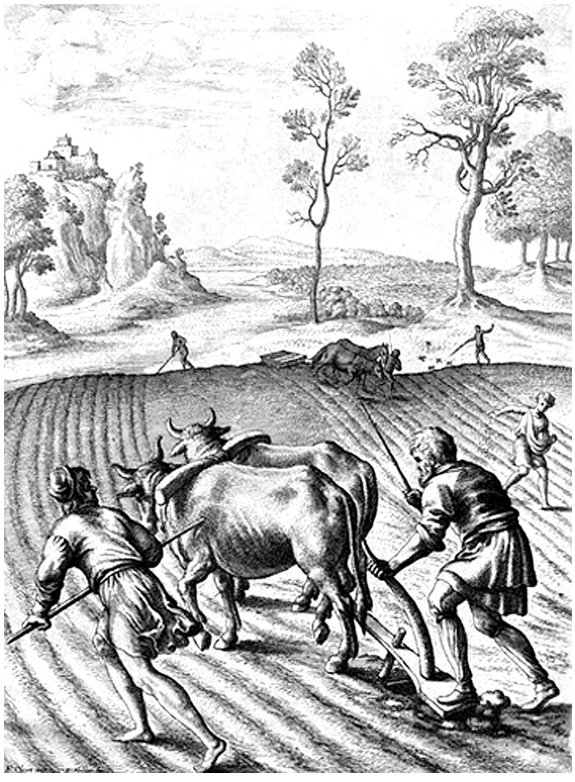
ISSN : 1812-5379 (Print)
ISSN : 1812-5417 (Online)
http://ansijournals.com/ja

# JOURNAL OF AGRONOMY



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Pakistan Journal of Agronomy 1 (2-3): 89-91, 2002

# Effect of Seedling Raising Method and Fertilizer Combination on the Yield of Late Boro Rice

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**Abstract:** The seedlings raised in polythene covering of seed bed were reported to produce the highest plant attributes in boro rice. Recommended NPK fertilizer + Ash + Cowdung produced the highest grain yield (5.98 t $ha^{-1}$) and also showed better performance in plant height, bearing tillers $hill^{-1}$, panicle length, sterile spikelets $panicle^{-1}$ and straw yield than other treatments. The treatment combination of seedlings raised in polythene cover of seed bed and recommended NPK + Ash + Cowdung produced the highest grain yield.

**Key words**: Seedling raising, fertilizer combination, soil solarization, polythene covering , late boro rice

## Introduction

Rice (*Oryzae sativa*) is one of the important staple food crops for nearly half of the world population, most of whom live in Asia (Anonymous, 1988). In Bangladesh, area under production was 9.84 million hectares with a total production of 17687 thousand tons in 1995-96 .In this year the share of boro rice area was 2.75 million hectares having a production of 7222 thousand tons. Boro rice occupies 26.47% of total rice area and contributes 40.83% of total rice production (Anonymous, 1997).

Seedlings for transplanted rice are raised in different ways in different rice growing countries of the world. For raising seedlings a seedling nursery either wet or dry is the most widely used as a normal method of seedling raising in Bangladesh and most of the rice growing countries of the world. With some modifications of conventional method of raising seedling, soil solarization and polythene covering of seedbed methods of raising seedlings were also used to get healthy seedlings. Nutrients deficiency in many of our soils are major constraints which may decrease rice yield and quality. Practically no soil can sustain crop yield for an indefinite period from its own nutrient reserves. Application of organic fertilizers in combination with inorganic fertilizers has good effect on crop yield. Combined application of organic and inorganic fertilizers was found to increase grain yield and straw yields of rice over organic and inorganic fertilizers applied alone (Gunasena and Ahmed, 1977). Hence, combined fertilizer application seems to be a good mean for increasing yield of rice. Application of organic fertilizers has been reported to decrease soil bulk density and increase infiltration rate, soil organic carbon content and the availability of soil N, P and K (Sharma and Sharma, 1994). Moreover, organic fertilizer has more residual value. It releases nutrient slowly so nutrient loses less and plants can take up nutrients gradually.

