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EFFECT OF VERMICOMPOST SUPPLEMENTATION WITH NPK ON THE GROWTH OF BLACK GRAM [*VIGNA MUNGO* (L.) HEPPER]

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ABSTRACT

Pot culture studies were conducted to evaluate the effect of application of NPK, vermicompost, and vermicompost + NPK on the growth of *Vigna mungo*. The results of the various growth parameters such as shoot length, root length, no of root hairs, fresh weight and dry weight of whole plant and leaf area of *V. mungo* grown in various treatments were recorded on the 15d, 30d, 45d, 60 and 75d. The results a various growth parameters of *V. mungo* were significantly ($P<0.001$) higher in the pot culture treatments which received vermicompost + NPK than the other treatments.

KEY WORDS: **Black gram, vermicompost, NPK, pot culture**

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INTRODUCTION

Vigna mungo, known as black gram, grown in Indian subcontinent. Along with mung bean, it was placed in *Phaseolus*, but has since been transferred to *Vigna*. At one time it was considered to belong to the same species as the mung bean. The product sold as "black lentil" is usually the whole urad bean or urad dal[1]. Vermicompost as an excellent plant growth medium and influence the development of the plants and promote leaf length, root length and number of leaves [2]. Several authors studied the effect of application of vermicompost, inorganic fertilizers and the combination of of vermicompost and inorganic fertilizers (NPK) on germination, growth, biochemical constituents and yield of various crops such as chilli, Tonga bean and tomato [3,4,5]. Hence, the present study was focused to evaluate on the effect of application of vermicompost with NPK on the growth of black gram (*Vigna mungo*).

MATERIALS AND METHODS

Pot culture studies with black gram

[*Vigna mungo* (L.) Hepper] (Vamban variety)Pot culture studies were conducted in the Department of Biology, Gandhigram Rural University, Gandhigram, to evaluate the effect of three different composts on the growth performance of black gram *V. mungo* with various treatments in earthen pots in triplicate using the following experimental design.

Experimental design for pot culture studies of [Vigna mungo (L.) Hepper]

Treatment No.	Treatments
T0	Sand + Red soil (1:1) (Control)
T1	Sand + Red soil (1:1) + 50g SDWCD compost1 / 10kg soil
T2	Sand + Red soil (1:1) + 50g SDWGM compost2 / 10kg soil
T3	Sand + Red soil (1:1) + 50g SDWPM compost3 /10kg soil
T4	Sand + Red soil (1:1) + Recommended dose of NPK *
T5	Sand + Red soil (1:1) + 25g SDWCD compost +1/2 dose of recommended NPK / 10kg soil
T6	Sand + Red soil (1:1) + 25g SDWGM compost + 1/2 dose of recommended NPK / 10kg soil
T7	Sand + Red soil (1:1) + 25g SDWPM compost+ 1/2 dose of recommended NPK / 10kg soil
T8	Sand + Red soil (1:1) + 50g SDWCD compost+ 1/2 dose of recommended NPK / 10kg soil
T9	Sand + Red soil (1:1) +50g SDWGM compost + 1/2 dose of recommended NPK / 10kg soil
T10	Sand + Red soil (1:1) + 50g SDWPM compost+ 1/2 dose of recommended NPK / 10kg soil

**** Recommended NPK /kg soil***
N – 1.10g urea, P – 2.08g super phosphate, K – 0.28g potash

***SDWCD Compost* 1:** Sawdust + cow dung + microbial consortium (50 ml /kg substrate with 10^8 cell /ml) + Earthworms (*E. eugeniae)* 20worm/kg substrate

***SDWGM Compost* 2:** Sawdust + goat manure + microbial consortium (50 ml /kg substrate with 10^8 cell /ml) + Earthworms (*E. eugeniae)* 20worm/kg substrate

***SDWPM Compost* 3:** Sawdust + poultry manure + microbial consortium (50 ml /kg substrate with 10^8 cell /ml) + Earthworms (*E. eugeniae)* 20worm/kg sustrate

