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Study on Integrated Weed Management of Pigeon Pea (*Cajanus Cajan* L. Millsp) at Kanke Block, Ranchi–A Case Study

S. Bhengra*, M. C. Jerai**, S. Kandeyang** & A. C. Pandey**#

Abstract : *The system approach or integrated weed management is new concept in controlling the weeds, in variation with the conventional method for sustainable agriculture. The aim of weed control is to manage the vegetation in such a way as will encourage the growth of plants beneficial to our interest at a particular place and time, and will suppress the remaining, relatively unwanted species.*

Information on such aspect under Jharkhand state is scanty. Hence, the present investigation entitled “Integrated weed management in pigeon pea-A case study” a field experiment comprising of eight treatments was conducted under All India Coordinated Research Project of Weed Control, realizing the need to study the weed infestation as well as to develop effective and economic weed management practice in pigeon pea.

The major weed flora have been identified at the experimental site, weed per square metre in weedy check at different stages have been identified and counted. Weed control measures had significant effect on weed count per meter² as well as on their dry weight. The minimum weed count was recorded from the plot receiving two hand weeding (30 & 60 DAS), which did not differ statistically with the performances of pre-emergence use of either oxyflourfen @ 0.2 kg ai ha-1 or imazethapyr @ 0.1 kg ai ha-1 in pigeonpea (75 cm) intercropped with two lines of blackgram and groundnut, respectively in this respect and showed its superiority over rest of the weed control treatments including weedy check. Hand weeding twice (30 & 60 DAS) recorded lowest weed count per metre² and dry weight of weeds.

Keywords: *Integrated weed management.*

INTRODUCTION

Pigeon pea being a widely spaced and slow growing crop during early stage, provides ample opportunity for weeds to grow which causes severe crop-weed competition for water, space, nutrients and sunlight and reducing the crop yield drastically. This necessitates the use of weed control measures to keep the weeds under check upto first 5-10 weeks because the crop canopy during this period is inadequate to cover the ground and to prevent weed growth.

Weeding by mechanical means sometimes becomes very difficult because of frequent rains due to which soil does not come in physical condition to permit use of the implements. Under such conditions, use of herbicides to control the weeds becomes more important. The efficient weed management is one of the most important production inputs in pigeon pea cultivation. There are several agronomical, mechanical, biological and chemical methods for weed

control. Practical experience shows that no single method will give a continuous and effective control of weeds in all situations. The most promising single approach to cropland weed control is the use of manual and mechanical methods in conjunction with herbicides. When the chemical methods are integrated into systems involving cultural, cropping, rotational and biological methods the outlook for eradication seems more hopeful. Intercropping with short duration legumes like urd bean, mung bean and with oilseeds like groundnut is another biological way of controlling weeds in pigeon pea. The way out of the situation appears to be integrated weed management aimed at bringing down the intensity of weed growth to economically significant levels with minimum influence on environmental pollution. It may be one of the potential methods of phytosanitation aimed at optimum condition for crop growth and adverse environment for weed growth.

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The common weed flora associated with pigeonpea are *Cyperus rotundus* L.; *Cynodon dactylon* L., *Eleusine indica* (L.) Gaertn., *Phyllanthus niruri* (L.) simplex., *Digitaria* spp., *Dactyloctenium aegyptium*, *Eragrostis tenella* Roem and Sch; *Setaria glauca* L., *Amaranthus viridis* Linn., *Mollugo* spp., *Celosia argentea* L.; *Commelina benghalensis* L.; *Digera arvensis* Forsk., *Trianthema monogyna* L.; *Tribullus terrestris* L., and *Euphorbia* spp. (Shetty, 1981, Kolar et al., 1985, Tewari et al., 1989, Varshney, 1992 and Singh and Singh, 1995). Earlier Shetty and Krantz (1980) observed that grassy weeds were dominant in the early part of the crop season while perennial sedges and broad leaved weed formed the bulk of the weed population at later stage of crop period.

