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Effect of Plant Extracts at Different Concentrations on Plant Height, Fresh and Dry Weight in the Screen House at Kadawa during 2023 and 2024 Rainy Season

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Abstract

Evaluation of different concentrations of plant extracts for the control of damping-off disease on maize (Zea mays) in Kano state was conducted at Kadawa Research Station of the Institute of Agricultural Research, Ahmadu Bello University, Zaria and the Research Farm of Federal College of Education (Technical) Bichi, Kano both in greenhouse and field experiments in 2023 and 2024. Different concentrations (10, 5, 3.3, 2.5 and 2%) of plant extracts were used which were applied as seeds treatments to test against damping –off pathogens. Disease incidence, plant height, fresh and dry weight were also assessed. Data were analyzed using SAS software to determine treatment effects. The findings revealed that plant extracts significantly reduced damping-off disease incidence compared to the untreated control. Neem, henna and garlic extracts were the most effective, particularly at higher concentrations (10%, 5% and 3.3%) reducing disease severity while enhancing seedling vigour. However, excessive concentrations caused phytotoxic effects in some treatments. The study demonstrated the potential of plant-based treatments as eco-friendly alternatives for managing damping-off disease in maize. Moreover, plant height, fresh and dry weight of maize were significantly increased when maize seeds were dressed with plant extracts before planting. Further research through field trials and formulation optimization is recommended to enhance effectiveness and farmer adoption. Its recommended that farmers in Kano State, Nigeria, should consider using the promising concentrations of each extracts as in neem (3.3-5%), garlic (2.5-5%), ginger (3.3-10%), onion (3.3-10%) and henna (2.5-10%) as bio-fungicides for seed treatment to reduce damping-off disease in maize.

Keywords: Concentration, Dry, Extracts, Fresh, Height

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Introduction

Maize (*Zea mays* L.) is one of the most important cereal crops grown in Nigeria, particularly in the northern regions such as Kano State. It serves as a staple food, livestock feed and industrial raw material. Despite its significance, maize production is constrained by various biotic and abiotic factors, among which damping-off disease is a major concern. This disease, primarily caused by soil-borne pathogens such as *Pythium spp., Fusarium spp.,* and *Rhizoctonia solani,* affects seedlings at the pre- and post-emergence stages, often resulting in significant stand loss and reduced grain yield (Okereke *et al.,* 2020).

According to Ayodele and Adekunle (2021), damping-off can cause up to 60% crop loss in poorly managed fields and its impact is more severe where farmers lack access to effective disease management strategies. Chemical fungicides have traditionally been used to control damping-off; however, their continued use has raised concerns due to environmental pollution, residual toxicity, pathogen resistance and high cost (Yusuf *et al*., 2019).

Several studies have demonstrated the efficacy of these extracts in inhibiting seed-borne and soil-borne pathogens. For instance, Emechebe *et al.* (2020) reported that neem and gralic extracts significantly reduced the incidence of damping-off in maize by inhibiting the growth of *Pythium* spp. Similarly, Adebayo *et al*., (2021) found that aqueous extracts of ginger and henna showed notable antifungal activity, which led to improved seedling emergence and vigour.This study seeks to contribute to sustainable agricultural practices by finding effective, low-cost and environmentally friendly alternatives to synthetic fungicides for the control of damping-off disease in maize. The disease is particularly severe in warm, humid conditions, exacerbating yield losses for maize farmers (Gaya, 2019). If left unmanaged, damping-off can cause up to 60–80% seedling death, leading to reduced plant populations and poor crop performance. To control damping-off disease, farmers often rely on synthetic fungicides, which, although effective, pose significant challenges, including high costs that make them inaccessible to resource-poor farmers, environmental concerns, as excessive use leads to soil and water contamination; health risks due to chemical residues in food and water; pathogen resistance, which reduces long-term effectiveness etc. Given these concerns, plant-based disease management strategies are gaining attention as environmentally friendly alternatives. In Nigeria, especially in northern regions like Kano State, damping-off can result in 30–70% seedling mortality if untreated (Bello, 2023).

Damping-off Disease in Maize

Damping-off in maize (*Zea mays* L.) is caused by a complex of soil-borne fungal and fungus-like pathogens that attack seeds and young seedlings. These organisms survive in the soil and crop residues, and under favorable conditions such as high soil moisture, poor drainage and cool temperatures they infect germinating seeds and emerging seedlings, leading to significant stand loss and reduced crop yield. Causal Organisms: Damping-off in maize is caused by several soil-borne pathogens, including: *Pythium spp., Fusarium spp., Rhizoctonia solani* and *Phytophthora spp.* These pathogens persist in soil and plant debris and can survive for long periods, making disease control difficult (Rojas *et al.,* 2019).

