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Perception of farmers towards ecosystem services associated with natural farming in Mandi district of Himachal Pradesh

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Abstract

The green revolution transformed Indian agriculture into a food sufficient sector but at the same time, made Indian agriculture depend on the heavy doses of fertilizers and pesticides for the surplus generation of food which deteriorated the physical and biological properties of soil and led to contamination of water bodies. This has created a need for soil restoration and nutrient regenerative techniques. In the notion of Natural Farming main emphasis is to join efforts with nature in an environmentally friendly and sustainable way while avoiding use of external inputs. The present study was carried out in Mandi district of Himachal Pradesh. A sample of 120 farmers was selected using simple random sampling without replacement from the four blocks viz. Balh, Drang, Dharampur, Karsog. Interview schedule was framed to ascertain the level of perception towards ecosystem services related to natural farming and document the constraints identified in the adoption of natural farming. The findings revealed that a high proportion of farmers were aware of ecosystem services (58.33%) and majority of the farmers (70.83%) were having medium attitude towards the ecosystem services associated with natural farming. The overall perception enumerated by averaging the percentages of two dimensions viz. awareness and attitude was found to be medium with 48.33 per cent of farmers. Furthermore, the lack of premium price for natural produce was ranked first among the constraints, followed by labor intensive farming, inclination towards traditional farm practices, lack of proper information and lack of extension personnel regarding SPNF practices. The results emphasized proper institutional and financial support to the farmers by the regulatory bodies to embrace natural farming on a larger scale.

Keywords: Natural farming, ecosystem services, perception, awareness, attitude, sustainable

Introduction

Agriculture is the science, art, and practice of cultivating the soil, producing food crops, and raising livestock, while preparing the resulting products for marketing in congruence with the laws of nature. Maharishi Mahesh Yogi defines agriculture as “The science and art of agreeing with the culturing intelligence of total natural law in order to create fully nourishing and vital food, the basis of perfect health for the individual and the nation” (Fergusson, 2017) [4]. The performance of agriculture, attributable to its backward and forward linkages, greatly influences the growth of other sectors of the economy as well as the overall economy. However, over time, Indian agriculture had continued to face ecological, economic, and existential crises. The primary concerns that emerge are increasing costs of cultivation, uncompensated prices for farm produce, indebtedness, farm-related suicides, lack of interest in agriculture among rural youth, migration of agricultural labor to non-farm jobs, and labor shortages. The rising rate of crop losses from extreme weather events brought on by the climate emergency makes the situation on farms much worse (Bharti & Sharma, 2020) [3].

Considering the outcomes of the Green Revolution, it is apparent that the Indian agricultural landscape grapples with reduced genetic diversity, increased vulnerability to pests,

enhanced soil erosion and water shortages, reduced soil fertility, micronutrient deficiencies, increased soil contamination, reduced availability of nutritious food crops for the local population, displacement of vast numbers of small farmers from their land, rural impoverishment, and increased tensions and conflicts. The beneficiaries of the Green Revolution are the agrochemical industries, large petrochemical companies, manufacturers of agricultural machinery, dam builders, and large landowners (Greenpeace, 2003) [5]. The escalating problems necessitate a paradigm change in favor of agro-ecological methods, which guarantee safe and wholesome food while being sustainable, non-degrading, and favorable to the environment. Therefore, an alternative sustainable ecological approach is used that supports and boosts crop productivity while also maintaining community health and operating in an environmentally friendly manner. As the farming world looks for more efficient and farmer-friendly methods, natural farming becomes more pertinent.

The benefits of natural farming practices are strongly supported by available data for biodiversity conservation, managing arthropod pests, weeds, and diseases, pollination services, maintaining soil quality, energy efficiency, lowering the risk of global warming, enhancing carbon

sequestration, water-holding capacity in surface soils, and resistance and resilience to extreme weather events (Aulakh *et al.*, 2022) ^[1] It is pioneered that farmers practicing natural farming promote heavily practices like minimal tillage, trenching, mulching, reduced use of fertilizers, and increased populations of microorganisms to improve overall ecosystem services. Furthermore, farmers perceive that natural farming practices enhance soil fertility and reduce erosion of soil (Sharma *et al.*, 2023) ^[13]. Farmer's perception towards natural farming related ecological benefits is identified as a major element influencing their adoption of natural farming. However, scientific data on adoption and perceptions of natural farming are rather limited. This study is critical in understanding how ecofriendly aspects of natural farming influence farmers' perception regarding sustainable agriculture practices. Therefore, the objectives of the study were as follows:

- To study farmers perception regarding ecosystem services related to natural farming.
- To identify the constraints faced by farmers in adoption of natural farming.

