ISSN: 0976-3031

Available Online at http://www.recentscientific.com

CODEN: IJRSFP (USA)

International Journal of Recent Scientific Research
Vol. 9, Issue, 6(C), pp. 27421-27426, June, 2018

International Journal of Recent Scientific Research

DOI: 10.24327/IJRSR

Research Article

EFFECTS OF VERMICOMPOST PRODUCED FROM SOLID WASTE ON THE GROWTH AND BIOCHEMICAL PARAMETERS OF MEDICINAL PLANT - *INDIGOFERA TINCTORIA*

Karpaga Jothi M[1]., Amish Abraham D[2] and *Saravana Ganthi A[1]

[1]Department of Botany, Rani Anna Govt. College for women, Tirunelveli - 627 008
[2]Department of Botany, St. John's College, Palayamkottai, Tirunelveli - 627 002

DOI: http://dx.doi.org/10.24327/ijrsr.2018.0906.2254

ARTICLE INFO

Article History:

Received 9th March, 2018
Received in revised form 16th April, 2018
Accepted 26th May, 2018
Published online 28th June, 2018

Key Words:

Indigofera tinctoria, medicinal plants, solid waste, vermicompost

ABSTRACT

In India, low soil fertility is the one of the major factors for highly reduced crop yield. The chemical fertilizers are harmful to the physical and biological conditions of the soil. Organic manure such as vermicompost is a suitable alternative for the chemical fertilizers. The soil solid waste is a major problem in the emerging Indian economy. The demands for medicinal plants are exploding. Cultivation of medicinal plants is an important sector in the current medicinal plant development. So the present study aimed to study the effect of vermicompost produced from the solid waste on the growth and biochemical parameters of medicinal plant in *Indigofera tinctoria*. *I. tinctoria* seedlings treated with 70% soil-30% vermicompost had been reported with high seed germination content compare to other concentrations and control. The growth parameters and biochemical parameters were higher in the 70% soil-30% vermicompost mixture.

INTRODUCTION

Changing scenario of herbal market and expanding global trade has opened up a new prospective for Indian agriculture. Medicinal plants are the important sources of raw drugs. The demand on plant based therapeutics has increased many folds in both developing and developed countries. Agro-technologies for cultivation of a number of species have been developed, but large scale cultivation of medicinal plants on farmland not yet begins. Many factors are influencing medicinal plant cultivation. Biofertilizers and vermicompost applications may promote the growth and yield of medicinal plants. Keeping view of medicinal plants varied therapeutic potential, considerable economic value and need for cultivation and present study conducted in the medicinal plant *Indigofera tinctoria,* This study is aimed to utilize the Solid biowastes accumulated in the Municipal area in Palayamkottai, Tirunelveli District, Tamil Nadu for the preparation of vermicompost by using earthworm species and to utilize as solid waste vermicompost for the improved growth of selected medicinal plant.

MATERIALS AND METHODS

For the present study collected semi decomposed Municipal solid wastes are collected from the Palayamkottai Municipality, Tirunelveli District, Tamil Nadu and the animal waste cow dung is collected from the farmers. These organic wastes were pre-composted for one month before using as a vermibed preparation. The earthworms *Eudrilus Eugenia* (Kinberg) was collected local vermiculturist from Tenkasi (Bhattacharjee and Chaudhuri, 2002). The rectangular tank (inner depth of 2.5feet, outer depth of 3 feet, a length of 15 feet and its height is 2 feet) was used to culture of earthworm. It was done properly in a humid and shady place. The collected vermicast was air- dried and used for plant growth.

The levels of physico - chemical parameters such as pH, EC, organic carbon, extractable phosphate, C:N ratio, bulk density and moisture content were estimated in the garden soil (earthworm unexposed soil) and vermicomposted solid waste (after vermicomposting for one month) by standard procedures. The effect of vermicompost on seed germination was analysed. Changes in the root and shoot fresh weights and Dry weights were observed. The effects of the vermicompost on the growth parameters like leaf area index**,** leaf area ratio, specific leaf weight**,** shoot/ root ratio, sturdiness quotient, plant length, root length, shoot length, number of leaves, leaf diameters and stem thickness were studied. The biochemical parameters like amino acids, proteins, sugars, starch, phenols, NR activity and lipid

Corresponding author:* **Saravana Ganthi A
Department of Botany, Rani Anna Govt. College for women, Tirunelveli - 627 008

content were analysed. The pigment changes on chlorophyll were recorded by the method of Arnon.

