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

NAAS Rating (2025): 5.20
www.agronomyjournals.com
2025; 8(9): 608-614
Received: 07-07-2025
Accepted: 09-08-2025

Krishna G Choli
College of Horticulture, UHS Campus, Bengaluru, Karnataka, India

Manjunath R
College of Horticulture, UHS Campus, Bengaluru, Karnataka, India

B Doddabasappa
Regional Horticultural Research and Extension Centre, UHS Campus, Bengaluru, Karnataka, India

Shivanna M
College of Horticulture, UHS Campus, Bengaluru, Karnataka, India

Anil Kumar S
Krishi Vigyan Kendra, Kolar, Karnataka, India

Corresponding Author:
Manjunath R
College of Horticulture, UHS Campus, Bengaluru, Karnataka, India

Tailoring fertility for arc potato seedlings (*Solanum tuberosum* l.): A study on growth and yield responses

Krishna G Choli, Manjunath R, B Doddabasappa, Shivanna M and Anil Kumar S

DOI: https://www.doi.org/10.33545/2618060X.2025.v8.i9i.3824

Abstract
The shortage of quality seed tubers remains a major constraint in potato (*Solanum tuberosum* L.) production, particularly in regions with limited access to certified planting material. Apical rooted cuttings (ARCs) provide a rapid, disease-free, and cost-effective alternative for seed tuber multiplication. The present study was conducted at the College of Horticulture, Bengaluru, to evaluate the influence of different nutrient management regimes on the growth, yield, and quality of ARC-derived potato seed tubers. Ten nutrient treatments, comprising varying levels of NPK fertilizers with or without foliar application of "Potato Special" (a micronutrient formulation), were evaluated in a randomized block design with three replications. Growth parameters, yield attributes, tuber yield and dry matter content were recorded and analyzed. Significant differences were observed among treatments for all traits studied. T3 (156:125:156 kg ha^{-1} NPK + Potato Special) exhibited superior vegetative growth, while T_1 (125:100:125 kg ha^{-1} NPK + Potato Special) and T_{10} (125:100:156 kg ha^{-1} NPK + Potato Special) produced the highest total and marketable tuber yields. Treatments with balanced NPK combined with micronutrient supplementation also improved tuber dry matter content. In contrast, lower nutrient levels (T_6) resulted in poor growth and yield. The findings confirm that optimized nutrient management, particularly the integration of balanced macronutrient doses with micronutrient foliar sprays, can enhance the productivity and quality of seed tubers derived from ARC technology. This approach offers a sustainable pathway for strengthening potato seed systems and improving farm profitability.

Keywords: Apical rooted cuttings, potato, nutrient management, seed tubers, growth, yield

Introduction
Potato (*Solanum tuberosum* L.), a member of the Solanaceae family, the continues to be an important vegetable crop worldwide (Sahair *et al*., 2018) [13]. Potato is the fourth most important food crop in India's northeastern plains, behind rice, wheat, and maize. With an annual production of almost 360 million tons, India is the world's second-largest producer of potatoes, right behind China (Anonymous, 2013) [2]. Due to its high nutritional value which includes carbs, proteins, dietary fiber, vitamins, minerals, and amino acids as well as its easy digestion and capacity to be produced in huge amounts, potatoes have become more popular as vegetables across the world (Fernandez-Lopez *et al*., 2020) [9].

The right amount and timing of nutrient treatment are essential for attaining good yields in potato production since potatoes are extremely sensitive to and require a substantial amount of nutrients (Biswas and Dutta, 2020) [6]. According to Tripathi *et al*. (2015) [19], these micronutrients are necessary for vital plant functions, such as increasing photosynthesis and the amount of chlorophyll in leaves, which raises the assimilative activity of plants as a whole. It has been demonstrated that foliar spraying potato leaves with micronutrients like boron (B), copper (Cu), manganese (Mn), zinc (Zn), and molybdenum (Mo) increases the uptake of nitrogen (N), phosphorus (P), and potassium (K). In addition, this treatment boosts photosynthesis, encourages tuber development, improves chlorophyll levels, and eventually increases potato harvests. A vital micronutrient for plant growth, boron (B) is involved in many processes including the synthesis of cell walls, sugar transport, cell division and development, auxin metabolism, pollination, fruit set, seed development, synthesis of amino acids and proteins, formation of nodules in legumes, and regulation of carbohydrate metabolism.

Micronutrients like zinc (Zn) and manganese (Mn) are essential for improving the productivity and quality of potato tubers, according a study by Singh *et al*. (2015) [19].

