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A Studies on response of different levels of F.Y.M. and Vermi-compost on the economics of maize (*Zea mays* L.)

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Abstract
Objective of a field experiment entitled ‘‘A Studies on response of different levels of F.Y.M. and Vermi-compost on yield and quality of maize (*Zea mays L.*) Under chitrakoot condition.’’ Was conducted Agricultural Research farm Rajaula during *kharif* season 2016 to find out the economics of the opted treatment. Maize contributes the maximum 40% among the cereal food crops in the global food production. The experiment was laid out in Randomized Block Design having 09 treatments T0 - 0% (control), T1 - 25% (F.Y.M.), T2 - 50% (F.Y.M.), T3 - 75% (F.Y.M.), T4 - 100%(F.Y.M.), T5 - 25% (Vermi-compost), T6 - 50% (Vermi-compost), T7 - 75% (Vermi-compost), T8 - 100%(Vermi-compost), comprising of organic manures (Farm yard manure and Vermi-compost) each treatment was replicated three times, making a total of 27 plots. Treatments were randomly arranged in each replication. Benefit Cost ratio was highest for T_8 followed by T_4. Treatment T_8 is superior for Vermi-compost application and T_4 was superior for FYM treatment.

Keywords: F.Y.M, Vermi-compost, economics, *Zea mays* L.

Introduction
Maize (*Zea mays* L.) is the third most important staple food crop of the world Next to wheat and rice. Maize has been an important cereal because of its great production potential and adaptability to wide range of environments. Maize occupies an important place in Indian economy, like rice, wheat and millets. Besides, being a potential source of food, it has various industrial uses namely, production of starch, syrup, alcohol, acetic acid and lactic acid.

Maize (*Zea mays* L.; 2n=20) is one of the most important and a strategic food crop cultivated in the world. Maize was first domesticated in Mexico, from its wild species ancestor, teosinte, about 9000 years ago, but maize landraces are widely found across the continents. Landraces (germplasm) evolved conventionally over the time, not only provides basic nutritional requirements as a food security but also in crop improvement programs very much depend on the availability of a wide and reliable crop genetic diversity (Sharma *et al.*, 2015).

Globally, it is cultivated on more than 160 million hectares area across 166 countries having wider diversity of soil, climate, biodiversity and management practices. Maize contributes the maximum 40% among the cereal food crops in the global food production. USA is the largest maize producer contributing nearly 35 percent to the total maize production, followed by China. Maize is the driver of the US economy, with highest productivity (>10 t/ha) which is double than the global average (5.3 t/ha). The productivity of maize in India is just half of the world average (DMR, 2016) [5].

The nutritive value of maize kernel contains about 10.4% moisture, 6.8% to 12% protein, 4% lipid, 1.2% ash, 2.0% fiber, 72% to 74% carbohydrates. It also contains macro and micronutrients such as 7 mg/100g calcium, 210 mg/100g phosphorus, 2.7 mg/100g iron, 0.38 mg/100g thiamine and 0.20 mg/100g riboflavin (Suleiman *et al*. 2013).

Materials and Methods
The experiment was conducted at the Rajaula Agricultural research farm of the Faculty of Agricultural Sciences, Mahatma Gandhi Chitrakoot Gramodaya Vishwavidyalaya, Chitrakoot – Satna (Madhya Pradesh), during the *Kharif* season of 2016. The experimental field is situated in the north eastern part of Madhya Pradesh. All the facilities necessary for conducting the experiment, including labour and resources, which were necessary for normal cultivation were readily available in the department.

The climate of the region is semi-arid and sub-tropical having extreme winter and summer. During the winter months, the temperature drops down to as low as 4-6 °C while in the summer the temperature reaches above 49 °C.

The soil samples were taken from different places of the experimental field with the help of auger from 12 – 15 cm depth after clearing the surface of vegetation. These samples were properly mixed, air dried in diffused sunlight, finally powdered and again mixed thoroughly. A representative sample of 5 g was taken for each analysis and subjected to mechanical and chemical analysis.

The experiment was laid out in Randomized Block Design having 09 treatments T0 - 0% (control), T1 - 25% (F.Y.M.), T2 - 50% (F.Y.M.), T3 - 75% (F.Y.M.), T4 - 100%(F.Y.M.), T5 - 25% (Vermi-compost), T6 - 50% (Vermi-compost), T7 - 75% (Vermi-compost), T8 - 100% (Vermi-compost), comprising of organic manures (Farmyard manure and Vermi-compost) each replicated three times, making a total of 27 plots. Treatments were randomly arranged in each replication.

