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"Comparative Study of Soil Mixed vermicompost and Cattle Dung on the Growth Parameters of *Triticum astivum* (Wheat) and *Faciolus mungo* (Urad) Plant"

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Abstract: The application of vermicompost to improve the physical properties of soils is a promising technology to meet the requirements of high plant growth and cost-effective recovery. Therefore, the aim of this study was to investigate the comparative effect of different proportion of vermicompost and cattle dung mixed soil on *Triticum astivum* (Wheat) and *Faciolus mungo* (Urad) Plant. Different growth parameters viz. germination studies, plant length, dry weight and photosynthetic pigment were analyzed. In the present investigation highest germination percentage, plant length,dry weight of root /shoot and chlorophyll-carotenoid percentage were recorded in 50% soil treated with vermicompost and cattle dung than control soil and other proportions. It has also found that all the selected growth parameters of both Wheat and Urad plant showed significant improvement in vermicompost treated soil than cattle dung treated soil. The present investigation clearly revealed that the addition of vermicompost to soil greatly enhanced the yield in Wheat and Urad plant.

Keywords: Vermicompost, cattle dung compost, chlorophyll, dry weight, germination.

Introduction

The quality of the soil is an imperative factor to yields in crop farming and therefore the practice of applying organic manure to maintain soil fertility is a key prerequisite to sustain and eminence crop production. With the increase in world population and the on-going need for fertilisers to produce food crops, organic manure offers an alternative fertiliser to fulfil the requirements of elements. Although India could achieve self-sufficiency in agriculture by an increased use of chemical fertilizers but it also deteriorates soil health and causes eco-pollution (Joshi, *et.al.*2013).The adoption of organic farming practices not only declining the risk of soil spoiling but also increase global productivity and environment protection (Waniet *et.al*.,2002). Organic fertilizer has greater advantage over chemicals therefore it has more realized (Mathivanan, 2012). There are so many types of organic wastes viz. animal dung, urban waste, municipal solid waste etc. recognized as a raw material for preparation of compost and use for agriculture practice .With the help of composting process not only the problems of waste is eliminated but it is also used as a complete nutrients source for plant growth (Hoitink, 1993). Traditional composting of cattle dung wastes has been known for many years for but new methods of composting i.e. vermicomposting have become much more popular and significant due to their high nutrients value then simple composting.

Vermicompost is a finished goods that formed by microbial-earthworm interaction. (Edwards and Burrows, 1988).By that interaction organic compound is turn in to small absorbable component (Aira *et al.,* 2000). The use of vermicompost alone or in combination with other bio-fertilizers have been proved by several investigators and found growth and yield of various crops like Urad and Soyabean (Javed and Panwar, 2013), Setaria grass (Sabrina *et al*. 2013), Lilies (Mirakalaeie *et al.* 2013), Marigold (Paul and Bhattacharya 2012), Groundnut (Mycin*et al*. 2010), Okra (Ansari and Kumar Sukhraj 2010), Cucumber (Azarmi *et al.* 2009), Tomato (Lazcano *et. al*. 2009), Amaranthus sp. (Uma and Malathi 2009), Garlic (Suthar 2009), Strawberry (Singh *et al*. 2008), Spinach (Peyvast *et. al.* 2008), Maize (Gutie'rrez-Miceli *et al.* 2008), Sorghum (Hameeda *et al.* 2007), Potato (Alam *et al*. 2007) , Radish (Bucker field *et.al.*1999), Grape (Buckerfield and Webster,1998) Garden cress (Maseiandro *et.al.* 1997),Onion (Thanunathan, 1997) , Vanila (Siddagan gaiah *et.al.* 1996)Cloves and Black Peppers (Thankamani *et.al.*1996), Cardamom (Vadiraj *et.al.*1993), Tomato and Peppers (Wilson and Carlile, 1989), Soyabean (Chan and Griffith, 1988), Junipers (Scott ,1988) , Wheat and Cabbage (Edwards and Burrows, 1988). The present investigation was designed to keeping in view that organic fertilizer could be substitute of chemical fertilizer.

