Indian Journal of Hill Farming 25(1):21-25 Available online at www.kiran.nic.in

Effect of Integrated Nutrient Management Modules on Growth, Yield and Quality Attributes in Taro (*Colocasia esculenta* L. Schott)

V. K. Verma*, A. K. Jha, K. K. Wanshnong, T. L. Swer

ABSTRACT

An investigation was carried out to evaluate the effect of different organic manures on growth, yield and quality attributes in taro at ICAR Research Complex for NEH Region, Umiam, Meghalaya during April to October 2011under rainfed condition. Seven treatment combinations were evaluated on taro cultivar BCC-1 in randomized complete block design with three replications.The highest petiole length, number of cormels, length, diameter and weight of corms as well as cormel were recorded from the treatment T_3 {vermicompost (1t/ha) + Full FYM (10t/ha) + 75% recommended dose of NPK} which was statistically at par with T_2 {vermicompost (1t/ha) + Full FYM (10t/ha) + 50% recommended dose of NPK}. The highest yield (18. 47 t/ha) was also recorded in INM treatment T_3closely followed by T_2(18.10t/ha). However, organic treatment T_4 {FYM (10 t/ha) + neem cake (1t/ha)} showed highest dry matter (27.29%) and starch (17.06%) content.

Keywords: Taro, Vermicompost, Neem cake, Mustard cake, Dry matter and Starch.

INTRODUCTION

Taro (*Colocasia esculenta* L. Schott) is an important staple food crop grown throughout many Pacific island countries, parts of Africa, Asia and the Caribbean for its fleshy corms and nutritious leaves. The corm is an excellent source of carbohydrate, the majority being starch of which 17-28% is amylose, and the remainder is amylopectin. All parts of the colocasia are consumed,*viz*. the leaves, petioles, corm and cormels for curry preparation, corms for snacks, baby feed and pig feed,etc. Taro is thought to have originated in North Eastern India and Asia (Kuruvilla and Singh 1981; Ivancic 1992) and gradually spread worldwide by settlers. It is widely grown as a rainfed crop in the valley and *Jhum* area in entire North Eastern States of India. The productivity of taro in the region is very low due to non-availability of quality planting materials and no or limited uses of organic and inorganic fertilizers.

The information regarding nutritional requirement of this crop is very scanty. To improve the yield and quality of taro, there is a need to standardize the optimum dose of nutrients for improving the physico-chemical properties of soil as well as yield and quality of produce. The integrated nutrient management (INM) approaches not only improve the quality of the produce but also help in improving the soil fertility including the biosphere. In addition, they are eco-friendly, easily available and cost-effective. Therefore, it becomes essential to integrate the chemical fertilizers and organic manures. Thus, the present investigation has been carried out to study the response of the crop to integrated nutrient management modules.

MATERIALS AND METHODS

The present experiment was conducted during April to October 2011, at Horticulture Farm of ICAR Research Complex for NEH Region, Umiam, Meghalaya. Weather parameters of the area are shown in Table 1. The soil type is alfisol with sandy loam texture and acidic in reaction(pH 5.8). The experiment was carried out under rainfed condition using taro cultivar BCC-1 with seven treatments and three replications under Randomized Complete Block Design. The sprouted cormels were planted at 45x45cm spacing. The treatments were (T_1) vermicompost (1t/ha) + full FYM (10t/ha)+ 25% recommended dose of NPK (80: 60: 80 kg/ha), (T_2) vermicompost (1t/ha) + full FYM + 50%

ICAR Research Complex for NEH Region, Umiam-793103, Meghalaya
*Corresponding author E-mail: verma.veerendra @gmail.com

Table 1: Crop weather parameters of taro cultivated during April 2011 to March 2012