Materials and Methods

The present study was conducted in the Mandi district of Himachal Pradesh during the year 2024-2025. The district was purposively selected due to its early deployment of natural farming technique under the *Prakritik Kheti Khushal Kisan Yojana* (PK3Y) initiated in 2018. Since, Mandi is one of the most densely populated districts of Himachal Pradesh, with a substantial portion of its population dependent on agriculture for their livelihood, it contributes a diverse group of farmers, including both early adopters of natural farming and those currently in the transitioning phase. This diversity enabled a meaningful comparative analysis in terms of adoption levels, perceptions, and constraints associated with natural farming.

A total of 120 farmers practicing natural farming were selected as the sample for the study. The respondents were drawn from four blocks of Mandi district, namely Balh, Karsog, Drang, and Dharampur. An equal number of respondents were chosen from each block to maintain uniformity in the sampling procedure.

In the present study, perception was operationalized as an active process of becoming aware and deriving meaningful understanding from a particular situation. Perception was assessed along two dimensions: awareness and attitude regarding ecosystem services in the context of natural farming. The level of awareness was measured using nine statements, developed based on an extensive review of literature and consultation with subject experts. The response of farmers was collected as yes and no with 1 and 0 score, respectively. The farmers were then grouped into three categories of awareness level i.e. low, medium and high based on the total mean and standard deviation. To ascertain the level of attitude, four principal categories of ecosystem services as contextualized by the Millennium Ecosystem Assessment (MEA)-provisioning, regulating, supporting, and cultural services-were operationalized under the purview of natural farming. A schedule comprising

twenty-three statements was prepared through expert consultation. Respondents were asked to express their opinions on a five-point continuum scale: strongly agree, agree, undecided, disagree, and strongly disagree with scores assigned 5, 4, 3, 2, and 1, respectively. Total attitude scores were computed for each respondent, and based on the mean and standard deviation, the farmers were categorized into low, medium, and high attitude groups. Overall perception was then analysed by computing the average percentages in each category across the two dimensions of awareness and attitude.

Constraints were operationalized as the primary hurdles or barriers perceived by farmers in the adoption and continued practice of natural farming. The interview schedule was crafted to encompass social, economic, and cultural constraints. Through the application of the Garrett Ranking Technique, twelve commonly cited constraints were identified and subsequently prioritized. Each constraint was ranked according to the mean Garrett score, with Rank I indicating the constraint perceived to the higher extent and Rank XII to the lesser extent. Additionally, open-ended questions were framed to bring forth the suggestions from the farmers regarding frameworks to alleviate the documented constraints. The most widely spoken solutions were precisely documented. It was made sure that all questions were clearly understood by the farmers, with further clarifications if necessary.

Results and Discussion

Perception of farmers towards ecosystem services related to natural farming

a. Awareness level

The farmers perception was interpreted in the form of overall awareness and overall attitude and statement wise awareness and attitude towards natural farming. The results in Table 1 revealed that majority of farmers (58.33%) had a high level of awareness, followed by 25.84 per cent with a medium level of awareness and 15.83 per cent with a low level of awareness. The findings are basically favourable for the awareness level, could be due to peer learning, knowledge diffusion and proactive learning by the presence of early adopters. However, a considerable portion of farmers were still unaware. The probable reason behind this might be the gaps in educational levels, limited exposure to information channels and negligence for the ecological aspects of natural farming while focussing only on economic benefits of its practices.

Table 1: Overall awareness of farmers towards ecosystem services (n=120)

S. No.	Category	Range	Frequency	Percentage
1.	Low	Less than 4	19	15.83
2.	Medium	4 to 11	31	25.84
3.	High	More than 11	70	58.33

Mean=7.50, SD=3.40

To elucidate awareness levels of the farmers practicing natural farming, detailed analysis was conducted presented in Table 2 for a comprehensive overview.

