Biological Forum – An International Journal **14(3): 1630-1636(2022)**

ISSN No. (Print): 0975-1130
ISSN No. (Online): 2249-3239

Effect of Weed Management Practices on Pigeon Pea and Green Gram intercropping System based on rainfed condition in Kymore Plateau of Madhya Pradesh

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(Received 01 August 2022, Accepted 03 September, 2022)
(Published by Research Trend, Website: www.researchtrend.net)

ABSTRACT: The field experiment to determine "Effect of different weedicides in pigeon pea [*Cajanus cajan* (L.) Millsp] + green gram (*Vigna radiata* (L.) Millsp) intercropping system under rainfed condition in Kymore Plateau of Madhya Pradesh" during *kharif* and *rabi* seasons in the year 2012-13 was conducted at the Rajoula Research Farm, M.G.C.G.V., Chitrakoot, Satna, Madhya Pradesh. Present experiment has been designed to select the appropriate weed management practice in pigeon pea cultivation as the weed management has its own importance in terms of yield and economics. The aim of this study to assess the most suitable weed management practices for pigeonpea + green gram intercropping system. Results revealed that intercropping system pigeon pea + green gram (2:2) is an superseding cropping system in respect to crop growth, root and root nodulation, yield attributes, yield and economics as compared to alone pigeon pea or green gram. Whereas, the application of pre emergence weedicide Pendimethelin @ 1.0 kg ai with post emergence weedicide Imazethapyr @0.1 kg ai/ha (W_5) or by pre emergence weedicide Oxyfluorfen @ 0.2 kg ai/ha with post emergence weedicide Imazethapyr @ 0.1 kg ai/ha ((W_6). These weedicides were found efficient in controlling weeds and in relation to higher yield attributes, seed and straw yield of pigeon pea and green grammost appropriate, profitable and productive treatment combination for pigeon pea and green gram intercropping system. In case of economics of intercropping system I_2: pigeon pea + green gram (2:2) was found better in terms of benefit: cost ratio.

Keywords: Herbicide, Intercropping, Pigeon pea, Green gram, Yield, Economics.

INTRODUCTION

Traditionally pulses have been considered important elements of cropping systems in India. They were popular because of their importance as a source of protein and ability to fix atmospheric nitrogen (N) and thus improve soil fertility. It is grown predominantly under rainfed conditions. In India, pigeon pea ranks second *i.e.* next to chickpea among important pulse crops. Pigeon pea is of dietary importance with a seed protein content more than that of other important grain legumes. Besides being rich source of protein, the crop is also important for sustainable agriculture, enriching the soil through biological nitrogen fixation. Pigeon pea an important pulse crop of India, being a kharif season crop, is highly infested with grassy and broad leaved weeds. Timely weed control is essential for realization of yield potential of this crop. Due to wider row spacing and initial slow growth of pigeonpea, weeds pose a major problem to its productivity (Rajesh *et al.*, 2015; Khazi *et al*., 2017). The crop canopy does not cover the inter row space during initial phase of growth and weeds compete with the crop plants for available moisture, nutrients and light and thus the crop suffers

from early weed infestation. Therefore, it is necessary to keep the crop weed-free during the early growth period (4-6 weeks). Pigeonpea because of its slow initial growth rate is very sensitive to weed competition in the first 45 to 60 days after sowing. In many rainfed pigeonpea growing area, optimum land preparation is seldom done and weeds cause severs yield losses ranged from 70 to 90% as reported by Padmaja *et al*. (2013). To achieve the target of additional production of pulses the intercropping is the ultimate solution. It overcomes the drawbacks of mono cropping systems and suppresses weed growth as reported by Kiroriwal and Yadav (2013). Green gram or Moong is a leguminous pulse crop, grown all over India a protein rich dal. It is an excellent source of high quality protein. Being a leguminous crop, it has the capacity to fix atmospheric nitrogen through symbiotic nitrogen fixation; it is also used as a green manure crop.Intercropping in India is mainly confined to rainfed cultivation. The pigeon pea and green gram crop in general faces the problem of both grassy and non-grassy weeds. A conspicuous reduction in yield of pigeon pea + green gram intercropping system has also been noted by Chunni *et al*. (2016). The application of pendimethlin controlled the weed efficiently and produced significantly higher yield of pigeon pea + green gram intercropping system (Singh *et al.*, 2016). The conventional method of weeding is time consuming besides being costly. Thus, it becomes essential to develop on efficient and economically viable technology to overcome this problem in pigeon pea and green gram intercropping system. Therefore, there was a need to study the effect of intercropping system based on rainfed condition and weed management practices on growth, yield attributes and yield attributes of pigeon pea and green gram based cropping system.

