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EFFECT OF NUTRIENT SOLUTION ON QUALITY OF OKRA

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Abstract

A field experiment was conducted to observe the effect of full recommended doses of fertilizer (RDF) alone and in combination with 1000, 3000 and 5000 times diluted nutrient solution together with 50 and 75% RDF on the quality of okra (BARI Dherosh-1). Total soluble solids (brix value), protein, ash, ascorbic acid and β-carotene contents in okra were highest where 1000 times diluted nutrient solution was added along with 100% recommended dose of fertilizers. The same treatment increased sweetness, softness, mucilage and flavor and reduced fiber content of okra. Treatment receiving thousand times diluted nutrient solution along with 75% RDF also showed similar results in most of the parameters of the crop studied.

Key words: Nutrient solution, quality, okra

Introduction

Okra is cultivated mainly for its immature fruits used as vegetable, stews and soups as well as popular dishes. When ripe, the black or brown white-eyed seeds are sometimes roasted and used as a substitute for coffee. The crop is used in paper industry and the stem of the plant is used for the extraction of the fibre (Choudhury 1983). The green fruit is a rich source of vitamins, Ca, K and other minerals; tender pods have high mucilage content. Pods also have some medicinal value and a mucilaginous preparation from the pod can be used as a plasma replacement or blood volume expander (Savello *et al.* 1980). Tender green pods of okra generally marketed as fresh but sometimes also available in canned or dehydrated form. Thus, quality assurance is a prime for its use in several dimensions.

Ukisinki is a nutrient solution containing more than 40 elements developed by Aller Corporation of Japan and reported to improve nutritional quality of many vegetable crops in Japan. It stimulates growth, yield, quality and taste of agricultural crops (okra, tomato, cucumber, eggplant, lettuce, pumpkin, cabbage, carrot, orange and rice). It is used in combination with or to supplement a portion of recommended doses of nutrients. There is a possibility of improving the quality of okra in terms of nutritional values as reported in Japan. But no work has so far been carried out in our agro-climatic conditions to assess the

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effect of ukisinki. Keeping these facts in mind the present investigation was carried out to assess the effect of ukisinki on the quality of okra.

Materials and Methods

A field experiment was conducted at the research farm of Bangabandhu Sheikh Mujibur Rahman Agricultural University (BSMRAU), Gazipur, Bangladesh during 15 March to 6 July, 2010. The experiment was arranged in a RCBD with six treatment combinations replicated thrice. Plot size was 2.4 m x 2 m. Okra (BARI Dherosh-1) was used as the test crop. The row to row and plant to plant distances were 60 cm and 50 cm, respectively accommodating 16 plants in each plot. The treatment combinations comprised of three levels of nutrient solution (1000, 3000, 5000 times dilution concentration ukisinki solution) together with full or partial (75 and 50%) recommended doses of fertilizers (RDF). The detailed treatment combinations were T_1. Control (100% RDF), T_2. 1000 times diluted nutrient solution (TDNS) + 100% RDF T_3. 3000 TDNS + 100% RDF, T_4. 5000 TDNS + 100% RDF, T_5. 1000 TDNS +75% RDF and T_6. 1000 TDNS + 50% RDF. All treatments received full doses of recommended nitrogen. The total amounts of P, K, S, B, Zn and cow-dung (10 ton/ha) were applied as basal dose. Nitrogen was applied in four equal installments at 15, 30, 45 and 60 days after sowing as top dressing.

Preparation and application of 1000, 3000 and 5000 times diluted nutrient solution

Twelve liters of nutrient solution was applied as irrigation water in each plot at seedling, maximum growth, and flowering stages and 3 days before the final the harvest of fruit. Intercultural operations were done when necessary.

Mature fruits of okra were harvested from 10 randomly selected plants of each plot. The fruits were air-dried and then oven-dried (at 65^0C for 72 hrs.) for dry weights of fruits and finally grounded for analysis.

Total soluble solids (TSS) by Abbe Refractometer (Rangana 1979), total ash content (AOAC 2000), nitrogen content in pod (Black 1965), reducing and non-reducing sugar (Somogyi 1952; using Bertrand-A, Bertrand-B, and Bcrlrand-C solutions) ascorbic acid (Purseglove 1987) and ß- carotene by spectrophotometer (Model 200-20, Hitachi, Japan) at 663, 645, 505 and 453 nm were determined. Calculation was done by the following formula of Nagata *et al.* (1992). ß- carotene content = **0.216** [663] + **0.452** [453] - **1.22** [645] – **0.304** [505] Where, Bold figures indicate optimal density.

Statistical analysis was done following DMRT (Gomez and Gomez 1984).

Results and Discussion

Different levels of nutrient solution applied in association with RDF had significant effect on TSS (brix) content of okra (Table 1). The highest level of TSS (3.96%) was found in

T_5 treatment (1000 TDNS + 75% RDF) but the effect of this treatment was statistically similar to T_2 (1000 TDNS +100% RDF) treatment. The lowest level of TSS was found in absolute control having recommended dose of fertilizer devoid of nutrient solution. It was observed that TSS could highly be increased with the application of nutrient solution along with recommended dose of fertilizer.

