Original Research Article

Farmers' participatory on-farm trials for dissemination of brinjal variety-*HZKB 1* under organic cultivation in Uttarakhand and Jammu & Kashmir

Abstract

With the aim to introduce the farmer's potential brinjal variety in a new region, the brinjal variety HZKB-1 (*Hulyal Zulapi Kari Badane*-1) in comparison with three check varieties *Pant Rituraj, Hisar Shyamala* and BR-112 was evaluated for its performance and suitability through farmers' participation using Researcher-managed farmer-implemented trials (RMFITs) during *Kharif* 2021. Across the 28 farmer's fields, it was replicated seven times covering Uttarakhand (Dehradun and Almora) and Jammu & Kashmir (Rajouri). Thus, the data recorded were analyzed using a Randomized Block Design showed significant differences among all the varieties for the parameters observed. The data revealed the superiority of HZKB-1 in terms of fruit yield (335.00 q/ha) which was 10.45 %, 16.15 % and 9.74 % higher over the checks BR-112, *Pant Rituraj* and *Hisar Syamala*. It took 122.86 days for the first picking and recorded superior in yield-related traits *viz.* fruit weight (240.49 g), fruit diameter (12.11 cm) and fruit length (13.94 cm). However, the plant height (79.37 cm) found at par to *Pant Rituraj* (89.59 cm) where BR-112 recorded the highest leaf length (21.74 cm) and leaf width (17.70 cm) than the HZKB-1 recorded with 17.51 cm and 14.07 cm of leaf length and leaf width respectively. Apart from that the Farmer-managed trials (FMTs) conducted at 23 farmer's fields covering the same target area revealed Rajouri as the most suitable district for the cultivation of HZKB-1 variety. As per the growers' feedback, the variety has a shelf life of 5-7 days and negligible pest damage was observed. The desirable traits of the variety exhibited in new areas under organic cultivation enable the cultivar for suitable breeding material in crop improvement programs. It is also concluded that the participation of farmers in technology evaluation supported extending the adoption and popularizing the technology for wider acceptance.

Keywords: *Solanum melongena*, eggplant, Participatory evaluation, Researcher-Managed Farmer-Implemented trials (RMFITs), Farmer-managed trials (FMTs), OFT

Introduction:

Brinjal (*Solanum melongena* L.) is an important vegetable crop in India and is grown throughout the year. However, it is widely cultivated in both temperate and tropical regions of the globe mainly for its immature fruits as vegetables. (Rai *et al.,* 1995). Globally, India is the largest producer of vegetables and ranks second in the production of brinjal or eggplant (Pramila *et al*., 2017).

Farmers need improved eggplant varieties for sustainable production and adaptation to climate change challenges (Taher *et al*., 2017). Landraces are crop varieties that have been differentiated by farmers through a historical selection process and they represent a great genetic heritage as a source of agricultural biodiversity. These local varieties are better adapted to specific agro climatic conditions, and they are suitable for new agriculture kinds, such as organic production (Martinez-Ispizua *et al.*, 2021). Over the generations, this practice resulted in ever-increasing quantities of locally adapted varieties known as the landraces, traditional varieties, local varieties, farmers' varieties etc. Seed travelled across the continents and countries into new environments where both natural selection and farmer's selections crafted and drafted varieties to increase local adaptations and ultimately enhance productivity (Singh and Agarwal 2021).

The brinjal variety HZKB-1 was developed by grassroots woman farmer Smt. Laxmibai Zulapi, (Bagalkot, Karnataka) in the year 2010 through continuous selection method from locally grown brinjal variety having farmer preferred traits *viz.,* high yield (35-40 t/ha), big size of fruits, round, glossy, dark purple colour with good taste and most suitable to organic cultivation. This variety received recognition at National Innovation Foundation for the 8^{th} National Grassroots Innovation Awards.

The temperature ranges between 13^0 to 30^0 C is most suitable for the cultivation of HZKB-1, brinjal variety (NIF-India, 2015). Brinjal is also cultivated as off-season crop in hilly areas (Uttarakhand), mainly by small farmers as a source of cash income (Panwar *et al*., 2013).