Table 2: Item wise awareness of farmers towards ecosystem services (n=120)

S. No	Statements	Yes		no	
		f	%	f	%
1.	Understand the term ecosystem services	104	86.67	16	13.33
2.	Ecosystem services important for agriculture	96	80.00	24	20.00
3.	Identify pollination as an ecosystem service	62	51.67	58	48.33
4.	Soil health is influenced by farm activities	114	95.00	6	5.00
5.	If, currently using any sustainable farming practice	84	70.00	36	30.00
6.	Aware of practices that enhance ecosystem services on farm	58	48.33	62	51.67
7.	Improving ecosystem services could enhance farm profitability	72	60.00	48	40.00
8.	If, observed any benefits from natural pest control	64	53.33	56	46.67
9.	Soil erosion prevented through effective plant roots	110	91.67	10	8.33

A large proportion (86.67%) of farmers understood the term “ecosystem services”, and 80.00 per cent attributed to their importance in agriculture. Additionally, 95.00 per cent of farmers agreed that soil health is influenced by farm activities, only 51.67 per cent were able to identify pollination as an ecosystem service. 70.00 per cent of farmers were reported to use at least one sustainable farming method, yet only 48.33 per cent were aware of practices especially aimed at improving ecosystem services on their farms. Furthermore, 60.00 per cent believed that improving ecosystem services could improve their farm profitability. 53.33 per cent of farmers observed benefits from natural pest control, while 91.67 per cent recognized that effective plant roots could prevent soil erosion. These findings highlight an overall positive awareness among farmers, particularly in acknowledging soil health and sustainable practices, however, gaps are visible in recognition of certain services like pollination and natural pest control.

b. Attitude level

The results in Table 3 revealed that nearly three-fourth (70.83%) of farmers had a medium attitude towards ecosystem services related to natural farming which was followed by high (19.17%) and low (10.00%) attitude

levels. The moderate attitude among farmers reflects a phase of partial acceptance of natural farming as well as preference for economic considerations. Although farmers optimized natural farming as low impact agriculture, they require prior experience, continuous training, education, extension support and proven benefits to develop a more favorable attitude. This suggests that while farmers consider resource efficiency and green nature of natural farming, ambiguities about input availability and economic viability limit their initiative for long term and sustained adoption of natural farming thereby impeding them to realize actual environmental gains over time.

Table 3: Overall attitude of farmers towards ecosystem services related to natural farming (n=120)

S. No.	Category	Range	Frequency	Percentage
1.	Low	Less than 84	12	10.00
2.	Medium	84 to 101	85	70.83
3.	High	More than 101	23	19.17
Mean=92.65, SD=8.87				

Statement wise analysis has been made to dig deeper into the farmers opinions. Table 4 has been presented for a more coherent and descriptive analysis of each ecosystem service.

Table 4: Item-wise attitude of farmers towards ecosystem services related to natural farming (n=120)

Target services	SA		A		UD		DA		SDA		Mean score	Rank
	f	%	f	%	f	%	f	%	f	%		
Provisioning Services												
Application of animal manure increases crop yield and production	68	56.67	50	41.67	2	1.67	0	0.00	0	0.00	4.55	I
NF produces enough food	61	50.83	39	32.50	9	7.50	11	91.17	0	0.00	4.25	II
NF maintain the supply of quality food material	35	29.17	63	52.50	19	15.83	3	2.50	0	0.00	4.08	III
NF is most sustainable means of food production	49	40.83	27	22.50	38	31.67	6	5.00	0	0.00	3.99	IV
Regulating Services												
Intercropping with live mulch crops enhance water use efficiency	65	54.17	32	26.67	21	17.50	2	1.67	0	0.00	4.33	I
NF plays a vital role in climate change and regulation	49	40.83	57	47.50	13	10.83	1	0.83	0	0.00	4.28	II
Practices such as wide and diverse rotations, no monocultures also increase nutrient retention	42	35.00	56	46.67	19	15.83	3	2.50	0	0.00	4.14	III
NF promotes the sustainable use of natural resources like soil and water	37	30.83	53	44.17	26	21.67	4	3.33	0	0.00	4.02	IV
NF practices like mulching or maintaining ground cover increases water retention	26	21.67	69	57.50	24	20.00	1	0.83	0	0.00	4.00	V
NF can enhance quality of water on farms and surrounding area	26	21.67	53	44.17	41	34.17	0	0.00	0	0.00	3.87	VI
NF does not affect the quality of downstream water sources	8	6.67	53	44.17	55	45.83	4	3.33	0	0.00	3.54	VII
NF benefit pollinators	10	8.33	46	38.33	61	50.83	3	2.50	0	0.00	3.52	VIII
Crop diversification and rotation reduce the pest disease incidence	32	26.67	29	24.17	11	9.17	43	35.83	5	4.17	3.34	IX
Controlling pests on farms with presence of natural predators	12	10.00	48	40.00	27	22.50	26	21.67	7	5.83	3.26	X
Supporting Services												
Intercropping with legumes enhances soil fertility	74	61.67	43	35.83	3	2.50	0	0	0	0.00	4.59	I
NF enhances decomposition by encouraging breakdown of organic matter	74	61.67	40	33.33	6	5.00	0	0.00	0	0.00	4.57	II
Application of jivamrit and ghanjivamrit increases soil fertiltiy	72	60.00	38	31.67	10	8.33	0	0.00	0	0.00	4.52	III

