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Effect of Foliar Application of Nutrients on Growth, Yield and Quality of Potato (*Solanum tuberosum* L.) under Hill Zone of Karnataka, India

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A B S T R A C T

A field experiment was conducted to know the "Effect of foliar application of nutrients on growth and yield of potato (*Solanum tuberosum* L.)" at department of vegetable science, College of Horticulture, Mudigere during 2017-18. The results revealed that foliar applications of micronutrient mixture @ 5g/lit recorded significantly higher plant height (63.40 cm), number of leaves (189.20), number of stem (5.87), plant spread (52.31 cm), Leaf area index (5.67), fresh weight of leaf (55.07 g), fresh weight of stem (81.69 g), dry weight of leaf (7.93 g), dry weight of stem (14.52 g), dry weight of root (5.76 g), total dry matter production (28.21 g/plant) with respect to growth parameters at 90 days after planting. Yield and quality parameters viz. applications of micronutrient mixture @ 5g/lit recorded significantly maximum yield per plant (249.6 gm), yield per plot (7.49 kg), marketable yield per hectare (18.72 t/ha) and higher quality parameter *viz.* TSS (6.20 ^{o}brix), reducing sugar (1.45%), non-reducing sugar (0.96%) and starch (19.00%)as compared to control.

Introduction

Potato (*Solanum tuberosum* L.) is the world's fourth important food crop after wheat, rice and maize because of its great yield potential and high nutritive value. In Karnataka potato being one of the most important short duration cash crops. The average yield of potato in Karnataka state is much lower (14 t ha-1) as compared to national average. At present, to fulfill the needs of increasing population, one of the possibilities is to increase the area as well as productivity. However, for increasing productivity and quality, nutrition is a key factor in production technology will have to be given emphasis, to produce higher yields of good quality tubers by evolving fertilizer schedules that are suited to specific agro-ecological situations. It is now established that, fertilizer is a kingpin in the process of improving yield and quality of any crop.

The sources of nutrients especially that of major nutrients do have an effect on plant growth, yield and quality of the crop. In view of these facts, the study was under taken to know the effect of foliar application of nutrients on yield and quality of potato.

Materials and Methods

The soil of the experimental area was sandy loam having good physical and chemical properties and pH of the soil was 6.2. This experiment was undertaken to find out the best nutrient formulation to obtain good growth, yield and yield attributes in potato. The design followed was RCBD (Randomized Complete Block Design) with 12 treatments replicated thrice in plots of 2m x1.8 m size with 60 x 20 cm spacing during Kharif 2017. The treatments included under the study were, T_1 (control)- RDF (FYM 25 t/ha + N:P:K at 100:75:100 kg/ha), T_2 - T_1 + Calcium nitrate 0.3%, T_3 - T_1+ Calcium nitrate 0.5%, T_4 - T_1+ Magnesium sulphate 0.3%, T_5 - T_1+ Magnesium sulphate 0.5%, T_6 -T_1+ Zinc sulphate 0.3%, T_7 - T_1+ Zinc sulphate 0.5%, T_8 - T_1+ Potassium schoenite 0.3%, T_9- T_1+Potassium schoenite 0.5%, T_{10}-T_1 + Boron 0.1%, T_{11}-T_1 + Boron 0.2%, T_{12} - T_1+Micronutrient mixture 0.5% (Fe, Cu, Mo, Mn, B, Zn). Nutrient formulation was applied 15 and30 days after flowering. The observations on growth parameters were recorded at 90 days after planting.

Results and Discussion

Growth parameters

The results revealed that foliar application of Micronutrient mixture 0.5% (T_{12}) has shown the maximum plant height (63.40 cm), number of leaves (189.20), number of stem(5.87), plant spread (52.31 cm), Leaf area index (5.67), fresh weight of leaf (55.07 g), fresh weight of stem (81.69 g), dry weight of leaf (7.93 g), dry weight of stem (14.52 g), dry weight of root (5.76 g), total dry matter production (28.21 g/plant) as compared to control (Table 2). The enhancement in growth parameters was due to the effective role of micronutrients in controlling various enzymes activities, photosynthetic pigments formation, cell division and producing certain biochemical growth promoting substances like auxins, cytokinins and gibberellin which consequently affecting plant growth. The findings are in line with Dod *et al.*, (1989) in capsicum, Deka and Shadeque (1991) in French bean, Thakare *et al.*, (2007) and Kumar *et al.*, (2008) in potato and Sathya *et al.*, (2010) in tomato.

