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Effect of integrated nutrient management on quality of potato (*Solanum tuberosum* L.) cv. Kufri Chandramukhi under Southern Telangana Agroclimatic region

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Abstract
The present investigation entitled "Effect of Integrated Nutrient Management on quality of potato (*Solanum tuberosum* L.) cv. Kufri Chandramukhi under Southern Telangana Agroclimatic region" was carried out during *Rabi* season of 2021-22 at College of Horticulture, Sri Konda Laxman Telangana state horticultural university, Rajendranagar, Hyderabad. The experiment was laid out in Randomized Block Design (RBD) with nine treatments and three replications. Treatments consisted of T_1: Control (100% RDF), T_2: 50% RDF + Vermicompost (3 t ha^{-1}), T_3: 50% RDF + Biofertilizer (*Azotobacter* - 6.25 kg ha^{-1}), T_4: 50% RDF + Green leaf manure (3.75 t ha^{-1}), T_5: 50% RDF + Vermicompost (1.5 t ha^{-1}) + Biofertilizer (*Azotobacter*-3.125 kg ha^{-1}), T_6: 50% RDF + Vermicompost (1.5 t ha^{-1}) + Green leaf manure (1.875 t ha^{-1}), T_7: 50% RDF + Biofertilizer (*Azotobacter*-3.125 kg ha^{-1}) + Green leaf manure (1.875 t ha^{-1}), T_8: 25% RDF + Vermicompost (1.5 t ha^{-1}) + Biofertlizer (*Azotobacter*-3.125 kg ha^{-1}) + Green leaf manure (1.875 t ha^{-1}), T_9: 100% Organic Manures FYM (7.5 t ha^{-1}), Vermicompost (1.5 t ha^{-1}), Biofertilizer (*Azotobacter*-3.125 kg ha^{-1}), Green leaf manure (1.875 t ha^{-1}). Different integrated nutrient management treatments have a significant influence on the quality paramaters of potato. Highest starch content (23.19%), ascorbic acid (14.11 mg 100g fresh $weight^{-1}$), total sugars (0.57%) and reducing sugars (0.49%) was recorded when 50% of recommended dose of fertilizer (RDF) was applied in combination with vermicompost @ 1.5 t ha^{-1} and Biofertilizer @ *Azotobacter*-3.125 kg ha^{-1}. TSS found to be non-significant.

Keywords: Potato, Telangana, quality, Kufri Chandramukhi, integrated nutrient management

Introduction
Potato (*Solanum tuberosum* L.) is an autotetraploid (2n = 4x = 48) with a basic chromosome number 12. It is native to Peruvian-Bolivian Andes (South America) and is a member of the Solanaceae (nightshade family). Potato was introduced by Portuguese in India (17^{th} century). In the volume of world crops production, potato ranks fifth following sugarcane, maize, rice and wheat (FAOSTAT data 2014) [3].
The crop is grown on 2.22 million hectares of area and produced 53.6 million MT in 2020-2021 (NHB Database, 2020-2021) [8] making India as the world's second-largest producer of potatoes, behind China. However, India's potato productivity (183.3 q/ha) is quite low compared to other countries. The main potato - producing states in India are in North *i.e.*, Punjab, Haryana, Uttar Pradesh, Bihar, West Bengal, Gujarat and Madhya Pradesh. In South India, Potato cultivation is seen in very few parts like Nilgiri hills, Bangalore. In Telangana, potato is cultivated around Ranga Reddy and Medak districts in an area of 1100 hectares.
The potato is a nourishing food that is rich in nutrients and is simple to digest. It contains about 20.6% carbohydrates, 2.1% protein, 0.3% fat, 1.1% crude fibre and 0.9% ash. It also contains a good amount of essential amino acids like leucine, tryptophane and isolucine (Khurana and Naik, 2003) [5].
Many factors influence potato tuber production, among them nutrient management is one of the important factors that affect the tuber yield. Inorganic fertilizers are the direct source of nutrients. But, high doses of chemical fertilizers are consistently applied without the use of organic manures or bio fertilizers, which results in decreased soil microbial activity, decreased soil humus and increased soil, water, air pollution. Organic sources on the other hand are also a source of primary, secondary and micronutrients for the growth of plant (Roy and Singh, 2014) [11] and are a constant supply of energy for heterotrophic microorganisms that help to

increase the availability of nutrients and the quality and quantity of agricultural output. As no one source can provide the necessary amount of plant nutrients, integrated usage of all sources is necessary to provide the crop with a balanced diet (Dash *et al*. 2010) [2].

