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Dalit Kumar Jayswal
Department of Horticulture, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Adhartal, Jabalpur, M.P, India

DP Sharma
Department of Horticulture, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Adhartal, Jabalpur, M.P, India

TR Sharma
Department of Horticulture, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Adhartal, Jabalpur, M.P, India

AK Dwivedi
Department of Soil Science and Agricultural Chemistry, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Adhartal, Jabalpur, M.P, India

AS Gontia
Department of Plant Physiology, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Adhartal, Jabalpur, M.P, India

N Lal
Department of Horticulture, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Adhartal, Jabalpur, M.P, India

Correspondence
Dalit Kumar Jayswal
Department of Horticulture, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Adhartal, Jabalpur, M.P, India

Effect of Pruning intensity and Nutrition on NPK content in Guava leaves *cv*. Allahabad Safeda

Dalit Kumar Jayswal, DP Sharma, TR Sharma, AK Dwivedi, AS Gontia and N Lal

Abstract
A field experiment was conducted to study the changes in the nutrient composition in guava leaves after pruning and application of fertilizers. The maximum Nitrogen percentage was found in P_3 (40cm) pruning in both years while P_1 (0cm) unpruned plant recorded the lowest. The pruning intensity did not have any significant effect on Phosphorus content. Similarly, the highest Potassium percentage was found in P_3 (40cm) pruning in both years while P_1 (0cm) unpruned plant recorded the lowest. The significant difference was also observed for N, P and K content due to different fertilizers levels. The highest N, P and K percentage was estimated in leaves under F_6 [5 kg FYM + 2 kg VC + 75% RDF {225:150:150g NPK} + *Azotobacter* 150gm + PSB 100gm / Plant] and minimum N and K percentage was found in F_4, whereas, F_1 Check (5 kg FYM+2kg VC/ Plant) had the lowest phosphorus content. The interaction effect due to pruning intensity and fertilizers was found to be significant for nutrient like N and K, whereas, P (%) showed non-significant. Leaf nitrogen and Potassium (%) content increased with the increase in severity of pruning, whereas, leaf Phosphorus content was found to be Non-significant.

Keywords: Guava, Pruning intensity, Nutrition, Nitrogen, Phosphorus, Potassium

1. Introduction
Guava (*Psidium guajava* L.) is one of the most important fruit of the tropics and sub-tropics of the world. It belongs to family Myrtaceae and is aptly called as 'Apple of the tropics'. It was introduced to India during the 17th century by the Portuguese explorers brought the fruit and many others to Goa (Menzel and Paxton, 1985) [11]. In, Madhya Pradesh guava is cultivated in district Rewa, Satna, Balaghat, Panna, Seoni, Umaria, Katni, Sheopur, Gwalior, Shivpuri, Betul, Chhindwara etc.

Pruning of guava is one of the most important practices that influence the vigour, productivity and quality of the fruits (Gadgil and Gadgil, 1933) [3]. A new growth can be ensured by pruning and it is one of the cultural practices which are being practiced in temperate and sub-tropical fruit crops to bring a new growth. Pruning helps in balance between vegetative and reproductive growth of the plant. A light pruning is considered necessary to encourage new shoots after the harvest. Shoot pruning is helpful in reducing the tree size and improve the fruit quality and also provide opportunity to increase the number of tree per unit area. (Lal *et al.*, 2000) [9]. Use of organic manures along with bio-fertilizers and inorganic fertilizers as a cheap source of available nutrient to plants has resulted in beneficial effects on growth, yield and quality of various fruit crops (Ram and Rajput, 2000) [13]. Keeping in view of above mentioned facts, the present investigation was conducted to study how nutrient levels of leaves got changed after pruning and fertilizers application.

2. Material and Methods
The present investigation was carried out at Demonstration Farm, Horticulture Nursery, Department of Horticulture, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur during 2015 to 2017. The experimental material consisted of six year old uniform plants of Guava cv. Allahabad Safeda. The trees were maintained under uniform cultural practices during the entire course of investigation. The pruning was done on 24th of May 2015 and 2016 and treatment consisted of three pruning levels, *i.e.* unpruned (P_1), pruning at 20cm from shoot apex (P_2), pruning at 40cm from shoot apex (P_3) and six fertilizers doses *i.e.* F_1Check (5 kg FYM + 2 kg Vermicompost / Plant), F_2 (5 kg FYM + 2 kg VC + *Azotobacter* 150gm /Plant), F_3 (5 kg FYM + 2 kg VC + PSB 100gm / Plant), F_4 (*Azotobacter* 150gm + PSB 100gm /

