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Response of processing varieties of potato (*Solanum tuberosum* L.) under varying levels of nutrient in northern hill zone of Chhattisgarh

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Abstract
The present investigation noticed that the "Response of processing varieties of potato (*Solanum tuberosum* L.) under varying levels of nutrient in northern hill zone of Chhattisgarh" was carried out at the research farm of Potato and temperate fruit research station, Mainpat, Surguja (C.G.) during *Rabi* of 2024-25, varieties Kufri Chipsona-1 (V_1) recorded the maximum all growth parameters, yield attributing characters, total tuber yield and quality characters viz. plant emergence (84.74%) plant height (38.27cm), number of shoots plant^{-1} (4.98) and number of compound leaves plant^{-1} (44.20) on yield parameters, number of tuber plant^{-1} (7.48), fresh weight of tuber plant^{-1} (259.36 g), tuberization efficiency (2.42) total tuber yield (155.30 q ha^{-1}) and tuber yield<50 g. (14.80 q ha^{-1}), 50-100 g. (54.14 q ha^{-1}), >100g. (86.36 q ha^{-1}), dry matter content (22.07%.), starch content (18.55 %), protein content (1.55%) as compare to Kufri Chipsona-3 (V_2) and Kufri Frysona (V_3) varieties.
Among the fertilizer levels 150% RDF (F_3) recorded maximum all growth parameters, yield attributing characters, total tuber yield and quality characters viz. plant emergence (75.56%), plant height (39.87 cm), number of shoots plant^{-1} (5.11) and number of compound leaves plant^{-1} (47.16), and on yield parameters, number of tuber plant^{-1} (7.29), fresh weight of tuber plant^{-1} (242.22 g),total tuber yield (134.29 q ha^{-1}), dry matter content (22.69%), starch content (17.60%) and protein content (1.53%) which was closely followed by 100% RDF (F_2) and 50% RDF (F_1).

Keywords: Potato (*Solanum tuberosum* L.), Processing varieties, Nutrient management, Growth and yield attributes, Quality parameters, Kufri Chipsona-1, Kufri Chipsona-3, Kufri Frysona, Northern hill zone of Chhattisgarh

Introduction
Potato (*Solanum tuberosum* L.) is known as king of vegetable crop and poor man's food has emerged, as fourth most important food crop in India after rice, wheat and maize. It is an important food and vegetable crop of the world, produces more weight and calories per unit area as compared to all other field crops (Das, 1993). Potato tubers are also rich source of starch, vitamins specially C and B and minerals. Potato tubers are contains carbohydrates (20.6%), protein (2.1%), fat (0.3%), crude fiber (1.1%) and ash (0.9%).
Potato processing varieties are specially bred potato types that meet specific biochemical and morphological standards for creating high-quality processed products like chips and French fries, rather than being consumed fresh. Key characteristics include a high tuber dry matter content (21-24%), low reducing sugars to prevent undesirable darkening, and low levels of glycoalkaloids and phenols, which can cause bitterness and browning. The development of these varieties, such as India's Kufri Chipsona-1 and Kufri Chipsona-2, along with standardized storage at 10-12 °C and sprout suppression, has revolutionized the potato processing industry by providing a reliable source of quality raw material.
Potato is cultivated on the global basis in 16.50 million ha with a production of 375 million tonnes (FAOSTAT, 2023) [5]. India is the world's second-largest potato producer country after China. Potato is one of the most important cash crops in India. It is cultivated on an average 2.30 million ha with a production of 59.73 million tonnes with productivity of 25.53 tonnes ha^{-1} (Anonymous, 2023a) [1].

Uttar Pradesh is the major potato producing state with a 31.26% share followed by West Bengal, Bihar, Gujarat, Madhya Pradesh, Punjab, and Assam respectively. It accounts for nearly 3/4 of the area and contributes to 82% of total potato production in the country. The maximum area as well as the production of potato was recorded in Uttar Pradesh than in West Bengal. In Chhattisgarh, potato occupies about 41330 hectares with a production of 655000 tonnes and a productivity of 15.32 tonnes per hectare. The highest area (7520 ha) and production (103800 tonnes) was recorded in Surguja district followed by Balrampur and Raigarh districts of Chhattisgarh (Anonymous, 2023b) [2].

