EVALUATION OF THE BIOEFFICACY OF VITAL-05 (BRASINOSEROIDS, TRICONTANOL AND VITAMINS) LIQUID FERTILISER ON THE GROWTH AND YIELD OF LETTUCE IN GHANA

EXECUTING AGENCY: SCHOOL OF AGRICULTURE, UNIVERSITY OF GHANA

JOB OWNERSHIP: DIVINE WINNERS COMPANY LTD

INVESTIGATOR: DR. JOSEPH HONGER

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DR. J.O. HONGER

(SENIOR RESEARCH FELLOW)

SUMMARY

Research work was carried out to evaluate the effect of Vital-05 liquid fertiliser for its effect on the growth and yield of lettuce in Ghana. Three rates of the product (50 ml/15 l, 100 ml/15 l and 150 ml/15 l), and a non-treatment control were the five treatments evaluated in the study. Treatments were applied to transplanted lettuce seedlings immediately after transplanting and repeated at 15 days and 30 days after transplanting, using a knapsack fitted with a cone nozzle. Six weeks after transplanting, data on fresh and dry weight of leaves, roots and of the entire plant were collected on middle plants in each plot. Also collected were data on the number of leaves and chlorophyll content of the fresh leaves. The data were subjected to analysis of variance and means separated by LSD at 5%. Vital-05 applied at 100 ml/15 l and 150 ml/15 l produced the highest number of leaves, chlorophyll content and weight of the above ground plant parts compared to the non-treatment control and performed the same as the reference fertiliser. For cost effective use, Vital-05 liquid fertiliser is recommended to be applied at 100 ml/15 l (2.7 l/ha in 400 l of water) for the cultivation of lettuce in Ghana.

INTRODUCTION

Plants, like all other living things, need food for their growth and development (Uchida, 2000). In general, plants require about 16 essential nutrients which serve as their source of nourishment. Among these 16 elements, Carbon, hydrogen, and oxygen are derived from the atmosphere and soil water. The remaining 13 essential elements (nitrogen, phosphorus, po-tassium, calcium, magnesium, sulfur, iron, zinc, manganese, copper, boron, molybdenum, and chlorine) are supplied either from soil minerals and soil organic matter or by organic or inorganic fertilizers (Uchida, 2000).

Generally, inorganic fertilisers are found to be very efficient as they are produced in specific formulations which allow them to supply some specific nutrients in a specific proportion to the plants. On the other hand, organic fertilisers are reportedly more environmentally friendly and have so many advantages compared to inorganic ones. While there are several organic fertilisers available in Ghana, there are others that are intended to be introduced. One of the latter group of fertilisers is Vital-05 liquid fertiliser.

Vital-05 liquid fertiliser is a plant bio-stimulant containing Brassinoseroids and essential vitamins. It is reported to accelerate plant metabolic processes and helps to enhance the uptake of nutrients. The product is a natural plant growth stimulator and improves soil structure and infiltration.

Vital-05 liquid fertiliser has been imported into Ghana and is intended to be registered for the production of vegetables and fruit crops in the country. The product has been submitted to PPRSD for efficacy trials prior to its registration.

OBJECTIVE

In this research work Vital-05 liquid fertiliser was evaluated for its effect on the growth and yield of Lettuce (*Lactus sativa*) at the research farm of the University of Ghana.

MATERIALS AND METHODS

Site of the experiment

The experiment was carried out at The University of Ghana farm located at Legon in the Greater Accra Region (050 39' N, 00 11' W). The soil type is classified as the Adenta series, a savannah Acrisol (FAO/UNESCO, 1999).The farm engages in large scale production of vegetables both for research and commercial purposes, all year round.

Soil analysis

Prior to the commencement of the experiment soil samples were collected at random from the sites at a depth of 20 cm. These were bulked and composite samples taken for analysis. Sampled soil was air dried, crushed and sieved with a 2 mm sieve mesh. It was then analysed in the Ecological Biological Laboratory of the University of Ghana for Soil pH, particle size distribution, and bulk density. Also determined were total nitrogen and phosphorous, organic carbon and calcium content and cation exchange capacity.

Field layout and Experimental Design

The ploughed and harrowed field was divided into plots. Each plot was of the dimensions 1.25 m x 2.5 metres. Compost was incorporated uniformly into the soil at a rate of 10 t/ha. The plots were arranged on the field using the Randomised Complete Block Design (RCBD) with four replicates.

