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Effect of N, P and their interaction on Physico- Chemical Parameters of Guava (Psidium guajava) cv. L-49 under Malwa Plateau Conditions

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***Abstract*-** The results were obtained from the investigation shows that the individual application of nitrogen and phosphorus and their interaction significantly influence the physico- chemical properties of guava cv. L-49. Treatments with higher doses of nitrogen were found very effective in improve the physico-chemical parameters of guava fruit. The maximum fruit diameter (7.40 cm), fruit length (7.31 cm) and pulp weight (200.01g) was recorded by combined application of 600 g N and 400 g P_2O_5 (N_2P_2) per tree. The effect of treatment interaction was non significant on the TSS, acidity and tss/acidity ratio. The maximum total sugars (7.987%) were recorded in N_1P_2, non-reducing sugar (4.097%) were recorded in N_2P_0 and maximum reducing sugar (4.253%) was recorded in N_1P_0 treatment combination.

***Index Terms*-** Guava, Physico-chemical, Nitrogen and Phosphorus

I. INTRODUCTION

Guava (*Psidium guajava* L.), is one of most popular fruits grown in tropical, sub-tropical and some parts of arid regions of India, which belongs to the family Myrtaceae. It is the fifth most important fruit in area after mango, banana, citrus and apple and fifth most important fruit in production after banana, mango, citrus and papaya. Nature has endowed it liberally to tolerate the drought and flood condition and adoptability to a wide range of soil and climatic conditions. Its cultural requirement is also very limited. Besides other factors of crop production, nutrients play an important role in the production of guava. Medeiros *et al*. (2004) also reported that, the application of N fertilizer provided an increment in the diameter of the guava fruits. The total soluble solids, ascorbic acid, reducing sugar, non-reducing sugar, total sugar and pectin content, as well as TSS: acid ratio in fruits linearly increased with increasing rates of nitrogen fertilizer (Lal and Sen, 2001). Fruit quality was best when the trees received N: P_2O_5: K_2O at 600:300:300 g/tree (Wagh and Mahajan, 1987).

II. MATERIAL AND METHODS

The experiment was conducted at the Department of Fruit Science, K.N.K. College of Horticulture, Mandsaur (M.P.) during 2010-2011. The soil of the experimental plot is black in colour and having 165.20, 15.75 and 520.40 kg nitrogen, phosphorus and potassium per hectare along with pH of 7.9. The experiment was laid out on six year old guava tree cv. L-49 planted at the distance of 6 m x 6 m. Nitrogen and phosphorus were applied in the form of urea (46% N), and single super phosphate (16% P_2O_5) respectively. There were three levels of each of nitrogen (0, 300 and 600 g N/tree) and phosphorus (0, 200 and 400 g P_2O_5/tree) applied. Each treatment was replicated thrice with one plant in each replication. Full dose of phosphorus along with half dose of nitrogen were applied in the month of June, while remaining half dose of nitrogen was applied in the October month.

The data on physico- chemical parameters of fruits were recorded. Physico- chemical parameters of fruits were determined using to average size fruits collected randomly from each replication. The TSS (^{0}Brix) was recorded with the help of a hand refractometer. Acidity was estimated by simple acid– alkali titration method as described in A.O.A.C. in (1970). Sugars in fruits were estimated by the method suggested by Nelson (1944). Assay method of ascorbic acid was followed given by Ranganna (1977). The estimation of pectin was according to the method of Kertesz (1951).

III. RESULTS AND DISCUSSION

Effect of N, P and their interaction on physical parameters:

The physical parameters were significantly influenced by the nitrogen and phosphorus. In the nitrogen application the maximum fruit length (6.92 cm) and diameter (7.02 cm) at harvest, volume of fruit (187.18 ml), pulp weight (174.75 g) and seed weight (9.00 g) was observed in N_2 (600 g N/tree) at harvest which was significantly higher than the N_1 (300 g N/tree) and control. The physical characteristics of fruit is an expression of the plant's vegetative activity, it may be presumed that the nitrogen treatment at optimum level leads to increase the shoot and leaf development that is ultimately capable of manufacturing greater amount of food materials and the same when translocated into the fruit bearing areas leading to enhancement in weight and size of the fruits. Singh (1985), Dubey *et al*. (2001), Yadav (2002) Medeiros *et al*. (2004) and Meena *et al*. (2005) also reported the similar results in the guava.

The phosphorus also significantly influenced the physical parameters. The maximum fruit length (6.48 cm) and diameter (6.71 cm) at harvest, volume of fruit (174.57 ml), pulp weight (162.95 g) and seed weight (8.04 g) was observed in P_2 (400 g P_2O_5/tree) which was significantly higher than the P_1 (400 g P_2O_5/tree) and control, except fruit diameter and; seed weight,

which was at par with the P_1. The experimental findings are accordance with the results reported by Singh and Rajput (1977). The increase in fruit size by addition of adequate quantity of phosphorus was possibly due to its beneficial effects, on the vegetative growth. This might be indirectly contributed towards increase in the fruit size.