MATERIALS AND METHODS

The field experiment was conducted at the Rajoula Research Farm, M.G.C.G.V., Chitrakoot, Satna (M.P.) during *kharif* and *rabi* season of 2012-13. The experimental soil was sandy loam having fertility states of 120 kg N, 15 kg P_2O_5 and 291 kg K_2O/ha with electrical conductivity 0.20 ds/m and soil pH 7.46 were estimated by alkaline potassium permanganate method (Subbaiah and Asija 1956), Olsen's method (Olsen *et al.*, 1954) and 1 N NH_4OAc (Hanway and Heidal 1952), combined glass electrode pH meter method respectively. The treatments comprised two cropping systems (sole pigeonpea and pigeonpea + green gram 2:2 row ratio) the main plots and six weed management practices (weedy check, pendimethalin 1 kg ai/ha PE, oxyflyorfen 0.2 kg ai/ha PE, imazethapyr 0.1 kg ai/ha, postemer, pendimethalin + in azethapyr and oxyfluorfen + imazethapyr) in the sub-plots. The twelve treatment combinations were laid out in split plot design with three replications. Pigeon pea "ICPL 88039" and green gram "Samrat" were sown on 21 July 2012 keeping row to row 60 and 20 cm, and plant to plant 20 and 10 cm., respectively. The fertilizers were applied @ 20: 60: 20 kg N: P_2O_5: K_2O/ha for both the crops. Data on seed yield were recorded from the net plot, whereas growth and yield attributes were recorded from 5 randomly selected plants in each plot. Various data collected and observation recorded during the course of investigation were analyzed statistically by using analysis of variance technique appropriate to split plot design as per the procedure suggested by Panse and Sukhatme (1967). The treatment differences were tested for significance by 'F' test the data in which the treatment effects were significant the appropriate standard error of mean and the critical different (C.D.) were worked out at 5% level of significance.

RESULTS AND DISCUSSION

Plant height (cm) and dry matter per plant (g). Plant height of pigeon pea gradually increased with the advancement in age of crop shown in Table 1. Highest plant height of pigeon pea was recorded in under I_2: PP+GG (2:2) (86.26 and 125.88 cm) at 60 and 90 DAS respectively, however it was maximum in case of I_1: sole pigeon pea at 30 DAS. In weed control measures, the plant height of pigeon pea was obtained significantly higher under W_3 (33.88 cm) at 30 DAS, W_2 (88.82 cm) at 60 DAS and W_5 (136.47 cm) at 90 DAS, as compared to all other weed management measures. Plant height of green gram was not significantly affected due to cropping system at 30 and 50 DAS but at affected significantly at 70 DAS, while the height was significantly affected by weed control methods at all the growth stages of crop. In weed control measures maximum plant height of green gram was recorded in W_5: Pendimethelin @ 1.0 kg ai + Imazethapyr @0.1 kg ai/ha at 50 and 70 DAS, which statistically at par with the treatment W_6: Oxyfluorfen @ 0.2 kg ai/ha PE + Imazethapyr @0.1 kg ai/ha. Plant height and dry matter per plant of pigeon pea were affected significantly due to cropping system treatment except dry matter per plant, which was affected significantly only at the crop growth stage of 90 DAS. The maximum plant dry matter was recorded under in I_1: Sole pigeon pea at 30, 60 and 90 days of crop stages shown in Table 2. Minimum dry matter per plant was found in I_2: PP+GG (2:2) at all the stages of crop growth. In case of weed management plant dry matter of pigeon pea was found statistically significantly higher under W_5: Pendimethelin @ 1.0 kg ai + Imazethapyr @0.1 kg ai/ha (3.65 and 8.13 g) at 30 and 60 DAS than other weed management treatments except W_6: Oxyflorfen @ 0.2 kg ai/ha PE + Imazethapyr @0.1 kg ai/ha post emergence at 90 DAS (34.33 g). Pigeon pea sole recorded markedly more plant dry matter probably due to more inter and intra

