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Effect of Some Synthetic Plant Hormones on Root Initiation of *Cajanus Cajan* Juvenile Stem Cuttings

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ABSTRACT

This study was conducted to determine the effect of some synthetic plant hormones on root initiation of stem cuttings from *Cajanus cajan*, a medicinal and food crop under-utilized in Nigeria. Out of two hundred and fifty seeds sown in the greenhouse, only one hundred and twenty-six germinated. Healthy seedlings were selected for uniformity on the seventh day when a pair of simple leaves appeared. Cuttings were made just above the roots. The cuttings were placed in glass beakers covered with black cloth. Each beaker contained a known concentration of plant hormone made from the stock solution. Stock solutions of Indole-3-acetic acid (IAA), Naphthaleneacetic acid (NAA), 2,4-dichlorophenoxyacetic acid (2,4-D), 2,4,5-trichlorophenoxyacetic acid (2,4,5-T), Indole-butyric acid (IBA), 2-methyl-4-chlorophenoxyacetic acid (MCPA) and Thiourea were prepared and the cuttings were treated with each of the following concentrations 0.1mg/l, 0.5mg/l, 1mg/l, 5mg/l and 10mg/l of the above-mentioned hormones for 24 hours. Distilled water served as the control. The treated cuttings were washed with distilled water. Roots were initiated after the hormonal treatment. Among all the plant hormones used, NAA gave the best result by initiating 32.8 mean number of roots and 23.3 mean length of roots. This was followed by IBA at 5mg/l with 28 and 15.3 mean number and length of root respectively. 0.5mg/l IAA, 10mg/l Thiourea and 0.2mg/l MCPA, each stimulated rooting more than the control. Cuttings treated with 2,4-D and 2,4,5-T at 0.1mg/l initiated roots less than that of the control. Higher concentrations of MCPA, 2,4-D and 2,4,5-T were toxic to the cuttings. The use of NAA at 10mg/l or IBA at 5mg/l as root treatment before planting is recommended.

Keywords: plant hormones, stem cuttings, root initiation.

INTRODUCTION

Pigeon pea is a legume cultivated for its seeds which have a relatively high protein content ranging from 19 - 22%. It is also rich in starch, crude fibre, calcium, manganese trace elements and minerals. (Eltayeb et al.,2010; Amartei et al., 2002;). Oke (2010) also reported that the leaves of *C. cajan* contain 22.4% crude protein. The high protein content of pigeon pea seeds and leaves makes the crop an excellent source of human and livestock feed.

Nix et. al. (2015) reported that a total of 27 flavonoids in seven different classes have been isolated from *C. cajan* leaves, seeds, roots and stem, over more than 40 years of research.

It is a medicinal plant, food crop and nitrogen fixer (Olayaki, et al., 2009). The seed water extract significantly increased litter size and serum progesterone in pregnant rats, an effect attributed to its phytoestrogen content (genistein, diadzan and secoisolari-ciresinol (Olayaki, et al.,, 2009). Studies have shown that it possesses anti- bacterial, anti-plasmodial and anti-sickling activities (Onah, et al., 2002; Duker-Eshun, 2004., Agus et al., 2017).

There are many benefits of intercropping with pigeon pea which include the following among others, such as source of green manure, cover crop, anti-erosion, windbreaker and for yam staking.

Despite the potential inherent in the crop, its use is severely limited by its difficulty in cooking which consumes a lot of fuel and its unpleasant taste. This should encourage research studies into the development of improved varieties with better qualities which can be multiplied by vegetative propagation hence this study.

The aim of this study was to determine the effect of NAA, IBA, IAA, Thiourea, MCPA, 2,4-D and 2,4,5-T on root formation and elongation of juvenile stem cuttings of *Cajanus cajan*.

MATERIALS AND METHODS

The seeds of *Cajanus cajan* used for this experiment were grown in the greenhouse. Out of 250 seeds sown only 126 germinated.

Healthy seedlings were selected for uniformity on the seventh day when a pair of simple leaves appeared. Cuttings were made just above the roots and placed in glass beakers covered with black cloth. Each beaker contained a known concentration of growth substance made from the stock solution. The growth substances whose stock were prepared and used were Indole-3-acetic acid (IAA), Naphthaleneacetic acid (NAA), 2, 4 – dichlorophenoxy acetic acid (2, 4 – D), 2, 4, 5 – trichlorophenoxy acetic acid (2, 4, 5 – T), Indole – butyric acid (IBA), 2 – methyl – 4 – chlorophenoxy acetic acid (MCPA) and Thiourea. The basal end of the cuttings was dipped into each of the following concentrations 0.1mg/L, 0.5mg/L, 1mg/L, 5mg/L and 10mg/L of the above-mentioned growth substances for 24 hours and distilled water served as the control.

