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Weed spectrum, yield parameters and crop yield as influenced by integrated weed management in redgram based intercropping system

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Abstract
A field experiment was conducted at a farmer field in Tiruchchirappalli District of Dharmanathapuram village, Tamilnadu during *kharif* 2016, to study the weed management practices in redgram based intercropping system. The experiment was laid out in split plot design with three replications. The treatments included five cropping systems viz., redgram + blackgram (1:1), redgram + blackgram (1:2), redgram + sesamum (1:1), redgram + sesamum (1:2) and sole redgram in the main plot. Five weed management practices were assigned to sub plot viz., unweeded control, two hand weeding on 15 and 30 DAS, pre-emergence application of pendimethalin 1.0 kg ha^{-1} followed by one hand weeding on 30 DAS, pre-emergence application of pendimethalin 1.0 kg ha^{-1} followed by post-emergence application of imazethapyr 0.75 kg ha^{-1} and post-emergence application of imazethapyr 0.75 kg ha^{-1} on 15 DAS followed one hand weeding on 30 DAS. Among the intercropping system redgram + blackgram (1:2) intercropping system checked growth of weed density, weed dry weight and higher weed control efficiency was higher in redgram + blackgram (1:2) intercropping system. Sole cropping of redgram increased its growth parameters and yield attributes of redgram Among the weed management practices, pre-emergence application of pendimethalin @ 1.0 kg + hand weeding on 30 DAS effectively control the weed count, weed dry matter production and there by favorably influenced the growth attributes, yield attributes and yield of redgram. Adoption of redgram + blackgram intercropping system raised as 1:1 ratio under additive series with pre-emergence application of pendimethalin @ 1.0 kg + hand weeding on 30 DAS fetched higher revenue.

Keywords: Intercropping, weed management, weed density, yield components, pod yield

Introduction

Pulses are one of the major segments of Indian agriculture after cereals and oilseeds. Pulses combined with oilseeds are the third largest import after petroleum and gold. Notably, India imports 3.5 million tonnes of pulses every year from various countries (Sanjay Deshpande, 2015) [11]. Among various pulses grown, redgram ranks second in terms of production in India, while it ranks almost a top in terms of daily consumption. Redgram recognized as a valuable source of protein which has diversified uses as food, feed, fodder and fuel (Ramjit Kaur *et al*. 2015) [9]. Indian sub-continent alone contributes nearly 92 per cent of the total redgram production in the world. However, India leads in redgram production and acreage, its productivity is 697 kg ha^{-1} which is lower than the global productivity (FAO, 2013) [4]. In Tamil Nadu, redgram in cultivated in 37,769 ha with the productivity of 20,400 tones and with an average productively of 540 kg ha^{-1} which is lower than national productivity (Anilkumar, 2012) [2]. Since area under pulse cannot be increased in future due to ever increasing demand of land for the high yielding cereals, cash crops and other non-agricultural purposes. It is imperative to raise the productivity by vertically with minimum cost of cultivation and by suitable them in multiple, mixed and intercropping system to meet the growing demand of the increasing population.

Intercropping is one of the most important techniques of crop production because of efficient utilization of available natural resources like water, nutrients and solar energy (Sharma and Kulhari, 2004) [12]. It also has many advantages such as increase in yield, which includes greater stability of production, minimum risk with greater diversity of food and income sources. Extensive ground cover by pigeonpea prevents soil erosion by wind and water, encourages infiltration of rain water and smoothers the weeds. Pigeonpea has more advantages when it is grown under intercropped situation. Thus, it becomes necessary to development efficient and profitable pigeonpea based intercropping system.

Redgram faces heavy infestation in the early stages of crop growth, because of its slow growth habit in the initial stages coupled with wider spacing. Weeds cause 40-64% yield loss (Ahlawat *et al.* 2005) [1]. Number of herbicides now available is capable of controlling many

weeds very effectively. However, in tropical countries of ours a wide spectrum of weed flora is observed. Higher rate of herbicides may leave residue to succeeding crops. Further the continuous use of herbicides may eliminate all the susceptible weed species and their place may be taken over by some resistance ones, or the existing ones may develop resistance. All these eventualities have to be borne in mind when resource is taken to chemical weed control. In the past encouraging results have been obtained with butachlor, oxyfluorofen, lentagran, thiobencarp, pendimethalin and fluchloralin Use of herbicides in conjunction with manual practices would make the herbicidal control more acceptable to farmers and allow complete control of weeds laborers. Though, intercropping can be a potential tool to manage weeds the system by itself would not ensure complete weed control especially in the early stage of crop growth where the crop canopy is inadequate to suppress weed growth. In these conditions, herbicides in combination with cultural practices offer economically suitable and effective control of weeds in pigeonpea. Extensive research has been conducted on chemical weed control in redgram in India, which showed promising results with a number of pre-emergence herbicides as well as post emergences. The development of some new herbicides in recent past has opened up excellent opportunities for chemical weed control in redgram based intercropping system.

