



Residual Effect of Integrated Nutrient Management on Seed Quality Attributes at Different Fruit Pickings of Tomato (*Lycopersicon esculentum* Mill.)

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ABSTRACT

Residual effect of nutritional treatments, consisting of various organic sources viz., FYM, poultry manure, neem cake, *azotobacter*, VAM, PSB, and pea crop residue, along with the inorganic fertilizers, was tested on seed quality attributes of tomato at different fruit pickings. The treatments were actually administered in the first crop in the okra- pea-tomato cropping system. The fruits harvested in the first picking resulted in greatest 1000 seed weight, germination percentage, seedling length and seedling vigour index having considerable differences over the late pickings. Among different treatments, the application of VAM +50% P and full dose N and K through fertilizers, proved best almost in all the fruit picking with respect to all the above seed quality attributes, closely followed by the application of PSB +75% P and full dose of N and K through fertilizers.

Keywords: Tomato, residual effect, INM, picking, seed quality.

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Good quality seed is a pre-requisite for higher productivity of any crop. The losses in the seed viability and vigour depend on various factors, like genetic makeup of seed material, harvesting stage of the seed, fruit position on the mother plant, fruit size, fruit pickings, and prevailing environmental condition at harvesting time. The crop like tomato in which multiple fruit pickings are done over a long period, variation in seed quality may occur from one picking to the other. Nutrient application also plays a major role for harnessing yield and quality. Balance nutrition is one of the major parameter which facilitates the defense mechanism for several insect and disease pest as well. Apart from this, it also improves plant resistance power under unfavorable agro climatic conditions (Singh *et al.*, 2012). At present chemical fertilizers contribute a lot in fulfilling the nutrient requirement of tomato but their regular, excessive and unbalanced use may lead to health and ecological hazards, besides causing deterioration in physico-chemical properties of soil (Singh and Kumar, 2009), which may ultimately lead to poor yield and quality of fruit as well as seed. With this view, now it is widely being felt that organic sources should form an integral component of the crop nutrition. The traditional organic manures release the nutrients slowly, hence the effect is exhibited not only on the instant crop but also it is reflected on the performance of other succeeding crops. Similarly, the biofertilizers enrich the soil with beneficial microorganisms

which may show a prolonged effect on the sequential crops. Therefore, a modest attempt in this investigation was made for evaluating different seed quality parameters in different pickings of tomato as influenced by the residual effect of different integrated nutritional treatments.

The study was carried out with tomato cultivar Pant T-3 at Horticultural Research Centre of G.B. Pant University of Agriculture and Technology, Pantnagar during summer season of 2002 and 2003. The soil of the experimental plot was sandy loam, with neutral pH (6.85), medium in organic carbon (0.72%), high in available nitrogen (282.4 kg/ha), low in available phosphorus (22.8 kg/ha) and medium in available potassium (200.0 kg/ha). The treatments comprised of : T₁ - recommended dose of NPK through fertilizers, T₂ - FYM (15 t/ha) + rest amount of NPK through fertilizer, T₃ - neem cake (3 q/ha) + rest amount of NPK through fertilizer, T₄ - poultry manure (3 t/ha) + rest amount of NPK through fertilizers, T₅ - *Azotobacter* + 75 per cent of N and full dose of P and K through fertilizers, T₆ - VAM + 50 per cent P and full dose of N and K through fertilizer, T₇ - PSB + 75 per cent P and full dose of N and K through fertilizers, T₈ - *Azotobacter* + VAM + PSB + rest amount of NPK through fertilizers, T₉ - micronutrients through multiplex (2.5 ml/litre) + recommended dose of NPK through fertilizers, T₁₀ - FYM + *Azotobacter* + VAM + PSB + rest NPK through fertilizers and T₁₁ - recommended dose of NPK through fertilizers + pea straw incorporation. The treatments

were actually applied in the first crop of okra in okra-pea-tomato cropping system and later their residual effect was recorded in tomato. All the cultural operations were followed which are recommended to raise a good crop of tomato. In all, seven fruit pickings were done. The seeds were extracted by natural fermentation method from well ripened fruits. Thirty days old seeds were used for recording various attributes of seed quality. The germination and seedling length were recorded on the final count day of germination i.e., 14 days after sowing. The seedling vigour index was calculated by multiplying germination percentage with seedling length. The data presented in tables represent the pooled mean of two years.

