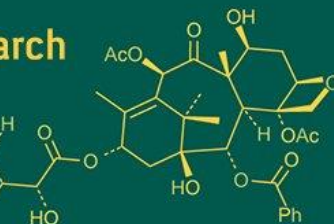
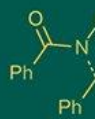


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Effect of Bio-Stimulant on Growth and yield of potato (*Solanum tuberosum*)

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Abstract

A field experiment was conducted during the Kharif season of 2025 at the AICRP on Potato, Horticulture Research and Extension Centre (HREC), Somanahallikaval, Hassan district, Karnataka, to evaluate the effect of different bio-stimulant formulations on the growth, yield and productivity of potato (*Solanum tuberosum* L.) cv. Kufri Karan. The experiment was undertaken to assess the influence of bio-stimulant application on vegetative growth, biomass accumulation, tuber development and yield performance and to identify a promising treatment under the agro-climatic conditions of Hassan. The experiment was laid out in a Randomized Complete Block Design with ten treatments and three replications. The treatments comprised control, medium control and T-and W-cell-free supernatants and spent medium formulations applied at different dilutions. The crop was planted at a spacing of 60 × 20 cm with 75 plants per plot, and observations were recorded on germination, plant height, plant spread, fresh and dry biomass, leaf area, tuber characteristics and yield.

Significant differences were observed among the treatments for most growth and yield attributes. The highest germination percentage at 20 days after planting was recorded with W-cell-free supernatant at 1:100 dilution (99.60%). T-cell-free supernatant at 1:100 dilution recorded the maximum plant height at 45 days, while W-cell-free supernatant at 1:150 dilution produced the highest plant height at 75 days. W-cell-free supernatant at 1:100 dilution resulted in superior plant spread and total dry biomass, whereas T-cell-free supernatant at 1:150 dilution recorded the highest leaf area at 45 days. For yield attributes, W-cell-free supernatant at 1:150 dilution recorded the highest tuber length (7.88 cm), tuber weight (76.29 g), number of tubers per plant (12.18), total tuber yield (23.66 t ha⁻¹) and marketable yield (22.45 t ha⁻¹). The corresponding control values were 6.02 cm, 56.87 g, 9.42 tubers plant⁻¹, 18.20 t ha⁻¹ and 16.95 t ha⁻¹, respectively. Overall, W-cell-free supernatant at 1:150 dilution was identified as the most promising treatment for enhancing potato growth, tuber development and productivity under the conditions of the study.

Keywords: Potato, bio-stimulant, cell-free supernatant, vegetative growth, tuber development, yield

Introduction

Potato (*Solanum tuberosum* L.) is one of the most important food crops worldwide and belongs to the family Solanaceae. It is widely cultivated because of its high yield potential, relatively short crop duration, nutritional value and adaptability to diverse agro-climatic conditions. Potato tubers are an important source of carbohydrates, starch, protein, dietary fibre, vitamin C and essential minerals such as potassium, magnesium and iron. (FAO, 2008) [1]. In addition to its importance as a vegetable, potato serves as an important raw material for the food-processing industry, particularly for the production of chips, French fries and starch. Potato cultivation has expanded considerably in India and is an important component of vegetable production and food security. Major potato-producing regions include Uttar Pradesh, West Bengal, Bihar, Madhya Pradesh, Gujarat, Punjab, Haryana, Assam and Karnataka. In Karnataka, potato is cultivated mainly in districts such as Hassan, Chikkamagaluru, Chamarajanagar, Dharwad and Belagavi during the *Kharif* season, while Chikkaballapura and Kolar are important during the *Rabi* season. Among these regions, Hassan has a significant role in potato production and supports cultivation during both *Kharif* and *Rabi* seasons. (Anon, 2024) [2]. Growth and productivity of potato are strongly influenced by environmental conditions, soil fertility and crop management practices. The crop requires relatively mild temperatures during early growth and cooler conditions during tuber development.

Adequate availability of nutrients and water is essential for optimum vegetative growth, tuber initiation and tuber development.

