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# EFFECT OF AQUEOUS PLANT EXTRACTS AND INORGANIC FERTILIZER ON THE GERMINATION, GROWTH AND DEVELOPMENT OF MAIZE (Zea mays)

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**ABSTRACT**

This study was conducted to evaluate the effect of Plant extract and inorganic fertilizer on the germination and early seedling growth of maize, Bio-fertilizers have the ability to symbiotically relate to the roots of plants. These living microorganisms help to transform complicated organic material into basic compound, helping the plant to grow and nurture in a natural way. Aqueous extracts of *Azadirachta indica* was obtained using cold maceration method the experiment was designed in a completely randomize design both in the *in vitro* and field experiments, the germination rate, plumule and radicle lengths as well as the dry matter accumulations of the maize plant were determined. The extract was diluted using serial dilution method to obtain 100,75,50, & 25% of the extract and an inorganic fertilizer NPK. Aqueous extract of the plant demonstrated ability to stimulate the germination, growth and development of maize crop. The effect of the extracts increases with increase in the concentration of the extracts with the best activity in 100% concentration of the extract, which was as effective as the Inorganic fertilizer in all the parameters considered used in the studies. Application of organic biofertilizer is recommended as it increases the yield and early germination of the plant.

**Keywords**: Fertilizer, *Azadirachta indica*, Germination, Maize

## INTRODUCTION

Agriculture as the main source of livelihood and food security in Nigeria and is facing a challenge of matching food, fodder, fuel, and fiber production with population growth. Nigeria is blessed with a lot of natural endowment which if properly harnessed will make it compete favorably with other industrialized nations of the world technology and development. Although endowed with all these gifts, little or no efforts are being made to put them to optimum conversion for the enhancement of the living standard of the teeming population (Musa *et al*., 2022; Kogel *et al*., 2016 Yao *et al*., 2010 ). It is imperative therefore that resource productivity be increased in order to bridge the gap between per capita food production and population growth. This calls for increased use of inputs such as clean irrigation water, organic manures fertilizers and crop protection techniques, which impact on the economics of agricultural production, environmental quality as well as soil fertility (Adesemoye & Kloepper, 2009).

One of the principal sources of cereals for food, fodder, and processed industrial products is maize (*Zea mays* L.). Around 790 million tons of maize are produced worldwide each year; in some nations, it serves as a staple crop and accounts for more than one-third of all calories and proteins. Since maize seed is a living thing, it is exposed to a variety of environmental conditions that degrade its quality. Despite maize's tremendous potential for output and several benefits, the crop's yield per unit area is poor in India. The major issues restricting maize output are slow germination and low seed viability (Ambrosini et al., 2012; Prince and Prabakaran, 2011). The grass family "Poaceae" includes the crop known as maize (*Zea mays* L.). It is one of the most widely grown cereal crops in the world and is grown all over the world (Prince and Prabakaran, 2011). It is a large, antagonistic, annual C4 plant with a height range of 1 to 4 meters that bears its leaves alternately down the length of a robust stem. The leaves are broad, narrow, and roughly a tenth as long as they are wide. Wind pollinates maize, and self- and cross-pollination are frequently feasible. The seed can remain viable for a longer period of time under favorable conditions, unlike mature pollen that is shed off, which typically lasts for only 10 to 30 minutes (Prince and Prabakaran, 2011 Pindi . & Satyanarayana, 2012). As a warm-weather crop, maize is often grown in a variety of climatic circumstances (Prince and Prabakaran, 2011). With an annual rainfall of 60 cm, maize can be successfully produced. In the wild, maize plants do not develop or grow. Only with human care can it grow and endure (Prince and Prabakaran, 2011). According to Prince and Prabakaran (2011), maize has a wide range of uses, including those for food, animal feed, industry, and pharmaceuticals.

Native to the dry areas of the Indian subcontinent, neem, *Azadirachta indica*, grows to heights of 12–24 m at 50–100 m elevations with 130 mm of annual rainfall being sufficient for normal growth. Neem is well-known for its use in India and is mostly used in the growing of rice. In Sanskrit, neem is also known as "arista," which means "perfect, complete, and imperishable." The Sanskrit word "nimba," which meaning "to give good health," is derived from the verb.

