EFFECT OF LEAF CLIPPING AND SPLIT APPLICATION OF NITROGEN ON PRODUCTIVITY OF BRIDEGROOM RICE

ABSTRACT

A Field experiment was carried out during Samba 2023 at Experimental Farm, Department of Agronomy, Annamalai University, Tamil Nadu, India to study the effect of leaf clipping and split application of nitrogen on productivity of bridegroom rice. The experiment was laid out in Factorial randomized block design (FRBD) with three replications. The treatments consisted of two factors viz., Factor I -leaf clipping(L): L_1- No leaf clipping, L_2- leaf clipping on 30 DAT at one third of leaf, L_3- leaf clipping on 45 DAT at one third of leaf and Factor II - split application of N (N) : N_1- no splits (no NPK), N_2 -recommended 4 equal splits (basal,25,50,75 DAT, N_3- 5 equal splits (basal 20, 40, 60,80 DAT) and N_4- 6 equal splits (basal, 15, 30, 45, 60 ,75 DAT). Among the different treatments in Factor I and Factor II, leaf clipping on 45 DAT (L_3) and application of nitrogen in 6 equal splits (N_4) registered higher growth, yield attributes and yield of rice. The interaction effect between leaf clipping and split application of N was significant. Among the treatment combinations, leaf clipping on 45 DAT at one third of leaf along with application of nitrogen in 6 equal split registered its superiority compared to others which recorded the higher values for growth attributes viz., plant height (243 cm), number of tillers hill^{-1} (23.42), root length (33.56cm), root volume (45.19 cc) and dry matter production (12592 kg ha^{-1}). Yield attributes viz., number of panicles m^{-2} (407.62) and number of grains panicle^{-1} (158.34) and test weight (42.34g) and yields of rice (grain - 3950 kg ha^{-1} and straw - 6530 kg ha^{-1}). Thus, it can be concluded that leaf clipping on 45 DAT at one third of leaf along application of nitrogen in 6 equal splits is a viable practice to enhance the growth and yield of bridegroom rice.

Keyword: *Leaf clipping; split application of nitrogen; bridegroom rice; growth and yield.*

INTRODUCTION

Rice (*Oryza sativa* L.) is one of the most important stable foods of nearly more than half of the global population and the majority of Asians consumes rice thrice a day. More than 90% of the world's rice is grown and consumed in Asia. The refrain, "rice is life" is the most fitting for India because this crop is essential to the country's food security and provides a living for millions of people. 14.29 Mt of India's total rice output is derived from the dry season (rabi) and the rest from the rainy season (kharif) [**1**]. According to United Nations estimates, by 2050, there will be 9.7 billion people on the planet. As a result, providing food and nutrition security for this expanding population is getting more difficult. Despite being a cereal with a high caloric and calorie content, rice's grains are deficient in protein, minerals, and other nutrients [**2**]. Now a day, all over the world, scientists focused their attention on nutritional security than food security to alleviate malnutrition. After green revolution, improved rice varieties replaced our traditional rice due to their high yield potential. But most of the improved rice varieties are lack of vitamins and minerals. At the same times, traditional varieties are a viable source of various agricultural properties as well as sources of many bioactive non-vital nutrients. Traditional rice varieties are rich in nutrients such as vitamin D, calcium, thiamine, riboflavin, glutamic acids, and high in fiber [**3**]. They are low in fat, sugar, gluten, and contain oryzanol, a molecule that reduces fat production in the body, making them a great diet for diabetics and hypertensive people. Additionally, a few nutritional components are also present in various fragments of traditional rice (viz. endosperm, germ function, and bran) in small quantities with different biological activities called bioactive compounds [**4** and **5]**.

Farmers in Tamil Nadu have documented 174 traditional rice varieties as a result of this. Some of the rice varieties are *Karuppukavuni, Kullakkar, Illupai poo, Mapillai samba, Kichadi Samba, Thuyamalli, Kaivara samba, Karunguruvai, Kothamalli samba, Tiruchengode samba, Salem senna, Sivan samba, Thanga samba,* etc., Among then bridegroom rice is one of the most important rice variety. Mappillai samba also has a unique name "Bridegroom Rice"**,** which has an interesting historical significance and interesting stories behind it. The story goes back to the early days when grooms were often tasked with lifting heavy rocks to demonstrate their strength. To aid them in this endeavour, the grooms were provided with Mappillai Samba rice, renowned for its ability to enhance physical prowess. This tradition, known as Mappillai Samba, has endured through generations. Rightfully So, Mappillai Samba rice is filled with rich iron, fibre, vitamins, and antioxidants, providing enormous benefits to our body**.** It aids in blood, muscle, neuron, and vein nourishment, improves male fertility, lowers cholesterol, and cures colon cancer [**6**]. However the productivity is very low due to lodging in nature, poor responsive inorganic fertilizers and inadequate application essential plant nutrients and lack of adaptation improved agronomic management practices. Among them, lodging and inadequate and improper application of nitrogen greatly affects the yield. Hence, suitable agronomic management practices are needed to increase the yield of Bridegroom rice. Some of them are leaf clipping and application of N in split doses.