Materials And Methods

Seed Materials

Wheat (*Triticum astivum*) and Urad (*Faciolus mungo*) seeds were collect from Agriculture Regional Research Centre, Kothi Road, Ujjain(M.P.)India.

Vermicompost

Vermicompost was obtained from Govt. Madhav Science College, Ujjain (M.P.) India.

Soil

Fertilizer free soil was collected from the field near Advance College, Ujjain. It was thoroughly washed by distilled water to remove chemicals.

Cattle dung

Urine free cattle dung was collected in large-sized rectangular plastic container from cattle house of Ujjain city (Suthar and Singh, 2008).

Experiment was conducted in duplicate sets with different proportions of soil-vermicompost and soil-cattle dung mixture mentioned in table no.1.These mixtures were seeded by *Triticum astivum*(Wheat) and *Faciolus mungo*(Urad) in a plastic pot (Fig,no.1&2).Sets were kept under optimum condition for plant growth. Adequate moisture was maintained by addition of distilled water. The effects of soil mixed vermicompost and cattle dung on the growth of plants were measured by following criteria.

Table 1. *Different proportion of vermicompost and cattle dung with soil*

Composition (Total 800gm)	Vermicompost treated soil		Cattle dung treated soil	
	Vermicompost	Soil	Cattle dung	Soil
Control A	800 gm	----	800 gm	----
75%	600 gm	200 gm	600 gm	200 gm
50%	400 gm	400 gm	400 gm	400 gm
25%	200 gm	600 gm	200 gm	600 gm

Fig 1. *Experiment setup of Urad plant*

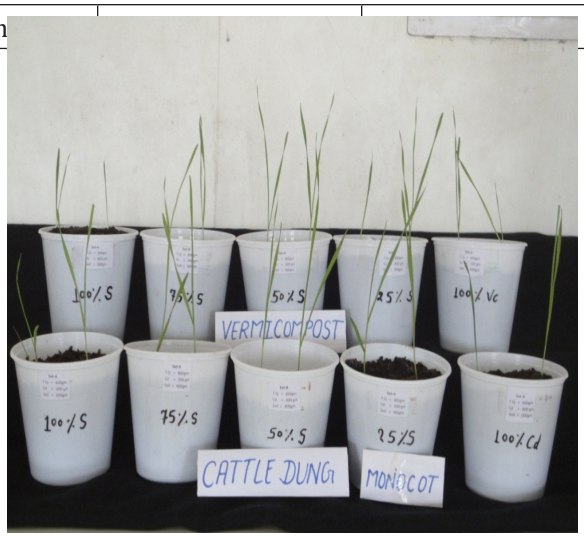

Fig 2. *Experiment setup of Wheat plant*

Germination study

Germination study was conducted in the pots filled with soil mixed with different doses of Vermicompost and cattle dung. The result was measured on the basis of arising of germinating filaments from seeds.

Length of plant

The length of 14 days old Wheat and Urad plants were measured by using a scale and the values were recorded in centimeter.

Dry weight of root and shoot

The same plants used for root and shoot growth measurement. They were kept in a hot air oven at 105°C for 24 hrs. and dry weight taken by using an electrical single pan balance. The values of dry weight were expressed in g/root or shoot.

Chlorophyll

Leaf of Wheat and Urad plant were estimated for total chlorophyll. One gm. of fresh leaf was crushed, mixed with10 ml (80 %) acetone and centrifuged at 800 rpm for 15 minutes. The supernatant was separated and the residue was again re-extracted with 10 ml (80 %) acetone. Supernatant was diluted and their absorbance values were taken at 645 and 663 nm in a UV-Spectrophotometer (Arnon, 1949).The concentration of chlorophyll was quantified by following formula.

Chlorophyll a = [(12.7 X OD at 663) – (2.69 X OD at 645)] X dilution factor

Chlorophyll b = [(22.9 X OD at 645) – (4.68 X OD at 663)] X dilution factor

Total chlorophyll = [(20.2 X OD at 645) – (8.02 X OD at 663)] X dilution factor.

