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Effect of organic manures and inorganic fertilizer on growth and tuber yield of cassava (*Manihot esculenta*) CV. M4

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Abstract

The present investigation “Effect of organic manures and Inorganic fertilizer on growth and tuber yield Cassava (*Manihot esculenta*) cv M4” was conducted in Research Field, Department of Horticulture, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, during October 2020 to July 2021. The cuttings were planted at 1m×1m spacing pattern. The experiment was laid out with thirteen treatments replicated thrice in Randomized Block Design. The plants were watered immediately after planting and at weekly intervals during growing period. Based on the present investigation it is concluded that T11 RDF (50%) (N:P:K) 37.5: 25:37.5 kg ha⁻¹+ 50% (FYM 12.5+ Vermicompost 5 + Goat manure 4 t ha⁻¹) gave best plant height (cm), number of leaves per plant, Stem diameter (cm), Number of tuberous root per plant, tuber length (cm), tuber diameter (cm), average tuber weight (g) tuber yield per plot (kg), tuber yield per hectare (t/ha) of cassava (*Manihot esculenta*).

Keywords: Tuber, cassava, randomized block design

Introduction

Cassava (*Manihot esculenta*) is a perennial shrub and a tuberous root crop and is a native of Tropical America and was introduced from Brazil into India by the Portuguese in the 17th century. The importance of cassava as a food and industrial crop relies on its roots since they accumulate starch (approximately 30-60% dry matter) and so, it is considered the second source of starch globally, after maize (FAO, 2013) [7].

Cassava (*Manihot esculenta*) is a member of the family Euphorbiaceae. It is an important crop of Africa, Asia, and Latin-America (Ravi *et al.*, 1996) [19]. Storage root have high starch content (89%) (Silvestre, 1989). The leaves and tender shoots are important sources of vitamins, minerals, and proteins (Balagopalan, 2002; Nweke *et al.*, 2002) [5, 15]. Starch of cassava has wide industrial applications. It is extensively used in the manufacture of adhesive, dextrines, food paste and as filler in the manufacture of paints (Godfrey *et al.*, 2012) [8]. Cassava crop is well known for its adaptation to poor soils conditions, and responds well to better management practices. It is also resistant to drought (Chantaprasan and Wanapat, 2003). The most common methods of cassava propagation is stem cuttings and sexual seed, but propagation by stem cuttings is mostly the commonest practice. There exists conflicting reports about the appropriate cutting orientations. As par Oguzor (2007) [17] report vertical method of planting cassava gave the best sprouting percentage of 88.8% than horizontal and inclined planting. According to their report there is no significant difference on the number of germinated nodes among the planting methods. Mbah *et al.* (2008) [11] reported higher tuber yield in vertical and inclined positions compared to horizontal method. Keating *et al.* (1988) [10] reported that planting method did not have significant effect on growth and yield of cassava.

Cassava is well adapted to poor soils and is relatively tolerant to drought, the crop is usually grown under marginal soil and climatic conditions and often with very limited inputs of fertilizers and pesticides. In India, cassava is cultivated in varied agro climatic and pedogenic environments. In India, it is cultivated in 2.07 lakh ha with the production of 72.37 lakh MT. The leading cassava producing states are Tamil Nadu (62.50%) followed by Kerala (33.97%). In Tamil Nadu, it is cultivated mainly in Salem, Namakkal, Dharmapuri, Villupuram and Erode districts for industrial uses and grown in black soils (Vertisols) and red soils (Alfisols).

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Materials and Methods

The present study entitled "Effect of organic manures and Inorganic fertilizer on growth and tuber yield of Cassava (*Manihot esculenta*) cv M4" comprised of field experiment which was laid out at Horticulture Research Farm, Department

of Horticulture, Naini Agriculture Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, 211007 (U.P) India during 2020-2021. Different treatment combinations were

