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Effect of Skill Development Initiative on Income and Input of Organic Growers in Some Southern Indian States

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Abstract: Agroecosystem health, biodiversity, biological cycles and soil biological activity are all enhanced by organic farming, which is an integrated production management method. The present study aims to investigate the impact of organic farming on input cost and crop yield on the lands of small as well as marginal scale farmers who underwent training as per the guidelines of National Skill Development Corporation (NSDC) and the Agriculture Skill Council of India (ASCI) in southern India (Andhra Pradesh, Karnataka, Telangana). A two-staged process was implied where ASCI trained 24 scientist of Patanjali Organic Research Institute (PORI) as per standard document QP AGR/Q1201. PORI scientists trained 50 farmers in selected states and they in turn trained 5,058 farmers as a farmer to farmer approach. The results revealed low input cost, increment in crop production and good soil fertility. The net profit attained from paddy, red chilli, sugarcane and cotton in Andhra Pradesh was Rs.27500, 38500, 90000, and 19000, respectively whereas net profit attained from paddy, turmeric and cotton in Telangana was of Rs. 12466, 61200, and 54000, respectively. Thus, there is a need to formulate a long-term perspective plan focussing on the progress of the organic agricultural sector in terms of production and productivity.

Keywords: Agri-input, Profitability, Organic farming, Training program, Soil health

The primary source of livelihood for about three-fourths of the Indian population is agriculture and its allied sectors (Singh 2021). Agriculture in India has a long history, dating back to the Indus Valley Civilization (Vasey 2002). But lately, it is undergoing a structural transition in India that is resulting in a crisis. As India's economy is consistently growing because of industrial and service sectors, the relative contribution of agriculture's proportion in India's Gross Domestic Product (GDP) is progressively declining over time (Yadav et al 2019). The leading cause behind this shift is that agriculture is no longer a profitable economic activity compared to other sectors, so its income is insufficient to cover the cultivators' expenses. Moreover, in the past few years, the increase in agricultural production output is gradually increasing, but the injudicious use of pesticides, heavy metals, chemical fertilizers, antibiotic residue, nitrate, and genetically modified organisms that contributes to colossal adverse health effects. An inadequate application of chemical fertilizers makes the soil compact, reduces soil fertility, pollutes air and water, with increase in greenhouse gases, and thereby poses threat to human and environment (Sharma and Singhvi 2017).

As an effort to yield more nutritious and safe food, organically cultivated foods demand has led to an upsurge in past years due to their health benefits (Rembialkowska 2007, Dangour et al 2010). Ecologically stated organic farming is more environment-friendly than conventional farming and promotes consumer health by keeping soil healthy and maintaining the integrity of the ecosystem (Srivastava et al 2018, Singh 2021). Among 172 nations that practice organic farming, India is distinctive in that it has 650000 organic farmers, 699 processors, 669 exporters, and 720000 hectares under cultivation. Nevertheless, with merely 0.4 percent of total agricultural land under organic cultivation, the industry has a long journey ahead (Bordolo 2016). India's soil is endowed with various naturally accessible organic nutrient supplies that help organic farming (Adolph and Butterworth 2002, Reddy 2010, Deshmukh and Babar 2015). The southern states like Karnataka, Andhra Pradesh, Telangana has diverse agriculture production exposed to long coastal lines, has varied agro-climate zones, distinguished soil types, and natural vegetation to grow Cotton, maize, pulses, oilseeds, fruits, and vegetables. The current study implemented and investigated the effect of skill development in various approaches of organic farming on the lands of small (1-2-hectare land holding) as well as marginal (land holding <1 hectare) scale farmers of Karnataka, Andhra Pradesh, and Telangana by minimizing input cost and enhancing net profit in an environmental- friendly manner.

MATERIAL AND METHODS

The study's goal was to develop a model for enhanced organic output that would result in enhancing farm revenue through a demonstrative farmer to farmer strategy in Karnataka, Andhra Pradesh, and Telangana. The Agriculture Skill Council of India (ASCI) edified a 24-member team of expert master trainers from Patanjali Organic Research Institute (PORI) for eight days in September, 2018 at PORI, Haridwar, India, who comprehended the regional dynamics and farmer profiles. The training was based on National Skill Development Corporation (NSDC) and ASCI document QP-AGR/Q1201 and its detail is depicted in Figure 1 (https://nsdcindia.org/sites/default/files/QP_AGR-Q1201_Organic-Grower.pdf).