plant space facilitated more spreading and photosynthetic efficiency of pigeon pea plants. The beneficial and synergetic effect of short duration legumes as components of intercropping systems contributed in significant increase of growth para meters (Singh and Abraham 2017).

Root length (cm). Root length per plant of pigeon pea did not affect significantly due to cropping system but it was affected significantly by weed control measures at both the growth stages shown in Table 3. The data revealed that root length of pigeon pea was found higher under I_1: sole PP (13.73 and 16.93 cm) respectively, at 60 and 90 days after sowing. In case of the weed management practices, the highest root length of pigeon pea was recorded under the treatment W_5: Pendimethelin @ 1.0 kg ai + Imazethapyr @0.1 kg ai/ha (14.27 & 20.04 cm) respectively at both the stages followed by W_6: Oxyflorfen @ 0.2 kg ai/ha PE + Imazethapyr @0.1 kg ai/ha post emergence. Root length per plant of green gram was affected significantly due to weed control methods at 50 and 70 DAS. It was recorded significantly higher under W_5: Pendimethelin @ 1.0 kg ai + Imazethapyr @0.1 kg ai/ha being at par with W_6: Oxyfluorfen @ 0.2 kg ai/ha PE + Imazethapyr @0.1 kg ai/ha at 50 and 70 DAS respectively. Minimum root length was found in weedy check at both the stages of crop growth. Root length found higher under sole pigeon pea but root width and dry matter were found higher under I_2: PP + GG (2:2). This increase might be due to lower competition faced by pigeon pea leading to more vertical plant and root growth.

Table 1: Effect of weed management and intercropping practices on plant height of pigeon pea and green gram.

Treatments	Plant height (cm) of pigeon pea			Plant height (cm) of green gram		
	30 DAS	60 DAS	90 DAS	30 DAS	60 DAS	90 DAS
Cropping system						
I_1: sole pigeon pea	31.64	85.36	124.30	0.00	0.00	0.00
I_2: pigeon pea + green gram (2:2)	31.31	86.26	125.88	28.58	43.51	63.29
SEm ±	**1.10**	**1.69**	**0.98**	**0.20**	**1.96**	**0.53**
CD at 5%	**NS**	**NS**	**NS**	**1.19**	**11.94**	**3.24**
Weed management						
W_1: Weedy check	33.67	80.36	118.10	26.60	39.62	54.51
W_2: Pendimethalin @ 1kg ai/ha	31.10	88.82	124.66	29.30	46.30	61.14
W_3: Oxyflorfen @ 0.2 kg ai/ha PE	33.88	88.38	122.57	28.80	40.46	57.05
W_4: Imazethapyr @ 0.1 kg ai/ha	30.03	83.99	122.63	31.13	45.72	62.57
W_5: Pendimethelin @ 1.0 kg ai + Imazethapyr @0.1 kg ai/ha	30.77	86.41	136.47	27.73	53.85	73.04
W_6: Oxyflorfen @ 0.2 kg ai/ha PE + Imazethapyr @0.1 kg ai/ha post emergence	29.42	86.90	126.10	27.93	35.14	71.45
SEm ±	**1.63**	**3.27**	**2.52**	**1.15**	**3.13**	**0.73**
CD at 5%	**NS**	**NS**	**7.42**	**NS**	**NS**	**2.16**

Table 2: Effect of weed management and intercropping practices on plant dry matter (g) of pigeon pea and green gram.