Keeping in view the above facts, the investigation to evaluate the performance and suitability of farmer's variety under organic cultivation, the Researcher Managed Farmers Implemented trials (RMFITs) and Farmer-Managed Trials (FMTs) were carried out at the farmers' fields in Rajouri (Jammu & Kashmir), Almora and Dehradun (Uttarakhand) districts. As per the

contingency plan for districts, Department of Agriculture and Farmers Welfare, Government of India, according to Agro-Ecological Sub Region (ICAR), Rajouri and Almora falls under Western Himalayas, Warm Sub-humid (To Humid with Inclusion of Per-humid) Eco-sub region (14.2) while Dehradun comes under Western Himalayas, Warm Sub-humid (To Humid with Inclusion of Per-humid) Eco-sub region. (14.4). However, according to the Agro-Climatic Zone (Planning Commission), the target areas identified for the RMFITs and FMTs falls under Western Himalayan Region (I). Thus, all the target area has similarity and appears suitable for cultivating farmer's brinjal variety.

Materials and Methods:

In order to check the performance and suitability of farmer's traditional brinjal variety HZKB-1 (Hulyal Zulapi Kari Badane-1) to introduce variety at Uttarakhand (Dehradun and Almora) and Jammu & Kashmir (Rajouri), the Researcher Managed Farmers Implemented trials (RMFITs) were conducted under organic cultivation during *Kharif* (April to October) 2021. Total of four varieties including three check varieties *Pant Rituraj*, *Hisar Shyamala* and BR-112 were replicated seven times across the 28 farmer's fields covering targeted areas. Farmers grew the varieties in under their own conditions and resources except for the seeds of test varieties provided by researchers. The observations on yield and yield attributing traits, i.e. plant height, leaf length, leaf width, number of branches per plant, days to first picking, fruit length, fruit diameter and fruit weight were recorded from ten randomly selected plants. The data thus recorded were subjected to statistical analysis using standard protocols by following Randomised Block Design (RBD). Apart from this, the Farmer managed trials (FMTs) on HZKB-1 variety were also undertaken at 23 farmer's fields covering same target locations and organic cultivation to find out the most suitable area for the cultivation of variety. The data thus recorded for the same parameters were analysed using simple mathematical calculations.

Result and discussion:

Researcher-Managed Farmer-Implemented Trials (RMFITs)

The data analyzed using standard statistical protocols for Randomised Block Design (RBD) and presented in Table 1 indicated a significant difference among all the varieties for the parameters observed i.e. Plant height, Leaf length, Leaf width, Days to first picking, Fruit length, Fruit diameter, Single Fruit weight and Yield except number of branches per plant. It reveals that all the test and check varieties differ from each other shows variations in their

performance. However, the data recorded for number of branches per plant reported no significant difference and variation in branch numbers among the varieties.

Plant growth-related traits:

Plant height (cm): It revealed from the data presented (Table 1) that the HZKB 1 recorded with the higher plant height (73.88 cm) than the BR-112 (75.37 cm) and at par with the *Hisar Shyamala* (81.74 cm). Where the *Pant Rituraj* (89.59 cm) was recorded with the highest plant height among all the test varieties. It showed variation in plant height among the different varieties might be due to variation of genotypes. Similar findings were earlier reported by Hossain *et al.* (2002) and Rahman *et al.* (2011). The optimum plant height and medium branches are the most desirable character for the vegetative growth of brinjal crop found appropriate in the present test variety.

