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Vermiwash: A Potent Liquid Biofertilizer

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ABSTRACT:

Present study focus on the effect of foliar spray of vermiwash of different vermicomposts prepared from different animal agro and kitchen wastes on the growth, flowering period and productivity of wheat (*Triticum aestivum*), gram (*Cicer arietinum*), pea (*Pisum sativum*) and mustard (*Brassica compastis*) crops. The vermiwash of vermicompost of goat dung with vegetable wastes 10 mg/m² shows significant growth in wheat which is followed by goat dung with wheat bran after 30 days of showing. After 50 days the combination of buffalo dung with vegetable wastes show significant growth in case of wheat crops. The combination of buffalo dung with gram bran gives highly significant growth of gram plant. The combination of horse dung with gram bran has maximum growth in mustard and pea plants. The foliar spray of all the different concentration of vermiwash has significant decreasing in flowering period of all the experimental Rabi crops. The maximum significant productivity observed in crops treated with different concentration of vermiwash with respect to control.

KEY WORDS: Wastes, *Eisenia foetida*, Vermicompost, Vermiwash, Rabi Crops, Growth and Productivity.

INTRODUCTION:

In India the process of higher levels of food production for match the demand of growing population, using chemical fertilizer and pesticides at large scale. This excess and continuous use of chemical fertilizer and pesticides did increased the productivity at certain levels but has lead to the various ill effect on the soil fertility and quality of crops productivity, besides causing the deficiency and imbalance of micronutrients. These problems can solve by the use of biofertilizer and biopesticides. Management of biological wastes through vermicomposting is a useful process by which can minimize the pollution.

The biological wastages are serious problems for society; its decomposition causes odor problems (Reinecke et al., 1992; Mitchell, 1997; Gunadi and Edwards, 2003; Loh et al., 2004; Garg et al., 2006). These biological wastes are managed through the vermicomposting by the help of different species of earthworms and its changes these wastes in to valuable products, 'vermicompost' (Chan and Griffith, 1988; Fredrickson et al., 1997; Appelholf et al., 1998; Hand et al., 1998; Kaviraj and Sharma, 2003; Kaushik and Garg, 2004). Bansal and Kapoor 2000 has been reported that various agriculture residue are manage by earthworm.

Vermiwash is very good liquid manure and affect significantly on the growth and productivity of crop during foliar spray, (Subasasri, 2003; Weersighe et al., 2006). Buckerfield et al., 1999 has reported that, it is coelomic fluid extraction contains several enzyme, plant growth hormones like cytokinins, gibberlines and vitamins along with micro and macro nutrients. It

increases the disease resistant power of crop, (Umamaheswari et al., 2003; Phathak and Ram, 2004; Yadav et al., 2005; Nath et al., 2009a, 2009b). Tripathi and Bhardwaj (2004) have reported that nitrogen in the form of mucus, nitrogenous excretory substance, growth stimulating hormones and enzyme are present in vermiwash. Karuna et al., (1999) studied the stimulatory effect of vermiwash on crinkle red variety of *Andurium andreanum*. Study the effect of vermiwash on plants growth have been done by Weershighe et al., (2006) on tea coconut and horticulture crops. Suthar et al., (2005) have reported that significant effect of vermiwash on the seed germination and development of hatchling. Rao and Chandra (2005) have studied that the vermiwash is an effective liquid fertilizers initiation and lasting inflorescence of *Anthoriums*.

It have been studied that increase in the microbial activity in vermicompost and its extracts, (Edwards and Fletcher, 1998) could result in production of significant quantities of plant growth regulators such as IAA gibberellins and cytokinines by microorganism. Large amount of humic acid present in vermiwash which produced during vermicomposting and has been positive effect on the growth (Atiyeh et al., 2002; Arancon et al., 2003 and Ramamoorthy, 2004).

The aim of the study was to explore the growth, flowering period and productivity of crops by use of vermiwash, prepared from different feed stocks of animal agro/kitchen wastes of with the help of earthworm *Eisenia foetida* through vermicomposting.

MATERIALS AND METHODS:

Collection of wastes:

Animal wastes (cow, buffalo, sheep, horse, goat dung) were collected from different farms houses of these animal of Gorakhpur district and different agro kitchen wastes were collected from rural and urban parts of Gorakhpur districts. Partially decomposed mixture of animal, agro/kitchen wastes were use for enhancement of vermicomposting efficiency. After the collection the mixture of organic wastes sprayed in a layer of 1-2 feet and exposed to sun light for 5 to 10 days to removing the various harmful organism and noxious gases (Nath and Singh, 2011; Nath et al., 2011).

Collection of earth worm:

Earthworms *Eisenia foetida* an epigeic species were collected from U.P. agro states industrial area, Gorakhnath Goakhpur. The collected earthworms cultured in laboratory condition, temperature and humidity should maintained for their survival, moisture maintain up to 40% to 60%.

Experimental setup for vermicomposting

The experimental for vermicomposting were conducted on cemented earth surface. There are 35 vermibed formed by different combination of animal, agro/kitchen wastes in 1:1 ratio the size of each vermibed is 3m×1m×9cm. After formation of vermibed moist it and inoculated 2kg of cultured *Eisenia foetida* in each, covered the bed by tored and useless jute pockets and moist the bed daily up to 40 to 50 days for maintaining the moisture content. After one week interval turned the mixture of bed manually up to 3 weeks. After 45 to 50 days granular tea like vermicompost appear on the upper surface of beds. These vermicomposts use for extraction of vermiwash.

Extraction of vermiwash

Vermiwash extracted from vermiwash collecting device. The apparatus made from plastic or metals drum having capacity of 2 liter and a tap at the bottom the drum filled with broken breaks, about 10cm thickened which is followed by sand layer of 2-3 cm thickness lastly with filled with vermicompost with heavy population of earth worms simultaneously added fresh water in to drum and a container kept bellow the tap of drum. The watery extract of vermicompost, vermiwash drained out off drum. The colure of vermiwash ranges from yellowish to black. After 1 to 2 days the process of extraction has been completed. The different concentrations of collected vermiwash were used for foliar spray on crops.

Experimental deigned

There are 6 squires of size 1 m² area used for each concentration of different combinations of treated vermiwash for each crops. Wheat (PBW154), gram (Awarodhi) pea and mustered (MySL103) showed in each experimental field. After 20 days freshly extracted vermiwash sprayed over it. Three concentrations 10, 20 and 30 mg/m² using foliar spray over the crops of wheat, gram pea and mustered, however, 5, 10 and 15 mg/m² for pea. In this way there were six squires treated with each concentration of each combinations remain one is used as control. 10 days after each treatment measured the growth and flowering period of each squires and finally measured the productivity in per m² area.

Statistical Analysis

All the reported data are mean ± SE of 6 replicates. The two way analysis of variance (ANOVA) was used to analyze the significant difference between vermiwash of different combination of wastes and their concentration for observation of growth, flowering period and productivity. The test performed to identify that which combination and

concentration of vermiwash is effective for growth and productivity of crops. Student 't' test also applied to all data with respect to control in table 5 for analysis of significant effect on lowering of flowering period (Sokal and Rohlf, 1973).

RESULTS:

There was significant dose and time dependent effect of vermiwash of different vermicomposts of animal agro and kitchen wastes observed on the growth, flowering periods and productivity of different Rabi crops viz. wheat, gram, pea and mustered. In case of wheat after 30 days of sowing the vermiwash of combination of goat dung with wheat and goat dung with vegetable wastes shows higher 26.20±0.97 and 26.45±0.53 cm growth respectively, where as the maximum growth 65.00±0.88 observed in conc. of 30 mg/m² of combination of buffalo dung with rice bran (table 1). Treatment of per 10 mg/m² conc. of vermiwash of buffalo dung with gram bran after 30days on gram plant have maximum growth 19.67±0.78 cm which is followed by buffalo dung with straw 18.17±0.78 and sheep with gram 18.10±1.67 cm. The maximum growth was 36.76±0.63 cm observed in 30 mg/m² conc. of foliar spray of vermiwash of buffalo dung with gram bran on the gram plant (table-2).

The treatment of vermiwash was significant dose and time dependent growth of mustard plant observed after spray of vermiwash of buffalo dung with wheat bran at 10 mg/m² after 30 days sowing. The maximum significant growth at 20 and 30 mg/m² was observed in vermiwash of horse dung with gram bran after 50 days of sowing of crops (table 3), where as the maximum

growth was observed in 30 mg/m² treatment of vermiwash of horse dung with gram bran after 50 days of sowing of pea crop (table 4).

