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PERFORMANCE OF LEAF CHARACTER UNDER VARIOUS SOURCES OF FERTILIZERS IN AFRICAN MARIGOLD

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ABSTRACT

The field experiment was carried out taking different sources of fertilizers comprising of organic fertilizer (vermicompost, poultry manure) and bio-fertilizer (*azospirillum*, PSB) at KVK, farm, O.U.A.T, Bhubaneswer, Odisha to identify the suitable bio-organic combination for production of African marigold cv. Sirakole for with perfect leaves number in different seasons. Application of 25% organic fertilizer (vermicompost + poultry manure) and 75% inorganic fertilizer with bio-fertilizer in Rabi season proved to be advantageous as it exhibited required number of leaves for higher yield. In kharif season maximum number of leaves appeared in 120 days in the same treatment.Minimum number of leaves observes in control plot which reflected weak growth of plants.

KEYWORDS: Organic Fertilizer, Vermicompost, Poultry Manure, Bio-Fertilizer, Leaf Number

INTRODUCTION

Man's love and demand for flowers and floricultural products at national & international level, is the driving force for floricultural industry to become one of the most expanding & dynamic enterprise in today's world. Marigold is one of the commercially exploited flower crops that belong to the family Asteraceae and genus Tagetes. It has gained popularity amongst the gardeners on account of its easy culture and wide adaptability. Though marigold is one of the important commercial flower crops of Odisha, its yield levels are quite low and hence there is a need to standardize the optimum dose of nutrients particularly the integrated nutrient management practices.

Although a number of varieties of African marigold are commercially grown in the state, but var. Sirakole assumes greater significance since this variety produces attractive orange colour flowers throughout the year while others bloom only during the rabi season.

The recent energy crisis, high fertilizer cost and low purchasing power of the farming community have made it necessary to rethink alternatives. Unlike chemical fertilizer, organic manure and bio fertilizer available locally at cheaper rates. They enhance crop yield per unit of applied nutrients by providing a better physical, chemical and microbial environment. This ultimately improves crop yield. The available quantity of animal excreta and crop residues cannot meet the country's requirements for crop production. Therefore, maximizing the usage of organic waste and combining it with chemical fertilizers and biofertilizers in the form of integrated manure appears to be the best alternative. In the present investigation different organic, inorganic and bio fertilizer sources of fertilizers are used in a aim to not only to increase the yield of the flower but also to get maximum return from the flower crop.

MATERIALS METHODS

The field experiment was conducted in marigold for two consecutive cropping and three growing season (Kharif, Rabi and Summer) at the Krishi Vigyan Kendra farm , Jajpur of OUAT, Bhubaneswar during the period 2011-12 and 2012-13.The experiment was laid out in randomized block design with pooled over the season with three replications. Fifteen treatments combinations comprising Recommended dose of fertilizer (RDF), Vermicompost (VC), Poultrymanure (PM) and Biofertilizer (BF) were used in the experiment. The detail of the treatments are : T_1 - Control, T_2 - RDF, T_3 - PM(25% RDN) +75% RDʻNP', T_4 -VC(25% RDN) +75% RDʻNP', T_5 - BF + 75% RDʻNP', T_6 - PM (50% RDN) +50% RDʻNP', T_7 - VC (50% RDN) +50% RDʻNP', T_8 – VC (25% RDN) +BF + 75% RDʻNP' , T_9 - PM (25% RDN) + BF+75% RDʻNP', T_{10} - PM(12.5% RDN) +VC (12.5% RDN) +75% RDʻNP', T_{11} - PM(12.5% RDN) +VC (12.5% RDN)+ BF+75% RDʻNP', T_{12} - PM (50% RDN) + BF +50% RDʻNP', T_{13} – VC(50% RDN) + BF+50% RDʻNP', T_{14} - PM(25% RDN) +VC(25% RDN) +50% RDʻNP', T_{15} - PM (25% RDN) +VC (25% RDN)+ BF +50% RDʻNP'. Well decomposed farm yard manure (FYM) @ 25t / ha was thoroughly incorporated in all the experimental plots during the final land preparation. The recommended dose of chemical fertilizers at the rate of 200 kg N and 200 kg P2O5 per hectare were also applied as per the treatment schedule along with a common dose of 200 kg K2O to all the experimental plot except T1.