Even after being grown for commercial purposes in India for a considerable amount of time, the potato crop still faces many important obstacles. One of the main problems, which causes continuously low yields, is the lack of healthy seed tubers available in the right amounts and at the right periods from long distances with high expenses. Compared to other crops, potatoes multiply rather slowly even in the best of circumstances, they usually only produce four or six times as much as they started with. Because of this, growing seed tubers takes up a lot of acreage, and producing enough commercial tubers to meet demand takes time. Additionally, certified potato seed tubers are frequently in limited supply and aren't always accessible in the requisite amounts or at the needed times and locations. But because of the costs involved with cold storage and long-distance shipping, these seeds are somewhat expensive.

Tissue culture is the use of technology and apical rooted cuttings (ARCs) to increase the supply of high-quality seed potatoes. As a specialized method of plant propagation, plant tissue culture entails the sterile cultivation of disease-free plant tissues on synthetic growth media. Rapid multiplication and fewer field generations are made possible by this technique, which preserves the quality of the seed (Sharma and Pandey, 2013) [15]. To produce mini-tubers, in-vitro-generated plantlets are first acclimated to the field before being transplanted (Tadesse *et al*., 2001) [18]. Apical cuttings, on the other hand, are rooted transplants made from tissue culture. Though they are vegetatively propagated and disease-free, these cuttings resemble seedlings cultivated in nurseries. A cost-effective and efficient technique of propagating potatoes, ARCs have the potential for fast regeneration and genetic integrity. According to Tsoka *et al*. (2012) [20], they have great potential for the preservation and generation of superior potato seed tubers.

As of right now, no studies have been done to determine the ideal fertilizer dose for producing potato seed tubers with ARC technology. Thus, the purpose of this study is to ascertain which nutrients are required in order to produce seed tubers with ARC technology more productively.

Materials and Methods

The study was conducted at the Regional Horticultural Research and Extension Centre (RHREC) on the UHS campus at GKVK, Bengaluru in the Rabi season of 2023. Apical Rooted Cuttings ((ARC) of Kufri Karan potato produced at RHREC Bengaluru tissue cultured planting material was used under RCBD experimental design with the following10 treatments and 03 replications with spacing of 60 cm x 20 cm and plot size of 2.4 m x 2m.

Treatment details

- **T_1:** 125:100:125 kg ha^{-1} N:P:K + Potato special (UHSB Package)
- **T_2:** 125:100:125 kg ha^{-1} N:P: K
- **T_3:** 156: 125:156 kg ha^{-1} N: P: K+ Potato special
- **T_4:** 156: 125: 156 kg ha^{-1} N: P: K
- **T_5:** 93.5: 75: 93.5 kg ha^{-1} N: P: K+ Potato special
- **T_6:** 93.5: 75: 93.5 kg ha^{-1} N: P: K
- **T_7:** 93.5: 100: 125 kg ha^{-1} N: P: K + Potato special
- **T_8:** 125: 100: 93.5 kg ha^{-1} N: P: K + Potato special
- **T_9:** 156: 100: 125 kg ha^{-1} N: P: K + Potato special
- **T_{10}:** 125: 100: 156 kg ha^{-1} N: P: K + Potato special

The potato special of UHSB-3 micronutrient formulation for foliar spray 3 g L-1 contains zinc, manganese, iron, boron, and copper in the ppm of 200, 75, 100, 75, and 25 respectively.

The tubers were harvested once they achieved the desired stage of physiological maturity. The plants from each plot were then uprooted, and data were collected for each treatment. To gather observations, five plants were randomly chosen and tagged from the net plot in each treatment and observations for plant height(cm), number of branches per plant, number of leaves per plant, plant spread(cm^2), leaf area(cm^2), number of tubers per plant, average tuber size of 20 tubers(g), average weight of 20 tubers (g)

The soil samples were collected from the experimental site both before and after harvest at a depth of 0-15 cm as per soil analysis standard and determined for some of the physical (bulk density, water-holding capacity, porosity, and texture) and chemical (pH, electrical conductivity (EC), organic carbon (OC), available nitrogen (N), available phosphorus (P_2O5), available potassium (K_2O), exchangeable calcium (Ca), exchangeable magnesium (Mg), available sulfur (S), and available micronutrients including iron (Fe), manganese (Mn), zinc (Zn), and copper (Cu) properties as per the standard protocols.

Samples of plants and tubers were collected from each treatment and dried in a hot-air oven and analysed for nutritional levels, including nitrogen, phosphorus, potassium, calcium, magnesium, and sulfur, as well as micronutrients such as zinc, iron, manganese, and copper as per the standard protocols. The initial weight of tubers in each treatment was determined using an electric weighing scale. The tuber weights for each treatment were then recorded at intervals of 15, 30, 45, 60, 75 and 90 days following storage. The cumulative weight reduction was determined and expressed as a percentage of physiological weight loss. Following the cropping season, a financial study was performed to evaluate cost-effectiveness and establish benefit-cost ratios. This entailed comparing entire cultivation expenditures to the revenue obtained from tuber sales.