Month	Temp, ^{0}C (Max)	Temp, ^{0}C (Min)	Rainfall, (mm)	RH, % (Morn)	RH, % (Eve)	Sunshine Hrs	
						Total	Average
2011							
April	27.85	14.44	177.80	75.00	67.53	173.70	5.79
May	28.86	17.05	429.90	84.29	73.29	142.70	4.68
June	28.92	19.50	635.10	88.77	75.13	102.60	3.42
July	28.93	19.74	340.40	89.13	76.42	72.70	2.57
August	29.17	19.51	380.80	91.35	74.58	97.00	3.38
Sept	29.43	18.82	276.30	89.93	78.80	122.10	4.07
Oct	28.55	15.55	187.90	86.65	73.06	199.10	6.62
Nov	24.25	9.23	101.30	82.47	65.03	205.60	6.85
Dec	22.07	6.91	12.30	85.55	61.94	182.20	6.12
2012							
Jan	18.51	5.35	32.90	84.22	68.12	177.32	5.72
Feb	22.97	7.23	Nil	79.34	50.44	221.56	7.64
March	26.90	12.02	1.80	77.61	46.90	216.69	6.99

recommended dose of NPK, (T_3) vermicompost (1t/ha) + full FYM + 75% recommended dose of NPK, (T_4) FYM (10 t/ha) + neem cake (1t/ha), (T_5) FYM (10 t/ha) + mustard cake (1t/ha), (T_6) recommended dose of FYM + NPK @ 80: 60: 80 kg/ha and (T_7) as control without any supplement of manure and fertilizers. The observations were recorded for fourteen growth, yield and quality related traits. The observations for growth and yield related traits were petiole length (cm), number of petioles, number of side shoots, number of cormels and yield per plant, length (cm), diameter (cm) and weight (g) of corm and cormels and yield (t/ha). The observation for quality traits were dry matter (%) and starch (%) content. The dry matter (%) was estimated based on fresh and dry weight basis. The samples were oven dried to constant weight at 60^{0}C. Starch content analyses was carried out after removal of sugars by 80% ethanol, the samples were hydrolysed into glucose and estimated by phenol-sulphuric acid method. The mean data obtained from six randomly selected plants in each replication were statistically analysed by SAS software and the mean differences were compared by Duncan's multiple range test.

RESULTS AND DISCUSSION

The results of present investigation showed significant differences for all the traits(Table 2). The maximum petiole length (70.34cm) was noticed in treatment T_3 followed by T_2 (68.91cm) and T_6 (67.21cm). However, treatments T_2 and T_6 were statistically at par with T_3. While the lowest petiole length (56.94 cm) was in T_7 (control) where plots were deprived off the use of any INM treatments. Similarly, the maximum number of petiole per plant was in treatment T_3 (12.33) followed by T_2 (12.16) and both treatments were statistically at par as well as significant over T_7.

The highest number of side shoots per plant was observed from the treatment T_3 (3.50) which were statistically at par with treatment T_4 (3.19). However, the lowest number of side shoot was recorded from T_7 (1.83). Likewise, maximum number of cormels per plant was recorded from T_3 (7.90) which were statistically at par with T_2 (7.64) and the lowest number was in T_7 (control).

The highest length (7.54cm), diameter (4.56cm) and weight of corm (75.77g) were recorded from the treatment T_3. However, the lowest length (5.38cm), diameter (3.37cm) and weight of corms (51.94g) were recorded from treatment T_7. However, T_2 was at par with T_3 for length, diameter and weight of the corm. Similarly, the highest length, diameter and weight of cromels 7.29(cm), 2.33 (cm) and 23.69 (g) respectively, were also recorded from the treatment T_3 and treatment T_2 was at par with T_3 for cormel length (7.25cm), cormel diameter (2.32cm) and weight (23.37g). The lowest length, diameter and weight of corm and cormels were recorded from the T_7 (control).

For economic traits yield per plant and yield per hectare (346g and 18.47t, respectively) was highest in treatment T_3 followed by T_2 ie. 338g and 18.10t,

Table 2: Effect of integrated nutrient management on yield and quality attributes of taro cultivar BCC-1

