Biological Forum – An International Journal **13(2): 31-38(2021)**

ISSN No. (Print): 0975-1130
ISSN No. (Online): 2249-3239

Impact of the Various Organic Manures Supplemented with Standard Package on Soil Properties for Mulberry Production in Chamarajanagar District under Southern Dry Zone of Karnataka

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(Received 15 March 2021, Accepted 26 May, 2021)
(Published by Research Trend, Website: www.researchtrend.net)

ABSTRACT: Soil health is determined by a set of highly correlated and interdependent physical, chemical and biological properties. Organic matter is the soul of the fertility and productivity, without which the soil is lifeless. The cost of mulberry leaf production is increasing every year because of the requirement of high and costly chemical inputs. Approximately 60% of the total cost of leaf production is accounted for the consumption of costly chemical fertilizers and farm yard manure. These inputs are becoming costlier day by day due to escalating price and are also becoming scarce. Nitrogenous fertilizers are used excessively in many crops in the country. Nitrogen (350 kg/ha/year) requirement for mulberry cultivation leads to increased cost of production. Further, the required type and quantum of fertilizer often may not be easily available to the small farmers. So, in the view of avoiding the application of single source of chemical fertilizers we have applied the different organic manures as supplements with package of practices to overcome the major issues *Viz.*, poor soil fertility and lesser mulberry leaf yield. The Studies on "Effect of different organic manures supplemented with standard package of practice on properties of soil in relation to mulberry production in Chamarajanagar district under Southern dry zone of Karnataka" was conducted at Krishi Vigyan Kendra, Chamarajanagar, Karnataka. The results revealed that, the lowest bulk density, maximum water holding capacity, ideal soil pH, optimum EC, little higher organic carban, available nitrogen, phosphorus, potassium in soil, maximum shoot height, more number of shoots/plant and maximum fresh leaf yield/plant and leaf yield/hectare were recorded after second crop was found significantly higher in the V_1 mulberry field package of practices supplemented with vermicompost (T_6). The quality parameters of leaves were also improved in same treatment compared to the existing package of practices. So, this study clearly indicates that, supplementation of organic manures rich in the physical and chemical properties directly helps to improve the properties of soil and plant characteristics required to achieve successful sericulture crop.

Keywords: Organic manures, Inorganic fertilizers, Soil properties, Mulberry growth and yield

INTRODUCTION

Majority of sericulture farmers in Chamarajanagar district under southern dry zone of Karnataka are with small and marginal land holdings. The soils are red loamy, sandy, black loamy and sandy, black cotton type. The pH of soil ranges between 7.5 to 9.5 with poor soil fertility. The mulberry leaf yield and quality depends on the soil type, varieties, available plant nutrients in soil, agronomical factor and agro-climatic conditions. Hence, native soil fertility alone cannot be relied upon for quantity and quality of mulberry leaf productivity, unless the soil is replenished with external sources through fertilizers. Hence, a package of fertilizers schedule is vital for obtaining higher leaf yield (Anonymous, 2002).

Previously, no studies have been conducted in view of improving soil fertility and mulberry yield in southern dry zone of Karnataka. So our investigation team have decided to carry this work through changing the various organic supplements with package of practices to enhance the physical, chemical and biological soil fertility status and growth and yield of mulberry which leads to complete whole sericulture operations in successful manner.

In view of the above, concept of organic farming is an ecofriendly approach has been realized to a greater extent. In this context, organic manures, green manures, dual-purpose legumes, non-edible oilcakes and vermicompost are most relevant in the mulberry production process. Further, they are dependent solely on foliar harvest and are responsible for rapid nutrient mining from soil reserves, yield as well as quality of leaf and eventually the cocoon yield are equally important for economic viability. Hence, production and use of various organic manures should be improved, not only for enhancing the crop productivity but, also reducing cost of cultivation to protect environment and avoid pest and disease outbreaks (Jayaraj *et al.*, 2006).

