

RESEARCH ARTICLE

Assessment of yield and economics of vegetables as intercropping system in coconut garden for additional returns

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SUMMARY

A field experiment was conducted on assessment of yield and economics of vegetables as intercropping system in coconut garden for additional returns at different villages of Tiptur taluk, Tumkur districts of Karnataka during from 2013 to 2015 to study the influence of intercropping system on coconut yield, economics of coconut based intercropping system with vegetables and the soil fertility status of coconut garden. The experiment consisted of three different intercropping systems viz., coconut sole cropping as farmers practice (T_1), coconut + vegetable cowpea (T_2) and coconut + French bean (T_3) with seven replications at farmers field in a 36 year old coconut garden of Tiptur tall variety planted at 9m x 9m spacing. The average three year results of experiments were recorded. The yield of coconut was found to higher nut yield (9594 nuts/ha/year) under french bean as intercrop in coconut garden followed by cowpea as intercrop in coconut garden (9348 nuts/ha/year) during third year. Whereas lowest nut yield was recorded in coconut sole crop in farmers practice. The highest net annual income Rs. 99,720/ha and B:C 3.22 were recorded in coconut + French bean intercropping system with more additional income and market demand of beans followed by coconut + vegetable cowpea (Net annual income Rs. 84,260/ha and B:C 3.10) with less market demand of vegetable cowpea, where as lowest net annual income Rs. 43,107/ha and B:C 2.34 were recorded in coconut sole cropping with no additional income from the farmers practices. The soil fertility status viz., NPK availability in soil were analyzed before and after the experimental period of three year. Gradually increased N, P and K content of soil in coconut intercropping with beans and cowpea on far with each other, but lowest soil fertility were recorded in coconut as sole cropping system in farmers practices due to high biomass of french bean and cowpea, which fixes atmospheric nitrogen, residue incorporated into soil and suppression of weed growth results in improvement of soil fertility status. Higher net returns and improve the soil fertility by growing the french bean as intercrops in coconut garden is more suitable cropping system to boost economy of farmers.

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Coconut (*Cocos nucifera* L.) is a high value perennial plantation crop grown in an area of 2.07 million ha with a production of 23,351 million nuts and productivity 11277 nuts/ha in India during 2012-13 (Anonymous, 2015). Coconut cultivated in 19 states and 3 Union Territories in India. Kerala, Tamil Nadu, Karnataka and Andhra Pradesh contribute 90 per cent of area and 91 per cent of production. 90 per cent coconut holdings are owned by small and marginal farmers in the country contributes more than Rs. 10,000 crores annually to GDP (Anonymous, 2012). The unstable copra prices in the national and international markets, small and marginal land holdings, lack of value addition facilities etc. have aggravated the economic difficulties to many coconut farmers. However, research efforts have resulted in evolving viable technologies to increase the productivity of coconut. Studies have revealed that sole crop of coconut with a spacing of 7.5m x 7.5m effectively uses only 22.3 per cent of land area (Durieux, 1997), while the average air space utilization by the canopy is about 30 per cent and solar radiation interception is about 50 per cent (Thiruvarassan *et al.*, 2014 and Dan *et al.*, 2005). Adoption of coconut based intercropping system is one of the ways to utilize the natural resources effectively. The potential for increasing the productivity per unit area of land, time and inputs through coconut cropping system is considerably higher in perennial crops (Bavappa and Jacob, 1982 and Bavappa *et al.*, 1986).

The main aim of the Krishi Vigyan Kendra is to reduce the time lag between generation of technology at the research institution and its transfer to the farmers for increasing productivity and income from the agriculture and allied sectors on sustained basis. KVKs are grass root level organizations meant for application of technology through assessment, refinement and demonstration of proven technologies under different 'micro farming' situations in a district (Das, 2007).

Objective:

- To study the influence of intercropping system on coconut yields.
- To study economics of coconut based intercropping system with vegetables as compared to farmers practice.
- To study the soil fertility status of coconut garden growing with vegetables as intercrops before and after conduct of on farm trials.