Seed selection, processing and sowing

Certified seeds of *V. mungo* (L.) Hepper (Vamban variety) were procured from the Horticultural College, Periyakulam, Tamil Nadu, India. Healthy hand sorted seeds were washed with distilled water and then with 0.1 percent mercuric chloride. Ten healthy, undamaged seeds were sown per pot containing the

experimental medium as given in the table showing the experimental design. All the pots were watered regularly and observed periodically for growth parameters, i.e., seed germination, shoot length, root length, number of root hairs, fresh weight of the plant, dry weight of the plant and leaf area of *V. mungo* using a standard procedure[6]. The experimental results are presented in the form of tables using Microsoft Excel (Version 2003 and 2007). Mean values are three replicates were also calculated with the help of the Microsoft Excel (Version 2003 and 2007).Two way ANOVA of various growth parameters were calculated using MATLAB (7.8 Version). The data input was done manually and computed. The output results obtained from the software indicate whether the differences between the treatments are significant (at P <0.001) or insignificant. These values are provided in the respective tables for discussion. The treatments which showed insignificant difference are grouped as on par.

RESULTS AND DISCUSSION

Pot culture studies with Black gram [Vigna mungo (L.) Hepper] (Vamban variety).

The results of the present study on the growth parameters on *V. mungo* are given in Table 1 to12 and Figure 1. The germination efficiency of the seeds of *V. mungo* in various treatments (T0–T10) is shown in Figure1. The germination efficiency was 80.76 percent in the control pot (T0), 89.48 percent in the NPK treatment (T4), 88.11 to 89.54 percent in the compost treatments (T1–T3) and 90 to 95.10 percent in the compost + NPK treatments (T5–T10). Similar result was recorded by[7] and they stated that the sawdust vermicompost showed 75.56% germination index. The results of better growth parameters of *V.mungo* such as shoot length (34.77±0.03 cm), root length (32.64 ± 0.05 cm), no of root hairs (48.66 ± 0.03), fresh weight of whole plant (21.99 ± 0.09 g), dry weight of whole plant (4.99 ± 0.13 g), leaf area (72.89 ± 0.11 cm^2) of *V. mungo* measured on 15, 30, 45, 60 and 75d in pot culture studies. Two way ANOVA results of shoot length, root length, no of root hairs, fresh weight, dry weight of whole plant and leaf area of *V. mungo* were significantly (P<0.001) higher in the pots which received NPK (T4), vermicompost (T1–T3), and vermicompost + NPK (T5–T10) than in the control (T0). [3] was reported on the higher and better growth of chilli crop with a supplementation of vermicompost with NPK treated plots. [8] revealed that the plants grown in pots containing 60 % Sawdust vermicompost were higher growth index, shoot fresh weight, shoot dry weight and leaf area than (p=0.05) control treatments.

Figure 1

Germination efficiency of the seeds of V.mungo in different treatments and in the control

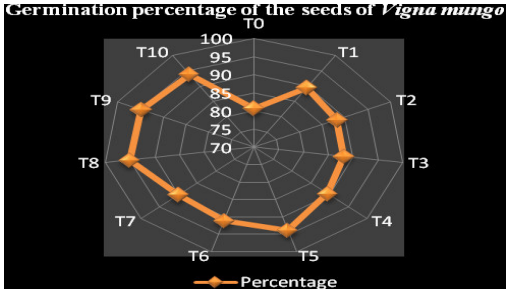

Table 1

Shoot length of V. mungo in pot culture studies with different compost and NPK fertilizerin various treatments at different intervals (15d to 75d)

Treatments	Shoot length (cm)				
	15d	30d	45d	60d	75d
T0	9.08 ± 0.07	18.93 ± 0.05	21.18 ± 0.01	26.55 ± 0.21	29.19 ± 0.07
T1	13.71 ± 0.04	21.67 ± 0.09	24.73± 0.05	29.70± 0.13	31.94 ± 0.07
T2	11.46 ± 0.10	19.59 ± 0.06	23.65± 0.08	29.16± 0.12	30.87 ± 0.14
T3	10.19 ± 0.15	20.45± 0.01	23.60± 0.03	28.41± 0.05	31.81 ± 0.09
T4	17.95 ± 0.02	24.76 ± 0.13	26.99± 0.04	31.89 ± 0.02	33.47± 0.02
T5	16.88 ± 0.01	23.62 ± 0.02	24.91± 0.04	30.80 ± 0.07	32.38± 0.11
T6	15.73 ± 0.08	22.55± 0.03	22.85± 0.12	29.94 ± 0.09	31.90 ± 0.04
T7	13.98 ± 0.12	22.10 ± 0.03	23.00± 0.01	28.05± 0.05	31.17± 0.06
T8	19.31 ± 0.05	25.87 ± 0.11	27.72± 0.01	32.44 ± 0.08	34.77± 0.03
T9	19.00 ± 0.03	25.19 ± 0.01	27.51± 0.07	32.00 ± 0.03	33.68 ± 0.02
T10	18.13 ± 0.11	24.94± 0.10	27.00± 0.05	31.98 ± 0.03	33.11 ± 0.01

