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Effect of different herbicides on growth, yield and available N in pigeon pea growing soil

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Abstract
A field experiment was conducted during *kharif* season of 2020-21 at Mega Seed, Pulses and Castor Research Unit, Navsari Agricultural University, Navsari to study the effect of different herbicide on growth, yield and available N in pigeon pea growing soilunder large plot technique design. Pendimethalin 1000 g a.i./hashowed significantly higher plant height and number of plant branches at 60,90 DAS and seed yield and stalk yield at harvest whereas it was remained at par with treatment of pendimethalin 2000 g a.i./ha followed by all the treatment except control. The treatment *i.e.* application of pendimethalin 2000 g a.i./ha showed significantly highest available N in soil at 60, 90 DAA and at the time of harvest it was remained at par with treatment of pendimethalin 1000 g a.i./ha followed by control, Imazethapyr 150 g a.i./ha, Imazethapyr 75 g a.i./ha and oxyfluorfen 250 g a.i./ha respectively.

Keywords: Pigeon pea, growth, yield, available N

Introduction
Pigeon pea [*Cajanus cajan* (L.) Millsp.] Commonly known as red gram, tur or arhar is originated in Asian continent. Pigeon pea is cultivated in tropical and sub-tropical areas between 30^0 N and 30^0 S Latitude. Pigeon pea is the fifth prominent legume crop in the world. India being the largest producer of pigeon pea in the world contributes around 92% of the world's total production (FAOSTAT, 2013) [4]. After Chickpea (39%), pigeon pea (21%) is second most important pulse crop grown in India. Maharashtra, Madhya Pradesh, Karnataka, Uttar Pradesh, Gujarat and Jharkhand were the prominent pigeon pea producing states in India covering approximately an area of 4.46 M ha put of total arable land was involved in pigeon pea production during 2020 having production and productivity of 3.83 MT and 859 kg/ ha, respectively (Anon, 2020a) [1]. In Gujarat, it occupies an area of 212.70 thousand ha and production of 210.69 thousand tones with productivity 990.54 kg/ha during 2020 (Anon, 2020b) [2].

The pigeon pea is subjected to several abiotic and biotic stresses. Pigeon pea is also heavily affected with weeds which compete with pigeon pea for growth factors like nutrients, moisture and also provide shelter to insect pests. The critical period of crop weed competition is during the first eight weeks after sowing. Therefore, it is imperative to manage weeds and pest at proper time with suitable methods to obtain maximum grain yield. Chemical weed control is one of the potential alternatives to control the weed infestation in many crops due to other socio-economic factors like non-availability of working force, high labour cost as well as consistently varying climatic conditions *etc.*

In the last few decades, the predominant weed control method in many parts of the world concerns the use of effective and reliable chemical herbicides. Pendimethalin, oxyfluorfen and imazethapyr are two pre-emergence and post emergence herbicides, mainly used in crop cultivation. The addition of chemical substance may disturb the soil equilibrium and thus fertility of the soil. Soil microbes are involved in different soil processes such as recycling of essential plant nutrients; humus formation and hence in maintaining soil structure stability. Soil fertility depends on type of microorganisms involved in transformation and translocation of available N in soil**.**Therefore, field experiments were conducted to find out effective weed control by which herbicide and its effect on available N and yield of pigeon pea.

Material and Method
The present study was conducted at the Mega Seed, Pulses and Castor Research Unit, Navsari Agricultural University, Navsari during *kharif* season of 2020-2021. Navsari Agricultural University campus is geographically located at 20° 57' N latitude and 72° 54' E longitude at an

altitude of 10 meters above the Mean Sea Level. The soil of the experimental field was clay with pH value 7.5 to 7.7, electrical conductivity 0.40 to 0.49 dS/m, organic carbon 0.68%, available N 258.42 to 264.12 kg/ha, available P 40.23 to 45.80 kg/ha and available K 350.36- 378.44 kg/ha. Total seven treatments of soil applied herbicides *viz*. T_1 (Control), T_2pendimethalin 30% EC (1000 g a.i./ha), T_3pendimethalin 30% EC (2000 g a.i./ha), T_4oxyfluorfen 23.5 EC% (125 g a.i./ha), T_5oxyfluorfen 23.5% EC (250 g a.i./ha), T_6 imazethapyr 10% SL (75 g a.i./ha), T_7imazethapyr 10% SL (150 g a.i./ha) were taken. Pigeon pea variety '*GT-102'* were sown at 12 kg seed per hectare, respectively. Pre-emergence herbicides (pendimethalin and oxyflourfen) were applied in the next day after sowing of the crop while post-emergence herbicide (imazethapyr) was applied 25 days after sowing the crop.