Results

The study revealed significant variation among nutrient treatments for growth, yield, and quality parameters of potato seed tubers derived from apical rooted cuttings (ARCs).

Vegetative growth was consistently superior in T_3, which produced taller plants, more branches, and plant spread compared to other treatments (Table 1, Table 2, and Table 3). In contrast, T_6 recorded the lowest growth values, reflecting the limitations of reduced nutrient supply.

Yield performance followed a similar trend. T_1 and T_{10} achieved the highest tuber yields per hectare and greater proportions of marketable tubers (Table 4; Fig. 1), while T6 consistently produced the lowest yield. The positive association between vegetative vigor and tuber bulking was evident across treatments.

Quality traits were also influenced by nutrient management. Treatments supplemented with Potato Special recorded higher tuber dry matter and better storability, with T_{10} achieving the highest dry matter percentage (Table 5). Among the various treatments, T_{10} (125: 100: 156 kg N: P: K + Potato special) yielded the highest number of seed tubers. ARC plantlets of Kufri Karan produce the highest number of seed tubers per plant, with tubers of medium size that are well-suited for seed production (Plate 3 & 4). Overall, balanced NPK application in combination with micronutrient foliar sprays proved most effective in enhancing growth, yield, and quality of ARC-derived potato seed tubers.

Discussion

Establishment and Survival

All treatments recorded high survival percentages of apical rooted cuttings, ranging from 94.16% (T_1) to 98.33% (T_5) (Table 1). The lack of significant differences indicates that survival was primarily influenced by the inherent vigor of tissue culture–derived ARC plantlets, which typically establish well due to their healthy root systems and virus-free status. Similar stability in ARC survival under different nutrient regimes has been reported by Barman *et al*. (2018) [3].

Vegetative Growth Response

Marked variation was observed across treatments in plant height, branching, leaf production, and plant spread (Tables 1, 2, 3). Among treatments, T_3 consistently outperformed others, producing taller plants, more branches, and greater leaf numbers. These results highlight the growth-promoting synergy between balanced macronutrient supply and micronutrient supplementation. Nitrogen promotes protein synthesis and meristematic activity, phosphorus supports root and shoot development, while potassium regulates photosynthesis and water balance (Mitchell *et al*., 1985) [11]. The addition of micronutrients through Potato Special likely enhanced chlorophyll formation and overall vigor, explaining the stronger vegetative growth observed.These outcomes are also in consistent with what Mirdad (2010) [10].

Yield Performance and Tuber Characteristics

Yield attributes mirrored vegetative responses. Treatments T_1 and T_{10} recorded the highest tuber yields per hectare (Table 4; Fig. 1) and greater proportions of marketable tubers. In contrast, T_6 consistently produced the lowest yield, confirming the limitation of reduced nutrient supply for tuber bulking. Larger tuber size and higher average tuber weight were linked with better vegetative growth, which enhanced photosynthesis production and source–sink translocation. El-Hadidi *et al*. (2017) [8] observed similar findings in potatoes.

The marketable tuber yield per hectare of potato produced by apical rooted cutting method, broken down by grade, showed considerable variation in the data (Table 6, Plate 3 & 4). The maximum output of A-grade tubers (>75 g) was seen in T_1 at 2.44 t ha^{-1}. Conversely, T6 produced 1.66 t ha^{-1} of the fewest A-grade tubers. The maximum commercial yield of 51–75 g B-grade tubers was recorded in T_1 at 5.12 t ha^{-1}. With a yield of 3.58 t ha^{-1} for B-grade tubers, T_{10} had the lowest yield. The largest measured number of C-grade tubers (26-50 g) in T_1 was 4.34 t ha^{-1}. On the other hand, with 2.79 t ha^{-1} of C-grade tuber yield, T_7 had the lowest yield (Table 6). Since this intern assisted in better photosynthesizing and building up photosynthates in the tubers, better growth may be the cause of the maximum growth and production of tuber yield. This may be because of more efficient metabolism, increased mobilization of photosynthetic processes, and improved source-sink relationships in potato plants. Singh *et al*. (2001) [17] state that these variables have an impact on the tuber's weight, which raises the tuber yield.

The maximum seed tuber yield, 8.81 t ha^{-1}, was reported (Table 6) for D-grade tubers (0-25 g) in T_{10}; there were no significant differences in seed tuber yield. The key to tuber quality is potassium. It improves disease resistance, skin finish, and tuber size. While high nitrogen levels can lead to an abundance of foliage but undeveloped tubers, high potassium levels can enhance the overall quality of the tubers. In order to maximize seed tubers. Bekele *et al*. (2020) [4] observed a similar event.