Carotenoid

For carotenoid estimation, the absorbance values of the same plant extract was taken at 480 nm in a UV spectrophotometer (Arnon,1949). The concentration of carotenoid was quantified by following formula.

$$(1000\text{-}A_{470}) - 1.90 \text{ X (Chlor.A-63.14) X (Chlor. B) X2/14}$$

Results

Germination study

Germination percentages of the seed are influenced by the application of various doses of Vermicompost and cattle dung. The highest germination percentage (100%) was recorded in Wheat and Urad seed grown with of 50% of vermicompost and cattle dung treatment while lowest germination percentage (70%) was recorded in both types of seed grown without vermicompost and cattle dung treatment. It was also found that highest germination percentages of Wheat and Urad seeds were recorded grown with vermicompost treated soil than cattle dung treated soil. A germination study of Wheat and Urad seed grown under various doses of vermicompost and cattle dung treatment is shown in table no.2.

Table 2. *Germination percentage of both Wheat and Urad plant in different proportions of vermicompost/cattle dung with soil*

Vermicompost treated soil			Cattle dung treated soil		
Proportion	**Average germination % of Wheat plant**	**Average germination % of Urad plant**	**Proportion**	**Average germination % of Wheat plant**	**Average germination % of Urad plant**
100% VC	85	70	100% CD	80	80
75% VC	90	90	75% CD	85	85
50% VC	100	100	50% CD	100	100
25% VC	85	90	25% CD	80	80
100% Soil	70	70	100% Soil	70	70

Length measurement

The length of Wheat and Urad plant were measured in centimeter. The highest length of Urad plant was recorded in soil treated with 50 % Vermicompost (22.60 cm.) and 50 % cattle dung (17.80 cm.) while lowest length was recorded in 100 % vermicompost(2.3 cm) and 100 % cattle dung (12.95 cm.). It was also found that the highest growth recorded in soil treated with vermicompost than soil treated with cattle dung (Table no.3,fig. no.5, 6 & 7).

Table 3: *Effect of vermicompost/cattle dung –soil mixture on the length of Urad plant*

Date	100 % soil		75 % soil		50 % soil		25 % soil		100 % Control	
	Soil	Soil	VC	CD	VC	CD	VC	CD	VC	CD
24/02/2014	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
25/02/2014	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
26/02/2014	1.00	0.65	1.35	0.75	2.30	1.35	1.30	1.40	0.00	1.10
27/02/2014	1.35	1.35	0.90	1.95	1.55	0.95	0.65	1.20	0.00	0.90
28/02/2014	1.15	1.00	1.35	0.75	1.65	1.50	1.25	1.20	0.00	1.20

01/03/2014	1.05	1.25	1.25	1.35	2.15	1.50	0.85	0.60	0.00	1.30
02/03/2014	0.90	1.00	1.50	1.15	2.55	1.50	1.25	0.90	0.00	0.75
03/03/2014	1.10	1.05	1.25	0.97	2.90	2.50	1.70	1.20	0.00	1.00
04/03/2014	2.35	1.30	1.80	1.18	2.15	2.00	1.10	1.15	0.00	0.85
05/03/2014	1.45	2.15	1.80	1.05	1.95	1.15	0.70	1.40	0.00	1.20
06/03/2014	2.05	1.30	1.65	0.95	1.40	1.85	1.40	0.90	1.30	1.25
07/03/2014	0.90	1.20	1.30	1.00	1.40	1.30	1.00	1.00	1.00	1.20
08/03/2014	0.80	1.20	1.30	1.00	1.30	1.20	1.00	1.00	0.00	1.10
09/03/2014	0.80	1.20	1.30	1.10	1.30	1.00	1.00	1.00	0.00	1.10
Total	**14.90**	**14.65**	**16.75**	**13.20**	**22.60**	**17.80**	**13.20**	**12.95**	**02.30**	**12.95**

