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EVALUATION OF SEED TUBER PERFORMANCE OF POTATO (*SOLANUM TUBEROSUM* L.) VARIETIES PRODUCED USING APICAL ROOTED CUTTINGS UNDER CENTRAL TELANGANA REGION

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ABSTRACT

The present investigation was conducted during Rabi 2024-25 at the Fruit Research Station, Sangareddy, Sri Konda Laxman Telangana Horticultural University. The experiment was laid out in a Randomized Block Design with six varieties, namely Kufri Mohan (T_1), Kufri Chipsona-1 (T_2), Kufri Fryom (T_3), Kufri Sangam (T_4), Kufri Karan (T_5) and Lady Rosetta (T_6). Significant differences were observed among the varieties with respect to growth and yield parameters. Kufri Fryom recorded the highest plant height (54.86 cm), plant spread in the East-West (40.85 cm) and North-South (34.93 cm) directions, number of leaves (53.20), leaf area (32.35 cm²), fresh and dry haulm weight (130.93 g and 24.4 g, respectively), average tuber diameter (37.30 mm) and tuber yield (308.5 g per plant, 6.17 kg per plot and 12.34 t per hectare). Kufri Karan, in contrast, produced the highest number of tubers per plant (10), the maximum seed material sufficient for 150 ha and the highest number of Grade-C (3.00) and Grade-D (5.50) tubers. These results indicate that Kufri Fryom is best suited for achieving higher tuber yield, while Kufri Karan is more suitable for seed material production. Both varieties performed well in terms of growth and yield under open field conditions using apical rooted cuttings in the Central Telangana Region.

Key words : Potato, Apical rooted cuttings, Growth and yield parameters.

Introduction

The potato (*Solanum tuberosum* L.), a highly productive crop of the Solanaceae family, is widely recognized for its starchy edible tubers and is often referred to as the “king of vegetables.” It originated in the Andean region of South America, particularly near Peru and Bolivia (Pandey and Sarkar, 2005). India is currently the world’s second-largest producer of potatoes after China, cultivating the crop on 2.34 million hectares and yielding around 60.22 million metric tons (MT) with an average productivity of 25.74 MT/ha (Anonymous, 2024). Major potato-producing states include Uttar Pradesh, West Bengal, Bihar, Madhya Pradesh and Gujarat. In South India, Karnataka leads in production, followed by Tamil Nadu, Telangana, Andhra Pradesh and Kerala. Telangana alone produces 34,650 MT from 1,390 hectares, with Medak and parts of Ranga Reddy districts being key cultivation areas. Potatoes thrive in temperatures ranging from 15°C to 25°C and can be grown in various soil types such as alluvial, black, red and laterite soils with a pH between 5.2 and 7.0 (Zelelew *et al*., 2016).

Potato tubers primarily consist of water, accounting for approximately 70-82%, while the remaining 17-29% is dry matter. They are a valuable source of carbohydrates (11-23%), proteins (0.8-3%), fats (0.1%), fiber (0.6%) and minerals (1.1%). Additionally, they contain essential amino acids such as isoleucine, leucine, tryptophan and their high vitamin C content aids in enhancing iron absorption (Sukwariya *et al*., 2023). Potatoes are also

rich in B vitamins such as niacin, thiamine, pyridoxine and their related compounds (Yadav *et al*., 2015). In recognition of their global importance, the Food and Agriculture Organization declared 2008 as the International Year of the Potato.

In India, most seed potato production is concentrated in Punjab, where seed plot techniques and aeroponic systems are widely used. These seeds are then transported to distant regions in the east and south, increasing costs and compromising quality. With seed tubers accounting for nearly 50% of total production costs, affordability becomes a major concern, particularly for small and marginal farmers. Furthermore, traditional seed production is challenging in warmer regions due to the high prevalence of diseases. Although, True Potato Seed (TPS) is a cheaper alternative, its use is limited by high labor requirements and sensitivity to adverse weather.

A promising alternative is the use of Apical Rooted Cuttings (ARC), which enables decentralized, cost-effective and disease-free seed production. ARC involves tissue culture-derived plantlets maintained in a juvenile state to produce first-generation tubers (G0), which are then multiplied through subsequent stages (G1 to G3) to produce certified seeds. This approach not only reduces the seed production cycle but also adapts well to the favorable *Rabi* season conditions in Eastern and Southern India. The underlying principle of ARC is that removing the apical bud reduces the concentration of indole-3-acetic acid (IAA), promoting lateral bud growth and enabling faster shoot multiplication (Buckseth *et al*., 2019; Anjani, 2024).

