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YUSUFARI OASIS AND SAND DUNES ARE POTENTIAL RESOURCE FOR NATURE-BASE ECOTOURISM SITE IN YOBE STATE, NORTH-EAST NIGERIA

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Abstract

Yusufari called Tulo Tulo Oasis in Yobe State, North-East Nigeria, is a notable tourist destination, often referred to as the desert land of hope and best referred to as mini-Dubai. This breathtaking oasis and dunes combine natural beauty, a rich cultural heritage, and exciting, unique activities. This study sought to investigate the potential of the oasis in combination with dunes to draw the interest of both local and international tourists. This study clearly shows that by fully exploiting its tourism capabilities, as shown in Plates 1-6, the Yobe State Government and Nigeria can promote sustainable tourism, stimulate the local economy, generate employment opportunities, and showcase the natural beauty of this area.

Keywords: Oasis, Tourism, Destination, Sand Dunes Yobe State, Nigeria

INTRODUCTION

In the entire portion of the world, arid areas occupy 41% component of the earth's surface (Bauer, 2009). The tourism industry has now grown to be the world's largest industry and one of its fastest-growing economic sectors (Erturk, 2020). Ekundayo et al (2015) asserted that in an era of economic challenges, tourism is one of the few economic sectors in the world

growing strongly, driving economic progress in developing and developed countries alike and most importantly, creating much-needed jobs. A dune is an amount of sand formed by the erosional action of wind or water (Elhag et al., 2019). Dunes are creations from nature's dazzling handiwork. They are prominent geomorphological features of an arid environment whose morphological (shape, size, height, interdune distance), granulometric and

compositional characteristics in combination with their dynamics (Michel et al., 2018) make them irresistible tourist attractions. Nigeria is a nation rich in cultural and nature-based legacies derived from its diverse communities (Adekunle, 2024). This is because of its importance for research, education, tourism, history, economy, arts and the variety of plants and animal species. The natural environment influences tourists on anything interesting and valuable, as well as those who are interested in visiting tourist destinations, sightseeing, and gaining a new experience of a particular destination (Irawan et al., 2022). In Asia, activities like sledging, jogging, parasailing, paragliding, dune Camel/Horse riding, sandboarding, dune cycling, biking tour, Snorkelling/Scuba diving, Sailing and kayaking, bungee jumping, nature photography, cultural study, camping and village homestay have been practiced in Sikkim, Goa and Rajasthan in India (BharatGoGreen, 2023). Even though desert dunes in these destinations have pronounced the required physical characteristics that can support a variety of recreational activities. Oases are formed along the bank of the dry river. The Oases are largely spread in the Northern part of Yobe State and the Diffa region of the Niger Republic. The larger concentration of the oases is within the political boundary of Niger republic

Specifically Gudumaria District of the Diffa region. The most prominent Oases sites within the Nigerian boundary include Tulotulo, Kaska, Sosono, and Maimalari, among several others. Some scholars refer to these Oases as Manga grassland Oasis (Abubakar et al, 2021).

Based on the literature that has been gathered, indicated that there is a limited online information gap about Yusufari Oasis and dunes, hindering awareness, visibility and underreporting on its existing, making it a relatively unknown tourist destination. These motivate the

Researchers to produce and document online database which would explore and showcases the potentiality of the Oasis and dunes, locally and internationally as a tourist's destination hotspot and might not yet gained the same level of recognition as other popular tourist destination globally, but Tulo tulo oasis features fit viral publicity, Despite its unique landscape and cultural significance in Yusufari, Yobe State, Nigeria. This review work seeks to assess tourist alterations and expose their potential within the Yusufari Oasis tourist destination, and identify and geomorphological features of the dunes and oasis

STUDY AREA

Yusufari, is one of the Local Government Area in Yobe State, situated on the longitude 130 04'06" N and latitude 110 10'33" E it share a border in the north with the republic of Niger in the semi-arid region of north-east Nigeria, with high temperatures throughout the year often reaching 400 C (1040 F) with average annual rainfall of around 500 mm The terrain consists

of undulating plains, with elevations ranging from 322 m to 355 m (see: <https://en-Manga.com>, Fulani and other few tribes of people who have inhabited the area for centuries Articles connctnigeria.com (Anon, 2025). Ng.topographic-map.com/maps/ghff/Yobe. (Anon,2025). It has an area of 3,928 km² www.wikipedia.org (Anon, 2025).