Table 2

Two way ANOVA showing the Shoot length of V. mungo in pot culture studies with different compost and NPK fertilizer in various treatments at different intervals (15d to 75d)

Source	SS	df	MS	F	P	Significant level
Between the days	2006.03	4	501.507	492.87	P< 0.001	***
Between the treatments	255.52	10	25.552	25.11	P< 0.001	***
Error	40.7	40	1.018			
Total	2302.25	54				

Table 3

Root length of V. mungo in pot culture studies with different compost and NPK fertilizer in various treatments at different intervals (15d to 75d)

Treatments	Root length (cm)				
	15d	30d	45d	60d	75d
T0	8.00 ± 0.09	12.81± 0.14	17.79 ± 0.01	20.40± 0.07	26.66± 0.03
T1	10.85± 0.23	15.77± 0.07	19.73± 0.03	22.62± 0.12	28.90± 0.06
T2	9.90 ± 0.08	13.70± 0.05	18.65± 0.03	21.56± 0.26	27.78± 0.13
T3	8.86± 0.10	12.63± 0.11	19.61± 0.14	22.41± 0.17	26.65± 0.09
T4	12.31± 0.03	17.43± 0.06	21.82± 0.18	24.96± 0.12	31.56± 0.07
T5	11.68± 0.02	14.80± 0.09	20.77± 0.08	23.94± 0.04	29.49± 0.07
T6	11.60± 0.01	15.75± 0.04	21.70± 0.06	21.90± 0.01	27.41± 0.01
T7	10.93± 0.06	14.17± 0.04	19.93± 0.02	21.88± 0.15	28.17± 0.11
T8	13.31± 0.12	18.33± 0.10	23.22± 0.02	26.19± 0.05	32.64± 0.05
T9	12.26 ±0.04	16.80± 0.15	23.15± 0.12	25.12± 0.02	30.57± 0.02
T10	13.20± 0.01	15.98± 0.17	22.09± 0.05	25.07± 0.02	31.52± 0.02

Table 4

Two way ANOVA showing the Root length of V. mungo in pot culture with different compost andNPK fertilizer in various treatments at different intervals (15d to 75d)

Source	SS	df	MS	F	P	Significant level
Between the days	2159.62	4	539.906	1240.11	P<0.001	***
Between the treatments	156.22	10	15.622	35.88	P<0.001	***
Error	17.41	40	0.435			
Total	2333.26	54				

Table 5

No of root hairs of V.mungo in pot culture studies with different compost and NPK fertilizer in various treatments at different intervals (15d to 75d)

Treatments	No of root hairs				
	15d	30d	45d	60d	75d
T0	7.00 ± 0.06	15.00 ± 0.22	20.33 ± 0.03	27.66 ± 0.01	34.67 ± 0.12
T1	10.33 ± 0.02	18.00 ± 0.05	23.67 ± 0.06	33.67 ± 0.03	40.00 ± 0.05
T2	9.66 ± 0.02	17.33 ± 0.01	22.66 ± 0.04	32.33 ± 0.02	38.66 ± 0.20
T3	8.67 ± 0.04	18.00 ± 0.08	20.00 ± 0.04	29.00 ± 0.08	36.33 ± 0.25
T4	12.33 ± 0.01	20.66 ± 0.10	26.66 ± 0.11	35.33 ± 0.07	45.33 ± 0.07
T5	11.00 ± 0.09	19.66 ± 0.09	24.33 ± 0.14	34.00 ± 0.09	42.00 ± 0.01
T6	10.66 ± 0.17	19.00 ± 0.07	24.00 ± 0.19	32.00 ± 0.16	43.00 ± 0.13
T7	11.33 ± 0.21	18.33 ± 0.02	23.67 ± 0.22	33.00 ± 0.01	44.67 ± 0.10
T8	14.00 ± 0.13	22.33 ± 0.13	28.33 ± 0.25	38.33 ± 0.04	48.66 ± 0.03
T9	13.33 ± 0.07	20.66 ± 0.16	27.00 ± 0.02	36.66 ± 0.15	46.00 ± 0.03
T10	14.66 ± 0.03	21.00 ± 0.04	27.33 ± 0.09	37.33 ± 0.08	45.33 ± 0.09

