



## Effect of Seriwaste Vermi Compost as a Substitute for Inorganics on Growth, Yield and Economics of Hybrid Maize

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Field experiments were conducted for two years during Kharif 2010 to 2011 at Agricultural Research Station (ARS), TNAU, Bhavanisagar, Tamil Nadu under irrigated eco-system to study the influence of seriwaste vermicompost as a substitute for inorganic fertilizer on productivity and economics of hybrid maize (CoH(M)-5). The experiments were laid out in RBD with three replications. The results indicated that 50% recommended dose of fertilizer (RDF) + 50% seriwaste vermicompost (2.5 tonnes/ha) registered higher yield attributes and yield with increased net return and B:C ratio in hybrid maize. This was closely followed by 25% RDF + 75% seriwaste vermicompost (3.25 tonnes/ha) as compared to either 100% inorganics or organics alone.

**Key words:** Seri waste, inorganics, yield, economics, nutrient uptake, hybrid maize

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Maize (*Zea mays L.*) is one of the most important cereal crop grown all over the globe for food and feed for cattle and poultry feed. In India, Maize contributes nearly 8.0 per cent to the national food basket and more than Rs.100 billion to the agricultural GDP at current prices apart from providing employment to over 100 million man days at the farm downstream agricultural and industrial sectors (Crop Report, 2009 – 2010).

Seriwaste vermicompost is used only in mulberry for several years to increase the yield and to produce healthy leaves to improve the silk yield. Using the seriwaste vermicompost to the field crops to increase their yield and quality of the food grains is a new trend. In recent years, recycling of crop residues has received considerable interest. In sericulture farms, the left over mulberry leaves from rearing bed and field and other waste including silk worm litter are not properly utilized in preparing compost of highly organic and nutritive value. The mixed sericultural farm wastes (silkworm rearing wastes, leftover mulberry leaves, green twigs, farm weeds etc.) can be composted following anaerobic decomposition technique as called seriwaste vermicompost.

Information on the direct effect of these organic manures coupled with inorganic fertilizers on the yield of maize crop and economics are very meagre. Hence, this study was contemplated in hybrid maize (CoH(M)5) under irrigated garden land conditions to find out the influence of seriwaste vermicompost on growth and yield of hybrid maize.

### Materials and Methods

Field experiments were conducted during 2010 to 2011, with a view to study the effect of seriwaste vermicompost utilization on growth, yield and economics of hybrid maize at Agricultural Research

Station, Bhavanisagar, Tamil Nadu Agricultural University. The experimental field was geographically situated at 11°N latitude and 77°E longitude with 256 metres above mean sea level in Erode district, Tamil Nadu. Soil characteristics of the experimental field were: Coarse sand (37.5 %), Fine (26.5 %), Silt (12.3 %), Clay (23.7 %), Texture (Sandy clay loam). Single value constants: Bulk density ( $1.42 \text{ mg m}^{-3}$ ), Particle density ( $2.21 \text{ mg m}^{-3}$ ) and Water holding capacity (39.2 %). Chemical properties like Organic carbon (0.45 %), Available nitrogen ( $195 \text{ kg ha}^{-1}$ ), Available phosphorus ( $18.5 \text{ kg ha}^{-1}$ ), Available potassium ( $560 \text{ kg ha}^{-1}$ ), pH 8.4 and EC ( $0.3 \text{ dSm}^{-1}$ ). The Seriwaste vermicompost contains N 2.90, P 0.94, K 1.70, Protein 19.06, Ca 1.66, Mg 0.71 and Su 0.29 %. The experiment was laid out in Randomized Block Design with three replications. The treatments comprised of T<sub>1</sub> - 100% of Recommended Dose of Fertilizer (RDF) (100:75:75 N: P<sub>2</sub>O<sub>5</sub>: K<sub>2</sub>O kg ha<sup>-1</sup>); T<sub>2</sub> - 75% of RDF + 25% Seriwaste compost; T<sub>3</sub> - 50% of RDF + 50% Seriwaste compost; T<sub>4</sub> - 25% of RDF + 75% Seriwaste compost; T<sub>5</sub> - Seriwaste compost 100% (5 t/ha); T<sub>6</sub> - Vermicompost 100% (5 t/ha); T<sub>7</sub> - Seriwaste compost 50% + Vermicompost 50%; T<sub>8</sub> - Absolute control. Seriwaste vermicompost was prepared as per the standard recommended procedure. All the fertilizers and organics including FYM were applied basally as per the recommended procedure and applied as per the treatment schedule.