Considering the above facts, the present research has been undertaken. It also helps to find out a suitable seedling raising method and the effective fertilizer dose on the yield of boro rice.

## Materials and Methods

The study was conducted at the net house of the Department of Agronomy, Bangladesh Agricultural University, Mymensingh. The experiment was set up at pots during the period from January to June, 1998. The rice variety BR2 (Mala) was selected for experimentation. The experiment consisted of following treatments

**Methods of seedling raising**

$M_1$ = Conventional
$M_2$ = Soil solarization
$M_3$ = Polythene covering of seedbed at pot after sowing of seed.

**Fertilization at pot**

$T_1$ = Control
$T_2$ = Recommended NPK fertilizer
$T_3$ = Ash (10 t $ha^{-1}$)
$T_4$ = Cowdung (10 t $ha^{-1}$)
$T_5 = T_2 + T_3$
$T_6 = T_3 + T_4$
$T_7 = T_2 + T_4$
$T_8 = T_2 + T_3 + T_4$.

The experiment was laid out in a randomized complete block design having three replications. The treatment combinations were 24 and unit pot size was 0.204 $m^2$ in diameter. Certified seeds were collected from BARC. The collected seeds were treated against seed borne diseases. The selected seeds completed sprouting within 24 hours. Seedlings raised from those sprouted seeds in three different methods like conventional, soil solarization method and polythene covering of seedbed.

**Conventional method:** The conventional seedbeds were prepared in pots and the pots filled with fine silty loam soil. Fertilizers were applied at the rate of 1.88, 2.29 and 1.88 g of N, P and K respectively in 0.204 $m^2$ nursery bed (pot) through urea, triple super phosphate and muriate of potash at the time of seed bed preparation. Then the sprouted seeds were sown very thickly on the well puddled seed bed. The seed bed was kept moist by frequent splashing of water.

**Soil solarization method:** The collected silty loam soil was covered with a white polythene sheet for 15 days to destroy the weed seeds and to dry the plant debries. After 15 days the soil was made fine with wooden hammer and the pot was filled with this soil. Fertilizers were thoroughly mixed with the upper 15 cm of the soil. Fertilizers were applied at the rate of 1.88, 2.29 and 1.88 g of N, P and K in 0.204 $m^2$ nursery bed (pot) through urea, triple super phosphate, respectively at the time of seed bed preparation. Then the sprouted seeds were sown very thickly on the well puddled seed bed. The seed bed was kept moist by frequent splashing of water.

**Polythene covering of seedbed after sowing of seeds method:** The sprouted seeds were spread on a well fertilized and puddled pot as done for the previous method then the pot was covered with polythene sheet. Then 5.0 g urea solution was sprayed in seed bed after 15 days of broadcasting.

The seedlings then transplanted on the experimental pots which were cleaned, washed and filled with 35 kg of fine silty loam soil before use. Thirty days old seedlings were transplanted and two seedlings were transplanted for each hill. The pots were observed frequently to notice any change in plant characters from the beginning to the end throughout field duration of crops. Fertilizers were applied at the rate of 60,8 and 30 kg $ha^{-1}$ as N P and K (Anonymous, 1997 ) through urea, triple super phosphate and muriate of potash respectively. Cowdung and ash were applied at the rate of 10 t $ha^{-1}$ as basal dose before 7 days of transplanting. Triple Super Phosphate and MP were applied as basal dose before 2 days of transplanting. Urea was applied into three equal splits 15, 30, and 45 days after transplanting, respectively. Irrigation was done as and when necessary. The experimental crop was infested yellow stem borer which was controlled by using Basudin 10G (16.8 kg $ha^{-1}$).

The crop was harvested when 80% grains were ripened. Harvested crops were threshed, cleaned and sun-dried. Single hill

was randomly selected from each pot and tagged for data collection. All the crop characters except the grain and straw yield were collected from randomly selected hills from each of the pots. The harvested grain and straw samples were processed, dried and weighed. Observations were made on the following plant characters from each pot.

