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GROWTH OF RICE, MUNGBEAN, SOYBEAN, PEANUT, RICE BEAN AND BLACKGRAM AS SOLE AND INTERCROPS

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SUMMARY

Studies on sole and intercropping systems reveal that rice-based intercropping systems like rice+mungbean and rice+blackgram accumulated greater amount of combined dry matter at 60 DAS than the respective sole crops; while sole crops of peanut, soybean and rice bean recorded greater amount of dry matter than the intercropped ones. Intercropping of 2 rows of rice+1 row of mungbean and 2 rows of rice+1 row of blackgram recorded higher combined LAI at 45 DAS than sole crops of mungbean and blackgram, whereas intercropping of rice+soybean, rice+peanut and rice+rice bean recorded LAI lower than the respective component crops of legume. At 60 DAS, 2 rows of rice+1 row of soybean and 2 rows of rice +1 row of blackgram recorded higher combined LAI than sole cropping of legumes.

INTRODUCTION

Substantial yield advantages from intercropping compared to sole cropping have often been attributed to the fact that different crops could complement each other and make better use of resources when grown together rather than grown separately (Willey, 1979). The loss of yield of upland rice due to diverse agro-climatic conditions can be compensated by intercropping with deep rooted leguminous crops for better utilisation of underground resources like water and nutrients and for proper control of weeds by intercrops, hence this study was undertaken.

MATERIALS AND METHODS

The investigation was conducted in 1985 and 1986 during wet (*kharif*) season at Kalyani (9.75 m above sea level, 89°E, 23°N) on a sandy loam (Entisol, Udifluvents) soil having 0.06%N, 15.88 kg available P/ha, 80.4 kg available K/ha and pH 7.6 under rainfed upland condition. There were 21 treatment combinations (Table I) in a Randomised Block Design with 4 replications in 1985 and 3 replicates

Table I. Treatments used in the experiment

Sl. No.	Treatments	Proportion
1.	Sole rice (R)	—
2.	Sole mungbean (MB)	—
3.	Sole soybean (SB)	—
4.	Sole peanut (PN)	—
5.	Sole ricebean (RB)	—
6.	Sole blackgram (BG)	—
7.	Rice+mungbean (2R+1 MB)	2 : 1
8.	Rice+mungbean (4R+1 MB)	4 : 1
9.	Rice+mungbean [2R+1 MB (D)]	2 : 1
10.	Rice+soybean (2R+1 SB)	2 : 1
11.	Rice+soybean (4R+1 SB)	4 : 1
12.	Rice+soybean [2R+1 SB (D)]	2 : 1
13.	Rice+peanut (2R+1 PN)	2 : 1
14.	Rice+peanut (4R+1 PN)	4 : 1
15.	Rice+peanut [2R+1 PN (D)]	2 : 1
16.	Rice± ricebean (2R+1 RB)	2 : 1
17.	Rice+ricebean (4R+1 RB)	4 : 1
18.	Rice+ricebean [2R+1 RB (D)]	2 : 1
19.	Rice+blackgram (1R+1 BG)	2 : 1
20.	Rice+blackgram (4R+1 BG)	4 : 1
21.	Rice+blackgram [2R+1 BG (D)]	2 : 1

D=Deferred sowing (sowing of intercrops after one month of rice sowing)

in 1986. Spacing of the crops (i) rice-row to row 20 cm (ii) mungbean, soybean, rice bean and blackgram—30 cm × 10 cm (20 cm × 15 cm for intercrops) and (iii) peanut—40 cm × 15 cm (20 cm × 15 cm for intercrop) were sown in rows. Seed rates of rice (cv 'ES 123'), mungbean (cv. 'B 105'), soybean cv. Improved Pelican'), Peanut (cv. 'JL 24'), ricebean (cv. 'S 9') and blackgram (cv. 'T 9') were : 70, 20, 80, 100, 20 and 20 kg/ha, respectively, in pure stands. The seed rate for component crops in intercropping systems was based on their ratio of land use. The date of sowing was 8 and 16 June in 1985 and 1986, respectively.

In rice, fertilizers were applied @ 30 kg each of P_2O_5 and K_2O/ha as basal and 60 kg N/ha in two equal splits at 22 and 45 DAS. In mungbean, soybean, rice bean and blackgram, the fertilizer doses were : 20, 40 and 20 kg N, P_2O_5 and K_2O_5/ha, respectively, and in peanut 20, 40 and 30 kg N, P_2O_5 and P_2O/ha, respectively, as basal. In the intercropped plots, the fertilizer for rice was applied only in rice rows and for intercrops only in intercropped rows.

For growth analysis, the destructive samples (0.3 m^2) were taken at intervals of two weeks from 30 days after sowing (DAS) for dry matter. Leaf area index (LAI) was determined on the basis of area-weight relationship of measured/punched (circular pieces for legumes and rectangular bit for rice) leaf surface.

