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Response of sweet potato to different levels of fertilizers and Novel

SB Shah, KD Desai and AK Pandey

Abstract
A field experiment was laid out at AICRP on Tuber Crops, Regional Horticultural Research Station (RHRS), Navsari Agricultural University, Navsari on sweet potato cv. Bhukanti during *Rabi*, 2017-18. The experiment was arranged over 12 treatment combinations comprising, 3 levels of RDF (F_1: 100% RDF, F_2: 80% RDF and F_3: 60% RDF) and 4 levels of spraying 2% Novel (S_1: No spray, S_2: spraying 2% Novel at 30 and 45 DAP, S_3: Spraying 2% Novel at 30, 45 and 60 DAP and S_4: spraying 2% Novel at 30, 45, 60 and 75 DAP) which was laid out in a randomized block design (with factorial concept) and replicated thrice. Application of 100% RDF (F_1) recorded higher average tuber weight of 186.87 g with minimum number of tuberous roots (3.03) and statistically remained at par with F_2 treatment. Other yield parameters did not show significant effect due to different levels of fertilizers. Maximum tuber yield (0.513 kg vine^{-1}) and average tuber weight (189.69 g) was obtained in S_4 treatment (spraying 2% Novel at 30, 45, 60 and 75 DAP) and statistically remained at par with S_3 treatment. Significantly higher total tuber yield (5.872 kg net plot^{-1} and 30.58 t ha^{-1}), marketable tuber yield (4.867 kg net plot^{-1} and 25.35 t ha^{-1}), and harvest index (46.14%) with lower number of tuberous roots (2.92) was recorded in the S_4 treatment. F_1 and S_4 treatments recorded higher total sugars content of 2.62 per cent and 2.64 per cent, respectively.

Keywords: Sweet potato, fertilizers, Novel

Introduction
Tuber crops are the most important food crops after cereals and grain legumes. The main feature of tuber crops is that they produce more yield per unit area in less time. They are tolerant to drought and can be grown even on undulated and unfertile soil. Among different tuber crops, sweet potato [*Ipomoea batatas* (L.) Lam.] is an important tuber crop belongs to family Convolvulaceae. It is herbaceous perennial but cultivated as annual. It is vegetatively propagated from vine cuttings taken from freshly harvested vines from secondary nursery or from the previous crop (Selvakumar, 2014) [9]. Its origin is South America. It is also known as Irish potato or white potato. It is also an important leafy vegetable crop in Asia, China, Australia and Africa. It is the cheapest source of calories and a chief source of starch.

It was widely perceived that inorganic fertilizers were one of the most important inputs of increasing the productivity of crops (Anon., 1997) [1]. However, it has been repeatedly confirmed that continuous, sole and imbalanced use of chemical fertilizers deteriorates soil health and ecological balance, which leads to decrease nutrient uptake efficiency (Saravaiya *et al*., 2010) [8]. Soils that receive plant nutrients only through chemical fertilizers are showing decline in productivity and deficiency in secondary and micronutrients. On the other hand, the organic matter content of most of the soils is very low which have made it necessary to rethink alternatives.

Previous world research work on sweet potato showed that this crop response good to application of biofertilizers. 'Novel' (patented) is enriched sap obtained from banana pseudostem, which is a unique product of Navsari Agricultural University. Though, research work of Novel application is very less as it was developed and patented in 2012. Very few research projects have been carried out on different cereals, fruits and vegetables in our institute. However, there is a wide information gap on the efficacy of enriched banana pseudostem sap (Novel) as an organic liquid nutrient in India and abroad.

Materials and methods
A field experiment was laid out at AICRP on Tuber Crops, Regional Horticultural Research Station, ASPEE College of Horticulture and Forestry, Navsari Agricultural University, Navsari

on sweet potato cv. Bhukanti during *Rabi* 2017.

