Journal of Crop and Weed **1** (1) : 17-20 (2005)

Studies on growth of rice and greengram in intercropping , as influenced by nitrogen levels in rice, during rainy season of West Bengal

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ABSTRACT

An intercropping experiment of direct- seeded rice(cv. MW-10) and green gram (cv.B-105) was conducted at the University farm, Nadia, West Bengal, India during *kharif* season of 2000 and 2001 in randomized block design (RBD) with replications. Treatments comprised of three lovels of N (0, 30 and 60 kg/ha) in rice and two intercropping arrangements (2R : 2G and 4R : 2G). Canopy of rice, at 50 and 75 DAS, was taller in intercropping than in sole cropping at 0 kg N/ha. In intercropping , canopy height of rice increased, and that of greengram decreased with increasing levels of N in rice . The leaf and shoot dry matter of intercropped rice, at 75 DAS , were 58-61 and 54- 58% in 2 : 2, and 80 –87 and 75-82% (of sole crops) in 4 :2 rows, respectively. The leaf and shoot dry matter of greengram at 50 DAS, were 65-79 and 71-79% in 2 : 2 and 50-57% and 49-55% (of sole crops) in 4 : 2 rows, respectively. In intercropping, the CGR of rice and greengram were 9.01 and 3.38 g/m^2/day in 4: 2 rows at 60 kgN/ha in rice , and 4.06 and 5.72 g/m^2/day in 2:2 rows without N in rice, respectively. The CGR of rice increased, and that of greengram decreased with increasing levels of N in rice. The CGR of rice was higher and that of greengram lower in 4.2 than in 2 : 2 arrangement. Total biomass in intercropping was always higher than sole greengram, but higher than sole rice, only when N was not applied.

The need to reduce the huge gap between the demand and production of pulse crops, *vis-à-vis,* the necessity of producing rice, the staple food crop of the locality, simultaneously from the same land, find the scope of growing these crops in intercropping systems. Thus, greengram can be intercropped with direct-seeded rice on upland Gangetic alluvial soil of West Bengal , under rainfed condition during rainy season . Legume can improve the physical properties of soil and soil fertility, especially the organic carbon and nitrogen status of soil (Thind *et al.*,1997), and can meet nitrogen requirement of the associated non-legume crop to some extent in intercropping (Bandyopadhyay and De, 1986). The above considerations indicate the scope to conduct the present experiment, to find out the suitable intercropping systems of the above crops and to determine the nitrogen economy in the intercropping systems, if any.

MATERIALS AND METHODS

The present intercropping experiment was conducted at the Viswavidyalaya farm, Jaguli, Nadia, West Bengal, India, situated at 88.53^{0}E longitude, 22.93^{0}N latitude and 9.75m above mean sea level, during *kharif* seasons of 2000 and 2001. The experimental soil was sandy loam, having initially 0.59% organic C, 0.076% total N, 17.80 kg av. P/ha, 81.8 kg av. K/ha and 6.8 pH. The experiment was laid out in randomized block design (RBD) with three replications. The treatments comprised of sole and intercroppings of direct-seeded rice cv. MW-10 (115days) and greengram cv. B-105 (70days), two intercropping arrangements (2R:2G and 4R :4G) and three levels of N (0, 30 and 60 kg/ha) in rice. Spacing between two rows of rice and greengram were 20 cm and 30 cm, respectively, and that of an adjacent rows of

two crops in intercropping was 25 cm . The fertilizers were added at 40 kg P_2O_5 and 30kg K_2O/ha, through single super phosphate and muriate of potash respectively, to all plots as basal . Nitrogen at 15 kg/ha through urea was applied as basal to both crops except to rice, scheduled to be treated with 0 kg N/ha. Topdressing at 15 kg N/ha was done to rice rows once at 34 DAS to N_{30} treated rice and twice at 34 and 57 DAS to N_{60} treated rice rows.

RESULTS AND DISCUSSION

Canopy height

Canopy height of the individual crops did not vary much at 25 DAS and was not presented.

Rice : canopy height of intercropped rice, at 50 and 75 DAS were appreciably higher than that of sole crop, when no nitrogen was applied (Table 1). At 30 kg N/ha level, increase in height due to intercropping over sole cropping was up to the level of significance only in 2:2 arrangement, at 75 DAS. At 60 kg N/ha level, height of intercropped rice was at par with that of sole crop. Canopy height of intercropped rice increased significantly with increasing levels of nitrogen at both the satges. It was slightly, though not significantly, higher in 2:2 than in 4:2 arrangement, at 50 DAS. Intercrop competition from associated taller greengram crop was probably higher in 2:2 than in 4:2 arrangement, and caused slight enhancement in canopy height of rice.

