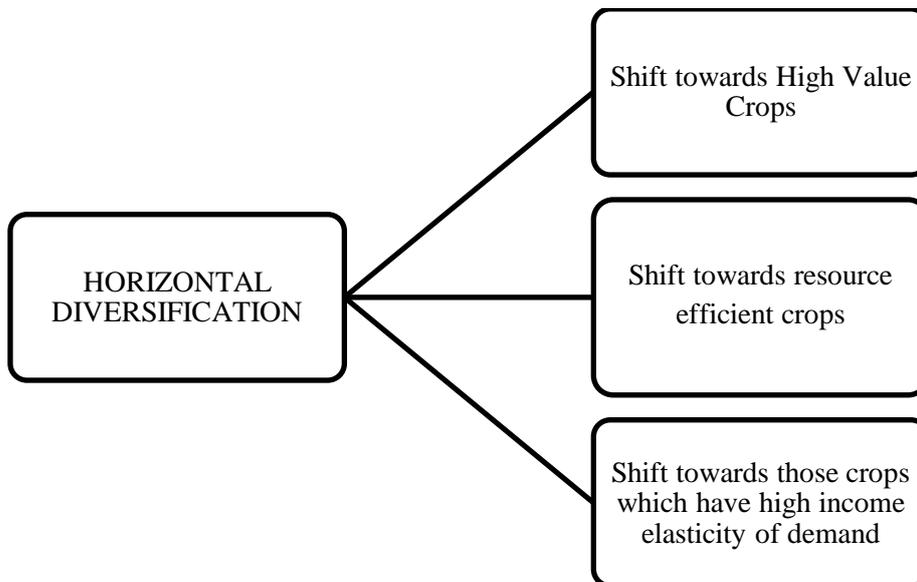
DISCUSSION:

Diversification of Cropping Patterns:

Diversification of Cropping Patterns refers to bringing about a desirable change in the existing cropping patterns towards more balanced cropping system. In agriculture, diversification refers to the addition of new crops or enterprises with or without the addition a shift from one crop or enterprise in a production system. This includes horizontal as well as vertical diversification of agriculture.

Horizontal Crop Diversification:

Horizontal crop diversification stands for inclusion of more and varied crops in the cropping system, using multiple cropping techniques, rather than concentrating on repetition of few crops. One desirable aspect of such diversification is to promote those cropping patterns which lead to sustainable agricultural practices.



Vertical Crop Diversification:

Vertical crop diversification stresses upon the development of allied sectors and shift of burden from cultivation to allied activities e.g. animal husbandry, horticulture, floriculture, food and fruit processing etc.

For the purpose of the study, only horizontal diversification has been considered which means the broadening

of the base of the system, simply by adding more crops to the existing cropping system utilizing multiple cropping techniques.

Objectives of Crop Diversification:

Crop diversification targets to achieve the following objectives:

- (i) Equilibrium in demand and supply of agricultural produce: As a response to the Green Revolution, the production of wheat, rice and coarse cereals has surged up in Punjab, Haryana and Western Uttar Pradesh, leading to the state of food sufficiency. However, with improvement in standard of living, the demand for varied produce e.g. pulses, oilseeds, fruits and vegetables has increased manifold. Thus, in order to streamline demand and supply, crop diversification is an effective strategy.
- (ii) To ensure gainful returns to the farmers: For this purpose, diversification needs to be in favor of high value crops. When high value crops are included in the cropping system, net returns to the farmers are maximized.
- (iii) To provide hedge against adverse agro-climatic conditions: Crop diversification can shift the risks associated with monsoon failure, floods and the like conditions. If one of the crops is affected, its loss can be offset by other crop. Some crops have better climatic resilience. These should be included in the cropping system.
- (iv) To provide hedge against price fluctuations: Prices of agricultural produce are subject to the application of Cobweb model. As such diversification can provide a hedge against price fluctuation of select crops and ensure better returns to the farmers.
- (v) To strengthen agro ecological system: Each crop requires different set of nutrients from the soil. If it is repeated time and again, soil fertility gets reduced and high intensity of fertilizers is required. Diversification ensures restoration of nutrients and hereby rejuvenation of the soil.
- (vi) Shifting additional burden from agriculture: By diversification of agriculture and development of allied sectors, additional burden can be shifted, making it remunerative to the persons involved.
- (vii) Optimum utilization of resources: While selecting a particular crop, the opportunity cost of alternative crop shall always be considered by making cost-benefit analysis of the crops. If diversification is commensurate with such consideration, it leads to optimum utilization of resources.
- (viii) Sustainable development of the farm sector: To ensure food and nutritional security to the large population, sustainability of farm sector is the necessity. With diversification of cropping patterns, soil health can be retained in rejuvenated form.