Biostimulants comprise a diverse group of substances and microorganisms capable of inducing physiological, biochemical and molecular responses in plants. Their beneficial effects may include stimulation of root growth, improved nutrient uptake and utilization, enhanced nitrogen metabolism, phosphorus mobilization, increased soil microbial activity and improved photosynthetic performance. In the present study, the biostimulant comprises duckweed extract and growth-regulating compounds, including abscisic acid (ABA), salicylic acid and tuberonic acid. Application of such a biostimulant at critical stages of potato growth may support plant development and help the crop cope with establishment stress, abiotic stress and limited nutrient availability. Such effects may subsequently influence tuber number, tuber size and overall yield. (Patrick, 2015) ^[3]

Although biostimulants are increasingly being used in agricultural production, information regarding their response in potato under specific agro-climatic conditions remains limited. In the Hassan region, where potato cultivation has considerable potential, challenges such as low productivity, declining soil health and limited availability of suitable production technologies emphasize the need to evaluate alternative and sustainable crop-management practices. Therefore, systematic evaluation of biostimulants under local growing conditions is necessary to determine their effectiveness in improving potato growth and yield.

Therefore, the present study was undertaken to evaluate the "Effect of biostimulant application on growth and yield of potato (*Solanum tuberosum* L.)" under the agro-climatic conditions of Hassan, Karnataka. The study was specifically aimed at assessing the influence of biostimulant application on growth characteristics and yield performance of potato and determining its potential as a sustainable production practice.

Materials and Methods

The experiment was conducted at AICRP on Potato, Horticulture Research and Extension Centre (HREC), Somanahallikaval, Hassan district, Karnataka located at 12° 13' and 13° 33' N, 75° 33' and 76° 38' E during Kharif 2025 (June-August) with 10 bio-stimulant formulations in a Randomized Complete Block Design (RCBD) with three replications at a spacing of 60 × 20 cm using 75 plants per plot with the variety Kufri Karan. The treatments consisted of ten bio-stimulant formulations namely Control, Medium Control (1:100), T-Spent Medium (1:5 dilution), W-Spent Medium (1:5 dilution), T-Cell Free Supernatant (1:50 dilution), W-Cell Free Supernatant (1:50 dilution), T-Cell Free Supernatant (1:100 dilution), W-Cell Free Supernatant (1:100 dilution), T-Cell Free Supernatant (1:150 dilution), W-Cell Free Supernatant (1:150 dilution). The recommended quantity of farm yard manure was applied to the experimental site at the rate of 25 tonnes per hectare and thoroughly incorporated into soil. Then the land was laid out into sub plots of size 2.8 x 2.4 m and a total of 30 plots were prepared. Five tagged plants per treatment were selected randomly and observations were recorded on selected plants for different growth, and yield characters in potato variety Kufri Karan in each replication.

Morphological parameters

Germination percentage (%)

The germination percentage was worked out after 20 days after planting. It was calculated by using the formula

$$\text{Germination (\%)} = \frac{\text{Total number of tubers germinated}}{\text{Total number of tubers planted}} \times 100$$

Plant height (cm)

Height of the plant was measured from ground level to the tip of the plant at 45 and 75 Days After Planting (DAP) and expressed in centimetres.

Plant spread (cm)

It was measured by recording the plant spread from North-South to East-West directions in tagged plants at 45 and 75 DAP. Average was worked out and expressed in centimetres.

Total fresh weight of plant (g)

Fresh biomass production of different plant parts at 45 and 75 days after planting was estimated by uprooting the five plants randomly in each treatment. Then leaves, stems and roots were separated and recorded for their fresh weight. The total fresh biomass production was calculated by adding fresh weight of leaves, stems and roots and the mean value was expressed in grams per plant.

Total dry weight of plant (g)

Five plants were sampled randomly at 45 and 75 days after planting and at harvest and were separated into leaf, stem and roots. The same were dried in hot air oven at 80 °C until a constant weight was attained. The total dry biomass production was calculated by adding dry weight of leaves, stems and roots and expressed as grams per plant.

Leaf area (cm²)

The leaves from five selected plants from each treatment were used for estimation of leaf area. Leaf area was computed by using Leaf Area Meter (LAM 211) and was expressed as square centimetres per plant.

Yield parameters

Number of tubers per plant

The numbers of tubers in each of five plants were counted. The mean was recorded as number of tubers per plant.

Tuber length (cm)

Tuber length was recorded from the tagged five plants and expressed in centimetres.

Tuber weight (g)

The weight of tubers in each grade was recorded in grams per plant during harvesting using sensitive balance and the average was recorded.