Data were analysed statistically by one-way ANOVA in a general linear model using SAS (SAS Institute Inc. 1990). The means of all plant growth parameters for each potting mixture at each growth stage were separated statistically using Tukey's multiple range. Significance was defined as $P \leq 0.05$.

RESULTS AND DISCUSSION

The physical parameters in the present study included pH, electrical conductivity, organic carbon, Total nitrogen, extractable phosphorus, carbon/ nitrogen ratio, bulk density and moisture. The results were analysed following 9 kg soil + 1 kg VC, 8 kg soil + 2 kg VC, 7 kg soil + 3 kg VC, 6 kg soil + 4 kg VC and 5 kg soil + 5 kg VC respectively. Except bulk density all other selected parameters were maximum in 7 kg soil + 3 kg Vermicompost (VC). The total nitrogen content was increased by 57.06% when 7 kg soil mixed with 3 kg of vermicompost. In this experiment the more available phosphate probably could have contributed to decrease of soil pH caused by the application of vermicompost. MSW composts application tended to reduce Bulk densities at the end of the experiment (Table 1). By the final sampling date treatments with high dose (7 kg Soil and 3kg VC, respectively) had significantly lower ($p < 0.05$) bulk densities than the control and the low dose treatment as well. The decrease in bulk density appears to have been due to dilution of the denser mineral fraction by the less dense MSW compost doses. These results are in line with Haynes and Naidu *(1998)* and Civeira and Lavado (2006) who reported that lighter compost particles might penetrate the soil matrix and eventually decrease bulk densities. Soil moisture was significantly affected by MSW compost additions at the end of the experiment ($p < 0.05$) (Table 1). High composts doses (7 kg, Soil and 3 kg respectively) showed the maximum soil moisture rates compared to control. An increase of moisture should be considered a consequence of total porosity augmentation in soils after MSW compost application (Weber *et al.,* 2007).

Table 1 Physio-Chemical properties of garden soil and Vermicomposted Municipal waste (VC) in experimental treatments (after 30 days)

Chemical and physical properties	Control	9 kg soil + 1 kg VC	8 kg soil + 2 kg VC	7 kg soil + 3 kg VC	6 kg soil + 4 kg VC	5 kg soil + 5 kg VC
PH	7.57	6.28	6.58	6.7	6.56	6.48
Electrical conductivity dsm-1	0.49	2.15	2.20	2.25	2.28	2.19
Organic carbon gkg-1	234.98	186.12	176.14	176.20	166.10	166.08
Total nitrogen g kg-1	14.8	20.46	21.98	23.25	20.96	20.92
Extractable Phosphate mg kg-	12.0	12.32	13.50	17.85	17.80	17.45
C:N ratio	16.0	16.34	16.94	19.5	18.6	18.0
Bulk density gcm-3	1.52	1.45	1.31	1.36	1.37	1.20
Moisture %	31	41	58	72	70	64

Effect of Vermicompost on seed germination

Seed germination of medicinal plant treated with 70% soil-30% vermicompost reported with high seed germination content compare to other concentrations and control. The control plants exhibit seed germination of medicinal plants content compare with vermicompost treated plants (Table: 2). *I. tinctoria* was showed 98% seed germination.

Table 2 Seed germination of percentage of medicinal plant selected for the study

Treatments	Control - Total	90% Soil - 10% VC	80% Soil - 20% VC	70% Soil - 30% VC	60% Soil - 40% VC	50% Soil - 50% VC
Germination %	66.00	86.00	93.00	98.00	80.00	64.00

Effect of Vermicompost on the fresh weight in Indigofera tinctoria seedlings

Changes in the root and shoot fresh weights in *I. tinctoria* seedlings with the treatment of vermicompost were analysed. The enhancement of the maximum fresh weight was significantly noticed by 1.963 gm. in stem treatment 3. The fresh weight content of the root, stem and leaf of the *I. tinctoria* treated with 70%s oil-30% vermicompost was very high compared to other concentrations and control plants (Table 3).