Leaf length (cm) and Leaf width (cm): The variety BR-112 was recorded with the highest leaf length (21.74 cm) and leaf width (17.70 cm). However, the HZKB 1 reported the next best leaf length (17.51 cm) which was found higher than the *Pant Rituraj* and *Hisar Shyamala* reported with 17.17 cm and 15.49 cm. While in the case of leaf width, HZKB-1 reported at par leaf width (14.07 cm) to *Pant Rituraj* (14.60 cm) which was higher than the *Hisar Shyamala* (13.87 cm). **No. of branches/ plant:** The varieties HZKB-1, *Pant Rituraj*, BR-112 and *Hisar Shyamala* reported 6.66, 6.18, 7.01 and 7.19 number of branches per plant respectively. However, data presented showed no statistical difference among the varieties. Rani *et al.,* (2018) at Jammu, Parida *et al.,* (2020) and Mehraj *et al.* (2015) also reported similar findings in terms of number of branches. **Days to first picking**: Similarly, HZKB-1 took lesser 122.86 days for the first picking as compared to BR-112 took 126 days and reported at par to *Hisar Shyamala* recorded with 115.57 days. Whereas, *Pant Rituraj* noted with lesser 108.98 days to first fruit picking. BR-112 reported with minimum days to first fruit picking by Parida *et al.,* (2020) was found contradictory with the present findings. It also indicated the earlier fruiting and harvesting of HZKB-1.

Yield and yield-related traits:

Fruit length (cm) and fruit diameter (cm): Fruit length and fruit diameter is an important parameter from the consumers' point of view. The variety HZKB 1 was recorded with a significant and superior fruit length (13.94 cm) and fruit diameter (12.11 cm) over all the tested check. Whereas, *Pant Rituraj*, BR-112 and *Hisar Shyamala* were recorded respectively with 7.86 cm and 6.49 cm; 8.04 cm and 7.30 cm; 8.29 cm and 7.00 cm of fruit length and

fruit diameter. The observation of phenotypic characters viz. plant height, number of primary branches, fruit length and fruit diameter for the variety *Pant Rituraj* recorded at Uttarakhand by Singh *et al*. (2014) and Panwar *et al.,* (2013) is in partial confirmation with the present result obtained. **Fruit weight:** Moreover, the HZKB-1 variety showed a significantly higher **fruit weight** of 240.49 g as compared to check *Pant Rituraj*, BR-112, *Hisar Shyamala* recorded with 83.38 g, 120.62 g and 99.19 g of fruit weight respectively. Tripathi *et al.,* (2009), Munnipian *et al.,* (2010), Chattopadhyay *et al.,* (2011) and Lokesh *et al.,* (2013) recorded variations in fruit length, width and average fruit weight in brinjal which supports the present result obtained.

Fruit yield: The data presented indicated the statistically significant variation between all selected varieties (Table 1.). The brinjal variety HZKB-1 (335.00 q/ha) showed significant and 9.74%, 10.45% and 16.15% higher fruit yield as compared to check varieties *Hisar Shyamala* (302.36 q/ha), *Pant Rituraj* (300.00 q/ha) and BR-112 (280.90 q/ha) respectively. The present yield obtained by *Hisar Shyamala* and BR-112 and *Pant Ruturaj* is in line with the yield range revealed by Singh G. (2012). The higher yield of HZKB-1 might be due to the higher fruit length, width and average fruit weight. The positive and significant correlation between fruit length, width and average fruit weight with yield was earlier reported by Nayak and Nagre (2013) which completely supports the present findings. The similar direct effect and positive correlation between fruit weight and fruit yield were also recorded by Sujin *et al.* (2017)

Farmer-Managed Trials: Simultaneously, the farmers-managed trials (FMTs) were also conducted at Almora (10 locations), Dehradun (08 locations), Rajouri (05 locations) districts covering two states Uttarakhand and Jammu & Kashmir under organic cultivation to check the best suitability of the variety. The mean of different parameters observed from all the locations of respective districts was presented in Table 2.