Treatment symbols	Treatments combinations
T ₁	RDF (100%) (N:P:K) 75: 50:75 kg ha ⁻¹
T ₂	RDF (50%) (N:P:K) 37.5: 25:37.5 kg ha ⁻¹ + FYM (50%) 12.5 t ha ⁻¹
T ₃	RDF (75%) (N:P:K) 56.25: 37.5:56.25 kg ha ⁻¹ + FYM (25%) 6.25 t ha ⁻¹
T ₄	RDF (25%) (N:P:K) 18.75: 12.5:18.75 kg ha ⁻¹ + FYM (75%) 18.75 t ha ⁻¹
T ₅	RDF (50%) (N:P:K) 37.5: 25:37.5 kg ha ⁻¹ + Vermicompost (50%) 5 t ha ⁻¹
T ₆	RDF (75%) (N:P:K) 56.25: 37.5:56.25 kg ha ⁻¹ + Vermicompost (25%) 2.5 t ha ⁻¹
T ₇	RDF (25%) (N:P:K) 18.75: 12.5:18.75 kg ha ⁻¹ + Vermicompost (75%) 7.5 t ha ⁻¹
T ₈	RDF (50%) (N:P:K) 37.5: 25:37.5 kg ha ⁻¹ + Goat manure (50%) 4 t ha ⁻¹
T ₉	RDF (75%) (N:P:K) 56.25:37.5:56.25 kg ha ⁻¹ + Goat manure (25%) 2 t ha ⁻¹
T ₁₀	RDF (25%) (N:P:K) 18.75:12.5:18.75 kg ha ⁻¹ + Goat manure (75%) 6 t ha ⁻¹
T ₁₁	RDF (50%) (N:P:K) 37.5: 25:37.5 kg ha ⁻¹ + 50% (FYM 12.5+ Vermicompost 5 + Goat manure 4 t ha ⁻¹)
T ₁₂	RDF (75%) (N:P:K) 56.25: 37.5:56.25 kg ha ⁻¹ + 25% (FYM 6.25+ Vermicompost 2.5 + Goat manure 2 t ha ⁻¹)
T ₁₃	RDF (25%) (N:P:K) 18.75: 12.5:18.75 kg ha ⁻¹ + 75% (FYM 18.75+ Vermicompost 7.5 + Goat manure 6 t ha ⁻¹)

Results and Discussion

The findings of the present experiment entitled, "Effect of organic manures and Inorganic fertilizer on growth and tuber yield Cassava (*Manihot esculenta*) cv M4" is being presented and discussed in the following pages under appropriate headings. Data on vegetative growth and yield observations were analyzed and discussion on experiment findings in the light of scientific reasoning has been stated.

The experimental findings based on parameters are summarized below.

The plant height was influenced by different level of organic manures and Inorganic fertilizer on plant height at 60, 120, 180, 240 days after planting and result were found to be significant. The highest plant height (37.60, 62.15, 102.64 and 184.46) at 60, 120, 180, 240 days after planting was observed in treatment combination of T₁₁ RDF (50%) (N:P:K) 37.5: 25:37.5 kg ha⁻¹+ 50% (FYM 12.5+ Vermicompost 5 + Goat manure 4 t ha⁻¹). The plant height was found to be minimum (28.82, 47.58, 78.89 and 130.14) in the treatment combination of T₁ RDF (NPK @ 75:50:75Kg/ha).The plant height was influenced by different level of organic manures and Inorganic fertilizer on number of leaves per plant at 60, 120, 180, 240 days after planting and result were found to be significant. The highest number of leaves per plant (16.45, 30.84, 48.01 and 74.34) at 60, 120, 180, 240 days after planting was observed in treatment combination of T₁₁ RDF (50%) (N:P:K) 37.5: 25:37.5 kg ha⁻¹+ 50% (FYM 12.5+ Vermicompost 5 + Goat manure 4 t ha⁻¹). The number of leaves per plant was found to be minimum (6.85, 13.82, 27.81 and 48.57) in the treatment combination of T₁ RDF (NPK @ 75:50:75Kg/ha).The Stem diameter (cm) was influenced by different level of organic manures and Inorganic fertilizer on Stem diameter (cm)at 60, 120, 180, 240 days after planting and result were found to be significant. The highest Stem diameter (cm) (9.26, 9.89, 10.15 and 10.25) at 60, 120, 180, 240 days after planting was observed in treatment combination of T₁₁ RDF (50%) (N:P:K) 37.5: 25:37.5 kg ha⁻¹+ 50% (FYM 12.5+ Vermicompost 5 + Goat manure 4 t ha⁻¹). The Stem diameter (cm) was found to be minimum (7.49, 7.06, 7.84 and 8.21) in the treatment combination of T₁ RDF (NPK @

