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BIO-FERTILIZER AND WEEDING REGIMES EFFECT ON YIELD AND YIELD ATTRIBUTES OF SUMMER MUNGBEAN

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ABSTRACT

Pramanik JK, Chowdhury AKMSH, Jamil Uddin FM (2015) Bio-fertilizer and weeding regimes effect on yield and yield attributes of summer mungbean. *Int. J. Sustain. Crop Prod.* 10(1), 26-32.

The experiment was conducted at the Agronomy Field Laboratory of Bangladesh Agricultural University, Mymensingh from February to June 2010 to know the effect of bio-fertilizer and weeding on the yield and yield attributes of summer mungbean (cv. Binamoog-7). Treatments were five levels of bio-fertilizer: 0, 1, 2, 3, 4 kg ha^{-1} and four levels of weeding: no weeding, one weeding, two weeding, and three weeding. Weeding was done by using niri and khurpi. The experiment was laid out in randomized complete block design with three replications. Result of our present study indicated that application of bio-fertilizer up to 2 kg ha^{-1} increased the number of branches $plant^{-1}$, number of pods $plant^{-1}$ length pod^{-1}, number of seeds pod^{-1}, seed weight $plant^{-1}$, 1000-seed weight and seed yield of summer mungbean. In case of weeding, the entire yield contributing characters responded linearly with increasing the number of weeding treatment. Among the weeding regimes, the maximum number of branches $plant^{-1}$, number of pods $plant^{-1}$, length of pod^{-1}, number of seeds pod^{-1}, seed weight $plant^{-1}$, 1000-seed weight and seed yield were obtained from three times weeding plots. Application of 2 kg bio-fertilizer ha^{-1} combination with three times weeding may be recommended for maximum yield of summer mungbean.

Key words: *mungbean, bio-fertilizer, weeding, seed yield*

INTRODUCTION

Mungbean (*Vigna radiata* L. Wilezek) is one of the most popular leguminous crops in Bangladesh. It is an important pulse crop due to it's economic importance principally seeds with 51% carbohydrate, 26% protein, 10% moisture, 4% minerals and 3% vitamins (Kaul 1982 and Afzal *et al.* 2008). In the Indian sub-continent especially in Bangladesh mungbean is mainly used as 'Dal' or vegetable soup. It serves as vital source of vegetable protein, minerals, and vitamins particularly in developing countries. In Bangladesh, mungbean grows well all over the country. Among the pulses, it ranks third in area and production and the first in market price. The total production of mungbean in Bangladesh in 2009-10 was 20177 metric tons from an area of 2429123254 hectares and the average yield was about 0.86 t ha^{-1} (BBS 2013). In Bangladesh, the main form of protein readily available to the bulk of the population is plant protein. The daily per capita consumption of pulses in Bangladesh is only 13.29 grams (BBS 2011), while the World Health Organization (FAO 1999) suggested 45 grams per capita per day for a balanced diet. To meet the demand of increasing population, pulse production is urgently needed to minimize the shortage of protein of Bangladesh. Cultivation of mungbean can also improve the physical, chemical and biological properties of soil as well as increase soil fertility status through biological nitrogen fixation with symbiont *Bradyrhizobium* from the atmosphere (Peoples *et al*. 1995; Sattar and Ahmed, 1995; Johal *et al*. 1994; Mohamad and Hossain, 2003; Khalequzzaman and Hossain, 2008; Mulas *et al.* 2011). Seed inoculation with effective *Bradyrhizobium* can play a vital role in the formation of nodules to fix atmospheric nitrogen by symbiotic process in the root system of legume crops making the nutrient available to the plants (Bhuiya *et al.* 1984; Basu and Bandyopadhyaay, 1990; Chouwdhury *et al*. 2000; Chatterjee and Bhattacharjee, 2002; Mia and Shamsuddin, 2010; Mmbaga *et al.* 2014). Franco (1978) revealed that Rhizobium strains in association with the host plant were able to fix approximately 20 percent atmospheric nitrogen throughout the world annually. *Bradyrhizobium* inoculation increased mungbean seed yield from 4.3% to 16.2% as reported by Vaishya *et al.* (1983). In Bangladesh, inoculation with increased 57% effective nodules, 77% dry matter production, 64% grain yield and 40% hay yield as compared with uninoculated mungbean cultivation (Chanda *et al.* 1991). Uddin *et al*. (2013) reported that mungbean produced higher yield with response to different doses of phosphorus and planting date when seeds were inoculated with rhizobium at the time of sowing.

