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Original Article

Comparative studies of vegetative growth and nutritional properties of two basils (*Ocimum gratissimum* L. and *Ocimum basilicum* L.)

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ABSTRACT

This study assessed the influence of super grow concentrations on the vegetative growth and nutritional values of two species of *Ocimum*. The experiment was laid out in a completely randomized design (CRD) in ten replications with four treatments of Super-grow (a liquid organic nutrient) with varied concentrations (T1: 5 ml, T2: 10 ml, T3: 15 ml, and Control: 0 ml). The two species of *Ocimum* leaf seedlings were nursed for five weeks and transplanted into pots. Data was collected on ten randomly selected plants, which included the number of leaves, leaf area, and plant height (cm). Matured plants were also evaluated for selected nutritional properties. Results showed that plant height and number of leaves of *O. gratissimum* across the nutrient concentrations were significantly longer and higher, respectively, compared to *O.* while, 10ml/litre nutrient concentration gave the optimal for both parameters. However, the leaf area of *O. basilicum* across the nutrient concentrations was significantly wider than that of *O. gratissimum*, while, 10ml/litre nutrient concentration gave the optimal leaf area. The results of the proximate showed that moisture content was higher in *O. basilicum* (63.9%) compared to *O. gratissimum* (60.53%) in plants that did not receive super-grow. *O. gratissimum* has a higher percentage of crude fiber (2.16) compared to *O. basilicum* (2.06). For carbohydrate, magnesium, copper, and cadmium, both species of *Ocimum* did not differ significantly ($P < 0.05$).

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K E Y W O R D S : *Ocimum spp, Lamiaceae, Nutritional properties, phytochemicals, Super-grow*

INTRODUCTION

Vegetables are the edible sections of herbaceous plants that are consumed whole or in pieces, raw or cooked, as a side dish or salad, they can also be a fragrant, bitter, or insipid (Monari *et al*, 2021). The various part of the plant such as the leaves, stalk, roots, seeds and bulbs contribute to human nutrition. Leafy vegetables, on the other hand, are high in macro and micro nutrients, which are important for sustaining a healthy lifestyle. Leafy vegetables are common elements in the ordinary Nigerian's diet and supply significant amounts of nutritious nutrients (Ajayi *et al.*, 2018). Despite the fact that they are mostly water, green vegetables are a real natural pharmacy of minerals, vitamins, and phytochemicals (Alam *et al.*, 2020).

*Ocimum basilicum, (*formerly *O. americanum*) is also locally called "efirin wewe" in Yoruba and commonly referred to as American basil (Bep, 1982). *0cimum*

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basilicum is used as spice in local dishes and even earned the name sweet basil. When added to boiling meat, it gives it a very nice smell and also adds flavor to the cooked meat (Sofowora, 1982). Extract from this plant is useful as pesticides, this plant when planted around human habitation is used to drive snakes away from the neighborhood (Sofowora,1982). *Ocimum grastissimum* is a herbaceous plant of the *Lamiaceae* family (Piras *et al.*, 2018). It is widespread in tropical and warm-weather locations (Okigbo Piras *et al.*, 2018). *O. grastissimum* is cultivated in gardens and used as a fever-relieving tea leaf (Mgbemena and Amako, 2020). It is germicidal and is widely used in toothpastes, mouthwashes, and topical ointments (Awosolu *et al.*, 2018; Alaba & Sokunbi, 2018). It works well as a gargle for sore throats and tonsillitis. It's also utilized as a cough suppressant and expectorant. The plant extract is used to treat animal and human gastrointestinal helminths (Alaba & Sokunbi, 2018). According to phytochemical investigations, both aqueous and methanolic extracts of *Ocimum grastissimum* are high in tannins, steroids, terpenoids, flavonoids, and hydrogencyanide, and have a high antioxidant activity (Zareiyan and Khajehsharifi, 2022).

Given the importance of these herbs in people's diet and health, super-grow (liquid organic nutrient) was used because it promotes plant growth and development, it enhances soil water holding capacity, aeration and fertility and also the release of nutrients is slower, but long lasting, as compared to inorganic fertilizers, which are frequently lost quickly through leaching in porous soil and heavy rainfall locations. Hence, this study evaluated the influence of super-grow concentrations on the growth, the proximate and selected minerals in *Ocimum grastissimum* and

0cimum basilicum. Their growths, and their nutritional contents were also compared.

