RESEARCH ARTICLE

Influence of Different Weed Management Practices on Weed Indices and Growth Parameters of Summer Moong (*Vigna radiata* L.Wilczek) Under Irrigated Conditions of Punjab

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Abstract

A field experiment was conducted during *summer* season of 2019-20 at the Campus for Research and Advanced Studies Dhablan of General Shivdev Singh Diwan Gurbachan Singh Khalsa College, Patiala, Punjab. A set of 12 different treatment combinations were laid out in randomized block design with 3 replications. Different weed management practices significantly influenced weed indices, growth and economics of summer moong crop. Besides weed free treatment, weed indices like total weed population (3.13 m^{-2}), weed dry weight (4.07 gm^{-2}) and weed index except weed control efficiency (%) were recorded significantly minimum with application of Pendimethalin @ 1.0 kg ha^{-1} pre emergence (PE) followed by hand weeding (H.W.) at 30 date after sowing (DAS), followed by the application of Imazethapyr @75 gm ha^{-1} (PE) followed by one hand weeding at 30 DAS at all growth stages. All growth parameters *viz.,* plant height (36.28 cm), number of branches $plant^{-1}$ (10.16) and dry weight (76.63 g) $plant^{-1}$ significantly increased with application of Pendimethalin @ 1.0 kg ha^{-1}(PE) followed by H.W. at 30 DAS. The benefit cost ratio (2.68) was significantly maximum with application of Pendimethalin @ 1.0 kg ha^{-1} (PE) followed by H.W. at 30 DAS.

Keywords: Economics, Herbicide, Plant height, Summer moong, Weed.

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Introduction

Mungbean (*Vigna radiata* L.Wilczek), 2n=2x=22, belongs to the family Fabaceae also known as green gram. It requires a hot climate, but in India, it is grown in three seasons: kharif, rabi, and summer crop. The leguminous crop possesses root nodules, which increase the fertility of soil by fixing atmospheric nitrogen across symbiotic association with *Rhizobium*. After chickpeas and pigeon pea, mungbean is India's third important pulse crop in production and area cultivated, which is one of vast pulses production in the universal. In Punjab, area and production of mungbean during *kharif* season in 2019 –2020 was 3.2 thousand ha^{-1} and 2.7 thousand tones, respectively yield was 8.34q ha^{-1}(Anonymous 2020). Weed management has always been important in summer mung production. The choice of weed control methods depends on the available technology, cropping system and farmer resources. Hand weeding and chemical weed control are the most common weed control methods in India's mungbean. This practice is possible only after a stage when weeds have put forth sufficient growth to provide sufficient grip for uprooting. Chemical weed control has been found to be more economical than hand weeding. If weeds are not controlled at early stage, they cause considerable loss to the crop. D iscovery of several selective herbicides (Pendimethalin, Imazethapyr, Imazamox and Quizalofop) for green gram has also opened up new opportunities for productivity enhancement through efficient weed management. This situation coupled with acute labor strategy and higher costs involved in hiring labor has necessitated the identification of suitable chemical weed management strategies in green gram.

Materials And Methods

The field experiment was conducted during *summer* season of 2019-20 at Campus for Research and Advanced Studies Dhablan, of Post Graduate Department of Agriculture, General Shivdev Singh Diwan Gurbachan Singh Khalsa College, Patiala. The soil of the experiment field was clayey in texture, neutral in reaction (7.1), low in available nitrogen (187.26 kg ha^{-1}), medium in available phosphorus(19.4 kg ha^{-1}), medium in available potassium (130.0 kg ha^{-1}) and medium in organic carbon (0.6%). The experiment comprising of 12 treatment combinations *viz.,* T_1 (Weedy check), T_2 (Weed free), T_3 (Farmer practices IC+HW (15 DAS + 30DAS), T_4 Paddy straw mulching, T_5 (Hoeing (by wheel)), T_6 (Hand weeding 35 DAS), T_7 (Two hand weeding 25 and 45 DAS), T_8 (Pendimethalin @ 1.0 kg ha^{-1}), T_9 (Imazethyper @ 75 gm ha^{-1} (PE)), T_{10}(Pendimethalin @ 75 gm ha^{-1} (PE) followed by H.W. at 30 DAS, T_{11}(Imazethypr @ 75 gm ha^{-1} (PE) followed by H.W. at 30 DAS, T_{12} (Pendimethalin @ 1.0 kg ha^{-1} (PE) + Paddy straw mulching and replicated three times. Summer mung cultivar SML-832, was sown in lines by Kera method keeping row to row spacing of 30 cm on first fortnight of April. The recommended dose of nutrient was applied for raising the crops. All the recommended package of practices was followed to raised the crop. The crop was harvested during second first of June, 2020. Weed control

