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EFFECTS OF NAPHTHALENE ACETIC ACID ON YIELD ATTRIBUTES AND YIELD OF TWO VARIETIES OF RICE (*ORYZA SATIVA* L.)

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Abstract

Effects of 100 and 200 ppm of naphthalene acetic acid (NAA) on yield attributes and yield of two varieties of rice during 2009 - 2010 Boro season were evaluated. The highest plant height was observed due to 200 ppm in both BRRI dhan-29 (V_1) and BRRI dhan-50 (V_2). Number of tillers per plant were found to increase due to 100 ppm NAA only in BRRI dhan-29 and varied non-significantly. Yield attributes, *viz.* number of branches per panicle, number of grains per panicle and filled grains per panicle increased in BRRI dhan-29, following both 100 and 200 ppm NAA, whereas, most of the yield parameters decreased in BRRI dhan-50. Due to 100 and 200 ppm NAA, grain yield per plant increased by 27.67 and 6.85%, respectively in BRRI dhan-29 though not statistically significant. However, in BRRI dhan-50 grain yield per plant decreased by 26.54% due to 100 ppm and 27.67% due to 200 ppm. Out of the two concentrations 100 ppm NAA produced better stimulation.

The use of growth regulators is considered as one of the way of increasing yield. NAA, a synthetic growth regulator has proved its potentiality that in appropriate concentration NAA affects the growth and yield of a number of plants *viz.* tomato (Chhonker and Singh 1959), bitter gourd (Jahan and Fattah 1991) and cowpea (Ullah *et al*. 2007). Reports regarding the growth and yield aspect with NAA on cereal plants including rice are available in other countries (Misra and Sahu 1957, Chaudhuri *et al.*1980, Singh and Gill 1985, Grewal and Gill 1986, Muthukumar *et al.* 2005). In Bangladesh very limited research has been done on growth and yield aspects on cereal crops with NAA. Therefore, the present investigation was undertaken to study the effect of NAA on yield attributes and yield of two varieties of rice.

The pot experiment was conducted in the garden of the Department of Botany, University of Dhaka during the period from November, 2009 to April, 2010. Each pot (about 30 cm in diameter at the top) was filled with 9.0 kg air dried soil. Cow-dung was mixed uniformly during pot preparation and 2 g of gypsum was also added in each pot (equals to 444 kg/ha). The experiment was laid out in a randomized complete block design (RCBD) with three replications. Plant materials were collected from Bangladesh Rice Research Institute (BRRI), Joydebpur, Gazipur. BRRI dhan-29 is a high yielding variety released in 1994 and BRRI dhan-50 is an aromatic variety released in 2008. Seeds were sterilized by 0.5% calcium hypochlorite solution and were sown on November 7, 2009. Seedlings were transplanted to pots at 5- leaf stage at 36 days after sowing. Five hills were placed in each pot, each hill containing one seedling. Thinning was done in such way that a healthy seedling of uniform size and vigour was allowed to grow. Irrigation was done as per necessity. Weeding was done twice on 25 and 45 day after transplanting (DAT). Split applications of urea were applied twice at the rate of 1 g per pot (equals to 222 kg/ha) at 20 DAT and at 50 DAT. There were three treatments as follows; T_0 = distilled water (Control), T_1 = 100 ppm NAA and T_2 = 200 ppm NAA.

Treatments were applied as foliar spray at 57 DAT. Plant height, number of tillers per plant, number of panicles per plant, length of panicle, number of branches per panicle, total grains per panicle, filled grains per panicle, per cent un-filled grains per panicle and 1000-grain weight were recorded after harvest. Yield per plant was calculated according to the formula of ICRISAT

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(1992). Harvest index was also calculated. Data were analyzed statistically (Steel and Torrie 1960) and treatment means were compared by LSD test at 5% level of significance.

Results presented in Table 1 showed that at harvest plant height was non-significantly affected by both the treatments and the longest plants were recorded from T_2 treatment. In case of V_1, plant height was found to increase only due to T_2 treatment whereas, in V_2 plant height increased due to both the treatments. Akter (2010) reported both increase and decrease in plant height of maize following NAA application. Yield and all the yield attributes except 1000-grain weight in both the rice varieties were non-significantly affected by NAA treatments (Table I). Number of tillers per plant has an indirect effect on yield, but it has a positive effect via the number of panicles per plant. Number of tillers per plant and number of panicles per plant decreased due to both the treatments. However, in case of interaction, number of tillers per plant and number of panicles per plant increased by 30.38 and 17.34%, respectively following T_1 treatment in the variety V_1. Similar results of increases in number of ear bearing tillers following NAA application were reported by Singh and Gill (1985) on wheat and barley, Chaudhuri *et al.* (1980) and Grewal and Gill (1986) in rice. Akter (2010) found increase in number of cob per plant due to NAA treatment in maize; however, Misra and Sahu (1957) reported decrease in number of panicles per plant following NAA application in rice.

Table 1. Effect of NAA on yield attributes and yield of BRRI dhan-29 (V1) and BRRI dhan-50 (V2) during harvest. n = 3.