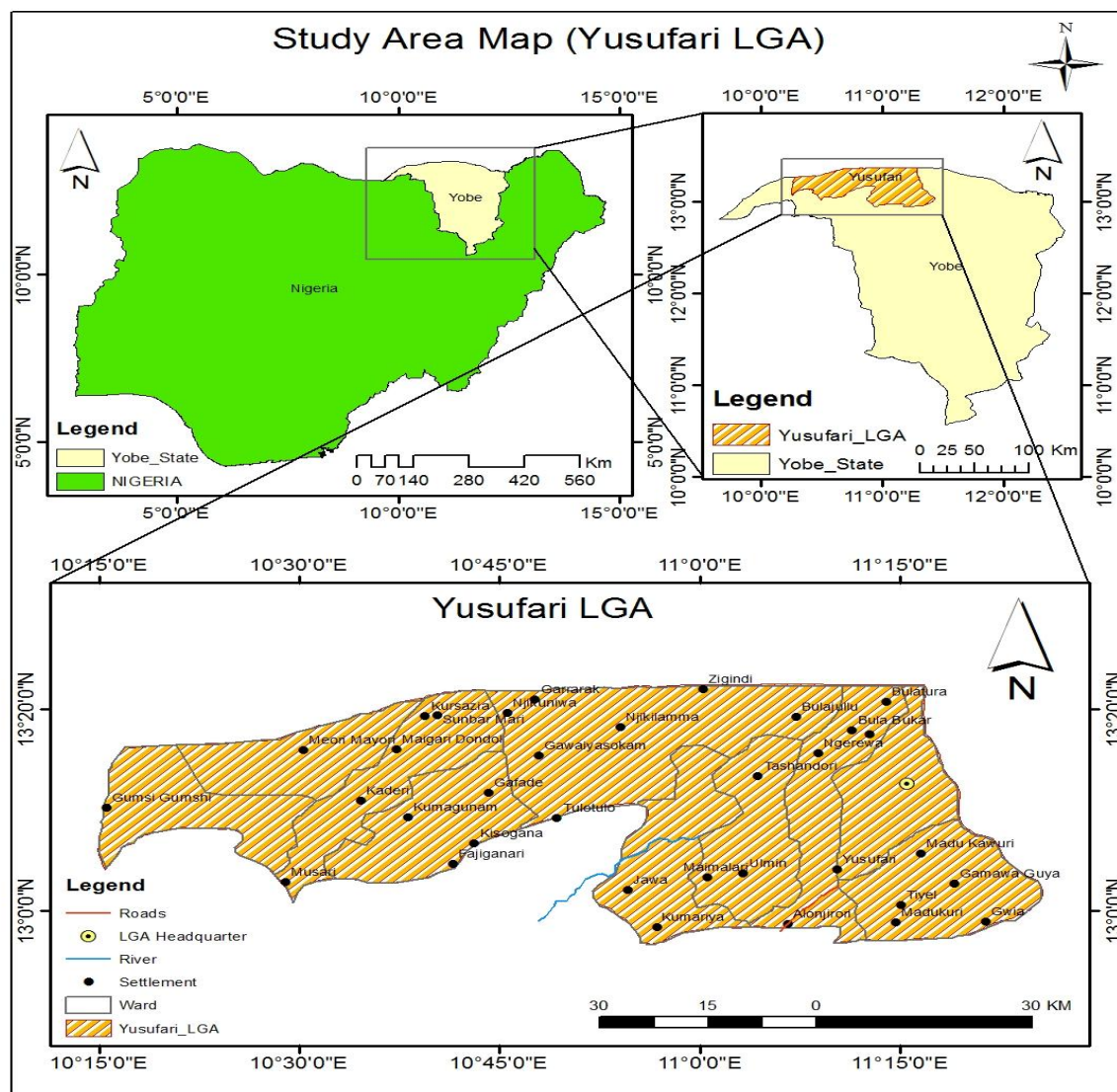


Figure: 1

Map of Nigeria, Showing the Location of Yusufari Local Government Area in Yobe State
Source: Agbo, (2025)

DESERT LAND OF HOPE (MINI DUBAI)

Yusufari have notable oasis refer to as the Tulo Tulo oasis or Yusufari oasis kenempres.org (Anon, 2025). The oasis is surrounded by rolling sand dunes and desert plain, creating stunning contrast between the lush greenery and the arid dessert landscape. The oasis is also home to the village of Tulo Tulo meaning marshy land with abundance of water and settled among the palm tree and hill

DESERT LAND OF HOPE (MINI DUBAI)

Yusufari has a notable oasis referred to as the Tulo Tulo oasis or Yusufari oasis (Anon, 2025). The oasis is surrounded by rolling dunes and desert plains, creating a stunning contrast between the lush greenery and the arid desert landscape. The oasis is also home to the village of Tulo, Tulo meaning marshy land with an abundance of water and is settled among the palm trees and hills. Tulo Tulo in Yobe state has immense tourism potential, boasting breathtaking natural beauty, rich cultural heritage, and exciting activities. This hidden gem is often referred to as the desert land of hop or 'Mini Dubai's Anon, 2025) due to its unique landscape and potential for tourism development, which is compared to the luxurious and modern. Natural oasis: Like Dubai's transformation from a desert oasis to a luxurious city, Yusufari Oasis is a natural haven in the desert, offering a serene

atmosphere where a megacity could be made or experimented with the Dubai government has established. This envisage may scare away possible intruders in search of earth minerals and scare resources from distant or foreign countries under disguises, such as what is experienced in the far north east and north west of Nigeria

1. Unique landscape: Yusufari's unique landscape, featuring dunes, Doum palm Hyphaene thebaica trees, and a natural spring, bears some resemblance to Dubai's iconic desert landscape.