Table 3 Seed Germination of selected Medicinal Plant

Groups	Sum of Squares	Df	Mean Square	F	Sig.
Between	231.500	3	77.167	0.699	0.564
Within	2208.333	20	110.417		

The tabulated value of "F" for the give degree of freedom (i.e 2 and 15) at the 1% level is much less than the calculated value of all variables of *I. tinctoria*. Thus the hypothesis was rejected and concluded that there is a difference in the average value of root, stem, and leaves of *I. tinctoria,* when treated with various concentrations vermicompost and control (Table 4).

Table 4 Vermicompost effect on the root and shoot fresh weight in *I. tinctoria* seedlings (gm)

Treatment	Root			Stem			leaf		
	20^{th} day	40^{th} day	60^{th} day	20^{th} day	40^{th} day	60^{th} day	20^{th} day	40^{th} day	60^{th} day
C	1.012	1.251	1.392	1.014	1.312	1.537	1.069	1.292	1.548
T1	1.026	1.328	1.476	1.023	1.408	1.698	1.089	1.438	1.654
T2	1.031	1.343	1.531	1.026	1.438	1.755	1.111	1.481	1.754
T3	1.044	1.358	1.432	1.041	1.453	1.963	1.131	1.788	1.443
T4	1.040	1.358	1.259	1.031	1.318	1.876	1.121	1.647	1.069
T5	1.037	1.261	1.092	1.041	1.300	1.726	1.111	1.481	1.054

Effect of Vermicompost on the dry weight in Indigofera tinctoria seedlings

Among the different concentrations, the plant treated with 70% soil - 30% vermicompost reported with high dry weight content compared to other concentrations and control (Table: 5). The high, dry weight was significantly increased with the highest percentage of 70% soil - 30% vermicompost respectively in the treatments 3 & 4.

The tabulated value (Table: 6) for a dry weight of "F" for the given degree of freedom (2, 15) at the 1% level is much less than calculated value of all variable of *I. tinctoria.* Thus the hypothesis was rejected and concluded there in a difference in the average value of root, stem and leaves of *I. tinctoria* when treated with various concentrations of vermicompost and control.

Table 5 Results of anova analyses explaining variation in fresh weight of *I. tinctoria* seedlings

Part	Groups	Sum of Squares	Df	Mean Square	F	Sig.
Root	Between	2.145	2	1.073	15.666	0.000
	Within	1.027	15	0.068		
Stem	Between	1.570	2	0.785	86.907	0.000
	Within	0.135	15	0.009		
Leaf	Between	1.818	2	0.909	20.982	0.000
	Within	0.650	15	0.043		

Effect of Vermicompost on the growth parameters in Indigofera tinctoria seedlings

The effect of the vermicompost on the growth parameters like leaf area ratio, shoot/ root ratio, sturdiness quotient was studied in the control and different concentration of garden soil and vermicompost treated plants after the 20th day, 40th day and 60th days of treatment. The leaf area index value was high in the plant treated with 70% Soil - 30% VC concentration compared to other concentrations and control. The leaf area index values were displayed in Table 7. The leaf area ratio values of the plant treated with 70% Soil - 30% VC showed the highest value compared to other concentrations and control plants (Table 7).

Table 6 Vermicompost effect on the root and shoot dry weight in *I. tinctoria* seedlings (gm)

Treatment	Root			Stem			leaf		
	20th day	40th day	60th day	20th day	40th day	60th day	20th day	40th day	60th day
C	0.062	0.236	0.364	0.119	0.262	0.358	0.129	0.250	0.371
T1	0.043	0.308	0.423	0.224	0.356	0.397	0.247	0.275	0.404
T2	0.081	0.446	0.567	0.532	0.545	0.591	0.349	0.281	0.405
T3	0.074	0.548	0.564	0.544	0.667	0.706	0.450	0.485	0.521
T4	0.067	0.458	0.469	0.233	0.058	0.661	0.323	0.367	0.415
T5	0.057	0.351	0.454	0.213	0.052	0.551	0.229	0.350	0.471

The specific leaf weight was more in *I. tinctoria* treated with 70% soil-30% vermicompost compared to other concentrations and control. The root shoot ratio (Table: 7) and Sturdiness Quotient also high in *I. tinctoria* treated with 70% Soil - 30% VC compared to other concentration of garden soil and vermicompost. Paszt *et al*. (2011) observed that the organic fertilizers induced a considerable branching of the root system, as derived from the highest total root length and a number of tips. Similar results with the application of vermicompost having favourable effects on the growth, development and physiology on *Lilium asiatic* hybrid var. *Navona* were obtained by Ladan Moghadam *et al*. (2012).