Pythium species – These are fungus like organisms (*oomycetes*) commonly found in soil and water. They are major contributors to both pre-emergence and post-emergence damping-off, causing seed rot, root infection and seedling collapse. *Pythium spp.* such as *Pythium ultimum, P. aphanidermatum,* and *P. irregulare* have been associated with damping-off in a wide range of crops, including maize (Bayer Crop Science, 2024). *Rhizoctonia solani* – A true fungus frequently involved in damping-off. It infects seeds and the stem base, causing reddish brown lesions, soft decay and girdling of the hypocotyl, which results in seedling collapse. It is active under a range of soil moisture conditions and can survive in soil as resilient structures. *Fusarium species* – These fungi may act alone or in disease complexes, especially under warmer and drier soil conditions. *Fusarium spp.* contributes to pre- and post-emergence damping off and can also lead to root and crown rot in affected seedlings. Other associated organisms – While less commonly reported in maize, related soil fungi such as *Phytophthora spp., Sclerotium spp.,* and *Alternaria spp.* have been implicated in damping off or similar seedling diseases in other crops. Under certain conditions, these organisms may contribute to complex disease interactions (Lamichhane, and Dürr, 2017). Together, these pathogens form a disease complex, meaning that more than one organism may be present and contribute to seed and seedling losses in a field. The severity of disease often depends on environmental conditions that favor the activity and reproduction of these species (*Rhizoctonia solani*).

It occurs in two main forms based on the stage of infection:

Pre-Emergence Damping-Off:

Pre-emergence damping-off occurs when pathogens infect seeds in the soil before they can germinate or emerge. In this form, soil-borne organisms such as *Pythium spp., Rhizoctonia solani* and *Fusarium spp*. invade the seed during imbibitions or early germination, causing seed rot or failure to emerge (Lamichhane and Dürr, 2017). Environmental factors like excess soil moisture, cool temperatures and poor drainage increase the risk, because these conditions favor pathogen activity and delay seed germination (Lamichhane *et al.,* 2017). Symptoms include; rotting seeds in the soil Poor or uneven germination, reduced stand density. Impact: Pre-emergence damping-off directly reduces plant population, leading to gaps that lower overall yield potential.

Post-Emergence Damping-Off:

Post-emergence damping-off occurs after seedlings have emerged from the soil. In this stage, the pathogen infects the stem base or root collar, leading to water-soaked lesions, soft rot and sudden collapse of the seedling

(Lamichhane and Dürr, 2017; Rojas *et al.*, 2019). Seedlings may appear healthy early in infection but rapidly wilt and die as the disease girdles the stem. Symptoms include; water-soaked, darkened areas at the soil line, constriction or girdling of the stem and sudden seedling collapse. Post-emergence damping-off causes stand loss and weak plants that cannot compete for space and resources, resulting in poor crop development. The major fungi associated with both types of damping-off include: *Pythium spp*. common in wet soils and responsible for rapid seed rot (Rojas *et al.*, 2019). *Rhizoctonia solani* attacks roots and stem bases, especially under moderate moisture (Lamichhane and Dürr, 2017). *Fusarium spp.* often occurs in disease complexes, exacerbating seedling blight (Rojas *et al.,* 2019).

Materials and Methods

Experimental Sites

The experiments were carried out at Kadawa Irrigation Research Station of the Institute of Agricultural Research, Ahmadu Bello University Zaria (11˚ 65' N, 8˚ 45' E) situated in the Sudan Savanna Ecological Zone of Nigeria, during 2023 and 2024 rainy seasons. The Meteorological data of the area for rain fall, temperature, relative humidity and wind speed were collected from International Institute for Tropical Agriculture (IITA), Kano substation.

Treatment and Experimental Design

Screen house experiment was conducted using a maize variety (*SAMMAZ 27*). The experiment was 5x6 factorial laid out in a randomized complete block design (RCBD) which consisted of 30 treatments replicated 3-times with five botanical extracts(neem and henna leaves, onion bulb, ginger rhizome and garlic clove) applied at six (6) concentration levels: 10%, 5%, 3.3% 2.5%, 2% and 0% as control. The extracts were separately prepared as aqueous neem leaf extract (ANLE), aqueous henna leaf extract (AHLE), aqueous ginger rhizome extracts (AGRE), aqueous onion bulb extract (AOBE) and aqueous garlic clove extract (AGCE). The extracts obtained and the different concentrations were used as the experimental treatments in the screen house experiment.

