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IMPACT OF BIOFERTILIZER APPLICATION ON DRY MATTER PRODUCTION AND HARVESTING INDEX IN *COLOCASIA ESCULENTA* (L.) SCHOTT VAR. *ANTIQUORUM*

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Abstract

An experiment was conducted during the year 2016-17 at the Agricultural Research Farm of the School of Agriculture, Lovely Professional University, Phagwara, Punjab, India to investigate the effect of biofertilizer application on the dry matter content and harvest index of Arvi (a type of Taro). The study was carried out in a two factorial RBD with five treatments and three replications. Two varieties namely Gurdaspuri Local and Desi Arvi were grown with at a spacing of 45 x 20 cm. It was found that maximum dry matter content was recorded in the treatment T5 in Gurdaspuri Local (12.58%) and in T3 in Desi Arvi (20.71%), while the harvesting index of Gurdaspuri local ranged from 0.408 in T_3 to 0.862 in T_2 while of Desi Arvi variety ranged from 0.351 in T_5 to 1.454 in T_3, which may be due to the greater accumulation of photosynthates in corms because of the application of biofertilizers like PSB or *Azotobacter* or VAM.

Key words : Arvi, *Azotobacter*, biofertilizers, *Colocasia*, PSB, VAM.

Introduction

Taro is a perennial, herbaceous, subtropical or tropical plant usually grown for its starchy and sweet flavored corms. Taro roots, also known as dasheen and eddoe, are grown in many areas of the world. Taro plant grows from 1 meter to 2 meters tall. Its leaves are also nutritious, similar to an elephant ear, light green in colour, elongated and heart shaped. It is botanically known as *Colocasia esculenta* (L.) Schott var. *antiquorum* and belongs to the family Araceae. The systemic position of the plant is described below:

Domain: Eukaryota	Order: Arales
Kingdom: Plantae	Family: Araceae
Phylum: Spermatophyta	Genus: *Colocasia*
Subphylum: Angiospermae	Species: *esculenta*
Class: Monocotyledonae	Var: *esculenta, antiquorum*

Taro is also grown as an ornamental plant (Onwueme, 1999 and Safo-Kantaka, 2004). It grows very quickly and new plants can be formed easily by the dispersal of seeds and corms which re-sprout easily. It is a plant which can be seen growing in a wide range of habitats i.e. moist forests, wet areas in riparian regions, along riverbanks, marshes, streams and canals. It is mainly cultivated for its fleshy corms and cormels, though all plant parts are consumed i.e. the leaves, petioles, corms and cormels. Its corms can be consumed as snacks, baby feed and pig feed, etc. and cormels for curry preparation. The corms can also be eaten as boiled, fried or roasted and are used for the preparation of starch and flour. The corm of Colocasia is a rich source of starch (up to 21% of total carbohydrates), protein (> 3%) and minerals and protein *i.e.* 3.9% (Gopalan *et al*., 1977). The puree made from its corms is used as a baby food which is easily digestible and low-allergenic. Due to scarcity, it is also used as a famine food.

Integrated Nutrient Management (INM) refers to the maintenance of soil fertility including the biosphere and of plant nutrients delivered at a superior level for sustaining the favored productiveness and improving the quality of the produce through optimization of the benefits from all viable sources of natural, inorganic and biological components in an integrated way. Bio-fertilizers are the materials which employ microorganisms to make the soil fertile. These fertilizers aren't harmful to crops or different

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vegetation like chemical fertilizers. They may be truly taken from the animal wastes alongside the microbial combinations. Microorganisms are used to boom the level of nutrients in the plants. They permit the vegetation to develop in a wholesome environment. They are additionally environment friendly and do not cause the pollution of any kind. Use of bio-fertilizers within the soil, makes the plants wholesome in addition to protect them from getting any disease.