Some workers have observed a marked suppression shift or buildup of certain weed species when the crops were intercropped or grown on the same piece of land continuously. For example Abraham (1982) working at New Delhi noticed that when sorghum was intercropped with cowpea (Fodder/grass), green gram, soybean or groundnut the system suppressed the growth of *Trianthema* spp., but *Cyperus* spp. and *Dactyloctenium* spp. were not affected much. Similarly, Shetty and Rao (1981) reported from Hyderabad that in pearl millet + groundnut intercropping system *Digitaria* spp., *Celosia* spp. and *Cyperus* spp. were dominant but when pearl millet was raised alone, the weed composition was a mixture of *Digitaria* spp., *Cyperus* spp., *Celosia argentea*, *Phyllanthus* spp., *Eragrostis* spp. and *Brachiaria* spp. Venkateswarlu and Ahlawat (1983). Pigeonpea, because of its slow initial growth rate, is vulnerable to weed competition in the first 45-60 days of its growth (Shetty, 1981). The first quarter of the crop life in general, is considered more susceptible for weed competition (CORP, 1981). Pigeonpea being slow initial growth rate during 5-7 weeks period is very sensitive to weed competition. In this regard weed control at early stage of crop period is very effective to increase the yield (Madhiyazhagan *et al.*, 1992).

MATERIAL AND METHODS

Realizing the need to develop effective and economic weed management practice in pigeon pea, a field experiment comprising of eight treatments (1) Farmers' practice (One hoeing at 30-35 DAS) (2) Two hand weeding (30 & 60 DAS) (3) Imazethapyr @ 0.1 kg ai/ha as pre-emergence followed by intercultivation at 40-45 DAS (4) Intercropping with two

lines of Groundnut (5) Intercropping with two lines of Groundnut combined with Imazethapyr @ 0.1 kg ai/ha as pre-emergence (6) Intercropping with two lines of Black gram (7) Intercropping with two lines of Black gram in combination with Oxyfluorfen @ 0.2 kg ai/ha as pre-emergence and (8) Weedy check, in randomized block design replicated thrice during the wet season, 2004 at the university farm on medium acidic (pH- 5.7), Sandy laom soil (34.2 % Silt and 13 % Clay) have been low available Nitrogen (269 kg/ha), medium available P₂O₅ (24.9 kg/ha.) and K₂O (200 kg/ha), was conducted under All India Co-ordinated Research Project Weed Control at Birsa Agricultural University, Kanke, Ranchi Farm. The observations have been recorded, investigated and analyzed statistically.

RESULT AND DISCUSSION

Studies on Weeds

Weed Flora

The major weed flora of the experimental field consisted of *Ageratum conyzoides* L., *Amaranthus viridis* L., *Bidens pilosa* L., *Brachiaria brachylocha* L., *Celosia argentea* L., *Cleome viscosa* L., *Commelina benghalensis* L., *Cynodon dactylon* (L.) Pers., *Cyperus rotundus* L., *Dactyloctenium aegyptium* (L.) P. Beauv., *Echinochloa crusgalli* L., *Eclipta alba* L., *Eleusine indica* L., *Euphorbia hirta* L., *Gynandropsis pentaphylla* DC, *Phyllanthus niruri* L., *Setaria glauca* L. and *Xanthium strumarium* L. (Table 1).

Weed Count

Data on weed count per square metre at different growth stages of pigeonpea as influenced by weed management practices have been presented in Table 2. Weed count per square metre increased at different stages of growth and development of crop. It was also recorded that all the weed control treatments proved to be effective in reducing the population of weeds as compared to weedy check.

At 30 days after sowing, the minimum weed count per square metre (22) was recorded in two hand weeding (30 & 60 DAS) and this density of weed m⁻² was significantly inferior to that recorded under rest of the treatments except pre-emergence application of imazethapyr @ 0.1 kg ai ha⁻¹ in pigeonpea (75 cm) intercropped with 2 lines of groundnut (33.0) and pre-emergence application of imazethapyr @ 0.1 kg ai ha⁻¹ followed by intercultivation at 40-45 DAS (38.33).