Determinants of Crop Diversification:

Selection of a particular crop over other alternates is a complex problem, affected by multiplicity of factors. These factors include economic as well as non-economic considerations. Due to lack of application of knowledge, research and extension services in the farm sector, such a decision is seldom taken wisely. Following are the factors determining the selection of a particular crop in the cropping system:

- (i) Resource related factors like irrigation facility, expected rainfall, soil fertility etc.
- (ii) Agricultural technology related factors like availability of quality seeds, fertilizers, irrigation technologies etc.
- (iii) Infrastructural variables like logistics, warehousing, regulated markets etc.
- (iv) Institutional variables like regulatory policies, research and extension facilities, pricing policy etc.
- (v) Household related factors like number of family members, working members, food and fodder requirement etc.
- (vi) Responsiveness of farmers to the Government policies and programs in this direction.

RESTRAINTS AND CHALLENGES:

Availability of input resources is the prime restraint in the crop diversification. The state lacks sufficient irrigation infrastructure. Only 77% of the area is irrigated and private tube wells irrigating about 69% of the area are the main source of irrigation followed by canals which cover about 18%. Climatic conditions are also getting adverse. In the recent years, due to climate change, timing of monsoon arrival and size of rainfall have changed drastically. Average annual rainfall deficiency is about 46% from normal. As a large portion of cultivated area is rain fed, rainfall plays a crucial role in determination of farm yields and cost of cultivation, and diversification practices. There is wide variety in annual rainfall across different agro climatic regions. While western region faces less rainfall, it is prone to drought situations, Eastern and south eastern regions of the state are rich in distribution of rainfall. It has wide implications for diversification of agriculture from more water intensive crops to less intensives ones. Dissemination of weather forecasts to the farmers especially through mobile phones can change their agri-practices and enhance their climatic resistance. Size of landholdings is another important

variable affecting diversification practices. It determines the extent of mechanization, farm inputs, availability of labour, and per capita yields. 40% of landholdings in U. P. are marginal sized engaging almost 80% farmers. Of total cultivated area, 24% landholdings come under the category of small farms engaging 13% farmers. Only 2% farms are large sized with landholding of 10 ha or above. Average size of landholdings is 0.80 ha, making it practically difficult to carry out diversified crops. Infrastructural facilities like warehousing facility, regulated markets etc. are also not commensurate to the size of the State economy.

CONCLUSIONS AND POLICY IMPERATIVES:

With the given technological advances and capital investment in the farm sector, crop diversification can be an effective strategy to avoid early operation of the Law of Variable Proportions. If crops are diversified, increasing returns can be availed and the operation of the Law of returns can be postponed. Although Government has drafted various policies to this end viz. Soil Health Card scheme, Pradhan Mantri Fasal Bima Yojana, Dugdha Niti, Pashu Vikas Niti, etc. there are many areas which require urgent attention. Farm electrification for increased access to cheap irrigation facility, increased investment in fertilizers, seeds, agricultural machinery and infrastructural facilities, and sensitization of farmers through research and extension services are some of the areas which have huge potential to make diversification a success.

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