Treatments	Plant dry matter (g)of pigeon pea			Plant dry matter (g)of green gram		
	30 DAS	60 DAS	90 DAS	30 DAS	60 DAS	90 DAS
Cropping system						
I_1: sole pigeon pea	2.80	7.45	31.87	0.00	0.00	0.00
I_2: pigeon pea + green gram (2:2)	2.67	7.36	27.75	1.03	2.40	7.95
SEm ±	**0.07**	**0.62**	**0.57**	**0.12**	**0.07**	**0.18**
CD at 5%	**NS**	**NS**	**3.47**	**0.75**	**0.40**	**1.10**
Weed management						
W_1: Weedy check	2.02	7.06	28.85	0.76	1.55	7.16
W_2: Pendimethalin @ 1kg ai/ha	2.90	8.03	27.11	1.23	2.89	8.75
W_3: Oxyflorfen @ 0.2 kg ai/ha PE	2.40	6.22	27.83	1.17	1.77	7.13
W_4: Imazethapyr @ 0.1 kg ai/ha	2.33	7.39	29.42	0.99	2.22	7.85
W_5: Pendimethelin @ 1.0 kg ai + Imazethapyr @0.1 kg ai/ha	3.65	8.13	31.22	1.07	2.94	9.07
W_6: Oxyflorfen @ 0.2 kg ai/ha PE + Imazethapyr @0.1 kg ai/ha post emergence	3.10	7.61	34.44	0.94	3.00	7.78
SEm ±	**0.30**	**0.73**	**1.18**	**0.12**	**0.11**	**0.27**
CD at 5%	**0.88**	**NS**	**3.48**	**NS**	**0.33**	**NS**

In case of the weed management practices, these were recorded higher under the treatment Pendimethelin @ 1.0 kg ai + Imazethapyr @0.1 kg ai/ha at all the crop stages being at par with W_6: Oxyfluorfen @ 0.2 kg ai/ha PE + Imazethapyr @0.1 kg ai/ha post emergence. Minimum values were recorded under weedy check. Similar were the findings reported by Pusdekar *et al.* (2008); Dangi *et al*. (2012).

Table 3: Effect of weed management and intercropping practices on root length (cm) of pigeon pea and green gram.

Treatments	Root length (cm) of pigeon pea		Root length (cm) of pigeon pea	
	60 DAS	90 DAS	60 DAS	90 DAS
Cropping system				
I_1: sole pigeon pea	13.73	16.93	0.00	0.00
I_2: pigeon pea + green gram (2:2)	13.22	16.63	10.50	16.96
SEm ±	**0.65**	**0.52**	**0.07**	**0.02**
CD at 5%	**NS**	**NS**	**0.41**	**0.13**
Weed management				
W_1: Weedy check	12.41	15.20	7.56	15.88
W_2: Pendimethalin @ 1kg ai/ha	14.58	18.29	10.16	16.39
W_3: Oxyflorfen @ 0.2 kg ai/ha PE	12.29	13.76	7.94	16.36
W_4: Imazethapyr @ 0.1 kg ai/ha	13.35	15.80	8.66	16.50
W_5: Pendimethelin @ 1.0 kg ai + Imazethapyr @0.1 kg ai/ha	14.27	20.04	14.03	20.11
W_6: Oxyflorfen @ 0.2 kg ai/ha PE + Imazethapyr @0.1 kg ai/ha post emergence	13.95	17.55	14.61	16.52
SEm ±	**0.55**	**0.71**	**0.27**	**0.22**
CD at 5%	**1.63**	**2.10**	**0.79**	**0.65**

