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Impact of Front-Line Demonstrations on Production Technology of Ginger cv. Suprabha in Korea District under the Northern Hill Region of Chhattisgarh

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Abstract

Ginger, the rhizome of *Zingiber officinale* Roscoe, is one of the most widely used spices from the family Zingiberaceae. India is the largest ginger-producing country in the world, with an annual production of 795,028 tonnes from an area of 138,479 ha during 2008–09 (Spices Board 2011). The field experiment on ginger was carried out in the Northern Hilly region of Chhattisgarh, focusing on the potential to substantially improve production and productivity, particularly in the Korea district. The study was conducted during the Kharif seasons in seven villages: Salka, Nagar, Umjhar, Tilwandad, Dakaipara, Bhandarpara, and Sonhat, under Baikunthpur and Sonhat blocks of Korea district. The Krishi Vigyan Kendra (KVK) in Korea conducted front line demonstrations with an improved package of practices for ginger cultivation over two years (2015-16 and 2016-17) and achieved yields significantly higher than those obtained by farmers using traditional practices. The yield of ginger can be increased by demonstrating improved cultivation technology on farmers' fields under the supervision of KVK scientists. The average yield from 24 demonstrations over an area of 15 ha was found to be 265.3 q/ha, compared to 171.7 q/ha from existing practices. This represents an average yield increase of 54.20%, with an extension gap of 187.2 q/ha over two years. The demonstrations showed active participation of farmers, aiming to showcase the potential of improved vegetable production technologies. These technologies included the use of improved varieties, rhizome treatment with bio-culture, balanced fertilizer application, and pest management.

Key words: Ginger, Variety, FLD, Technology gap, Economics, Extension gap, Technology index

Krishi Vigyan Kendra (KVK/ Farm Science Center), is an innovative science-based institution that plays a pivotal role in bridging the gap between research scientists and farmers. The primary aim of KVKs is to reduce the time lag between the generation of new technology at research institutions and its transfer to farmers, thereby enhancing productivity and income in the agriculture and allied sectors on a sustained basis. KVKs operate at the grassroots level, focusing on the application of technology through assessment, refinement, and demonstration of proven technologies tailored to various micro-farming situations in a district. Ginger, the rhizome of *Zingiber officinale* Roscoe, is one of the most widely used spices from the family Zingiberaceae. India is the largest ginger-producing country globally, with an annual production of 795,028 tonnes from an area of 138,479 ha during 2008–09 [1]. Ginger is consumed either fresh or dried within the country, while importing countries mainly use it in the form of oleoresin or essential oils. The appearance of dry ginger is crucial for fetching premium prices. Essential oils, oleoresin, starch, protein, and crude fiber are vital quality attributes of ginger [2]. Quality requirements for exporting spices have been formulated [1] (Spices Board 1998). Studies have shown that ginger is a shade-tolerant crop [3-6]. Research on mango-based intercropping has rated ginger as a shade-loving crop, highly suitable for intercropping in mango orchards (KAU 1992). There is an increasing trend to export ginger oils and oleoresin, highlighting the need to assess the influence of shade regimes on the quality of ginger, including its spice oil, non-volatile ether extract, starch, and crude fiber content.

Ginger is one of the most important spices worldwide. For over 2,000 years, Chinese medicine has recommended ginger for curing and preventing various health problems. It is known to promote energy circulation and positively influence the body’s metabolic rate. Historically, ginger was highly valued, equivalent in price to a whole sheep in ancient Rome. After the fall of the Roman Empire, ginger's popularity waned but resurged in Europe later. Throughout history, ginger has influenced trade and economy, being a highly prized commodity. The Chinese and Indians have used ginger tonics to treat ailments for over 4,700 years. During the Roman Empire, it was a precious trade item due to its medicinal properties. Proper digestion and nutrient absorption are crucial for health, and ginger plays a significant role in promoting these processes. Ginger helps in preventing food fermentation and obstruction in the digestive tract, which can lead to nutrient deficiencies. It promotes regular digestion and metabolism,

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thereby supporting a strong immune system. The Journal of Microbiology and Antimicrobials published a 2011 study highlighting ginger's effectiveness in enhancing immune function, outperforming conventional antibiotics against Staphylococcus aureus and Streptococcus pyogenes.