Table 6

Two way ANOVA showing the No of root hairs of V. mungo in pot culture studies with different compost and NPK fertilizer in various treatments at different intervals (15d to 75d)

Source	SS	df	MS	F	P	Significant level
Between the days	6503.24	4	1625.81	1158.09	P<0.001	***
Between the treatments	416.07	10	41.61	29.64	P<0.001	***
Error	56.15	40	1.4			
Total	6975.47	54				

Table 7

Fresh weight of the whole plant of V. mungo in pot culture studies with different compost and NPK fertilizer in various treatments at different intervals (15d to 75d)

Treatments	Fresh weight of whole plant (in gram)				
	15d	30d	45d	60d	75d
T0	4.52 ± 0.08	6.81 ± 0.14	9.11 ± 0.04	12.95 ± 0.05	12.13 ± 0.11
T1	4.96 ± 0.01	8.46 ± 0.32	11.91 ± 0.13	13.24 ± 0.09	15.42 ± 0.07
T2	4.83 ± 0.05	8.37 ± 0.24	10.96 ± 0.29	13.20 ± 0.06	15.39 ± 0.05
T3	4.79 ± 0.01	8.32 ± 0.09	10.82 ± 0.16	13.17 ± 0.18	15.18 ± 0.01
T4	5.88 ± 0.03	9.28 ± 0.05	12.29 ± 0.07	13.88 ± 0.20	19.55 ± 0.03
T5	5.74 ± 0.03	9.19 ± 0.06	12.22 ± 0.01	13.78 ± 0.12	19.34 ± 0.03
T6	5.67 ± 0.01	9.08 ± 0.20	12.17 ± 0.03	13.70 ± 0.14	19.15 ± 0.09
T7	5.10 ± 0.09	8.99 ± 0.11	12.06 ± 0.03	13.66 ± 0.02	18.17 ± 0.08
T8	6.13 ± 0.04	9.39 ± 0.22	12.45 ± 0.01	14.07 ± 0.09	21.99 ± 0.09
T9	5.91 ± 0.10	9.33 ± 0.03	12.41 ± 0.10	14.00 ± 0.01	21.86 ± 0.09
T10	5.85 ± 0.07	9.30 ± 0.02	12.36 ± 0.08	13.94 ± 0.04	21.70 ± 0.03

Table 8

Two way ANOVA showing the Fresh weight of whole plant of V. mungo in pot culture studies with different compost and NPK fertilizer in various treatments at differen(15d to 75d)

Source	SS	df	MS	F	P	Significant level
Between the days	1029.66	4	257.415	175.73	P<0.001	***
Between the treatments	68.11	10	6.811	4.65	P<0.001	***
Error	58.59	40	1.465			
Total	1156.37	54				

Table 9

Dry weight of whole plant of V. mungo in pot culture studies with different compost and NPK fertilizer in various treatments at different intervals (15d to 75d)

