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Application of vermiwash on growth and yield of green gram (*Vigna radiata*) in sandy regosol

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ABSTRACT

A field experiment was conducted at the crop farm, Eastern University, Sri Lanka to study the effect of vermiwash application on growth and yield of green gram (Vigna radiata). The experiment was laid out in a Randomized Complete Block Design with five treatments having four replicates. The treatments were recommended inorganic fertilizer (T1) and ½ doses of recommended basal and top dressing with different concentration of vermiwash;25%(T2), 50% (T3), 75% (T4) and 100% (T5). Vermiwash was applied at once in two weeks and data were recorded at 2nd, 4th, 6th, 8th weeks after planting (WAP). The results revealed that number of branches, days for 50% and 100% flowering, number of pods per plant and number of seeds per pod were significantly (P<0.05) varied at 8th week after planting and it was high in T4. Minimum duration of 30 days and 35 days were taken by T4 for 50 % and 100 % flowering respectively. Foliar application of vermiwash increased the root length and dry weight of root was high in T5 followed by T4 at 2nd, 4th, 6th and 8th WAP. However, there was no significant variation between T5 and T4 in dry weight of shoots. Further, plant height, dry weight of roots, leaf area index and yield components are significantly influenced (P<0.01) by application of vermiwash. Yield in T4 was 2.3 and 2.5 times greater than control at 6th WAP and 8th WAP, respectively. This study suggests that application of ½ doses of recommended basal and top dressing supplemented with 75% vermiwash (T4) would be more suitable for cultivation of green gram in sandy regosol.

Keywords: *Foliar Spray, Green Gram, Vermiwash, Yield*

INTRODUCTION

Sri Lanka is a developing country dependent main on Agriculture sector. In ancient time, farmers used indigenous methods and traditional knowledge for their agricultural purpose. At present, people use higher amount of agrochemicals and synthetic fertilizers to improve agricultural productivity. Furthermore, modern crop practices utilizing heavy doses of pesticides, fungicides and herbicides destroy native soil biota. Therefore, proper solution should be practiced to reduce the environmental damage. Reduction of usage of inorganic fertilizer and increase the usage of organic fertilizers are one of the solutions to rectify this issue. Organic farming produces good quality of food by using eco-friendly methods.

Vermiwash is a one of the examples for organic liquid fertilizer which is produced with the help of earthworms. Vermiwash contains micro and macro nutrients, hormones which promote plant growth and yield (Sharma *et al*., 2005), increases soil fertility (Leifeld and Fuhrer, 2010), reduces agricultural greenhouse gas emissions (Gomiero *et al*., 2008) and reduces nitrogen losses from the system (Drinkwater *et al*., 1998). Further, it is less expensive compared with chemical fertilizer and ease to produce. Vermiwash is an eco friendly organic liquid fertilizer which could be used as a foliar

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spray on many different crops (Jandaik *et al*., 2015).

On the other hand, nowadays, accumulation of wastes is a serious problem which needs to be managed to make environment free from pollution. Vermiwash helps to manage market wastes in a profitable manner. It can be used for crop production as foliar and soil application. Presently, foliar application is the current trend of sustainable crop production to fulfill the target production with low quantity of manure. Most of the developed countries widely use this system and it must be extended among developing countries.

Green gram (*Vigna radiata*) is an important pulse crop cultivated and consumed in Sri Lanka. It provides protein requirement for vegetarian population of the country (Kamannavar *et al*., 2011). Mung beans are high in vitamins, minerals and fiber and believed to heel many ailments, good source of antioxidant, which may reduce risk of chronic diseases such as heart diseases, diabetes, and certain cancers (Dzudie and Hardy, 1996). Further, it is a good source of potassium, magnesium and fiber, which have been linked to lower blood pressure levels in adults with and without high blood pressure and soluble fiber and resistant starch, which can promote digestive health. Poor nutrient status of the soil has been identified as one of the major factors limiting the crop production. Application of vermiwash improves yield under adverse climatic conditions and poor soil fertility. Therefore, present study was carried out to determine the effect of vermiwash on growth and yield of greengram in sandy regosol.

