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Effect of Integrated Weed Management on Yield Attributes, Yield and Economics of Rainfed Pigeon Pea (*Cajanus cajan* (L.) Millsp)

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ABSTRACT

The experiment was carried out at agronomy Research Farm of Narendra Deva University of Agriculture and Technology, (Kumarganj), Faizabad (U. P.) India, during the kharif season 2011 - 12. The experiment was laid out in randomized block design having ten treatments i.e. (Fluchloralin @ 1kg a.i ha^{-1} PPI, Fluchloralin @ 1kg a.i ha^{-1} as PPI + one hand weeding at (30DAS), Anilophos @ 1 kg a.i ha^{-1} as PE, Anilophos @1 kg a.i ha^{-1} as PE one hand weeding at (30 DAS). Pendimethalin @ 1 kg a.i ha^{-1} as PE, Pendimethalin @ 1 kg a.i. ha^{-1} as PE + one hand weeding at (30 DAS), one hand weeding at (25 DAS), two hand weeding (25 and 45 DAS), weedy check and weed free check. All the treatments were replicated three times. Among the weed management practices integrated approach i.e Pre emergence application of Pendimethalin @ 1 kg a.i. ha^{-1} + one hand weeding at (30 DAS) proved its superiority over other methods of weed control in respect of all the yield attributes and yield characters of pigeon pea crop, which was comparable with weed free check.

Key words: *Pigeon pea, IWM, Yield attributes, Yield, Weeds control method*

INTRODUCTION

The weeds are serious problem in pigeon pea and drastically reduce the yield; hence, for their control different methods (mechanical, cultural and chemical) are used, due to shortage of laborer's. First two methods are rarely used while herbicides are not sustainable over long periods. In India cultivated on an area of 4.04 million ha with annual production and productivity of 2.65 million tonnes and 656 kg ha^{-1} respectively, while, its area, production and productivity in U.P. is 0.32 m ha, 0.29 m tonnes and 891 kg ha^{-1}, respectively (Anonymous, 2012-2013). In India, pigeon pea is grown during kharif (rainy season). Due to rainy season, slow initial growth and sowing at wider row spacing, severe infestation of weeds is observed in pigeon pea which results in low grain yield. Reduction in yield due to weeds in pigeon pea to the tune of 55-60% has been reported Kandasamy[6].

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However, due to frequent rains it becomes difficult to do hand weeding at proper time. Furthermore, non- availability of labour for hand weeding is another problem. So there is a need to find effective weed control techniques using herbicides. In pigeon pea, initial six weeks period is the critical period of the crop-weed competition. Therefore, weeds must be controlled during this period for obtaining high grain yields. Pre-emergence herbicides may help in checking weed growth during this period. Pendimethalin, as pre-emergence, has been found promising in controlling weeds and improving pigeon pea yield reported that Reddy *et al*[9]. Integrated weed management is a system approach where by whole land use planning is done in advance to minimize the adverse effect of weeds in aggressive forms and give a strongly competitive advantage to crop plant over the weeds[5].

MATERIALS AND METHOD

The field experiment was conducted during *Kharif* season 2011-12 at Agronomy Research Farm of Narendra Deva University of Agriculture & Technology, Kumarganj, Faizabad (U.P.). On the basis of mechanical analysis the soil has been classified as silt loam. The chemical analysis shows that the soil was medium in fertility status and saline in soil nature.

The experiment was laid out in Ten treatments Fluchloralin (1.0 Kg ai ha^{-1}) PPI, Fluchloralin + one hand weeding (at 30 DAS), Anilophos (1.0Kg ai ha^{-1}) PE, Anilophos + one hand weeding (at 30 DAS), Pendimethalin (1.0 Kg ai ha^{-1}) PE, Pendimethalin + one hand weeding (at 30 DAS), One hand weeding (at 25 DAS), Two hand weeding (at 25 and 45 DAS), Weedy check and Weeds free check of various methods of weed control were tested in randomized block design with 3 replications. In herbicidal treatments, Fluchloralin (45% EC) @ 1 kg ai ha^{-1} was applied as PPI. The herbicide was sprayed with the help of a hand operated Knapsack sprayer fitted with flat fan nozzle using 600 liters of water per hectare. Anilophos (24% EC) was sprayed as pre-emergence (PE) into soil. Pendimethalin (30% EC) @ 1.0 kg/ha was applied as pre-emergence. Hand weeding was done with the help of a hand chisel locally known as khurpi as per treatments. Application of fertilizers an amount of 18 kg N, 46 kg P_2O_5 and 20 kg K_2O ha^{-1} was applied. Full quantity of fertilizer was applied basal through, Diammonium phosphate (18% N, 46% P_2O_5) and Muriate of potash (60%K_2O) just before sowing.