Table 7 Results of anova analyses explaining variation in dry weight of *I. tinctoria* seedlings

	Groups	Sum of Squares	Df	Mean Square	F	Sig.
Root	Between	0.004	2	0.002	13.966	0.000
	Within	0.002	15	0.000		
Stem	Between	0.007	2	0.003	11.507	0.001
	Within	0.004	15	0.000		
Leaf	Between	0.012	2	0.006	20.959	0.000
	Within	0.004	15	0.000		

H_0: rejected.

The vermicompost increased leaf area and biomass in various plants have been reported by some researchers (Bachman and Metzger, 2008; Singh *et al*., 2008; Singh *et al.,* 2010; Wang *et al*., 2010; Warman and Anglopez, 2010) which are in agreement with the findings of the current study.

The tabulated value (Table: 8) growth parameters of "F" for the given degree of freedom (i.e. 2, and 15) at the 1% level is much less than the calculated value of all variables of *Indigofera tinctoria*. Thus the hypothesis was rejected and concluded there is a difference in the average value of leaf area index, leaf area ratio, specific leaf weight, shoot/ root ratio and sturdiness quotient of *Indigofera tinctoria* when treated with various concentrations of vermicompost and control.

The growth performance *I. tinctoria* studied after the treatment of different concentrations of vermicompost. All the concentrations showed good performance compared to control. Among all 70% Soil + 30% VC concentration showed overall good performance in different growth parameters of *I. tinctoria.* Growth performance was studied with the help of the following parameters, plant length, height, root length, shoot length, number of leaflets, leaflet diameter and stem thickness. The plant length 27.960 cm, 51.980 cm and 75.160 cm respectively, for 20th day, 40th day and 60th day plants (Table 9). The height of the plant was maximum in 70% Soil - 30% VC concentration. It was 9.730 cm, 14.180 cm and 16.460 cm respectively, for 20th day, 40th day and 60th day plants. Root length was observed in 70% Soil - 30% VC concentration was 18.230 cm, 37.800 cm and 65.600 cm respectively, for 20th day, 40th day and 60th day plants (Table 9). The shoot length value also showed more variation in different concentration and control, but the maximum was found in 18.230 cm, 37.800 cm and 65.600 cm in 70% Soil - 30% VC concentration respectively for 20th day, 40th day and 60th day plants (Table 9). This effect could be due to the presence of phytohormones in organic fertilizers that stimulate plant growth (Gajalakshmi *et al*., 2001; Nogales et al., 2005). Leaflet diameter showing different ranges in different concentrations, the maximum leaflet diameter was found in same concentration and values are 1.283 cm, 2.080 cm and 2.100 cm respectively, for 20th day, 40th day and 60th day plants (Table 9). Stem thickness for 20th day, 40th day and 60th day plants was 0.333 cm, 1.680 cm and1.960 cm respectively (Table 9).

Tabulated value (Table 10) for growth measurement of the given degrees of freedom (i.e. 2 and 15), at the 1% level is much less than the calculated value of all variables of *I. tinctoria.* Thus the hypothesis was rejected and concluded that there is a difference in the average value of length of plant, root, shoot and number of leaves, diameter, stem thickness of *I. tinctoria* when treated with various concentrations of vermicompost and control.

Biochemical Analysis

The biochemical parameters like amino acids, proteins, sugars, starch, and lipid content were observed more in *I. tinctoria* treated with 70% Soil + 30% VC compared to control and other concentrations (Table 11).

