



P-ISSN: 2349-8528

E-ISSN: 2321-4902

www.chemijournal.com

IJCS 2020; 8(5): 2265-2267

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Received: 09-07-2020

Accepted: 14-08-2020

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Yield influence with nutrient, weed and pest management in redgram (*Cajanus cajan*)

K KalaichelviDOI: <https://doi.org/10.22271/chemi.2020.v8.i5ae.10642>**Abstract**

Pigeonpea (*Cajanus cajan* (L.) Millsp.) is the most important food legume, nutritionally an important pulse crop used in various forms but mostly as split pulses or 'dal'. The grains are rich in proteins, carbohydrate, fat and other nutritional factors and used in daily diet in India. An area of 49,000 ha is under Redgram with a production of 53,000t and productivity of 1043 kg/ha in Tamil Nadu. It is programmed to study the critical component which causes yield reduction in redgram by which we can improve the productivity of the crop. Hence, a field experiment was conducted to study the influence of weed, nutrient and pest management on yield in redgram. The recommended INM (FYM at 5 t /ha /vermicompost 2.5 t/ha + RDF NPKS Zn (25:50:25:20 kg NPKS/ha) + seed treatment with sodium molybdate @4 g/kg seed), IWM ((Pendimethalin at 0.75 kg/ha on 3 DAS + one HW on 40 DAS), IPM (prophylactic spray of Indoxacarb 15.8 % at the time of flowering @ 375 ml/ha + one systemic insecticide spray 15 days after first spray) and their different combinations were imposed and assessed for their influence on growth and yield in redgram. From this study, it was revealed that there was a yield loss of 46 % without adopting the IWM practices in pigeonpea. Hence weeds are considered to be the most important yield limiting factor in pigeonpea followed by insect infestation especially podfly, pod bug and borers in Coimbatore zone. Adoption of IWM practices has recorded an average weed control efficiency of 63.9% in pigeonpea. Grain yield was significantly higher with adoption of INM+IWM+IPM (994 kg/ha), INM+IWM (978 kg/ha), IWM+IPM (878 kg/ha) and IWM alone (828 kg/ha). Based on economics, it was observed that adoption of IWM alone has recorded higher net income and benefit cost ratio over other treatments. Since the cost of vermicompost is higher, the treatments which include INM and its combinations have recorded lower net income and benefit cost ratio.

Keywords: Redgram, yield influence, nutrient, weeds and pest**Introduction**

Pigeonpea [*Cajanus cajan* (L.) Millsp.] is the most versatile food legume, nutritionally an important pulse crop used in various forms but mostly as split pulses or 'dal'. The grains are rich in proteins, carbohydrate, fat and other nutritional factors and used in daily diet in India (Gopalan *et al.*, 1971) [3]. It accounts for 5% of global pulse production. Of the global acreage and production, Asia is nearly the sole contributor and of that too, India alone accounts for over three-fourths of area and four-fifths of production (Ahlawat *et al.*, 2005) [1]. Redgram is cultivated in an area of 44,38,000 ha with a production of 42,89,000 t and productivity of 967 kg/ha in India and 49,000 ha, 53,000t and 1043 kg/ha in Tamil Nadu (www.indiastat.com) Besides being the major sources of dietary protein, they also play an important role in sustaining nutrient level in soil productivity by fixing atmospheric nitrogen (Kumar Rao and Dart, 1987) [4] for crop productivity and checks soil erosion. Red gram is hardy legume crop with deep root system. It has the ability to fix atmospheric nitrogen to the rate of 31 to 97 kg/ha to the soil for succeeding crops. Redgram productivity is improved by good agronomic packages. In this research, it was programmed to study the influence of weed, nutrient and pest management on productivity in Redgram.

Materials and Methods

The Field experiment has been conducted on influence of weed, nutrient and insect management at Pulse Research Block, Agricultural College and Research Institute, Coimbatore on Aug'2015. Treatments were imposed on INM (FYM at 5 t /ha /vermicompost 2.5 t/ha + RDF NPKS Zn (25:50:25:20 kg NPKS/ha) + seed treatment with sodium molybdate

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@4 g/kg seed), IWM ((Pendimethalin at 0.75 kg/ha on 3 DAS + one HW on 40 DAS), IPM (prophylactic spray of Indoxacarb 15.8 % at the time of flowering @ 375 ml/ha + one systemic insecticide spray 15 days after first spray) and their different combinations as per the technical programme. Weed density and Weed dry weight was recorded on 70 DAS. Observation on plant population, plant height, number of

primary and secondary branches per plant, number of pods per plant, number of grains per pod has been recorded. Crop was harvested on 11.2.2016. Grain and stalk yield has been recorded per individual treatments and computed per ha. Statistical analysis has been done and the economics was worked out.

