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Bioefficacy of herbicides in groundnut (*Arachis hypogaea* L.) + Pigeonpea [*Cajanus cajan* (L.) Millsp.] (4:1) intercropping system

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Abstract
A field experiment was conducted during *kharif*, 2016-17 at Agriculture College Farm, UAS Raichur on clay loam soil with a view to find a suitable herbicide for groundnut + pigeonpea intercropping system. The lower total weed density, total weed dry weight and weed index was recorded with application of pendimethalin 38.7 % CS @ 750 g ha^{-1}PE fb imazethapyr + imazamox 70% WG@ 70 g ha^{-1} (POE) at 20-25 DAS + IC at 45 DAS. Higher weed control efficiency was recorded in pendimethalin 38.7 % CS @ 750 g ha^{-1}PE fb imazethapyr + imazamox 70% WG@ 70 g ha^{-1} (POE) at 20-25 DAS)+ IC at 45 DAS (47.74 %). Whereas, significantly higher plant height, total dry matter production, leaf area, leaf area index, number of pods per plant, pod weight, pod, haulm, seed, stalk, husk yield and groundnut equivalent yield was recorded with application of pendimethalin38.7 % CS @ 750 g ha^{-1}PE fb imazethapyr + imazamox 70% WG@ 70 g ha^{-1} (POE) at 20-25 DAS)+ IC at 45 DAS followed by pendimethalin 38.7 % CS @ 750 g ha^{-1}PE fb imazethapyr 10 % SL @ 75 g ha^{-1}POE (at 20-25 DAS)+ IC at 45 DAS.

Keywords: Bio efficacy, herbicides, weed management

Introduction
Intercropping has become a popular practice with the farmers, as it acts as means of insurance in the event of unfavourable conditions. Weed control in intercropping is important as in sole crops since weeds are additional competitors for resources in an already strained system. Groundnut + pigeonpea intercropping systemis prevalent on Semi-arid tropic areas. Groundnut + pigeonpea intercropping is advantageous because groundnut being a short duration crop utilizes resources effectively early in the season. Pigeonpea being a long duration crop can utilise the resources during the post monsoon period, so the competition between two crops does not exist.

Physical or mechanical methods are traditional methods of weed control in groundnut and pigeonpea. Often 2-3 hand weeding are required to keep the crop weed free. Manual weeding is difficult due to continuous rains and increased cost of operation and scarcity of labour (Guggari *et al*., 1995) [3]. Controlling weeds by hand or intercultural operation alone cannot control weeds during crop growth period right from the very early initial stage. Further, weeding cannot be carried out quickly and at required stage in cropped area during the season due to labour scarcity and expensive wages. Hence there is a need to follow an alternative and appropriate method of weed management practices particularly at early stage of crop growth. Chemical weed management using herbicides in cultivated agricultural crops has opened new vistas. The herbicides use efficiency has found to be higher when applied with other mechanical weed control practices. Certain herbicides can be applied as pre and post emergence which help in checking weed growth in early stages of crop growth. The further weed population if any could easily be kept under check by fallowing certain cultural practices like manual hand weeding and intercultivation. So, keeping these facts in view, the present study was undertaken to find the bioefficacy of herbicides in groundnut + pigeonpea (4:1) intercropping system.

Materials and Methods
An experiment was conducted during *kharif* 2016-17 University of Agricultural Sciences, Raichur.

The data of prevailing climatic parameters were collected from meteorological station located within one kilometre from experimental area. Climate is sub-tropical, average annual rainfall was 628.9 mm. The total rainfall received during June 2016 to March 2017 was 755.2 mm.

The soil of experiment site was deep black (sand 20 % silt 22.80 % and clay 57.20 %) with a bulk density of 1.29 Mg m^{-3} having pH 8.12 and electrical conductivity of 0.26 ds m^{-1}. The soil was medium in organic carbon (0.65 %), medium in available nitrogen status (223 kg ha^{-1}), medium in available P_2O_5 (55.6 kg ha^{-1}) and high in available K_2O(180.8 kg ha^{-1}). The overall pest and disease incidence during entire crop growth period was below the threshold level. The crop was sown on July, 2016 by manual line sowing at spacing 30 cm X 10 cm and 150 cm X 18 cm (groundnut and pigeonpea, respectively).The variety K-9 and TS-3R selected for study.