Observations on growth, yield attributes and yield of hybrid maize and uptake of nutrients were recorded and subjected to statistical analysis. Economics was also worked out for various treatmental combinations.

## **Results and Discussion**

### ***Effect on growth and yield parameters of hybrid maize***

The plant height, Leaf area index (LAI) and

dry matter production (DMP) of hybrid maize were influenced by the application of organic manures and inorganic fertilizer levels (Table 1). Among the treatment combinations, application of 50% RDF +

50% seriwaste vermicompost (T<sub>7</sub>) recorded taller plants (100.90 cm) with higher LAI (3.36) and DMP (7392 kg/ha) at 60 DAS which was on par with 25% RDF + 75% seriwaste compost (T<sub>4</sub>).

**Table 1. Effect of treatments on growth, yield attributes and yield of hybrid maize (mean of two years)**

Treatment	Plant Height		DMP (kg/ha) (60 DAS)	Cob weight (g)	Cob length (cm)	100 grain weight (g)	Grain yield (kg/ha)	Stover yield (kg/ha)
	(cm) 60 DAS	LAI (60 DAS)						
T <sub>1</sub> - 100% of recommended dose of fertilizer	104.2	3.43	6553	140.2	16.4	21.91	5271	9384
T <sub>2</sub> - 75% of RDF + 25% Seriwaste compost	108.7	3.87	6895	147.6	16.5	22.92	5547	9732
T <sub>3</sub> - 50% of RDF + 50% Seriwaste compost	115.2	5.12	7932	201.5	20.6	28.76	6447	11266
T <sub>4</sub> - 25% of RDF + 75% Seriwaste compost	110.7	4.01	7319	164.4	17.2	23.39	5862	10313
T <sub>5</sub> - Seriwaste compost 100% (5 t/ha)	100.2	2.31	6598	107.2	11.5	21.66	4033	8983
T <sub>6</sub> - Vermicompost 100% (5 t/ha)	98.8	2.21	6252	78.8	10.6	20.24	3790	7977
T <sub>7</sub> - Seriwaste compost 50% + Vermicompost 50%	101.3	2.81	6747	113.7	13.3	23.31	4037	9101
T <sub>8</sub> - Absolute control	89.1	2.18	6564	77.2	10.2	19.64	3297	6630
SEd	4.6	0.10	225	2.3	0.5	0.60	159	303
CD (P=0.05)	9.8	0.30	481	4.9	1.1	1.20	341	650

With respect to organics, combined application of seriwaste vermicompost 50% + vermicompost 50% (T<sub>7</sub>) recorded taller plants with higher LAI and DMP as compared to their individual application. The least values of growth parameters were obtained with the absolute control (T<sub>8</sub>) treatment. Increased growth attributes of hybrid maize in these treatments might be due to proper partitioning of photosynthates to satisfy the potential sink capacity resulting from higher availability of NPK for plant uptake. Similar results were also reported in maize-wheat cropping system by Gill *et al.* (1994). This might also be due to better nutrient release from the organic manures and better crop growth might be the result of adequate nutrition (Chandrasekara *et al.*, 2000). Improved growth parameters of maize due to organic manure with inorganic fertilizer application in maize as earlier reported by Nanjappa *et al.* (2000).