The master trainers were allied with farmers of Karnataka, Telangana, and Andhra Pradesh, for skill development under organic farming techniques and agricultural excellence trained certain farmers, for eight days (120 hours) in ICAR institutions/universities and are referred as farmer scientists. The selected farmer scientists consented to provide 0.4 ha land for organic farming experimental research, and designated as farm labs. The farmer scientists maintained these farm labs with the collaboration of PORI scientists. PORI supported the farmer scientist with numerous biofertilizers (depending on soil analysis results) and a soil testing kit called 'Dharti ka Doctor' (an indigenous PORI kit) to detect pH, organic carbon, and NPK [nitrogen (N), phosphorus (P) and potassium (K)]. these farmer scientists further trained fellow farmers of their region. The fellow farmers were trained about the approach, the tools, technology and methods including extension method. The farmers who practiced organic farming methods were examined by several government agencies and categorized as unsuccessful or successful depending on their knowledge and practical skills. PORI interviewed organic growers and their experiences were recorded and available online at http://patanjalifarmersamridhi.com/img/Flip%20Book/turnjs4/samples/basic/Orgainc_Farming.html.

RESULTS AND DISCUSSION

The small and medium scale farmers successfully attained skill development on various aspects of organic farming as revealed via following parameters.

Statistics of training program: The training program in three different states of southern India (Karnataka, Telangana, and Andhra Pradesh) integrated 26, 11 and 13 farmer scientists, respectively. In Andhra Pradesh, Karnataka, and Telangana, the program was successfully implemented in 4, 7 and 3 districts, respectively. State-wise implementation statistics revealed enrolment of 1816, 1717 and 1525 farmers in total, respectively. However, only 1438, 1088 and 1046 farmers were certified after evaluation by government agencies (Fig. 2).

Soil analysis and input supply by PORI: The fertility of the soil is significant in influencing the productivity of all farming methods. In Andhra Pradesh, primary Kharif crops grown in the state include rice, maize, jawar, bajra, ragi, and pulses, which are recognized for their high nutritional content and are the staple food of millions of people. During the Kharif-2019 season, farm labs grew paddy and received free phosphate rich organic manure (PROM), Poshak, Jaivik Khad, phosphate solubilizing bacteria (PSB), Rhizobium, and farm yard *manure (FYM)* to apply in the fields, as well as *Trichoderma* and *Pseudomonas* to combat fungal infections.

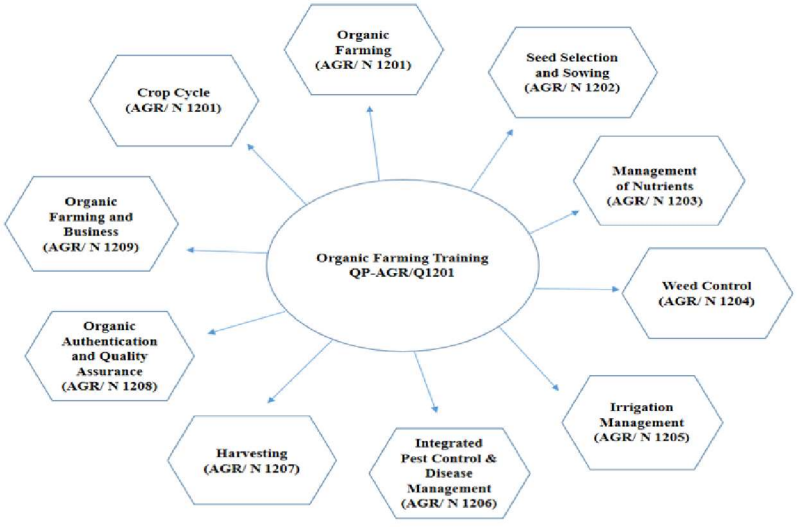

Fig. 1. Schematic representation of components of organic farming training program