Experiment included twelve treatments were laid out in Randomized Complete Block Design (RCBD) with three replications. FYM at 10 t ha was applied 15 days prior to sowing and recommended fertilizer (25: 75: 25 N:P:K ha^{-1})was adopted in the study. Five herbicides were used, *viz*., pendimethalin 38.7% CS, alachlor 50 % EC and pedimethalin 30% + imazethpyr (2%) (Premix) was applied as pre emergence spray to the soil surface as per treatment on the next day after sowing. The herbicides were applied using knapsack sprayer and sufficient quantity of moisture was maintained in the soil at the time of application. imazethpyr (10% SL) @ 75 g ha^{-1} and Imazethapyr + Imazamox 70% WG (Premix) @ 70 g a.i. ha^{-1} were applied as post emergent foliar spray as per the treatment, between 20-25 Days after sowing.

The Weed index (WI) and weed control efficiency (WCE %) were calculated using following formulae

Weed control efficiency (WCE) denotes the magnitude of reduction in weed dry weight due to weed control treatments. It was calculated by using the formula given by Patel *et al.* (1987) and expressed in percentage.

$$WCE\ (\%) = \frac{DMC - DMT}{DMC} X\ 100$$

Where,
WCE = Weed control efficiency (%)
DMC = Dry matter of weeds in weedy check plot (g)
DMT =Dry matter of weed in treated plots (g)

Weed Index

It indicates the reduction in crop yield due to crop weed competition as compared to weed free plots. Weed index was worked out by using the formula given by Gill and Vijaya Kumar (1969) [2].

$$WI\ (\%) = \frac{X - Y}{X} X\ 100$$

Where,
WI = Weed index (%)
X = Grain yield of weed free plot (kg ha^{-1})
Y = Grain yield of treated plot (kg ha^{-1})

Groundnut equivalent yield

Seed yield of pigeonpea obtained from different treatments were converted into groundnut pod equivalent on the basis of local market prices one month after harvest.

$$GEY\,(kg\ ha^{-1}) = \frac{\text{Seed yield of pigeonpea (kg ha}^{-1}\text{)}\ X\ \text{Price (Rs. kg}^{-1}\text{)}}{\text{Groundnut price (Rs.kg}^{-1}\text{)}} + \text{Pod yield of groundnut (kg ha}^{-1}\text{)}$$

The economics of all the treatments were calculated by considering the prevailing prices of inputs and produce. Weed data were subjected to square root transformation to normalize their distribution before statistical analysis. The experimental data were analysed statistically by following Fischer's method of analysis of variance wherever 'F' test was significant at p=0.05 the results have been compared among treatments based on critical difference at same level of significance.

Results and Discussion

At 60 DAS, significantly lower plant height (17.7 cm) was recorded in weedy check (T_{12}: 17.7 and 76.5 cm in groundnut and pigeonpea, respectively). Whereas, significantly higher plant height was recorded in weed free check (T_{11}:36.6 and 103.9). Among herbicide treatments, significantly higher plant height was recorded with application of pendimethalin 38.7 % CS @ 750 g ha^{-1} as pre emergence followed by imazethapyr + imazamox 70% @ 70 g ha^{-1} as post emergence at 20 DAS+ IC at 45 DAS (T_6) compared to other herbicide treatments. This could be due to better control of weeds at all the stages of crop growth which created congenial environment for both the crops. The results are in conformity with the findings of Sasikala *et al.* (2006) [8]. Table 1.

Significantly lower total dry matter production was recorded in weedy check in groundnut (T_{12}: 10.4 and 19.2 g $plant^{-1}$ in groundnut and pigeonpea, respectively) compared to other treatments. However, it was on par with alachlor 50 % EC @ 1000 g ha^{-1} PE + IC at 45 DAS in groundnut (T_2: 12.28, g $plant^{-1}$ at 60 DAS and pigeonpea 25.7g $plant^{-1}$ at 45, 90, 135 DAS and at harvest, respectively). Nevertheless, significantly higher dry matter production was recorded in weed free check in groundnut (T_{11}: 23.33 and 50.7 g $plant^{-1}$ in groundnut and pigeonpea, respectively). However, it was on par with application of pendimethalin 38.7 % CS @ 750 g ha^{-1} PE fb imazethapyr + imazamox 70% WG (Premix) @ 70 g ha^{-1} POE (at 20-25 DAS) + IC at 45 DAS in groundnut (T_6: 21.37 and 48.2g $plant^{-1}$ groundnut and pigeonpea, respectively). The increase in the dry matter of groundnut and pigeonpea attributed to decreased weed population and lesser dry weight of weeds resulting in decreased competition by weeds for moisture, light, space and nutrients. The lowest total dry matter production per plant was recorded in weedy check (T_{12}). The results are in line with the findings of Komal *et al.* (2015) [4] in greengram.