Weed is an important factor responsible for low yield of crops (Islam *et al.* 2006). Weed is very much eco-friendly with the growth and development of mungbean and yield losses due to weed in mungbean ranges from 27 to 100% (Madrid and Vega, 1971; BARI 1985. Therefore, weed control is very essential for mungbean cultivation. In Bangladesh, farmers do not interest to control weed in mungbean; possibly, it may be one of the causes for low yield of mungbean in the country. The time of weeding has an important effort on the growth and yield of mungbean. Weeding at wrong time and also at wrong stage of the crop during growing season may not be beneficial. Not much research work so far was made on the effect of bio-fertilizer and weeding on mungbean growth and yield. In this context, the present study was therefore undertaken to estimate the effect of bio-fertilizer and weeding regimes on the yield and yield attributes of mungbean.

MATERIALS AND METHODS

The experiment was conducted at the Agronomy Field Laboratory (Table 1) of Bangladesh Agricultural University, Mymensingh during February to June 2010. It was located at 24.750 N latitude and 90.50 E longitudes at an altitude of 18 m from the sea level. The experiment was laid out in randomized complete block design with three replications. The unit plot size was 5 m^2 (2 m × 2.5 m). Treatments were five levels of bio-fertilizer: I_0 = Control (no bio-fertilizer), I_1 = 1.0 kg ha^{-1}, I_2 = 2.0 kg ha^{-1} , I_3 = 3.0 kg ha^{-1} and I_4 = 4.0 kg ha^{-1} bio-fertilizer and four weeding regimes: W_0 = No weeding, W_1 = One weeding (15 DAS), W_2 = Two weeding (15 DAS and 30 DAS) and W_3 = Three weeding (15 DAS, 30 DAS and 45 DAS). Summer mungbean variety "Binamoog-7" (released 2005) was used as the experimental crop. Liquid broth of BINA-MB mix culture, a mixture of three *Bradyrhizobium* strains *viz.*, BINA-MB-441, BINA-MB-169 and BINA-MB-301were used in this experiment, which was collected from the Soil Microbiology Laboratory of Bangladesh Institute of Nuclear Agriculture (BINA), Mymensingh. The experimental plot was opened with a power tiller on 15 February 2010 and subsequently ploughed twice with country plough followed by laddering to achieve a medium tilth required for the crop. The land was finally prepared on 2 March 2010 by country plough followed by laddering. The unit plots were uniformly fertilized with, triple super phosphate and muriate of potash at the rate of 75 and 40 kg ha^{-1}, respectively, during final land preparation (Miah *et al.* 2009). The other fertilizer like Zn, Boron was not considered at the time of final land preparation but it can be applied (FRG 2012). The quantity of seed required for each plot was weighed on the basis of experimental specification and kept in polythene bags. Before sowing, seeds of mungbean were mixed with molasses for adhering to the bio-fertilizer. Then the bio-fertilizer was mixed thoroughly with the seed as per treatments and the seeds were placed in a cool dry place to avoid sticking together. The seeds were sown continuously with 30cm row spacing and 3cm soil depth in the afternoon of 3 March, 2010. After sowing, the seeds were covered with soil to preserve moisture.

Thinning of seedling was done after 15 days of sowing to maintain uniformity of plant population. Weeding was done as per treatment. Irrigation was not given at the early stages of crop growth, as there was no symptom of moisture stress. However, there was heavy rainfall on middle April and middle May 2010. The excess water was removed from the field at that time. The insecticide Malathion 57EC was sprayed @ 1.51 ha^{-1} at the time of 50% pod formation stage to control pod borer. When 80% of the pods of mungbean turned brown in color, the crop was assessed to attain maturity.