Total tuber yield per hectare (t/ha)

The total tuber yield per plot was computed by summing up all the harvested tubers of each treatment, converted to tuber yield per hectare and expressed in tonnes per hectare.

$$\text{Tuber yield (t/ha)} = \frac{\text{plot yield}}{\text{plot size}} \times \frac{10,000}{1000}$$

Marketable yield per hectare (t/ha)

Marketable yield per plot was calculated by subtracting tuber rottage from total tuber yield per plot and converted to tonnes per hectare.

Experimental results**Growth parameters**

Significant variations among potato genotypes were observed in growth parameters such as germination percentage, plant height, plant spread, total fresh weight of the plant and total dry weight of the plant and leaf area per plant across different growth stages (Table 1 and Table 2).

Germination percentage

The significantly highest germination percentage at 20 DAS was recorded in T₈: W-Cell Free Supernatant (1:100 dilution) (99.60%), while significantly minimum germination percentage (90.40%) was observed in T₄ W-Spent Medium (1:5 dilution) are presented in Table 1.

Plant height at 45 DAS

At 45 DAS, significantly maximum plant height (79.14 cm) was recorded in T₇: TCFS (1:100), while significantly minimum plant height (59.42 cm) was observed in T₁: Control.

Plant height at 75 DAS

At 75 DAS, significantly highest plant height was recorded in T₈: T-Cell Free Supernatant (1:150 dilution) (113.48 cm), while significantly lowest plant height was observed in T₁: Control (87.84 cm).

Plant spread (North-South) at 45 DAS

At 45 DAS, significantly highest plant spread was recorded in T₈: W-Cell Free Supernatant (1:100 dilution) (64.16 cm), while significantly lowest plant spread was observed in T₁: Control (48.26 cm).

Plant spread (North-South) at 75 DAS

At 75 DAS, significantly highest plant spread was recorded in T₈: W-Cell Free Supernatant (1:100 dilution) (64.45 cm), while significantly lowest plant spread was observed in T₁: Control (48.45 cm).

Plant spread (East-West) at 45 DAS

At 45 DAS, significantly highest plant spread was recorded in T₈: W-Cell Free Supernatant (1:100 dilution) (62.48 cm), while significantly lowest plant spread was observed in T₁: Control (46.18 cm).

Plant spread (East-West) at 75 DAS

At 75 DAS, significantly highest plant spread was recorded in T₉: T-Cell Free Supernatant (1:150 dilution) (78.07 cm), while significantly lowest plant spread was observed in T₁: Control (1:100) (60.95 cm).

Total fresh weight of plant at 45 DAS

At 45 DAS, significantly highest total fresh weight of plant was recorded in T₉: T-Cell Free Supernatant (1:150 dilution) (215.80 g), while significantly lowest total fresh weight of plant was observed in T₁: Control (148.20 g).

Total fresh weight of plant at 75 DAS

At 75 DAS, significantly highest total fresh weight of plant was recorded in T₈: W-Cell Free Supernatant (1:100

dilution) (303.43 g), while significantly lowest total fresh weight of plant was observed in T₅: T-Cell Free Supernatant (1:50 dilution) (272.57 g).

Total Dry weight of the plant at 45 DAS

At 45 DAS, significantly highest total dry weight of plant was recorded in T₈: W-Cell Free Supernatant (1:100 dilution) (22.02 g), while significantly lowest total dry weight of plant was observed in T₁: Control (16.42 g).

Total Dry weight of the plant at 75 DAS

At 75 DAS, significantly highest total dry weight of plant was recorded in T₈: W-Cell Free Supernatant (1:100 dilution) (34.46 g), while significantly lowest total dry weight of plant was observed in T₁: Control (25.42 g).

Leaf area per plant at 45 DAS

At 45 DAS, significantly highest leaf area per plant was recorded in T₉: T-Cell Free Supernatant (1:150 dilution) (486.2 cm²), while significantly lowest leaf area per plant was observed in T₁: Control (315.4 cm²).

Leaf area per plant at 75 DAS

At 75 DAS, the maximum leaf area per plant was recorded in T₁₀: W-Cell Free Supernatant (1:150 dilution) (592.8 cm²), the minimum leaf area per plant was observed in T₁: Control (458.6 cm²).