MATERIALS AND METHODS

The experiment was carried out at Crop farm of Eastern University Sri Lanka using Randomized Complete Block Design having five treatments replicated four times. Green gram, Variety *MI 5* was used. Department of Agriculture recommended basal fertilizer with top dressing (T1), 1/2 doses of recommended basal and top dressing with different concentration of vermiwash viz; 25% (T2), 50% (T3), 75% (T4) and (T5) 100% at once in two weeks were used as treatments. Fruit wastes of non-infected over ripen fruits were collected from Chenkalady market. Cow dung was collected from animal farm in Eastern University, Sri Lanka (EUSL). Red earth worms, coarse sand, loam soil, and broken bricks were collected from EUSL premises. Vermiwash unit was set up in barrel with a tap. For that empty barrel with one side open was used. Broken bricks layer of 25 cm was placed while keeping the tap open. A 25 cm layer of coarse sand follows the layer of bricks were placed. Then 30-45 cm layer of loam soil was placed and gently moistened. Red earthworms were introduced in to barrel. Cow dung, leaf mould and waste fruits parts were introduced in to the barrel and gently moistened. The tap was kept open for one week. Water was added every day to keep the unit moist. In the 8^{th} day tap was closed and collected liquid was poured in to the barrel. In the 9^{th} day again tap was opened and collected liquid was poured in to barrel again until complete two weeks. Then after two weeks vermiwash was collected through the tap (Ansari, 2012). Different concentration of vermiwash was prepared according to the treatments. Foliar spray of vermiwash was done 1^{st}, 3^{rd}, 5^{th}, 7^{th} weeks after planting. 10 ml of vermiwash per plant was sprayed at each application and distilled water was applied for the control. All agronomic practices except fertilization were followed as per the recommendation of Department of Agriculture, Sri Lanka. Plant height, number of branches per plant, root length, days to 50% and 100% flowering

and dry weights of shoot and root were measured at 2nd, 4th, 6th and 8th weeks after planting by using destructive method. Leaf area index was calculated until 8th week. Picking was done at harvesting stage. Number of pods per plant and length and girth of pod was recorded at each picking and also fresh weights of pods were taken at each picking separately. Further, number of seeds per pod and weigh of 100 seeds were taken during harvesting. Sun dried seed weight also recorded. Yield per each picking was taken separately. Total yield was calculated by the accumulation of yield per each picking. Parametric and non-parametric analysis were done depend on data type by using statistical softwares SAS and minitab.

RESULTS AND DISCUSSION

Plant height

There was a significant (P<0.01) difference among treatments on average plant height at 2nd WAP. Highest plant height of 19.34 cm was recorded in T5, followed by 18.41 cm in T4 while minimum plant height of 15.50 cm was in T1.

It is agreeable with Manyuchi *et al*. (2013) where 100% vermiwash contain high amount of macro and micro nutrients, plant growth promoters and shows better growth on all crops. Vermiwash are enriched in certain metabolites, vitamins that belong to the B group or provitamin D which also help to enhance plant growth (Ansari, 2008). It may be the reason for having a higher plant height in vermiwash treated plants compared with control. However, maximum plant height of 46.05 cm, 57.50 cm and 57.68 cm were recorded in T4 while minimum plant height of 27.27 cm, 37.40 cm and 40.43 cm were recorded in T5 at 4th, 6th and 8th WAP, respectively. According to Chattopadhyay (2015), undiluted vermiwash was phytotoxic to *Vigna radiata* as it significantly reduced the percentage of germination seedling length and plant height of the test crop. During this study green gram plants were exposed to undiluted vermiwash twice within a month. This undiluted overdose may be the reason for minimum plant height observed in T5. These results conclude that application of 75% concentration vermiwash would be more effective on plant height of green gram.

Table 1: Effect of Vermiwash application on average plant height (cm) of green gram

	Plant Height (cm)			
Treatments	**At 2nd WAP**	**At 4th WAP**	**At 6th WAP**	**At 8th WAP**
T1	15.50 ± 0.54e	32.65 ± 1.60d	42.83 ± 0.69d	42.83 ± 0.62d
T2	16.53 ± 1.00d	37.47 ± 1.08c	46.40 ± 0.93c	46.83 ± 0.64c
T3	17.53 ± 1.00c	42.75 ± 0.68b	53.10 ± 1.66b	53.53 ± 1.10b
T4	18.41 ± 0.55b	46.05 ± 0.74a	57.50 ± 0.69a	57.68 ± 0.99a
T5	19.34 ± 1.59a	27.27 ± 0.74e	37.40 ± 0.70e	40.43 ± 1.69e
F test	**	**	**	**

Value represent mean ± standard error of four replicates. F test: - **: P<0.01; Means followed by the same letter in each column are not significantly different according to the Duncan's Multiple Range Test at 5% level.

