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Evaluation of different genotypes of potato under the organic production system in Sikkim

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Abstract

A field experiment was conducted at College of Horticulture, Bermiok, Sikkim, in the *Rabi* season during 2024-2025 and 2025-2026 to evaluate five different varieties of potato, viz., Kufri Thar-2, Kufri Himalini, Kufri Uday, Kufri Jyoti, and local genotype (Sombaria) under the organic production system in Sikkim conditions. The treatments were laid out in RBD and replicated thrice. All the varieties gave 100% sprouting after 50 days of planting. The highest number of shoots per hill was noted under Kufri Jyoti (4.58) at 50 days of planting, which was followed by Kufri Himalini (3.74), Kufri Uday (3.41), and Kufri Thar-2 (3.34), respectively. In case of grade-wise tuber number, Kufri Jyoti was found to be the best performer with the highest number of tubers grade <25 g (1,54,000 per ha) and >25 g (9,07,000 per ha). Similarly, Kufri Jyoti gave the highest tuber yields (both grade-wise and total), which were statistically at par with Kufri Himalini. The local genotype Sombaria was the poorest performing genotype among all the varieties of potato. Overall, Kufri Jyoti emerged as the best-performing variety, followed by Kufri Himalini, while the local genotype performed the poorest in terms of growth and yield attributes.

Keywords: Organic cultivation, potato, Sikkim, varietal evaluation.

Introduction

Potato (*Solanum tuberosum* L.), popularly known as ‘the king of vegetables’, is an annual, tetraploid ($2n = 48$), herbaceous tuber crop of the Solanaceae family. The crop finds a prime position in the economies of poor and marginal farmers and plays a vital role in nutritional security by producing more food per unit area and time compared to wheat, rice, and maize in a short period of time (Li *et al.*, 2025) ^[1]. It is originated from Peru (South America) and now rules the world as one of the most important food crops grown in developed as well as in developing countries due to its diversified uses as food, feed and raw material for producing starch. It contains many essential food ingredients required for maintaining beneficial effects on human health. It contains about 80 per cent water, 2 per cent protein and 18 per cent starch. As a food, it is one of the cheapest and easily available sources of carbohydrates, proteins and appreciable amount of vitamin B and C as well as some minerals. The protein in potato is of high biological value (Singh *et al.*, 2025) ^[2]. It also contains a substantial quantity of energy: edible protein (2.8 g), starch (16.3 g), total sugar (0.6 g), crude fibre (0.5 g), carbohydrate (22.6 g), and vitamin C (25 mg) per 100 g of fresh tubers (Bhuwneshwari *et al.*, 2013) ^[3].

India is one of the major potato-producing countries in the world with a production of 56.7 million tonnes from a land area of 2.2 million hectares, contributing over 14% to the global production (Sahu *et al.*, 2024) ^[4]. In India, the crop is grown in almost all states, except in Kerala under diversified agro-climatic conditions. About 90 per cent of the total potato area is located in the subtropical plains, 6 per cent in the hills, and 4 per cent in the plateau region of peninsular India. In the state of Sikkim, potato is mainly cultivated in *Rabi* season. Organic potato production depends on growing conditions, nutritional support, and pest control, especially late blight. Those circumstances are partially overcome in conventional agriculture by fertilizing and spraying pesticides (Ierna, *et al.*, 2024) ^[5]. The potato is also one of the most highly demanded products in the organic market, however, its yield levels are typically lower in organic systems than in conventional high input ones. To obtain a high level of crop production, it is essential to

identify its suitable variety for the specific region. Keeping in this view, the present research was conducted to evaluate different genotypes of potato under the organic production system in Sikkim.

Materials and Methods

The field experiment was conducted during two consecutive winter seasons (December–March) during 2024-25 and 2025-26 at the Research Farm, College of Horticulture, Bermiok, Sikkim, located at 27°23'36.3" N latitude and 88°46'92.7" E longitude, at an altitude of 867 m above mean sea level. During the cropping period, maximum temperatures ranged from 11–18°C, while minimum temperatures varied between 2–8°C. The season was predominantly dry with occasional rainfall, relative humidity ranged from 55–75%, and bright sunshine averaged 4–6 hours per day. Five potato genotypes, namely Kufri Thar-2, Kufri Himalini, Kufri Uday, Kufri Jyoti, and the local genotype Sombaria, were evaluated under an organic production system. The experiment was laid out in a Randomized Block Design (RBD) with five replications. Organic nutrient management was applied uniformly to all treatments using farmyard manure (FYM) at 30 t ha⁻¹ and rock phosphate at 200 kg ha⁻¹. Plant protection was achieved using biopesticides, with *Trichoderma* spp. for disease management and neem oil for insect pest control. The crop was planted during the first week of December in both years, and dehauling was carried out 86 days after planting. Observations on growth, yield, and incidence of major pests and diseases were recorded at harvest. Tuber moth, late blight, and viral diseases were observed during the experimental period. The recorded data were subjected to analysis of variance (ANOVA) appropriate for a Randomized Block Design to

determine the significance of treatment effects.