Plant height (cm), bearing tillers hill$^{-1}$, panicle length (cm), Grains panicle$^{-1}$, sterile spikelets panicle$^{-1}$ (no), 1000 grains weight (g), grain yield (kg) and straw yield (kg).

All data was analyzed statistically. The significance of mean difference was adjusted by Duncan's Multiple Range Test(Gomez and Gomez, 1984).

## Results and Discussion

Plant height, bearing tillers hill$^{-1}$, panicle length, grains panicle$^{-1}$, sterile spikelets panicle$^{-1}$, 1000 grains weight, grain yield and straw yield varied significantly due to seedlings raised in different methods. The tallest plant (113.03 cm) was observed with seedlings grown in polythene covering seedbed (Table 1); while the shortest plant was (107.75 cm) found with seedlings of soil solarization method of raising seedlings. Seedlings that are developed from the stated improved techniques of seedling raising are taller (Sethi and Mistra, 1975; and Khan and Haque, 1979) having higher dry matter content and the lowest mortality than conventional techniques (Khan and Haque, 1979). However, the magnitude of reduction in field duration may not be too high (Islam, 1982). The highest number of bearing tillers hill$^{-1}$ was (11.60) produced from the seedlings grown in polythene covering of seedbed; while the lowest one was (8.59) recorded from the seedlings grown in soil solarization method. The highest number of bearing tillers hill$^{-1}$ might be due to the seedlings produced under high temperature in polythene covering seedbed (Table 1). These findings are in agreement with the findings of Bhuiya and Akhanda (1982). The highest panicle length (22.37 cm) was observed with seedlings grown in polythene covering method; while the lowest one (21.1 cm) was found in the seedlings grown under soil solarization method which was statistically identical with those grown under conventional method (Table 1). Grains panicle$^{-1}$ ranged between 107.65 and 89.41 having the highest with seedlings raised in polythene covering seedbed and the lowest one with those raised in conventional method (Table 1). Seedlings raised in conventional method produced the highest sterile spikelets while the lowest sterile spikelets panicle$^{-1}$ were found in polythene covering seedbed (Table 1). The highest 1000 grain weight (21.40 g), grain yield (5.09 t ha$^{-1}$) and straw yield (5.52 t ha$^{-1}$) was observed from seedlings grown in polythene covering of seedbed; while the lowest 1000 grain weight (21.03 g), grain yield (4.84 t ha$^{-1}$) and straw yield (5.26 t ha$^{-1}$) was found in seedlings raised in conventional method (Table 1). Grain yield was affected significantly due to the seedling raising technique. Seedlings under polythene cover technique produced less grain yield ( 4.41 t ha$^{-1}$) (Islam, 1988). This result was in contradiction with the finding of Khan and Haque ( 1979). The lower grain yield in seedling of polythene cover might be associated with the shorter vegetative period of the plants. In addition, the seedlings under polythene cover were in higher temperature and they might be affected by sudden adverse situation of cool temperature when transplanted in the field. In spite of that, Khan and Rahman (1974) found better yield from growing seedlings under polythene cover.

