Effect of Organic Manures on Sustainable Growth and Yield Parameters of Taro (*Colocasia esculenta*)

P. Madhanakumari and M. Mahalakshmi

Research Journal of Agricultural Sciences
An International Journal

P- ISSN: 0976-1675
E- ISSN: 2249-4538

Volume: 13
Issue: 01

Res. Jr. of Agril. Sci. (2022) 13: 078–080

CARAS

Res. Jr. of Agril. Sci. (Jan-Feb 2022)
13(1): 078–080

ISSN: 0976-1675 (P)
ISSN: 2249-4538 (E)

www.rjas.org

Short Communication

Effect of Organic Manures on Sustainable Growth and Yield Parameters of Taro (*Colocasia esculenta*)

P. Madhanakumari[1] and M. Mahalakshmi*[2]

Received: 30 Sep 2021 | Revised accepted: 15 Dec 2021 | Published online: 11 Jan 2022

***Key words*:** Taro, Organic manures, Yield, Sea weed extract, Vermicompost

Taro, (*Colocasia esculenta* [L.] Schott) is an under exploited crop grown throughout all the tropics specially in warmer areas. It is the staple food in many countries like pacific, Caribbean, and Asia and a supplement to potatoes in southern united states. All the parts of the crop are consumed viz. petioles, leaves, corms, cormels for various preparation like curry, snacks, baby weaning food. This crop is used for multidimensional purpose viz. medicinal, ornamental, fodder and as vegetable. This tuber is excellent source of carbohydrate in which majority of starch is amylose besides it has numerous health benefits such as immune boosting, reducing weight gain and fatigue, lowering blood pressure, supports thyroid function.

Though the continuous and wide use of synthetic fertilizer increases the yield of the crop and meeting the food security of the world, those plants do not have well established root and shoot system are poor in nutrients [1]. And the intensive food production leads to deterioration of soil health, contamination of the food chain and water by persistent pesticide residues or nitrates, reduction in the nutrient and flavour in crop in addition to potential health hazards [2]. The alternative method which aims in sustainable and safe food production is organic method of crop production to maintain the soil health and ecofriendly with the maximum use of on-farm resources.

In this context the organic manures like farm yard manure, vermicompost, neem oil cake, phosphobacteria are excellent soil amendments for the soil health and as well as for the plants. The sea weed extract has growth stimulating property because it contains amino acids and plant hormones like auxin and cytokinin [3]. Panchagavya enhances biological efficiency of crops. Effective microorganisms enhance the physical and chemical and biological environment of soil, suppress the incidence of pests and pathogen [4]. Thus, an experiment was conducted to study the efficiency and role of organic manures in combination with inorganic fertilizers in taro.

The study was conducted during February- August 2020 at Annamalai University, Tamil Nadu, India. The experimental field was located at Tiruvannamalai district of Tamil Nadu, India. The experimental area was a tropical region, located at 12.15°North latitude, 79.09°East longitude at an altitude of 168m above mean sea level. The experiment was laid out in randomized block design comprising of 9 treatments, replicated thrice. The treatments were T_1: RDF + 12.5t FYM ha^{-1} T_2: RDF + 12.5t FYM ha^{-1} + 3% panchagavya + 2kg phosphobacteria ha^{-1} T_3: RDF + 12.5t FYM ha^{-1} + 5% panchagavya + 2kg phosphobacteria ha^{-1} T_4: RDF + 5t vermicompost ha^{-1} + 2kg phosphobacteria ha^{-1} T_5: RDF + vermicompost (5t ha^{-1}) + seaweed extract (3ml/litre) + 2kg phosphobacteria ha^{-1} T_6: RDF + 5t vermicompost ha^{-1} + seaweed extract (5ml/litre) + 2kg phosphobacteria ha^{-1} T_7: RDF + 1t neem oil cake ha^{-1} + 2kg phosphobacteria ha^{-1} T_8: RDF + 1t neem oil cake ha^{-1}) + effective microorganisms (1:500) + 2kg phosphobacteria ha^{-1} T_9: RDF + 5t vermicompost ha^{-1} + effective microorganisms (1:1000) + 2kg phosphobacteria ha^{-1}. Farm yard manure, Vermicompost, Neem oil cake, phosphobacteria were applied as basal form. Seaweed extract, effective microorganisms, and panchagavya were soil drenched on the day of sowing, 30th and 60th days after sowing as per the treatment. Taro variety selected for study is Sree Rashmi. The tubers were sown at a spacing of 45 × 45 cm in ridges and furrows. The observation was recorded by randomly selecting five plants from each plot. The observations recorded for the study are number of days taken foe sprouting, plant height, number of leaves per plant, leaf length, leaf width, number of cormels per plant, total cormel yield/plot(kg), The folate content of the cormels was estimated by Reversed-phase high performance liquid chromatography (RP-HPLC) equipped with fluorometric detection [5]. The total starch of the cormels was estimated by colorimetric method for determination of sugars and related substances [6]. The total sugars of the cormels were estimated by colorimetric method for determination of sugars and related substances [7].

