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Productivity and economic advantages of flower crops in coconut based intercropping system

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ABSTRACT

An experiment was conducted to study the performance of flower crops as intercrop in coconut, during the year 2013 to 2015 at Coconut Research Station, TNAU, Aliyarnagar. The five flower crops *viz*., Chrysanthemum (*Dendranthema grandiflora*), Celosia (*Celosia* sp.), Marigold (*Tagetes erecta*), Zinnia (*Zinnia* sp.) and Gomphrena (*Gompherena globosa*) were planted in the coconut garden to identify the most suitable flower crops for growing as intercrop in adult coconut garden and to evaluate the economic viability of the cropping system. Results showed that in a Coconut + Marigold (*Tagetes erecta*) intercropping system, an average flower yield of 6,053 kg ha^{-1} was recorded from marigold with a net income of Rs. 2,54,983 /ha and B:C ratio of 1.87 followed by Coconut + Gomphrena (*Gomphrena globosa*) with a net income of Rs. 2,40,458/ha and B:C ratio of 1.85. Based on economics, it is recommended that Marigold and Gomphrena were the remunerative flower crops in a 24 year old coconut gardens as intercrops without reduction in nut yield.

Key words: *Cocos nucifera*, marigold, gomphrena, nut yield, economics.

INTRODUCTION

Coconut is grown in more than 93 countries of the world in an area of 12.29 million ha with a total production in terms of copra equivalent of 11.04 million MT. Indonesia (25.63%), Philippines (23.91%), India (19.20%) are the major coconut producing countries of the world. India occupies a predominant position in respect of production of coconut in the world, cultivated in 1.97 million ha in 19 states and 3 Union Territories producing 20,439 million nuts with an average productivity of 10,345 nuts per ha as per Coconut Development Board (CDB) statistics for the year 2014-15.

The local coconut industry has been reeling from unstable market situation characterized by low copra prices in the international market. In the hope of helping the coconut farmers, a technology was developed to maximize land use and generate additional income (Margate and Magat, 8). The growth habit and canopy configuration of coconut palms strongly support different coconut based cropping systems. Coconut intercropping system ensures maximum resource capture and use, leading to higher yield per unit area of soil, water and light. The beneficial interactions of inter/mixed cropping of coconut with different crops in improving soil nutrient status of the system has been reported by Maheswarappa *et al*., (5). Coconut is usually planted with a spacing of 7.5 m × 7.5 m offering ample scope for intercropping with suitable perennial, biennial and seasonal crops including medicinal and aromatic plants leading to considerable increase in the production and productivity per unit area, cropping intensity by more efficient utilization of sunlight, soil, water and labour (Nath *et al*., 10). Earlier research efforts have revealed that tuber crops, fruit crops, rhizomes, pulses and vegetables can be grown well under coconut garden. In the present scenario of fluctuation in coconut price and high production cost, the pure crop of coconut is no more economical. Hence, intercropping in coconut garden becomes indispensable for augmenting the income of the coconut farmers. Government of India has identified floriculture as a sunrise industry and accorded it 100% export oriented status. Owing to steady increase in demand of flowers, floriculture has become one of the important commercial trades in Agriculture. Hence, commercial floriculture has emerged as hi-tech activity-taking place under controlled climatic conditions inside greenhouse, and is being viewed as a high growth Industry. Coconut based intercropping with flower crops requires short period of planting time, smaller area (unutilised spaces between coconut), provides additional income to coconut farmers. Hence a study was conducted to evaluate the impact of intercropping flower crops in coconut on productivity per unit area and economics of the system.

