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Feasibility and Profitability of Legume Intercrops in Banana

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ABSTRACT: *A field experiment was conducted at Horticultural College and Research Institute, Anantharajupet, Kadapa district of Andhra Pradesh during 2010 -11 to find out feasible and profitable legume intercrops* viz. *bush beans, dolichos beans, cluster beans, blackgram, greengram, cow pea and field bean in banana. Intercrops significantly influenced the plant height of banana, but the effect was non significant with respect to pseudo stem circumference and number of leaves per plant, number of fingers per bunch and number of hands per bunch of banana. The study revealed that intercropping banana with cluster bean (48.96 t ha^{-1}) showed highest banana equivalent yield which was comparable with that of black gram (48.51 t ha^{-1}) followed by field bean (47.76 t ha^{-1}) and sole banana (47 t ha^{-1}). It was lesser than sole banana in rest of the intercropping combinations. Land equivalent ratio (LER) was greater than one in all the intercropping combinations and were found to be advantageous over sole cropping. LER was significantly higher with cluster bean (1.58) followed by black gram (1.49), field bean (1.49), dolichos bean (1.48) and green gram (1.47) followed by cowpea (1.45) and bush beans (1.44). Highest Benefit cost ratio was recorded in intercropping with dolichos bean (2.49) which was on par to that of cluster bean (2.37), black gram (2.37), field bean (2.29), bush beans (2.19), green gram (2.18) followed by cowpea (2.09) and sole banana(1.98).*

Key words: Banana equivalent yield, banana, growth, intercropping, legumes and LER

INTRODUCTION

Intercropping, which is the simultaneous cultivation of crops is a predominant cropping system in developing countries, it is currently accomplished in many portions of the world [Francis 5]. It is an advanced agrotechnique [Thayamini & Brintha 12] of growing two or more crops at the same time during the same season on the same piece of land [Geiler *et al*., 6]. The system has been shown not only to be more efficient than sole cropping [Remison, 10] but also to improve the overall ecology [Adelana, 1]. The main idea of intercropping is to get improved productivity per unit land area and time, and also impartial and judicious exploitation of land resources and farming inputs including labour. It is eminent to point out that to produce additional food from less expense of land through more efficient use of natural means with minimal impact on the environment in order to meet the increasing population request intercropping is a viable option. Ijoyah and Fanen [7] further reports that the choice of crop combination is key to successful intercropping. Incompatibility factors such as planting density, root system and nutrient competition need to be considered. Farmers practice intercropping with a wide array of crops, consisting ordinarily of a major crop and other insignificant crops. However, it is pertinent that the selection of compatible crops be given priority as this depends on their growth habit, land, light, water and fertilizer utilization [Thayamini & Brintha, 12]. Intercropping plays a vital role in subsistence food production in both advanced and emerging countries [Adeoye *et al*., 2]. Legumes can relocate fixed nitrogen to intercropped cereals through their common growing period and this N is an imperative resource for the cereals [Bhagad *et al*., 4]. In a general note, Shafik and Soliman [11] put it that

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intercropping may lead to overall yield advantage. Inter cropping system is an important approach of cropping system for increasing crop yield. Plant competition is an inevitable phenomenon in intercropping system that reduces intercrop productivity. It also increased land equivalent ratio (LER) to varying degrees.

Kadapa district is potential area for production of banana. In the past few years banana farmers are facing various problems in respect of increasing cost of production per unit area due to high diesel cost, high labour charges, more dependency on chemical fertilizers, high transportation charges, poor market facilities & rate. Under such situation it is necessary to reduce the banana cost of production per unit area which is possible by growing the intercrops. Since banana is a long duration and wider spaced crop, there is a scope to grow short duration narrow spaced intercrops for better utilization of resources and greater stability of yields. Now a days, the area of banana is increasing due to high local demand as well as high market price. Traditionally, farmers of Kadapa region cultivate banana as a sole crop. On the other hand, different short duration vegetable crops were also cultivated as mono crop. Due to limited plain land such intercropping system would be benefit for the farmers. Farmers often demand for quick return from their crops, so they can get quick return by growing short duration intercrops crops with banana. As such type of investigations in banana is scant the present study was therefore undertaken to in order to examine the feasibility of growing different short duration legumes as intercrops in banana.