To see the effect of different treatments on weeds and crop, a number of observations on yield attribute and yield of crop. Since it is very difficult to study all the individuals of plant population, five plants from each plot were selected randomly and tagged for further study. The data recorded in respect of different observations in the present study were analyzed statistically with Randomized Block Design (R.B.D.) as suggested by Cochran and Cox (1957). The standard error of means was calculated in each case and critical a difference (C.D.) at 5% level was worked out for comparing the treatment means, wherever, F test was found significant.

RESULT AND DISSCUSSION

Number of pods $plant^{-1}$

Significantly higher number of pods $plant^{-1}$ was counted in pendimethalin @ 1.0 kg

Table 1: Effect of various: weed control treatments on yield attributes of pigeon pea

Treatments	No. of pods plant^{-1}	No. of seeds pod^{-1}	100 seed weight (g)	Seed yield (q ha^{-1})	Stalk yield (q ha^{-1})	Harvest index (%)
T_1: Fluchloralin @ 1 kg a.i. ha^{-1} as PPI	162.47	4.00	12.48	15.41	79.05	16.34
T_2: Fluchloralin @ 1 kg a.i. ha^{-1} as PPI +one hand weeding at 30 DAS	189.90	4.53	12.67	17.54	87.54	16.70
T_3: Anilophos @ 1 kg a.i. ha^{-1} as PE	156.13	3.97	12.39	13.97	69.37	16.79
T_4: Anilophos @ 1 kg a.i. ha^{-1} as PE +one hand weeding at 30DAS	171.23	4.23	12.80	15.66	82.95	15.89
T_5: Pendimethalin @ 1 kg a.i. ha^{-1} as PE	185.13	4.03	12.94	16.85	88.31	15.91
T_6: Pendimethalin @ 1 kg a.i. ha^{-1} as PE +one hand weeding at 30 DAS	215.40	4.60	13.21	19.09	90.58	17.41
T_7: One hand weeding at 25 DAS	152.57	3.90	12.00	13.92	69.36	16.73
T_8: Two hand weeding at 25 and 45 DAS	213.10	4.43	13.08	18.91	90.20	17.32
T_9: Weedy check	130.63	3.87	11.32	11.31	55.42	16.95
T_{10}: Weed free check	227.90	4.77	13.76	20.22	93.06	17.83
SEm±	1.71	0.17	0.46	0.51	2.43	0.36
C.D. at 5%	5.08	0.50	NS	1.51	7.22	1.07

Table 2: Economics of various treatments of weed control given to pigeon pea

Treatments	Seed yield (q ha^{-1})	Stalk yield (q ha^{-1})	Cost of cultivation (Rs ha^{-1})	Gross return (Rs ha^{-1})	Net return (Rs ha^{-1})	B:C ratio
T_1: Fluchloralin @ 1 kg a.i. ha^{-1} as PPI	15.41	79.05	16683.65	73497.5	56813.85	3.40
T_2: Fluchloralin @ 1 kg a.i. ha^{-1} as PPI +one hand weeding at 30 DAS	17.54	87.54	18833.65	83291	64457.35	3.42
T_3: Anilophos @ 1 kg a.i. ha^{-1} as PE	13.97	69.37	16635.28	66085.5	49450.22	2.97
T_4: Anilophos @ 1 kg a.i. ha^{-1} as PE +one hand weeding at 30DAS	15.66	82.95	18785.28	75082.5	56299.22	2.99
T_5: Pendimethalin @ 1 kg a.i. ha^{-1} as PE	16.85	88.31	16732.03	80646.5	63914.47	3.82
T_6: Pendimethalin @ 1 kg a.i. ha^{-1} as PE +one hand weeding at 30 DAS	19.09	90.58	18882.03	89947.0	71064.97	3.76
T_7: One hand weeding at 25 DAS	13.92	69.36	18183.28	66284	48100.72	2.65
T_8: Two hand weeding at 25 and 45 DAS	18.91	90.20	20333.28	85930	65596.72	3.23
T_9: Weedy check	11.31	55.42	16033.28	53553	37519.72	2.34
T_{10}: Weed free check	20.22	93.06	21408.28	94839	73430.72	3.43