MATERIAL AND METHODS

The on farm trials were conducted for assessment of yield and economics of vegetables as intercropping system in coconut garden for additional returns at farmer's field of Tumkur district, Karnataka state during the year from 2013-14 to 2015-16. The experiment was laid out three treatments with seven trials in a 36 year old coconut garden of Tiptur Tall variety planted with a spacing of 9m x 9m. A plot of coconut sole crops was maintained as control (Farmers practice). French bean (Arka Suvidha) and vegetable cowpea (Arka Suman) as intercrops in coconut garden. Parvagondanahalli, Ramanahalli and Lakkiahalli village of Tiptur taluks were selected to conduct three years on farm trials with an area of 1.2 ha every year.

- T₁ - Coconut sole cropping (Farmers practice)
- T₂ - Coconut + vegetable cowpea (Arka suman)
- T₃ - Coconut + French bean (Arka suvidha)

The critical inputs were supplied to farmers and applied as per treatments (T₂) followed University of Agricultural Sciences, Bengaluru package of practices and treatments (T₃) followed Indian Institute of Horticulture Research, Bengaluru as source of technology. The on farm trial plots at farmer's fields were regularly monitored by scientists of Krishi Vigyan Kendra, Konehalli, Tiptur. Basic data of the farmers field were collected before initiation of on farm trials. The data were analysed with appropriate statistical procedures.

RESULTS AND DISCUSSION

The results obtained from the present investigation as well as relevant discussion have been summarized under following heads :

Influence of intercropping system on coconut yield:

The yield data (Table 1) of coconut were recorded during the year from 2013-14 to 2015-16. The yield of coconut was found to slightly increase during first year and gradually increased to higher nut yield (9594 nuts/ha/year) during third year in french bean as intercrop in coconut garden followed by cowpea as intercrop in coconut garden with 8487 nuts/ha/year during first year and gradually increased to higher (9348 nuts/ha/year) during third year. Where as lowest nut yield was recorded in coconut sole crop (Farmers practice) during three year as compared to intercropping system in coconut garden (Varghese *et al.*, 2013 and Ahmed *et al.*, 2007). The additional increase in yield of coconut with intercropping

of vegetable could be due to synergistic effect of crop combination and also legumes crops increases soil nutrient content. Results analogous to these finding were also reported by Marimuthu (2005) and Maheswarappa *et al.* (2003).

Influenced of intercrop yield by cropping system :

The yield data on intercrops were recorded (Table 2). The variation in the yield of the intercrop was found during the cropping period. The data revealed that the intercrop yield of cowpea (2760 kg/ha) and french bean (3245 kg/ha) during first year, which increased to 3210 kg/ha and 3707 kg/ha during third year in cowpea and french bean, respectively. This might be due that the growing of legumes crops such as cowpea and french bean as intercrops in coconut garden, residual incorporated into soils which improve the physical, chemical and biological property of soil (Sujatha *et al.*, 2011 and Bavappa, 1990). Whereas no additional crops yield was obtained in farmers practices and also decreases soil fertility status (Khandekar *et al.*, 2014 and Islam *et al.*, 2008).

Economics of intercropping system in coconut :

The economic of intercropping system in coconut was worked out by calculating total cost of cultivation, gross return, net return and B:C (BCR) of all treatments. Total cost of cultivation was calculated by total sum of

expenditure of land preparation, seed, manure and fertilizers, plant protection measures, irrigation and labour component etc. in coconut and intercrops. The data (Table 3) revealed that highest net returns (Rs.99,720/ha/year) and BCR (3.22) was obtained in French beans as intercrops in coconut followed by cowpea as intercrops in coconut with net return (Rs. 84,260/ha/year) and BCR (3.10). Whereas lowest net returns (Rs. 43,107/ha/year) and BCR (2.34) was obtained in coconut as sole crop in farmers practice. This might be due to that additional income obtained from growing cowpea and French bean as intercrops in coconut garden and also market rate of beans as more demand compared to cowpea as less demand in market (Bari and Rahim, 2010 and Nair and Gopalakrishnan, 1990). The farmers sold the coconut Rs. 9/nut, price of beans Rs. 18/kg, veg. cowpea Rs. 15/kg at farmer field and on that base profitability was calculated (Bari and Rahim, 2012 and Maheswari *et al.*, 1985).