Figure 1: Picture showing *Ocimum basilicum*

Fig 2: Picture showing *Ocimum gratissimum*

MATERIALS AND METHODS

Study Area

The experiment was carried out at the screen house of College of Agriculture (Latitude 7^0, $52'37^0$ N and Longitude 4^0, $18'13$, 76^0 E) Osun State University, Nigeria. The pot experiment was set up under the temperature range of 25ºC to 35ºC. The soil type was a well drained sandy-loam.

Experimental Design

The experiment was laid out in a two-factor factorial Complete Randomized Design (CRD) in ten replications with four concentrations (T1: 5ml, T2: 10ml, T3: 15ml, and Control T4: 0ml) of super-grow (organic liquid nutrient).

Collection of Planting Materials

The two species of *Ocimum* seedlings were sourced from the department of Agronomy, Osun State University, Osogbo, Nigeria, nursed for five weeks and were transplanted into each pots at the nursery house. Weeds were handpicked and irrigation was done regularly at the same rate. Super-grow (organic nutrient source) at different rates were applied every two weeks.

Data Collection

From each replication, data was collected on ten randomly selected plants. Parameters were taken using The International Plant Genetic Resources Institute (IPGRI) (2003) guides, which includes:

Plant Height: The length of the plant was determined by measuring the base of the plant to the highest point.

***Number of leaves*:** The number of leaves was determined by direct counting.

Leaf Area: The length and width of the leaf was measured then multiplied together.

Laboratory Analyses

The proximate including: moisture content, ash, crude fat, crude fibre, crude protein and carbohydrate were determined according to the AOAC method (AOAC, 2000). Mineral contents of samples were determined by atomic absorption spectrophotometer (AAS) according to the methods of AOAC (2003).

Statistical Analysis

Data collected were subjected to one-way analysis of variance (ANOVA) using SAS 2011, where significant differences were found, the means were separated using Duncan Multiple Range Test (DMRT).

RESULTS

Vegetative growth parameters of *O. gratissimum* and *O. basilicum*

Table 1 presents vegetative growth parameters of *O. gratissimum* and *O. basilicum* under different concentrations of the organic nutrient used. Results showed that plant height (28.9-29.5 cm) and number of leaf (167-190) of *O. gratissimum* across the nutrient concentrations were significantly longer and higher compared to *O. basilicum*,(24.4-30.7cm) and (44.6-47.6) respectively while, 10ml/litre nutrient concentration gave respective optimal values for both parameters. However, the leaf area of *O. basilicum* (16.2-18.8) across the nutrient concentrations was significantly wider than that of *O. gratissimum*, (4.3-4.6). 10ml/litre nutrient concentration gave the widest leaf area in both species compared to plants that were sprayed with other concentrations.

Table 1: Vegetative Growth parameters of *O. gratissimum* L.and *O. basilicum* L. under different concentrations of super-grow

	***Ocimum gratissimum* L.**				***Ocimum basilicum* L.**			
Parameters	**5ml**	**10ml**	**15ml**	**Control**	**5ml**	**10ml**	**15ml**	**Control**
Height (cm)	29.29^{a}	29.47^{a}	28.93^{a}	29.38^{a}	24.77^{c}	30.74^{b}	24.67^{c}	24.41^{c}
No of leaves	186.0^{a}	190.0^{b}	173.7^{bc}	167.0^{c}	44.6^{d}	45.8^{d}	47.56^{d}	46.4^{d}
Leaf area	4.59^{b}	4.37^{b}	4.28^{b}	4.49^{b}	16.19^{a}	18.80^{a}	16.56^{a}	17.57^{a}

^{abc} Means on the same row with different superscript are significantly different (P<0.05)

Proximate content of *Ocimum gratissimum* L. and *Ocimum basilicum* L. under different concentrations of super-grow

