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RESEARCH ARTICLE :

Quality of tomato hybrid COTH 3 (*Solanum lycopersicum* L.) as influenced by biofertilizers and different levels of NPK fertilizers under shade net condition

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SUMMARY : The study was conducted at College orchard, Department of Horticulture, Agricultural College and Research Institute, Madurai during the period of 2012-2013 to study the effect of biofertilizers *viz*., Azophos, Methylobacterium and Azophosmet in presence of different level of NPK fertilizers on quality of Hybrid tomato (COTH 3) under shade net condition. The quality traits *viz.,* Ascorbic acid content, TSS, shelf life in fruits and yield was higher with the application of Azophosmet along the application of 50 per cent recommended dose of N and P and 100 per cent recommended dose of K. in both the seasons.

KEY WORDS :
Hybrid tomato, TSS, Ascorbic acid, Shade net

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BACKGROUND AND OBJECTIVES

Tomato (*Solanum lycopersicum* L.) is most important and popular vegetable widely grown vegetable in the world. It is an excellent processing vegetable. The fruits are eaten as raw, as salad or cooked. The fruit is a rich source of vitamin A (590 microgram / 100g) and vitamin C (27 mg/100g). Then the fruits are used for preparation of products like sauces, pickles, puri, paste, syrub and ketchup.

RESOURCES AND METHODS

The experiment was carried out at the college orchard, Department of Horticulture, Agricultural College and Research Institute, Madurai, during (July to December 2012) and the second experiment was carried out during (December to April 2013). An investigation was conducted to study the effect of organic manure like farm yard manure (FYM 25 t/ha) and graded dose of N, P, K along with bio-fertilizers *viz.*, Azophos, Methylobacterium and Azophosmet on growth and development of hybrid tomato (COTH 3) under shade net condition. The experimental was laid Randomized Block Design with three replications.

Treatment imposed from the seed treatment at 100 g of hybrid tomato seeds were used to produce seedlings for one ha. Biofertilizers *viz.*, Azophos, Methylobacterium and Azophosmet at 4 gram of each inoculant per 40 gram of seeds were mixed with tomato seeds by rice gruel and shade dried for 30 minutes and then sown in protrays filled with well decomposed coir pith. Seeds were sown in separate protrays without biofertilizers inoculation to serve as control. Biofertilizers *viz.*, Azosphos, Methylobacterium and Azophosmet at the rate 200g each were mixed with rice gruel and made into slurry. Then seedling roots were dipped in the slurry for 30 min and transplanted.

Treatment details :

T_1 : 200 kg N+300 kg P_2O_5+200 kg K_2O (RDF)
T_2 : 100% NPK RDF + Azophos
T_3 : 100% NPK RDF + Methylobacterium
T_4 : 100% NPK RDF + Azophosmet
T_5 : 75% NP +100% K RDF + Azophos
T_6 : 75% NP +100% K RDF + Methylobacterium
T_7 : 75% NP +100% K RDF + Azophosmet
T_8 : 50% NP +100% K RDF + Azophos
T_9 : 50% NP +100% K RDF + Methylobacterium
T_{10}: 50% NP +100% K RDF + Azophosmet

A constant level of 200 kg of K_2O is applied in the form of muriate of potash for all treatments.

Twenty five per cent of N as urea, K as muriate of potash and entire dose of P as single super phosphate was applied at the time of planting and the remaining dose of N and K was applied as top dressing on 30th, 45th and 60th days after transplanting. Azophos, Methylobacterium and Azophosmet at the rate of 4 kg ha^{-1}, 2 kg ha^{-1} and 2 kg ha^{-1}, respectively were thoroughly mixed with sieved 50 kg of FYM and then applied on the sides of the ridges at the time of transplanting.

OBSERVATIONS AND ANALYSIS

The results obtained from the present study as well as discussions have been summarized under following heads:

Yield :

The treatment T_{10} (50 % N + 50 % P and 100 % K of RDF + 2 kg Azophosmet) recorded highest yield per hectare (125.09 t ha^{-1}) in first season. In the second crop, T_{10} (50 % N + 50 % P and 100% K of RDF + 2 kg Azophosmet) registered the highest fruit yield (126.40 t ha^{-1}) (Table 1). Similar finding was reported earlier in okra by Mariappan *et al.*, 2012. Better performance of the crop by combined inoculation of Azospirillum, Methylobacterium and Phosphobacteria in cotton was documented earlier by Gomathy *et al*., 2008. There was also early flowering and boll development due to combined inoculation. In the present study, 50% N and P + 100% K along with 2 kg Azophosmet had resulted early flowering in tomato.