Number of branches per plant

Vermiwash application was significantly influenced (P<0.05) the number of branches per plant at 4th, 6th and 8th WAP were confirmed with *P* values of 0.002, 0.000, 0.000 and chi square values of 16.5, 27.19, and 32.67 (Table 2). At 4th, 6th and 8th WAP, the highest numbers of branches were observed in T4. Similar findings were noted by Ranjan and Murugesan (2012) stated that 75% vermiwash shows highest number of branches and leaves on cowpea (*Vigna unguiculata).* This may be due to the higher amounts of available N in vermicompost than conventionally composted manure (Taleshi *et al*., 2011).

Table 2: Vermiwash application on number of branches of green gram

Treatments	Number of branches and leaves					
	4th WAP		6th WAP		8th WAP	
T1	04	15	05	21	05	21
T2	04	18	05	25	05	25
T3	04	19	06	26	06	26
T4	05	21	07	27	07	27
T5	03	12	05	21	05	21
Chi square	16.5	48.32	27.19	45.52	32.67	39.77
***P* value**	0.002	<0.001	<0.0001	<0.001	<0.0001	<0.001

Leaf area index (LAI)

At 2nd WAP, 100% vermiwash showed better growth on green gram leaves but continuous application of undiluted vermiwash decreased the growth of green gram leaves than other treatments (Table 3). Foliar application of vermiwash increased the LAI in T4 (1.24, 4.95 and 4.96) followed by T3 (0.89, 4.34 and 4.34), T2 (0.83, 3.70, 3.80) and T1 (0.71, 3.02 and 3.01) at 4th, 6th and 8th WAP respectively. In addition, plant growth hormones were increased which promote the rapid cell division, cell enlargement and the overall plant growth. Reddy and Ohkura (2004) reported that application of vermicompost increase number of leaves and leaf area of sorghum. The reason may be plant-available form of nitrogen (nitrate) is grater in vermicompost.

Table 3: Vermiwash application on average leaf area index of the plant of green gram

	Leaf Area Index			
Treatments	**2 WAP**	**4 WAP**	**6 WAP**	**8 WAP**
T1	0.29 ± 0.31e	0.71 ± 0.18d	3.02 ± 0.89d	3.01 ± 0.20d
T2	0.36 ± 1.49d	0.83 ± 0.30c	3.70 ± 0.54c	3.80 ± 0.83c
T3	0.44 ± 0.81c	0.89 ± 1.16b	4.34 ± 1.56b	4.34 ± 1.63b
T4	0.56 ± 1.09a	1.24 ± 1.83a	4.95 ± 1.61a	4.96 ± 0.85a
T5	0.51 ± 0.60b	0.58 ± 1.15e	2.32 ± 1.22e	2.33 ± 0.47e
F test	**	**	**	**

Value represent mean ± standard error of four replicates. F test: - **: P<0.01; Means followed by the same letter in each column are not significantly different according to the Duncan's Multiple Range Test at 5% level.

Root length

The root tip length can be increased mainly because of the plant growth regulatory activity of vermiwash extracts. Root tip cells are highly sensitive to auxin than micro and macro nutrients, vitamins and amino acids (Sundararasu and Jeyasankar 2014). Foliar application of vermiwash increased the length of taproot in T5, followed by T4 while minimum length was observed in T1 at 2^{nd}, 4^{th}, 6^{th} and 8^{th} WAP. Application of vermiwash at the rate of 100% concentration at two-week interval increased the length of tap root of green gram. These results are in agreement with Ranjan and Murugesan (2012) where 100% vermiwash showed maximum root length and 0% vermiwash shows minimum root length on cowpea. Also, Manyuchi *et al*. (2013) found that 100% vermiwash contain high amount of macro and micro nutrients and plant growth promoters and shows better growth on crops.