The plant height was observed during the different stages of plant growth viz., 45th, 90th, 135th days after sowing (Table 1). The maximum plant height was recorded in T_6 (RDF+ vermicompost + sea weed extract @ 5ml + phosphobacteria)

* **M. Mahalakshmi**
✉ mahalaxmimohan13@gmail.com

[1-2] Department of Horticulture, Faculty of Agriculture, Annamalai University, Annamalainagar - 608 002, Tamil Nadu, India

and T_9 (RDF + neem oil cake + effective microorganism (1:1000) + phosphobacteria) the least value of plant height was observed in T_1 (RDF + FYM - control). At 45 DAS, plant height was found to be maximum in T_6 with 45.72 cm and T_9 with 43.73 cm, on 90 days after sowing (DAS) the maximum plant height was observed in T_6 with 97.43 cm and T_9 with 93.61cm. At final observation during 135 DAS the plant height was maximum in T_6 with 144.99 cm followed by T_9 with 139.64 cm. During all the stages the minimum plant height was measured in T_1 (RDF + farm yard manure - control) with 25.33cm, 70.35cm, 94.83cm respectively. Growth enhancement mainly due to the presence of increased amount of macro and micro nutrients, amino acids, vitamins, cytokinins and auxin. These hormones have an important role in cell size enhancement and cell division [8-9]. The increase in plant height due to vermicompost may be due to stimulated metabolic process, growth synthesis and deposition of more metabolites in plant tissue [10]. Application of phosphobacteria showed increased in plant height and total corm yield in Yam. This is because phosphobacteria secrete organic acids which dissolve this unavailable phosphate into soluble form and make it available to the plants [11].

Table 1 Effect of organic manures of growth attributes of taro

Treatments	Number of days taken for sprouting	Plant height (cm)			No of leaves / plant	Leaf length cm	Leaf width cm	Number of cormels / plant	Total yield /plot
		45 days	90 days	135 days					
T_1	25.27	25.33	70.35	94.83	5.78	22.82	13.77	5.46	3.72
T_2	17.78	42.07	89.94	133.42	9.33	39.53	26.39	15.88	16.69
T_3	21.12	37.41	80.76	117.64	7.27	31.91	19.83	10.55	9.10
T_4	19.91	39.89	84.66	123.56	8.25	35.15	22.21	12.66	11.79
T_5	18.97	40.48	86.54	127.88	8.53	36.69	23.74	13.64	13.35
T_6	15.12	45.72	97.43	144.99	11.24	45.48	31.26	20.34	24.13
T_7	23.62	34.53	74.09	107.32	6.36	26.45	16.21	7.64	5.73
T_8	22.56	35.39	76.21	111.33	6.55	28.69	17.49	8.52	6.74
T_9	16.34	43.73	93.61	139.64	10.12	42.54	28.93	18.22	20.45
S. ED	1.14	0.73	1.55	2.28	0.15	1.24	0.98	0.86	0.91
C.D (p=0.05)	0.49	1.55	3.28	4.83	0.31	2.74	2.11	1.84	1.94

The number of leaves were found to be maximum in T_6 (RDF+ vermicompost+ sea weed extract @ 5ml + phosphobacteria) with 11.24 leaves plant^{-1} followed by T_9 (RDF + neem oil cake + effective microorganism (1:1000) + phosphobacteria) with 10.12 leaves plant^{-1} and least number of leaves were noted in T_1 (RDF + farm yard manure - control) with 5.78 leaves plant^{-1}. The leaf length and lead width were found to be maximum in in T_6 (RDF + vermicompost+ sea weed extract @ 5ml + phosphobacteria) with 45.48 and 31.26 respectively. It is followed by T_9 (RDF + neem oil cake + effective microorganism (1:1000) + phosphobacteria) with 42.54 and 28.93 respectively. Sea weed extract has polysaccharides such as fucoidan and laminarin as sugars which exhibit very strong growth promoting activities [12]. Sea weed extract also contains micro elements like iron, zinc and macro elements like nitrogen, phosphorus, magnesium, and calcium which is responsible for the growth.

