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Effect of Pigeonpea to (*Cajanus cajan* L. Millsp.) to topping technique and potassium levels

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Abstract
The present investigation entitled "Response of pigeon pea (*Cajanus cajan* (L.) Millsp.) to topping times and potassium levels" was under taken at Department of Agronomy farm, College of Agriculture, Dhule (MS) during *kharif* season of 2017 to find out suitable topping times and potassium levels for pigeon pea. The experiment was laid out in split plot design with three replications. The treatments comprised of four topping times *viz*., no topping (T_1), topping at 30 DAS (T_2), topping at 45 DAS (T_3) and topping at 60 DAS (T_4) and four potassium levels *viz*. 00 kg K_2O ha-$^{-1}$ (P_1), 20 kg K_2O ha-$^{-1}$ (P_2), 30 kg K_2O ha-$^{-1}$ (P_3) and 40 kg K_2O ha^{-1}(P_4) were tried under study. The soil of experimental field was well drained, clayey in texture, low in available nitrogen (160 kg ha^{-1}), moderately low in available phosphorus (15.50 kg ha^{-1}), rich in available potassium (355 kg ha^{-1}). The crop was sown on 26th June 2017 by dibbling method. The full dose of P_2O_5 and N was given at the time of sowing and different levels of K_2O were given to different plots as per treatments. The different growth characters were affected significantly due to topping times. The treatment no topping (T_1) recorded significantly higher plant height (122.85 cm). The treatment topping at 45 DAS (T_3) recorded significantly maximum number of primary branches plant-$^{-1}$(15.25) and secondary branches plant-$^{-1}$ (20.03). The yield attributing characters like number of pods plant-$^{-1}$ (394.42), weight of pods plant-^{1}(161.67 g), and weight of 100 seeds (11.55 g) was recorded higher in treatment topping at 45 DAS (T_3) which was significantly more than other treatments. The highest seed yield (17.16q ha^{-1}) was also obtained from the treatment topping at 45 DAS (T_3). Similarly, recorded highest gross (97907 ha^{-1}) and net returns (56089 ha^{-1}) as well as Benefit cost ratio (2.34).
Among the potassium treatment 30 kg K_2O ha^{-1} (P_3) recorded higher values of growth and yield characteristics, i.e., number of primary branches plant^{-1}(14.10) and secondary branches plant^{-1} (18.88). The yield attributes *viz*., number of pods plant^{-1} (380.08), weight of pods plant^{-1}(157.83 g), weight of 100 seeds (11.34 g), and also seed yield (16.47 q ha^{-1}) was recorded higher by the same treatment 30 kg K_2O ha^{-1} (P_3). In terms of economics, the treatment 30 kg K_2O ha^{-1} (P_3) recorded higher gross monetary return (93867 ha^{-1}), net return (42401 ha^{-1}) and B: C ratio (2.24). The interaction effect between topping times and potassium levels were found non significant in all parameters.
On the basis of result for obtaining the highest yield and monetary returns from pigeon pea cultivation the topping at 45 DAS with application of 30 Kg K_2O ha^{-1} was found suitable.

Keywords: Pigeonpea, technique, *Cajanus cajan* L. Millsp., treatment

Introduction
Pulses occupy an indispensable place in our daily diet as a source of protein. Pulse crops also have the unique potentiality to associate symbiotically with *Rhizobium* Sp. and fix atmospheric nitrogen, thereby enriching the soil. The production of pulses has remained almost stagnant at around 13-14 million tonnes for the last many years. As a result of ever increasing population, the per capita availability of pulses has shown a sharp decline in recent years and it has come to less than 40g/day at present, against a normal requirement of 69 g/day. Pigeon pea is an important pulse crop and 91 per cent of the world's pigeon pea is produced in India. The crop is largely grown under rain fed situation, its agronomic practices are required to be standardized for realizing yield potential. Among them optimum plant population and the number of reproductive sink/plant are the key factors determining the yield. Reddy and Narayanan (1987) reported that nipping of terminal bud in sesamum activated the dormant lateral buds to produce more branches which finally resulted in yield increase. Since limited data are available on these aspects in pigeon pea, an experiment was planned to study the effect of topping on growth and yield.
The nutrient requirements are similar to rice and wheat and they thrive under varied edaphic regimes. In general, farmers apply low rates of nitrogen (N) and phosphorus (P), but potassium (K) is frequently absent from their fertilizer schedule.