The crops were harvested from central 2 m^2 area of each plot for yield data on different dates as they attained maturity. Data on plant height, number of branches $plant^{-1}$, pods $plant^{-1}$, seeds pod^{-1}, pod length and seed weight $plant^{-1}$ were recorded from ten randomly selected plants. For this ten randomly selected plants were uprooted carefully from each plot. Then crop were bundled and sun dried for two days in threshing floor. Seeds were then separated from the plants by beating the bundles with wooden sticks. The collected seeds were dried in the sun for maintaining 14% moisture level. The dried seeds and stover were cleaned and weighed $plot^{-1}$. Seed yield and stover yield together were regarded as biological yield. The biological yield was calculated with the following formula:

Biological yield = Seed yield + Stover yield

Harvest index was calculated with the following formula:

$$\text{Harvest index} = \frac{\text{Seed yield}}{\text{Seed yield} + \text{Stover yield}} \times 100$$

The collected data were compiled and analyzed statistically using the analysis of variance technique (ANOVA) for each of the characters under study was done by F (variance) ratio. The differences among treatment means were adjudged by Duncan's Multiple Range Test (Gomez and Gomez, 1984) with the help of a computer based package programmed MSTAT-C.

Table 1. Morphological, Physical and Chemical characteristics of soil samples

a) Morphological characteristics of soil

(i) Location	:	Agronomy Field Laboratory, Bangladesh Agricultural University, Mymensingh
(ii) Agro-ecological Zones (AEZ-9)	:	Old Brahmaputra Flood Plain
(iii) Soil Types	:	Non-calcareous Dark-Grey Flood Plain
(iv) Soil Series	:	Sonatola
(v) Parent Materials	:	Old Brahmaputra River Borne Deposit

b) Physical characteristics of soil

(i) Sand (2.00-0.5 mm dia)	:	25.2%
(ii) Silt (0.5-0.002 mm dia)	:	72.0%
(iii) Clay (below 0.002 mm dia)	:	2.8%
(iv) Textural Class	:	Silty loam

c) Chemical characteristics of soil

Sl. No.	Chemical Properties	Analytical data
1.	pH	6.8
2.	Organic carbon (%)	0.93
3.	Total nitrogen (%)	0.13
4.	Available phosphorus (ppm)	13.9
5.	Available potassium (ppm)	16.3
6.	Exchangeable potassium (ppm)	0.28

Source: Weather Yard, Department of Irrigation and Water Management, Bangladesh Agricultural University, Mymensingh

RESULTS AND DISCUSSION

Effect of Bio-fertilizer

Bio-fertilizer had a significant effect on number of branches plant^{-1}, Number of pods plant^{-1}, pod length, number of seeds pod^{-1}, seed weight plant^{-1}, 1000-seed weight, seed yield, stover yield, biological yield and harvest index. The highest number of branches plant^{-1} (2.69), number of pods plant^{-1} (20.35), pod length (5.43 cm), number of seeds pod^{-1} (17.23), seed weight plant^{-1} (28.32 g), 1000-seed weight (40.68 g), seed yield (1.96 t ha^{-1}), stover yield (3.0 t ha^{-1}), biological yield (4.96 t ha^{-1}) were found from 2 kg ha^{-1} of bio-fertilizer applied plots and the lowest were in control plots (Table 2). The highest pods plant^{-1} may be the resultant effect of maximum number of branches were produced from the same treatment. The highest number of seeds pod^{-1} were obtained at 2 kg ha^{-1} just because of highest corresponding value of number of branches, number of pod, pod length as well (Mulas *et al.* 2011). The lowest seed weight plant^{-1} (13.09 g) was found from control treatment because of quantitative effect of maximum number of branches plant^{-1}, number of pods plant^{-1}, length pod^{-1} and number of seeds pod^{-1}. The result revealed that application of bio-fertilizer increased the seed yield than that of no bio-fertilizer application up to a certain level. The highest seed yield of (1.96 t ha^{-1}) was obtained due to the positive contribution of potential yield contributing characters under the study, for example number of branches, pods, pod length, number of seeds and seed weight (Malik 1994 and Celal 2004). Variation in harvest index was found to be significant due to bio-fertilizer level (Table 1). 3 kg ha^{-1} bio-fertilizer gave significantly the highest harvest index (42.92%). The lowest harvest index (35.58%) was found in 4 kg ha^{-1} bio-fertilizer. Ghulam *et al.* (2006) (experiment conducted in Pakistan) noticed that seed inoculation and fertilizer application significantly increased the mungbean yield. They stated, when inoculated by 22-57 kg NP ha^{-1} (Nitrogen and Phosphorus fertilizers) produced higher yield (1131.9 kg ha^{-1}) of mungbean with an increase of 73.98% over control. Nadeem *et al.* (2004) conducted an experiment at Agronomic Research Area, University of Agriculture, Faisalabad, Pakistan and found number of pod-bearing branches plant^{-1}, number of seeds pod^{-1}, 1000-seed weight and seed yield of mungbean were significantly affected by seed inoculation.

