E-ISSN: 2618-0618
P-ISSN: 2618-060X

NAAS Rating (2025): 5.20
www.agronomyjournals.com
2025; SP-8(8): 196-198
Received: 13-06-2025
Accepted: 17-07-2025

Vandana Yadav
Project Assistant, AICRP Potato, College of Agriculture Raipur, IGKV, Chhattisgarh, India

Pravin Kumar Sharma
Principal Scientist (Vegetable Science), College of Agriculture Raipur, IGKV, Chhattisgarh, India

Corresponding Author:
Vandana Yadav
Project Assistant, AICRP Potato, College of Agriculture Raipur, IGKV, Chhattisgarh, India

Effect of seed soaking and foliar spray of PGRs on growth and yield components of potato (*Solanum tuberosum* L.) cv. Kufri Pukhraj

Vandana Yadav and Pravin Kumar Sharma

DOI: https://www.doi.org/10.33545/2618060X.2025.v8.i8Sc.3533

Abstract
A field investigation was carried out at Research cum Instructional Farm, College of Agriculture, Indira Gandhi Krishi Vishwavidyalaya, Raipur (Chhattisgarh) during year 2019-20 to study the effect of plant growth regulators and their methods of application on growth and yield performance of potato. The experiment was conducted in Factorial Randomized Block design consisting 10 treatment combinations comprised of two levels of methods of application *viz.,* M_1 (Seed treatment) and M_2 (Foliar spray) and five levels of PGRs (plant growth regulators) *viz.,* R_1 (control), R_2 (GA_3 @ 25 ppm), R_3 (GA_3 @ 50 ppm), R_4 (IBA @ 100 ppm) and R_5 (IBA @ 200 ppm). Results revealed that among the mode of PGRs application, spraying method was found better than seed treatments and recorded for higher total yield **(**28.91 t/ha) while among PGRs used, the application of IBA @ 200 ppm was most effective for potato as recorded the highest total tuber yield of 29.31 t/ha, which was at par with IBA 100 ppm with total tuber yield of 29.11 t/ha. The interaction effect of these two factors revealed that treatment like spraying of IBA @ 100 ppm was most effective for enhancing the tuber yield (30.57 t/ha) with maximum net realization (328078.91 Rs./ha) as well as B:C ratio of 2.28.

Keywords: Potato, PGRs, methods of application, GA_3 and IBA

Introduction
Potato (*Solanum tuberosum* L.) is a vegetable crop of major economic importance worldwide. It is the world's fourth most cultivated food crop after wheat, rice and maize (Ruan *et al,* 2021) [9]. Potato play vital role in food security forever increasing world population. It is a good, cheap source of carbohydrates, vitamins, minerals and proteins. It has multipurpose use in daily consumption and also industrial purpose (Hoque, 2010) [5]. Potatoes are praised by its short growth period, high adaptability and production. India produced 48562.00 MT from a land area of 2051.00 ha with an average yield of 23.67 MT/ha during 2019-20 (Anonymous, 2021) [1] but in case of Chhattisgarh the area under potato cultivation is 42750 hectares with the production of 614056 MT with an average productivity of 14.36 MT/ha during 2020-21 (Anonymous, 2022) [2].

Stolon growth and tuber initiation in potato are complex developmental processes influenced by many factors including phytohormones (Vreugdenhil and Struik 1989) [12]. The role of gibberellins in tuber formation is supported by Vreugdenhil and Sergeeva (1989) [12]. Recent studies confirm a role of auxins in stolon swelling and tuber initiation (Dragicevic *et al.* 2008) [4]. Growth regulators and photoperiod influence potato tuberization (Silva *et al.,* 2001) [11]. Plant hormones have been studied for decades, but the interactions that take place between them are still being discovered (Ross and O'Neill, 2001) [8]. Hormones play a crucial role in the control of potato tuberization (Vreugdenhil and Struik, 1989) [12] and the effect of exogenous plant growth regulators are commercially significant for the inducing of potato tuberization (Zhang *et al.,* 2005) [13]. Gibberellin application enhanced shoot emergence, increased shoot height, stems per hill and number of tuber per hill (Khurana and Pandita, 1987) [6]. However, IBA is preferred than other growth substances as, it has low auxin activity and destroys relatively slowly by auxin degrading enzymes. IBA is persistent in nature. IBA at the concentration of 200 ppm should be sprayed on the potato foliage at 40 days and 55 days after planting.