MATERIALS AND METHODS

The present study was carried out by the Krishi Vigyan Kendra, Baikunthpur, Korea under the University of Indira Gandhi Krishi Vishwavidyalaya, Raipur Chhattisgarh during kharif season from 2015-16 to 2016- 17 (2 years) in the farmers' fields of adopted Seven villages viz., Salka, Nagar, Umjhar, Tilwandad, Dakaipara, Bhandarpara and Sonhat of Korea district in northern Hill region of Chhattisgarh. In total 24 front line demonstrations in 15 ha area in different villages were conducted. Materials for the present study with respect to FLDs and farmers practices were given in (Table 1). In case of local check plots, existing practices being used. In general, soils of the area under study were medium black cotton with medium to low fertility status. In the present study, the data on output of Zinger cultivation were collected from FLDs plots, besides the data on local practices commonly adopted by the farmers of this region were collected. In demonstration plots, few critical inputs in the form of quality seed, balanced fertilizers, agro-chemicals etc. were provided and non-monetary inputs like timely Sowing and weeding were also performed. Whereas traditional practices were maintained in case of local checks. The demonstrations on farmers fields were facilitated by KVK scientists in performing field operations like sowing, spraying, weeding, harvesting etc., during the course of training and visits. For the study technology gap, extension gap and technology index were calculated by Samui *et al.* [7].

Extension gap (q ha^{-1}) = Demonstration yield – Farmer's yield

Technology gap (q ha^{-1}) = Potential yield – Demonstration yield

Technology index (%) = [Potential yield– Demonstration yield / Potential yield] × 100

Table 1 Particulars showing the details of Zinger growing under front line demonstration and existing practice

S No.	Operation	Existing practices	Improved practices demonstrated
1.	Variety and rhizome treatment	Local seeds No seed treatment	Improved and purified Rhizome from Suprabha Rhizome treatment with *Trichoderma viridi* (10g/kg Seed) or Mencojeb + Carbendazim (2 g/kg rhizome)
2.	Sowing method	By flat bed	By raised bed
3.	Spacing	No use of proper spacing	30x20 cm Row to Row & Plant to plant
4.	Fertilizer application	FYM -10 t/ha. N:P:K @ 60:30:00 kg/ha Un-aware of bio-fertilizers	FYM -25 t/ha. N:P:K@100:50:50 kg/ha Dipping of Rhizome with bio-fertilizers (Trichoderma & Pseudomonas)
5.	Weed management	No use of proper weed management	Use of proper weed management
6.	Pest management	Non-adoption of IPM practices	Adoption of IPM practices
7.	Quality improvement at farm level	Un-hygienic	Adoption of improved post-harvest handling

RESULTS AND DISCUSSION

The results of 24 front-line demonstrations (FLDs) conducted during 2015-16 to 2016-17 over a 15-ha area on farmers' fields in seven villages of Korea district indicated that the cultivation practices used in the FLDs—such as improved varieties, raised seedbed preparation, balanced fertilizer application, and integrated pest management produced, on average, 28.53% more yield of ginger compared to local checks. This demonstrates that the FLDs had a significant positive impact on the farming community of Korea district, motivating them to adopt the new agricultural technologies demonstrated in the FLD plots. Data further showed that the yield of ginger increased successively in the following years, clearly indicating the positive impact of FLDs over existing cultivation practices (Table 2). From the first year onwards, farmers participated enthusiastically in the FLDs, leading to encouraging results in subsequent years. The observed technology gap may be attributed to variations in soil fertility status and weather conditions. Therefore, variety-wise, location-specific recommendations are necessary to minimize the technology gap for yield levels in different situations.