The six different types of soil in Andhra Pradesh include red soil (65%), black soil (25%), alluvial soils (5%), costal sands (3%), laterite and lateritic soils (1%), and problem soils (1%). Moreover, soil testing at farm labs found that nitrogen (281-700 kg ha^{-1}), phosphorus (11-35 kg ha^{-1}) and potash's levels (151-300 kg ha^{-1}) were moderate to high. The organic carbon concentrations ranged from 0.4 to 0.8, whereas the pH ranged from 6.9 to 7.3. Karnataka's agricultural industry is distinguished by immense steppes of the drought-prone region and occasional pockets of irrigated territory. The most prominent types of soil categories identified in Karnataka were red soils (red gravelly loam soil, red loam soil, red gravelly clay soil, red clay soil); black cotton soil (gravelly soil, loose, black soil, basalt deposits); and lateritic soils (lateritic gravelly soil, lateritic soil). Soil degradation (soil compaction, salinity, sodicity, waterlogging, and pesticide residue), multiple nutrient shortages, low organic carbon content, and a reduction in productivity have been documented in the state under various agricultural methods. Additionally, the pH of the soil in the state ranges from 6.5 to 8.2. Soil testing in farm labs revealed that nitrogen (141-700 kg ha^{-1}), phosphorus (6-35 kg ha^{-1}), and potassium (101-300 kg ha^{-1}) levels ranged from low to high while organic carbon concentrations range from 0.4 to 0.7.

Subsequently, during *Kharif*-2019, all farm labs received free biofertilizers and pesticides such as phosphate rich organic manure, Poshak, Jaivik Khad, PSB, KMB, Rhizobium, and FYM use in the fields, as well as *Trichoderma* and *Pseudomonas* to fight against fungal infections. Kannan and Ramappa (2017) showed in a study that farmers' training on fertilizer application and education had positive and significant effect on adoption of soil nutrient technology to yield paddy in Karnataka, India.Additionally, the qualitative soil testing of Telangana state revealed the presence of vertisols, alfisols, inceptisols, and entisols. The primary constraints of all crops were drainage and texture. In addition, the primary constraints for crop growth in all soils were drainage, texture, coarse fragments, soil depth, pH, and organic carbon (OC). Soil testing at eight farm labs found that phosphorus (6-17 Kg/ha) and potash's (101-200 Kg/ha) levels are low to medium, while nitrogen levels are medium (281-420 Kg/ha). Organic carbon concentrations range from 0.5 to 0.7 and pH ranged from 6.5 to 7.5. All farm labs received free Prom, Poshak, Jaivik Khad, PSB, KMB, *Rhizobium*, and FYM to use in the fields and *Trichoderma* and *Pseudomonas* to combat fungal infections.

A similar technique for estimate of marginal impacts has been adopted by Khanna (2001) to examine the adoption decisions of soil testing and variable rate of technology for fertiliser application. The study revealed that because organic elements are restored by adding fertilizer, there is a natural loss of organic elements from the soil after each cropping cycle. In order to enhance the sustainability of organic practices, soil organic activity must be increased. It was demonstrated unequivocally that the biofertilizers contributed to Good Agricultural Practices by applying low organic inputs in farmer's fields, which lead to the improved productivity of safe food in selected agroecosystems. To preserve soil fertility, strategies such as mixed farming, producing crops that attract insects, relay cropping, and so on were employed to maintain a balance in the physical and chemical characteristics of the soil. Farmer trainees also