Table 1: Effect of weed management practices on weed density, dry weight and weed control efficiency on 70 DAS in pigeonpea

Treatments	Grass weed density	Sedge weed density	BLW density	Total weed density	Total weed dry weight (kg/ha)	Weed control efficiency (%)
	(No/m ²)					
T ₁ – INM	52 (7.2)	80 (9.0)	16 (4.2)	148 (12.2)	2480	6.2
T ₂ – IWM	11 (3.2)	67 (8.1)	7 (2.9)	84 (9.2)	987	62.6
T ₃ – IPM	23 (4.9)	92 (9.6)	11 (3.5)	125 (11.3)	2213	16.3
T ₄ – INM+IWM	45 (6.8)	40 (6.5)	17 (4.4)	103 (10.2)	987	62.6
T ₅ – INM +IPM	49 (7.1)	36 (6.1)	22 (4.8)	107 (10.4)	1973	25.3
T ₆ – IWM+IPM	29 (5.5)	17 (3.8)	4 (2.3)	51 (7.2)	989	62.6
T ₇ – INM+IWM+IPM	19 (4.4)	55 (7.0)	12 (3.7)	85 (9.1)	880	66.7
T ₈ – Control	69 (8.1)	123 (10.9)	14 (3.8)	206 (14.4)	2643	-
Sed	1.0	1.3	0.6	1.1	504.1	
CD (p=0.05)	2.1	2.9	1.2	2.3	1081.3	

Figures in parenthesis are transformed (Square root x+2) values

Weed density, Dry weight and Weed Control efficiency with adoption of IWM and Without IWM

Grass weed density (No/m²)

Grass weed density was significantly lowered with adoption of IWM alone, INM+IWM +IPM. This was followed by adoption of IWM + INM and IWM +IPM. All the treatments which includes IWM practices has recorded lesser grass weed density and this was also on par with IPM alone since in this specific treatment sedge density was more. All other treatments without IWM practices have recorded significantly higher grass weed density.

Sedge weed density (No/m²)

Sedge weed density was significantly lowered in IWM +IPM and IWM +IPM. Sedges weed density was also higher in IWM alone also, this showed that sedges could not be effectively controlled with the current recommended integrated weed management practices. Hence, a specific

technology has to be developed for managing *Cyperus* sp. under cropping condition in redgram.

Broad leaved weed density (No/m²)

Broad leaved density was significantly lowered with adoption of Integrated Weed Management practices.

Total weed density (No/m²) and Weed Dry weight (kg/ha)

Total weed density and weed dry weight was significantly lowered with adoption of integrated weed Management practices. Significantly higher weed density was recorded with control and non adoption of integrated weed management practices.

Weed Control Efficiency (%)

Adoption of Integrated Weed Management practices has recorded an average weed control efficiency of 63.9% on 70 DAS in pigeonpea and non adoption of weed management practices has resulted in poor weed control efficiency.

Table 2: Effect of management practices on plant height, number of branches per plant, number of pods per plant, 100 seed weight, grain yield and stalk yield in pigeonpea

Treatments	Plant height (cm)	Number of branches per plant	Number of pods per plant	Number of seeds per pod	100 seed weight (g)	Grain yield (kg/ha)	Stalk yield (kg/ha)
T ₁ – INM	188.3	11.0	106.7	3.7	9.9	446	2100
T ₂ – IWM	228.3	15.5	255.3	3.6	10.1	828	2714
T ₃ – IPM	210.0	13.5	157.4	3.6	10.0	577	2495
T ₄ – INM+IWM	244.3	17.5	285.4	3.7	10.0	978	2944
T ₅ – INM +IPM	228.3	15.2	198.4	3.6	10.2	593	2410
T ₆ – IWM+IPM	254.7	16.7	282.1	3.8	10.1	878	2650
T ₇ – INM+IWM+IPM	248.7	17.2	297.3	3.7	10.0	994	2973
T ₈ – Control	145.4	9.5	55.2	3.4	9.7	220	1673
SEd	6.6	1.0	17.0	0.2	0.3	72	267
CD (p=0.05)	14.1	2.2	36.6	NS	NS	155	573

Effect of different management practices on growth and yield in pigeonpea

Growth attributes

Plant height was significantly higher with adoption of INM+IWM (244.3), IWM +IPM (254.7) and INM +IWM +IPM (248.7) might be due to the lesser crop weed competition over other treatments. Significantly shorter plants were recorded with control. Number of branches per plant

was significantly higher with adoption of IWM alone, INM+IWM, IWM +IPM and INM+IWM+IPM. This might be due to the lesser weed competition as all the treatments which was included with Integrated Weed Management practices (PE application of Pendimethalin at 0.75 kg/ha on 3 DAS + Hand Weeding on 50 DAS) has recorded significantly more number of branches over those treatments which did not included with Integrated Weed Management practices.