MATERIALS AND METHODS

An effort was made at Horticultural College and Research Institute, Anantharajupet, Kadapa district of Andhra Pradesh 2010 -11 to evaluate the performance of seven legume crops *viz*. bush beans, dolichos beans, cluster beans, black gram, green gram, cow pea and field bean as intercrops in banana. A field experiment was laid out in Randomized Complete Block Design with three dispersed replications for selecting responds. Totally eight different treatments were taken in the study, such as T_1-sole banana, T_2 - banana + bush beans, T_3 - banana + dolichos beans, T_4 - banana + cluster beans, T_5 -banana + blackgram, T_6 - banana + greengram, T_7 - banana +cow pea and T_8 - banana +field bean. Grandnaine banana was planted at a spacing of 2x2 m to accommodate 3 rows of bush beans, dolichos beans, cluster beans, black gram, green gram and 2 rows of cow pea and field bean with following spacings, 45x15 cm (cluster bean, dolichos bean, bush beans and field bean) and 30x15 cm(cowpea, green gram and black gram). The soil of the experimental site was sandy loam with pH 6.0 to 7.0, 45 to 50 days old banana seedlings were transplanted into the respective pits on first week of September. The seeds of all the intercrops were planted between the two rows after planting the banana. Nutrients were applied for main crop. Additional fertilizers were not applied for intercrops. Standard package of practices were adopted for banana as well as for intercrops. Necessary intercultural operations were done to facilitate the growth and development of the crops. All intercrops were harvested within 90 days after sowing. The yield data of intercrops was recorded by total harvested yield on unit plot basis and then converted into t/ha yield. Bush beans, dolichos beans and cluster beans were harvested for vegetable purpose, black gram, green gram, cow pea and field bean for seed purpose and banana for table purpose. Collected data were analyzed by following standard statistical methods. Banana equivalent yield was calculated by converting yield of intercrops to the yield of banana on the basis of prevailing market prices of the individual crops. The formula is as follows:

Banana equivalent yield = $Y_0 + (Y_i \times P_i) / P_0$

Where: Y_0 = Yield of banana

Y_i = Yield of intercrop

P_i = Selling price of intercrop

P_0 = Selling price of banana

Land Equivalent ratio (LER) = LER of Banana + LER of Legume

Where: LER of Banana = Intercrop yield of banana / Sole crop yield of banana

LER of Legume = Intercrop yield of legume / Sole crop yield of legume

Benefit Cost Ratio (BCR) = Gross return / Cost of cultivation

RESULTS AND DISCUSSION

Growth parameters of banana

The effect of different legume intercrops on growth parameters of banana was presented in Table 1. Among the different growth parameters, intercrops significantly influenced the plant height of banana, but the effect was non significant with respect to pseudo stem circumference and number of leaves per plant of banana. Among the different intercrops tried, the plant height of banana was significantly maximum in T_4 -banana + cluster bean, which was on par to that of T_8 - banana + field bean, T_6- banana + green gram,

Table 1
Growth characters, yield attributes and yield of banana as influenced by different legume intercrops in banana

Treatments	*Plant height (m)*	*Pseudo stem circumference (m)*	*No. of leaves per plant*	*No. of Fingers/ bunch*	*No. of hands/bunch*	*Bunch Weight (kg)*	*Banana yield(t/ha)*
T_1 : Sole banana	1.92	0.65	14.22	169.67	9.00	24.03	47.00
T_2:Banana+Bush beans	2.03	0.67	14.22	159.00	8.67	17.5	42.43
T_3:Banana+Dolichos bean	1.97	0.60	13.77	153.33	9.00	21.7	46.53
T_4:Banana+Clusterbean	2.09	0.67	14.10	162.00	9.33	22.23	48.82
T_5:Banana+Blackgram	1.92	0.62	13.88	175.00	10.0	22.33	48.14
T_6:Banana+Greengram	2.04	0.65	14.45	151.33	9.00	18.50	45.82
T_7:Banana+Cowpea	1.99	0.61	14.32	161.67	9.33	20.1	43.96
T_8:Banana+Field bean	2.08	0.062	14.00	172.67	10.00	26.33	47.51
CD at 5%	0.13	NS	NS	NS	NS	3.862	2.61

T_2-banana + bush beans, T_3- banana + dolichos beans, T_7-banana +cow pea followed by T_5- banana +black gram and T_1-sole banana.

