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EFFECT OF WEED MANAGEMENT PRACTICES ON GROWTH AND YIELD OF PIGEONPEA [*CAJANUS CAJAN* (L.) MILLSP.]

B. S. VINUTHA* AND M. B. PATIL
Department of Agronomy,
College of Agriculture, Vijayapur, University of Agricultural Sciences, Dharwad - 580 005, Karnataka, INDIA
e-maill: vinuthabs6250@gmail.com

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***Corresponding author**

ABSTRACT
A field experiment was conducted during *kharif*, 2014 at Agriculture Research Station, Almel to evalvate the optimum dosage and efficacy of new molecules of herbicides used alone or in combination with cultural methods for better management of weeds in pigeon pea. Ten treatments were replicated thrice in Randomized Complete Block Design (RCBD). Significantly higher seed and stalk yield of pigeon pea was recorded in the treatment which received application of pendimethalin 38.7% C.S @ 1.0 kg a.i. ha^{-1} (PE) *fb* imazethapyr + imaza mox 70% WG (POE) @ 70 g a.i. ha^{-1} and one inter cultivation at 60 DAS (19.31 and 44.42 q ha^{-1}, respectively). Growth parameters viz., plant height (143. 93 cm), number of primary branches (14.50), total dry matter (136.74 g $plant^{-1}$) and yield parameters like number of pods per plant (128.43 $plant^{-1}$) and 100 seed weight (12.60 g) of pigeonpea were also increased significantly with application of pendimethalin 38.7% C.S @ 1.0 kg a.i. ha^{-1} (PE) *fb* imazethapyr + imazamox 70% WG (POE) @ 70 g a.i. ha^{-1} and one intercultivation at 60 DAS as compared to weedy check. Combination of pre and post emergence herbicides along with manual/mechanical method of weed control has resulted in significant increase in growth and yield of pigeonpea.

INTRODUCTION

Pigeonpea [*Cajanus cajan* (L.) Millsp.] is one of the important pulse crops in the world and widely grown throughout the tropics in Africa, America, Australia, Hawaii, West Indies, Srilanka and China. Pigeonpea is commonly known as red gram, *tur* or *arhar* and it is the fifth prominent legume crop in the world and second in India after chickpea occupying 14.5 per cent of area and 15.5 per cent of total pulse production (Mishra *et al*., 2011). In India, it occupies an area of 3.90 m ha with a production of 3.38 m t and average productivity of 871 kg per ha which is far below the world's average productivity (1049 kg ha^{-1}). In Karnataka, it occupies an area of 0.66 m ha with a production of 0.63 m t and average productivity is 950 kg per ha (Anon., 2013).

Pigeonpea is grown during *kharif* season after the onset of monsoon. Sole pigeonpea gets heavily infested with weeds due to wider row and plant to plant spacing; these weeds compete with pigeonpea for growth factors like nutrients, moisture and gave shelter to insect pests. The yield loss in sole pigeonpea due to weeds was 32 to 90 % (Talnikar *et al*., 2008). The critical period of crop weed competition is during the first eight weeks after sowing. Therefore, it is imperative to manage weeds at proper time with suitable methods to obtain maximum grain yield. Weeding by mechanical methods is very common and sometimes these methods becomes very difficult to accomplish because of frequent rains coupled with non-availability of labours in time. Under such conditions, use of herbicides to control the weeds is only the best option to reduce the losses caused by weeds (Manu, 2013). In many advanced countries, herbicide usage for control of weeds in crop lands has been proved successful and is now gaining importance in Indian agriculture. With this background the present study was undertaken to give an efficient weed management package to the pigeonpea growing farmers in order to achieve better yields under rain fed conditions.