2. Tourism potential: Yusufari Oasis has been identified as a Tourism potential destination, with opportunities for a luxury resort, recreational activities, and cultural experience, similar to Dubai's tourism industry.

3. Government initiative: The Nigerian government has initiated efforts to develop the Yusufari oasis into a tourist destination, drawing inspiration from Dubai's successful tourism model.

Some of the nature-based attraction sites of yusufari oasis

Oasis Pond: Visit the tranquil oasis pond surrounded by lush green vegetation, Doum Palm Hyphaene thebaica and palm tree,

offering a serene escape from the desert heat
article connectinnigeria.com (Anon, 2025).
Sand Dunes: Explore the majestic dunes which
can reach up to 30 metres (100 feet)
surrounding the oasis, perfect for sandboarding,
camel riding, or simply taking in the
breathtaking views Tulo Tulowa village
refineding.com (Anon, 2025).

Articlec onnctnigeria.com (2021) reported that
annually, Nigeria spends millions of naira to
experience the desert safari in Dubai. Here are
some reasons why it is called Mini Dubai. Of
course, tweets about this oasis' potential were
online as far back as 2013. Tour Nigeria had
tried to draw attention to the dunes in 2018
with a photo taken by Irene Backer. But its
potential was first captured in August 2019
when Muhammad Bukar Umara, a Nigerian
digital storyteller who specializes in
documentary photography.



Plate: 1 showcasing the Oasis with Doum Palm *Hyphaene thebaica*, trees and Grass surrounded by sand dunes in Yusufari Local Government Area
Tijjani Idriss Yusufari O. Nismate, (2025)..



Plate: 2 showcasing the Oasis narrowed pond surrounded by reddish undulating landscape and palm trees *Phoenix dactylifera*.
Source: Jelani and Moha (2023).



Plate: 3 showcasing pond oasis surrounded by sand dunes landscape, vegetation, Doum Palm *Hyphaene thebaica*, and other Acacia trees spp in Yusufari local government area
Source: Agbo, (2025)



Plate: 4 showcasing the pond oasis, scattered Doum Palm *Hyphaene thebaica* and (4x4 wheels), drive Jeep used in sand dunes area
Source Tijjani Idriss Yusufari Onismate, (2025)



Plate: 5 showcasing the Oasis pond with Doum Palm *Hyphaene thebaica*, Date Palm *Phoenix dactylifera* tree along the bank of the pond and surrounded by sand dunes in Yusufari Local Government Area
Source: Jelani and Moha (2023).



Plate: 6 showcasing Reddish Undulating Landscape this covers the unique reddish landscape, creating picturesque scenery that's perfect for photography and the visitor relaxing on the hill of web sand dunes in Yusufari Local Government Area.

Source: Tijjani Idriss Yusufari Onismate, (2025)

CONCLUSION

Annually, Nigerians spend millions to experience the desert safari in Dubai, but do you know that we have the same picturesque location right here in Nigeria, that is Yusufari Oases and Sand Dunes, which support different characteristics ranging from variable shapes, sizes, heights and colours. These characteristics would constitute its potential for ecotourism utilization. These potentials made oases and desert dunes exceptionally attractive compared to beach dunes, which are shapeless, heightless and single colour. Sand Dune's characteristics in the study area can support a range of ecotourism activities like hiking, sandboarding, camel riding, dune athletics, parasailing, paragliding and a host of other activities which will consolidate tourist satisfaction and improve revenue generation to achieve financial independence. The following recommendations are deemed fit based on the findings of this study.

i. Since desert oasis and dunes support varieties of ecotourism activities, which made it an avenue for luxury potential eco-destinations, there is a need for the provision of on-site or up-site accommodations, transportation and security facilities to access the area via 4-wheel drive and Giwa-Giwa vehicles. To cater to

tourists' expectations when visiting a chosen destination, there are several Departments /Ministries /Governments and Non-Government bodies that could play a significant role in improving the experience of tourists and making the place popular among tourists.

ii. Frequent monitoring of dunes' status in the study area should be carried out because dunes are mobile, and these characteristics that support sand-based ecotourism activities change over time due to the erosional action of wind.

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Table 1: Showing the Most Visited Countries by International Tourists

RANK	COUNTRY	REGION	TOURIST ARRIVAL 2011	TOURIST ARRIVAL 2010
1	France	Europe	79.5 Million	77.5 Million
2	United State	North America	62.3 Million	59.8 Million
3	China	Asia	57.6 Million	55.7 Million
4	Spain	Europe	56.7 Million	52.7 Million
5	Italy	Europe	46.2 Million	43.6 Million
6	Turkey	Europe Asia	29.3 Million	27.0 Million
7	United Kingdom	Europe	29.2 Million	28.3 Million
8	Germany	Europe	28.4 Million	26.9 Million
9	Malaysia	Asia	24.7 Million	24.6 Million
10	Mexico	North America	23.4 Million	23.3 Million

Source: Mejabi, (2015)



Effect of Dye and Drainage Waste Water on Growth of Some *Amaranthus Species* in Gashua, Yobe State.

