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Growth and Dry Matter of Aus Rice as Affected by Weeding in Aus-Maize Fodder Intercropping

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Abstract: The experiment consisted of five intercropping systems, (viz. I. sole aus rice, ii. aus rice + maize at 75 X 25cm^2 spacing, iii. aus rice + maize at 75 X 50cm^2 spacing, iv. sole maize at 75 X 25cm^2 and v. sole maize at 75 X 50cm^2 spacing) and three weeding practices (viz. I. no weeding, ii. two weeding and iii. weed free up to harvest). Dry matter production of aus rice increased gradually with the progress of its growth duration up to 90 days after sowing. Intercropping and weeding practices adversely affected the dry matter production of aus rice that was especially noticeable in aus rice intercropping with maize at 75 X 25cm^2 spacing under no weeding condition. The highest grain yield was obtained in sole aus and fodder yield was obtained in sole maize at 75X 25cm^2 spacing and both were under weed free conditions.

Key words: Aus-maize intercropping, weeding, grain yield, fodder production

Introduction

Crops have critical period of weed competition and first 20-40 days after sowing (DAS) was the most critical for weed removal in crop. Monocot and dicot weeds removed at 40 DAS which almost 50% reduced weed dry matter (Pillai and Rao, 1974). Keeping the fields' weedy up to 40 DAS reduced grain yield by 43.8% reported by Varshney (1991). Weil (1982) observed a negative correlation between crop density and weed dry matter.

Intercropping practices suppressed weeds with increasing crop population. Recently intercropping has been recognized as a beneficial system for crop production and evidence suggest that intercropping can provide substantial yield advances compared with sole cropping (Singh *et al*., 1992). Crop growth parameters and dry matter production is the indicator of ultimate yield and benefit. A few researches have been done to investigate the feasibility of dry matter production of rice and maize fodder intercropping. The present experiment therefore, was undertaken to explore the dry matter production of aus rice by maize fodder intercropping under different weeding practices.

Materials and Methods

The experiment was conducted at the Agronomy Field Laboratory, Bangladesh Agricultural University, Mymensingh, during the period from April to August 1996. The intercropping treatments were I. sole aus rice, ii. aus rice + maize at 75 X 25cm^2 spacing, iii. aus rice + maize at 75 X 50cm^2 spacing, iv. sole maize at 75 X 25cm^2 and v. sole maize at 75 X 50cm^2 spacing and three weeding practices viz. I. no weeding, ii. two weeding and iii. weed free up to harvest. The experiment was laid out in a randomized complete block design with four replications. The unit plot size was 4.0 X 2.5m^2. Out of 15 treatment combinations five were weeded two times on 20 DAS and 40 DAS. Another five were weeded up to harvest and rest of five were unweeded.

Both sole aus and intercropped aus rice plots were fertilized at the rate of 60-60-40 kg/ha N, P_2O_5 and K_2O in the form of urea, TSP and MP, respectively. In sole maize plots nitrogen was applied @ 100 kg/ha. Seeds of aus rice (var. Niamat) and maize (var. Barnali) were sown in line on 22 April 1996. Fodder maize was harvested at 50% silking stage. Rice plant was cut for growth character study at 30, 50, 70, 90 DAS and full maturity stage. Data were recorded on yield and yield contributing characters of aus rice. The plant height, dry matter, growth rate of 30, 50, 70 and 90 DAS for aus rice were recorded. Five plants of each treatment were uprooted washed and dried in an electrical oven at a temperature of 70°C for 72 hours to determine the dry matter production. Data were analyzed statistically and differences among the treatments on growth characters and dry matter production were tested with DMRT by Gomez and Gomez (1984).

Results and Discussion

The effect of interaction of intercropping and weeding practices on plant height of aus rice at different DAS are presented in Table 1. Results revealed that plant height was not significantly affected by the interaction of intercropping and weeding practices at 30, 50 and 70 DAS. Plant height was significantly affected by the interaction of intercropping and weeding practices on 90 DAS and at harvest. At 90 DAS and harvest the tallest plant of 124.95 cm was observed in sole aus rice with weed free condition and the lowest (81.55cm) in aus rice + maize at 75 X 25cm^2 spacing under no weeding condition. Similar results were also reported elsewhere by Alam *et al*. (1995) and Naseem *et al*. (1995).