MATERIALS AND METHODS

A field experiment to find out the optimum dosage and efficacy of different herbicides used alone or in combination with cultural methods for better management of weeds in pigeonpea during *kharif*, 2014 at Agriculture Research Station, Almel. The soil of experiment site is medium deep black soil having pH 7.90 with low in available nitrogen (154.00 Kg ha^{-1}), medium in available phosphorous (24.00 Kg ha^{-1}) and potassium (287 Kg ha^{-1}) status.

The treatments comprised of Pendimethalin 38.7% C.S @ 1.0 kg a.i. ha^{-1} (PE) *fb* two inter cultivations (30 and 60 DAS), Pendimethalin 38.7% C.S @ 1.0 kg a.i. ha^{-1} (PE) imazethapyr 10% SL @ 100 g a.i. ha^{-1} (POE) and one inter cultivation at 60 DAS, Pendimethalin 38.7% C.S @ 1.0 kg a.i. ha^{-1} (PE) *fb* imazethapyr + imazamox 70% WG (POE) @ 70 g a.i. ha^{-1} and one inter cultivation at 60 DAS, Oxyfluorfen 23.5% E.C @ 125 g a.i. ha^{-1} (PE) *fb* two inter cultivations (30 and 60 DAS), Oxyfluorfen 23.5% E.C @ 125 g a.i. ha^{-1} (PE) *fb* imazethapyr 10% SL @ 100 g a.i. ha^{-1} (POE) and one inter cultivation at 60 DAS, Oxyfluorfen 23.5% E.C @ 125 g a.i. ha^{-1} (PE) *fb* imazethapyr + imazamox 70% WG (POE) @ 70 g a.i. ha^{-1} and one inter cultivation at 60 DAS, RPP (Pendimethalin 30% E.C @ 1.0 kg a.i ha^{-1} (PE) + one inter cultivation at 25 DAS), Farmers practice (One hand weeding at 25 DAS and two inter

cultivations at 45 and 60 DAS), weed free and weedy check treatments replicated thrice under Randomized Complete Block Design (RCBD). The required amount of herbicides for the experimentation was calculated by using the following formula.

$$F = \frac{R \times 100 \times A}{\text{Purity } \% \times 10{,}000}$$

Where,

F = Formulated product required in kg or litre ha^{-1}.

R = Dose in a.i. kg ha^{-1} to be sprayed (recommended rate).

A = Area to be sprayed (m^2).

The calculated amount of herbicide was sprayed to each treatment using knapsack sprayer with flat fan nozzle WFS 72 with a spray volume of 750 litres of water per ha. The pre-emergence herbicides *viz*., pendimethalin and oxyfluorfen were sprayed uniformly one day after sowing of the crop. The post emergence herbicides *viz*., imazethapyr and imazethapyr + imazamox (combi product) were applied uniformly when weeds were at 3-4 leaf stage as per the treatment. Hand weeding was carried out on bunds side and paths whenever the weeds emerged in order to keep the experimental site clean. Hand weeding and inter cultivation was done as per the treatment requirement. The data on growth parameters, dry matter production and its distribution were recorded from 5 randomly selected plants at 30, 60, 90 and 120 days after sowing. Other biometric observations (yield and yield parameters) are taken as per the standard procedure. The crop was sown on 14th July 2014 and harvested on 20th December 2014.

