Effect of Foliar Fertilizer Application on Agro Physiological Characteristics and Herbage Yield of Some Selected Leafy Vegetables

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Abstract

One- third of children deaths in Africa are attributable largely to protein energy malnutrition and micronutrient deficiencies which can be solved by exploring underutilized nutritious crop. Experiment was conducted at the Crop Production Screen House and Albishiri Irrigation Farm both in Minna during the dry Season of 2021. The objective was to determines the effect of application of organic foliar fertilizers rates on physiology and yield response of leafy vegetables in Minna. The experiment consisted of factorial combination of (10 treatments) in completely randomized design and five rates of foliar fertilizer 0 L ha^{-1}, 0.5 L ha^{-1}, 1.0 L ha^{-1}, 1.5 L ha^{-1} and 2.0 L ha^{-1} and total of 40 pots. Data were collected on plant height, number of leaves, fresh shoot weight and dry weight, leaf area The results indicated that, the effects of organic foliar fertilizer rates on plant height at 4,5 and 6 WAS rate of 2.0 L ha^{-1} produced significantly taller Plant Height and this was also similar to Number of Leaves, Dry Shoot Weight at 4,5,6 WAS respectively results shown that vegetable seeds had significant effects on fresh weight and dry weight of the harvested vegetable while foliar application at 1.0 L ha^{-1}, recorded the lowest plant height, Number of Leaves respectively it is therefore recommended that farmer should adopt the application of organic foliar fertilizer(Super Agro) at the rate of 2.0 L ha^{-1}.

Keywords: Foliar Fertilizer, Amaranthus, Corchorus, Irrigation, Herbage yield

Introduction

Vegetables refers to the fresh, edible part of a plant that can be consumed raw or cooked (Ward, 2016). This can be classified into fruit vegetables such as tomatoes, cucumber, okra; root and tuber vegetables such as potato, sweet potato, radish; green leafy vegetables such as amaranthus, celery, cabbage and bulb vegetables such as onion, garlic and shallot (Abewoy, 2018). Vegetables are important for nutrition in terms of bioactive nutrient molecules like dietary fiber, vitamins, and minerals (Keatinge *et al.*, 2011). They are resources for overcoming micronutrient deficiencies and provide smallholder farmers with much higher income and more jobs (Abewoy, 2018). Vegetable are produced all over the world but in a varied extent. Asia is the largest vegetable producer. China and India is the two largest vegetable producer of Asia covering 62 % of world's total production with an individual country contribution of 554 and 127 million metric tons respectively (Shahbandeh, 2020). However, on the way of achieving higher yield, they face various challenges such as climate change impacts (Kabir, 2015). Therefore the objectives are to determine the effect of foliar application of organic fertilizer rates on physiology and yield responses of leafy vegetables, to investigate the factors that influence utilization and production of the leafy vegetables. Evaluate the nutritional quality of leafy vegetable under the application of different rates of foliar fertilizer

Materials and Methods

Experimental Site

The experiment was conducted in the dry season of 2021 at the Crop Production Screen House Federal University of Technology and Albishiri Irrigation Farm both Minna ($9^{O}37'$N, $6^{O}28'$E). In the Southern Guinea Savanna of Nigeria.

Soil Collection and Sampling for fhe Field experiment

Soil samples was collected at random across the experimental site at the depth of 0 – 15cm along a transect and then bulked together to form the composite sample.

Experimental materials

Landraces of Amaranthus and corchorus varieties was obtained from the irrigation farmers in Minna

Niger State and it was used for the experiment.

Source of foliar fertilizer and its active ingredient

Foliar fertilizer was obtain from an Agro- chemical shop in Minna. The Super gro fertilizer contained Nitrogen 72 g, Phosphorus 45 g, Potassium 30 g, Sulphur 15 g, Calcium 9 g, Magnesium 7 g, Iron 5 mg, Iodine 3 mg, Marine 1 mg and Zinc 1 mg per litre.

Treatments and experimental design

The screen house experiment were factorial combination tlaid out in a completely randomised design (CRD)o vegetables varieties(Amaranthus and Corchorus) and five rate of foliar fertilizer (Super Gro) (0 L ha^{-1}, 0.5 L ha^{-1}, 1.0 L ha^{-1}, 1.5 L ha^{-1} and 2.0 L ha^{-1}). a total of 40 (pots) treatments. The field experiment was a factorial combination laid out in a randomized complete block design (RCBD) with three replications.

