

A Comparative Study of Agricultural Practices in Villages of Solan District, Himachal Pradesh

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ABSTRACT: The world is at a critical juncture given climate change. There is a dire need to move away from earth-eating farming techniques to sustain in the future. Sustainable agricultural practices minimize the damage of natural resources. The agricultural sector is the mainstay of the Indian economy. A comparative study was conducted to explore the agricultural practices using qualitative tools of data collection. The data were collected from 35 households of villages of Nauni, Shamror, and Thana Panda from Solan district, Himachal Pradesh. The present study shows the increasing share of small landholdings in the Indian scenario. Awareness and funding are the two critical factors to include small landholdings in the sustainable growth of agriculture.

INTRODUCTION

The word agriculture is derived from two Latin roots: *ager* which means “field” and *culture* which carries a double meaning in English of both to cultivate and the way of life. The term agriculture refers to the intentional cultivation of plants and tending of domesticated animal species for human benefit. Agriculture has been the dominant human economy since cultivation originated independently 3-10 million years ago in several different old-world regions (Mannion, 1999). Humankind came up with settled agriculture during the Neolithic period (4000-1800 BC). The main agricultural sites were in southeast and southwest Asia, which now constitutes India, Iran, Iraq, Israel, and the adjoining areas. Nile River in Egypt, the Danube in Europe, and Indus-Ganga in India were the main centre of the agricultural farmlands. Agriculture today is the basis of humankind.

India is a developing country that relies on the agriculture sector for 17% of the total Gross Domestic

Product (GDP). This primary sector, that is, the agriculture sector employs around 58% of the population. During the two years of the pandemic, when other sectors were not doing well, agriculture shone like a bright star for the Indian economy. With changing times, there has been neoliberal thinking that to grow economically, India needs to sacrifice agriculture. On the contrary, to achieve inclusive growth across all the countrymen India needs to focus on its primary sector. The need of the hour is to make farming an economically viable and sustainable practice. There is a global change in the environment. Natural resources are stressed more than ever. Increasing globalization, industrialization, and urbanization are responsible for the decline in the quality of air, soil, and water. Land degradation and depletion of groundwater are of major concern for Indian agriculture. Land degradation may occur due to agro-climatic conditions such as slope, rainfall etc., and/or man-made factors such as deforestation, over-cultivation of cropland, overgrazing, etc. Overdependence of agriculture on rainwater is also

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an issue. To tackle the climate change catastrophe in the future, India needs to develop sustainable agricultural practices. To further boost development across, the need of the nation is healthy and sustainable agriculture, a healthy environment, and wealthy farmers.

Sustainable agriculture is that which is healthy in the eco-system, economically viable, socially equitable, and humanitarian. A healthy ecosystem can be achieved by self-regulation and resource use efficiency. Self-regulation can be achieved by introducing diversity in species and resource use efficiency by using viable use of various resources. Sustainable agriculture is a combination of three goals – environmental health, social equity, and economic viability.

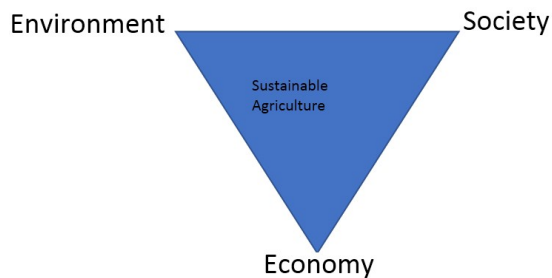


Figure 1: Sustainable agriculture gives equal weight to environmental, social, and economic concerns in agriculture.

Source: Nature Education Courtesy of Brodt *et al.*, 2011.

Economic viability means that there should be a positive net return. It should also provide for the family's well-being health, satisfaction and security. Social equitability means that the system must ensure that resources and power are distributed equitably so that the basic needs of all are met and their rights are assured. Environmental health is ensured by the judicious use of natural resources such that the needs of today are met keeping in mind the needs of future generations.

Need for Sustainable Agriculture

The interest in the sustainability of agricultural and food systems can be traced to environmental concerns that began to appear in the last four decades. It is increasingly recognized that development initiatives that pay attention to local perceptions and ways are more likely to be relevant

to people's needs and to generate sustainable interventions. The imperativeness of sustainable agriculture can be described by considering the aspects of food security of human and animal life, economic growth of a nation, protection of precious natural resources, maintenance of a stock of reserves for future generations, and a rise in the standard of living of farmers and their families.

