Physiological Parameters and Yield of Green Gram As Influenced By Weed Management Practices

ABSTRACT

A field experiment was conducted at Anbil Dharmalingam Agricultural College and Research Institute, Tiruchirappalli during *Summer,* 2021 to evaluate the weed management practices in green gram. The study comprised of eleven weed management practices with different combination *viz*., pre emergence (PE) application of Diclosulam at 17.5 g/ha, Pendimethalin + Imazethapyr 1 kg/ha, post emergence (POE) application of Fluazifop-p-butyl + Fomesafen 313 g/ha, Acifluorfen sodium + Clodinofop propargyl 187.5 g/ha, PE Diclosulam 17.5 g/ha *fb* POE Fluazifop-p-butyl + Fomesafen 313 g/ha , PE Pendimethalin + Imazethapyr 1 kg/ha *fb* POE Fluazifop-p-butyl + Fomesafen 313 g/ha, PE Diclosulam 17.5 g/ha *fb* POE Acifluorfen sodium + Clodinofop propargyl 187.5 g/ha, PE Pendimethalin + Imazethapyr 1 kg/ha *fb* POE Acifluorfen sodium + Clodinofop propargyl 187.5 g/ha, PE Pendimethalin1 kg/ha *fb* HW on 30 DAS, HW on 20 and 40 DAS and unweeded control (UWC) in green gram. The results revealed that the highest plant height, number of branches plant^{-1}, DMP, LAI, CGR, RGR and NAR were registered in PE Pendimethalin + Imazethapyr at 1 kg ha^{-1} *fb* POE Fluazifop-p-butyl + Fomesafen at 313 g ha^{-1}. The grain and haulm yields were also higher in PE Pendimethalin + Imazethapyr at 1 kg ha^{-1} *fb* POE Fluazifop-p-butyl + Fomesafen at 313 gha^{-1} and it was on par with PE Pendimethalin + Imazethapyr at 1 kg ha^{-1} *fb* POE Acifluorfen sodium + Clodinofop propargyl at 187.5 g ha^{-1}. Hence, application of PE Pendimethalin + Imazethapyr at 1 kg ha^{-1} *fb* POE Fluazifop-p-butyl + Fomesafen at 313 g ha^{-1} was found to be the most viable option for getting higher growth and yield in green gram.

Keywords: Green gram; weed management; Growth; Physiological parameters; Yield.

INTRODUCTION

"Pulses are rich source of dietary proteins and inseparable ingredients of vegetarian diet. India contributes about 25 per cent of global pulse production. India is the first largest producer of pulses in the world" [1]. "Green gram (*Vigna radiata L.*) is one of the most important pulse crop. Among the grain legumes, in India green gram stands third position after chickpea and pigeon pea" [2]. "In India, green gram is grown in an area of 4.75 m.ha with a production of
2.45 mt and an average productivity of 516 kg ha^{-1}. In Tamil Nadu, green gram is the major traditional pulse crop cultivated under 1.70 L.ha with production of 0.76 L.t and an average productivity of 451 kg ha^{-1}" [3].

"Weeds are the major yield limiting biotic constraint in green gram. The yield loss due to severe weed infestation varies from 30-80 per cent in green gram" [4]. "The control of weeds during critical period of crop weed competition is very important so as to avoid yield loss" [5]. "Improper weed control results in greater yield loss" [6]. So there is a need to control weeds in order to reduce the yield loss in green gram. Therefore, effective weed management practices are more important for green gram cultivation.

"Hand weeding is difficult due to non-availability of labour as well as high cost of weeding" [5]. "Under these circumstances, one of the best method for controlling weeds is through application of herbicides at appropriate time. Herbicides are used extensively in Indianagriculture nowadays to control or kill weeds and to have timely weed management" [7]. Herbicides are controlling weeds in very broad spectrum with appropriate application [8]. Hence, the present investigation has been carried out to evaluate the different weed management practices on the performance of green gram under sodic soil.

MATERIALS AND METHODS

A field experiment was conducted at Anbil Dharmalingam Agricultural College and Research Institute, Tiruchirappalli, Tamil Nadu during *Summer,* 2021. The experimental field was located at 10° 45' N latitude, 78° 36' E longitude and at an altitude of 85 m above MSL. The experimental soil was low in available nitrogen, medium in available phosphorus and high in available potassium.