Material and Methods

A field experiment was laid at PG Research block, Department of Vegetable Science, College of Horticulture, Sri konda laxman Telangana state horticultural university, Rajendranagar, Hyderabad during *Rabi*, 2021-2022. The experimental site is situated at a latitude of 17º.32' North, longitude of 78º.40' East and altitude of 542.3 m above mean sea level. The soil is sandy loam in texture. The experiment was laid out in Randomized Block Design (RBD) with nine treatments and three replications. The site was levelled and divided into plots of 2m x 2m size. The path of 0.5m size was provided between each bed. Healthy, uniform sized tubers were planted at spacing of 50x30 cm during November, 2021. The seed tubers are treated to protect them from attack of fungal diseases when planted in the field and to get higher sprouting percentage. So, before planting, the seed tubers were dipped in the solution of (Mancozeb 50 % + Carbendazim 25 %) @ 3g l^{-1} of water for 30 minutes and then they were dried under shade. Inorganic fertilizers at the rate of 120 kg ha^{-1} N, 80 kg ha^{-1} P_2O_5 and 100 kg ha^{-1} K_2O were applied. Out of these nutrient doses 1/2 (half) of nitrogen and full dose of P_2O_5 and 2/3rd of K_2O were broadcasted as basal application and uniformly incorporated into the soil. The rest of nitrogen was given in two equal splits, one as first top dressing at 21 DAP and the remaining 1/4th of N along with remaining 1/3rd K_2O were applied as second top dressing at 42 DAP. The fertilizers were applied in the form of Urea, Single Super Phosphate (SSP), Murate of Potash (MOP). FYM, Vermicompost, Green leaf manure and Biofertilizer (*Azotobacter*) was applied before planting as per the treatment. The data were analysed statistically by following the analysis of variance (ANOVA) technique as asserted by Panse and Sukhatme (1985) [9].

Application of Biofertilizer

Azotobacter was taken in a container and mixed with FYM and water and are covered with a moist gunny bag cloth. It was maintained wet by regularly moistening the cloth so as to enhance the multiplication of the bacteria and increase in number. After one week, these are incorporated in to the main field as per the treatments.

Results and Discussion

Quality parameters

Starch content (%)

The data regarding starch content after harvest as influenced by the integrated nutrient management are presented in the table 1.

Significantly, T_5 50% RDF + Vermicompost (1.5 t ha^{-1}) + Biofertilizer (*Azotobacter*-3.125 kg ha^{-1}) recorded highest starch content (23.19%) which was statistically at par with T_2 50% RDF + vermicompost (3 t ha^{-1}) (22.31%) and T_3 50% RDF + Biofertilizer (*Azotobacter* - 6.25 kg ha^{-1}) recorded lowest starch content (16.02%). Highest starch content as a result of using organic manures, chemical fertilizers and biofertilizers together which improves nutrient absorption. Increase in starch content because of there is a greater supply of potassium and minerals. Starch is carried from leaves to tubers by the enzyme starch synthetase, which is activated in partly by potassium. The present results are in close conformity with the findings of Congera *et al.* (2021) [1] and Patel *et al*. (2022) [10] in potato.

Ascorbic acid (mg 100g fresh weight^{-1})

The data pertaining to ascorbic acid after harvest as influenced by the integrated nutrient management are presented in the table 1.

Significantly, T_5 50% RDF + Vermicompost (1.5 t ha^{-1}) + Biofertilizer (*Azotobacter*-3.125 kg ha^{-1}) recorded highest ascorbic acid content (14.11 mg 100g fresh weight^{-1}) which was statistically at par with T_2 50% RDF + Vermicompost (3 t ha^{-1}) (13.54 mg 100g fresh weight^{-1}) and the T_3 50% RDF + Biofertilizer (*Azotobacter* - 6.25 kg ha^{-1}) recorded lowest ascorbic acid content (11.26 mg 100g fresh weight^{-1}). The highest ascorbic acid content resulted from increased carbohydrate synthesis which boosts the production of vitamin C. The present findings were in accordance with those of Jayathilake *et al.* (2003) [4] in onion, Meena *et al.* (2014) [6] in tomato and Mishra *et al*. (2014) [7] in knol-khol.