MATERIALS AND METHODS

Field experiment was conducted for three consecutive years from 2013 to 2015 under AICRP

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(Palms) at Coconut Research Station, TNAU, Aliyarnagar to find out the most suitable flower crops for growing as intercrops in a 24 years old coconut garden and to evaluate the economic viability of the intercrop. The research station is situated at 10.49° N latitude and 77° E longitude with an altitude of 20 m above the mean sea level. Initial soil analysis indicated that the soil was low in available nitrogen (120 kg ha^{-1}), medium in P_2O_5 (19 kg ha^{-1}) and high in K_2O (522 kg ha^{-1}). The soil was sandy loam, non-calcarious, non-saline and neutral in pH. The experiment on intercropping of flower crops in coconut garden was laid out in RBD with four replications. The experiment consisted of five treatments *viz*.,: T_1: Coconut + Gomphrena (*Gompherena globosa*), T_2: Coconut + Chrysanthemum (*Dendranthema grandiflora*), T_3: Coconut + Marigold (*Tagetes erecta*), T_4: Coconut + Celosia (*Celosia* sp.), T_5: Coconut + Zinnia (*Zinnia* sp.) and T_6: Coconut - monocrop (control). Five flower crops were planted during July-August, 2013 in a coconut garden of 24 year old hybrid (VHC-2) planted at a spacing of 7.5 m × 7.5 m. Flower crops Gomphrena, Chrysanthemum, Marigold, Celosia and Zinnia were annual in nature. The intercrops were grown in a plot size of 225 m^2 accommodating four palms within each system. All through the experimental period, vermicompost and FYM were applied as organic manure basally and inorganic fertilizers were applied as top dressing in split doses. The recommended package of practices was followed as per the regular schedule. Benefit Cost ratio was computed as the present value of benefits divided by the present value of costs by using the following formula:

$$BCR = \frac{\sum_{t=1}^{t=T} \frac{(Benefit_t)}{(1+r)^t}}{\sum_{t=1}^{t=T} \frac{(Cost_t)}{(1+r)^t}}$$

Where, B_t is the benefit in time, *t* and C_t is the cost in time *t,* r is the discount rate.

Nut equivalent yield of intercropping systems as well as economics was worked out based on prevailing market price on input and output (Ghosh and Bandopadhyay, 3, Thiruvarassan *et al.*, 12).

$$\text{Nut equivalent yield (NEY)} = \frac{\text{Yield of intercrop} \times \text{Market price}}{\text{Prevailing market price of a nut}}$$

RESULTS AND DISCUSSION

Maximum number of flowers per plant (16.6 flowers /plant) and the highest flower weight (9.1 g) recorded in Gomphrena and Marigold respectively (Table 1). The highest flower yield of 6053 kg/ha recorded in Marigold and was followed by Gomphrena (5206 kg/ha), Chrysanthemum (4502 kg/ha) and Celosia (4067 kg/ha). The lowest flower yield of 3509 kg/ha recorded in zinnia.

Annual leaf production, total inflorescence and nut yield per palm did not differ significantly among the coconut based flower intercropping system. However, increases of about 2 to 8 percentage was observed with intercropped palms over the monoculture (Table 2). It is likely, that part of the fertilizers applied to the intercrops which would have been otherwise lost through run-off or by other means, had been absorbed by the coconut palms, thereby there was improvement in the yield. Moreover, weed management and cultivation intended mainly for the intercrops to improve soil aeration and make the nutrients more available to the plants also benefited the main crop. Similar results were reported earlier by Margate and Magat (8) in coconut based multiple cropping systems. Mohandas (9) reported that intercropping herbal plants in coconut enhanced the mean annual nut yield to the tune of 18 per cent (145 nuts/ palm /year) over that of pure coconut (123 nuts / palm / year). Korikanthimath (4) also opined that increased nut yield in the coconut based system was due to additional input the coconut had received in terms of irrigation, fertilizerand weed control, etc. The congenial microclimate due to intercropping associated with increased microbial activities, improvement in soil fertility might have favoured the growth and yield of coconut. The improvement in nut yield of the main crop by intercropping was also reported by many workers (Maheswarappa *et al*., 6, Nath *et al*., 11 and Basavaraju *et al*., 1).