At 60 of groundnut and 90 DAS of pigeonpea, significantly higher leaf area $plant^{-1}$ was recorded in weed free check in groundnut (6.8, and 6.48 in groundnut and pigeonpea, respectively). However, it was on par with application of pendimethalin 38.7 % CS @ 750 g ha^{-1} PE fb imazethapyr + imazamox 70% WG @ 70 g ha^{-1} POE (at 20-25 DAS) + IC at 45 DAS (T_6) and pendimethalin 38.7 % CS @ 750 g ha^{-1} PE fb imazethapyr 10 % SL @ 75 g ha^{-1} POE (at 20-25 DAS) + IC at 45 DAS (T_5). Significantly lower leaf area $plant^{-1}$ was recorded in weedy check in groundnut (3.5 and 2.16 dm^2 in groundnut and pigeonpea, respectively). However, it was on

par with application of alachlor 50 % EC @ 1000 g ha^{-1} PE + IC at 45 DAS (T_2) in groundnut (3.79, 3.20 dm^2 in groundnut and pigeonpea respectively).

Significantly lower leaf area index was recorded in weedy check in groundnut (T_{12}: 1.16 and 0.08 in groundnut and pigeonpea, respectively). Nevertheless, significantly higher leaf area index was recorded in weed free check (T_{11}) was on par with the application of pendimethalin 38.7 % CS @ 750 g ha^{-1} PE fb imazethapyr + imazamox 70% WG @ 70 g ha^{-1} POE (at 20-25 DAS) + IC at 45 DAS in groundnut (T_6: 2.23 and 0.22, in groundnut and pigeonpea, respectively) and pendimethalin 38.7 % CS @ 750 g ha^{-1} PE fb imazethapyr 10 % SL @ 75 g ha^{-1} POE (at 20-25 DAS) + IC at 45 DAS in groundnut (T_5: 2.19 and 0.22 in groundnut and pigeonpea, respectively).

This might be due to persistence of the assimilatory surface area is pre-requisite, and this over a prolonged period resulted in higher photosynthetic activity and ultimate productivity. Leaf area being the photosynthetic surface plays a vital role in production and availability of photosynthates. The results was confirmed by earlier work in groundnut (Samant and mshra, 2014) [7].

Weed free check recorded significantly higher pod yield (T_{11}:1790 kg ha^{-1}) which was 133 percent higher over weedy check. Among the herbicide treatments, significantly higher pod yield was recorded with application of pendimethalin38.7 CS @ 750 g ha^{-1}PE fb imazethapyr + imazamox70% WG (premix) @ 70 g ha^{-1}POE at 20-25 DAS(T_6:1590 kg ha^{-1}) which was about 107 per higher over weedy check. However, it was on par with application of pendimethalin38.7 % CS @ 750 g ha^{-1}PE fb imazethapyr 10 % SL @ 75 g ha^{-1}POE at 20-25 DAS + IC at 45 DA3S(T_5:1515 kg ha^{-1}) which was 97.2 per cent higher over weedy check (T_{12}). and it was on par with application of pendimethalin30 % EC+ imazethapyr2 % (Premix) @ 1000 g ha^{-1}POE 20-25 DAS + IC at 45 DAS (T_9:1470 kg ha^{-1}) and about 86.4 per cent increase in the yield over weedy check. (T_{12}). Significantly lower pod yield was recorded in weedy check (T_{12}: 768 kg ha^{-1}). This might be due to timely and effective control of weeds right from germination of crops by pre emergence herbicides coupled with post emergence herbicides along with the inter cultivation which provided weed free environment to the groundnut and pigeonpea resulting in higher yields than other treatments.

Application of pendimethalin38.7 % CS @ 750 g ha^{-1}PE fb imazethapyr+ imazamox70% WG (Premix) @ 70 g ha^{-1}POE (at 20-25 DAS) + IC at 45 DAS recorded significantly higher haulm yield (T_6: 1752 kg ha^{-1}), However, it was on par with rest of the treatments except, application of alachlor 50 % EC @ 1000 g ha^{-1}PE + IC at 45 DAS(T_2), imazethapyr10 % SL @ 75 g ha^{-1}POE at 20-25 DAS + IC at 45 DAS(T_3) and imazethapyr+ imazamox70 % WG (Premix) @ 70 g a i ha^{-1}POE + IC at 45 DAS (T_4) and hand weeding at 20 DAS + IC at 45 DAS(T_{10}) (1600,1500, 1550, and 1570 kg ha^{-1}respectively). Weedy check recorded significantly lower haulm yield (T_{12}: 1100 kg ha^{-1}) than all other weed management practices.