Number of nodules per plant and dry weight of root nodules/plant (g). Cropping system did not influenced number of root nodule as well as dry weight of nodules per plant in pigeon pea. However, weed management practices significantly affects number of nodules per plant at 90 DAS and dry weight of nodules per plant at both the stages of growth shown in Table 4. Maximum number of nodules per plant (9.75) at 60 DAS and dry weight of nodules per plant (0.30 & 0.57 g) at 60 aand 90 Das was recorded under I_1: sole pigeon pea. Maximum number of nodules per plant (10.38 and 20.35) and dry weight of nodules per plant (0.33 and 0.66 g) were observed under W_5: Pendimethelin @ 1.0 kg ai + Imazethapyr @0.1 kg ai/ha at 60 and 90 DAS. The differences between W_5: Pendimethelin @ 1.0 kg ai +Imazethapyr @ 0.1 kg ai/ha and W_6: Oxyflorfen @ 0.2 kg ai/ha PE + Imazethapyr @ 0.1 kg ai/ha post emergence were non significant in case of dry weight of nodules per plant. Root length of green gram was increased with the advancement of crop growth stage up to 70 days. It was recorded significantly higher under W_5: Pendimethelin @ 1.0 kg ai + Imazethapyr @0.1 kg ai/ha being at par with W_6: Oxyfluorfen @ 0.2 kg ai/ha PE + Imazethapyr @0.1 kg ai/ha at 50 and 70 DAS respectively. Minimum root length was found in weedy check at both the stages of crop growth. Number of nodules per plant and their dry weight were found to be distinctly higher at 60 and 90 days crop stages under various weed management practices, however they were not affected significantly by cropping system treatments. Among weed control practices, maximum values of number of nodules and dry weight of nodules per plant were noticed W_5: Pendimethelin @ 1.0 kg ai + Imazethapyr @0.1 kg ai/ha at 60 and 90 DAS stages of crop growth and minimum were noticed in weedy check similar result found that (Singh *et al.*, 2016).

Yield attributes. A perusal of data showed that number of pods/plant and seed yield per plant of pigeon pea was higher under I_1: sole PP (53.09) as compared to I_2: PP+GG (2:2) (51.83) shown in Table 5. The maximum pod length was noticed in case I_2: pigeon pea + green gram 2:2 (4.04 cm) and W_4: Imazethapyr @ 0.1 kg ai/ha (4.35 cm). Seeds/pod of pigeon pea was not affected significantly due to various cropping systems, however weed management practices showed significant impact on number of seeds per pod. Under weed management practices affected hundred seed weight of pigeon pea significantly. The data clearly indicated that the highest 100 seed weight was recorded little under I_2: pigeon pea + green gram (2:2) in case of cropping system treatment, while in case of weed management practices, it was recorded highest under W_5 as well as W_6. In weed management treatment, it was noted significantly greater under W_6: Oxyfluorfen @ 0.2 kg ai/ha PE + Imazethapyr @0.1 kg ai/ha followed by W_5: Pendimethelin @ 1.0 kg ai + Imazethapyr @ 0.1 kg ai/ha and minimum in W_1: Weedy check. This variation in yield attributes may be due to greater growth parameters and more nodule formation which weight have promoted for greater formation of yield attributes parameters. It may be due to the better field conditions obtained due to weed free soil. These results are mostly similar to the results reported by Tomar *et al.* (2004); Reddy *et al*. (2008); Nirala *et al*. (2012); Hemlata and Dewangan (2012). The increase in seed and yield attributes was mainly due to maintenance of weed free environment, especially during critical growth stages of crop, reduce crop weed competition which helped in better growth

and development of pigeon pea and green gram ultimately resulting in higher yield attributes. These findings are accordance with the findings those of (Chhodavadia *et al*., 2014; Chaudhari *et al.*, 2016).

