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Economic Analysis of Natural Farming based Apple Orchards in Himachal Pradesh

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***Abstract*:** The apple production was evaluated under two farming systems i.e., Subhash Palekar's Natural Farming (SPNF) and conventional chemical based farming (CF) systems in Himachal Pradesh, India. The data was collated from 110 apple orchards spread all across the state during the cropping season of 2020. The total variable cost of apple cultivation under natural farming was 56.53 % lower than conventional farming (CF), thereby clearly highlighting the advantage of natural farming over CF. Net returns of apples under natural farming were better (27.41%) than CF apples mainly due to sizable reduction in cultivation costs. The success of progressive SPNF adopters proves that natural farming has viable potential to sustain apple farming and enhance mountainous farmers' income in the backdrop of the looming threat of climate change.

***Keywords*:** ZBNF, SPNF, Apple cultivation, Economic impact, Net returns

The Green Revolution induced modern agricultural production technologies completely changed the Indian food production scenario towards self-sufficiency. But its untenable dependence on chemical inputs set off negative externalities like plummeting factor productivity, increasing cultivation cost, and exorbitant pesticide residues in farm products (Kotschi 2015, Supriya et al 2018, NAAS 2019, IPBES 2019). Rising awareness about nutritional quality and safety of food has led the consumer's quest for safer and chemical-free foods produced ecologically and authentically by local systems. At the same time, increasing cultivation cost and unstable commodity prices have strained the livelihood of farmers and has resulted in agrarian distress (Mishra 2008). Climate change induced catastrophes have shaken the socio-economic foundations of the hill farming systems across hilly regions in India. The rate of warming in the Himalayas is greater than the global average, confirming that the Himalayas are among the most vulnerable regions to climate change (Shrestha et al 2012). Coordinated efforts are required for adaptation and mitigation as the vulnerable mountain ecosystems are likely to face a greater risk of climate change impacts than other ecosystems (Negi et al 2012). Climate change impacts have also brought back attention to agro-ecology, its stability, and its resilience. The need of the hour is to promote farming systems and technologies which enhance income and also prove ecologically sound.

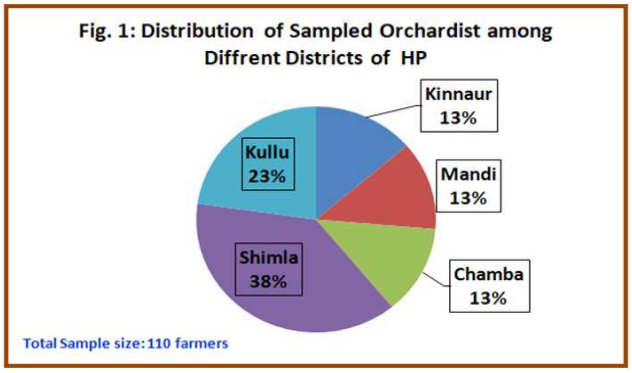
Himalayan state of Himachal Pradesh has accomplished a magnificent revolution in fruit production and the horticultural sector of the state has crossed agriculture in terms of value addition by contributing about 40 percent of the agricultural GDP (Anonymous 2021, Negi 2020). But Himalayan horticultural production is equally vulnerable to climate change and is facing threats like increasing incidences of pest and disease attacks, declining productivity, and replacement of apples with other crops. (Basannagari et al 2013, Asghar et al 2013). The temperature in apple growing regions of the mountain state of Himachal Pradesh, India showed increasing trends whereas precipitation showed decreasing trends (Rana et al 2011). This apple centric horticultural development, achieved through the use of modern production technologies, is significantly dependent upon the use of synthetic chemical inputs particularly fertilizers and pesticides (Randev 2015, Chand et al 2017). Typically considered a chemical free farming state, pesticide presence and levels are high in the produce of Himachal Pradesh (Anonymous 2015). Pesticide residues are always an important issue in food exports as several shipments of Indian agricultural produce have been rejected after the identification of residues. The quest for alternate methods, especially those which are low on chemical use, is being recognised by every section of society. In such a scenario, farmers' financial opulence can be improved by spreading the agro-ecologically compatible technologies and innovations capable of minimising the cost and improving crop productivity and quality. Such alternative

natural farming practices with ecological and social benefits have emerged and been promoted in pockets (Park and DuPonte 2008, Brown 2018). These practices are sustainable alternatives to chemical farming as they seek to optimise the use of locally available resources in place of external inputs.