Mulberry is an important food plant of silkworm, *Bombyx mori* L and it is a perennial crop continuously gives foliage throughout the year. The continuous usage of chemical fertilizers affecting soil health in addition to environmental pollution and impair the balanced availability of different plant nutrients. This can be improved by enriching the soil with organic manures in addition to chemical fertilizers to safeguard the soil health and crop quality. In this direction, an experiment was carried out to evaluate the effect of combined use of organic manures and inorganic fertilizers on soil parameters & growth parameters of V-1 variety of mulberry.

MATERIAL & METHODS

Location: KVK, Chamarajnagar during 2013-14.
Mulberry variety: V-1 with spacing 90 × 90 cm
Experimental Design: RCBD with 7 treatments and 4 replications
The mulberry cultivation practices were followed as per Dandin *et al.* (2010).

Treatment details:

T_1 : 20T FYM+ Rec. NPK kg/ha/yr
T_2 : 2.56T Honge cake + Rec. NPK kg/ha/yr
T_3 : 1.92T Neem cake + Rec. NPK kg/ha/yr
T_4 : 2.32T Jatropha cake + Rec. NPK kg/ha/yr
T_5 : Cowpea as green manure+ Rec. NPK kg/ha/yr
T_6 : 5.88T Vermicompost + Rec. NPK kg/ha/yr
T_7 : Rec. NPK kg/ha/yr alone.
All the organic manures are supplied on the basis of nitrogen % in FYM

RESULTS AND DISCUSSION

Different types of organic manures and inorganic fertilizers are known to enhance growth and yield as well as quality of mulberry by providing the essential nutrients required by the plant, making available otherwise unavailable nutrients. The combined application of organic manures and inorganic fertilizers will not only sustain the soil fertility but also improve the mulberry productivity, nutrient use efficiency, biodiversity, soil and environmental quality. In turn such mulberry leaves are known to provide the required nutrients for better growth of the silkworm leading to better cocoon production in terms of qualitatively and quantitatively.

In the present study, the effect of organic manures (FYM, hongecake, neemcake, *Jatropha* cake, vermicompost and cowpea as intercrop along with chemical fertilizers were applied in equal split doses) on mulberry growth and quality was investigated and are discussed in the light of the earlier findings under following headings.

A. Effect of different organic manures on properties of soil in mulberry garden

Bulk density (g/cc) and maximum water holding capacity (%). Bulk density and maximum water holding capacity of the soil differed significantly due to application of different types of organic manures (Table 1). The lowest bulk density (1.45 g/cc) and Maximum water holding capacity of the soil (35.79 %) was noticed in T_6 treatment which recieved 5.88 tonnes of Vermicompost + recommended N,P & K @ 350: 140: 140 kg / ha / year through chemical fertilizers. Similarly, highest bulk density (1.51 g/cc) and lowest maximum water holding capacity of the soil (30.83 %) were recorded in T_7 applied with recommended N, P & K @ 350: 140: 140 kg / ha / year through chemical fertilizers alone. Reduction in the bulk density and improvement in the maximum water holding capacity of the soil may be due to continuous application of organic manures. Sarkar *et al*. (2003) opined that addition of organic materials had increased organic carbon, aggregate stability and moisture retention capacity and infiltration rate of the surface soil while reducing the bulk density. Vermicompost is formed from the biooxidation and stabilization process of organic material which involves the joint action of earthworms and microorganisms and does not involve a thermophilic stage. Vermicompost is a peat like material with excellent structure, porosity, aeration, drainage and moisture holding capacity (Dominguez, 1997). Haimi and Hunta (1987) demonstrated that vermicompost is considerably superior than compost with regard to physical and chemical characteristics. Vermicompost can also influence a number of physical, biological and chemical processes of soil which have their bearings on plant's growth. The results of this study are in agreement with the findings of Jayaraj *et al*. (2006); and Manjunatha *et al*. (2006).

Table 1: Bulk density and maximum water holding capacity of soil in V_1 mulberry garden as influenced by different organic manures before and after experimentation.