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ABSTRACT

The textile industry plays a significant role in the economic development of African countries, including Nigeria. With its major contribution to the source of employment, foreign exchange earnings, and industrial output, hence considered a crucial component of the national economy. However, the growth of the textile industry has been accompanied by environmental challenges, precisely the management of wastewater generated during textile manufacturing processes. The arid and semi-arid zone of Nigeria, where irrigation practices are widely adopted, faces the most serious ecological and environmental problems arising from a shortage of water (drought) and many more, this study intend to use waste water from local textile industries and other places to test its effect on growth of some varieties of plants to ensure recycling and practice of zero waste. The experiment was carried out at the Department of Biological Science, Botanical Garden, Federal University Gashua, located at latitude 12°52'5" N and Longitude 11°2'47" E, Yobe State, Nigeria, to evaluate the effect of textile dye waste and drainage water on the growth of some *Amaranthus* species. The experiment was laid out in a completely randomized block design with two treatments and replicated three 3 times. Three (3) varieties of *Amaranthus* spp. were used: *Amaranthus caudatus*, *Amaranthus tricolor* and one Local check, *Amaranthus doguwa*. Varieties were screened using plastic pots. The parameters evaluated were: vegetative, physiological and growth. Finding reveals that a higher concentration of dye waste with a pH of 10.93 significantly inhibited growth, causing stunted development. The result of different concentrations of dye waste and drainage water on the growth parameters of plants, i. e plant height, number of leaves, and stem diameter across the weeks, shows that *Amaranthus caudatus* spp. has the highest plant height, *Amaranthus caudatus* produces the highest number of leaves, 10, while *tricolor* spp has the lowest number of leaves with 6. In stem diameter, *Amaranthus Caudatus* has the highest stem diameter of 1.2cm of while *tricolor* has the stem diameter of 0.6cm. The germination success of *Amaranthus* species indicated that *Amaranthus caudatus* has the highest percentage of 66% while Local check *Amaranthus* spp (*Doguwa*) has the lowest percentage of 53%. These findings highlight the need for proper waste management practices and water quality monitoring to safeguard crop production and food security in the area.

Keywords: Dye waste, Drainage waste, Drought, Recycling, and Zero Waste.

INTRODUCTION

Amaranthus species, commonly known as amaranths or pigweeds, are a group of plants cultivated for their fresh edible leaves and grains. These plants are valued for their nutritional content, adaptability to various environmental conditions, and relatively high tolerance to stress factors such as drought and poor soil quality (Akinola et al., 2020). In regions where agricultural land is limited or degraded due to industrial activities, amaranths offer a viable option for food production and soil remediation. However, the growth and productivity of amaranth plants can be adversely affected by several factors of environmental pollutants, ranging from those present in wastewater and industrial sources. Studies investigating the impact of industrial pollution on crops have reported reduced growth, yield losses, and physiological disorders in plants exposed to contaminated water and soil (Adekiya et al., 2018). Therefore, understanding the effects of dye waste and drainage water from textile industries on the growth of amaranths in Gashua, Yobe State, is crucial for assessing the risks to agricultural productivity and food security in the region.

The textile industry plays a crucial role in the economic development of many countries, including Nigeria. With its significant contribution to employment generation, foreign exchange earnings, and industrial output, the sector is considered a vital component of the national economy (Onuoha, 2020). However, the growth of the textile industry has been accompanied by environmental challenges, particularly concerning the management of wastewater generated during textile manufacturing processes.

Textile manufacturing involves various stages, including dyeing, printing, and finishing, all of which require substantial amounts of water. According to estimates, the textile industry is

one of the largest consumers of water globally, with an average water consumption of 100-150 liters per kilogram of textile produced (UNIDO, 2018). Along with water, the industry also consumes a wide range of chemicals, including dyes, detergents, and auxiliary agents, many of which end up in wastewater effluents discharged into water bodies (Nasir et al., 2021).

One of the most significant pollutants in textile wastewater is synthetic dyes. These dyes impart color to textiles but can pose serious environmental hazards if not properly managed. Synthetic dyes are complex organic compounds that are often resistant to degradation, making them persistent in the environment (Singh et al., 2019). When textile wastewater containing these dyes is discharged into water bodies without adequate treatment, it can lead to water pollution, affecting aquatic ecosystems and posing risks to human health (Okonkwo et al., 2019).