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was done as per treatment. The experimental field was infested with both grassy and broad leaf weeds. *Chenopodium album, Rumex dentatus, Fumaria parviflora, Melilotus spp. Anticulata, Avena ludov, Ingallis arvensis* etc. *Chenopodium albumn, Medicago denticulate* and *Avena ludoviciana* were the dominant seeds of the experimental field. Weed population (No. m^{-2}) and dry weight of weeds (g m^{-2}) were recorded by using 1 m^2 quadrate randomly placed at two places in net plot at 20, 40 DAS and at harvest. The weed plants were sun dried and then oven dried at 600C until constant weight. Weed control efficiency (%) and weed index were measured by using the following formula at 20, 40 DAS and at harvest.

$$\text{WCE (\%)} \frac{\textit{Dry matter of weeds in control plot X Dry matter of weeds in treated plots}}{\textit{Dry matter of weeds in treated plots}}$$

$$\text{WI (\%)} = \frac{\textit{Yield of crop from weed free plot X Yield of crop from treated plot}}{\textit{Yield of crop from treated plot}} X\ 100$$

For periodical plant height (cm) and number of branches $plant^{-1}$ were recorded by calculating the average of five plants selected at random at 20 days intervals till harvest. Dry matter accumulations (g $plant^{-1}$) were recorded by five randomly selected plants from each plot at 20 days intervals. Gross return was worked out by multiplying grain and straw yield with their prevailing/market prices and expressed in rupees $hectare^{-1}$. Net return was calculated by subtracting cost of cultivation from gross return and B: C ratio was calculated from net return and cost of cultivation. The data were analyzed as per the standard procedure for "Analysis of Variance" (ANOVA) as described by Gomez and Gomez (1984). The significance of treatments was tested by 'F' test (Variance ratio). Standard error of mean was computed in all cases. The difference in the treatment mean was tested using critical difference (CD) at 5% probability level.

Results And Discussions

Total Number of Weed

Influence on different weed management practices on total weed populations m^{-2} is presented in Table 1 showed that different weed management practices significantly influence the weed population sat 20, 40 DAS and at harvest. Besides weed free treatment significantly, lowest weed populations was found with the application of pendimethalin (PE) @ 1.00 kg ha^{-1} followed by H.W. at 30 DAS however it was statistically at par with the application of Imazethypr(PE)@ 0.75gmha^{-1}followedbyH.W.at 30 DAS, hand weeding at 35 DAS, two hand weeding at 25 and 45 DAS, Pendimethalin(PE)@1.0kgha^{-1}+ Paddy straw mulching and farmer practices IC + HW (15 DAS+ 30 DAS) treatments at 20, 40 DAS and at harvest. Significantly, maximum weed populations were found in weedy check (control) treatment. Data clearly showed that Pendimethalin (PE) followed by hand weeding at 30 DAS has effectively suppressed the weed intensity and reduced the weed dynamics of grasses and broadleaved weeds. Similar findings were ported by Bhutada *et al*.(2013), Naidu *et al*.(2012) and Malik *et al*.(2005).

