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Short communication

Evaluation and economics of different intercrops in banana

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Banana, one of the most important tropical fruits of the world, also called as "Apple of Paradise" because of its antiquity. In India, it is grown in an area of 3.84 lakh hectares with an annual production of 77.9 lakh tonnes (Anon., 1). This contributes to 11.67 per cent of total area and 24.29 per cent of total production of fruit crops in India. In Kerala, it is grown in 72,570 ha with a production of 57,4260 tonnes. Its ability to give high returns within a short time compared to other fruit crops has resulted in its cultivation being taken up by small as well as big farmers. Intercropping is a common practice in banana orchards to check weed growth, improve soil health and to augment the additional income. Cropping intensity as well as crop production can be increased by multiple cropping practices and this has long been recognized as a common practice. Intercropping can provide substantial yield advantages compared with sole cropping (Singh, 9). The inter row space in banana remains underutilized in the early growing period and during which short duration crops may be grown as intercrops (Bose, 3) thus, allowing one to grow more than one crop and also to efficiently utilize the space and other resources (Chundawat *et al*., 4). Banana is a common crop in Thrissur district of Kerala and most of the farmers follow intercropping system. However, the intercrops selected by farmers are not profitable. The success of intercropping system depends mainly on selection of suitable crops and agronomic modifications of resource use (Midmore, 8). Therefore, an on-farm trial was conducted to find out the most productive and remunerative banana based intercropping systems at farmer's field in Thrissur district of Kerala for two consecutive years (2006 and 2007).

The trial was conducted in complete randomized block design with three replications. The unit plot size was 6 m × 6 m with plant to plant spacing 2 m × 2 m. The variety of banana 'Nendran', okra 'Pusa Sawani', pumpkin 'Arka Suryamukhi' and bitter gourd 'Arka Harit' were used in the trial. The banana suckers were planted in 60 × 60 × 60 cm size of pits. Four inter-cropping systems such as banana (sole), banana + okra, banana + pumpkin and banana + bitter gourd were tested. The soil of the experimental site was sandy loam with pH of 6.8 having low nitrogen (211.4 kg/ha), medium P_2O_5 (32.12 kg/ha) and optimum K_2O (299 kg/ha) content. Fertilizer dose was calculated on the basis of soil test results and applied at the rate of 650-150-350 kg/ha NPK and 10 tonnes/ha of farm yard manure. Fifty percent farm yard manure was well mixed at the time of final land preparation. Rest 50% farm yard manure, 50% P and K were applied during pit preparation. Remaining P, K and all N were top dressed in ring method at 30, 60 and 90 cm apart from plant in three successive intervals of 30, 60 and 90 days after planting. No additional fertilizer was applied for intercrops but adequate plant protection and intercultural operations were done as and when required. Three irrigations were applied in all treatments before top dressing of fertilizers. Three weedings and earthing up operations were also done at 60 and 135 days after planting and before flowering of banana. Data on plant height, number of leaves per plant, number of fingers per bunch, weight of fingers and bunch, fruit yield of banana and intercrop yield were taken.

Banana Equivalent Yield (BEY) was calculated as suggested by Anjeneyulu *et al.* (2) given below:

$$\text{BEY} = \text{yield of banana} + \frac{\text{Yield of intercrop} \times \text{Price of intercrop (Rs./kg)}}{\text{Price of main crop (Rs./kg)}}$$

Two years data were pooled together for statistical analysis. Economics of each treatment was computed with prevailing market rates. Collected data were analyzed statistically using computer package MSTATC (Gomez and Gomez, 5).

The yield and yield contributing characters of banana showed that highest plant height (2.37 m), leaves per plant (20.89) and number of finger per bunch (126.8) in banana + bitter gourd intercropping (Table 1). Maximum weight of finger (201.40 g) was recorded from intercrop combination of banana + pumpkin, which was statistically similar to other intercrop combinations except sole banana. All intercrop combinations also produced higher bunch weight than sole banana. Higher fruit yield was obtained from banana + pumpkin followed by banana + bitter gourd and banana + okra

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intercrop combinations. Higher yield advantage in banana + pumpkin combination might be due to higher canopy coverage produced by pumpkin, which helped to retain better soil moisture, lowering soil temperature and resulting in enhanced growth and fruit yield. Fruit yield was lowest in sole banana compared to all other intercropping systems. This result indicated the complementary effect of banana-based intercropping systems. Similar complementary effects of intercropping systems were also observed by Haque and Hamid (6).

The yield of pumpkin was maximum compared to okra and bitter gourd indicating that it was more compatible with banana (Table 2). Lowest yield was recorded in okra, which was due to viral infection and poor growth because of shading due to banana leaf. In contrast pumpkin yielded significantly better under the intercropping system and was found more compatible with banana than other vegetables. The highest banana equivalent yield (94.03 t/ha) was obtained from banana + pumpkin followed by banana + bitter gourd intercropping system and lowest in sole banana (51.13 t/ha). Crop index of intercropping systems indicated that 20% yield advantage in banana + pumpkin combination compared with sole banana, followed by banana + bitter gourd (17%) and banana + okra (15%) intercrop combinations. Such yield advantage with intercropping over sole cropping was also noted by Haque *et al*. (7).

The highest gross return was recorded from banana + pumpkin combination followed by banana + bitter gourd. All the intercropping systems showed higher gross return with higher cultivation cost then the sole crop (Table 3). Higher cost was involved in intercropping systems due to the additional expense on crop management though resulting in higher gross return and gross margin in intercropping system. Cost: benefit analysis further showed highest B: C ratio (2.41) for banana + pumpkin combination.

From present study it can be concluded that banana with pumpkin intercropped combination gave higher yield and benefit cost ratio than other combination. Therefore, this combination could be recommended for banana growing areas in Thrissur district of Kerala for sustainable and economical production.

Table 1. Yield and yield attributes of banana in different intercropping systems.

Treatment	Plant height (m)	No. of leaves per plant	No. of fingers per bunch	Weight of fingers (g)	Weight of bunch (kg)	Fruit yield (t/ha)
Banana (sole)	2.16	18.49	117.7	175.90	20.58	51.63
Banana + okra	2.12	19.20	121.2	190.30	23.75	59.63
Banana + pumpkin	2.22	19.45	122.2	201.40	24.76	62.19
Banana + bitter gourd	2.37	20.89	126.8	191.40	24.16	60.69
CD at 5%	0.05	0.38	2.35	47.50	1.55	9.80

Table 2. Yield of banana and intercrops in banana based intercropping systems.

Treatment	Banana yield (t/ha)	Intercrop yield (t/ha)	Banana equivalent yield (t/ha)	Crop index (%)
Banana (sole)	51.63	-	51.13	100
Banana + okra	59.63	2.20	61.98	115
Banana + pumpkin	62.19	24.90	94.03	120
Banana + bitter gourd	60.69	5.57	76.10	117

Table 3. Economics of banana based intercropping system.

Treatment	Gross return (Rs./ ha)	Total cost of cultivation (Rs./ ha)	Net return (Rs./ha)	Benefit : cost ratio
Banana (sole)	1,18,110	81,405	36,705	1.45
Banana + okra	1,43,190	83,571	59,619	1.71
Banana + pumpkin	2,17,204	90,254	1,26,950	2.41
Banana + bittergourd	1,75,800	93,754	82,046	1.87

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