The marketable yield varies considerably across treatments; T_1 produced the largest yield, 11.91 t ha^{-1}, while T_7 produced the lowest yield, 8.19 t ha^{-1}, according to Table 6. Healthy plants generate more marketable tubers per plant because they have a higher tuberization efficiency. A similar phenomenon was noted by Bhuwneshwari *et al*. (2013) [15] in potato plants.

Notably, T_{10} had the largest tuber production per plant (Table 4, Plate 3 & 4), weighing 306.00 g. On the other hand, T_6 had the lowest tuber yield per plant, weighing 230.90 g. T1 had the maximum yield per plot (8.74 kg). On the other hand, T_6 had the lowest tuber yield per plot, weighing 5.98 kg. T_1 produced the maximum output of 18.22 t ha^{-1} (Figure 3). On the other hand, T_6 produced the fewest tubers 12.47 t ha^{-1}. Increased plant height, stem count, leaf count, and leaf area per plant contributed to the greater tuber output by helping to synthesize more photosynthesis, which in turn encouraged more stolons to initiate per hill and bulking. The yield per hectare and plot grows with plant yield. Sarnaik (2001) [14] and Patel *et al*. (2003) [12] demonstrated comparable outcomes in potatoes.

Treatment T_{10} had the greatest tuber dry weight (20.17%) (Table 5). T_2, on the other hand, had the lowest tuber dry weight (16.20%). Treatment T_{10} yielded the maximum yield, 3.43 t ha^{-1}. On the other hand, T_5 yielded 2.12 t ha^{-1}, the lowest yield of tubers ever reported. The dry matter was a genetic characteristic that differs significantly throughout cultivars. The increased tuber dry matter accumulation in different cultivars might be attributed to cell proliferation and elongation in different tissues. Cultivars whose senescence started earlier generated less dry matter in tubers when individual leaves lost their capacity for photosynthesis, according to Sharma *et al*. (1990) [16]. These investigations' results are comparable to those of Elfnesh *et al*. (2011) [7] and Abbas *et al*. (2011) [1].

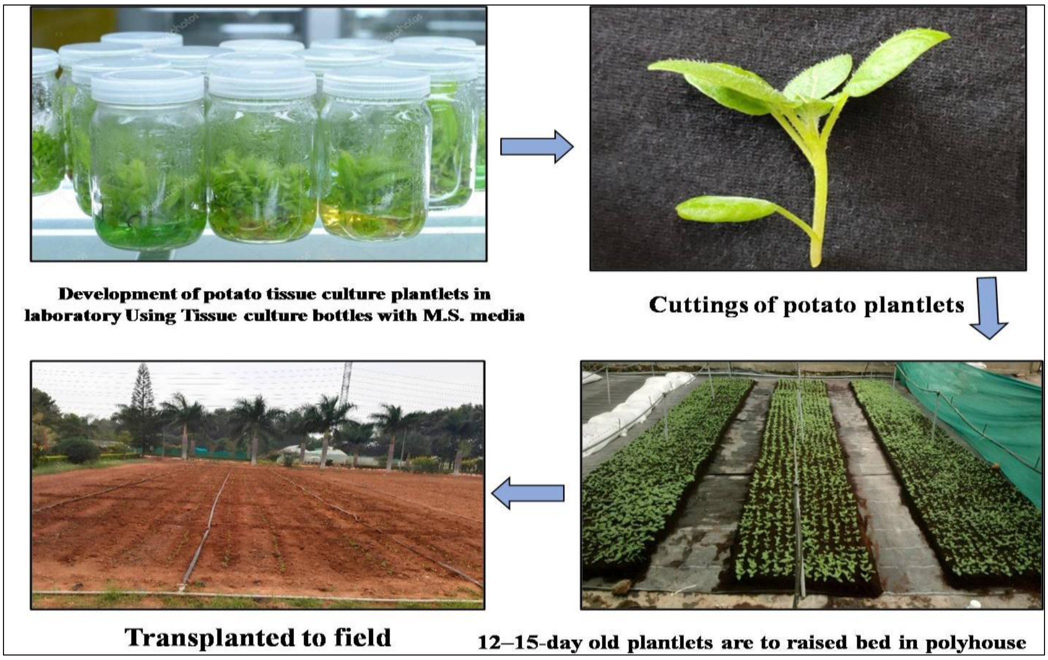

Plate 1: Apical rooted cuttings (ARC) plantlets production of potato

Plate 2: General view of the experimental plot

Table 1: Performance of apical rooted cuttings of potato at different doses of nutrients for survival or germination percentage and plant height (cm)