Treatments	Bulk density (g/cc)	Maximum water holding capacity (%)
Before Experimentation	1.51	31.07
After experimentation		
T_1 : 20T FYM+ Rec. NPK kg/ha/yr	1.47	35.08
T_2 : 2.56T Honge cake + Rec. NPK kg/ha/yr	1.47	33.54
T_3 : 1.92T Neem cake + Rec. NPK kg/ha/yr	1.50	33.70
T_4 : 2.32T *Jatropha* cake + Rec. NPK Kg/ha/yr	1.46	34.58
T_5 : Cowpea as green manure+ Rec. NPK kg/ha/yr	1.49	35.12
T_6 : 5.88T Vermicompost+ Rec. NPK kg/ha/yr	1.45	35.79
T_7 **:** Rec. NPK kg/ha/yr alone	1.51	30.83
F – Test	*	*
S. Em ±	0.01	0.45
C.D @ 5%	0.03	1.35

*Significant at 5%

Soil pH and EC (dSm^{-1}) of soil in mulberry garden. Application of organic manures and inorganic fertilizers significantly influenced on soil pH and Electrical conductivity (Table 2). The ideal soil pH for growth and development of mulberry plants (7.95) was recorded in T_6 applied with 5.88 tonnes of Vermicompost + recommended N,P & K @ 350: 140: 140 kg / ha / year through chemical fertilizers followed by T_4 (7.96) applied with 2.32T of Jatropha cake + recommended N, P & K @ 350: 140: 140 kg / ha / year through chemical fertilizers. While, the maximum and minimum EC (0.27 and 0.24 dSm^{-1}) was recorded in T_7 and T_6, respectively. The soil pH was neutral in T_6 where organic manures were applied may be due to mineralization, degradation of hydrolyzed polysaccharides and synthesis of organic acids by microorganisms through the breakdown of the substrate leads to maintain ideal and neutral pH. This view was supported by the findings of Mahimairaja *et al*. (1994) and Wong *et al.* (2001). The improvement in EC might be due to volume reduction which might have increased the concentration of nutrients and insoluble salts. The decrease in soluble salt contents of the treated soil might be due to the utilization of these salts by the microorganisms for the metabolism and biomass. Similarly, Srikantaswamy *et al*. (2006) revealed that in-situ soil moisture conservation practices *viz.,* as a summer ploughing + application of FYM + ridge and furrow making + green manure mulch (during monsoon) + biofertilizers/crop cover with crop residues significantly improve the mulberry leaf yield against the conventional practices besides the improving the soil moisture, OC and EC contents.

Table 2: pH, Electrical conductivity and organic carbon content of soil in V_1 mulberry garden as influenced by different organic manures before and after experimentation.

Treatments	pH	Electrical conductivity (dSm^{-1})	Organic Carbon (%)
Before Experimentation	8.23	0.27	0.52
After experimentation			
T_1 : 20T FYM+ Rec. NPK kg/ha/yr	8.02	0.26	0.62
T_2 : 2.56T Honge cake + Rec. NPK kg/ha/yr	8.01	0.25	0.66
T_3 : 1.92T Neem cake + Rec. NPK kg/ha/yr	7.98	0.24	0.62
T_4 : 2.32T *Jatropha* cake + Rec. NPK kg/ha/yr	7.96	0.24	0.69
T_5 : Cowpea as green manure+ Rec. NPK kg/ha/yr	7.98	0.26	0.63
T_6 : 5.88T Vermicompost + Rec. NPK kg/ha/yr	7.95	0.24	0.71
T_7 **:** Rec. NPK kg/ha/yr alone	8.20	0.27	0.60
F – Test	*	NS	*
S. Em ±	0.01	0.01	0.01
C.D @ 5%	0.03	-	0.03

*Significant at 5%, NS- Non significant

B. Organic Carbon (%) content of soil in mulberry garden

Organic carbon content of soil differed significantly due to application of different organic manures to mulberry (Table 2).

More organic carbon content of soil was exhibited with T_6 (0.71%) which was followed by T_4 (0.69 %) and T_2 (0.66 %) over other treatments. Low organic carbon content of soil was exhibited with T_7 (0.60 %). These results are in accordance with the observation of Garcia *et al*. (1993) who reported that decomposition of

organic manure improves the organic matter content of the soil leading to increase in the soil organic carbon. The results of this study are in agreement with the findings of Shashidhar *et al*. (2009).

