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NITROGEN SKIPPING THROUGH DUAL CROPPING OF *Azolla* WITH RICE

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ABSTRACT

The possibility of skipping a top dressing of fertilizer N through the use of *Azolla microphylla* was studied. Inoculation of *A. microphylla* on 10 day after transplantation at 1 t ha^{-1} and incorporation at 30 DAT increased the soil organic carbon content and available N status. Skipping of the second top dressing of fertilizer N at 25 Kg ha^{-1} which coincides with *Azolla* trampling saves the fertilizer and labour for top dressing besides increasing the rice yield significantly at all the seasons tested.

KEY WORDS : *Azolla*, N reduction, organic carbon, yield.

Nitrogen is an important growth limiting factor for rice which largely determines the yield level. However, indiscriminate use of nitrogenous fertilizers would affect the soil quality. Considering the very low efficiency of applied nitrogenous fertilizer and the possibility of only a partial substitution to rice, it has become a necessity to integrate the use of bio, organic or inorganic sources of N for higher N use efficiency, increased yield and sustained soil fertility (Kannaiyan *et al.*,1990). Biological nitrogen fixation through *Azolla - Anabaena* complex is considered to be a potential biological system by contributing 40 - 60 Kg N ha^{-1} besides increasing rice yield at comparatively low cost in low land cultivation (Kannaiyan, 1992). Although reduction in fertilizer N input to the tune of 25 per cent is recommonded, so far no specific study is conducted to know at which time, the input reduction is to be advocated. The present study was undertaken to know whether the N is needed uniformly in all application time or to skip one of the top dressings.

MATERIALS AND METHODS

Field experiments were conducted at Tamil Nadu Rice Research Institute, Aduthurai during 1993, 1994 and 1995 *Kuruvai* season (June - Sep) and 1994 and 1995 *Thaladi* season (Oct - Mar) to test the efficacy of *Azolla microphylla* inoculation on nitrogen reduction to rice. The trials were conducted in a randomised block design with three replications using ADT 36 and ADT 38 rice varieties for *Kuruvai* and *Thaladi* seasons respectively.

The recommended fertilizer N @125 Kg ha^{-1} (both seasons) as urea was applied in four splits viz., 50 kg N as basal dose and 25 kg N each in three top dressing on 15,30 and 45 Days After Transplantation (DAT). This treatment was tested with *A. microphylla* with the skipping of any one of the three top dressings as well as uniform reduction of N either in all the application schedule or at basal only. P as single super phosphate and K as muriate of potash were applied basally at 50 Kg ha^{-1} each. Fresh fronds of *A. microphylla* was inoculated at 1000 Kg ha^{-1} on 10 DAT and incorporated at 30 DAT. The trials were conducted in a clayey loam soil with a mean pH 7.0, CEC 36 meg, 100 g^{-1}, organic carbon 0.75%, total N 0.13%, 70 Kg ha^{-1} available P and 92 kg ha^{-1} exchangable K.

Young seedlings of ADT 36 (25 days) and ADT 38 (30 days) were transplanted in plots of 4m x 3m size. Soil samples were collected at 35 and 65 DAT to analyse the organic carbon (Walkley and Black, 1934) and available N (Subbiah and Asija, 1956). Grain yield was recorded at the time of harvest.

RESULTS AND DISCUSSION

It is evidently clear from the results, that dual cropping of rice with *Azolla microphylla* results in the enhancement of soil organic matter (Table - I). The role of organic matter in maintaining soil quality has been emphasized by Reagnold (1985) as it encouraged soil aggregation, water holding capacity, nutrient supply as well as biological activity which ultimately improved the soil fertility and productivity. Satapathy and Singh (1991) have demonstrated the role of *Azolla* in the build up of soil organic matter in rice soil.

The available N content was increased in soil incorporated with *A. microphylla* (Table - II). The increase in available N in soil might also be due to

Table 1. Effect of *Azolla* dual cropping on soil organic carbon content (in percentage)

TREATMENTS (Kg N ha -1)				KURUVAI SEASON									THALADI SEASON					
				1993			1994			1995			1994			1995		
				0	35 DAT	65	0	35 DAT	65	0	35 DAT	65	0	35 DAT	65	0	35 DAT	65
50	25	25	25	0.90	0.61	0.81	0.88	0.72	0.66	0.78	0.82	0.73	0.88	0.82	0.70	0.83	0.84	0.82
50	-	25	25 +A.M		0.58	1.09		0.94	1.02		1.04	1.09		0.96	1.04		0.99	1.00
50	25	-	25 +A.M		0.73	1.12		0.98	1.10		1.17	1.12		1.14	1.22		1.12	1.18
50	25	25	- +A.M.		0.64	1.07		0.81	0.92		0.98	1.01		0.93	0.98		0.89	0.94
40	20	20	20 +A.M.		0.55	0.98		0.84	0.30		1.04	1.01		1.00	0.94		0.85	0.92
25	25	25	25 +A.M.		0.49	0.98		0.86	0.98		1.16	1.04		0.94	0.92		0.83	0.90
12.5	25	25	25 +A.M.		0.38	0.95		0.80	0.92		0.98	0.95		0.92	0.98		0.83	0.86
			CD (0.05)		0.05	0.04		0.12	0.07		0.09	0.06		0.10	0.08		0.16	0.15

Table 2. Effect of *Azolla* dual cropping on soil available N status (in Kg ha^{-1})