Soil Analysis

Soil samples were collected from Bichi and Kadawa at a depth of 0–15 cm using a soil auger. Several subsamples were taken randomly across each site and combined to form composite samples. The samples were air-dried at room temperature, crushed gently and passed through a 2 mm sieve to remove debris and obtain uniform particles for analysis. Physical properties were first determined: soil texture was analyzed using the hydrometer method to obtain percentages of sand, silt and clay, while bulk density was measured using the core method to assess soil compaction.
Chemical properties were then analyzed using standard laboratory procedures. Soil pH was measured in a soil–water suspension (1:2.5) using a pH meter. Organic carbon was determined using the Walkley–Black method, while total nitrogen was analyzed using the Kjeldahl method. Available phosphorus was measured using the Bray-1 extraction method and exchangeable bases (potassium, calcium and magnesium) were determined using ammonium acetate extraction followed by instrumental analysis. Finally, cation exchange capacity (CEC) was calculated to assess the soil's ability to retain nutrients. The results from these analyses were used to evaluate soil fertility status and suitability for maize production (Garba *et al.,* 2024). The results were prepared in Table 1.

Preparation of Plant Extracts

The plant parts (leaves of neem and henna, onion bulb, ginger rhizome and garlic clove) were weighted onan electronic scale (WH-B20) and then washed with clean water. Parts of plant used for the experiment is shown in Table 2a. To get the extract of neem and henna leaves, onion bulb, ginger rhizome and garlic clove, the weighted plant parts were separately crushed in a mortar and pestle as described by using the method of Abdallah *et al* (2021). The 10g of each crushed plant part were separately mixed with100, 200, 300, 400 and 500 ml of distilled water and squeezed through 3 folds of fine cotton cloth. The extracts were then calculated to obtain the different concentrations as 10%, 5%, 3.3%, 2.5%, 2% and 0%.Control was considered to be low percent (0%) of each extracts.

Screen House Experiments (Pot Experiments)

The experiment was conducted in the screen house of five (5) plant extracts at six (6) different concentrations (10%, 5%, 3.3%, 2.5%, 2% and 0%) as 5x6 factorial laid out in a randomized complete block design (RCBD). The experiment consisted of 30 treatments replicated 3-times.

Twenty (20) viable seeds of maize for each treatments were soaked in different concentrations (10%, 5%, 3.3%, 2.5%, 2% and 0%) of the respective plant extract (Botanical Priming) for 6 hours. The untreated seeds were also soaked in water only (Hydropriming) for the same period as in the treated seeds to serve as control treatment. The soaked seeds were air dried for 2hours.The treated seeds were sown in the pots containing naturally infested soil with the pathogenic fungus (such as *Pythium spp*.).The pot sown with non-treated seeds served as control treatments. Hand weeding was done once at two weeks after sowing (WAS). NPK 20:10:10 fertilizer was applied at the rate of 7.5g/pot at two weeks after sowing (WAS).

Data Collection and Analysis

The following parameters were recorded:

A. Plant Height (cm)

In each pot, three (3) plants were randomly tagged and their height was measured using a meter rule at 14 days after sowing and the averages were recorded in the fields.

B. Fresh and Dry Matter Weight (g)

Four (4) weeks after sowing, three (3) plants in each pot were uprooted and their averages fresh weight was taken using an electronic scale (WH-B20) and recorded separately in the fields. The average dry weight was determined after sun dry for 72 hours.

$$\textit{Percent Seed Germination (\%)} = \frac{\textit{Number of seeds germinated}}{\textit{Total number of seeds sown}} \; x100$$

Incidence of Damping off

The pre-emergence seed rot was recorded at seven (7) days after sowing (DAS) and post-emergence seedling mortality was also recorded at 14 days after sowing (DAS) in the screen house experiments. Percent pre-emergence seed rot and percent post-emergence seedling mortality were calculated by the formula developed (Kumar *et al,* 2018).

$$\textit{\%PESM} = \frac{\textit{Number of seeds rot per pot}}{\textit{Total number of seeds sown per pot}} \; x100$$

$$\textit{\%POESM} = \frac{\textit{Number of seedlings affected per pot}}{\textit{Total number of seeds sown per pot}} \; x100$$

PESM is pre emergence seedling mortality and POESM is post emergence seedling mortality.