C. Effect of different organic manures on available NPK of mulberry garden

Significant improvement was observed in soil fertility due to imposition of different organic manures and chemical fertilizers. The availability of soil NPK in the mulberry garden was increased due to application of 5.88 tonnes of Vermicompost + recommended N,P & K @ 350: 140: 140 kg / ha / year through chemical fertilizers (T_6) which recorded maximum available NPK of 283.42, 49.85 and 186.14 kg/ha over other treatments. The next best treatment was T_4 (278.23 N, 44.63 P and 185.25 K kg/ha), respectively with the application of 2.32T of *Jatropha* cake + recommended N, P & K @ 350: 140: 140 kg / ha / year through chemical fertilizers. The increased availability of NPK in soil may be attributed to better nitrogen fixing capacity of *Azospirillum brasilense*, P solubilization and mobilization by *A. awamori* and in presence of FYM, vermicompost, green manure and oilcakes and inorganic fertilizers. Yadav and Nagendra Kumar (1989) also opined better N fixing ability of *Azospirillum* contributing to nitrogen economy and soil fertility. Similar results were also observed by Ramakrishna Naika (2008) (Table 3).

Table 3: Macro nutrient content of soil in V_1 mulberry garden as influenced by different organic manures before and after experimentation.

Treatments	Available Nitrogen (kg /ha)	Available Phosphorus (kg /ha)	Available Potassium (kg /ha)
Before experimentation	234.37	31.9	173.2
After experimentation			
T_1 : 20T FYM+ Rec. NPK kg/ha/yr		43.93	182.79
T_2 : 2.56T Honge cake + Rec. NPK kg/ha/yr		43.61	181.23
T_3 : 1.92T Neem cake + Rec. NPK kg/ha/yr		44.23	183.19
T_4 : 2.32T *Jatropha* cake + Rec. NPK kg/ha/yr		44.63	185.25
T_5 : Cowpea as green manure+ Rec. NPK kg/ha/yr		43.61	182.46
T_6 : 5.88T Vermicompost + Rec. NPK kg/ha/yr		49.85	186.14
T_7 : Rec. NPK kg/ha/yr alone		40.01	179.84
F – Test		*	*
S. Em ±		0.68	0.90
C.D @ 5%		2.03	2.68

*Significant at 5%

D. Effect of different organic manures on growth and yield of mulberry

Shoot height and number of shoots/plant. Application of different types of organic manures and inorganic fertilizers to the soil showed significant increase in growth parameters of mulberry (Table 4 & 5).

The maximum shoot height (90.10 and 119.65 cm) during first crop and (92.30 and 121.63) during second crop, highest number of shoots per plant (10.73 and 12.70) during first crop and (11.26 and 13.11) during second crop at 45th and 60th day after pruning were recorded significantly in V_1 mulberry raised with 5.88 tonnes of Vermicompost + recommended N,P & K @ 350: 140: 140 kg / ha / year through chemical fertilizers (T_6). The next best treatments were application of 2.32 tonnes of *Jatropha* cake + recommended N,P & K @ 350: 140: 140 kg / ha / year through chemical fertilizers (T_4) recorded good result in both first and second crop. However, a value for this trait was lowest when mulberry raised with the application of recommended N, P & K @ 350: 140: 140 kg / ha / year through chemical fertilizers (T_7) shows lowest observation during first crop on 45th and 60th day after pruning. The profound increase in shoot height and more number of shoots may be due to addition of nitrogen to the soil through different types of organic manures with in-organic fertilizers besides improving the organic carbon content and water retention capacity. Similar kinds of findings was observed by Shivakumar *et al*. (2000) who reported that, combined application of organic manures and inorganic fertilizers increased the number of shoots per plant. These results are in line with findings Murarkar *et al*. (1998) observed that, application of full dose of NPK + vermicompost @ 6000 kg/ha proved to be significantly superior for obtaining maximum number of branches and plant height in mulberry as compared to control. Further, the growth parameters in the present study showed almost the same trend of the previous workers such as Narayanaswamy *et al*. (2006) and Ravikumar *et al*. (2006).

Table 4: Shoot height of mulberry as influenced by the application of different organic manures.

