International Journal of Modern Agriculture, Volume 10, No.2, 2021
ISSN: 2305-7246

Study on Crop Diversification & Diversified Farming System

Benaka Prasad SB[1], Humeera Tazeen[2]

[1] Department of chemistry, Faculty of Engineering and Technology, Jain (Deemed-to-be University), Karnataka
[2] Food Technology, Faculty of Engineering and Technology, Jain (Deemed-to-be University), Karnataka
Email - sb.benakaprasad@jainuniversity.ac.in

Abstract

Crop diversification is among the most pocket friendly means of reducing farmers' income uncertainties, especially for poor small farmers. Poverty, however, is a nuanced term that requires more than just money. This analysis looks at the influence of the divergence of crops to Sustainable Development Goals, while also taking account of other dimensions of poverty: food safety, nutrition and climate change vulnerability. Indian rural economies are essentially known as crop economies. The diversification level of agricultural enterprises represents the degree of economic growth in rural areas. Agriculture is faced with the omnipresent issue of decision-making on the profitable diversification of crop production. The crop diversification has been largely seen as a ray of hope for their economic development for the rural economy as a whole, and particularly for small and marginal farmers. Agricultural diversification is often practiced to avoid risks and uncertainties that indicate climate and organic vagaries. The farmers in general grow their livelihoods at the early stage of growth. As the population increases, they are trying to grow more so that overall output in the farm is maximized.

Keywords: crop diversification, ecological balance, farmer income, fertilizers, sustainable development goals

Introduction

Climate change has become a significant global challenge to sustainable farm production and livelihoods. The danger in severe climate changes, such as droughts, floods, heat waves and cyclones, is more apparent. Huge cases affect farming productivity and food supply, cause loss of productive assets (e.g., livestock), intensify rural poverty, drive out migratory powers, reduce demand for industrial products and services and trigger over-exploitation of natural resources (e.g. water, soil, and forest).A deepening crisis is facing global food security. Food demand will increase over the decades to come but increased development will destroy the climate, with detrimental consequences for humanity, as new ground is transformed into agriculture. Therefore, production gaps must be increased by unit area output from existing croplands to close output gaps. Depending on current production levels, however, heavy use of input including pesticides and fertiliser can affect wildlife as well as the environment and put human health at risk. Environmentally sounding aims to increase output by more careful use of feedback with minimal adverse effects.

Biodiversity encompasses the role of the ecosystem & provides services like biological pest control & nutrient cycling which may reduce dependence on synthetic input but are characterized by poor biodiversity by traditional agricultural systems. Strategies for supporting biodiversity & ecosystem services into the traditional agricultural systems, comprising agroenvironmental schemes have been recommended, but have restricted consumption and succeeding since implementation is challenging and could result in reductions in yields even in the direct response to a single result like pest control. While several researches indicating scope for agro ecological strategy in smallholders' farming areas, studies on higher input systems are lacking, for example, in East African grain crops. In multiple countries and years, no work evaluated a comprehensive intervention and monitoring treatment to decide whether ecosystem amenities mitigate the need for artificial contributions at a local level without the gain penalty. [1]

Diversification in crops is one of the cheapest ways to increase farmers' incomes, particularly between poor farmers. Poverty is, however, a complicated term that requires more than money. This analysis examines the contribution of diversification of crops to the "No Hunger" sustainable development target, taking into account other aspects of deficiency, including gender equity, food safety and nutrition besides climate change susceptibility. It shows that it is not good analysis of the influence of crop divergence to food protection and nourishment, gender equity and the discount of farmers' resistance to temperature change. While many factors influenced the use of crop diversification in the studies, they have nothing to do with poverty reduction. To evaluate the impacts of crop divergence to sustainable expansion goals as shown in fig. 1, new methods of analysis and policy assessment that pursue a sustainable approach to poverty should be undertaken.