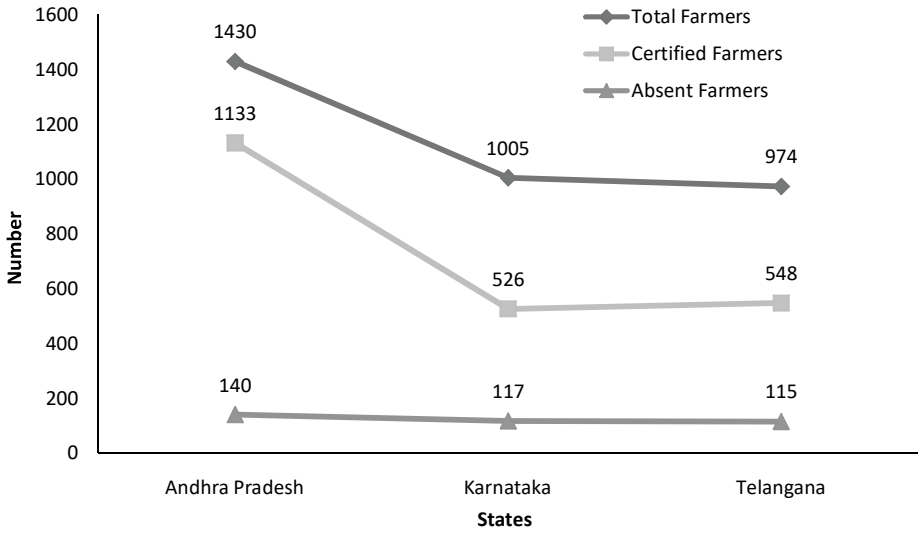

Fig. 2. State-wise detail of farmers involved in training program

gained insight on an integral part of soil management and focused on differences in soil types that defined specific interventions to enhance the soil quality for the land use selected.

Impact of training on input cost and profitability: Agroecology is a scientific study, cultural practices, or a social movement to establish agricultural and farming systems that make the most meaningful use and conservation of natural resources while requiring minor external inputs (Wezel et al 2009). The profit is assessed when the individual compares the advantages of conventional agriculture with organic farming. In Andhra Pradesh, the average cost of cultivation in farm labs under paddy, red chilli, sugarcane, and cotton was INR 32,750, 97,500, 2,10,000 and 35,000, respectively, whereas the net profit was calculated to be INR 27,500, 38,500, 90,000 and 19,000, respectively. In contrast, the average cost of cultivation in Karnataka farm labs for paddy crop and banana was 40,321 per acre and INR 84,250 respectively, with a net profit of INR 53,472 and 76,750, respectively. Moreover, in Telangana, the average cost of cultivation in farm labs under paddy, turmeric, and cotton was amounted to be 32,133 per acre, 62,000 per acre, and 24,000 per acre, respectively, with a net profit of INR 12,466, 61,200 and 54,000, respectively in farm labs (Table 1). The results stated above clearly depicted that horticulture provided relatively significant returns while also benefiting the soil ecology.

Organic Farming Issues: Farmer's Perspective

The adoption of new technology or farming techniques has piqued the curiosity of many people throughout the years. Farmers in India had been practicing eco-friendly agriculture for generations before the arrival of the 'green revolution,' which was based on the traditional agricultural practices used in western nations. For a variety of reasons, many small and marginal farmers have not entirely embraced conventional farming and continue to practice a more or less environmentally friendly method. They control self-regulated ecological and biological processes by utilizing local or farm-derived renewable resources. In the southern states like Andhra Pradesh, Karnataka, and Telangana, farmers agreed to start growing crops with organic methods after observing its profit and advantages. Nevertheless, they still need proper extension and training on using bio-fertilizers and bio-pesticides in the fields. Seed accessibility is also critical for native or high-producing cultivars. However, under present training program, trainers were motivated to make good networks and search reliable seed companies, from whom they and the farmers they have trained may get good quality seed of crop varieties in advance before sowing. Product price premiums, natural resource conservation in the form of better soil, nutrients and water quality, soil erosion prevention, and preservation of natural and agro-biodiversity are significant advantages attained with organic farming in the respective states.

Impact evaluation of PORI's training program by OP&HS: A third party, OP & HS, commenced the impact assessment of farmer scientists to understand the project's efficacy. The assessment of the trainee farmers instilled a sense of discipline and sincerity in the applicants, intending to retain, recalling, and implementing what they had provided to them in terms of teachings and practical application. The aggregated response showed that 92% of the trainee farmers had not undergone training in the southern region in the past. Moreover, almost 27% of the respondents acknowledged that they received proper advice and guidance on farming, while 27% assisted in farming and 45% ensured that things were done correctly. In addition, 40% of the farmers in the southern part felt that the most substantial benefit they received was reducing input costs. Organic farming has traditionally been considered to increase crop quality; this has been proven via farmer reactions. The farmers perceived an immediate and apparent improvement