Data on number of leaves per plot were taken from 5 plants in every plot. The total number of leaves of each sample plant were counted and recorded at 30DAT, 60DAT, 90DAT and 120 DAT. The data were complied properly and analyzed statistically.

RESULT AND DISCUSSION

The approach of integrated nutrient management aims at efficient and judicious use of all the major sources of plant nutrients in an integrated manner, so as to get maximum yield without any deleterious effect on soil fertility and reduce the dependency on chemical fertilizers in crop production to certain extent. The present investigation was undertaken to study the effect of inorganic and organic sources of nutrients and biofertilizers on growth characters of marigold in three seasons under field conditions. A balanced supply of major nutrients combined with appropriate cultural practices are very important for higher yields of flower. Many researchers' report has shown that biofertilizers in combination with inorganic fertilizers and organic manures have augmented the growth of the produce in a number of crops.

At 30 DAT and 60 DAT it was observed that number of leaves was significantly influenced by various treatments only during rabi and summer seasons (Table 1, Figure 1). Plants with maximum number of leaves was obtained in the treatment receiving Vermicompost (25% RDN) and 75% chemical fertilizers (T_4). Significantly less number of leaves was observed in control plot i.e.T_1 receiving no fertilizer. On pooled analysis of data the treatmentT_4 recorded the maximum number of leaves. On the other hand, significantly minimum number was recorded in control. Interaction of treatments with season was not found significant with respect to this parameter. However, treatment T_4 in kharif and T_1 in summer recorded maximum and minimum values respectively.

At 90 DAT and 120 DAT (Table 2, Figure 2) maximum number of leaves per plant was recorded with T_{11} receiving 75% RDʻNP' along with poultry manure, vermicompost and biofertilizers at 120 days of planting in kharif, rabi and summer seasons. It was followed by T_9 in all three seasons. T_{11} was at par with T_9, T_8, T_{10} and T_{15} while the minimum number was recorded with control T_1. Production of leaves is proportional to the plant height besides it also depends on

number of branches, hence the number of leaves was obviously more under T_{11} followed by T_9 and T_8. Application of 75% RD'NP' was found optimum for higher leaf production in combination with FYM and biofertilizers. The reason stated above for recording maximum and minimum height and number of branches per plant may also hold good for higher and lower production of leaves under these treatments as observed in the present study. Similar findings were reported by Shubha (2006), who concluded that application of biofertilizers *viz.*, *Azotobacter* and PSB in combination with chemical fertilizers increased number of leaves per plant in marigold as compared to application of chemical fertilizers alone. Chaudhary *et al.* (2013) and Tripathy *et al.* (2013) also observed maximum number of leaves with application of organic and inorganic fertilizers in gladiolus. `

Pooled over the season showed that the treatment T_{11} was superior over all other treatments and followed by $T_{9,}$ T_8 and T_{10} without showing significant variation from each other. On the other hand, T_1 recorded the lowest number of leaves which differed significantly from other treatments. The number of leaves of the plant in the kharif season was found significantly superior from rabi and summer. The plants in rabi had significantly more leaves than those in summer. The interaction effect of the treatments and season on number of leaves was not significant. However, T_{11} in kharif season had the maximum number of leaves while T_1 (control) in summer season recorded the minimum value for this parameter.

Number of leaves per plant under T_{11} receiving poultry manure (12.5% RDN) + vermicompost (12.5% RDN) + biofertilizer + 75% RD'NP' might be due to integrated nutrients which might have played an important role in metabolic activities of plants resulting in synthesis of chlorophyll and cytochromes which are essential for photosynthesis and respiration process in the plants. Similar beneficial effect of integrated nutrient management practices on vegetative growth in rose was reported by Singh *et al.* (2006), Shashikanth (2005) in marigold. Beneficial effect of biofertilizer on plant spread was also reported by Pandey *et al*. (2010) and Verma (2010) in chrysanthemum.