Treatments	Survival / Germination (%)	Plant height (cm)			
		30 DAP	45 DAP	60 DAP	75 DAP
T_1- 125:100:125 kg ha^{-1}N: P: K + Potato special	94.16	27.01	32.92	46.32	50.48
T_2- 125:100:125 kg ha^{-1} N: P: K	95.83	26.99	31.99	45.59	49.84
T_3- 156: 125: 156 kg ha^{-1} N: P: K+ Potato special	99.16	32.00	39.85	56.92	63.60
T_4- 156: 125: 156 kg ha^{-1} N: P: K	97.50	30.33	35.25	51.08	62.41
T_5- 93.5: 75: 93.5 kg ha^{-1} N: P: K+ Potato special	98.33	26.06	35.06	41.26	49.33
T_6- 93.5: 75: 93.5 kg ha^{-1} N: P: K	96.66	26.56	34.07	41.40	49.95
T_7- 93.5: 100: 125 kg ha^{-1} N: P: K + Potato special	96.66	27.66	34.33	44.50	50.26
T_8-125: 100: 93.5 kg ha^{-1} N: P: K + Potato special	97.50	28.28	34.77	45.32	52.35
T_9- 156: 100: 125 kg ha^{-1} N: P: K + Potato special	95.83	27.66	34.14	50.93	60.66
T_{10}- 125: 100: 156 kg ha^{-1} N: P: K + Potato special	97.50	25.33	34.00	49.84	58.78
Mean	96.91	27.78	34.63	47.31	54.76
S.Em±	1.52	2.49	2.54	1.83	1.49
C.D at 5%	4.52	7.41	7.55	5.45	4.45

DAP- Days After Planting

Table 2: Performance of apical rooted cuttings of potato at different doses of nutrients for number of branches per plant

Treatments	Number of branches per plant			
	30 DAP	45 DAP	60 DAP	75 DAP
T_1- 125:100:125 kg ha^{-1}N: P: K + Potato special	4.20	5.26	5.46	7.73
T_2- 125:100:125 kg ha^{-1} N: P: K	4.40	5.20	5.31	6.86
T_3- 156: 125: 156 kg ha^{-1} N: P: K+ Potato special	4.86	5.33	6.06	7.86
T_4- 156: 125: 156 kg ha^{-1} N: P: K	4.26	5.11	5.60	7.83
T_5- 93.5: 75: 93.5 kg ha^{-1} N: P: K+ Potato special	3.33	4.26	4.80	6.26
T_6- 93.5: 75: 93.5 kg ha^{-1} N: P: K	3.83	3.95	4.46	6.13
T_7- 93.5: 100: 125 kg ha^{-1} N: P: K + Potato special	3.80	4.90	5.26	6.70
T_8-125: 100: 93.5 kg ha^{-1} N: P: K + Potato special	4.33	4.86	5.40	7.26
T_9- 156: 100: 125 kg ha^{-1} N: P: K + Potato special	4.26	4.83	5.43	7.46
T_{10}- 125: 100: 156 kg ha^{-1} N: P: K + Potato special	4.20	4.26	5.06	6.66
Mean	4.15	4.80	5.28	7.08
S.Em±	0.51	0.44	0.36	0.31
C.D at 5%	1.54	1.33	1.06	0.92

DAP- Days After Planting

Table 3: Performance of apical rooted cuttings of potato at different doses of nutrients for plant spread (cm)

Treatments	Plant spread (cm)							
	30 DAP		45 DAP		60 DAP		75 DAP	
	EW	NS	EW	NS	EW	NS	EW	NS
T_1- 125:100:125 kg ha^{-1} N: P: K + Potato special	41.31	42.96	48.06	59.45	67.60	73.44	77.12	82.43
T_2- 125:100:125 kg ha^{-1} N: P: K	38.51	43.58	46.10	57.68	65.19	72.56	77.62	82.28
T_3- 156: 125: 156 kg ha^{-1} N: P: K+ Potato special	44.08	49.06	49.40	61.72	73.90	76.55	82.32	83.84
T_4- 156: 125: 156 kg ha^{-1} N: P: K	40.12	45.04	52.27	57.47	71.86	75.29	71.47	83.68
T_5- 93.5: 75: 93.5 kg ha^{-1} N: P: K+ Potato special	38.78	42.96	50.52	57.66	67.82	75.84	72.12	81.62
T_6- 93.5: 75: 93.5 kg ha^{-1} N: P: K	35.31	40.82	45.39	52.37	57.88	72.16	66.83	79.90
T_7- 93.5: 100: 125 kg ha^{-1} N: P: K + Potato special	40.99	45.65	48.70	57.22	64.68	72.06	74.96	79.25
T_8-125: 100: 93.5 kg ha^{-1} N: P: K + Potato special	40.99	44.90	49.68	59.06	65.92	77.16	70.73	83.15
T_9- 156: 100: 125 kg ha^{-1} N: P: K + Potato special	36.63	40.42	45.79	55.73	66.12	75.78	76.62	84.30
T_{10}- 125: 100: 156 kg ha^{-1} N: P: K + Potato special	38.2	44.81	48.87	55.14	67.84	76.08	80.90	84.59
Mean	39.49	44.02	48.47	57.35	66.88	74.69	75.06	82.50
S.Em±	2.02	2.15	2.42	2.07	3.83	2.30	2.09	1.52
C.D at 5%	6.00	6.41	7.19	6.17	11.40	6.84	6.22	4.52