Table 1 : Influence of bio fertilizers and different levels of NPK fertilizers under shade net condition on total fruit yield per hectare (tonnes) in tomato (COTH 3) grown in two seasons

Treatments	Fruit yield per hectare		
	1st season crop	2nd season crop	Pooled mean
T_1	97.89	96.00	96.94
T_2	107.67	113.77	110.72
T_3	106.61	110.98	108.79
T_4	114.67	117.46	116.06
T_5	102.70	108.04	105.37
T_6	99.27	100.06	99.66
T_7	121.90	123.79	122.84
T_8	124.26	125.89	125.07
T_9	118.11	119.82	118.96
T_{10}	125.09	126.40	125.74
S.E.±	0.1686	0.1721	0.1692
C.D.(P=0.05)	0.3542	0.3615	0.3556

Total soluble solids :

Among the two seasons, the treatment T_{10} (50% N + 50% P and 100% K of RDF + 2 kg Azophosmet) had the highest TSS value of 5.59 and 5.42 °Brix followed by T_8 (50% N + 50% P and 100% K of RDF + 4 kg Azophos) which recorded 5.13 and 5.22 °Brix. The least TSS content was recorded in treatment T_{-1}(control) 4.36 and 3.82 °Brix during first and second season crop, respectively (Table 2).

In the pooled analysis, treatment T_{10} (50% N + 50% P and 100% K of RDF + 2 kg Azophosmet) had highest TSS value of (5.50 °Brix) and the treatment T^{-1}(control) had least TSS content value of (4.09 °Brix)

Ascorbic acid :

The treatment T_{10} (50% N + 50% P and 100% K of RDF + 2 kg Azophosmet) recorded the highest ascorbic acid content (35.73 and 34.96 mg per 100g) and the treatment T_1 (control) recorded less ascorbic acid content

Table 2 : Influence of bio fertilizers and different levels of NPK fertilizers under shade net condition on total soluble solids ^{0}brix and ascorbic acid (mg per 100g of fruit) in tomato fruit (COTH 3) grown in two seasons

Treatments	Total soluble solids ^{0} Brix			Ascorbic acid		
	1st season crop	2nd season crop	Pooled mean	1st season crop	2nd season crop	Pooled mean
T_1	4.36	3.82	4.09	32.96	33.07	33.01
T_2	4.93	3.59	4.26	35.17	35.33	35.25
T_3	3.63	4.32	3.97	33.91	33.42	33.66
T_4	4.93	4.52	4.72	34.69	34.70	34.69
T_5	4.38	4.29	4.33	34.07	34.11	34.09
T_6	4.49	4.87	4.68	33.37	33.91	33.64
T_7	5.04	5.10	5.07	34.82	33.49	34.15
T_8	5.13	5.22	5.17	35.56	35.56	35.56
T_9	4.41	4.42	4.41	33.49	34.82	34.15
T_{10}	5.59	5.42	5.50	35.73	34.96	35.34
S.E.±	0.0089	0.0097	0.0082	0.0157	0.0140	0.0137
C.D. (P=0.05)	0.0188	0.0205	0.0172	0.0329	0.0295	0.0287

of 32.96 and 33.07 mg per 100g during first and second season crop, respectively.

Treatment T_{10} (50% N + 50% P and 100% K of RDF + 2 kg Azophosmet) had highest ascorbic acid content of 35.34 mg per 100 g and least ascorbic acid content was recorded in T_1 (33.01 mg per 100 g) in both the seasons (Table 2). Organic manures, inorganic fertilizers and biofertilizers showed positive effect on ascorbic acid content of fruits. In the present study, 50% N and P + 100% K along with 2 kg Azophosmet had resulted in the highest ascorbic acid content of the fruits. Promotive effect of nutrients on ascorbic acid content has been reported earlier in tomato by Hattap, 1982 and in chilli by Niraijana and Devi, 1990. Increase in ascorbic acid content was reported due to biofertilizers in amaranthus (Swaminathan *et al.,* 1993), pumpkin (Karuthamani, 1995) and brinjal (Nandhakumar and Veeraragavathatham, 2001).