Nigeria, like many other developing countries, faces challenges related to the management of industrial wastewater, including textile effluents. The textile industry in Nigeria is concentrated in certain regions, such as Lagos, Kano, and Kaduna, where textile manufacturing clusters have emerged over the years (Nweze et al., 2018). However, the environmental impacts of textile industry activities, particularly concerning wastewater pollution, extend beyond these industrial clusters, affecting water resources and agricultural lands downstream (Singh et al., 2019).

Gashua, a town located in Yobe State, Nigeria, is home to several textile industries that discharge their effluents into nearby water bodies, including rivers and streams. The indiscriminate discharge of untreated wastewater containing dye residues and other pollutants raises concerns about the environmental and public health implications in

the region. Studies conducted in similar settings have documented elevated levels of heavy metals, organic pollutants, and other contaminants in soil and water samples collected near textile industrial areas (Okonkwo et al., 2019).

MATERIALS AND METHODS

Study Area

This study was conducted in the Department of Biological Sciences Biological Garden, which is located in the Central Laboratory Complex of Federal University Gashua, Yobe State, Nigeria. Gashua is located in the northern part of Nigeria, with geographical coordinates of 12°52'5" N and 11°2'47" E, with an average elevation of about 299 mm above the sea level (Saleh and Ahmed, 2019; Yuguda et al., 2020). The area experiences a semi-arid climate characterized by high temperatures and low rainfall. The study site was selected based on its significant presence of dyeing industries and accessibility for research purposes.

Sample Collection and Preparation

Dyeing waste and drainage water samples were collected from AISARA (Local Dyeing Industry) located at Sabon Gari Ward, Opposite Mass Transit, while the drainage water was collected at Gashua's largest gutter channel located at Katuzu ward toward the river Katuzu, Bade Local Government, Gashua, Yobe State. Samples were collected in clean, sterilized containers to prevent contamination. Care was taken in collecting representative samples from different sources to ensure the reliability of the analysis.

Before analysis, the collected samples were transported to the laboratory in coolers to maintain their integrity. Upon arrival at the laboratory, samples were stored at appropriate temperatures and subjected to preliminary analysis within 24 hours of collection.

Seeds of the *Amaranthus* species were obtained from the Bauchi State Agricultural Development Programme (BSADP) and subjected to surface sterilization to remove any external contaminants. The seeds were then germinated in petri dishes lined with filter paper moistened with distilled water, as the control, dyeing waste, and drainage water samples.

Treatment combination

A pot experiment was conducted to evaluate the effect of dyeing waste and drainage water on the growth and yield parameters of *Amaranthus* species. Plastic pots filled with a soil ratio of 2:1 of Sandy loam soil were used for the experiment.

15 seeds of the *Amaranthus* species were sown in the plastic rubber pots of 18cm length, and treatments were applied using different concentrations of dyeing waste, drainage water, and control (distilled water). The pots were arranged in a completely randomized design (CRD) with three replicates per treatment. The local dyeing wastewater was mixed with soil at four ratios (0, 0.5, 1, and 1.5 liters) with 500g of soil, respectively, and each pot was loaded with an equal percentage of soil/wastewater mixture. The 0% wastewater containing pot, i.e. pot filled with only soil, was used as a positive control to compare the impact of different ratios of wastewater on the growth of *amaranthus*. For irrigation, an equal volume of freshwater was applied twice to each pot in the morning and late evening. Under these controlled conditions, plants were grown for 42 days until their harvest. During this period, no

additional wastewater was applied. After 42 days, the plants were harvested carefully and taken to the laboratory for further analysis.

DATA COLLECTION

Germination success for different Amaranthus species was counted and recorded using a relationship: $\times 100$

Germination was monitored daily until no further germination was observed.

Plant height at maturity (cm)

Plant heights were measured for each variety every week with the help of a measuring tape, and the height was recorded.

Leaf number

The number of leaves was counted every week and recorded accordingly.

Stem diameter (cm)

The diameters of the stems were measured using thick sewing thread and a meter rule. The average values were recorded accordingly.

Statistical Analysis

Data obtained from the experiments were subjected to analysis of variance

(ANOVA) using appropriate statistical software. Mean separation was done using Duncan's multiple range test at $p < 0.05$. Results were presented as means \pm standard error of the mean (SEM) or standard deviation (SD) as applicable.