After 24h hormonal treatment, the growth substances were poured away and refilled with distilled water at the same level as the growth substances in beakers covered with moist black cloth. The cuttings were examined for root initiation and daily data collection for 10 days.

RESULTS AND DISCUSSION

Most of the stem cuttings started forming roots on the third day after hormonal application. In some, rooting started after two days while in others, it started a day after hormonal treatment.

Fig 1 and 2 show that NAA at 10mg/L initiated an average of 32.8 roots which on average were 23.3mm long. This was followed by IBA at 5mg/L with an average of 28 roots, 15.3mm long. IAA at 5mg/L (23.0 roots), Thiourea at 10mg/L (19.7 roots) and 0.1mg/L of MCPA (16.3 roots) each stimulated rooting more than the control (15.3).

Cuttings treatment with 2, 4 – D and 2, 4, 5 – T each at 0.1mg/L initiated 10 and 16.8 roots respectively. Higher concentrations of MCPA, 2, 4 – D and 2, 4, 5 –T, killed the cuttings (Fig. 1).

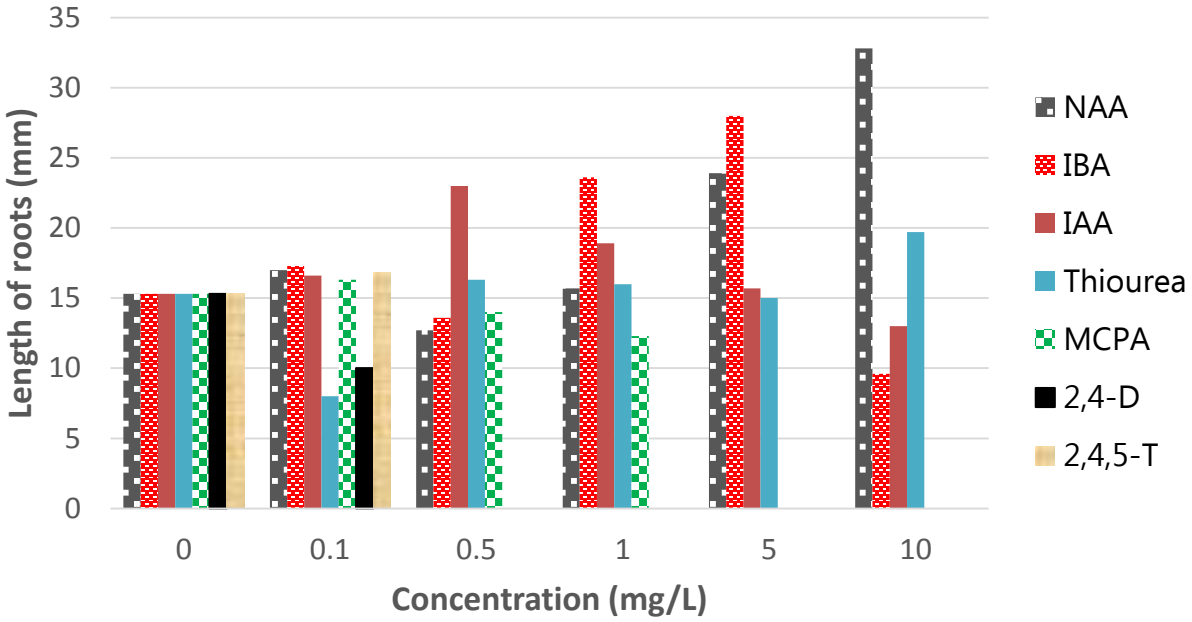

Fig. 1: EFFECT OF DIFFERENT CONCENTRATIONS OF PLANT HORMONES ON ROOT INITIATION OF *C. cajan* STEM CUTTINGS

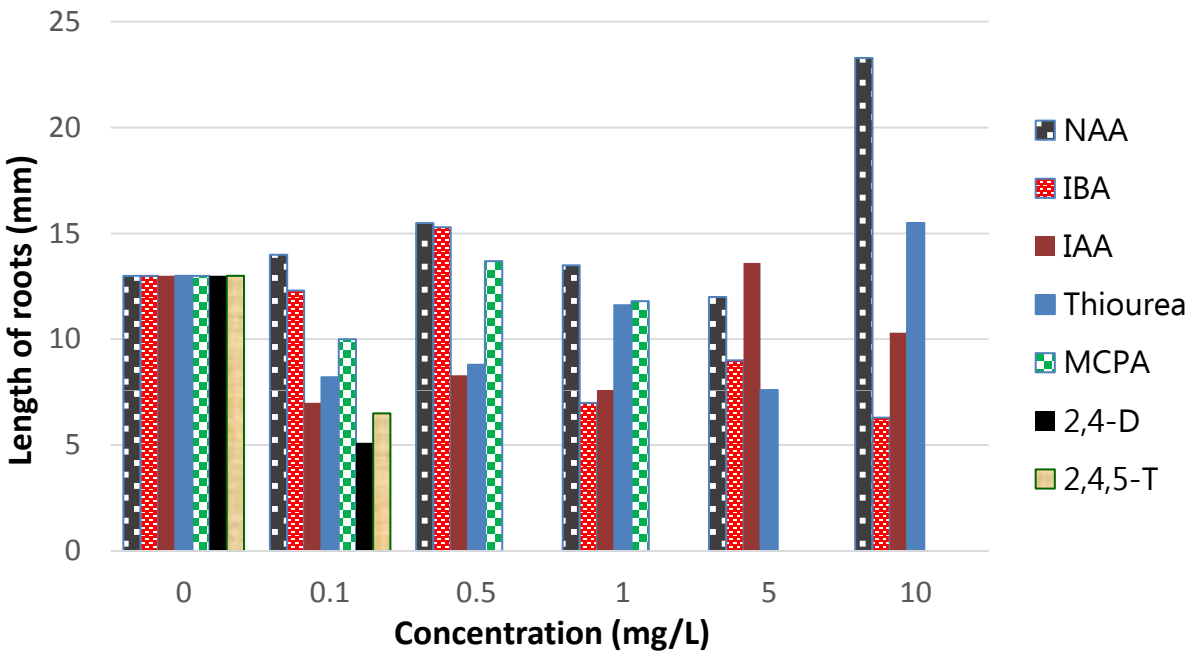

Fig. 2: EFFECT OF DIFFERENT CONCENTRATIONS OF PLANT HORMONES ON ROOT LENGTH OF *C. cajan* STEM CUTTINGS

It was observed that NAA at 10mg/L gave the best result both in number and length of roots as the treatment gave 114% and 79.2% increase respectively. This result is in agreement with the report of Ullah et. al., (2013) which showed that NAA at the highest concentration of 400 ppm tested gave the maximum increase in number and size of root of Marigold when compared with IBA at the same concentration.