The field experiment was laid out in randomized block design (RBD) with three replications and eleven treatments. The treatments comprised of pre emergence (PE) application of Diclosulam at 17.5 g/ha, Pendimethalin + Imazethapyr 1 kg/ha, post emergence (POE) application of Fluazifop-p-butyl + Fomesafen 313 g/ha, Acifluorfen sodium + Clodinofop propargyl 187.5 g/ha, PE Diclosulam 17.5 g/ha *fb* POE Fluazifop-p-butyl + Fomesafen 313 g/ha , PE Pendimethalin + Imazethapyr 1 kg/ha *fb* POE Fluazifop-p-butyl + Fomesafen 313 g/ha, PE Diclosulam 17.5 g/ha *fb* POE Acifluorfen sodium + Clodinofop propargyl 187.5 g/ha, PE Pendimethalin + Imazethapyr 1 kg/ha *fb* POE Acifluorfen sodium + Clodinofop propargyl 187.5 g/ha, PE Pendimethalin 1 kg/ha *fb* HW on 30 DAS, HW on 20 and 40 DAS and unweeded control (UWC). The variety used for the experiment was VBN (Gg) 4.

Observations recorded during the course of investigation were plant height (cm), number of branches $plant^{-1}$, dry matter production (kg/ha), leaf area index (LAI), crop growth rate (CGR) (g/m^2 /day), relative growth rate (RGR) (g/g/day) and net assimilation rate (NAR) (g/cm^2 /day) by adopting standard procedure. The phytotoxic effect of herbicides on green gram was recorded after herbicide application. The observations were taken on 7 and 15 days after herbicide application. Phytotoxicity scoring were made by using rating scale of 0 (normal/no injury) to 10 (complete toxicity) as proposed by Rao [9]. The grain and haulm

yields were recorded and expressed in kg/ha. “All the recorded data were analyzed statisticallyas per the method suggested by Gomez and Gomez” [10].

RESULTS AND DISCUSSION

Growth parameters

Adoption of different weed management practices improved the growth parameters *viz.*, plant height, number of branches plant^{-1} and dry matter production of green gram (Table 1). The tallest plant height (12.1, 24.5 and 46.8 cm), higher number of branches plant^{-1} (4.3/plant) and dry matter production (1066, 1703 and 2700 kg/ha) at 30 DAS, 45 DAS and harvest stages were recorded in PE Pendimethalin + Imazethapyr 1 kg/ha *fb* POE Fluazifop-p-butyl + Fomesafen 313 g/ha and it was comparable with PE application of Pendimethalin + Imazethapyr at 1 kg ha^{-1} *fb* POE Acifluorfen sodium + Clodinofop propargyl at 187.5 g ha^{-1}. This was due to better weed control by the herbicides and increased WCE which result in well-developed foliage canopy and better light interception on crops. This is in conformity with the findings of Ramesh and Rathika [5].

Physiological parameters

The leaf area index (LAI) of green gram promotes photosynthate translocation to meet sink requirements, making it directly tied to grain yield. The highest LAI (1.14, 3.13 and 2.82 at 30 DAS, 45 DAS and harvest stages) was registered with PE application of Pendimethalin + Imazethapyr at 1 kg ha^{-1} *fb* POE Fluazifop-p-butyl + Fomesafen at 313 g ha^{-1} and it was on par with PE Pendimethalin + Imazethapyr at 1 kg ha^{-1} *fb* POE Acifluorfen sodium + Clodinofop propargyl at 187.5 g ha^{-1} (Table 2). The effective control of weeds in these treatments might have favoured the crop growth through better availability of resources. This is in conformity with the findings of Shruthi and Salakinkop [11] and Shanmugapriya et al. [12]. UWC registered lower LAI due to severe weed infestation.

Among all the weed management practices, application of PE Pendimethalin + Imazethapyr at 1 kg ha^{-1} *fb* POE Fluazifop-p-butyl + Fomesafen at 313 g ha^{-1} was registered higher CGR (4.35 and 4.09 g m^{-2} day^{-1}), RGR (0.075 and 0.019 g g^{-1} day^{-1}) and NAR (0.275 and 0.140 mg cm^{-2} day^{-1}) at 30-45 DAS and 45-harvest stage, respectively) and it was followed by PE application of Pendimethalin + Imazethapyr at 1 kg ha^{-1} *fb* POE Acifluorfen sodium + Clodinofop propargyl at 187.5 g ha^{-1} at 30-45 DAS and 45-harvest (Table 2). Sequential application of pre emergence followed by post emergence herbicides was effectively controlled the grasses, sedges and broad leaved weeds and thereby enhanced the CGR, RGR and NAR as reported by Srijani Maji et al. [13].