RESULT

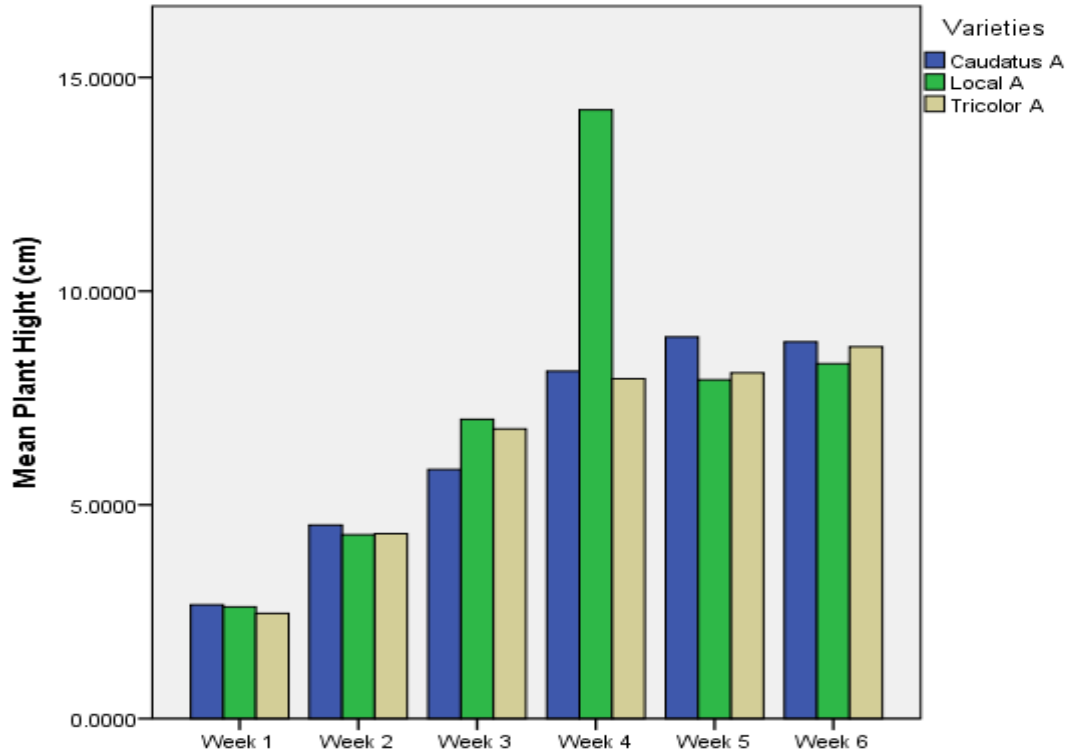
The result of the physicochemical properties of dye waste and drainage water was presented in Table 1: about eight different parameters were

measured. The result indicated that high pH was 10.93 in dye waste, which is highly alkaline and 6.15 in drainage water, which is mildly acidic in nature. The water temperature was 28 °C in the drainage water and 27 °C in the dye waste. The salinity was 8330ppm in dye waste and 119ppm in drainage water. Dissolved oxygen level was 8.20ppm in drainage water and 5.30ppm in dye waste. The electrical conductivity was 239cm in drainage water and 5.05cm in dye waste. Biochemical dissolved phosphate (PO₄) was 2.0ppm in drainage water and 0.18ppm in dye waste. Nitrate was not detected, and the chlorine was 35.5ppm in drainage water and 4.5ppm in dye waste.

Germination Success of Amaranthus species

The result of the germination success of Amaranthus species was presented in Table 2. below were counted and recorded. The result indicated that Caudatus amaranthus has the highest percentage of seed germination with 66% while the Local amaranthus has the lowest seed germination with 53%. The result of the effect of plant height in (cm) was presented in Figure 1, indicating that at week 1, Caudatus A. recorded the highest height of 3cm, while Tricolor A. had the lowest of 2.6cm. In week 2, Caudatus A. has the highest height of 4.8cm, while Local A. has the lowest of 4.6cm. In week 3, Local A. has the highest height of 7.5cm, while Caudatus A. has the lowest of 6cm. In week 4, Local A. has the highest height of 14.8cm, while Tricolor A. has the lowest of 7cm. In week 5, Caudatus A. has the highest height of 8.7cm, while Local A. has the lowest of 7cm. In week 6, Caudatus A. has the highest height of 8.6cm, while Local A. has the lowest of 7.3cm.