Table 4: Vermiwash application on average root length (cm) of green gram

	Root length (cm)			
Treatments	**2^{nd} WAP**	**4^{th} WAP**	**6^{th} WAP**	**8^{th} WAP**
T1	2.15 ± 1.163e	7.48 ± 1.45e	13.72 ± 0.47e	13.92 ± 0.40d
T2	2.35 ± 3.061d	8.49 ± 0.53d	14.29 ± 1.09d	14.68 ± 1.57c
T3	2.59 ± 0.571c	10.49 ±0.37c	14.75 ± 0.93c	15.11 ± 0.88b
T4	3.08 ± 0.714b	11.58 ± 1.32b	15.73 ± 0.74b	16.02± 0.68ab
T5	3.30 ± 1.795a	12.49 ± 0.78a	16.30 ± 1.66a	16.14 ± 0.70a
F test	**	**	**	**

Value represent mean ± standard error of four replicates. F test: - **: P<0.01; Means followed by the same letter in each column are not significantly different according to the Duncan's Multiple Range Test at 5% level.

Days for 50% and 100% flowering

Vermiwash application was significantly influenced (P<0.05) the days for 50% and 100% flowering at 4th and minimum duration was taken by T4 and maximum duration was taken by T5. Application of vermiwash at the rate of 75% concentration at two week interval reduced the time taken to complete 50% and 100% flowering.

Decreased number of days to attain 50% and 100% flowering of green gram treated with vermiwash may be due to the increased levels of auxin, N and P in the flowering shoots of the plants. This supports the report of Taleshi *et al*. (2011) who stated that application of vermiwash decrease flowering duration.

Table 5: Vermiwash application on days for 50%, 100% flowering of the green gram plant

Treatments	Days for 50% flowering	Days for 100% flowering
T1	35	41
T2	36	40
T3	33	38
T4	30	35
T5	41	46
Chi square	12.31	12.31
***P* value**	0.015	0.015

Dry weights of the root and shoot

The effect of vermiwash on average dry weight of the root of green gram from 2nd WAP to 8th WAP is given in Table 6. There was a significant difference (P<0.05) among the treatments on average dry weight of the roots at 2nd WAP. Highest dry weight of roots was noted in T5 while lowest dry weight was in T1 until two months. Present study is in line with Ali *et al*. (2007) reported that fresh weight and dry weight of lettuce (*Lactuca sativa*) plants significantly increased after application of vermicompost.

Table 6: Vermiwash application on average dry weight of the roots (g) of green gram

	Dry weight of roots (g)			
Treatments	**2nd WAP**	**4th WAP**	**6th WAP**	**8th WAP**
T1	0.14 ± 1.04d	0.51 ± 1.13d	0.64 ± 0.85b	0.66 ± 0.13b
T2	0.26 ± 0.37c	0.59 ± 0.54c	0.69 ± 1.23b	0.69 ± 1.23b
T3	0.26 ± 1.46c	0.58 ± 0.38c	0.75 ± 0.97a	0.75 ± 0.97a
T4	0.33 ± 0.95b	0.67 ± 1.32b	0.76 ± 1.23a	0.76 ± 1.23a
T5	0.43 ± 0.58a	0.74 ± 0.83a	0.79 ± 0.48a	0.79 ± 0.48a
F test	**	**	*	*

Value represent mean ± standard error of four replicates. F test: - *: P<0.05; **: P<0.01; Means followed by the same letter in each column are not significantly different according to the Duncan's Multiple Range Test at 5% level

There were no significant differences (P>0.05) on average dry shoot weight among treatments at 2nd and 8th WAP. However, significant variation (P<0.01) was observed at 4th and 6th WAP. Maximum dry weight of shoot was observed in T4 (11.68 g), followed by T3 (10.72 g) at 4th WAP. At 6th WAP, the maximum dry weight of shoot of 20.67 g observed in T4 followed by 18.33 g in T3 while the minimum dry shoot weight was 16.24 g in T5. However, there was no significant differences (P>0.05) on average dry shoot weight among T1, T2 and T5 and T2 and T3 at 6th WAP. Paul and Bhattacharya (2012) reported that plant fresh and dry weights were increased after application of vermicompost on African marigold.

Table 7: Vermiwash application on average dry weight of the shoots (g) of green gram

	Dry weight of shoots (g)			
Treatments	**2nd WAP**	**4th WAP**	**6th WAP**	**8th WAP**
T1	0.56 ± 1.15	6.83 ± 2.41c	16.32 ± 1.35c	18.29 ± 2.46
T2	0.54 ± 1.35	5.79 ± 0.44d	16.95± 0.47bc	16.96 ± 1.03
T3	0.58 ± 1.40	10.72 ± 0.47b	18.33 ± 0.06b	18.33 ± 0.14
T4	0.59 ± 0.56	11.68 ± 1.07a	20.67 ± 1.21a	21.11 ± 0.77
T5	0.59 ± 0.70	6.03 ± 0.66d	16.24 ± 1.30c	15.70 ± 1.00
F test	ns	**	**	ns

Value represent mean ± standard error of four replicates. F test: - ns: not significant; **: P<0.01; Means followed by the same letter in each column are not significantly different according to the Duncan's Multiple Range Test at 5% level.

