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Research Article

Comparative studies on the rooting effect of indole-acetic acid and Gibbrellic acid in sweet potato

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Abstract

Studies on the effects of two exogenous plant hormones namely; indole acetic Acid (IAA) and Gibberellic Acid (GA_3) on the rooting of *Ipomea batata* were carried out *in-vitro.* The different standard cuttings of potato were immersed in different concentrations of 0.1 ppm, 0.3ppm and 0.4ppm of IAA and Gibberellic Acid (GA_3) using quick immersion method and statistically compared. Effect of IAA and GA were compared in different Petri-dish and observed four weeks. The experiments were laid down on completely randomized design and the results showed that 0.1ppm of IAA was more effective and promoted quicker rooting than the remaining two concentrations of IAA, while at relatively similar concentration of 0.1ppm GA_3 produced higher number of roots and root length when compared with the remaining two concentrations of GA_3. From the results obtained the treatment with lower concentration revealed higher number of roots and root length compared with control. This shows that 0.1ppm of IAA is most preferred and more suitable for initiation of roots in sweet potato.

Keywords: indole acetic Acid (IAA), Gibberellic Acid (GA_3), rooting, *Ipomea batata*

INTRODUCTION

The sweet potato *(Ipomoea batatas)* is a dicotyledonous plant that belongs to the family convolvulaceae. Its large streachy, sweet tasting tuberous roots are an important root vegetable (Purseglove, 1991; Woolfe, 1992). The young leaves and shoots are sometimes eaten as greens of the approximately 50 genera and more than 1,000 species of convolvulaceae *I. batatas* is the only crop plant of major importance some others are used locally, but many are actually poisonous. The sweet potato is a tuberous plant in the same genus as the morning glory, it is a long tapered tuber with a smooth skin, the flesh of the tuber ranges from white to yellow, orange and purple. It is often confused with the potato which is in the same order but not the same family. The soft, sweet, orange variety is called a “yam” in most of the United States but should not be confused with the true yam.

Sweet potatoes are rich in dietary fiber, vitamin C and vitamin B6. In tropical areas they are a staple food crop. The tubers, leaves and shook are all edible, the tubers are most frequently boiled, fried or baked. tubers can also be processed to make starch and a partial flour substitute the plants and tubers are frequently used for animal feed industrial uses include the production of starch and a partial flour substitute. The plants and tubers are frequently used for animal feed industrial uses include the production of starch and industrial alcohol.

The plant is a tropical annual vine that does not tolerate frost. Depending on the variety and conditions tubers mature in 3-9 months. Sweet potatoes rarely flower outside of the tropics and are primarily propagated by cuttings and tubers some variants are sold as house plants. Sweet potatoes are believed to have originated in South America and spread throughout the tropical Americans into the Caribbean and across the South specific to Eastern Island. Very likely the

tuber drifted across the sea in a manner coconuts still do today.

Potato is one of the most important crops in the world due to its high nutritional value. But its production is still low due to high market demands.

MATERIAL AND METHODS

Collection of samples

Sweet potato plant *(I. batata)* were collected from Bayero University, Kano research farm site and identified. The samples were brought to the laboratory in moistened polythene bags and standard cutting were prepared using a sterile knife. The different cuttings were left in moistened polythene bag until treatment.

Laboratory processing and examination of sample

Indole acetic acid and Gibberellic acid powders were dissolved in 50% ethanol as described by Joel (1992) and Kutama et al. (2008)

A mixture of IAA and Gibberellic Acid (1:1;v/v) was also prepared at three different concentrations: prepared stem cuttings of sweet potato were replicated three times under randomized block design and treated with the auxins and Gubberellic acid at different concentrations; 0.1g/L

- 0.3 g/L
- 0.4 g/L
- Control

By quick immersion/dip method of MacDonald (1986). While stem cutting where immersed for few seconds and removed immediately. Later, the cuttings were returned to the wetted petri-dish separately which were filled with soil from the garden and watered very well. Stems were placed in each concentration of IAA and Gibberellic acid of 0.1, 0.3, 0.4 respectively including the control.