Materials and Methods

The field experiment was conducted during *Rabi*, 2024-25 at Research farm of Potato and temperate fruit research station, Mainpat, Surguja (C.G.). Geographically, Mainpat is situated in the north of Chhattisgarh and lies between $22^0 76'$ N latitude and $83^0 31'$ E longitude having an altitude of 1085 meter above mean sea level. The soil of experimental field was '*Inceptisols*' which is locally known as '*Chawar*'. The soil was slightly acidic (pH 6.13) in nature with medium in fertility having 0.42 % soil organic carbon, low N (204.8 kg ha^{-1}), medium P (13.7 kg ha^{-1}) and medium K (218.8 kg ha^{-1})

The experiment was laid out in a split plot design with three replications. The treatment consisted three potato varieties *viz.* Kufri Chipsona-1, Kufri Chipsona-3, Kufri Frysona as main plots and three fertilizer levels *viz.* F_1- 50% RDF, F_2-100% RDF, F3-150% RDF as sub plots.

The fertilizers were applied as per the treatments. The N, P and K were applied through Urea, Single super phosphate and Muriate of potash. The whole amount of P, K and half amount of N were applied at the time of tuber planting as a basal dose. Whereas, half amout of N was applied as a top dressing 30 DAP and before earthing up.

Results and Discussion

Plant Emergence (%)

At 20 DAS, significant differences in plant emergence were observed among the varieties. The highest emergence was recorded with Kufri Chipsona-1 (V_1) (84.74%), which was statistically at par with Kufri Chipsona-3 (V_2) (80.26%), whereas the lowest emergence was recorded with Kufri Frysona (V_3) (55.18%). This variation might be due to varietal characteristics and good tuber quality.

Among fertilizer levels, significant differences were also observed at 20 DAP. The highest emergence (75.56%) was recorded with 150% RDF (F_3), which was statistically at par with 100% RDF (F_2) (73.11%). The lowest emergence was obtained with 50% RDF (F_1) (71.51%).

Plant Height (cm)

Among the varieties, Kufri Chipsona-1 (V_1) consistently recorded higher plant height at all growth stages, while Kufri Frysona (V_3) showed the lowest plant height throughout the period of observation. This could be due to inherent growth habits governed by genetic traits. Similar results were reported by Kumar *et al*. (2004) [8].

With respect to fertilizer levels, the tallest plants were recorded with 150% RDF (F_3) at all stages of crop growth, whereas the shortest plants were observed under 50% RDF (F_1).

Number of Shoots Plant^{-1}

Across varieties, Kufri Chipsona-1 (V_1) produced a significantly higher number of shoots per plant at all observation stages, while Kufri Frysona ($_{V3)}$ consistently recorded the lowest. The differences in shoot number may be attributed to varietal genetic makeup, as also reported by Baishya *et al*. (2010) [3].

With respect to fertilizer treatments, the maximum number of shoots per plant was observed under 150% RDF (F_3), which was statistically at par with 100% RDF (F_2). The minimum number of shoots was consistently recorded under 50% RDF (F_1).

Number of Compound Leaves Plant^{-1}

Among varieties, Kufri Chipsona-1 (V_1) produced significantly more compound leaves per plant compared to other varieties at all growth stages, whereas Kufri Frysona (V_3) recorded the least. This may be attributed to genetic growth habits, as also reported by Joseph *et al*. (2011) [7].

Among fertilizer levels, the maximum number of compound leaves per plant was found under 150% RDF (F_3), followed by 100% RDF (F_2), while the minimum was recorded with 50% RDF (F_1). The increase in leaf number with higher fertilizer application may be due to enhanced vegetative growth through increased nutrient supply for protoplasm and meristematic activities. Similar findings were reported by Sood (2007) [10] and Bose *et al*. (2008) [4].

Number of Tubers Plant^{-1}

Among the varieties, Kufri Chipsona-1 (V_1) recorded the highest number of tubers per plant (7.48), while Kufri Frysona (V_3) recorded the lowest. The variation may be due to varietal growth habits and better nutrient absorption, which enhanced photosynthesis and translocation of assimilates towards tuber formation. These results are in agreement with Kumar *et al*. (2004) [8].

With respect to fertilizer levels, the highest number of tubers per plant (7.29) was recorded under 150% RDF (F_3), followed by 100% RDF (F_2), while the lowest was observed under 50% RDF (F_1).