The seed test weight, an important physical parameter of good quality of seed, differed significantly owing to the residual effect of IPNM treatments at all the fruit pickings except second and third pickings. The highest seed test weight was obtained at the first picking, after which it gradually decreased till the last picking, the reduction being more conspicuous in the sixth and seventh pickings. The reduction in seed test weight occurred in the range of 25.08 to 31.58 % in the last picking over the first picking under different treatments. The highest seed test weight among all the treatments was observed under the T_6 , which contained VAM + 50% P and full dose of N and K through fertilizers (T_6), closely followed by T_7 in most of the pickings. The higher seed test weight under T_6 and T_7 might be due to the VAM and *phosphobacteria* which physiologically influence the activity of enzymes that lead to increased cell metabolism and change in the biochemical composition of the seed. Another reason might be due to the increased absorption of nitrogen in the presence of phosphatic biofertilizers and its direct participation in the protein synthesis which increased protein content as reported by Subbiah and Ramanathan (1982).

The germination percentage was significantly influenced by the various integrated nutritional treatments in all the pickings except the first one. Generally the highest germination percentage was observed in T_6 , closely followed

by T_7 in different pickings. Similarly like seed test weight, the germination percentage was in general, highest in the first picking, after which it gradually declined till the last picking (Table 1). Comparatively better seed germination percentage observed in earlier pickings may be because of prevalence of comparatively better environmental conditions and sound physiological state of plants and seed. These results corroborate the earlier findings of Dharmatti *et al.* (1990).

The seedling length exhibited by seeds of different pickings was significantly influenced by different treatments in all the seven pickings (Table 2). The length was found to be maximum in T_6 with non-significant difference from T_7 at all the stages of pickings. The minimum length was observed with T_1 . Among different pickings, comparatively higher seedling length was noticed in the first and second pickings than the other ones and a gradual decline occurred in each successive picking, the last one showing a decline in the range of 7.80 to 14.02 per cent over the first spicking.

As evident from the table 2, the treatments had significant variation in seedling vigour index (SVI) in all the seven pickings. In general, the seedling vigour index was higher in first two pickings, which declined in successive later pickings. The reduction in the seedling vigour index was to the tune of 13.47 to 19.20 per cent in the last picking over the first picking. The probable reason for such findings may be a healthy and vigorous growth state maintained by the plants during the stage of first picking. Internal hormonal level and metabolic activities are higher during initial stages of harvest. The leaf area index as well as net photosynthetic area during this period was also maximum because of the absence of yellowing and senescent leaves during early phases. This would have led to proper formation and accumulation of photosynthates in the seeds. Among the treatments, the T_6 always resulted in the higher seedling vigour index in all the pickings, closely followed by T_7 . The T_6 and T_7 supplied with VAM and PSB respectively, would have allowed balanced uptake of

Table 1: Residual effect of INM treatments on Seed test weight and germination capacity exhibited at different fruit picking of tomato.

Treatments	Seed test weight (g) at different pickings							Germination (%) at different pickings						
	I Picking	II Picking	III Picking	IV Picking	V Picking	VI Picking	VII Picking	I Picking	II Picking	III Picking	IV Picking	V Picking	VI Picking	VII Picking
T_1	3.52	3.51	3.34	3.13	2.93	2.74	2.53	90.00	89.00	88.50	87.17	85.84	85.67	84.34
T_2	3.31	3.31	3.30	3.09	2.92	2.70	2.48	90.67	90.67	89.50	86.84	86.17	85.84	85.67
T_3	3.56	3.46	3.38	3.20	3.06	2.74	2.51	91.50	91.00	90.17	87.83	87.50	87.17	86.33
T_4	3.46	3.40	3.37	3.04	2.96	2.66	2.44	90.00	88.00	87.67	84.00	85.50	85.34	84.50
T_5	3.52	3.49	3.33	3.18	3.04	2.75	2.49	92.17	91.17	88.17	89.00	88.00	87.33	86.33
T_6	3.61	3.58	3.53	3.46	3.20	2.78	2.47	92.34	91.84	90.50	89.84	88.67	88.67	87.50
T_7	3.59	3.54	3.44	3.24	3.09	2.78	2.51	92.17	91.33	91.17	89.83	88.67	87.17	86.50
T_8	3.37	3.34	3.29	3.18	3.08	2.75	2.50	90.34	89.50	89.67	87.34	87.00	86.34	85.84
T_9	3.35	3.34	3.25	3.12	2.90	2.68	2.46	90.50	89.17	88.17	87.50	86.84	86.17	85.00
T_{10}	3.50	3.35	3.28	3.17	2.92	2.66	2.44	90.34	91.00	87.67	87.50	86.67	86.17	85.00
T_{11}	3.53	3.53	3.42	3.26	3.11	2.79	2.50	92.00	91.17	89.17	89.00	87.67	85.00	87.50
SEm±	0.036	0.041	0.092	0.078	0.169	0.074	0.077	0.259	0.571	0.620	0.906	0.597	0.535	0.566
CD at 5%	0.074	0.086	0.192	0.162	0.353	0.154	0.160	0.539	1.191	1.294	1.889	1.245	1.115	1.181