Table 2. Effect of bio-fertilizer on the yield contributing parameters of mungbean

Level of bio-fertilizer (kg ha^{-1})	Number of Branches plant^{-1}	Number of pods plant^{-1}	Length pod^{-1} (cm)	Number of seeds pod^{-1}	Seed weight plant^{-1} (g)	1000-seed weight (g)	Seed yield (t ha^{-1})	Stover yield (t ha^{-1})	Biological yield (t ha^{-1})	Harvest Index (%)
0	2.33c	17.82d	4.85c	14.25e	13.09e	35.15d	1.54d	2.15c	3.69d	41.62b
1	2.54b	18.59c	5.40a	15.94c	18.90c	37.17b	1.74b	2.66b	4.40bc	39.54bc
2	2.69a	20.35a	5.43a	17.23a	28.32a	40.68a	1.96a	3.00a	4.96a	39.46c
3	2.45b	18.88c	5.23b	15.18d	17.11d	35.56c	1.70b	2.26c	3.96c	42.92a
4	2.45b	19.85b	4.9c	16.64b	20.65b	36.98bc	1.63c	2.95a	4.58b	35.58d
S($\bar{X}$)	0.03	0.17	0.08	0.13	0.46	0.35	0.03	0.07	0.09	0.64
Level of significance	**	**	**	**	**	**	**	**	**	**

Mean followed by the same letter(s) within a parameter do not differ significantly at 5% level of LSD; ** = Significant at 1% level

Effect of Weeding

In our present study, weeding regimes significantly influenced the number of branches plant^{-1}, number of pods plant^{-1}, pod length, number of seeds pod^{-1}, weight of seed plant^{-1}, 1000-seed weight, seed yield, stover yield and harvest index. The highest number of branches plant^{-1} (2.68), number of pods plant^{-1} (20.14), pod length (5.44 cm), number of seeds pod^{-1} (16.30), seed weight plant^{-1} (24.63 g), 1000-seed weight (39.35 g), seed yield (2.00 t ha^{-1}), stover yield (2.99 t ha^{-1}), biological yield (4.99 t ha^{-1}) were obtained from three time weeding plots and the lowest number of branches plant^{-1} (2.29), number of pods plant^{-1} (17.98), (5.02 cm), numbers of seeds pod^{-1} (15.17), seed weight plant^{-1} (14.13 g), 1000-seed weight (34.34 g), seed yield (1.48 t ha^{-1}), stover yield (2.35 t ha^{-1}) and biological yield (3.83 t ha^{-1}) were obtained from control treatment (Table 3) (Khan *et al*. 2008; Rehman and Ullah, 2009; and Jarin 2013). Harvest index was also significantly affected by different levels of weeding (Table 3). Two times weeding produced the highest harvest index (42.61%) and the lowest harvest index (38.73%) was found form control treatment.

From Table 3, it is observed that the increasing levels of weeding increased the number of branches plant^{-1}. The highest number of pods plant^{-1} (20.14) was observed from three weeding due to taller plant and higher number of branches obtained at the same treatment (Khan *et al*. 2008; Rehman and Ullah, 2009; and Jarin 2013). It is obvious that if the land receiving weed free for a longer period thus achieved maximum yield. It was observed that seed yield increased when the weed free duration extend up to 45 days and after this increase in the duration of weed free had no beneficial effect on seed yield. This result obtained in this study at 3 times weeding (45 days weed free) is in agreement with the findings of (Singh *et al*. 1996, Sultana *et al*. 2009) who was conducted an experiment in Indian soil. The crop weed associations in mungbean and determine the occurrence and frequency distribution of weed species at different time intervals during the crop season showed that mungbean should be kept weed free during the first 43 days of sowing (Jha *et al*. 1997; Sultana *et al*. 2009).

Singh *et al.* (1996) carried out a field experiment on green gram cultivar k851 to determine the crop weed competition in summer green gram and they found that seed yield was decreased by 35% when the crop was infested for the first 30 DAS. Yield increased with increase in weed free duration to the first 45 DAS (0.81 t ha^{-1} compared with 0.88 t ha^{-1}) in free plots.