Fresh Weight of Tubers Plant^{-1} (g)

Kufri Chipsona-1 (V_1) recorded the maximum fresh weight of tubers per plant (259.36 g), while Kufri Frysona (V_3) recorded the lowest. Among fertilizer levels, significantly higher fresh tuber weight per plant (242.22 g) was observed with 150% RDF (F_3), followed by 100% RDF (F_2), whereas the lowest weight was observed with 50% RDF (F_1).

Tuberization Efficiency (Tuber:Haulm)

Significant differences were recorded among varieties, with Kufri Chipsona-1 (V_1) exhibiting the highest tuberization efficiency (2.42), while Kufri Frysona (V_3) recorded the lowest (2.21).

Among fertilizer levels, the highest tuberization efficiency (2.46) was recorded with 150% RDF (F_3), followed by 100% RDF (F_2). The minimum efficiency (2.14) was observed under 50% RDF (F_1).

Grade-wise and Total Tuber Yield (q ha^{-1})

Among varieties, Kufri Chipsona-1 (V_1) recorded significantly higher yields in all grades: <50 g (14.8 q ha^{-1}), 50-100 g (54.14 q ha^{-1}), >100 g (86.36 q ha^{-1}), with the maximum total yield (155.30 q ha^{-1}). Kufri Frysona (V_3) consistently recorded the lowest yields across grades.

With respect to fertilizer levels, 150% RDF (F_3) gave the highest yields of <50 g (13.49 q ha^{-1}, at par with 100% RDF), 50-100 g (50.09 q ha^{-1}), >100 g (70.70 q ha^{-1}), and total tuber yield (134.29 q ha^{-1}). The minimum yield across all categories was

observed with 50% RDF (F_1). Yield improvement with higher nutrient application may be attributed to better nutrient availability, improved vegetative growth, carbohydrate synthesis, and efficient translocation, in accordance with Sarkar *et al*. (2011) [9].

Economics (Gross Returns, Net Returns, and B:C Ratio)

Among varieties, the cost of cultivation remained similar; however, Kufri Chipsona-1 (V_1) registered the highest gross return (₹310,600 ha^{-1}), net return (₹211,833 ha^{-1}), and benefit-cost ratio (2.14). In contrast, Kufri Frysona (V_3) recorded the lowest gross return (₹174,140 ha^{-1}), net return (₹75,423 ha^{-1}), and B:C ratio (0.76).

Among fertilizer levels, the maximum gross return (₹268,580 ha^{-1}) and net return (₹162,771 ha^{-1}) were recorded with 150% RDF (F_3), while the highest B:C ratio (1.54) was obtained with 100% RDF (F_2). The lowest gross return (₹225,680 ha^{-1}), net return (₹134,055 ha^{-1}), and B:C ratio (1.46) were recorded with 50% RDF (F_1).

Table 1: effect of different varieties on germination percentage, plant height (cm), Number of shoots plant^{-1}, Number of compound leaves plant^{-1} of different fertilizer levels

Treatment	Plant emergence (%)	Plant height (cm) 90 DAS	Number of shoots plant^{-1} 90DAS	Number of compound leaves plant^{-1} 90 DAS
Varieties				
V_1-Kufri Chipsona-1	84.74	38.27	4.98	44.20
V_2- Kufri Chipsona-3	80.26	37.49	4.80	43.33
V_3- Kufri Frysona	55.18	35.53	4.31	42.96
SEm±	1.77	0.33	0.36	1.01
CD (P= 0.05%)	6.95	1.31	1.41	3.95
Fertilizer Levels				
F_1- 50% RDF	71.51	33.47	4.22	39.69
F_2- 100% RDF	73.11	37.96	4.76	43.64
F_3- 150% RDF	75.56	39.87	5.11	47.16
Sem±	1.27	0.66	0.11	0.69
CD (P= 0.05%)	3.91	2.05	0.34	2.11

Table 2: effect of different varieties on Number of tuber plant^{-1} at harvest, Fresh weight of tuber plant^{-1} (g) at harvest, Tuberization efficiency, Grade wise and total tuber yield (q ha^{-1}) of different fertilizer levels