Among herbicide treatments, significantly higher seed yield was recorded with application of pendimethalin38.7% CS @ 750 g ha^{-1}PE fb imazethapyr+ imazamox70% WG (premix) @ 70 g ha^{-1}POE at 20-25 DAS(T_6:1301 kg ha^{-1}) However, it was on par with pendimethalin 38.7 % CS @ 750 g ha^{-1}PE fb imazethapyr10 % SL @ 75 g ha^{-1}POE (at 20-25 DAS+ IC at 45 DAS(T_5: 1275 kg ha^{-1}), pendimethalin 30 % EC+ imazethapyr 2 % (Premix) @ 1000 g ha^{-1}POE 20-25 DAS+ IC at 45 DAS (T_9:1252 kg ha^{-1}) and weed free check(T_{11}:1376 kg ha^{-1}). Significantly lower seed yield was recorded in weedy check (T_{12}:723 kg ha^{-1}).

In general, there was an increase in the seed yield due to application of Pendimethalin38.7% CS @ 750 g ha^{-1}PE imazethapyr+ imazamox70% WG (premix) @ 70 g ha^{-1}POE at 20-25 DAS (T_6) to the extent of 79.94 % over weedy check which was highly conspicuous.

The results indicated that significantly lower stalk yield was recorded in weedy check (T_{12}: 1505 kg ha^{-1}) compared to other treatments. Among herbicide treatments, application of pendimethalin38.7% CS @ 750 g ha^{-1}PE fb imazethapyr+ imazamox 70% WG (Premix) @ 70 g ha^{-1}POE at 20-25 DAS+ IC at 45 DAS (T_6) recorded significantly higher stalk yield (2560 kg ha^{-1}) compared to other treatments. However, it was on par with the application of pendimethalin 38.7 % CS @ 750 g ha^{-1}PE fb imazethapyr 10 % SL @ 75 g ha^{-1}POE (at 20-25 DAS) + IC at 45 DAS(T_5), pendimethalin30 % EC+ imazethapyr 2 % (Premix) @ 1000 g ha^{-1}POE (20-25 DAS) + IC at 45 DAS(T_9), Alachlor 50 % EC @ 1000 g ha^{-}PE fb imazethapyr + imazamox 70 % WG 20DAS +IC at 45 DAS(T_8) and alachlor 50 % EC @ 1000 g ha^{-1}PE fb imazethapyr 10 % SL @ 75 g ha^{-1}POE20-25 DAS +IC at 45 DAS(T_7)and weed free check (T_{11}) (1905, 2312, 2105, 1942 and 2470 kg ha^{-1} respectively). Table 2.

The results indicated that application of pendimethalin 38.7 % CS @ 750 g ha^{-1}PE fb imazethapyr + imazamox 70% WG (Premix) @ 70 g ha^{-1}POE at 20-25 DAS + IC at 45 DAS (T_6) recorded significantly higher groundnut equivalent yield (2760.9 kg ha^{-1}) as compared to rest of the treatments except application of pendimethalin38.7 % CS @ 750 g ha^{-1}PE fb imazethapyr 10 % SL @ 75 g ha^{-1}POE at 20-25 DAS + IC at 45 DAS (T_5: 2662.5) and weed free check (T_{11}: 3028.4 kg ha-1). Significantly lower groundnut equivalent was recorded in weedy check (T_{12}: 1418.7 kg ha-1). While, rest of the treatments were intermediate.

This might be due to timely and effective control of weeds right from germination of crops by pre emergence herbicides coupled with post emergence herbicides along with the inter cultivation which provided weed free environment to the groundnut and pigeonpea resulted in higher yields than other treatments. The results of this study confirmed the earlier findings of Dhonde *et al*. (2009) [1], Komal *et al*. (2015) [4].