All the data collected on different parameters were subjected to statistical analysis using SAS software. The means for all the treatments were compared by DMRT (Duncan's Multiple Range Test). The significance of the difference among the means was calculated by LSD (Least Significance Difference) test at P≤0.05.

Results and Discussion

Result in Table 2 showed the effect of different concentrations of plant extracts on plant height, fresh and dry weight in the screen house at Kadawa during 2023 and 2024 rainy season. Result also indicated that highest plant height (24.92) were observed in AHLE and lowest (23.18) in ANLE in 2023. Highest (25.98) plant height were also observed in ANLE and lowest (24.00) in AGRE in 2024. Fresh and dry weights highest in AGCE in 2023 (FW = 4.69 g, DW = 1.64 g). This shows that AGCE was the most effective extract in 2023, followed by AGRE and AOBE. ANLE and AHLE were less effective. AGCE was also effective, with the highest biomass (FW = 4.89 g, DW = 1.73 g). This shows that in 2024, ANLE and AGCE were best performers, while AOBE and AGRE were least effective.

Effect of Different Concentrations of Plant Extracts on Damping-Off on Maize

Result also showed that the effects of concentration level in 2023. At control (0%) performed worst with FW = 2.71 g and DW = 0.59 g. Biomass increased strongly with higher concentrations (FW = 5.58 g at 10% and 2.71 g at 0%). In 2024, at 10% concentration, highest FW = 5.61 g and DW = 2.20 g. At control (0%), lowest biomass (FW = 2.84 g, DW = 0.65 g) were observed. This shows that concentration was the most decisive factor: higher levels (≥5%) consistently reduced damping-off and improved maize performance. Statistically, AGCE consistently emerged as the most effective extract (best at reducing disease and enhancing biomass). ANLE was also very effective, especially in 2024, giving strong germination and survival. AHLE moderate, while AOBE and AGRE less effective, particularly at lower concentrations. Concentration response was highly significant at 10% and 5% concentrations performed best, while untreated control consistently gave the worst results. ANLE and AGCE are best; higher concentrations are most effective. The lack of PE × CO interaction suggests that all extracts follow the same trend of increasing effectiveness with higher concentrations.

Plant Height in the Screen House Experiment

Plant height at 14 days after sowing (14 DAS) is an important indicator of early seedling vigor, establishment, and the ability of maize plants to compete favorably for nutrients, water and light. In this study, conducted in the screen house at Kadawa during the 2023 and 2024 rainy seasons, significant differences in plant height were observed across treatments involving neem, henna, garlic, onion, and ginger extracts at varying concentrations. Treated seedlings generally recorded taller plants compared to untreated controls. This improvement can be attributed to the antifungal properties of plant extracts, which suppressed soil-borne pathogens responsible for damping-off, particularly *Pythium, Fusarium, and Rhizoctonia*. By reducing disease incidence, seedlings were able to channel more resources into growth and elongation. Neem and garlic, for example, are rich in bioactive compounds such as *azadirachtin* and *allicin* that inhibit pathogen growth while stimulating physiological processes that favor vegetative development (Meena *et al.*, 2017).

Environmental conditions influenced plant height in the screen house trials. In the screen house, uniform conditions provided an environment conducive for consistent growth. Nonetheless, treated plants consistently out-performed controls emphasizing the reliability of plant extracts as a management tool. Concentration effects were also clear: higher extract concentrations (5–10%) generally enhanced plant height more than lower concentrations (2–3.3%). This dose-dependent response suggests that sufficient levels of bioactive compounds are necessary to suppress pathogens effectively and stimulate seedling vigor. Paparella *et al.* (2015) reported similar findings, showing that seed priming with natural compounds improves germination and early growth. The findings align with earlier reports that effective disease suppression is directly linked with improved seedling traits, including plant height (Lamichhane *et al.,* 2017). Enhanced early growth also confers long-term advantages, as taller, vigorous seedlings are better able to intercept sunlight and achieve higher biomass, which can contribute to increased yield (Worku *et al*., 2021).