Effect of intercrops on soil fertility status of coconut:

The soil fertility status *viz.*, NPK availability, pH and electrical conductivity (EC) in soil were analyzed after the experimental period of three years and compared with the pre experimental (Farmers practice) soil fertility status. The numerical increase in all the three major nutrients was observed over the pre-treatment observation. The available N (264 kg/ha), P (20 kg/ha),

Table 1 : Influence of intercropping system on coconut yield

Tech. option	Details of technology	Coconut yield (Nuts /ha/year)			Cumulative 3 year mean nut yield (Nuts/ha/year)
		2013-14	2014-15	2015-16	
T ₁	Coconut sole crop (Farmers practice)	8487	8364	8241	8364
T ₂	Coconut + Veg. cowpea	8487	8733	9348	8856
T ₃	Coconut + French bean	8733	8979	9594	9102

Table 2 : Influenced of intercrop yield by cropping system

Tech. option	Details of technology	Vegetable yield (kg /ha)			Cumulative 3 year mean vegetable yield (kg/ha)
		2013-14	2014-15	2015-16	
T ₁	Coconut sole crop (Farmers practice)	Mono-cropping			
T ₂	Coconut + Veg. cowpea	2760	3040	3210	2970
T ₃	Coconut + French bean	3245	3515	3707	3489

Table 3 : Yield and economics of coconut based cropping system with vegetables

Tech. option	Details of technology	Yield of coconut (nuts/ha/yr)	Yield of vegetable (kg/ha)	Gross income (Rs./ha)	Cost of production (Rs./ha)	Net income (Rs./ha/yr)	B:C
T ₁	Coconut sole crop (Farmers practice)	8364	--	75,276	32,169	43,107	2.34
T ₂	Coconut + Veg. cowpea	8856	2970	1,24,260	40,000	84,260	3.10
T ₃	Coconut + French bean	9102	3489	1,44,720	45,000	99,720	3.22

(Coconut Rs. 9/nut, Price of beans Rs. 18/kg, Veg. cowpea Rs. 15/kg)

Table 4 : Soil fertility status of coconut intercrops with vegetables

Soil fertility status	Coconut sole crop (FP)		Coconut + veg. cowpea		Coconut + French bean	
	Pre-treatment (2013-14)	Post treatment (2015-16)	Pre-treatment (2013-14)	Post treatment (2015-16)	Pre-treatment (2013-14)	Post treatment (2015-16)
N (kg/ha)	241	235	241	262	241	264
P (kg/ha)	17	16	17	19	17	20
K (kg/ha)	156	154	156	162	156	163
pH	7.7	7.8	7.7	7.5	7.7	7.4
EC(ds/m)	0.31	0.32	0.31	0.29	0.31	0.30

K (163 kg/ha) status was higher in coconut + French bean intercrops, which is on par with coconut + Cowpea intercrops (Table 4). Whereas lowest available N (235 kg/ha), P (16 kg/ha), K (154 kg/ha) status was recorded in coconut as sole crops (Shajikumar, 1991). This might be due to that incorporation of residual after harvest of beans and cowpea pod (Maheswarappa *et al.*, 2013) and also high biomass of French bean and cowpea, which fixes atmospheric nitrogen, residue incorporated into soil and suppression of weed growth results in improvement of soil fertility status (Mini *et al.*, 2015).

Conclusion :

The experiment concluded that the highest nut yield, annual net return and B:C were recorded in French bean as intercrops in coconut garden with more additional income and market demand of beans followed by cowpea as intercrops in coconut garden, less market demand of vegetable cowpea, whereas lowest net annual income were recorded in coconut sole cropping with no additional income from the farmers practices. N, P and K content of soil in coconut intercropping with beans and cowpea on par with each other, but lowest soil fertility were recorded in coconut as sole cropping system in farmers practices. Higher net returns and improve the soil fertility by growing the French bean as intercrops in coconut garden is more suitable cropping system to boost economy of farmers.

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