Pod length and girth

Length and girth of the pod was significantly influenced (P<0.01) by the application of vermiwash (Table 8). The longest pods were obtained in T4. The reason may be due to presence of micronutrients which involved in the cellular mechanism and respiration that affect positively for improvement in fruit size (Polara *et al*., 2017). Minimum length was showed in T5. The reason may be 100% vermiwash contain large amount of salts and it may inhibit plant growth and produce malformed pods and fruits and decrease length of pods (Fernandez *et al*., 2010).

At 8th WAP, the maximum girth of the pod in T4 and it was significantly higher (P<0.01) compared with control. Minimum girth of pods was observed in T5. According to these results, application of vermiwash as a foliar spray increased the girth of pods in T4 by 1.5 times compared to control. Also, these results are in agreement with Alam *et al*. (2007) reported 100% vermiwash decrease yield of potato (*Solanum tuberosum*). Foliar application of vermiwash at the rate of 75% at two week interval would be the best one to get higher pod girth. At 6th WAP similar pattern noted in pod length and pod girth as 8th WAP.

Table 8: Vermiwash application on average pod length (cm) and girth (cm) of green gram

Treatments	6th WAP		8th WAP	
	Pod length	Pod girth	Pod length	Pod girth
T1	8.72 ± 1.08d	1.64 ± 0.39d	9.72 ± 1.61d	1.77 ± 0.69d
T2	10.13 ± 1.08c	1.73 ± 0.43c	10.28± 0.23c	1.89 ± 0.72c
T3	10.59 ± 0.80b	2.11 ± 0.29b	10.64± 0.95b	2.15 ± 1.02b
T4	11.23 ± 0.80a	2.58 ± 2.00a	11.70± 0.96a	2.64 ± 1.02a
T5	8.52 ± 1.42e	1.55 ± 1.66e	9.17 ± 1.14e	1.69 ± 1.02e
F test	**	**	**	**

Value represent mean ± standard error of four replicates. F test: - **: P<0.01; Means followed by the same letter in each column are not significantly different according to the Duncan's Multiple Range Test at 5% level.

Fresh weight of pod

The fresh weight of pods were significantly different (P<0.01) among treatments (Table 9). At 6th WAP and 8th WAP, maximum fresh weight was observed 4.35 g and 4.46 g in T4 and followed by 3.38 g and 3.34 g in T3, 2.51 g and 2.53 g in T2, 1.68 g and 1.64 g in T1 and 1.28 g and 1.31 g in T5. Foliar application of vermiwash increased the fresh weight of pods of green gram. The present results match with Bhalerao *et al*. (2015) where different concentration of vermiwash presence of more amounts of macro, micro nutrients and plant growth regulators. Application of vermiwash at the rate of 75% concentration at two week interval increased the fresh weight of green gram pods. Because of 75% vermiwash contain most appropriate amount of nutrients than other concentrations (Bhalerao *et al*., 2015). In this study, at 8th WAP fresh pod weight was increased than 6th WAP. The reason might be the 4th application of vermiwash was done 7th WAP and it contain large amount of growth promoters (Bhalerao *et. al*., 2015).

Table 9: Vermiwash application on average fresh pod weight of green gram

Treatments	Fresh pod weight (g)	
	6th WAP	8th WAP
T1	1.68 ± 0.53d	1.64 ± 0.83d
T2	2.51 ± 0.74c	2.53 ± 0.44c
T3	3.38 ± 1.29b	3.34 ± 1.96b
T4	4.35 ± 1.66a	4.46 ± 0.61a
T5	1.28 ± 0.40e	1.31 ± 1.47e
F test	**	**

Value represent mean ± standard error of four replicates. F test: - **: P<0.01; Means followed by the same letter in each column are not significantly different according to the Duncan's Multiple Range Test at 5% level.