Materials and Methods

The present investigation was conducted during the *Rabi* 2024-25 season at the Fruit Research Station, Sangareddy, SKLTGHU, Telangana, which is located at an altitude of 560.30 meters above mean sea level in a semi-arid tropical climatic zone. The soil at the experimental site is sandy loam in texture. The experiment was laid out in a Randomized Block Design (RBD) with six treatments (varieties): T_1-Kufri Mohan, T_2-Kufri Chipsona-1, T_3-Kufri Fryom, T_4-Kufri Sangam, T_5-Kufri Karan, T_6-Lady Rosetta.

The apical rooted cuttings were procured from Suhas Potato Nursery, Hassan, Karnataka, India. After plot preparation, healthy and uniform 15-day-old cuttings were carefully selected and transplanted into the main field, maintaining a spacing of 50 × 30 cm between each seedling. Inorganic fertilizers were applied at 125 kg N, 100 kg P_2O_5 and 125 kg K_2O per hectare. The first earthing up was performed at 20 days after transplanting (DAT) and the second at 40 DAT. Humic acid was applied twice, at 15 and 30 DAT to enhance root growth and plant immunity. Additionally, copper oxychloride (2-3 g/L) was sprayed every 10 days as a preventive measure against late blight disease. For data collection, five plants were randomly selected from the net plot area of each treatment and replication. The average of the observations recorded from these five plants across four replications was used to represent each variety for a given trait. The biometric data collected during the crop growth period were statistically analyzed following the methods described by Gomez and Gomez (1984).

Results and Discussion

Vegetative Parameters

Plant height (cm)

Significant differences in plant height among the potato varieties under evaluation were observed, as presented in Table 1. Among the varieties, T_3-Kufri Fryom recorded the highest plant height (54.86 cm), whereas T_6-Lady Rosetta exhibited the lowest plant height (30.01 cm). The variation in plant height across the six potato varieties reflects the influence of both genetic and environmental factors. The superior growth observed in T_3-Kufri Fryom may be attributed to its origin from tissue culture-derived mother plants, which are known for their vigorous growth. Furthermore, first-generation apical rooted cuttings performed better than subsequent generations, likely due to their juvenile state and enhanced growth potential. Similar findings were reported by Handayani *et al*. (2023).

Plant Spread (East-West and North-South) (cm)

Significant variation in plant spread among the potato varieties was observed (Table 1). T_3-Kufri Fryom recorded the maximum plant spread in both directions, with values of 40.85 cm in the East-West and 34.93 cm in the North-South direction. In contrast, T_6-Lady Rosetta showed the lowest spread, with 25.72 cm and 23.75 cm in the East-West and North-South directions, respectively. The greater spread in Kufri Fryom may be attributed to a higher number of branches, increased plant stature and more leaves per plant. These factors collectively contribute to enhanced plant vigor and canopy development. Similar observations were made by Amarananjundeswara *et al*. (2025).

Number of compound leaves per plant

The number of compound leaves per plant differed significantly among the treatments (Table 1). T_3-Kufri Fryom recorded the highest number of compound leaves (53.20), while T_6–Lady Rosetta had the lowest (31.50).

Table 1 : Vegetative Parameters of seed potato tubers obtained from apical rooted cuttings in different varieties

Varieties/ Treatments	Plant height (cm)	Plant spread (East-West) (cm)	Plant spread (North-South) (cm)	Number of compound leaves per plant	Leaf area (cm^2)	Mortality rate (%)	Fresh weight of haulm/plant (g)	Dry weight of haulm/plant (g)
T_1	38.89	35.23	28.84	41.60	24.61	10	107.92	19.85
T_2	34.99	32.37	26.58	38.30	25.89	8.75	99.9	16.55
T_3	54.86	40.85	34.93	53.20	32.35	5	130.93	24.4
T_4	45.94	38.24	32.87	47.5	29.54	10	118.1	22.25
T_5	35.96	33	28.32	41.95	28.08	6.25	102.5	17.88
T_6	30.01	25.72	23.75	31.50	18.17	15	89.8	14.4
S.E(m) ±	1.038	0.862	0.779	1.081	0.652	0.697	2.858	0.488
C.D at 5%	3.128	2.597	2.348	3.257	1.967	NS	8.616	1.471

According to Bhuwneshwari *et al*. (2013) and Rajegowda *et al*. (2021), such differences may be attributed to genetic variability among cultivars and their adaptability to prevailing environmental conditions.