Agro-economic Research Centre (2018)¹ researched on the socio-economic and ecological sustainability of Malana village. This is a repeat survey of Malana village after 25 years. It discussed potential attributes as indicators of the sustainability of the mountain system in Malana hills. The production of traditional crops is considered to be uneconomical due to the primitive nature of crop production, harsh climatic conditions, and availability of alternative options to get more return from the small land base. Verma *et al.*, 2019 discussed the strategies to improve the sustainability of agriculture, soil fertility, and the economic development of farmers.

Indian farmers are becoming poor due to the daily deterioration in agriculture, the main reasons for this, not receiving quality-based seeds, delay water irrigation, reduced soil fertility, and excessive use of chemical fertilizers.

Snyder and Cullen (2014) conducted fieldwork in Ghana, Ethiopia, and Tanzania. They explored how fundamental social dynamics in rural landscapes are often overlooked by sustainable intensification interventions. Small farm size is not tenable for living. But still, farmers don't give up on their traditional livelihood. Land acts as a basis for a sense of belonging to their community and their family.

Sustainability in agricultural systems incorporates concepts of both resilience (the capacity of systems to buffer shocks and stresses) and persistence (the capacity of systems to continue over long periods) and addresses many wider economic, social and environmental outcomes.

SMALL LANDHOLDINGS AND INDIAN AGRICULTURE

Small landholder farmers are vital for India's agriculture and rural economy. Small landholder farmers are defined as those marginal and sub-marginal

farm households that own or/and cultivate less than 2.0 hectares of land constitute about 86 per cent of the country’s farmers (Agricultural Census, 2015-16)². Their contribution to household food security and poverty alleviation is disproportionately high and is increasing. Moreover, as the national population increases, the number of small-holdings increases. Increasingly smallholdings may lead to non-cultivable land. As per the latest information available from Agriculture Census, the average size of operational holdings has decreased from 2.28 hectares in 1970-71 to 1.84 hectares in 1980-81, to 1.41 hectares in 1995-96 and 1.08 hectares in 2015-16.

Cleaveland (1998) in his studies gave examples of non-sustainable smallholder intensive agriculture like the Kusasi. There are several determinants for the sustainability of small landholders. Myers (1995) talks about the importance of the study of the local farming system and the analysis includes sustainability of the farming system before the introduction of exogenous changes.

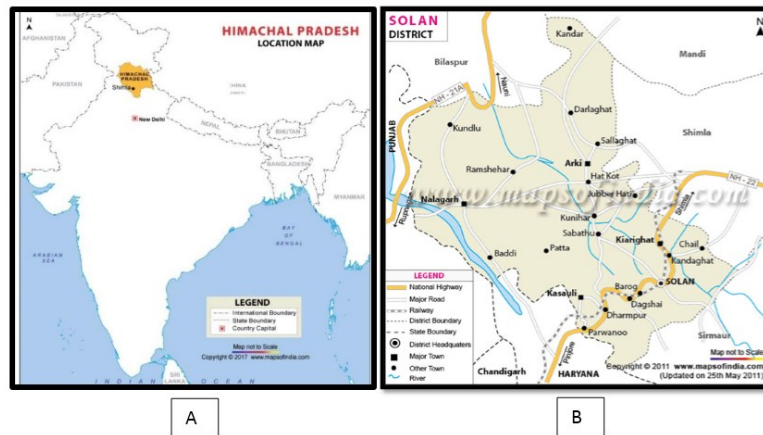
Thus the rationale of the present study is based on the need to focus on fundamental questions of how sustainable our current food systems and

evolutionary trajectory are, given the factors of climate change, economic inequalities, and our over-consumption of Earth’s resources. The present study addresses a significant technological change in human history, that is, food production(agriculture) and the need for changes in agricultural practices. To understand these, an attempt has been made to conduct a comparative study of agricultural practices in villages of Solan district, Himachal Pradesh. Following are the objectives of the study:

Objectives of the study: a) To study the inclusion of small landholders in sustainability; b) to study the type of agriculture and its sustainability; and c) to study the awareness among farmers about the government schemes.

METHODOLOGY

The present study entails the descriptive method of research. The present study was conducted in the Solan district, Himachal Pradesh. The State of Himachal Pradesh has been divided into agro-climatic zones. Solan falls in the agro-ecological zone of sub-tropical, sub-montane, and low hills.