Fig5. *Effect of vermicompost-soil mixtures on the length of Urad plant.*

Fig6. *Effect of cattle dung-soil mixtures on the length of Urad plant*

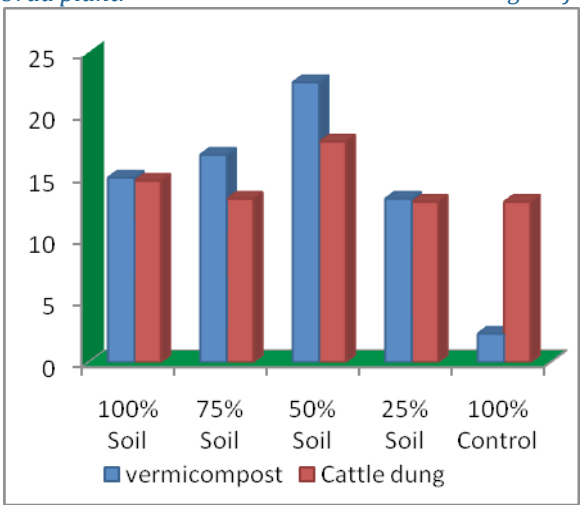

Fig7. *Effect of different proportion of soil-compost mixtures on the length of Urad plant.*

The highest length of Wheat plant was recorded in soil treated with 50 % Vermicompost (26.70 cm.) and 50 % cattle dung (24.15 cm.) while lowest length was recorded in 100 % soil (13.35 cm). It has also found that,highest length recorded in soil treated with vermicompost than cattle dung treated soil (Table no.4,fig. no.3,4&8).

Table 4. *Effect of vermicompost/cattle dung –soil mixture on the length of Wheat plant*

Date	100 % soil		75 % soil		50 % soil		25 % soil		100 % Control	
	Soil	Soil	VC	CD	VC	CD	VC	CD	VC	CD
24/02/2014	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
25/02/2014	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
26/02/2014	1.05	1.95	1.70	2.25	2.35	2.90	1.15	3.15	1.35	1.55
27/02/2014	1.05	0.00	0.55	1.60	1.20	1.40	1.09	1.80	1.79	1.75
28/02/2014	0.95	1.30	1.65	1.25	2.20	1.70	1.51	2.05	1.66	2.05
01/03/2014	1.05	1.05	1.50	1.95	1.55	2.00	1.40	1.70	1.15	1.50
02/03/2014	1.00	1.60	1.95	1.50	1.50	2.60	1.95	2.70	1.95	1.70
03/03/2014	1.00	0.95	1.35	2.65	1.95	3.00	1.30	2.80	1.65	1.65
04/03/2014	1.05	1.50	1.37	2.55	2.55	1.80	1.70	3.00	1.50	1.75
05/03/2014	1.20	1.20	2.55	2.65	2.20	2.35	1.35	2.25	2.30	2.35
06/03/2014	1.30	1.35	1.95	2.60	3.10	2.10	1.90	3.25	1.30	1.30
07/03/2014	1.30	1.20	1.60	1.70	3.10	1.50	1.50	2.00	1.30	1.10
08/03/2014	1.20	1.10	1.60	1.50	2.80	1.40	1.50	1.10	1.20	1.10
09/03/2014	1.20	1.10	1.50	1.50	2.20	1.40	1.40	1.10	1.20	1.10
Total	**13.35**	**14.30**	**19.27**	**23.70**	**26.70**	**24.15**	**17.75**	**26.90**	**18.35**	**18.90**