Superstar-9396 variety of maize was selected for the experiment. This variety has been developed by Super Seed Private Limited, Hisar (Haryana), cob with Grain Colour orange yellow, Ear shape conico cylindrical, Grain Texture semi flint, Disease Tolerant to turcicum leaf blight & DM, plant type semi erect, suitable for growing in central India. Plant highs 200-220 cm high, *Kharif* Maturity (days) 90-95 and Special Features Heat tolerant. It is suitable for planting in June – July in plains.

The economic feasibility of treatments was calculated as under:

Gross Return = Yield (t ha^{-1}) x Selling rate (Rs. t^{-1})

Net return=Gross return – cost of cultivation

$$\text{Cost: Benefit ratio} = \frac{\text{Gross return cost}}{\text{Total input cost}}$$

Cost of cultivation (Rs. ha^{-1})

Results and Discussion

Economics of all the treatments are given in Table 1 which showed that control treatment has lowest output as compare to other treatment. Highest output was recorded by treatment T_8 followed by T_4. Lowest input cost was taken by T_5 followed by T_6 but output of these two treatments was lower than the control treatment. Therefore T_5 and T_6 are not the suitable treatments. Highest input cost was recorded for treatments T_4 followed by T_3. Benefit cost ratio (B: C ratio) was also calculated and presented in Table 4.4 and Figure 4.5. B; C ratio was highest for T_8 followed by T_4. Treatment T_8 is superior for Vermi-compost application and T_4 was superior for FYM treatment. These two treatments were significantly differs from other treatments based on CD value for yield per plot. B:C ratio was also higher for these two treatments which showed that per unit input for these two treatment can return lot of output. Therefore it can be concluded that Treatment T_8 and T_4 were overall best performing treatments for maize crop.

Table 1: Economics of the opted treatments for Maize crop

Treatment	Yield (q/ha)	Yield (kg/ha)	Rate of maize seeds	Total output (Rs.)	Input cost (Rs.)	B:C ratio
T_0	16.14	16140	120.00/kg	1936800	8340	232.23
T_1	21.54	21540	120.00/kg	2584800	8236	313.84
T_2	26.07	26070	120.00/kg	3128400	8452	370.14
T_3	27.34	27340	120.00/kg	3280800	8668	378.50
T_4	32.2	32200	120.00/kg	3864000	8884	434.94
T_5	18.94	18940	120.00/kg	2272800	8127	279.66
T_6	24.67	24670	120.00/kg	2960400	8236	359.45
T_7	27.54	27540	120.00/kg	3304800	8344	396.07
T_8	33.2	33200	120.00/kg	3984000	8451	471.42

