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Post Flowering Photosynthetic Contribution and Productivity of Rice (*Oryza sative* L.) under Different Establishment Methods

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Abstract—*A field experiment was conducted to study the "Post flowering photosynthetic contribution (PFPC) and productivity of rice (Oryza sative L.) under different establishment methods" at Instructional-cum-Research Farm of Assam Agricultural University, Jorhat during 2013-2014. The experiment was laid out in a split plot design with four replications. The treatments consisted of two different method of establishment viz., System of Rice Intensification (SRI) and conventional method of transplanting in main plot and six different rice genotypes involving four hybrids viz., DRRH2(V_1), Arize6444(V_2), PAC837(V_3), NK5251(V_4) and two high yielding varieties (HYVs) viz., Kanaklata(V_5) and Joymati (V_6) in sub plots. The soil of the experimental plot was sandy loam, acidic in reaction (pH 6.1), medium in organic carbon content (0.62%), medium in available N (294.09kg ha^{-1}) and K_2O(139.01 kg ha^{-1}) and low in available P_2O_5(20.11 kg ha^{-1}). The result of the experiment revealed that higher post flowering photosynthetic contribution (59.46%) was recorded in SRI method of establishment compared to the conventional method (33.53%).Among the different genotypes the highest post flowering photosynthetic contribution (53.15%) was recorded in genotype PAC 837. PAC 837 recorded 42.53% more post flowering photosynthetic contribution than Kanaklata and 38.95% more than Joymati. Higher grain (14.9%) and straw (30.77%) yield were recorded under the SRI method of establishment as compared to conventional method. Among different rice genotypes the highest grain yield was recorded in rice hybrid PAC837 (52.67q/ha) which was 12.66% and 28.43% more than average yield of other hybrids and HYVs, respectively.*

Keywords*: Rice, SRI, Post flowering photosynthetic contribution.*

1. INTRODUCTION

"Rice is life" for more than half of the humanity, considering its important position, the United Nations designated the year 2004 as the "International Year of rice". Rice is the foremost staple food for more than 50% of the world's population in Asia, where 90 per cent of the world's rice is grown and consumed. It is a major staple food crop for many developing countries and not only a main source of calories but also an important source of income and employment for many farmers, particularly poor household. Rice, the staple cereal food grain of majority of India's over one billion population, contributes to nearly 44% of total food grain production. On the other hand rice cultivation is a very water-intensive activity. It is estimated that to produce one kilogram of rice requires 3,000-5,000 liters of water. About two or three times more water is needed for rice cultivation than other irrigated crops. As rice crop is being traditionally cultivated under continuous submerged conditions, some alternate methods have to be searched to minimize the water requirement of rice crop. In this aspect, SRI cultivation method offers a wonderful approach to minimize water consumption for rice cultivation and to increase the productivity (Laulanie,1993).

The SRI is a new methodology for increasing the productivity of irrigated rice by changing the management of plants, soil, water and nutrients resulting in both healthy soil and plants, supported by greater root growth and the soil microbial abundance and diversity. SRI method reduced the seed rate by 80%, water requirement by 29% and growth duration by 8-12 days; thereby enhancing the water productivity and per day productivity of rice cultivars**.** Uphoff *et al.* (2002) stated that the best SRI yields can be achieved with HYV's or hybrids but even traditional varieties can perform better under SRI. Rice hybrids have a mean yield advantage of 10-15% over varieties (Yang *et al.*, 1999) since they possess a more vigorous and extensive root system and increased growth rate during vegetative period (Yamauchi, 1994) when grown under normal transplanting condition. Besides, rice hybrids exhibited highest yield potential even under SRI method, due to profuse tillering capacity, lodging tolerance, greater stress resistance and wide ecological adaptability(Yan., 2002).

2. MATERIALS AND METHODS

A field experiment was conducted instructional-cum-research (ICR) farm of Assam Agricultural University, Jorhat during 2013-2014, to study the Post flowering photosynthetic contribution (PFPC) and productivity of rice (*Oryza sative* L.) under different establishment methods. The experiment was laid out in split plot design with four replication. The treatments consisted of two different methods of establishment viz., System of rice intensification(SRI) and Conventional method of transplanting in main plot and six different rice genotypes involving four hybrids viz., DRRH2(V_1), Arize6444(V_2), PAC837(V_3),NK5251(V_4) and two high yielding varieties (HYVs) viz., Kanaklata (V_5) and Joymati(V_6) in sub plots. The soil of the experimental plot was sandy loam, acidic in reaction (pH 6.1), medium in organic carbon content(0.62%), medium in available N(294.09kg ha^{-1}) and K_2O(139.01 kg ha^{-1}) and low in available P_2O_5(20.11 kg ha^{-1}).SRI involved planting of 12 days single seedling /hill at 25cm×25cm and conventional method involved planting of single seedling of 45 days (5-6 leaf stage) at 20cm×20cm spacing.