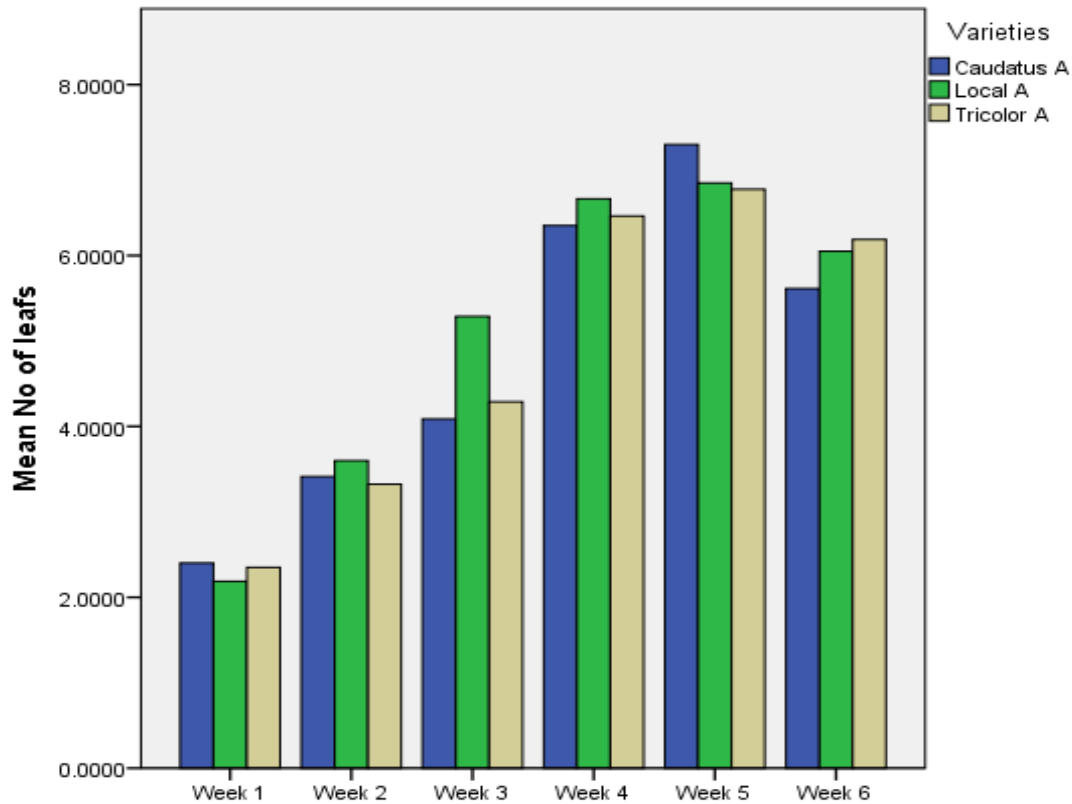
Figure 1: Effect of Plant Height (cm) on growth of some *Amaranthus species* under two different treatment (drainage and dyeing waste water)



The result of the effect of the number of leaves on the growth of *Amaranthus species* is presented in Figure 2: below. The result indicated that in week 1, *Amaranthus caudatus* has the highest number of leaves recorded, with 3 different leaves, while Local A. has the lowest leaf number of 2. In week 2, Local A. has the highest number of 4 leaves, while Tricolor has the lowest number of 3 leaves. In

week 3, Local A. has the highest number of 6 leaves, while Caudatus A. has the lowest number of 4 leaves. In week 4, Local A. has the highest number of 7 leaves, while Caudatus A. has the lowest number of 6 leaves. In week 6, Tricolor has the highest number of 6 leaves, while Caudatus A. has the lowest number of 5 leaves

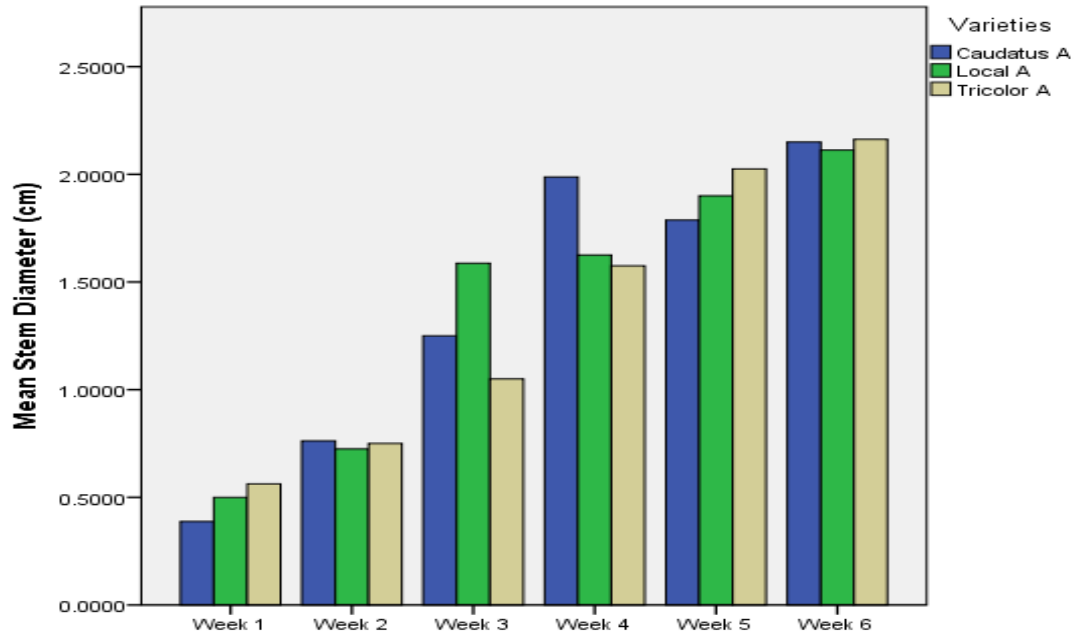
Figure 4.4: Effect of Plant Leaf Number on growth of some *Amaranthus* species under two different treatment (drainage and dyeing waste water)