Materials and Methods

The present study was carried out during the year 2016-17 at the Agricultural Research Farm of the School of Agriculture, Lovely Professional University, Phagwara, Punjab, India. The experiment was laid out in a two factorial Randomized Block Design with five treatments and three replications. Two varieties namely Gurdaspuri Local and Desi Arvi were planted with a spacing of 45 x 20 cm with five treatments *viz*. T_1 (vermicompost + NPK), T_2 (vermicompost + NPK + VAM + PSB), T_3 (vermicompost + NPK + Azotobacter + PSB), T_4 (vermicompost + VAM + PSB) and T_5 (vermicompost + Azotobacter + PSB). Five uniform plants were selected randomly in each treatment for recording dry matter content (%) and harvest index. The dry matter content of various components of plants *viz*. leaves, corms and roots were taken from the fresh weight of sampled leaves, corms and roots constant dry weight at oven temperature (100°C). The dry matter content was determined by dividing the dry weight of the produce by the fresh weight of the produce. The value obtained was then multiplied by 100 and expressed in %.

The formula suggested by Mazurczyk *et al*. (2009) was used for calculating the harvesting index in which the dry matter of corms obtained on a particular harvest date was divided by the total dry weight of plant including the corms.

Results and Discussion

The observation pertaining to fresh weight (g), dry matter content (%) and harvest index (%) has been described below as well as expressed graphically in table 1 and from fig. 1. The maximum fresh weight in leaves (Fig. 1a) was recorded in T_2 in Gurdaspuri Local (136.33 g) and T_4 in Desi Arvi (88.33 g). This was followed by T_5 both in Gurdaspuri Local (81.33 g) and Desi Arvi (63.33 g), while, the lowest fresh weight was recorded in T_3 in Gurdaspuri Local (63.33 g) and T_1 in Desi Arvi (36.33 g). Mean performance of both varieties was recorded to be highest in T_2 (109.83 g) followed by T_5 (85.83 g), T_4 (77.50 g) and T_1 (75.66 g), while average fresh weight among all the treatments was found to be maximum in Gurdaspuri Local (92.53 g). Dry matter content of leaves (Fig. 1b) was recorded to be maximum in T_3 in Gurdaspuri Local (8.27%) and T_1 in Desi Arvi (8.62%). This was followed by T_1 in Gurdaspuri Local (8.96%) and Desi Arvi (6.55%), while, the lowest dry matter was recorded in T_2 in Gurdaspuri Local (4.34%) and T_3 in Desi Arvi (5.16%). Mean performance of both varieties was recorded to be highest in T_1 (8.29%) followed by T_3 (6.71%), T_5 (6.19%) and T_4 (6.18%), while average dry matter among all the treatments was found to be maximum in Gurdaspuri local (6.67%).

The fresh root weight of roots, presented in fig. 1(c), reveals that maximum fresh weight was recorded in T_2 in Gurdaspuri Local (101.66 g) and T_3 in Desi Arvi (56.66 g). This was followed by T_4 in Gurdaspuri Local (88.33 g) and T_1 in Desi Arvi (51.33 g), while the lowest fresh weight was recorded in T_3 in Gurdaspuri Local (29.33 g) and T_5 in Desi Arvi (44.66 g). Mean performance of both varieties was recorded to be highest in T_2 (125.83 g) followed by T_4 (76.66 g), T_1 (56.83 g) and T_3 (43.00 g). The maximum dry matter of roots (Fig. 1d) was recorded in T_3 in Gurdaspuri Local (13.55%) and T_4 in Desi Arvi (11.03%). This was followed by T_5 in Gurdaspuri Local (12.75%) and T_1 in Desi Arvi (10.66%), while, the lowest dry matter was recorded in T_2 both in Gurdaspuri Local (7.26%) and Desi Arvi (5.43%). Mean performance of both varieties was recorded to be highest in T_3 (11.26%) followed by T_1 (10.58%), T_5 (10.35%) and T_4 (9.35%), while average dry matter among all the treatments was found to be maximum in Gurdaspuri Local (10.35%).