Fig 3. *Effect of vermicompost-soil mixtures on the length of Wheat plant.*

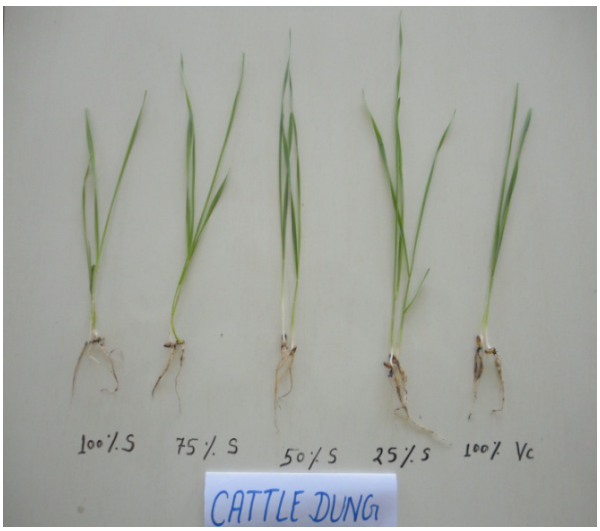

Fig 4. *Effect of cattle dung-soil mixtures on the length of Wheat plant.*

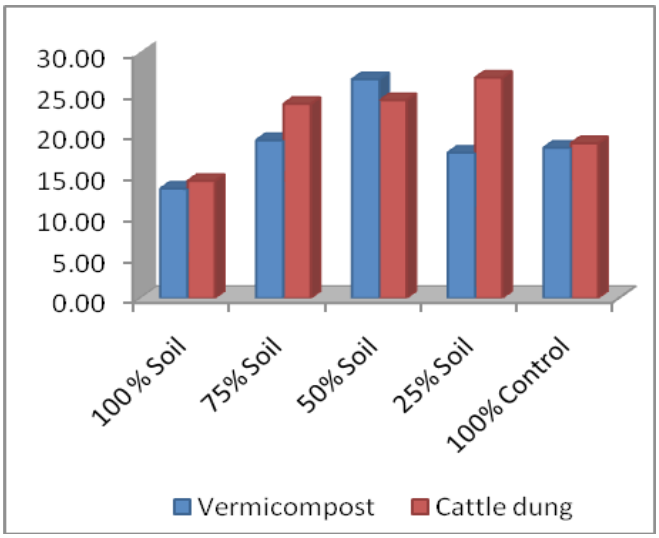

Fig 8. *Effect of different proportion of soil-compost mixtures on the length of Wheat plant*

Dry weight measurement

The highest dry weight of Urad plant shoot was recorded 90 mg grown in 50 % soil treated with vermicompost and 75 mg in 50 % soil treated with cattle dung while lowest dry weight was recorded 30 mg grown in 100 % vermicompost and 60mg in 100 % soil (Fig.9). The highest dry weight of Urad plant root was recorded 40 mg (50% soil treated with vermicompost) and 35 mg (50% soil treated with cattle dung) while lowest dry weight recorded were15 mg (100% vermicompost) and 25 mg (100% soil) respectively (Table no.5 and fig.10).

Table 5. *Effect of different proportion of vermicompost/cattle dung-soil mixtures on dry weight of Urad plant.*

Combination	Proportion	Average Shoot weight(mg)		Average Root weight (mg)	
		Biomass	Dry mass	Biomass	Dry mass
Soil with cattle dung	100 % Soil	290	60	120	25
	75 % Soil	310	60	130	35
	50 % Soil	335	75	145	35
	25 % Soil	320	70	140	30
	100 % Cattle dung	330	75	140	30
Soil with Vermicompost	100 % Soil	320	70	150	35
	75 % Soil	350	75	160	35
	50 % Soil	410	90	180	40
	25% Soil	410	90	180	40
	100 % Vermicompost	130	30	060	15

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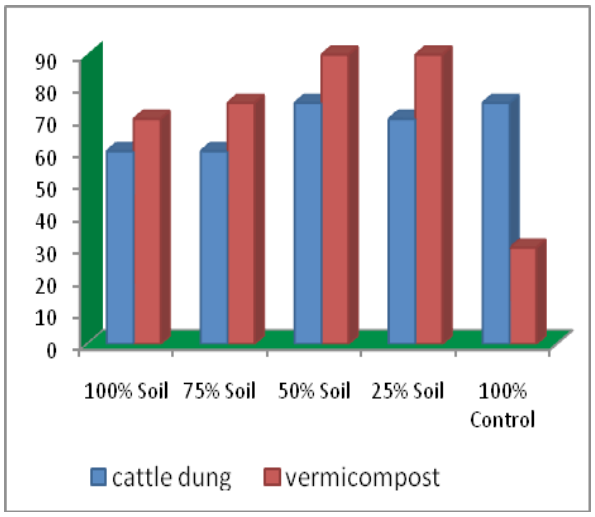