The interactions between N and significantly influenced the physical parameters. The nitrogen particularly at higher level interacted positively with phosphorus. The maximum fruit length (7.31 cm) and fruit diameter (7.40 cm) at harvest, pulp thickness (2.58 cm) and pulp weight (200.01 g) were recorded in N_2P_2 (600 g N + 400 g P_2O_5) which was significantly different from other levels of NP and control. The pulp thickness was at par with N_2P_1 (600 g N + 200 g P_2O_5). The increase in physical parameters of the fruit may be due to the positive interaction of nitrogen with the phosphorus. Nitrogen is constituent of proteins, enzymes and chlorophyll which is associated with the photosynthesis and growth and phosphorus plays an important role in the photosynthesis besides being a constituent of nucleo-proteins. Optimum vegetative growth increases the synthesis of food materials. These activities of nitrogen and phosphorus might have been interacted positively and stimulated the physical characters of the guava fruit positively.

Effect of N, P and their interaction chemical parameters:

The N and P nutrients and their interactions significantly influenced the chemical constituent's viz. TSS, reducing, non-reducing and total sugars, pectin, TSS/acid ratio and ascorbic acid of the fruit over the control.

The application of nitrogen significantly influenced the chemical characteristics of fruit over the control. In the application of nitrogen the highest TSS/acid ratio (35.653), ascorbic acid content (205.484 mg), pectin content (0.803%), total soluble solids (10.185 ^{0}Brix) and non-reducing sugar (3.953%) was recorded in N_2 (600 g N/tree) treatment, which was significant to the control, were as TSS/acid ratio and TSS was at par with N_1 (300 g N/tree). The maximum total sugar (7.929%) and reducing sugar (4.112%) was recorded in N_1 (300 g N/tree) treatment which was significantly higher than the N_2 (600 g N/tree) and control. The explanation of significance of above mentioned chemical parameters are that, the nitrogen had no direct effect on the chemical parameters of the fruit but it may help in the uptake of other nutrients which improve the quality of fruits. These results are accordance with the findings of Singh (1985), Tassar *et al*. (1989), Bhatia *et al*. (2001), Lal and Sen (2001) and Meena *et al*. (2005) in guava.

The application of phosphorus also had significant effect on chemical characteristics of fruit over the control. In the application of phosphorus the maximum TSS/acid ratio (35.918), ascorbic acid (197.082 mg), pectin (0.755%), total soluble solids (10.046 ^{0}Brix), total sugars (7.809%), reducing sugar (3.886%) and non-reducing sugar (3.924%) was recorded in P_2 (400 g P_2O_5/tree) treatment which was significantly higher than P_1 (200 g P_2O_5/tree) and control except total sugars, reducing sugar and non-reducing sugar which was at par with P_1 (200 g P_2O_5/tree). The overall improvement in the fruit quality as a result of improvement in various chemical characteristics by application of phosphorus may be explained by the fact that phosphorus enters into the composition of phospholipids and nucleic acids, the latter combines with proteins and result in the formation of nucleo proteins which are important constituents of the nuclei of the cells. The chain reactions in these components might have possibly caused improvement in quality. Similar results were also reported by Singh and Rajput (1977) and Tassar *et al*. (1989) in guava.

The interaction of N and P also had significant effect on chemical characteristics of fruit over the control. In the NP interaction maximum ascorbic acid (206.433 mg) and pectin (0.830%) was recorded in N_2P_2 (600 g N + 400 g P_2O_5) which was significant over the control. The maximum total sugars (7.987%) in N_1P_2 (300 g N + 400 g P_2O_5), reducing sugar (4.253%) in N_1P_0 (300 g N + 0 g P_2O_5) and non-reducing sugar (4.097%) was obtained in N_2P_0 (600 g N + 0 g P_2O_5) which was superior to the control. These results are accordance with the findings of Singh *et al*. (1992) and Singh *et al*. (1993) in guava.