Yield parameters

The number of cormels plant^{-1} was found to be maximum in T_6 (RDF + vermicompost + sea weed extract @ 5ml + phosphobacteria) with 20.34 followed by T_9 (RDF + neem oil cake + effective microorganism (1:1000) + phosphobacteria) with 18.22 and least value was noted in T_1 (RDF + farm yard manure - control) with 5.46. Further, sea weed extract and vermicompost help the soil to create an environment suitable for root growth by increasing microbial diversity and improving biological activities like respiration, nitrogen mobilization and mineralization of mineral nutrients [13].

Since the cormels are the only marketable produce of the plant, the weight of the corm was not considered for the total yield of the plant. The maximum amount, total cormel yield plot^{-1} was found highest under treatment T_6 (RDF + vermicompost + sea weed extract @ 5ml + phosphobacteria) with 618.94g, 24.13 Kg, 30.93 tonnes respectively. This was followed by T_9 (RDF + neem oil cake + effective microorganism (1:1000) + phosphobacteria) with 524.55g, 20.45 kg and 26.21tonnes respectively. The least amount of yield was noted under treatment T_1 (RDF+ farm yard manure - control) with 95.46g, 3.72kg and 4.76 tonnes. The increased yield and yield characters may be due to the presence of some required quantity of macro and micro nutrients in sea weed extract. It may also be due to presence of stimulators such as auxins, gibberellins and cytokinin, trace elements like (iron, calcium, zinc, cobalt, molybdenum, manganese, and nickel), vitamins and amino acids. Application of sea weed extract increased the yield in tomato because sea weed extract has an ability to increase the efficiency of plants to do photosynthesis [14]. In addition to reducing the cost of inorganic fertilizers, application of sea weed extract enhances the yield and yield characters along with the quality of produce in organic vegetables production thereby increasing the domestic and international market [15]. Application of phosphobacteria increases the yield in potato plants [16]. This is because the phosphobacteria has the ability to contribute well in root formation as well as inducing the plant growth [17].

Cytokinin in sea weed extract shifts distribution of photosynthate from vegetative parts to the developing pods and promote pod development, producing pods with superior quality [18-22]. Application of sea weed extract stimulate different aspects of plant growth like development of root system, absorption of mineral, enlargement of shoot, increased rate of photosynthesis and crop yield.

SUMMARY

The field experiment was conducted to study the influences of organic manures on the yield of taro variety Sree Rashmi at Kollakudi village, Tamil Nadu between February – August 2020 in randomized block design with nine treatments and three replications. Organic manures used for the study were farm yard manure, vermicompost, neem oil cake, phosphobacteria were applied as basal form and Seaweed extract, effective microorganisms, and panchagavya, were soil drenched on the day of sowing, 30th and 60th days after sowing as per the treatment. Results revealed that the maximum values

of growth and quality parameters viz. number of taken for sprouting 15.12, plant height on 45, 90, 135 days were 45.72cm, 97.43cm, 144.99cm respectively, number of leaves/plant 11.24, leaf length 45.48cm, leaf width 31.26cm, number of cormels/ plant 20.34, total cormel yield / plot (24.13 kg), were recorded under the treatment of RDF + vermicompost (5t ha^{-1}) + sea weed extract (5ml/ litre) + phosphobacteria (2 kg ha^{-1}) proved best treatment in respect of these parameters. Among all the organic manures sea weed extract combined with vermicompost and phosphobacteria proved beneficial in respect of yield and yield attributes. The minimum values of all these characters were recorded under control. It may be concluded that the sea weed extract, vermicompost, phosphobacteria to be feasible substitute to synthetic fertilizers also plays prominent role in production of quality tubers. This practice can be further recommended to farmers for increasing the yield and enhancing the productivity of the crop thereby improving the monetary return.