TREATMENTS (Kg N ha -1)				KURUVAI SEASON									THALADI SEASON					
				1993			1994			1995			1994			1995		
				0	35 DAT	65	0	35 DAT	65	0	35 DAT	65	0	35 DAT	65	0	35 DAT	65
50	25	25	25	95.2	119.00	148.4	90.7	130.2	135.4	91.0	133.0	145.6	96.6	120.4	135.8	95.8	126.0	130.2
50	-	25	25 +A.M		133.0	156.8		141.4	149.8		140.0	151.2		127.4	142.8		131.6	138.6
50	25	-	25 +A.M		138.6	161.0		148.4	155.2		147.0	156.8		130.2	148.4		135.8	142.8
50	25	25	- +A.M.		130.2	154.0		134.4	145.4		135.8	154.0		126.0	138.6		132.5	137.5
40	20	20	20 +A.M.		133.0	152.6		133.0	142.8		142.8	142.8		126.0	140.0		128.6	134.4
25	25	25	25 +A.M.		127.4	154.0		131.6	140.0		123.3	149.8		127.4	141.4		130.2	136.4
12.5	25	25	25 +A.M.		124.6	155.4		131.6	137.2		128.8	147.0		124.6	138.6		131.6	137.5
			CD (0.05)		7.74	7.57		5.38	9.63		6.01	7.96		4.99	4.05		7.67	6.41

ammonia excretion by *A. microphylla* during the growth. Lakshmanan *et al.*, (1996) found the continuous excretion of ammonia by *Azolla* during the growth and a large scale release just after trampling of *Azolla*.

Skipping of N as urea at the time of second top dress which normally coincides with *Azolla* incorporation on 30 DAT resulted in the increased organic matter content and available N status in both *Kuruvai* and *Thaladi* seasons. This might be due to the decomposition of *A. microphylla* resulted in the release of N. The mineralization of *Azolla* fresh biomass reached maximum between 2-3 weeks after incorporation and declined there after (Kannaiyan, 1995).

Dual cropping of *Azolla* with rice always resulted in yield increase (Table - III). However, the yield was greater when the second top dressing or nitrogenous fertilizer was skipped by recording 31, 18 and 33 per cent increase over the uninoculated control during *Kuruvai* seasons of 1993, 94 and 95 respectively. Similar trend was

Table 3. Effect of *Azolla* dual cropping on rice yield (t/ha^{-1})

TREATMENTS (Kg N ha -1)				*KURUVAI* SEASON				Per cent increase over control	*THALADI* SEASON			Per cent increase over control
				1993	1994	1995	Mean		1994	1995	Mean	
50	25	25	25	3.12	5.28	4.18	4.19	-	4.58	4.52	4.55	-
50	-	25	25 +A.M	3.61	5.94	5.26	4.93	17.6	5.44	5.34	5.39	18.4
50	25	-	25 +A.M	4.09	6.25	5.60	5.31	26.7	5.74	5.60	5.67	24.6
50	25	25	- +A.M.	3.46	5.77	5.31	4.84	15.5	5.15	5.12	5.13	12.7
40	20	20	20 +A.M.	3.88	5.86	5.16	4.96	18.3	5.19	5.14	5.16	13.4
25	25	25	25 +A.M.	3.88	5.66	4.91	4.81	14.7	5.21	5.10	5.15	13.1
12.5	25	25	25 +A.M.	3.60	5.63	4.91	4.71	12.4	4.99	4.98	4.98	9.4
			CD (0.05)	0.81	0.39	0.68			0.30	0.22		

seen in *Thaladi* seasons also. Increase in the grain yield of rice due to *Azolla* inoculation has been very well established (Kannaiyan, 1995).

Since *Azolla* is usually trampled on 30 DAT which coincides with the second top dressing of N and there is more of ammonical N released at that time, the second top dressing becomes an extra dose and it shall be skipped. Further, skipping a top dressing saves fertilizer and labour. The study clearly indicated the possibility of reducing N when *Azolla* is raised as dual crop and this reduction could be effected by skipping of second top dressing of fertilizer N instead of uniformly reducing the N at all stages.

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PHYSIOLOGICAL ANALYSIS OF GROWTH PARAMETERS AND YIELD ATTRIBUTES IN RAINFED HIRSUTUM COTTONS

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ABSTRACT

Fourteen cotton genotypes were evaluated during 1990-91 for physiological parameters and yield attributes for higher productivity under rainfed condition. Productivity of high yielding genotypes was associated with low leaf area, high total dry matter, higher leaf efficiency, higher harvest index and boll number per plant. Among the high leaf area genotypes, Allepox Rex was identified as the best performer.

KEY WORDS : Cotton ; Growth parameters ; yield attributes ; productivity

INTRODUCTION

Seed cotton yield in cotton is a complex character which is influenced by several physiological parameters, yield attributes, genotypes and environmental factors and hence, the selection made for one character generally brings about simultaneous change in others. Therefore, the information on the interrelationship of various characters are useful for effective selection of one character without sacrificing much in others. Since this information is scanty in rainfed hirsutum cotton, the present study was undertaken to investigate the extent of the contribution of physiological parameters and yield attributes for higher productivity in high leaf area cotton genotypes under rainfed conditions.

MATERIALS AND METHODS

The field experiment was conducted during 1990-91 in medium black soil at Agricultural Research Station, Dharwad. Fourteen cotton (G.hisutum. L) genotypes including two locals Sharada and Abadhita as checks were raised in randomized block design, replicated thrice. The genotypes were grown in 3 row plots of 6.0 m length spaced at 20 cm. The fertilizers were applied