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EFFECT OF NIPPING AND GROWTH RETARDANT ON GROWTH, YIELD AND UPTAKE OF NUTRIENT OF PIGEONPEA

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ABSTRACT

The field experiment was conducted at Agronomy Farm, College of Agriculture, Nagpur during *kharif* season of 2018-2019 to study the effect of nipping and growth retardant on pigeonpea variety PKV-TARA. The experiment was laid out in randomized block design with seven treatments which replicated three times. The soil was medium black in colour, fairly deep, well drained and clayey in texture. The results revealed that nipping at 60 DAS + foliar application of mepiquat chloride @ 500 ppm at 60 DAS (T_6) was found significantly superior over rest of the treatments in respect to plant height, number of branches plant^{-1}, dry matter accumulation plant^{-1}, seed yield plant^{-1} and NPK uptake.

(Key words: Pigeonpea, nipping, growth retardant, growth and nutrient uptake)

INTRODUCTION

Pigeonpea (*Cajanus cajan* L. Millsp.) is a important legume crop, plays a vital role in daily diet and belongs to family *Leguminoceae*. It is also known as red gram, tur, arhar. It is often cross-pollinated crop (20 to 70 %) with diploid chromosome number 2n=22. Its drought tolerance and the ability to use residual moisture during the dry season make it an important crop. Food values of pigeonpea is protein 22.3%, fat 1.7 %, mineral 3.5 %, fiber 1.5 % and carbohydrates 57.5% in 100 g edible portion. It is occupying an area of 36.3 lakh ha, production of 27.6 lakh tonnes with an average productivity of 760.33 kg ha^{-1}. After gram, pigeonpea is the second most important pulse crop in the country. It accounts for about 11.8% of the total pulse area and 17% of the total pulse production of the country. In Maharashtra, the area under pigeonpea was 1.22 million hectares and production was 1.05 million tonnes and productivity was 937 kg ha^{-1} during the year 2017-18 (Anonymous, 2017).

Nipping by removing the tendrils is an important agronomic practice which helps to reduce the apical dominance. These tendrils acts as sink in the plant, thereby affecting the translocation of photosynthesis to the reproductive parts. Nipping of tendrils has been found to increase the number of branches, pod set per cent and better source-sink relation, thereby enhancing the yield of plants. (Sharma *et al*., 2003). Mepiquat chloride (MC) (l,l-dimethyl piperidinium chloride) is a gibberellic acid suppressant that is absorbed by the green portions of the plant and serves to reduce cell elongation, thus offering the potential of decreasing leaf area and restricting additional plant height. (York, 1983 and Kerby ,1985). Mepiquat chloride has also been found for enhancing earliness with regards to fruiting development (York, 1983; Kerby,1985). The aim of this study was to manage vegetative development of pigeonpea throughout the season by multiple applications of low concentrations of mepiquat chloride.

MATERIALS AND METHODS

An experiment entitled “Effect of nipping and growth retardant on pigeonpea variety PKV-TARA” was conducted at Agronomy Farm, College of Agriculture, Nagpur during *kharif* season of 2018-2019. The topography of experimental plot was leveled and the soil was medium black in color, fairly deep, well drained and clayey in texture. It was poor in available nitrogen and medium in available phosphorus and high in available potassium and slightly alkaline (pH 7.70) in reaction. The crop variety PKV-TARA was used with the spacing of 90 cm × 30 cm. Gross plot size was 5.4 m × 3.6 m and net plot size was 3.6 m × 2.7 m.

The present experiment was laid out in Randomized Block Design with seven treatments *viz.*, T_1-Control, T_2-Nipping at 60 DAS, T_3-Nipping at 90 DAS, T_4-Foliar application of mepiquat chloride @ 500 ppm at 60 DAS, T_5-Foliar application of mepiquat chloride @ 500 ppm at 90 DAS, T_6-Nipping at 60 DAS + foliar application of mepiquat chloride @ 500 ppm at 60 DAS, T_7-Nipping at 90 DAS + foliar application of mepiquat chloride @ 500 ppm at 90 DAS. These were replicated three times. The crop was sown on 17th July 2018. Observations viz., plant height, number of

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branches plant^{-1}, dry matter accumulation plant^{-1} were recorded at harvest. Seed yield plant^{-1} was also recorded. Nutrient uptake (NPK) was also calculated. Total nitrogen content in plant and seed sample was estimated by Kjeldahls method as described by Piper (1966). Phosphorus content in plant and seed was estimated by vanadomolybdate method as suggested by Piper (1966). Potassium content in plant and seed was estimated by flame photometer as suggested by Piper (1966).