Tabulated value of for the given degrees of freedom (i.e. 2 and 15), at the 1% level is much less than the calculated value of all variables of *I. tinctoria*. Thus the hypothesis was rejected and concluded that there is a difference in the average value of amino acid, protein, sugar, phenol, starch, lipids and nitrate reductase activity of *I. tinctoaria* when treated with various concentrations of vermicompost and compost (Table 12).

Table 8 Vermicompost effect on the growth parameters in *I. tinctoria* seedlings

Treatment	Leaf area index (cm^2)			Leaf area ratio (cm^2)			Specific leaf weight (gm)			Shoot / Root ratio (cm^2)			Sturdiness quotient (cm^2)		
	20^{th} day	40^{th} day	60^{th} day	20^{th} day	40^{th} day	60^{th} day	20^{th} day	40^{th} day	60^{th} day	20^{th} day	40^{th} day	60^{th} day	20^{th} day	40^{th} day	60^{th} day
C	0.092	0.100	0.104	11.000	12.160	14.116	0.813	0.813	0.813	0.029	0.050	0.071	0.813	1.656	2.644
T1	0.100	0.104	0.108	13.550	14.810	15.130	0.842	0.842	0.842	0.047	0.075	0.104	0.842	1.777	2.734
T2	0.180	0.192	0.2 12	15.000	17.580	18.192	0.936	0.936	0.936	0.049	0.081	0.105	0.936	1.840	2.830
T3	0.2 12	0.2 16	0.2 20	28.342	32.330	34.227	1.118	1.118	1.118	0.050	0.085	0.121	1.118	2.079	3.006
T4	0.1 96	0.2 04	0.2 16	21.120	22.410	23.108	0.9 08	0.9 08	0.9 08	0.023	0.067	0.115	0.9 08	1.714	2.998
T5	0.1 88	0.1 96	0.2 08	18.160	22.060	23.075	0.8 52	0.8 52	0.8 52	0.029	0.050	0.071	0.8 52	1.700	2.829

Table 9 Results of anova variation in growth parameters of *I. tinctoria* analyses explaining seedlings

Parameter	Groups	Sum of Squares	df	Mean Square	F	Sig.
Leaf Area Index	Between	0.000	2	0.000	0.167	0.847
	Within	0.006	15	0.000		
Leaf Area Ratio	Between	190.955	2	95.478	1.840	0.193
	Within	778.225	15	51.882		
Specific Leaf Weight	Between	0.001	2	0.001	5.156	0.020
	Within	0.002	15	0.000		
Shoot / Root Ratio	Between	0.976	2	0.488	4.636	0.027
	Within	1.579	15	0.105		
Sturdiness Quotient	Between	16.810	2	8.405	112.291	0.000
	Within	1.123	15	0.075		

H_o: rejected for specific leaf weight, shoot / root ratio and sturdiness quotient.

Table 10 Results of anova analyses explaining variation in growth parameters of *I. tinctoria* seedlings

Parameter	Day	N	Mean	Std. Deviation	t	df	Sig.
RGR	40^{th}	6	3.4333	1.12635	-0.407	10	0.693
	60^{th}	6	3.7500	1.54013			
RLGR	40^{th}	6	1.3333	0.36560	-0.592	10	0.567
	60^{th}	6	1.4417	0.25965			
RSGR	40^{th}	6	1.9083	0.53890	-2.187	10	0.054
	60^{th}	6	4.0833	2.37522			
RRGR	40^{th}	6	1.1917	0.18005	-6.069	10	0.000
	60^{th}	6	4.5833	1.35708			

H_o: rejected except RGR and RLGR.

Tabulated value of for the given degrees of freedom (i.e, 2 and15), at the 1% level is much less than the calculated value of all variables of *I. tinctoria*. Thus the hypothesis was rejected and concluded that there is a difference in the average value of chlorophyll a, chlorophyll b and Total chlorophyll of *I. tinctoria* when treated with various concentrations of vermicompost and compost (Table: 14).