The data pertaining to fresh weight of corms, presented in Fig. 1(e), reveals that maximum fresh weight was recorded in T_1 in Gurdaspuri Local (430.00 g) and T_1 in Desi Arvi (448.33 g). This was followed by T_4 in Gurdaspuri Local (403.33 g) and in Desi Arvi (350.66 g), while the lowest fresh weight was recorded in T_3 in Gurdaspuri Local (202.00 g) and T_3 in Desi Arvi (153.33 g). Mean performance of both varieties was recorded to be highest in T_1 (439.16 g) followed by T_2 (353.16 g), T_4 (334.16 g) and T_5 (243.00 g), while average fresh weight among all the treatments was found to be maximum in Gurdaspuri local (324.00 g). The dry matter of corms (Fig. 1f) was maximum in T_5 in Gurdaspuri Local (12.58%) and T_3 in Desi Arvi (20.71%). This was followed by T_1 in Gurdaspuri Local (11.31%) and T_4 in Desi Arvi (15.26%), while, the lowest dry matter was recorded in T_3 in Gurdaspuri Local (8.83%) and T_5 in Desi Arvi (5.03%). Mean performance of both varieties was recorded to be highest in T_3 (14.77%) followed by T_4

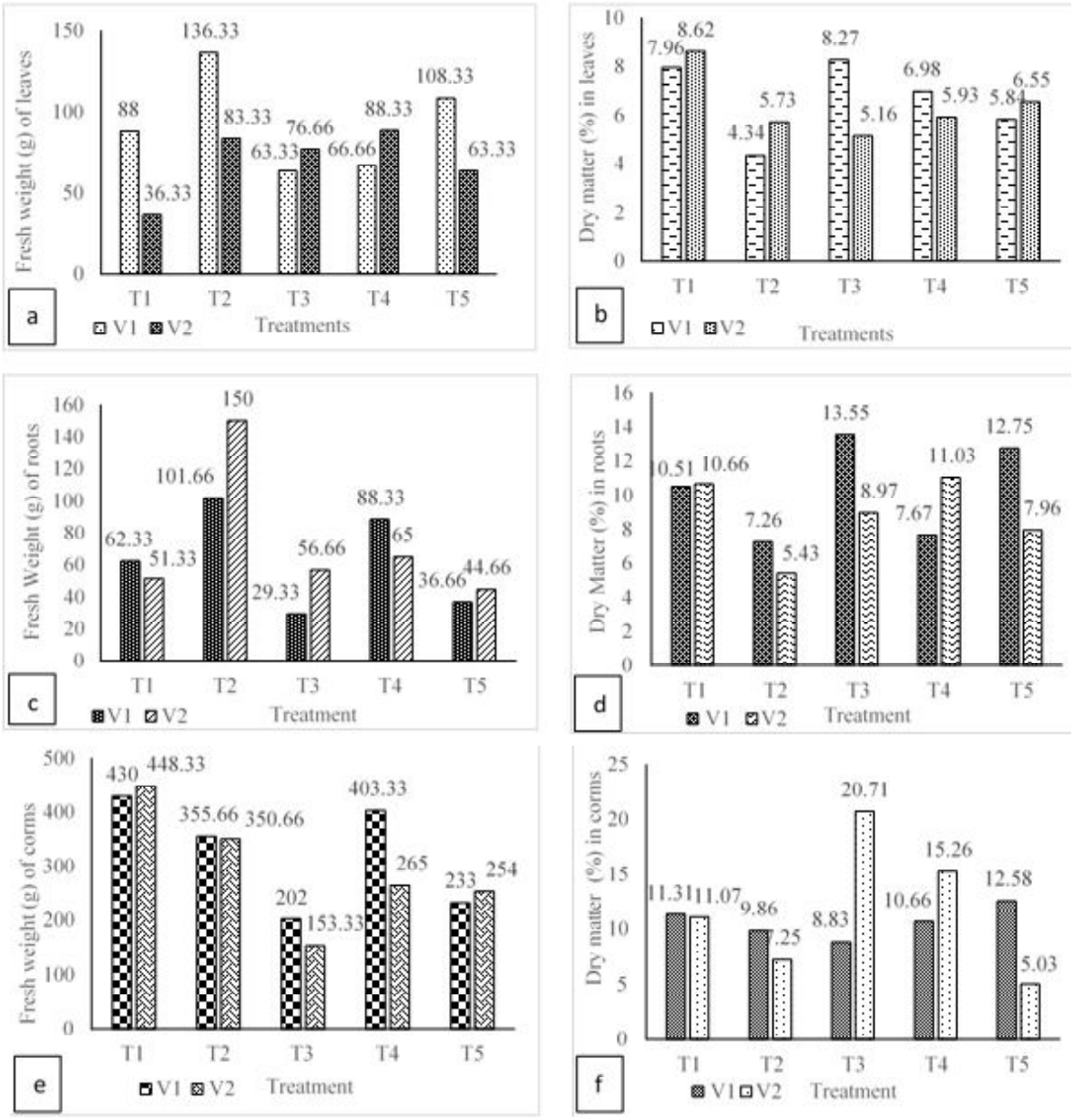

Fig. 1 : Fresh weight and dry matter content of leaves, roots and corms of arvi under different treatments [T_1 (vermicompost + NPK), T_2 (vermicompost + NPK + VAM + PSB), T_3 (vermicompost + NPK + Azotobacter + PSB), T_4 (vermicompost + VAM + PSB) and T_5 (vermicompost + Azotobacter + PSB)].

(12.96%), T_1 (11.19%) and T_5 (8.56%), while average dry matter among all the treatments was found to be maximum in Desi Arvi (11.86%). Similarly, Kumar *et al*. (2011) also observed high dry matter content (20.29%) by the application of recommended dose of nitrogen through FYM.

Observation recorded on fresh weight of the vegetative parts above the ground was significantly high under all organic treatments where as dry matter was found to be high under treatment with 100% RDF from inorganic sources. However, the fresh weight of corms was high in treatment with 100% RDF from inorganic sources and dry matter content in corms with organic source. Similarly, dry matter content in root was also high in treatment with organic nutrient sources. The greater dry matter in such treatments might be associated with greater accumulation of photosynthates in corms in the presence of biofertilizers like PSB or *Azotobacter* or VAM. Similarly, Hota *et al*. (2014) also recorded significantly highest content of dry matter (23.40%) in colocasia due to the application of lime, FYM, ½ NPK along with VAM which was found to be at par with the values of dry matter obtained by the application of 150% NPK (23.28%) and of lime with FYM, ½ NPK and