Weeds were allowed to grow freely in the control plots throughout the cropping season. Other crop management practices followed as per recommendations for the region. Treatment wise soil samples are collected on 5, 10, 20, 30, 60, 90 and days after application of herbicides and at the time of harvest from experimental field.

The samples collected from each treated plots were analyzed for periodical available N in soil. Various observations recorded periodically during the course of experiment, analyzed statistically by using analysis of variance technique appropriate to large plot technique. The treatment differences were tested for significance by 'F' test and the data in which the treatment effects were found significant the appropriate standard error of mean and the critical different were worked out at 5% level of significance.

Result and Discussion

Plant Height

The result revealed that there is no significant effect of different herbicide treatments on plant height were recorded at 30 DAA. The differences in height of the pigeon pea at 60 and 90 days after sowing were found to be significant. The treatment of pendimethalin 1000 g a.i./ha (T_2) showed significantly higher plant height 115.11 cm and 133.11 cm at 60 and 90 DAA, respectively and remained at par with treatment of pendimethalin 2000 g a.i./ha followed by imazethapyr 75g a.i./ha, imazethapyr 150g a.i./ha, oxyfluorfen 125 g a.i./ha and oxyfluorfen 250 g a.i./ha. The lowest plant height 92.28 cm at 30 DAA and 108.15 cm at 60 and 90 DAA were observed under T_1 (Control).It reflects that slow initial growth of pigeon pea encourage rapid growth and severe infestation of weeds. Hence, initial period of 6-8 weeks of pigeon pea are critical in terms of crop weed competition and for the control of weeds by application of different herbicide in the field that indirectly reduce the competition for water, space, sunlight and nutrient for the pigeon pea and reflect in the plant height.

In order to maximize yield, it is an essential for the crop to utilize equitably and efficiently all available resources *viz.*, water, nutrient, light and CO_2. This could be achieved by optimum plant population and plant height. Initial plant height (30 DAA) was not affected significantly due to weed competition. However, plant height at 60 and 90 DAA of plant height was affected significantly due to applications of different herbicides. Ratnam *et al.* (2011) [8] reported that significantly highest plant height of chickpea were recorded in PRE application of pendimethalin @ 1500 g a.i./ha followed by imazethapyr @ 63 g a.i./ha at 15 DAS. Singh and Sekhon (2013) [10] reported that significantly higher plant height of pigeon pea were recorded in pendimethalin 0.75 kg a.i./ha followed by pendimethalin 0.45 kg a.i./ha as pre emergence. Significantly highest plant height of pigeon pea in PRE application of pendimethalin @ 1000 g a.i./ha followed by imazethapyr @ 75 g a.i./ha at 45 DAS, imazethapyr @ 100 g a.i./ha at 45 DAS, reported by Kumar *et al.* (2020) [6]. These findings are in agreement with the present investigation.

Number of Plant Branches

The results obtained from number of branches per plant revealed that the plant branches recorded on 30, 60 and 90 DAA was not affected significantly by different herbicide application. However, the statistically significant effect of different herbicides on plant height was observed on later phase (60, 90 DAA). The result indicated that there was no significant effect of different herbicide treatments on number of branches/plant recorded at 30 DAA. The treatment pendimethalin 1000 g a.i./ha (T_2) showed significantly higher number of branches/plant *i.e*. 9.80 and 18.60 at 60 and 90 DAA, respectively and remained at par with imazethapyr 75 g a.i./ha at 60 DAA while at 90 DAA it remain at par with all the treatment except control.

However, the lowest numbers of branches/plant was observed in T_1 (Control) *i.e*. 5.60, 6.20 and 12.00 at 30, 60 and 90 DAA, respectively. Singh and Sekhon (2013) [10] reported that significantly higher plant branches of pigeon pea were recorded in pendimethalin 0.75 kg a.i./ha as Pre emergence followed by pendimethalin 0.45 kg a.i./ha. Chandrakar *et al.* (2018) [3] revealed that significantly higher number of plant branches (30, 60, 90 and at harvest) of chickpea were recorded in pendimethalin 1.0 kg a.i./ha as pre emergence. These findings are in agreement with the present investigation.

