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EFFECT OF SHADE ON YIELD OF RICE CROPS

Golam Moula*

ABSTRACT: A study was undertaken to observe the effect of shade of the trees on the yield of paddy and green straw of two different rice varieties, local variety, Kazol Shail and high yielding variety, BRRI-32. The yields of paddy of Kazol Shail in the shaded and un-shaded area were 0.76 and 2.21 t ha^{-1}, respectively. The yields of paddy of BRRI-32 in the shaded and un-shaded area were 1.83 and 3.63 t ha^{-1}, respectively. The yields of green straw of Kazol Shail in the shaded and un-shaded area were 4.89 and 10.11 t ha^{-1}, respectively. The yields of green straw of BRRI-32 in the shaded and un-shaded area were 7.61 and 14.17 t ha^{-1}, respectively. The results revealed that the yield of paddy of Kazol Shail and BRRI-32 in the un-shaded area are 190.79% and 98.36% higher than in the shaded area, respectively. The yield of green straw of Kazol Shail and BRRI-32 in the un-shaded area are 106.75% and 86.20% higher than in the shaded area, respectively.

Key Words: Rice; Shade; Yield, Yield Component; Bangladesh.

INTRODUCTION

Bangladesh is a flood prone region due to its geographical location. An extensive network of rivers (290 rivers alongwith 8236 km^2 riverine land) contributes considerably to the socio-economic lives of the country. The economy is predominantly agrarian. The majority of the people (65% of the total labour force) depend directly or indirectly on agriculture for earning their livelihood. Flooding is a major problem resulting in affecting natural resources, agricultural production and human sufferings almost every year. To save the lives and properties construction of embankment is the history of Bangladesh since time immemorial. Over the last few decades, nearly 13,000 km of embankment have been constructed in Bangladesh (Islam, 2000).

The Forest Department of Bangladesh and the local people dwelling adjacent to the embankment planted various kinds of trees to the embankment. So, it is important to observe the effect of shade on the agricultural crops. Light is one of the most important factors determining the growth of plants. The sun is the source of radiant energy, which is visible to eye and about 39% of the total radiation reaches on the earth from the sun (Weaver and Clement, 1938). Light affects plants growth in many ways. Shade at different plant growth stages such as flowering stage, early milk stage etc. causes reduction in yield of crops. Rice grown in shaded plots have a higher percentage of missing hills than those grown in un-shaded plots. As a result, shaded plots give lower yield than the un-shaded plots (Quddus and Pendleton, 1991). Although the shade effect on yield of agricultural crops are reported elsewhere (Stansel et al., 1965; Willeng and Holiday 1971; Quddus and Pendleton 1991), there is no available report on the same in Bangladesh. Rice is our major crop and 95% food demand is provided by it (BBS, 1997). It is an important factor to select rice for observation. During Aman season (from August to mid December) farmers grow local rice variety such as Kazol Shail, Raja Shail and high yielding rice variety, BRRI-32 and BRRI-11. In the study area local farmers prefer Kazol Shail due to availability of seeds (Anon. et al., 2000). On the other hand BRRI-32 produces highest paddy yield in the coastal area of Noakhali district (Bhuiyan et al., 2000). So, Kazol Shail and BRRI-32 were selected for the present study.

MATERIALS AND METHODS

The study was undertaken in 2000 at Keramatpur under Sadar Thana of Noakhali District in Bangladesh. The study

*Bangladesh Forest Research Institute, Chittagong, Bangladesh.

area is a vast saline area of Agro-Ecological Zone, AEZ-18 (Young Meghna Estuarine Floodplain) (Anon et al., 1998). The area is a rainfed low land and the cropping pattern is fallow transplanted Aman fallow. The experimental plots were situated at the west (inner) side and adjacent to the north-south directed Keramatpur Embankment. There are different plant species planted by the adjacent landowners.

The length of shade in the inner of the embankment at 8 a.m., 9 a.m., 10 a.m., 11 a.m. and 12 noon were 14.02m, 7.99m, 3.97m, 2.43m and 1.22m, respectively. For the present study different areas were defined as follows:

Shaded Area: Distance up to 4 m from the margin of the toe line of the embankment.

Buffer Area: Distance from 4 m to 8 m

Un-shaded Area: Distance from 8 m to 12 m.

Each of the rice variety was planted on three different plots (4 m x 4 m) under different shade conditions (Figure 1).