Table 1 Yield and yield difference of Zinger under front line demonstrations

Year	No. of FLDs	Yield (q/ha)		Additional yield over local check (q/ha)	Per cent increase yield over local check
		FLD	Local Checks		
2015-16	12	182.47	142.50	39.97	28.04
2016-17	12	186.34	144.42	41.92	29.02
Total	24	368.81	286.92	81.89	57.06
Mean		184.40	143.46	40.94	28.53

Table 2 Yield gap and technology index in front line demonstrations

Year	No. of FLD	Technology gap (Kg/ha)	Extension Gap (Kg/ha)	Technology Index (%)
2015-16	12	67.53	39.97	27.01
2016-17	12	63.66	41.92	25.46
Total	24	131.19	81.89	52.47
Mean		65.59	40.94	26.23

The highest extension gap ranged from 39.97 q/ha to 41.92 q/ha during the study period, emphasizing the need to educate farmers through various means to adopt improved agricultural production technologies. Increasing the use of the latest production technologies and high-yielding varieties will help reverse the trend of a wide extension gap. New technologies will eventually lead farmers to discontinue old varieties and adopt new ones. The technology index, which indicates the feasibility of the demonstrated technology at farmers' fields, showed a decrease from 27.01% (2015-16) to 25.46% (2016-17), exhibiting the feasibility of the demonstrated technology (Table 2).

Greater use of the latest, improved production technologies applied to high-yielding varieties can bridge the extension gap between demonstration yield and farmers' yield [8-12]. The economics of growing ginger under FLDs were estimated, and the results are presented in Table 3. Economic analysis of yield performance revealed that, besides higher production, participating farmers in FLDs realized a higher price for their produce compared to the local checks due to better quality. FLDs recorded higher mean gross returns (Rs. 507,295.3/ha) and mean net returns (Rs. 746,595.7/ha), with an average benefit-cost ratio (7.11) compared to the local checks in our study [13-15].

Table 3 Economics of front-line demonstrations of Zinger

Year	Cost of cultivation (Rs./ha)		Gross returns (Rs./ha)		Average net returns Rs./ha)		Benefit cost ratio	
	FLD	Local check	FLD	Local check	FLD	Local check	FLD	Local check
2015-16	729880	570000	82890.6	78570.2	646989.4	491429.8	7.80	6.25
2016-17	85497.24	80526.56	931700	722100	846202	641573	9.89	7.96
Total	815377.24	650526.56	1014590.6	800670.2	1493191.4	1133002.8	17.69	14.21
Mean	407688.62	325263.28	507295.3	400335.1	746595.7	566501.4	8.86	7.11

CONCLUSION

Based on the findings of the present study, it is concluded that FLDs of improved technology reduce the technology gap to a considerable extent, leading to increased productivity of ginger in Korea district of Chhattisgarh. This also improved linkages between farmers and scientists, building confidence in the adoption of improved technology. Productivity enhancement under FLDs over traditional ginger cultivation practices created greater awareness and motivated other farmers, who were not previously growing ginger, to adopt improved technologies for this rhizome spice crop. The study of yield gap analysis of ginger through Front Line Demonstrations (FLDs) revealed that losses caused by rhizome rot disease, in terms of yield (q/ha), could be mitigated by 28.04% to 29.02%. The technology gap, which indicates the difference between the demonstration yield and the potential yield, ranged between 67.53 and 63.66 q/ha. This gap can be attributed to variations in soil fertility and local climatic conditions. The extension gap, ranging between 39.97 and 41.92 q/ha, emphasized the need to educate farmers through various means such as training and FLDs. The technology index, which measures the feasibility of the demonstrated technology, ranged between 27.01% and 25.46%, indicating the good performance of the interventions aimed at reducing the yield gap in ginger.

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