Significantly higher number of pods per plant was recorded in weed free check (T_{11}: 23) which was on par with application of pendimethalin 38.7 % CS @ 750 g ha^{-1} PE fb imazethapyr + imazamox 70% WG (Premix) @ 70 g ha^{-1} POE (at 20-25 DAS) + IC at 45 DAS (T_6) and pendimethalin 38.7 % CS @ 750 g ha^{-1} PE fb imazethapyr 10 % SL @ 75 g ha^{-1} POE (at 20-25 DAS) + IC at 45 DAS (T_5) and pendimethalin 30 % EC+ imazethapyr 2 % (Premix) @ 1000 g ha^{-1} POE (20-25 DAS) + IC at 45 DAS (T_9) alachlor 50 % EC @ 1000 g ha^{-} PE fb imazethapyr + imazamox 70 % WG (Premix) @ 70g a.i. ha^{-1} POE + IC at 45 DAS (T_8) (22.1, 20.1, 19.8 and 19.5, respectively). Weedy check (T_{12}) recorded significantly lower number of pods per plant (10.3) which was on par with application of alachlor 50 % EC @ 1000 g ha^{-1} PE + IC at 45 DAS (T_2) and imazethapyr 10 % SL @ 75 g ha^{-1} POE (at 20-25 DAS)+ IC at 45 DAS (T_3) and imazethapyr + imazamox 70 % WG (Premix) @ 70 g a i ha^{-1} POE (at 20-25) DAS + IC at 45 DAS (T_4) (11.6, 12.9 and 14.10, respectively).

Significantly higher pods weight (g plant^{-1}) was recorded in weed free check (T_{11}: 36.60 g) which was on par with application of pendimethalin 38.7 % CS @ 750 g ha^{-1} PE fb imazethapyr + imazamox 70% WG (Premix) @ 70 g ha^{-1} POE

(at 20-25 DAS) + IC at 45 DAS (T_6), pendimethalin 38.7 % CS @ 750 g ha^{-1} PE fb imazethapyr 10 % SL @ 75 g ha^{-1} POE (at 20-25 DAS) + IC at 45 DAS (T_5), pendimethalin 30% EC+ imazethapyr 2% (Premix) @ 1000 g ha^{-1} PE + IC at 45 DAS (T_9) and alachlor 50 % EC @ 1000 g ha^{-} PE fb imazethapyr + imazamox 70 % WG (Premix) @ 70g a i ha^{-1} POE + IC at 45 DAS (T_8) (34.3, 31.3, 31 and 30.7 g respectively). Nevertheless, weedy check (T_{12}) recorded significantly lower pods weight (16.67 g plant^{-1}) than all herbicide treatments and weed free check except with application of alachlor 50 % EC @ 1000 g ha^{-1} PE + IC at 45 DAS (T_2) and imazethapyr 10 % SL @ 75 g ha^{-1} POE (at 20-25 DAS)+ IC at 45 DAS (T_3) and imazethapyr + imazamox 70 % WG (Premix) @ 70 g a. i. ha^{-1} POE (at 20-25) DAS +IC at 45 DAS (T_4), (18.6, 19.0 and 19.70 g respectively).

The major monocot weeds observed in the experiment plot were *Cynodon dactylon*, *Dactyloctenium aegyptium*, *Digitaria marginata*, *Erogrostis gangetica* and *Panicum spp*., while common broad-leaved weeds observed were *Tribulus terrestris*, *Abutilon indicum*, *Amaranthus viridis*, *Digeriaa rvensis*, *Euphorbia hirta*, *Lagasca mollis*, *Leucus aspera*, *Mimosa pudica*, *Parthenium hysterophorus*, *Portulaca oleracea*, *Phyllanthus niruri*, *Tridax procumbens* and *Trichodesma spp*, no sedge weed appeared in the experiment

At 60 DAS, significantly higher total weed density was recorded in weedy check (T_{12}: 15.21m^{-2}) compared to other weed management practices. Nevertheless, there was no significant difference was observed with respect to dicot weed density among herbicide treatments. Significantly lower number of dicot weeds was recorded in weedy check (T_{11}: 0.71 m^{-2}). Table 3.

At 60 DAS, significantly higher total dry weight of weeds was recorded in weedy check (10.14 m^{-2}) compared to other treatments. However, there was no significant difference was observed with respect to total weed density among herbicide treatments. Significantly lower total dry weight of weeds (T_{12}: 0.71 g m^{-2}) recorded in weed free check.

At 60 DAS, there was slight decrease in weed population and dry weight of weeds was because of inter cultivation carried out at 45 DAS. The significant effect of herbicides in combination with inter cultivation can be ascribed to the broad spectrum weed control as the herbicides have controlled specific weeds and inter cultivation removed the weeds which were not controlled by herbicides. The results are in conformity with the findings of Tiwari *et al.* (2006) and Singh *et al.* (2014).