Greengram : Canopy of greengram at 50 DAS, under 2:2 row arrangement in association with rice without nitrogen, was significantly taller than in 4:2 arrangement in association with rice at 60 kg N/ha (Table 1). Other intercropping treatments were at par among themselves, in this respect. Intercropped greengram decreased in height with increasing dose of nitrogen of associated rice crop. In 2:2 rows, it was slightly taller than in 4:2 rows, probably due to higher intercrop competition.

Dry matter accumulation

Rice : Leaf dry matter of rice, at 25 DAS, varied slightly , anly due to nitrogen and population. Variation among treatments increased with in age (Table-2). Leaf growth of rice, at 50 and 75 DAS, were reduced appreciably due to intercropping, as compared to sole cropping, at respective levels of nitrogen. This reduction was mainly due to reduction of population and partly to competition. Among different intercropping treatments, the highest leaf growth of rice was recorded in 4:2 arrangement at 60 kg, followed by 30 kg N/ha, the lowest leaf growth being produced in 2:2 rows without nitrogen , at both 50 and 75 DAS . Leaf growth of rice increased with increasing levels of nitrogen, and was higher in 4:2 than in 2:2 arrangement. In 2:2 and 4:2 arrangements, intercrop population of rice were 40 and 57 per cent, whereas, leaf growth at 75 DAS was 58 to 61 per cent and 80 to 87 per cent of their sole crops respectively. Thus considering the population, rice leaf growth in intercropping was much higher than respective sole cropping. This was possible probably due to combination of two crops having different growth habits, which caused intercrop competition to be more beneficial than intercrop competition. Shoot growth of rice increased at high rate up to 75 DAS . The trend of variation due to treatments was more or less similar to that of leaf (Table-2). Shoot growth of rice, at 75 DAS was 54 to 58 per cet and 75 to 82 per cent of their sole crops in 2:2 and 4:2 spatial arrangements, respectively.

Greegram: Leaf growth greengram at 25 DAS was reduced slightly due to nitrogen

application in associated rice crops and reduced population (Table-2) The differences among the treatments, in this respect, increased with age. Leaf dry matter of greengram at 50 DAS decreased due to intercropping as compared to sole crop mainly due to reduction in population and partly to competition. Among different intercropping systems leaf growth of greengram was the highest in 2:2 arrangement in association with rice grown at followed by 30 kg N/ha and the lowest in 4:2 rows in association with rice grown at 60 kg /ha. Leaf growth of intercropped greengram at 50 DAS decreased with increasing rate of N of associated rice crop, and was appreciably higher in 2:2 than in 4:2 arrangement. Leaf growth of greengram at this stage was 69 to 79 per cent in 2:2 and 50 to 57 per cent in 4:2 arrangements where greengram population were 60 and 43 per cent of sole crops, respectively. It indicated advantages in intercropping under both arrangements in terms of leaf growth on population basis.

Shoot growth of greengram followed the similar trend of variation as in case of leaf. The growth of greengram shoot at 50 DAS was 71 to 79 per cent and 49 to 55 per cent of sole crops in 2:2 and 4:2 rows, respectively.

Crop growth rate

Rice: Crop growth rate (CGR) of rice was much higher during 50-75 DAS than in 25-50 DAS (Table-1). The CGR of rice increased with increase in the levels of N, the values and the rates of increase being much higher in sole cropping than in intercropping . The CGR values were higher in 4:2 than in 2:2 arrangements. The CGR of intercropped rice was the highest in 4:2 rows at 60 kg N/ha and the lowest in 2:2 rows without N during both the stages.

Greengram : The CGR of greengram was reduced in intercropping as compared to sole cropping . In intercropping values decreased with increasing levels of N of associated rice crop and were lower in 4:2 arragements. The intercropped greengram recorded the highest CGR in 2:2 rows in association with rice without N, and the lowest in 4:2 rows in combination with rice at 60 kg N/ha .

Biomass production

The shoot growth of greengram at 50 DAS and that of rice at 75 DAS were added to get total biomass production of different cropping systems (Table –1) . Total biomass of different intercropping systems were higher than that of sole greengram and that of sole rice grown without N. Intercropping with rice at 30 kg N /ha produced higher biomass in 4:2 rows, but not in 2:2 rows than the respective sole rice. Inter cropping with rice at 60 kg N /ha in both arrangements were inferior to respective sole rice in this respect. Total biomass in intercropping increased slightly with increasing levels of N in rice and was slightly higher in 4:2 than in 2:2 arrangements.

REFERENCES

Bandyopadhyay, S.K. and De, R. 1986. Nitrogen relationship and residual effect of intercropping sorghum with legumes. *J. Agric. Sci.* **197**(3): 629-632.