This lack of K is responsible for low yields and poor crop quality because, apart from other major physiological and biochemical requirements in plant growth, K is a key nutrient element in the biosynthesis of protein in pulse crops. In view of above consideration the present investigation entitled "Response of pigeon pea (*Cajanus cajan* L. Millsp.) to topping times and Potassium Levels" was carried out the effect of increasing rates of K fertilization on yield and quality of pigeon pea adequately fertilized with other plant nutrients.

Material and Methods

A field experiment was conducted at Department of Agronomy farm, College of Agriculture, Dhule (MS) during *kharif* season of to find out suitable topping times and potassium levels for pigeon pea split plot design with three replications. The treatments comprised of four topping times *viz.*, no topping (T_1), topping at 30 DAS (T_2), topping at 45 DAS (T_3) and topping at 60 DAS (T_4) and four potassium levels *viz*. 00 kg K_2O ha^{-1} (P_1), 20 kg K_2O ha^{-1}(P_2), 30 kg K_2O ha^{-1}(P_3) and 40 kgK_2O ha^{-1}(P_4) were tried under study. The soil of experimental field was well drained, clayey in texture, low in available nitrogen (160 kg ha^{-1}), moderately low in available phosphorus (15.50 kg ha^{-1}), rich in available potassium (355 kg ha^{-1}) and slightly alkaline in reaction with pH 8.4. The gross and net plot size was 6.00 X 5.40 m^{2}and 5.20 X 3.60 m^2, respectively. The crop was sown on 26th June 2017 by dibbling method. The full dose of P_2O_5 and N was given at the time of sowing and different levels of K_2O were given to different plots as per treatments. Nipping of apical or terminal shoot was done by hand clipping at 30,45 and 60 DAS was compared with control plot (no nipping). four potassium levels *viz*. 00 kg K_2O ha^{-1} (P_1), 20 kg K_2O ha^{-1}(P_2), 30 kg K_2O ha^{-1}(P_3) and 40 kgK_2O ha^{-1} (P_4) were tested. The crop was raised following the other recommended package of practices. The growth and yield attributes *viz*., plant height, number of primary branches, secondary branches, number of pods per plant and test weight were recorded at harvest. The crop was harvested at its full maturity stage and the yield data was recorded.

Results and Discussion

Effect of topping

The topping of terminal bud at 45 DAS registered significantly maximum number of primary branches plant-^{1}(15.25) and secondary branches plant-$^{-1}$ (20.03). The yield attributing characters like number of pods plant-$^{-1}$ (394.42), weight of pods plant-^{1}(161.67 g), and weight of 100 seeds (11.55 g). Topping of terminal bud at 45 DAS significantly reduced the plant height and increased the number of primary and secondary branches, pods per plant and test weight. Similar results were reported by Mishra and Nayak (1997) in Jute crop. The increased yield components may be attributed to activation of lateral dormant buds by arresting the terminal growth through topping of terminal bud which might have facilitated the significant increase in the yield attributes. Similar findings were reported by Ramanathan and Chandrashekharan (1998) in sesamum crop.

Pigeonpea recorded a seed yield of 17.16q ha^{-1} and 16.47 q ha^{-1}when the terminal shoot was topped at 45 DAS, and fertilized with 30 kg K_2O ha^{-1}, respectively. Topping had significant influence on the seed yield. Narayanan and Narayanan (1987) also reported favourable effect of nipping on seed yield in sesame. The increase in seed yield due to topping was 10.70 per cent over the: No Topping (Table1). The reduced yield in other treatments may be attributed to reduction in growth and yield components.

Effect of potassium

Among potassium treatment 30 kg K_2O ha^{-1} (P_3) recorded higher plant height as compared to other potassium treatments The treatment 30 kg K_2O ha^{-1} (P_3) cm registered maximum number of primary branches plant^{-1}(14.10) and secondary branches plant^{-1} (18.88). The yield attributes *viz*., number of pods plant^{-1} (380.08), weight of pods plant^{-1}(157.83 g), weight of 100 seeds (11.34 g) seed yield of 16.47 q ha^{-1}when the fertilized with 30 kg K_2O ha^{-1}.