The highest dry matter of aus rice was accumulated in sole aus under weed free condition at 30, 50, 70 and 90 DAS. The lowest dry matter was recorded in aus rice + maize at 75 X 25cm^2 spacing under no weeding condition at 30, 50, 70 and 90 DAS (Table 2). The highest crop growth rate of aus rice was observed in sole aus rice under weed free condition and the lowest in aus rice + maize at 75 X 25cm^2 spacing under no weeding condition within 30-50, 50-70 and 70-90 DAS. The vegetative growth of aus rice in intercropping system with maize was adversely affected which was reflected by the reduced no. of plants/m^2, no. of total tillers/m^2 and plant height and ultimately dry matter production of aus rice was severely curtailed. Within 50-70 DAS in sole aus X weed free, sole aus X two weeding and rice + maize at 75 X 50cm^2 spacing under weed free conditions gave the highest crop growth rates which were statistically identical. Within 70-90 DAS results revealed that the highest (24.79 g/m^2 per day) crop growth rate was recorded in sole rice under weed free and the lowest (3.00 g/m^2 per day) in aus rice + maize at 75 X 25cm^2 spacing under no weeding conditions (Table 2). Results revealed that crop growth rate of aus rice were observed to be higher in latter stages of growth.

Table 1: Interaction effect of intercropping and weeding on plant height of aus rice in aus - maize intercropping at different days after sowing (DAS)

Interaction (Intercropping X Weeding)	Plant height (cm)				
	30 DAS	50 DAS	70 DAS	90 DAS	At harvest
Aus rice sole x No weeding	34.87	64.85	78.55	91.60 c	91.60 c
Aus rice sole x Two weeding	35.70	68.00	87.05	117.80 a	117.80 a
Aus rice sole x Weed free	34.34	67.48	89.35	124.95 a	124.95 a
Aus rice + maize at 75 X 50cm^2 spacing x No weeding	37.04	65.25	73.85	92.45 c	92.45 c
Aus rice + maize at 75 X 50cm^2 spacing x Two weeding	36.46	67.40	76.35	105.20 b	105.20 b
Aus rice + maize at 75 X 50cm^2 spacing x Weed free	35.56	67.15	83.15	107.35 b	107.35 b
Aus rice + maize at 75 X 25cm^2 spacing x No weeding	38.02	64.10	72.70	81.55 d	81.55 d
Aus rice + maize at 75 X 25cm^2 spacing x Two weeding	39.27	68.05	74.45	94.45 c	94.45 c
Aus rice + maize at 75 X 25cm^2 spacing x Weed free	45.03	67.03	76.80	99.10 bc	99.10 bc
S $\bar{x}$	-	-	-	2.749	2.749
Level of significance	NS	NS	NS	0.05	0.05

Figures in a column having the same letter(s) do not differ significantly NS = Not significant

Table 2: Interaction effect of intercropping and weeding on dry matter production and crop growth rate of aus rice in aus rice – maize intercropping at different days after sowing (DAS)