There was a marked influence of nutrient solution on per cent ash content of okra (Table 1). The highest content of ash (5.59%) was found in T_2 (1000 TDNS + 100% RDF) treatment which was statistically similar with T_5 (1000 TDNS + 75% RDF). Ash content of okra might be increased with the application of 1000 TDNS having recommended dose of fertilizers as per the result of the study.

A significant influence of nutrient solution on per cent protein content of okra was observed (Table 1). Protein content was highest (4.17%) in T_2 (1000 TDNS + 100% RDF) which was statistically similar to T_3 (3000 TDNS + 100% RDF) and T_5 (1000 TDNS + 75% RDF) but superior to the rest of the treatments. It was revealed that protein content might be increased if 1000 TDNS was applied with irrigation water receiving 100% recommended dose of fertilizers.

Table 1. Effect of different levels of nutrient solution and fertilizers on TSS, ash, protein and N content of okra.

Treatment	TSS (%)	Ash (%)	Protein (%)	N (%)
T_1. Control (100% RDF)	3.12^{b*}	4.21^{c}	3.02^{b}	0.483^{b}
T_2.1000 TDNS + 100% RDF	3.94^{a}	5.59^{a}	4.17^{a}	0.667^{a}
T_3. 3000 TDNS + 100% RDF	3.13^{b}	4.34^{bc}	3.55^{ab}	0.568^{ab}
T_4.5000 TDNS + 100% RDF	3.03^{bc}	3.80^{c}	2.89^{b}	0.462^{b}
T_5.1000 TDNS +75% RDF	3.96^{a}	5.04^{ab}	3.55^{ab}	0.568^{ab}
T_6.1000 TDNS + 50% RDF	2.98^{c}	4.30^{bc}	3.18^{b}	0.508^{b}
CV%	1.82	8.77	12.69	12.69

*Means followed by a common letter(s) in a column are not significantly different at 5% level by DMRT.

Nitrogen content of okra was significantly influenced by the nutrient solution (Table 1). Significantly higher nitrogen content (0.667%) was observed in T_2 treatment (1000 TDNS + 100% RDF) whose effect was however, statistically similar to T_5 (1000 TDNS + 75% RDF). Similar results were found in the percent total sugar (1.5%), per cent reducing sugar (1.11%), per cent non-reducing sugar (0.39%) and ascorbic acid content (21.70 mg/100g) of okra (Table 2).

Nutrient solution exerted significant influence on ß-carotene content of okra (Table 2). The highest level of ß-carotene content (233.60 mg/100 g) was found in T_2 (1000

TDNS + 100% RDF) which was statistically similar to T_1 (100% RDF only), T_3 (3000 TDNS + 100% RDF) and T_5 (1000 TDNS +75% RDF).

The highest ash, protein, nitrogen and ß–carotene contents were obtained with 100% RDF in combination with 1000 TDNS. This was perhaps due to the higher concentration of nutrient solution applied through T_2 treatment compared to the rest of the treatments. Thousand times diluted nutrient solution also supplemented 25% RDF showing similar results in most of the parameters as that obtained in T_2.

Table 2. Effect of different levels of nutrient solution and fertilizers on sugar (reducing, non-reducing), ascorbic acid and ß-carotene content of okra.

Treatment	Sugar			Ascorbic acid (mg/100g)	ß-carotene (mg/100g)
	Total	Reducing	Non-reducing		
T_1. Control (100% RDF)	0.91^{bc*}	0.69^{b}	0.22^{b}	18.37^{c}	220.80^{abc}
T_2.1000 TDNS + 100% RDF	1.50^{a}	1.11^{a}	0.39^{a}	21.70^{a}	233.60^{a}
T_3. 3000 TDNS + 100% RDF	0.95^{bc}	0.72^{b}	0.23^{b}	19.33^{b}	224.90^{ab}
T_4.5000 TDNS + 100% RDF	0.63^{d}	0.48^{c}	0.15^{b}	17.13^{d}	208.30^{c}
T_5.1000 TDNS + 75% RDF	1.01^{b}	0.77^{b}	0.24^{b}	19.93^{b}	225.03^{ab}
T_6.1000 TDNS + 50% RDF	0.78^{cd}	0.60^{bc}	0.19^{b}	17.83^{c}	212.93^{bc}
CV%	9.79	13.09	29.59	1.96	3.33

*Means followed by a common letter(s) in a column are not significantly different at 5% level by DMRT.

Organoleptic (taste, sweetness, softness) test showed that most of the respondents (r) recommended okra fruits obtained by treating with 1000 TDNS + 100% RDF for its higher taste indicating sweetness (78.46% r), color (68.46% r), softness (87.46% r), mucilage (81.46% r), flavor (93.07% r) and lower fiber content (15.69% r). Treatment T_5 (1000 TDNS + 75% RDF) followed T_2 treatment in recording the above mentioned parameters. Fiber content was low in T_2 and T_5 treatments than the rest of the treatments as per the report of the respondents.

Conclusion

Thousand times diluted nutrient solution played important role in increasing the quality of okra when applied with 100% recommended dose of fertilizers. The same concentration of nutrient solution when applied with 75% recommended dose of fertilizers showed more or

less similar results in improving the quality of okra grown in Shallow Red Brown Terrace Soil of Madhupur Tract.

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