Table 2 presents the proximate analysis of *Ocimum gratissimum* L. and *Ocimum basilicum* L. as influenced by different concentrations of super-grow with means on the same row with different superscript signifying significant difference (P<0.05). Moisture content (%) was significantly highest for *O. basilicum* at 0ml of super-grow with a mean value of 63.9and lowest at *Ocimum gratissimum* at 5ml of super-grow with a mean value of 60.53. Ash content (%) was highest at *Ocimum gratissimum* at 10ml of super-grow with a mean value of 1.05 and lowest at *Ocimum basilicum* at 5ml of super-grow and *Ocimum basilicum* at 0ml of super-grow with a mean value of 0.96. *O. gratissimum* at 15ml of super-grow was highest with a mean value of 2.11 for Crude fat (%), followed by *O. basilicum* at 15ml of super-grow with a mean value of 2.04 and was significantly lowest at *O. gratissimum* at 5ml of super-grow with a mean value of 1.67. Crude fibre (%) was significantly highest at *O. gratissimum* at 15ml of super-grow with a mean value of 2.16 and was lowest at *O. basilicum* at 15ml of super-grow with a mean value of 2.06. *O. basilicum* at 0ml of super-grow was significantly highest with a mean value of 3.15 for Crude protein (%), followed by *O.* at 0ml of super-grow with a mean value of 3.02 and lowest at *O. basilicum* at 5ml of super-grow with a mean value of 2.87. Carbohydrate (CHO) was significantly highest at *O. gratissimum* at 5ml of super-grow and *O. basilicum* at 5ml of super-grow with a mean value of 31.79 and lowest at *O. basilicum* at 0ml of super-grow with a mean value of 27.96. Calorie was significantly highest at *Ocimum basilicum* at 5ml of super-grow with a mean value of 134.65followed by *Ocimum gratissimum a*t 5ml of super-grow with a mean value of 134.47 and lowest at *O. basilicum* at 0ml of super-grow with a mean value of 123.85.

Table 2: Proximate content of *Ocimum gratissimum* L. and *Ocimum basilicum* L. under different concentrations of super-grow

	***Ocimum gratissimum* L.**				***Ocimum basilicum* L.**			
Parameters	**5ml**	**10ml**	**15ml**	**Control**	**5ml**	**10ml**	**15ml**	**Control**
Moisture content(%)	60.53 ±1.2^{c}	63.47 ±0.8^{ab}	63.3 ±0.9^{ab}	63.47 ±0.7^{ab}	60.57 ±1.1^{c}	63.33 ±0.8^{ab}	63.30 ±0.6^{b}	63.9 ±0.5^{a}
Ash (%)	1.01 ±0.04^{ab}	1.05 ±0.03^{a}	1.03 ±0.02^{a}	1.00 ±0.04^{ab}	0.96 ±0.03^{b}	1.03 ±0.02^{a}	0.99 ±0.03^{ab}	0.96 ±0.02^{b}
Crude fat (%)	1.67 ±0.15^{g}	1.97 ±0.12^{c}	2.11 ±0.10a	1.96 ±0.11^{cd}	1.69 ±0.14^{f}	1.94 ±0.13^{e}	2.04 ±0.12^{b}	1.95 ±0.11^{de}
Crude fibre (%)	2.12 ±0.08^{b}	2.15 ±0.07^{ab}	2.16 ±0.06^{a}	2.15 ±0.07^{ab}	2.12 ±0.08^{b}	2.08 ±0.09^{c}	2.06 ±0.08^{c}	2.07 ±0.07^{c}
Crude protein (%)	2.88 ±0.12^{f}	2.94 ±0.10^{e}	3.01 ±0.09^{c}	3.02 ±0.08^{c}	2.87 ±0.11^{f}	2.98 ±0.09^{d}	3.11 ±0.08^{b}	3.15 ±0.07^{a}
CHO (%)	31.79 ±1.1^{a}	28.42 ±0.9^{bc}	28.36 ±0.8^{bc}	28.49 ±0.9^{bc}	31.79 ±1.0^{a}	28.65 ±0.8^{b}	28.50 ±0.7^{bc}	27.96 ±0.6^{c}
Kcal (g)	134.47 ±2.5^{a}	125.12 ±2.1^{bc}	126.22 ±1.9^{b}	125.52 ±2.0^{bc}	134.65 ±2.3^{a}	125.79 ±2.0^{bc}	126.36 ±1.8^{b}	123.85 ±1.7^{c}