Growth promoting activity of vermicompost in the present study is to coincide with the report of Suhane (2007) who has reported that vermicompost has very high porosity, aeration, drainage and water holding capacity than the conventional compost and this again due to humus content. The vermicompost supply balanced nutrients to plant roots and stimulate growth; increase organic matter content of the soils and thus also improve their physical and chemical properties; add useful microorganisms and thus increase their biological properties and capacity of fertility renewal *(Singh,* 1992). In addition, vermicompost contains enzymes like amylase, lipase, cellulase and chitinase, which continuously break down organic matter into the soil and release the nutrients make available to the plant roots (Chaouri *et al.,* 2003; Tiwari *et al.,* 1989). Vermicompost also contains the most nutrients in plant available forms such as nitrates, phosphates and exchangeable calcium and soluble potassium (Orozco *et al.,* 1996; Edwards, 1998). Microorganism including bacteria, fungi, yeasts actinomycetes and algae are active in vermicompost applied field, they are capable of producing plant growth regulators such as auxins, gibberellins, cytokinins, ethylene and abscisic acid in appreciable quantities (Frankenberger and Arshad, 1995).

Table 11 Vermicompost effect on the growth parameters in *I. tinctoria* seedlings

Treatment	Plant Length (cm)			Root Length (cm)			Shoot Length (cm)			Number of Leaves			Leaf Diameters (cm)			Stem Thickness (cm)		
	20^{th} day	40^{th} day	60^{th} day	20^{th} day	40^{th} day	60^{th} day	20^{th} day	40^{th} day	60^{th} day	20^{th} day	40^{th} day	60^{th} day	20^{th} day	40^{th} day	60^{th} day	20^{th} day	40^{th} day	60^{th} day
C	20.340	41.420	66.100	4.960	9.800	15.430	15.380	31.620	54.800	9.660	38.200	138.000	0.950	1.120	1.410	0.416	1.440	1.500
T1	21.060	44.440	68.360	5.650	11.680	15.730	15.410	32.760	55.760	9.760	49.600	146.600	0.962	1.280	1.600	0.566	1.500	1.530
T2	23.410	45.800	70.760	6.480	12.200	16.200	16.930	33.800	58.430	12.660	50.400	148.330	1.103	1.440	1.800	0.016	1.600	1.660
T3	27.960	51.980	75.160	9.730	14.180	16.460	18.230	37.800	65.600	16.660	51.800	250.000	1.283	2.080	2.100	0.333	1.680	1.960
T4	27.710	44.240	74.960	9.860	12.040	16.420	14.080	32.820	62.460	14.910	49.200	211.600	0.966	1.460	1.830	0.033	1.480	1.660
T5	26.310	42.860	70.730	8.110	11.440	15.700	11.550	30.800	60.000	10.150	47.800	161.660	0.950	1.400	1.660	0.783	1.300	1.580

Effect of vermicpompost on the pigment changes in Indigofera tinctoria seedlings

Chlorophyll content also observed more in plant treated with 70% Soil + 30% VC compared to control and other concentrations. The results for chlorophyll a, chlorophyll b and total chlorophyll were tabulated in 13.

Based on the discussion, it could be concluded that these solid wastes available in enormous quantities could be used as an effective medium for Vermiculture supplemented with cattle dung not only served as a suitable medium for the growth and reproduction of the earthworms but also yielded a valuable biomanure for agriculture practices.

Table 12 Results of anova analyses explaining variation in growth parameters of *I. tinctoria* seedlings

Parameter	Groups	Sum of Squares	df	Mean Square	F	Sig.
Length of Plant	Between	6527.129	2	3263.565	261.051	0.000
	Within	187.525	15	12.502		
Length of Root	Between	218.133	2	109.066	50.008	0.000
	Within	32.714	15	2.181		
Length of Shoot	Between	5940.730	2	2970.365	317.495	0.000
	Within	140.335	15	9.356		
Number of Leaves	Between	89010.978	2	44505.489	65.532	0.000
	Within	10187.087	15	679.139		
Leaf Diameters	Between	2.346	2	1.173	10.988	0.001
	Within	1.602	15	0.107		
Stem Thickness	Between	5.984	2	2.992	66.492	0.000
	Within	0.675	15	0.045		

H_o: rejected.

