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INFLUENCE OF DIFFERENT VERMICOMPOST DOSES ON THE GROWTH PERFORMANCE OF GLORIOSA SUPERBA LINN. IN CULTURABLE WASTELAND SOIL.

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ABSTRACT:

Agricultural practices in culturable waste lands are very hard and unsafe due to low moisture and organic content in the soil. Therefore, a vast chunk of land is left unused. In the present study it was tried to evaluate the performance of Gloriosa superba in such soil amended with different doses of vermicompost. In each treatment maximum percentage increase over control in new leaves emergent was on 90th days, shoot length & rhizome weight on 60th days and in dry weight it was on 30th days. The growth performance was recorded increasing with increasing the doses of vermicompost. On the basis of dry weight results treatment T2 (3 Part soil + 1Part vermicompost may be suitable for cultivation of this plant in culturable waste land soil, if vermicompost available in plenty treatment T3 & T4 also may be applicable.

KEY WORDS: Culturable wasteland, Vermicompost and Medicinal plant.

INTRODUCTION:

In Bihar total 5,443.68 sq. km area is under the category of wastelands, which is 5.78% of its total geographic area (94171 sq. km). In Jharkhand 11,165.26 sq. km areas come under wasteland category, which is 14.01% of its total geographical area (79706 sq. km). Different report states that 0.45 lakh hectare land in Bihar and 18.35 lakh hectare land in Jharkhand are under the category of culturable waste land. Under such conditions, medicinal plants with inherent capability to grow under natural stress with rather better yields of secondary metabolites (active constituents) would be crops of choice for sustainability. Very less or no organic content and scarcity of irrigation water are the major cause for negligence of such culturable waste lands in old Bihar (Bhagalpur Banka & Dumka). Annual rain fall in these areas is very low, highly erratic and ill distributed with long dry spells. The occurrence of the culturable waste lands is seen mostly in hilly and deforested areas, where temperature is high up to 40^{0}C. So, it is very difficult to maintain the or-

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ganic matter content at a satisfactory level. As a result of these two factors, utilization of culturable waste lands/uplands in this area is very poor. In some areas of upland farmers grow less economic rainy crops like maize, sorghum, millets etc and left the land barren for whole year. Therefore, viewing the conditions of culturable waste land present study was aimed to utilize such land amended with vermicompost for steady nutrient supply and maintaining the moisture of soils and another thing is to grow valuable crops that may provide a sustainable and costly means of produce as return to farmers. Cultivation of medicinal and aromatic plants provides sustainable means of natural sources of high value industrial raw material to benefit farmers.

Vermicompost technology or Vermitechnology has solved such problems wherever it has been implemented (Roy and Tiwari, 2008). It is a natural aerobic process of converting all biodegradable wastes into plant nutrient rich organic manure (Edwards & Burrows, 1988; Bhawalkar, 1991) through feeding the earthworms. The earthworms play significant role in the nutrient cycle of soil and has found helpful to increase the percentage of micronutrient (Umamaheshwari, 2005) and improve the soil structure such as soil porosity, soil aggregation, water and nutrient conservation in the soil (Ellerbrock & Hoen, 1999).

In old Bihar medicinal plant cultivation is not well practiced (Tiwari and Roy, 2012), however, in culturable waste land areas this has great possibilities. Gloriosa superbaLinn. now listed in endangered list (Shivkumar *et al.*, 2002; Badola, 2002) is naturally grow in the study area and used for various medicinal purposes. In Indian system of medicine, the tubers are used as tonic, antiperiodic, antihelmenthic and also against snake bite (Gupta *et al.*, 2005). G. superba also widely used for colic, chronic ulcers, cancer, leprosy, labor pains, abortions and poisoining (Kala, 2011; Haroon *et al.*, 2008). The annual requirement of Gloriosa superba rhizome has been estimated about 630 quintals in ISM Ahmad (1993). In recent years this has gained importance in medicinal industry for large scale colchicines production (Kokate, 2004). Presently its commercial production is well practiced in Tamilnadu with an annual production of about 600 Tons of seeds in 6000 acres (Mohan, 2008). Under sole crop of G. superba cultivation Solanki, *et al.*, (2013) in his two years findings recorded 8.47 quintal/hectare yield with a investment of Rs. 99729.7/hectare, net income Rs. 73, 975.3/hectare and its benefit cost ratio is 1: 1.74. Viewing these all facts and benefit in mind, in present study Gloriosa superba Linn. was selected to evaluate its growth performance on different vermicompost doses in culturable waste land soil.