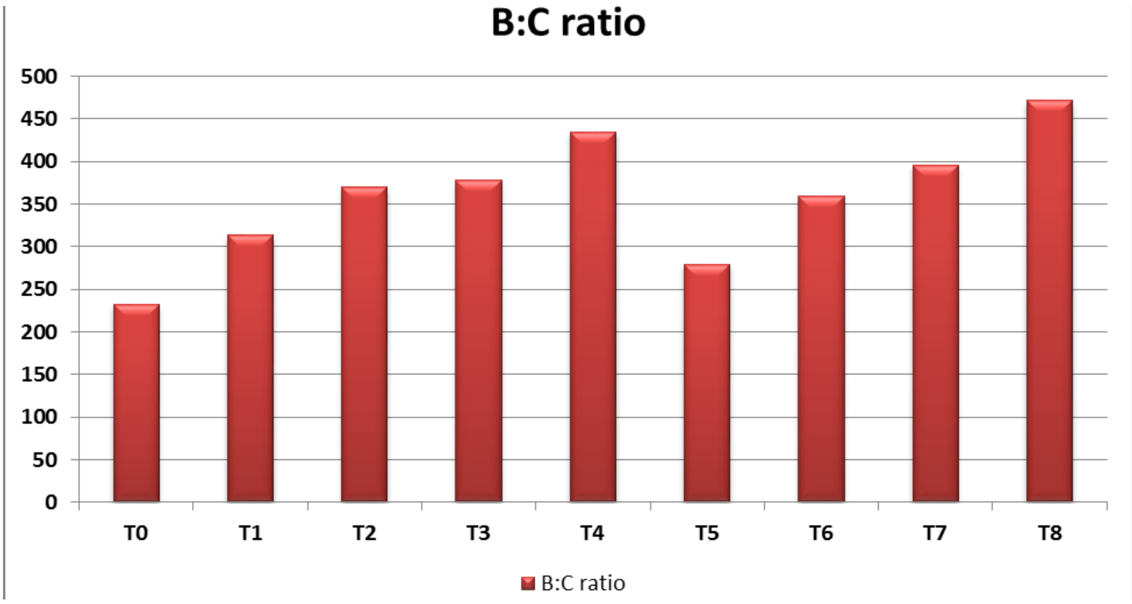

Fig 1: Benefit cost ratio (B: C ratio) of opted treatments

Summery and conclusion

The analysis of variance revealed highly significant differences among treatments for 11 traits *viz.*, plant height at 30 DAS, plant height at 60 DAS, plant height at 90 DAS, number of ears per plant, green cob yield per plant, number of kernel rows, number of grain per rows, ear weight, grain yield per plant (g), hundred seed weight (g) and yield per plot (kg). Remaining 15 traits were non-significant among the treatments. It means there is no difference in all eight treatments for rest 15 non-significant traits. So, any of the treatment can be considered for increasing these 15 traits. Economics of all the treatments showed that control treatment has lowest output as compare to other treatment. Highest output was recorded by treatment T_8 followed by T_4. Lowest input cost was taken by T_5 followed by T_6 but output of these two treatments was lower than the control treatment.

Benefit Cost ratio was highest for T_8 followed by T_4. Treatment T_8 is superior for Vermi-compost application and T_4 was superior for FYM treatment. These two treatments were significantly differs from other treatments based on CD value for yield per plot. B: C ratio was also higher for these two treatments which showed that per unit input for these two treatments can return lot of output.

Table 2: Mean performance of various yield and quality attributing trait in Maize

Particulars	Days to maturity	Stem diameter (cm.)	Ear length (cm.)	Ear diameter (cm.)	Kernel row arrangement (Rank)	Number of kernel rows	Number of grain per rows	Mean Ear weight (g)	Grain yield per plant (g)	Shelling (%)	Moisture (%)	Hundred seed weight (g)	Yield per plot (kg)
	14	15	16	17	18	19	20	21	22	23	24	25	26
T_0	87.33	1.43	10.38	3.66	2.27	12.07	22.93	35.89	21.63	60.06	16.63	16.22	2.42
T_1	86.67	1.34	10.55	3.46	2.00	11.73	27.53	30.71	16.85	54.21	16.63	19.65	3.23
T_2	86.67	1.40	11.40	3.55	2.27	12.73	32.80	50.47	34.02	67.43	15.67	20.32	3.91
T_3	86.33	1.44	11.58	3.67	2.33	12.67	40.47	48.46	32.36	66.66	18.00	22.86	4.10
T_4	86.67	1.30	9.89	3.66	2.27	12.13	46.27	46.14	29.95	64.62	15.43	31.50	4.83
T_5	87.00	1.41	10.46	3.50	1.87	11.67	24.07	42.82	26.82	61.50	17.50	19.02	2.84
T_6	86.67	1.40	10.83	3.56	2.27	11.80	32.67	36.10	21.29	60.47	16.87	24.81	3.70
T_7	85.67	1.44	10.75	3.71	2.27	12.93	40.80	51.78	33.84	65.11	17.77	24.83	4.13
T_8	86.33	1.35	11.62	3.83	2.00	12.73	48.00	52.47	35.25	67.14	18.63	29.73	4.98
Mean	86.59	1.39	10.83	3.62	2.17	12.27	35.06	43.87	28.00	63.02	17.01	23.22	3.79
Sum	779.33	12.51	97.47	32.60	19.53	110.47	315.53	394.84	252.02	567.20	153.13	208.95	34.13
Minimum	85.67	1.30	9.89	3.46	1.87	11.67	22.93	30.71	16.85	54.21	15.43	16.22	2.42
Maximum	87.33	1.44	11.62	3.83	2.33	12.93	48.00	52.47	35.25	67.43	18.63	31.50	4.98
Range	1.67	0.14	1.73	0.37	0.47	1.27	25.07	21.76	18.39	13.22	3.20	15.28	2.57
Standard Error	0.15	0.02	0.20	0.04	0.06	0.16	3.10	2.65	2.23	1.45	0.35	1.68	0.28
Standard Deviation	0.46	0.05	0.59	0.12	0.17	0.49	9.29	7.94	6.68	4.36	1.06	5.05	0.85
Coefficient of variation	0.54	3.59	5.48	3.17	7.70	4.03	26.50	18.10	23.86	6.91	6.24	21.75	22.52

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