Nursery for SRI method was prepared in tray. The tray was filled with compost and fine soil, mixed thoroughly and the seed was uniformly spread. The bed was kept moist by sprinkling water frequently. At 12 days the seedlings were uprooted along with soil, without disturbing the root system. The seedlings for the conventional method were raised in field itself. The field was thoroughly ploughed and raised seed bed of 10m length and 1.25m breadth was prepared with 30cm gap in between the beds. In each seed bed 20kg FYM, 80g Urea, 80g SSP and 40g MOP were applied and mixed thoroughly with soil. The pre sprouted seeds were sown uniformly and the bed was kept moist by sprinkling water as and when required. In SRI method, manuring was done as per recommendation for SRI method and in conventional method the recommended doses of FYM were applied to each plot in around 25 days prior to the transplanting of the seedlings. The calculated quantity of fertilizers were applied in the conventional plots and mixed uniformly two days before transplanting of the rice seedlings. The fertilizers were applied in the form of Urea, SSP and MOP. For hybrid varieties one fourth of total urea, full doses of SSP and MOP were applied at the time of final land preparation and the remaining 2^{nd} one fourth 3^{rd} one fourth and 4^{th} one fourth of urea are applied as top dressing at maximum tillering, panicle initiation and booting stage respectively. For high yielding genotypes half of Urea and MOP, full dose of SSP were applied at the time of final land preparation and remaining half of urea and MOP was applied in two split doses. After mixing the fertilizers with the soil the plots were leveled properly. In conventional method irrigation was done at 5cm depth at three days after disappearance of ponded water and in SRI method irrigation was done at 2.5cm depth at hair line crake of the soil.

3. RESULTS AND DISCUSSION

Post flowering photosynthetic contribution (PFPC%)

The results showed that different methods of establishment significantly affected the post flowering photosynthetic contribution of rice. Higher post flowering photosynthetic contribution was recorded in SRI method of establishment compared to the conventional method (Table1). SRI method recorded the 77.33% higher post flowering photosynthetic contribution than the conventional method. Which might be due to better root growth. Similar finding was also reported by Prema (2007).The effect of different genotypes on post flowering photosynthetic contribution was found to be significant. Among the different genotypes the highest post flowering photosynthetic contribution was recorded in genotypes PAC 837 which was significantly higher than the Kanaklata and Joymati and statistically at par with NK5251, A*rize*6444 and DRRH2. PAC 837 recorded 42.53% more post flowering photosynthetic contribution than Kanaklata and 38.95% more than Joymati respectively (Table1).The variation in post flowering photosynthetic contribution among rice genotypes was due to the variation in genetical characters among the genotypes towards photosynthesis.

Grain and straw yield

Methods of establishment significantly affected grain and straw yield of rice (Table 2)**.** Higher grain and straw yield were recorded in SRI method than conventional method which might be due to the planting of younger seedling leading to increase in yield attributing characters such as effective tillers per hill, number of grains per panicle and higher number of filled grains per panicle under SRI method. Similar results were also reported by Mohanty *et al.* (2014).

Rice genotypes significantly affected grain and straw yield. Higher grain and straw yield were recorded in rice hybrids as compared to the HYVs. Rice hybrid PAC 837 recorded the highest grain yield which might be due to the higher value of yield attributing characters and genetic yield potential of the rice hybrids. The increase in straw yield in rice hybrid PAC837 might be due to the conversion of photosynthates into shoot in contrast to economic parts of the plant (Satyanaryan *et al.,* 2007) (Table 2).

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Table 1: Effect of methods of establishment and genotypes on Post Flowering Photosynthetic Contribution (%) of rice

Treatments	PFPC(%)
Methods of establishment(M)	
SRI	59.46
Conventional	33.53
SEm ±	2.19
CD(P=0.05)	9.85
Genotypes(V)	
DRRH2	49.18
Arize 6444	49.84
PAC837	53.15
NK5251	51.28
Kanaklata	37.29
Joymati	38.25
SEm±	3.45
CD(P=0.05)	9.98
Interaction (M x V)	NS

Table 2: Effect of methods of establishment and genotypes on grain and straw yield (q/ha) of rice

Treatments	Grain yield (q/ha)	Straw yield(q/ha)
Methods of establishment(M)		
SRI	49.01	80.86
Conventional	42.64	61.83
SEm +	0.47	0.71
CD(P=0.05)	2.11	3.21
Genotypes(V)		
DRRH2	45.33	70.67
Arize 6444	46.87	73.11
PAC837	52.67	82.04
NK5251	48.07	74.99
Kanaklata	40.63	63.03
Joymati	41.39	64.21
SEm +	1.26	2.00
CD(P=0.05)	3.63	5.78

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