The petri-dish were also labeled as follows o.1 g/L, 0.3 g/L, 0.4 g/L, control respectively, in the control only distilled water was applied, span of time of rooting was determined/observed each day. Root length and number of roots were determined after four weeks of immersion.

RESULTS

Table 1. Effect of different concentration of 1AA and GA_3 on the no of roots after four (4) weeks

	Concentration (ppm)			
Hormones	0.1	0.3	0.4	Control
1AA	26	1.5	14	1
GA	14	9	8	1
SE:				2.903

From the study conducted No of roots were observed from the effect of different concentration of 1AA and GA_3. Using Analysis of variance it was observed that there was no significance difference between the two hormones. But significance differentiations of the two hormones, heats significant difference was then applied it was found that 0.1ppm 1AA GA_3 is the most effective concentration on plant roots.

Table 2. Effect of different concentration of 1AA and GA3 on the mean no root length of at four (4) weeks

	Concentration (ppm)			
Hormone	0.1	0.3	0.4	Control
1AA	1.23	0.9	0.71	0.2
GA_3	0.89	0.72	0.56	0.1
S.E.±				0.709

Using analysis of variance (ANOVA) no significance difference was observed between the Hormones 1AA and GA_3 and the concentrations 0.1ppm, 0.3ppm, and 0.4ppm on the length of roots at 4 weeks.

DISCUSSION

The effects of the two (2) different plant hormones (indole-acetic acid and Gibbrellic acid) on the rooting of stem cuttings of sweet potato which is a crop investigated in this study. It is known that while some species of plant can be propagated from seed easily and cheaply, many horticultural crops are propagated from stem cuttings, which posses some difficulty to propagate. Therefore, there is absolute need to improve the rooting practices of these plant species through hormonal treatments (Sam and Esenowo, 2006).

The results of the study shows that indole acetic acid which is an auxin generally promoted the rooting of stem cuttings and therefore should be used in the propagation of the plants. However, from the statistical calculation using ANOVA, the effects of the plant hormones (i.e IAA and GA_3) on the rooting effect of sweet potato stem cutting had no significant difference but the different concentration of IAA and GA_3 (0.1ppm,0.3ppm and 0.4ppm) showed significant difference on Table 1.While the root length on Table 2 showed no significant difference between the hormones and the different concentration.

Based on the Table 1, it shows that 1AA at relatively lower concentration promoted root production. The treatment with 0.1ppm of 1AA influenced appreciable root number, gibberellic acid also gave a better performance at a low concentration of 0.1ppm. However at higher concentration (03ppm and 0.4ppm) of indole - acetic acid and gibberellic acid the rooting effect seemed to take more time in the initiation of roots.

Indole acetic acids(IAA) is the most common auxin as it is the only one present in all plants. Auxin is a plant hormone produced in the stem tip that promotes cell elongatio.(Taiz,2002). 1AA being major auxin is involved in many of the physiological processes in plants (Arteca, 1996).

Auxins were the first hormone to be discovered and they play a very big role in growth regulation of both the stem and the root, the effect of this hormone was first observed by Charles and Francis Darwing where lower concentration of auxins were found to be the plant stimulator.

Gibberellins were first discovered in Japan, were long days and cold stimulate its production of this hormone is very active metabolically as it's effect is extremely low concentration. (Buchanan, 2002). gibberellic are produced in greater mass when the plant is exposed to cold temperatures. GA regulates growth application of very low concentrations can have a profound effect while too much will have the opposite effect. It is usually used in concentrations between 0.01-10mg/L.

CONCLUSION

Treatment with 0.1 ppm of 1AA and GA was found to produce more roots compared 0.3 ppm 0.4 ppm concentration of 1AA and GA. But 0.1 ppm of 1AA was more effective in enhancing the rooting effect and root length of sweet potato. 0.1 ppm of GA and 0.3 ppm, 0 .4ppm of 1AA and GA produced roots but were not as much as that of 0.1ppm of 1AA.
At the beginning of this investigation 0.4ppm was thought to be the treatment with high concentration that will produce more roots when compared with 0.1ppm and 0.3ppm having lower concentration, but that was not so. From this investigation it was concluded that 0.1ppm is the suitable concentration for the propagation of plants.

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