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Diverging Views on Zero Budget Natural Farming (ZBNF): Insights from Farmers in Northern Karnataka

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HIGHLIGHTS

- The Kruskal-Wallis test demonstrated significant differences in viewpoints among adopters, planners, and non-adopters on most ZBNF statements
- Divergent perspectives views were observed on the necessity of Indigenous cattle, labour intensity, dependency on heavy machinery and pollution levels associated with ZBNF
- There was a consensus among groups regarding the sustainable handling of resources on-site and the superior quality of ZBNF output.

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ABSTRACT

Zero Budget Natural Farming (ZBNF) is promoted as an alternative farming method to achieve sustainability and build a climate-resilient agricultural system. The perception of farmers towards ZBNF determines its adoption. For the study was conducted in 2020 two districts of Northern Karnataka were chosen and respondents were categorised into adopters, planners, and non-adopters. From each group, 50 respondents were selected. The Kruskal-Wallis test was conducted to test the significant difference followed by the post hoc Dunn-Bonferroni test. Significant differences were found in 13 out of 15 statements, particularly concerning the necessity of indigenous cattle ($H = 16.71$, $p < 0.001$), labour intensity ($H = 17.59$, $p < 0.001$), and the reduction in yield during the first year of ZBNF ($H = 32.16$, $p < 0.01$). Planners and adopters differed significantly on statements such as ZBNF's labour-intensive nature ($p = 0.006$) and its independence from heavy machinery ($p = 0.003$). The Dunn-Bonferroni post hoc test highlighted differences across three groups on statements like all types of crops can be cultivated in ZBNF and there is no pesticidal residual effect of ZBNF products on human health. These distinct perceptions highlight the need for targeted outreach strategies based on farmers' perception.

INTRODUCTION

Agriculture in India is securing food for 18 per cent of the world's population and sustains 15 per cent of global livestock with just 2.5 per cent of the global land area (Gulati & Banerjee, 2019). With intensive resource usage, India is the world's largest extractor of groundwater (World Bank, 2012), with over 85 per cent of it used for irrigation (Central Ground Water Board 2017; Shiao et al., 2015). By 2019-20, fertilizer consumption increased to 29.04 MMT and 144.9 kg/ha (FAI, 2020). This has led to nitrate contamination in water bodies (Swaney et al., 2015) and land degradation (ISRO, 2016). Agriculture contributes to 20 per cent

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of the country's greenhouse gas emissions, primarily from livestock and the use of nitrogenous fertilizers (Ministry of Environment, 2015). Crop residue burning is a significant contributor to air pollution, especially in the north western region (Kaskaoutis et al., 2014). Land holdings have become increasingly fragmented, leading to a rise in the number of small and marginal landholders (Department of Agriculture, 2016). Previous agricultural strategies focused primarily on increasing production and ensuring food security, while often neglecting the need to raise farmers' income and sustainability (Nain et al., 2020; Jadhav, 2021).

The government is encouraging various farming systems that promote the judicious use of agricultural chemicals while enhancing sustainability. Government of India has initiated schemes like Paramparag at Krishi Vikas Yojana (PKVY), Mission Organic Value Chain Development for North East Region (MOVCDNER), PM Programme for Restoration, Awareness, Nourishment and Amelioration of Mother Earth (PM-PRANAAM), Galvanizing Organic Bio-Agro Resources Dhan (GOBARdhan) for sustainable agriculture and increasing farmers' income. PKVY launched in 2015, is part of the Soil Health Management initiative under the National Mission on Sustainable Agriculture. In 2018, various organic farming models, including Natural Farming, Rishi Farming, Vedic Farming, Cow Farming, Homa Farming, and ZBNF, were incorporated into the revised guidelines of the PKVY and RKVY. Zero Budget Natural Farming, renamed as Bhartiya Prakritik Krishi Padhati (BPKP), is a sub-scheme of PKVY since 2020-21 that claims to raise the returns and yields of farmers without using chemicals and pesticides (NABARD, 2024).

ZBNF promoted in India by Subhash Palekar since the 1990s include natural farming principles; diverse crops, year-round living roots, minimal intervention, indigenous seeds, integrating animals, diverse organic residues, and pest management without synthetic chemicals (Vijaykumar, 2021). ZBNF is an agro-ecological approach that promotes crop growth in harmony with nature, improving soil fertility through principles like diversification, nutrient recycling, and beneficial biological interactions (Palekar, 2006; Palekar, 2014).