Coconut with Marigold (*Tagetes erecta*) recorded an average flower yield of 6,053 kg/ha with a net income of Rs. 2,78,350/ha and B:C ratio of 1.87 followed by Coconut + Gomphrena (*Gomphrena globosa*) with a net income of Rs. 2,30,975/ha and B:C ratio of 1.85 (Table 3). The lowest net income (Rs. 113750/ha) and B:C (1.77) ratio were obtained with coconut alone as a monocrop. Das (2) and Maheswarappa *et al*., (6) have demonstrated the much higher employment potential of coconut based

Table 1. Growth and yield parameters of flower crops when grown as intercrops in coconut garden

Treatments	Flowers per plant	Flower weight (g)	Flower yield (kg/ha)
T_1 - (Coconut + Gomphrena)	16.6	0.7	5206
T_2 - (Coconut + Chrysanthemum)	4.5	3.1	4502
T_3 - (Coconut + Marigold)	3.5	7.1	6053
T_4 - (Coconut + Celosia)	5.5	5.5	4067
T_5 - (Coconut + Zinnia)	6.1	4.0	3509
T_6 - (Coconut	--	--	--

Table 2. Growth yield parameters of coconut.

Treatments	Annual leaf production (Nos.)	Functional leaves (Nos.)	Total Inflorescence (Nos.)	Pre- treatment yield (Nut/ Palm/Year)	Mean Nut yield (Nut/Palm/Year) (2012-15)
T_1 - (Coconut + Gomphrena)	13.0	35.2	10.0	122	144
T_2 - (Coconut + Chrysanthemum)	12.6	35.6	10.2	124	143
T_3 - (Coconut + Marigold)	12.5	32.2	10.5	132	138
T_4 - (Coconut + Celosia)	13.3	34.9	10.6	125	136
T_5 - (Coconut + Zinnia)	12.8	35.7	10.9	133	135
T_5 - (Coconut)	13.1	34.9	10.4	130	133
SEd±	0.53	1.74	0.48	6.9	17.3
CD(P=0.05)	NS	NS	NS	14.6	NS

Table 3. Economics and nut equivalent yield of flower crops in coconut garden.

Treatments	Flower yield (kg/ ha)	Nut yield (Nuts/palm/ year)	Nut equivalent yield	Gross income (Rs./ha)	Net income (Rs./ha)	B:C ratio
T_1 - (Coconut + Gomphrena)	5206	144	13015	382125	230975	1.85
T_2 - (Coconut + Chrysanthemum)	4502	143	11255	334875	182125	1.80
T_3 - (Coconut + Marigold)	6053	138	15133	435800	278350	1.87
T_4 - (Coconut + Celosia)	4067	136	10168	359400	214550	1.83
T_5 - (Coconut + Zinnia)	3509	135	8773	327710	222160	1.84
T_6 - (Coconut)	--	133	--	227500	113750	1.77

multistoried and mixed farming systems and more profitable to integrate a number of subsidiary crops and animal components with coconut rather than raising it as a monocrop. Mahmud and Akuba (7) concluded that “intercrops had no bad effect on coconut production and in certain cases they tend to increase the production of coconut and give an additional income to farmers”. Intercropping system under coconut is more profitable than mono cropping which promises to the farmers a lot besides generating additional employment opportunity. Nut equivalent yield for an intercrop was maximum in case of Marigold (15,133) followed by Gomphrena (13,015) and Chrysanthemum (11,255) intercropping system. Similarly, the highest nut equivalent yield (26,718) in coconut + blackpepper + pineapple cropping system was reported by Ghosh and Bandopadhyay (3) followed by coconut + blackpepper + banana.

Based on the performance and economics of the commercial flower crops, Marigold and Gomphrena can be grown as remunerative flower crops in adult coconut gardens as intercrops without reduction in nut yield. The income generated by the intercropping system with Marigold (59.13 %) and Gomphrena (50.75%) was more than the double the netincome compared coconut monoculture. The coconut crop benefited from the additional fertilizers applied for the intercrops, in addition to spinoffs’ from weed management and cultivation, thereby increasing yield.

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