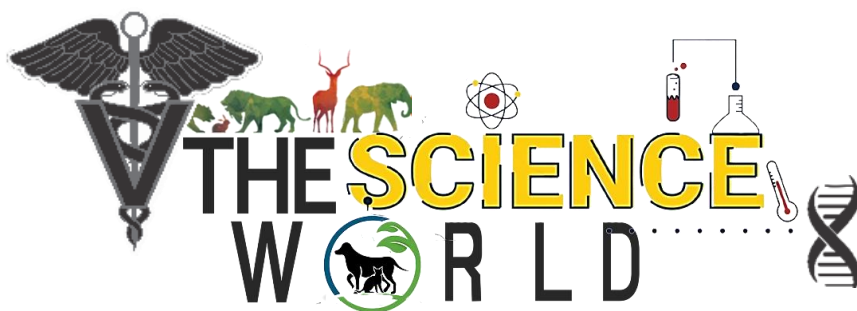




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Popular article

Overview of potential for diversification of crops and cropping system

Amit Anil Shahane

Assistant Professor (Agronomy), College of Agriculture (Central Agricultural University, Imphal), Kyrdemkulai, Meghalaya, India – 793 105
(Correspondence email: amitiari89@gmail.com)
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Abstract

The modern input intensive agriculture born to meet everincreaing need of provisional services showed the varying level of natural resource degradation leading to reduction in factor productivity and ultimately concern of sustainability. Among the different avenues stress to address this situation diversification is one potential solution. The article highlights potential area/ crops requiring diversification, major factors affecting diversification along with their pros and cons. The cereal based cropping systems and sugarcane due to adverse effects on natural resources, vegetables such as potato, tomato and onion due to price drop leading to glut condition in market with consideration for using them for processing are highlighted crops for diversification; while in case of cotton, monopoly of single species *Gossypium hirsutum* [that too with Bt gene], higher cost of cultivation, increased pest and diseases insurgence, and pollution due to excessive use of agrochemicals are potential reason for diversification. The such as soybean, maize, short duration pigeon pea, vegetable crops such as cowpea, garden pea, French bean, mustard, spring sunflower as well as medicinal and aromatic plants such as mentha, seed spice such as cumin and coriander provide potential options of diversification. Besides that vertical diversification through processing and value addition is important due to increased market of processed [ready to cook, ready to eat ready to serve] food products.

Keywords- Horizontal diversification, cereal crops, cotton, sugarcane, rice.

In India, the shift from food security to economical, nutritional and ecological security is occurred and occurring. The major precursor for this shift includes significant increase in production of provisional services, from agro-ecosystem, changes in demography, increase in awareness and demand for nutritious and safe food, development and adoption of environmental responsive practices and desire to excel on economic front. The growth in agriculture and allied sectors are described in terms of economic and ecological aspect at regional and global scale; hence development and utilization of resources and practices



addressing both economical and ecological goal are top most agenda for development. The recent practices in agriculture and allied sector to achieve this goals are A) development of tailor made fertilizers (nano-fertilizers and coated fertilizers), B) promotion and use of enriched organic manure and biodynamic formulation through natural and organic farming, C) exploring root rhizosphere for development of consortia based biofertilizers, D) shifting crop cultivation zones, F) development and use of mitigation and adaptation strategy for addressing climate change, G) Soil health management practices, H) development of new varieties and plant types such as genetically modified crops, hybrid and high yielding varieties, I) Changing crop cultivation practices such as system of rice intensification, system of crop intensification and different crop establishment methods, hydroponics, aeroponics, farming system based approach, etc. J) Identification and use of resource conservation technology in different production system, K) diversification of cropping and / or farming system, L) Development of intensive and energy efficient farming system, M) promotion of entrepreneurship development in different farming activities and allied enterprises, N) Development of low dose agrochemicals for stress management in agriculture, O) Identification and promotion of Indigenous Technical Knowledge, P) Identification and promotion of traditional underutilized crops and their wild relatives, Q) Increase in use of crops biomass in bioenergy production, R) Maximize rainwater harvesting and efficient use of irrigation water, S) energy plantation as well as energy harvesting in barren land through solar panels, T) Alternate agriculture (agroforestry), U) Increase in emphasis on cultivation of medicinal and aromatic plants, V) Policy and institutional support for promotion of post-harvest processing and value addition of different agricultural commodity, W) Ecological quantification of production systems, X) Incorporation of precision agriculture principles in different production system, Y) changes in sociological dimensions in production system such as co-operative and corporate farming, farmer producer organization, etc. and Z) large scale acceptance of integrated management system for nutrient, insect-pest disease and weed management.

