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Effects of Pre-sowing Seed Treatments on Tomato (Lycopersicon esculentum (L.) Mill) Seedling Emergence

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Abstract—**The effects of pre-sowing seed treatments with the bioregulators, Indole – acetic acid (IAA), Indole butyric acid (IBA) and Naphthalene acetic acid (NAA) on seedling emergence of tomato (Lycopersicon esculentum (L.) Mill, genotypes NHLy 11, NHLy 12, NHLy 13, NHLy 15 and NHLy 16 were investigated. The treatments consisted of soaking in 25mg/L, 50mg/L, 75mg/L, 100mg/L, 125mg/L and 150mg/L concentrations of each of the bioregulators and control replicated three times in a completely randomised design. Results showed that seedling emergence was enhanced by all bioregulator treatments at 100mg/L relative to control, the highest values being 92.1, 88.4 and 89.4% for the IAA, IBA and NAA treatments respectively. Marked reduction of seedling emergence was recorded at higher concentrations of 125 and 150mg/L for all test genotypes. This work showed that pre-sowing seed treatments with the bioregulators used in this work are effective in enhancing seedling emergence of tomato, especially at 100mg/L concentration.**

Keywords—**Bioregulators, Lycopersicon esculentum, pre-sowing seed treatment, seedling emergence**

I. INTRODUCTION

The tomato (Lycopersicon esculentum (L.) Mill) belongs to the Nightshade family and serves as a source of health – promoting nutrients. The crop is grown under a wide range of soil and climatic conditions in the field. In temperate countries, it is grown under protection in plastic greenhouses and in heated glasshouses [1], [2]. It is grown extensively in the field in warmer parts of Europe such as Bulgaria, Romania, Spain and Italy; and in some parts of the United States such as Florida, Georgia, Ohio, Texas, New York, New Jersey, Michigan, Virginia, Indiana, Maryland, California Illinois, Utah and Pennsylvania [3]. In Nigeria, the tomato is cultivated almost throughout the country but the most important areas lie in the Northern and South-western parts of Nigeria.

Germination includes all the steps from the seed imbibing water until the seedling is self-sustaining. Within the seed, reserve substances are enzymatically converted into materials used in synthesis or are oxidised through respiration to release energy. The seed requires water, oxygen and the proper temperature range such that biochemical processes can operate [4], [5]. A seed is considered germinated when it has produced a plant that is potentially capable of continuous growth. This study investigated the phytotoxic effects of the bioregulators IAA, IBA and NAA on seedling emergence of test tomato genotypes.

II. MATERIALS AND METHODS

Tomato Seeds: Healthy seeds of five improved tomato genotypes (NHLy 11, NHLy 12, NHLy 13, NHLy 15 and NHLy 16) were obtained from the Genetic Resources Unit of National Horticultural Research Institute (NIHORT), Idi-Ishin, Ibadan.

Preparation of Test Solutions of Bioregulators:

This was done by using the method of [6] with slight modifications. A 37.5 mg of IAA, IBA and NAA were each dissolved in 10ml 60% ethanol containing 0.5% Tween 20 in different 250ml volumetric flasks. Distilled water was added to the mark in each flask to afford concentrations of 150mg/L (15%) solutions. These solutions were serially diluted with distilled water to give 125mg/L (12.5%), 100mg/L (10%), 75mg/L (7.5%), 50mg/L (5%) and 25mg/L (2.5%) concentrations of each bioregulator. The six concentrations of each compound were used in the bioassay for phytotoxicity.

Seedling Emergence Tests: Prior to germination, the seeds of the five tomato genotypes were subjected to pre-sowing treatments. One hundred healthy seeds of each tomato genotype were soaked respectively in 25mg/L, 50mg/L, 75mg/L, 100mg/L, 125mg/L and 150mg/L concentrations of each of the bioregulators, IAA, IBA and NAA and in a control (distilled water) for 24 hours in the dark at 250C. The seeds were sown on moist, sieved and sterilised soil in seed trays (330x200x60mm) at the rate of 25 seeds per row and were then covered with 10mm of moist soil [7]. The treatments were replicated three times in a completely randomised design. Emergence of seedlings, depicted by fully unfolded cotyledons was recorded daily until no further seedlings appeared for three consecutive days. Seedling emergence was then expressed as a cumulative of daily emergence counts converted to percentages of total seeds.

Statistical Analysis: The data obtained were expressed as the mean + standard error of the means (mean + SEM). Significant differences between means were determined by the student t-test [8].

III. RESULTS AND DISCUSSION

The results are presented in Tables 1 to 3 which show that in all treatments there was no marked reduction in the percentage of seedling emergence for the 25 mg/L concentration compared with the controls. At 50 and 75mg/L concentrations of IAA and IBA, there were slight increases in the percentage of seedling emergence for most tomato genotypes, with greater effects noticed at the 75mg/L concentrations (Tables 1 and 2). However, for the NAA treatments, only the NHLy 16 genotype gave increases at both concentrations with the higher value of 83.2 recorded at the 75 mg/L concentrations (Table 3). At 100mg/L, all bioregulator treatments enhanced seedling emergence relative to controls, the highest values being 92.1, 88.4 and 89.8% for the IAA, IBA and NAA treatments respectively.