Yield and harvest index. Seed yield of pigeon pea sole (11.36.68 kg/ha) was recorded higher than I_1: sole pigeon pea (1119.67 kg/ha) shown in table - 6. In weed management, W_5: Pendimethelin @ 1.0 kg ai + Imazethapyr @0.1 kg ai/ha (1126.77 kg/ha) gave significantly higher seed yield than rest of weed management treatments and is at par with W_6: Oxyflorfen @ 0.2 kg ai/ha PE + Imazethapyr @0.1 kg ai/ha post emergence (1311.80 kg/ha). Minimum seed yield was recorded in weedy check treatment. Straw yield of pigeon pea was non-significantly affected by the inter cropping but significantly with weed management practices. In case of weed management practices, treatment W_5: Pendimethelin @ 1.0 kg ai + Imazethapyr @0.1 kg ai/ha gave significantly higher straw yield of 1745.48 kg/ha which is at par with W_6. Minimum straw yield was found in weedy check treatment.

Table 4: Effect of cropping system and weed management on root nodules and dry weight of root nodules (g) of pigeon pea and green gram.

Treatments	Pigeon pea				Green gram			
	Number of nodules per plant		Dry weight of root nodules/plant (g)		Number of nodules per plant		Dry weight of root nodules/plant (g)	
	60 DAS	90 DAS	60 DAS	90 DAS	60 DAS	90 DAS	60 DAS	90 DAS
Cropping system								
I_1	9.75	15.67	0.30	0.57	0.00	0.00	0.00	0.00
I_2	8.33	15.75	0.28	0.52	17.30	22.79	0.63	0.25
SEm ±	**1.17**	**0.44**	**0.02**	**0.02**	**2.82**	**1.25**	**0.32**	**0.01**
CD at 5%	**NS**	**NS**	**NS**	**NS**	**17.16**	**7.61**	**NS**	**0.06**
Weed management								
W_1	7.87	13.07	0.26	0.46	13.00	22.76	0.19	0.27
W_2	9.33	15.70	0.32	0.55	13.22	19.99	0.31	0.24
W_3	8.23	12.20	0.26	0.50	18.11	33.54	0.20	0.25
W_4	9.37	14.52	0.27	0.53	18.55	19.77	2.71	0.23
W_5	10.38	20.35	0.33	0.66	21.11	20.22	0.19	0.24
W_6	9.09	18.40	0.30	0.59	19.83	20.44	0.18	0.28
SEm ±	**0.84**	**0.59**	**0.01**	**0.03**	**1.49**	**3.05**	**0.51**	**0.01**
CD at 5%	**NS**	**1.74**	**0.04**	**0.08**	**NS**	**NS**	**NS**	**NS**

Table 5: Effect of intercropping and weed management practices on yield attributes of pigeon pea and green gram.

Treatments	Yield attributes of pigeon pea					Yield attributes of green gram				
	Pod length (cm)	Pods/ plant	Seeds/ pod	100 seed weight (g)	Seed yield per plant (g)	Pod length (cm)	Pods/ plant	Seeds/ pod	100 seed weight (g)	Seed yield per plant (g)
Cropping system										
I_1	53.09	3.88	3.11	11.31	20.61	0.00	0.00	0.00	0.00	0.00
I_2	51.83	4.04	3.11	11.39	19.64	5.89	26.96	7.20	6.09	48.44
SEm ±	**0.22**	**0.04**	**0.02**	**0.07**	**0.62**	**0.07**	**0.65**	**0.04**	**0.09**	**0.04**
CD at 5%	**NS**	**NS**	**NS**	**NS**	**NS**	**0.43**	**3.95**	**0.25**	**0.55**	**0.24**
Weed management										
W_1	44.40	3.77	2.85	10.83	17.80	4.97	22.53	6.22	5.13	47.67
W_2	52.23	3.56	3.03	11.50	20.46	5.84	24.73	6.85	5.41	49.00
W_3	46.60	3.74	2.83	10.75	18.19	5.26	25.67	6.18	6.13	47.33
W_4	50.93	4.35	2.95	11.17	18.97	5.91	24.40	7.09	5.47	47.67
W_5	61.60	4.13	3.47	11.92	22.85	6.73	32.67	8.30	7.20	49.67
W_6	59.00	4.20	3.50	11.92	22.48	6.62	31.73	8.53	7.20	49.33
SEm ±	**1.23**	**0.25**	**0.10**	**0.15**	**0.46**	**0.09**	**0.88**	**0.06**	**0.21**	**0.21**
CD at 5%	**3.62**	**NS**	**0.29**	**0.45**	**1.36**	**0.27**	**2.58**	**0.18**	**0.61**	**0.62**