There was a significant time and dose dependent decreasing in flowering period of wheat, gram, pea and mustered after spray of vermiwash of different vermicomposts of different animal agro and kitchen wastes with respect to control. The significant reduction in flowering period of wheat observed in cow dung with wheat bran, however, the same combination of 30 mg/m² conc. have highly significant i.e. 68.2±2.2 days than those of 10 mg/m² concentration. In case of flowering period of gram crops, the combination of cow dung with gram bran has maximum significant effect. Buffalo dung with gram bran have reduced period of flowerination of mustard crops (table 5).

The significant productivity observed in combination of buffalo dung with rice bran i.e. 0.496±0.01 kg/m² which is followed by the treatment of 10 mg/m² concentration buffalo dung with rice bran. The highest significant productivity recorded in goat dung with wheat bran i.e. 0.621±0.06 kg/m² conc. in 30 mg/m². In case of gram crops the maximum productivity observed in combination of buffalo dung with gram bran (0.425±0.08 kg/m²) at 30 mg/m². The highly significant productivity found in combination of horse dung with wheat bran (406±0.02 kg/m² by used of 30 mg/m² concentration of vermiwash in case of mustard crop. For pea crop the significant productivity observed in vermiwash of horse dung (0.680±0.08 kg/m²) without any combination of agro waste (Table-6).

Table-1: Effect of different concentration of vermiwash of different vermicomposts of different combinations of animal, agro and kitchen wastes on the growth (cm)of wheat (*Triticum aestivum*).

Vermiwash	Days after sowing		
	30		
	Concentration (mg / m ²)		
	10	20	30
Control	17.95±1.67	17.95±1.67	17.95±1.67
Cow Dung	*# 20.04±2.00	24.02±2.90	26.24±2.12
Cow Dung+ Gram Bran	22.67±2.07	27.55±2.21	30.00±0.68
Cow Dung+ Straw	22.25±1.63	24.45±0.52	26.95±0.45
Cow Dung +Wheat Bran	20.95±1.82	23.40±0.36	25.00±0.00
Cow Dung +Rice Bran	20.50±1.92	23.05±0.73	25.02±0.08
Cow Dung + Vegetable Wastes	18.00±1.05	19.55±1.32	21.50±0.23
Cow Dung + Barley Bran	23.46±1.70	25.95±1.22	27.45±0.08
Buffalo Dung	*#20.07±0.00	23.17±0.38	25.25±0.08
Buffalo Dung +Gram Bran	22.02±0.72	26.50±2.71	28.50±1.67
Buffalo Dung + Straw	21.20±0.50	24.43±3.42	26.50±1.89
Buffalo Dung + Wheat Bran	24.50±2.10	23.72±2.32	25.00±2.65
Buffalo Dung + Rice Bran	20.00±2.10	27.05±1.49	28.95±2.52
Buffalo Dung + Vegetable Wastes	20.04±1.67	22.17±0.92	24.35±1.25
Buffalo Dung + Barley Bran	22.17±1.58	24.25±0.34	24.95±2.12
Goat Dung	*#20.01±1.77	22.52±1.62	23.57±0.38
Goat Dung + Gram Bran	20.00±1.82	21.23±1.44	27.95±0.83
Goat Dung + Straw	24.03±1.23	26.08±0.62	28.52±1.25

Goat Dung + Wheat Bran	26.20±0.97	29.80±1.45	31.94±0.92
Goat Dung + Rice Bran	21.22±0.92	27.33±1.87	29.23±1.48
Goat Dung + Vegetable Wastes	26.54±0.53	28.15±0.77	32.27±0.98
Goat Dung + Barley Bran	25.62±1.82	27.43±1.89	29.56±1.46
Sheep Dung + Gram Bran	*#18.62±1.23	27.92±0.62	30.57±0.23
Sheep Dung + Gram Bran	18.45±0.63	19.92±0.78	20.98±0.34
Sheep Dung + Straw	20.00±0.22	22.55±0.12	24.80±1.78
Sheep Dung + Wheat Bran	23.23±0.24	25.67±0.23	28.68±2.96
Sheep Dung+ Rice Bran	22.46±0.42	24.40±0.26	26.62±1.23
Sheep Dung + Vegetable Wastes	18.02±1.69	19.48±1.32	20.80±1.33
Sheep Dung + Barley Bran	22.67±1.50	22.93±1.43	24.67±1.10
Horse Dung	*#22.52±1.27	23.47±0.34	26.75±0.24
Horse Dung + Gram Bran	24.80±1.38	26.27±1.44	30.51±0.38
Horse Dung + Straw	20.50±2.34	22.10±2.61	25.20±0.42
Horse Dung + Wheat Bran	20.00±0.89	22.87±0.94	24.50±1.52
Horse Dung + Rice Bran	19.85±0.72	21.33±1.47	25.45±1.82
Horse Dung + Vegetable Wastes	20.50±0.16	23.57±1.98	26.27±0.68
Horse Dung + Barley Bran	21.45±0.12	25.47±1.24	28.91±0.74

Table-1: Cont....

Days after sowing			Days after sowing		
40			50		
Concentration (mg / m ²)			Concentration (mg / m ²)		
10	20	30	10	20	30
19.83±1.43	19.83±1.43	19.83±1.43	22.63±0.98	22.63±0.98	22.63±0.98
*#26.00±0.50	27.03±1.62	29.08±0.34	*#32.00±2.12	35.07±2.12	38.00±0.00
35.67±0.55	38.60±0.44	39.95±0.21	44.83±2.12	49.93±2.48	52.02±0.52
25.05±0.56	25.83±0.68	28.95±0.24	30.00±2.00	32.19±0.58	34.83±0.58
32.86±1.92	35.60±0.92	39.00±2.24	41.43±1.68	45.73±0.38	48.92±1.21
25.00±2.11	26.67±0.38	29.00±2.61	30.60±2.62	33.62±0.34	36.57±1.24
27.68±2.21	27.87±0.20	30.67±1.68	26.50±2.34	29.55±0.24	32.21±2.00
30.00±1.13	33.60±0.80	35.75±0.68	40.31±1.98	43.50±2.12	44.02±2.12
*#25.25±0.61	30.40±1.20	36.95±0.59	*#34.53±1.28	37.73±0.22	40.90±1.94
30.02±1.21	33.57±2.10	35.00±0.60	40.20±1.26	43.10±0.24	46.10±1.78
28.20±0.32	30.75±1.43	34.25±1.63	34.57±0.88	38.79±1.67	36.79±0.82
38.25±0.34	41.57±1.92	44.57±2.21	50.21±0.66	53.83±1.82	58.80±1.92
40.26±1.80	46.33±0.80	48.00±1.61	59.80±0.62	62.53±2.25	65.00±0.88
32.00±1.10	34.30±0.70	38.70±1.60	41.21±0.94	44.10±2.52	47.31±0.98
36.21±1.91	39.50±0.72	42.00±1.33	48.00±0.80	51.31±0.88	54.72±0.34
*#27.00±2.00	29.02±1.31	31.08±0.34	*#36.20±0.28	39.90±0.56	42.62±0.78
33.20±2.71	36.57±1.30	38.15±0.48	47.00±2.12	49.08±0.52	53.27±0.62
24.00±2.24	37.93±1.42	38.95±1.87	47.20±0.42	50.67±1.37	52.62±0.94
36.21±1.14	39.87±1.44	40.25±1.80	49.50±0.44	52.53±1.26	54.53±1.62
25.00±1.00	27.53±2.22	30.00±0.86	31.21±0.46	34.93±1.25	38.40±1.32
33.40±0.50	38.47±0.73	39.57±1.82	45.21±2.12	48.77±1.25	53.42±1.59
32.56±0.20	36.10±0.88	38.95±0.32	43.10±0.29	46.20±0.16	50.00±2.12
*#31.51±0.62	34.61±2.12	38.25±0.58	*#41.95±0.62	44.58±0.10	48.20±0.52
33.40±1.25	36.57±2.16	38.45±0.68	43.95±2.42	47.68±1.07	50.00±0.00
36.89±1.23	40.87±0.16	42.95±0.82	52.00±0.67	55.00±2.02	58.32±0.25
33.90±1.34	37.97±0.16	40.00±0.50	47.00±0.12	50.00±0.21	52.95±1.20
26.40±1.16	29.42±0.20	32.52±1.80	31.95±0.32	34.10±0.58	38.25±1.88
31.08±0.38	34.30±1.25	37.30±0.82	42.93±0.13	45.42±0.00	48.52±0.88
30.71±0.34	33.50±1.37	35.95±0.12	41.95±0.07	44.50±0.02	47.95±1.52
*#29.00±0.89	32.57±0.74	36.00±0.62	*#38.42±2.50	41.32±1.28	45.25±1.62
29.90±0.26	33.47±0.98	36.67±1.38	37.85±2.10	41.52±1.24	44.95±1.58
26.00±1.02	28.60±0.94	32.00±1.48	32.87±0.58	35.35±0.38	39.80±0.05
27.40±1.00	30.43±0.20	34.48±1.40	35.32±0.59	38.60±0.42	40.95±0.52
28.76±0.52	21.67±0.65	35.85±2.43	36.00±0.80	39.95±0.58	43.05±1.92
26.05±0.07	29.03±2.02	32.45±1.82	33.45±0.06	36.17±1.62	39.00±0.02
30.00±0.00	34.30±2.98	38.30±1.83	41.50±0.28	45.10±1.58	48.50±0.42