In summary, plant height at 14 DAS was significantly improved by plant extract treatments at Kadawa across two seasons. This highlights the potential of botanicals not only as disease control agents but also as growth enhancers, making them sustainable alternatives to synthetic chemicals in maize production systems. This aligns with the findings of Amadioha (2003) and Adeniyi, *et al.* (2014), who noted that garlic and ginger contain bioactive compounds that reduce early root-zone infections. By 14 DAS, consistent growth trends were maintained in the treated plots. Neem and henna continued to provide superior results. Plants in neem-treated plots were notably taller, likely due to *azadirachtin*, a bioactive compound that promotes systemic resistance to fungal pathogens (Musa *et al.*, 2018). At 21 DAS, cumulative growth effects became more pronounced. Neem-treated plants had the highest average height, followed closely by ginger and henna treatments. Henna's contribution may be linked to its phenolic compounds, which enhance plant defense and reduced infection at the collar region (Aliyu *et al*., 2020).

Fresh and Dry Weight in the Screen House

Fresh weight (FW) and dry weight (DW) of maize seedlings at 4 weeks after sowing (4 WAS) are important indicators of early plant vigor and the effectiveness of seed treatments against soil-borne pathogens. In this study, maize seeds treated with plant extracts (notably ANLE and AGCE) recorded significantly higher FW and DW compared to untreated controls in the screen house trials at Kadawa durng the 2023 and 2024 rainy seasons. Higher biomass accumulation in treated seedlings was attributed to two key mechanisms: (i) suppression of damping-off pathogens such as *Pythium, Rhizoctonia,* and *Fusarium,* which reduces root damage and ensures better nutrient and water uptake and (ii) physiological enhancement from bioactive compounds in botanicals, which improve seedling vigor, root initiation and metabolic activity. The screen house generally showed higher FW and DW than the field, likely due to reduced abiotic stress and lower pathogen pressure under controlled conditions. However, in the field, environmental variability and higher disease pressure amplified differences between treated and untreated seedlings. Concentration effects were also evident: higher extract concentrations (5–10%) produced superior biomass compared to lower doses (2–3.3%), reflecting a dose-dependent response consistent with previous reports. Among botanicals, ANLE and AGCE performed best, likely due to their broad-spectrum antifungal properties and potential growth-promoting effects. These findings align with earlier studies highlighting that seed treatments with plant extracts enhance early seedling biomass, which is strongly correlated with later crop establishment and yield (Lamichhane*et al.,* 2017; Paparella *et al.,* 2015).

The results demonstrate the potential of botanicals as sustainable alternatives to synthetic fungicides for managing damping-off while improving early crop growth. For practical application, standardization of extract concentration and preparation is recommended to ensure consistent effectiveness. This aligns with findings by Musa, *et al.* (2018) who reported that ANLE enhances plant biomass through antifungal and growth-promoting effects. Similarly, AGCE and AGRE treatments improved shoot development due to their antimicrobial properties (Adeniyi, *et al*., 2014). Dry matter content was also notably improved in treated plots, particularly in ANLE and AGRE treatments. This indicated enhanced physiological activity and resistance to pathogenic stress. According to Amadioha (2003), such extracts suppressed soil-borne pathogens, allowing better root development and nutrient assimilation.

Summary

This study evaluated the efficacy of different concentrations (0%, 2%, 2.5%, 3.3%, 5% and 10%) of selected plant extracts: neem (*Azadirachta indica),* henna *(Lawsonia inermis),* garlic *(Allium sativum),* onion *(Allium cepa)* and ginger *(Zingiber officinale)* on plant height, fresh and dry weight as well as for controlling damping-off disease in maize

(*Zea mays* L.).The study was conducted in the screen house at Kadawa in 20203 and 2024, where maize seeds were treated with plant extracts before sowing in the screen house. Plant height, fresh and dry weight were assessed to determine the effectiveness of each extract on each parameter. Results revealed that plant extracts significantly reduced disease incidences compared to untreated controls, with ANLE, AHLE and AGCE extracts showing the highest efficacy. The effectiveness increased with concentration, with 5% and 10% showing the highest disease suppression. All plant extracts exhibited antifungal activity; however: Neem and garlic extracts showed the highest efficacy in reducing disease incidence. Ginger, onion and henna showed moderate but significant effects. Plant extracts improved plant height and fresh weight and dry weight. This indicates that disease control contributed to better seedling vigour and growth performance.

Soil analysis from Kadawa showed sandy loam texture with low organic matter and nitrogen, which may favor disease development. However, the use of plant extracts helped mitigate these effects. The study confirmed that the effectiveness of plant extracts is concentration-dependent, with moderate to high concentrations providing better disease control without noticeable phytotoxic effects. These findings support the use of plant extracts as eco-friendly and sustainable alternatives to chemical fungicides.