At 60 DAS, significantly higher weed control efficiency (91.31 %) was recorded with application of pendimethalin 38.7 % CS @ 750 g ha^{-1}PE fb imazethapyr + imazamox 70% WG @ 70 g ha^{-1} POE (at 20-25 DAS) + IC at 45 DAS (T_6), which was on par with rest of the treatments.

The result showed that weedy check recorded higher weed index (T_{11}: 57.09 % and 47.46 % in groundnut and pigeonpea respectively). Among herbicide treatments, lower weed index was recorded with application of pendimethalin38.7 % CS @ 750 g ha^{-1}PE fb imazethapyr + imazamox 70% WG (Premix) @ 70 g ha^{-1}POE (at 20-25 DAS) + IC at 45 DAS (T_6: 11.47 and 5.45 % in groundnut and pigeonpea, respectively) and pendimethalin38.7 % CS @ 750 g ha^{-1}PE fb imazethapyr 10 % SL @ 75 g ha^{-1}POE (at 20-25 DAS) + IC at 45 DAS) (T_5), (15.36 and 7.34 % in groundnut and pigeonpea, respectively).

This might be due to combination of both cultural and chemical methods which was found to be more effective in suppressing the weed density as well as weed dry matter. Higher weed indices in the weedy check this reduction in yield might be attributed to higher density of monocots, dicots and higher dry matter production of weeds under weedy check. These results are confirmatory with the findings of Rao *et al.* (2010) [6] and Komal *et al*. (2015) [4].

Table 1: Plant height, total dry matter production, leaf area and leaf area index of groundnut and pigeonpea as influenced by different weed management practices in groundnut+ pigeonpea intercropping system

Treatment	Plant height (cm)		Total dry matter production (g plant^{-1})		Leaf area plant^{-1})		Leaf area index	
	GN	PP	GN	PP	GN	PP	GN	PP
T_1: Pendimethalin 38.7 % CS @ 750 g ha^{-1} PE + IC at 45 DAS	28.9	86.2	17.15	32.40	5.60	3.70	1.86	0.137
T_2: Alachlor 50 % EC @ 1000 g ha^{-1} PE + IC at 45 DAS	25.6	79.3	12.28	25.70	3.79	3.20	1.26	0.11
T_3: Imazethapyr 10 % SL @ 75 g ha^{-1} POE (at 20-25 DAS)+ IC at 45 DAS	27.0	81.3	14.90	29.80	5.00	3.47	1.66	0.12
T_4: Imazethapyr + Imazamox 70 % WG (Premix) @ 70 g a i ha^{-1} POE (at 20-25 DAS) + IC at 45 DAS	27.3	83.5	16.07	31.20	5.50	3.64	1.83	0.13
T_5: Pendimethalin 38.7 % CS @ 750 g ha^{-1} PE fb Imazethapyr 10 % SL @ 75 g ha^{-1} POE (at 20-25 DAS)+ IC at 45 DAS	33.6	100.9	21.04	46.50	6.50	5.94	2.19	0.22
T_6: Pendimethalin 38.7 % CS @ 750 g ha^{-1} PE fb Imazethapyr + Imazamox 70% WG@ 70 g ha^{-1} POE (at 20-25 DAS) + IC at 45 DAS	34.6	101.1	21.37	48.20	5.70	6.00	2.23	0.22
T_7: Alachlor 50 % EC @ 1000 g ha^{-1} PE fb Imazethapyr 10 % SL @ 75 g ha^{-1} POE (at 20- 25 DAS) + IC at 45 DAS	29.4	88.7	17.38	33.00	6.10	3.80	1.90	0.14
T_8: Alachlor 50 % EC @ 1000 g ha^{-} PE fb Imazethapyr + Imazamox 70 % WG (Premix) @ 70g a i ha^{-1} POE + IC at 45 DAS	31.8	90.5	18.40	37.00	6.16	4.32	2.05	0.16
T_9: Pendimethalin 30 % EC+ Imazethapyr 2% (Premix) @ 1000 g ha^{-1} PE + IC at 45DAS	32.1	95.6	20.24	44.20	6.39	5.25	2.13	0.20
T_{10}: One hand weeding at 20 DAS + IC at 45 DAS	33.4	88.8	17.85	41.90	6.70	4.05	2.03.	0.15
T_{11}: Weed free check	36.6	103.9	23.33	50.70	6.8	6.48	2.26	0.24
T_{12}: Weedy check	17.7	76.5	10.40	19.20	3.5	2.16	1.16	0.08
S.Em±	1.5	3.5	1.42	1.88	0.10	0.40	0.02	0.01
CD (p=0.05)	4.5	10.3	4.14	5.51	0.30	1.20	0.07	0.03

