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Effect of organic manures on growth, yield and economics of onion (*Allium cepa* L.) in agroclimatic condition of Satna region

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The field experiment was conducted during winter season of 2021-22 at the Research Farm, A.K.S. University, Satna (M.P.) The soil of the experimental field was silty clay-loam having pH 7.91, electrical conductivity 0.18 dS/m, organic carbon 0.47%, available N, P_2O_5 and K_2O 174.62, 12.14 and 200 kg/ha, respectively. The total rainfall received during crop season 2021-22 was 12.01 mm. The treatments comprised three levels of poultry manure (2, 5 and 7 t/ha) and four levels of vermicompost (2, 5, 7 and 10 t/ha). Thus 12 treatment combinations (T_1 - Poultry manure 2 t/ha + vermicompost 2 t/ha,T_2 - Poultry manure 2 t/ha + vermicompost 5 t/ha, T_3 - Poultry manure 2 t/ha + vermicompost 7 t/ha,T_4 - Poultry manure 2 t/ha + vermicompost 10 t/ha, T_5 - Poultry manure 5 t/ha + vermicompost 2 t/ha, T_6 – Poultry manure 5 t/ha + vermicompost 5 t/ha, T_7 - Poultry manure 5 t/ha + vermicompost 7 t/ha,T_8 - Poultry manure 5 t/ha + vermicompost 10 t/ha,T_9 - Poultry manure 7 t/ha + vermicompost 2 t/ha, T_{10} - Poultry manure 7 t/ha + vermicompost 5 t/ha,T_{11} - Poultry manure 7 t/ha + vermicompost 7 t/ha and T_{12} - Poultry manure 7 t/ha + vermicompost 10 t/ha) were laid out in a randomized block design keeping three replications. Onion variety Agrifound Light Red was transplanted on 29 October 2021 following the cultural practices as per treatments. The crop was grown as per recommended package of practices. The crop was harvested on 16 April 2022. The periodical field and laboratory observations were recorded and presented after statistical computation. The TSS in mature bulbs was determined by hand refract meter.

Amongst the organic treatments, T_{12} having poultry manure 7 t/ha + 10 t/ha vermi-compost resulted in significantly higher plant height, leaves/plant, neck diameter, leaf area, leaf area index, relative growth rate, crop growth rate and net assimilation rate at 30, 60, 90 and 120 DAT stages. At 120 days stage, T_{12} produced the maximum plant height, leaves/plant, neck diameter, leaf area index and crop growth rate, and recorded 52.10 cm, 12.56/plant, 2.27 cm, 3.109 and 5.89 g/cm^2/day, respectively. On the other hand, maximum leaf area (407.20 cm^2) was recorded at 90 DAT. T_{12} also noted maximum relative growth rate (49.20 g/g/day) and net assimilation rate (1.435 mg/cm^2/day) at 30 DAT. This was followed by T_{11} and T_{10} treatments having organic sources of poultry manure 7 t/ha + 7 t/ha vermicompost and poultry manure 7 t/ha + 5 t/ha vermicompost. The lower level of nitrogen through each of the poultry manure and vermicompost brought about significant reduction in these growth parameters of onion (Table 1). Applied organic fertilizer through poultry manure 7 t/ha + vermicompost 10 t/ha encouraged the plant foliage and boosted plant growth at every stage, because it is an integral part of the chlorophyll, all proteins, enzymes and structural materials.

Yield can be considered to be final expression of the physiological and metabolic activities of plant. The factors which are directly responsible for ultimate bulb production are fresh and dry weight of bulb, diameter and length of bulb. The best treatment was T_{12} having poultry manure 7 t/ha+10 t/ha vermicompost. Accordingly, the maximum fresh weight of bulb 65.10 g, dry weight 10.21 g, bulb diameter 6.62 cm and length of bulb 7.90 cm was noted in T_{12} (Table 2). The second best treatment was T_{11} having poultry manure 7 t/ha+7 t/ha vermicompost sources, which recorded 59.10 g fresh bulb weight, dry weight of bulb (9.64 g) and 6.53 cm of bulb diameter. This was followed by T_{10} (Poultry manure 7 t/ha + vermicompost 5 t/ha). The organic manures given in T_1 (Poultry manure 2 t/ha + vermicompost 2 t/ha) recorded significantly lowest length of bulb (6.01 cm), dry weight (8.11 g) and diameter of bulb (5.61 cm).

