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Effect of Natural Farming Practices on Growth and Yield of Onion (*Allium cepa* L.) under Front Line Demonstrations in Kashmir Valley

S. N. Kirmani[1]*, W. H. Raja[2], Manoj Kumar[3], Geetika Malik[4], Karan Chhabra[5] and Kounsar Javeed[6]
[1]SMS Horticulture, ICAR KVK Baramulla (J& K), India.
[2]Sr Scientist and Head, ICAR, KVK Baramulla (J& K), India.
[3]Pr. Scientist and Head, KVK Pali, (J& K), India.
[4]Sr. Scientist, ICAR CITH Srinagar (J& K), India.
[5]SMS Agrometeorology, KVK Baramulla (J& K), India.
[6]Assistant Professor, SKUAST Kashmir (J& K), India.

(Corresponding author: S. N. Kirmani)*
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ABSTRACT: Front Line Demonstrations (FLDs) conducted during the rabi season of 2022–23 by Krishi Vigyan Kendra (KVK) Baramulla across selected villages of different blocks in the Union Territory of Jammu and Kashmir to evaluate the performance of natural farming practices in onion cultivation under farmer field conditions. The effect of the input Jeevamrit was assessed on growth, yield, and economic parameters of two onion varieties, Red Globe and CITH-O-2, by comparing demonstration plots with adjacent plots under farmers' practice. Application of Jeevamrit resulted in noticeable improvement in bulb weight, bulb dimensions, and vegetative growth attributes in both varieties. The treated plots recorded higher average bulb weight (280 g in Red Globe and 375 g in CITH-O-2) along with increased shoot length, indicating enhanced crop vigor. Based on average bulb weight and estimated plant population, natural farming plots achieved a higher projected bulb yield of 71.2 t ha^{-1} in Red Globe and 82.5 t ha^{-1} in CITH-O-2, representing yield advantages of 12.0 and 4.2 per cent, respectively, over farmers' practice. Economic analysis further revealed higher gross and net returns under natural farming, with improved benefit–cost ratios in both varieties, particularly in CITH-O-2. The FLDs clearly demonstrated the technical feasibility, yield advantage, and economic viability of natural farming practices, strengthening farmer confidence and supporting wider adoption of low-input, sustainable onion production systems in temperate regions.

Keywords: Natural farming, Jeevamrit, Onion, FLD, KVK, Sustainable agriculture.

INTRODUCTION

Onion (*Allium cepa* L.) is one of the most widely cultivated vegetable crops in India and plays a crucial role in nutritional security, farm income, and employment generation. India ranks second globally in onion production, and the crop occupies a significant area in temperate regions such as the Kashmir Valley, where it serves as an important rabi vegetable. The crop occupies a prominent place in temperate regions such as the Kashmir Valley, where it is cultivated mostly under open-field conditions (SKUAST-K, 2019). However, productivity in farmers' fields often remains below potential due to imbalanced nutrient management, rising input costs, and gradual deterioration of soil health under intensive chemical-based agriculture.

In recent years, natural farming has emerged as a promising alternative production system emphasising soil biological health, reduced dependence on external inputs, and ecological sustainability. Natural farming practices rely on on-farm biological formulations such as Jeevamrit, Beejamrit, botanical extracts, and mulching to enhance nutrient cycling and microbial activity. Jeevamrit, a fermented microbial consortium prepared using cow dung, cow urine, jaggery, pulse flour, and native soil, has been reported to improve soil enzymatic activity, nutrient solubilization, and plant growth through enhanced rhizosphere interactions (Palekar, 2016; Yadav and Meena 2019). Application of bio-inputs and natural farming formulations has been reported to enhance soil biological activity, crop growth, and yield attributes in vegetable crops (Raina and Gupta 2021). ZBNF reduces the cost of cultivation but it adversely affects the crop yield when compared with conventional farming (Mohammed Ghouse *et al.*, 2025). Traditional knowledge systems are crucial for promoting sustainable living by offering valuable insights and practices in areas like resource management, biodiversity conservation, and climate change adaptation (Sharma, 2025).