Biometric attributes

Biometric attributes of potato as influenced by different varieties are presented in Table 1. Plant emergence was uniformly high, with all improved varieties recording 100% emergence, whereas the local genotype (Sombaria) showed a slightly lower emergence of 98%, indicating good establishment of all genotypes under organic conditions. Significant variation was observed among the varieties for the number of shoots per hill. Kufri Jyoti recorded the highest number of shoots per hill (4.58), which was significantly higher than that of the other varieties, while the local genotype recorded the lowest value (3.12). Higher shoot numbers may increase photosynthetic area, ultimately influencing tuber formation and yield. The variation may be attributed to genetic differences among varieties.

Tuber yields

Data regarding the tuber yields (t/ha) are presented in Table 1. The highest tuber yield of grade 0-25 g was recorded in Kufri Jyoti (1.28 t/ha), followed by Kufri Uday (0.92 t/ha), Kufri Himalini (0.88 t/ha), and Kufri Thar-2 (0.63 t/ha). The highest yield of grade >25 g was obtained from Kufri Jyoti (28.32 t/ha), which was at par with Kufri Himalini (27.87 t/ha). The lowest yield for grades >25 g was observed in the local genotype (18.69 t/ha). Kufri Jyoti (29.59 t/ha) recorded the highest total tuber yield and was significantly superior to all other varieties. The superior performance of Kufri Jyoti may be due to improved vegetative growth, more efficient nutrient utilization, and greater adaptability to organic conditions.

Table 1: Biometric attributes and tuber yields of different varieties of potato under organic production system during 2024-2026 (Pooled data)

Treatment	Plant emergence (%) at 50 DAP	No of shoots per hill at 50 DAP	Tuber yield (t/ha)			Tuber number ('0000) per ha		
			0-25 g	>25 g	Total	0-25 g	>25 g	Total
Kufri Thar-2	100%	3.34	0.63	22.47	23.10	10.20	62.90	73.10
Kufri Himalini	100%	3.74	0.88	27.87	28.75	12.85	68.75	81.60
Kufri Uday	100%	3.41	0.92	23.72	24.64	13.25	62.65	75.90
Kufri Jyoti	100%	4.58	1.28	28.32	29.59	15.40	90.70	106.10
Local genotype	98%	3.12	0.51	18.18	18.69	9.15	58.70	67.85
SE(m)	-	0.38	0.05	0.99	0.99	0.69	3.66	3.56
CD (P=0.05)	-	0.12	0.15	3.08	3.09	2.14	11.41	11.09
CV (%)	-	7.14	11.32	8.64	8.37	11.88	11.5	9.46

Tuber number

A similar trend was observed for tuber number. Kufri Jyoti produced the highest number of marketable tubers (>25 g) (90.70 × 10⁴/ha) and total tubers (106.10 × 10⁴/ha), followed by Kufri Himalini (81.60 × 10⁴/ha) and Kufri Uday (75.90 × 10⁴/ha). The local genotype recorded the lowest total tuber number (67.85 × 10⁴/ha). Overall, the results indicate that Kufri Jyoti was the best-performing genotype under the organic production system, followed by Kufri Himalini, owing to its superior shoot production, tuber yield, and tuber number. Higher tuber number in Kufri Jyoti indicates better tuberization efficiency under organic conditions.

Discussion

The results clearly indicate that varietal differences significantly influenced the growth and yield of potato under the organic production system. Among the varieties evaluated, Kufri Jyoti performed the best in terms of number of shoots per hill, tuber yield, and total tuber number. This superior performance may be attributed to its better genetic potential, higher vegetative

growth, efficient utilization of organic nutrients, and greater tolerance to pest and disease conditions under organic conditions. Similarly, Gogoi *et al.* (2026)^[6] observed that Kufri Jyoti performed considerably well under organic production system in within the Central Brahmaputra Valley Zone of Assam. Kufri Himalini also exhibited good performance and can be considered a suitable alternative under organic conditions. Janani *et al.* (2025)^[7] reported that Kufri Himalini performed well under organic cultivation, exhibiting the highest total tuber yield combined with marketable tuber yield. In contrast, the local genotype Sombaria gave the poorest performance across most of the observed parameters. Based on the results, it can be concluded that Kufri Jyoti is the most suitable variety for cultivation under organic conditions of Sikkim, followed by Kufri Himalini. Overall, varietal selection plays a crucial role in enhancing productivity in organic farming systems.

Conclusion

In terms of growth, production, and quality criteria under organic potato farming, the study finds that there are notable

varietal differences across five potato cultivars. Kufri Jyoti is the most suitable variety under organic conditions of Sikkim. Kufri Himalini is the second-best performing variety. Varietal selection plays a crucial role in improving productivity under organic farming systems. The findings underscore the importance of varietal selection based on organic production system and local agro-ecological conditions for optimizing potato productivity and quality.

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