Each value is the mean ± SE of six replicates. 2way ANOVA: Significant (P<0.05) * within column, # within row.

Table-2: Effect of different concentration of vermiwash of different vermicomposts of different combinations of animal, agro and kitchen wastes on the growth (cm) of gram (*Cicer arietinum*).

Vermiwash	Days after sowing		
	30		
	Concentration (mg / m ²)		
	10	20	30
Control	10.83±0.98	10.83±0.98	10.83±0.98
Cow Dung	*#13.01±1.12	13.75±1.45	14.25±1.38
Cow Dung+ Gram Bran	13.57±1.70	14.30±1.20	15.25±1.08
Cow Dung+ Straw	13.45±0.48	14.33±0.76	15.45±0.73
Cow Dung +Wheat Bran	16.25±0.32	17.93±0.24	18.83±0.48
Cow Dung +Rice Bran	14.00±0.82	15.30±1.16	16.28±2.00
Cow Dung + Vegetable Wastes	15.20±1.24	16.83±0.78	17.93±1.77
Cow Dung + Barley Bran	12.00±0.78	13.00±0.33	14.00±1.29
Buffalo Dung	*#15.80±0.34	16.30±0.64	17.83±0.38
Buffalo Dung +Gram Bran	19.67±0.78	21.73±1.32	23.00±0.63
Buffalo Dung + Straw	18.17±0.98	20.43±0.69	22.00±0.94
Buffalo Dung + Wheat Bran	14.75±1.72	16.20±2.00	17.34±0.76
Buffalo Dung + Rice Bran	12.75±1.22	13.33±1.63	14.20±1.31
Buffalo Dung + Vegetable Wastes	15.65±1.32	17.20±0.34	18.35±1.47
Buffalo Dung + Barley Bran	12.00±2.00	13.20±0.52	15.00±2.00
Goat Dung	*#12.00±0.50	12.62±0.76	13.36±0.96
Goat Dung + Gram Bran	17.02±0.45	19.18±1.17	20.28±0.81
Goat Dung + Straw	16.60±0.55	18.50±0.47	20.00±0.59
Goat Dung + Wheat Bran	12.00±0.88	13.17±0.71	14.00±0.32
Goat Dung + Rice Bran	15.59±0.74	17.07±0.64	18.20±0.14
Goat Dung + Vegetable Wastes	12.90±0.67	14.20±1.76	15.10±1.92
Goat Dung + Barley Bran	10.57±0.81	11.61±0.87	12.38±0.76
Sheep Dung + Gram Bran	*#16.00±2.00	17.23±0.47	18.21±0.49
Sheep Dung + Gram Bran	18.10±1.67	19.57±0.83	21.00±0.73
Sheep Dung + Straw	12.02±1.84	13.20±1.23	14.45±0.26
Sheep Dung + Wheat Bran	16.02±0.58	17.37±1.44	18.40±0.78
Sheep Dung+ Rice Bran	12.04±1.07	13.60±0.58	14.62±0.34
Sheep Dung + Vegetable Wastes	12.20±1.25	13.10±1.03	14.00±2.00
Sheep Dung + Barley Bran	12.20±1.25	13.10±1.03	14.00±2.00
Horse Dung	*#16.23±0.96	17.23±1.13	18.45±0.90
Horse Dung + Gram Bran	13.98±0.52	15.50±0.88	17.00±0.46
Horse Dung + Straw	17.75±0.79	19.47±0.76	20.00±0.37
Horse Dung + Wheat Bran	15.80±1.12	17.23±0.43	18.62±0.87
Horse Dung + Rice Bran	16.92±1.19	18.03±1.34	19.92±0.70
Horse Dung + Vegetable Wastes	13.00±0.32	14.20±2.00	15.00±0.84
Horse Dung + Barley Bran	15.20±0.64	16.47±0.67	18.00±0.73

Table-2: Cont....

Days after sowing			Days after sowing		
40			50		
Concentration (mg / m ²)			Concentration (mg / m ²)		
10	20	30	10	20	30
13.22±1.34	13.22±1.34	13.22±1.34	16.40±0.74	16.40±0.74	16.40±0.74
*#18.52±1.21	20.30±0.34	21.32±0.61	*#28.00±0.66	29.52±0.54	30.92±0.98
20.00±1.12	21.53±0.38	22.72±0.45	25.57±0.64	27.38±2.00	28.82±1.36
19.00±1.27	20.50±2.00	22.62±0.55	23.92±0.48	26.05±1.24	27.20±0.71
24.57±1.38	26.20±0.54	27.47±0.71	30.92±0.73	33.27±0.47	34.45±0.63
18.75±1.57	20.50±0.32	22.67±1.23	22.68±0.64	24.50±0.36	25.75±0.52
16.95±2.00	18.23±0.62	20.00±2.00	20.75±0.30	22.03±0.29	23.23±1.18
18.50±0.93	19.35±0.50	20.45±0.97	22.72±1.28	24.30±0.35	25.45±2.00
*#23.00±0.32	24.58±0.73	24.98±0.81	*#27.80±2.00	29.97±0.45	30.97±0.84
26.52±0.90	28.58±1.17	29.88±0.76	32.00±1.16	35.43±1.17	36.76±0.63
23.65±0.71	25.15±1.32	26.20±0.74	29.75±1.50	31.15±0.94	32.25±0.51
19.52±0.63	21.03±1.05	22.10±1.62	24.70±0.94	26.92±0.71	28.00±0.43
17.00±0.34	19.95±2.00	21.50±1.18	24.00±0.84	25.00±0.84	26.20±0.70
24.25±1.14	26.30±0.38	27.87±1.28	32.95±0.39	34.37±0.80	35.68±0.94
14.00±2.00	18.27±0.56	21.30±1.34	18.30±0.48	23.50±0.60	28.92±1.34