Leaf area (cm^2)

The data on leaf area (Table 1) revealed that T_3-Kufri Fryom had a significantly higher leaf area (32.35 cm^2), while T_6-Lady Rosetta recorded the smallest leaf area (18.17 cm^2). Leaf area development plays a crucial role in potato tuber production, as a larger leaf area enhances photosynthetic efficiency, ultimately contributing to greater yields. Fully expanded, mature leaves were found to better support tuberization and promote larger tuber development compared to immature or senescing leaves with smaller areas. Similar results were reported by Ebrahim *et al*. (2018) and Sruthi *et al*. (2021).

Mortality rate (%)

The mortality rate data showed that T_3-Kufri Fryom recorded the lowest mortality rate of 5%, whereas T_6-Lady Rosetta had the highest mortality rate of 15% (Table 1). The lower mortality in Kufri Fryom may be associated with its robust growth and adaptability under field conditions.

Fresh and dry haulm weight per plant (g)

Significant variation in haulm weight was recorded among the treatments (Table 1). T_3-Kufri Fryom had the highest fresh haulm weight (130.93 g) and dry haulm weight (24.4 g), whereas T_6-Lady Rosetta had the lowest fresh (89.77 g) and dry (14.4 g) haulm weights. These differences may be due to variations in genetic makeup, sprouting capacity and photosynthetic efficiency, which influence assimilate accumulation and consequently, shoot biomass. Similar results were reported by Sharma *et al*. (2015).

Yield Parameters

Number of tubers per plant

The treatments exhibited significant variation for this parameter, as shown in Table 2. Among the varieties, T_5-Kufri Karan recorded the highest number of tubers per plant (10), while T_6-Lady Rosetta had the lowest (4.6). The increase in the number of tubers per plant was positively correlated with traits such as greater plant height, a higher number of leaves and increased branching, all of which contributed to higher overall yield. Similar results were reported by Sruthi *et al*. (2021) and Amarananjundeswara *et al*. (2025).

Seed material yield per hectare (Including seed tubers and tuber pieces)

The data on seed material yield presented in Table 2

Table 2 : Yield parameters of seed potato tubers obtained from apical rooted cuttings in different varieties.

Varieties/ Treatments	Number of tubers per plant	Average tuber diameter (mm)	Total available seed material per hectare (Number of Tubers & Tuber Pieces per plant)		Tuber yield per plant (g)	Tuber yield per plot (kg)	Tuber yield per hectare (t/ha)
T_1	7.5	33.75	7.5 (10)	75 ha	263.75	5.28	10.55
T_2	5.7	26.15	5.7 (8)	45.6 ha	194	3.88	7.76
T_3	8	37.30	8 (12)	96 ha	308.45	6.17	12.34
T_4	7	35.34	7 (10)	70 ha	243.5	4.87	9.74
T_5	10	29.15	10 (15)	150 ha	280.05	5.60	11.20
T_6	4.6	24.60	4.6 (6)	27.6 ha	112.20	2.24	4.49
S.E(m) ±	0.177	0.948	-	-	7.214	0.144	0.289
C.D at 5%	0.534	2.857	-	-	21.75	0.435	0.870

revealed significant differences among the varieties. T_6-Lady Rosetta yielded the lowest amount, sufficient to cover only 27.6 hectares, whereas T_5-Kufri Karan produced the highest quantity of seed material, sufficient to cover 150 hectares. This included both mini and micro tubers suitable for direct planting and larger tubers that could be sliced into uniform seed pieces weighing approximately 25 grams. Meanwhile, T_3-Kufri Fryom recorded the highest average tuber weight among the varieties. These findings are in line with those of Amarananjundeswara *et al*. (2025).

Average tuber diameter (mm)

Significant differences in average tuber diameter were observed among the treatments (Table 2). T_3-Kufri Fryom recorded the maximum tuber diameter (37.30 mm), while T_6-Lady Rosetta had the minimum (24.60 mm). Variations in tuber size are influenced by both genetic and environmental factors. Genetically, differences in growth patterns, hormonal activity and inherent traits affect tuber development, whereas environmental factors such as soil quality, climate, water availability and agronomic practices further influence tuber size. Similar observations were reported by Sruthi *et al*. (2021).