DAP- Days After Planting

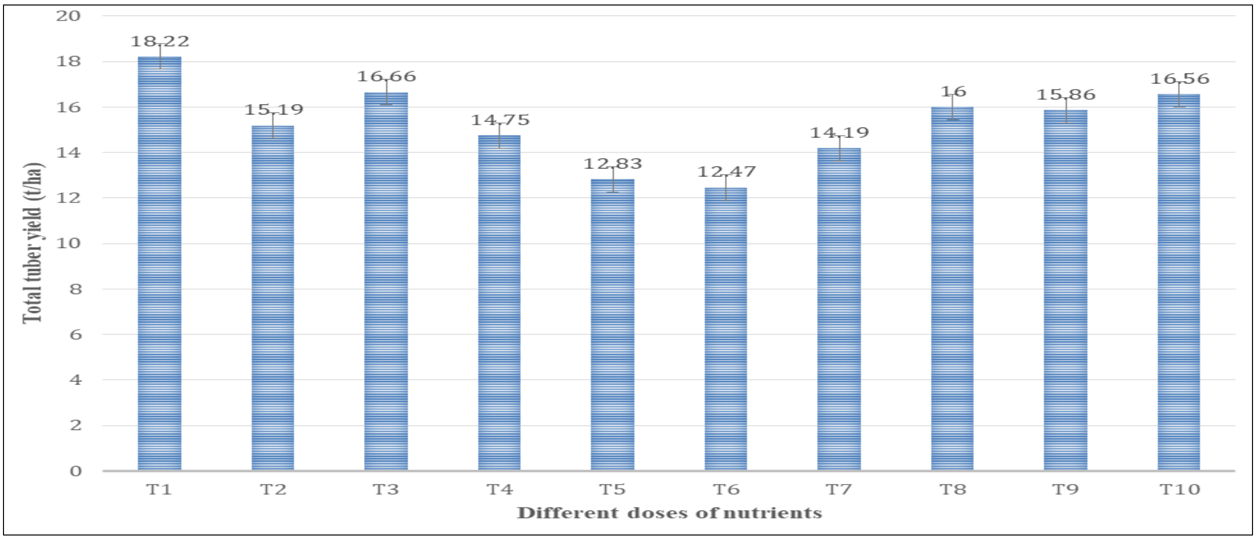

Fig 1: Performance of Apical rooted cuttings with different doses of nutrients on Tuber yield per hectare

Table 4: Performance of apical rooted cuttings of potato at different doses of nutrients for tuber yield

Treatments	Tuber yield per plant (g)	Tuber yield per plot (kg)	Total tuber yield per hectare (t)
T_1- 125:100:125 kg ha^{-1} N: P: K + Potato special	279.76	8.74	18.22
T_2- 125:100:125 kg ha^{-1} N: P: K	272.06	7.29	15.19
T_3- 156: 125: 156 kg ha^{-1} N: P: K+ Potato special	263.76	7.99	16.66
T_4- 156: 125: 156 kg ha^{-1} N: P: K	268.83	7.08	14.75

T_5- 93.5: 75: 93.5 kg ha^{-1} N: P: K+ Potato special	248.90	6.16	12.83
T_6- 93.5: 75: 93.5 kg ha^{-1} N: P: K	230.90	5.98	12.47
T_7- 93.5: 100: 125 kg ha^{-1} N: P: K + Potato special	260.00	6.81	14.19
T_8-125: 100: 93.5 kg ha^{-1} N: P: K + Potato special	267.10	7.68	16.00
T_9- 156: 100: 125 kg ha^{-1} N: P: K + Potato special	271.00	7.61	15.86
T_{10}- 125: 100: 156 kg ha^{-1} N: P: K + Potato special	306.00	7.95	16.56
Mean	266.83	7.32	15.27
S.Em±	5.26	0.53	0.48
C.D at 5%	15.65	1.58	1.43

Table 5: Performance of apical rooted cuttings of potato at different doses of nutrients for tuber dry weight (%) and dry weight of tuber (t ha^{-1})