^{abc} Means on the same row with different superscript are significantly different (P<0.05)

Mineral analysis of *Ocimum gratissimum* L. and *Ocimum basilicum* L. under different concentrations of super-grow

Table 3 presents mineral analysis of *Ocimum gratissimum* and *Ocimum basilicum* as influenced by different level of super-grow nutrient concentrations. Potassium (mg/100g) ranged from 1314-1324 across in the species and across all super-grow concentrations. Sodium (mg/100g) in the two species at both 0ml and 15 ml super-grow concentrations (66.5-69.9). The same trend was observed in Calcium (mg/100g) which ranged from 2.64-280 at both 0ml and 15 ml super-grow concentrations for both species evaluated. Phosphorus (mg/100g) was significantly higher (3.85-4.05) in *Ocimum gratissimum* at all levels of super-grow concentrations compared to *Ocimum basilicum* (3.75-3.86). Magnesium content (mg/100g) for both *O. gratissimum* and *O. basilicum* at was lowest at 5ml of super-grow concentration while it was highest and not significantly different among other concentrations. Copper (mg/100g) was significantly highest at *Ocimum basilicum* at 10ml of super-grow, *Ocimum basilicum* at 15ml of super-grow, *Ocimum basilicum* at 0ml of super-grow and *Ocimum gratissimum* at 15ml of super-grow with a mean value of 1.07 and lowest at *Ocimum gratissimum* at 5ml of super-grow and *Ocimum gratissimum* at 0ml of super-grow with a mean value of 1.03. Iron (mg/100g) was highest at *Ocimum gratissimum* at 15ml of super-grow with a mean value of 11.55, followed by *Ocimum basilicum* at 15ml of super-grow and *Ocimum basilicum* at 0ml of super-grow with a mean value of 11.40 and lowest at *Ocimum gratissimum* at 0ml of super-grow with a mean value of 6.60. Manganese (mg/100g) was significantly highest at *Ocimum basilicum* at 0ml of super-grow with a mean value of 6.35, and lowest at *Ocimum gratissimum* at 5ml of super-grow with a mean value of 5.80. Zinc (mg/100g) was significantly highest at *Ocimum basilicum* at 15ml of supergrow and *Ocimum basilicum* at 0ml of super-grow with a mean value of 11.1 and lowest at *Ocimum gratissimum* at 10ml of super-grow with a mean value of 10.50. Lead (mg/100g) was the same in all concentrations of *O. gratissimum* (0.03) and lower than those of *Ocimum basilicum* (0.03-0.05), all the values are safe for human consumption. Cadmium (mg/100g) had the same value (0.02) for both species across all super-grow concentrations.

DISCUSSION

The result on vegetative parameters showed there is significant difference between parameters measured except in height of the two species. In same vein, Alamene & Howells (2022), reported an increase in vegetative parameters of fluted pumpkin as influenced by Super-grow liquid fertilizers. The result further showed that 15ml of super-grow had highest effect on vegetative parameters of fluted pumpkin between 4-8weeks after planting. In this study 10ml concentration of super-grow seemed to have highest effect on leaf area and number of leaves of *Ocimum* species evaluated, beyond this concentration, the vegetative growth parameters evaluated diminshed. This corroborates Sanni *et al*., (2021) that reported an increase in height of *Capsicum annum* as Super-grow inclusion decreases. However, Alamene & Howells (2022), reported respective increase

in vegetative parameters of fluted pumpkin and *C. annum* to increase in volume of Super-grow used, even in yield, while Sanni *et al.*, (2021), reported otherwise. The variations in the result may be attributed to environmental conditions, soil properties and plant species used but not the application rates effects of Super-grow (Gulser, 2015). Olaghere & Omotesho (2019), also reported high use of Super-grow among vegetable farmers as it increases their yield.