Among these options use of diversification play an important role considering its potential in achieving economic security, nutritional security, energy security and environmental responsiveness. The diversification can be achieved changing the crops, cropping system or crop cultivation methods, crop establishment methods, one or more crop cultivation practice which is categories as horizontal diversification (Hufnagel et al., 2020); while increase scope for processing, value addition and other form of post-harvest technologies leads to another type of diversification called as vertical diversification [R]. The horizontal



diversification is addressed mainly by crop diversification and diversification of rice in north-west plain zone is one of the best example (Shahane and Shivay, 2019); while other includes diversification through orchards rather than arable crops [mostly sugarcane] and diversification through different types of intercropping as well as alley cropping, lay farming, relay cropping and even with sequential cropping. The concept of horizontal diversification can be also addressed through following integrated farming system rather than cropping system alone. The IFS incorporate multiple enterprises of different origin such as plants, insect, animal, fish and other aquatic animal, hater harvesting, biomass recycling and so on. Alternative agriculture the term used for form of agriculture in area where regular crop cultivation practices is not possible due to topographic and climatic reason and in this agroforestry is one such practice which can address the diversification through its four major types viz., agri-silviculture, agri-pastoral, silv-pastoral and agri-silvi-pastoral. The other type of agroforestry with including of horti-agriculture, horti-agri-pastoral, horti-silviculture, etc. can also stand as potential option for diversification. The vertical diversification can be addressed through secondary agriculture which involves processing and adding values to the agricultural produce (Yadav et al., 2020). The committee of doubling farmers income of Ministry of Agriculture and Farmers welfare define secondary agriculture is productive activity at enterprise level which can able to meet three criteria viz., 1) utilize primary agricultural produce and by-produce as raw material or biological material available in locality in rural agrarian area, 2) deploy locally available skills or high level of rural manpower to operate/ manage production of good and services and 3) can be categorizes appropriately under the micro, small and medium enterprises development (Anonymous, 2018). According to this the major avenues for vertical diversification through secondary agriculture includes beer keeping sericulture, moriculture, production of planting materials, production of bio-fertilizer, bio-pesticides and bio-inputs, soil testing, production of animal feed, coir extraction, etc.

The major factors affecting the diversification includes adverse effect of monoculture on natural resources, economically competitive options for diversification and intensification [maize, short duration pigeon pea, soybean for rice and mustard barley for wheat], market condition [glut in market] leading to reduced income, changing government policies or need for such changes at national level, climate changes related concerns as well as weather abnormalities and concern of sustainability in production system. The rice-wheat cropping system, sugarcane, cotton and tobacco are known example for need for diversification due to adverse effect on soil, water requirement in production system, degrading natural resource



bases, pollution of environment and decreased income due to increase in quantity and cost of purchased inputs; while in case of potato, tomato and onion, glut condition in market and severe price drop are major reason for need for diversification. The processing is potential options while requirement of row produce quality standard for processing is consideration. So, diversification should start from field itself by cultivating varieties and fooling the agricultural practices suitable for developing produce suitable for processing rather than diverting the excess market produce to processing factory. The market demand based diversification of crop varieties includes use of traditional nutritionally superior varieties (brown/ black rice, basmati rice, and aromatic rice) (Sihi et al., 2017), geological indication varieties, bio-fortified varieties (Yadava et al., 2020) and organic produce for rice and product diversification such as jaggery and *khandsari* production for sugarcane and export quality tobacco varieties. The cultivation methods and crop establishment methods is well known and explored options for diversification in cereal crops leading to reduce the resource use and degradation of natural resources with or mostly without yield penalties. The vertical mulching is affected by availability of processing and value addition facilities, market infrastructure and storage facilities [Important for perishable commodities such as vegetables and fruits which are mostly being processed], capital support through loan and incentives, availability of cost effective row materials for longer duration in years or round the year and required market demand [including export potential]. The other specification such as quality assurance, preventions of adulteration and use of recommended ingredients [preservative, additives, colouring agents, etc.] should be regulated and also add cost to company; while these factors will insure sustained market demand. The major potential for crop diversification includes shifting of crop cultivation zone, market demand and higher prices for pulses and oilseed crops, increased demands of madecinal and aromatic plants, export potential due to opening of new market, technological and knowledge up gradation for protected cultivation, cooperative or hire basis facilities for processing and value addition, promotion of agro-industries in rural area and human resource development through imparting knowledge and training. These potentials are crop region specification and need to be quantified rather than considering together.