The highest plant height of 87.24 cm was recorded at Almora. Where the maximum leaf length (17.60 cm) and leaf width (15.23 cm) was recorded at Dehradun. The highest number of branches (8.64 branches/ plant) at Rajouri and lower days taken to first fruit picking (106.30 days) were recorded at Almora. Whereas in Rajouri highest fruit length (18.36 cm) and fruit diameter (14.90 cm) were recorded. Similarly, the highest fruit yield (350.00 q/ha) was also recorded at Rajouri. The agro-ecological factors may be affecting the performance

of a variety under different agro-climatic conditions. The conclusion revealed after the study of vegetable cultivation in north-west Himalayan region by Sharma (2007) supports the present findings. As per the growers' feedback, the variety has purple-colored fruits with a shelf life of 5-7 days after harvesting. It also found negligible pest and disease occurrence which might support higher fruit-yielding of variety. The result revealed by Vethamonai *et al*., (2020) is in coordination with the present findings.

The characters showing higher variations have comparatively more scope for improvement (Mohanty 2002). As per the study of Bhushan *et al.* (2018) at Subtropical Plains of North-Western Himalayan Region, the yield attributing traits viz. fruit weight, fruit diameter and fruit length contribute majorly towards total genetic diversity were reported superior in HZKB-1. Such conserved traditional Plant Genetic Resources (PGR) most essential for crop improvement programs in order to meet global challenges in relation to the food and nutritional security in future Govindraj *et al*. (2015).

Conclusion:

The study concluded that the farmer's traditional brinjal variety HZKB-1 under organic cultivation reported with higher fruit size and yield observed during RMFITs compared to the checks. The superior performance of the HZKB-1 variety reflects its suitability for cultivation at the target areas of Uttarakhand (almora and Dehradun districts) and Jammu & Kashmir (Rajouri district). However, based on FMTs it was found most suitable to cultivate at Jammu & Kashmir (Rajouri district). The participation of farmers through RMFITs and FMTs can play an important role in disseminating of farmers' variety in the target areas. Adopting such traditional variety that yielded higher under organic cultivation might generate additional income for the small farmers in hilly areas. As visual observation noticed negligible insect pest and disease occurrences on HZKB-1, therefore it can be a future thrust to work on varietal improvement considering the scopes of plant protection too.

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Table 1: Comparative study of traditional brinjal variety HZKB-*1* in Researcher managed at farmers' implemented trials under Uttarakhand & Jammu and Kashmir

Treatment No.	Name of varieties	Plant height (cm)	Leaf length (cm)	Leaf width (cm)	No. of branches per plant	Days to first picking	Fruit length (cm)	Fruit diameter (cm)	Single Fruit weight (gm)	Yield (q/ ha)
T1	HZKB-1	75.37	17.51	14.07	6.66	122.86	13.94	12.11	240.49	335.00
T2	*Pant Rituraj*	89.59	17.17	14.60	6.18	108.98	7.86	6.49	83.38	300.00
T3	BR-112	73.88	21.74	17.70	7.01	126.00	8.04	7.30	120.62	280.90
T4	*Hisar Shyamala*	81.74	15.49	13.87	7.19	115.57	8.29	7.00	99.19	302.36
S.Em. ±		3.51	0.86	0.81	0.34	3.73	0.78	0.70	34.96	3.93
CD		10.43	2.55	2.41	1.00*	11.09	2.32	2.09	103.87	11.67
CV%		11.59	12.63	14.28	13.17	8.34	21.70	22.61	68.05	3.41

Note: * = Non-significant

Table 2: Performance of traditional brinjal variety HZKB-*1* under farmers' participatory on-farm trials (FPOFT) conducted at farmers' fields in Uttarakhand & Jammu and Kashmir

Target areas (locations)	Plant height (cm)	Leaf length (cm)	Leaf width (cm)	No. of branches per plant	Days to first picking	Fruit length (cm)	Fruit diameter (cm)	Single Fruit weight (gm)	Yield (q/ ha)
Almora (10)	87.24	16.43	13.64	5.80	106.30	10.77	10.29	189.72	318.00
Dehradun (08)	79.35	17.60	15.23	7.71	124.13	9.19	9.46	127.18	324.13
Rajouri (05)	81.13	16.16	8.74	8.64	129.20	18.36	14.90	625.40	350.00