Table 1 : Harvesting index of arvi under different treatments.

Treatments	Harvesting index		
	V_1 (Gurdaspuri Local)	V_2 (Desi Arvi)	Mean
T_1	0.657	0.667	0.662
T_2	0.862	0.706	0.784
T_3	0.408	1.454	0.931
T_4	0.738	0.929	0.834
T_5	0.687	0.351	0.519
Mean	0.670	0.821	
	CD	SE (d)	SE (m)
V	N/A	0.129	0.091
T	N/A	0.204	0.144
V × T	0.610	0.288	0.204

$MgSO_4$ (23.18%), whereas, no significant variation in the values of dry matter content was observed due to the sole application of Nitrogen, Phosphorus and Potash as well as combined application of NP, NK and NPK. Verma *et al.* (2012) also observed dry matter content of 24.75% in T_1 (vermicompost @ 1 t/ha with full FYM @ 10 t/ha and 25% recommended dose of NPK @ 80: 60: 80 kg/ ha).

The harvesting index (table 1) of Gurdaspuri local ranged from 0.408 in T_3 to 0.862 in T_2 while of Desi Arvi variety ranged from 0.351 in T_5 to 1.454 in T_3. On an average T_3 and T_4 were reported to have highest harvesting index. High value of harvesting index in plants where biofertilizers had been applied in combination as 50% replacement of inorganic fertilizers may be due to greater dry matter production by plants and is in accordance with the findings of Narayan *et al.* (2013) who also reported significantly superior harvest index in potato when 75% of RDF was combined with 8 t/ha vermicompost and preserving tuber treatment with *Azotobacter* and PSB. Similarly, Mohammadi *et al.* (2013) also observed harvest index of 78.3% due to the application of biofertilizer Nitragin which is a combination of species of *Azotobacter* along with *Azospirillum*) and HB101 (a completely organic natural extract) interaction.

Conclusion

Application of biofertilizers like *Azotobacter*, or VAM in combination of PSB can minimize the need of inorganic fertilizers and ensure better dry matter production which is due to high nutrient uptake in presence of these microorganism supporting high rate of photosynthetic activity.

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