*#17.20±1.34 25.10±1.73 23.78±0.86 16.00±0.76 24.00±0.43 16.21±0.50 17.50±0.40	18.20±0.74 26.53±1.37 25.13±0.94 17.30±0.66 25.28±0.79 17.23±0.83 19.00±0.89	19.41±1.44 27.63±0.83 26.25±0.74 18.23±0.63 26.00±0.69 18.35±0.81 20.10±0.96	*#21.95±0.54 30.02±0.74 29.00±0.98 19.00±1.17 30.21±1.28 18.50±0.44 19.57±0.78	23.42±0.56 32.48±0.83 31.21±1.26 20.17±1.31 32.43±0.91 20.20±0.48 20.00±0.38	24.72±1.40 33.98±0.49 32.72±0.63 21.75±0.80 33.92±0.76 21.45±0.71 22.20±1.18
*#22.92±0.38 24.25±1.21 14.98±2.00 21.00±1.26 20.21±0.94 20.75±0.26 17.25±0.33	24.13±1.21 25.90±2.00 16.37±1.64 22.00±0.90 22.00±0.84 22.20±0.67 19.30±0.60	25.78±1.32 27.00±0.96 17.38±0.71 23.25±0.45 23.65±0.67 23.42±1.33 20.00±1.58	*#28.52±0.35 30.75±0.59 18.72±0.69 24.95±1.15 28.92±1.74 29.00±0.76 20.10±0.83	30.30±0.90 32.35±0.34 20.08±0.84 26.25±1.34 30.47±2.00 30.47±2.00 22.65±0.96	32.00±1.30 33.78±1.23 21.80±1.43 27.65±0.29 32.00±0.36 32.21±0.44 24.92±0.39
*#19.20±0.48 21.00±0.31 25.00±0.68 22.10±0.28 19.10±0.37 17.00±0.44 17.34±1.70	20.23±0.50 22.30±0.46 25.10±0.60 23.47±0.41 20.33±0.58 18.30±0.48 18.08±1.30	21.87±0.46 23.60±0.53 27.92±0.50 25.00±0.47 22.00±0.67 19.60±0.80 20.00±1.21	*#22.10±0.52 27.00±0.71 31.06±1.10 27.25±0.93 22.00±0.70 20.00±0.51 20.00±0.46	23.38±0.63 28.60±0.29 32.35±0.34 28.75±0.24 23.37±0.77 20.98±1.33 21.00±2.00	24.82±0.87 30.00±2.00 34.00±1.17 30.00±1.24 24.82±0.73 22.00±0.62 22.45±0.72

Each value is the mean ± SE of six replicates. 2way ANOVA: Significant (P<0.05) * within column, # within row

Table-3:- Effect of different concentration of vermiwash of different vermicomposts of different combinations of animal, agro and kitchen wastes on the growth (cm) of mustard (*B.rapa sub sp.compestris*).

Vermiwash	Days after sowing		
	30		
	Concentration (mg / m ²)		
	10	20	30
Control	20.60±2.72	20.60±2.72	20.60±2.72
Cow Dung	24.22±3.75	27.72±3.73	29.37±3.37
Cow Dung+ Gram Bran	24.92±3.25	29.40±2.68	32.46±2.61
Cow Dung+ Straw	25.70±2.67	27.03±3.09	30.00±3.18
Cow Dung +Wheat Bran	26.85±3.18	29.83±2.87	32.00±1.21
Cow Dung +Rice Bran	26.00±4.96	28.00±2.61	31.10±3.17
Cow Dung + Vegetable Wastes	27.76±2.62	30.20±1.30	32.45±3.00
Cow Dung + Barley Bran	25.00±1.34	27.67±3.12	30.00±2.68
Buffalo Dung	30.00±3.24	32.20±4.94	34.79±3.71
Buffalo Dung +Gram Bran	25.21±1.94	27.75±2.80	30.21±2.63
Buffalo Dung + Straw	26.10±2.71	28.62±3.99	30.12±2.44
Buffalo Dung + Wheat Bran	33.13±3.64	35.67±1.64	37.92±3.79
Buffalo Dung + Rice Bran	23.88±2.36	26.82±3.32	28.28±2.82
Buffalo Dung + Vegetable Wastes	27.80±3.52	30.18±3.00	32.41±2.38
Buffalo Dung + Barley Bran	22.72±2.47	24.93±3.42	26.98±3.54
Goat Dung	27.82±3.93	29.32±2.98	32.00±2.63
Goat Dung + Gram Bran	22.00±2.71	24.45±3.67	26.62±3.37
Goat Dung + Straw	23.72±4.28	26.33±2.84	28.79±2.49
Goat Dung + Wheat Bran	28.57±3.30	31.13±3.94	34.21±2.79
Goat Dung + Rice Bran	23.21±3.96	25.71±2.82	28.00±3.86
Goat Dung + Vegetable Wastes	29.00±2.77	31.65±3.73	33.80±4.17
Goat Dung + Barley Bran	26.40±2.63	28.75±3.00	31.00±4.28
Sheep Dung + Gram Bran	22.21±2.49	24.75±2.82	27.00±2.00
Sheep Dung + Gram Bran	25.00±3.85	27.58±2.76	30.45±2.93
Sheep Dung + Straw	32.00±1.23	34.63±3.32	37.00±2.77
Sheep Dung + Wheat Bran	24.25±3.17	26.82±2.53	39.93±3.86
Sheep Dung+ Rice Bran	22.00±2.92	24.18±3.41	27.00±3.48
Sheep Dung + Vegetable Wastes	28.00±3.72	30.23±2.70	33.45±2.59
Sheep Dung + Barley Bran	28.20±2.80	30.40±3.33	33.68±3.93
Horse Dung	22.00±2.83	25.07±2.37	28.00±2.42
Horse Dung + Gram Bran	26.21±2.74	29.27±3.38	32.89±2.73
Horse Dung + Straw	19.10±3.69	22.10±3.67	25.70±2.82
Horse Dung + Wheat Bran	24.00±4.00	27.01±2.86	30.00±3.37
Horse Dung + Rice Bran	26.11±3.38	29.95±1.98	32.17±2.71
Horse Dung + Vegetable Wastes	22.00±3.76	25.13±3.15	27.00±3.23
Horse Dung + Barley Bran	19.76±2.98	22.95±2.79	25.88±2.48

Table-3: Cont....

Days after sowing			Days after sowing		
40			50		
Concentration (mg / m ²)			Concentration (mg / m ²)		
10	20	30	10	20	30
27.07±3.42	27.07±3.42	27.07±3.42	31.42±3.00	31.42±3.00	31.42±3.00
42.42±2.45	43.43±4.00	44.87±2.92	48.17±3.26	52.75±3.78	55.00±2.00
39.21±3.15	41.63±2.73	44.00±3.00	45.79±3.47	47.25±2.52	50.87±2.68
35.15±2.49	37.35±2.94	40.20±2.70	40.80±2.83	43.20±2.92	46.00±2.78
36.25±3.72	39.83±2.72	42.43±3.78	42.75±2.71	45.77±2.17	48.71±2.98
37.80±2.90	40.38±2.28	42.87±4.00	45.64±1.91	48.00±2.28	51.00±3.43
42.21±4.17	43.50±2.36	46.00±1.98	53.24±2.00	56.00±3.76	59.12±2.60
36.87±3.23	39.63±4.00	42.00±2.38	43.46±2.21	46.30±2.39	49.00±3.38
44.23±2.92	47.00±3.76	49.21±3.46	56.67±3.00	59.20±3.00	62.76±2.83
34.90±3.16	37.93±2.94	41.52±3.28	39.41±2.49	42.05±2.91	45.77±2.74
40.97±2.00	43.47±2.77	45.82±4.00	52.89±3.37	55.20±3.73	58.00±3.63
42.72±3.74	45.42±3.00	48.50±3.73	48.21±4.10	51.81±3.82	54.68±2.43
31.92±2.29	34.77±2.99	37.21±2.92	42.90±2.89	45.00±2.94	48.63±2.79
40.45±3.38	43.02±4.10	45.72±3.17	48.47±3.41	50.13±3.38	53.42±3.27
36.98±3.70	40.70±3.34	43.00±3.51	48.00±2.73	52.10±4.00	55.90±3.67
38.25±3.38	41.42±4.12	44.00±2.48	44.00±3.31	47.80±4.10	50.64±2.93
34.00±3.72	36.93±2.79	39.82±3.18	38.74±2.52	42.77±3.73	45.71±3.14
37.78±3.74	40.20±2.64	43.00±3.72	45.44±2.73	48.85±2.18	51.59±4.00
34.95±3.92	37.43±2.83	40.00±4.11	40.68±3.00	43.20±2.27	46.29±3.38
39.21±2.98	42.12±3.70	45.32±3.81	42.12±4.00	55.90±3.29	58.00±3.52
40.74±2.01	43.57±2.92	46.00±2.37	49.83±3.62	52.27±3.34	55.50±3.69
34.00±2.73	36.45±3.27	39.00±2.00	37.60±1.94	40.30±2.89	43.38±3.55
20.82±3.00	31.60±2.00	34.00±1.89	36.78±2.83	39.30±2.83	41.96±3.71
32.50±3.76	35.58±1.96	38.21±2.00	36.99±3.41	39.90±2.74	42.00±2.89
41.85±4.00	44.25±3.34	47.21±2.86	47.12±2.83	50.00±2.60	53.16±2.38
35.72±3.23	38.35±2.63	41.21±3.37	39.21±4.00	42.18±3.00	45.30±3.29
37.21±2.43	40.00±1.78	42.52±2.86	45.88±3.82	48.00±3.48	51.58±4.12
38.00±3.24	40.92±3.34	43.00±2.91	43.27±3.69	46.32±4.00	49.00±2.94
39.12±3.00	41.13±2.80	43.89±1.98	42.00±2.73	45.20±3.90	48.00±3.48
38.00±2.89	41.72±2.43	44.00±2.28	40.10±2.18	51.10±2.35	53.00±2.27
43.56±1.94	46.47±2.50	49.50±2.37	57.96±2.45	60.50±3.14	63.68±2.38
35.26±4.00	38.23±2.38	41.18±2.56	47.00±2.38	50.10±2.86	53.23±3.73
40.16±3.35	43.40±1.90	46.30±3.61	44.31±2.71	57.85±2.43	60.46±2.63
41.00±3.65	44.43±2.71	47.00±4.00	42.19±2.69	55.45±3.38	58.00±4.21
34.26±4.10	37.38±3.35	40.12±4.12	41.77±2.86	44.28±3.47	47.14±2.98
40.00±2.86	43.38±3.59	46.38±2.87	46.20±3.27	49.25±4.21	52.00±3.77