Adoption of IWM alone, INM +IWM, IWM+IPM and INM+IPM+IWM has recorded significantly more number of pods per plant (255.3, 285.4, 282.1 and 297.3) over all other treatments might be due to the lesser crop weed competition. Control has recorded significantly lesser number of pods per plant (55.2). Number of seeds per pod was not significantly differed among the treatments and was in the range of 3.4 to 3.7. Test weight was not significantly influenced by adoption of different management practices and their combinations. Average test weight observed in this experiment is 10.0 g. The major contributing components for improved grain yield under elevated CO₂ were number of pods, number of seeds and test weight which recorded an increase of 97.9%, 119.5% and 7.2%, respectively (Vanaja *et al.*, 2014). The higher yield resulted due to more number of pods per plant as it is one of the important yields attributing character (Dhanalakshmi *et al.*, 2017)^[2].

Grain yield and stalk yield

Grain yield was significantly higher with adoption of INM+IWM (T₄), IWM +IPM (T₆) and INM+IWM+IPM (T₇)

and yield was 979, 877 and 994 kg /ha respectively. Except INM+IWM+IPM, remaining all the treatments was on par with adoption of Integrated Weed Management alone. The yield increase was about 50.6% (INM), 73.4% (IWM), 62.6% (IPM), 77.5% (INM+IWM), 62.9% (INM +IPM), 74.9% (IWM +IPM) and 78% (INM+IWM+IPM) over control. From this it was observed that adoption of IWM has increased the yield when individual and as well as with other combinations. Hence, Weeds are identified to be the major yield limiting factor in pigeonpea followed by insect infestation especially podfly and bug in Coimbatore zone. Weed management play crucial role in field crop production and it reduce crop yield approximate 34 to 63 % (Singh *et al.* 2004; Mukherjee, 2014)^[6, 5]. Only if proper weed management practices were adopted there was an additional yield with adoption of INM and IPM. There was a yield loss of 46 % without adopting the Integrated Weed Management practices in pigeonpea.

Stalk yield was significantly lowered with adoption of INM alone and control. Remaining all other individual management practices and combinations has recorded more stalk yield.

Table 3: Effect of individual and combined management practices on economics

Treatments	Grain yield (kg/ha)	Stalk yield (kg/ha)	Gross Income (Rs./ha)	Cost of Cultivation (Rs./ha)	Net Income (Rs./ha)	B: C
T ₁ INM	446	2100	21092	39955	-18863	0.53
T ₂ IWM	828	2714	38928	17555	21373	2.22
T ₃ IPM	577	2495	27235	12565	14670	2.17
T ₄ INM+IWM	978	2944	45935	46665	-730	0.98
T ₅ INM+IPM	593	2410	27952	45825	-17873	0.61
T ₆ IWM+IPM	878	2650	41210	23425	17785	1.76
T ₇ INM+IWM+IPM	994	2973	46667	52536	-5869	0.89
T ₈ Control	220	1673	10547	10845	-298	0.97

Economics

Cost of cultivation was higher with adoption of INM+IWM+IPM (Rs. 52,536/-) and was lesser with control (Rs. 10,845/-). Since the cost of vermicompost is Rs. 25,000/- per 2.5 t (recommended quantity per hectare), the treatments which includes Integrated Nutrient Management has recorded negative net returns even if higher yield was recorded with combination of IWM. Net income was higher with adoption of IWM alone Rs. 21,373/- /ha. This was followed by combination of IWM +IPM and also the adoption of IPM alone has recorded marginal increase in net income but was lesser than practicing IWM alone. Benefit cost ratio was higher with practicing Integrated Weed Management alone (2.22) due to higher yield and lesser cost of cultivation.

Conclusion

A field experiment was conducted to study the influence of weed, nutrient and pest management on yield in redgram. From this study, it was revealed that there was a yield loss of 46 % without adopting the IWM practices in pigeonpea. Hence weeds are considered to be the most important yield limiting factor in pigeonpea followed by insect infestation especially podfly, pod bug and borers in Coimbatore zone. Adoption of IWM practices has recorded an average weed control efficiency of 63.9% in pigeonpea. Grain yield was significantly higher with adoption of INM+IWM+IPM (994 kg/ha), INM+IWM (978 kg/ha), IWM+IPM (878 kg/ha) and IWM alone (828 kg/ha). Based on economics, it was observed that adoption of IWM alone has recorded higher net income and benefit cost ratio over other treatments. Since the cost of vermicompost is higher, the treatments which include INM

and its combinations have recorded lower net income and benefit cost ratio.

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