EFFECT OF PLANTING SEASON ON LEAF CHARACTERS

The result indicated that number of leaves in marigold was significantly influenced by different planting seasons. In 30 DAT and 60DAT significantly more number of leaves was recorded in rabi season followed by kharif and summer season.

In 90 DAT and 120 DAT, It was found significantly more number of leaves under kharif planting followed by rabi. On the other hand, significantly less number of leaves were produced under summer planting. For the plants under kharif and rabi planting, the growing conditions were more or less similar and favourable while prevalence of higher temperature coupled with high rate of evapo-transpiration during the growth period (March - April) of summer planted crop probably did not allow the plants to grow.

Favourable growing condition with mild temperature, higher relative humidity and low rate of evapotranspiration prevailing during the growth period of kharif and rabi season planted crop might have resulted in better vegetative growth, whereas, higher temperature coupled with high rate of evapotranspiration during growth period might have become unfavourable for summer planted crop, which resulted in poor vegetative growth of plants.

Effect of planting time on vegetative growth characters of marigold cv. African yellow has been reported by Mohanty *et al.* (1993) and Samantaray *et al.* (1999), who observed that significantly greater plant height, plant spread and number of primary and secondary branches as well as stem thickness either under May or July planting. However, they found no significant difference with respect to above growth parameters under November and January planting.

It was concluded that integrated nutrient management practices involving chemical fertilizers, poultry manure, vermicompost and biofertilizers significantly influenced growth and flowering in marigold cv. Sirakole. Number of leaves per plant were significantly improved and desirable due to application of 75% RDN'P' i.e. 150 kg N. 150 kg P/ha in combination with 200 kg potash, vermicompost (12.5 % RDN), poultry manure (25% RDN), FYM (25 t/ha) and biofertilizers @ 10 kg/ha (*Azospirillum* and PSB at 1:1 ratio)in rabi season.

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APPENDIES

Table 1: Effect of Different Sources of Nutrition on Number of Leaves of Marigold in Three Seasons

Treatments		30 DAT				60 DAT			
		Kharif	Rabi	Summer	Mean	Kharif	Rabi	Summer	Mean
T_1	Control	26.93	28.62	25.42	26.96	125.41	98.32	48.32	90.66
T_2	Recommended dose of fertilizer	73.46	88.61	58.36	73.43	190.92	184.34	109.86	161.66
T_3	Poultry manure (25% RDN) + 75% RDʻNPʼ	71.81	86.32	54.60	70.90	188.62	182.72	105.35	158.86
T_4	Vermicompost (25% RDN) + 75% RDʻNPʼ	80.23	94.56	60.42	78.36	198.33	190.33	117.48	168.66
T_5	Biofertilizer + 75% RDʻNPʼ	54.39	63.81	42.81	53.63	158.48	135.81	79.40	124.53
T_6	Poultry manure (50% RDN) + 50% RDʻNPʼ	51.80	61.23	40.35	51.10	155.66	130.80	75.31	120.56
T_7	Vermicompost (50% RDN) + 50% RDʻNPʼ	48.92	58.52	38.15	68.53	148.33	126.32	72.34	115.63
T_8	Vermicompost (25% RDN) + Biofertilizer + 75% RDʻNPʼ	61.35	71.40	46.39	59.66	178.22	158.93	92.65	143.23
T_9	Poultry manure (25% RDN) + Biofertilizer + 75% RDʻNPʼ	65.92	75.65	48.60	63.36	182.6	165.32	95.32	147.73
T_{10}	Poultry manure (12.5% RDN) + Vermicompot (12.5% RDN) + 75% RDʻNPʼ	55.67	68.38	43.52	55.80	164.90	145.43	88.44	132.90
T_{11}	Poultry manure (12.5% RDN) + Vermicompost (12.5% RDN) + Biofertilizer + 75% RDʻNPʼ	68.41	79.52	50.56	66.13	184.54	178.54	101.42	154.80
T_{12}	Poultry manure (50% RDN) + Biofertilizer + 50% RDʻNPʼ	46.33	50.93	35.30	44.16	143.99	121.98	68.83	111.56
T_{13}	Vermicompost (50% RDN) + Biofertilizer + 50% RDʻNPʼ	40.27	44.30	31.61	38.70	141.61	114.61	60.10	105.43
T_{14}	Poultry manure (25% RDN) + Vermicompost (25% RDN) + 50% RDʻNPʼ	43.55	46.37	33.46	41.06	139.47	119.43	64.31	107.70
T_{15}	Poultry manure (25% RDN) + Vermicompost (25% RDN) + Biofertilizer + 50% RDʻNPʼ	35.47	39.44	29.93	34.9	132.64	109.87	55.33	99.23
	Mean	54.93	63.81	42.61		162.21	144.15	82.26	
	SEm ±	6.13	5.68	5.70		12.60	11.10	15.70	
	CD (5%)	NS	16.45	16.51		34.50	32.20	NS	
	Pooled	**Season**	**Treat**	**Tr x S**		**Season**	**Treat**	**Tr x S**	
	SEm ±	1.53	3.37	5.85		6.35	7.40	12.82	
	CD (5%)	5.32	9.50	NS		21.97	20.81	NS	