The experiment comprised of three levels of fertilizers [F_1: 100% RDF (NPK 75:50:75 kg/ha + FYM 15 t/ha), F_2: 80% RDF (NPK 60:40:60 kg/ha + FYM 12 t/ha) and F_3: 60% RDF (NPK 45:30:45 kg/ha + FYM 9 t/ha)] and four levels of spraying 2% Novel organic liquid nutrient (Novel)[S_1: No spray, S_2: spraying at 30 and 45 DAP, S_3: Spraying at 30, 45 and 60 DAP and S_4: spraying at 30, 45, 60 and 75 DAP]. Full dose of FYM was applied and thoroughly mixed in soil while preparing land. 50% Nitrogen and potash with full dose of phosphorous was applied at the time of land preparation. Remaining half quantity of nitrogen and potash was applied in two equal splits at 30 and 60 DAP. Quantity of solution of Novel was calculated as per the growth of sweet potato vine and was sprayed according to the treatment. Cuttings were planted on 16th November, 2017 and required intercultural operations were carried out time to time. Planting was done at a distance of 60 cm × 20 cm in the plots having 2.4 m width and 2.4 m length. The tuberous roots after harvest were bought to the laboratory for bio-chemical analysis. In which the starch, total sugar, dry matter and moisture content of tuberous roots was analyzed with the procedure given by Rangana (1979) [7].

Result and Discussion

The effect of levels of fertilizers on yield and yield attributes revealed that application of 100% RDF exerted significant influence on number of tuberous roots per vine and average tuber weight. Maximum average tuber weight of 186.87 g and lowest number of tuberous roots (3.03 vine^{-1}) were recorded with the application of 100% RDF. Application of 60% RDF resulted in maximum number of tuberous roots (3.47 vine^{-1}). That may be resulted in lower values of average tuber weight (164.29 g). According to Dumbuya *et al.* (2017) [4] number of tuberous roots was increased with decreasing levels of potassium fertilizers but that resulted in more number of unmarketable tubers per vine. Other yield and yield attributes were found to be non-significant, irrespective of different levels of fertilizers. However, application of 100% RDF recorded maximum tuber yield (0.483 kg vine^{-1}), tuber length (20.19 cm) and girth (16.46 cm), total tuber yield (5.273 kg net plot^{-1} and 27.47 t ha^{-1}), marketable tuber yield (4.330 kg net plot^{-1} and 22.55 t ha^{-1}) and harvest index (44.85). It may be due to optimum dose of fertilizers facilitates more production of photosynthetic assimilates and accumulation of them in sink *i.e.* tuberous roots resulting in higher yield and yield attributing parameters.

Application of four sprays of 2% Novel at 30, 45, 60 and 75 DAP (S_4) resulted in significantly higher yield and yield attributes *viz.*, tuber yield (0.514 kg vine^{-1}), average tuber weight (189.69 g), total tuber yield (5.872 kg net plot^{-1} and 30.58 t ha^{-1}), marketable tuber yield (4.867 kg net plot^{-1} and 25.35 t ha^{-1}) and harvest index (46.14%). However, treatment S4 negatively influenced the number of tuberous roots (2.92) per vine. Tuber length and tuber girth were found to be non-significant but showed increasing trends with increasing levels of 2% Novel and recorded maximum tuber length (20.21 cm) and girth (16.39 cm) with maximum number of sprays. Higher tuber length, tuber girth and average tuber weight might be due to the reason that produced assimilates to be distributed in less number of tubers, resulted in maximum size of tubers ultimately leads to higher yield. Kalariya *et al.*, (2018) [5] described this might be due to involvement of Novel which contained fair amount of macro and micro nutrients as well as growth promoting substances which induced better vine growth. The other bio-parameters which could have helped in the increase of yield were synthesis of carbohydrates and their translocation to the potential storage organs through better growth.

In this study, damage of tubers by sweet potato weevil was found non-significant but tubers obtained from the plots received 100% RDF with four sprays of 2% Novel (F_1S_4) were intact (zero per cent damage). This might be credited to stout stem due to higher amount of P_2O_5 and K_2O received, which did not allow weevil to penetrate beneath the soil.