RESULTS AND DISCUSSION

Dry matter

Sole (pure) crop of mungbean produced maximum dry matter at 30 DAS (Table II) followed by rice+mungbean (2 : 1 ratio, simultaneous sowing), sole rice bean, rice+mung bean (4 : 1) and rice+blackgram (2 : 1 ratio, simultaneous sowing)

Table II. Effect of intercropping on the combined dry matter accumulation (g/m^2) and on combined LAI at different stages of growth*

Particulars	Combined dry matter (g/m^2)				Combined LAI			
	1985		1986		1985		1986	
	60 DAS	90 DAS	60 DAS	90 DAS	45 DAS	60 DAS	45 DAS	60 DAS
R	511	686	506	685	3.49	4.31	3.30	4.10
MB	584	—	577	—	3.59	—	3.51	—
2R+1 MB	638	468	614	464	4.04	3.12	3.91	2.96
4R+1 MB	581	556	574	560	3.74	3.51	3.59	3.36
2R+1 MB (D)	499	714	486	709	2.65	3.82	2.55	3.60
SB	593	971	615	1005	2.74	3.65	2.71	3.52
2R+1 SB	607	864	605	842	3.71	4.48	3.46	4.29
4R+1SB	556	801	554	776	3.50	4.25	3.29	4.07
2R+1SB (D)	444	685	437	673	2.66	3.59	2.54	3.41
PN	603	1073	632	1132	2.62	3.59	2.68	3.68
2R+1 PN	567	813	531	797	3.34	4.18	3.22	3.99
4R+1 PN	532	737	562	731	3.35	4.12	3.23	3.94
RB	590	699	574	681	3.29	3.81	3.42	3.76
2R+1RB	465	580	454	549	3.35	4.21	3.11	3.68
4R+1 RB	452	544	450	525	3.02	3.70	2.77	3.27
2R+1 RB (D)	421	674	420	667	2.55	3.59	2.44	3.37
BG	512	594	504	595	3.22	3.55	3.32	3.62
2R+1 BG	586	739	577	728	3.82	4.64	3.88	4.53
4R+1 BG	542	716	539	710	3.57	4.20	3.51	4.01
2R+1 BG (D)	432	685	423	668	2.62	3.83	2.51	3.64
S. Em (±)	5.5	6.00	5.7	5.6	0.034	0.039	0.021	0.037
CD at 5%	15.6	17.04	16.2	16.1	0.097	0.111	0.060	0.105

*Dry matter and LAI of deferred sown intercrops were not recorded at 45 DAS, as the age of intercrops at that time was only 15 days.

during both the years. But at 45 DAS, maximum dry matter accumulation was recorded with pure mungbean followed by rice+mungbean (2 : 1 ratio, simultaneous sowing) in 1985 but sole rice bean in 1986. Intercropping treatments of all legumes in 1 : 2 ratio produced maximum dry matter over 1 : 4 ratio at all the stages. At 60 DAS, rice+mungbean (2 : 1 simultaneous sowing) intercropping accumulated significantly higher amount of dry matter in 1985 but sole peanut accumulated in 1986. Reddy and Willey (1981) recorded higher amount of dry matter accumulation of millets when grown with groundnut. In 1986, among the different intercropping systems, rice + mungbean (2 : 1 ratio, simultaneous sowing) produced highest amount of dry matter. Simultaneous sowing of rice + blackgram intercropping systems recorded higher amount of dry matter production than either of rice or of blackgram during both the years at all the stages of growth. In intercropping of rice + mungbean at 75 and 90 DAS, only dry matter of rice was recorded except in deferred sown treatment as mungbean was already harvested. At 75 and 90 DAS, pure stands of peanut and soybean produced higher amount of dry matter over intercropping. This result was in agreement with the findings of Allen and Obura (1983). Rice+ rice bean intercropping systems recorded poor amount of dry matter during both the years due to suppressing effect of rice bean, while under deferred sown condition, rice+rice bean intercropping exhibited good performance.

Leaf area indices (LAI)

In case of combined LAI, it was observed that rice+mungbean (2 : 1 and 4 : 1 ratios with simultaneous sowing) produced significantly the highest LAI upto 45 DAS (Table II). Rice + peanut, rice + blackgram and rice + soybean (2:1 ratio, simultaneous sowing) intercropping systems recorded higher LAI over respective sole crops during all the stages of growth. The combined LAI of rice+rice bean exhibited lower value sole rice due to smothering effect of rice bean on rice at 45 and 60 DAS during both than the years of experimentation. The LAI of peanut and soybean were significantly lowered than sole crop of rice as those crops put forth slow growth during initial stage; however, those crops exhibited significantly higher LAI during the latter stages when growth of rice crop declined. At 60 DAS, rice + blackgram (2 : 1 ratio, simultaneous) recorded the highest combined LAI. The combined LAI of rice+ legumes were higher in 2 : 1 ratio than in 4 : 1 ratio in simultaneous sowing during all the stages; however, rice+peanut did not follow the same trend. Rice + soybean, rice + rice bean and rice + backgram intercropping systems (simultaneous) exhibited higher combined LAI upto 60 DAS than deferred sown treatment with the same proportion. In case of rice + mungbean deferred sown treatment, lower combined LAI was recorded than in simultaneous (2 : 1 ratio) sown treatment. Higher leaf area index had been reported under intercropping systems by several workers (Lin *et al.*, 1981; Reddy and Willey, 1981; and Mandal *et al.*, 1986).

Correlation

Correlation was found to be highly significani at 1% level between LAI and dry matter (Table III). However, LAI and dry matter was not significantly correlated at 60 DAS in 1986. Although the growth habit and duration of the component crops, in the intercropping systems, varied, in spite of that the correlation was found to be significant as the crops did not affect each other adversely, rather some sort of complementary/supplementary relationship developed. Where ever LAI was higher dry matter production was also higher as a result of increased amount of photosynthesis. In 1986, the DM production at 60 DAS was less and therefore, it was not correlated with LAI.

Table III. Correlation co-efficient value (r) of LAI Vs dry matter

Stage of growth	r value	
	1985	1986
At 30 DAS	0.719**	0.718**
At 45 DAS	0.655**	0.771**
At 60 DAS	0.745**	0.238
At 75 DAS	0.695**	0.690**

**Significant at 1% level

Thus, it can be concluded that practising crop intensification through intercropping of rice with legumes will bring about an increased utilization of photosynthetically fixable energy as an efficient harnessing technology of the bountiful solar energy.

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