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INFLUENCE OF ORGANIC AND CHEMICAL FERTILIZERS ON GROWTH AND YIELD ATTRIBUTES OF PEARL MILLET (*PENNISETUM AMERICANUM L*) CROP

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ABSTRACT

Field experiment was carried out at outdoor nursery of Solapur University, Solapur, Maharashtra. The experimental design was laid out in randomized block design with five treatments and replicated three times with recommended dose of fertilizer in a plot size of 2 m x 1 m. Treatment consist of vermicompost (T_1), NADEP compost (T_2), pit compost (T_3), chemical fertilizers (T_4) was applied in the proportion 50:25:25 kg of NPK/ha according to recommended dose of fertilizers and control (T_5). Vermicompost (T_1), NADEP (T_2) and pit (T_3) organic fertilizer were used at same rate @ 1.25 kg (@ 0.625 kg/sq. m) in plot size 2m x1m as per usual practice of farmers. Straight chemical fertilizers (Urea-21.7gm + Single super phosphate – 31.25gm + Murate of potash – 8.3gm) combinally used in Treatment T_4 having plot size 2m x 1m. The highest height of Pearl millet crop (118.33cm/plant) was observed in vermicompost treatment (T_1) and lowest plant height (79.11cm/plant) was observed in control treatment (T_5) after 120th day. The highest length of fruits Pearl millet (15.99cm/plant) was observed in vermicompost treatment (T_1) and lowest length of fruits Pearl millet (11.91cm/plant) was observed in control treatment (T_5) after 120th day. The highest mean weights of fruits (12.56gm/plant) was observed in NADEP compost treatment (T_2) and lowest value (9.12gm/plant) was observed in control treatment (T_5) after 120th day. The highest dry weight of 100 seeds (gm) of Pearl millet crop (1.96gm) was observed in chemical fertilizer treatment (T_4) and lowest dry weight of 100 seeds (gm) of Pearl millet crop (1.33gm) was observed in control treatment (T_5) after 120th day. The highest fruit yield/plot of Pearl millet crop (0.726kg/plot) was observed in vermicompost treatment (T_1) and lowest value (0.434 kg/plot) was observed in control treatment (T_5) after 120th day. The highest grain yield/plot of Pearl millet crop (0.28 kg/plot) was observed in vermicompost treatment (T_1) and lowest value (0.21 kg/plot) was observed in control treatment (T_5) after 120th day.

Keywords: *Fertilizers, growth, Pearl millet, treatment, vermicompost, yield*

INTRODUCTION

Pearl millet *(Pennisetum glaucum L.*) is an important cereal grain crop ranking as sixth most in world. (Singh et al., 2003). Pearl millet *(Pennisetum glaucum L.)* grows in the agricultural field of low fertility soil, zero application fertilizer and low water holding capacity (Gabatshele et al., 2014). It require low nutrient demand but, could produce appreciable yields with adequate nutrients supply (Maman et al., 2000). The organic residues are used in agricultural practices for the maintenance of fertility level. The organic manure contains macro and micro nutrient which are needed to improve physicochemical and biological properties of soil. (Lakum et al., 2011). Applications of chemical fertilizers in agriculture produced ecological problems, and also it degraded physico-chemical and biological qualities of soil and finely it leads to low crop yields (Abdullahi et al, 2014). Farmers want to ensure good crop yield by using more than the recommended rates, and apply so much such that it has a residual effect on both the soil and the crop. Apart from that, a large amount of excess fertilizer application may be wasted through leaching which may pollute rivers and meet to the fresh water systems (Tankou, 2004). Mostly, the soil upon which we grow our crops does not contain enough of these nutrients to support good growth and development. In such cases, we must supplement the nutrient deficiencies by supplying substances which provide these nutrients known as fertilizers (Uriyo, 1979). As the fertilizer rates are increased, the efficiency of fertilizer nutrient use decreases, leaving behind in the soil an increasing proportion of the added nutrients. When nutrient content of the soil is already sufficient, adding fertilizer to the soil is likely to be damaging to both the soil and the crop (Loks et al, 2014). The aim of this research paper is to access the effect of different fertilizer treatment on growth and yield parameters of Pearl millet (*Pennisetum glaucum L.*) crop.