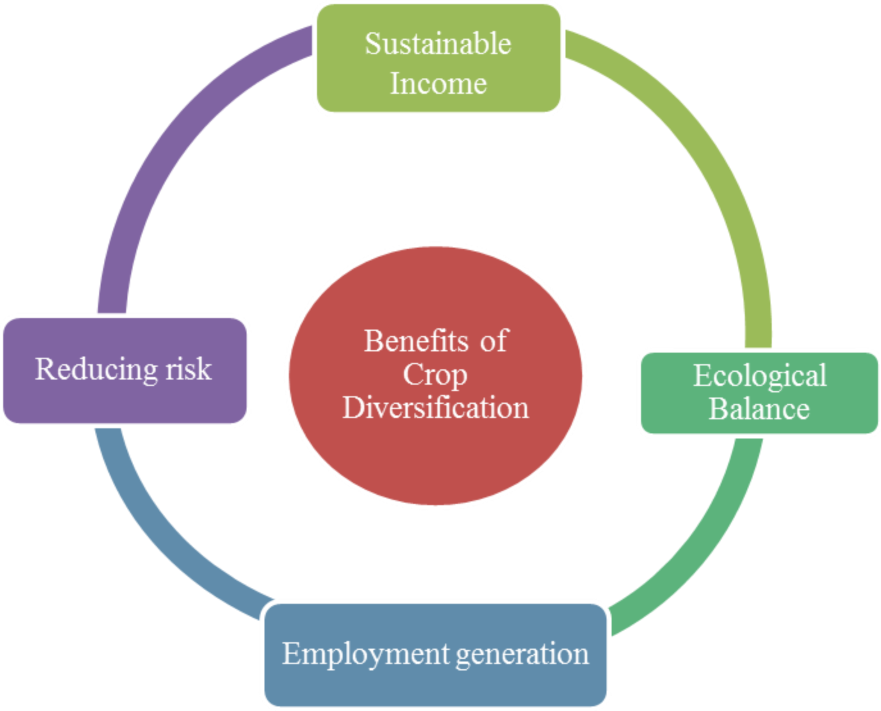

Figure 1. Benefits of Crop Diversification in Agriculture

Diversification of crops can be seen as an effort to increase crop diversity by, for example, crop rotation, multiple plantings or cross-cultivation as opposed to advanced agriculture in order to boost the efficiency, stability & delivery of ecosystem services. This could be a step towards creating more sustainable systems of small-scale production, developing value chains and contributing to socio-economic gains. Practices of crop diversification include increased crop diversity, more diversified crop rotations, mixed crops, cereal-dominated cultivations, perennially or grassland crops and regionally adapted species or variety mixes.

Crop diversification and/or additional measures such as seed variable or changing crop trends may lead to higher besides more stable prices, increase effectiveness and result in greater long-term pliability of agricultural ecosystems. These practises can lead to more space, time and genetic diversion in crop systems. Diversifications have a more regular or constant soil covering and varied management policies, including 'plots' of land,' 'sowing dates', 'fertilization,' 'irradiation,' 'harvesting' and the reduction in workplace and economic risk, with the consequences of diversification of phenological phases (relevant for biodiversity and adaptation to climate changes).