Table.1 Effect of foliar application of nutrients on yield and quality parameters of potato

Treatments	Yield per plant (g)	Yield per plot (kg)	Marketable yield per hectare (t)	TSS (°brix)	Reducing sugar (%)	Non reducing sugar (%)	Starch (%)
T1	157.45	4.72	10.96	5.25	1.03	0.57	13.16
T2	163.72	4.91	11.53	5.40	1.04	0.62	13.65
T3	169.22	5.08	11.99	5.53	1.05	0.62	14.03
T4	199.84	6.00	14.49	5.96	1.30	0.66	17.13
T5	207.3	6.22	15.12	5.96	1.34	0.66	17.99
T6	191.84	5.76	13.85	5.83	1.23	0.59	16.11
T7	193.27	5.80	13.91	5.95	1.26	0.59	16.61
T8	217.18	6.52	15.93	6.10	1.35	0.95	18.00
T9	228.94	6.87	16.88	6.16	1.40	0.95	18.40
T10	188.01	5.64	13.51	5.59	1.17	0.52	14.50
T11	189.63	5.69	13.53	5.67	1.20	0.57	15.24
T12	249.6	7.49	18.72	6.20	1.45	0.96	19.00
S.Em±	8.06	0.24	0.30	0.09	0.04	0.05	0.03
CD @5%	23.64	0.71	0.90	0.27	0.13	0.14	0.09

Table.2 Effect of foliar application of nutrients on growth parameters of potato

Treatments	Plant height (cm)	Number of leaves per plant	Number of stems	Plant spread (cm)	Leaf area index	Fresh weight of leaf (g)	Fresh weight of stem (g)	Dry weight of leaf (g)	Dry weight of stem (g)	Dry weight of roots (g)	Total dry matter (g plant^{-1})
T1	55.53	140.07	3.67	38.12	3.70	36.19	67.42	6.32	11.65	4.52	22.49
T2	57.13	142.30	4.07	39.36	3.97	38.57	68.12	6.66	12.04	4.60	23.30
T3	57.60	145.32	4.25	40.72	4.21	39.50	68.28	6.80	12.19	4.65	23.64
T4	59.43	165.41	5.47	45.22	5.41	45.67	74.20	7.27	12.71	5.08	25.06
T5	59.73	168.80	5.53	48.92	5.48	45.94	75.04	7.28	13.14	5.30	25.72
T6	58.30	159.40	4.80	42.83	4.95	43.73	72.42	7.12	12.38	4.84	24.34
T7	58.98	161.40	5.07	43.67	5.26	45.23	73.68	7.26	12.43	4.92	24.61
T8	61.41	174.47	5.73	49.02	5.53	46.25	75.35	7.31	13.20	5.34	25.85
T9	62.00	179.67	5.80	51.05	5.65	51.07	77.75	7.79	13.41	5.47	26.67
T10	57.86	148.73	4.27	41.58	4.53	42.67	70.47	7.00	12.26	4.73	23.99
T11	58.10	151.60	4.67	42.46	4.76	43.00	70.50	7.10	12.30	4.81	24.21
T12	63.40	189.20	5.87	52.31	5.67	55.07	81.69	7.93	14.52	5.76	28.21
S.Em±	0.22	0.24	0.17	0.07	0.02	1.47	1.07	0.05	0.45	0.06	0.47
CD @5%	0.65	0.70	0.50	0.21	0.06	4.30	3.14	0.14	1.31	0.17	1.38

Yield and quality parameters

The results revealed that foliar application of Micronutrient mixture 0.5% (T_{12}) has shown the maximum yield per plant (249.6 gm), yield per plot (7.49 kg), marketable yield per hectare (18.72 t/ha) and higher quality parameter *viz.* TSS (6.20 ºbrix), reducing sugar (1.45%), non-reducing sugar (0.96%) and starch (19.00%) as compared to control (Table 1). Increase in yield and yield attributes due to micronutrients application may be attributed to enhanced photosynthetic activity and increased production and accumulation of photosynthates, carbohydrates and favorable effect on vegetative growth which increased tubers yield per plant. This may be due to increase in the amount of chlorophyll in leaves and photosynthetic area which in turn leads to enhanced photosynthetic rate and ultimately accumulation of nutrients in tuber which improves protein, sugars and starch content of tubers Baghet and Sarnaik (1988). Similarly, many scientists reported that application of micronutrients significantly increased protein and starch content in potato tuber (Kazemi, 2013; Mousavi *et al.,* 2007; Noaema and Sawicka, 2017; Bhatt and Srivastava, 2006; Kirynkhin and Bezzubtseva, 1980; Parmar *et al.,* 2016).

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