Table 1
Major Weeds of the Experimental Plot in Weedy Check

Common name	Scientific name	Family	Type of weed
Floss flower	<i>Ageratum conyzoides L.</i>	Compositae	Annual and dicot weed
Pig weed	<i>Amaranthus viridis L.</i>	Amaranthaceae	Annual
Blackjack	<i>Bidens pilosa L.</i>	Compositae	Annual and dicot weed
Hadapoda	<i>Brachiaria braciensis L.</i>	Compositae	Annual and dicot weed
Cock's comb	<i>Celosia argentea L.</i>	Amaranthaceae	Annual
Spider flower	<i>Cleome viscosa L.</i>	Caparaceae	Annual and dicot weed
Day flower	<i>Commelina benghalensis L.</i>	Commelinaceae	Annual and dicot weed
Bermuda grass	<i>Cynodon dactylon (L.) Pers.</i>	Poaceae	Perennial and monocot weed
Purple nut sedge	<i>Cyperus rotundus L.</i>	Cyperaceae	Perennial and monocot weed
Crowfoot grass	<i>Dactyloctenium aegyptium (L.) P. Beauv.</i>	Poaceae	Annual and monocot weed
Wild rice	<i>Echinochloa colonum L.</i>	Poaceae	Annual and monocot weed
Barnyard grass	<i>Echinochloa crusgalli L.</i>	Poaceae	Annual and monocot weed
Bhangra	<i>Eclipta alba, Hassak</i>	Compositae	Annual and dicot weed
Goose grass	<i>Eleusine indica L.</i>	Poaceae	Annual and monocot weed
Bari Dhudhi	<i>Euphorbia hirta L.</i>	Euphorbiaceae	Annual and dicot weed
Cat's whiskers	<i>Gynandropsis pentaphylla DC</i>	Caparaceae	Annual and dicot weed
Niruri	<i>Phyllanthus niruri L.</i>	Euphorbiaceae	Annual and dicot weed
Fox tail	<i>Setaria glauca</i>	Poaceae	Annual and monocot weed
Cocklebur	<i>Xanthium strumarium L.</i>	Compositae	Annual and dicot weed

Table 2
Weed Count (m-2) at Different Stages of Growth as Influenced by Weed Management in Pigeonpea

Treatments	Weed count (m-2) at different days after sowing			
	30 DAS	60 DAS	90 DAS	At harvest
T1- Farmers' practice (One hoeing at 30-35 DAS)	89	161.33	212.67	242.67
T2- Two hand weeding (30 & 60 DAS)	22	56.67	69.67	66.67
T3- Imazethapyr @ 0.1 kg ai/ha as pre-emergence followed by intercultivation at 40-45 DAS	38.33	62.33	75	117.67
T4- Intercropping with two lines of Groundnut	55.67	89	100	154.67
T5- Intercropping with two lines of Groundnut combined with Imazethapyr @ 0.1 kg ai/ha as pre-emergence	33	67.33	75.67	90.67
T6- Intercropping with two lines of Black gram	50	88	125.33	167
T7- Intercropping with two lines of Black gram in combination with Oxyfluorfen @ 0.2 kg ai/ha as pre-emergence	43	63.33	75.33	82.67
T8- Weedy check	133.33	208.67	298.33	382.33
SEm ±	5.81	11.58	11.59	8.08
CD (P = 0.05)	17.63	35.12	35.17	24.5
CV (%)	17.35	20.14	15.57	8.54

At 60 days after sowing, the minimum weed count was recorded by two hand weeding treatment (30 & 60 DAS) (56.67), which was significantly superior to Farmers' practice of weed management (One hoeing at 30-35 DAS) (161.33) and weedy check (208.67) and the performances of the rest of the weed control treatments were comparable to that of two hand weeding in this regard.

90 days after sowing, two hand weeding (30 & 60 DAS) recorded the least weed count per square meter (69.67) and was significantly superior to farmers'

practice (212.67), pigeonpea (75 cm) intercropped with 2 lines of blackgram (125.33) and weedy check (298.33) and simultaneously it did not differ statistically with rest of the treatments in this respect.

At harvest, the minimum weed count per square metre (66.67) was recorded from the plots receiving two hand weeding (30 & 60 DAS) which was statistically alike with pre-emergence application of oxyfluorfen @ 0.2 kg ai ha-1 in pigeonpea intercropped with 2 lines of blackgram (82.67) and pre-emergence application of imazethapyr @ 0.1 kg ai ha-1 in

pigeonpea (75 cm) intercropped with 2 lines of groundnut (90.67) and was significantly superior to rest of the treatments including weedy check.