Yield parameters

Significant variations among potato genotypes were observed in yield parameters such as tuber length, tuber weight, number of tubers per plant, total tuber yield per hectare and marketable yield per hectare in different potato genotypes (Table 3 and Table 4)

Tuber length

The significantly highest tuber length was recorded in T₁₀: W-Cell Free Supernatant (1:150 dilution) (7.88 cm), while significantly lowest tuber length was observed in T₁: Control (6.02 cm).

Tuber weight

The significantly highest tuber weight was recorded in T₁₀: W-Cell Free Supernatant (1:150 dilution) (76.29 g), while significantly lowest tuber weight was observed in T₁: Control (56.87 g).

Number of tubers per plant

The significantly highest tuber weight was recorded in T₁₀: W-Cell Free Supernatant (1:150 dilution) (12.18), the significantly lowest tuber weight was recorded in T₁: Control (9.42).

Total tuber yield per hectare

The significantly highest total tuber yield per hectare was recorded in T₁₀: W-Cell Free Supernatant (1:150 dilution) (23.66 t ha⁻¹), the significantly lowest total tuber yield per hectare was observed in T₁: Control (18.20 t ha⁻¹).

Marketable yield per hectare

The significantly highest marketable yield per hectare was recorded in T₁₀: W-Cell Free Supernatant (1:150 dilution) (22.45 t ha⁻¹), the significantly lowest marketable yield per hectare was observed in T₁: Control (16.95 t ha⁻¹).

Discussion

The application of different bio-stimulant formulations showed considerable variation in germination, growth and yield attributes of potato during the *Kharif* season. Germination percentage at 20 DAS was highest in W-Cell Free Supernatant at 1:100 dilution (T_8). However, as the bio-stimulant spray was imposed only after 30 DAS, the variation in germination percentage could not be attributed to the bio-stimulant treatments. The differences may be due to seed tuber quality, physiological age, dormancy status, sprouting vigour, soil temperature, soil moisture and field establishment conditions. Similar effects of seed tuber physiological condition and environmental factors on potato emergence and establishment were reported by Midmore (1984) [4], Struik and Wiersema (1999) [5] and Zou *et al.* (2025) [6].

Plant height and plant spread were considerably improved by the application of cell-free supernatant treatments. T-Cell Free Supernatant at 1:100 dilution (T_7) recorded the highest plant height at 45 DAS, whereas W-Cell Free Supernatant at 1:100 dilution (T_8) recorded the maximum plant height at 75 DAS. W-Cell Free Supernatant at 1:100 dilution (T_8) also recorded the maximum plant spread in both North-South and East-West directions at most stages. The increase in plant height and spread may be attributed to the presence of bioactive compounds and growth-promoting metabolites in the cell-free supernatant, which might have enhanced cell division, cell elongation, nutrient uptake and overall vegetative growth following foliar application. The increased plant spread may further be associated with enhanced lateral canopy expansion and photosynthetic efficiency. Similar improvement in vegetative growth due to bio-stimulant application was reported by Khan *et al.* (2009) [7], Rouphael *et al.* (2017) [8], Al-Zubaidi *et al.* (2018) [9], Drobek *et al.* (2019) [10] and Mbuyisa *et al.* (2024) [11].

The total fresh weight and total dry weight of the plant also varied significantly among the treatments. W-Cell Free Supernatant at 1:100 dilution (T_8) recorded the highest total fresh weight at 75 DAS, while T-Cell Free Supernatant at 1:150 dilution (T_9) performed closely. T_8 recorded the highest total dry weight at both 45 and 75 DAS. The increase in total fresh weight may be attributed to enhanced nutrient uptake, cell division, leaf and stem development, water retention and photosynthetic activity, resulting in greater accumulation of vegetative biomass. Similarly, the higher dry weight may be due to improved nutrient uptake, root growth, chlorophyll synthesis, leaf area development and photosynthetic efficiency, which collectively promoted greater biomass production and dry matter accumulation. The bioactive metabolites such as phytohormones, amino acids and organic acids present in the cell-free supernatants may have further stimulated metabolic activity and assimilate translocation. Similar findings were reported by Sarhan and Taha (2011) [12], Rizk *et al.* (2013) [13], Kahlel and Sultan (2019) [14].