Dry Weight of Weed (g)

The data on dry weight of weeds (g) m^{-2} was recorded at 20, 40 DAS and harvest presented in Table 2 showed that all the treatments gave lower dry weight of weeds as compared to weedy check. The significantly lower dry weight of weed (g) m^{-2} was recorded with application of pendimethalin (PE) @ 1.00 kg ha^{-1} followed by H.W. at 30 DAS at all growth stages. However, it was statistically at par with the application of imazethypr (PE)@ 0.75gmha^{-1}followed by H.W. at 30 DAS at 20, 40 DAS at harvest. The maximum dry weight of weed was found in weedy check treatment. The results of the present study showed that different weed control treatments significantly influenced dry weight of weeds. All the herbicidal treatments i.e. Pendimethalin and Imazethypr as PE might have effectively reduced the dry weight of weeds significantly over weedy check (control). Similar results were reported by Koodi *et al*. (2010), Chaudhary *et al*. (2016), Chhodavavadia *et al*. (2014).

Table 1: Influence of different weed management practices on total number of weed population m^{-2}

S.No.	*Treatments*	*20DAS*	*40DAS*	*At Harvest*
T_1	Weedy check(Control)	5.44	10.18	10.58
T_2	Weed free	1.00	1.00	1.00
T_3	Farmer practices IC+HW(15DAS+30DAS)	1.96	2.34	3.68
T_4	Paddy straw mulching	3.46	3.57	5.51
T_5	Hoeing (by wheels)	3.29	2.85	5.42
T_6	Handweeding 35 DAS	1.57	3.13	4.18
T_7	Two Hand Weeding 25 and 45 DAS	1.84	2.28	3.48
T_8	Pendimethalin (PE) @1.0 $kgha^{-1}$	2.53	3.17	4.73
T_9	Imazethypr (PE) @ 0.75 $gmha^{-1}$	2.64	3.28	4.87
T10	Pendimethalin (PE) @1.0 $kgha^{-1}$followed by H.W. at 30 DAS	1.07	2.21	3.13
T11	Imazethypr (PE) @ 0.75 $gmha^{-1}$followed by H.W.at 30 DAS	1.30	2.24	3.32
T12	Pendimethalin (PE) @1.0 $kgha^{-1}$+ Paddy straw mulching	1.89	2.49	3.74
SEd ±		0.45	0.50	0.50
CD (0.05)		0.94	1.04	1.05

Weed Control Efficiency and Weed Index

The data pertaining to weed control efficiency (%) was recorded at 20, 40 DAS and at harvest is presented in Table 3, The maximum weed control efficiency was recorded in weed free and the minimum weed control efficiency was observed in weedy check at the growth stages at all growth stages. At 20 DAS, the minimum weed control efficiency (%)(0.00, 0.00 and 0.00) were found under the treatment T_1 (Control), significantly higher weed control efficiency was recorded with treatment T_2 (Weed free) which was at par with hoeing. Two hand weeding 25 and 45 DAS, Pendimethalin (PE)@1.0 $kgha^{-1}$, Imazethypr @ 0.75 gm ha^{-1}, Imazethypr (PE) @ 0.75 gm ha^{-1} followed by one-hand weeding and Pendimethalin (PE)@ 1.0 $kgha^{-1}$paddy straw mulching.

Table 2: Influence of different weed management practices on dry weight of weed (g)m^{-2}

S. no.	*Treatments*	*20DAS*	*40DAS*	*At Harvest*
T_1	Weedy check(Control)	3.96	11.84	18.29
T_2	Weed free	1.00	1.00	1.00
T_3	Farmer practices IC +HW(15DAS+30DAS)	1.75	2.75	3.81
T_4	Paddy straw mulching	3.14	3.74	5.81
T_5	Hoeing (by wheels)	3.06	3.66	5.95
T_6	Hand weeding35DAS	1.79	3.11	5.15
T_7	Two Hand Weeding 25 and 45 DAS	1.70	2.30	4.98
T_8	Pendimethalin (PE) @ 1.0 $kgha^{-1}$	1.95	3.18	5.37
T_9	Imazethypr (PE) @ 0.75 $gmha^{-1}$	1.96	3.59	4.38
T10	Pendimethalin (PE) @ 1.0 $kgha^{-1}$ followed by H.W.at 30 DAS	1.01	2.62	4.07
T11	Imazethypr (PE)@ 0.75 gm ha^{-1}followed by H.W. at 30 DAS	1.02	2.68	4.17
T12	Pendimethalin (PE) @ 1.0 $kgha^{-1}$ + Paddystrawmulching	1.78	2.76	4.26
SEd±		0.23	0.31	0.40
CD (0.05)		0.49	0.68	0.85