MATERIALS AND METHODS:

Vermicompost Production:

Vermicompost was produced under Pit method (10' x 3' x 1.5' sized cemented tanks) of vermicomposting. Earthworm's species Eisenia foetida was used to prepare vermicompost from the mixture of cow dung and vegetable waste in 3:1 ratio.

Experimental Pot Preparation:

Culturable wasteland soil of Bhagalpur & Banka districts were collected randomly from 10 sites and mixed them to make sample. Three set of experimental pots were loaded with the mixture of soil and vermicompost in 3:1 (T2), 2:1 (T3) and 1:1 (T4) ratios were made and loaded into same size of earthen pots. For control (T1) one pot of the same size was loaded only with soil. Potted plants were sprinkled with water on every alternate day.

Data Collection:

Gloriosa superba was planted in the green house of University Department of Botany, T. M. Bhagalpur University, Bhagalpur, Bihar, India for the years 2007 and 2008, studies were carried out in earthen pots in triplicate. The data of the growth performance was taken at the interval of 30 days for three times. At the end of every growth period various morphometric data in term of shoot length, number of new emergent leaves, fresh rhizome weight and dry biomass were recorded. All data are analyzed from three sets of test plants.

Statistical Analysis: The raw data obtained between different treated and untreated (control) Gloriosa superba plants were analyzed statistically by the standard methods. "Agriculture statistic: Rangaswami (1995) for the standard error (SE) 5 % and 1 % level of significant.

i) Students t-test: This test was conducted to know whether the difference of mean were significant or not. The threshold value of significance for t-value was considered at the possibility ($P<0.10$, $P<0.05$ & $P<0.25$) and final results were tabulated.

ii) ANOVA (analysis of variance): This test was conducted in two way to know the effect of different vermi-doses on different vegetative part and dry weight whether the difference of means was significant or not at the possibility ($P<0.05$ & $P<0.01$) final result were tabulated and represented.

RESULTS AND DISCUSSION:

Several earlier workers like Kulkarni, *et al.*, (1996); Sevaga perumal, *et al.*, (1998); Atiyeh, *et al.*, (1999); Garg and Bhardwaj (2000) have demonstrated the application of vermicompost to increase growth and yield of various crops. Biomass increase of Acacia mearnsii, Eucalyptus grandis and Pinus patula (Donald and Visser, 1989), a significant increase in shoot length and dry biomass in Alibizia lebbeck, Azadirachta indica, Pterocarpus santalinus and Tarmarindus indica in vermicompost supplemented potting media was observed by Vijaya and

Aliya (2003). However, fragmentary reports are available witnessing the effect of vermicompost on the growth performance of medicinal plants (Vijaya and Aliya 2003, Jayant, *et al.*, 2007 and Patil, 2009). So far no work has been done to observe the sole effect of different vermicompost doses on growth performance of Gloriosa superba.

Growth Performance:

On the application of different vermin doses Gloriosa superba showed following performance of growth.

i) Shoot Length: Under the different treatments there was increase in shoot length and it was found maximum in case of T4 treatment where percent increase in shoot length was recorded 401.6% after 60 days (Table 1). Though a comparative study of data also indicates that there was a pattern of gradual increase in each treatment at the end of each period of time interval, however, it was found maximum after 60 days under T4 treatment. This result was also found highly significant (Table 1a) on putting the data under ANOVA and t-test.

ii) Fresh Rhizome Weight: Increase in fresh weight of rhizome was found statistically non-significant after 60 days in T3 whereas after 60 days significant increase 404.17% was recorded at $P<0.05$ level in T4 treatment (Table 2a , b). Except T3 on 60 days all increase was noticed statistically significant at $P<0.05$ level and $P<0.10$ level. Treatments and days were also positively correlated under ANOVA test (Table 2a, b). A comparative study of data also indicates that at the end of each time interval the rhizome got maximum increase in weight.

iii) New Leaf Emergent: The data depicted in table 03 reveals that there was impact of both numbers of days as well as the different treatments on emergent of new leaves on all treatments. The T4 treatment showed maximum 110.53% increase over control on 90 days but statistically all the increase was non-significant.