Length of cob, cob weight and test weight (100 grain weight) were significantly influenced by the application of organic manures and inorganic fertilizers. Application of 50% RDF + 50% seriwaste vermicompost (T<sub>7</sub>) and 25% RDF + 75% seriwaste vermicompost (T<sub>4</sub>) recorded higher values of cob length (20.6 cm), cob weight (201.5 g) and test weight (20.6 g). This was next followed by application of 75% RDF + 25% seriwaste vermicompost (T<sub>2</sub>) which was on par with 100% RDF (T<sub>1</sub>).

With respect to organics, combined application of seriwaste vermicompost 50% + vermicompost 50% (T<sub>7</sub>) recorded higher values of yield attributes as compared to their individual application. Individual application of seriwaste vermicompost was efficient than vermicompost. The cob length, cob weight and test weight were the lowest with absolute control (T<sub>8</sub>). Increased yield attributes were obtained due to application of seriwaste compost at 25, 50 and 75 per cent along with 75, 50 and 25 per cent RDF. Growth of the crop determines the yield attributes. In maize, increased growth parameters made the yield attributes viz., length and weight of cob and test weight were more and acceleration in the

translocation of photosynthates might have resulted in increased yield attributes. The findings of Gill *et al.* (1994) and Sahoo and Panda (2000) were in line with the above results.

#### Effect on grain and stover yield of hybrid maize

Grain and stover yield of hybrid maize were significantly influenced by the application of organic manures and inorganic fertilizer levels. Higher grain (6447 kg ha<sup>-1</sup>) and stover (11266 kg/ha) yield were recorded with the application of 50% RDF + 50% seriwaste vermicompost (T<sub>7</sub>) followed by the application of 25% RDF + 75% seriwaste compost (T<sub>4</sub>). Among the other treatments, application of 75% RDF + 25% seriwaste compost (T<sub>2</sub>) recorded higher grain and stover yields which was on par with 100% RDF (T<sub>1</sub>) (Table 1).

However, with the organics, combined application of seriwaste vermicompost 50% + vermicompost 50% (T<sub>7</sub>) recorded increased grain and stover yields as compared to their individual application. Among the individual application, seriwaste vermicompost recorded higher yields than vermicompost. The grain and stover yields were the lowest (3297 kg ha<sup>-1</sup> and 6630 kg ha<sup>-1</sup>, respectively) with absolute control (T<sub>8</sub>). This could be attributed to the slow and steady rate of NPK release into soil solution to match the required absorption pattern of maize, probably, the adequate NPK supply might have promoted its translocation from source to sink resulting in improved vegetative growth, lengthier cobs, more number of grains and finally yield. The combined application of organic and inorganic fertilizer led to a significant increase in yield of sorghum and it has been indicated earlier by Gangwar and Niranjana (1991).

#### Effect on Nutrient uptake

Nutrient (N, P and K) uptake was significantly influenced by organic and inorganic fertilizer treatments. Among the different treatments, 50% RDF

+ 50% seriwaste vermicompost (T<sub>7</sub>) recorded higher NPK uptake (79.6, 24.6 and 93.1 kg ha<sup>-1</sup>) followed by 25% RDF + 75% seriwaste vermicompost (T<sub>4</sub>) and

75% RDF + 25% seriwaste vermicompost (T<sub>2</sub>) as compared to other treatments.

**Table 2. Effect of treatments on uptake of major nutrients (kg/ha) in hybrid maize (60 DAS) (mean of two years)**

Treatment	Nitrogen	Phosphorus	Potassium
T <sub>1</sub> - 100% of Recommended Dose of Fertilizer (RDF) 74.8:20.4:89.5 (150:75:75 N: P <sub>2</sub> O <sub>5</sub> : K <sub>2</sub> O kg ha <sup>-1</sup> )			
T <sub>2</sub> - 75% of RDF + 25% Seriwaste compost	75.8	21.7	90.0
T <sub>3</sub> - 50% of RDF + 50% Seriwaste compost	79.6	24.6	93.1
T <sub>4</sub> - 25% of RDF + 75% Seriwaste compost	77.2	22.8	90.4
T <sub>5</sub> - Seriwaste compost 100% (5 t/ha)	68.6	19.3	87.3
T <sub>6</sub> - Vermicompost 100% (5 t/ha)	67.2	20.1	85.5
T <sub>7</sub> - Seriwaste compost 50% + Vermicompost 50%	65.7	19.7	80.2
T <sub>8</sub> - Absolute control	64.9	18.9	78.7
control SEd	3.3	0.7	2.2
CD (P=0.05)	6.5	1.5	4.6

