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A model organic farm - An holistic approach for sustainable agriculture

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ABSTRACT

A model organic farm was in operation since 2006-08 on holistic approach comprising of integrated farming system components *viz*., cows/cattle, sheep, annual crops (ragi, maize, groundnut etc) Orchards (mango, guava, sapota. etc). Scientific recycling of all crop and animal wastes in crop production was done. Biodigester was constructed to prepare liquid manure out of cattle shed waste washing, crop residues and weeds. In the biodigester co-composting of wide C:N ratio (crop residues, weeds, fibrous materials) and narrow C:N ratio materials was done so that nutrients are released quickly into the liquid manure. The farm soils were analyzed block wise soil organic carbon was low to medium (0.52 to 0.68 %). pH was also low (4.4 to 5.2) and lime was applied @ 938 kg/ha. In the first year 10 tons of FYM for ragi, groundnut and redgram and 12 tons for maize was applied. Crops were top dressed with 900 liters of Jeevamrutha and 980 liters of cattle urine diluted with water (1:10). Plant protection for crops was through the use of clerodendron extract, NSKE sprays, light traps, *Trichograma viridae* seed treatment. Contents of cattle urine, Jeevamrutha, bio-digester manure varied greatly with breed, type of feeds and other inputs used. Yields of ragi (1979 kg/ha), redgram (2343 kg/ha) and groundnut (1188 kg/ha) were higher than the inorganic block (1733, 1080, and 743 kg/ha, respectively). Further Mango, Sapota and Cashew also produced higher yields (5537, 2234 and 855 kg/ha) as compared to previous years (4000, 1500 and 700 kg/ha, respectively). High net returns and B:C ratios were realized from organic block. Major break through in crop yield was by using bio-digester manure or other liquid manures as top dress material to meet the crop demand.

Key words : Model organic farm, Sustainable agriculture, Ragi, Redgram, Groundnut, Mango, Sapota and cashew yield, B: C ratio

INTRODUCTION

Agricultural scenario after green revolution is dismal and coupled with many problems. Fast expansion in cultivated area, reduction in the use of organic manures and continuous cropping with only fertilizers have created hungry and thirsty soils. Organic agriculture is a holistic crop production and management system, which encourages conservation and development of on-farm natural resources and their optimum utilization so organic agriculture claims to be sustainable. In the context of agriculture, sustainability basically refers to the successful management of resources of agriculture to satisfy human needs while at the same time maintaining or enhancing the quality of the environment and conserving natural resources. Sustainability in organic farming must, therefore, be seen in a holistic sense, which includes ecological, economical and social aspects. Sustained production at higher levels becomes possible only when the factors leading to the continued maintenance of soil health are adequately taken care of. Hence, the sustainability of present level of agriculture is at stake.

Organic farming and integrated farming also represent real opportunities on several levels, contributing to rural economies through sustainable development. Indeed, new employment opportunities in farming, processing and related services are already evident in the growth of the organic sector. As well as the environmental advantages, these farming systems can bring significant benefits both to the economy and the social cohesion of rural areas (Pandey *et al.,* 2008). Organic farming can be practiced in any situation from lowest rainfall areas to highest rainfall areas. Managing local natural resources like seeds, manure, plant protection technique, rain water harvesting will reduce the input cost and improve farm income. It does not involve borrowing heavy loan for input purchases. Organic farming seeks balance and harmony among the various inputs. additionally organic farming strives to maintain and enhance soil fertility through crop rotation and composting. Avoids deficiency of nutrients in soil, which directly influences farmer's income and thus their level of independence versus debt. There is a noticeable improvement in the farmers' income by adopting the organic farming system. In this model organic farm, organic inputs produced and used for organic farming practices to disseminate the organic farming system to organic growers. For this direction model organic farm was established with holistic approach for sustainable agriculture.

MATERIALS AND METHODS

Field trails were carried out at Model Organic Farm,

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Table 1 : Qualitative analysis of liquid manures - cattle urine

Parameters	Desi cow	Buffaloe	Cross breed	Bio-digester	FYM
pH	7.35	8.64	8.78	7.45	7.91
EC(dSm-1)	46.4	70.40	79.9	0.023 %	0.80 %
N(%)	0.61	0.68	0.81	0.91 %	0.63 %
P(%)	0.01	0.009	0.009	0.63 %	0.80 %
K(%)	0.98	1.15	1.49	196	8036
Ca (meq/l)	2.81	1.6	1.40	46.5	13.2
Mg(meq/l)	9.60	8.7	7.4	22.0	30.4
Na (meq/l)	0.14	0.16	0.17	21.0	132.4
Fe (ppm)	3.06	6.81	3.70		
Mn (ppm)	0.46	1.14	0.57		
Zn (ppm)	3.85	8.28	3.76		
Cu (ppm)	0.99	1.18	1.01		

ARS, Balajigapade, Chikkabalapur district located in Eastern Dry Zone (Zone-5) of Karnataka, India during two *Kharif* season of 2006.-08. The experimental site is situated at latitude of 13.4^0 north, longitude of 77.7^0 east and at an altitude of 870 meters above mean sea level with average annual rainfall of 697.2 mm. The soil experimental site was red sandy loam with slightly acidic in nature. The field trails was conducted in two blocks, organic and inorganic to find out the effect of organic manures and liquid manures on productivity and nutrient availability, economics after harvesting of crops. The details of material used and experimental techniques adopted during the course of investigation are furnished in below.