Leaf area per plant was significantly influenced by the bio-stimulant treatments. T-Cell Free Supernatant at 1:150 dilution (T_9) recorded the maximum leaf area at 45 DAS, whereas W-Cell Free Supernatant at 1:150 dilution (T_{10})

recorded the maximum at 75 DAS. The increased leaf area may be attributed to the presence of plant growth-promoting metabolites such as auxins, cytokinins, gibberellins, amino acids and vitamins, which enhance cell division, cell elongation, nutrient uptake and chlorophyll synthesis, thereby improving photosynthetic efficiency and leaf expansion. The larger photosynthetic surface area would have resulted in greater assimilate production and enhanced vegetative growth. The superior response of T_9 and T_{10} indicates that the 1:150 dilution provided an optimum concentration of bioactive compounds for maximizing canopy development. Similar findings were reported by Issa *et al.* (2019) [15] and Wadas and Dziugiel (2019) [16].

The application of bio-stimulants also significantly improved tuber length and tuber weight. W-Cell Free Supernatant at 1:150 dilution (T_{10}) and T-Cell Free Supernatant at 1:150 dilution (T_9) produced large-sized tubers and recorded superior tuber weight, whereas the control generally produced smaller tubers. The improvement in tuber size and weight may be related to better root development and more efficient acquisition of water and nutrients. Improved potassium uptake and utilization may also have supported carbohydrate transport, starch formation and enlargement of tuber cells, thereby increasing tuber size and weight. Enhanced photosynthetic efficiency and greater translocation of assimilates to developing tubers may have further contributed to tuber bulking. Similar responses were reported by Sarhan and Taha (2011) [12] and Ros *et al.* (2015) [17].

The number of tubers per plant was highest with W-Cell Free Supernatant at 1:150 dilution (T_{10}), followed by T-Cell Free Supernatant at 1:150 dilution (T_9). The increase in tuber number may have resulted from better canopy growth, enhanced photosynthetic capacity and greater movement of assimilates from the leaves towards the stolons. In addition, jasmonic acid and its hydroxylated product, tuberonic acid, may have contributed to the response by encouraging stolon swelling, cellular activity at the stolon tip and initiation of new tubers. The role of jasmonic acid and related compounds in potato tuber formation was also documented by Koda *et al.* (1991) [18], Pelacho and Mingo-Castel (1991) [19] and Miyawaki *et al.* (2021) [20].

The highest total tuber yield per hectare and marketable yield per hectare were recorded with W-Cell Free Supernatant at 1:150 dilution (T_{10}), followed by T-Cell Free Supernatant at 1:150 dilution (T_9). The higher productivity under these treatments may be explained by the combined contribution of more tubers, greater individual tuber weight and improved tuber size. Enhanced leaf area, chlorophyll content, nutrient uptake and photosynthetic efficiency may have increased the synthesis of carbohydrates and their transfer to developing tubers during the bulking period. Greater dry-matter deposition and production of a larger proportion of well-developed tubers consequently resulted in higher total and marketable yield. Similar increases in potato yield following bio-stimulant application were reported by Sarhan and Taha (2011) [12], Garai *et al.* (2021) [21] and Mbuyisa *et al.* (2024) [11].

Table 1: Germination percentage and effect of bio-stimulant on plant height (cm) and plant spread at different growth stages of potato (*Solanum tuberosum* L.)

Sl. No.	Treatments	Germination (%)	Plant height (cm)		Plant spread(cm) EW		Plant spread(cm) EW	
		20 DAS	45 DAS	45 DAS	75 DAS	45 DAS	75 DAS	75 DAS
1.	Control	96.45	59.42	46.18	60.95	48.26	48.45	87.84
2.	Medium Control (1:100)	93.78	61.18	47.52	62.63	49.84	49.75	90.62
3.	T-Spent Medium (1:5 dilution)	94.80	66.84	50.14	64.61	52.15	52.28	96.48
4.	W-Spent Medium (1:5 dilution)	90.40	64.72	51.83	67.39	53.72	53.07	98.24
5.	T-Cell Free Supernatant (1:50 dilution)	96.20	68.96	53.26	69.65	55.34	55.13	101.16
6.	W-Cell Free Supernatant (1:50 dilution)	92.30	66.28	54.38	71.47	56.28	56.27	103.42
7.	T-Cell Free Supernatant (1:100 dilution)	97.40	79.14	57.24	74.72	59.42	58.5	108.84
8.	W-Cell Free Supernatant (1:100 dilution)	99.60	72.18	62.48	75.99	64.16	64.45	113.48
9.	T-Cell Free Supernatant (1:150 dilution)	96.25	77.26	61.35	78.07	63.25	62.94	110.62
10.	W-Cell Free Supernatant (1:150 dilution)	98.10	73.42	58.12	72.93	60.18	59.78	104.60
	S.Em ($\pm$)	0.03	3.56	2.81	3.61	2.91	2.90	5.24
	CD @ 5%	0.09	10.59	8.34	10.72	8.64	8.61	15.28

Table 2: Effect of bio-stimulant on Total fresh weight of plant, Total dry weight of plant and Leaf area per plant at different growth stages of potato (*Solanum tuberosum* L.)