Material and Methods

The experiment was conducted during 2019-20 at Research cum Instructional Farm, College of Agriculture, Indira Gandhi Krishi Vishwavidyalaya, Raipur (Chhattisgarh). The soil of experimental plot was clay loam in texture, low in organic carbon and available nitrogen, medium in available phosphorus and rich in available potassium. The experiment was laid out in Factorial Randomized Block Design with four replications and each replication contained 60 tubers. There were 10 treatment combinations involving two levels of methods of PGR application *viz.*, M_1 - Seed treatment and M_2 - Foliar spray and five levels of PGRs (plant growth regulators) *viz.*, R_1 - Control, R_2 - GA_3 @ 25 ppm, R_3 - GA_3 @ 50 ppm, R_4 - IBA @ 100 ppm and R_5 - IBA @ 200 ppm. The seed tubers of potato variety 'Kufri Pukhraj' with good appearance, no mechanical damage, no disease, and a weight of approximately 50 g were selected and planted at 60 x 20 cm spacing in 3.0 x 2.4 m^2 plots. The selected tubers were washed and dried in a ventilated dark place. After 15 days, they were immersed in (GA_3 @ 25 ppm), (GA_3 @ 50 ppm), (IBA @ 100 ppm) and (IBA @ 200 ppm) before sowing. Tubers immersed in water and spray of water was considered as control treatment for comparison. PGRs were applied by spraying to leaves at early (30 DAT) and late (60 DAT) stages.

Results and Discussion

Growth parameters *viz*., emergence percent (92.78%), plant height (52.58 cm) and number of shoots $plant^{-1}$ (4.49) were recorded higher under M_1 (seed treatment) with PGRs while the highest emergence percentage (93.35%) was observed in R_2 (GA_3 @ 25 ppm) followed by 92.96% in R_4 (IBA @ 100 ppm). Paikra *et al.*, 2020 [7] also reported the highest emergence percentage in GA_3 @ 25 ppm. The highest plant height (52.84 cm) was observed in R_3 (GA_3 @ 50 ppm), however the highest number of shoots $plant^{-1}$ (4.81) was recorded with R_4 (IBA @ 100 ppm) which was at par with R_5 (IBA @ 200 ppm) but significantly higher than other treatments (Table 1). Similar results has also been reported by Paikra *et al.*, 2020 [7].

The data presented in Table 1 and 2 indicated that the effect of method of application of various PGRs was found significant regarding yield attributes as well as yields of potato. The smallest and largest sized *i.e.*, 0-25 g and > 75 g tuber yield were produced maximum (1.17 and 12.34 t/ha, respectively) under seed treatment method of PGRs while the medium sized *i.e.*, 25-50 g and 50-75 g tuber yield were produced higher (9.11 and 6.77 t/ha, respectively) when PGRs were sprayed in potato foliage, however the total tuber yield (28.91 t/ha) was also recorded maximum from foliar spray of PGRs. The maximum grade-wise yield of tubers *i.e.*, 0-25 g, 25-50 g, 50-75 g and total tubers yield were recorded maximum (1.44, 9.90, 7.40 and 28.91 t/ha, respectively) with R_5 (IBA @ 200 ppm) but grade >75 g tubers yield was recorded the highest under R_2 (GA_3 @ 25 ppm). Haulm yield on dry weight basis also recorded with R_5 (IBA @ 200 ppm) *i.e.* 7210.07 kg/ha. The combination of M_2R_4 *i.e.* spraying of IBA @ 100 ppm was most effective for enhancing the tuber yield and recorded 30.57 t/ha. It was observed that interactions between foliar application method and plant growth regulator IBA @ 200 ppm *i.e.*, M_2T_5 recorded significantly higher yield (1.67, 10.20 and 8.31 t/ha for 0-25 g, 25-50 g, 50-75 g sized tuber, respectively and >75 g tuber yield was recorded significantly higher with the interaction of M_1T_2 *i.e.*, seed treatment with GA_3 @ 25 ppm but found non-significant for total tuber yield while the maximum yield was recorded under M_2R_4 *i.e.*, spraying of IBA @ 100 ppm (30.57 t/ha). It is found that haulm yield on dry weight basis (7187.50 kg/ha) was obtained maximum in M_1T_5 *i.e.* seed treatment with IBA @ 200 ppm.