Leaf clipping is one of the most affordable methods of raising yield by cutting one third of leaf very commonly, which also has the added benefit of preventing lodging in the event of excessive vegetative growth and giving farmers fresh feed for their work animals without compromising grain output. Therefore, cutting leaves doesn't actually harm grain production. Cutting also provides more green feed to the animals; it might turn out to be one of the most economical ways to increase the land's total yield [**7**]. Fertilizers are mainly recommended for crop plants to supply essential nutrient element throughout the growth and development period. Among the all essential nutrient elements, nitrogen is needed most for crop plants. Applying nitrogen on time and in parts allows rice to use it more efficiently throughout the growth season. This is because providing nitrogen to the crop reduces nitrogen losses and provides targeted nutrients at growth peaks. Nitrogen application ranged from 120 to 190 kg N ha^{-1} in split doses improved plant height, panicle length, number of filled grains $panicle^{-1}$ and grain yields significantly [**8**]. In general, 200 kg ha^{-1} of nitrogen application in 4 equal splits increasing the yield parameters of number of panicle m^{-2}, number of filled grains $panicle^{-1}$, test weight and yield of rice [**9**]. Rice is a poor nitrogen user, nitrogen usage efficiency ranged from 30 to 50 %. One method for effectively using nitrogen throughout the growth season is the split application of nitrogenous fertilizers, which improves nitrogen absorption, decreases de-nitrification losses, and synchronizes with plant needs [**10**]. Researches on combined effect of leaf clipping and split application nitrogen on rice is very limited and particularly nil in bridegroom rice. Therefore, an experiment was programmed to study the effect of leaf clipping and application nitrogen in split doses on growth and yield of rice.

MATERIALS AND METHODS

`A Field experiment was carried out during Samba 2023 at Experimental Farm, Department of Agronomy, Annamalai University, Tamil Nadu, India (11.38^{0}N latitude and 79.72^{0}E longitudes with an altitude of + 5.79 m MSL) to study the effect of leaf clipping and split application of nitrogen on productivity of bridegroom rice. The experiment was laid out in

Factorial randomized block design (FRBD) with three replications. The treatments consisted of two factors viz., Factor I - leaf clipping (L): L_1 - No leaf clipping, L_2- leaf clipping on 30 DAT at one third of leaf, L_3- leaf clipping on 45 DAT at one third of leaf and Factor II - split application of N (N) : N_1- No split (no NPK), N_2 – recommended 4 equal splits (basal, 25, 50, 75 DAT, N_3 - 5 equal splits (basal 20, 40, 60, 80 DAT) and N_4 - 6 equal splits (basal, 15, 30, 45, 60 ,75 DAT). For this investigation bridegroom rice was fertilized with 150:50:50 NPK kg ha^{-1}. Entire P_2O_5 was administered as a baseline. At the basal, tillering, panicle initiation, and heading phases, K was administered in four equal splits. Required quantity of N was applied as per the treatments. Growth attributes (plant height, number of productive tillers $hill^{-1}$, root length, root volume and dry matter production), yield attributes (number of panicles m^{-2} and number of grains $panicle^{-1}$ and test weight) and yields of bridegroom rice was recorded at critical stages. The statistical analysis of the data followed [**11]** recommendations. The critical difference (CD) were arrived at 5% probability level (P = 0.05). Treatment differences that not significant were denoted by 'NS'.

RESULTS AND DISCUSSION

Growth attributes

Leaf clipping and split application N significantly influenced on the growth attributes *viz.*, plant height, number of productive tillers $hill^{-1}$, root length, root volume and dry matter production of bridegroom rice (Table 1).