Total uptake of (NPK) = Uptake by seed + Uptake by straw

$$\text{Uptake by seed (kg ha}^{-1}) = \frac{\text{Nutrient content \%} \times \text{Grain yield (kg ha}^{-1})}{100}$$

$$\text{Uptake by straw (kg ha}^{-1}) = \frac{\text{Nutrient content \%} \times \text{Straw yield (kg ha}^{-1})}{100}$$

RESULTS AND DISCUSSION

Effect of nipping and growth retardant

Plant height (cm)

The data pertaining to mean plant height as influenced by different treatments are presented in table 1. The effect of different treatments on mean plant height was found to be non significant at 30 DAS and 60 DAS. At 90 DAS, the significantly more plant height was observed with treatments, control (T_1), nipping at 90 DAS (T_3), foliar application of mepiquat chloride @ 500 ppm at 90 DAS (T_5), nipping at 90 DAS + foliar application of mepiquat chloride @ 500 ppm at 90 DAS (T_7), it might be due to apical dominance because nipping and spray of mepiquat chloride was not applied to these treatments. At 120 DAS and at harvest significantly superior plant height was observed by no nipping (T_1) treatment over rest of the treatments. Similar results were observed by Kithan and Singh (2017). They reported that as in terminal nipping practice, the apical bud is nipped and so the utilization of the photosynthates by the crop for lateral branches could be higher and this might be the reason for decreased plant height with nipping treatments. Similar results were observed by Vasudevan *et al.* (2008). They reported that decrease in plant height with pinching at 35 DAS could be ascribed to pinching of apical bud which curb the vertical growth of plant resulting in translocation of photosynthates to leaf axils thus, encouraging auxiliary branches.

Number of branches plant^{-1}

The data pertaining to number of branches plant^{-1} as influenced by different treatments are presented in table 1. From the data on mean number of branches, it was revealed that the mean number of branches increased up to harvest. Numbers of branches were significantly influenced due to different treatments at all observation stages except at 30, 60 DAS. At 90 DAS, treatments of nipping at 60 DAS + foliar application of mepiquat chloride @ 500 ppm at 60 DAS (T_6) recorded significantly higher number of branches, however, the lowest number of branches observed in no nipping and no application of mepiquat chloride i.e. control (T_1), nipping at 90 DAS (T_3), foliar application of mepiquat chloride @ 500 ppm at 90 DAS (T_5) and Nipping at 90 DAS + foliar application of mepiquat chloride @ 500 ppm at 90 DAS (T_7) treatments. It might be due to nipping of terminal bud which promoted lateral branching and ultimately have more number of branches plant^{1}. Similar results were reported by Sharma *et al*. (2003).They noted that nipping of terminal bud at 50 DAS significantly increased the number of primary and secondary branches. At 120 DAS and at harvest, nipping at 60 DAS + foliar application of mepiquat chloride @ 500 ppm at 60 DAS (T_6) recorded significantly superior number of branches, however, the lowest number of branches observed in no nipping and no mepiquat chloride application (T_1) treatments. Treatment nipping at 60 DAS + foliar application of mepiquat chloride @ 500 ppm at 60 DAS (T_6) found at par with treatments nipping at 60 DAS (T_2) and foliar application of mepiquat chloride @ 500 ppm at 60 DAS (T_4). Mepiquat chloride suppresses vegetative growth resulted in occurrence of side branches. This might be the reason for increased number of branches plant^{-1} in present investigation. This result is close conformity with Chandewar *et al.* (2016). They reported that application of 150 ppm mepiquat chloride at flowering stage was significantly increased branches plant^{-1} over control. Numbers of branches plant^{-1} were more in case of nipped plants. This might be due to nipping effect of apical buds which resulted in production of more secondary branches and restriction to vertical growth on account of effective translocation of hormones, particularly auxins which are being diverted to the potential and tertiary shoot buds which in normal conditions remain dormant (Kumar , 2018).