RESULTS AND DISCUSSION

Effect on growth parameters

Weed free and weedy check treatments recorded significantly higher and lower growth parameters viz., plant height, number of primary branches and total dry matter production. Among different weed management treatments, application of pendimethalin 38.7% C.S @ 1.0 kg a.i. ha^{-1} (PE) *fb* imazethapyr + imazamox 70% WG (POE) @ 70 g a.i. ha^{-1} and one inter cultivation at 60 DAS recorded significantly higher plant height (13. 93 cm), number of primary branches (14.50) and total dry matter production (136.74 g $plant^{-1}$) and it was on par with treatment which received farmers practice (One hand weeding at 25 DAS and two inter cultivations at 45 and 60 DAS) (141.33 cm, 11.93 and 117.49 g $plant^{-1}$, respectively) and application of oxyfluorfen 23.5% E.C @ 125 g a.i. ha^{-1} (PE) *fb* imazethapyr + imazamox 70% WG (POE) @ 70 g a.i. ha^{-1} and one inter cultivation at 60 DAS (141.07 cm, 12.07 and 127.59 g $plant^{-1}$, respectively) (Table 1). Increase in growth parameters was due to the reduced weed infestation in early stage of crop and resulted in less competition between crop and weed for growth factors. All these have to be enabled the crop to draw more nutrients and moisture during pre-flowering stage finally leading to more primary branches per plant (Basavraj Kumbar *et al*. 2014). More number of leaves per plant has higher photosynthetic area, accumulates more dry matter in plant parts and resulted in higher total dry matter content. This is in line with the findings of Yadav and Singh (2009).

Effect on yield and yield parameters

Weed free and weedy check treatments recorded significantly higher and lower yield & yield attributing parameters. Among different weed management treatments, significantly higher seed and stalk yield was recorded in treatment which received application of pendimethalin 38.7% C.S @ 1.0 kg a.i ha^{-1} (PE) *fb* imazethapyr + imazamox 70% WG (POE) @ 70 g a.i ha^{-1} and one inter cultivation at 60 DAS (19.31 and 44.42 q ha^{-1}, respectively) (Table 2). Significantly higher seed and stalk yield in these treatments were attributed due to application of herbicides controlled the weeds in early growth stages of crop and followed by inter cultivation at 60 DAS efficiently controlled post emergent weeds in later stages and it has created

Table 1: Effect of different weed management practices on growth parameters of pigeonpea

Treatment	Plant height at 120 DAS (cm)	No. of primary branches at 90 DAS	Total dry matter production (g) at 120 DAS
T_1:Pendimethalin 38.7% C.S @ 1.0 kg a.i. ha^{-1} (PE) *fb* two intercultivations (30 and 60 DAS)	131.30	10.40	96.31
T_2:Pendimethalin 38.7% C.S @ 1.0 kg a.i. ha^{-1} (PE) *fb* imazethapyr 10% SL @ 100 g a.i ha^{-1} (POE) and one intercultivation at 60 DAS	132.50	11.07	98.82
T_3:Pendimethalin 38.7% C.S @ 1.0 kg a.i. ha^{-1} (PE) *fb* imazethapyr + imazamox 70% WG (POE) @ 70 g a.i ha^{-1} and one inter cultivation at 60 DAS	143.93	14.50	136.74
T_4: Oxyfluorfen 23.5% E.C @ 125 g a.i. ha^{-1} (PE) *fb* two inter cultivations (30 and 60 DAS)	129.07	10.30	88.78
T_5: Oxyfluorfen 23.5% E.C @ 125 g a.i. ha^{-1} (PE) *fb* imazethapyr 10% SL @ 100 g a.i. ha^{-1}(POE) and one inter cultivation at 60 DAS	138.87	11.60	107.95
T_6: Oxyfluorfen 23.5% E.C @ 125 g a.i. ha^{-1} (PE) *fb* imazethapyr + imazamox 70% WG (POE) @ 70 g a.i ha^{-1} and one inter cultivation at 60 DAS	141.07	12.07	127.59
T_7: RPP (Pendimethalin 30% E.C @ 1.0 kg a.i ha^{-1} (PE) + one inter cultivation at 25 DAS)	125.77	9.80	76.07
T_8: Farmers practice (One hand weeding at 25 DAS and two inter cultivations at 45 and 60 DAS)	141.23	11.93	117.49
T_9: Weed free check	150.63	15.07	158.57
T_{10}: Weedy check (Control)	98.20	7.33	63.73
S.Em ±	3.48	0.93	8.55
C.D.at 5%	10.17	2.71	24.97

*DAS = days after sowing, PE = pre emergence, POE = post emergence, *fb* = followed by