## MATERIALS AND METHODS

### Collection of Plant Materials

A secateur was used to cut a branch from the biological garden of the federal university Dutsin-Ma that contained reproductive parts of *Azadirachta indica*. The samples were then identified and authenticated at the Department of Plant Science and Biotechnology, a voucher number was issued, and the sample was deposited in the herbarium.

### Preparation of Plant Samples

Freshly gathered plant samples were properly cleaned under running water, air-dried at room temperature (25–30 $^0$C) in the laboratory, and then ground into a fine powder using a pestle and mortar and sieved. 200g of the powdered sample was weighed and immersed in 100ml of water for 24 hours while being shaken intermittently at set intervals. The suspension was filtered, decanted, and the extract reconstituted using distilled water. The extract was then taken

as (100%) extract and serially diluted with water to get concentrations of 75, 50, and 25%, using distilled water (0%) as the control. The Singh *et al.* (2011) extraction method was utilized to get the aqueous leaf extract.

**Experimental Design.**
In this study, a total of ten viable seeds were planted into petri dishes with a two-fold of Whatman No 1 filter paper using the Complete Randomized Design (CRD). Each day, 5ml of aqueous leaf extract in dilutions of (100, 75, 50, and 25) for each plant were added to the Petri plates, with water serving as the control (0%). Each treatment was divided into three replications, totaling 15 Petri dishes, all of which were held at room temperature (25–30 oC) and contained three Petri plates per treatment(Musa *et al*. 2022).

**Seed viability test**
The viability of the seeds to be planted was tested using the flotation method; the seeds were steeped in a beaker of water; the ones that sank were regarded to be viable, while the ones that floated were not viable and were thrown away (Santos *et al*., 2012).

**Determination of Germination rate**
Growth rates were assessed on a weekly basis, and germination rates were calculated by counting the number of seeds showing signs of germination in each petri dish (Faruk, 2021).

**Determination of radicle and plumule length**
The lengths of the radicle and plumule were measured using a string and meter rule; measurements were simply taken using the string, transferred to the meter rule, and recorded (Musa *et al*., 2017).

**Determination of fresh weight and dry matter accumulation**
Dry weight of the maize plant was determined by placing the maize plant in an oven at a high temperature and taking measurements everyday until a steady weight was attained (Megali *et al*., 2913; Singh et al., 2011). Fresh weight of the maize plant was assessed using an electric weighted balance at the conclusion of the experiment.

**Data Analysis**
Data collected on the rate of germination were analyzed using simple percentages, while data obtained on the plumule and radicle length and dry matter accumulation were analyzed using One way Analysis of Variance (ANOVA) means were separated using Duncan range multiple range test.

**RESULTS AND DISCUSSIONS**
The effects of several aqueous leaf extracts of *A. indica* on maize growth showed that, the extracts stimulated the germination and growth of Maize. This effect is concentration dependent with the best results obtained with the highest concentration of the extracts. This finding is similar to that of Musa *et al*. (2022) who also observed a concentration dependent positive effect of the aqueous leaves extracts of *Vernonia amygdalina* on the germination and early seedling growth of cowpea. This is further corroborated by the findings of Farouk *et al*. (2014). Who reported that the aqueous leaves extracts of *Eucalyptus camaldulensis* stimulated the germination rate and early seedling growth of common beans. The effect of the aqueous leaves extracts of A. indica is an indication that it can be used to dress the plants seeds for better germination rate.
The overall results obtained from the germination and seedling development considered revealed that there is no significant difference between the effect of the Aqueous leaves extracts of *A. indica* with the conventional Nitrogenous phosphorous Potassium (NPK) Fertilizer. This is an indication that despites the heavy fertilizer requirement of Maize, the plant extracts is still able to sustain the germination and development of the maize plants without any symptom of deficiency for a reseanable period of time.
The effect of the Aqueous leaves extracts of *A. indica* revealed a significant increase in the radicle and plumule length of the test plant and exhibiting an effect without sigmificant difference when compared with NPK . this finding is in agreement with that of Faruk *et al*. (2021) who reported a significant increase in the length of the plumule and radicle of Phaseolus vulgaris when treated with the methanolic leaves extracts of *Azadirachat infica* ,they reported that as the concentration increases so the effect of the extracts in stimulating the growth rate of the plumule and radicle.