Treatments	Plant height (cm)	No. of tillers/ plant	No. of pani-cles/ plant	Length of pani-cle (cm)	No. of branches /panicle	Total grains/ panicle	Filled grains/ panicle	% of unfilled grains/ panicle	1000-grain weight (g)	Yield/ plant (g)	Harvest index (%)
Mean effect											
T_0	78.42	8.67	8.50	20.68	9.30	110.38	101.92	7.89	18.84 a	15.96	55.15
T_1	78.70	8.50	8.00	21.10	9.85	115.35	106.89	7.23	18.31 a	16.06	49.18
T_2	80.42	7.83	7.83	20.94	9.65	113.58	105.46	7.30	17.58 b	14.30	47.24
LSD 0.05	NS	NS	NS	NS	NS	NS	NS	NS	0.403	NS	NS
Interaction effect											
V_1T_0	79.77	7.67	7.67	21.97	9.60	115.16	105.12	9.16	19.96 a	16.01	54.34
V_1T_1	79.33	10.0	9.00	22.42	10.10	126.46	115.78	8.51	19.58 a	20.44	54.65
V_1T_2	82.33	7.33	7.33	21.85	9.70	133.76	124.91	6.62	18.41 b	17.11	52.12
V_2T_0	77.07	9.67	9.33	19.38	9.00	105.59	98.71	6.62	17.71 c	15.90	55.97
V_2T_1	78.07	7.00	7.00	19.77	9.60	104.24	98.00	5.94	17.04 d	11.68	43.71
V_2T_2	78.50	8.33	8.33	20.02	9.60	93.41	86.00	7.98	16.42 e	11.50	42.35
LSD 0.05	NS	NS	NS	NS	NS	NS	NS	NS	0.403	NS	NS

Mean followed by same letter do not differ significantly at 5% level.

Results also showed that except % of un-filled grains per panicle length of panicle, number of branches per panicle, total grains per panicle and filled grains per panicle increased due to both the treatments. In case of V_1, length of panicle increased due to T_1 and decreased due to T_2, whereas, in V_2 length of panicle increased due to both the treatments. Similar results of increase have also been reported in maize (Akter 2010). Dasgupta (1975) obtained reduced pod length with higher concentrations of NAA on groundnut. Irrespective of treatments, number of branches per panicle, total grains per panicle and filled grains per panicle increased, whereas, % of un-filled grains per panicle decreased in the variety V_1. But all these yield parameters except number of branches per panicle decreased following both the treatments, whereas, % of un-filled grains per panicle

increased due to T_2 treatment in the variety V_2. Reports regarding increase in number of grains per panicle are in conformity with those of other workers in various plants *viz.* rice (Misra and Sahu 1957, Chaudhuri *et al.*1980 and Grewal and Gill 1986), wheat and barley (Singh and Gill 1985) and maize (Akter 2010).

Treatment means revealed that 1000-grain weight decreased following both the treatments and the decreases were significant. However, 1000-grain weight also decreased due to both the treatments in both the varieties and the decreases were significant except T_1 treatment in V_1. The weight of 1000-grain depends on size and filling of the grains. The reduction in weight of 1000-grain in all probability was due to less accumulation of photosynthate in the grain. Reports regarding both increase and decrease in 1000-grain weight were recorded by different workers. The results are in conformity with the findings of Singh *et al.* (1972) on pea and Ullah *et al.* (2007) on cowpea who reported that 1000-grain weight decreased due to higher concentration of NAA.

Results also indicate that grain yield per plant increased due to T_1 treatment but decreased due to T_2 treatment. However, grain yield per plant increased due to both the treatments in V_1, whereas, decreased in V_2. Grain yield due to T_1 increased by 27.67% in the variety V_1 but decreased by 26.54% in the variety V_2. Due to T_2 treatment, the increase in the yield was 6.85% in V_1, whereas, the decrease was 27.67% in V_2. Similar results of increase in grain yield were reported by many investigators *viz.* Chaudhuri *et al.* (1980), Sahu and Murty (1981) and Grewal and Gill (1985) in rice, Tulsa Ram *et al.* (1997) in sorghum, Muthukumar *et al.* (2005) in baby corn and Akter (2010) in maize. Decreased grain yield was also reported by Borkar *et al.* (1991) in cowpea. Harvest index decreased following both the treatments. Harvest index was found to increase due to T_1 and decrease due to T_2 in V_1, but decreased due to both the treatments in V_2. Harvest index varied from 52.12 - 54.65% in V_1 and from 42.35 - 55.97% in V_2 and also varied non-significantly. The value of harvest index varied with the fraction of biological yield being transferred to the seed.

Findings of this study indicated that the increase in yield following both the treatments in the variety V_1 could be due to the combined effect of increases in almost all the reproductive parameters and also decrease in per cent of un-filled grains per panicle. Moreover, increase in yield per plant achieved with T_1 treatment was due to increased assimilative area and as a result more photosynthesis throughout the growth period. Thus, 100 ppm NAA proved to be more stimulative. The results also indicate that NAA has both stimulatory and inhibitory effect on different yield parameters, and it depends on several factors including the varietal difference and concentration of the chemical. The results are consistent with the view that the plant growth regulators can exert quite different effects in different plants (Ridge 1991). Thus, analyses of data indicate that, out of the two concentrations of NAA, 100 ppm NAA produced better stimulations in the variety V_1 but the magnitude of effect was different.

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