The diversification of intensive cereals based cropping system are discussed and emphasized most both at research and policy focus due to adverse effect of these cropping system on the natural resources, concerns of pollution and contribution to climate change from such cropping system [, changes in the insect-pest and disease scenarios over the years increased need of government support (through subsidies on inputs, interventions of reducing



the cost of cultivation and intensive on and above the minimum support price), increase prices of purchased inputs, as well as reducing income per unit area. The rice-wheat cropping system, rice-rice cropping system, sugarcane based cropping system as well as tobacco based cropping system are the major cropping system considered for implementation of diversification programme in India in last decade. The increased emphasis on the natural farming, promotion of organic farming, increase in diet diversification through animal origin diet/food, promotion of millets as nutritive-cereals will add the potential options for this diversification. The concern of natural resource degradation, higher input required and government intention to reduce the attention on only 2 to 3 crops in the form of subsidy and incentives through MSP will also add reasons for diversification in major cereal based production system.

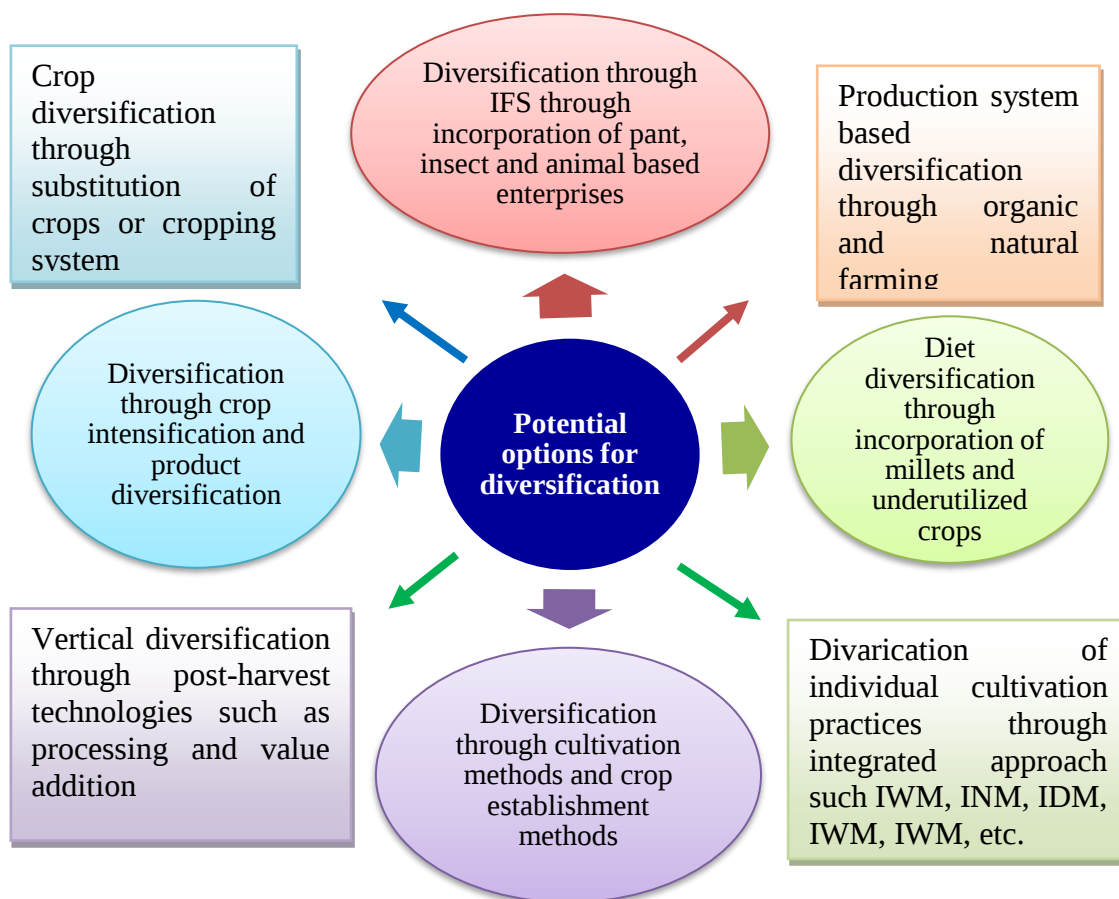


Figure 1. Broad preview of potential options for diversification in agriculture.

