

Effect of different tillage practice, herbicide and *Rhizobium* on weed, yield and economics of Mung bean (*Vigna radiata* L.)

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Abstract

In order to study the effect of bio-fertilizer, tillage practices and weed control methods on weed density, yield and economics of Mung bean a farmer's participatory trail was conducted during *Zaid* season of 2013 and 2014 on the farmers' field at Manjosh village in Jamui district (Bihar). The experiment consisted of two tillage practice (zero tillage and conventional tillage) and herbicide (application and no application) along with *Rhizobium* inoculation and un-inoculation in factorial randomized block design with three replication. Minimum weed density and weed dry weight and maximum weed control efficiency was recorded by zero tillage method of sowing. However, maximum grain yield, stover yield, gross return, net return and B:C ratio was also recorded by above respective treatment during both the years of experiment and in pooled. Application of Pendimethalin at 1.00 kg ha⁻¹ was recorded minimum weed density and weed dry weight with higher weed control efficiency and also gave maximum grain yield, stover yield, gross return, net return and B:C ratio during both the years of experiment and in pooled. Seed treatment with *Rhizobium* was also recorded maximum performance of yield and economics with minimum weed density and dry weight during both the years of experiment and in pooled.

Keywords: Zero tillage, Pendimethalin, *Rhizobium*, weeds, mung bean, *Vigna radita* L

Introduction

Mung bean is cultivated throughout the country and occupies an area of more than 3.0 million hectare. The productivity averaged over 10 year has sown only a marginal increase. Mung bean also called as greengram, moong bean and golden gram. Pulses are mainly grown under rainfed condition (>87%) of arid and semi arid zones where water is a scare resource, In spite of development of more than 550 high yielding disease resistant varieties for different agro-ecological region, their adoption is poor due to non-availability of quality seed to farmers. The several constraints of low productivity of green gram, weeds have been recognized as an important one, which complete with crop plants for nutrients and other growth factors, and in absence of an effective control measures weeds remove considerable quantity of applied nutrients resulting in higher loss in yield. Weed infestation during the crop period causes more than 40% reduction in grain yield, depending on the weed densities and type of weed flora present. Weeds in green gram are generally controlled with manual and cultural manipulations. Now a day, herbicide use for weed control in green gram is becoming increasingly popular.

The most widely used bio-fertilizer is *Rhizobium* consisting of a specific bacterium *Rhizobium*; this is one of the important nitrogen fixing bacterium which helps the legume to maintain soil fertility by way of their symbiotic association and nitrogen fixation. A legume plant, having effective root nodules cannot only meet its own nitrogen requirement but can also enrich the soil nitrogen content, thus improving soil fertility and sustainability. Legumes are cultivated widely in different parts of India. In recent years, there has been an emphasis on bacterial fertilization of green gram because inoculation with appropriate strains of Rhizobia has considerably increased the yield of greengram. It has been reported that there is more

yield of subsequent crops in *Rhizobium* inoculated fields than in non-inoculated control. Response to *Rhizobium* inoculation has been simply demonstrated with most of the legumes like Pigeonpea, urdbean, mungbean, gram, soybean etc. Besides, legume cultivation also leaves behind a naturally nitrogen enriched soil for subsequent cultivars. Therefore, keeping the view of above factors, there was a need of an experiment to find out the effect of bio-fertilizer, tillage practices and weed control methods on weed, yield and economics of green gram.

Material and Methods

The field experiment was carried out on farmer's participatory mode at Manjosh village in Jamui district (Bihar) during *Zaid* season of 2011 and 2012. The experiment was laid out in factorial randomized block design with three replications. The experiment consisted of two tillage practice (zero tillage and conventional tillage) and herbicide (application and no application) with *Rhizobium* inoculation and un-inoculation. Total 8 treatment combinations viz. T₁ - Zero tillage, T₂ - Zero tillage + Pendimethalin at 1.00 kg ha⁻¹ as pre emergence, T₃ - Zero tillage + Pendimethalin at 1.00 kg ha⁻¹ as pre emergence + Seed inoculation through *Rhizobium* culture, T₄ - Zero tillage + Seed inoculation through *Rhizobium* culture, T₅ - Conventional tillage, T₆ - Conventional tillage + Pendimethalin at 1.00 kg ha⁻¹ as pre emergence, T₇ - Conventional Method + Pendimethalin at 1.00 kg ha⁻¹ as pre emergence + Seed inoculation through *Rhizobium* culture, and T₈ - Conventional Method + Seed inoculation through *Rhizobium* culture were generated. In zero tillage method crop was sown through ZT seed drill without any tillage practice at 45 cm row spacing by using seed rate 20 kg ha⁻¹ along with pre-plant herbicide glyphosate at 1.00 litre ha⁻¹ before 5 days of sowing. Sowing of seeds was done on 10 March and 12 March in 2011 and 2012 respectively. Where as in