Treatment	Petiole length	No of petioles	No. of Side Shoots/ plant	No. of cormels / plant	Corm length (mm)	Corm diameter (mm)	Average corm wt. (g)	Cormel length (mm)	Cormel diameter (mm)	Cormel wt (g)	Yield/ plant (g)	Yield (t/ha)	Dry Matter (%)	Starch (%)
T_1	64.62^{bc}	10.06^{b}	2.08^{de}	5.50^{bc}	6.95^{bc}	3.83^{bc}	68.65^{d}	6.74^{b}	2.15^{b}	19.88^{c}	217.0^{c}	12.36^{d}	24.75^{bdc}	16.90^{a}
T_2	68.91^{ab}	12.16^{a}	2.55^{cd}	7.64^{a}	7.20^{ab}	4.23^{ab}	74.16^{ab}	7.25^{a}	2.32^{a}	23.37^{a}	338.0^{a}	18.10^{a}	23.22^{d}	15.27^{c}
T_3	70.34^{a}	12.33^{a}	3.50^{a}	7.90^{a}	7.54^{a}	4.56^{a}	75.77^{a}	7.29^{a}	2.33^{a}	23.69^{a}	346.0^{a}	18.47^{a}	23.79d^{c}	14.08^{d}
T_4	61.24^{c}	9.66^{b}	3.19^{ab}	5.80^{b}	7.24^{ab}	4.52^{a}	73.66^{bc}	6.72^{b}	2.15^{b}	21.64^{b}	288.0^{b}	14.61^{b}	27.39^{a}	17.06^{a}
T_5	62.25^{c}	10.60^{b}	2.72^{bc}	5.00^{cd}	6.43^{c}	4.13^{bc}	72.44^{c}	6.61^{b}	2.12^{b}	20.85^{bc}	280.0^{b}	13.34^{c}	26.44^{ab}	16.54^{b}
T_6	67.21^{ab}	9.70^{b}	2.66^{c}	4.58^{d}	6.45^{c}	3.70^{dc}	70.00^{d}	6.66^{b}	2.13^{b}	20.00^{c}	278.0^{b}	13.53^{c}	22.74^{d}	12.37^{e}
T_7	56.94^{d}	7.60^{c}	1.83^{e}	4.89^{d}	5.38^{d}	3.37^{d}	51.94^{e}	5.1^{c}	1.63^{c}	12.79^{d}	136.51^{d}	5.97^{e}	25.42^{abc}	11.27^{f}
Mean	64.50	10.30	2.65	5.90	6.74	4.05	69.52	6.62	2.12	20.29	269.58	13.92	24.82	14.78
CV (%)	3.72	7.55	10.09	5.32	4.60	5.90	1.34	4.06	4.09	4.42	2.99	2.59	1.23	0.03
LSD (0.05)	4.27	1.39	0.48	0.53	0.55	0.43	1.67	0.48	0.15	1.60	14.36	0.42	1.97	0.36

Means sharing the same letter(s) are statistically non-significant at 5% probability level

(Where: T_1=vermicompost (1t/ha) + full FYM (10t/ha)+ 25% recommended dose of NPK (80: 60: 80 kg/ha), T_2=vermicompost (1t/ha) + full FYM + 50% recommended dose of NPK, T_3=vermicompost (1t/ha) + full FYM + 75% recommended dose of NPK, T_4= FYM (10 t/ha) + neem cake (1t/ha), T_5= FYM (10 t/ha) + mustard cake (1t/ha), T_6= recommended dose of FYM + NPK @ 80: 60: 80 kg/ha and T_7= control)

respectively and was statistically at par with T_3. The lowest yield (136.51g/plant and 5.97t/ha) were recorded from the treatment T_7. There was no significant difference for yield per hectare between the treatments T_2:T_3 and T_5:T_6.

The results on quality analysis revealed the highest dry matter content (27.39%) from the treatment T_4 followed by T_5 (26.44%), T_7 (25.42%) and T_1 (24.75%). However T_4, T_5 and T_7 were statistically at par for dry matter content. Likewise, starch content (17.07%) was also highest in the treatment T_4 (Fig.1)which was statistically at par with T_1 (16.91%).