Dry Matter Accumulation by Weeds

Data on dry matter accumulation by weeds in gram per square metre at different days after seeding of pigeonpea as affected by weed management practices have been presented in Table 3.

Dry matter accumulation by weeds increased at different stages of growth and development of crop. It was also registered that all the weed control measures significantly restricted the dry matter accumulation by weeds at 30, 60 and 90 days after sowing and at harvest of the crop compared to the weedy check.

At 30 days of sowing, minimum dry matter production by weeds (9.23 g m⁻²) was recorded from the plots receiving two hand weeding (30 and 60 DAS) and this method of weed management showed its superiority over rest of the measures and it was 82.8 per cent more efficient than the weedy check in arresting dry matter production by weeds.

At 60 days after seeding, the least dry matter production by weeds (14.10 g m⁻²) was recorded from the plots where two hand weedings (30 and 60 DAS) were done, which proved statistically alike with pre-emergence application of imazethapyr @ 0.1 kg ai ha⁻¹ followed by intercultivation at 40-45 DAS (20.7 g m⁻²) intercropped with 2 lines of groundnut + pre-emergence use of imazethapyr @ 0.1 kg ai ha⁻¹ (18.8 g m⁻²) and intercropped with 2 lines of blackgram + pre-emergence application of oxyflourfen @ 0.2 kg ai ha⁻¹ (19.03 g m⁻²) treatments and these measures of weed management were significantly superior to rest of the treatments.

At 90 days stage of crop growth, the plots receiving two hand weedings at 30 and 60 days after sowing registered the least dry matter production by weeds (25.23 g m⁻²) which was statistically on par with groundnut intercropped and use of imazethapyr @ 0.1 kg ai ha⁻¹ as pre-emergence and blackgram intercropped and use of oxyflourfen @ 0.2 kg ai ha⁻¹ as pre-emergence treated methods. These three methods were significantly efficient in reducing the dry matter production by weeds in comparison to other methods of weed management and weedy check.

At harvest, the pattern of dry matter accumulation by weeds was similar with that of 90 days stage. Hand weeding twice treatment had the least dry matter production (37.09 g m⁻²) which proved statistically similar with that of intercropped with groundnut and blackgram and pre-emergence treatment with

imazethapyr @ 0.1 kg ai ha⁻¹ (55.1 g m⁻²) and oxyflourfen @ 0.2 kg ai ha⁻¹ (45.0 g m⁻²) respectively and showed its superiority over rest of the treatments. However, the efficacy of pre-emergence application of imazethapyr @ 0.1 kg ai ha⁻¹ followed by inter-cultivation at 40-45 DAS was statistically similar with both the intercropping treatments combined with pre-emergence application of imazethapyr and oxyflourfen in this respect.

Weed Control Efficiency

Data on weed control efficiency at 30, 60 and 90 days after sowing and at harvest as influenced by weed management practices have been presented in Table 4. Weed management treatments had positive influence on weed control efficiency at different stages of crop growth.

Weed control efficiency increased with increase in time but the magnitude of increase differed according to treatments adopted. Amongst the weed management treatments two handweeding (30 and 60 DAS) was found to be the most effective in controlling weeds at different stages i.e. 30, 60 and 90 days stage of plant growth and at harvest and showed weed control efficiency 82.87, 85.11, 83.71 and 81.23 per cent respectively.

At 30 and 60 days stage of plant growth, pigeonpea (75 cm) intercropped with 2 lines of groundnut + pre-emergence application of imazethapyr @ 0.1 kg ai ha⁻¹ recorded 76.18 and 80.14 per cent weed control efficiency respectively. At 90 days after sowing and at harvest pigeonpea (75 cm) intercropped with 2 lines of blackgram + pre-emergence application of oxyflourfen @ 0.2 kg ai ha⁻¹ recorded 75.16 and 78.12 per cent weed control respectively. The data further revealed that the lowest weed control efficiency (16.84, 21.83, 50.98 and 22.59 per cent respectively) were recorded under farmers' practice of weed management (One hoeing at 30-35 DAS) in pigeonpea (75 cm) at 30, 60 and 90 days after sowing and at harvest respectively.

Weed Index and Weed Seed Rain

Data on weed index and weed seed rain as influenced by integrated weed management have been presented in Table 5. All the weed control treatments influenced the weed index value of pigeon pea as compared to weedy check.