At 40 DAS and 60 DAS, significantly higher weed control efficiency was found with treatment T_2 (Weed free), followed by the application of Pendimethalin (PE) 1.0 kg followed by H.W at 30 DAS and lowest weed control efficiency was recorded with T_1 (Control).However, it was at par with the application of hand weeding 35 DAS, Imazethypr @ 0.75 gm ha^{-1}followed by one hand weeding and Pendimethalin (PE) @ 1.0 kg ha^{-1} paddy straw mulching. The higher weed control efficiency could be due to better weed control owing to lower dry weight throughout the crop growth under these treatments. Similar results were reported by Rathi *et al*. (2008) and Kaur *et al*. (2009).

The minimum weed index was recorded in treatment T_1 (weed free) and among the other treatments, the lowest weed index was observed with application of Pendimethalin (PE) followed by H.W at 30 DAS. Highest value of weed index was observed with T_1(control) while application of Pendimethalin (PE) @ 1.0 kg ha^{-1} paddy straw mulching, Farmer practices IC+ HW(15DAS+30 DAS), Two hand weeding 25 and 45 DAS, hand weeding 35 DAS and paddy straw mulching, Hoeing, Two hand weeding 25 and 45 DAS and Pendimethalin (PE)@ 1.0 $kgha^{1}$ were statistically at par with each other. This might be due to effective control of weeds and lower dry matter production of weeds under these treatments. The higher weed index was in weed free. Similar results were reported by Parvender *et al*. (2006) and Butter *et al*. (2006)

Growth Parameters

The data pertaining to plant growth parameters *viz.,* plant height (cm), numbers of branches $plant^{-1}$, and dry matter (g) presented in Table 4 showed that different management practices significantly affected all the growth parameters. Significantly higher plant height (cm),numbers of branches $plant^{-1}$, dry matter (g) were observed with the application of pendimethalin (PE) @ 1.0 kg ha^{-1} followed by H.W.at 30 DAS at all growth stage. However, it was statistically at par with application of Imazethypr (PE) @ 0.75 gm ha^{-1} followed by H.W. at 30 DAS, Two Hand Weeding 25 and 45DAS and Farmer practices IC + HW (15DAS+30DAS) at 40 DAS and at harvest. Significantly, lower plant height (cm), numbers of branches $plant^{-1}$, and dry matter (g) were recorded with controlled plot at 20, 40 DAS

Table 3: Influence of different weed management practices on weed control efficiency(%) and weed index (%)

S.No.	*Treatments*	*Weed control efficiency(%)*			*Weed Index (%)*
		20 DAS	*40 DAS*	*At Harvest*	
T_1	Weedy check(Control)	00	00	00	47.51
T_2	Weed free	93.67	91.55	94.53	0.00
T_3	Farmer practices IC +HW(15DAS+30DAS)	55.80	76.77	79.16	8.11
T_4	Paddy straw mulching	20.70	68.41	68.23	24.86
T_5	Hoeing(by wheels)	22.79	69.08	67.46	18.58
T_6	Handweeding35 DAS	94.79	73.73	71.84	12.16
T_7	Two Hand Weeding 25 and 45 DAS	57.07	80.57	72.77	9.60
T_8	Pendimethalin (PE) @ 1.0 $kgha^{-1}$	50.75	73.14	70.63	19.13
T_9	Imazethypr(PE)@0.75 $gmha^{-1}$	50.50	69.67	76.05	19.96
T10	Pendimethalin (PE) @ 1.0 $kgha^{-1}$followed by H.W. at 30 DAS	74.49	77.87	77.74	6.64
T11	Imazethypr (PE) @ 0.75 gm ha^{-1}followed by H.W. at 30 DAS	74.24	77.36	77.20	7.87
T12	Pendimethalin (PE) @ 1.0 $kgha^{-1}$+Paddystrawmulching	55.05	76.68	76.70	8.63
SEd ±		1.79	1.07	1.50	4.59
CD(0.05)		3.71	2.41	3.12	7.64

Table 4: Influence of different weed management practices on plant height (cm), number of branches plant^{-1} and dry weight (g) of summer mung.