Sl. No.	Treatments	Total fresh weight of plant (g)	Total fresh weight of plant (g)	Total dry weight of plant (g)	Total dry weight of plant (g)	Leaf area per plant (cm ²)	Leaf area per plant (cm ²)
		45 DAS	75 DAS	45 DAS	75 DAS	45 DAS	75 DAS
1.	Control	148.20	274.25	16.42	25.42	315.4	458.6
2.	Medium Control (1:100)	152.80	281.50	16.98	26.18	327.8	469.2
3.	T-Spent Medium (1:5 dilution)	176.50	278.30	17.54	27.14	381.6	496.8
4.	W-Spent Medium (1:5 dilution)	169.40	284.72	18.16	27.96	366.2	487.4
5.	T-Cell Free Supernatant (1:50 dilution)	191.60	272.57	18.84	28.74	425.8	528.6
6.	W-Cell Free Supernatant (1:50 dilution)	183.20	281.66	19.22	29.28	407.4	516.8
7.	T-Cell Free Supernatant (1:100 dilution)	198.40	294.28	20.16	30.46	442.6	548.2
8.	W-Cell Free Supernatant (1:100 dilution)	209.60	303.43	22.02	34.46	419.5	535.4
9.	T-Cell Free Supernatant (1:150 dilution)	215.80	302.74	21.72	32.54	486.2	578.6
10.	W-Cell Free Supernatant (1:150 dilution)	188.10	291.45	20.84	31.12	472.8	592.8
	S. Em ($\pm$)	9.51	6.15	0.96	1.52	21.04	26.94
	CD @ 5%	28.27	18.27	2.85	4.50	62.51	80.04

Table 3: Effect of bio-stimulant on tuber length, tuber weight, number of tubers per plant, total tuber yield per hectare, marketable yield per hectare.

Sl. No.	Treatments	Tuber length (cm)	Tuber weight (g)	Number of tubers per plant	Total tuber yield per hectare (Tonnes)	Marketable yield per Hectare (Tonnes)
1.	Control	6.02	56.87	9.42	18.20	16.95
2.	Medium Control (1:100)	6.36	58.71	9.68	18.65	17.36
3.	T-Spent Medium (1:5 dilution)	6.18	61.50	9.94	19.35	18.05
4.	W-Spent Medium (1:5 dilution)	6.54	60.26	10.18	19.05	17.75
5.	T-Cell Free Supernatant (1:50 dilution)	6.72	66.95	10.44	20.45	19.15
6.	W-Cell Free Supernatant (1:50 dilution)	6.88	63.46	10.72	20.10	18.82
7.	T-Cell Free Supernatant (1:100 dilution)	7.16	72.85	11.08	21.45	20.10
8.	W-Cell Free Supernatant (1:100 dilution)	7.32	65.14	11.26	22.10	20.75
9.	T-Cell Free Supernatant (1:150 dilution)	7.64	74.60	11.74	22.95	21.55
10.	W-Cell Free Supernatant (1:150 dilution)	7.88	76.29	12.18	23.66	22.45
	S. Em ($\pm$)	0.35	3.40	0.55	1.06	1.00
	CD @ 5%	1.03	10.12	1.64	3.16	2.96

Conclusion

Bio-stimulant application significantly improved potato growth, biomass accumulation, tuber development and yield. W-Cell Free Supernatant at 1:100 dilution (T₈) was superior for vegetative growth and biomass production. W-Cell Free Supernatant at 1:150 dilution (T₁₀) recorded the highest tuber number, tuber size, total yield and marketable yield. T-Cell Free Supernatant at 1:150 dilution (T₉) also showed consistently superior performance across major growth and yield attributes.

Overall, W-Cell Free Supernatant at 1:150 dilution (T₁₀) was identified as the most promising treatment for enhancing

potato productivity.