PE= Pre emergence, POE= Post emergence, IC= Intercultivation, DAS= Days after sowing, SL= Soluble liquid, EC= Emulsifiable concentrates, WG= Wettable granules, SC= Soluble concentrates, a.i = Active ingredient, WCE – Weed control efficiency, GN=Groundnut, PP=Pigeonpea

Table 2: Pod yield, haulm yield of groundnut and seed, stalk, husk yield of pigeonpea and groundnut equivalent yield of groundnut as influenced by different weed management practices in groundnut+ pigeonpea intercropping system

Treatment	Yield(kg ha^{-1})				GEY (Kg ha^{-1})	Number of pods per plant		Pod weight (g)	
	Groundnut		Pigeonpea						
	Pod Yield	Haulm Yield	Seed Yield	Stalk yield		GN	PP	GN	PP
T_1: Pendimethalin 38.7 % CS @ 750 g ha^{-1}PE + IC at 45 DAS	1304	1680	1020	2287	2222	14.20	85.00	23.30	35.01
T_2: Alachlor 50 % EC @ 1000 g ha^{-1}PE + IC at 45 DAS	1120	1600	917	1864	1945	11.60	36.40	18.60	22.89
T_3: Imazethapyr 10 % SL @ 75 g ha^{-1}POE (at 20-25 DAS)+ IC at 45 DAS	1210	1500	965	1780	2078	12.90	36.80	19.00	23.10
T_4: Imazethapyr + Imazamox 70 % WG (Premix) @ 70 g a i ha^{-1}POE (at 20-25 DAS) + IC at 45 DAS	1295	1550	996	1840	2191	14.10	50.40	19.70	25.80
T_5: Pendimethalin 38.7 % CS @ 750 g ha^{-1}PE fb Imazethapyr 10 % SL @ 75 g ha^{-1}POE (at 20-25 DAS) + IC at 45 DAS	1515	1730	1275	1905	2662	20.10	114.90	31.30	47.01
T_6: Pendimethalin 38.7 % CS @ 750 g ha^{-1}PE fb Imazethapyr + Imazamox 70%WG@ 70 g ha^{-1}POE (at 20-25 DAS) + IC at 45 DAS	1590	1752	1301	2560	2760	22.10	124.80	34.30	50.60
T_7: Alachlor 50 % EC @ 1000 g ha^{-1}PE fb Imazethapyr 10 % SL @ 75 g ha^{-1}POE (at 20-25 DAS) + IC at 45 DAS	1305	1690	1094	1942	2289	16.80	88.70	25.00	35.60
T_8: Alachlor 50 % EC @ 1000 g ha^{-}PE fb Imazethapyr + Imazamox 70 % WG (Premix) @70ga i ha^{-1}POE (at 20-25 DAS)+ IC at 45 DAS	1377	1650	1230	2105	2484	19.50	95.50	30.70	36.60
T_9: Pendimethalin 30% EC+ Imazethapyr 2% (Premix) @ 1000 g ha^{-1}PE + IC at 45DAS	1470	1720	1252	2312	2588	19.80	107.00	31.00	45.20
T_{10}: One hand weeding at 20 DAS + IC at 45 DAS	1360	1570	1182	1750	2423	17.00	92.50	27.30	36.00
T_{11}: Weed free check	1790	1895	1376	2470	3028	23.00	125.70	36.60	53.80
T_{12}: Weedy check	768	1100	723	1505	1418	10.30	22.90	16.67	16.80
S.Em±	42	49	44	224	180	1.47	3.75	2.39	1.11
CD (p=0.05)	124	144	130	657	505	4.30	11.02	7.02	3.24

PE= Pre emergence, POE= Post emergence, IC= Intercultivation, DAS= Days after sowing, SL= Soluble liquid, EC= Emulsifiable concentrates, WG= Wettable granules, SC= Soluble concentrates, a.i = Active ingredient, WCE = Weed control efficiency, GEY- Groundnut equivalent yield, GN=Groundnut, PP=Pigeonpea

Table 3: Total weed density, Total weed dry weight, weed control efficiency and Weed index of groundnut and pigeonpea as influenced by different weed management practices in groundnut+ pigeonpea intercropping system

