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Lablab Bean Based Intercropping System in Northwest Region of Bangladesh

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Abstract: Institute of Biological Science, University of Rajshahl, Rajshahi 6205, Bangladesh Department of Genetics and Breeding, University of Rajshahi, Rajshahi 6205, Bangladesh Fruit Research Station, BARI, Binodpur, Rajshahi, Bangladesh. A field experiment on lablab bean based intercropping system was conducted at the Botanical Garden of Rajshahi University during the winter of 1999-2000 and 2000-2001. The experiment was conducted in with sole lablab bean and other crops as like as lettuce and spinach and their intercropping combinations. The yield and yield components of lablab bean were influenced by intercrops and the lablab bean JessoreI/lettuce intercropping in 1:1 ratio gave the highest monetary return and land equivalent ratio (LER) of 2.00. The yield advantage was more in intercropping than all sole cropping systems, except when it was intercropped with spinach.

Key words: Intercropping, companion crop, lablab bean, lettuce, spinach and relative yield, LER

Introduction

Bean is used in crop rotation for the improvement of soil fertility Bean sprouts are also a nutritious vegetable consumed in many Asian countries but unknown in Bangladesh. They are high in protein and mineral contents and meal with other vegetables or as a replacement for them. Lettuce [*Lactuca sativa* L. (2n=18)] is a winter leaf-,vegetable, which is used as most popular salad plant in almost al parts of the world. Spinach (*Beta vulgaris* 2n=18) is also an annual winter leafy vegetable, which is very popular in Bangladesh for its flavor and high nutritive value.

Intercropping or mixed cropping forms a cropping practices where total production from a unit area of land in a farming year is achieved through growing two or more crops simultaneously in the same land area, particularly in tropics (Andrews and Kassam, 1976) and in densely populated countries, sole crop in sequence or a combination of mixed and sole crop in sequence (BARI, Annual Report, 1996-97). Intercropping gives a greater stability of yield over monoculture (Willey and Reddy, 1981). Besides it often provides higher economic and monetary return and total production per hectare compared to mono culture (Grimes *et al.,* 1983; Kurata, 1986) and ensure greater resource use efficiency (Herrara and Harwood, 1974; Pathick and Malla, 1979). It has been reported from many countries viz., Bangladesh, India. China, Tiwan, Sri Lanka, Vietnam, Africa and Latin America (Beets, 1977). A previous study at Rajshahi University revealed that short duration of leafy vegetables like lettuce and spinach can be profitably intercropped with long duration of lablab bean.

Rajshahi is the very potential area for production of winter vegetables. But the people of this region suffer much from malnutrition than any other parts of Bangladesh. The main reason of this situation is that the productions of vegetables cans not meet even half of the requirements here. This is due to the fallacy of seeking to attain food self-sufficiency through increased production of rice and other cereals. Traditionally, the farmers of Rajshahi area cultivate long duration lablab bean as well as short duration lettuce and spinach as a mono crop. The farmers don't know how to cultivate more production from per unit area, how to cultivate lablab beans, lettuce and Bengal spinach simultaneously. Indeed such type of investigation in bean, lettuce and spinach is scants.

Materials and Methods

The experiment was conducted at the Botanical Garden of Rajshahi University. Rajshahi in the north west region of Bangladesh during the period of winter rabi season of 2000 and 2001 in randomized complete block design (RCBD) with three dispersed replications for selecting responds. The unit plot dimension was 1.5x2 m. Bean spacing (plant to plant 2.75 m apart) were maintained to accommodate lettuce (some population) and spinach per unit plot.

Two genotypes of lablab bean, namely Jessore-1 and Rajshahi-1, lettuce and Bengal spinach were collected from the Breeding and Biotechnology Laboratory, Genetics and Breeding Department, Rajshahi University and totally eight different treatment combinations were

taken in the study. Such as, sole bean Jessore-1, sole bean Raishahi-1, sole lettuce, sole Bengal spinach, bean Jessore-1+lettuce, bean Jessore-1 +spinach, bean Rajshahi-1+ lettuce, bean Rajshahi-l+ spinach. The intercrop combination was in replacement series and 50% land was devoted to the intercrop. The land of the experimental site was rainfed medium high and the soil was moderately acidic reaction (pH 5.9 to 8.5). Fifteen days old bean seedlings were transplanted into the respective pits on 2nd October in both the first year and second year. Twenty-thirty days-old lettuce seedlings were also transplanted as sole crops and intercrops to the respective unit plots at a spacing of 45 x 45cm. The seeds of spinach were directly broadcast in well leveled preselected unit beds as soles and intercrops and mixed with soil thoroughly on the 5th October in both the years. Marketable lettuce, spinach and edible lablab beans were harvested from mid-November to February.

