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Response of Cauliflower to Organic Nutrition under Integrated Farming in Homesteads

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***Abstract* – The performance of cauliflower crop under varying sources of organic manures available in an integrated farming system was evaluated at FSRS, Kottarakkara during December 2011 to March 2012. The different sources tried were goat manure, poultry manure, vermicompost at 50 per cent level substitution of nitrogen, 100 per cent organic nutrition and 100 per cent chemical fertilizers. Analysis of the results revealed curdyields to be betterfor the organically grown plants and the curds raised with organic and integrated sources were found to retain the quality longer than chemical fertilizer application. Low temperature storage proved better than open storage.The economic analysis proved that organic nutrition with the biowastes available within the farming system was more economic and sustainable compared to the use of purchased chemical inputs**.

***Keywords* – Biowaste, Cauliflower, Farming System, Organic Nutrition, Recycling.**

I. INTRODUCTION

An integrated farming system includes combinations of different crops, livestock and/ poultry and other enterprises that ensure profitability andsustainability to the system. The dependence on external inputs, especially nutrient sources, is considerably reduced as recycling holds key to nutrient management. Chemical fertilizers, though are ready sources of nutrients, cause problems for human health and environment [1]. Crop residues, animal wastes, composted organic wastes etc can successfully used for crop production integrated with chemical fertilizers or singly in integrated systems. Ref. [2] opined that horticultural and vegetable crops could provide two to three times more energy production than cereal crops on the same piece of land and this would ensure nutritional security oninclusion in the existing system. Homestead farming falls in line with integrated farming systems except that the selection of the components is based on the interests and needs of the farm family.Although a large quantity of biomass is available for use as nutrient inputs in these systems [3], scientific explorations on the response of component crops to these organic manures have not been conducted largely in homesteads. In this background, an experiment was initiated to evaluate the performanceof cauliflower (*Brassica oleracea* var. *botrytis* L), a newly introduced vegetable crop in homestead farming systems of southern Kerala, under the different sources of nutrients available in the homesteads.

II. MATERIALS AND METHODS

The experiment was laid out in the station farm in randomized block design during December 2011 to March 2012.The soil belonged to the ultisol lateritegroup with initial pH of 4.1, available N, P and K, 128.5, 12.82 and 212.16 $kgha^{-1}$respectively.The treatments included were T1: 100%POP recommendation as chemical fertilisers, T2: 50% NPKas chemicals+ 50% substitution with vermicompost + poultry manure,T3: 50% NPK as chemicals+ 50% substitution with vermicompost + goat manure and T4: 100% NPK as organic manures (vermicompost + goat manure + poultry manure). Seedlings of cauliflower, hybrid variety NS 60 N, were trans planted at 20 days in furrows at a spacing of 45 cm x 45 cm. FYM @25 tha^{-1} was uniformly applied in all plots initially and the nutrient sources as per treatments in three splits, one week after transplanting, 20 DAPand30 DAP. Chemical fertilizers were applied in two splits, after transplanting and 30 DAP. The other management practices were done as per the KAU recommendations for the crop. Observations on growth parameters were recorded at periodic intervals and yields at harvest. The data were subjected to statistical analysis and the cost of cultivation under the different sources were worked out. As goat manure, vermicompost and poultry manure were produced *in situ*, from the livestock, poultry and crop components within the homestead, the cost of these inputs were accounted as the labour required for the production. The soil samples were analysed for chemical parameters after the harvest of the crop as per standard procedures.

Shelf life of the curds was also assessed under different storage conditions. The conditions included S1 : normal under ambient conditions, S2 in polythene covers with holes under ambient conditions, S3: refrigerator in polythene covers with holes, S4: : refrigerator without covers S5: air conditioned storage in polythene covers with holes, S6: air conditioned storage without covers. Spoilage was assessed by the decrease in weight, loss of normal colour, variations in texture and growth of moulds.

III. RESULTS AND DISCUSSION

Growth Characters:

The data on the biometric observations at varying stages of the crop are presented in Table 1.

The plant height and number of leaves during the growth stages did not show any significant variation among the treatments, except at the initial stages. However, comparatively better plant growth and leaf spread were noticed in the treatment in which organic manures alone were given, followed by the combination of chemicals with vermicompost and goat manure. Curd formation too was early in these two treatments. Plant height and number of leaves were lowest for the chemical fertilizer applied plants at harvest and these agree with those reported [4]. Delayed curd formation (40.5 days) was recorded when chemical fertilizers were the major source of nutrients in

Table 1: Growth parameters of cauliflower under different sources of nutrients

Treatments	Height(cm)			Number of leaves			Days to 50 % curd formation	Root length at harvest (cm)
	1 MAP	2 MAP	At harvest	1 MAP	2 MAP	At harvest		
T1	1.83	13.95	15.10	5.75	18.28	19.15	40.75	21.67
T2	2.33	14.48	15.24	5.85	17.98	19.68	38.5	19.93
T3	2.16	14.94	16.69	5.58	17.78	20.68	37.5	20.42
T4	3.34	15.38	17.80	5.93	18.58	20.75	37.0	23.16
CD	0.894	ns	ns	ns	ns	ns	ns	ns

cauliflower compared to organic and integrated applications (37.0, 37.5and 38.5 days), but the effect was non significant.