Table 2: Effect of Different Sources of Nutrition on Number of Leaves of Marigold in Three Seasons

Code	Treatments	90 DAT				120 DAT			
		Kharif	Rabi	Summer	Mean	Kharif	Rabi	Summer	Mean
T_1	Control	252.41	182.41	105.21	180.00	271.43	213.63	123.21	202.73
T_2	Recommended dose of fertilizer	255.95	216.42	141.36	204.53	277.11	237.23	164.21	226.19
T_3	Poultry manure (25% RDN) + 75% RDʻNP’	265.34	225.83	164.88	218.63	295.59	253.20	188.33	245.67
T_4	Vermicompost (25% RDN) + 75% RDʻNP’	262.82	218.68	163.21	214.86	287.52	249.59	182.65	239.87
T_5	Biofertilizer + 75% RDʻNP’	254.30	213.92	135.82	201.33	275.56	235.11	159.21	223.29
T_6	Poultry manure (50% RDN) + 50% RDʻNP’	258.36	217.40	152.67	209.45	282.11	243.25	175.59	233.60
T_7	Vermicompost (50% RDN) + 50% RDʻNP’	257.30	215.85	143.91	205.66	278.77	239.88	167.35	228.60
T_8	Vermicompost (25% RDN) + Biofertilizer + 75% RDʻNP’	282.31	254.33	178.33	238.30	317.43	283.51	202.45	267.78
T_9	Poultry manure (25% RDN) + Biofertilizer + 75% RDʻNP’	285.54	258.37	175.46	239.73	320.21	288.40	203.91	270.83
T_{10}	Poultry manure (12.5% RDN) + Vermicompot (12.5% RDN) + 75% RDʻNP’	284.58	251.62	174.59	236.86	315.26	277.31	201.36	264.60
T_{11}	Poultry manure (12.5% RDN) + Vermicompost (12.5% RDN) + Biofertilizer + 75% RDʻNP’	304.23	281.33	191.81	259.10	331.42	301.33	211.40	281.37
T_{12}	Poultry manure (50% RDN) + Biofertilizer + 50% RDʻNP’	275.69	231.49	170.35	225.76	302.20	259.35	193.46	251.63
T_{13}	Vermicompost (50% RDN) + Biofertilizer + 50% RDʻNP’	274.82	224.62	168.51	222.63	299.21	254.43	190.36	247.97
T_{14}	Poultry manure (25% RDN) + Vermicompost (25% RDN) + 50% RDʻNP’	260.24	221.38	153.65	211.70	285.28	246.34	178.35	236.60
T_{15}	Poultry manure (25% RDN) + Vermicompost (25% RDN) + Biofertilizer + 50% RDʻNP’	283.89	240.56	171.42	231.90	312.55	271.50	199.73	261.23
	Mean	270.48	230.24	159.37		296.75	256.91	182.73	
	SEm ±	11.00	16.60	12.20		12.10	10.10	12.28	