Table 2: Effect of different weed management practices on yield and yield parameters of pigeonpea

Treatment	No. of pods plant^{-1}	100 seed weight (g)	Seed yield (q ha$^{-1)}$	Stalk yield (q ha^{-1})
T_1:Pendimethalin 38.7% C.S @ 1.0 kg a.i. ha^{-1} (PE) *fb* two intercultivations (30 and 60 DAS)	101.40	11.80	15.61	36.74
T_2:Pendimethalin 38.7% C.S @ 1.0 kg a.i. ha^{-1} (PE) *fb* imazethapyr 10% SL @ 100 g a.i.ha^{-1} (POE) and one intercultivation at 60 DAS	110.57	11.80	16.85	39.58
T_3:Pendimethalin 38.7% C.S @ 1.0 kg a.i. ha^{-1} (PE) *fb* imazethapyr + imazamox 70% WG (POE) @ 70 g a.i. ha^{-1} and one intercultivation at 60 DAS	128.43	12.60	19.31	44.42
T_4: Oxyfluorfen 23.5% E.C @ 125 g a.i. ha^{-1} (PE) *fb* two intercultivations (30 and 60 DAS)	91.13	11.43	12.08	29.52
T_5: Oxyfluorfen 23.5% E.C @ 125 g a.i. ha^{-1} (PE) *fb* imazethapyr 10% SL @ 100 g a.i. ha^{-1} (POE) and one intercultivation at 60 DAS	115.67	11.93	15.12	37.47
T_6: Oxyfluorfen 23.5% E.C @ 125 g a.i. ha^{-1} (PE) *fb* imazethapyr + imazamox 70% WG (POE) @ 70 g a.i. ha^{-1} and one intercultivation at 60 DAS	123.73	12.30	17.98	42.58
T_7: RPP (Pendimethalin 30% E.C @ 1.0 kg a.i ha^{-1} (PE) + one intercultivation at 25 DAS)	87.80	10.97	11.52	28.25
T_8: Farmers practice (One hand weeding at 25 DAS and two intercultivations at 45 and 60 DAS)	121.40	12.33	17.80	41.18
T_9: Weed free check	137.33	12.60	20.94	48.45
T_{10}: Weedy check (Control)	60.27	9.40	6.50	16.19
S.Em ±	8.47	0.46	1.37	1.78
C.D.at 5%	24.73	1.34	4.01	5.21

*DAS = days after sowing, PE = pre emergence, POE = post emergence, *fb* = followed by

a congenial conditions for crop to come up well under weed free situation and resulted in higher yield. This was evidenced from the findings of (Channappagoudar and Biradar, 2007 and Vyas *et al.,* 2003). Higher nutrient uptake by crop due to selective nature of herbicide during early growth stage of the crop minimized the crop-weed competition (Basavraj Kumbar *et al.,* 2014). Thus crop plants might have used available resources effectively throughout the crop growth stages resulting in higher seed and stalk yield. Results obtained in this study are in conformity with findings of Poonia and Pithia (2013).Yield parameters like number of pods per plant and 100 seed weight were significantly higher in treatment which received application of pendimethalin 38.7% C.S @ 1.0 kg a.i. ha^{-1} (PE) *fb* imazethapyr + imazamox 70% WG (POE) @ 70 g a.i. ha^{-1} and one inter cultivation at 60 DAS (128.43 plant^{-1}and 12.60 g, respectively). It was due to higher primary branches having more flowers per plant and resulted in more pod formation per plant. This also confirms the earlier findings of Nagaraju and Mohankumar (2009). The higher 100 seed weight is due to more seed size as evidenced by better utilization of resources by the crop, because of weed suppression (Chauhan *et al.,* 1999). The findings are in line with the results of Veeresh Hatti *et al*. (2014). Pigeonpea yields can be increased significantly to the tune of 30 per cent more by adopting this combination of cultural method with pre and post emergent herbicides application at right periods of crop growth.

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