LITERATURE CITED

1. Basumatary P, Sailia L. 2019 Impact of fertilizer levels on yield and quality of French bean (*Phaseolus vulgaris* L.) types. *Crop Research* 54: 42-45.
2. Chnadhini Kumar R, Kumar R, Prakash O. 2019. The impact of chemical fertilizers on our environment and ecosystem. *Research Trends in Environmental Sciences.* pp 69-86.
3. Priyadharshini VM, Madhanakumari P. 2021. Effect of biostimulants on the yield of bush bean (*Lablab purpureus* var. typicus). *Annals of Plant and Soil Research* 23(1): 66-70.
4. Avdeenko A, Aydeenko S, Domatskiy V, Platonov A. 2020. *Bacillus subtilis* based products as an alternative to agrochemicals. *Crop Research* 21: 156-159.
5. Elansary HO, Skalicka-Woźniak K, King IW. 2016. Enhancing stress growth traits as well as phytochemical and antioxidant contents of Spiraea and Pittosporum under seaweed extract treatments. *Plant Physiol. Biochemistry* 105: 310-320.
6. Kannan P, Paramasivan M, Marimuthu S, Swaminathan C, Bose J. 2021. Applying both biochar and phosphobacteria enhances *Vigna mungo* L. growth and yield in acid soils by increasing soil pH, moisture content, microbial growth and P availability. *Agriculture, Ecosystems and Environment* 308: 107258.
7. Kharbyngar B, Devi S. 2019. Influence of seaweed extract organic and inorganic fertilizers on growth and yield of cauliflower (*Brassica oleracea* var *botrytis*) cv. Pant sugra. *Jr. Pharmacognosy and Phytochemistry* 8(4): 2088-2090.
8. Ordog V, Stirk WA, Staden VJ, Novak O, Strnad M. 2004. Endogenous cytokinins in the three genera of macroalgae from the chlorophyta. *Journal of Phycology* 40: 88-95.
9. Ramya SS, Vijayanand N, Rathinavel S. 2015. Foliar application of liquid bio-fertilizer of brown alga *Stoechospermum marginatum* on growth, biochemical and yield of *Solanum melongena*. *Int. Jr. Rec. Org. Was. Agriculture* 4: 167-173.
10. Kumar V, Jaiswal RC, Singh AP, Kumar V, Khuranas MP, Panday SK. 2001. Effect of biofertilizers on growth and yield of potato. *Jr. Indian Potato Association* 28(1): 60-61.
11. Venkatesan K, Jansirani P, Kamalkumar R, Sujatha R. 2015. Effect of organic management on the growth and yield of elephant foot yam. *Jr. Root Crops* 39(2): 260-262.
12. Abdul Raheem SM. 2009. Effect of nitrogen fertilizer and seaweed extracts on vegetative growth and yield of cucumber. *Diyala Agric. Sci. Journal* 1: 134-145.
13. Battacharyya D, Babgohari MZ, Rathor P, Prithiviraj B. 2015. Seaweed extracts as biostimulants in horticulture. *Scientia Horticulturae* 196: 39-48.
14. Saravanan S, Thampithurai S, Veeraragavatnatnam D, Sabbaia A. 2003. Effect of sea weed extract and chlormequat on growth and fruit yield of tomato (*Lycopersicon esculentum* Mill.). *Indian Jr. Agric. Research* 37(2): 79-87.
15. Chatterjee R, Thirumdasu RK. 2014. Nutrient management in organic vegetable production. *Int. Jr. Food, Agri. and Veterinary Science* 4: 156-170.
16. Youssef FA, El-Segali MU, Abou-Taleb SM, Massoud KW. 2019. Response of cowpea (*Vigna unguiculata* L.) plant to seaweed and yeast extracts. *Plant Archives* 19(2): 2363-2370.
17. Kumar A, Kumar J, Ram B. 2007. Effect of inorganic and bio-fertilizers on growth, yield and quality of tomato (*Lycopersicon esculentum* Mill.). *Progressive Agriculture* 7(1/2): 151-152.
18. Abdel-Mawgoud AMR, Tantaway AS, Magda MH, Hoda AM. 2010. Seaweed extract improves growth, yield and quality of different watermelon hybrids. *Res. Jr. Agric. Biol. Sciences* 6: 161-168.
19. Ahmed YM, Shalaby EA. 2012. Effect of different seaweed extracts and compost on vegetative growth, yield and fruit quality in cucumber. *Jr. Hortic. Sci. Ornam. Plants* 4: 235-240.
20. Babu S, Rangasamy R. 2012. Effect of *Kappaphycus alvarezii* SLF treatment on seed germination, growth and development of seedling in some crop plants. *Jr. Acad. Ind. Research* 1: 186-195.
21. Divya K, Roja MN, Padal SB. 2015. Effect of seaweed liquid fertilizer of *Sargassum wightii* on germination, growth and productivity of brinjal. *Int. Jr. Adv. Res. Sci. Eng. Technology* 2: 868-871.
22. Kocira S, Szparaga A, Kubon M, Czerwinska E, Piskier T. 2019. Morphological and biological responses of *Glycine max* (L.) Merr. to the use of seaweed extract. *Agronomy* 9(2): 93-115.
23. Sridhar S, Rangasamy R. 2010. Significance of sea weed liquid fertilizers for minimizes chemical fertilizers and improving yield of *Arachis hypogea* under field trial. *Recent Res. In Sci. Tech*. 2: 73-80.
24. Madhanakumari P, Priyadarshini VM. 2021. Effect of biostimulants on the growth of bush bean (*Lablab purpureus* var. typicus) cv. Co (Gb) 14. *Plant Archives* 21(1): 63-65.