Intercropping of Green Gram (*Vigna radiata* L) with Upland Rice (O*ryza sativa* L) under Rainfed Condition of Nagaland

H. Lawrence and T. Gohain

Abstract

A field experiment was conducted at the Research Farm of Biocontrol Lab., Department of Agriculture, Govt. of Nagaland, Medziphema during *kharif* season of 2007 to evaluate the performance of intercropping green gram with upland rice under rainfed condition of Nagaland. The treatments consisted of seven combinations of rice + green gram intercropping with different plant populations and replicated thrice in randomized block design. The result indicated that maximum plant height (139.57 cm) of rice was recorded under sole cropping and the lowest (128.67 cm) was in rice + green gram intercropping planted at 1:4 ratio but in case of green gram, the highest plant height (57.87 cm) was recorded in sole green gram and lowest (47.10 cm) was in rice + green gram (1:4 ratio). All the yield contributing characters such as number of panicles/m^2, number of grains/panicle, grain yield etc. of rice was maximum in pure stand, similarly in green gram also all the growth and yield contributing characters were highest in pure stand. But there was about 25% yield advantages of growing green gram as intercrop along with upland rice. Out of the different treatment combinations maximum benefit was recorded rice + green gram intercropping at 4:1 ratio.

Key words: Intercropping, rice, productivity, green gram

Introduction

The state of Nagaland constitute 8 hill districts and span over 16,579 sq. km with a total population of 19,88,636 (2001 census). The total crop area is about 386790 ha out of which *Jhum* paddy occupies an area of 68500 ha (2006). The resource poor tribal people of this region earning their livelihood from subsistence cropping. Rainfed uplands situated between hillocks and bottom-valleys, locally known as danger lands, constitute a major portion of arable land. Rice is the most dominant rainy season crop of these lands. It constitutes about 90 percent of the crop area and is utilized as major food items of this region. Most of the farmers sow rice (direct seeded upland) along with other crops at mixed crop.

Crop diversification through intercropping has long been recognized as a kind of biological insurance against risks and aberrant rainfall behavior in dry environment (Dutta and Bandyopadhyay, 2006). It increases the cropping intensity, productivity, profitability, optimized utilization of soil, water, nutrients and sunlight (Kumar and Singh, 2006). Besides increased overall productivity and income, intercropping of legumes with cereals helps in conserving moisture by reducing runoff, improving physical properties of soil and building-up of soil fertility. Legumes like green gram/black gram being short duration herbs may constitute potential intercrop in upland rice under rainfed condition. Therefore, current study was made to diversify upland rice through intercropping with green gram for improving and stabilizing productivity of rainfed uplands.

Materials and methods

A field experiment was carried out in loamy soil, high in organic carbon (1.86%) and available nitrogen (233 kg/ha), medium in available phosphorus (24.52 kg/ha) and low in available potassium (94 kg/ha) at 0-15 cm soil depth during 2007-08 at Bio-control lab farm, Medziphema. The experiment consisted of 7 treatment combinations of upland rice + green gram intercropping under different row arrangement. The treatments tried in randomized block design were replicated thrice. The crops were sown as per the treatment in the second week of June. A fertilizer dose of 40-20-20 kg N-P-K was applied to rice sole plots and rice + green gram plots, whereas, in green gram sole plot a fertilizer dose of 20-20-20 kg N-P-K was applied. All the cultural operations were carried out as and when required. Observations on plant height, number of tillers, number of panicles, length of panicle, number of seed/panicle, test weight for rice and number of leaves/plant, number of branches/plant, no. of seed/pod, grain yield for

Department of Agronomy,
School of Agricultural Sciences & Rural Development,
Nagaland University, Medziphema – 797 106

green gram were recorded and analyzed statistically. The Rice equivalent yield (REY) of the system was computed based on the prevailing market price for comparison of treatments.

Results and discussions

The data (Table 1) revealed that plant height of rice differ significantly due to intercropping with green gram. It was observed that highest plant height (140 cm) was recorded in sole rice plots and lowest (129 cm) was recorded when rice was planted with green gram at 1:4 ratio. Similar results were also reported by Barthakur *et al*. (1985) and Joy *et al*. (1987).

Number of tillers per hill at both 30 and 90 days after sowing and number of panicles per running meter and length of panicle also varied significantly among the different treatments. In all the cases sole rice recorded higher values compared to intercropped rice. These results were in conformity with the findings of Joy *et al.* (1987) and Libvoon *et al.* (1989).

The maximum number of grains per panicle (197.33) was recorded in T_1 (sole rice) followed by T_3 (192.67) and T_4 (188.67) and the lowest (163.33) was in T_6 where, rice + green gram was planted at 1:4 ratio. Similar results were also observed by Livoon *et al.* (1989). Highest percentage of filled grains were recorded in T_1 (92), followed by T_3 (91) and T_4 (90.33) and the lowest (79.67) was in T_7 where, rice was planted with green gram at 1:4 ratio. Highest grain yield (1.71 t/ha) was obtained in T_1 (sole rice) which was statistically at par with T_3 (1.52 t/ha) and T4 (1.32 t/ha). The lowest rice grain yield (3.83 kg/ha) was recorded in T_7 which was statistically at par with T_6. Similar result was also observed by Mandal *et al.* (1989).