Several studies have indicated the positive role of Jeevamrit and other bio-inputs in improving growth and

yield of vegetable crops such as tomato, chilli, brinjal, and onion under different agro-climatic conditions (Sharma and Singh 2020; Khan *et al*., 2022). However, most available evidence is either experimental-station-based or region-specific, with limited validation under farmer field conditions, particularly in temperate Himalayan ecosystems. Moreover, the adoption of natural farming practices by farmers remains low due to a lack of visible proof, confidence, and locally generated scientific data. Recent studies have also highlighted the potential of natural and low-input farming practices in improving vegetable crop productivity and sustainability under diverse agro-climatic conditions (Sharma *et al*., 2021; Verma and Mehta 2020; Khan *et al.,* 2019).

Front Line Demonstrations (FLDs) are an effective extension tool of ICAR aimed at demonstrating newly recommended technologies directly on farmers' fields under real farming situations (Dubey and Verma 2021). FLDs not only generate location-specific data but also facilitate rapid dissemination and adoption of proven technologies through farmer-to-farmer learning. In hill and Himalayan regions, low-input and soil-centric approaches such as natural farming are especially relevant due to fragile ecosystems and high cost of external inputs (NAAS, 2019).

In this context, the present study was undertaken at Krishi Vigyan Kendra (KVK) Baramulla to scientifically evaluate the effect of natural farming practice using Jeevamrit on growth and yield attributes of onion under temperate conditions and to assess its demonstration potential through FLDs.

MATERIALS AND METHODS

A. Experimental Site and Climatic Conditions

The Front-Line Demonstrations were conducted during the rabi season of 2022–23 at selected farmer fields under the jurisdiction of Krishi Vigyan Kendra (KVK) Baramulla, Jammu & Kashmir. The region falls under temperate agro-climatic zone characterised by cold winters, mild summers, and well-distributed rainfall. The soils of the area are generally loamy to clay loam with medium fertility status.

B. Experimental Design and Treatments

The demonstrations were laid out on farmers' fields using a simple comparative design comprising two treatments:

- **T1 (Treated):** Natural farming practice with application of Jeevamrit
- **T2 (Control):** Farmers' practice without application of Jeevamrit

Two onion varieties from ICAR- CITH for popularisation were selected:

- Red Globe and
- CITH-O-2

Each treatment was maintained on adjacent plots to ensure uniform soil and climatic conditions. All other agronomic practices such as spacing, irrigation, and intercultural operations were kept uniform across treatments, except for the natural farming input.

C. Preparation and Application of Jeevamrit

Jeevamrit was prepared using fresh indigenous cow dung, cow urine, jaggery, pulse flour, and a handful of local soil, following standard natural farming guidelines.

Fig. 1. Distribution of onion seedlings and Jewamrit for FLD to farmers in Baramulla District.

The mixture was fermented for 48–72 hours under shade with periodic stirring. Jeewamrit along with Onion seedlings, was handed over to Farmers and were fully guided on the method of application and management of Onion on scientific lines. Jeevamrit was applied as soil drenching at critical crop growth stages.

D. Data Collection and Statistical Interpretation

Observations were recorded at harvest on randomly selected plants from each plot from all the farmers' place. Growth and yield parameters including average bulb weight, bulb length, bulb diameter, number of shoots per plant, and shoot length, were recorded. As FLDs are primarily extension-oriented, data were analysed using simple averages and percentage comparison to assess performance differences between treated and control plots.

RESULTS AND DISCUSSION

A. Effect of Natural Farming on Bulb Yield Attributes

The application of Jeevamrit under natural farming practice resulted in a noticeable improvement in bulb size and weight in both onion varieties (Table 1). In Red Globe, the average bulb weight increased by 12.0 per cent over control, while in CITH-O-2, an increase of 4.2 per cent was recorded. Improvement in bulb dimensions, such as length and diameter, was also evident in treated plots.