Collected data were analyzed by following standard statistical methods and significant test was computed from F test. LSD (0.05) technique and CV (%).

To evaluate the productivity advantage of intercrops relative yields were calculated with the following formula (IRRI, 1974).

$$\text{Relative yield (RY)} = \frac{\text{Intercrop yield of bean/lettuce/spinach}}{\text{Solecrop of bean/lettuce/spinach}}$$

Land equivalent ratio (LER) was calculated on the basis of the total biological yield and total monetary return from the system. The efficiency of land utilization under intercropping is indicated by LER value. The LER value more than one indicate the superiority of intercropping over sole cropping. The formula is as follows:

$$\text{LER} = \frac{\text{Inter crop yield of bean}}{\text{Sole crop yield of bean}} + \frac{\text{Intercrop yield of lettuce/spinach}}{\text{Sole crop yield of lettuce/spinach}}$$

Results and Discussion

The yield and yield components of lablab bean were influenced by intercrop species (Table 1). All the intercrop combinations also performed better yield than those of the sole crop but the individual yield of lablab bean is decreased in Jessore-1/spinach and Raj shahi-1/spinach combination. Superior values of the above yield and yield attributes of bean were recorded from Jessore- 1/lettuce combination closely followed by Jessore-1/ spinach combination. On the other hand, correspondingly lowest values were obtained from sole Rajshahi-1, Rajshahi-1/lettuce and Rajshahi-1/ spinach combinations gave the similar yield levels. The yield variations among two different bean crops (Jessore-1 and Rajshahi-1) was due to the reason of bearing habit and genetic yield potentiality. Lablab bean grew slowly in the early stage and had no shading effect on the intercrop. Though the yield and yield component of lettuce and spinach were not influenced by the main crops. the component crops gave lower yield as compared with its respective sole cropping treatment. The main reason of reduction of yield of the component crops were due to lower number of plants per unit area as bean covered few land in intercropping combination. Fifteen percent less number of plants are grown per unit area in case of intercropped bean.

The yield of Jessore-1 /lettuce (29.17 t ha^{-1}) which was significantly higher than sole Rajshahi-1 (Table 2) was due to more number of branch exposed to the sunlight. more inflorescence per plant, pods/inflorescence and weight of mature green pods than in the sole bean because of extra care during the intercultural operation such as fertilization. irrigation, mulching, earthing, etc. of companion crops. The inner lower loser branches of the sole lablab bean had no pods, but there was a good number of pods in each branch of the intercropped bean. Legumes such as bean. pigeon pea are a versatile crops and perform differently in different environment. The plant height, biomass and grain yield per plant was higher in intercropped pigeon pea than in sole pigeon pea f (Venkatswarlu *et al.,* 1979). The Reduction of yield and yield components in situation bean intercropping with spinach due to the excess irrigation during the intercultural operation of spinach. Because. bean is a moderately irrigated plant. so due to excess irrigation its vegetative growth increased vigorously, as a reset number of inflorescence are decreased. On the other hand, in growing reason, lettuce removed water from the ground surface and drained the soil, which favored bean roots to grow vigorously. Yield of bean did not vary in two years due to similar climatic condition.

All the intercropping combinations provide the higher LLR value in total productivity than the sole bean (Table 2). Bean Jessorc-1 /lettuce intercropping gave the highest LER of 1.98 followed by LER of 1.86 from bean Raj shahi-1/lettuce. Bean Rajshahi-1 /spinach intercropping produced lower bio-mass production or total productivity. Similar results were reported in chili/maize intercropping (Quasem *et al.*, 1986).

Total monetary returns from all the intercropping was higher than sole crops. The highest LER of 2.00 was in Jessore/lettuce intercropping system. The monetary return (ton ha^{-1}) of sole and intercrop and LER is shown in Table 3.

The overall yield benefit was more in intercropping than in all tested sole crops. The highest monetary return was

Table 1: Lablab beans yield and yield components as influenced by intercrop species (average of two \ear's data)

Cropping pattern	Node length (cm)	Inflore scence/ /plant	Flowers /inflore scence	Pods/ inflore sence	Size of pods		10 green seeds weight (gm)	Weight of matures green pods (gm)	Pod yield (kg u. p^{-1})	Stalk yield (kg u. p^{-1})
					Length (cm)	Diameter (cm)				
Sole J-1	16.1	45.67	30	21	12.23	2.67	4.82	15.73	15.09	4.40
J-1+lettuce	15.43	46	31.33	22	12.52	2.95	4.94	16.61	16.80	4.42
J-1+spinach	17.53	44	29.33	19.33	11.83	2.66	4.75	15.88	13.50	4.58
Sole R-1	16.50	41.67	33.33	23.33	14.37	1.6	4.06	11.10	10.01	3.91
R-1+ lettuce	17.20	43.33	34.33	24	14.63	1.69	4.11	10.70	11.10	4.39
R-1+spinach	17.79	41.33	32.67	22.33	14.18	1.38	3.81	10.25	9.46	4.64