At higher concentrations of 125 and 150mg/L, most seedlings showed abnormalities like partial unfolding of the cotyledons and non-emergence of primary leaves from the coleoptiles. These culminated into appreciable reduction in percentage seedling emergence for the test tomato genotypes relative to the control, especially at the 150mg/L concentration. Seedling emergence was moderately enhanced by bioregulator treatments in the concentration range of 25 to 75mg/L in test tomato genotypes relative to control (Tables 1 to 3) while all the treatments enhanced seedling emergence at the100mg/Lconcentration.

Table I: Effects of IAA on Emergence of Tomato Seedlings

IAA Conc. (mg/L)	**Seedling emergence (%)***				
	NHLy 11	**NHLy 12**	*1) NHLy 1*	**NHLy 15**	**NHLy 16**
Control	78.1±0.30	77.9±0.70	79.2±0.60	77.4±1.02	78.9±0.92
25	76.4±1.10	73.0±1.01	77.5±0.84	76.9±0.75	77.2±1.21
50	77.9±1.30	78.5±0.63	79.1±1.32	78.2±1.24	79.8±0.68
75	80.3±0.27	81.2±0.39	81.6±0.53	79.6±0.92	83.8±1.37
100	90.3±1.12**	90.1±0.82**	88.7±0.61**	89.8±0.71**	92.1±0.49**
125	77.8±0.80	78.8±1.07	79.7±1.29	81.3±0.43	78.9±1.42
150	68.1±1.90	67.8±1.14	69.4±1.36	67.1±0.86	69.1±1.77

*Means ± S.E. (n = 3)
** Significantly different from other values in the column ($p<0.05$)

Table II: Effects of IBA on Emergence of Tomato Seedlings

IBA Conc. (mg/L)	***A.***	***Seedling emergence %***			
	NHLy 11	**NHLy 12**	*1) NHLy 1*	**NHLy 15**	**NHLy 16**
Control	76.8±1.21	77.2±0.71	78.5±0.96	79.2±0.29	75.8±1.62
25	71.2±1.10	73.4±0.33	71.5±1.00	72.5±0.33	73.4±0.67
50	78.9±0.34	79.2±0.81	78.7±0.42	76.8±0.54	81.9±0.32
75	81.7±0.71	83.4±0.23	82.8±1.37	82.7±0.16	81.4±1.14
100	88.3±0.82**	88.4±1.22**	87.3±0.93**	86.8±0.40	88.2±0.38**
125	73.5±1.34	76.7±1.02	75.9±1.14	74.7±0.71	76.2±0.19

150	63.9±0.47	62.8±1.81	62.7±0.58	64.2±0.43	63.9±0.21

* Means ± S.E. (n = 3)

** Significantly different from other values in the column ($p<0.05$).

Table III: Effects of NAA on Emergence of Tomato Seedlings

NAA Conc.(mg/L)	*B.* NHLy 11	NHLy 12	NHLy 13	NHLy 15	NHLy 16
	Seedling emergence (%)*				
Control	76.5±0.31	78.7±0.51	79.3±1.40	82.4±0.37	75.6±0.12
25	72.6±0.73	73.6±0.16	72.1±0.27	70.8±0.56	73.4±0.27
50	70.3±1.24	72.1±1.08	71.3±0.82	75.7±1.31	76.6±0.30
75	70.9±0.62	73.8±0.81	79.1±1.24	77.5±0.21	83.2±0.18
100	88.3±0.37**	86.7±0.42**	89.8±0.77**	89.5±0.18**	89.2±1.06**
125	76.1±0.14	72.3±0.71	78.7±0.33	79.4±1.71	76.5±0.31
150	61.2±0.92	60.3±0.68	60.1±0.97	59.2±0.46	63.2±0.57

* Means ± S.E. (n = 3)

** Significantly different from other values in the column ($p<0.05$).

The same result was reported by [9] while working with soybean seeds immersed for six hours in GA3 solutions of concentration range 50 to 100mg/L. Also [10] noticed increased soybean emergence and germination while utilising 0.1mg/L GA3 in which the seeds had been immersed for three hours. Higher concentrations of the bioregulators (125 and 150mg/L) resulted in reduction of seedling emergence of test genotypes in comparison with the control. For the NAA treatments, only the NHLy16 genotype gave increased seedling emergence at 50 and 75mg/L, all the other genotypes did not (Table 3). A possible explanation could be the different genotypes used, as growth characteristics of tomato are believed to be governed chiefly by genetic traits [11]. This has been demonstrated in soybean by [12] who utilised eighteen different genotypes and observed increase in germination in some and lack of sensitivity in others, under similar treatment.

The results show that only the 100mg/L concentration of the bioregulators gave significantly ($p<0.05$) high percentage of seedling emergence which ranged from 86.7 to 92.1% in test genotypes (Tables 1 to 3). This result suggests that 100mg/L is the 'effective concentration' of the bioregulators suitable for field application.

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