Fig 9. *Dry weight (mg) measurement of shoot of Urad plant.*

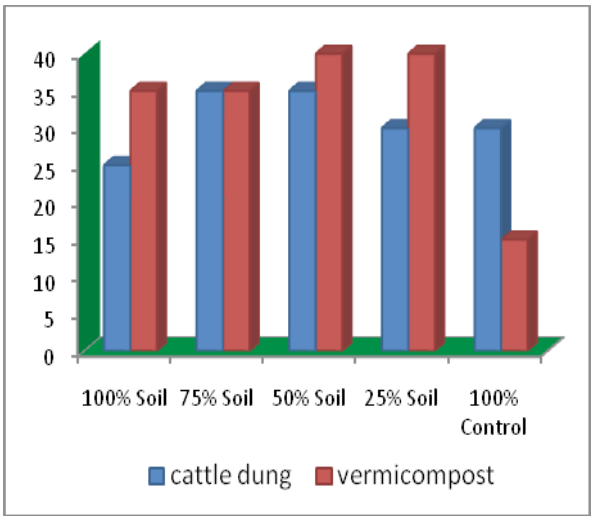

Fig 10. *Dry weight (mg) measurement of root of Urad plant.*

The highest dry weight of Wheat plant shoot was recorded 110 mg grown in 50 % soil treated with vermicompost and 100 mg in 25 % soil treated with cattle dung. The lowest dry weight shoot of Wheat plant was recorded 60 mg grown in 100 % vermicompost and 50 mg in 100 % soil (Fig.11). The highest dry weight of Wheat plant root was recorded 50 mg grown in 50% soil treated with vermicompost and 40 mg in 25 % soil treated with cattle dung. The lowest dry weight root of Wheat plant was recorded 25 mg grown in 100 % soil and 25 mg in 50 % soil treated with cattle dung (Table no.6 and fig.12).

Table 6. *Effect of different proportion of vermicompost/cattle dung-soil mixtures on dry weight of Wheat plant*

Combination	Proportion	Average Shoot weight(mg)		Average Root weight (mg)	
		Biomass	Dry mass	Biomass	Dry mass
Soil with Cattle dung	100 % Soil	220	50	110	30
	75 % Soil	320	60	140	30
	50 % Soil	280	50	120	25
	25 % Soil	440	100	190	40
	100 % Cattle dung	370	80	160	35
Soil with Vermicompost	100 % Soil	310	70	120	25
	75 % Soil	320	75	130	30
	50 % Soil	500	110	210	50
	25 % Soil	385	80	165	40
	100 % Vermicompost	330	60	140	30