Diversification of cropping systems can be also achieved through incorporation of concepts such as seed village concept, in-situ conservation of genetic resources, cultivation of exotic vegetables for export, incorporating the polyhouse and shadenets based cultivation of crops/

vegetables during off-season to harvest maximum returns, cultivation of flowers and establishments of nurseries of ornamentals plants in peri-urban area as well as nurseries of vegetables and fruit plants in intensively irrigated area.

Diversification through farming system approach can be achieved through incorporating the multiple enterprises which are complimentary or supplementary to main crop based enterprises. At the same time, farming system approach provide the opportunities for enhancing the resources recycling and multiple uses of resources and input producing thereby reducing the dependence on purchased inputs []. The diversification of farm produce supply chain through different options helps in increasing the farmer share in consumer money. The options for such diversification includes reducing the chain length, organization of farmers-consumer markets, sale of farm produce through self help groups of farmers or village woman groups, small scale processing rather than selling unprocessed farm produce directly to consumers, purchase of farm inputs for entire group of farmers in *ad hoc* mode, increasing the entrepreneurship attitude among the farmers, encouraging the input production in the farm itself and regulation of sale-purchase of farm produce in perfect market with active participation of farmer representative.

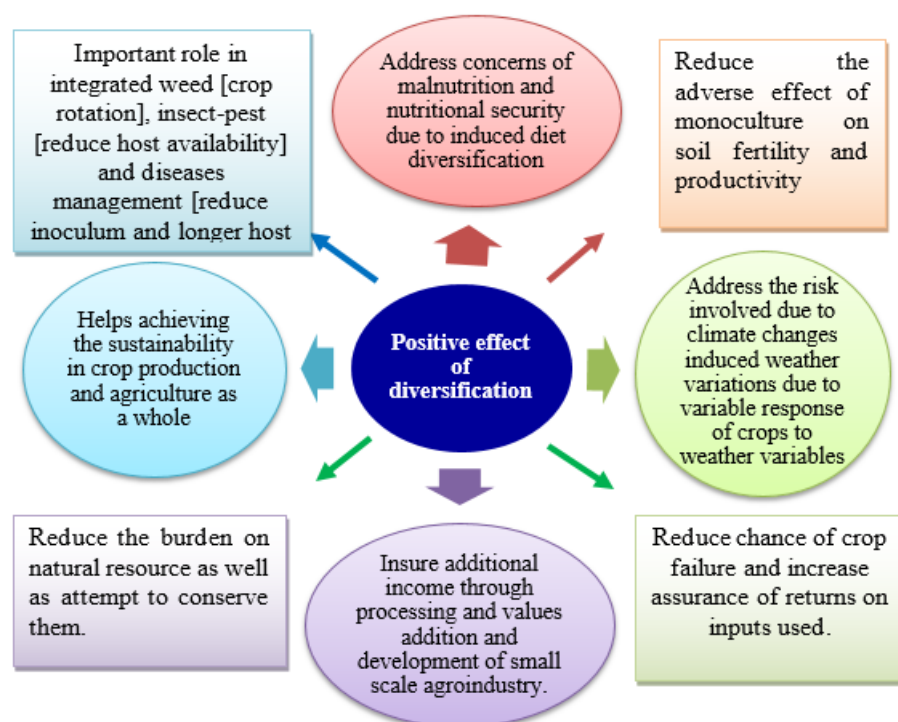


Figure 2. Potential benefits of diversification in agriculture

The diversified forms of the vegetable cultivations such as Kitchen garden, terrace garden, nutritional garden and vertical garden are the potential options to achieve the nutritional security of farm family and income security through reducing cost on purchase of vegetables. At the same time use of traditional vegetable such as different beans (Indian bean (*Lablab purpureus*), sword bean (*Canavalis gladiata*)), drumstick (*Moringa oleifera*) and grain Amaranthus also helps in diversifying the vegetable cultivations. The cultivation of fruits on farm bund and in backyard garden, promotion of improved early fruiting varieties of mango (Amrapali), banana (grand nain variety), papaya (*Carica papaya*), Guava (*Psidium guajava*), etc. and growing of fruits plants such as ber (*Ziziphus mauritiana*), wood apple (*Limonia acidissima*) and Java plum (*Syzygium cumini*) bring the diversification in agriculture. The medicinal and aromatic plants (MAPs) are the important part of the diversification considering their wider adaptability, high market demand, premier prices and capacity to grow with less resources in dryland and as well as hilly area and marginal lands. Some of the important MAPs are Ghiukumari (*Aloe barbadensis*), Tulasi (*Ocimum sanctum*), Mentha (*Mentha sp.*), lemon grass (*Cymbopogon citratus*), citronella (*Cymbopogon winterianus*) and Ashwagandha (*Withania somnifera*). Increasing diversification by introduction of fodder/ forage crop as break crops helps in achieving the several objectives such as reducing crop bounded and crop associated weed, breaking the cycles of insect-pest and disease causing pathogen, increase the opportunity for inclusion of animal based enterprises in the farming system, enriching soil with organic matter thereby enriching the soil fertility and reduce the burden of purchased input. The fodder obtained from Lucerne (*Medicago sativa*), berseem (*Trifolium alexandrium*), Oat (*Avena sativa*), pearl millet (*Pennisetum glaucum*) and Sorghum (*Sorghum bicolor*) are nutritious and fetch high prices in market due to increase in animal based enterprises in India to meet the growing need of Indian population.