75:50:75Kg/ha).Influence of different level of organic manures and Inorganic fertilizer on number of tubers roots per plant was found to be significant different among the treatments. The maximum number tubers per plant (10.30) was recorded in the treatment combination of T₁₁ RDF (50%) (N:P:K) 37.5: 25:37.5 kg ha⁻¹+ 50% (FYM 12.5+ Vermicompost 5 + Goat manure 4 t ha⁻¹). The minimum number of tubers per plant (4.93) was recorded in the treatment T₁ RDF (NPK @ 75:50:75Kg/ha).The maximum tuber length (cm) (62.64) was recorded in the treatment combination of T₁₁ RDF (50%) (N:P:K) 37.5: 25:37.5 kg ha⁻¹+ 50% (FYM 12.5+ Vermicompost 5 + Goat manure 4 t ha⁻¹). The minimum tuber length (cm) (33.83) was recorded in the treatment T₁ RDF (NPK @ 75:50:75Kg/ha).The maximum tuber diameters (cm) (21.93) was recorded in the treatment combination of T₁₁ RDF (50%) (N:P:K) 37.5: 25:37.5 kg ha⁻¹+ 50% (FYM 12.5+ Vermicompost 5 + Goat manure 4 t ha⁻¹). The minimum tuber diameters (cm) (9.78) was recorded in the treatment T₁ RDF (NPK @ 75:50:75Kg/ha).The maximum average tuber weight (g) (341.39) was recorded in the treatment combination of T₁₁ RDF (50%) (N:P:K) 37.5: 25:37.5 kg ha⁻¹+ 50% (FYM 12.5+ Vermicompost 5 + Goat manure 4 t ha⁻¹). The minimum average tuber weight (g) (181.48) was recorded in the treatment T₁ RDF (NPK @ 75:50:75Kg/ha).The maximum tuber yield per plant (kg) (3.52) was recorded in the treatment combination of T₁₁ RDF (50%) (N:P:K) 37.5: 25:37.5 kg ha⁻¹+ 50% (FYM 12.5+ Vermicompost 5 + Goat manure 4 t ha⁻¹). The minimum tuber yield per plant (kg) (0.930) was recorded in the treatment T₁ RDF (NPK @ 75:50:75Kg/ha). The maximum tuber yield per plot (kg) (14.03) was recorded in the treatment combination of T₁₁ RDF (50%) (N:P:K) 37.5: 25:37.5 kg ha⁻¹+ 50% (FYM 12.5+ Vermicompost 5 + Goat manure 4 t ha⁻¹). The minimum tuber yield per plot (kg) (3.58) was recorded in the treatment T₁ RDF (NPK @ 75:50:75Kg/ha).The maximum tuber yield per hectare (t ha⁻¹) (35.07) was recorded in the treatment combination of T₁₁ RDF (50%) (N:P:K) 37.5: 25:37.5 kg ha⁻¹+ 50% (FYM 12.5+ Vermicompost 5 + Goat manure 4 t ha⁻¹). The minimum tuber yield per hectare (t ha⁻¹) (8.94) was recorded in the treatment T₁ RDF (NPK @ 75:50:75Kg/ha).

Table 1: Effect of organic manures and inorganic fertilizer on growth parameters of cassava (*Manihot esculenta*) CV. M4