TSS (ºBrix)

The data pertaining to ascorbic acid after harvest as influenced by the integrated nutrient management are presented in the table 1.

The findings of this study showed that the use of various integrated nutrient management treatments had no significant effect on total soluble solids (TSS).

Total sugars (%)

The data pertaining to total sugars (%) after harvest as influenced by the integrated nutrient management are presented in the table 1.

According to the results of the present study, the use of various integrated nutrient management treatments had a significant impact on total sugars. Significantly, T_5 50% RDF + Vermicompost (1.5 t ha^{-1}) + Biofertilizer (*Azotobacter*-3.125 kg ha^{-1}) recorded maximum total sugars (0.57%) which was statistically at par with T_2 50% RDF + Vermicompost (3 t ha^{-1}) (0.56%) and T_3 50% RDF + Biofertilizer (*Azotobacter*-6.25 kg ha^{-1}) recorded minimum total sugars (0.49%). The reason for the more total sugar was improved nutrient availability and sugar synthesis when plants received chemical fertilizers, organic manures and biofertilizers all at once. The present results are in close conformity with the findings of Jayathilake *et al.* (2013) [4] in onion and Congera *et al.* (2021) [1] in potato.

Reducing sugars (%)

The data regarding reducing sugars (%) at after harvest as influenced by the integrated nutrient management are presented in the table 1.

The results of the present study showed that the use of various integrated nutrient management treatments had a significant effect on reducing sugars. Treatment T_5 50% RDF + Vermicompost (1.5 t ha^{-1}) + Biofertilizer (*Azotobacter*-3.125 kg ha^{-1}) recorded the maximum reducing sugars (0.49%) which was statistically at par with the T_2 50% RDF + Vermicompost (3 t ha^{-1}) (0.46%) and T_7 50% RDF + Green leaf manure (1.875 t ha^{-1}) + Biofertilizer (*Azotobacter*-3.125 kg ha^{-1}) (0.46%) and minimum reducing sugars (0.39%) were found in the T_3 50% RDF + Biofertilizer (*Azotobacter*-6.25 kg ha^{-1}). The increased supply of nitrogen needed for the tuber growth and development may have resulted in increasing in reducing sugars which boosted sugar buildup following starch synthesis. Under the combined application of inorganic, organic and bio-fertilizer, the sugar content is high which undoubtedly represents the higher nutritional availability to the plant. Similar results have been reported by Congera *et al.* (2021) [1] in potato.

Table 1: Effect of integrated nutrient management on starch content, ascorbic acid, TSS, total sugars and reducing sugars of potato.

Treatments	Starch Content (%)	Ascorbic Acid (mg 100 g fresh weight^{-1})	TSS (ºBrix)	Total Sugars (%)	Reducing Sugars (%)
T_1	18.26	12.78	3.23	0.52	0.44
T_2	22.31	13.54	3.39	0.56	0.46
T_3	16.02	11.26	3.06	0.49	0.39
T_4	16.93	11.55	3.07	0.50	0.41
T_5	23.19	14.11	3.68	0.57	0.49
T_6	17.54	11.78	3.12	0.51	0.42
T_7	22.05	13.34	3.38	0.53	0.46
T_8	21.57	13.27	3.34	0.53	0.43
T_9	17.94	12.63	3.18	0.52	0.44
SEm (±)	0.34	0.20	0.12	0.007	0.01
CD at 5%	1.02	0.62	NS	0.02	0.04

Conclusion

Based on the study, it was concluded that, different integrated nutrient management treatments have a significant influence on the quality of potato and 50% RDF + Vermicompost (1.5 t ha^{-1}) + Biofertilizer (*Azotobacter*-3.125 kg ha^{-1}) (T_5**)** recorded highest starch content (23.19%), ascorbic acid (14.11mg 100 fresh weight^{-1}), total sugars (0.57%) and reducing sugars (0.49%) over other treatments and hence potato crop in Southern Telangana can be recommended with application of 50% inorganic fertilizer dosage along with Vermicompost @1.5 t ha^{-1} and Biofertilizer, *Azotobacter*-3.125 kg ha^{-1} for good quality tubers.

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