Karnataka has been a pioneer in scaling up ZBNF, with collaboration between Subhash Palekar and the Karnataka Rajya Raita Sangha, farmers' movement, in 2002 (Khadse et al., 2018). In 2018, the Karnataka state government started ZBNF scheme with an allocation of 50 crores. This program encourages farmers from all agro-climatic zones to receive training in ZBNF for implementation in their fields (Thangjam et al., 2024; Kumar et al., 2023). Thus, scaling ZBNF requires a deeper understanding of farmers' opinion on sustainable practices which helps to minimise indiscriminate inputs usage and to conserve agriculture biodiversity.

METHODOLOGY

The study was carried out in 2020 in the northern region of Karnataka, India, due to the implementation of the 'Zero Budget Natural Farming' (ZBNF) movement by farmers' organizations in the area. A significant number of farmers in Karnataka have already adopted this practice. The State Agricultural Universities (SAUs) and the agricultural department of the state government collaborated to provide training to farmers under a government scheme. The study was conducted in two randomly selected districts, Belagavi and Haveri, and three randomly selected taluks from each district. Specifically, Belagavi, Hukeri, and Kittur taluks were selected from Belagavi district, while Haveri Savanur and Hirekerur taluks were selected from the Haveri district. The respondents were classified into three groups: Adopters, Planners, and Non-adopters, and were chosen based on criteria i.e., for adopters, the criteria include a minimum of 3 years of experience in zero budget natural farmingand a minimum of 2.5 acres of the area under ZBNF. Planners must be registered under the ZBNF training program since 2019 and be practicing ZBNF on at least 0.25 acres. Non-adopters should not be practicing ZBNF but must be well aware of ZBNF. Additionally, all respondents should reside in the same village as the adopters and planners. Twenty-five farmers were selected from each category in each district, resulting in a total of 150 respondents for the study.

A structured interview schedule was developed and a personal interview was done to collect data. The Kruskal-Wallis test was employed to identify significant differences in perceptions of ZBNF among the three groups. Following this, a post hoc Dunn-Bonferroni test was conducted to ascertain which specific groups exhibited differing perceptions.

RESULTS

The Kruskal-Wallis test results in Table 1indicated significant differencesin perspectives among adopters, planners, and non-adopters regarding the majority of the statements related to zero budget natural farming. In particular, there were significant contrasts in views regarding the necessity of indigenous cattle, the labor intensity of ZBNF practices, the dependency on heavy machinery, and the pollution levels associated with ZBNF. Additionally, opinions on the suitability of zero budget natural farming for all types of farmers, the prospect of cultivating diverse crops, cost reduction benefits, and initial yield reduction reveal significant disparities between the groups. Significant differences were also evident in views on the sustainability of ZBNF, its impact on soil enrichment and nutrient security, and the absence of pesticidal residues and the high market value of ZBNF produce. However, opinions on the sustainable management of on-farm materials and the quality of ZBNF production did not show significant differences, suggesting a consensus among the groups regarding these aspects.

The Dunn-Bonferroni post hoc test results in Table 2 suggested that there were notable differences in the perceptions across three pairs of groupsfor statements like "All types of crops can be cultivated in ZBNF", "In the first year of ZBNF, there is a reduction in the yield" and "There is no pesticidal residual effect of ZBNF products on human health". Planners and adopters had significant difference towards various statements about ZBNF such as "ZBNF practices were labor-intensive" ($p = 0.006$), "ZBNF does not depend on heavy machinery" ($p = 0.003$), "In the present context of agriculture, ZBNF cannot be suitable for all types of farmers" ($p = 0.003$), and others.

Furthermore, significant differences between planners and non-adopters were observed for statements such as "Indigenous cattle are pre-requisite for ZBNF" ($p = 0.001$), "All types of crops can be cultivated in ZBNF" ($p = 0.04$), "In the first year of ZBNF, there is a reduction in the yield" ($p = 0.029$), and "ZBNF decreases

Table 1. Statements according to Kruskal Wallis test (n=150)

S.No.	Statements	H Statistic	p-value
1.	Indigenous cattle are pre-requisite for ZBNF.	16.71	0.000235*
2.	ZBNF practices are labour-intensive.	17.59	0.000151*
3.	ZBNF does not depend on heavy machinery.	10.25	0.005933*
4.	ZBNF does not cause much pollution.	9.41	0.009068*
5.	In the present context of agriculture, ZBNF cannot be suitable for all type of farmers.	13.18	0.001377*
6.	All type of crops can be cultivated in ZBNF.	32.44	<0.01*
7.	ZBNF decreases cost of production to greater extent.	25.53	<0.01*
8.	In the first year of ZBNF, there is reduction in the yield.	32.16	<0.01*
9.	ZBNF is a sustainable type of farming.	15.91	0.000350*
10.	Over the years, ZBNF makes soil system enriched with microorganisms.	27.53	<0.01*
11.	Sustainable management of on-farm materials is possible by ZBNF.	3.21	0.201037
12.	Quality production is possible in by ZBNF.	1.03	0.598728
13.	Nutrient security can be achieved by ZBNF.	17.15	0.000189*
14.	There is no pesticidal residual effect of ZBNF products on human health.	29.90	<0.01*
15.	ZBNF produce has high market value.	8.02	0.018113*