Yield and yield attributes:

Perusal of the data presented (Table 2) reveal non significant variations in the diameter of curds and yields per hectare whereas the weight of individual curds were significantly greater in the organically grown plants (463.83 g). The trend noticed in the yield parameters reflected in the yields and the percentloss at harvest was least in the organically grown plants. Inclusion of organic manures in the nutrient package ensures a steady release of nutrients throughout the growth stages of the crop. Inorganic fertilizers are subjected to various losses which often results in low nutrient use efficiencies. In addition, the organic manures enhance soil aggregation, soil aeration promotes microbial activity creating favourable environment for the growth and productivity of the crop [5]. Ref. [4] reported highest yields and quality of broccoliwith addition of poultry manure along with FYM wherein the vegetative growth was maximum with the latter source. Vermicompostas the best soil additive in cabbageand bell pepperin terms of yield, net economic return, and water use efficiency has been earlier documented Ref.[6]. The cumulative effect ofthe different organic materials associated with higher vegetative growth, maximum photosynthates production and better establishment of source sink relationship would have resulted in thehigher yields in the present study reducing the need for chemical fertilizer inputsin homestead cultivation.

Table 2: Yieldsand economics ofcauliflower under ifferent sources of nutrients

Treatments	Weight of curd/ plant (g)	Diameter of curd (cm)	Yield t/ha	Marketable yield t/ha	B:C
T1	325.00	40.38	11.93	10.10	1.122
T2	307.93	40.35	11.51	9.73	0.863
T3	403.75	43.08	13.21	11.67	1.032
T4	463.83	46.37	13.75	13.25	1.312
CD	86.69	ns	ns	ns	ns

Soil properties

The changes in soil chemical parameters with the different sources of nutrients are presented in Table 3. It is evident that significant increases are recorded in the soil pH, organic carbon, available P and K with the sources added. The soil has been found to be more acidic while organic carbon, indicative of soil nitrogen, available P and Kvalues reveal soil build up of these nutrients. This conforms with the reports on organic nutrient sources enriching soil [7] and also indicates the lower nutrient input requirement during the next cropping season.

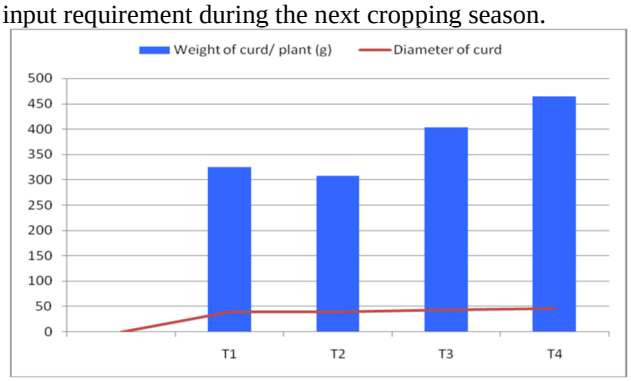

Fig.1. Significant variations in the size of curds under different sources of nutrients

Table 3: Changes in soil fertility status with integrated and organic nutrient management

Treatments	Soil pH	Organic C %	Available P kg/ha	Available K kg/ ha
T1	4.68	1.26	53.42	1337.95
T2	4.26	1.34	131.04	960.06
T3	5.76	2.45	284.86	1030.28
T4	4.72	1.44	98.78	1138.81
CD	0.394	0.405	20.943	183.86

Economics:

The economics of cultivation using the different sources of nutrients are depicted as benefit cost ratio in Table 2. Although non significant, it is very evident that manuring with the insitu wastes: vermicompost, poutry manure and goat manure, was more profitable compared to chemical sources.The lower B:C ratios noticed on integration of vermicompost and poultry manure with chemicals is due to the lower yields recorded. Being produced *insitu*, the cost of the nutrient inputs was low and limit to the labour needed for the production alone and the higher yields contributed to the better B: C values. Similar observations on organic farming being profitable when input are produced within the farm, have been made [8].

Shelf Life:

The harvested curds were kept under different storage conditions to assess the shelf life of the vegetable. It was observed that the curds were spoiled in 2 days when stored under ambient conditions with or without covers, air conditioned storage with covers proved to be the best

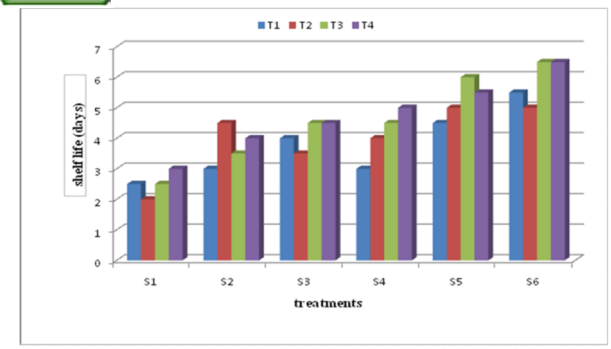

Fig.2. Shelf life of the curds under different storage conditions in days

followed by refrigerated storage (Fig.2). Cauliflower is extremely perishable and should be stored for very short periods of time and ideal storage temperature recommended is 32°F and 95+ percent relative humidity [9]. Storage at high temperatures is reported to rapidly deteriorate the quality and shelf life of cauliflower [10] and is clearly observed in the present study. The loss in weight ranged from 8.3 to 37.8 percent in the curds of the treatments one week after storage and the rate of weight loss increased with time progress of the storage period in all conditions. This implies that under tropical conditions as experienced in the district, curds turn unfit for consumption in a very short span, in less than one week.

CONCLUSION

The study brings to light the positive response of cauliflower, a heavy feeder of nutrients, to organic nutrition. Being a new crop in the southern parts of Kerala, the high yields noted in the study would pave way for encouraging use of organic materials in its cultivation. This is important in the present day agriculture when indiscriminate use of chemicals are causing serious problems related to soil, environment and health. However, the curds should be used within one week of harvest as quality deterioration is rather rapid during storage under tropical conditions which is relevant in homesteads. Chemical free production and bio waste recycling are crucial in homestead based farming systems as sustainability of the system and nutritional security of the farm household are what that receives utmost priority.

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