Materials and methods:

The effects of organic and chemical fertilizers were tested on Pearl millet (*Pennisetum glaucum L.*) vegetable. The experimental design was laid out in randomized block design with five treatments and replicated three times with recommended dose of fertilizer in a plot size of 2m x 1m. Treatment consist of vermicompost (T_1), NADEP compost (T_2), pit compost (T_3), chemical fertilizers (T_4) was applied in the proportion 50:25:25 Kg of NPK/ha according to recommended dose of fertilizers and control (T_5). Vermicompost (T_1), NADEP (T_2) and pit (T_3) organic fertilizer were used at same rate @ 1.25kg/plot (@ 0.625kg/sq. m) in plot size 2m x1m as per usual practice of farmers. Straight chemical fertilizers (Urea-21.7gm+single super phosphate–31.25gm+murate of potash – 8.3gm) combinally used in Treatment T_4 having plot size 2 m x 1 m. Total 44 seeds were sown in each plot. Drip irrigation system was used in whole study work of field. The yield and growth characters of Pearl millet *(Pennisetum glaucum L.*) were observed at 120th day from the date of planting.

Experimental details and cultivation practice for Pearl millet (Bajara) crop were described bellow

Experimental details and cultivation practice for Pearl millet crop	
Botanical name:	*Pennisetum americanum L.*
Local name:	Bajara (In Marathi)
Varity:	Local
Experiment:	Field
Design:	Randomized block design
Plot size:	2m × 1m ($2m^2$)
Replications:	Three
Treatments:	Five
Crop population:	44 (Crop spacing 60cm X 20cm), (Krushidarshani, 2014)

Fertilizer treatment details:		
T_1	:	Vermicompost prepared from agricultural solid waste@ 6.25 t/ha, (Aryal and Tamrakar, 2013).
T_2	:	NADEP organic fertilizer prepared from agricultural solid waste @ 6.25 t/ha, (Aryal and Tamrakar, 2013).
T_3	:	Pit organic fertilizer prepared from municipal solid waste @ 6.25 t/ha, (Aryal and Tamrakar, 2013).
T_4	:	Chemical fertilizer- 50:25:25 - N: P_2O_5: K_2O Kg/ha**,** (Krushidarshani, 2014).
T_5	:	Control
Quantity of fertilizers used in plot size 2 m × 1 m		
T_1	:	@ 1.25 kg/plot (@ 0.625 kg/sq. m)
T_2	:	@ 1.25 kg/plot (@ 0.625 kg/sq. m)
T_3	:	@ 1.25 kg/plot (@ 0.625 kg/sq. m)
T_4	:	According to Recommended dose of fertilizer (Urea 21.7gm+single super phosphate 31.25gm+ murate of potash 8.3gm)
T_5	:	Control

Result and discussion:

All the all values of nutrients found after their analysis in laboratory using known standard methods for prepared organic fertilizers and experimental soil are represented in table no. 1.

Table 1. Soil and organic fertilizers characteristics.

Parameters	Soil	T_1	T_2	T_3
pH	08.14	8.04	7.67	7.12
Moisture (%)	8.10	30.27	18.35	05.35
Org. matter (%)	1.00	16.39	11.76	11.30
N (%)	0.32	1.06	0.92	0.81
P (%)	0.27	1.52	1.06	0.20
K (%)	0.11	1.06	1.91	0.86

T_1 indicates vermicompost, T_2 indicates NADEP compost and T_3 indicates Pit compost

The yield and growth characters of Pearl millet were observed at 120th day from the date of planting.

Table 2
Effects of fertilizer treatment on growth components of Pearl millet after 120th day

Treatments	Mean plant height (cm/plant)	Mean length of fruits/plant (cm/plant)	Mean weights of fruit/plant (gm/plant)	Dry weight of 100 seeds (gm)	Fruit yield/plot (kg/plot)	Grain yield/plot (kg/plot)
T_1	118.33	15.99 (±1.85)	12.47 (±8.87)	1.94	0.726	0.28
T_2	110.7	14.74 (±3.21)	12.56 (±3.47)	1.88	0.609	0.25
T_3	101.25	13.94 (±3.94)	12.49 (±3.35)	1.63	0.536	0.22
T_4	95.33	12.85 (±1.91)	12.05 (±0.84)	1.96	0.614	0.24
T_5	79.11	11.91 (±0.56)	9.12 (±1.95)	1.33	0.434	0.21

T_1 indicates vermicompost, T_2 indicates NADEP compost, T_3 indicates pit compost, T_4 indicates chemical fertilizers and, T_5 indicates control. The bracket values represent standard deviation.

Plant height (cm/plant) after 120th days:

Plant height of Pearl millet crop was observed (without damaging the crop system) in each research plot. Average plant height (cm) in the treatments T_1, T_2, T_3, T_4 and T_5 were found to

be 118.33cm, 110.7cm, 101.25cm, 95.33cm and 79.11cm respectively (Fig. no. 01). The highest plant height (118.33 cm/plant) was observed in vermicompost treatment (T_1) followed by NADEP compost treatment (T_2.). The minimum plant height (101.25 cm/plant) was observed with application of pit compost (T_3) and lowest value (79.11 cm/plant) was observed in control treatment (T_5) after 120th day.