Table 3: Mineral content of *Ocimum gratissimum* and *Ocimum basilicum* as influenced by different level of super-grow liquid fertilizer

	Ocimum gratissimum				***Ocimum basilicum***			
Parameters (mg/100g)	**5ml**	**10ml**	**15ml**	**Control**	**5ml**	**10ml**	**15ml**	**Control**
Potassium	1314^{a}	1324 ^{a}	1324 ^{a}	1323 ^{a}	1319 ^{a}	1323 ^{a}	1323 ^{a}	1323 ^{a}
Sodium	64.5^{e}	66.6^{c}	68.2^{b}	69.9^{a}	65.2^{d}	66.2^{c}	66.5^{c}	66.6^{c}
Calcium	2.54^{c}	2.59^{bc}	2.75 ^{a}	2.80^{a}	2.57^{c}	2.60^{bc}	2.64^{b}	2.65^{b}
Phosphorus	3.85^{b}	4.01^{a}	4.05^{a}	4.05^{a}	3.75^{c}	3.80^{bc}	3.83^{bc}	3.86^{b}
Magnesium	0.45^{b}	0.60^{a}	0.61^{a}	0.60^{a}	0.49^{b}	0.65^{a}	0.66^{a}	0.66^{a}
Copper	1.03^{d}	1.05^{c}	1.07^{a}	1.03^{d}	1.06^{b}	1.07^{a}	1.07^{a}	1.07^{a}
Iron	10.80 ^{d}	11.00 ^{c}	11.55 ^{a}	10.60 ^{d}	11.05 ^{c}	11.30 ^{b}	11.40 ^{b}	11.40 ^{b}
Manganese	5.80^{d}	6.01^{c}	6.10^{bc}	6.10^{bc}	6.15^{bc}	6.20^{ab}	6.25^{ab}	6.35^{a}
Zinc	10.53^{e}	10.50^{e}	10.60^{e}	10.70^{d}	10.90^{c}	11.01^{b}	11.1^{a}	11.1^{a}
Lead	0.03^{b}	0.03^{b}	0.03^{b}	0.03^{b}	0.05^{a}	0.04^{a}	0.03^{b}	0.03^{b}
Cadmium	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02

^{abc} Means on the same row with different superscript are significantly different (P<0.05)

There were differences observed in the proximate compositions of both species evaluated under different concentrations of super-grow. Ash content was highest in the species with 10ml of super-grow concentration. The ash content recorded was however low to reports from Ishola *et al*., (2017) study (6.56%). The variation might be due to genetics and environment. *O. basilicum* had the highest value for crude fat compared to *O. gratissimum*, although it is important to note that nutrient source inclusion level could give way to complex relationship between the species. Crude fibre, was highest at *O. gratissimum* compared to *O. basilicum*. *O. gratissimum* and *O. basilicum* both shared highest value for carbohydrate. Although, there were variations between proximate compositions of the two species, all values recorded can meet daily nutrient requirement in human diet (Ishola *et al*., 2017).

The mineral content such as potassium available helps to maintain healthy blood pressure (Ishola *et al*., 2017). Calcium (Ca) and potassium (K) are reported to be responsible for the repair of worn out cells, strong bones and teeth, building of red blood cells and for body mechanisms (Shuaib *et al*., 2015). On the mineral content, Shuaib *et al.*, (2015) reported that *O. gratissimum* contained higher concentrations of calcium and iron, while those of potassium, sodium, and phosphorus were higher in *O. basilicum.* This is similar to reports in this study except that *O. gratissimum* had the highest value for all except for zinc, magnesium and lead content. The variation in the result may have been a reason of nutrient source inclusion level (Shuaib *et al*., 2015). *O. basilicum* and *O. gratissimum*, shared highest value for zinc, this indicates that both can be a good source of nutrients for diabetic patients.

CONCLUSION AND RECOMMENDATION

The leaves of *O. gratissimum* and *O. basilicum* contain an appreciable amount of proximate, and minerals. However, inclusion of super-grow liquid fertilizer at different level had inconsistent influence on the basils. 10ml concentration of super-grow seemed to boost the species growth and most proximate and selected minerals evaluated, and hence recommended for growers. Beyond this concentration, both agronomical and physiological parameters studied either remained unchanged or dwindled.

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Authors' contributions

FMO conceived the research idea and managed all aspects of the manuscript. VMA collected field data and wrote the first draft of the manuscript. GGD did the laboratory

analysis. All authors read and approved the final manuscript.

Ethical Statement

Not applicable

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