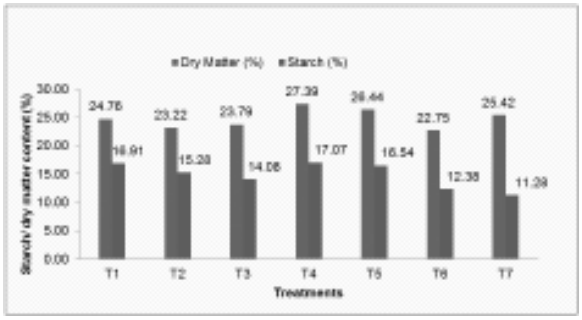

Fig. 1: Effect of INM on starch and dry matter content in taro

From the above results,treatment T_3 (Vermicompost (1t/ha) + Full FYM + 75% recommended dose of NPK) found to be the best integrated nutrient management module for petiole length, number of petioles, number of side shoots, number of cormels per plant, size and weight of corm as well as cormels and yield per plant and per hectare followed by T_2 (Vermicompost (1t/ha) + Full FYM + 50% recommended dose of NPK). However, both the treatments are statistically at par for these growth and yield related traits. Sen et al. (2007) also reported highest stolon yield in swamp taro with organic (25%) and inorganic (75%) source of nitrogen combination. Suthar(2009) also observed the maximum range of some plant parameters i.e. root length, shoot length, leaf length, fresh weight, number of cloves in garlic were in the treatment using 15t/ha vermicompost + 50 % NPK and Mondal et al.(1993) observed better net production values in potato when 75% RDF was applied together with FYM @ 10 t per ha. The increased mean growth and yield attributing traits by the application of NPK with FYM and vermicompost was attributed to solubilization effect of plant nutrients by the addition of FYM and vermicompost leading to increased uptake of NPK as reported by Nair and Peter (1990) in chilli.

The quality traits like dry matter content was highest in T_4 (FYM (10 t/ha) + neem cake (1t/ha) followed by T_5 (FYM (10 t/ha) + Mustard cake (1t/ha). Sable et al.(2007) also reported significantly higher T.S.S and shelf life when vermicompost and neem cake were applied in tomato.

For organic production of taro, treatment T_4 i.e.FYM (10 t/ha) + neem cake (1t/ha) showed significantly higher yield and quality attributes over T_5 which comprises of FYM (10 t/ha) + Mustard cake (1t/ha). This may be due to extended availability of nitrogen to the crop by slow releasing neem cake which is an effective nitrogen inhibitor and also having pesticidal properties. Kamal et al. (2012) also reported the highest dry weight of root (7.32 g), dry weight of rhizome per plant (40.35 g) and total dry matter yield (6.85 t/ha) from neem cake applied @ 2.0 t/ha in turmeric.

In conclusion, for higher yield and related attributes application of vermicompost (1t/ha) + FYM (10t/ha) + 50% recommended dose of NPK (80:60:80)has been found suitable. However, for organic production system, use of FYM (10 t/ha) + neem cake (1t/ha) is recommended for improved yield and quality traits.

ACKNOWLEDGEMENTS

We would like to express our thanks to the Director, ICAR Research Complex for NEH Region, Umiam, Meghalaya for the financial support for the present research work and to the Head Division of Agricultural Engineering for providing the weather data.

REFERENCES

Ivancic A (1992). Breeding and genetics of taro (*Colocasia esculenta*(L.) Schott. Ministry of Agriculture and Lands, Solomon Islands UNDP, Food and Agriculture Organizations of the United Nations,pp 1-97

Mondal SS, Chettri M, Sarkar S,Mondal TK (1993). Integrated nutrient management with sulphur bearing fertilizer, FYM and crop residues in relation to growth and yield of potato. J. Indian Potato Assoc. 20(2):139-143

Kuruvilla KM, Singh A (1981). Karyotypic and electrophoretic studies on taro and its origin. Euphytica 30: 405-413

Kamal MZU,Yousuf MN (2012). Effect of Organic Manures on Growth, Rhizome Yield and Quality Attributes of

Turmeric (*Curcuma longa* L.). The Agriculturists 10 (1): 16-22

Nair M, Peter KV (1990). Organic, inorganic fertilizers and their combinations on yield and storage life of hot chilli. Veg Sci 17: 7- 10

Sable CR, Ghuge TD, Jadhav SB, Gore AK (2007). Impact of organic sources on uptake, quality and availability of nutrients after harvest of tomato. J Soils and Crops 17(2): 284-287

Sen H, Mukherjee P, Mukherjee A (2007). Crop response of swamp taro to organic source of nitrogen in lower gangetic plains. Proc. of the 13th ISTRC Symposium, pp 170-176

Sen H, Das S,Dwivedi AK(1998). Stolon production of swamp taro (*Colocasiaesculenta*L. Schott) as influenced by different organic and inorganic nitrogenous fertilizers.J Root Crops 24: 81-84

SutharSurindra(2009).Impact of vermicompost and composted farmyard manure on growth and yield of garlic (*Allium sativum* L.) field crop. Int J Plant Prod 3(1): 27-38