Table 1. Crop wise input cost and profit details in southern states of India

States	Crop	Average cost (INR per acre)	Gross income (INR)	Net profit (INR)
Andhra Pradesh	Paddy	32,750	60250	27,500
	Red Chilli	97,500	1,36,000	38,500
	Sugarcane	2,10,000	3,00,000	90,000
	Cotton	35,000	54,000	19,000
Telangana	Paddy	32,133	44,599	12,466
	Turmeric	62,000	1,23,200	61,200
	Cotton	24,000	78,000	54,000
Karnataka	Paddy	40,321	93,793	53,472
	Banana	84,250	1,61,000	76,750

in quality. The Southern states had a nearly 96% reflection of quality. Additionally, 63% of respondents believed there was some increment in crop proportions, whereas 37% said there was no increase in output. Reduction in the input cost directly impacts the income and thus becomes an essential element to be examined. Among respondents from the southern region, 61% said they saved up to 30% on pesticide input costs by using adequate bio-pesticides as per soil testing reports. The organic activity of soil is a daunting task that must be followed as a sustainable agricultural practice to enrich and promote soil organic activity, resulting in increased soil fertility. The OP&HS designed questionnaire showed that 98 percent of responders in the southern state used organic enrichment. Subsequently, it was observed that 98% of the cultivators had adopted an utterly organic procedure for making bio-pesticide (Table 2). According to the study's framework, different crops would have to be introduced in each of the locations to improve income. However, many farmers expressed concerns about weather and water availability at the onset of this study. In addition, 84% of respondents from the southern region were able to retain and recollect what they had been taught, and the insights provided on alternative crops that may benefit them were valuable (Impact assessment report 2021).

Table 2. Impact assessment by OP and HS

Parameters	Sub-parameters	Impact statistics (%)
Training status	Trained prior	8
	Trained first time	92
Trainee feedback on farmer scientist	Assisted in farming	27
	Regular Supervision	45
	Improvement required	1
	Advice and guidance on farming	27
Impact of training	Knowledge enhancement	24
	Reduction in input cost	40
	Increase in production	9
	Overall benefits	27
Impact on output quality	Positive	96
	Not sure	4
Increment in crop proportions	Positive	63
	No increase	37
Pesticide expense cost	Saved up to 30%	61
	No saving	4
	Non-irrigated	21
Organic enrichment of soil	Adopted	98
	Not yet	2
Adoption of biopesticides	Completely organic	98
	Partial use of chemical pesticide	2
Knowledge of alternative crops	Affirmed	84
	Denied	16

Recommendations

There is a high-profit gain from organic sugarcane and red chilli in Andhra Pradesh state. However, certain places were considered suitable for sugarcane than others, and vice versa for red chilli. In Karnataka, both paddy and banana crops were high profit fetching crops as per the present study. Additionally, millets can be produced in enormous quantities for marketing purposes since more people choose to eat millets instead of rice owing to health concerns such as diabetes, high blood pressure, and obesity. Furthermore, alternate agricultural methods were suggested in the Andhra Pradesh and Karnataka regions, which were less good for one crop but extremely suitable for another. Subsequently, cotton and turmeric are also high-profit crops in the Telangana state. Cotton grows poorly in some areas but thrives in others, and vice versa. To maximize benefits, farmers should have access to new kinds of high-quality seeds, the biofertilizers should be applied based on the soil test report and also be made available to farmers on a timely basis. The vegetable cultivation is more profitable in organic farming than field crops. Crop rotation using pulses (green gram/black gram, pigeon pea, and soybean) and vegetables in *Rabi* season would enhance production and support prices for crops cultivated in *Kharif* season. In continuation, organic producers should make an effort to self-market their products by advertising them through mass media and social media, the internet, and personal contacts, as well as by establishing organic food shops in residential areas. Because organic farming used to generate lower money than conventional farming, early support for organic farmers may be more advantageous.

CONCLUSION

This training program has successfully helped a considerable number of individuals in accomplishing their goals. Farmers gain insight into revolutionary organic farming methods that enhanced crop yield, with minimal input cost, the net profit on various crops ranged between INR 12466 to 90000. The goal of the study was sustained with 98% adoption of bio-pesticides. Additionally, 40% of respondents revealed reduction in input cost. Formation of clusters, self-help groups, and other efforts are still needed to promote organic farming. However, more thorough scientific analyses at both the experimental and field level are required in order to comply with an organic agriculture system with clear management guidelines. Organic farming would grow tremendously in India if properly encouraged.

AUTHOR CONTRIBUTIONS

All authors have made a substantial contribution to the work.

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