Treatment symbols	Plant height				Number per Of plant				Leaves				steam diameter (cm)			
	60 DAP	120 DAT	180 DAT	240 DAT	60 DAP	120 DAT	180 DAT	240 DAT	60 DAP	120 DAT	180 DAT	240 DAT	60 DAP	120 DAT	180 DAT	240 DAT
T ₁	28.82	47.58	78.89	130.14	6.85	13.82	27.81	48.57	7.49	7.06	7.84	8.21				
T ₂	35.14	59.37	98.26	180.08	15.76	29.66	47.15	74.15	9.17	9.52	9.68	9.89				
T ₃	31.68	54.06	90.23	162.42	9.26	20.58	36.91	66.59	7.60	8.16	8.49	8.96				
T ₄	33.19	56.37	92.94	168.44	12.10	24.76	42.32	71.37	8.44	8.94	9.04	9.35				
T ₅	34.11	56.84	95.78	174.32	14.82	26.09	44.36	72.28	8.92	9.23	9.23	9.68				
T ₆	30.03	53.53	83.41	158.87	8.55	17.43	34.57	60.81	6.85	7.85	8.19	8.53				
T ₇	32.59	54.49	92.52	167.57	10.39	21.88	39.22	67.64	7.84	8.49	8.75	9.14				
T ₈	34.20	57.95	97.71	176.27	15.22	27.41	45.07	74.07	9.05	9.51	9.34	9.83				
T ₉	30.33	53.66	88.47	160.50	9.16	18.09	34.63	61.92	7.25	8.07	8.38	8.63				
T ₁₀	32.98	55.80	92.59	167.59	11.96	22.72	42.12	70.53	8.14	8.86	9.04	9.33				
T ₁₁	37.60	62.15	102.64	184.46	16.45	30.84	48.01	74.34	9.26	9.89	10.15	10.25				
T ₁₂	31.99	54.34	91.17	164.08	10.26	20.86	37.31	67.23	7.75	8.36	8.44	9.07				
T ₁₃	33.37	56.81	93.13	169.64	14.28	26.03	43.23	71.65	8.44	9.10	9.16	9.58				
F-Test	S	S	S	S					S	S	S	S				
C.D.at 0.5%	1.001	1.325	0.351	1.016	0.791	1.693	2.169	2.597	0.830	0.184	0.276	0.414				
S.Ed (+)	0.485	0.642	0.170	0.492	0.383	0.820	1.051	1.258	0.402	0.089	0.134	0.200				
C.V.	1.813	1.414	0.226	0.362	3.933	4.351	3.201	2.273	6.025	2.44	1.841	2.649				

Table 2: Effect of organic manures and inorganic fertilizer on yield parameters of cassava (*Manihot esculenta*) CV. M4

Treatment symbols	Number of tuberous roots per plant	Tuber length (cm)	Tuber diameter (cm)	Tuber weight (g)	Tuber yield per plant (kg)	Tuber yield per plot (kg)	Tuber yield (q ha ⁻¹)
T ₁	4.93	33.83	9.78	181.48	0.93	3.58	8.94
T ₂	9.25	57.79	21.50	328.75	2.85	11.55	28.88
T ₃	8.04	49.36	13.38	219.09	1.90	7.46	18.64
T ₄	8.42	55.39	17.44	281.88	2.42	9.60	23.93
T ₅	8.83	55.87	19.78	304.29	2.49	10.08	25.19
T ₆	7.69	42.27	11.12	203.21	1.73	6.90	17.25
T ₇	8.39	54.48	15.51	267.67	2.06	8.09	20.22
T ₈	9.09	56.49	21.46	308.89	2.77	11.04	27.60
T ₉	7.51	46.79	11.68	214.62	1.80	7.17	17.94
T ₁₀	8.40	54.97	16.75	281.55	2.37	9.46	23.66
T ₁₁	10.30	62.64	21.93	341.39	3.52	14.03	35.07
T ₁₂	8.42	53.41	13.68	222.90	1.95	7.55	18.87
T ₁₃	8.77	55.81	18.71	288.97	2.42	9.63	24.09
F-Test	S	S	S	S	S	S	S
C.D.at 0.5%	0.364	2.108	1.275	9.149	0.075	0.564	1.430
S.Ed (+)	0.176	1.021	0.618	4.433	0.037	0.274	0.693
C.V.	2.599	2.394	4.624	2.049	1.994	3.749	3.799

Conclusion

Based on the result of experiment, it may be concluded that the treatment T₁₁ RDF (50%) (N:P:K) 37.5: 25:37.5 kg ha⁻¹+ 50% (FYM 12.5+ Vermicompost 5 + Goat manure 4 t ha⁻¹) was recorded the best among in all combination of organic manures and Inorganic fertilizer in term of growth and yield attribute parameters parameter viz., plant height (184.46), number of leaves per plant (74.34), Stem diameter (cm) (10.25), number tubers per plant (10.30), tuber length (cm) (62.64), tuber diameters (cm) (21.93), average tuber weight (g) (341.39), tuber yield per plant (kg) (3.52), tuber yield per plot (kg) (14.03) and tuber yield per hectare (t ha⁻¹) (35.07). The T₂ RDF (50%) (N: P:K) 37.5: 25:37.5 kg ha⁻¹+ FYM (50%) 12.5 t ha⁻¹ was obtained the highest cost benefit ratio (1: 3.14).

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