conventional method the field was ploughed three times and planking was done each after ploughing and then seed broadcasted in the field. Pre-emergence herbicide Pendimethalin at 1.00 kg ha⁻¹ was applied two days after sowing. The total rainfall recorded during crop growth period was 9.4 and 12.4 mm, minimum temperature range from 12 to 20 °C and 12.5 to 21°C and maximum temperature 33 to 40°C and 33.5 to 40°C during spring 2011 and 2012 respectively. Mechanical and chemical analysis of soil was done before experiment to know the initial status of the soil. The soil was sandy loam having 60% sand, 20% silt and 14.4% clay. The soil was clay loam in texture, high in organic carbon (0.72 %), available N (258 kg ha⁻¹), p (20.38), K₂O (153.6 kg) content with Ph 6.5. Green gram variety SML-668 was used as test crop. The crop was raised with recommended agronomic practices and harvested in two picking within the last week of May. The observations were recorded for various vegetative traits of green gram crop.

Results and Discussion

Effect on weeds

Tillage practices herbicides and *Rhizobium* significantly affected the weed density, weed dry weight and weed control efficiency. However, individuals of the density of broad leaf weeds, grasses and sedges were also showed significant variation among tillage practices herbicides and *Rhizobium* culture. It further revealed that minimum weed population, weed dry weight and maximum weed control efficiency were recorded by zero tillage method of sowing. Similar finding was also reported by Behera and Sharma, (2011) [1] Mandal *et al.*, (2002). In zero tillage plots lesser weeds infestation might be due to the field was not ploughed and the suppressed weed seeds do not come in the surface of soil resulting in lower weed density and weed dry weight. Maximum performance of above these parameters was also recorded by Pendimethalin at 1.0 kg ha⁻¹ as pre emergence and *Rhizobium* inoculation. Similar result was reported by Kumar and Tiwari, (2004) [3] for Pendimethalin and Thakur and Pawar (1995) [8] for *Rhizobium* inoculation. Lower weed density and weed dry weight in Pendimethalin treated plots was due to the better control of the weeds by this herbicide. However, *Rhizobium* inoculation increased both root and shoot length and gave the

maximum performance of growth parameters and also developed a good crop canopy which suppressed the weed growth. Interaction effect of bio-fertilizer, tillage practices and weed control methods was unchanged with weed density and weed dry weight. However, weed control efficiency was significantly affected by bio-fertilizer, tillage practices and weed control methods (data not presented).

Effect of yield and economics

Grain yield and stover yield was significantly affected by tillage practices herbicides and *Rhizobium* culture. Maximum grain yield and stover yield were recorded by zero tillage method of sowing. Similar finding was reported by Meena *et al.*, (2015) [6] Behera *et al.*, (2011) [1] Mandal *et al.*, (2002). This might be due to better growth and yield attributes in zero tillage plots. Application of Pendimethalin at 1.0 kg ha⁻¹ as pre emergence and *Rhizobium* culture recorded maximum grain yield and stover yield. Das *et al.*, (1997) [2] Kundu *et al.*, (2009) [4] reported similar result for Pendimethalin. The lower weed density and dry weight of weeds under this treatment reduced the crop weed competition which had favoured the higher crop growth and yield attributes and provides the highest grain and stover yield in herbicide treated plots. Singh and Pareek, (2003) [7] reported that biofertilizer like *Rhizobium* significantly increased grain yield and stover yield and entire yield attributes. This might be due to the greater availability of nitrogen and phosphorus for plant resulting increased grain yield and stover yield. Maximum gross return, net return and B:C ratio were recorded by zero tillage method of sowing. Due to lower labour requirement in zero tillage method of sowing its recorded lower cost of cultivation. Pendimethalin at 1.0 kg ha⁻¹ as pre emergence and *Rhizobium* culture recorded maximum gross return, net return and B:C ratio.