Summarized data (Table 2) revealed that among the treatment combinations, M_2R_4 *i.e.*, spraying with IBA @ 100 ppm resulted in maximum net return as well as B:C ratio (Rs.328078.91/ha and 2.28, respectively). The present findings are in accordance with Silu *et al.*, 2012 [10] and Bhatia *et al.*, 1992 [3].

Table 1: Effect of different plant growth regulator on growth and yields of potato.

Treatments	Emergence (%)	Plant height (cm)	No. of shoots/plant	Yield of tubers(t/ha)					Haulm yield on dry weight basis (kg/ha)
				0-25g	25-50g	50-75g	>75g	Total yield	
M1	92.78	52.58	4.49	1.17	8.13	5.94	12.34	27.59	6684.72
M2	92.15	51.52	4.29	1.09	9.11	6.77	11.95	28.91	6941.67
C.D.	NS	1.05	0.19	NS	0.36	0.40	NS	0.97	NS
T1	91.68	51.46	4.19	0.91	7.77	6.21	12.21	27.09	6414.93
T2	93.35	51.76	4.09	1.17	7.94	5.00	14.13	28.23	6612.85
T3	92.87	52.84	4.19	1.39	8.29	6.68	11.15	27.51	6888.89
T4	92.96	52.13	4.81	0.73	9.21	6.50	12.66	29.11	6939.24
T5	91.48	52.06	4.65	1.44	9.90	7.40	10.58	29.31	7210.07
C.D.	1.43	NS	0.30	0.15	0.56	0.63	0.81	1.54	NS
M_1R_1	92.18	51.44	4.20	0.81	6.86	6.75	12.44	26.85	6375.00
M_1R_2	94.18	52.41	4.14	1.31	7.32	3.79	15.14	27.55	6385.42
M_1R_3	94.05	53.55	4.36	1.46	7.73	5.98	11.68	26.84	6711.81
M_1R_4	93.35	52.96	4.75	1.07	9.16	6.71	10.70	27.65	6763.89
M_1R_5	90.15	52.53	4.98	1.21	9.60	6.50	11.74	29.04	7187.50
M_2R_1	91.18	51.47	4.19	1.01	8.68	5.67	11.97	27.32	6454.86
M_2R_2	92.53	51.11	4.04	1.04	8.55	6.21	13.13	28.92	6840.28
M_2R_3	91.69	52.13	4.01	1.33	8.85	7.38	10.62	28.18	7065.98
M_2R_4	92.56	51.31	4.87	0.39	9.26	6.30	14.63	30.57	7114.59
M_2R_5	92.81	51.59	4.33	1.67	10.20	8.31	9.42	29.58	7232.64
C.D.	2.02	NS	NS	0.21	0.80	0.89	1.14	NS	NS

Table 2: Effect of different plant growth regulator on economics of potato.