Among the different days of leaf clipping, one-third of leaf clipping on 45 DAT (L_3) recorded higher value of the plant height (235 cm), maximum number of tillers $hill^{-1}$ (20.56), longer root length (31.86 cm), larger root volume (40.19 cc) and elevated dry matter production (11868 kg ha^{-1}) of bridegroom rice. Non lodging of crop, erectness of leaves, better utilization of sun light, higher photosynthetic activity improved the cell division, cell elongation and enlargement caused tallest plant at one third leaf clipping on 45 DAT [**12]**. One third of leaf clipping on 45 DAT increased the root length and root volume of rice, therefore, the plant extracted higher amount of applied nutrients, which favourably enhanced growth attributes of rice [**13].** Cutting of leaves had no significant effect on tiller number $plant^{-1}$ in bridegroom rice [**14]**. Leaf clipping did not affect dry matter production at harvest stage, which significantly increased the dry matter accumulation of rice due to production of more number of tillers $hill^{-1}$, root length, root volume and number leaves [**15]** (Khalifa *et al.*, 2008). Weaker culm caused crop lodging which affects the photosynthetic activity and accumulation photosynthates resulted in lesser growth attributes at L_1 (no leaf clipping).

Among the different split dose of N, application of N in 6 equal split doses (N_4) recorded the higher value of plant height (241.23cm), more number of tillers hill^{-1} (22.32), increased in root length (31.38), root volume (41.26 cc) and dry matter production (12044 kg ha^{-1}) of bridegroom rice. This was on par with application of N in 5 equal splits (N_3) which was superior over recommend application of N in 4 equal splits (N_2) which recorded next higher plant height (239.01cm), total number of tillers hill^{-1} (20.90), root length (29.56 cm), root volume (38.793 cc) and dry matter production (11573 kg ha^{-1}) in bridegroom rice. The lowest values on growth attributes were observed without nitrogen application (N_1). The plant height was significantly increased with the increase in the availability of nitrogen levels at different growth stages. Higher availability of nitrogen due to split doses enhanced the cell division; cell elongation and enlargement resulted in higher growth parameters in bridegroom rice [**16]**. Increase in plant height in response to split application of N fertilizers is probably due to higher photo assimilates and there by more dry matter accumulation. Elevated leaf area caused higher photo assimilate production resulted in improved dry matter accumulation [**17**]. Numbers of tillers were increased with increase in split application of N, which could be attributed to the better leaf development, tiller production and elevated leaf photosynthetic activity [**18**]. Increased in N splits increased the dry matter accumulation of bridegroom rice due to increasing vegetative growth resulting from higher photosynthetic activities caused by nitrogen [**19**]. Split application of N also produced more DMP that could produce additional photosynthates for the development of root system and increased root growth [**20]** who reported that split application of N significantly increased the dry matter of plant height, root growth and number of leaves as well as total dry matter at tillering, flowering and harvesting stage.

Among the various treatment combinations, one third of leaf clipping on 45 DAT and application of nitrogen in 6 equal splits (L_3N_4) significantly registered higher plant height (243cm), higher number of tillers hill^{-1} (23.42), more root length (33.56 cm), larger root volume (45.19 cc) and increased dry matter production (12592 kg ha^{-1}) in bridegroom rice. This was followed by 45 DAT of leaf clipping and application of N in 5 equal splits (L_3N_3) recorded relatively higher plant height (240.89 cm), total number of tillers hill^{-1} (22.89), root length (32.89cm), root volume (43.21cc) and dry matter production (12384 kg ha^{-1}) over other treatment combination. Leaf clipping at the early vegetative stage significantly increased plant growth, reduced the lodging due to increased culm diameter and culm wall thickness which improved root growth and involvement of leaves in better photosynthesis resulted in improved growth attributes in lateral stages, similarly, N application improved photosynthetic activity, enhanced the crop growth and increases the number and size of meristematic cells, which leads to formation of new shoot due to the role of split application of nitrogen in improving rice growth, internode elongation, and photosynthesis, vigorous vegetative growth by increased cell division and cell elongation [**21**].The least values on growth attributes were recorded with no leaf clipping and no N application (L_1N_1), which recorded the fewer values on plant height (186.98 cm), total number of productive tillers hill^{-1} (10.61), root length (11.78 cm), root volume (20.23 cc) and dry matter production (5413 kg ha^{-1}) in bridegroom rice.