*= 5.00% level of significance;

Table 2. Post Hoc Test- The Dunn-Bonferroni test

S. No.	Statements	Planner–Adopter (N_1=50)		Planner–Non Adopter (N_2=50)		Adopter–Non Adopter (N_3=50)	
		Test Statistic	p value	Test Statistic	p value	Test Statistic	p value
1.	Indigenous cattle are pre-requisite for ZBNF.	-2.9	0.699	24.95	0.001*	27.85	<0.001*
2.	ZBNF practices are labour-intensive.	23.25	0.006*	-11.25	0.18	-34.5	<0.001*
3.	ZBNF does not depend on heavy machinery.	-24.77	0.003*	-3.4	0.685	21.37	0.011*
4.	ZBNF does not cause much pollution.	-9.93	0.237	15.6	0.063	25.53	0.002*
5.	In the present context of agriculture, ZBNF cannot be suitable for all type of farmers.	24.6	0.003*	-3.27	0.697	-27.87	0.001*
6.	All type of crops can be cultivated in ZBNF.	-30.02	<0.001*	17.27	0.04*	47.29	<0.001*
7.	ZBNF decreases cost of production to greater extent.	-16.24	0.052	25.72	0.002*	41.96	<0.001*
8.	In the first year of ZBNF, there is reduction in the yield.	46.45	<0.001*	18.05	0.029*	-28.4	0.001*
9.	ZBNF is a sustainable type of farming.	17.89	0.031*	33.11	<0.001*	15.22	0.067
10.	Over the years, ZBNF makes soil system enriched with microorganisms.	12.26	0.14	42.34	<0.001*	30.08	<0.001*
11.	Nutrient security can be achieved by ZBNF.	-23.8	0.004*	9.01	0.271	32.81	<0.001*
12.	There is no pesticidal residual effect of ZBNF products. on human health	-24.75	0.003*	20.04	0.015*	44.79	<0.001*
13.	ZBNF produce has high market value.	3.01	0.712	21.35	0.009*	18.34	0.025*

*= 5.00% level of significance

cost of production to a greater extent" (p =0.002), among others. Moreover, significant differences between adopters and non-adopters were found for most of the statements, including "Indigenous cattle are pre-requisite for ZBNF" (p < .001), "ZBNF practices are labour-intensive" (p <0.001), "ZBNF does not depend on heavy machinery" (p = 0.011), "ZBNF decreases cost of production to a greater extent" (p <0.001), and "In the first year of ZBNF, there is a reduction in the yield" (p = 0.001). The results revealed that perceptions about zero-budget natural farming produce having high market value also differ significantly between planners and non-adopters (p = 0.009) and between adopters and non-adopters (p = 0.025).

Statements that did not show significant differences in perceptions between planners and non-adopters, were "ZBNF practices are labour-intensive" (p = 0.18), "ZBNF does not depend on heavy machinery" (p = 0.685), "In the present context of agriculture, ZBNF cannot be suitable for all types of farmers" (p = 0.697). Only statement "ZBNF is a sustainable type of farming" (p = 0.067) did not significantly differ between adopters and non-adopters.

DISSCUSSION

The post hoc analysis of perceptions towards ZBNF among adopters, planners, and non-adopters revealed distinct differences among these groups, indicating varying levels of comprehension. Disparities were observed in the perception of the importance of indigenous cattle in ZBNF between planners and non-adopters and between adopters and non-adopters. Non-adopters appeared to disagree with the idea compared with both planners and adopters. This difference may result from the lack of direct experience and understanding of the role of indigenous cattle in ZBNF, such as providing essential inputs like cow dung and urine, which are vital

for natural fertilization processes. Both adopters and planners recognized the importance of indigenous cattle, reflecting a deeper engagement with the principles of ZBNF.

Adopters stated that ZBNF practices were more labor-intensive than planners (Rao et al., 2021). Adopters, with their firsthand experience, recognized the increased labor requirements due to the manual nature of various ZBNF practices, such as preparing bio-inputs and maintaining soil health without chemicals, which aligns with the principles of minimal external input and reliance on traditional farming methods (Shankar, 2020). In contrast, planners may not have implemented ZBNF extensively and do not fully grasp labor demands. Non-adopters appeared to agree with adopters regarding the high labor requirement, which could be a deterrent to adopting ZBNF practices. This aligns with the broader understanding that sustainable farming practices often require more manual labor than conventional methods (Priya & Naidu, 2019; Kuramdasu et al., 2021). Additionally, adopters differed significantly from planners and non-adopters in their perceptions that ZBNF does not depend on heavy machinery. This perception reflects adopters acceptance of ZBNF's low-tech, sustainable approach, which relies more on manual labor and less on mechanization.