Table 2: Residual effect of INM treatments on seedling length and seed vigour index exhibited at different fruit picking of tomato.

Treatments	Seedling length (cm) at different pickings							Seed vigour index at different pickings						
	I Picking	II Picking	III Picking	IV Picking	V Picking	VI Picking	VII Picking	I Picking	II Picking	III Picking	IV Picking	V Picking	VI Picking	VII Picking
T ₁	13.70	13.34	13.37	12.51	11.95	12.14	11.91	1232.33	1187.35	1185.38	1090.32	1025.34	1037.73	1005.61
T ₂	13.94	13.57	13.40	12.98	12.54	12.42	11.92	1263.87	1231.21	1199.53	1126.31	1080.60	1065.44	1021.15
T ₃	14.29	14.24	13.82	13.28	13.05	13.02	12.70	1306.83	1295.49	1245.27	1166.42	1142.10	1135.16	1096.27
T ₄	13.46	13.36	13.26	13.25	12.89	12.61	12.41	1211.57	1175.00	1162.24	1112.42	1102.49	1090.83	1048.41
T ₅	15.24	14.68	14.00	13.81	13.55	13.51	13.20	1404.87	1342.62	1259.51	1228.92	1192.84	1179.17	1138.98
T ₆	16.42	16.32	15.64	14.92	14.56	14.57	14.28	1514.89	1498.59	1423.16	1338.58	1289.39	1290.10	1249.33
T ₇	16.14	16.09	15.32	14.78	14.30	13.84	13.91	1487.78	1469.42	1394.40	1327.82	1267.67	1205.94	1202.90
T ₈	14.18	14.62	13.64	13.00	12.95	12.63	12.45	1281.23	1304.44	1207.23	1134.84	1125.90	1090.66	1068.90
T ₉	15.19	15.17	14.11	13.46	13.52	13.34	13.06	1374.77	1352.05	1233.19	1207.58	1174.35	1149.61	1116.49
T ₁₀	13.58	13.69	13.32	13.94	12.92	12.88	12.33	1226.17	1246.36	1181.43	1131.59	1119.41	1098.54	1047.75
T ₁₁	15.33	15.39	14.62	14.20	13.89	13.95	13.61	1409.62	1402.59	1306.86	1264.73	1216.29	1222.20	1190.15
SEm±	0.183	0.159	0.206	0.615	0.411	0.336	0.317	18.073	17.874	20.514	38.328	30.892	35.809	26.857
CD at 5%	0.383	0.331	0.430	1.282	0.857	0.700	0.661	37.701	37.285	42.792	79.951	64.441	74.608	56.025

phosphorus and other minerals which may have resulted in higher seed and seedling vigour in these treatments. [Dev and Sharma \(2002\)](#), [Demir and Ellis \(1992\)](#) and [Meher et al. \(1996\)](#) also observed similar findings in tomato.

The tomato fruits harvested in the first picking resulted in greatest 1000 seed weight, germination percentage, seedling length and seedling vigour index having considerable differences over the late pickings. Among different treatments, the application of VAM +50% P and full dose N and K through fertilizers, proved best almost in all the fruit picking with respect to all the above seed quality attributes, closely followed by the application of PSB +75% P and full dose of N and K through fertilizers.

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