Fertilization of seedbed manifested significant variation in respect of plant height, bearing tillers hill$^{-1}$, panicle length, grains panicle$^{-1}$, sterile spikelets panicle$^{-1}$, 1000 grains weight, grain yield and straw yield. The tallest plant (111.90 cm) from recommended NPK + cowdung was the consequence of availability of different nutrients supplied as fertilizers and cowdung; while seedlings grown without fertilizers suffered from malnutrition which led to the shortest plant (106.50 cm) (Table 2). It was observed that the highest (11.44) bearing tillers hill$^{-1}$, longest panicle (21.89 cm), highest numbers of grains panicle$^{-1}$ (100.50), lowest sterile spikelets panicle$^{-1}$ (29.99), highest grain yield (5.98 t ha$^{-1}$), highest straw yield (6.17 t ha$^{-1}$) were recorded from the seedlings raised with recommended NPK + Ash + Cowdung due to proper plant nutrient; while the lowest number of bearing tillers hill$^{-1}$ (7.67) shortest panicle (20.94 cm), lowest grains panicle$^{-1}$ (88.83) lowest straw yield (4.95 t ha$^{-1}$) were recorded in the seedlings grown without fertilizer due to insufficient nutrients (Table 2). The highest sterile (34.34) spikelets panicle$^{-1}$ was found in Ash (Table 2). The lowest grain yield was recorded (4.48 t ha$^{-1}$) in Cowdung. This might be due to late release of plant nutrients to crop plants. The similar result was also reported by Reddy *et al.* (1985) and Gunasena and Ahmed (1977). The highest 1000 grains weight (21.60 g) was observed in the treatment where recommended NPK + Cowdung were applied. On the other hand, lowest 1000 grain weight (20.81 g) was produced in control (Table 2). Dei (1975) reported that organic matter when applied in conjunction with inorganic fertilizer appreciably increased the N, P, K and silicon contents of rice plant. Combined application of organic and inorganic fertilizers was found to increase the grain and straw yield of rice over solitary application of organic or inorganic fertilizers (Reddy *et al.*, 1985; Gunasena and Ahmed, 1977). Shahu and Nayak (1971) studied the effect of organic and inorganic fertilizers of rice yield and recommended a combination of fertilizer and manure for higher yield of rice such as 45 kg N ha$^{-1}$ each from fertilizer and farm yard manure.

Combination of methods of raising seedlings and fertilization did not exert any significant effect on plant height, panicle length, sterile spikelets panicle$^{-1}$ but affected number of bearing tillers hill$^{-1}$, grains panicle$^{-1}$, grain yield, and straw yield significantly. Apparently the shortest (103.37 cm) plant was observed seedlings raised in polythene covering of seedbed and ash. On the other hand, the tallest one (115.23 cm) was recorded from combination of seedlings raised in soil solarization method and recommended NPK + Ash + Cowdung (Table 3). The lowest number of bearing tillers hill$^{-1}$ (6.35) was observed in treatment combination of seedlings raised in polythene covering of seedbed and Ash. On the contrary, the highest bearing tillers hill$^{-1}$ (13.67) was noticed in treatment combination of soil solarization method of raising seedlings and recommended NPK + Ash + Cowdung (Table 3). The longest panicle (22.97 cm) was recorded seedlings raised in polythene covering of seedbed with recommended NPK + Cowdung. On the other hand, the shortest panicle (20.37 cm) was observed in the treatment combination of conventional method of seedlings raising and recommended NPK + Ash (Table 3). The highest number of grains panicle$^{-1}$ (116.07) was observed in seedlings raised in soil solarization method and recommended NPK + Ash + Cowdung. The lowest grains panicle$^{-1}$ (81.4) was observed by seedling raised in polythene covering of seedbed and control (Table 3). It was observed that the treatment combination of seedlings raised in soil solarization method and cowdung produced the highest (38.33) sterile spikelets panicle$^{-1}$ in appearance. On the other hand, the lowest (22.27) sterile spikelets panicle$^{-1}$ was found in seedlings raised in soil solarization method and recommended NPK + Ash + Cowdung (Table 3). It was observed that the seedlings raised in soil solarization method with Ash + Cowdung gave lowest 1000 grain weight (20.40 g) while the highest 1000 grains weight (22.39 g) was produced in treatment combination of seedlings raised in soil solarization method and recommended NPK + Ash + Cowdung (Table 3). The highest grain yield (6.20 t ha$^{-1}$) was produced seedlings raised in polythene covering of seedbed and recommended NPK + Cowdung while the lowest grain yield (4.31 t ha$^{-1}$) was produced in conventional method of raising seedlings with control (Table 3). It was noticed that the highest straw yield (6.51 t ha$^{-1}$) was found in the combination of seedling raised in polythene covering of seedbed and recommended NPK + Ash + Cowdung while the lowest straw yield (4.83 t ha$^{-1}$) was obtained in seedlings raised in polythene covering of seedbed with control (Table 3).