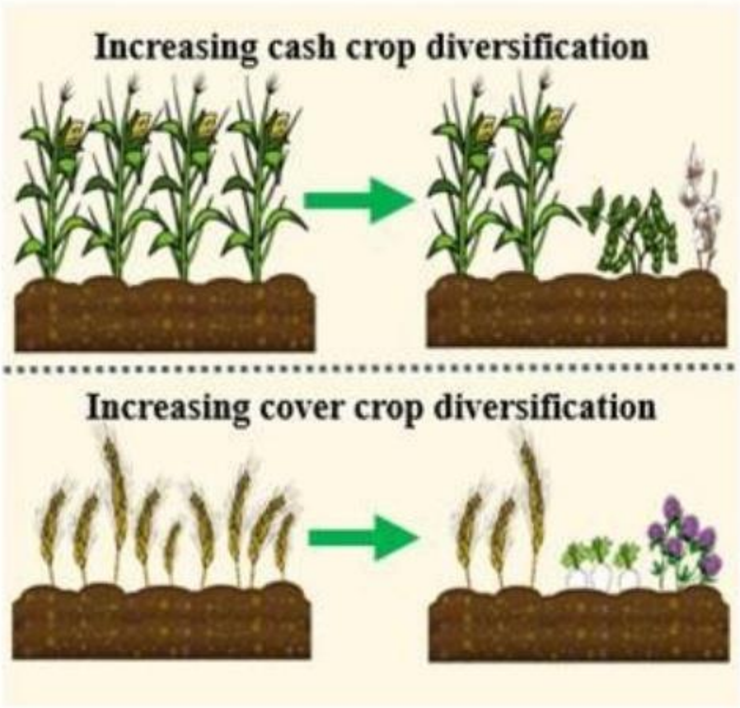

Figure 2. Cash & Cover Crop Diversification

A deeper examination at 'diversification' shows that the word does not have a simple definition and that is why it is recycled in very different senses. Many writers use term only to designate divergence by crops, such as mixed cultivations. Others only refer to management techniques for diversification, e.g. varying seed periods. Few use it to combine the method of cultivation and management. For the scale evaluated the same is true: Field, farm and landscape surveys are carried out. Diversification concepts which apply to each stage of crop diversification, for example covering crops and diversification by managing strategies such as lowering field layering, construction systems at farm and designated measures at countryside levee rely on this very complex diversification approach. In a diverse approach to agriculture, it is not clear in which circumstances diversification steps are chosen. In a diverse approach to agriculture, it is not clear in which circumstances diversification steps are chosen. The selection of the mixture of procedures seems to focus on conceptions of diversity as well as depends among other things on the reliance on ecosystem services (ES).

Diversification of crops provides an excellent opportunity to achieve food security without affecting our environmental footprint. Rotation of crops in agricultural systems and crop coverage have been very successful strategies worldwide for achieving crop diversification as shown in fig. 2. The advantages of these isolated methods are well known as shown in fig. 3. But we are not yet able to grasp the merits of double crop diversification, one way to construct sustainable production systems by rotating crops in rising seasons and another way by covering crops in non-cultural seasons for particular areas, namely the South East of the United States.