Table 1: Effect of N, P and their interaction on physical parameters of guava fruit

Treatment	Fruit length (cm) at harvest	Fruit diameter (cm) at harvest	Volume of fruit (ml)	Specific gravity	Pulp Thick-ness (cm)	Pulp weight (g)	Pulp Per-centage (%)	Seed weight (g)	Seed/ pulp ratio
N_0	5.68	6.12	132.77	0.975	2.37	123.27	95.05	6.31	0.052
N_1	6.24	6.50	159.76	0.981	2.45	148.88	95.01	7.72	0.053
N_2	6.92	7.02	187.18	0.981	2.38	174.75	95.12	9.00	0.052
S. Em. ±	**0.023**	**0.065**	**3.642**	**0.002**	**0.057**	**3.501**	**0.121**	**0.193**	**0.001**
C.D. at 5%	**0.065**	**0.184**	**10.336**	**NS**	**NS**	**9.936**	**NS**	**0.547**	**NS**
P_0	6.03	6.39	146.22	0.979	2.36	136.07	94.88	7.19	0.054
P_1	6.33	6.53	158.92	0.980	2.34	147.87	95.01	7.80	0.053
P_2	6.48	6.71	174.57	0.978	2.50	162.95	95.28	8.04	0.050
S. Em. ±	**0.023**	**0.065**	**3.642**	**0.002**	**0.057**	**3.501**	**0.121**	**0.193**	**0.001**
C.D. at 5%	**0.065**	**0.184**	**10.336**	**NS**	**NS**	**9.936**	**NS**	**0.547**	**NS**
N_0P_0	5.41	6.02	118.83	0.967	2.40	108.55	94.50	6.29	0.058
N_0P_1	5.78	6.23	137.90	0.983	2.43	130.15	95.84	5.51	0.044

N_0P_2	5.85	6.11	141.57	0.976	2.27	131.11	94.82	7.14	0.055
N_1P_0	6.10	6.42	152.83	0.985	2.48	143.29	95.13	7.21	0.051
N_1P_1	6.34	6.45	157.67	0.977	2.24	145.61	94.61	8.26	0.057
N_1P_2	6.27	6.62	168.79	0.980	2.64	157.75	95.28	7.68	0.050
N_2P_0	6.57	6.74	167.00	0.984	2.21	156.37	95.02	8.08	0.052
N_2P_1	6.87	6.91	181.19	0.981	2.34	167.86	94.59	9.63	0.057
N_2P_2	7.31	7.40	213.35	0.978	2.58	200.01	95.74	9.30	0.047
S.Em.±	**0.039**	**0.112**	**6.308**	**0.004**	**0.099**	**6.064**	**0.210**	**0.334**	**0.002**
C.D. at 5%	**0.112**	**0.319**	**NS**	**NS**	**0.282**	**17.209**	**0.595**	**0.947**	**0.006**

Table 2: Effect of N, P and their interaction on chemical parameters of guava fruit

Treatment	TSS (^{0}Brix)	Acidity (%)	TSS/ acid ratio	Total sugars (%)	Reducing sugar (%)	Non-reducing sugar (%)	Ascorbic acid content (mg/100g pulp)	Pectin (%)
N_0	8.639	0.286	30.562	7.593	3.688	3.905	182.403	0.653
N_1	9.806	0.285	34.709	7.929	4.112	3.817	200.002	0.706
N_2	10.185	0.289	35.653	7.707	3.753	3.953	205.484	0.803
S. Em. ±	**0.178**	**0.005**	**0.891**	**0.021**	**0.002**	**0.022**	**0.216**	**0.002**
C.D. at 5%	**0.504**	**NS**	**2.530**	**0.061**	**0.006**	**0.061**	**0.612**	**0.006**
P_0	9.222	0.281	33.024	7.624	3.785	3.840	195.093	0.680
P_1	9.361	0.295	31.982	7.795	3.883	3.911	195.714	0.728
P_2	10.046	0.284	35.918	7.809	3.886	3.924	197.082	0.755
S. Em. ±	**0.178**	**0.005**	**0.891**	**0.021**	**0.002**	**0.022**	**0.216**	**0.002**
C.D. at 5%	**0.504**	**NS**	**2.530**	**0.061**	**0.006**	**0.061**	**0.612**	**0.006**
N_0P_0	8.417	0.267	31.840	7.380	3.521	3.859	181.323	0.622
N_0P_1	8.583	0.295	29.233	7.578	3.813	3.764	182.667	0.665
N_0P_2	8.917	0.295	30.613	7.821	3.730	4.091	183.220	0.672
N_1P_0	9.250	0.283	32.875	7.817	4.253	3.563	199.630	0.644
N_1P_1	9.750	0.290	33.912	7.983	3.963	4.020	198.782	0.711
N_1P_2	10.417	0.282	37.339	7.987	4.120	3.867	201.593	0.762
N_2P_0	10.000	0.293	34.356	7.677	3.580	4.097	204.324	0.774
N_2P_1	9.750	0.300	32.801	7.823	3.873	3.950	205.693	0.807
N_2P_2	10.806	0.273	39.801	7.620	3.807	3.813	206.433	0.830
S.Em.±	**0.308**	**0.008**	**1.544**	**0.037**	**0.004**	**0.037**	**0.374**	**0.004**
C.D. at 5%	**NS**	**NS**	**NS**	**0.105**	**0.011**	**0.106**	**1.060**	**0.011**

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