Intercropping of 2 lines of groundnut in pigeonpea (75 cm) + pre-emergence application of imazethapyr @ 0.1 kg ai ha⁻¹ recorded lowest value of weed index (8.6%) followed by pigeonpea (75 cm) intercropped with 2 lines of blackgram (12.2%) which indicated that

Table 3
Dry Matter Accumulation by Weeds as Influenced by Weed Management in Pigeonpea

<i>Treatments</i>	<i>Dry matter accumulation by weeds (g/m²) at different days after sowing</i>			
	<i>30 DAS</i>	<i>60 DAS</i>	<i>90 DAS</i>	<i>At harvest</i>
T1- Farmers' practice (One hoeing at 30-35 DAS)	44.8	74	75.73	152.57
T2- Two hand weeding (30 & 60 DAS)	9.23	14.1	25.23	37
T3- Imazethapyr @ 0.1 kg ai/ha as pre-emergence followed by intercultivation at 40-45 DAS	14.83	20.7	39.53	69.4
T4- Intercropping with two lines of Groundnut	24.17	30.7	51.5	74.5
T5- Intercropping with two lines of Groundnut combined with Imazethapyr @ 0.1 kg ai/ha as pre-emergence	12.83	18.8	27.13	55.1
T6- Intercropping with two lines of Black gram	20.9	37.67	60.07	85.43
T7- Intercropping with two lines of Black gram in combination with Oxyfluorfen @ 0.2 kg ai/ha as pre-emergence	17.4	19.03	30.13	45
T8- Weedy check	53.87	94.67	154.9	209.25
SEm ±	0.75	2.96	2.59	8.75
CD (P = 0.05)	2.29	8.97	7.86	26.53
CV (%)	5.27	13.23	7.34	16.97

Table 4
Weed Control Efficiency at Different Stages of Crop Growth as Influenced by Weed Management in Pigeonpea

<i>Treatments</i>	<i>Weed control efficiency (%) at different days after sowing</i>			
	<i>30 DAS</i>	<i>60 DAS</i>	<i>90 DAS</i>	<i>At harvest</i>
T1- Farmers' practice (One hoeing at 30-35 DAS)	16.84	21.83	50.98	22.59
T2- Two hand weeding (30 & 60 DAS)	82.87	85.11	83.71	81.23
T3- Imazethapyr @ 0.1 kg ai/ha as pre-emergence followed by intercultivation at 40-45 DAS	72.47	78.13	74.61	64.79
T4- Intercropping with two lines of Groundnut	55.13	67.57	66.75	62.2
T5- Intercropping with two lines of Groundnut combined with Imazethapyr @ 0.1 kg ai/ha as pre-emergence	76.18	80.14	69.57	72.04
T6- Intercropping with two lines of Black gram	61.2	60.21	61.23	56.66
T7- Intercropping with two lines of Black gram in combination with Oxyfluorfen @ 0.2 kg ai/ha as pre-emergence	67.7	79.9	75.16	78.12
T8- Weedy check	0	0	0	0

Table 5
Weed Index and Weed Seed Rain as Influenced by Weed Management in Pigeonpea

<i>Treatments</i>	<i>Weed index (%)</i>	<i>Weed seed rain (m-2)</i>
T1- Farmers' practice (One hoeing at 30-35 DAS)	31.8	1123066
T2- Two hand weeding (30 & 60 DAS)	0	354654
T3- Imazethapyr @ 0.1 kg ai/ha as pre-emergence followed by intercultivation at 40-45 DAS	15.1	646909
T4- Intercropping with two lines of Groundnut	15.9	784433
T5- Intercropping with two lines of Groundnut combined with Imazethapyr @ 0.1 kg ai/ha as pre-emergence	8.6	464704
T6- Intercropping with two lines of Black gram	12.2	620781
T7- Intercropping with two lines of Black gram in combination with Oxyfluorfen @ 0.2 kg ai/ha as pre-emergence	20.1	405663
T8- Weedy check	69.4	620781

there was 8.6 and 12.2 per cent decrease in grain yield of pigeonpea respectively compared to two hand weeding treatment while under weedy check the decrease was 69.4 per cent.

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