Treatment	Total weed density (No. m^2)	Total weed dry weight (g plant^{-1})	Weed control efficiency (%)	Weed index	
				Groundnut	Pigeonpea
T_1: Pendimethalin 38.7 % CS @ 750 g ha^{-1} PE + IC at 45 DAS	4.06 (16)	4.04 (15.9)	87.30	27.15	25.87
T_2: Alachlor 50 % EC @ 1000 g ha^{-1} PE + IC at 45 DAS	4.41 (19)	4.21 (17.3)	85.45	37.43	33.36
T_3: Imazethapyr 10 % SL @ 75 g ha^{-1} POE (at 20-25 DAS)+ IC at 45 DAS	4.06 (16)	4.32 (18.2)	85.84	32.40	29.87
T_4: Imazethapyr + Imazamox 70 % WG (Premix) @ 70 g a i ha^{-1} POE (at 20-25 DAS) + IC at 45 DAS	3.80 (14)	4.53 (20.1)	86.62	27.65	27.62
T_5: Pendimethalin 38.7 % CS @ 750 g ha^{-1} PE fb Imazethapyr 10 % SL @ 75 g ha^{-1} POE (at 20-25 DAS)+ IC at 45 DAS	3.24 (10)	3.24 (10.0)	90.23	15.36	7.34
T_6: Pendimethalin 38.7 % CS @ 750 g ha^{-1} PE fb Imazethapyr + Imazamox 70% WG@ 70 g ha^{-1} POE (at 20-25 DAS) + IC at 45 DAS	3.08 (9)	3.07 (8.9)	91.31	11.17	5.45
T_7: Alachlor 50 % EC @ 1000 g ha^{-1} PE fb Imazethapyr 10 % SL @ 75 g ha^{-1} POE (at 20-25 DAS) + IC at 45 DAS	3.53 (12)	3.56 (12.2)	87.79	27.09	20.49
T_8: Alachlor 50 % EC @ 1000 g ha^{-} PE fb Imazethapyr + Imazamox 70 % WG (Premix) @ 70g a i ha^{-1} POE + IC at 45 DAS	3.53 (12)	3.76 (13.7)	89.45	23.07	10.61
T_9: Pendimethalin 30 % EC+ Imazethapyr 2% (Premix) @ 1000 g ha^{-1} PE + IC at 45DAS	3.24 (10)	3.11 (9.2)	91.21	18.32	9.01
T_{10}: One hand weeding at 20 DAS + IC at 45 DAS	3.08 (9)	3.36 (10.8)	88.09	24.02	14.10
T_{11}: Weed free check	0.71 (0)	0.71 (0)	-	0.00	0.0
T_{12}: Weedy check	15.21 (231)	10.14 (102.4)	0.00	57.09	47.46
S.Em±	0.30	0.27	2.79	-	
CD (p=0.05)	0.90	0.79	8.18	-	

Original total weed density and weed dry weight and weed control efficiency (x) data were transformed into $(x+0.5)^{1/2}$

* Figures in parenthesis indicate original value.

Conclusion

Application of pendimethalin 38.7 % CS @ 750 g ha^{-1}as pre emergence followed by imazethapyr + imazamox 70% WG (Premix) @ 70 g ha^{-1}post emergence at 20-25 DAS with inter cultivation at 45 DAS was found effective in controlling the weeds which resulted in higher growth and yield components consequently higher yield in both the crops.

References

1. Dhonde MB, Kate SR, Pandure BS, Tambe AD. Integrated weed management in pigeonpea. Indian J Weed Sci. 2009; 41(1-2):102-105.
2. Gill, Vijay Kumar B. Chemical weed control in groundnut. Indian J Weed Sci. 1969; 24:72-74.
3. Guggari AK, Manjappa K, Desai BK, Chandranath HT. Integrated weed management in groundnut. J Oilseeds Res. 1995; 12(1):65-68.
4. Komal Singh SP, Yadav RS. Effect of weed management on growth, yield and nutrient uptake of greengram. Indian J Weed Sci. 2015; 47(2):206-210.
5. Patel SL, Agarwal SK, Chandrakar PK. Weed management studies in *rabi*/summer groundnut grown after rice. J Oilseeds Res. 1997; 14(1):55-58.
6. Rao SS, Madhavi M, Raghava Reddy. Integrated weed management in winter season groundnut (*Arachishypogaea* L.). J Oilseeds Res. 2010; 28(1):57-59.
7. Samant TK, Mishra KN. Efficacy of post- emergence herbicide quizalofop ethyl for controlling grassy weeds in goundnut. Indian J Agric. Res. 2014; 48(6):488-492.
8. Sasikala B, Kumari CR, Obulamma U, Reddy CR. Effect of chemical weed control on yield and economics of *rabi* groundnut. J Res., ANGRAU. 2006; 35(3):70-73.