*Significant at 5% level of probability ** Significant at 1% level of probability,
J-1=Jessore-1, R-I= Rajshahi-1, u.p.= Unit plot, NS= nonsignificant

Table 2: Total yield and relative yield of bean and other crops in sole and intercrop system and land equivalent ratios (LER)

Cropping pattern	Bean yield			Lettuce yield		Spinach yield		LER
	Pod	Stalk	Relative	t ha^{-1}	Relative	t ha^{-1}	Relative	
Sole J-1	26.20	7.64	1.00					1.00
Sole R- 1	17.38	6.79	1.00					1.00
Sole lettuce			1.00	46.88	1.00			1.00
Sole spinach			1.00			48.96	1.00	1.00
J- I + lettuce	29.17	7.67	1.09	41.88	0.89			1.98
J- I+-Spinach	23.43	7. 95	0.92			43.96	0.90	1.82
R-1+lettuce	19.27	7.62	0.98	41.56	0.88			1.86
R-1+spinach	16.42	8.06	0.90			43.92	0.89	1.79

Table 3: Monetary return of sole and intercrop in total and land equivalent ratios (LLR)

Cropping pattern	Bean yield			Lettuce yield		Spinach yield		LER
	Pod	Stalk	Relative	tk ha^{-1}	Relative	tk ha^{-1}	Relative	
Sole J-1	222700	3820	1.00					1.00
Sole R-1	147730	3395	1.00					1.00
Sole lettuce			1.00	421920				1.00
Sole spinach			1.00			440640		1.00
J-I+lettuce	247945	3835	1.11	376920	0.89			2.00
J-1-spinach	199155	3975	0.90			285740	0.65	1.55
R- I+ lettuce	163795	3810	1.10	374040	0.88			1.98
R- I +spinach	139570	4030	0.95			285480	0.65	1.60

Note: Farm gate price (Tk/kg):

Crop	tk ha^{-1}
Bean pod	= 8.50
Lettuce fresh yield	= 9
Spinach fresh yield	= 6.50
Bean stalk	= 0.5

from the Jessore-1/lettuce intercropping system (LER=2.00). Fifty five to hundred percent yield benefit was obtained from different intercrop cornbinations. The yield of lablab bean both in Jessore-1/spinach (LER=1.82) and in Rajshahi- 1 /spinach (LER=1.79) was reduced than in Jessore-1/lettuce (LER=1.98) and Rajshahi-1 lettuce (LER=1.86) intercropping. The reduction of yield and yield components in situation lablab bean intercropping with spinach due to the excess irrigation during the intercultural operation of spinach. Because, bean is a moderately irrigated plant, so due to excess irrigation its vegetative growth increased vigorous. as a result number of inflorescence are decreased. On the other hand. in growing reason, lettuce removed more water from the ground surface and drained the soil which favored bean roots to grow vigorously. This is proved in legume and non legum intercropping. Paudel (1992) discussed the scope of fulfilling the substance needs and also profitability of pigeon pea in intercropping system. Agrawal (1995) also observed more vield benefit and more profit from intercropping than in sole cropping system.

Lablab Jes sore-1/lettuce intercropping gave 100% more yield benefit (Table 3) over sole systems. The combined effect of two crop is highly encouraging due to efficient resource utilization. Lablab bean is unable to utilize resources properly at the early growth stage, but the fast growing lettuce utilized the available resources in intercropping. The another important side of lettuce is that, it is not so frequent irrigated plant like spinach, as a result, it is low cost cultivable, on the other hand, for high market value it is an excellent cash crop for farmers. In this contest, in compared with splinach. it is mentionable that there is no shading effect of lablab bean on lettuce, even the cool environment due to shading effect of bean in beneficial to lettuce because: (I) uniformly cool weather promotes maximum yield of high quality lettuce. High

temperatures, prevent heading, promote seed stalk development and result in flavor and (ii) because of high ambient temperatures occurring near the time of harvest. Tip burn, a physiological disease is especially damage to head lettuce due to death and browning of leaf tissue inside the head (Grogan, 1987). As lettuce have no moisture and other wetted effect which bean favored most, after lettuce harvesting, bean developed lateral branches occupied the space of lettuce and utilized the resources fully.

Therefore, lettuce is the best suited intercrop species with lablab bean and lablab bean/lettuce intercropping system is recommended to the farmers for general cultivation instead of growing sole bean and lettuce.

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