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Performance of Seedling Ages and Seedling Raising Techniques on Yield and Yield Components of Transplant Aman Rice

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Abstract: The experiment was carried out to investigate the effect of (a) three seedling ages viz. 21, 28 and 35 days and (b) four seedling raising techniques viz. normal wet, modified wet, floating and modified dapog on the yield and yield components of transplant aman rice cv. Binadhan 4. Except the number of non-effective tillers hill^{-1}, weight of 1000-grains, harvest index and other characters were significantly influenced by both seedling ages and seedling raising techniques. Besides these, straw and biological yield showed non significant results in respect of seedling ages. The interaction between seedling ages and seedling raising techniques had significant effect on number of total tillers hill^{-1}, number of effective tillers hill^{-1}, grain, straw and biological yield.

Key words: Seedling ages, seedling raising techniques, yield, biological yield, harvest index, aman rice

Introduction

The agriculture of Bangladesh is predominantly rice based but the production is very poor. The average yield of rice in Bangladesh is around 1.967 t ha^{-1} (Anonymous, 1999a), which is less than the world average (3.845 t ha^{-1}) and frustratingly below the highest Asian ranking country (6.868 t ha^{-1}) demonstrated like in Korea (Anonymous, 1999b). Among the various factors that influence rice production, seedling age is an important one because it has a tremendous effect on plant height, tiller production, panicle length, grain formation, grains panicle^{-1} and other yield contributing characters (Ali *et al.*, 1995). The farmers of Bangladesh do not give attention to the age of seedling at transplanting and they often use tender or aged seedlings. For this reason, yield was reduced significantly. We overcome this situation maintaining optimum age of seedling for maximum yield.

Rice seedling is raised by farmers adopting different methods. Wet and dry seedbeds are widely used practices as normal methods for raising seedling in Bangladesh and in the most rice growing countries of the world (Rahman, 1969). On the other hand, Bangladesh is a country of natural calamities. In the rainy season in some years, it is not possible to raise seedling due to excessive rainfall or sudden flood. In these situations, the prepared seedbed that flooded for a few days causes severe damage to the seedling. In a situation like that, there occurs an acute shortage of seedlings, which could possibly be minimized by adopting some alternative technologies of seedbed preparation to save the farmers from total failure of rice crop.

Considering the above facts, present study was carried out:

I. To find an optimum seedling age for transplantation and a suitable seedling raising technique (s) and B.
ii. To determine their effect on growth and yield of transplant aman rice.

Materials and Methods

The experiment involving three seedling ages viz. 21, 28 and 35 days old and four seedling raising techniques viz. normal wet (NW), modified wet (MW= partial flooding and drying), floating (F) and modified dapog (MD) on the yield and yield components of Binadhan 4 was conducted at the Agronomy Field Laboratory, Bangladesh Agricultural University, Mymensingh during June to December 2000 (Kharif season). The study area belongs to the Old Brahmaputra Floodplain Soil (agro ecological zone 9), which falls into non-calcareous dark gray Floodplain soil (UNDP and FAO, 1988). The soil texture was silty loam with pH 6.4-7.3.

The seedbed preparation procedures are given below:

Normal wet seedbed: Normal wet seedbed was prepared for raising seedling as the procedure followed by Anonymous (2000) except the modification of the size (2.0× 1.0 m^2). Three equal sizes of bed were prepared for sowing the sprouted seeds for raising seedling of three different ages.

Modified wet seedbed: The size and method of preparation of modified wet seedbed was same as normal wet seedbed previously described. The only difference was that, borders of each three beds were slightly raised with soil at a height of 20 cm from the ground. Each bed was flooded for 48 h at 3 days interval beginning sowing date up to transplanting date. It was done to create stress to the seedlings.

Floating seedbed: For the preparation of floating seedbed, compact banana stems were collected. To make a frame, the stems were tied with the help of bamboo and metallic wire, which was floated on water in the pond of Agronomy Field Laboratory. Then a mat made of bamboo slips was spread on the float and mud layer of about 4 cm thick was plastered. The bed was divided into three equal parts with a gap of 10 cm. The float was tied with a bamboo pole so that it can not move.

Modified dapog seedbed: For raising seedling in modified dapog, the required piece of land was cleaned, compacted and leveled. The border of the bed was raised at a height of 25 cm from the ground by soil. Then the bed was covered by a polythene sheet, which was in position by fixing few small bamboo pegs along with the sides of the bed. The whole bed was marked into three small portions. The sprouted seeds were sown very thickly on the polythene sheet. The bed was kept moist by frequent splashing of water and the first few days the bed was protected from scorching sun by providing a temporary shade made of bamboo slips. The seedling was pressed down lightly with hands to keep the roots of the seedling in contact with the polythene sheet so that they could absorb necessary moisture. The seed rate in this bed was 1 kg m^{-2}. Ten percent urea solution was used in this bed when the seedling was 15 days old. Soil dust and well decomposed cowdung were mixed well and applied on the modified dapog seedbed about 1 cm thick layer on 15 days after sowing. It was done to make further establishment of the seedling up to the date of transplantation.