Application of different levels of fertilizers showed non-significant impact on quality parameters *viz.*, starch content, β carotene content, dry matter and moisture content of tubers except total sugars content. However, application of 100% RDF recorded higher amount of starch (15.46%), β carotene (7.12 mg 100g^{-1}), dry matter (27.71%) and significantly higher total sugars (2.62%) with minimum moisture content (72.47%) of tubers. Effect of spraying levels of 2% Novel on quality parameters was also found non-significant except total sugars. Though, maximum starch (15.52%), β carotene (7.20 mg 100g^{-1}), dry matter (27.71%) and significantly higher total sugars (2.64%) with minimum moisture content (72.29%) of tubers was obtained with the treatment which received four sprays of 2% Novel. Anonymous (2014) [3] had obtained same kind of results in onion. The results obtained in the present investigation are also supported by the findings of Anonymous (2012) [2] and Patel *et al.* (2017) [6] in mango. The increased in total sugars may attributed to adequate supply of macro and micro nutrients with four sprays of 2% Novel that might synthesize and accumulate total sugars in tubers.

Table 1: Effect of fertilizer levels and spraying 2.0% Novel on yield and yield parameters of sweet potato

Treatments	Number of tubers per vine	Tuber girth (cm)	Tuber length (cm)	Tuber yield (kg vine^{-1})	Average tuber weight (g)	Tuber yield (kg net plot^{-1})		Tuber yield (t ha^{-1})		Harvest index (%)	SPW damage (%)
						Total	Marketable	Total	Marketable		
F_1	3.03	16.46	20.19	0.483	186.87	5.273	4.330	27.47	22.55	44.85	2.41
F_2	3.43	16.33	19.93	0.448	175.95	5.177	3.982	26.96	20.74	43.20	3.12
F_3	3.47	16.14	19.22	0.438	164.29	5.134	4.163	26.74	21.68	41.40	2.80
S.Em.±	0.12	0.32	0.51	0.019	4.96	0.194	0.211	1.01	1.10	1.26	0.53
CD 5%	0.35	NS	NS	NS	14.56	NS	NS	NS	NS	NS	NS
S_1	3.53	16.19	19.57	0.427	164.63	4.733	3.900	24.65	20.31	39.93	4.00
S_2	3.40	16.32	19.61	0.440	172.59	5.008	3.887	26.08	20.24	41.71	2.64
S_3	3.39	16.34	19.73	0.443	175.90	5.166	3.979	26.90	20.72	44.82	2.89
S_4	2.92	16.39	20.21	0.514	189.69	5.872	4.867	30.58	25.35	46.14	1.57
S.Em.±	0.14	0.37	0.59	0.021	5.73	0.224	0.244	1.17	1.27	1.46	0.61
CD 5%	0.40	NS	NS	0.063	16.81	0.657	0.715	3.42	3.72	4.27	NS
F×S	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

S.Em.±	0.24	0.63	1.02	0.037	9.93	0.388	0.422	2.02	2.20	2.52	1.06
CD 5%	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
CV%	12.36	6.72	8.95	14.02	9.79	12.93	17.58	12.93	17.58	10.12	66.44

Table 2: Effect of fertilizer levels and spraying 2.0% Novel on quality parameters of tuber

Treatments	Starch (%)	Total sugars (%)	β carotene (mg 100g^{-1})	Dry matter (%)	Moisture (%)
F_1	15.46	2.62	7.12	27.53	72.47
F_2	15.10	2.58	7.08	26.29	73.71
F_3	15.16	2.52	7.07	26.70	73.30
S.Em.±	0.12	0.03	0.07	0.50	0.50
CD 5%	NS	0.08	NS	NS	NS
S_1	14.96	2.50	7.09	27.08	72.92
S_2	15.14	2.58	7.10	26.62	73.38
S_3	15.33	2.57	6.97	25.96	74.04
S_4	15.52	2.64	7.20	27.71	72.29
S.Em.±	0.14	0.03	0.08	0.58	0.58
CD 5%	NS	0.09	NS	NS	NS
F×S	NS	NS	NS	NS	NS
S.Em.±	0.25	0.05	0.14	1.00	0.58
CD 5%	NS	NS	NS	NS	NS
CV%	2.80	3.61	3.36	6.45	2.36

Conclusion

Application of 100% RDF along with four sprays (at 30, 45, 60 and 75 DAP) of 2% Novel largely improves yield and quality of sweet potato. It can be concluded from the present investigation that the combined use of inorganic fertilizers ad Novel is efficient than application of inorganic fertilizers alone in improving yield and quality in sweet potato cultivation.

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