Amongst the treatments, T_{12} (Poultry manure 7 t/ha + 10 t/ha vermicompost) resulted in

Table 1: Growth and yield attributes of onion as influenced by different organic treatments

Treatments	Plant height (cm) at 120 DAT	Number of leaves/ plant at 120 DAT	Neck diameter (cm) at 120 DAT	Leaf area (cm) at 120 DAT	Leaf area (cm) at 90 DAT	Leaf area index at 120 DAT	Relative growth rate (g/g/day) at 30 DAT	Crop growth Rate (g/ cm^2/day) at 120 DAT	Net assimilation rate (mg/cm^2/day) at 30 DAT
T_1 Poultry manure 2 t/ha + vermicompost 2 t/ha	42.1	7.56	1.29	195.7	198.2	0.781	32.1	3.35	1.123
T_2 Poultry manure 2 t/ha + vermicompost 5 t/ha	44.2	8.34	1.55	202.1	207.6	0.822	34.3	3.49	1.135
T_3 Poultry manure 2 t/ha + vermicompost 7 t/ha	43.7	8.21	1.32	270.1	226.7	1.103	37.5	3.79	1.149
T_4 Poultry manure 2 t/ha + vermicompost 10 t/ha	41.9	9.56	1.38	294.3	220.9	1.401	39.1	3.91	1.178
T_5 Poultry manure 5 t/ha + vermicompost 2 t/ha	39.8	10.12	1.21	263.6	241.5	1.419	40.6	4.15	1.213
T_6 Poultry manure 5 t/ha + vermicompost 5 t/ha	44.4	8.65	1.81	290.8	261.3	1.565	41.7	4.32	1.239
T_7 Poultry manure 5 t/ha + vermicompost 7 t/ha	40.8	9.21	1.27	301.1	270.4	1.723	42.9	4.54	1.254
T_8 Poultry manure 5 t/ha + vermicompost 10 t/ha	45.6	10.23	1.75	301.4	179.1	1.909	43.4	4.73	1.269
T_9 Poultry manure 7 t/ha + vermicompost 2 t/ha	48.2	11.56	1.69	325.6	309.6	2.105	44.7	4.86	1.281
T_{10} Poultry manure 7 t/ha + vermicompost 5 t/ha	44.6	10.11	1.81	398.2	350.6	2.332	46.1	4.98	1.296
T_{11} Poultry manure 7 t/ha + vermicompost 7 t/ha	49.2	9.56	1.55	319.1	380.1	2.501	47.3	5.62	1.354
T_{12} Poultry manure 7 t/ha + vermicompost 10 t/ha	52.1	12.56	2.27	360.2	407.2	3.109	49.2	5.89	1.435
C.D. 5%	2.609	1.489	0.349	7.519	5.302	0.048	2.193	0.412	0.031

Table 2: Yield and economics of onion as influenced by different organic treatments

Treatments	Fresh weight of bulb (g)	Dry weight of bulb (g)	Bulb diameter (cm)	Length of bulb (cm)	Bulb yield (t/ha)	Net income (Rs/ha)	B:C ratio
T_1 Poultry manure 2 t/ha + vermicompost 2 t/ha	48.1	8.11	5.61	6.01	30.16	70055	1.84
T_2 Poultry manure 2 t/ha + vermicompost 5 t/ha	42.7	8.32	5.73	6.59	30.84	72226	2.07
T_3 Poultry manure 2 t/ha + vermicompost 7 t/ha	43.4	8.45	5.84	6.26	31.52	73314	1.35
T_4 Poultry manure 2 t/ha + vermicompost 10 t/ha	45.3	8.53	5.95	7.04	31.34	74253	1.26
T_5 Poultry manure 5 t/ha + vermicompost 2 t/ha	49.2	8.59	6.13	6.74	32.09	74990	2.13
T_6 Poultry manure 5 t/ha + vermicompost 5 t/ha	52.7	8.64	6.17	7.82	32.53	75123	1.97
T_7 Poultry manure 5 t/ha + vermicompost 7 t/ha	44.1	8.68	6.22	7.81	33.02	75781	1.89
T_8 Poultry manure 5 t/ha + vermicompost 10 t/ha	55.1	9.01	6.31	6.35	33.91	76156	1.76
T_9 Poultry manure 7 t/ha + vermicompost 2 t/ha	52.9	9.35	6.38	6.97	35.36	80118	2.61
T_{10} Poultry manure 7 t/ha + vermicompost 5 t/ha	53.6	9.49	6.44	7.26	37.94	83226	2.13
T_{11} Poultry manure 7 t/ha + vermicompost 7 t/ha	59.1	9.64	6.53	7.34	39.25	85166	2.53
T_{12} Poultry manure 7 t/ha + vermicompost 10 t/ha	65.1	10.21	6.62	7.90	42.31	90282	2.89
C.D. 5%	3.178	0.774	0.337	0.427	4.348	--	--

significantly highest net income (Rs.90282/ha) with 2.89 B: C ratio. The second best fertility treatment T_{11} (Poultry manure 7 t/ha + 7 t/ha vermicompost) recorded net income of Rs.85166/ha with B: C ratio 2.53, followed by T_{10} (Poultry manure 7 t/ha + vermicompost 5 t/ha) and T_9 (Poultry manure 7 t/ha + vermicompost 2 t/ha) grained third and fourth position and recorded Rs.83226/ha with 2.13 B:C ratio and Rs.80118/ha with 2.61 B:C ratio. On the other hand, treatment having minimum doses of organic manures (T_1) gained the significantly lowest net income (Rs.70055/ha with 1.84 B:C ratio) followed by Rs.72226/ha with 2.07 B:C ratio and Rs.73314/ha with 1.35 B:C ratio in T_2 (Poultry manure 2 t/ha + vermicompost 5 t/ha) and T_3 (Poultry manure 2 t/ha + vermicompost 7 t/ha), respectively.

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