Table 13 Vermicompost effect on the biochemical changes in *I. tinctoria* seedlings

Treatment	Amino Acids (mg/g fr.wt)			Proteins (mg/g fr.wt)			Sugars (mg/g fr. wt)			Phenols (mg/g fr.wt)			Starch (mg/g fr.wt)			Lipids (mg/g fr.wt)			Nitrate Reductase Activity (mg/g fr.wt)		
	20 days	40 days	60 days	20 days	40 days	60 days	20 days	40 days	60 days	20 days	40 days	60 days	20 days	40 days	60 days	20 days	40 days	60 days	20 days	40 days	60 days
C	0.058	0.098	0.123	0.102	0.155	0.135	0.098	0.127	0.227	0.005	0.005	0.006	0.104	0.112	0.235	0.032	0.037	0.045	0.098	0.129	0.161
T1	0.158	0.162	0.198	0.113	0.126	0.273	0.174	0.294	0.347	0.005	0.005	0.006	0.145	0.164	0.274	0.043	0.069	0.090	0.101	0.133	0.198
T2	0.242	0.292	0.313	0.225	0.262	0.346	0.209	0.312	0.413	0.006	0.006	0.007	0.235	0.248	0.313	0.110	0.158	0.195	0.118	0.146	0.205
T3	0.292	0.312	0.476	0.327	0.357	0.615	0.342	0.347	0.616	0.006	0.006	0.007	0.360	0.567	0.818	0.125	0.172	0.234	0.126	0.167	0.224
T4	0.182	0.217	0.391	0.260	0.279	0.392	0.219	0.309	0.510	0.006	0.006	0.007	0.316	0.518	0.749	0.091	0.098	0.125	0.108	0.149	0.183
T5	0.142	0.167	0.273	0.154	0.163	0.381	0.194	0.263	0.379	0.006	0.006	0.007	0.248	0.452	0.694	0..083	0.088	0.094	0.095	0.124	0.154

Table 14 Results of anova analyses explaining variation in growth parameters of *I. tinctoria* seedlings

Parameter	Groups	Sum of Squares	df	Mean Square	F	Sig.
Amino Acids	Between	0.044	2	0.022	2.231	0.142
	Within	0.149	15	0.010		
Proteins	Between	0.088	2	0.044	3.236	0.068
	Within	0.205	15	0.014		
Sugars	Between	0.602	2	0.301	1.965	0.175
	Within	2.298	15	0.153		
Phenols	Between	2.391	2	1.195	6.949	0.007
	Within	2.580	15	0.172		
Starch	Between	0.238	2	0.119	3.017	0.079
	Within	0.591	15	0.039		
Lipids	Between	0.010	2	0.005	1.725	0.212
	Within	0.042	15	0.003		
Nitrate reductase activity	Between	0.019	2	0.010	25.834	0.000
	Within	0.006	15	0.000		

H_o: rejected for phenol and nitrate reductase activity.

Table 15 Vermicompost effect on the pigment changes in *I. tinctoria* seedlings

Treatment	Chlorophyll a (mg/g fr. wt)			Chlorophyll b (mg/g fr. wt)			Total Chlorophyll (mg/g fr. wt)		
	20 days	40 days	60 days	20 days	40 days	60 days	20 days	40 days	60 days
C	0.010	0.025	0.043	0.015	0.040	0.051	0.026	0.065	0.097
T1	0.041	0.043	0.068	0.063	0.076	0.103	0.104	0.177	0.171
T2	0.055	0.067	0.096	0.097	0.107	0.159	0.152	0.174	0.255
T3	0.103	0.100	0.148	0.133	0.172	0.272	0.236	0.273	0.422
T4	0.071	0.086	0.122	0.123	0.144	0.209	0.193	0.231	0.330
T5	0.051	0.073	0.088	0.089	0.127	0.133	0.194	0.263	0.379

Table 16 Results of anova analyses explaining variation in pigment analysis of *I. tinctoria* seedlings

Parameter	Groups	Sum of squares	df	Mean square	F	Sig.
Chlorophyll a	Between	0.005	2	0.002	2.345	0.130
	Within	0.016	15	0.001		
Chlorophyll b	Between	0.014	2	0.007	2.074	0.160
	Within	0.051	15	0.003		
Total Chlorophyll	Between	0.036	2	0.018	2.273	0.137
	Within	0.117	15	0.008		

H_o: accepted.

References

Bachman, G.R., and Metzger, J.D. 2008. Growth of bedding plants in commercial Potting substrate amended with vermicompost. *Bioresource Technol.,* 99, 3155 - 3161.