The data from Table 3 revealed that significant difference in plant height and number of leaves at both 30 and 60 days after sowing were observed. Maximum plant height was observed in both T_7 (15.05 cm) and T_2 (14.09 cm) and lowest at T_3 (12.33 cm) at 30 days after sowing. On the other hand at 60 DAS, T_2 recorded maximum plant height (57.87 cm) followed by T_3 (54.77 cm). Both T6 and T_7 recorded the lowest plant height i.e. 47.42 cm and 47.10 cm respectively. Number of leaves per plant and number of branches per plant did not show significant difference due to intercropping of rice and green gram.

Maximum number of pods per plant (4.33) was recorded in T6 followed by T2 (4.00) and T4 (4.00). However, different treatments did not show any significant effect on number of pods per plant due to intercropping. Highest length of pod (8.00 cm) was recorded in T6 and lowest (6.53 cm) was in T5. On an average, 7-8 seeds per pod was recorded. However, T2 recorded maximum number of seeds per pod (8.33) and the lowest (6.33) was in T4. In pure green gram treatment a maximum of 6 t/ha grain yield was recorded and it decreased with increase in plant population and row arrangements in different treatments combination with rice (Table 4).

From rice equivalent yield (REY) of the intercropping systems (Table 4), it is evident that there was about 10 % and 24 % yield advantages of growing green gram as intercrop along with upland rice at 4: 1 ratio over sole crop of rice and sole crop of green gram, respectively. The same system of rice + green gram intercropping at 4:1 ratio would therefore, give maximum benefit to the farmers.

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Table 1 : Effect of rice + Green gram intercropping on growth parameters of rice

Treatments	Plant height (cm)	No. of tillers /running meter (90DAS)	No. of panicle/running meter	Length of panicle (cm)
T1- Sole rice	140.0	72.7	54.3	43.0
T2- Sole GG	-	-	-	-
T3- R+G (4:1)	136.0	55.0	52.7	40.0
T4- R+G (3:1)	137.0	54.0	51.3	41.6
T5- R+G (1:1)	137.0	47.0	45.0	42.6
T6- R+G (1:3)	132.0	43.7	40.7	39.0
T7- R+G (1:4)	129.0	36.7	37.0	28.0
S. Em ±	2.83	3.12	1.51	3.11
CD (*P*=0.05)	7.32	6.95	3.37	6.93

Table 2 : Effect of intercropping systems on yield parameters and yield of rice

Treatments	No. of grains/panicle	Filled grains percentage	Grain yield (kg/ha)	Straw yield (kg/ha)
T1- Sole rice	197.33	92.00	1708	1858
T2- Sole GG	-	-	-	-
T3- R+G (4:1)	192.67	91.00	1516	1642
T4- R+G (3:1)	188.67	90.33	1317	1446
T5- R+G (1:1)	180.33	88.67	1033	1117
T6- R+G (1:3)	167.67	83.33	533	708
T7- R+G (1:4)	163.33	79.67	383	408
S. Em±	5.78	1.83	0.23	0.21
CD (*P*=0.05)	12.89	4.08	0.50	0.48

Table 3 : Effect of intercropping systems on growth parameters of green gram

Treatments	Plant height (cm)		No. of leaves/plant		No. of branches per plant
	15 DAS	60 DAS	15 DAS	60 DAS	
T1- Sole rice	-	-	-	-	-
T2- Sole GG	14.09	57.87	2.73	10.59	1.67
T3- R+G (4:1)	12.33	54.77	2.20	10.17	1.67
T4- R+G (3:1)	13.99	53.57	2.13	11.84	1.67
T5- R+G (1:1)	13.73	50.00	2.60	9.22	1.67
T6- R+G (1:3)	13.96	47.42	2.40	8.96	2.00
T7- R+G (1:4)	15.05	47.10	2.13	8.83	1.67
S.Em±	0.72	2.17	0.26	0.44	0.19
CD (p=0.05)	1.62	4.84	NS	NS	NS

Table 4 : Effect of intercropping systems on yield parameters of green gram

Treatments	No. of pods/plant	Length of pods (cm)	No. of seeds per pod	Test weight (gm)	Grain yield (kg/ha)	REY of system (kg/ha)
T1-Sole rice	-	-	-	-	-	1708.0
T2-Sole GG	4.0	7.80	8.33	43.00	600	1500.0
T3-R+G (4:1)	3.67	7.17	6.67	41.33	140	1866.0
T4-R+G (3:1)	4.00	7.00	6.33	41.67	120	1617.0
T5-R+G (1:1)	3.67	6.53	7.33	41.00	280	1733.0
T6-R+G (1:3)	4.33	8.00	8.00	42.33	400	1533.0
T7-R+G (1:4)	3.33	6.67	7.67	41.67	470	1175
S. Em±	0.71	0.82	0.95	0.84	0.01	-
CD (p=0.05)	1.59	1.83	2.12	ns	0.02	-