The soil of the experimental site at Model Organic Farm was red sandy loam in texture and classified under the order Alfisols, Vijapura series, isohyperthermic family of oxihaplustaf. The soil pH was slightly acidic (4.4 to 5.2) having low cation exchange capacity (7.50 C mol kg^{-1}) with an electrical conductivity of 0.25 dSm^{-1}. The organic carbon content was low to medium (0.52 to 0.68 %). The soil was low in available nitrogen (202.8 kg ha^{-1}), high in available phosphorus (24.2 kg ha^{-1}) and medium in available potassium (218 kg ha^{-1}).

Organic input of the farm:

Scientific recycling of all crop and animal wastes in crop production was done. Biodigester was constructed to prepare liquid manure out of cattle shed waste washing, crop residues and weeds. Liquid Organic Manures analyzed for nutrient content *viz*., cattle urine of cross breeds, desi cow, buffalo and jeevamrutha, beejamrutha, bio-digester and FYM is presented in Table 1 and 2. Great variation in the contents of cattle urine exists among the breeds, kinds of feeds and hence the bio-digester liquid manure. Among these manures FYM was applied as basal dose at the time of sowing and other dry land horticultural crops. Liquid manures *viz*., bio-digester, Jeevamrtha were applied in 2-3 splits as per the crop requirement on N-equivalent basis and also top dressing after rain fall to meet the crop requirement and other block maintained inorganically.

Biodiversity of the farm:

Presently there were nineteen plant species and residues of each plant species which were used in biodigester and number of each plant species in the farm are given in the Table 2.

Table 2 : Different plant species and their number

Sr. No.	Scientific name	Common name	Nos.
1.	*Eucalyptus golbulus*	Neelagiri	930
2.	*Casurina equestifolia*	Surugi	619
3.	*Acacia ariculiformis*	Acacia	2300
4.	*Dendro calamus strctris*	Bamboo	40
5.	*Simarouba glauca*	Simarouba	100
6.	*Gravelia robusta*	Silver oak	309
7.	*Azardirachta indica*	Bevu	45
8.	*Syzigium jambuliana*	Jambu Nerale	20
9.	*Mimosa leucocephala*	Sabubul	250
10.	*Delonix regia*	Gulmohar	6
11.	*Acacia longifolia / pendula*	Polyalthia	23
12.	*Embelica officinalis*	Bettada nelli	10
13.	*Aurtocarpus integrifolia*	Halasu	41
14.	*Tamarindus indica*	Hunase	42
15.	*Tectona grandis*	Teak	200
16.	*Mangifera indica*	Mango	260
17.	*Anacardium occidentale*	Cashew	145
18.	*Melia azardirachta*	Kadu bevu	3
19.	*Pongemia glabra*	Onge	25

Table 3 : Yield and economics of different crops

Crops	Yield kg/ha		Cost of cultivation (Rs/ha)		Net returns (Rs/ha)		C B ratio	
	Organic	Inorganic	Organic	Inorganic	Organic	Inorganic	Organic	Inorganic
Ragi	1979	1733	12883	12648	8038	4682	1.62	1.37
Redgram	2343	1080	14413	12949	24412	4871	2.70	1.38
Groundnut	1188	743	14303	13332	4678	-1393	1.33	0.90
Mango	5537	4000	14125	12500	47495	25000	4.36	3.00
Sapota	2234	1500	10800	13000	25420	17000	3.35	2.30
Cashew	885	700	7813	11000	35188	34000	5.50	4.09

RESULTS AND DISCUSSION

The results indicated that the grain yield of ragi (1979 kg/ha), redgram (2343 kg/ha) and groundnut (1188 kg/ha) were higher in organic farming system as compared to yields of inorganic block (1733, 1080, and 743 kg/ha, respectively) (Table 3). Further dry land horticultural crops *viz*., Mango, Sapota and Cashew also produced higher yields (5537, 2234 and 855 kg/ha, respectively) as compared to previous years (4000, 1500 and 700 kg/ha, respectively). In organic block higher grain yield in different crops were due to organic manures might have supplied some of the micronutrients besides improving the soil aggregation, soil carbon, soil fertility, water holding capacity, solubility and availability of soil nutrients. Favourable effects of organic manures on soil pH, EC, redox potential, CEC and microbial population of the rhizosphere. Therefore, it could be concluded that organic manures is a good amendment as well as store house of nutrients for plant growth as reported by Poornesh *et al*. (2004), Sheshadri Reddy *et al.* (2004) and Rukmangada Reddy *et al.* (2007) and Jagadeesha (2009).

Application of organic manures alone resulted in lowest cost of cultivation, highest net returns in turn to get the high B: C ratios (1.62, 2.70, 1.33, 4.36, 3.38 and 5.50, respectively of Ragi, Redgram, groundnut, Mango, Sapota and Cashew) (Table 3). This is because of lower cost of cultivation due to cheaper organic manures containing most of the plant nutrients. Due to application of organic manures alone resulted in lowest cost of cultivation and also major break through in crop yield by using bio-digester manure or other liquid manures as top dress material to meet the crop demand. Further, application of N through organic manure not only reduced the cost of cultivation but also resulted in higher grain yield thereby increasing the net returns as reported by Jagadeesha (2009) and Gungal (2007). Major break through in crop yield was by using bio-digester manure or other liquid manures as top dress material to meet the crop demand. The study clearly revealed that application of organic manures at equivalent recommended nitrogen dose could be successfully used for different crops to substitute the chemical fertilizers.

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