Yield attributes and yield

Leaf clipping and application nitrogen in split doses significantly enhanced the yield attributes and yield of bridegroom rice (Table 2). Among the different days of leaf clipping, one third leaf clipping on 45 DAT (L_3) recorded significantly highest values for number of panicle m^{-2} (334.38), number of grains panicle^{-1} (150.11), 1000 grain weight (40.72 g) in bridegroom rice. The same treatment registered significantly higher grain yield (3578 kg ha^{-1}) and straw yield (6060 kg ha^{-1}) of bridegroom rice. The per cent increase in grain yield over one-third of leaf clipping on 30 DAT (L_2) and no leaf clipping L_1 was 7.3% and 21.7% respectively. It could be due higher photosynthetic activity, production of higher number of spikelets per panicle, increased in accumulation photosynthates in the economic part which caused higher grain and straw yield [**22**] and [**23**].One third leaf clipping on 30 DAT (L_2) was next in order and recorded relatively higher values for number of panicle m^{-2} (289.05), number of filled grains panicle^{-1} (142.51), 1000 grain weight (38.7 g), grain (3325 kg ha^{-1}) and straw yield (5789 kg ha^{-1}) over no leaf clipping (L_1). The lesser yield attributes *viz.*, number of panicle m^{-2} (255.2), number of filled grains panicle^{-1} (124.6) and 1000 grain weight (35.6 g) and yields *viz.*, grain yield (2826 kg ha^{-1}) and straw yield (5250 kg ha^{-1}) in bridegroom rice was recorded under L_1 (no leaf clipping).

Among the different split dose of N, application of N in 6 equal splits (N_4) recorded significantly more number of panicle m^{-2} (355.96), higher number of filled grains panicle^{-1} (151.41), increased in 1000 grain weight (41.11) and elevated grain (3646 kg ha^{-1}) and straw (6146 kg ha^{-2}) yield of bridegroom rice which was comparable with application of N in 5 equal split and recorded number of panicle m^{-2} of 325.7, number of filled grains panicle^{-1} of 146.6 and 1000 grain weight of 40.1g. The grain and straw yield at N_3 was 3556 kg ha^{-1} and 5980 kg ha^{-1}, respectively. Recommend N in 4 equal splits was next in order. Yield attributes were significantly increased with increase in availability of nitrogen level at different growth stages. Increase in grain yield at application of N in 6 equal splits could be due to application nitrogen in split doses enhanced availability and utilization of N by rice crop which improved the number of panicle m^{-2}, number of grains $panicle^{-1}$ and 1000 grains weight. Higher number of panicle m^{-2} is influenced by the number of tillers that develop during the vegetative stage; higher number of grains $panicle^{-1}$ and number filled spikelet due to N fertilization might be due to optimum availability of N, resulting in more synthesis of photosynthates and a possible source to sink relationship [**24**]. Split application of N actively involved in photosynthesis, carbohydrate accumulation and grain filling in rice, which produced more number of filled grain and recorded higher grain and straw yield [**25**, **26** and **27**]. Increased N splits significantly enhanced the grain yield due to higher yield attributes coupled with efficient translocation of food material to sink. Application of nitrogenous fertilizer at proper time with a suitable rate according to the soil conditions can significantly increased grain yield. Split application of nitrogen at critical growth stages like tillering can increase the number of panicles and number of spikelets per spike in rice [**28].** The higher straw yield might be due to increased number of tiller $hill^{-1}$, length of the plant which ultimately increase straw yield [**29**]. The lowest yield attributes and yield of Bridegroom rice was observed without N addition (N_1).

Among the treatment combinations, one third of leaf clipping on 45 DAT and application of N in 6 equal splits (L_3N_4) significantly recorded more number of panicle m^{-2} (407.6), higher number of filled grains $panicle^{-1}$ (158.34), increased 1000 grains weight (42.34 g) and highest grain (3950 kg ha^{-1}) and straw (6530 kg ha^{-1}) yield in bridegroom rice. This was followed by one third of leaf clipping on 45 DAT and application of N in 5 equal splits (L_3N_3) and recorded relatively more number of panicle m^{-2} (379.6), higher number of filled grains $panicle^{-1}$ (154.1), increased 1000 grains test weight (41.32 g) and highest grain (3865 kg ha^{-1}) and straw (6530 kg ha^{-1}) yield in bridegroom rice. The highest yield attributes and yield recorded at one third of leaf clipping on 45 DAT and application of N in 6 equal splits (L_3N_4) could be due to leaf clipping at early vegetative stage significantly increased growth attributed which favoured the yield attributed resulted in higher grain and straw yield. Increased synthesis of carbohydrates might have increased the grain yield due to assimilation of photosynthates, further split application of N enhanced N availability in the soil at all critical growth stages and increased the nutrient uptake by the crop resulted in higher growth and yield attributes resulted in higher grain and straw yield [27].