Each value is the mean ± SE of six replicates. 2way ANOVA: Significant (P<0.05) * within column, # within row

Table- 4:- Effect of different concentration of vermiwash of different vermicomposts of different combinations of animal, agro and kitchen wastes on the growth (cm) of pea (*Pisum sativum*).

Vermiwash	Days after sowing		
	30		
	Concentration (mg / m ²)		
	10	20	30
Control	10.33±0.76	10.33±0.76	10.33±0.76
Cow Dung	17.30±0.98	20.67±0.79	23.00±0.94
Cow Dung+ Gram Bran	19.39±1.28	22.25±0.96	25.60±0.84
Cow Dung+ Straw	17.80±1.41	20.63±0.47	23.12±1.24
Cow Dung +Wheat Bran	16.00±0.79	19.10±0.39	22.36±0.84
Cow Dung +Rice Bran	23.46±0.38	26.37±0.43	29.00±0.77
Cow Dung + Vegetable Wastes	20.00±0.45	23.37±0.65	26.00±0.43
Cow Dung + Barley Bran	17.38±0.69	20.38±1.27	23.31±0.67
Buffalo Dung	19.00±0.77	22.68±1.10	25.10±1.18
Buffalo Dung +Gram Bran	25.40±1.25	28.20±1.18	31.71±1.29
Buffalo Dung + Straw	18.00±1.12	21.32±0.89	24.00±0.45
Buffalo Dung + Wheat Bran	15.85±0.70	18.17±0.94	31.34±0.68
Buffalo Dung + Rice Bran	15.41±0.92	18.75±0.76	21.56±1.18
Buffalo Dung + Vegetable Wastes	18.37±0.48	21.53±1.23	24.00±1.21
Buffalo Dung + Barley Bran	16.00±0.29	19.35±1.19	22.60±1.26

Goat Dung	18.85±0.86	21.43±0.74	24.18±0.58
Goat Dung + Gram Bran	17.90±1.17	20.93±0.53	23.90±0.54
Goat Dung + Straw	13.88±0.64	16.50±0.67	19.00±0.68
Goat Dung + Wheat Bran	13.61±1.38	16.15±0.74	19.29±0.94
Goat Dung + Rice Bran	20.38±0.91	23.35±1.19	26.13±1.18
Goat Dung + Vegetable Wastes	20.64±1.43	23.00±1.28	26.78±1.21
Goat Dung + Barley Bran	21.28±0.28	24.82±0.67	27.91±1.31
Sheep Dung + Gram Bran	19.50±0.49	20.82±0.63	23.13±0.94
Sheep Dung + Gram Bran	17.24±0.58	20.97±0.45	23.99±0.87
Sheep Dung + Straw	20.81±1.24	23.12±0.57	26.80±0.64
Sheep Dung + Wheat Bran	18.60±0.55	21.22±0.73	24.00±0.38
Sheep Dung+ Rice Bran	21.80±1.60	24.50±0.63	27.44±1.18
Sheep Dung + Vegetable Wastes	20.96±1.23	23.38±0.58	26.19±1.29
Sheep Dung + Barley Bran	20.60±1.10	23.45±0.45	26.38±0.84
Horse Dung	23.96±0.78	26.72±0.73	29.90±0.48
Horse Dung + Gram Bran	24.29±0.63	27.42±0.98	30.66±0.74
Horse Dung + Straw	24.55±0.14	27.43±1.21	30.30±1.20
Horse Dung + Wheat Bran	27.00±1.24	30.87±0.59	33.17±0.73
Horse Dung + Rice Bran	22.38±0.53	25.30±0.63	28.00±0.63
Horse Dung + Vegetable Wastes	22.59±0.45	25.28±0.76	28.12±0.53
Horse Dung + Barley Bran	19.21±0.29	22.90±1.13	25.00±0.70

Table-4: Cont....

Days after sowing			Days after sowing		
40			50		
Concentration (mg / m ²)			Concentration (mg / m ²)		
10	20	30	10	20	30
22.30±0.62	22.30±0.62	22.30±0.62	30.91±0.64	30.91±0.64	30.91±0.64
26.79±0.83	29.00±0.78	32.14±0.96	32.09±0.29	35.35±0.92	38.00±0.73
30.78±1.21	33.05±1.28	36.00±0.98	42.33±0.83	45.15±1.12	48.30±0.96
33.08±0.96	36.00±1.13	39.36±0.74	47.80±0.92	50.22±1.09	53.19±1.17
30.00±0.71	33.23±1.04	36.44±0.45	40.60±0.53	43.66±1.20	46.07±1.03
41.89±0.64	44.42±1.08	48.00±0.83	53.14±1.13	57.30±0.43	60.00±1.13
41.74±0.53	45.65±1.17	48.88±1.19	52.00±1.12	55.07±0.85	58.21±0.83
34.38±1.18	37.40±0.39	40.56±1.21	47.77±0.93	50.50±0.84	53.74±1.21
23.00±1.21	25.40±0.76	28.00±0.98	32.56±0.80	35.25±0.53	38.10±1.24
40.10±0.68	43.18±0.67	46.89±1.29	60.17±0.78	63.43±0.76	66.48±0.88
30.33±0.74	33.23±0.74	36.54±0.72	48.20±0.64	51.43±0.68	54.66±0.81
43.27±0.68	46.50±1.13	49.44±1.13	60.00±0.52	63.18±0.79	66.30±0.73
24.19±0.99	27.83±1.24	30.36±1.19	37.03±1.18	40.70±0.88	43.80±0.48
26.80±1.13	29.19±0.73	32.30±1.21	40.00±1.09	47.30±1.12	50.00±1.23
32.57±0.98	35.10±0.64	38.21±0.83	52.70±1.21	55.28±1.23	58.37±1.31
24.03±0.72	27.10±0.29	30.44±0.39	34.93±0.83	37.08±0.84	40.16±1.06
26.37±1.14	29.10±0.55	32.31±0.48	31.13±0.45	34.37±0.43	37.48±0.53
23.35±1.09	26.83±1.13	29.40±0.47	30.30±0.59	33.32±0.64	36.20±0.69
27.68±1.22	30.70±1.09	33.84±0.38	37.86±0.57	40.93±0.79	43.00±0.76
37.40±0.67	40.43±1.21	43.32±0.67	47.90±0.81	50.30±0.83	53.45±0.94
37.54±0.63	40.28±0.83	43.48±1.13	52.28±0.70	55.37±0.91	58.00±0.49
39.26±0.45	42.42±0.72	45.33±0.91	46.27±1.25	59.02±1.18	62.76±0.98
23.70±1.13	25.25±0.45	28.63±0.94	27.88±1.13	30.76±1.14	33.36±1.18
37.00±1.39	40.42±0.67	43.60±1.10	49.12±0.86	52.47±1.09	55.77±1.09
27.06±0.74	30.20±0.92	33.55±0.38	37.56±0.93	40.73±0.80	43.92±1.23
21.00±0.59	24.55±0.42	27.40±0.80	31.83±0.94	34.57±0.91	37.18±0.83
32.29±0.55	35.20±1.29	38.31±0.92	38.00±0.81	41.40±0.93	44.21±0.74
39.40±1.19	41.45±0.91	44.39±0.66	48.77±0.62	51.60±0.70	54.00±0.65
31.42±0.29	34.55±0.34	37.60±0.52	42.02±0.51	45.35±0.62	46.00±0.54
43.84±0.39	46.00±0.82	49.03±0.38	58.97±0.43	61.20±0.38	64.34±0.49
41.27±0.63	44.50±0.93	47.31±0.92	67.69±0.72	70.45±0.65	73.59±0.53
33.44±0.93	36.28±1.13	39.12±0.69	46.19±0.63	49.97±0.74	52.86±0.62
37.96±0.62	40.72±0.73	47.41±0.91	55.58±0.45	58.30±1.03	61.45±0.38
39.90±1.14	42.45±0.62	45.61±0.45	57.49±1.08	60.28±0.62	63.37±1.13
38.45±1.09	41.20±0.81	44.83±0.42	65.90±1.13	68.82±0.38	71.88±0.94
28.00±0.83	31.43±1.13	34.66±1.08	51.83±0.89	58.77±0.29	61.00±0.71