Stalk Yield and Seed Yield

The result presented in Table 3revealed that stalk yield and seed yield of pigeon pea was significantly influenced due to different treatments of herbicides. Significantly higher stalk and seed yield was recorded under the treatment pendimethalin 1000 g a.i./ha (T_2) at harvest and stood at par with the treatment of pendimethalin 2000 g a.i./ha, imazethapyr 75g a.i./ha, imazethapyr 150g a.i./ha, oxyfluorfen 125 g a.i./ha and oxyfluorfen 250 g a.i./ha. except control. The lowest stalk and seed yield of pigeon pea was recorded under untreated control treatment (T_1).The significant higher yield was observed in treatments which received herbicides over untreated control. This might be due herbicide treated plot have comparatively higher weed control over untreated control plots. This may also facilitates the better availability of moisture, nutrients and solar energy reflecting in higher vegetative growth. Similar finding were also established by Meena *et al.* (2010) [11] reported that number of pods per plant, grain and stover yield of pigeon pea higher yield was recorded with pendimethalin 900 g a.i./ha as pre emergence. Ratnam *et al.* (2011) [8] reported that significantly highest yield attributes and grain yield of chickpea were recorded in PRE application of pendimethalin @ 1500 g a.i./ha followed by imazethapyr @ 63 g a.i./ha at 15 DAA. Similar result was reported by Rai *et al.* (2016) [7] in pigeon pea. Khanna *et al.* (2012) [5] found significantly higher grain yield of pigeon pea in pendimethalin 0.75 kg a.i./ha as pre emergence followed by 0.45 kg a.i./ha. Similar result was recorded by Singh and Singh and Sekhon (2013) [10]. Kumar *et al.* (2020) [6] reported

that significantly highest yield and yield attributes of pigeon pea were recorded in PRE application of pendimethalin @ 1000 g a.i./ha followed by imazethapyr @ 75 g a.i./ha at 45 DAS, imazethapyr @ 100 g a.i./ha at 45 DAS. These findings are in agreement with the present investigation.

Available N

The observation of available N from each period were analysed statistically and the results are present in Table 4. The result revealed that there was no significant effect of herbicide treatment on available N in soil recorded at different time intervals except available N recorded on 60, 90 and at the time of harvest. The treatment (T_3) *i.e.* application of pendimethalin 2000 g a.i./ha showed significantly highest available N in soil at 60, 90 DAA and at the time of harvest, respectively and remained at par with treatment of pendimethalin 1000 g a.i./ha followed by control (T_1), imazethapyr 150 g a.i./ha (T_6), imazethapyr 75 g a.i./ha (T_7) and oxyfluorfen 250 g a.i./ha (T_5) respectively. The lowest values of available N in soil were observed in treatment of oxyfluorfen 125 g a.i./ha (T_4).

Among all the treatments, higher available N content in soil was observed in treatment of pendimethalin. It may be due to effective weed control due to pendimethalin and thereby loss of N through uptake of weeds is reduced. Further, correlation between pendimethalin and microbial population and pendimethalin and N content in soil was positive. Saha *et al.* (2015) [9] reported that that application of both pendimethalin and oxyfluorfen exhibited a stimulatory effect on ammonification by significant increasing ammonical N up to the 45th day and had an adverse effect on nitrification (NO_3−N) up to 7–30 days. The decline in nitrification was more prominent with both pendimethalin and oxyfluorfen application in black soil of peanut field.

Table 1: Effect of different herbicide on plant height at 30, 60 and 90 DAA

Treatment	Plant height (cm)		
	30 DAA	60DAA	90 DAA
T_1: Control	45.27	92.28	108.15
T_2: Pendimethalin 1000 g a.i./ha	50.22	115.11	133.11
T_3: Pendimethalin 2000 g a.i./ha	49.55	113.48	129.43
T_4: Oxyfluorfen 125 g a.i./ha	47.45	105.88	121.54
T_5: Oxyfluorfen 250 g a.i./ha	46.17	103.94	114.28
T_6: Imazethapyr 75g a.i./ha	49.76	112.75	131.48
T_7: Imazethapyr 150g a.i./ha	48.31	110.66	129.83
SEm±	2.66	5.04	6.010
CD at 5%	NS	14.58	17.41
CV%	12.35	10.45	10.84

Table 2: Effect of different herbicide on number of branches/plant at 30, 60 and 90 DAA

Treatment	Number of branches per plant		
	30 DAA	60 DAA	90 DAA
T_1: Control	5.60	6.20	12.00
T_2: Pendimethalin 1000 g a.i./ha	6.60	9.80	18.60
T_3: Pendimethalin 2000 g a.i./ha	6.40	9.40	17.40
T_4: Oxyfluorfen 125 g a.i./ha	6.20	8.20	16.80
T_5: Oxyfluorfen 250 g a.i./ha	6.00	6.60	15.80
T_6: Imazethapyr 75g a.i./ha	6.40	9.40	18.40
T_7: Imazethapyr 150g a.i./ha	6.20	8.20	16.40
SEm±	0.32	0.53	1.18
CD at 5%	NS	1.52	3.41
CV%	11.57	14.26	15.98