Visual crop phytotoxicity rating

Application of pre emergence and post emergence herbicides and their doses did not show any phytotoxicity symptoms on green gram. The phytotoxicity effect on green gram has been rated as “none”.

Table 1. Effect of weed management practices on plant height, no. of branches plant^{-1} and dry matter production (DMP) in irrigated green gram

Treatments	Plant height (cm)			No. of branches plant^{-1}	DMP (kg ha^{-1})		
	30 DAS	45 DAS	Harvest		30 DAS	45 DAS	Harvest
T_1 - PE Diclosulam @ 17.5 g ha^{-1}	8.8	16.2	29.7	2.16	809	1300	1887
T_2 - PE Pendimethalin + Imazethapyr @ 1 kg ha^{-1}	9.1	17.1	33.6	2.37	868	1406	2256
T_3 - POE Fluazifop-p-butyl + Fomesafen @ 313 g ha^{-1}	8.9	16.9	32.9	2.29	852	1388	2125
T_4 - POE Acifluorfen sodium + Clodinofop propargyl @ 187.5 g ha^{-1}	8.7	16.7	31.0	2.21	839	1362	1974
T_5 - PE Diclosulam @ 17.5 g ha^{-1} *fb* POE Fluazifop-p-butyl + Fomesafen @ 313 g ha^{-1}	10.8	19.3	38.5	2.64	947	1489	2378
T_6 - PE Pendimethalin + Imazethapyr @ 1 kg ha^{-1} *fb* POE Fluazifop-p-butyl + Fomesafen @ 313 g ha^{-1}	12.1	24.5	46.8	4.35	1066	1703	2700
T_7 - PE Diclosulam @ 17.5 g ha^{-1} *fb* POE Acifluorfen sodium + Clodinofop propargyl @ 187.5 g ha^{-1}	10.3	18.9	37.4	2.42	933	1472	2339
T_8 - PE Pendimethalin + Imazethapyr @ 1 kg ha^{-1} *fb* POE Acifluorfen sodium + Clodinofop propargyl @ 187.5 g ha^{-1}	11.9	23.8	44.2	3.73	1043	1677	2655
T_9 - PE Pendimethalin @ 1 kg ha^{-1} *fb* HW on 30 DAS	10.9	21.3	42.5	2.97	965	1550	2453
T_{10} - HW at 20 and 40 DAS	11.0	22.2	43.3	3.32	1001	1631	2576
T_{11} - Unweeded Control (UWC)	7.9	15.7	28.0	1.45	722	988	1305
SEd	0.5	0.9	1.6	0.13	41	63	99
CD (P=0.05)	0.9	1.7	3.2	0.26	82	126	199

Table 2. Effect of weed management practices on leaf area index (LAI), crop growth rate (CGR), relative growth rate (RGR) and net assimilation rate (NAR) in irrigated green gram

Treatments	LAI			CGR ($g\ m^{-2}\ day^{-1}$)		RGR ($g\ g^{-1}\ day^{-1}$)		NAR ($mg\ cm^{-2}\ day^{-1}$)	
	30 DAS	45 DAS	Harvest	30-45 DAS	45 - Harvest	30-45 DAS	45 - Harvest	30-45 DAS	45 - Harvest
T_1 - PE Diclosulam @ 17.5 g ha^{-1}	0.52	1.97	1.03	3.35	2.40	0.03	0.015	0.221	0.107
T_2 - PE Pendimethalin + Imazethapyr @ 1 kg ha^{-1}	0.71	2.39	1.78	3.67	3.48	0.03	0.018	0.232	0.136
T_3 - POE Fluazifop-p-butyl + Fomesafen @ 313 g ha^{-1}	0.68	2.12	1.71	3.66	3.02	0.03	0.017	0.232	0.125
T_4 - POE Acifluorfen sodium + Clodinofop propargyl @ 187.5 g ha^{-1}	0.66	2.00	1.62	3.57	2.51	0.03	0.015	0.225	0.108
T_5 - PE Diclosulam @ 17.5 g ha^{-1} *fb* POE Fluazifop-p-butyl + Fomesafen @ 313 g ha^{-1}	0.88	2.82	2.16	3.70	3.64	0.03	0.018	0.241	0.138
T_6 - PE Pendimethalin + Imazethapyr @ 1 kg ha^{-1} *fb* POE Fluazifop-p-butyl + Fomesafen @ 313 g ha^{-1}	1.14	3.13	2.82	4.35	4.09	0.07	0.019	0.275	0.140
T_7 - PE Diclosulam @ 17.5 g ha^{-1} *fb* POE Acifluorfen sodium + Clodinofop propargyl @ 187.5 g ha^{-1}	0.82	2.74	2.03	3.68	3.55	0.03	0.018	0.241	0.137
T_8 - PE Pendimethalin + Imazethapyr @ 1 kg ha^{-1} *fb* POE Acifluorfen sodium + Clodinofop propargyl @ 187.5 g ha^{-1}	1.11	3.03	2.70	4.33	4.01	0.03	0.019	0.272	0.139
T_9 - PE Pendimethalin @ 1 kg ha^{-1} *fb* HW on 30 DAS	0.96	2.68	2.43	4.00	3.70	0.03	0.018	0.251	0.138
T_{10} - HW at 20 and 40 DAS	1.01	2.84	2.56	4.30	3.78	0.03	0.018	0.256	0.139
T_{11} - Unweeded Control (UWC)	0.27	1.34	0.86	1.81	1.28	0.02	0.011	0.217	0.118
SEd	0.04	0.11	0.09	0.16	0.14	0.00	0.0005	0.01	0.005
CD (P=0.05)	0.07	0.21	0.18	0.32	0.27	0.00	0.0010	0.02	0.011