Land preparing and check basin construction

The land will dig, ploughed and levelled. Then check basins of 3 m x 3 m was constructed. The gross plot size was 3m x 3m (9 m^2) and a net plot of 1.5 m x 3 m (4.5 m^2). An alley of 0.5 m was left between treatments and replicates.

Watering of pots and irrigation of plots

The pots were watered (3liter) before planting and watered as when required to ensure the pots are kept moist. Watering was done every other day until harvest. In the field, the plots was irrigated a day to planting and immediately after planting. Irrigation continue twice in every week. The field was irrigated to field capacity at each time of irrigation.

Data collection

Growth parameters

Five plants in each treatment plot will be randomly selected and tagged for the measurements of growth parameter (Plant height, number of ;leaves, stem girth, number of branches, leaf area) at 2, 3, 4 and 5 WAS. The length and breadth of the leaves were multiplied by a constant of to obtain the leaf area the length and width of five leaves from the base to the tip of the plant was measured for each tagged plant and multiplied by a constant to obtain this parameter. The mean was calculated and recorded.

Fresh shoot weight (kg ha^{-1})

The effect of foliar applied foliar fertilizer rates on fresh shoot weight of some vegetables grown under screen house is shown in table . The foliar fertilizer rates had a significant effect on fresh shoot weight, such that the application of foliar fertilizer at the rates of 2.0 L ha^{-1} produced heavier fresh shoots than all the other application rates compared with the control (0 L ha^{-1}) and the application rate of 0.5 L ha^{-1} which produced similar lightest fresh shoots.

Dry shoot weight (kg ha^{-1})

The effect of foliar applied foliar fertilizer rates on dry shoot weight of some vegetables grown under screen house is shown in Table 4.16. Dry shoot weight differed significantly among the foliar fertilizer rates. The application of foliar fertilizer at the rate of 2.0 L ha^{-1} produced significantly heavier shoots than all the other application rates compared with the control (0 L ha^{-1}) and the application rate of 0.5 L ha^{-1} which produced statistically similar lightest shoots.

Moisture content

The effect of foliar applied foliar fertilizer rates on moisture content of some vegetables grown under screen house is shown in Table 1 Moisture content was not significantly different among the foliar fertilizer rates. Moisture content did not differ significantly among the vegetables tested in this study

Ash content

The effect of foliar applied foliar fertilizer rates on ash content of some vegetables grown under screen house is shown in Table Ash content differed significantly among foliar fertilizer rates. The application of foliar fertilizer at the rate of

2.0 L ha^{-1} produced significantly higher ash content similar with the application rate of 1.0 L ha^{-1} compared with the control, application rates of 0.5 and 1.5 L ha^{-1} which produced similar lowest ash content.

Fat content

Screen house is shown in Table. The foliar fertilizer rates had a significant effect on fat content. The application of foliar fertilizer at the rate of 2.0 L ha^{-1} produced significantly higher fat content similar with the application rate of 1.5 L ha^{-1} compared with the control (0 L ha^{-1}) which produced the lowest fat content

Crude protein

The effect of foliar applied foliar fertilizer rates on crude protein content of some vegetables grown under screen house is shown in Table 4.20. The foliar fertilizer rates had a significant effect on crude protein content.

Crude fibre content

The effect of foliar applied foliar fertilizer rates on crude fibre content of some vegetables grown under screen house is shown in theTable. The foliar fertilizer rates had a significant effect on crude fibre content.

Data analysis

Data collected were subjected to Analysis of Variance (ANOVA) using the Statistical Analysis

System (SAS) package version 9.0 (2013) means were separated using Duncan Multiple Range Test (DMRT) at P≥0.05.