S. No.	Treatments	Plant height (cm)			Number of branches plant^{-1}			Dry weight (g)		
		20 DAS	40 DAS	At harvest	20 DAS	40 DAS	At harvest	20 DAS	40 DAS	At harvest
T_1	Weedy check (Control)	8.01	18.41	32.35	2.6	3.20	8.33	4.79	11.83	61.73
T_2	Weed free	12.12	27.58	39.17	3.9	5.55	10.23	7.16	14.30	77.06
T_3	Farmer practices IC + HW (15DAS+30DAS)	9.69	24.86	35.87	3.0	4.56	9.60	6.83	12.90	70.36
T_4	Paddy straw mulching	8.01	19.54	32.55	2.8	3.82	9.06	5.35	11.96	64.20
T_5	Hoeing (by wheels)	8.76	20.05	32.75	2.8	3.59	9.07	5.40	12.13	65.83
T_6	Hand weeding 35 DAS	9.54	21.45	32.18	3.0	4.45	9.10	5.46	12.70	68.06
T_7	Two Hand Weeding 25 and 45 DAS	10.51	24.91	35.87	3.12	4.70	9.73	7.05	13.73	72.30
T_8	Pendimethalin (PE) @ 1.0 kg ha^{-1}	9.01	20.97	32.08	2.9	4.45	9.18	5.72	12.50	67.63
T_9	Imazethypr (PE) @ 0.75 gm ha^{-1}	8.86	20.63	32.75	2.9	4.18	9.10	5.68	12.23	65.10
T_{10}	Pendimethalin (PE) @ 1.0 kg ha^{-1} followed by H.W.at 30 DAS	11.23	25.85	36.28	3.5	5.20	10.16	7.11	14.26	76.63
T_{11}	Imazethypr (PE) @ 0.75 gm ha^{-1} followed by H.W. at 30 DAS	10.69	25.58	36.05	3.11	4.75	9.93	7.06	14.20	74.30
T_{12}	Pendimethalin(PE) @ 1.0 kg ha^{-1}+ Paddy straw mulching	9.67	21.17	28.68	3.02	4.40	9.16	6.02	12.36	68.90
SEd ±		0.17	0.93	1.20	0.16	0.35	0.46	0.81	0.87	1.10
CD		0.35	2.73	3.35	0.33	0.72	0.97	1.59	1.81	2.21

and harvest. Similar results were reported by Kushwaha (2010), Yadav *et al*.(2019) and Koodi (2010). This is due to that plant height increased significantly in weed free treatment at various stages of crop with larger canopy development which might enhance interception, absorption and utilization of radiant energy available for essential growth and development of crop. The number of branches plant-1significantly increased due to the appealing nutritional environmental which have enhanced the metabolic activities in plants, promoting apical growth and increasing the number of branches. Dry weight (g) plant^{-1} was increased due to minimum crop-weed competition, proper supply of light, optimum temperature, optimum space, and improvement in them or phological and physiological characters of plant. The plant height and number of branches plant^{-1}were increased, so that the dry weight (g) plant^{-1} was surely increased.

In term economics, besides control treatment, B: C ration was significantly maximum with the application of pendimethalin (PE) @ 1.0 kg ha^{-1} followed by H.W.at 30 DAS (2.65). Similar findings were reported by Khushwaha 2010 and Patel *et al*.(2018).

Conclusion

From the above study it is inferred that different weed management practices significantly affect weed indices, plant growth parameters and economics of summer moong. The weed indices like total weed population(m^{-2}), weed dry weight (g m^{-2}), weed index except weed control efficiency (%) was recorded significantly minimum with application of Pendimethalin @ 1.0 kg ha^{-1} (PE) followed by H.W. at 30 DAS. Similar trend was followed in case of plant growth parameters and economics of summer moong.

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