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Effect of Pre-soaking seeds with Plant Growth Regulators and Nutrient Solution on Dry Matter Production of Rice

by

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Introduction: Pre-sowing treatment of seeds with plant growth regulators and nutrient solutions has been found to be effective in increasing germination of seeds, vegetative growth of plants and their yield (Mitchel, 1951; Garg, 1959 and Vaish, 1966). The experimental results of Dastur and Bhat (1955) and Mukherjee and Kumar (1956) which revealed that dry matter content in plant was also affected by these substances led to the planning of the present investigation.

Material and Methods: The experiment was conducted at Bihar Agricultural College Farm, Sabour, during the years 1964 and 1965. The soil of the experimental plot was clay loam with medium fertility. Seeds of an early *aman* variety of rice Br. 34 were soaked for 24 hours before sowing in the nursery bed with all possible combinations of 0, 50, 75 and 100 ppm concentrations of NAA and IAA each and 0 and 1 Molar concentrations of K_2HPO_4. While soaking, care was taken to get the solution fully absorbed by seeds to avoid the risk of constituents being leached out by an excess of the solution. This was achieved by keeping the ratio of seeds to solution at 3:1. Seeds in control treatment were soaked with distilled water only. After soaking for 24 hours, seeds were washed with distilled water to remove any trace of the adhering chemicals on seed coat. The seeds were then spread out and air dried in shade before sowing in the nursery bed treatmentwise.

Transplanting in the field was done with 30 days old seedlings. Five plants were uprooted from each plot for recording dry matter content 15, 30, 45 and 60 days after transplanting in 1964 and 15, 30, 45, 60 and 75 days after transplanting in 1965. The whole culm was taken out of soil with the help of a shovel. All roots were carefully removed and culms without roots were dried to a constant weight in an electric oven.

Results: The mean data on dry matter accumulation at different stages of growth as affected by different concentrations of plant growth regulators and nutrient solution have been summarised in Table 1.

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TABLE 1. *Mean dry weight of shoot per culm in rice at different stages of growth under different treatment (in g)*

Treatments	1964 Days after transplanting				1965 Days after transplanting				
	15	30	45	60	15	30	45	60	75
0 ppm NAA	2.38	8.42	31.28	53.99	2 33	13.06	32.44	53.67	77.12
50 ,, ,,	2.58	10.30	36.06	54.31	2.53	15.16	41.67	59.93	87.84
75 ,, ,,	2.83	10.64	35.77	60.19	2.57	15.10	39.67	70.73	90.78
100 ,, ,,	2.39	10.53	36.45	59.08	2.53	15.62	36.59	61.76	83.35
'F' test	Sigt	Sigt	Sigt	Sigt	N.S.	Sigt	Sigt	Sigt	Sigt
S. Em. ±	0.07	0.28	0.60	0.86	0.07	0.51	1.41	2.55	1.56
C D. at 5%	0.22	0.80	1.70	2.44	—	1.44	4.01	7.22	4.42
0 ppm IAA	2.40	9.25	34.73	54.47	2.28	13.84	33.65	57.07	79.55
50 ,, ,,	2.58	9.91	35.58	57.53	2.54	14.85	37.60	61.13	86.60
75 ,, ,,	2.62	10.25	34.47	58.12	2.56	15.30	39.70	62.52	90.32
100 ,, ,,	2.58	10.48	34.79	57.45	2 57	14.94	39.41	65.39	82.62
'F' test	N.S.	Sigt	N.S.	Sigt	Sigt	N.S.	Sigt	N.S.	Sigt
S. Em. ±	0.07	0.28	0.60	0.86	0.07	0.51	1.41	2.55	1.56
C.D. at 5%	—	0.80	—	2.44	0.21	—	4.01	—	4.42
0 Molar K_2HPO_4	2.38	10.09	32.48	53.74	2.40	14.62	36.98	59.38	83.84
1 ,, ,,	2.71	9.86	37.31	60.04	2.58	14.85	38.21	63.67	86.21
'F' test	Sigt	N.S.	Sigt	Sigt	Sigt	N.S.	N.S.	N.S.	N.S.
S. Em. ±	0.05	0.19	0.42	0 60	0.05	0.31	1.00	1.80	1.10
C.D. at 5%	0.16	—	1.20	1.72	0.14	—	—	—	—