Enhanced bulb development under Jeevamrit application may be attributed to increased microbial population and improved nutrient availability in the root zone (Singh *et al*., 2018; Yadav and Meena 2019). Jeevamrit is known to stimulate beneficial microorganisms that enhance nitrogen fixation, phosphorus solubilization, and micronutrient uptake, leading to improved sink development in bulb crops.

B. Effect on Vegetative Growth Parameters

Vegetative growth parameters showed a positive response to natural farming inputs. Shoot length was significantly higher in treated plots, particularly in CITH-O-2, where shoot length increased from 40 cm in the control to 54 cm under Jeevamrit application (Table 1). Increased shoot length indicates better photosynthetic surface area, which ultimately contributes to higher bulb yield.

The number of shoots per plant remained unchanged across treatments, suggesting that Jeevamrit primarily influenced plant vigour and biomass accumulation rather than shoot proliferation. Similar observations have been reported by earlier workers in onion and other vegetable crops under bio-input-based nutrient management (Sharma and Singh, 2020; Khan *et al.*, 2022).

C. Effect of natural farming on Yield Performance

Based on the average bulb weight and estimated plant population for 1-hectare, natural farming plots recorded higher projected yield per hectare compared to farmers' practice in both varieties. Red Globe under natural farming achieved an estimated yield of 151.2 t ha^{-1}, reflecting a notable yield advantage under temperate conditions. CITH-O-2 exhibited superior yield potential, with an estimated yield of 71.2 t ha^{-1}, confirming its suitability for high-productivity systems (Table 2). The magnitude of yield improvement was more pronounced in Red Globe, indicating greater responsiveness of medium-yielding varieties to Jeevamrit application. These results demonstrate the practical feasibility of yield enhancement through low-cost natural farming inputs under farmer field conditions.

D. Effect on Economics and Benefit–Cost Ratio

Natural farming recorded higher gross and net returns in both onion varieties due to increased yield levels without a proportionate rise in input costs. Despite the additional cost involved in Jeevamrit preparation and application, the incremental returns outweighed the added expenses, resulting in improved profitability. The B:C ratio was consistently higher under natural farming, indicating better economic efficiency compared to farmers' practice. CITH-O-2 recorded the highest B:C ratio, highlighting its economic suitability for adoption under natural farming systems (Table 3). These findings reinforce that natural farming is not only agronomically beneficial but also economically viable for onion cultivation under temperate conditions.

E. Extension Impact and Farmer Response

The FLDs generated a strong visual impact, as treated plants exhibited healthier foliage and larger bulbs compared to control plots. Participating farmers expressed satisfaction with the performance of natural farming practices, citing reduced input costs and visible yield improvements. Distribution of onion seedlings and Jeevamrit during FLDs further enhanced farmer participation and awareness, reinforcing the role of FLDs as an effective extension strategy for promoting sustainable agriculture.

Table 1: Effect of Natural Farming Practice on Onion Growth and Yield.

Parameter	Red Globe (Treated)	Red Globe (Control)	CITH-O-2 (Treated)	CITH-O-2 (Control)
Avg. bulb weight (g)	280	250	375	360
Avg. bulb length (cm)	7.5	7.0	8.0	7.5
Avg. bulb diameter (cm)	9.0	8.2	8.0	6.0
No. of shoots/plant	9	9	8	8
Shoot length (cm)	38	32	54	40

Values are means across Front Line Demonstration sites in almost Five Villages in five different Blocks of District Baramulla of Jammu and Kashmir.

Red Globe

CITH-O-2

Table 2: Effect of natural farming practices on the estimated bulb yield of onion.