**Table 1: Results showing the effect of aqueous leaves extracts of *Azadirachta indica* on the germination rate of maize plant (*In vitro*).**

| Treatment (%) | 2DAS | 3DAS | 4DAS | 5DAS | 6DAS | 7DAS |
|---|---|---|---|---|---|---|
| 0 | 5 | 15 | 39 | 41 | 42 | $45\pm0.22^{a}$ |
| 25 | 8 | 25 | 40 | 40 | 45 | $49\pm0.11^{a}$ |
| 50 | 15 | 25 | 48 | 52 | 55 | $61\pm0.03^{b}$ |
| 75 | 16 | 35 | 50 | 59 | 66 | $78\pm0.04^{ab}$ |
| 100 | 24 | 34 | 74 | 89 | 100 | $100\pm0.12^{c}$ |
| NPK | 26 | 38 | 77 | 91 | 100 | $100\pm0.12^{C}$ |

**Table 2: Results showing the effect of aqueous leaves extracts of *Azadirachta indica* on the germination rate of maize plant on the field**

| Treatment (%) | 3DAS | 5DAS | 6DAS | 8DAS | 10DAS |
|---|---|---|---|---|---|
| 0 | 5 | 15 | 39 | 41 | $54\pm0.22^{a}$ |
| 25 | 8 | 25 | 40 | 40 | $62\pm0.11^{a}$ |
| 50 | 15 | 25 | 48 | 52 | $71\pm0.03^{b}$ |
| 75 | 16 | 35 | 50 | 59 | $86\pm0.04^{b}$ |
| 100 | 24 | 34 | 74 | 89 | $100\pm0.12^{c}$ |
| NPK | 25 | 39 | 76 | 91 | $100\pm0.13^{C}$ |

**Table 3: Results showing the effect of aqueous leaves extracts of *Azadirachta indica* on the germination rate of maize plant on the field**

| Treatment (%) | Plumule (cm) | Radicle (cm) |
|---|---|---|
| 0 (Control) | 3.3±0.0.10[a] | 3.8±0.22[a] |
| 25 | 3.4±0.10[b] | 3.8±0.13[a] |
| 50 | 5.5±0.10[b] | 6.6±0.15[ab] |
| 75 | 6.3±0.22[b] | 9.9±0.24[b] |
| 100 | 7.5±0.11[c] | 11.3±0.20[c] |
| NPK | 7.68±0.31[c] | 11.8±0.32[c] |

**Table 4: Results showing the effect of aqueous leaves extracts of *Azadirachta indica* on the germination rate of maize plant on the field**

| Treatment (%) | Fresh weight(g) | Dry weight (g) | Dry matter accumulation (g) |
|---|---|---|---|
| 0 (Control) | 7.3±0.0.10[a] | 2.8±0.22[a] | 4.5±0.13±0.13[a] |
| 25 | 8.4±0.10[b] | 3.8±0.13[a] | 4.6±0.13±0.12[a] |
| 50 | 11.5±0.10[b] | 4.6±0.15[ab] | 7.0±0.04±0.04[b] |
| 75 | 16.3±0.22[b] | 7.9±0.24[b] | 8.4±0.03±0. 04[b] |
| 100 | 25.5±0.11[c] | 10.3±0.20[c] | 15.2±0.05±0.03[c] |
| NPK | 27.68±0.31[c] | 11.8±0.32[c] | 15.88±0.04[c] |

## CONCLUSION

Aqueous extracts of *Azadirachta indica* has demonstrated ability to stimulate the germination, growth and development of maize crop. The effect of the extracts increases with increase in the concentration of the extracts with the best activity in 100% concentration of the extract, which was as effective as the Inorganic fertilizer used in the studies

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