Conclusion

From the present investigation we conclude that zero tillage method of sowing with Application of Pendimethalin at 1.0 kg ha⁻¹ as pre emergence and *Rhizobium* inoculation is the best combination for sowing of mung bean in *Zaid* season. It gave maximum yield and economics with minimum weed population and recommended for marginal farmers as well as big farmers.

Table 1: Effect of tillage practices herbicides and *Rhizobium* culture on weed density, weed dry weight and weed control efficiency in mung bean (pooled data over two year mean)

Treatments	Weeds density (No./0.25m ²)			Weeds dry weight (g/0.25m ²)	Weeds control efficiency (%)	
	Broad leaf weeds	Grasses	Sedges			
Tillage Practices						
T ₁	Zero tillage (ZT)	6.53	6.58	1.31	6.60	49.60
T ₂	Conventional Tillage (CT)	12.13	9.40	1.73	10.28	40.80
	F-test	S	S	S	S	S
	S.Ed. (±)	1.71	0.70	0.08	1.07	2.17
	C.D. at 5%	5.12	2.11	0.25	3.21	6.50
Herbicide						
H ₁	No herbicide	11.03	8.88	1.75	9.95	0.00
H ₂	Pendimethalin at 1.0 kg ha ⁻¹ as pre emergence	7.63	7.10	1.29	6.93	83.14
	F-test	S	S	S	S	S
	S.Ed. (±)	0.97	0.41	0.11	0.93	18.43
	C.D. at 5%	2.93	1.23	0.34	2.81	55.12
<i>Rhizobium</i>						
R ₁	No <i>Rhizobium</i>	9.58	8.20	1.57	8.88	20.52

R ₂	<i>Rhizobium</i> inoculation	9.08	7.78	1.48	8.00	24.06
	F-test	S	S	S	S	S
	S.Ed. (±)	0.08	0.10	0.02	0.17	0.81
	C.D. at 5%	0.24	0.31	0.07	0.52	2.45

Table 2: Effect of tillage practices herbicides and *Rhizobium* culture on yield and economics of mung bean (pooled data over two year mean)

	Treatments	Grain yield (q ha ⁻¹)	Stover yield (q ha ⁻¹)	Cost of Cultivation (Rs./ha)	Gross return (Rs./ha)	Net return (Rs./ha)	B:C ratio
	Tillage Practices						
T ₁	Zero tillage (ZT)	7.60	22.73	17225	39533.00	22308.00	1.29
T ₂	Conventional Tillage (CT)	6.47	20.51	18225	38112.00	20887.00	1.14
	F-test	S	S	S	S	S	S
	S.Ed. (±)	0.36	0.60	280.97	297.79	281.01	0.02
	C.D. at 5%	1.09	1.82	840.12	890.42	840.22	0.07
	Herbicide						
H ₁	No herbicide	6.63	20.69	17900	35542.00	17642.00	0.98
H ₂	Pendimethalin at 1.0 kg ha ⁻¹ as pre emergence	7.44	22.55	18500	37609.00	19109.00	1.23
	F-test	S	S	S	S	S	S
	S.Ed. (±)	0.30	0.36	214.13	294.90	314.47	0.07
	C.D. at 5%	0.92	1.09	640.25	881.78	940.29	0.23
	<i>Rhizobium</i>						
R ₁	No <i>Rhizobium</i>	6.50	20.49	18300	35800.00	17500.00	1.12
R ₂	<i>Rhizobium</i> inoculation	7.57	22.76	18700	39351.00	20651.00	1.19
	F-test	S	S	S	S	S	S
	S.Ed. (±)	0.30	0.54	75.29	314.94	287.36	0.01
	C.D. at 5%	0.91	1.62	225.12	941.68	859.21	0.05

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