Treatments	**Tuber dry weight (%)**	**Dry weight of tuber (t ha^{-1})**
T_1- 125:100:125 kg ha^{-1}N: P: K + Potato special	17.16	3.11
T_2- 125:100:125 kg ha^{-1} N: P: K	16.20	2.46
T_3- 156: 125: 156 kg ha^{-1} N: P: K+ Potato special	18.60	3.10
T_4- 156: 125: 156 kg ha^{-1} N: P: K	17.80	2.62
T_5- 93.5: 75: 93.5 kg ha^{-1} N: P: K+ Potato special	16.60	2.12
T_6- 93.5: 75: 93.5 kg ha^{-1} N: P: K	17.40	2.16
T_7- 93.5: 100: 125 kg ha^{-1} N: P: K + Potato special	18.68	2.65
T_8-125: 100: 93.5 kg ha^{-1} N: P: K + Potato special	17.80	2.84
T_9- 156: 100: 125 kg ha^{-1} N: P: K + Potato special	18.76	2.97
T_{10}- 125: 100: 156 kg ha^{-1} N: P: K + Potato special	20.17	3.34
Mean	**17.91**	**2.73**
S.Em±	**0.72**	**0.13**
C.D at 5%	**2.16**	**0.39**

Table 6: Performance of apical rooted cuttings of potato at different doses of nutrients for marketable, un-marketable and total marketable tuber yield (t/ha)

Treatments	**Marketable tuber yield (t ha^{-1})**			**Seed tuber yield (t ha^{-1})**	**Total marketable tuber yield (t ha^{-1})**
	>75 g (A-grade)	**51-75 g (B-grade)**	**26-50 g (C-grade)**	**<25 g (D-grade)**	
T_1- 125:100:125 kg ha^{-1} N: P: K + Potato special	2.44	5.12	4.34	6.28	11.91
T_2- 125:100:125 kg ha^{-1} N: P: K	2.23	3.80	3.26	5.83	9.31
T_3- 156: 125: 156 kg ha^{-1} N: P: K+ Potato special	2.16	4.16	3.38	6.89	9.71
T_4- 156: 125: 156 kg ha^{-1} N: P: K	1.81	3.72	3.15	6.08	8.69
T_5- 93.5: 75: 93.5 kg ha^{-1} N: P: K+ Potato special	1.99	4.02	3.15	3.66	9.17
T_6- 93.5: 75: 93.5 kg ha^{-1} N: P: K	1.66	3.80	3.16	3.81	8.62
T_7- 93.5: 100: 125 kg ha^{-1} N: P: K + Potato special	1.76	3.63	2.79	5.94	8.19
T_8-125: 100: 93.5 kg ha^{-1} N: P: K + Potato special	2.08	4.11	3.33	6.45	9.53
T_9- 156: 100: 125 kg ha^{-1} N: P: K + Potato special	1.90	4.04	3.36	6.61	9.31
T_{10}- 125: 100: 156 kg ha^{-1} N: P: K + Potato special	1.71	3.58	3.07	8.11	8.37
Mean	1.97	3.99	3.29	5.96	9.28
S.Em±	0.62	1.17	0.17	1.02	0.57
C.D at 5%	1.84	3.48	0.51	3.05	1.69

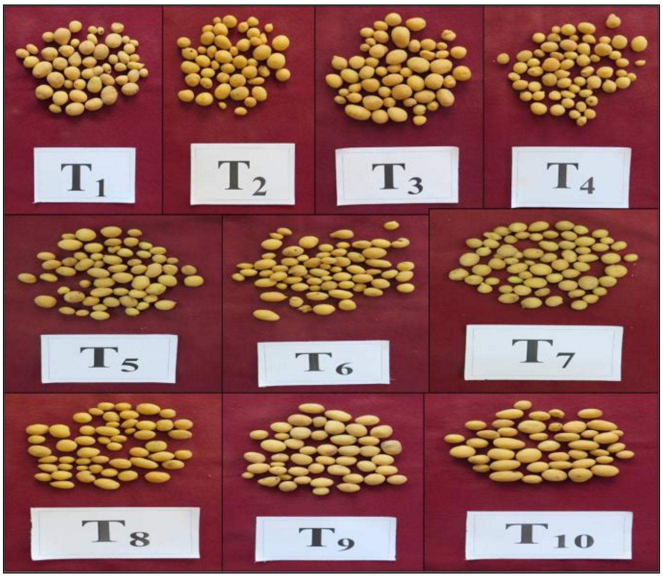

Plate 3: Seed tubers obtained from different treatments

Plate 4: Grades of tubers obtained from different treatments

Conclusion

The present study demonstrated that nutrient management significantly influences the growth, yield, and quality of potato seed tubers produced through apical rooted cuttings (ARCs). Among the treatments, the combined application of higher NPK levels with Potato Special (micronutrient formulation) consistently enhanced vegetative growth, tuber yield, and dry matter accumulation. In particular, T_3 (156:125:156 kg ha^{-1} NPK + Potato Special) excelled in growth parameters, while T_1 (125:100:125 kg ha^{-1} $_{NPK}$ + Potato Special) and T_{10} (125:100:156 kg ha^{-1} NPK + Potato Special) recorded the highest tuber yields and dry matter content. Conversely, lower nutrient levels (T_6) resulted in reduced growth and yield. These findings highlight the potential of integrating optimized macronutrient doses with micronutrient foliar sprays to maximize the efficiency of ARC technology for seed potato production.