Materials and Methods

The experiment was conducted at a farmer's field in Tiruchchirappalli District of Dharmanathapuram village, Tamil Nadu. The experimental village is geographically situated at 10º 90' N latitude and 78º 78' E longitude at an altitude of 53 meters above mean sea level. The soil of the experimental field was sandy loam in texture. The soil of the experimental site was low in available N, medium in available P and high in available K. Redgram (*Cajanus Cajan* L. Mill sp.) variety Co (Rg) 7, blackgram T9 and sesamum TMV 4 were used as the test variety for the study. The treatments were laid out in split design included five cropping systems viz., redgram + blackgram (1:1), redgram + blackgram (1:2), redgram + sesamum (1:1), redgram + sesamum (1:2) and sole redgram in the main plot. Five weed management practices were assigned to sub plot viz., unweeded control, two hand weeding on 15 and 30 DAS, pre-emergence application of pendimethalin 1.0 kg ha^{-1} followed by one hand weeding on 30 DAS, pre-emergence application of pendimethalin 1.0 kg ha^{-1} followed by post-emergence application of imazethapyr 0.75 kg ha^{-1} and post-emergence application of imazethapyr 0.75 kg ha^{-1} on 15 DAS followed one hand weeding on 30 DAS. The redgram seeds were dibbled at 60 cm between rows and 30cm between the plants. The seeds of intercrops *viz.*, blackgram and sesamum were sown in 1:1 and 1:2 ratio with redgram in additive series. Sesamum seeds were mixed with sand for uniform distribution of seeds while sowing. An intra-row spacing of 10 cm for blackgram, 30 cm for sesamum was adopted Pre-emergence herbicide was applied as per the treatment on third day after sowing and then irrigated. Post-emergence herbicides and hand weeding were adopted as per the treatment schedule the observation on weeds count, weed dry weight were recorded to work out weed control efficiency. Data on weed density and weed dry weight was subjected to square root transformation $\sqrt{x + 0.5}$ before statistical analysis.

Results and Discussion

Weed flora of experimental field consists of nine species of broad leaved weeds, four species of grasses and one species of sedges. Among the grasses Cynodon dactylon, *Panicum repens* and *Panicum flavidum* are major grasses, with respect to broad leaved weeds *Trianthema portulascatrum*, *Phyllanthus niruri*, *Phyllanthus madraspatensis* and *Amaranthus viridis* were found higher in number. *Cyperus rotundus* was the only sedge present.

Adopting intercropping had significant effect on total weed density and weed dry weight. Intercropping of redgram + blackgram (1:2) minimized the total weed density on30 and 45 DAS and it was on par with redgram + sesamum (1:2). Sole redgram recorded higher total weed density at 30 and 45 DAS. Weed suppression was observed in intercropping system depended largely on the nature of component crop (Moody and Shetty, 1981). In this study this benefit largely was pronounced in redgram + blackgram (1:2) and followed by redgram + sesamum (1:2). Being a crop of vigour growth habit, blackgram offers an effective competition with weeds at initial stages and form a dense soil cover along with redgram. The crop vigour, the shading effect of leguminous intercrops smothered the weed growth. In line with the results of the present studies, the favourable impact of leguminous intercrops like blackgram, greengram on weed suppression was reported by Kuri *et al.* (2012) [6]. The intercropping suppressed the weed growth due to their spreading canopy coverage. The lowest weed DMP might be due to the early establishment on the land surface, which resulted in smoothening of weeds. The increased population per unit area and crop competition the possible reasons for effective weed control. Greater reduction in weed dry weight in intercropping was also reported by Rajesh *et al*. (2014) [8].

Weed management system significantly influenced the weed densiy and weed dry weight. The lowest weed density and dry weight was observed with pre-emergence application of pendimethalin followed by hand weeding on 30. The unweeded control plot recorded higher weed density and weed density. This might be due pre-emergence application of pendimethalin was effectively only for the initial period of about 30 days only and later on as the effect of herbicides diminished weeds appear again and it was controlled by hand weeding on 30 DAS. Reddy *et al.* (2007) [10], and Dixit *et al.* (2016) [3] lends support to the present investigation.