Each value is the mean ± SE of six replicates. 2way ANOVA: Significant (P<0.05) * within column, # within row

Table- 5:- Effect of different concentration of vermiwash of different vermicomposts of different combinations of animal, agro and kitchen wastes on the flowering period (day) of wheat, gram, mustard, and pea.

Vermiwash	Crops			Crops		
	Wheat			Gram		
	Concentration (mg / m ²)			Concentration (mg / m ²)		
	10	20	30	10	20	30
Control	90.20±2.0	90.20±2.0	90.20±2.0	48.2±3.2	48.2±3.2	48.2±3.2
Cow Dung	82.4±2.1*	80.2±3.0*	78.2±2.1*	43.0±4.2	40.0±2.0	38.2±1.2
Cow Dung+ Gram Bran	77.6±2.0*	75.0±2.0*	73.4±1.2*	34.2±1.2*	31.0±2.2*	29.4±2.4*
Cow Dung+ Straw	84.8±2.5	82.0±1.0 *	80.2±1.4*	34.6±1.6*	31.4±1.0*	29.8±2.0
Cow Dung +Wheat Bran	72.6±1.6*	70.5±1.5*	68.2±2.2*	41.6±1.2*	39.2±1.5*	37.4±1.5*
Cow Dung +Rice Bran	82.2±2.1*	80.0±3.0*	78.4±2.6*	44.2±2.6	42.2±1.2	40.6±1.4*
Cow Dung + Vegetable wastes	85.4±1.5	83.0±2.0	81.2±1.2*	45.6±2.0	43.2±1.0	41.2±1.7*
Cow Dung + Barley Bran	78.8±1.4*	76.0±1.5*	74.2±2.4*	44.2±1.0	42.0±1.0	40.4±1.8*
Buffalo Dung	82.4±2.0*	80.0±1.0*	78.4±1.4*	42.6±2.4	40.0±2.0*	38.2±1.6*
Buffalo Dung +Gram Bran	80.4±2.4*	78.5±2.0*	76.2±1.5*	40.0±1.2	39.2±1.2*	37.4±2.0*
Buffalo Dung + Straw	82.2±1.2*	80.2±1.3*	78.2±1.2*	41.5±1.6*	39.5±1.4	37.8±2.1*
Buffalo Dung + Wheat Bran	76.4±1.4*	74.4±2.4*	72.4±1.3*	43.2±1.2	41.2±2.0*	39.2±1.6*
Buffalo Dung + Rice Bran	74.2±2.2*	72.2±1.2*	70.0±1.2*	44.4±1.6	42.0±2.1	40.4±1.8*
Buffalo Dung + Vegetable Wastes	81.2±1.5*	79.2±2.0*	77.0±1.4*	41.2±1.5*	39.0±0.0*	37.0±1.7*
Buffalo Dung + Barley Bran	80.4±2.1*	78.3±2.5*	76.2±2.6*	46.2±1.2	44.2±0.2	42.4±1.6
Goat Dung	82.6±2.1*	80.0±2.2*	78.8±1.6*	46.6±1.4	44.2±0.5	42.6±1.4
Goat Dung + Gram Bran	77.2±1.2*	75.2±1.5*	73.4±2.6*	41.2±2.1*	39.5±2.0*	37.5±2.6*
Goat Dung + Straw	78.4±2.3*	75.0±2.0*	73.2±1.7*	42.2±1.6	40.0±2.1*	38.2±2.1*
Goat Dung + Wheat Bran	76.5±1.2*	74.8±1.6*	72.6±1.2*	47.2±1.0	45.0±1.0	43.2±1.6
Goat Dung + Rice Bran	84.6±1.7	82.0±1.0*	80.2±2.1*	41.5±1.0*	39.5±1.2*	37.6±1.2*
Goat Dung + Vegetable Wastes	78.4±1.5*	76.2±2.0*	74.4±1.6*	47.2±2.0	45.0±1.0	43.2±2.1
Goat Dung + Barley Bran	79.2±2.1*	77.4±1.5*	75.2±2.1*	47.2±2.1	45.0±0.5	43.4±2.4
Sheep Dung + Gram Bran	80.2±1.8*	78.0±0.2*	76.2±1.6*	42.2±2.3	40.0±0.7*	38.6±2.4*
Sheep Dung + Gram Bran	78.4±2.3*	76.2±2.3*	74.2±1.5*	41.4±2.4*	39.5±1.2*	37.8±2.4*
Sheep Dung + Straw	77.2±1.6*	75.8±2.1*	73.4±1.5*	48.2±1.6	46.0±1.0	44.2±2.6
Sheep Dung + Wheat Bran	78.1±1.7*	76.3±2.3*	74.2±1.8*	44.6±1.5	42.0±1.0	40.6±1.6*
Sheep Dung+ Rice Bran	82.7±1.6	80.4±2.4*	78.2±1.6*	42.3±2.2	40.4±2.2*	38.2±2.4*
Sheep Dung + Vegetable Wastes	79.6±2.3*	77.0±2.3*	75.2±1.2*	42.0±1.2*	40.2±1.2*	38.4±2.6*
Sheep Dung + Barley Bran	79.4±2.4*	77.2±2.1*	75.4±1.6	47.4±1.6	45.0±2.2	43.2±2.4
Horse Dung	90.5±3.4	88.2±3.0	85.4±3.2	48.6±2.1	45.2±0.7	42.2±1.6
Horse Dung + Gram Bran	80.8±4.4	78.2±12*	75.6±2.4*	43.6±2.0	41.2±1.0*	39.4±2.1*
Horse Dung + Straw	85.2±2.3	82.0±2.1*	79.6±2.7*	41.4±1.2*	39.5±2.0	37.4±1.5*
Horse Dung + Wheat Bran	84.4±4.6	82.2±2.2*	80.2±1.5*	44.4±2.0	42.0±2.3	39.6±2.5*
Horse Dung + Rice Bran	82.6±3.6*	80.6±3.0*	98.3±2.5*	46.2±1.5	44.2±2.0	42.3±1.6
Horse Dung + Vegetable Wastes	84.4±2.5	81.7±1.0*	79.0±2.1*	47.4±2.0	45.2±1.0	43.6±2.5
Horse Dung + Barley Bran	80.2±2.4	78.5±2.1*	75.0±2.0*	46.2±2.1	44.2±1.2	42.3±1.5

Table- 5. Cont....