Treatments	Yield (t/ha)	Cost of cultivation (Rs/ha)			Cost (Rs/ha)		Sale price (Rs/t)	Net returns* (Rs/ha)	B:C ratio
		Seed	Fertilizer	Cultivation	Inputs	Produce			
M_1R_1	26.85	40000	9191.55	47774.1	96965.65	375900.00	14000	278934.35	1.88
M_1R_2	27.55	40000	9562.80	47774.1	97336.90	385727.55	14001	288390.65	1.96
M_1R_3	26.84	40000	9934.05	47774.1	97708.15	375813.68	14002	278105.53	1.85
M_1R_4	27.64	40000	12371.55	47774.1	100145.65	387042.92	14003	286897.27	1.86
M_1R_5	29.04	40000	15551.55	47774.1	103325.65	406676.16	14004	303350.51	1.94
M_2R_1	27.32	40000	9191.55	47774.1	96965.65	382616.60	14005	285650.95	1.95
M_2R_2	28.91	40000	9562.80	47774.1	97336.90	404913.46	14006	307576.56	2.16
M_2R_3	28.17	40000	9934.05	47774.1	97708.15	394577.19	14007	296869.04	2.04
M_2R_4	30.57	40000	12371.55	47774.1	100145.65	428224.56	14008	328078.91	2.28
M_2R_5	29.57	40000	15551.55	47774.1	103325.65	414246.13	14009	310920.48	2.01

Conclusion

From one year experimentation it can be concluded that application of PGRs on the foliage of potato in spray form was found suitable method, while IBA @ 100 ppm proved better economic PGR for potato cultivation.

References

1. Anonymous. Agriculture statistics at a glance. 2021.
2. Anonymous. Horticulture and Farm Forestry. Nawa Raipur, Atal Nagar; 2022.
3. Bhatia AK, Pandita ML, Khurana SC. Effect of plant growth substances and sprouting conditions on sprout growth. J Indian Potato Assoc. 1991;18(3-4):151-154.
4. Dragicevic I, Konjevic R, Vinterhalter B, Vinterhalter D, Neskovic M. The effect of IAA and tetcyclacis on tuberization in potato (*Solanum tuberosum* L.) shoot culture *in vitro*. Plant Growth Regul. 2008;54:189-193.
5. Hoque ME. *In vitro* tuberization in potato (*Solanum tuberosum* L.). Plant Omics J. 2010;3(1):7-11.
6. Khurana SC, Pandita ML. A note on the, effect of gibberellic acid on growth and deve1oprnent of two commercial potato varieties. Haryana J Hortic Sci. 1987;16(1-2):151-153.
7. Paikra S, Kumar V, Sharma PK. Studies on the effect of plant growth regulators and their application methods on growth, yield and quality attributes of Potato (*Solanum tuberosum* L.) variety Kufri Pukhraj under agro-climatic conditions of Chhattisgarh plains. Int J Chem Stud. 2020;8(2):2714-2719.
8. Ross JJ, O'Neill DP. New interactions between classical plant hormones. Trends Plant Sci. 2001;6:24.
9. Ruan S, Wang L, Li Y, *et al*. Staple food and health: a comparative study of physiology and gut microbiota of mice fed with potato and traditional staple foods (corn, wheat and rice). Food Funct. 2021;12(3):1232-1240.
10. Silu M, Patel NM, Bhadoria HS, Wankhade VR. Effect of plant growth regulators and methods of application on growth and yield of potato (*Solanum tuberosum* L.) cv. Kufri Badshah. Ad Res J Crop Imp. 2012;3(2):144-147.
11. Silva JAB, Otoni WC, Martinez CA, Dias LM, Silva MAP. Microtuberization of Andean potato species (*Solanum* spp.) as effected by salinity. Sci Hortic. 2001;89:91-101.
12. Vreugdenhil D, Struik PC. An integrated view of the hormonal regulation of tuber formation in potato (*Solanum tuberosum* L.). Physiol Plant. 1989;75:525-531.
13. Zhang Z, Zhou W, Li H. The role of GA, IAA and BAP in the regulation of *In vitro* shoot growth and microtuberization in potato. Acta Physiol Plant. 2005;27(3):363-369.