Subhash Palekar Natural Farming (SPNF) is rooted in Indian tradition and is a holistic alternative based on the latest scientific discoveries in Agriculture. The F.A.O. has urged all countries to move towards the adoption of Agroecology to meet the twin goals of global food security and conservation of the environment and SPNF principles are in sync with the principles of Agroecology. It has been widely accepted by the farmers (Neelam and Kadian 2016, Tripathi et al 2018, Khadse and Rosset 2019). The viability of the organic and natural farming systems is well contested among the scientific fraternity with arguments both in favour and against (Seufert et al 2012, Strohbach et al 2015, Kuruganti 2019, NAAS 2019, Rao 2019). Highlighting the predominance of smallholder farmers, SPNF was adopted in Himachal Pradesh (HP), under the scheme 'Prakritik Kheti Khushhal Kisan' (PK3) Yojna launched in 2018, with the objective to make agriculture economically viable and profitable and reduce agrarian distress and risk through cost reduction and sustainable climate-resilient agricultural practices. SPNF practices have been adopted by a substantial number of farmers across the state for growing a diversified basket of agricultural crops like cereals, pulses, oilseed, vegetables, and fruits. Apple orchardists of the state have also embraced natural farming methods for apple cultivation in a big way. However, not much scientific data pertaining to various aspects of the cost of cultivation and performance of various crops including apple under the SPNF system is available. Keeping in view the above background, the present study was an attempt to evaluate the economic impact of apple cultivation under SPNF practices.

MATERIAL AND METHODS

This study on SPNF Apple cultivation in Himachal Pradesh was conducted during the year 2020 and data for this study was collected from randomly sampled 110 best apple orchardists practising SPNF and conventional farming (CF) methods. These orchardists were spread across apple producing districts namely Shimla (42), Kullu (25), Kinnaur (15), Mandi (14) and Chamba (14). The proportional distribution of sampled apple growers has been shown in Figure 1. These districts were selected because of their significant contribution with respect to the area and production of apples in the state. Data for this study was collocated by the field staff of ATMA i.e. BTMs and ATMs. Primary data were analysed using standard tabular and statistical methods.



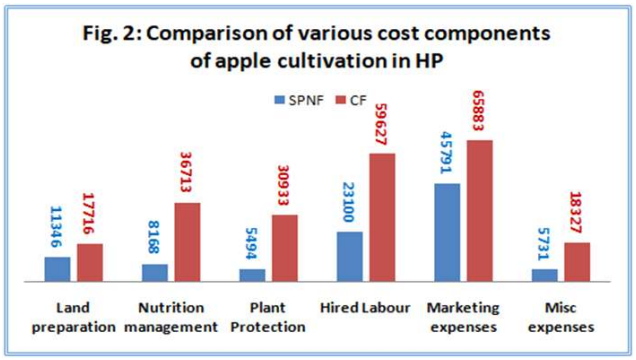
RESULTS AND DISCUSSION

Status of SPNF Apple cultivation in Himachal Pradesh): In a short span of 3 years, SPNF practices have become very popular among the apple orchardists of the state. Presently, SPNF practices usage for apple cultivation is being carried out in all the apple producing districts of the state. SPNF apple cultivation practices have been adopted by 12928 apple orchardists on 760.19 ha area spread across 47 blocks. Conventional farming of apples is highly reliant on capital and chemical inputs, therefore, farmers had expressed confidence in SPNF practices and given it a chance on a sizable part of their apple orchard. Most of the sampled orchardists have started converting their orchards under natural farming practices and the average area under SPNF and CF orchards was 0.42 and 0.33 ha, respectively. Per hectare planting density under SPNF (614) was higher than CF (506), respectively. The proportion of plants in the bearing stage under SPNF (63.7 %) was lower than CF (81.8 %).

Comparative economics: In order to assess the economic viability of Apple under Natural Farming, the study has conducted an empirical analysis on three important parameters: comparative economics, economic returns, and income. The total variable cost of apple cultivation under natural farming (₹ 99629 ha^{-1}) was 56.53 % lower than Conventional Farming (₹2,29,200 ha^{-1}), thereby clearly highlighting the advantage of natural farming over CF (Appendix 1). A significant reduction in the cost of cultivation of all the crops under ZBNF has already been documented by ABZBNF (2018), Kumar et al (2019) and Chandel et al (2021).