Variety	Treatment	Avg. bulb weight (g)	Estimated yield (t ha^{-1})	Yield increase over control (%)
Red Globe	Natural farming (Jeevamrit)	280	**71.2**	**12.0**
Red Globe	Farmers' practice	250	**62.66**	–
CITH-O-2	Natural farming (Jeevamrit)	375	**82.5**	**4.2**
CITH-O-2	Farmers' practice	360	**79.035**	–

As per SKUAST K Management POP:-
Spacing: 15 × 10 cm;
Marketable yield: 90%

Table 3: Economics of onion cultivation under natural farming and farmers' practice.

Variety	Treatment	Cost of cultivation (₹ ha^{-1})	Gross returns (₹ ha^{-1})	Net returns (₹ ha^{-1})	B:C ratio
Red Globe	Natural farming	88,500	22,68,000	21,79,500	**2.56**
Red Globe	Farmers' practice	85,000	20,25,000	19,40,000	2.38
CITH-O-2	Natural farming	88,500	30,37,500	29,49,000	**3.43**
CITH-O-2	Farmers' practice	85,000	29,16,000	28,31,000	3.35

Results are Based on Average Rates: -
Market price of onion = ₹15 kg^{-1}
Additional cost of Jeevamrit = ₹3,500 ha^{-1}
Base cost of cultivation (farmers' practice) = ₹85,000 ha^{-1}

Statistical note

"As Front-Line Demonstrations are extension-oriented and not replicated experiments, statistical tests such as t-test or ANOVA were not applied. Data were analysed using simple means and percentage increase over farmers' practice.

CONCLUSION

The Front-Line Demonstrations clearly indicated that natural farming practices using Jeevamrit positively influenced the growth, yield, and economic performance of onion under the temperate conditions of the Kashmir Valley. Application of Jeevamrit resulted in improved bulb weight, bulb dimensions, and vegetative growth, particularly shoot length, reflecting enhanced crop vigour and better nutrient utilisation. Both onion varieties responded favourably to natural farming, with CITH-O-2 exhibiting comparatively higher yield potential and economic returns, while Red Globe showed a greater percentage increase over farmers' practice. Based on estimated yield and economic analysis, natural farming plots recorded higher projected yield per hectare and improved benefit–cost ratios despite minimal additional input costs, indicating the economic viability of the practice. The demonstrations further revealed that yield enhancement was achieved primarily through improved

bulb development rather than changes in plant population or shoot number.

Overall, the study confirms that natural farming practices using Jeevamrit can be effectively promoted as a sustainable, low-input, and economically rewarding alternative to conventional chemical-based onion cultivation. The positive field performance and farmer response observed during the demonstrations highlight the potential of FLDs as an effective extension tool for wider dissemination and adoption of natural farming technologies in similar temperate and hill agro-ecosystems.

FUTURE SCOPE

1. The present Front Line Demonstrations provided field-level evidence on the benefits of natural farming practices; however, long-term multi-season studies are required to assess the sustained impact of Jeevamrit on onion productivity, soil health, and yield stability under temperate conditions.
2. Future research may focus on quantifying changes in soil biological properties, including microbial biomass, enzyme activity, and nutrient dynamics, to scientifically validate the mechanisms through which Jeevamrit enhances crop performance.
3. Comparative studies involving different dosages, frequency, and methods of Jeevamrit application can help optimize its use for onion and other vegetable crops.
4. There is scope to evaluate the combined effect of multiple natural farming inputs such as Beejamrit, botanical extracts, mulching, and bio-enhancers along with Jeevamrit for further yield and economic improvement.
5. Replicated trials with appropriate experimental designs can be undertaken to establish statistical significance of yield and growth responses observed under FLDs.
6. Future studies may also explore the impact of natural farming on bulb quality parameters, storage life, and market acceptability of onion produce.
7. Economic and adoption studies assessing farmer perception, scalability, and constraints will be useful for strengthening extension strategies and policy support for natural farming.
8. The findings can be extended to other vegetable crops and hill agro-ecosystems, facilitating wider promotion of sustainable, low-input farming systems through KVK-led programs.

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