Treatments	Shoot height(cm)			
	I crop		II crop	
	45 DAP	60 DAP	45 DAP	60 DAP
T_1 : 20T FYM+ Rec. NPK kg/ha/yr	89.13	115.65	90.11	116.32
T_2 : 2.56T Honge cake + Rec. NPK kg/ha/yr	86.72	113.14	88.53	114.32
T_3 : 1.92T Neem cake + Rec. NPK kg/ha/yr	89.72	114.55	89.81	117.89
T_4 : 2.32T *Jatropha* cake + Rec. NPK kg/ha/yr	89.86	118.23	91.36	120.32
T_5 : Cowpea as green manure+ Rec. NPK kg/ha/yr	84.32	114.32	86.06	115.15
T_6 : 5.88T Vermicompost + Rec. NPK kg/ha/yr	90.10	119.65	92.30	121.63
T_7 **:** Rec. NPK kg/ha/yr alone	80.23	112.20	81.32	112.91
F – Test	*	*	*	*
S. Em ±	0.65	0.86	0.68	0.74
C.D @ 5%	1.95	2.58	2.02	2.21

*Significant at 5%

Table 5: Number of shoots/plant of mulberry as influenced by the application of different organic manures.

Treatments	Number of shoots/plant			
	I crop		II crop	
	45 DAP	60 DAP	45 DAP	60 DAP
T_1 : 20T FYM+ Rec. NPK kg/ha/yr	9.10	10.93	9.44	11.08
T_2 : 2.56T Honge cake + Rec. NPK	9.33	11.07	9.69	11.34
T_3 : 1.92T Neem cake + Rec. NPK	9.08	10.99	9.52	11.06
T_4 : 2.32T *Jatropha* cake + Rec. NPK	9.67	11.60	10.12	12.19
T_5 : Cowpea as green manure+ Rec.	9.19	10.58	9.71	10.96
T_6 : 5.88T Vermicompost + Rec. NPK	10.73	12.70	11.26	13.11
T_7 **:** Rec. NPK kg/ha/yr alone	8.99	10.03	9.07	10.05
F – Test	*	*	*	*
S. Em ±	0.32	0.34	0.30	0.41
C.D @ 5%	0.95	1.02	0.91	1.20

NS-Non significant

Yield per plant and per hectare. Notable variation was registered with respect to leaf yield per plant and leaf yield per hectare of mulberry among different organic manures when applied to mulberry. Among the different treatments, significantly maximum leaf yield per plant (930.12 g) and leaf yield per hectare (55.97 tonnes) was recorded in T_6 applied with 5.88 tonnes of Vermicompost + recommended N, P & K @ 350: 140: 140 kg / ha / year through chemical fertilizers during first crop and 939.33g /plant and 56.32 tonnes/ha during second crop followed by T_4 and T_9. The lowest fresh leaf yield of (904.00 g/plant and 52.11 tones/ha during first crop and 905.21 g/plant and 52.20 tones/ha during second crop) was recorded in T_7 where only recommended N, P & K @ 350: 140: 140 kg / ha / year through chemical fertilizers was applied (Table 6).

Table 6: Leaf yield of mulberry as influenced by the application of different organic manures

Treatments	I crop		II crop	
	Leaf yield (g/plant)	Leaf yield (MT/ha/yr)	Leaf yield (g/plant)	Leaf yield (MT/ha/yr)
T_1 : 20T FYM+ Rec. NPK kg/ha/yr	908.26	53.41	911.67	53.53
T_2 : 2.56T Honge cake + Rec. NPK kg/ha/yr	911.60	53.57	915.31	54.06
T_3 : 1.92T Neem cake + Rec. NPK kg/ha/yr	912.87	53.98	916.26	54.43
T_4 : 2.32T *Jatropha* cake + Rec. NPK kg/ha/yr	919.32	55.08	924.66	55.92
T_5 : Cowpea as green manure+ Rec. NPK kg/ha/yr	907.80	53.12	910.48	53.91
T_6 : 5.88T Vermicompost + Rec. NPK kg/ha/yr	930.12	55.97	939.33	56.32
T_7 **:** Rec. NPK kg/ha/yr alone	904.00	52.11	905.21	52.20
F – Test	*	*	*	*
S. Em ±	0.64	0.56	0.71	0.62
C.D @ 5%	1.92	1.68	2.18	1.80