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References

1. FAO. Potato and its contribution to food security. Food and Agriculture Organization of the United Nations, Rome, Italy. 2008.
2. Anonymous. Annual report: Fully revised estimates report on area, production and yield of principal crops in Karnataka. 2024. p. 142.
3. Patrick du Jardin . Plant biostimulants: Definition, concept, main categories and regulation. Scientia Hortic. 2015;196:3-14.
4. Midmore DJ. Potato (*Solanum* spp.) in the hot tropics. I. Soil temperature effects on emergence, plant development and yield. Field Crops Res. 1984;8:255-271.
5. Struik PC, Wiersema SG. Seed potato technology. Wageningen Pers, Wageningen, The Netherlands. 1999. p. 383.
6. Zou C, van der Putten PE, Datema M, Mossink L, Lommen WJ, Struik PC, van Ittersum MK. Physiological age of potato seed tubers of contrasting cultivars hardly affects crop performance in a temperate climate. Potato Res. 2025;68(1):187-217.
7. Khan W, Rayirath UP, Subramanian S, Jithesh MN, Rayorath P, Hodges DM, Critchley AT, Craigie JS, Norrie J, Prithiviraj B. Seaweed extracts as biostimulants of plant growth and development. J Plant Growth Regul. 2009;28(4):386-399.
8. Rouphael Y, Colla G, Giordano M, El-Nakhel C, Kyriacou MC, De Pascale S. Foliar applications of a legume-derived protein hydrolysate elicit dose-dependent increases of growth, leaf mineral composition, yield and fruit quality in two greenhouse tomato cultivars. Sci Hortic. 2017;226:353-360.
9. Al-Zubaidi AHAA. Effect of humic acids on growth, yield and quality of three potato varieties. Plant Arch. 2018;18(2):1533-1540.
10. Drobek M, Frac M, Cybulska J. Plant biostimulants: Importance of the quality and yield of horticultural crops and the improvement of plant tolerance to abiotic stress—A review. Agronomy. 2019;9(6):335.
11. Mbuyisa S, Bertling I, Ngcobo BL. Impact of foliar-applied plant extracts on growth, physiological and yield attributes of potato (*Solanum tuberosum* L.). Agronomy. 2024;14(1):38.
12. Sarhan TZ, Taha ZK. Effect of humic acid and seaweed extracts on growth and yield of potato (*Solanum tuberosum* L., cv. Desiree). Mesopotamia J Agric. 2011;39(2):19-27.
13. Rizk FA, Shaheen AM, Singer SM, Sawan OA. The productivity of potato plants affected by urea fertilizer as foliar spraying and humic acid added with irrigation water. Middle East J Agric Res. 2013;2(2):76-83.
14. Kahlel AMS, Sultan FI. Response of four potato cultivars to soil application with organic and amino acid compounds. Res Crops. 2019;20(1):101-108.
15. Issa R, Boras M, Zidan R. Effect of seaweed extract on the growth and productivity of potato plants. Int J Agric Environ Sci. 2019;6(3):83-89.
16. Wadas W, Dziugiel T. Growth and marketable potato (*Solanum tuberosum* L.) tuber yield in response to foliar application of seaweed extract and humic acids. Appl Ecol Environ Res. 2019;17(6):13219-13230.
17. Ros AB, Narita N, Araujo HSD. Biostimulant effect on the initial growth and yield of sweet potato. Rev Ceres. 2015;62(5):469-474.
18. Koda Y, Kikuta Y, Tazaki H, Tsujino Y, Sakamura S, Yoshihara T. Potato tuber-inducing activities of jasmonic acid and related compounds. Phytochemistry. 1991;30(5):1435-1438.
19. Pelacho AM, Mingo-Castel AM. Jasmonic acid induces tuberization of potato stolons cultured *in vitro*. Plant Physiol. 1991;97(3):1253-1255.
20. Miyawaki K, Inoue S, Kitaoka N, Matsuura H. Potato tuber-inducing activities of jasmonic acid and related compounds (II). Biosci Biotechnol Biochem. 2021;85(12):2378-2382.
21. Garai S, Brahmachari K, Sarkar S, Mondal M, Banerjee H, Nanda MK, Chakravarty K. Impact of seaweed sap foliar application on growth, yield and tuber quality of potato (*Solanum tuberosum* L.). J Appl Phycol. 2021;33:1893-1904.