	CD (5%)	NS	42.20	35.40		35.08	29.30	35.57	
	Pooled	**Season**	**Treat**	**Tr x S**		**Season**	**Treat**	**Tr x S**	
	SEm ±	4.20	7.34	12.73		4.76	6.67	11.55	
	CD (5%)	14.53	20.66	NS		16.48	18.75	NS	

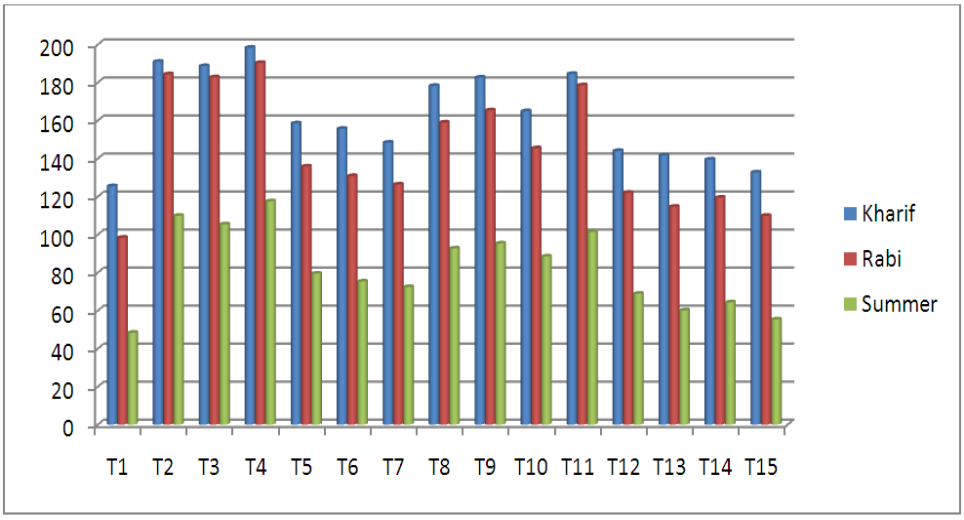

Figure 1: Effect of Different Sources of Fertilizer on Number of Leaves at 60 DAT i Marigold

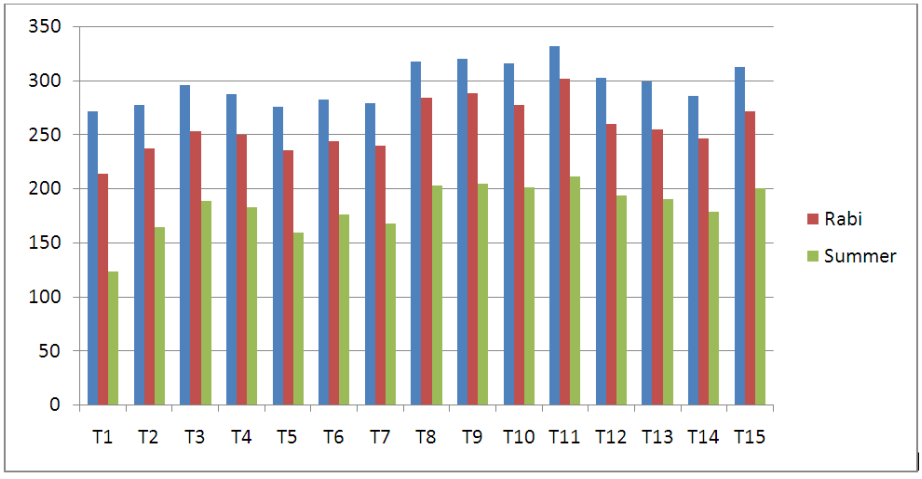

Figure 2: Effect of Different Sources of Fertilizer on Number of Leaves at 120 DAT i Marigold