Plant), F_5 [5 kg FYM + 2 kg VC + 100% RDF {300:200:200 g NPK} / Plant], F_6 [5 kg FYM + 2 kg VC + 75% RDF{225:150:150g NPK} + *Azotobacter* 150gm + PSB 100gm / Plant]. The experiment was conducted under factorial randomized block design with three replications and six plants were kept in each treatment. The balanced pruning was performed in all directions of the canopy, which were dense and overcrowded. The (P_1) trees were left as such without pruning. As per treatments the full dose of phosphorus, potassium and organic sources i.e. FYM, Vermicompost and bio-fertilizer were applied as a basal dose in the 1st week of July, while nitrogen was applied in two split doses, one with basal dose (1st week of July) and another after one month (1st week of August) through basin method.

For plant analysis, leaf samples were collected from the third pair of leaves in tagged shoots under all treatments at the maturity stages during both years. The leaf nitrogen was determined by Kjeldahl method and phosphorus by vanado-molebdate phosphoric yellow colour method suggested by Koenig and Johnson (1942) [6]. Potassium content was estimated by flame photometer and method suggested by (Black, 1965) [1]. The data of two years were analyzed as per method suggested by (Panse and Sukhatme, 1967) [12].

3. Results and Discussions

The effect of different level of pruning intensity and nutrition which include organic, chemical and bio-fertilizers on the macronutrient status of leaves of Allahabad Safeda Guava are given in Table 1 to 3.

3.1 Nitrogen (%) content in leaves

The plants receiving 40cm and 20cm pruning from shoot apex had significantly higher leaf nitrogen content than 0cm. The highest nitrogen content (2.221%) found in pruning at 40cm was significantly higher to the lower level of pruning intensities. The results confirm the findings of (Kaith *et al.,* 2011) [5]. Higher foliar nitrogen in heavily pruned trees may be due to low yield/tree and less overall accumulation of dry matter in the leaves. Since nitrogen is mobile, its translocation to the leaves could have aided its accumulation in the leaves. Similar results were also reported by (Kumar and Thakur, 2012) [7] and (Singh *et al.,* 2010) [15]. The application of different organic, inorganic, bio-fertilizers had significantly influenced the leaf nitrogen content at maturity during both the years (Table 1). The pooled data on leaf nitrogen content clearly indicate that in almost all levels where combined application of organic and inorganic/ bio-fertilizers were applied nitrogen content was improved significantly. The maximum leaf nitrogen content (2.229%) was recorded in F_6 treated with [5 kg FYM + 2 kg VC + 75% RDF {225:150:150g NPK} + *Azotobacter* 150gm + PSB 100gm / Plant] and minimum was recorded in F_4.The increase in leaf nitrogen content due to *Azotobacter* which soften middle lamella through action of pectinolytic enzymes, thus, enhancing mineral absorption. Improvement in soil aeration and better soil moisture retention in root zone increased microbial nitrogen fixation and, thus, improved the availability of macro- and micro-nutrients. The addition of FYM and Vermicompost improved the physical conditions of soil, root development and more soil moisture retention which resulted in increased absorption of water and nutrients and, consequently improved the leaf nutrient status (Kumar *et al.,* 2016) [8]. Interestingly, in the present study, *Azotobacter +PSB* with FYM and Vermicompost with 75% dose of recommended NPK had significantly increased the N levels of leaf as compared to others. Similar findings were also reported by (Dutta *et al.,* 2014) [2] and (Shukla *et al.,* 2009) [14]. As regards, the interaction effect between pruning intensity and nutrition was found to be significant and maximum leaf nitrogen (2.297%) was found in combination of P_3F_6.

3.2 Phosphorus (%) content in leaves

The leaf phosphorus content was not influenced by pruning intensities (Table 2). There is no systematic trend was found in the level of phosphorus. This could possibly be due to the antagonism between phosphate and nitrate anions at the absorption sites. Similar results were found by (Kaith *et al.,* 2011) [5] and (Kumar and Thakur, 2012) [7]. The application of different organic, inorganic, bio-fertilizers had significantly influenced the leaf phosphorus content at maturity during both the years (Table 2). The pooled data on leaf phosphorus content clearly indicate that in almost all levels where combined application of organic and inorganic/ bio-fertilizers were applied phosphorus content was improved significantly. The maximum leaf phosphorus content (0.283%) was recorded in F_6 treated with [5 kg FYM + 2 kg VC + 75% RDF {225:150:150g NPK} + *Azotobacter* 150gm + PSB 100gm / Plant] and minimum was recorded in F_1.The P level in leaf increased by application of different composition of bio and chemical fertilizers due to the fact that phosphorus solubilizing microbes present in the soil solubilize the fixed phosphorus and make it easily available to the plant (Meena *et al.,* 2013) [10]. More availability of P under PSB treatments can be attributing to the chelating agents and form stable complexes with Fe and Al and thereby release P to the soil solution making it available for more uptake by the plants (Goswami *et al.,* 2012) [4]. Similar results were reported by (Verma and chauhan, 2013) [16]. Interaction effect between pruning intensity and nutrition was found to be non-significant.