Treatments	Dry weight of whole plant (in gram)				
	15d	30d	45d	60d	75d
T0	0.63 ± 0.01	1.28 ± 0.04	1.63 ± 0.09	2.96 ± 0.02	3.40 ± 0.13
T1	0.95 ± 0.01	1.36 ± 0.01	2.39 ± 0.04	3.28 ± 0.07	3.92 ± 0.05
T2	0.90 ± 0.03	1.32 ± 0.06	2.37 ± 0.01	3.19 ± 0.01	3.78 ± 0.15
T3	0.87 ± 0.02	1.30 ± 0.09	2.00 ± 0.06	3.08 ± 0.03	3.70 ± 0.07
T4	1.16 ± 0.07	1.43 ± 0.02	2.59 ± 0.02	3.46 ± 0.10	4.56 ± 0.03
T5	1.12 ± 0.09	1.40 ± 0.01	2.55 ± 0.09	3.39 ± 0.04	4.32 ± 0.06
T6	1.09 ± 0.07	1.38 ± 0.10	2.50 ± 0.05	3.37 ± 0.11	4.25 ± 0.01
T7	1.02 ± 0.05	1.35 ± 0.08	2.44 ± 0.05	3.34 ± 0.09	4.14 ± 0.07
T8	1.19 ± 0.05	1.47 ± 0.03	2.63 ± 0.01	3.65 ± 0.03	4.99 ± 0.13
T9	1.17 ± 0.01	1.45 ± 0.03	2.60 ± 0.07	3.53 ± 0.08	4.90 ± 0.07
T10	1.15 ± 0.01	1.42 ± 0.05	2.57 ± 0.03	3.49 ± 0.02	4.83 ± 0.02

Table 10

Two way ANOVA showing the Dry weight of whole plant of V. mungo in pot culture studies with different compost and NPK fertilizer in various treatments at differen(15d to 75d)

Source	SS	df	MS	F	P	Significant level
Between the days	79.5454	4	19.8864	555.59	P<0.001	***
Between the treatments	3.0329	10	0.3033	8.47	P<0.001	***
Error	1.4317	40	0.0358			
Total	84.01	54				

Table 11

Leaf area of V. mungo in pot culture studies with different compost and NPK fertilizer in various treatments at different intervals (15d to 75d)

Treatments	Leaf area(cm^2)				
	15d	30d	45d	60d	75d
T0	13.32 ± 0.22	20.65 ± 0.18	32.23 ± 0.16	50.20 ± 0.21	59.18 ± 0.11
T1	15.46 ± 0.17	21.83 ± 0.23	40.16 ± 0.30	54.32 ± 0.16	68.29 ± 0.17
T2	15.23 ± 0.33	21.74 ± 0.14	39.88 ± 0.09	54.27 ± 0.31	68.20 ± 0.09
T3	15.12 ± 0.41	21.69 ± 0.26	39.81 ± 0.10	54.19 ± 0.39	68.08 ± 0.19
T4	17.91 ± 0.31	26.23 ± 0.36	47.19 ± 0.22	57.86 ± 0.28	71.79 ± 0.10
T5	16.82 ± 0.35	26.09 ± 0.30	45.14 ± 0.28	57.62 ± 0.33	71.46 ± 0.07
T6	16.20 ± 0.28	25.91 ± 0.18	45.10 ± 0.19	57.38 ± 0.27	71.40 ± 0.05
T7	16.09 ± 0.34	23.10 ± 0.20	44.98 ± 0.13	56.44 ± 0.31	70.55 ± 0.20
T8	18.49 ± 0.38	27.26 ± 0.39	48.07 ± 0.11	61.20 ± 0.36	72.89 ± 0.11
T9	18.36 ± 0.29	27.15 ± 0.21	47.62 ± 0.07	60.97 ± 0.25	72.82 ± 0.19
T10	18.07 ± 0.25	26.78 ± 0.17	47.56 ± 0.42	60.73 ± 0.18	72.78 ± 0.07

Table 12

Two way ANOVA showing the leaf area of V. mungo in pot culture studies with different compost and NPK fertilizer in various treatments at different intervals (15d to 75d)

Source	SS	Df	MS	F	P	Significant level
Between the days	21503.7	4	5375.92	2314.91	P<0.001	***
Between the treatments	516.3	10	51.63	22.23	P<0.001	***
Error	92.9	40	2.32			
Total	22112.8	54				

CONCLUSION

The present study clearly evident that the application of vermicompost become an excellent plant growth medium and thus influence the growth of black gram (*Vigna mungo*). The results of this study would also support farmers to use compost as better alternate for chemical fertilizers.

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