NF promotes biological diversity in an agro ecosystem	50	41.67	43	35.83	26	21.67	1	0.83	0	0.00	4.18	IV
Crop rotation has improved soil health and nutrient availability	32	26.67	76	63.33	7	5.83	5	4.17	0	0.00	4.12	V
Intercropping enhances overall biomass production	19	15.83	44	36.67	53	44.17	4	3.33	0	0.00	3.65	VI
Cultural services												
NF provides health benefits to people	63	52.50	53	44.17	4	3.33	0	0.00	0	0.00	4.49	I
NF sustains the elements of nature for a longer period	20	16.67	62	51.67	32	26.67	6	5.00	0	0.00	3.80	II
Aesthetic landscapes are maintained with NF	22	18.33	49	40.83	25	20.83	18	15.00	6	5.00	3.52	III

Among the provisioning services, majority farmers had a better attitude that application of animal manures in natural farming was able to increase crop yield and production (Rank I) with average score of 4.55. Farmers acknowledged the capacity of natural farming to produce enough food (Rank II) with mean score of 4.25. A significant proportion of farmers felt that natural farming maintained the supply of quality food material (Rank III) with average score of 4.08. Natural farming being most sustainable means of food production (Rank IV) with mean score of 3.99.

With respect to regulating services, intercropping with live mulch crops enhances water use efficiency (Rank I) with a mean score of 4.33, natural farming played a vital role in climate change and regulation (Rank II) with mean score of 4.28. Natural farming practices such as wide and diverse rotations, no monocultures increase nutrient retention (Rank III) with mean score of 4.14, natural farming promotes sustainable use of natural resources like soil and water (Rank IV) with mean score of 4.02. Natural farming practices like mulching or maintaining ground cover increases water retention (Rank V) with average score of 4.00. Natural farming enhances quality of water on farms and surrounding areas (Rank VI) and does not affect the quality of downstream water sources (Rank VII) with mean scores of 3.87 and 3.54 respectively. It benefits pollinators (Rank VIII) with mean score of 3.52, crop diversification and rotation reduce the pest disease incidence (Rank IX) with mean score of 3.34. Controlling pests on farms with presence of natural predators (Rank X) with mean score of 3.26.

In the category of supporting services, intercropping with legumes enhances soil fertility (Rank I) with mean score of 4.59, natural farming enhances decomposition by encouraging breakdown of organic matter (Rank II) with mean score of 4.57. Application of jivamrit and ghanjivamrit increases soil fertility (Rank III) with mean score of 4.52, natural farming promotes biological diversity in an agro ecosystem (Rank IV) with mean score of 4.18. Crop rotation has improved soil health and nutrient availability (Rank V) and intercropping enhanced overall biomass production (Rank VI) with mean scores of 4.12 and 3.65 respectively.

Further in case of cultural services, natural farming provides health benefits to people (Rank I) with mean score of 4.49 and sustains the elements of nature for a longer period (Rank II) with mean score of 3.80. Aesthetic landscapes are maintained by natural farming (Rank III) with average score of 3.52.

Overall, farmers maximum positive attitude was realized by intercropping with legumes enhancing soil fertility. Since intercropping with legumes is a widely adopted practice among farmers, they exhibited more positive attitude towards related statements. Further, farmers hold a positive attitude regarding ecosystem services related to natural

farming, especially those concerned with soil health, food production, soil fertility and biodiversity which may come from their farming experience. However, other services like cultural services and water related impacts of natural farming appear to be less clearly understood, indicating need for more awareness and radical consciousness to perceive them more positively rather than being uncertain about them.

c. Perception

The farmers perception was computed by averaging the percentages across two dimensions of awareness and attitude. The results in Table 5 revealed that 48.33 per cent of farmers fell under medium perception followed by 38.75 per cent under high perception and 12.92 per cent under low perception. Thus, after computing the average percentages, overall perception for ecosystem services related to natural farming was moderate.