(A) Location of Himachal Pradesh in India.
 (B) Research area of the present study in Solan district.
 Source: www.mapsofindia.com

A set of 21 questions were prepared by the researcher. The data was collected from three villages and 35 households. The researcher has selected one respondent from each household. So a total of 35 respondents were interviewed. It is to be mentioned here that the majority of the respondents interviewed

were females.

STUDY MATERIALS

Purposive sampling was conducted to meet the study’s objectives. So, people practicing agriculture,

animal husbandry, and labourers, employed women were interviewed. Those individuals were interviewed who were available depending on convenience, time, and money and it is called the Availability Sampling. Snowball sampling was also used where the respondents provided references for further sampling. Both the primary and the secondary data were collected from the units of study selected during this period. Primary data is the first-hand information and to collect it such methods were used as Observations, Interviews, and Case Studies, and Secondary data was collected from reference sources like census, internet databases. Table 1 shows the area and number of households of the study area.

TABLE 1

Area and number of households studied

Name of the village	Total households	Area of the village in hectares*	Cultivators*	Selected households
Nauni	44**	95.46	30	20
Shamror	16**	16.64	34	10
Thana Panda	6*	43.57	11	5

Source: * Data from District Census Handbook, Solan, 2011.³
** Data from Gram Panchayat Nauni Majhgaon, 2018.

RESULTS AND ANALYSIS

Solan district receives an annual rainfall of around 1200 mm. The distribution of rainfall is erratic. Soil is normally neutral which varies from Sandy loam to clay loam. The current area of study was in proximity and had access to Krishi Vigyan Kendra in Dr. Y. S. Parmar University of Horticulture and Forestry.

In Solan, there are two main crops seasons: (1) The Kharif season (season of the summer crops), and (2) The Rabi season (season of winter crops). Crops grown in the Rabi season are *kanak* (wheat), *kale chane* (black gram), *masur* (lentil), and soya bean. Crops grown in the Kharif season are *kukri* (maize) along with the pulses such as *mah* (black beans), *safedmah* (rongi), *rajma* (French bean). Vegetables grown in the summer season are *lauki*, ladyfinger, cucumber, cabbage, brinjal, green beans, tomatoes, and many more. Vegetables grown in the winter season are cauliflower, turnip, peas, spinach, onions, etc.

The data is presented according to thematic

categories such as agricultural practices, awareness about government schemes among farmers, etc. based on interview responses, open-ended discussions with participants, and field observations. The data is presented along with an analysis of the data.

Agricultural Practices

Organic farming is increasing its base in the state due to the low cost of input involved. A decreasing trend was observed among the farmers to use chemicals and chemical-based fertilizers which is not only saving them a lot of money as they use the naturally available resource but it is also increasing nutrients in the soil, leading to improvement of soil health in fields.

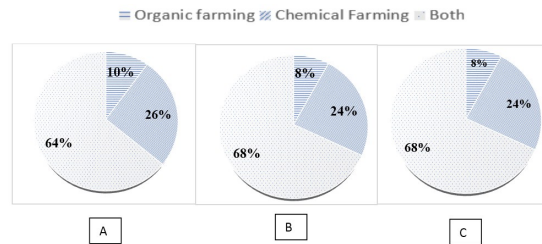
Types of Agriculture

Figure 2: Types of agriculture in villages (A) Nauni, (B) Shamror, and (C) Panda.

It was found that in Nauni village, 10% of farmers opt for organic farming, 26% opt for chemical farming and 64% of farmers opt for both. In Shamror village, 8% of farmers opt for organic farming, 24% opt for chemical farming and 68% of farmers opt for both and in Panda village, 8% of farmers opt for organic farming, 24% opt for chemical farming and 68% farmers opt for both. As per findings, maximum people practice both types of farming. Some people preferred chemical methods to increase their output while some who faced degradation of soil quality and low production, resorted to organic farming which was used by them in past times. The reason behind low productivity is that farmers are facing the deadening and homogenizing impact of economic globalization of the world.

Methods of Irrigation

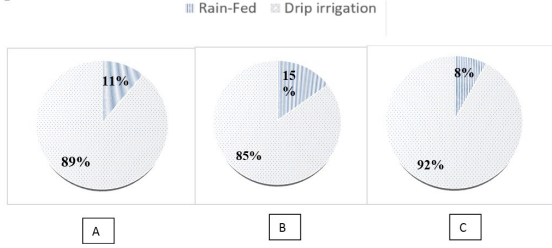


Figure 3: Methods of irrigation in villages (A) Nauni, (B) Shamror, and (C) Panda.