However, combined application of seriwaste vermicompost and vermicompost recorded higher values of NPK uptake as compared to their individual application, in which seriwaste vermicompost recorded higher values than the vermicompost application. The absolute control (T<sub>8</sub>) recorded the

**Table 3. Effect of treatments on economics of hybrid maize**

Treatment	Gross return (Rs.ha <sup>-1</sup> )	Cost of cultivation (Rs.ha <sup>-1</sup> )	Net return (Rs.ha <sup>-1</sup> )	B : C ratio
T <sub>1</sub> - 100% of Recommended Dose of Fertilizer	34440	12674	21766	1.7
T <sub>2</sub> - 75% of RDF + 25% Seriwaste compost	36199	11309	24890	2.2
T <sub>3</sub> - 50% of RDF + 50% Seriwaste compost	42059	11758	30301	2.6
T <sub>4</sub> - 25% of RDF + 75% Seriwaste compost	38266	11683	26583	2.3
T <sub>5</sub> - Seriwaste compost 100% (5 t/ha)	26894	11375	15519	1.4
T <sub>6</sub> - Vermicompost 100% (5 t/ha)	25133	11367	13766	1.2
T <sub>7</sub> - Seriwaste compost 50% + Vermicompost 50%	26950	11357	15593	1.4
T <sub>8</sub> - Absolute control	21769	10885	10884	1.0

Data not statically analysed

lowest values of NPK uptake (64.9, 18.9 and 78.7 kg ha<sup>-1</sup> respectively) as compared to other treatments. Increased nutrient uptake might be due to the increased dry matter production of maize crop as a result of increased N, P and K availability through organic manures. Similar results of increased nutrient uptake due to application of organics were reported by Rajkhowa *et al.* (2000) and Subha and Gajendragiri (2004).

The increased uptake of NPK at 100 per cent RDF resulted in vigorous growth of crop and higher photosynthetic rate leading to better uptake of nutrients throughout the crop growth period. Increased uptake was also due to higher fertility status of the soil. Similar findings were also reported by Gangwar and Niranjana (1991) and Misra *et al.* (1994).

### Effect on economics of hybrid maize

The cost of cultivation was higher (Rs.12674 ha<sup>-1</sup>) in the treatment of 100 per cent recommended dose of fertilizer (T<sub>1</sub>) which was followed by (Rs.11758 ha<sup>-1</sup>) 50% RDF + 50% seriwaste compost (T<sub>3</sub>), whereas gross return, net return and B: C ratio were higher in 50% RDF + 50% seriwaste compost (T<sub>3</sub>) (Rs. 42059.7 ha<sup>-1</sup>, Rs. 30301.75 and 2.6, respectively).

which was followed by 25% RDF + 75% seriwaste compost (T<sub>4</sub>) (Table 3). Seriwaste vermicompost at 50 per cent combined with 50 per cent recommended dose of fertilizer increased the growth and yield attributes resulting in increased grain yield. This might be the reason for the increased gross and net returns. The gross returns and net returns are Rs. 42059.75 ha<sup>-1</sup> and Rs. 30301.75 ha<sup>-1</sup> respectively. Higher gross returns were due to higher grain yield, consequently resulting better return for every rupee invested on cost of cultivation.

Hence, it can be concluded that application of seriwaste vermicompost at 50% (2.5 t/ha) + 50% recommended NPK (75:37:37.5 kg/ha) is more promising in enhancing the productivity and economics of hybrid maize under irrigated condition.

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