Experimental fields were ploughed for four times with a draft power of 7-8 m depth and then leveled by laddering. The land was prepared and maintained homogeneously.

For the Kazol Shail 25 days old seedlings were transplanted at 20 cm x 25 cm hill spacing @ 3-4 tillers per hill on August 23, 2000. For the BRRI-32, seeds were sown on August 1, 2000 in a seedbed and transplanted to the experimental plots on August 30, 2000 at 20 cm x 15 cm hill spacing @ 2-3 tillers per hill.

Nitrogen (N), phosphorus (P), and potassium (K) fertilizer were applied @ of 45-20-20 kg ha^{-1} and 65-20-20 kg ha^{-1} for Kazol Shail and BRRI-32, respectively. In both the whole of P and K were used as Triple Super Phosphate (TSP) and Murate of Potash (MP) respectively at final land preparation. In case of Kazol Shail, one third (15 kg) of the N were used as urea at final land preparation and rest of the N were used in two splits. On the other hand, in case of BRRI-32, sue of N was applied as follows:

1st top dress: @ 25 kg N ha^{-1} at 15 days after transplanting.

2nd top dress: @ 20 kg N ha^{-1} at 30 days after transplanting.

3rd top dress: @ 20 kg N ha^{-1} at 50 days after transplanting.

Two hands weeding at 15 and 30 days

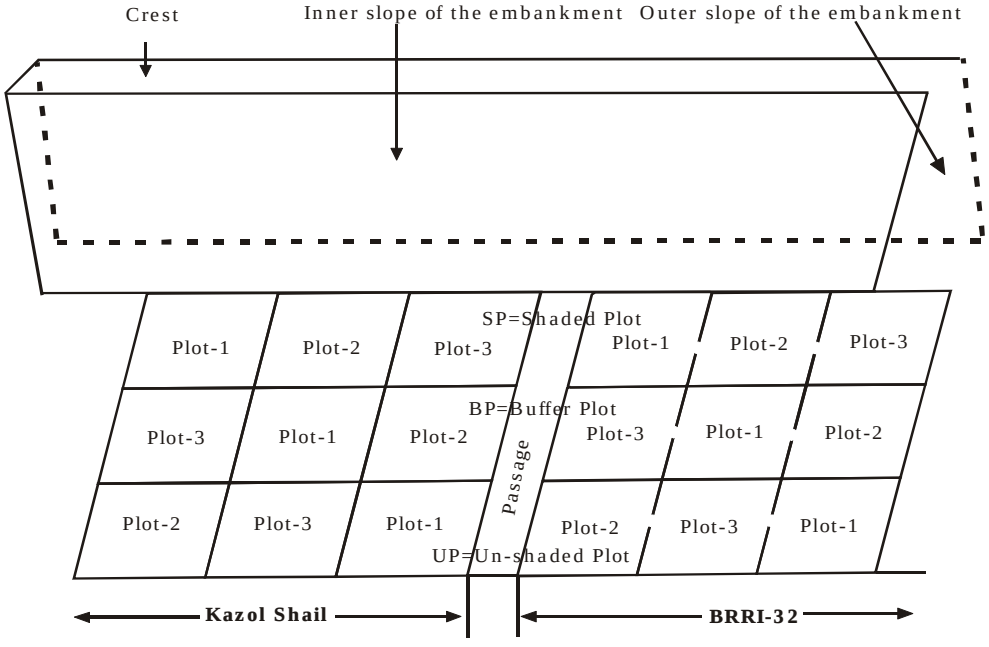

Figure 1. Experimental plots of the two rice varieties

after transplanting were followed. Integrated pest management was followed for insect control. BRRI-32 was harvested on December, 3 and Kazol Shail was harvested on December 12, 2000, manually.

The yield of paddy and green straw were measured just immediately after harvesting. Data were interpreted by "t" test. The yield was calculated by using the following formula. t ha^{-1}= {(kg $plot^{-1}$ / 16)x10,000} / 1000

RESULTS AND DISCUSSION

The yields of paddy of Kazol Shail in the shaded and in the un-shaded area were 0.76 and 2.21 t ha^{-1}, respectively. The yields of paddy of BRRI-32 in the shaded in the un-shaded area were 1.83 and 3.63 t ha^{-1}, respectively. The yields of green straw of Kazol Shail in the shaded and in the un-shaded area were 4.89 and 10.11 t ha^{-1} respectively. The yields of green straw of BRRI-32 in the shaded and in the un-shaded area were 7.61 and 14.17 t ha^{-1} respectively (Table 1).