The differences observed in several statements among the three groups demonstrated broad variations in perceptions. Notably, the perception of the initial reduction in yield during the first year of ZBNF revealed significant differences between planners and adopters, planners and non-adopters, and adopters and non-adopters. This highlighted diverse experiences and expectations regarding the initial challenges and short-term productivity of ZBNF (Kumar et al., 2020 & Veni et al., 2022). Adopters may acknowledge the initial yield reduction but also recognize the long-term benefits. Planners may possess theoretical knowledge that does not fully capture the practical challenges. Non-adopters, who may rely on secondary sources of information, might not fully believe in the initial yield reduction. Similarly, the statements on the applicability of ZBNF for various crops showed significant differences across all pairs. Adopters perceived ZBNF as more universally applicable, reflecting their successful adaptation and diverse crop cultivation under ZBNF principles (Akkamahadevi & Ashok, 2021). In contrast, planners and non-adopters were more skeptical, due to a knowledge gap regarding different crops under ZBNF.

Specific areas where perceptions varied mainly between two groups were also highlighted, such as the belief that ZBNF produce has a high market value, which showed significant differences between planners and non-adopters, and adopters and non-adopters. This indicated that while adopters and planners recognized the premium market value of ZBNF produce, non-adopters were not aware of the certification available for ZBNF produce to fetch a higher price in the market. This skepticism among non-adopters could be attributed to limited market exposure or a lack of consumer demand awareness for ZBNF grown produce. These findings were consistent with those of Vanpariya et al., (2020) & Veni et al., (2022).

The findings revealed that there were significant differences in perceptions about ZBNF's ability to enrich the soil system with microorganisms over time primarily between planners and non-adopters, and between adopters and non-adopters. Adopters, who have witnessed improvements in soil health and fertility through natural practices, strongly hold this view, whereas non-adopters do not fully appreciate this long-term benefit, possibly due to their reliance on chemical fertilizers. These results were in contrast to Sarada & Kumar (2018). While planners, despite not fully adopting ZBNF, share some positive views with adopters, likely influenced by their training and partial implementation experiences. This alignment between planners and adopters reflected an acknowledgment of the reduction in cost of production and ZBNF's environmental benefits, such as reduced pollution and enhanced soil biodiversity, which are core components of the training programs. These results were consistent with the findings of Shankar (2020). Interestingly, the perception that ZBNF is a sustainable type of farming differed significantly between planners and adopters but not between adopters and non-adopters. For the statement that ZBNF is not suitable for all types of farmers, there was a significant difference between planners and adopters and between adopters and non-adopters. Adopters seem to recognize the limitations of ZBNF for different farming contexts, which planners and non-adopters might underestimate. With regard to the attainment of nutrient security through ZBNF, there was a significant difference between planners and adopters, and between adopters and non-adopters. This indicated that adopters' insights were based on real-world application, whereas planners and non-adopters may offer a perspective based on their limited understanding with few crops under ZBNF.

Overall, these results underscore the varied level of understanding ZBNF practices among the three groups, with adopters generally holding the most favorable views influenced by their direct experience with the farming method. Planners, who were in the intermediary phase of training and partial adoption, exhibit perceptions that were often aligned with adopters but still show some skepticism similar to non-adopters. Non-adopters, who lack practical experience and exposure, tend to had the most reservations about ZBNF. This detailed understanding of perception differences is crucial for designing targeted interventions and educational programs to bridge the perception gaps and promote wider adoption of ZBNF practices.

CONCLUSION

The results revealed insights into the dynamics on perceptions of farmers on ZBNF. Adopters with more experience in ZBNF and strongly believed in its potential, recognizing its independence from heavy machinery, benefits to soil health and nutrient security. Planners hold a more complex view, agreeing on the importance of indigenous cattle and environmental benefits but expressed concern overlabour requirement for input preparation. Non-adopters were more sceptical, unconvinced about the role of indigenous cattle, benefits of ZBNF on health and soil. They had less positive view of ZBNF's suitability to wide crops and market potential. Thus, there is need for tailored institutional interventions by KVKs and SAUs in effective information dissemination and capacity building to address specific concerns and knowledge gaps by effectively communicating the benefits and building trust among the farmers.

Though ZBNF is promoted as alternate farming, the future policy initiatives need to be based on scientific validation of ZBNF in diverse agro-climatic conditions and providing marketing support to the farmers.

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