It was found that in Nauni village, 11% of farmers opt for a rain-fed method of irrigation and 89% of farmers opt for drip irrigation. In Shamror village, 15% of farmers opt for a rain-fed method of irrigation and 85% of farmers opt for drip irrigation and in Panda village, 8% of farmers opt for a rain-fed method of irrigation and 92% of farmers opt for drip irrigation. In all three villages, no farmer opted for a well-irrigated method of irrigation. Irrigation facilities were good in the area. The fields were supplied with micro-sprinkler irrigation facilities. Each of the three villages had community irrigation tanks. People said that there has been a tremendous decrease in the rainfall in past few decades.

Agriculture Practice Mechanism

Figure 4 suggests that in Nauni village, 5% of farmers opt for tractors, 70% of farmers opt for traditional tools and 25% of farmers opt for solar energy as an agriculture practice mechanism. In Shamror village, 5% of farmers opt for tractors, 70% of farmers opt for traditional tools and 25% of farmers opt for solar energy as an agriculture practice mechanism and in Panda village, 8% of farmers opt for the rain-fed method of irrigation and 92% of farmers opt for drip irrigation. In all three villages, no farmer opted for a well-irrigated method of irrigation. Respondents said that “earlier the wooden plough driven by a bull was used in preparing the soil for sowing seeds and plantation, but later on iron plough replaced them. Now, in Nauni, a mini tractor was being used which has the facility due to its geographical position and has access to roads. But Shamror being situated at a higher slope and no proper road facility to reach there, farmers still use lesser technologies. Hand-held machinery is used. Nauni has also access

to other latest technologies. Panda village is completely equipped with solar energy.

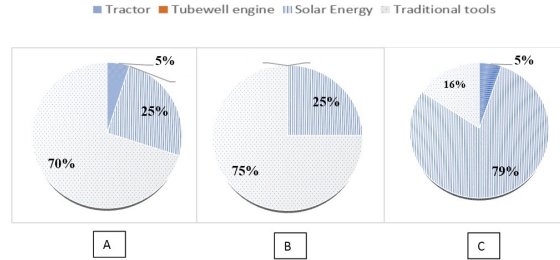


Figure 4: Agriculture practice mechanism in villages (A) Nauni, (B) Shamror, and (C) Panda

Methods of Agriculture

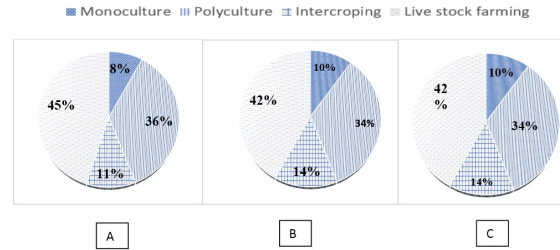


Figure 5: Method of Agriculture in villages (A) Nauni, (B) Shamror, and (C) Panda.

Figure 5 suggests that method of agriculture adopted by farmers in Nauni village, 8% monoculture⁴, 36% polyculture⁵, 11% intercropping, and 45% livestock farming whereas in Shamror village, 10% monoculture, 34% polyculture, 14% intercropping, and 42% livestock farming and in Panda village, 10% monoculture, 34% polyculture, 14% intercropping and 42% livestock farming. Families practice polyculture mainly and also practice livestock farming. The majority have one or two cows in their household. Seasonal vegetables are grown. They also have polyhouses. Anti-hail nets minimize flower drop, fruit drop, and fruit damage.

Types of Seeds

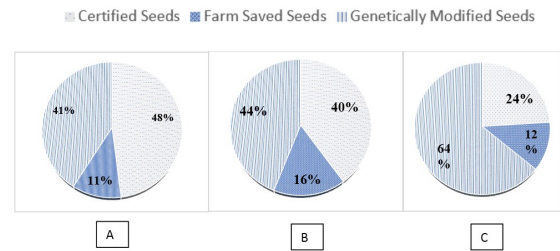


Figure 6: Types of seeds in villages (A) Nauni, (B) Shamror, and (C) Panda

Figure 6 suggests that in Nauni village, 11% of farmers use farm-saved seeds, 41% of farmers use genetically modified seeds and 41% of farmers use certified seeds. In Shamror village, 16% of farmers use farm-saved seeds, 44% of farmers use genetically modified seeds and 40% of farmers use certified seeds and in Panda village, 12% of farmers use farm-saved seeds, 64% of farmers use genetically modified seeds and 24% of farmers use certified seeds. Very few farmers use farm-saved seeds. Usually, they purchase certified seeds from the market in Solan. They are also provided with genetically modified seeds from Dr. Y. S. Parmar University at times.