Grain and haulm yield

Grain and haulm yields of green gram varied significantly with different weed management practices. PE application of Pendimethalin + Imazethapyr @ 1 kg ha^{-1} *fb* POE Fluazifop-p-butyl + Fomesafen @ 313 g ha^{-1} recorded significantly higher grain and haulm yields (708 kg ha^{-1} and 1602 kg ha^{-1}) than other treatments. However, it was comparable with PE Pendimethalin + Imazethapyr @ 1 kg ha^{-1} *fb* POE Acifluorfen sodium + Clodinofop propargyl @ 187.5 g ha^{-1} with grain and haulm yields of 673 kg ha^{-1} and 1531 kg ha^{-1} (Fig. 1). This might be due to the cumulative effect of increased level of yield attributes which was due to lesser weed competition at critical stages, better uptake of nutrients and good crop stand. These results were in conformity with the findings of Ramesh and Rathika [14].

The UWC registered significantly lower grain and haulm yield (281 kg ha^{-1} and 745 kg ha^{-1}). This could be due to severe weed infestation creates crop weed competition, results in crop plants unable to express their genetic potential. This corroborates with findings of Sudesh Kumar et al. [15].

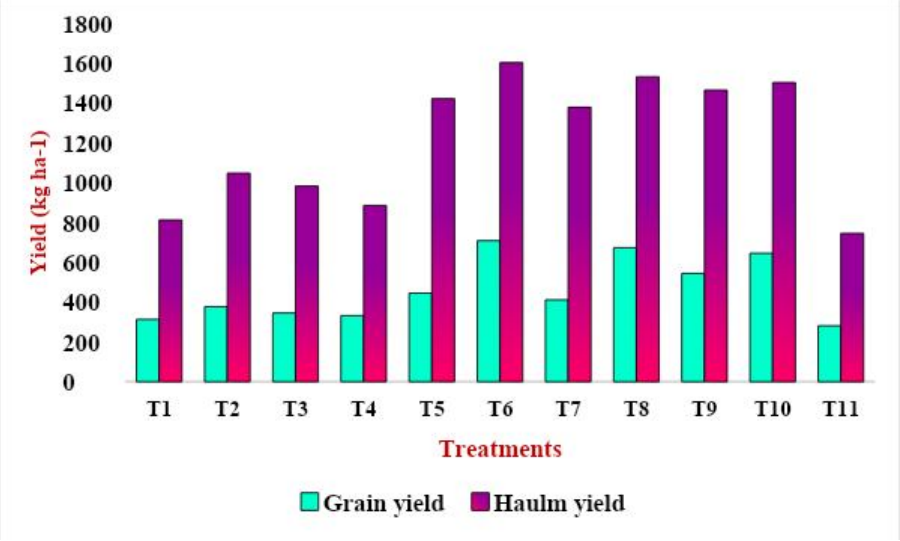

Fig 1. Grain and haulm yields (kg ha^{-1}) of green gram as influenced by weed management practices

CONCLUSION

From this field experiment, it was concluded that PE application of Pendimethalin + Imazethapyr @ 1 kg ha^{-1} *fb* POE Fluazifop-p-butyl + Fomesafen @ 313 g ha^{-1} was found to be the best weed management practices to attain increased growth and yield of irrigated green gram under sodic soil.

COMPETING INTERESTS

Authors have declared that no competing interests exist

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