Crops			Crops		
Pea			Mustard		
Concentration (mg / m ²)			Concentration (mg / m ²)		
5	10	15	10	20	30
50.2±2.1	50.2±2.1	50.2±2.1	52.4±3.6	52.4±3.6	52.4±3.6
51.6±2.4	48.2±3.0	46.2±1.2	37.6±3.6*	35.2±2.6*	33.2±2.5*
44.8±2.4	42.4±2.3*	40.2±2.5*	30.2±3.2*	28.2±3.7 *	26.4±1.5*
43.6±1.5*	41.0±2.0*	39.4±2.2*	30.4±3.8*	28.6±4.2*	26.4±1.5*
51.4±2.5	48.4±1.2	46.2±1.4	32.6±2.4*	30.0±6.2*	28.2±2.5*
40.6±1.6*	38.2±1.4*	36.4±1.7*	32.8±2.4*	30.2±2.5*	28.9±3.5*
41.3±1.5*	39.4±1.2*	36.2±1.4*	36.2±2.8*	33.8±3.6*	31.2±1.5*
49.2±1.5*	47.2±0.2	45.4±2.7	36.3±2.4*	34.4±3.2*	32.4±1.2*
49.2±2.5	47.2±0.2	45.4±2.7	32.6±3.7*	30.4±2.8*	28.6±2.6*
39.6±2.7*	37.2±0.4*	35.8±2.6*	26.4±1.5*	24.4±3.7*	26.2±3.2*
46.8±2.8*	44.4±0.6*	42.2±2.6*	26.2±2.5*	24.3±2.4*	23.4±1.6*
39.6±2.8*	37.0±1.2*	35.2±1.6*	28.6±3.4*	26.4±2.6*	24.4±2.2*
48.2±1.6	46.0±1.4	44.6±2.4	28.4±3.5*	26.2±2.5*	24.2±2.8*
47.4±1.4	45.0±1.0	43.2±2.4	30.4±2.8*	28.4±3.6*	26.3±2.4*
45.2±1.6	43.2±1.4*	41.6±2.7*	31.2±2.5*	29.2±2.4 *	27.4±1.2*

50.8±1.8	48.0±1.0	46.0±2.0	43.2±3.6*	41.2±3.8*	39.2±1.5*
50.2±2.5	48.2±1.4	46.2±2.7	34.6±2.5*	32.4±2.6*	30.8±1.6*
50.2±2.4	48.0±1.6	46.4±2.5	35.8±2.8*	33.6±2.5*	31.2±2.4*
43.6±1.4*	41.2±1.2*	39.2±1.7*	37.2±2.1*	35.8±3.7*	33.7±2.6*
45.4±2.5	48.0±1.0	46.2±1.4	38.2±1.6*	36.4±2.4*	34.3±1.8*
41.2±1.6*	39.0±2.0*	37.0±2.4*	40.6±2.3*	38.2±2.4*	36.6±2.7*
39.2±2.5*	37.2±1.5*	35.3±2.3*	40.2±2.4*	8.6±2.6*	36.9±2.6*
50.6±1.6	48.5±2.1	46.3±1.4	42.3±3.4*	40.5±3.8*	38.4±2.1*
44.6±2.5	42.2±2.0*	40.1±1.7*	34.6±3.8*	32.4±3.6*	30.6±2.8*
48.3±2.4	46.2±1.6	44.2±2.6	35.6±1.5*	33.4±1.5*	31.1±1.5*
49.4±2.0	47.2±1.0	45.3±1.5	38.4±3.3*	36.2±2.6*	34.3±1.4*
48.6±2.1	46.2±1.2	44.4±1.7	37.6±2.5*	35.2±3.8*	33.8±4.2*
43.7±1.8*	41.4±1.0*	39.2±2.4*	39.2±2.2*	37.2±2.5*	35.3±2.6*
50.2±1.2	48.4±1.4	46.3±2.1	40.2±2.5*	38.4±4.3*	36.2±2.5*
39.2±1.2*	36.2±2.4*	35.2±1.2*	33.2±2.6*	31.6±2.8*	29.3±1.5*
37.8±2.5*	35.3±2.0*	34.7±2.3*	27.4±3.6*	25.2±2.4*	24.3±1.3*
50.2±2.2	46.5±2.2	42.2±1.6*	28.6±2.4*	26.8±3.6*	24.2±3.7*
38.5±2.1*	36.2±2.3*	35.2±2.1*	30.0±2.3*	27.8±3.2*	25.2±2.5*
38.4±2.2*	36.2±1.0*	35.4±1.2*	30.7±1.6*	28.6±2.6*	26.4±3.4*
38.6±2.4*	36.0±2.0*	35.2±1.3*	32.6±2.5*	30.6±3.6*	28.4±2.5*
39.3±2.0*	37.0±2.3*	35.3±1.2*	32.4±3.8*	30.3±2.8*	28.6±3.6*

Each value is the mean ± SE of six replicates. 2way ANOVA: Significant (P<0.05) * within column, # within row

Table -6:- Effect of different concentration of vermiwash of different vermicomposts of different combinations of animal, agro and kitchen wastes on the productivity (Kg/m²) of wheat, gram, mustard, and pea.

Vermiwash	Crops Wheat			Crops Gram		
	Concentration (mg / m ²)			Concentration (mg / m ²)		
	10	20	30	10	20	30
Control	0.13±0.02	0.13±0.02	0.13±0.02	0.12±0.01	0.12±0.01	0.12±0.01
Cow Dung	# 0.21±0.02	0.25±0.02	0.30±0.01	*0.25±0.02	0.30±0.00	0.35±0.02
Cow Dung+ Gram Bran	*0.40±0.04	0.50±0.02	0.55±0.02	0.24±0.02	0.28±0.01	0.39±0.01
Cow Dung+ Straw	0.21±0.02	0.30±0.04	0.36±0.05	0.22±0.01	0.28±0.02	0.36±0.03
Cow Dung +Wheat Bran	0.37±0.04	0.43±0.01	0.45±0.03	0.29±0.03	0.35±0.03	0.40±0.04
Cow Dung +Rice Bran	0.28±0.04	0.32±0.08	0.36±0.04	0.22±0.03	0.27±0.04	0.31±0.03
Cow Dung + Vegetable wastes	0.29±0.05	0.31±0.09	0.34±0.01	0.21±0.04	0.25±0.05	0.14±0.03
Cow Dung + Barley Bran	0.39±0.08	0.42±0.08	0.47±0.02	0.21±0.03	0.26±0.06	0.33±0.07
Buffalo Dung	# 0.27±0.06	0.30±0.07	0.35±0.02	*0.25±0.02	0.30±0.07	0.36±0.07
Buffalo Dung +Gram Bran	*0.37±0.03	0.43±0.037	0.49±0.05	0.20±0.01	0.36±0.08	0.43±0.08
Buffalo Dung + Straw	0.30±0.02	0.34±0.02	0.39±0.04	0.26±0.04	0.32±0.06	0.37±0.01
Buffalo Dung + Wheat Bran	0.49±0.02	0.52±0.07	0.37±0.05	0.22±0.04	0.28±0.09	0.33±0.02
Buffalo Dung + Rice Bran	0.50±0.01	0.55±0.01	0.61±0.06	0.23±0.01	0.28±0.09	0.34±0.01
Buffalo Dung + Vegetable Wastes	0.38±0.07	0.41±0.01	0.44±0.09	0.33±0.02	0.36±0.0	0.41±0.03
Buffalo Dung + Barley Bran	0.38±0.06	0.43±0.02	0.49±0.08	0.15±0.04	0.21±0.067	0.37±0.02
Goat Dung	#0.30±0.05	0.34±0.05	0.38±0.09	#0.17±0.01	0.23±0.06	0.29±0.24
Goat Dung + Gram Bran	*0.34±0.06	0.46±0.08	0.49±0.05	*0.29±0.02	0.34±0.07	0.38±0.04
Goat Dung + Straw	0.42±0.07	0.50±0.04	0.59±0.08	0.24±0.04	0.33±0.05	0.40±0.06
Goat Dung + Wheat Bran	0.43±0.08	0.57±0.03	0.62±0.06	0.17±0.05	0.22±0.05	0.38±0.07
Goat Dung + Rice Bran	0.30±0.08	0.34±0.03	0.40±0.03	0.28±0.06	0.34±0.06	0.39±0.09
Goat Dung + Vegetable Wastes	0.42±0.08	0.45±0.04	0.47±0.03	0.18±0.02	0.22±0.07	0.26±0.09
Goat Dung + Barley Bran	0.38±0.06	0.43±0.05	0.50±0.01	0.16±0.01	0.20±0.02	0.27±0.06
Sheep Dung + Gram Bran	#0.40±0.07	0.43±0.05	0.47±0.02	#0.24±0.06	0.30±0.01	0.37±0.02
Sheep Dung + Gram Bran	*0.38±0.05	0.43±0.01	0.50±0.02	*0.28±0.05	0.32±0.02	0.38±0.03
Sheep Dung + Straw	0.43±0.05	0.48±0.01	0.49±0.25	0.16±0.02	0.21±0.03	0.37±0.03
Sheep Dung + Wheat Bran	0.31±0.04	0.45±0.06	0.52±0.05	0.23±0.04	0.28±0.03	0.35±0.04
Sheep Dung+ Rice Bran	0.27±0.05	0.32±0.07	0.38±0.06	0.26±0.05	0.31±0.07	0.37±0.01
Sheep Dung + Vegetable Wastes	0.30±0.03	0.43±0.08	0.46±0.01	0.29±0.01	0.32±0.04	0.35±0.03
Sheep Dung + Barley Bran	0.37±0.05	0.42±0.09	0.45±0.02	0.17±0.02	0.21±0.03	0.27±0.03