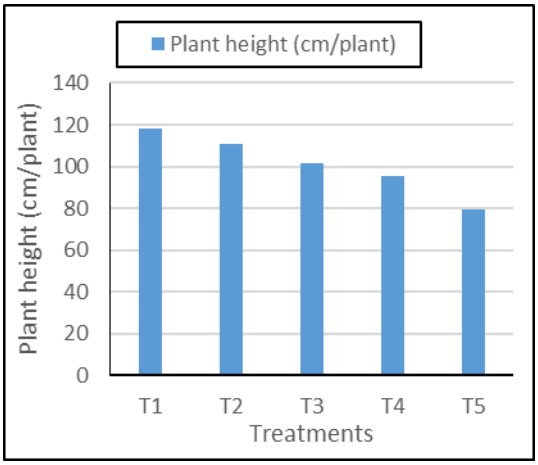


Fig. no.01: Effects of fertilizer treatments on plant height (cm/plant) of Pearl millet crop after 120th days

Length of fruits/plant (cm/plant) after 120th days:

Length of fruits (cm/plant) of Pearl millet crop in the treatments T_1, T_2, T_3, T_4 and T_5 were found to be 15.99cm (±1.85), 14.74cm (±3.21), 13.94cm (±3.94), 12.85cm (±1.91) and 11.91cm (±0.56) respectively (Fig. no. 02). The highest length of fruits (15.99cm/plant) was observed in vermicompost treatment (T_1) followed by NADEP compost treatment (T_2). The minimum length of fruits (13.94cm/plant) was observed with pit compost treatment (T_3) and lowest value (11.91 cm/plant) was observed in control treatment (T_5).

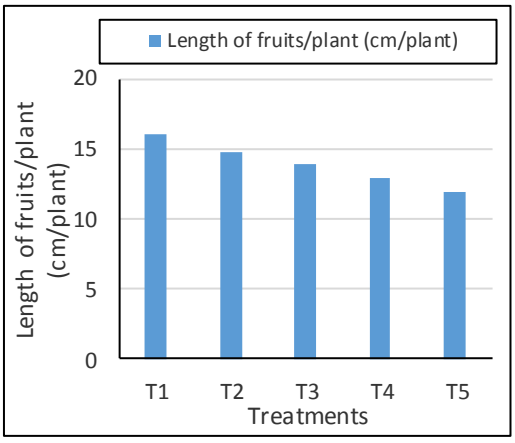


Fig. no.02: Effects of fertilizer treatments on length of fruits of Pearl millet crop after 120th days

Weights of fruit/plant (gm/plant) after 120th days:

Mean weights of fruit (gm/plant) of Pearl millet crop was observed at harvesting time (after 120th day). Mean weights of fruits (gm/plant) in the treatments T_1, T_2, T_3, T_4 and T_5 were found to be 12.47gm (±8.87), 12.56gm (±3.47), 12.49gm (±3.35), 12.05gm (±0.84) and 9.12gm (±1.95) respectively (Fig. no. 03). The highest mean weights of fruits (12.56gm/plant) was observed in NADEP compost treatment (T_2) followed by treatment pit compost treatment (T_3). The minimum mean weights of fruit (12.47gm/plant) was observed with application of vermicompost (T_1) and lowest value (9.12gm/plant) was observed in control treatment (T_5) after 120th day.

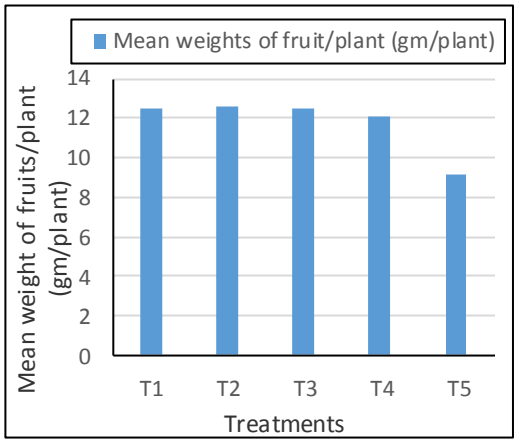
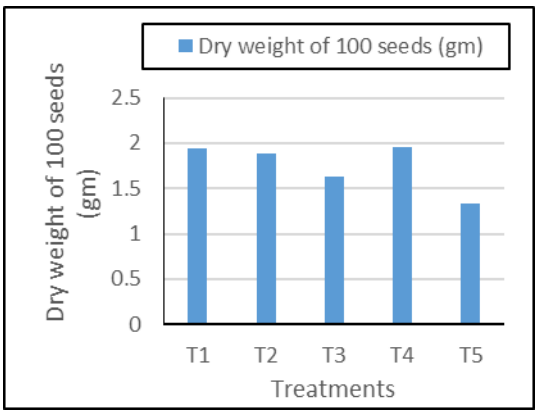