*Significant at 5%

The increased leaf yield may be due to more number of shoots, higher plant height and more number of leaves per plant. The positive influence of organic based nutrient management on leaf yield in terms of fresh weight can also be attributed to the fact that conjunctive application of vermicompost, FYM, green manures, oilcakes, and chemical fertilizers might have helped in slow and steady release of nutrients in addition to supply of important macro and micro-nutrients besides efficient supply of N and P by nitrogen fixing and phosphorus solubilizing bio-inoculants, respectively. The lowest leaf yield in 100 per cent recommended N, P & K @ 350: 140: 140 kg / ha / year through chemical fertilizers application may be due to less number of shoots and leaves per plant, shorter plant height and in turn these may be due to insufficient availability of nutrients in the root zone of mulberry plants to be absorbed by the roots. According to Rajeswara Rao *et al*. (2006) INM technologies like green manuring (dhaiancha), biofertilizers (*Azospirillum* + PSB), vermicomposting and trap cropping increased the mulberry leaf yield from 40 MT to 60 MT/ha/yr. According to Sannappa *et al*. (2005) application of 50 per cent recommended N through vermicompost registered significantly higher plant height, number of shoots, number of leaves, leaf area and leaf yield in mulberry. Similarly, Narayanaswamy *et al.* (2006) reported that, application of different organic manures and combination of organic manures + inorganic fertilizers recorded significantly higher number of shoots per plant, higher number of leaves and leaf yield per plant as compared to NPK alone through fertilizers in mulberry.

E. Influence of different organic manures and inorganic fertilizers on quality of mulberry leaf

Mulberry raised with different organic manures showed marked variation in respect of quality parameters of leaf *viz.,* moisture content, chlorophyll 'a', 'b', and total chlorophyll.

Moisture content of leaf. Leaf moisture percentage of V_1 mulberry differed significantly among the treatments. The mulberry plot which received 5.88 tonnes of Vermicompost (VC) / ha / year + recommended N,P & K @ 350: 140: 140 kg / ha / year through chemical fertilizers (T_6) recorded maximum mean leaf moisture (70.52 %) may be due to better water holding capacity for longer time of the vermicompost supply moisture to mulberry plant slowly and steadily (Table 7). Similarly, the lowest moisture content of 67.19 per cent in leaf was registered in T_7 applied with only recommended N, P & K @ 350: 140: 140 kg / ha / year through chemical fertilizers due to lack of organic manures. The increase in leaf moisture content may be due to water retention capacity of organic manures which steadily supply the moisture and increase the nitrogen uptake leading to increased the moisture content in leaf and fresh leaf weight. Similar results have also been reported by Rashmi (2005) and Murali *et al.* (2006).

Table 7: Moisture content of mulberry leaf as influenced by the application of different organic manures.

Treatments	Moisture (%)			Mean
	Tender leaves	Medium leaves	Coarse leaves	
T_1 : 20T FYM+ Rec. NPK kg/ha/yr	70.75	68.50	65.88	68.38
T_2 : 2.56T Honge cake + Rec. NPK kg/ha/yr	70.07	69.03	68.23	69.11
T_3 : 1.92T Neem cake + Rec. NPK kg/ha/yr	70.85	70.60	65.33	68.92
T_4 : 2.32T *Jatropha* cake + Rec. NPK kg/ha/yr	71.41	70.08	68.60	70.03
T_5 : Cowpea as green manure+ Rec. NPK kg/ha/yr	71.37	68.68	67.54	69.20
T_6 : 5.88T Vermicompost + Rec. NPK kg/ha/yr	72.01	70.18	69.38	70.52
T_7 **:** Rec. NPK kg/ha/yr alone	69.42	66.95	65.21	67.19
F – Test	*	*	*	
S. Em ±	0.274	0.247	0.297	
C.D @ 5%	0.820	0.730	0.884	