Conclusion and Recommendations

The results showed that certain extracts (e.g., ANLE, AHLE and AGCE) were more effective in reducing disease incidence compared to the control. Higher concentrations (10%, 5% and 3.3%) generally exhibited better disease suppression, though some extracts showed phytotoxic effects at higher levels. Seed priming with plant extracts improved maize seedling vigour and survival rates, suggesting additional benefits beyond disease control.

Based on the results obtained, the following recommendations were made:

i. Farmers in Kano State, Nigeria, should consider using ANLE, AHLE and AGCE extracts as bio-fungicides for seed treatment to reduce damping-off disease in maize.
ii. Farmers should consider the promising concentrations of each extracts as in neem (3.3-5%), garlic (2.5-5%), ginger (3.3-10%), onion (3.3-10%) and henna (2.5-10%).
iii. Proper concentration levels (10%, 5% and 3.3%) should be applied to balance disease control and seedling safety.
iv. Training should be organized to educate farmers on the preparation and application of plant-based treatments.
v. Further experiments should be conducted to assess the long-term effectiveness of plant extracts under real farming conditions.
vi. Additional studies should focus on the mechanisms by which these extracts suppress damping-off pathogens.

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Tables

Table 1: Physical and Chemical Properties of Soils of Experimental Field at Kadawa and Bichi

Soil Characteristics	
Physical Composition (%)	**Kadawa**
Sand	64.1
Silt	19.9
Clay	16.0
Textural Class	Sandy Loam
Chemical Properties	
Nitrogen	0.37
Phosphorus	3.01
Potassium	0.14
Sodium	0.54
Calcium	4.03
Organic Carbon	0.56
Magnesium	2.51
Cation Exchange Capacity	7.31
P^H ratio in 1:2:5 in H_2O	7.25 .
P^H ratio in 1:2:5 in $MCaCl_2$	6.56

Source: International Institute for Tropical Agriculture, Kano Substation

Table 2: Effect of Plant Extracts at Different Concentrations on Plant Height, Fresh and Dry Weight in the Screen House at Kadawa during 2023 and 2024 Rainy Season

Treatment	Screen House Experiment					
	PLH (cm)	FW (g)	DW (g)	PLH (cm)	FW (g)	DW (g)
Plant Extract (PE)		**2023**			**2024**	
ANLE	23.18	4.78	1.25	25.98a	4.40ab	1.40
AHLE	24.92	3.90	1.37	25.23ab	4.23ab	1.34
AGRE	24.00	4.58	1.56	24.00b	4.58ab	1.56
AOBE	23.81	4.05	1.56	24.59ab	4.14b	1.46
AGCE	24.41	4.69	1.64	24.63ab	4.89a	1.73
LSD (5%)	2.29	0.90	0.47	1.82	0.74	0.48
Concentration (CO)						
10%	25.39a	5.58a	2.17a	26.11ab	5.61a	2.20a
5%	25.99a	4.91ab	1.84a	27.32a	4.89ab	1.75ab
3.3%	25.97a	4.45bc	1.26bc	26.97a	3.39c	1.13cd
2.5%	24.05ab	5.04ab	1.65ab	24.49bc	5.12a	1.79ab
2%	22.85b	3.73c	0.99cd	24.00c	4.30bc	1.46bc
0%	20.13c	2.71d	0.59d	20.42d	2.84d	0.65d
LSD (5%)	2.50	0.99	0.52	1.99	0.81	0.53
Interactions						
PE Xco	NS	NS	NS	NS	NS	NS

*Means followed by the same letter within a treatment group are not statistically different at 5% level of probability using LSD. NS = Not Significant * = Significant at 5% probability level ** =Significant at 1% probability, PLH=Plant Height, FW= Fresh Weight, DW=Dry Weight, ANLE= Aqueous Neem Leaf Extract, AHLE=Aqueous Henna Leaf Extract, AGRE=Aqueous Ginger Rhizome Extract, AOBE=Aqueous Onion Bulb Extract, AGCE=Aqueous Garlic Clove Extract, PxC= Plant Extract and Concentration.*

Table 2a: Parts of Plant Used for the Experiment

Common Name	Scientific Name	Plant Parts	Active Compound
1. Neem	*Azadirachta indica*	Leaf	Azadrachtin
2. Garlic	*Allium sativum*	Clove	Allicin
3. Onion	*Allium cepa*	Bulb	Sulphur Compounds
4. Ginger	*Zingiber officinale*	Rhizome	Shogaol
5. Henna	*Lawsonia innermis*	Leaf	Lawsone