Conclusion

The diversification of major cereal or commercial crop based production system helps in reducing the burden of natural resources; while diversification of small and marginal farm through integrated farming system approach helps in achieving the nutritional and income security of farm families as a whole. At the same time, vertical diversification through value addition and processing helps in achieving the self-sufficiency and helps to reduce the dependence of farm on processing units. The diversification market related activities through farmer producer organization is helps in bringing more transparency and increase the farmers share in consumer money.



Table 1. Difference between diversification and monoculture

S. No.	Particular	Diversified farm	Monoculture
1.	Complexity of management	Higher due involvement of number of crops	Lees complexity due to single crop / enterprise
2.	Susceptibility of crops/ varieties to insect-pest and diseases	Lees due to diverse range of crops	More due to single crops on large area and continuous cultivation
3.	Potential for up scaling	Vertical diversification	Commercialization through input intensive agriculture.
4.	Soil degradation versus conservation	Less soil degradation and potential for soil conservation	More soil degradation and affect soil health
5.	Resilience against climate change	More resilient with availability mitigation and adaptation options for climate changes	Less resilient and affect significantly due to weather variations and climate change.
6.	Range of products	Wider range of products	Narrow range of products
7.	Stability and sustainability in production system	More stable and sustainable	Concerns of sustainability
8.	Major interventions required	Deriving location specific diversified cropping / farming system	Addressing concern of sustainability
9.	Factor productivity	Expcted to be higher over monoculture	Decreasing due to continuous cultivation
10.	Footprint through waste generation	Expected to be lower than monoculture	Expected to be higher than diversified farm
	Mecahnization and automation	Difficult due to involvement of multiple corps and achieved though vertical diversification	High possibilities and are explored

References-

- Anonymous. 2018. Report of the committee on doubling farmers' income, Volume IX, farm linked activities and secondary agriculture, Department of Agriculture, Cooperation and Farmers' Welfare, Ministry of Agriculture & Farmers' Welfare, Government of India; available online on: www.agricoop.gov.in.
- Hufnagel, J., Reckling, M. and Ewert, F., 2020. Diverse approaches to crop diversification in agricultural research. A review: Diverse approaches to crop diversification in agricultural research. A review. *Agronomy for Sustainable Development* 40(2): p.14; <https://doi.org/10.1007/s13593-020-00617-4>.



- Shahane, A.A. and Shivay, Y.S., 2019. Viable options for diversification of rice in non-conventional rice–conventional wheat cropping system in Indo-Gangetic plains. *International Journal of Bio-resources and Stress Management* 10(4): 352–363.
- Sihi, D., Dari, B., Sharma, D.K., Pathak, H., Nain, L. and Sharma, O.P., 2017. Evaluation of soil health in organic vs. conventional farming of basmati rice in North India. *Journal of Plant Nutrition and Soil Science* 180(3): 389–406.
- Yadav S.K., Kauldhar B.S., Sandhu P.P., Thakur K., Sucheta and Sharma T.R., 2020. Restrospect nad prospects of secondary agriculture and bioprocessing. *Journal of Plant Biochemistry and Biotechnology* 29(1): 1–14; <https://doi.org/10.1007/s13562-020-00550-3>.
- Yadava, D.K., Choudhury, P.R., Hossain, F., Kumar, D. and Mohapatra, T., 2020. Biofortified varieties: sustainable way to alleviate malnutrition. Indian Council of Agricultural Research, New Delhi, p. 86.