*Significant at 5%

Chlorophyll content. Supplying nitrogen to the plants by different sources of organic manures and in-organic fertilizers significantly influenced the chlorophyll content in leaves of V_1 mulberry. Maximum chlorophyll 'a' (1.79 mg/g), chlorophyll 'b' (0.61 mg/g) and total chlorophyll (2.33mg/g) contents of leaf was recorded in T_6 applied with 5.88 tonnes of Vermicompost + recommended N, P & K @ 350: 140: 140 kg / ha / year through chemical fertilizers) on 60th day of second crop (Table 8). While it was minimum in T_7 treated plots applied with recommended N, P & K @ 350: 140: 140 kg / ha / year through chemical fertilizers alone (1.71, 0.43 and 2.09 mg/g), respectively. The increase in chlorophyll content may be due to adequate supply of nutrients to the plants through different organic manures like Vermicompost, oilcakes, green manures, FYM and also by application of inorganic fertilizers. These observations are in agreement with the findings of Singhal *et al.* (2000) where, nitrogen helped in harvesting of solar energy through chlorophyll synthesis, as it is an essential constituent of chlorophyll.

Table 8: Chlorophyll contents of mulberry leaf as influenced by the application of different organic manures.

Treatments	Chlorophyll 'a' (mg/g)	Chlorophyll 'b' (mg/g)	Total chlorophyll (mg/g)
T_1 : 20T FYM+ Rec. NPK kg/ha/yr	1.75	0.52	2.25
T_2 : 2.56T Honge cake + Rec. NPK kg/ha/yr	1.72	0.58	2.27
T_3 : 1.92T Neem cake + Rec. NPK kg/ha/yr	1.75	0.50	2.24
T_4 : 2.32T *Jatropha* cake + Rec. NPK kg/ha/yr	1.72	0.59	2.32
T_5 : Cowpea as green manure+ Rec. NPK kg/ha/yr	1.73	0.51	2.20
T_6 : 5.88T Vermicompost + Rec. NPK kg/ha/yr	1.79	0.61	2.33
T_7 : Rec. NPK kg/ha/yr alone	1.71	0.43	2.09
	*	*	*
	0.01	0.01	0.01
	0.03	0.03	0.03

*Significant at 5%

The increased amount of chlorophyll content in leaves indicates the photosynthetic efficiency, thus it can be used as one of the criteria for quantifying photosynthetic rate in mulberry (Sujathamma and Dandin, 2000)**.**

CONCLUSION

Vermicompost used in the study in comparison to conventional organic manures supplemented with chemical fertilizers or standard package of practice, normally possesses higher levels of plant-available nutrients, particularly nitrogen and phosphorus. We probably be surprised at how dense vermicompost is, thanks to its impressive water retention capabilities. In southern dry zone areas of Karnataka with depleted – or depleting – water sources and/or soil heavy in sand or clay, adding vermicompost and other organic manures to the soil will help keep the water in the soil and conserve that precious resource. Vermicompost and other organic manures can be a thriving microbial community, full of beneficial fungi and bacteria that aid in soil health. Healthy soil is said to consist of around 5% organic material, but in over-farmed soil, that number has fallen to 1%. Introducing vermicompost and other organic manures supplemented in this study can help restore that balance. Similar to its effect on pathogens, oil cakes can kill or repel the pests, but vermicomposts can help stave off attack. Studies abound that vermicompost or other organic manures supplemented with standard package of practice results in a higher yield with crops ranging from normal yield to some more extent with the above discussed advantages. Vermicomposts and other organic manures can also feature hormones that regulate and promote plant growth. It's far beyond the scope of this article (and my own knowledge) to explain how, but the countless studies indicated that earthworms and the microbes found in lively vermicompost and other organic manures are shown to remediate soil contaminated with hydrocarbons, agrichemical pollutants, heavy metal free radicals, and more.

Acknowledgement: We are greatly acknowledged to Krishi Vigyan Kendra, Chamarajanagar, Karnataka and Department of Sericulture under University of Agricultural Sciences, GKVK, Bnegaluru for provided all the facilities to conduct this research.

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How to cite this article: Mahesh D. S., Doreswamy C., Ramakrishna Naika, Chikkalingaiah, Subbarayappa C.T. and Venkatesh M. (2021). Effect of Different Organic Manures Supplemented with Standard Package of Practices on Properties of Soil in Relation to Mulberry Production in Chamarajanagara District under Southern Dry Zone of Karnataka. *Biological Forum – An International Journal*, *13*(2): 31-38.