Yield attributes of banana

Data presented in Table 1 represents the effect of seven legume intercrops on yield attributes and yield of banana B.C. ratio. Influence of intercrops on number of fingers per bunch and number of hands per bunch of banana was not significant. Bunch weight (Kg) was significantly superior in intercropping T_8 - banana + field bean (26.33 kg) and in sole banana (24.03 kg) followed by T_5 - banana + black gram (22.33 kg), T_4 - banana + cluster beans (22.23 kg), T_3 - banana + dolichos beans (21.7 kg), T_7 - banana + cow pea (20.1 kg), T_6- banana + green gram (18.50 kg). The bunch weight was least with T_2- banana + bush beans (17.5 kg).

Banana yield

Intercropping of banana with cluster bean (T_4) (48.82) recorded highest banana yield (t/ha) which was on par when intercropped with black gram (T_5) (48.14), field bean (T_8) (47.51), sole banana(T_1) (47.00 t/ha) and dolichos bean (T_3) (46.53) followed by intercropping with green gram(T_6) (45.82) and cowpea(T_7) (43.96). The least banana yield was recorded in intercropping with bush beans (T_4) (42.43). Generally legumes in association with non-legumes not only helps in utilization of the nitrogen being fixed in the current growing season, but also helps in residual nutrients build up of the soil.

B.C. ratio

Obviously intercropping is beneficial with most of the crops. Highest Benefit cost ratio was recorded in intercropping with dolichos bean (2.49) which was on par to that of cluster bean (2.37), black gram (2.37), field bean (2.29), bush beans (2.19), green gram (2.18) followed by cowpea (2.09) and Sole banana(1.98) (Table. 2). Similarly Ajeet singh *et al.,* [3] reported that based on the B: C ratio and equivalent yield of banana, it is found that banana+ onion (3.35 & 741.9 q) followed by banana+ cow pea (3.13 & 616.2 q) are more economical as intercrops without any adverse effect on yield of banana. Besides additional income

Table 2
Effect of banana legume intercropping combinations on banana yield, intercrop yield, Banana equivalent yield, B.C ratio and Land equivalent ratio

Treatments	*Banana Yield (t/ha)*	*Intercrop yield (t/ha) (vegetable/seed)*	*Banana Equivalent yield (t/ha)*	*B : C ratio*	*Land equivalent ratio*
T_1: Sole banana	47.00	0	47	1.98	1.00
T_2:Banana+Bush beans	42.43	2.13	42.32	2.19	1.44
T_3:Banana+Dolichos bean	46.53	5.53	45.92	2.49	1.48
T_4:Banana+Clusterbean	48.82	2.67	48.96	2.37	1.58
T_5:Banana+Blackgram	48.14	0.5	48.51	2.37	1.49
T_6:Banana+Greengram	45.82	0.53	45.95	2.18	1.47
T_7:Banana+Cowpea	43.96	0.68	43.72	2.09	1.45
T_8:Banana+Field bean	47.51	0.75	47.76	2.29	1.49
CD at 5%	2.61	0.51	1.12	0.31	0.03

these intercrops also help in reducing the cost of cultivation.

Banana equivalent yield

Intercropping with cluster bean showed highest banana equivalent yield (48.96 t/ha) which was comparable with that of black gram followed by field bean and sole banana. It was lesser than sole banana in rest of the intercropping combinations (Table.2).

Land equivalent ratio (LER)

All the intercropping systems where the Land equivalent ratio (LER) was greater than one were found to be advantageous. LER was significantly higher with cluster bean (1.58) followed by black gram (1.49), field bean (1.49), dolichos bean (1.48) and green gram (1.47) followed by cowpea (1.45) and bush beans(1.44) (Table.2). The Land Equivalent Ratio value 1.58 in banana + cluster bean indicates that by intercropping banana and cluster bean at a spacing 2x2 m for both banana and cluster bean, a farmer could produce 48.82 tons of banana and 2.67 tons of cluster bean from one hectare of land instead of growing them separately in 1.58 ha of land to obtain the same combined yield. Similar result was observed by Rehman *et al* .[12] in banana + potato intercropping and by Qasem *et al*. 9[11] in Chili + maize intercropping. Conclusively Intercropping in banana can be remunerative and minimize risks associated with cultivating a single crop which will ensure more stable subsistence in terms of food nutrition and possible income.

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