Number of Extra, A, B, C, D grade tubers per plant based on weight

The data on tuber grades, as depicted in Table 3, showed that T_5-Kufri Karan produced the highest number of Grade-C and Grade-D tubers per plant, with values of 3 and 5.5, respectively. In contrast, T_6-Lady Rosetta recorded the lowest counts for these grades, with 2 and 2.35 tubers per plant, respectively. For Grade-A and Grade-B tubers, T_1-Kufri Mohan had the highest numbers at 0.75 and 1.95, respectively, whereas T_6-Lady Rosetta recorded the lowest, with 0 Grade-A and 0.3 Grade-B tubers. Regarding extra-class tubers, T_1 (Kufri Mohan) recorded 0.1, T_2 (Kufri Chipsona-1) had 0.25 and T_3 (Kufri Fryom) recorded the highest at 0.3. The variation in tuber grading among the varieties may be attributed to genetic traits and the adaptability of each variety to the environmental conditions of the experimental site. Preetham *et al*. (2018) reported that Kufri Jyothi produced the highest percentage of Grade-A tubers, though all varieties showed a higher proportion of Grade-B tubers compared to Grades A and C.

Tuber yield per plant (g)

Notable variations in tuber yield per plant were recorded among the varieties (Table 2, Plate 1). T_3-Kufri Fryom achieved the highest tuber yield per plant (308.45 g), while T_6-Lady Rosetta recorded the lowest (112.20 g). The increased yield in Kufri Fryom can be attributed to improved vegetative growth, which is reflected in greater plant height, a higher number of stems and more leaves. These factors enhance photosynthate production, promoting greater stolon formation and efficient tuber bulking, ultimately leading to higher yield. Similar findings were reported by Patel *et al*. (2003) and Eaton *et al*. (2017).

Tuber yield per plot (kg)

The yield per plot showed significant differences among the varieties. T_3-Kufri Fryom produced the highest tuber yield per plot at 6.17 kg, whereas T_6-Lady Rosetta recorded the lowest yield at 2.24 kg. These results are consistent with those reported by Patel *et al*. (2003) in potato.

Tuber yield per hectare (t/ha)

Significant differences in tuber yield per hectare were observed among the varieties studied (Table 2). T_3-Kufri Fryom recorded the highest yield of 12.34 t/ha, while T_6-

Plate 1 : Different seed potato tubers obtained from apical rooted cuttings.

Table 3 : Number of Extra, A, B, C and D grade tubers per plant based on weight of different potato varieties.

Number of Extra, A, B, C, D grade tubers per plant based on weight					
Varieties/ Treatments	**Extra class**	**A Grade**	**B Grade**	**C Grade**	**D Grade**
T_1	0.1	0.75	1.95	2.15	2.45
T_2	0.25	0.15	1.1	2.1	2.35
T_3	0.3	0.5	1.6	2.3	2.9
T_4	0	0.5	1.41	2.06	3
T_5	0	0.1	1.2	3	5.5
T_6	0	0	0.3	2	2.35

Note : Above 100: (Extra class), 75-100: (A), 50-75: (B), 25-50: (C), up to 25: (D)

T_1 - Kufri Mohan T_2 - Kufri Chipsona-1 T_3 - Kufri Fryom
T_4 - Kufri Sangam T_5 - Kufri Karan T_6 - Lady Rosetta

Lady Rosetta had the lowest yield at 4.49 t/ha. The yield potential of a crop variety is largely influenced by its genetic makeup, which governs traits such as the number of stolons, plant size and the efficiency of carbohydrate assimilation and translocation to developing tubers (Sruthi *et al*., 2021). According to Gebreselassie *et al*. (2016), genetic structure is a fundamental factor in yield determination, although environmental interactions with the genotype further influence tuber development and overall yield.

Conclusion

Among the varieties evaluated, Kufri Fryom (T_3) emerged as the top-performing variety, exhibiting superior vegetative growth traits along with the highest tuber yield and profitability. In contrast, Kufri Karan (T_5) produced the greatest total number of tubers, including the highest counts of Grade-C and Grade-D tubers and yielded the largest quantity of seed material. This performance was attributed to its balanced production of mini, micro and cuttable tubers (approximately 25 g), making it particularly suitable for seed production purposes. As a result, Kufri Karan was preferred for seed material generation, while Kufri Fryom stood out for achieving the highest tuber yield. Both Kufri Fryom and Kufri Karan apical rooted cuttings (ARCs) performed well under open field conditions in the Central Telangana Region, highlighting their potential for local seed production and improving potato cultivation in the area.

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