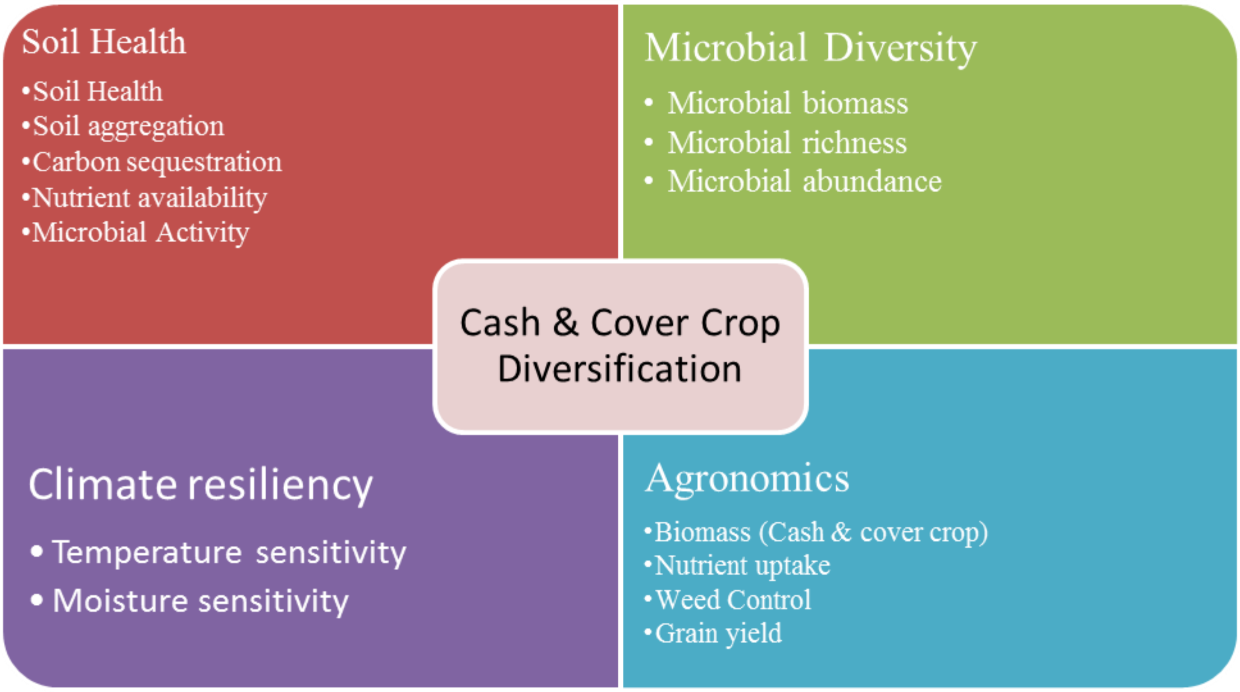

Figure 3. Overview of cash & cover crop diversification

LITERATURE REVIEW

Pretty Et Al. [2] found that Out of 208 farming diversification programs, 89 have contributed to an intensification in food production per hectare in 52 developing countries: the intensification of household gardening, including rice packs, and paddy-fish ponds on paddy-fields, cow & tree farms. The effect of crop diversity on food production for successful projects was extremely high and on average contributed to 93 percent growth in food production per hectare. They came to the conclusion that there were considerable positive consequences for food safety for the direct connection between food production and food safety for the 89 diversification initiatives.

Diversification of crops was critical in improving the food safety of households in central Malawi. There are widespread challenges posed by land degradation and declining productivity in smallholder farming and reinforced food manufacture systems. Farmers are dominated by agriculture in this region. Maize is the main food crop besides is thus grown by most farmers regardless of their soil suitability.

Snapp Et Al. [3] establish a positive relationship in Malawi among crop diversification & food diversity. These authors stated that a 2% increase in the quality of family diet in average intercrop quantities per maize farm was associated with the increase of a single unit and a 1% increase in maize crops cultivated on a farm.

Makate Et Al.[4] also noted that the diversification of crops had a major positive effect on cereal crop production, food security and nutritional indicators in Zimbabwe. It was necessary in Nicaragua to combine maize and beans that farmers accomplished in their maples for a long time, but the study found that adding additional crops and fauna, did not have significant effects on periodic starvation and that an combined approach to agro-ecology was needed. Guatemala showed that crop diversity trends vary widely across and across regions and that the poverty of food and hunger in comparison to maize and wheat diversified small farmers, who diversified from maize to kitchen pot is negative.

Nelson Mango Et Al.[5] discussed enhancing household food protection by crop diversification in central Malawi. The challenges posed by land degradation in the region in small and rain-based food creation systems are rising, and decreasing terrain fertility is dominating the farming sector. Maize is essential food crop, as such, most farmers cultivate it irrespective of whether the land is suitable. These prompted scientists to refer to it as "the maize poverty pit." Maize does not insecure food for farmers in the event of extended drought. Investigation in Sub-Saharan Africa, however, has exposed that the divergence of crops offers farmers diverse diets, increases incomes and enhances food safety. Following the climate change process, the government of Malawi has stepped up extension efforts in the past few years to diversify crops due to hunger and food insecurity.

At the same time, Bacon Et Al.[6] aims at deepening our social consequences understanding of the Diversified farming System (DFS) versus industrial development and to uncover a number of key influence on the continuity, transition and transformation of such structures. Case studies from the Central Valley of California, the Mesoamerican coffee agroforest systems, and the European Union's agricultural parks describe the key role that government policy has played in the emergence of the agriculture sector & the combination of the consumer demand & continuity-based governance system. They find DFS spread to generate social benefits such as reduced pesticide exposure, improved food protection, long farm season and healthier diets, as well as generating new costs, such as higher demand for manual labour in musculoskeletal wounds. Social movements will change governance and affect the spread of the DFS as well as policy-making that increases environmental gain and reduces social costs. More broad-based changes are therefore required to allow the socially sustainable expansion of DFS in market besides political systems and agricultural financial policies.