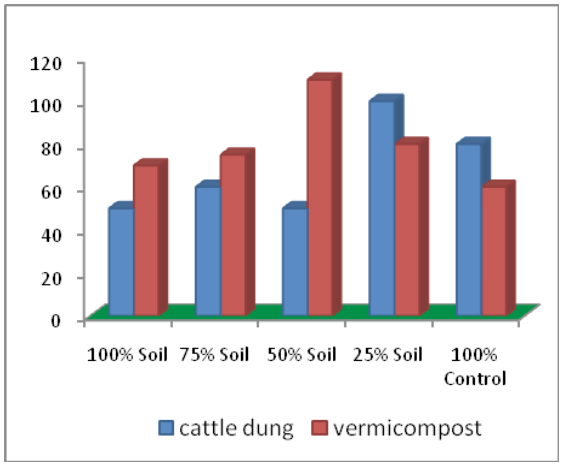

Fig 11. *Dry weight(mg) measurement of shoot of Wheat plant.*

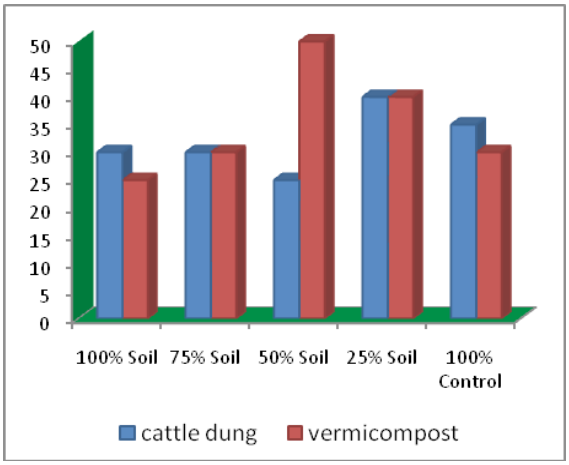

Fig 12. *Dry weight (mg) measurement of root of Wheat plant*

Chlorophyll detection

The consequence of different proportion of vermicompost and cattle dung mixed soil on the synthesis of chlorophyll pigment of Wheat and Urad plant leaves are presented in Table 7. The highest chlorophyll contents of Urad plant were measured 46.25mg/Lit and 52.34 mg/Lit in 50% soil treated with cattle dung and 50% soil treated with vermicompost respectively while lowest chlorophyll contentwas recorded in 100% soil (33.32mg/Lit) and 100 % vermicompost (21.22mg/Lit).

Table 7. *Chlorophyll contents of both Wheat and Urad plant leaf under influence of different proportions of vermicompost and cattle dung mixed soil.*

Combination	Proportion	Chlorophyll Content Of Urad plant leaf (mg./Liter)	Chlorophyll Content Of Wheat plant leaf (mg./Liter)
Soil with Cattle dung	100 % Soil	33.32	28.34
	75 % Soil	41.21	37.45
	50 % Soil	46.25	43.33
	25 % Soil	42.20	40.45
	100 % Cattle dung	43.13	39.22
Soil with Vermicompost	100 % Soil	34.12	32.31
	75 % Soil	40.23	38.62
	50 % Soil	52.34	44.35
	25 % Soil	43.45	40.74
	100 % Vermicompost	21.22	38.13

The highest chlorophyll contents of Wheat plant leaf were recorded 43.33 mg/lit (50 % soil treated with cattle dung) and 44.35 mg/Li (50 % soil treated with vermicompost) and the lowest was 28.33 mg/Lit 100 % soil.

Carotenoid detection

The effect of different quantities of vermicompost and cattle dung containing soil on the carotenoid pigment synthesis of Wheat and Urad plant also determined are depicted in table no. 8. The highest carotenoid pigments synthesis were recorded in Urad plant grown in 50 % of vermicompost treated soil (654.25 mg/Lit) and 50 % cattle dung treated soil (576.24 mg/Lit) while lowest value recorded in 100 % vermicompost (128.24 mg/Lit) and in 100 % soil (472.56 mg/Lit).

Table 8. *Carotenoid contents of both Wheat and Urad plant leaf under influence of different proportions of vermicompost and cattle dung mixed soil*

Combination	Proportion	Carotenoid Content of Urad plant leaf (mg./Liter)	Carotenoid Content of Wheat plant leaf (mg./Liter)
Soil with Cattle dung	100 % Soil	472.56	390.25
	75 % Soil	508.47	435.59
	50 % Soil	576.24	498.34
	25 % Soil	535.12	450.31
	100 % Cattle dung	490.78	413.48
Soil with Vermicompost	100 % Soil	423.35	401.25
	75 % Soil	542.25	469.42
	50 % Soil	654.25	531.29
	25 % Soil	510.56	486.43
	100 % Vermicompost	128.24	412.45

The highest carotenoid pigment of Wheat plant recorded were 498.34 mg/Lit and 531.29 mg/Lit in 50 % soil treated with cattle dung and 50 % soil treated with vermicompost respectively. The lowest carotenoid pigment was recorded in 100 % soil (390.25 mg/Lit) and 100 % vermicompost (401.25 mg/Lit).