Dry matter accumulation plant^{-1} (g)

The data pertaining to dry matter accumulation plant^{-1} as influenced by different treatments are presented in table 1. Total dry matter plant^{-1} was significantly influenced due to different stages of nipping and application of mepiquat chloride. The effect of different treatments on mean total dry matter of plant was found to be non significant at 30 DAS and 60 DAS. At 90,120 DAS and at harvest, nipping at 60 DAS + foliar application of mepiquat chloride @ 500 ppm at 60 DAS (T_6) recorded highest total dry matter plant^{-1} over no nipping and no mepiquat chloride application. Lowest dry matter observed with the treatment T_1 i.e. control. Treatment nipping at 60 DAS + foliar application of mepiquat chloride @ 500 ppm at 60 DAS (T_6) found at par with treatments nipping at 60 DAS (T_2) and foliar application of mepiquat chloride @ 500 ppm at 60 DAS (T_4).

It might be due to nipping of terminal bud and application of mepiquat chloride which increased more number of lateral branches resulted in increased growth attributes and better utilization of available resources and

Table 1. Effect of nipping and growth retardant on growth of pigeonpea

Treatments	Plant height (cm)					Number of branches $plant^{-1}$					Dry matter accumulation $plant^{-1}$ (g)					Seed yield $plant^{-1}$ (g)
	30 DAS	60 DAS	90 DAS	120 DAS	At Harvest	30 DAS	60 DAS	90 DAS	120 DAS	At Harvest	30 DAS	60 DAS	90 DAS	120 DAS	At Harvest	At Harvest
T_1-Control	27.67	64.03	117.06	135.70	141.17	3.60	8.63	9.23	11.03	12.63	15.33	37.53	61.63	81.80	95.80	30.80
T_2- Nipping at 60 DAS	27.57	63.87	99.44	106.77	110.87	3.40	8.67	13.30	15.17	16.66	15.03	37.80	65.23	85.57	106.27	37.22
T_3- Nipping at 90 DAS	27.53	64.00	115.70	120.80	123.43	3.40	8.67	9.60	13.07	14.50	14.80	37.83	61.97	84.00	98.87	35.40
T_4- Foliar application of mepiquat chloride @ 500 ppm at 60 DAS	27.97	63.73	100.91	107.66	111.63	3.80	8.53	13.20	15.07	16.53	15.40	37.67	65.20	85.38	105.83	36.72
T_5- Foliar application of mepiquat chloride @ 500 ppm at 90 DAS	27.57	63.73	116.54	121.17	125.20	3.60	8.80	9.53	12.97	14.26	14.90	37.90	61.90	83.70	97.90	34.50
T_6- Nipping at 60 DAS+ Foliar application of mepiquat chloride @ 500 ppm at 60 DAS	27.50	64.07	97.47	105.89	110.40	3.83	8.40	13.50	15.30	17.10	15.50	37.67	65.27	85.96	106.57	38.16
T_7- Nipping at 90 DAS+ Foliar application of mepiquat chloride @ 500 ppm at 90 DAS	27.57	63.67	116.46	120.56	123.17	3.80	8.93	9.63	13.23	15.13	15.40	37.70	61.80	84.10	100.90	35.80
SE (m) ±	0.13	0.21	1.59	1.31	0.44	0.14	0.17	0.24	0.24	0.51	0.17	0.23	0.35	0.46	0.39	0.67
CD at 5 %	-	-	4.77	3.93	1.32	-	-	0.72	0.72	1.53	-	-	1.05	1.38	1.17	2.01
GM	27.62	63.87	109.08	116.94	120.84	3.63	8.66	11.14	13.69	15.26	15.20	37.73	63.29	84.36	101.73	35.51