Note - I_1: sole pigeon pea, I_2: pigeon pea + green gram (2:2), W_1: Weedy check, W_2: Pendimethalin @ 1kg ai/ha, W_3: Oxyflorfen @ 0.2 kg ai/ha PE, W_4: Imazethapyr @ 0.1 kg ai/ha, W_5: Pendimethelin @ 1.0 kg ai + Imazethapyr @0.1 kg ai/ha and W_6: Oxyflorfen @ 0.2 kg ai/ha PE + Imazethapyr @0.1 kg ai/ha post emergence.

Table 6: Effect of weed management and intercropping practices on yields and harvest index of pigeon pea and green gram and harvest index.

Treatments	Pigeon pea				Green gram		
	Seed yield (kg/ha)	Straw yield (kg/ha)	Stick yield (kg/ha)	Harvest index (%)	Seed yield (kg/ha)	Straw yield (kg/ha)	Harvest index (%)
Cropping system							
I_1	1136.68	1500.99	5032.63	14.91	0.00	0.00	0.00
I_2	1119.67	1497.55	5235.64	14.27	738.09	1729.71	29.67
SEm ±	**9.65**	**23.69**	**158.25**	**0.39**	**15.59**	**54.25**	**0.49**
CD at 5%	**NS**	**NS**	**NS**	**NS**	**44.88**	**130.12**	**2.99**
Weed management							
W_1	917.70	1281.24	4139.92	14.54	535.18	1473.14	26.91
W_2	1151.38	1515.50	5305.20	14.46	796.29	1847.05	30.33
W_3	1027.08	1356.24	4697.56	14.63	544.29	1504.70	26.61
W_4	1034.37	1368.72	4801.73	14.38	698.14	1687.95	29.12
W_5	1326.73	1745.48	6094.43	14.53	979.62	2110.93	31.77
W_6	1311.80	1728.47	5765.96	15.02	874.99	1754.51	33.29
SEm ±	**20.10**	**30.97**	**167.12**	**0.29**	**19.20**	**55.15**	**0.64**
CD at 5%	**59.28**	**91.37**	**493.01**	**NS**	**56.65**	**162.71**	**1.87**

Stick yield was recorded higher with I_2: pigeon pea + green gram (2:2) (5235.64 kg/ha) which was statistically at par with that of under I_1: sole PP (5032.63 kg/ha). Among weed management practices, W_5: Pendimethelin @ 1.0 kg ai + Imazethapyr @0.1 kg ai/ha gave significantly higher straw yield of 6094.43 kg/ha which is at par with W_6. Minimum stick yield was recorded in weedy check treatment. The data revealed that it was significantly higher with pigeon pea sole (14.91 %) and minimum I_2: PP + GG 2:2 (14.27 %) treatment. Under weed management practices, it was recorded highest with W_6: Oxyflorfen @ 0.2 kg ai/ha PE + Imazethapyr @0.1 kg ai/ha post emergence (15.02 %). Seed yield of green gram was affected significantly due to cropping system and weed control methods. As there was the crop of green gram was absent under treatment I_1: sole pigeon pea, the seed yield of green gram was recorded significantly higher as 738.09 kg/ha under the single cropping system treatment compared I_2: PP+GG (2:2). In weed management treatment, the application of W_5: Pendimethelin @ 1.0 kg ai + Imazethapyr @0.1 kg ai/ha (979.62 kg/ha) gave significant higher seed yield (979.62 Kg/ha), straw yield (2110.93 Kg/ha) and harvest index (31.71 %) compared to control. The higher seed yield might be due to significantly greater yield attributes and better growth environments. Such enhancement might be due to least completion between crop plant and weeds which resulted better interception and utilization of radiant energy leading to higher photosynthesis and finally improvement yield of pigeon pea and green gram. The results confined to the findings Hemlata and Dewangan (2012); Nirala *et al*. (2012). This weight be because of better spatial arrangement of sole as well intercropping system (2:2). This system caused less competition for main crop pigeon pea and resulted into higher reproductive primodia formation in pigeon pea combined with weed management. The results were confirmed by Singh and Abraham (2017). If the crops grown together differ in the way they utilized resources, they can complement each other and make better combined use of resources than when they grow separately (Gomes and Gurevitch 2015).