Factors Affecting Farm Produce

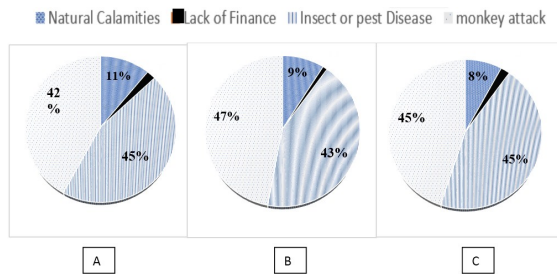


Figure 7: Factors affecting production in A) Nauni, B) Shamror, and C) Panda

Figure 7 suggests that factors affecting the production in Nauni village are, 11% by natural calamities, 2% by lack of finance, 45% by insects or pest disease and 42% by monkey attack whereas in Shamror village, 9% by natural calamities, 1% by lack of finance, 43% by insects or pest disease and 47% by monkey attack and in Panda village 8% by natural calamities, 2% by lack of finance, 45% by insects or pest disease and 45% by monkey attack. People were concerned about the pest attack in their tomato fields, especially in Nauni. Tomato cultivation is always labour-intensive. Farmers usually face damage to micro-sprinkler irrigation by rodents. Monkey versus man, where monkey destroys the agriculture produce. They also face natural calamities due to uncertain weather and an increase in temperature.

Inclusion of Small Landholders

Increasingly smallholdings may lead to non-cultivable land. The average size of landholding is 1.1 ha and may further go down given the

fragmentation of holdings. Even smaller land-holding was seen in Panda village.

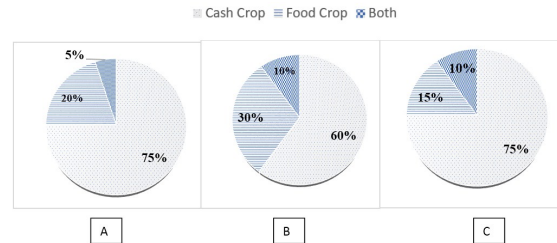


Figure 8: Type of Crops in villages (A) Nauni, (B) Shamror, and (C) Panda.

It was probed that in Nauni village, 5% of farmers opt for cash crops, 20% opt for food crops and 75% of farmers opt for both. In Shamror village, 10% of farmers opt for a cash crop, 30% opt for food crops and 60% of farmers opt for both and in Panda village, 10% of farmers opt for a cash crop, 15% opt for food crops and 75% farmers opt for both. There has been a change in the cropping pattern at the state level over the years brought about by diversification into the production of cash crops like ginger, potato, off-season vegetables, kiwi, cherries, hops, and into fields like apiculture and mushroom production. Cash crops are sown by the majority of farmers as the landholding sizes are small. The product is used for self-consumption as well as for selling into the market by some. Thus, the horticulture sector is emerging as a prime mover of the growth in agriculture in the last few years in the state. The process of crop diversification towards horticulture including vegetable crops is also manifested in the rising share of horticulture in the gross value of output originating in agriculture.

Awareness among Farmers about the Government Schemes

The awareness regarding the governmental initiatives has always been among the major hindering factors to take full advantage of the developmental efforts. Its human nature that people respond to incentives. It is truly so as present researcher observed in the field that almost every farmer knew about the PM-KISAN scheme⁶.

Various departments have worked tirelessly to reach to farmer's level and facilitate them. Soil Health

Card is one of the successful policies. Villagers have been given aid for the community water irrigation tank and micro-sprinkler irrigation facility. Naturally, Ventilated Poly Houses, Polytunnels established under the Himachal Pushp Kranti Yojana aimed to promote horticulture were situated in the villages. Panda village is provided with the benefits of solar energy under the PM-Adrash Gram Yojna. This village is also facilitated with ‘*Uthau Sinchai Yojana*’.

DISCUSSION

The villages under this study were near Dr. Y. S. Parmar University of Horticulture and Forestry. As a result, the village farmers were acquainted with the utilization of hybrid seeds, fertilizers, soil testing, and other technologies. Hilly areas have road connectivity issues. As Shamror village was at a greater slope, the farmers use manual labour to perform all the agricultural activities instead of machinery. While Nauni was at a lower slope it has access to the latest technologies like mini tractors.