From the results of the above study, it can be concluded that seedlings raised in polythene covering of seedbed is better to produce the highest plant attributes and recommended

Table 1: Effect of method of raising seedlings on crop characters of late boro rice cv. BR2

| Characters Treatments | Plant height (cm) | Bearing tillers hill$^{-1}$ (no) | Panicle length (cm) | Grains panicle$^{-1}$ (no) | Sterile spikelets panicle$^{-1}$ (no) | 1000 grain weight(g) | Grain yield (t ha$^{-1}$) | Straw yield (t ha$^{-1}$) |
|---|---|---|---|---|---|---|---|---|
| $M_1$ | 108.44b | 9.11b | 21.22b | 89.41b | 35.25a | 21.03 | 4.84b | 5.26b |
| $M_2$ | 107.75b | 8.59c | 21.11b | 91.28b | 34.70a | 21.34 | 5.06a | 5.34b |
| $M_3$ | 113.03a | 11.60a | 22.37a | 107.65a | 26.77b | 21.40 | 5.09a | 5.52a |

Table 2: Effect of fertilizers on crop characters of late boro rice cv. BR2

| Characters Treatments | Plant height (cm) | Bearing tillers hill$^{-1}$ (no) | Panicle length (cm) | Grains panicle$^{-1}$ (no) | Sterile spikelets panicle$^{-1}$ (no) | 1000 grain weight(g) | Grain yield (t ha$^{-1}$) | Straw yield (t ha$^{-1}$) |
|---|---|---|---|---|---|---|---|---|
| $T_1$ | 106.50b | 7.67e | 20.94 | 88.83d | 33.03 | 20.81 | 4.52d | 4.95c |
| $T_2$ | 108.70ab | 9.11d | 21.48 | 94.16c | 32.90 | 21.19 | 4.56cd | 5.00c |
| $T_3$ | 108.10ab | 9.08d | 21.88 | 91.86cd | 34.34 | 21.05 | 4.77c | 5.16c |
| $T_4$ | 109.56ab | 9.48cd | 21.30 | 95.12bc | 32.69 | 21.17 | 4.48d | 4.98c |
| $T_5$ | 109.60ab | 10.04bc | 21.53 | 100.50a | 33.73 | 21.17 | 4.65cd | 5.08c |
| $T_6$ | 111.80a | 10.30b | 21.70 | 99.76a | 30.77 | 21.51 | 5.42b | 5.74b |
| $T_7$ | 111.90a | 11.00a | 21.80 | 99.03ab | 30.48 | 21.60 | 5.61b | 5.93ab |
| $T_8$ | 111.70a | 11.44a | 21.89 | 99.60a | 29.99 | 21.55 | 5.98a | 6.17a |

Table 3: Effect of method of raising seedlings and fertilizer combination on crop characters of late boro rice cv. BR2