Number of pods per plant

Application of vermiwash significantly influenced (P<0.05) on number of pods per plant at 6th and 8th WAP (Table 10). At 6thand 8th WAP, the highest numbers of pods per plant were observed in T4. Vijaya and Seethalakshmi (2011) reported that vermiwash increased the number of pods per

plants and total yield of *Abelmoschus esculentus*. Minimum number of pods per plant was observed in T5 and this result are in line with Fernandez *et al*. (2010) who noted that growth of plants on adding high concentrations of vermicompost may get inhibited because of an increase in salts (especially Na) concentrations.

Table 10: Vermiwash application on number of pods per plant of the green gram

Treatments	Number of pods per plant	
	6th WAP	8th WAP
T1	23	21
T2	27	28
T3	30	30
T4	35	35
T5	18	15
Chi square	48.00	44.67
***P* value**	0.000	0.000

Number of seeds per pod

Vermiwash application significantly influenced ($P<0.05$) the number of seeds per pod at 6th and 8th WAP (Table 11). At 8th WAP, the highest numbers of seeds per pod were observed in T4 while minimum number of pods was observed in T5. These results are in agreement with Jaybhaye and Bhalerao (2015) that application of vermiwash increases number of seeds per pod of green gram and black gram.

Table 11: Vermiwash application on number of seeds per pod of green gram

Treatments	Number of seeds per pod	
	6th WAP	8th WAP
T1	9	9
T2	10	10
T3	10	10
T4	11	11
T5	8	8
Chi square	19.03	19.03
***P* value**	0.001	0.001

100 Seed weight (g)

Application with 75% vermiwash increased 100 seeds weight by 1.36 times in T4 over the control. Lower leaf area leads to poor dry matter partitioning to the grains may be the reason for lowest 100 seeds weight in T5. Rasheed *et al*. (2004) stated that higher leaf area attributed to higher dry matter accumulation potential of crop. Yield differences among the tested treatments might be due to different level of Nitrogen.

Table 12: Vermiwash application on 100 seed weight (g) of green gram

Treatments	100 seed weight (g)
	8th WAP
T1	6.13 ± 0.63d
T2	6.78 ± 1.53c
T3	7.48 ± 0.19b
T4	7.54 ± 1.15a
T5	5.53 ± 0.53e
F test	**

Value represent mean ± standard error of four replicates. F test: - **: P<0.01; Means followed by the same letter in each column are not significantly different according to the Duncan's Multiple Range Test at 5% level.

Total yield per plant (g)

Sun dried seed weight of green gram was significantly influenced (P<0.01) by the foliar application of vermiwash (Table 13). At 6thWAP and 8th WAP maximum seed weight was observed in T4 (29.02 g) and minimum seed weight per plant was showed in T5 (7.96 g and 6.63 g). Therefore, application of vermiwash at the rate of 75% concentration at two week interval increased the dry weight of green gram seeds per plant may be due to the increasing sink capacity through supply the photo assimilates and translocation to build high quality and larger seeds as documented by Kundu*et al*. (2013). In this study, at 6th and 8th WAP dry seed yield per plant increased in T4 by 2.28 times and by 2.50 times over T1 (control).

Table 13: Vermiwash application on average seed weight (g) per plant of green gram

Treatments	6th WAP	8th WAP
T1	12.68 ± 0.53d	11.58 ± 0.63d
T2	18.30 ± 0.74c	18.98 ± 1.23c
T3	22.44 ± 1.29b	22.44 ± 0.45b
T4	29.02 ± 1.66a	29.02 ± 0.33a
T5	7.96 ± 0.40e	6.63 ± 0.45e
F test	**	**

Value represent mean ± standard error of four replicates. F test: - **: P<0.01; Means followed by the same letter in each column are not significantly different according to the Duncan's Multiple Range Test at 5% level.

CONCLUSION

The data revealed that there was significant difference (P<0.01) in plant height, leaf area index, pod length and girth, fresh weight of the pods, 100 seed weight and yield per plant at 8th week after planting (WAP) and it was high in 1/2 doses of recommended basal and top dressing with 75% concentration of vermiwash (T4). Pod length and girth, fresh weight of pod, number of pods per plant, number of seeds per pod and 100 seed weight were higher in T4 at 8th WAP. Further, application of 75% vermiwash increase the yield in T4 by 2.3 and 2.5 times compared to control at 6th WAP and 8th WAP respectively. This study suggests that application of ½ doses of recommended basal and top dressing with foliar spray of 75% concentration of vermiwashat 1st, 3rd, 5th, 7th weeks after planting (T4) would be useful for farmers to cultivate green gram

without affecting the production, while maintain environment for future generation in sustainable manner.

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