Discussion

Presence of nutrients in a soil is essential for sustainable agricultural practice. Regular cultivation of crops exhausts soil nutrients that can be fulfilled by addition of supplement i.e. fertilizers. Using of organic matter such as animal manures has long been recognized in agriculture as beneficial for plant growth and yield and the maintenance of soil fertility.In present study, different proportions of vermicompost and cattle dung compost with soil were used on Wheat and Urad plant to evaluate their effects viz. germination percentage, height of plant, dry weight, and photosynthetic pigments. The seed germination test is performed to evaluate the recommended dose of appropriate compost to stimulate plant growth and yield.In the present study of seed germination, it was found that highest germination of Wheat and Urad seeds occur in 50 % soil mixed with eitherby vermicompost or by cattle dung than control soil. Similler finding also recorded in the seed germination percentage of groundnut when compare with control (Mathivanan, *et.al.* 2012). The highest germination percentage was also observed in radish grown in vermicompost treated soil compared to the control soil(Buckerfield, *et.al.* 1999).

The application of vermicompost increased the height of plants due to present of essential nutrients. In the experiment, the highest length of Wheat and Urad plants was recorded in 50 % soiltreated with vermicompost as compaired to cattle dung treated soil and control soil. This finding supported by several researchers who find out that growth and development of plants is due to the presence of humic acids (Arancon et al. 2005) and micro and macronutrients present abundantlyin vermicompost (Atiye *et al.,* 2002; Fernández-Luqueño et al. 2010). Hadi, *et al.* (2011) was observed that, the height of *Matricaria chamomomile* plant significantly increased when vermicompost was applied at the rate of 20 t/ha. The height of maize plant was also recorded by Gutie'rrez-Miceli *et al.* (2008) when grown in soil mixed with vermicompost.Similarly, vermicompost amendments increased plant a height of potato was reported by Alam et al. (2007) and Vijaya and Seethalakshmi (2011).

A significant increased concentration of photosynthetic pigments viz. Chlorophyll and Carotenoid were also observed in Wheat and Urad plant grown in vermicompost treated soil. In a study, Azarmi *et al.* (2009) reported that chlorophyll content of leaves of cucumber increased due to addition of vermicompost applications. Taleshi *et al.* (2011) reported that the available form of nitrogen (nitrate) is high in vermicompost than conventionally composted manure which is required for pigment synthesis.It was observed that addition of 8.2% w/w vermicompost /soil induced the largest increase in chlorophyll content in the leaves of common bean plants (Fernández, *et.al*.,2010). Berova, *et.al.* (2009) also found increasing concentration of photosynthetic pigments in leaf of *Capsicum annuum* plant is due to application of vermicompost.

The growth parameters of Wheat and Urad plant such as shoot and root dry weights were better in vermicompost treated soil than the cattle dung treated soil. Our results corroborate with the findings of other investigators that reported significant increase in growth parameters of plants after application of vermicompost in the growth media (Tomati, *et.al*., 1990 ; Joshi and Vig, 2010 and Bachman and Metzger, 2008). Scientists of different agricultural fields agreed that plant growth and development are strictly dependent on biological fertility factors. Earthworms may stimulate microbial activities and metabolism and also influence microbial populations. As a consequence, more available nutrients and microbial metabolites are released into the soil (Edwards, 1988).

Conclusion

Supplementation of nutrient to a soil is a good practice for agricultural but should not be short acting and cost effective.Therefore, it is necessary to arrange complementary resources which can long acting and minimize the use of chemical fertilizer. Although cattle dung is better solution but it can be excellent if it is processed by earthworm. Present study revealed that by using of vermicompost,seed germination rate increased that enhance the more number of seeds in soil as a plant. It also increased the length of plant that direct the more surface area for arising of leaf, flower and pod. By using of vermicompost, chlorophyll content also increased as compaired to cattle dung treated plant showed more production of Wheat and Urad.

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