Sprouted seeds were sown on each portion of prepared seedbed of each method at three different dates as per experimental treatments. First, second and third sowing was done on 10, 17 and 24th June, respectively. The experiment was laid out in a split plot design with four replications. The size of each unit plot was 10 m^2 (4.0× 2.5). Seedling of 21, 28 and 35 days old were uprooted from different seedbeds and were transplanted on 15th July 2000, maintaining the spacing of 20× 15 cm^2. Standard cultural practices were followed as and when necessary. Yield and

yield components were measured from randomly selected 10 hills of each plot. Analysis of variance was done with the help of computer package MSTAT. The mean differences among the treatments were adjudged as per tested with Duncan's multiple range test (Gomez and Gomez, 1984).

Results and Discussion

Age of seedlings significantly influenced plant height, number of total tillers hill^{-1}, number of effective tillers hill^{-1}, panicle length, number of total spikelets panicle^{-1}, number of filled grains panicle^{-1}, number of sterile spikelets panicle^{-1} and grain yield. The rest of other characters such as number of non-effective tillers hill^{-1}, weight of 1000-grains, straw and biological yield and harvest index exhibited non significant results (Table 1). Thirty five days old seedlings produced significantly the highest number of total tillers hill^{-1} (8.80), number of effective tillers hill^{-1} (7.50), panicle length (25.77 cm), number of total spikelets panicle^{-1} (120.23), number of filled grains panicle^{-1} (104.89). Plant height and grain yield the highest (129.10 cm) and (4.26 t ha^{-1}) at 35 days old seedling which was statistically at par with 28 days old seedling. Channabasappa *et al.* (1998) reported that under late-planted conditions both 35 and 45-days-old seedlings performed better for panicle number and grains panicle^{-1} giving significantly the higher grain yield than 25 days old seedlings. However, rice planted with 45-day-seedlings showed only marginal increase in yield of 35 days old seedling. Islam and Ahmed (1981) also reported that 30 days old seedlings gave higher yield than 20 or 40 days old seedling. In case of number of sterile spikelets panicle^{-1} the highest value was produced (18.59) from 21 days old seedlings, which was at par with 28 days old seedlings and the lowest value (15.34) was obtained from 35 days old seedlings. Murty and Sahu (1979) reported that spikelet sterility was decreased with transplanting of older seedlings.

Plant height, number of total tillers hill^{-1}, number of effective tillers hill^{-1}, panicle length, number of total spikelets panicle^{-1}, number of filled grains panicle^{-1}, number of sterile spikelets panicle^{-1} and grain, straw and biological yield varied significantly in respect of seedling raising techniques (Table 1). The characters, number of effective tillers hill^{-1}, weight of 1000-grains and harvest index showed non significant variation. Except number of sterile spikelets panicle^{-1}, other significantly varied characters gave the highest value in modified wet seedbed. Number of sterile spikelets panicle^{-1} seedling from modified dapog seedbed showed the highest value (21.20) and the lowest from modified wet seedbed (12.88). The characters like plant height and number of filled grains panicle^{-1} gave the highest values (129.58 cm) and (107.12) from modified wet seedbed and the lowest (124.40 cm) and (86.13) from modified dapog seedbed. It may be concluded that modified wet or partial flooding and drying techniques might have helped to enhance the increasing seedling height which ultimately influenced the plant height (Huang, 1989). In modified dapog plant height was the lowest, possibly due to unavailability of nutrients. Excluding plant height number of filled grains panicle^{-1} and number of sterile spikelets panicle^{-1} all other statistically varied characters, the highest value were statistically at par with normal and floating seedbed.

Number of total tillers hill^{-1}, number of effective tillers hill^{-1} and grain, straw and biological yield were significantly influenced by the interaction between seedling ages and seedling raising techniques. Other characters were varied non significant. Except straw yield the highest values for number of total tillers hill^{-1}, number of effective tillers hill^{-1}, grain and biological yield (9.18), (8.01), (5.25 t ha^{-1}) and (12.11 t ha^{-1}) were obtained from the interaction between 35 x MW (35 days old seedling x modified wet seedbed). The highest straw yield (7.09 t ha^{-1}) was obtained from the interaction between 35 x F (35 days old seedling x floating seedbed).