ROLE OF THE DFS IN UPLIFTING FARMERS SITUATION

We term a system of farming as "diversified" if the system requires functional biodiversity on a variety of spatial and/or temporal scales, using conventional and/or agro ecological know how. This usable biodiversity is managed by farmers to generate essential agriculture ecosystem services. Diversified farming systems (DFSs) involving many genetic variants of a specific crop and/or multiple crops cultivated as multicultural in the region (i.e. inside field), and they may encourage biodiversity in the soil by adding compost or manure. For cultivations, we say annual or perennial cultures, like tree crops. DFS can cover polyculture, non-crop planting, for example, insecticide strips, cattle or fish integration with crops, and/or crop rotation and livestock rotation over time, such as crop cover and grass rotation. DFS may include non-cultivated seedlings on boundaries like living fences and hectares, across the ground.

DFS can include, on a landscape scale, natural or semi-natural plant and animal populations of croplands in/region such as fallow fields, river buffers or combinations of riparian wilderness, pasturelands, meadowlands, woodlands, swamps, streams, rivers and lakes. Both the desired components of biodiverse and the related ecology preserve the resulting heterogeneous ecosystems. Agrobiodiversity components in a diversified farming system (DFS) communicate with each other and/or the corporeal environment to provide essential ecosystem services such as soil growth, nitrogen fixations, nutrient pedaling, water penetration, the elimination of pests or diseases as well as pollination.

Spatial considerations are critical since various component parts of the system have to be close enough to establish interactions and synergies at each relevant scale. For example, it depends on the separation between the different plants, so that their root systems interact, for the use of intercropping to mitigate underlying soil disorder. Similarly, wild bees can only provide full crop pollination if there is a adequate proportion of their normal habitat inside a given coldness from cultivated fields. DFS is not only spatially heterogeneous; due to human activities or natural succession processes it is also time consuming vector (e.g., harvests, crop rotations, ploughs, and other land organization or land usage change).[7]

Agro ecology and DFS

Agricultural ecology has been used for the ecological study of agricultural systems for more than 80 years. Many agro-ecological activities are designed to bring about respectful dialogue with indigenous and local knowledge used by farmers to manage environmentally sustainable processes in existing agroecosystems through western science knowledge. Recently, science has advanced into the social as well as economic aspects of food arrangements. Agricultural environment was also part of the response to industrial agriculture in the Green Revolution in various social movements looking for substitutions to industrialized agro-food systems.

Thus, agro ecology has many definitions and may apply to a number of sustainable farming practices or social movements, inter- or transdisciplinary sciences. DFS is not the agro ecological option.

Instead, DFS is a framework which draws an analysis and action orientated emphasis from agro-ecological, social and conservation sciences on agriculture systems, where cross-scale ecological diversification is an important instrument for ecosystem services, regeneration and the delivery of critical input to agriculture. Agro ecological concepts and methods can be employed for the evaluation of DFS and for the creation or revival of diversification processes. In this essay we are discussing the consequences, as well as the interplay between DFS and the current industrialized agricultural systems, supply chains, national & intercontinental policies of the ecological health and socio-economic wellbeing of the DFS. [6]

Advantages of Diversified Agroecosystems

Existing knowledge has shown that climate alteration can influence both the biotic (pest, pathogens), abiotic (radiation, temperature and water) of plant systems and the sustainability of food production and crop production. In order to achieve better performance under changing environmental conditions in view of expected changes in biotech conditions, more different agroecosystems with a broad range of characteristics and functions. Some of the main ways to prevent environmental change have been identified in order to protect crop production through the greater functionality of various agroecosystems.[8][9]

Pest suppression:

Pest control represents a permanent threat for farmers and an ecosystem service of great importance. Herbivorous insects may have important effects on plant production in agricultural systems, as in natural ecosystems. The challenges posed to pest control could be further stepped up in the future as climate change impacts pest ranges and eventually leads to new pests. The range extension and changes in phonological conditions are usually expected to increase insect pests as temperatures rise. Increased populations, development, migration and wintering will accompany this wealth. Changes are unlikely to occur at the same rate in the distribution and abundance of organisms and populations. Migrant pests will respond to climate change more swiftly than plants, and newly available plants and ecosystems will be able to colonies. There are still many obstacles to growth, including biotic factors such as rivalry, predation and other species parasitism. Facilitating such obstacles to the expansion of the range and the viability of the plague can directly negatively influence plague outbreaks and helps to protect farm productivity.

Disease suppression:

Losses of diseases can lead to deteriorations in crop production, and climate variations can potentially impact crop distributorisation in the new crops. From 2001 to 2003, pathogens illustrated 10% of the worldwide losses of wheat, rice and maize crops. The variety of crop species in an agroecosystem is much less stable than crop pests in terms of productivity and severity of a disease. The effect of climate alteration on disease incidence is even less convinced. Climate change can affect plant people positively, negatively, or in no way, but milder winters can suspend many crop circumstances for other diseases such as cercosporea lead spot illness for powdery mildew, brown rust, or strip roust. Climate change may have a positive or negative effect. Worldwide transition will also affect the distribution and availability, affect the transmission rates and possibilities of arthropod vectors that transmit viruses.

Buffering & mitigating climate instability:

As climate variations have increased, diversified agroecosystems are becoming more important in agriculture. Study has also exposed that crop harvests are highly sensitive to changes in temperature and plumage, particularly during flora and fruit expansion. Temperatures of maximum and minimum and seasonal changes can impact crop growth and development significantly. In several areas of the world, increased precipitation fluctuations, including overflow, drought and severe rainfall have influenced food security. Several important crop species have identified agricultural vulnerabilities. Rice production observations in the Philippines showed reduction in seed weight and in general production during the El Niño drought season. Wheat studies demonstrated a reduction in grain number and weight in heat pulses on the anthesis, demonstrating the effects of grain fill by temperature peaks. Researchers in maize have noted a reduction in pollen viability above 36 degrees Celsius in a variety of other plants.

Diversified agriculture and their barriers and challenges:

Economic policy inducements for the intensive management of the monocultures overwhelmed the incentives for the operation of diversified agriculture systems. Second, a great deal has been done to adjust agriculture to climate change by developing biotech strategies for the manufacture of drought-resistant plants that encourage agriculture to be more cost effective and in-depth. Finally, the mistaken assumption of the fact that biomass production is far higher in single crop systems than in multiple systems has hampered the transition to various systems. These barriers slower the rate of adoption as adaptation options of expanded agricultural systems and need to be spoken to speed up implementation of this strategy.[10]

DISCUSSION

According to the studies found, there is a largely positive contribution from crop diversification to the increase of food security & nutrition in poor families. The monocultures as well as intensively controlled organizations are more effective than expanded farming systems are a encounter to further drive agricultural systems towards greater multiplicity. The main goal of the modern agricultural model today is to maximize the production of biomass in one or two crops. Although ecosystem operations continue at a much smaller capacity, an absence of high-performance functionality can be replaced by external organization such as mechanization, chemical products and irrigation organizations. However, the future impact of temperature change on agriculture stability will also be complicated by our forecasts on production in addition to pricing of goods from large monocrop systems.

Experiments in Grassland demonstrated that a greater diversity of plant species is linked to increasing temporary stability over annual production of plants, showing that increased biodiversity can increase the provision of food, such as food forages, as productivity and sustainable. In a study that examines the effects of plant and herbal bio-mass on perennial herbicide polycultures, biomass increases log linearly with species wealth while pole cultures outgrown monoculture crops by an average of 73 percent. Land studies that manipulate variation in crop rotations also showed production growth and significantly increased maize grain yields and a more diversified crop. These findings show that various crops can generate higher as well as more reliable yields that increase the economic advantages of farmers as well. Though, all research has not shown that superior diversity helps to increase productivity. Three to six species of bio diversely rotated systems generated 25% less than the integrated single farm grain systems but the grains were of advanced superiority in one study. The higher superiority grain from a more biodiverse system must have a higher value to compensate for the financial benefits of greater manufacture of lower excellence monoculture.