Thind, G. S., Meelu, O.P. and Sharma, K.N. 1979. Effect of crop rotations on soil fertility. *Indian J. Agric. Sci.* **49**(4): 276-280.

Table 1 Effect of different treatments on canopy height (cm), crop growth rate (g/m^2) and biomass production (t/ha) of crops (mean of two years)

Treatment	Canopy height			Crop growth rate			Biomass production
	Rice		Green gram	Rice		Greengram	
	50 DAS	75 DAS	50 DAS	25-50 DAS	50-75 DAS	25-50 DAS	
RN_0	57.3	65.3		4.48	7.09		3.686
RN_{30}	68.3	83.4		6.35	8.08		4.531
RN_{60}	77.0	97.7		7.58	9.86		5.291
G			92.1			6.12	2.413
RN_0-G2:2	64.3	79.4	95.0	2.70	4.06	5.72	3.915
RN_0-G4:2	63.0	77.1	88.2	4.31	5.96	3.77	4.360
RN_{30}-G2:2	70.9	91.3	89.7	3.06	5.94	5.46	4.402
RN_{30}-G4:2	70.5	89.4	88.4	4.45	7.45	3.54	4.784
RN_{60}-G2:2	76.9	96.5	87.9	3.30	7.14	5.19	4.683
RN_{60}-G4:2	76.0	95.2	85.9	4.50	9.01	3.38	5.139
CD at 5%	2.53	5.10	5.70				
N level in rice							
N_0	63.7	78.2	91.6	3.51	5.01	4.78	4.147
N_{30}	70.7	90.3	89.0	3.66	6.79	4.50	4.591
N_{60}	76.4	95.8	86.9	3.99	7.97	4.28	4.908
CD at 5%	1.79	3.61	4.04				
Row arrangement in intercropping							
2:2(2R:2G)	70.6	89.0	90.8	3.06	5.71	5.34	4.305
4:2(4R:2G)	69.8	87.2	87.5	4.39	7.48	3.45	4.734
CD at 5%	NS	NS	3.23				

R=Rice, G = Greengram; N_0, N_{30} and N_{60} = 0, 30 and 60 kg N/ha in rice; NS = Not significant

Table 2 Effect of different treatments on dry matter accumulation (g/m^2) in leaf and shoot of crops at different stages of growth (mean of two years)

Treatment	Rice						Greengram			
	25 DAS		50 DAS		75 DAS		25 DAS		50 DAS	
	Leaf	Shoot	Leaf	Shoot	Leaf	Shoot	Leaf	Shoot	Leaf	Shoot
RN_0	44.4	79.3	88.5	191.3	169.3	368.6				
RN_{30}	53.4	92.5	112.4	251.2	199.2	453.1				
RN_{60}	53.0	93.0	166.5	339.7	230.3	529.1				
G							51.7	88.3	114.6	241.3
RN_0-G2:2	20.3	31.6	50.1	99.1	100.6	200.7	30.6	47.8	91.0	190.8
RN_0-G4:2	28.1	45.6	71.1	153.3	147.0	302.4	25.4	39.4	64.8	133.6
RN_{30}-G2:2	21.8	36.6	57.4	113.2	120.7	261.7	26.5	42.0	84.6	178.5
RN_{30}-G4:2	32.9	58.7	80.5	170.0	167.1	356.3	21.6	33.5	59.2	122.1
RN_{60}-G2:2	22.2	36.6	62.4	119.2	134.3	297.7	25.6	40.9	79.1	170.6
RN_{60}-G4:2	33.3	61.5	86.8	171.5	183.7	396.8	20.6	32.6	57.3	117.1
CD at 5%	10.54	18.74	15.29	26.13	19.94	40.44	3.46	7.25	13.18	26.90
N level in rice										
N_0	24.1	38.5	60.6	126.2	123.8	251.5	28.0	43.6	77.9	163.2
N_{30}	27.4	47.7	69.0	139.1	143.9	308.9	24.0	37.6	71.9	150.2
N_{60}	27.7	48.0	74.6	147.7	158.8	347.0	23.1	36.7	68.2	143.8
CD at 5%	NS	NS	10.82	18.44	14.10	28.59	2.45	5.11	9.30	18.98
Row arrangement in intercropping										
2:2(2R:2G)	21.4	34.2	56.7	110.6	118.5	253.3	27.6	43.6	86.0	177.2
4:2(4R:2G)	31.4	55.2	79.5	164.9	166.0	351.9	22.6	35.2	60.0	121.5
CD at 5%	NS	10.82	8.83	15.08	11.51	23.34	2.00	4.21	7.61	15.98

R=Rice, G = Greengram, N_0, N_{30} and N_{60} = 0, 30 and 60 kg N/ha in rice; NS = Not significant