a.i. ha^{-1} + one hand weeding at 30 DAS. Although the maximum number of pods plant^{-1} was recorded in weed free treatment. The possible region of increasing number of pods plant^{-1} by the pendimethalin @ 1.0 kg a.i. ha^{-1} + one hand weeding at 30 DAS might be due to healthy vegetative growth and controlling of weed population is concerned, thereby less competition was posed by weeds and therefore vegetative energy was converted in to reproductive phase and number of pod plant^{-1} was significantly increased. Similar findings were also reported by Ali[1].

Number of seeds pod^{-1}

The maximum number of seeds pod^{-1} was counted with pendimethalin @ 1.0 kg a.i. ha^{-1} + one hand weeding at 30 DAS which was found significantly superior over other treatments. These results are in conformity with the results obtained by Vyas *et al*[13]. **100-seed weight**

The 100 seed weight of pigeon pea was not affected due to any weed control treatments, however, the maximum weight of 100 seeds was obtained with pendimethalin @ 1.0 kg a.i. ha^{-1} + one hand weeding at 30 DAS. It is due the facts that seed weight is the genetical character of a variety which was not affected by various treatments of weed control. The similar findings have also been reported by Rana *et al*[8].

Seed yield (q ha^{-1})

Yield is the most important parameter which is influenced by various treatment including yield contributing characters which directly affected the seed yield. By large control of weeds by any measures of weed control was found favorable to improve the crop yield over

weedy check treatment. The crop available weed free condition throughout the season yielded significantly higher seed yield than other weed management practices. As far as application of various herbicides is concerned the pendimethalin @ 1.0 kg a.i. ha^{-1} + one hand weeding at 30 DAS gave significantly higher seed yield as compared to other herbicides. Fluchloralin @ 1.0 kg ha^{-1} + 1 hand weeding at 30 DAS found next best treatment for enhancing the seed yield. The minimum seed yield was recorded with one hand weeding 25 DAS. The unchecked weed growth reduced the seed yield of pigeon pea by (40.75%) when compared with pendimethalin @ 1.0 kg a.i. ha^{-1} + one hand weeding at 30 DAS. The positive response of pigeon pea crop to weed free and integrated method of weed control like pendimethalin @ 1.0 kg a.i. ha^{-1} + one hand weeding at 30 DAS was observed for improving all the yield contributing parameters. This leads to increase the seed yield. Significantly higher seed yield achieved in pendimethalin @ 1.0 kg a.i. ha^{-1} + one hand weeding at 30 DAS and weed free treatments due to less or no weed competition in there treatments which resulted in higher seed yield of pigeon pea. The present findings are in conformity to result obtained by Pardeshi *et al*[7].

Stalk yield (q ha^{-1})

The maximum stalk yield was recorded in weed free check, which was comparable with application of pendimethalin @ 1.0 kg a.i. ha^{-1} + one hand weeding at 30 DAS and it was significantly superior over other treatments. The lowest stalk yield was recorded with weedy check, which indicated that uncontrolled weeds were more aggressive to check growth and development of crop plants due to which lowest stalk yield was recorded under weedy check. Similar findings were also reported by Gogai *et al.* (1993).

Harvest index (%)

Significantly higher harvest index was calculated in weed free treatment which was closely followed by pre-emergence application of pendimethalin @ 1.0 kg a.i. ha^{-1} + one hand weeding at 30 DAS and lowest was recorded under weedy check. Significantly higher seed and stalk yields were recorded under the impact of above treatments, which favorers the way to obtain higher value of harvest index. Similar findings were also reported by Singh (2007).

Economics

The application of pendimethalin @ 1.0 kg a.i. ha^{-1} gave the highest B:C ratio followed by pendimethalin + one hand weeding 30 DAS alone and Fluchloralin + one hand weeding at 30 DAS. These treatments have also recorded higher net return. The weed free plot was not found to be economical in comparison to other herbicidal treatments because of higher expenditure involved in keeping the plots free from weeds. The better net return per rupee invested was mainly due to higher seed and stalk yields and low cost of cultivation with these treatments as compared to weed free plot, Shete *et al.* (2009) and Verma and Singh (2011) also reported the same result.

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