Treatment	Number of tuber plant^{-1} at harvest	Fresh weight of tuber plant^{-1} (g) at harvest	Tuberization efficiency	Grade wise and total tuber yield (q ha^{-1})			
Varieties				**<50 (g)**	**50-100(g)**	**>100(g)**	**Total yield**
V_1-Kufri Chipsona-1	7.48	259.36	2.42	14.80	54.14	86.36	155.30
V_2- Kufri Chipsona-3	7.09	225.15	2.28	12.06	46.74	71.77	130.56
V_3- Kufri Frysona	6.60	217.82	2.21	11.03	34.65	41.39	87.07
SEm±	0.05	0.88	0.03	0.19	1.44	1.46	2.04
CD (P= 0.05%)	0.18	3.46	0.10	0.74	5.65	5.75	8.00
Fertilizer Levels							
F_1- 50% RDF	6.82	227.18	2.14	11.70	40.50	60.64	112.84
F_2- 100 RDF	7.06	232.92	2.31	12.68	44.93	68.18	125.80
F_3- 150% RDF	7.29	242.22	2.46	13.49	50.09	70.70	134.29
SEm±	0.03	0.55	0.03	0.16	0.50	0.70	0.93
CD (P= 0.05%)	0.10	1.70	0.10	0.51	1.55	2.15	2.85

Table 3: effect of different varieties on Gross return (₹ ha^{-1}), Net return (₹ha^{-1}), B: C ratio, Grade wise and total tuber yield (q ha^{-1}) of different fertilizer levels

Treatment	Gross return (₹ ha^{-1})	Net return (₹ha^{-1})	B: C ratio
Varieties			
V_1-Kufri chipsona-1	310600	211833	2.14
V_2- Kufri Chipsona-3	261120	162403	1.64
V_3-Kufri Frysona	174140	75423	0.76
SEm±	4073	4073	0.04
CD (P= 0.05%)	15992	15992	0.16
Fertilizer levels			
F_1- 50% RDF	225680	134055	1.46
F_2- 100% RDF	251600	152883	1.54
F_3- 150% RDF	268580	162771	1.53
SEm±	1853	1853	0.02
CD (P= 0.05%)	5709	5709	0.05

Conclusion

On the basis of experimentation on varieties with fertilizer levels applied in potato crop under *Inceptisol* it can be concluded that:- Variety Kufri Chipsona-1 (V_1) recorded maximum growth parameters, yield attributes, all grade wise yield, total tuber yield, net income and B:C ratio under higher fertilizer level with 150 % RDF (F_3).

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Reference

1. Anonymous. Second advance estimates of area and production of horticulture crops. 2023a; p.2.
2. Anonymous. Area, production and productivity of horticulture crops in Chhattisgarh. Directorate of Horticulture, Govt. of Chhattisgarh, Raipur; 2023b. p.7.
3. Baishya LK, Kumar M, Ghosh DC. Effect of different proportion of organic and inorganic nutrients on productivity and profitability of potato (*Solanum tuberosum* L.) varieties in Meghalaya hills. Indian J Agron. 2010;55(3):230-4.
4. Bose US, Bisen A, Nayak S. Effect of different levels of nitrogen and potassium on growth and yield of potato (*Solanum tuberosum* L.). Green Farming. 2008;2(1):16-7.
5. FAOSTAT. Food and Agriculture Organization of the United Nations. Rome: FAO; 2023 [cited 2023 Nov 20]. Available from: http://www.fao.org/faostat/en/#data/QC.
6. Hedge DM, Dwivedi BS. Integrated nutrient supply and management as a strategy to meet nutrient demand. Fert News. 1993;38:49-50.
7. Joseph TA, Singh BP, Kaushik SK, Bhardwaj V, Pandey SK, Singh PH, *et al*. Kufri Girdhari: a medium maturing, late blight resistant potato variety for cultivation in Indian hills. Potato J. 2011;38(1):26-31.
8. Kumar R, Pandey SK, Uppal DS, Marwaha RS. Evaluation of potato (*Solanum tuberosum* L.) varieties for production

of chips. Indian J Agric Sci. 2004;74(11):578-82.
9. Sarkar A, Sarkar S, Zaman A, Devi WP. Productivity and profitability of different cultivars of potato (*Solanum tuberosum* L.) as affected by organic and inorganic sources of nutrients. Indian J Agron. 2011;56(2):159-63.
10. Sood MC. Integrated nutrient supply and management for potato production in mid hills of Shimla. Potato J. 2007;34(1-2):101-2.