Table 1: Showing effect of different vermin doses on Shoot Length (St. Lt.).

Time Interval (In Days)	Items	Treatments				t- test		
		T_1	T_2	T_3	T_4	T_2&T_1	T_3&T_1	T_4&T_1
30	Mean of St.Lt.	22.17	33.00	56.17	86.34	0.81^{NS}	1.68*	2.15**
	S.E.(±)	0.33	0.11	0.90	0.73			
	% increase	NA	48.85	153.36	289.45			
60	Mean of St.Lt.	27.60	64.24	131.0	138.44	1.03^{NS}	2.72**	2.74**
	S.E.(±)	0.43	0.42	1.60	0.63			
	% increase	NA	132.76	374.64	401.60			
90	Mean of St.Lt.	67.37	155.34	197.17	211.67	1.55*	1.24^{NS}	1.94*
	S.E.(±)	0.44	0.72	0.28	0.61			
	% increase	NA	130.58	192.67	214.20			

Table 1a: Showing ANOVA of Shoot Length.

Source of Variation	Sum of Square	Degree of Freedom	Mean of Sum	F-ratio
Days	72012.328	2	36006.164	24521.791
Treatment	61393.583	3	20464.527	13937.249
Interaction	9526.826	6	1587.804	1081.365
Error	35.24	24	1.468	
Total	142967.979	35		

ABBREVIATIONS USED IN TABLES: SE= Standard Error, % increase= Over Control, NS= Non Significant, *= Significant at .10 level, **= Significant at .05 level.

Table 02: Showing effect of different vermin doses on fresh rhizome weight (Rh. Wt.).

Time Interval (In Days)	Items	Treatments				t- test		
		T_1	T_2	T_3	T_4	T_2&T_1	T_3&T_1	T_4&T_1
30	Mean of Rh.Wt.	1.5	3.94	5.6	6.2	2.59**	2.83**	3.11**
	S.E.(±)	0.05	0.03	0.11	0.15			
	% increase	NA	162.67	273.34	313.34			
60	Mean of Rh.Wt.	2.4	9.3	11.0	12.1	2.14**	1.39^{NS}	2.35**
	S.E.(±)	0.15	0.57	0.25	0.20			
	% increase	NA	287.5	358.34	404.17			
90	Mean of Rh.Wt.	6.30	16.57	17.97	19.20	2.40**	1.87*	1.95*
	S.E.(±)	0.20	0.17	0.14	0.11			
	% increase	NA	163.02	185.24	204.77			

Table 2a: ANOVA of Fresh Rhizome Weight.

Source of Variation	Sum of Square	Degree of Freedom	Mean of Sum	F-ratio
Days	709.833	2	354.916	4714.763
Treatment	502.561	3	167.520	2225.362
Interaction	54.943	6	9.157	121.646
Error	1.806	24	0.075	
Total	1269.145	35		

Table 03: Showing effect of different vermin doses on new leaf emergent (No. Le).

Time Interval (In Days)	Items	Treatments				t- test		
		T_1	T_2	T_3	T_4	T_2&T_1	T_3&T_1	T_4&T_1
30	Mean of No. Le.	12	14	16	19	0.32^{NS}	0.59^{NS}	0.90^{NS}
	S.E.(±)	1.54	0.57	0.57	0.57			
	% increase	NA	16.67	33.34	58.34			
60	Mean of No.Le.	40	57	58	62	0.73^{NS}	0.76^{NS}	0.89^{NS}
	S.E.(±)	1.52	1.52	0.57	0.57			
	% increase	NA	42.50	45.00	55.00			
90	Mean of No.Le.	57	73	80	120	0.51^{NS}	0.70^{NS}	0.71^{NS}
	S.E.(±)	1.00	1.52	1.00	1.00			
	% increase	NA	28.08	40.36	110.53			

Table 04: Showing effect of different vermin doses on dry weight (Dr.Wt.).