The result of the effect of stem diameter on the growth of *Amaranthus* species was presented in Figure 4.5 above. The result shows that in week 1, Tricolor A. has the highest stem diameter of 0.6cm, while Caudatus A. has the lowest of 0.4cm. In week 2, Caudatus A. has the highest of 0.8cm while Local A. has the lowest of 0.7cm. In week 3, local A. has the highest of 1.3cm while Tricolor A. has the lowest of

1.0cm. In week 4, Caudatus A. has the highest of 2.0cm while Tricolor A. has the lowest of 1.5cm. In week 5, Tricolor A. has the highest of 2.0cm, while Caudatus A. has the lowest of 1.7cm. In week 6, Caudatus A. and Tricolor A. have the same increase of 2.3cm while Local A. has the lowest of 2.1c m

Figure 4.5: Effect of Plant Stem Diameter (Cm) on growth of some *Amaranthus* species under two different treatment (drainage and dyeing waste water)



A one-way Analysis of variance (a one-way ANOVA) was conducted to compare the effect of dyeing water and drainage water on the growth and development of *Amaranthus* species. There's a significant difference at $p < 0.05$ in the plant height, number of leaves, and the development of stem diameter with $F(119,24) = 1.781$, $P = 0.025$, $F(119,24) = 11.787$, $P = 0.000$, and $F(79,64) = 6.859$, $P = 0.000$, respectively

DISCUSSION

The effect of dye waste and drainage water on the growth of *Amaranthus* species was studied using growth parameters such as height, number of leaves and stem diameter. The result of different concentrations in weeks 1 to 6 on the height of *Amaranthus* plant (Figure 4.3) indicated that *Caudatus Amaranthus* had a better height because there was no stress from wastewater. This agrees with the earlier work

done by Murtaza et al. (2019), use of saline-sodic water for sustainable irrigation and is different from the work earlier done by Akbar et al. (2007) effect of marble industry effluence on seed germination. The number of leaves per plant is one of the good parameters for indicating the successful growth of a plant or not. Here, the result shows that the Local Amaranthus has the highest number of leaves across the weeks. This study agrees with the work of Adegbile et al. (2021), who work on the impact of heavy metals on soil and Amaranthus species growth in contaminated soil and is different from the work done by Judd et al. (2008), who work on plant systematics. Stem diameter also indicates the growth performance of the plant. The result of the study indicated that there is a significant increase in stem diameter across the week, where Caudatus and Tricolor Amaranthus had a better increase in stem diameter than the Local Amaranthus, which agrees with the finding of Sairam et al. (2002). Differential response of wheat genotype to long-term salinity stress in relation to oxidative stress, which is different from the work in Singh et al. (2015), who work on toxicity assessment of textile industry

effluent and its possible bioremediation options. Further, the lack of nitrate detection in both water sources could suggest limited nitrogen availability, which is essential for plant growth, particularly leaf development (Sharma et al., 2016). However, the better growth performance of Amaranthus species under drainage water irrigation, despite the absence of nitrates, highlights the relative importance of other factors like salinity, pH, and dissolved oxygen in determining plant growth outcome. These findings suggest that high levels of salinity and alkaline pH in dye wastewater are primary growth inhibitors, corroborating the work of Singh et al. (2015), who also reported reduced growth in plants irrigated with effluent from the textile industry due to elevated salinity and pH levels. Therefore, while drainage water offers more favorable conditions for the growth of Amaranthus species, the dye wastewater hinders growth due to its adverse chemical composition



Plate 1: Different of Amaranthus Spp before sowing.

CONCLUSION

The study indicated that the Amaranthus plant in the nursery stage demonstrated a growth pattern that is potentially related to the number of weeks it was planted; this was the same for height, number of leaves, and stem diameter. The controls for both the number of leaves, height, and stem diameter were uncharacteristically higher than those with dyeing wastewater applied. This probably could be due to the limited number of weeks sampled (six weeks) for this study, and the concentration of some physicochemical parameters in the dyeing wastewater that are above the maximum permitted or allowable limits, which can hinder

the development of plants. However, there was no significant statistical variation observed in growth performance in terms of height, number of leaves, and stem diameter of the remaining treatments that had concentrations of dyeing waste water.

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Table 1: Physicochemical properties of Dye waste and Drainage water

DYE WASTE WATER			DRAINAGE WATER	
S/N	PARAMETER	RESULT	RESULT	
1	P.H	10.93	6.15	
2	Temperature	27	28	
3	Salinity	8330ppm	119ppm	
4	Dissolved Oxygen	5.30ppm	8.20ppm	
5	Electrical Conductivity	5.05cm	339cm	
6	Biochemical Dissolved Phosphate (PO ₄)	0.18 ppm	2.20ppm	
7	Nitrate	Not Detected	Note Detected	
8	Chlorine	4.5ppm	35.5ppm	

Table 2: Germination Success of *Amaranthus species*

Varieties	Week 1	Week 2	Week 3	Total % of Germination
Caudatus <i>Amaranthus</i>	10	10	10	66%
Tricolor <i>Amarathus</i>	10	9	8	60%
Local <i>Amaranthus</i>	8	9	8	53%