Effect of NAA: It is evident from the table that at 15 days' stage of plant growth, treatment of seeds with NAA had exhibited significant influence on dry matter production only in 1964 where significantly highest dry matter was accumulated by 75 ppm, the remaining treatments being statistically at par. At 30 and 45 days' stages in both the years different concentrations although produced significantly more dry matter than the control, they did not differ among themselves in the first year; but in the second year 50 ppm was significantly superior to 100 ppm at 45 days' stage. At 60 days' stage in both the years the trend for maximum dry matter accumulation was under the treatment 75 ppm followed in descending order by 100 ppm, 50 ppm and 0 ppm. At 75 days' stage in 1965, 75 ppm maintained its superiority over others. Thus it is clear that pre-sowing treatment of seeds with NAA had favourable influence on dry matter production of rice plant.

Effect of IAA: A perusal of the data reveals that in 1964 the treatment difference turned out to be significant at 30 and 60 days' stage, whereas in 1965 the treatment difference was significant at 15, 45 and 75 days' stages of plant growth. In 1964 at 30 days' stage all the three concentrations having plant growth regulators were statistically alike but only 75 ppm and 100 ppm were alike and significantly superior to control.

In the second year at 15 and 45 days' stages there was no significant difference among the hormone treatments and each one of them gave significantly more dry matter than the control. At 75 days' stage, among the hormonal treatments, maximum dry matter was produced by the treatment 75 ppm followed by 50 ppm and 100 ppm. Control gave the minimum dry matter accumulation. Thus it can be concluded that like NAA, treatment of seeds with IAA also had favourable effect on dry matter accumulation in rice plant. A comparison between NAA and IAA did not show any significantly stable difference between the same concentrations of the two plant growth regulators at any stage of growth.

Effect of K_2HPO_4 (Nutrient solution): Treatment of seeds with one molar solution of K_2HPO_4 could induce significantly more dry matter production at all the stages of growth except at 30 days' stage in 1964. But in 1965 it could give significantly more dry matter only at 15 days' stage though a trend for higher dry matter accumulation due to the treatment of seeds with nutrient solution was observed at all subsequent stages.

Discussion: The growth of plant can be measured by the total dry matter it accumulates. This has been done in the present investigation by recording the dry weight of plants at regular intervals. The results obtained during the two years of experimentation present ample evidence to the utility of pre-soaking rice seeds with NAA and IAA for increasing the dry matter accumulation of plants. This was probably due to the stimulative effects of growth substances on plants. Besides, greater plant height and increased number of tillers and leaves as noted in the treated plots might have also contributed towards increase in the dry matter content of shoots. Any treatment that increases the photosynthetic activity of leaves must also favourably influence the growth made by plants. Similar reasonings have also been put forward by Dastur and Bhatt (1955).

On the whole, concentration upto 75 ppm of NAA and IAA favourably influnced the growth of plants which consequently resulted in increased dry matter production. Concentration of 100 ppm showed a retarding trend in most of the cases although in few cases non-significant increase was observed. This is due to stimulative effect of plant growth regulators upto the concentration of 75 ppm (Garg, 1959; Choudhry and Singh, 1960 and Vaish, 1966). The

observations recorded in the present study are in line with the results obtained by Bhardwaj and Rao (1955) and Pillai *et al.* (1958). The increased dry matter accumulation due to the treatment with K_2HPO_4 finds its support in the works of Narayanan *et al.* (1958) and Guptashakti (1961).

Summary: The investigation was undertaken with a view to find out the effect of pre-soaking seeds with plant growth regulators (NAA and IAA) and nutrient solution (K_2HPO_4) on dry matter accumulation of rice. The results obtained have shown that pre-soaking of rice seeds with 75 ppm NAA and IAA each and with one molar solution of K_2HPO_4 resulted in greater production of dry matter in rice plant.

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