CONCLUSIONS

This paper discussed that farmers are faced with increasing stress due to climate change and that increased deployment of crop diversification and diversified agrarian systems can be a industrious way of building pliability in farming systems. Scientific and political problems are at the heart of rising implementation of diverse farm management strategies. In the science field it could be supported to implement diversified farming systems if sharecroppers had a better understanding of optimizing a expanded framework for maximizing making and benefit. Models for crop besides landscape simulations that could simulate a variety of climate scenarios and landscape modelling using farm situations can enable farmers to find optimized production and benefit maintenance strategies. Participatory research focused on stakeholders would also be extremely helpful, as investigators would model approaches which seem plausible to farmers. In the area of policy, it could theoretically be possible in the USA to increase diversification within agricultural systems by adapting the income support schemes to encourage more diverse farming systems that support small farmers.

Diversified farming internationally has a significant role to play in the protection of food security besides development in areas with limited access by farmers to chemical, systemic or technical capital. A global study on diversified agricultural policy concluded that local seed and ecological agriculture better address the challenges of the developing world's climate change, hunger, poverty and productivity demands. The study has also shown that these more complex systems' environmental processes can be recycled to farmers from climate change in addition to enhance their food safety. Sympathetic the possible for rising diversity in agricultural systems is important if farmers are to adapt to greater future climate inconsistency. By adopting agricultural systems which promote bionetwork services for control of pesticides and diseases and resilience to the variability of climate changes, farmers are more resilient to environment change and are less at risk of losing output.

REFERENCES

1. G. M. Gurr et al., "Multi-country evidence that crop diversification promotes ecological intensification of agriculture," Nat. Plants, 2016, doi: 10.1038/NPLANTS.2016.14.
2. J. N. Pretty, J. I. L. Morison, and R. E. Hine, "Reducing food poverty by increasing agricultural sustainability in developing countries," Agric. Ecosyst. Environ., 2003, doi: 10.1016/S0167-8809(02)00087-7.
3. S. S. Snapp and M. Fisher, "'Filling the maize basket' supports crop diversity and quality of household diet in Malawi," Food Secur., 2015, doi: 10.1007/s12571-014-0410-0.
4. C. Makate, R. Wang, M. Makate, and N. Mango, "Crop diversification and livelihoods of smallholder farmers in Zimbabwe: Adaptive management for environmental change," Springerplus, 2016, doi: 10.1186/s40064-016-2802-4.
5. N. Mango, B. Zamasiya, C. Makate, K. Nyikahadzoi, and S. Siziba, "Factors influencing household food security among smallholder farmers in the Mudzi district of Zimbabwe," Dev. South. Afr., 2014, doi: 10.1080/0376835X.2014.911694.
6. C. Kremen, A. Iles, and C. Bacon, "Diversified farming systems: An agroecological, systems-based alternative to modern industrial agriculture," Ecol. Soc., 2012, doi: 10.5751/ES-05103-170444.
7. M. A. Aizen et al., "Global agricultural productivity is threatened by increasing pollinator dependence without a parallel increase in crop diversification," Glob. Chang. Biol., 2019, doi: 10.1111/gcb.14736.
8. P. A. Matson, W. J. Parton, A. G. Power, and M. J. Swift, "Agricultural intensification and ecosystem properties," Science (80-.)., 1997, doi: 10.1126/science.277.5325.504.
9. M. A. Altieri, "The ecological role of biodiversity in agroecosystems," Agric. Ecosyst. Environ., 1999, doi: 10.1016/S0167-8809(99)00028-6.
10. B. B. Lin, "Resilience in agriculture through crop diversification: Adaptive management for environmental change," BioScience. 2011, doi: 10.1525/bio.2011.61.3.4.