Weed control efficiency showed that intercropping of redgram + blackgram (1:2) recorded higher weed control efficiency. The lowest weed control efficiency was recorded by sole redgram. Among the weed management practices pre-emergence application of pendimethalin followed by one hand weeding at 30 DAS shows higher weed control efficiency.

Sole redgram produced significantly increased seed yield. It was followed by redgram + blackgram (1:1) intercropping system. Intercropping with blackgram or sesamum reduced the seed yield but it was maximum with sesamum at (1:2) ratio. The minimum reduction in redgram + blackgram was due to short duration, small stature and non-depletive nature. (Solanki *et al*. 2011) [13]. The minimum reduction might also due to the slow growth of pigeonpea and less competition with blackgram utilizes resources early efficiently and has capability use of low light levels and also the solar radiation was more efficiently converted to dry matter due to intercropping. Another fact for higher yield in intercropping system in that redgram makes rapid canopy coverage at the ground uses the resources more efficiently in such situations. The maximum reduction was found with sesamum

at 1:2 ratio. This may be due to increased total population per unit area increased competition for growth resources, this restricts the development of growth and yield attributes. This finding was coinciding with result of Kathmale *et al.* (2014) [5].

Among the weed management practices, the pre-emergence application of pendimethalin followed by hand weeding on 30 DAS recorded maximum seed yield and it was followed by two hand weeding. This was due to lesser competition for nutrients and other growth factors by the weeds. The uptake of nutrients by redgram in unweeded control was less as compared to treatments plots. The distinct reduction in weed dry matter production under pre-emergence application of pendimethalin 1.0 kg ha^{-1} + HW was on 30 DAS might have offered a weed free environment for redgram at critical stages. Thus the results are in accordance with the findings of negative correlation between crops as by Manoj Kumar Yadav *et al*. (2012) [7].

Table 1: Effect of weed control measures and intercropping system on weed parameters

Treatments	Weed density (No. m^2)		Weed dry matter (kg /ha)		WCE	
	30 DAS	45 DAS	30 DAS	45 DAS	30DAS	45DAS
M_1	53.72(7.36)	82.18(9.09)	39.14(6.30)	59.41(7.74)	21.02	25.77
M_2	43.53(6.64)	60.50(7.81)	31.23(5.63)	48.53(7.00)	33.06	45.35
M_3	62.30(7.92)	97.43(9.90)	42.43(6.55)	65.53(8.13)	8.40	12.01
M_4	49.07(7.04)	71.47(8.48)	35.06(5.96)	53.74(7.36)	27.85	35.44
M_5	68.02(8.28)	110.72(10.55)	46.10(6.83)	72.32(8.53)	-	-
S.Ed	0.05	0.14	0.07	0.15		
CD(p=0.05)	0.10	0.29	0.15	0.31	-	-
S_1	165.04(12.87)	240.51(15.52)	120.85(11.02)	162.24(12.76)	-	-
S_2	24.47(5.00)	39.87(6.35)	15.96(4.06)	31.58(5.66)	85.17	83.42
S_3	23.60(4.91)	37.99(6.20)	15.53(4.00)	30.51(5.57)	85.70	84.20
S_4	29.45(5.47)	47.55(6.93)	19.66(4.49)	35.64(6.01)	82.15	80.71
S_5	34.08(5.88)	56.32(7.54)	21.97(4.74)	39.55(6.33)	79.61	76.58
S.Ed	0.17	0.21	0.16	0.14	-	-
CD	0.38	0.44	0.35	0.28	-	-

Table 2: Effect of weed control measures and intercropping sytem on yield parameters

Treatments	Pods $plant^{-1}$	Seeds pod^{-1}	Test weight	Pod yield (Kg/ha)	Haulm Yield (kg/ha)
M_1	116.32	3.83	10.14	1048.64	2652.61
M_2	106.87	3.63	10.09	906.56	2229.55
M_3	109.24	3.57	10.03	884.03	2118.11
M_4	93.14	3.44	9.98	740.52	1850.56
M_5	120.41	3.97	10.16	1091.26	2733.83
S.Ed	0.96	0.029	0.09	7.34	21.52
CD	2.36	0.070	NS	17.95	45.33
S_1	34.47	2.52	9.95	450.43	1130.57
S_2	133.69	4.20	10.04	1103.78	2920.31
S_3	134.63	4.22	10.21	1210.58	3037.49
S_4	123.79	3.87	10.14	992.58	2447.37
S_5	110.52	3.63	10.05	913.64	2048.92
S.Ed	1.18	0.035	0.080	11.02	27.76
CD	2.81	0.090	NS	24.50	46.19

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