The highest gross income (Rs. 97907 ha^{-1}), net income (Rs. 56089 ha^{-1}) and benefit cost ratio (2.34) was realized when topping was done at 45 DAS and fertilized with 30 kg K_2O ha^{-1}. Roy and Singh (1992) also reported higher seed yield and net returns in chickpea when plants were nipped at 30 or 40 days after sowing.

The potassium treatment 30 kg K_2O ha^{-1} (P_3) recorded highest gross income (Rs. 93867 ha^{-1}), net income (Rs. 52049 ha^{-1}) and benefit cost ratio (2.24) was obtained with treatment fertilized 30 kg K_2O ha^{-1}.

Effect of interaction

The interaction effect between topping times and potassium levels were found non significant in all parameters.

On the basis of result for obtaining the highest yield and monetary returns from pigeon pea cultivation the topping at 45 DAS with application of 30 Kg K_2O ha^{-1} was found suitable.

Table 1: Effect of topping and potassium levels on growth, yield and yield attributes of pigeonpea

Treatment	Plant height (cm)	Number of primary branches plant^{-1}	Number of Secondary branches plant^{-1}	Number of pods plant^{-1}	Wt. of pods plant^{-1} (g)	100 seed weight (g)	Seed yield (q ha^{-1})
A. Topping(T)							
T_1: No Topping	204.81	12.32	17.40	372.17	150.45	11.5	15.50
T_2: Topping at 30 DAS	210.42	14.30	18.99	377.17	154.75	11.12	15.78
T_3: Topping at 45 DAS	214.08	15.25	20.03	394.42	161.67	11.55	17.16
T_4: Topping at 60 DAS	204.33	13.48	18.35	357.33	143.92	10.56	15.91
SE(m) ±	0.60	0.53	0.55	3.76	1.75	0.14	0.29
CD at 5%	2.077	1.85	NS	13.02	6.07	0.49	1.02
B. Potassium Levels(P)							
P_1: 00 Kg K_2O ha^{-1}	207.34	13.63	18.41	371.08	150.83	10.89	15.95
P_2: 20 Kg K_2O ha^{-1}	209.22	13.73	18.51	379.83	151.45	11.18	16.29
P_3: 30 Kg K_2O ha^{-1}	210.25	14.10	18.88	380.08	157.83	11.34	16.47
P_4: 40 Kg K_2O ha^{-1}	206.83	13.82	18.60	372.00	152.67	11.80	16.35
SE(m) ±	0.96	0.97	0.97	3.24	3.13	0.14	0.66

CD at 5%	NS	NS	NS	NS	NS	NS	NS
C. Interaction							
A x B							
SE(m) ±	1.92	1.94	1.94	6.48	6.26	0.28	1.33
CD at 5%	NS	NS	NS	NS	NS	NS	NS
B x A							
SE(m) ±	1.76	1.76	1.77	6.75	5.70	0.28	1.19
CD at 5%	NS	NS	NS	NS	NS	NS	NS
General Mean	208	13.82	18.80	375.27	152.70	11.07	15.84

Table 2: Gross income, Cost of cultivation, net income and benefit cost ratio of Pigeonpea as influenced by topping and potassium levels

Treatment	Cost of cultivation (₹ ha^{-1})	Gross monetary returns (₹ ha^{-1})	Net monetary returns (₹ ha^{-1})	B: C ratio
A. Topping (T)				
T_1: No Topping	41672	88206	46388	2.11
T_2: Topping at 30 DAS	42377	89884	48066	2.15
T_3: Topping at 45 DAS	42377	97907	56089	2.34
T_4: Topping at 60 DAS	42377	91638	49820	2.19
SE(m) ±	-	1849	1849	-
CD at 5%	-	5547	5547	-
B. Potassium Levels (P)				
P_1: 00 Kg K_2O ha^{-1}	41794	89844	48026	2.15
P_2: 20 Kg K_2O ha^{-1}	42206	91115	49297	2.18
P_3: 30 Kg K_2O ha^{-1}	42401	93867	52049	2.24
P_4: 40 Kg K_2O ha^{-1}	42619	92808	50990	2.22
SE(m) ±	-	2746	2746	-
CD at 5%	-	NS	NS	-
C. Interaction				
A x B				
SE(m) ±	-	5493	5493	-
CD at 5%	-	NS	NS	-
B x A				
SE(m) ±	-	5104	5104	-
CD at 5%	-	NS	NS	-
General Mean	41818	91909	50091	2.20

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