Table 1. Comparative yield of paddy and green straw of Kazol Shail and BRRI-32 in the shaded and un-shaded areas

(t ha^{-1})

Treatment	Paddy yield		Green straw yield	
	Kazol Shail	BRRI-32	Kazol Shail	BRRI-32
Shaded	0.76 a	7.83 a	4.89 a	7.61 a
Un-shaded	2.21 b	3.63 b	10.11 b	14.17 b

Means followed by same letters do not differ significantly at 0.1% level.

Willey and Holiday (1971) found 50% lower yield of spring wheat with 50% reduction of light intensity for 5-6 weeks between panicle initiation and anthesis. Nandy et al. (2003) observed 10% lower paddy yield of rice plant, c.v. Koshihikari in shaded plot with 78% of full solar radiation than un-shaded plot with 100% solar radiation at Fukui Prefecture Agriculture Expansion Station in Japan. Quddus and Pendleton (1991) studied with the effect of shading on the yield of main rice crop and following rice of IR50 at International Rice Research Institute (IRRI) Farm in Philippines. In their study they used Nylon mosquito net as a shading material. About 21% of incident light was reduced by providing the Nylon net at different plant growth stage up to 7 days after harvesting the main crops. They found 8% lower yield of main rice crops in the shaded plots than un-shaded plots. In following ratoon rice they found 72% higher yield in un-shaded plots than shaded plots.

Data on the yield of paddy and straw of both Kazol Shail and BRRI-32 in present study were interpreted by "t" test and were found significantly different at 0.1 % level of probability between shaded and un-shaded plots.

The shade of the canopies of the trees grown on the embankment affects significantly on the yields of paddy and green straw of local rice variety, Kazol Shail and high yielding rice variety BRRI-32. So, the farmers should cultivate shade tolerant agricultural crops in the shaded area.

LITERATURE CITED

Anonymous, 1998. Baseline Survey Report of FSR&D Site Atkapalia, Noakhali Sadar Thana, Noakhali, p. 52.

Anonymous, 2000. Annual Report 1999-2000 on Farm Research Division, Bangladesh Agricultural Research Institute, Noakhali, 27-30 August 2000, p. 60.

Bhuiyan, M.N. Rahman, M.J. and Uddin, M.J. 2000. Screening of transplanted Aman rice varieties for succeeding Rabi crop cultivation in saline areas of FSRD site Atkapalia, Noakhali. In: Masahireo et al. (eds.). Annual Report 1999-2000 on Farm Research Division, Bangladesh Agricultural Research Institute, Noakhali, 27-30 August 2000, p. 1.

BARI (Bangladesh Agricultural Research Institute), 1996. Annual Report for 1995. Bangladesh Agricultural Research Institute, Joydebpur, Gazipur, p. 66.

BBS 1997. Statistical yearbook of Bangladesh. Bangladesh Bureau of Statistics, p. 690.

Islam, M.N. 2000. Embankment erosion

control: Towards cheap and practical solutions for Bangladesh. The 2nd International Conference of Vetiver (ICV-2), Phetchaburi Province, Thailand, 18-22 January, p. 17.

Nandy, P. Paul, S.P. Moula, M.G. Imam, M.F. Basak, S.R. Mian, M.A.Q. and Mannan, M.A. 2003. Stakeholder analysis through participatory rural appraisal for land use and joint forest management in raised coastal areas. PRA Bull. p. 58.

Quddus, M. A. and Pendleton, J.W. 1991. Effects of shading on yield of main rice crop and the following ratoon rice. Bangladesh Rice J. 2 (1&2): 79-92.

Stansel, J.W. Bolich, C.N. Thusell, J.R. Hall, V.L. 1965. The influence of light intensity and nitrogen fertility on rice yield and component of rice. Rice J. 68: 34-35.

Weaver, J.E. and Clement, F.E. 1938. Plant Ecology. Tata Mc. Graw-Hill, Publishing Company Ltd. 601 p.

Willey, R.W. and Holiday, R. 1971. Plant population and shading studies in wheat J. Agric. Sci. Cambridge, 77:453-461.