Civeira, G., and Lavado, R.S. 2006. Organic matter addition effect on some hydrological properties in a degraded urban soil, Ciencia del Suelo, 24, 123-130.

Edwards, C.A., and Burrows, I. 1988. The potential of earthworm composts as plant growth media. In: Edwards, C.A., Neuhauser, E. (Eds.), Earthworms in Waste and Environmental Management. SPB Academic Press, The Hague, The Netherlands, 21-32.

Frankenberger, J.W.T., and Arshad, M. 1995. Phytohormones in Soils: Microbial Production and Function.Marcel and Deckker Pub., New York, pp: 503.

Gajalakshmi, S. E., Ramasamy, V., and Abbasi, S.A. 2001. Potential of two epigenic and two anecic earthworm species in vermicomposting of water hyacinth. *Bioresource Technology*, 76,177-181.

Haynes, R.J., and Naidu, R. 1998. Influence of lime, fertilizer and manure Applications on soil organic matter content and soil physical conditions: A review. Nutrient Cycling in Agro ecosystems, 51, 123-137.

Ladan Moghadam, A.R.Z., Oraghi Ardebili., and Saidi, F. 2012. Vermicompost induced changes in growth and development of *Lilium* Asiatic hybrid var. Navona. Afr. *J. Agri. Res*.,7 (17), 2609-2621.

Nogales, R. C., Cifuentes., and Benítez, E. 2005. Vermicomposting of winery Wastes: A laboratory study. *J. Envir. Sci. and Health,* Part B., 1234,:659-573.

Orozco, S.H., Cegarra, J., Trujillo, L.M., and Roig, A. 1996. Vermicompostsing of Coffee pulp using the earthworm *Eisenia fetida*: Effects on C and N contents and the availability of nutrients. *Biology and Fertility of Soils*, 22, 162-166.

Paszt, L.S., Sumorok, B., Malusa, E., Gluszek, S., and Derkowska, E. 2011. The influence of bioproducts on root growth and mycorrhizal ccurrence in the rhizosphere of strawberry plants'elsanta.' *J. Fruit Ornam. Plant Res.,* 19(1), 13-34.

Singh, R., Gupta, R.K., Patil, R.T., Sharma, R.R., Asrey, R., Kumar, A., and Jangra, K.K. 2010. Sequential foliar application of vermicompost leachates improves marketable fruit yield and quality of strawberry (*Fragaria ananassa* Duc.*),*94,793-387

Singh, R.D. 1992. Harnessing the earthworms for sustainable agriculture. Publication of Institute of National Organic Agriculture, Pune, India, 1-16.

Singh. R, Sharma, R.R, Kumar, S. Gupta, R.K and Patil, R.T (2008). Vermicompost substitution influences growth, physiological disorders, fruit yield. *Bioresource Technol.*, 99, 8507-8511.

Suhane, R.K. 2007. Vermicompost. Publication of Rajendra Agricultural University, Pusa, Bihar, India, 88.

Tiwari, S.C., Tiwari, B.K., and Mishra, B.B. 1989. Microbial population's enzyme activities and nitrogen, phosphorous, potassium enrichment in earthworm casts and in surrounding soil of a pineapple plantation. *J. Biol. Fert. Soils*, 8(1), 178- 182.

Wang, D., Shi, Q., Wang, X., Wei, M., Hu Liu, J., and Yang, F. 2010. Influence of cow manure vermicompost on the growth, metabolite contents, and antioxidant activities of Chinesecabbage (*Brassica campestris* ssp. chinensis). *Biol. Fertil. Soils*., 46, 689-696.

Warman, P.R., and AngLopez, M.J. 2010. Vermicompost derived from different feed Stocks as a plant growth medium. *Bioresource Technol.,* 101, 4479-4483.

How to cite this article:

Karpaga Jothi M *et al.*2018, Effects of Vermicompost Produced from Solid Waste on the Growth and Biochemical Parameters of Medicinal Plant - Indigofera Tinctoria. *Int J Recent Sci Res.* 9(6), pp. 27421-27426.
DOI: http://dx.doi.org/10.24327/ijrsr.2018.0906.2254

****