In conclusion the 35 days old seedlings gave better performance than 28 or 21 days old seedling in transplant aman season in the climatic conditions of the study area. This result also indicated that modified wet seedbed technique was the best followed by floating

Table 1: Effect of seedling ages, seedling raising techniques and their interaction on yield and yield components of transplant aman rice (cv. Binadhan 4)

Treatments	1	2	3	4	5	6	7	8	9	10	11	12	13
Seedling age (days)													
21	124.63b	7.02b	5.72c	1.29	23.20bc	112.54c	93.95c	18.59a	26.08	3.69b	6.04	9.93	39.56
28	127.96ab	7.49b	6.20b	1.29	24.27b	115.08b	98.18b	17.00ab	26.09	4.10a	5.95	10.04	40.54
35	129.10a	8.80a	7.50a	1.30	25.77a	120.23a	104.89a	15.34b	26.13	4.26a	6.00	10.26	41.52
Seedling raising techniques													
NW	126.65b	7.71a	6.47a	1.24	25.12ab	116.32a	99.63b	16.69b	26.09	4.27a	6.60a	10.82a	40.38
MW	129.58a	8.23a	7.20a	1.03	26.07a	120.00a	107.12a	12.88c	26.12	4.65a	6.64a	11.32a	41.36
F	127.18b	7.86a	6.62a	1.24	25.33ab	117.81a	101.49b	16.32b	26.10	4.28a	6.58a	10.97a	40.36
MD	124.40c	6.45b	5.06b	1.40	23.68b	107.33b	86.13c	21.20a	26.10	2.97b	4.37b	7.33b	39.85
Seedling age x seedling raising techniques													
21 x NW	125.58	6.93 c	5.63 c	1.30	24.28	113.43	93.22	20.21	26.09	3.94 b	6.11 b	10.05 c	39.21
21 x MW	126.94	7.53 bc	6.18 bc	1.35	24.60	116.59	99.84	16.75	26.09	4.03 ab	6.50 ab	10.52 bc	38.30
21 x F	126.78	7.03 c	5.88 c	1.15	24.42	112.23	95.69	16.54	26.12	3.26 b	5.07 bc	8.23 d	39.13
21 x MD	125.24	6.60 bc	5.21 cd	1.29	23.52	107.90	87.04	20.86	26.07	3.54 b	5.57 bc	9.10 cd	38.84
28 x NW	127.11	7.53 bc	6.40 bc	1.13	24.34	116.86	100.96	15.90	26.08	4.30 ab	6.64 ab	10.93 b	39.38
28 x MW	129.70	7.99 bc	6.62 b	1.38	25.22	119.04	104.31	13.73	26.07	4.67 ab	6.56 ab	11.23 ab	41.60
28 x F	127.22	7.66 bc	6.40 bc	1.27	24.58	116.47	100.86	15.60	26.09	4.42 ab	6.69 ab	11.11 ab	39.80
28 x MD	124.02	6.71 c	5.37 c	1.35	22.96	107.96	86.61	21.35	26.12	2.99 c	3.90 c	6.89 e	43.40
35 x NW	129.45	8.06 ab	7.06 ab	1.00	25.26	118.69	104.70	13.99	26.12	4.56 ab	7.07 a	11.63 ab	39.20
35 x MW	131.09	9.18 a	8.01 a	1.18	26.89	127.36	114.22	13.13	26.17	5.25 a	6.86 ab	12.11 a	43.35
35 x F	129.53	8.11 ab	7.08 ab	1.03	26.37	124.74	107.91	16.83	26.09	4.83 ab	7.09 a	11.90 a	40.62
35 x MD	123.33	6.05 e	4.60 d	1.45	24.58	106.12	81.75	24.37	26.12	2.39 c	3.63 d	6.02 e	39.70

1 = Plant height (cm); 2 = Number of total tillers hill^{-1}; 3 = Number of effective tillers hill^{-1}
4 = Number of non-effective tillers hill^{-1}; 5 = Panicle length (cm); 6 = Number of total spikelets panicle^{-1}
7 = Number of filled grains panicle^{-1}; 8 = Number of sterile spikelets panicle^{-1}; 9 = Weight of 1000- grains (g)
10 = Grain yield (t ha^{-1}); 11 = Straw yield (t ha^{-1}); 12 = Biological yield (t ha^{-1})
13 = Harvest index (%)

In a column, figures under each level of treatments having the same letter (s) do not differ significantly at 5% level by DMRT

*NW = Normal wet; MW = Modified wet; F = Floating; MD = Modified dapog.

and normal wet seedbed, respectively. The lowest performance was showed in modified dapog seedbed technique. In flood affected area in Bangladesh, critical period is attained when unusual flood frequently destroy the seedlings. It is advisable to undertake suitable techniques of seedbed preparation like modified wet, floating or modified dapog which will ensure to stabilize the rice production from total failure.

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