CONCLUSION

The experimental results showed that there was a marked variation in the productivity of rice due to one-third of leaf clipping and split application of nitrogen. In the light of above said facts, it can be concluded that the combination of one third of leaf clipping on 45 DAT along with application of nitrogen in 6 equal splits are significantly enhanced the overall productivity of bridegroom rice. Therefore, this treatment can be recommended to the farming community, especially to traditional rice growers.

Table 1. Effect of leaf clipping and split application of N on growth attributes of bridegroom rice at harvesting stage

F – I / F - II	Plant height (cm) at harvest				Number of tillers $hill^{-1}$ at maximum tillering stage				Root length (cm) at flowering stage				Root volume (cc) at flowering stage				Dry matter production (kg ha^{-1}) at harvest			
	L_1	L_2	L_3	MEAN	L_1	L_2	L_3	MEAN	L_1	L_2	L_3	MEAN	L_1	L_2	L_3	MEAN	L_1	L_2	L_3	MEAN
N_1	186.9	215.6	223.5	208.7	10.6	15.0	16.4	14.69	11.7	20.45	29.78	20.67	20.23	28.34	30.98	26.51	5413	9912	10651	8658
N_2	226.3	230.3	232.6	229.7	16.6	18.7	19.5	18.32	19.2	28.29	31.21	26.25	29.21	34.51	41.41	35.04	8236	10641	11846	10241
N_3	237.5	238.6	240.8	239.0	19.0	20.7	22.8	20.90	25.3	30.42	32.89	29.56	33.45	39.72	43.21	38.79	10464	11872	12384	11573
N_4	239.4	241.2	243	241.2	20.5	22.9	23.4	22.32	28.6	31.91	33.56	31.38	34.78	43.81	45.19	41.26	11126	12414	12592	12044
MEAN	225.0	231.4	235.0		16.2	19.3	20.5		21.2	27.76	31.86		29.41	36.59	40.19		8809	11210	11868	
	L	N	L×N		L	N	L×N		L	N	L×N		L	N	L×N		L	N	L×N	
SEd	2.13	0.45	2.61		1.34	0.41	1.32		3.1	1.41	3.12		2.32	0.41	3.12		346	123	410	
CD (P= 0.05)	4.32	1.89	5.42		2.56	0.93	2.94		5.2	2.83	6.34		4.56	1.82	5.25		660	249	823	

Table 2. Effect of leaf clipping and split application of N on yield attributes and yields (grain and straw) of bridegroom rice

F –I / F -II	Number of panicle m^{-2}				Number of filled grains panicle^{-1}				1000 grain weight (g)				Grain yield (Kg ha^{-1})				Straw yield (Kg ha^{-1})			
	L_1	L_2	L_3	MEAN	L_1	L_2	L_3	MEAN	L_1	L_2	L_3	MEAN	L_1	L_2	L_3	MEAN	L_1	L_2	L_3	MEAN
N_1	169.2	210.3	239.6	206.3	97.6	126.7	139.5	121.2	29.6	32.7	38.9	33.7	1801	2548	2825	2391	3220	5180	5420	4606
N_2	251.7	287.9	310.6	283.4	125.3	137.1	148.4	136.9	35.4	39.4	40.3	38.3	3021	3445	3675	3380	5160	5678	5940	5592
N_3	279.9	317.6	379.6	325.7	136.1	149.6	154.1	146.6	38.2	40.9	41.32	40.1	3195	3610	3865	3556	5505	6085	6350	5980
N_4	319.9	340.2	407.6	355.9	139.3	156.5	158.3	151.4	39.3	41.6	42.34	41.1	3290	3700	3950	3646	5695	6215	6530	6146
MEAN	255.2	289.0	334.3		124.6	142.5	150.1		35.6	38.7	40.72		2826	3325	3578		5250	5789	6060	
	L	N	L×N		L	N	L×N		L	N	L×N		L	N	L×N		L	N	L×N	
SEd	26.1	13.0	34.3		4.31	1.93	5.34		1.44	0.43	1.23		39.4	45.5	78.92		68.14	78.68	136.2	
CD (P=0.05)	52.5	26.1	68.6		8.7	3.91	10.6		2.95	0.85	3.48		81.8	94.5	163.6		141.3	163.2	282.6	

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