The medium perception may have stemmed from the union of experience and exposure. Farmers with medium awareness levels may have some knowledge but may lack comprehensive understanding whereas farmers with medium positive attitude suggests their practical experience with the ecological improvements of natural farming and their openness towards adoption of sustainable natural farming techniques. Some may face constraints of limited training, lack of awareness and risk aversion which restrain them from environmental gains of natural farming practices. The findings are in similarity with Khadse *et al.* (2017)^[7], Rao *et al.* (2021)^[11], Veni *et al.* (2022)^[14], Rao *et al.* (2023)^[10].

Table 5: Overall perception of farmers towards ecosystem services related to natural farming (n=120)

S. No.	Category	Awareness (%)	Attitude (%)	Average (%)	Perception
1.	Low	15.83	10.00	12.92	Low
2.	Medium	25.84	70.83	48.33	Medium
3.	High	58.33	19.17	38.75	High
					Medium

Constraints faced by farmers in adoption of natural farming

The analysis of Table 6 indicated the constraints perceived by farmers in the adoption of natural farming practices. The table revealed that most farmers perceived the lack of premium price for natural produce as the major constraint in adoption of natural farming (Rank I). This was closely followed by labor intensive farming (Rank II), farmers inclination towards traditional farm practices (Rank III), lack of information regarding natural farming (Rank IV). Among other notable constraints were lack of extension personnel (Rank V), lack of awareness (Rank VI), and risk aversion in farmers (Rank VII). Some farmers also regarded

lack of consumer familiarity with natural produce (Rank VIII) and lower initial yields (Rank IX) as constraints. Furthermore, non-acceptance by fellow farmers was an

impediment (Rank X). Complex pest management (Rank XI) and higher initial cost (Rank XII) were observed as slight difficulties by farmers.

Table 6: Constraints faced by farmers in adoption of natural farming (n=120)

S.no	Constraints	Percent	Rank
Social Constraints			
1.	Lack of proper information regarding natural farming	79.67	IV
2.	Lack of awareness	78.58	VI
3.	Lack of extension personnel regarding NF practices	79.58	V
4.	Non acceptance by fellow farmers	76.58	X
5.	Consumer familiarity with natural produce	77.50	VIII
Economic Constraints			
6.	Labor intensive farming	81.25	II
7.	Lack of premium price for natural produce	81.83	I
8.	Lower initial yields	77.08	IX
9.	Higher initial cost	76.00	XII
Cultural Constraints			
10.	Complex pest management	76.17	XI
11.	Inclination towards traditional farm practices	80.33	III
12.	Risk aversion in farmers	77.58	VII

The probable reason behind this might be the underdeveloped market linkages, lack of specialized value chains and limited government support for marketing and certification systems. Labor intensive nature of natural farming, inclination towards traditional practices, lack of clearer information and lack of proper extension services also restrain adoption of natural farming to a greater extent. A good enabling environment is also necessary to increase adoption of natural farming and reduce significant cultural barriers. The findings are in line with Jadhav (2020) ^[6], Babalad (2021) ^[2], Rao *et al.* (2021) ^[11], Sharma *et al.* (2025) ^[12].

Suggestions to address the constraints faced by farmers in adoption of natural farming

It is recommended that every village must be provided with bio-input resource centers or community-based production units to save the cost as well as effort of farmers who face time constraints. Farmers must be given regular training through government-based institutions such as KVKs, ATMA and NGOs to sustain farmers trust for new innovations and prevent relapsing to conventional farming methods. Government must be responsible for providing subsidies as well as proper certification channels for natural growers. Development of specialized markets to ensure fair price for their natural produce while simultaneously enhancing consumer awareness about its potential benefits. Educate young farmers and school children, as they are more likely to understand ecological advantages of natural farming and empower them to influence their parents to embrace sustainable development. Extension services play an important role in expanding natural farming. Therefore, timely and required extension services must be ensured for the farmers. Exhibitions, campaigns, mass media and demonstrations must be used to create awareness among illiterate farmers.

Conclusion

The study indicated that a moderate proportion of farmers were aware of ecosystem services and most had a medium level of attitude regarding ecosystem services related to

natural farming. The average of two dimensions, viz. attitude and awareness revealed that a significant proportion of farmers had a medium overall perception towards ecosystem services related to natural farming. The key challenges faced by farmers were lack of premium price for natural produce, labor intensive farming, inclination towards traditional farm practices, lack of proper information and lack of extension personnel regarding natural farming. The primary difficulties call for greater institutional support and technical guidance from the government which will further satisfy the need for information and awareness on natural farming practice. Farmers must be given financial support in the form of subsidies and provided with premium pricing for their natural products to overcome the listed constraints. The information and findings concluded from this study will be valuable for the entire community involved in the practice of natural farming within the region and in other areas.

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