Land preparation cost (₹ 11346) under SPNF was 35.96 % lower than CF. The presence of companion crops under SPNF apple orchards leads to minimal weed growth, thereby, reducing the expenses on land management (Fig. 2).

Expenses on nutrition and pest management under SPNF were nearly 80 % lower than CF and it was the major attraction for orchardists to convert to SPNF practices in their apple orchards. Plant protection operation under CF involves exposure to many health hazards, therefore, alert and health conscious orchardists evaded these hazards by executing these operations by hiring the labour. But these operations under SPNF were happily carried out by the farmers themselves, leading to lower (23.19 %) dependence on hired labour. Increased awareness among consumers about the health hazards of chemical based farming has also helped the orchardist in the marketing of SPNF apples as in some cases buyers had started to lift their produce from the farm itself and it helped them save 45.96 % expense on marketing. Therefore, SPNF based apple farming is a win-win situation for the orchardists as well as society.



Productivity and returns: Productivity of apple orchards under natural farming was at par with CF and was rather marginally higher (2.10 per cent) than CF (152.6 q ha^{-1}). Price and gross profit received by SPNF apples were also 2.46 and 4.61% higher than CF apples. Net returns of apples under natural farming were better (27.41%) than CF mainly due to a sizable reduction in cultivation costs (Fig. 3). Chandel et al (2021) also reported that Fruit-pulse-vegetable based crop rotations generated 21.55% higher net returns under natural farming in Himachal Pradesh. Therefore, it can be asserted with authority that apple cultivation with SPNF practices is an economically viable option and it defies the concerns raised by the proponents of conventional apple farming. Besides this, economic returns of SPNF farming will be much higher if we take into account the positive externalities in the form of its beneficial impact on the environment and health of the apple producers and consumers.

Companion crops: Intercropping of leguminous companion crops for natural nitrogen fixing in soils is the most advocated practice in the natural farming of apple orchards. Rabi pea, kharif pea, French bean and kidney bean were the most preferred companion crops in the study area. Non-leguminous crops like tomato, garlic and cabbage/cauliflower, were also grown by farmers owing to remunerative prices fetched by these crops. Net returns from the cultivation of companion crops in apple orchards resulted in excellent financial gains for the farmers and made this farming really zero budget farming. Net returns under crops such as Cabbage/Cauliflower (₹153420 ha^{-1}) followed by Kharif pea (₹113689 ha^{-1}), Rabi Pea (₹45760 ha^{-1}), Tomato (₹42565 ha^{-1}), French bean (₹ 41251 ha^{-1}), Garlic (₹39442 ha^{-1}), Rajmah (₹ 31785 ha^{-1}) were sufficient enough to meet the working capital requirement of the main crop.

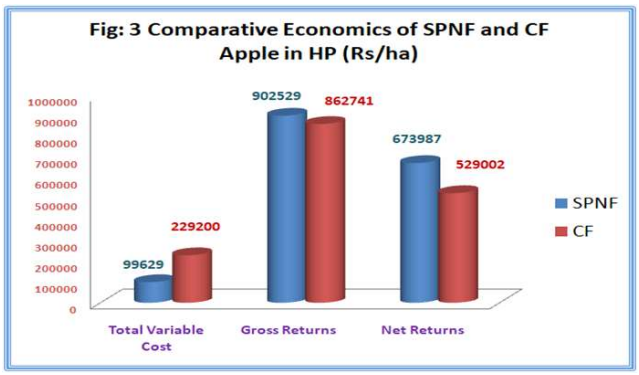
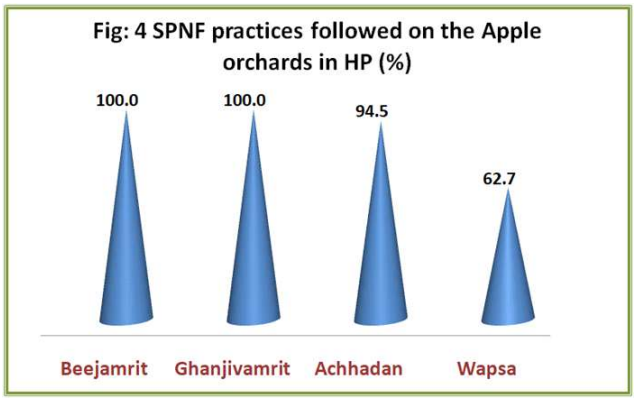