Interaction (Intercropping X Weeding)	Dry matter (g m^{-2})				Growth rate g m^{-2} day^{-1})		
	30 DAS	50 DAS	70 DAS	90 DAS	Within 30-50 DAS	Within 50-70 DAS	Within 70-90 DAS
Aus rice sole x No weeding	10.43 c	23.46 e	51.93 e	127.50 f	0.65 e	1.42 cd	3.58 f
Aus rice sole x Two weeding	19.29 b	44.23 b	164.25 b	550.35 b	1.25 b	6.00 a	19.31 b
Aus rice sole x Weed free	25.07 a	62.28 a	192.29 a	687.97 a	1.87 a	6.51 a	24.79 a
Aus rice + maize at 75 X 50cm^2 spacing x No weeding	3.76 f	17.26 f	41.12 ef	107.69 g	0.66 e	1.20 d	3.33 fg
Aus rice + maize at 75 X 50cm^2 spacing x Two weeding	7.69 d	27.18 d	91.27 c	231.43 d	0.97 cd	3.25 b	7.01 d
Aus rice + maize at 75 X 50cm^2 spacing x Weed free	9.68 c	31.22 c	157.74 b	319.40 c	1.07 c	6.33 a	8.08 c
Aus rice + maize at 75 X 25cm^2 spacing x No weeding	3.30 f	14.93 f	29.99 f	90.05 h	0.58 f	0.75 d	3.00 g
Aus rice + maize at 75 X 25cm^2 spacing x Two weeding	5.68 e	25.13 d	69.91 d	185.92 e	0.97 cd	2.24 c	5.80 e
Aus rice + maize at 75 X 25cm^2 spacing x Weed free	7.97 d	26.66 d	91.75 c	216.95 d	0.94 d	3.26 b	6.28 e
S $\bar{x}$	0.3518	0.6006	4.185	4.001	0.03162	0.2086	0.1405
Level of significance	0.01	0.01	0.01	0.01	0.01	0.01	0.01

Figures in a column having the same letter(s) do not differ significantly.

Table 3: Interaction effect of intercropping and weeding on growth characters of aus rice in aus rice – maize intercropping

Interaction (Intercropping X Weeding)	Plant Population (no. m^{-2})	No. of tillers hill^{-1}	No. of nonbearing tillers hill^{-1}	No. of grains panicle^{-1}	Biological yield (t/ha)	Harvest index (%)
Aus rice sole x No weeding	45.00 c	3.25	0.80	28.17 e	1.78 e	31.43 d
Aus rice sole x Two weeding	49.50 b	5.65	1.35	49.64 c	6.81 b	35.46 b
Aus rice sole x Weed free	52.00 a	6.50	1.70	60.55 a	8.14 a	42.18 a
Aus rice + maize at 75 X 50cm^2 spacing x No weeding	25.50 e	2.34	0.83	26.24 e	0.96 f	31.30 d
Aus rice + maize at 75 X 50cm^2 spacing x Two weeding	28.25 d	4.35	0.55	49.77 bc	4.09 c	35.40 b
Aus rice + maize at 75 X 50cm^2 spacing x Weed free	29.00 d	5.53	1.10	54.73 b	3.26 d	35.66 b
Aus rice + maize at 75 X 25cm^2 spacing x No weeding	22.75 f	2.85	0.85	25.76 e	0.86 f	31.18 d
Aus rice + maize at 75 X 25cm^2 spacing x Two weeding	30.50 d	3.95	0.45	44.91 d	3.12 d	34.56 c
Aus rice + maize at 75 X 25cm^2 spacing x Weed free	28.50 d	3.40	0.95	49.95 c	3.88 c	35.78 b
S $\bar{x}$	2.33	-	-	1.42	0.31	0.38
Level of significance	0.05	NS	NS	0.05	0.05	0.05

Figures in a column having the same letter(s) do not differ significantly. NS = Not significant

Table 4: Interaction effect on yield and yield components of maize fodder with weeding in aus rice – maize intercropping