Panda village developed sustainable technologies with the aid of the government under the PM- Adarsh Gram Yojana. Panda village had the facility of solar power. Solar fencing around the agricultural fields was seen there. Naturally Ventilated Poly Houses, Polytunnels established under the Himachal Pushp Kranti Yojana aimed to

promote horticulture were situated in the villages. These are some targeted investments by the government for the farmers. Nerker *et al.* (2013) also stated that investments should be done in the key areas having growth potential.

There is a visible caste demarcation in land ownership in these villages. It was seen that people belonging to higher castes like Brahmin and Rajput have larger land as compared to other caste people. While formulating policies due importance should be given to the social analysis of the population. (Sarkar, 2017).

Small landholders indulged in sowing cash crops, animal husbandry, and horticulture practices. Almost every household had another source of income such as labour or by working in the nearest town to fulfil their basic needs. This observation is also stated in the study of Snyder and Cullen (2014) who observed the significance of livestock. Livestock also provide increased economic stability to the farm or household, acting as a cash buffer (small livestock), capital reserve (large animals), and deterrent against inflation.

The majority of respondents stated that continuous cultivation of land, poverty and limited access to productive assets act as a crucial factor in limiting crop production among small landholders.

A comparative analysis of the present study with a few former research work is presented below in Table 2.

TABLE 2

Comparative analysis of the present study with previous research works

<i>Previous Studies</i>	<i>Present Study</i>
Snyder and Cullen (2014) discussed that small farm size is not tenable for living. Livestock farming becomes essential there.	A similar pattern was observed in the area under this study.
Sarkar (2017) discussed the importance of social analysis in research.	Social dynamics play an important role in development. The caste system is still prevalent in Nauni and Shamror villages. It was apparent from their talks.
Kumar(2010) also emphasized the importance of social dynamics.	
Hans and Rao (2018) emphasized the loss of farming activities. He also mentioned the environmental impact.	Respondents told that they are pursuing other economic activities to sustain. Some of them also work in a nearby town to earn a living while their family looks after the farm. There has been a shift in the cropping pattern and other practices.
Nerker <i>et al.</i> (2013) talk about the quality investments in areas having growth potential.	Targeted investments were seen in the form of poly houses, polytunnels, irrigation tanks, or solar panels. Farmers respond well to subsidized technologies.
Studies have established that the overuse of agrochemicals and insecticides causes an imbalance of soil nutrients and the challenges it poses in sustainably raising crops in the long run.	Respondents were of a similar opinion. The fertility of the soil has decreased to a large extent in the past few decades. Now, they have to administer larger amounts of fertilizers to obtain a good yield.

CONCLUSION

Agriculture and allied activities are the driving force for rural development in developing countries like India. Sustainable Agricultural practices ensure sustainable development. The present study reiterates the fact that landholding sizes are declining and to sustain, natural resources need to be used wisely. The presence of community irrigation tanks and micro-sprinklers in the villages offers an economical and viable option for irrigation in rain-fed agriculture systems. The villages have already untapped the potential of solar power in agricultural practices. Horticulture and livestock farming provides additional support to the farmers.

Adoption of new techniques and farming ways is possible because of awareness and funding by the government. The significant heterogeneity in household wealth, land tenure, social networks, access to input-produce markets, and extension services play a role in the successful adoption of sustainable practices. Sustaining agricultural productivity depends on the quality and availability of natural resources like soil and water. Land-use changes are happening quite fast in the villages. Farmers are shifting to alternate modes of livelihood as they face climate change issues leading to low production.

ACKNOWLEDGEMENT

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NOTES

1. <http://aercshimla.in/File/1/Malana%20Report.pdf>
2. All India Report on Agriculture Census 2015-16. Department of Agriculture, Cooperation and Farmers Welfare, Ministry of Agriculture and Farmers Welfare, New Delhi, 2020.
3. District Census Handbook Solan 2011. Directorate of Census Operations, Himachal Pradesh, India.
4. Monoculture: The practice of growing only one type of crop on a certain area of land.

5. Polyculture: Crop cultivation in which a variety of plants are grown together in the same field.
6. PM-KISAN: A Government of India initiative providing income support.
7. *Uthau Sinchai Yojana* % Lift Irrigation Scheme.

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