References

1. Abbas G, Farooq K, Hafiz IA, Hussain A, Abbasi NA, Shabbir G. Assessment of processing and nutritional quality of potato genotypes in Pakistan. Pak J Agri Sci. 2011;48(3):169–175.
2. Anonymous. Estimates of potato production. New Delhi: Directorate of Economics, Ministry of Agriculture; 2013.
3. Barman KS, Kumar A, Kasera S, Ram B. Integrated nutrient management in potato (*Solanum tuberosum*) cv. Kufri Ashoka. J Pharmacogn Phytochem. 2018;7(1):1936–1938.
4. Bekele D, Abera G, Gobena A. Effects of chemical fertilizer types and rates on tuber yield and quality of potato (*Solanum tuberosum* L.) at Assosa, Western Ethiopia. Afr J Plant Sci. 2020;14(4):155–164.
5. Bhuwneshwari B, Verma SK, Kamal Narayan KN, Paikra MS. Evaluation of processing potato genotypes for growth, yield and yield attributes under Chhattisgarh condition. 2013;8(1):241–245.
6. Biswas S, Dutta D. Effect of integrated nutrient management (INM) on nutrient uptake, yield and quality of potato (*Solanum tuberosum* L.). Int J Chem Stud. 2020;8(1):436–442.
7. Elfnesh F, Tekalign T, Solomon W. Processing quality of improved potato (*Solanum tuberosum* L.) cultivars as influenced by growing environment and blanching. Afr J Food Sci. 2011;5(6):324–332.
8. El-Hadidi E, Ewais M, Shehata A. Fertilization effects on potato yield and quality. J Soil Sci Agric Eng. 2017;8(12):769–778.
9. Fernandez-Lopez J, Botella-Martínez C, de Vera CNR, Sayas-Barberá ME, Viuda-Martos M, Sánchez Zapata E, Perea ÁJA. Vegetable soups and creams: Raw materials, processing, health benefits, and innovation trends. Plants. 2020;9(12):1769.
10. Mirdad ZM. The effect of organic and inorganic fertilizers application on vegetative growth, yield and its components, and chemical composition of two potato (*Solanum tuberosum* L.) cultivars. Alex Sci Exch J. 2010;31:102–120.
11. Mitchell L, Gardner FP, Pearce RB. Physiology of crop plants. Ames, Iowa: The Iowa State University Press; 1985. p. 82–84.
12. Patel NH, Patel RN, Singh SV, Pandey SK, Khurana SM, Kanbi VH. Assessment of processing potato varieties for dry matter, yield and storage behavior at Deesa (Gujarat). J Indian Potato Assoc. 2003;30(1–2):167–168.
13. Sahair R, Sneha S, Raghu N, Gopenath T, Karthikeyan M, Gnanasekaran A, Chandrashekrappa G, Basalingappa K. *Solanum tuberosum* L.: Botanical, phytochemical, pharmacological and nutritional significance. Int J Phytomedicine. 2018;10(3):115–124.
14. Sarnaik DA. Performance of newly released potato varieties in Chhattisgarh. Potato J. 2001;28(1):26–27.
15. Sharma AK, Pandey KK. Potato mini-tuber production through direct transplanting of in vitro plantlets in green or screen houses. Am Potato J. 2013;40(2):95–103.
16. Sharma MD, Thapa RB, Shreshta K, Chaudhary D. Evaluation of potato genotypes for keeping quality under ambient conditions in Nepal. Potato J. 1990;39(2):128–132.
17. Singh SV, Gupta PK, Sharma KP. Genetic divergence in potato (*Solanum tuberosum* L.) grown in twelve environments. J Indian Potato Assoc. 2001;15(2):45–52.
18. Tadesse M, Lommen WJM, Struik PC. Effects of temperature pre-treatment of transplants from in vitro produced potato plantlets on transplant growth and yield in the field. Potato Res. 2001;44(2):173–185.
19. Tripathi DK, Singh S, Singh S, Mishra S, Chauhan DK, Dubey NK. Micronutrients and their diverse role in agricultural crops: Advances and future prospective. Acta Physiol Plant. 2015;37:1–14.
20. Tsoka O, Demo P, Nyende AB, Ngamau K. Potato seed tuber production from in vitro and apical stem cutting under aeroponic system. Afr J Biotechnol. 2012;11(63):12612–12618.