Table 1 Effect of foliar application of foliar fertilizer rates on plant height of Corcurus and Amranthus at 4, 5 and 6 WAS

	Plant height (cm)		
	Weeks after sowing		
Treatment	4	5	6
Fertilizer (F) (L ha^{-1})			
0	28.85c	39.23c	46.95c
0.5	40.81b	60.18a	66.60b
1.0	50.85a	59.60a	67.60b
1.5	41.39b	52.43b	72.37a
2.0	51.83a	63.97a	73.60a
SE±	1.82	2.24	1.24
Vegetables (V)			
Amaranthus	58.62a	77.06a	89.92a
Corchorus	26.87b	33.11b	40.92b

SE±	1.15	1.42	0.78
Interaction			
F × V	**	**	**

Means with the same letter(s) under the same column are not significantly different from each other at P≤ 0.05 by DMRT.

Table 2 Interaction between foliar application of foliar fertilizer rates and vegetables on plant height at 4 and 5 WAS under irrigation

	Vegetable	
	Amaranthus	Corchorus
Fertilizer (F) (L ha^{-1})	**4 WAS**	
0	3.45g	8.59f
0.5	21.78c	10.59ef
1.0	35.76a	12.90def
1.5	30.82b	14.87de
2.0	31.79ab	15.40d
SE±	2.09	
	5 WAS	
0	23.98c	11.30e
0.5	42.29b	15.87de
1.0	53.62a	19.12cde
1.5	40.87b	22.08cd
2.0	55.55a	23.57cd
SE±	3.63	

Any two means within a column and row not sharing a letter differ significantlyfrom each other at 5 % probability level by DMRT.

Table 3 Interaction between foliar application of foliar fertilizer rates and vegetables on plant height at 4, 5 and 6 WAS grown under screen house

	Vegetable	
	Amaranthus	Corchorus
Fertilizer (F) (L ha^{-1})	**4 WAS**	
0	34.77c	22.93e
0.5	54.79b	26.83de

1.0	74.69a		27.00de
1.5	57.01b		25.77de
2.0	71.83a		31.83cd
SE±		2.57	
		5 WAS	
0	52.66c		25.80e
0.5	87.56a		32.80de
1.0	84.57a		34.63d
1.5	70.69b		34.17d
2.0	89.81a		38.13d
SE±		3.17	
		6 WAS	
0	62.13d		31.77h
0.5	94.99bc		38.20g
1.0	93.36c		41.83fg
1.5	99.97a		44.77ef
2.0	99.15ab		48.04e
SE±		1.75	

Any two means within a column and row not sharing a letter differ significantly from each other at 5 % probability level by DMRT.

Discussion

Effect of foliar applied foliar fertilizer rates on growth, yield and nutritional quality

The tallest plants, highest number of leaves per plant, widest leaves, bigger stems, heavier fresh shoots and roots, heavier dry shoots and roots obtained with the application of foliar fertilizer (Super gro) at the rate of 2.0 L ha^{-1} could be attributed to the availability of sufficiently high content of macro and micro nutrients in the foliar fertilizer which in turn provided the plants with required nutrient that may be insufficiently supplied through the root system in the soil. This finding is in conformity with the results of Shafeek *et al.* (2013) who reported that the superiority of highest levels of Stimufol foliar nutritional compound fertilizer at the highest levels of 200 g/fed in enhancing plant growth may be attributed to its high contents of macro and micro nutrients which provides the plants with required nutrients which one or more of them were insufficiently supplied through the root system in such low fertile soil. The authors also stated that foliar feeding is often the most effective and economical way to correct plant nutrient deficiencies. Abou-El-Nour (2002) reported that foliar application of nutrients could improve the nutrient utilization and lower environmental pollution through reducing the amounts of fertilizer added to soil.

Conclusion

From the results obtained from this study, it is concluded that the application of foliar fertilizer at the rate of 2.0 L ha^{-1} generally recorded significantly taller plants, higher number of leaves, wider stems and leaves, heavier fresh and dry fruits, higher ash content, crude protein content, fat content and crude fibre content under both screen house and irrigation conditions though statistically similar with application rates of 1.0 and 1.5 L ha^{-1} than the control (0 L ha^{-1}) which had the shortest plants, lowest number of leaves per ant, smallest stems and leaves, lighter fresh and dry shoots and roots and lowest nutritional parameters

measured in this study. Based on the context of this study, it is recommended that farmers in this agro- ecological zone of Nigeria should adopt the foliar application of foliar fertilizer (Super gro) at the rate of 2.0 L ha^{-1} for higher growth, yield and nutritional qualities of Amaranthus and Corchorus

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