Benefit cost ratio. Benefit: cost ratio was found to be significant under both treatments *viz.* cropping system and weed management practices and has been given Table 7. It was noted maximum B:C ratio was obtained under I_2: PP+GG 2:2 (5.43) followed by I_1: sole pegion pea (3.95).

Table 7: Interaction effects of cropping system and weed management on benefit: cost ratio of pigeon pea and green gram.

Weed management	Cropping system			
	I_1: sole pigeon pea	I_2: PP + BG (2:2)	I_1: sole pigeon pea	I_2: pigeon pea + green gram (2:2)
W_1	3.507	4.034	3.507	4.034
W_2	4.233	5.226	4.233	5.226
W_3	3.724	4.776	3.724	4.776
W_4	3.650	5.370	3.650	5.370
W_5	4.472	7.145	4.472	7.145
W_6	4.353	6.114	4.353	6.114
	2 I at same or different W	2 W at same I	2 I at same or different W	2 W at same I
SEm ±	0.14	0.15	0.14	0.15
CD at 5%	0.60	0.44	0.60	0.44

However, in weed management practices, benefit: cost ratio was calculated significantly higher under W_5: Pendimethelin @ 1.0 kg ai + Imazethapyr @0.1 kg ai/ha (5.34) than other treatments, followed by W_6: Oxyflorfen @ 0.2 kg ai/ha PE + Imazethapyr @0.1 kg ai/ha post emergence (5.12) treatment. Least value was observed in weedy check. Similar results were reported by Kundu *et al.* (2009); Ali *et al*., (2011).

CONCLUSION

On the basis of the results obtained from the experiment, It can be concluded that, under intercropping system based on pigeon pea + green gram (2:2) is an superseding cropping system in respect to crop growth, root length and root nodules, yield attributes, yield and befit cost ratio as compared to alone pigeon pea or green gram. Weed can be managed efficiently by application of the pre emergence weedicide Pendimethalin @ 1.0 kg ai with post emergence weedicide Imazethapyr @0.1 kg ai/ha (W_5) or by pre emergence weedicide Oxyfluorfen @ 0.2 kg ai/ha with post emergence weedicide Imazethapyr @ 0.1 kg ai/ha ((W_6). These weedicides were found efficient in controlling weeds and in relation to higher yield attributes, seed and straw yield of pigeon pea and green gram. Under intercropping system I_2: pigeon pea+green gram (2:2) combined with pre emergence application of Pendimethelin@ 1.0 kg ai or Oxyfluorfen @ 0.2 kg ai/ha with post emergence application of Imazethapyr @ 0.1 kg ai/ha was most appropriate, profitable and productive treatment combination for pigeon pea and green gram crops under rainfed area of Kymore plateau of Madhya Pradesh. Economics of intercropping system I_2: pigeon pea + green gram (2:2) was found better in terms of benefit: cost ratio.

Acknowledgement. We are grateful to the Department of Agronomy, Mahatma Gandhi Chitrakoot Gramodaya Vishwavidyalaya, Satana for providing research facilities.
Conflict of Interest. None.

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How to cite this article: Balkrishna Namdeo, Neelash Patel, Dig Vijay Dubey, Shriman Kumar Patel, Munesh Kumar and Vikash Singh Thakur (2022). Effect of Weed Management Practices on Pigeon Pea and Green Gram intercropping System based on rainfed condition in Kymore Plateau of Madhya Pradesh. *Biological Forum – An International Journal, 14*(3): 1630-1636.