Table 3. Effect of weeding on the yield contributing characters of mungbean

Level of weeding	Number of branches plant^{-1}	Number of pods plant^{-1}	Length pod^{-1} (cm)	Number of seeds pod^{-1}	Seed weight plant^{-1} (g)	1000-seed weight (g)	Seed yield (t ha^{-1})	Stover yield (t ha^{-1})	Biological yield (t ha^{-1})	Harvest Index (%)
No weeding	2.29c	17.98c	5.02c	15.17c	14.13c	34.34d	1.48d	2.35c	3.83d	38.73b
One weeding	2.54b	18.95b	5.09b	15.91b	19.38b	36.66c	1.63c	2.50bc	4.13c	39.38b
Two weeding	2.47b	19.32b	5.11b	16.02ab	20.32b	38.09b	1.91b	2.58b	4.49b	42.61a
Three weeding	2.68a	20.14a	5.44a	16.3a	24.63a	39.35a	2.00a	2.99a	4.99a	40.07b
S($\bar{X}$)	0.03	0.15	0.07	0.12	0.41	0.31	0.02	0.07	0.08	0.57
Level of significance	**	**	**	**	**	**	**	**	**	**

Mean followed by the same letter(s) within a parameter do not differ significantly at 5% level of LSD; ** = Significant at 1% level; 'ns' = non-significant

Interaction effect of bio-fertilizer and weeding

The interaction effect of bio-fertilizer and weeding regimes did not influence on number of branches plant^{-1}, but number of pods plant^{-1}, pod length, 1000-seed weight, seed yield, stover yield and biological yield was influenced by bio-fertilizer in combined with weeding level (Table 4). The highest number of pods plant^{-1} (22.11), pod length (6.3 cm) 1000-seed weight (43.07g), seed yield (3.73 t ha^{-1}), stover yield (3.73 t ha^{-1}) and biological yield (6.07 t ha^{-1}) were produced from the combined effect of 2 kg bio-fertilizer ha^{-1} and three times weeding and the lowest number of pods plant^{-1} (16.4), pod length (4.49 cm), 1000-seed weight (30.56 g), seed yield (1.18 t ha^{-1}), stover yield (1.72 t ha^{-1}) and biological yield (2.90 t ha^{-1}) were obtained from the control treatment. Pulses for long time have been grown with poor management practices resulting in poor yields. Proper seed bed, land preparation and weeding are important for adequate germination of seed, crop establishment and good yields. Weed infestation is one of the major factors lowering yield in pulses (Rehman and Ullah, 2009). Mungbean showed significant increase in plant height and number of pods plant^{-1}. Increase in plant height and number of pods plant^{-1} is inversely proportional to weed density and similar to the case with the number of grains pod^{-1}. Production capacity of mungbean can be determined by the number of pods plant^{-1} (Khan *et al.* 2008). Weed is one of the worst enemies of cultivated crops as it competes with it for space, nutrient, water and light, and finally reduces yield. About 69% reduction in mungbean gain yield due to weeds was estimated by Yadav and Singh (2005).

The highest number of seeds pod^{-1} (18.47), seed plant^{-1} (32.85g) were obtained from the 2 kg bio-fertilizer ha^{-1} combined with one time weeding, followed by 2 kg bio-fertilizer ha^{-1} with three time weeding and the lowest was obtained from no bio-fertilizer with three times weeding. Bio-fertilizer and weeding had no significant influence on harvest index (Table 3) (Akter *et al.* 2013). Numerically the highest harvest index (49.33%) was obtained from the treatment of 3 kg bio-fertilizer ha^{-1} combined with two times weeding and the lowest harvest index (32.23%) was obtained from the treatment of 4 kg bio-fertilizer ha^{-1} combined with no weeding (Akter *et al.* 2013).