| Characters Treatments | Plant height (cm) | Bearing tillers hill$^{-1}$ (no) | Panicle length (cm) | Grains panicle$^{-1}$ (no) | Sterile spikelets panicle$^{-1}$ (no) | 1000 grain weight(g) | Grain yield (t ha$^{-1}$) | Straw yield (t ha$^{-1}$) |
|---|---|---|---|---|---|---|---|---|
| $T_1M_1$ | 105.23 | 7.67gh | 21.04 | 85.13hi | 37.83 | 21.32 | 4.31h | 4.89fgh |
| $T_1M_2$ | 107.37 | 8.89efg | 21.10 | 88.83ghi | 37.50 | 21.28 | 4.39gh | 4.91fgh |
| $T_1M_3$ | 107.50 | 8.78fgh | 21.23 | 81.40i | 38.26 | 21.19 | 5.64bc | 5.63bcd |
| $T_2M_1$ | 108.17 | 8.55fgh | 21.00 | 84.47hi | 35.13 | 20.64 | 4.51eh | 4.83gh |
| $T_2M_2$ | 108.30 | 8.67fgh | 21.03 | 93.16fg | 36.20 | 20.83 | 4.42fgh | 4.96fgh |
| $T_2M_3$ | 109.93 | 9.33cdef | 21.60 | 96.73efg | 33.00 | 20.95 | 5.76bc | 5.98ab |
| $T_3M_1$ | 110.10 | 10.22bcd | 21.26 | 92.03fgh | 34.10 | 21.02 | 4.74dg | 5.11eh |
| $T_3M_2$ | 110.93 | 10.78b | 21.50 | 93.50fg | 29.97 | 21.03 | 4.54eh | 5.05eh |
| $T_3M_3$ | 103.37 | 6.35i | 20.37 | 84.26hi | 34.30 | 20.71 | 5.72bc | 6.05ab |
| $T_4M_1$ | 107.97 | 7.56h | 20.70 | 91.16fgh | 34.63 | 21.01 | 4.33gh | 4.91fgh |
| $T_4M_2$ | 106.67 | 8.33fgh | 21.63 | 98.80fgh | 38.33 | 21.20 | 4.46fgh | 4.93fgh |
| $T_4M_3$ | 106.90 | 9.22cf | 21.06 | 90.23fgh | 36.43 | 21.78 | 5.47c | 5.71bc |
| $T_5M_1$ | 106.50 | 8.67fgh | 20.60 | 95.77efg | 36.70 | 20.90 | 4.45fgh | 4.79h |
| $T_5M_2$ | 110.80 | 9.00dg | 21.56 | 96.10efg | 30.53 | 22.08 | 4.51eh | 4.88fgh |
| $T_5M_3$ | 110.33 | 9.11def | 21.60 | 89.00ghi | 35.07 | 21.40 | 5.65bc | 6.02ab |
| $T_6M_1$ | 109.43 | 10.44bc | 21.33 | 93.90fg | 31.63 | 21.61 | 4.89de | 5.32ch |
| $T_6M_2$ | 110.80 | 9.00dg | 21.43 | 97.10ef | 26.97 | 20.40 | 4.59eh | 4.97fgh |
| $T_6M_3$ | 110.87 | 10.89b | 22.63 | 102.47de | 26.57 | 21.29 | 5.70bc | 5.71bc |
| $T_7M_1$ | 110.23 | 10.11be | 22.77 | 104.37cd | 26.43 | 20.75 | 4.81def | 5.14eh |
| $T_7M_2$ | 113.37 | 10.67b | 21.83 | 110.67abc | 26.50 | 21.11 | 4.83def | 5.39cg |
| $T_7M_3$ | 114.10 | 12.78a | 22.97 | 112.67ab | 28.30 | 21.78 | 6.20a | 6.30a |
| $T_8M_1$ | 114.80 | 12.55a | 21.93 | 106.43bcd | 28.77 | 21.50 | 5.10d | 5.43cf |
| $T_8M_2$ | 115.23 | 13.67a | 22.53 | 116.07a | 22.27 | 22.39 | 4.91de | 5.56be |
| $T_8M_3$ | 114.87 | 13.11a | 22.83 | 111.40abc | 28.37 | 22.01 | 5.68bc | 6.51a |

In a column the values having common letter(s) do not differ significantly at 1% level of probability as per DMRT

$M_1$ = Conventional $M_2$ = Soil solarization $M_3$ = Polythene covering of seed bed at pot after sowing of seed

$T_1$ = Control $T_2$ = Rec. NPK $T_3$ = Ash (10 t ha$^{-1}$) $T_4$ = Cowdung $T_5$ = ($T_2$ + $T_3$) $T_6$ = ($T_3$ + $T_4$)

$T_7$ = ($T_2$ + $T_4$) $T_8$ = ($T_2$ + $T_3$ + $T_4$)

NPK + Ash + Cowdung produced the highest grain yield. Combined effect of polythene covering of seedbed and recommended NPK + Ash + Cowdung is better for highest grain yield.

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