Storage of tomato fruits :

Physiological loss in weight :

The physiological weight loss showed uniform increasing trend with the increase in the storage life. Both the season the overall mean physiological loss in weight was lowest in T_{10} (50% N, P and 100% K + Azophosmet) with 9.72 and 9.36 per cent during the entire storage period of 12 days. The highest overall mean physiological loss in weight was recorded in T_1 (RDF) with 13.88 and 13.77 per cent the fruits lost for 8 days only.

Both the season, the treatment T_{10} (50% N + 50% P and 100% K + 2 kg Azophosmet) had lowest physiological loss in weight of 9.54 per cent during the entire storage period of 12 days. The treatment T_1 (control) had highest physiological loss in weight of 13.82 per cent during the entire storage period of 12 days (Table 3).

Table 3 : Influence of bio fertilizers and different levels of NPK fertilizers under shade net condition on physiological loss in weight (%) in tomato fruit (COTH 3) during storage

Treatments	Physiological loss in weight		
	First season	Second season	Pooled mean
T_1	13.88	13.77	13.82
T_2	10.93	10.99	10.96
T_3	12.07	12.41	12.24
T_4	11.47	11.31	11.39
T_5	11.89	12.02	11.95
T_6	13.26	13.11	13.18
T_7	11.21	11.09	11.15
T_8	10.15	10.29	10.22
T_9	12.78	12.83	12.80
T_{10}	9.72	9.36	9.54
S.E.±	0.0216	0.0222	0.0218
C.D. (P=0.05)	0.0453	0.0467	0.0458

Shelf-life :

The treatment had significantly influenced the shelf life in two seasons. Among the two seasons the treatments T_{10} (50% N + 50% P and 100% K of RDF + 2 kg Azophosmet) had the highest shelf life of 12.47 and 12.31 days followed by T_8 (50% N + 50% P and 100% K of RDF + 4 kg Azophos) which recorded 11.89 and 11.77 days. The least shelf-life was recorded in treatment

T_{-1}(control) 7.53 and 7.14 days during first and second season crop, respectively (Table 4).

Table 4 : Influence of bio fertilizers and different levels of NPK fertilizers under shade net condition on self-life of tomato fruits (COTH 3) during storage

Treatments	Shelf life		
	First Season	Second Season	Pooled mean
T_1	7.53	7.14	7.33
T_2	11.03	11.19	11.11
T_3	9.37	9.87	9.62
T_4	10.22	10.63	10.42
T_5	9.93	10.11	10.02
T_6	8.24	8.58	8.41
T_7	10.57	11.00	10.78
T_8	11.89	11.77	11.83
T_9	8.71	9.16	8.93
T_{10}	12.47	12.31	12.39
S.E.±	0.0257	0.0255	0.0255
C.D. (P=0.05)	0.0541	0.0535	0.0536

In the pooled analysis, the treatment T_{10} (50% N + 50% P and 100% K of RDF + 2 kg Azophosmet) had the highest shelf-life of (12.39 days) and the treatment T_1 (control) had least shelf-life of 7.33 days. The present study on application of 50% N and P + 100% K along with 2 kg Azophosmet significantly altered the physiological loss in weight and self-life of tomato fruits during storage. The physiological loss in weight during storage occurs continuously due to moisture loss, thereby the fruits loose their freshness. In the present study, the tomato fruits stored well for 7-12 days at ambient conditions. The transpiration and respiration could have caused loss of turgor pressure in the fruits (Bourne, 1976). The rate of textural deterioration varied widely depending upon the commodity and storage conditions as observed earlier by various workers. In the case of bitter gourd the fruits stored well upto 4-6 days (Sankaran, 1999; Jayaraman and Raju, 1992 and Perkins and Collins, (1992).

Conclusion :

From the above discussion, it may be concluded that application of 50 per cent recommended dose of N, P and 100 per cent recommended dose of K + 2 kg Azophosmet ha^{-1} increases yield and quality of tomato hybrid (COTH 3).

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