Table 4. Interaction effect of bio-fertilizer and weeding on the yield contributing characters of mungbean

Interaction (Bio-fertilizer × Weeding)	Number of Branches Plant^{-1}	Number of pods plant^{-1}	Length pod^{-1} (cm)	Number of seeds pod^{-1}	Seed weight plant^{-1} (g)	1000-seed weight (g)	Seed yield (t ha^{-1})	Stover yield (t ha^{-1})	Biological yield (t ha^{-1})	Harvest Index (%)
I_0W_0	2.12	17.51gh	4.49gh	14.22gh	9.45k	30.56i	1.18n	1.72g	2.90k	40.76
I_0W_1	2.37	17.8fgh	5.36d	14.09gh	11.99jk	33.17h	1.39lm	2.12efg	3.51ij	39.65
I_0W_2	2.29	17.87fgh	5.55c	14.77fgh	14.89hij	38.44cd	1.83e-h	2.41ef	4.24e-h	43.13
I_0W_3	2.52	18.1fgh	5.69b	13.92h	16.02h	38.46cd	1.78f-j	2.38ef	4.15fgh	42.78
I_1W_0	2.25	18.09fgh	5.16e	14.94fg	12.53ij	33.92gh	1.31mn	2.05fg	3.36jk	39.04
I_1W_1	2.69	18.01fgh	5.08e	16.1e	19.02fg	38.40cd	1.63jk	2.15efg	3.78hij	43.20
I_1W_2	2.56	18.42fg	4.77f	16.19e	19.73efg	37.68def	1.98cde	2.95cd	4.93cd	40.19
I_1W_3	2.69	19.84bcd	4.38h	16.53cde	24.33c	38.68cd	2.02bcd	3.48ab	5.50b	36.76
I_2W_0	2.47	20.63bc	5.46cd	16.17e	21.43def	38.25cde	1.65ijk	2.35ef	4.00ghi	41.33
I_2W_1	2.75	20.8b	4.81f	17.18bc	32.85a	41.37ab	1.69h-k	2.95cd	4.64c-f	36.49
I_2W_2	2.65	20.15bcd	5.04e	17.1bcd	27.48b	40.02bc	2.14b	2.98cd	5.12bc	41.82
I_2W_3	2.89	22.11a	6.3a	18.47a	31.52a	43.07a	2.34a	3.73a	6.07a	38.54
I_3W_0	2.32	16.41i	5.1e	14.43fgh	12.49ij	34.60gh	1.74g-j	2.40ef	4.14fgh	41.98
I_3W_1	2.45	18.67ef	5.36d	14.57fgh	15.4hi	34.23gh	1.88d-g	2.25ef	4.13fgh	45.52
I_3W_2	2.40	19.59cde	5.1e	15.27f	17.29gh	35.87fg	1.94c-f	1.99fg	3.93ghi	49.33
I_3W_3	2.65	20.84b	5.36d	16.47cde	23.26cd	37.55def	2.05bc	2.38ef	4.43d-g	46.24
I_4W_0	2.31	17.29hi	4.57g	16.09e	14.74hij	34.35gh	1.53kl	3.21bc	4.74cde	32.23
I_4W_1	2.28	19.44de	5.14e	16.3de	17.64gh	36.12efg	1.53kl	3.05bc	4.58c-f	33.40
I_4W_2	2.44	20.55bc	5.11e	16.75b-e	22.2cde	38.47cd	1.67h-k	2.55de	4.22e-h	39.63
I_4W_3	2.78	19.82bcd	5.44cd	17.42b	28.02b	38.97cd	1.81f-i	2.98cd	4.79cd	37.76
$S(\bar{X})$	0.06	0.34	0.16	0.27	0.93	0.70	0.05	0.15	0.17	1.27
Level of significance	NS	**	**	**	**	**	**	**	**	NS

Mean followed by the same letter(s) within a parameter do not differ significantly at 5% level of LSD; ** = Significant at 1% level; 'ns' = non-significant[1]

[1] I_0 = Control (no bio-fertilizer), I_1 = 1.0 kg ha^{-1}, I_2 = 2.0 kg ha^{-1} , I_3 = 3.0 kg ha^{-1} and I_4 = 4.0 kg ha^{-1} bio-fertilizer and four weeding regimes: W_0 = No weeding, W_1 = One weeding (15 DAS), W_2 = Two weeding (15 DAS and 30 DAS) and W_3 = Three weeding (15 DAS, 30 DAS and 45 DAS)

CONCLUSION

From the above result it is revealed that yield and yield attributes were significantly influenced by different levels of bio-fertilizer and weeding regimes. The highest seed yield (2.34 t ha^{-1}) was produced from seed inoculated with bio fertilizer @ 2 kg ha^{-1} with three times weeding. Therefore, application of 2 kg bio-fertilizer ha^{-1} combination with three times weeding may be recommended for maximum yield of summer mungbean.

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