Table 3: Effect of different herbicide on dry pod and stalk yield of pigeon pea

Treatment	Yield (kg/ha)	
	Seed	Stalk
T_1: Control	938	2979
T_2: Pendimethalin 1000 g a.i./ha	1468	4438
T_3: Pendimethalin 2000 g a.i./ha	1424	4271
T_4: Oxyfluorfen 125 g a.i./ha	1285	3888
T_5: Oxyfluorfen 250 g a.i./ha	1279	3870
T_6: Imazethapyr 75g a.i./ha	1360	4113
T_7: Imazethapyr 150g a.i./ha	1302	3940
SEm±	89.86	277.30
CD at 5%	273	841
CV%	12.03	12.23

Table 4: Effect of different herbicides on periodical available N in soil

T.	Available N in soil (kg/ha)						
	5DAA	10DAA	20 DAA	30 DAA	60 DAA	90 DAA	H
T_1	264.15	251.86	270.36	260.81	263.68	265.12	263.12
T_2	269.36	273.41	271.58	255.86	264.78	266.70	264.70
T_3	267.49	291.33	281.68	263.58	267.46	267.69	265.69
T_4	263.04	259.40	256.38	233.30	220.36	223.18	221.18
T_5	268.42	278.05	257.79	235.79	242.89	257.81	255.81
T_6	267.65	273.67	268.50	246.48	250.17	251.04	249.04
T_7	269.11	264.70	276.15	252.92	261.58	261.71	259.71
SEm±	6.82	7.82	9.53	9.01	9.40	8.94	8.94
CD at 5%	NS	NS	NS	NS	28.50	27.11	27.11
CV%	4.42	5.01	6.14	6.25	6.43	6.04	6.09

Conclusion

Application of all the herbicidal treatments significantly increase plant height, number of plant branches, stalk yield, seed yield and available N in pigeon pea growing soil compared with unweeded control. The order of growth and yield attributes by different herbicides is as following: Pendimethalin > imazethapyr > oxyfluorfen. The treatment of pendimethalin 1000 g a.i./hash owed significantly number of plant branches, stalk yield, seed yield and available N. Overall, application of pendimethalin, oxyfluorfen and imazethapyr at recommended dose has no any pronounce impact on microbial population and available N content in soil.

References

1. Anonymous. Fourth Advance Estimates of Production of Commercial Crops. Department of Agriculture, Cooperation and Farmers Welfare, Directorate of Economics & Statistics 2020a.
2. Anonymous. Final advance estimate of A, P, Y of *kharif* and *rabi* crops of Gujarat state. Directorate of agriculture, Gandhinagar, Gujarat 2020b.
3. Chandrakar S, Raj VC, Chandrakar M. Effect of weed management on weeds and yield of chickpea varieties under south Gujarat conditions. Trends in Biosciences 2018;11(3):383-385.
4. FAO STAT 2013. http://faostat.fao.org.
5. Khanna Veena, Singh Guriqbal, Sharma Poonam, Kaur Harpreet. Influence of Herbicides on Rhizobium Growth and its Symbiosis with Pigeonpea, Trends in Biosciences 2012;5(2):133-135.
6. Kumar A, Dhaka AK, Kumar S, Singh S, Singh A. Influence of imidazolinones alone and in combination on pigeonpea (*Cajanus cajan* L.) Indian Journal of Agricultural Sciences 2020;90(7):1319-22.

7. Rai CL, Tiwari RK, Sirothia P, Pandey S. Intercropping and weed management effects on weed dynamics, productivity and economics of pigeon pea. Indian Journal of Weed Science 2016;48(1):44–47.
8. Ratnam M, Rao AS, Reddy TY. Integrated weed management in chickpea (*Cicerarietinum* L.). Indian Journal of Weed Science 2011;43(1&2):70-72.
9. Saha A, Ahammed Shabeer Banerjee K, Hingmire S, Bhaduri D, Jain NK, Utture S. Simultaneous analysis of herbicides pendimethalin, oxyfluorfen, imazethapyr and Quizalofop-p-ethyl by LC–MS/MS and Safety evaluation of their harvest time residues in peanut (*Arachishypogaea* L.). Journal of Food Science and Technology 2015;52(7):4001-4014.
10. Singh, Sekhon. Integrated Weed Management in Pigeonpea [*Cajanus cajan* (L.)]. World Journal of Agricultural Sciences 2013;9(1):86-91.
11. Meena Babulal, Sagarka BK, Pisal RR. Efficacy of new herbicides in *kharif* pigeonpea under south Saurashtracondition. Indian Journal of Weed Science 2010;42(1-2):98-100.