Time Interval (In Days)	**Items**	**Treatments**				**t- test**		
		T_1	**T_2**	**T_3**	**T_4**	**T_2&T_1**	**T_3&T_1**	**T_4&T_1**
30	Mean of Dr.Wt.	1.577	5.736	6.396	6.925	2.03**	0.66^{NS}	1.13^{NS}
	S.E.(±)	0.004	0.01	0.005	0.007			
	% increase	NA	263.73	305.59	339.13			
60	Mean of Dr.Wt.	2.607	8.668	8.710	9.445	1.96*	2.01**	2.09**
	S.E.(±)	0.01	0.20	0.01	0.03			
	% increase	NA	232.49	234.11	262.30			
90	Mean of Dr.Wt.	4.050	12.734	12.743	12.783	1.94*	1.95*	1.94*
	S.E.(±)	0.03	0.03	0.03	0.009			
	% increase	NA	214.42	214.65	215.63			

Table 4a: ANOVA of Dry Weight.

Source of Variation	Sum of Square	Degree of Freedom	Mean of Sum	F-ratio
Days	178.346	2	89.173	53526.295
Treatment	296.661	3	98.887	59357.061
Interaction	18.739	6	3.123	1874.745
Error	0.039	24	0.001	
Total	493.787	35		

iv) Dry Weight: Increase in dry weight was found statistically significant in all cases except T3 and T4 on 30 days, however all the treatments showed an increase over control. Over control the percent minimum increase was 214.42% in T2 on 90 days and maximum 339.13% in T4 on 30 days (Table 04). A positive correlation was recorded between days and different treatments in ANOVA (Table 4a). Under the different treatments there was increase in shoot length from 48.85% to 401.6%.The fresh weight of rhizome was noticed to increase at the end of each time interval, however, it was found between 162.67 to 404.17%. The percent increase of new leaf emergent was recorded 16.67 to 110.53%. On different treatments there was increase in dry weight and it was found maximum 339.13% in case of T4treatment on 30 days. Effects of vermicompost doses on growth performance in term of shoot length, number of branches, number of leaves, root length and dry biomass has also been well documented and supported by several workers like Tomati, *et al.*, (1988), Edwards & Bohlen (1996), kulkarni, *et al.*,(1996) Buckerfield, *et al.*, (1999), Donald and Visser (1989), Atiyeh, *et al.*, (1999), Sevugaperumal, *et al.*, (1998) and Tiwari and Roy (2012), on some other plants. Earlier Gayathiri and Anburani (2011) found 228.30 cm plant height and number of leaves 100.10 on integrated nutrient (FYM @25 ton/hectare + consortium biofertilizer 2 kg + 112.2:37.5:56.25 Kg NPK) application. Gupta, *et al.*, (2013) observed 144.96 cm plant height and number of leaves 172.03 on some different integrated nutrient (Vermicompost 4 ton/hectare + 40:16.67: 25 Kg NPK/hectare) application. In present study maximum shoot length 214.20 cm and number of leaves 201.00 observed in T4 treatment and recently Gupta et al. (2013) observed 130.36 cm plant height and number of leaves 154.37 on vermicompost application @6 tons/hectare.

CONCLUSION:

Present investigation clearly shows that on every quantity of vermicompost application Gloriosa superba performed better over control which was comparatively greater in T4 treatment. In test plants all the growth parameters were found to increase with increasing the doses of vermicompost even in nutrient deficient upland soils. Viewing the growth performance and findings of present study a mixture of soil and vermicompost in 3:1 (T2) may be very suitable and standardized vermicompost dose for its cultivation in culturable waste land soil. However, 2:1 (T3) and 1:1 (T4) mixture of soil and vermicompost showed increased performance but such a large quantity of vermicompost application for upland farmers is not feasible.

ABBREVIATIONS:

FYM= Farm Yard Manure, NPK= Nitrate Phosphate and Potash,

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