Table 2. Effect of nipping and growth retardant on nutrient uptake in pigeonpea

Treatments	Nitrogen uptake (kg ha^{1})			Phosphorus uptake (kg ha^{1})			Potassium uptake (kg ha^{1})		
	Grain	Straw	Total	Grain	Straw	Total	Grain	Straw	Total
T_1-Control	43.10	29.89	73.00	2.63	2.15	4.78	16.37	27.68	44.05
T_2- Nipping at 60 DAS	84.01	70.63	154.64	7.50	6.34	13.84	36.51	62.91	99.42
T_3- Nipping at 90 DAS	75.50	61.32	136.83	5.86	4.62	10.47	31.65	52.79	84.44
T_4- Foliar application of mepiquat chloride @ 500 ppm at 60 DAS	77.51	65.05	142.56	7.48	6.08	13.56	33.06	56.24	89.31
T_5- Foliar application of mepiquat chloride @ 500 ppm at 90 DAS	65.11	48.33	113.44	5.71	4.26	9.98	25.82	43.68	69.50
T_6- Nipping at 60 DAS+ Foliar application of mepiquat chloride @ 500 ppm at 60 DAS	88.71	76.50	165.20	7.63	6.39	14.02	39.18	67.82	106.99
T_7- Nipping at 90 DAS+ Foliar application of mepiquat chloride @ 500 ppm at 90 DAS	77.20	61.83	139.03	7.40	5.97	13.37	32.38	53.39	85.77
SE (m) ±	1.962	3.31	4.15	0.50	0.37	0.62	0.96	1.39	2.18
CD at 5 %	5.58	9.93	12.45	1.5	1.11	1.86	2.88	4.17	6.54
GM	73.02	59.08	132.10	6.31	5.12	11.43	30.71	52.07	82.78

hence more dry matter was produced. The same findings were also reported by Kithan and Singh (2017). They reported that nipping of terminal buds at 25 days after sowing significantly increased the number of branches owing to higher dry matter accumulation compared to the plants with no nipping. It was observed that there was a significant increase in the dry matter production of leaf, stem and reproductive parts due to application of growth retardants in the present study. Similar results were reported by Anita *et al.* (2007). They noted that an increase in total dry matter production by the application of mepiquat chloride could be attributed to higher stem thickness and more number of branches.

Seed yield plant^{-1} (g)

Data presented in table 1 indicate that the seed yield plant^{-1} (g) was influenced significantly by different treatments. The mean seed yield plant^{-1} was 35.51 g plant^{-1}. Amongst, the nipping at 60 DAS + foliar application of mepiquat chloride @ 500 ppm at 60 DAS (T_6) recorded significantly maximum seed yield plant^{-1} (38.16 g), moreover, it was significantly superior over rest of the treatments but found at par with treatments nipping at 60 DAS (T_2) and foliar application of mepiquat chloride @ 500 ppm at 60 DAS (T_4). However, no nipping and no application of mepiquat chloride (T_1) recorded significantly lowest seed yield plant^{-1} (30.80g). Application of mepiquat chloride might be restricting the vegetative growth and efficiently transporting the photosynthetes towards reproductive parts, resulting in higher seed yield. Similar results were found by Chandewar *et al*. (2016). They reported that application of mepiquat chloride at flowering stage @ 150 ppm recorded higher seed yield plant^{-1} (23.9 g) which was superior over control. Gnyandev (2019) reported that plants nipped (N_1) at 30 DAS recorded significantly highest values for all the seed yield parameters. Seed yield plant^{-1} (12.65 g), plot^{-1} (1.02 kg) and ha^{-1} (28.50 q) were more with nipping treatment.

Nutrient uptake by pigeonpea

Nitrogen, phosphorus and potash uptake by plant was significantly influenced due to nipping and growth retardant (Table 2). Treatment the nipping at 60 DAS + foliar application of mepiquat chloride @ 500 ppm at 60 DAS (T_6) recorded significantly higher nitrogen (165.20 kg ha^{-1}), phosphorus (14.02 kg ha^{-1}) and potash (106.99 kg ha^{-1}) uptake over other treatments. Similarly, in pigeonpea Chandewar *et al.* (2016) noted increase in nitrogen uptake with the application of mepiquat chloride at flowering stage @ 150% RDF over RDF. Similarly, in pigeonpea Dhaka *et al.* (2018) reported that nipping at the start of branching recorded significantly higher N uptake in seed (49.5 kg ha^{-1}), straw (172.8 kg ha^{-1}), total N uptake (222.2 kg ha^{-1}) over no nipping.

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