3.3 Potassium (%) content in leaves

The leaf potassium content increased significantly with the increase in severity of pruning (Table 3). Pruning at 40cm from shoot apex plants had significantly higher leaf potassium content than others and maximum potassium content (1.172%) was found in pruning at 40cm from shoot apex and minimum (1.062%) in unpruned plants. Higher foliar potassium content in 40cm pruned plants was due to less accumulation of dry matter and vigorous growth, which caused increased uptake of this element. The results confirm the findings of (Kaith *et al.,* 2011) [5] and (Kumar and Thakur, 2012) [7]. The application of different fertilizers had significantly influenced the leaf potassium content at maturity. The pooled data on leaf potassium content clearly indicate that in almost all levels where combined application of organic and inorganic/ bio-fertilizers were applied potassium content was improved significantly. The maximum leaf potassium content (1.196%) was recorded in F_6 treated with [5 kg FYM + 2 kg VC + 75% RDF {225:150:150g NPK} + *Azotobacter* 150gm + PSB 100gm / Plant] and minimum was recorded in F_4. These results are in accordance with findings of (Dutta *et al.,* 2014) [2] and (Goswami *et al.,* (2012) [4]. The interaction effect between pruning intensity and nutrition was found to be significant and maximum leaf potassium (1.245%) was recorded in combination of P_3F_6.

Table 1: Effect of pruning intensity and Nutrition on Nitrogen (%) content in leaves

Fertilizers (Factor B)	Pruning (Factor A)											
	Year 2015-16				**Year 2016-17**				**Pooled Data**			
	P1 (0 cm)	**P2 (20 cm)**	**P3 (40 cm)**	**Mean**	**P1 (0 cm)**	**P2 (20 cm)**	**P3 (40 cm)**	**Mean**	**P1 (0 cm)**	**P2 (20 cm)**	**P3 (40cm)**	**Mean**
F_1 Check (5 kg FYM + 2 kg Vermicompost/Plant)	1.993	2.113	2.182	2.096	2.040	2.140	2.200	2.127	2.017	2.127	2.191	2.111
F_2 (5 kg FYM + 2 kg VC + *Azotobacter* 150gm/Plant)	2.060	2.150	2.213	2.141	2.110	2.190	2.240	2.180	2.085	2.170	2.226	2.160
F_3 (5 kg FYM + 2 kg VC + PSB 100gm/Plant)	2.007	2.130	2.187	2.108	2.090	2.160	2.210	2.153	2.048	2.145	2.198	2.131
F_4 (*Azotobacter* 150gm + PSB 100gm/Plant)	1.977	2.080	2.150	2.069	2.010	2.107	2.170	2.096	1.993	2.093	2.160	2.082
F_5 (5 kg FYM + 2 kg VC + 100% RDF 300:200:200 g NPK /Plant)	2.110	2.194	2.243	2.182	2.131	2.230	2.267	2.209	2.121	2.212	2.255	2.196
F_6 (5kg FYM + 2 kg VC +75% RDF 225:150:150 g NPK + *Azotobacter* 150gm + PSB 100gm/Plant)	2.140	2.222	2.284	2.215	2.160	2.260	2.310	2.243	2.150	2.241	2.297	2.229
Mean	2.048	2.148	2.210		2.090	2.181	2.233		2.069	2.165	2.221	
	Pruning	Fertilizer	Interaction		Pruning	Fertilizer	Interaction		Pruning	Fertilizer	Interaction	
SEm ±	0.003	0.004	0.008		0.002	0.004	0.006		0.002	0.003	0.005	
CD at 5%	0.009	0.013	0.022		0.007	0.010	0.017		0.006	0.009	0.015	

Table 2: Effect of pruning intensity and Nutrition on Phosphorus (%) content in leaves