Fig. no.03: Effects of fertilizer treatments on mean weights of fruit/plant (gm/plant) of Pearl millet crop after 120th days

Dry weight of 100 seeds (gm) after 120th days:

Dry weight of 100 seeds (gm) of Pearl millet crop was observed at harvesting time (after 120th day). Dry weight of 100 seeds (gm) of Pearl millet crop in the treatments T_1, T_2, T_3, T_4 and T_5 were found to be 1.94gm, 1.88gm, 1.63gm, 1.96gm and 1.33gm respectively (Fig. no. 04). The highest dry weight of 100 seeds (gm) of Pearl millet crop (1.96gm) was observed in chemical fertilizer treatment (T_4) followed by vermicompost treatment (T_1). The minimum dry weight of 100 seeds (gm) of Pearl millet crop (1.88 gm) was observed with application of NADEP compost treatment (T_2) and lowest value (1.33gm) was observed in control treatment (T_5) after 120th day.



.Fig. no.04: Effects of fertilizer treatments on dry weight of 100 seeds of Pearl millet crop after 120th days

Fruit yield/plot (kg/plot) after 120th days:

Fruit yield/plot of Pearl millet crop was observed at harvesting time (after 120thday). Fruit yield/plot (kg/plot) of Pearl millet crop in the treatments T_1, T_2, T_3, T_4 and T_5 were Fruit yield/plot 0.726kg/plot, 0.609kg/plot, 0.536kg/plot, 0.614kg/plot and 0.434kg/plot respectively (Fig. no. 05). The highest fruit yield/plot of Pearl millet crop (0.726kg/plot) was observed in vermicompost treatment (T_1) followed by chemical fertilizer treatment (T_4). The minimum fruit yield/plot of Pearl millet crop (0.609 kg/plot) was observed with application of NADEP compost treatment (T_2) and lowest value (0.434 kg/plot) was observed in control treatment (T_5) after 120th day.

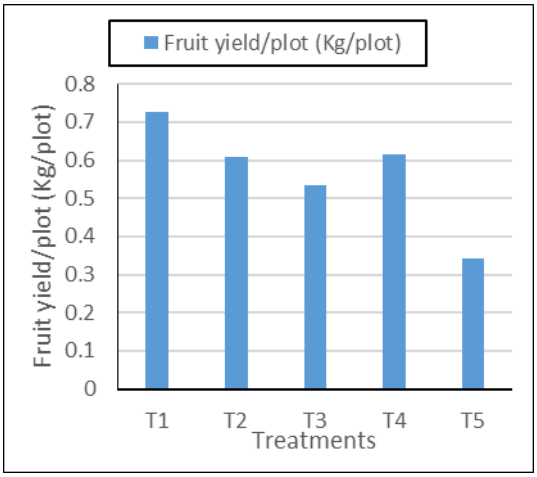


Fig. 5: Effects of fertilizer treatments on fruit yield of Pearl millet crop after

Grain yield/plot:

Grain yield/plot (kg/plot) of Pearl millet crop in the treatments T_1, T_2, T_3, T_4 and T_5 were found to be 0.28kg/plot, 0.25kg/plot, 0.22kg/plot, 0.24kg/plot and 0.21kg/plot

respectively (Fig. no. 06). The highest grain yield/plot of Pearl millet crop (0.28 kg/plot) was observed in vermicompost treatment (T_1) followed by chemical fertilizer treatment (T_4). The minimum grain yield/plot of Pearl millet crop (0.24 kg/plot) was observed with application of NADEP compost treatment (T_2) and lowest value (0.21 kg/plot) was observed in control treatment (T_5) after 120th day.

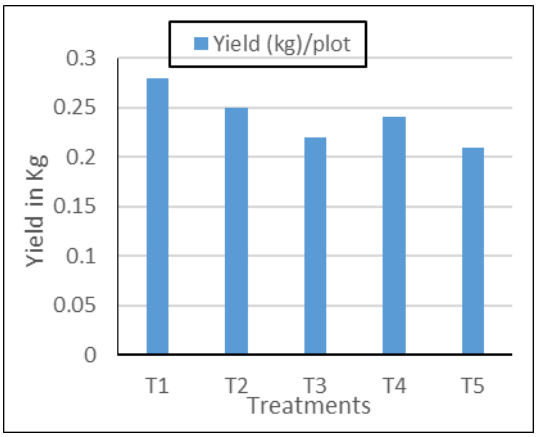


Fig. no. 06: Effects of fertilizer treatments on grain yield of Pearl millet crop after 120 days

CONCLUSION:

The study reveals that implementation of vermicompost fertilizer is the best fertilizer treatment for improving the production of Pearl millet in field trial. Therefore, it is advisable to prefer vermicompost over chemical fertilizer for growing Pearl millet crop.

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