Table 1. Comparative economics of SPNF and CF Apple orchards in HP (per ha)

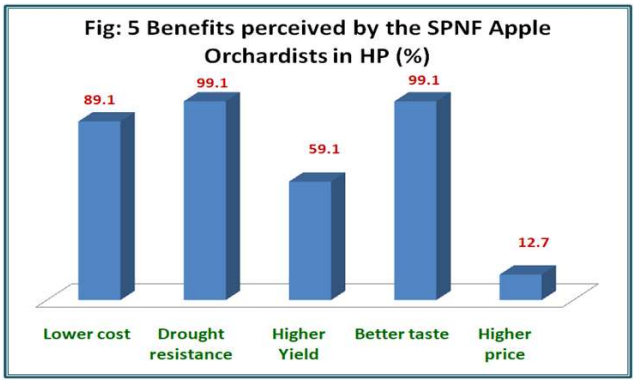
Particulars	SPNF	CF	% Change in SPNF over CF
Land preparation	11346	17716	-35.96
	(11.39)	(7.73)	
Nutrition management	8168	36713	-77.75
	(8.20)	(16.02)	
Plant protection	5494	30933	-82.24
	(5.51)	(13.50)	
Hired Labour	23100	59627	-61.26
	(23.19)	(26.02)	
Marketing expenses	45791	65883	-30.50
	(45.96)	(28.74)	
Misc expenses	5731	18327	-68.73
	(5.75)	(8.00)	
Total variable cost (Rs/ha)	99629	229200	-56.53
	(100.00)	(100.00)	
No. of plant protection sprays	6.39	7.10	-10.08
No. of nutritional sprays	8.13	5.00	62.50
Gross yield (q/ha)	155.8	152.6	2.10
Average price (Rs/q)	5791	5652	2.46
Gross returns (Rs/ha)	902529	862741	4.61
Net returns (Rs/ha)	673987	529002	27.41

Note: Figures in parenthesis are per cent of total variable cost

Natural farming practices: *Beejamrit, Ghanjivamrit and Jeevamrit, Achhadan* and *Wapsa* are the four pillars of Subhash Palekar Natural Farming. *Beejamrit, Ghanjivamrit* and *Jeevamrit* are various decoctions based on indigenous cows' urine and dung and ensure optimal nutrition and protection from diseases and infections during the various stages of plant growth. These practices were followed by 100 percent apple orchardists but *Achhadan* (94.5%) and *Wapsa* (62.7%) practices were slightly lacking because of the shortage of mulching material and labour intensive nature of these practices (Fig. 4). Partial adoption of SPNF technology pillars is resulting in lower productivity of apples under natural farming. It is expected that complete adoption of SPNF practices in the cultivation of apples can lead to better and sustainable productivity and quality of fruits in apple orchards in Himachal Pradesh.



Benefits of natural farming practices: There is no doubt about the social, economic, and environmental superiority of natural farming over conventional farming practices, yet effort was made to assess the preparation of the farmers on these aspects. According to our survey, farmers adopted SPNF for a number of reasons, including family wellbeing, food self-sufficiency, environmental issues, and cost-cutting. 99.1 per cent of the people said that they are getting better drought resistance in crops and the quality of products by using natural farming practices (Fig. 5). This shows that natural farming can be an effective tool in the hands of farmers against otherwise inevitable ill impacts of climate change. Critics have expressed major apprehension about windfall decline in crop productivity under natural farming. But 59.1 per cent of respondents reported improvements in yield levels by turning to SPNF. Saving on account of reduced cultivation cost under SPNF was confirmed by 89.1 per cent of apple orchardists but only 12.7 per cent of farmers received a better price for SPNF produce in the market. The major problems associated with natural farming in the state was the non-availability of a specialized market followed by labour-intensive farming and unfair price for products in the market (Vashisht 2021).



CONCLUSION

Orchardists of Himachal Pradesh have successfully demonstrated the worth of SPNF practices for producing good quality apples. They proved that apprehensions cast against the efficacy of natural farming practices in sustaining apple productivity were overhyped. This study based on the preliminary years of SPNF implementation in the apple orchards of the state shown that the adoption of a complete package of natural farming practices can go a long way in sustaining the long-term production and income of apple orchards in the state. These low cost and sustainable climate-resilient agricultural practices can be a boon for maintaining the agroecology of the state besides ensuring the minimal impact of climate change on the apple industry of the state, yet long-term studies are required.

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