Horse Dung	#0.37±0.02	0.42±0.02	0.57±0.05	#0.21±0.01	0.26±0.04	0.30±0.04
Horse Dung + Gram Bran	*0.40±0.03	0.44±0.02	0.60±0.05	*0.25±0.01	0.29±0.04	5.35±0.03
Horse Dung + Straw	0.35±0.03	0.40±0.04	0.46±0.03	0.29±0.07	0.34±0.04	0.39±0.06
Horse Dung + Wheat Bran	0.35±0.03	0.41±0.03	0.46±0.03	0.24±0.01	0.30±0.03	0.25±0.06
Horse Dung + Rice Bran	0.38±0.02	0.42±0.04	0.47±0.03	0.21±0.08	0.25±0.02	0.30±0.03
Horse Dung + Vegetable Wastes	0.35±0.07	0.39±0.04	0.44±0.04	0.19±0.09	0.23±0.02	0.27±0.04
Horse Dung + Barley Bran	0.42±0.02	0.45±0.05	0.49±0.05	0.18±0.09	0.27±0.01	0.29±0.01

Table-6: Cont....

Crops			Crops		
Pea			Mustard		
Concentration (mg / m ²)			Concentration (mg / m ²)		
5	10	15	10	20	30
0.10±0.04	0.10±0.01	0.10±0.01	0.31±0.02	0.31±0.02	0.31±0.02
# 0.25±0.03	0.31±0.00	0.35±0.02	# 0.31±0.02	0.36±0.02	0.43±0.02
*0.22±0.03	0.27±0.00	0.33±0.06	*0.40±0.08	0.45±0.01	0.49±0.02
0.18±0.04	0.24±0.01	0.29±0.09	0.39±0.06	0.45±0.02	0.59±0.08
0.11±0.06	0.27±0.02	0.31±0.03	0.39±0.05	0.44±0.03	0.54±0.02
0.22±0.05	0.29±0.00	0.34±0.01	0.41±0.05	0.46±0.03	0.50±0.01
0.32±0.09	0.35±0.06	0.39±0.02	0.41±0.06	0.44±0.04	0.49±0.02
0.23±0.06	0.28±0.09	0.33±0.01	0.40±0.09	0.44±0.05	0.49±0.02
*0.29±0.07	0.34±0.09	0.33±0.01	#0.29±0.00	0.35±0.08	0.48±0.06
0.20±0.06	0.26±0.01	0.30±0.01	*0.46±0.01	0.50±0.07	0.57±0.09
0.26±0.07	0.32±0.04	0.45±0.10	0.45±0.02	0.50±0.06	0.59±0.08
0.24±0.06	0.30±0.03	0.34±0.01	0.45±0.03	0.50±0.05	0.57±0.05
0.22±0.09	0.27±0.04	0.21±0.22	0.40±0.01	0.45±0.01	0.51±0.06
0.27±0.08	0.30±0.09	0.33±0.05	0.42±0.02	0.45±0.01	0.50±0.06
0.25±0.09	0.30±0.08	0.36±0.02	0.43±0.09	0.49±0.09	0.55±0.09
#0.22±0.01	0.28±0.09	0.35±0.04	#0.34±0.06	0.40±0.06	0.46±0.05
*0.22±0.02	0.26±0.06	0.33±0.09	*0.32±0.01	0.38±0.08	0.45±0.02
0.23±0.03	0.28±0.05	0.33±0.07	0.31±0.06	0.36±0.02	0.48±0.01
0.21±0.04	0.68±0.05	0.32±0.08	0.39±0.07	0.43±0.03	0.50±0.03
0.27±0.04	0.32±0.09	0.36±0.06	0.43±0.07	0.48±0.01	0.59±0.04
0.28±0.01	0.30±0.07	0.35±0.02	0.44±0.06	0.47±0.04	0.51±0.03
0.16±0.01	0.20±0.06	0.27±0.04	0.46±0.08	0.50±0.04	0.59±0.05
#0.16±0.02	0.20±0.08	0.25±0.03	#0.28±0.07	0.34±0.05	0.37±0.11
*0.16±0.03	0.20±0.01	0.27±0.01	*0.43±0.06	0.49±0.06	0.54±0.12
0.25±0.02	0.30±0.02	0.37±0.02	0.37±0.01	0.43±0.06	0.50±0.05
0.19±0.06	0.24±0.08	0.28±0.02	0.31±0.02	0.36±0.01	0.46±0.02
0.24±0.07	0.29±0.03	0.35±0.04	0.38±0.05	0.44±0.02	0.49±0.10
0.23±0.01	0.27±0.02	0.31±0.01	0.47±0.04	0.51±0.07	0.54±0.00
0.20±0.03	0.27±0.01	0.31±0.04	0.40±0.01	0.45±0.09	0.53±0.10
#0.25±0.01	0.30±0.01	0.36±0.01	*0.40±0.04	0.52±0.02	0.68±0.04
*0.30±0.00	0.36±0.01	0.39±0.03	0.42±0.06	0.54±0.08	0.66±0.02
0.27±0.01	0.31±0.01	0.35±0.04	0.40±0.02	0.50±0.06	0.58±0.00
0.31±0.04	0.35±0.02	0.41±0.02	0.49±0.00	0.52±0.09	0.60±0.09
0.30±0.04	0.35±0.03	0.39±0.01	0.47±0.06	0.51±0.05	0.60±0.01
0.23±0.03	0.27±0.08	0.31±0.05	0.49±0.08	0.52±0.02	0.60±0.02
0.16±0.04	0.29±0.05	0.34±0.04	0.45±0.09	0.49±0.02	0.56±0.08

Each value is the mean ± SE of six replicates. 2way ANOVA: Significant (P<0.05) * within column, # within row

DISCUSSION:

It is evident from the results that the vermiwash of different vermicomposts have time and dose dependent significant effect on the growth, flowerination period and productivity of wheat, gram pea and mustard crops. In a preliminary study Edwards and Fletcher, 1998; Nath and Singh, 2009; Nath et al., 2009a, 2009b reported in the microbial activity in vermicomposts could result in production of significant quantity of

plant growth regulators such as IAA, gibberellins, cytokinins, by microorganisms. Large amount of humic acid were produced during vermicomposting and these had been reported to have positive effects on plant growth (Atiyeh et al., 2002; Manivannan, 2004; Ramamoorthy, 2004; Nath and Singh, 2012). Vermicomposts had been shown to influence the growth and productivity of a variety of plants, cereals and legumes (Chan and Griffith, 1988), vegetable

(Edwards and Burrows, 1988; Atiyeh et al., 1999, 2001). Ornamental and flowering plants (Edwards and Burrows, 1988), field crops (Mba, 1996; Buckerfield and Webster, 1998). Atiyeh et al., (2001) have shown that vermicomposts when in bedding media had improved seed germination, enhanced the seedling growth and increased overall plant productivity. They have further shown that the greatest response from the plants could be observed only when the vermicompost was used at 10-40 % of the volume of plant growth medium. Parthasarathi and Rangnathan, (2000) have reported that supplementation of N.P.K. with pressmud vermicast had enhanced the growth and yield in black gram (*Vigna mungo*) and groundnut (*Arachis hypogaea*). Vermicompost had enhanced the germination rate in seeds (Edwards and Bohlen, 1996; Sevugaperumal et al., 1998; Parthasarathi and Rangnathan, 2000). Atiyeh et al., (2001) reported that increases in the rate of germination, growth and yield of tomato plants. Subler et al., (1998) demonstrated that improvement in the germination and growth of petunias, merigold, bachelor buottns, poinsettias, bell peppers and tomatoes in response to vermicompost substitution in to bedding plant container media. Data emerging from present study, it have concluded that vermiwash of different combination of animal, agro and kitchen waste is one of the better manure for foliar spray on the crops of wheat, gram, pea and mustard; which give significant increase in the growth and productivity and significant early flowerination.

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