Fertilizers (Factor B)	Pruning (Factor A)											
	Year 2015-16				**Year 2016-17**				**Pooled Data**			
	P1 (0 cm)	**P2 (20 cm)**	**P3 (40 cm)**	**Mean**	**P1 (0 cm)**	**P2 (20 cm)**	**P3 (40 cm)**	**Mean**	**P1 (0 cm)**	**P2 (20 cm)**	**P3 (40cm)**	**Mean**
F_1 Check (5 kg FYM + 2 kg Vermicompost/Plant)	0.197	0.207	0.220	0.208	0.210	0.207	0.217	0.211	0.203	0.207	0.218	0.209
F_2 (5 kg FYM + 2 kg VC + *Azotobacter* 150gm/Plant)	0.207	0.210	0.213	0.210	0.220	0.237	0.230	0.229	0.213	0.223	0.222	0.219
F_3 (5 kg FYM + 2 kg VC + PSB 100gm/Plant)	0.230	0.230	0.223	0.228	0.240	0.250	0.240	0.243	0.235	0.240	0.232	0.236
F_4 (*Azotobacter* 150gm + PSB 100gm/Plant)	0.210	0.210	0.217	0.212	0.220	0.220	0.233	0.224	0.215	0.215	0.225	0.218
F_5 (5 kg FYM + 2 kg VC + 100% RDF 300:200:200 g NPK /Plant)	0.257	0.250	0.253	0.253	0.273	0.270	0.260	0.268	0.265	0.260	0.257	0.261
F_6 (5kg FYM + 2 kg VC +75% RDF 225:150:150 g NPK + *Azotobacter* 150gm + PSB 100gm/Plant)	0.280	0.270	0.290	0.280	0.287	0.290	0.283	0.287	0.283	0.280	0.287	0.283
Mean	0.230	0.229	0.236		0.242	0.246	0.244		0.236	0.238	0.240	
	Pruning	Fertilizer	Interaction		Pruning	Fertilizer	Interaction		Pruning	Fertilizer	Interaction	
SEm ±	0.003	0.004	0.007		0.003	0.004	0.008		0.002	0.002	0.004	
CD at 5%	-	0.012	-		-	0.013	-		-	0.007	-	

Table 3: Effect of pruning intensity and Nutrition on Potassium (%) content in leaves

Fertilizers (Factor B)	Pruning (Factor A)											
	Year 2015-16				**Year 2016-17**				**Pooled Data**			
	P1 (0 cm)	**P2 (20 cm)**	**P3 (40 cm)**	**Mean**	**P1 (0 cm)**	**P2 (20 cm)**	**P3 (40 cm)**	**Mean**	**P1 (0 cm)**	**P2 (20 cm)**	**P3 (40cm)**	**Mean**
F_1 Check (5 kg FYM + 2 kg Vermicompost/Plant)	1.023	1.080	1.123	1.076	1.030	1.100	1.151	1.094	1.027	1.090	1.137	1.085
F_2 (5 kg FYM + 2 kg VC + *Azotobacter* 150gm/Plant)	1.050	1.113	1.153	1.106	1.070	1.141	1.200	1.137	1.060	1.127	1.177	1.121
F_3 (5 kg FYM + 2 kg VC + PSB 100gm/Plant)	1.043	1.090	1.143	1.092	1.060	1.110	1.170	1.113	1.052	1.100	1.157	1.103
F_4 (*Azotobacter* 150gm + PSB 100gm/Plant)	0.993	1.040	1.090	1.041	1.001	1.050	1.120	1.057	0.997	1.045	1.105	1.049
F_5 (5 kg FYM + 2 kg VC + 100% RDF 300:200:200 g NPK /Plant)	1.093	1.163	1.193	1.150	1.121	1.201	1.230	1.184	1.107	1.182	1.212	1.167
F_6 (5kg FYM + 2 kg VC +75% RDF 225:150:150 g NPK + *Azotobacter* 150gm + PSB 100gm/Plant)	1.110	1.200	1.220	1.177	1.143	1.230	1.270	1.214	1.127	1.215	1.245	1.196
Mean	1.052	1.114	1.154		1.071	1.139	1.190		1.062	1.127	1.172	
	Pruning	Fertilizer	Interaction		Pruning	Fertilizer	Interaction		Pruning	Fertilizer	Interaction	
SEm ±	0.002	0.003	0.006		0.002	0.003	0.005		0.002	0.002	0.004	
CD at 5%	0.006	0.009	0.016		0.006	0.009	0.016		0.005	0.006	0.011	

4. Conclusion
It is concluded that pruning intensity and bio-fertilizer had positive response on leaf nutrient status of guava cv. Allahabad Safeda. The leaf nutrient status of guava was highly influenced by pruning intensity and bio-fertilizer combinations and highest leaf N, P and K was recorded with pruning at 40cm from shoot apex (P_3) and F_6 [5 kg FYM + 2 kg VC + 75% RDF {225:150:150g NPK} + *Azotobacter* 150gm + PSB 100gm / Plant].

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