Interaction (intercropping x weeding)	Plant height (cm)	Base diameter (cm)	No. of leaves / plant	Fodder yield (t/ha)
Aus rice + maize at 75 X 50cm^2 spacing x No weeding	184.3 g	0.97 h	9.84 l	9.97 k
Aus rice + maize at 75 X 50cm^2 spacing x Two weeding	197.4 d	1.03 f	10.38 g	14.19 l
Aus rice + maize at 75 X 50cm^2 spacing x Weed free	200.5 c	1.09 e	10.57 de	16.61 g
Maize sole at 75 X 50cm^2 spacing x No weeding	187.6 f	1.00 g	10.00 h	10.19 j
Maize sole at 75 X 50cm^2 spacing x Two weeding	200.9 c	1.18 bc	10.49 f	15.39 h
Maize sole at 75 X 50cm^2 spacing x Weed free	207.3 b	1.23 a	10.63 c	17.22 f
Aus rice + maize at 75 X 25cm^2 spacing x No weeding	192.6 e	1.00 g	10.02 h	13.63 g
Aus rice + maize at 75 X 25cm^2 spacing x Two weeding	197.1 d	1.14 d	10.56 e	19.98 d
Aus rice + maize at 75 X 25cm^2 spacing x Weed free	199.8 d	1.20 b	10.78 b	23.69 b
Maize sole at 75 X 25cm^2 spacing x No weeding	196.8 e	1.01 fg	10.06 h	18.17 e
Maize sole at 75 X 25cm^2 spacing x Two weeding	206.4 b	1.17 c	10.58 d	20.96 c
Maize sole at 75 X 25cm^2 spacing x Weed free	212.6 a	1.23 a	10.90 a	26.91 a
S $\bar{x}$	1.14	0.02	0.10	0.33
Level of significance	0.01	0.01	0.01	0.01

Figures in a column having the same letter(s) do not differ significantly.

Number of plants/m^2 varied significantly due to intercropping and weeding practices (Table 3). The highest (52.00) number of plants/m^2 was recorded in sole rice under weed free conditions and the lowest (22.75) in aus rice + maize at 75 X 25cm^2 spacing under no weeding condition. Results indicated that lower no. of rice plants/m^2 were raised due to intercropping. Number of tillers/hill and number of non-bearing tillers/hill were not significantly affected by the interaction of intercropping and weeding practices (Table 3). Maize plants suppressed the growth of rice plants in an intercropping system through severe competition for nutrients, moisture, space and sunlight. The highest number of grains/panicle (60.55) was recorded from aus rice sole under weed free condition and the lowest (25.76) in aus rice + maize at 75 X 25cm^2 spacing under no weeding condition. Number of grains/panicle of aus rice was depressed due to intercropping with maize under no weeding condition, because of less availability of nutrients, soil moisture, space, air and sunlight compared with sole aus rice. The highest biological yield of 8.14 t/ha was obtained in sole aus rice under weed free condition and the lowest (0.86 t/ha) in aus rice + maize at 75 X 25cm^2 spacing under no weeding condition. The highest harvest index of aus rice (42.18%) was measured from sole aus rice under weed free condition and the lowest (31.18) in aus rice + maize at 75 X 25cm^2 spacing under no weeding condition (Table 3).

The tallest plant height (212.6 cm) was recorded in sole maize at 75 X 25cm^2 spacing under weed free condition and the shortest (184.3 cm) in aus rice + maize at 75 X 50cm^2 spacing under no weeding condition (Table 4). This result is in agreement with Amano and Salazar (1989). The highest base diameter of 1.23 was obtained cm in both sole maize at 75 X 50cm^2 and 75 X 25cm^2 spacing and weed free condition. The lowest of 0.97 cm was found in aus rice + maize at 75 X 50cm^2 spacing under no weeding condition. Results revealed that base diameter was decreased with increase in plant population. The highest number of leaves (10.90) was obtained in sole maize at 75 X 25cm^2 under weed free condition and the lowest (9.84) in aus rice + maize at 75 X 50cm^2 spacing under no weeding condition (Table 4). This occurred due to competition of plant and weeds for nutrients, space, air, sunlight and soil moisture. The highest fodder yield of 26.91 t/ha in sole maize at 75 X 25cm^2 spacing under weed free condition and the lowest (9.97 t/ha) was for aus rice + maize at 75 X 50cm^2 spacing under no weeding condition. The results are in conformity with the findings of Mamun *et al*. (1994). They found that fodder yield of maize increased with plant population. Weed free condition and more population of maize plant were mainly responsible for increase in fodder yield. On the other hand, severe weed competition and intercropping with rice reduced the fodder yield of maize. From the above discussion it may be concluded that sole aus rice under weed free condition produced the highest dry matter at different DAS. Dry matter production gradually increases with the progress of growth duration in all treatments.

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