It was also observed that IBA at very low concentration of 0.5mg/L, stimulated more roots than different concentrations of IAA tested. However, better performance of IBA was attributed to its higher: stability both in solution and in plant tissues, translocation and movement of sugars to the base of the cutting, (Pandey et al., 2011). Reports have shown the results of other studies on the effect of NAA, IBA and other auxins on the rooting of African blackwood (Amri, et al., 2010), *Robinia pseudoacacia* and *Grewia optiva* (Swamy et al., 2002), *Ginkgo biloba* (Pandey et al., 2011), Marigold (Ullah et al., 2013), Sugarcane (Tolera, 2016), Rosemary, Sage and Elderberry (Gudeva et al., (2017).

Poor performance of 2,4–D, 2,4, 5 –T and MCPA is because they contain phenoxy compounds which caused leaf injury and made the base of the treated cuttings to be swollen (Gana, 2010). The reason for the poor performance of the phenoxy compounds tested in this study was reported by Vanneste and Friml (2009), that the distance transport of manufactured food from the source (leaves) to the sink (base of the cuttings) which is required to provide nutrients to the base was not available because the leaves were injured and there was no synthesis of sugars which are vital in the rooting of cuttings. The phenoxy compounds were toxic and also inhibited root growth on the treated cuttings.

10mg/L of NAA and 5mg/L of IBA were therefore effective in stimulating increased number and length of roots on the stem cuttings of *Cajanus cajan.*

Based on the above findings, NAA at 10m/L or IBA at 5mg/L is recommended as root treatment on juvenile stem cuttings prior to cultivation. This would enable multiplication of desirable traits in pigeon pea such as soft seed coat (for easy cooking), better taste, high-yielding and pest-resistant varieties via vegetative propagation in order to meet the growing need of Nigerian farmers to ensure food security in the country.

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