Crop Establishment and Management

Three weeks old seedlings of the Eden variety of lettuce were transplanted in the field at a spacing of 25 cm x 25 cm corresponding to a plant population of 160,000 plants per hectare. Each bed contained 50 plants. Weeding was carried out when necessary using hand hoe. Foliage insects were controlled once using Lambda-cyhalothrin applied at 2 ml/l when plants were 2 weeks old after transplanting.

Treatments evaluated

Five treatments were evaluated in the study. These were three different rates of Vital-05, one rate of GeoOrganic (humic/fulvic) liquid fertiliser as a reference and a non-treatment control (Table 1).

Table 1. Treatments evaluated in the study

Designation	Fertiliser	Amount per plot (4.5 m^2) in180 ml of water	Amount per area of 375 m^2 in 15 l of water	Amount per hectare in 400 l of water
TI	Vital-05	0.60 ml	50.0 ml	1.35 l
T2	Vital-05	1.2 ml	100 ml	2.7 l
T3	Vital-05	1.8 ml	150 ml	4.05 l
T4(Reference)	GeoOrganic	12.00 ml	1000 ml	13.3 l
T5	Control	-	-	-

Treatments application

Treatments were applied to the transplanted lettuce seedlings same day after transplanting and repeated at 15 and 30 days after tranplanting, using a knapsack fitted with a deflector nozzle discharging at 400 l/ha. In all there was a total of 3 applications

Data Collection
Five (5) plants in the middle of each plot were harvested at 42 days after transplanting (DAT) when plants were mature (Figs. 1, 2 and 3) and the following data were collected: number of leaves, fresh weight of leaves, fresh root weight, total fresh weight and chlorophyll content. Number of leaves was determined by counting the leaves manually, fresh weight was determined by weighing harvested lettuce with digital weighing balance. Dry matter of the above stated parameters, except chlorophyll content was determined by cutting, oven drying and weighing the entire above ground vegetation.

Data analysis
The data obtained on the fresh and dry weight of leaves, roots and total fresh weight and chlorophyll content were subjected to analysis on variance. On the other hand, the number of leaves was transformed using square root transformation before analysis. Data analysis was carried out using Genstat software, version 12. Means were separated using LSD at 5%.

Results

A. Soil analysis

The physical and chemical properties of the soil at the study area are presented in Table 2. The soil was fairly balanced in the micro-nutrients and moderate for P and K.

Table 2. Soil Physical and chemical properties at the experimental site

pH	OC (%)	N (%)	P (mg/kg)	K (cmol/kg)	Ca	Mg	TP	Sand	Silt	Clay
4.6	1.15	0.12	75.8	50.0	5.0	2.1	1420	72.4	18.0	12.5

B. Effect of Vital-05 and GeoOrganic liquid fertilisers on number of leaves, fresh weight of leaves, fresh root weight, fresh total weight and chlorophyll content of lettuce plants.

I. Number of leaves.

There was significant difference ($p>0.05$) in the number of leaves produced by the lettuce plants that received the different treatments. The highest number of leaves was produced by plants treated with Vital-05 applied at 150 ml/15 l while the lowest was produced by plants that were grown on plots that did not receive any liquid fertiliser (Table 3). There was no significant difference in number of leaves produced by plants treated with Vital-05 applied at 100 ml/15 l and 150 ml/15 l and the reference fertiliser (Table 3).

II. Fresh leaf weight

Significant difference ($p>0.05$) in the weight of fresh leaves produced by lettuce plants that received the different treatments was observed. The highest was produced by plants

treated with Vital-05 applied at 150 ml/15 l while the lowest was produced by plants that were grown on plots that did not receive any liquid fertiliser (Figs. 3 and 4). The difference in fresh weight of leaves produced by plants treated with Vital-05 applied at 100 ml/15 l and 150 ml/15 l and the reference fertiliser was not significant (Table 3).

III. Fresh roots weight

There was significant difference ($p>0.05$) in the fresh weight of roots produced by lettuce plants that received the different treatments. The highest was produced by plants treated with Vital-05 applied at 150 ml/15 l while the lowest was produced by plants that were grown on plots that did receive any liquid fertiliser. The difference in fresh weight of roots produced by plants treated with Vital-05 applied at 100 ml /15 l and 150 ml/15 l and the reference fertiliser was not significant (Table 3).

IV. Fresh total weight

There was significant difference ($p>0.05$) in the fresh total weight of lettuce plants that received the different treatments. The highest was produced by plants treated with Vital-05 applied at 150 ml/15 l while the lowest was produced by plants that did not receive any of the liquid fertilisers. The difference in fresh weight of leaves produced by plants treated with Vital-05 applied at 100 ml/15 l and 150 ml/15 l and the reference fertiliser was not significant (Table 3).

V. Chlorophyll content of lettuce plants

There was significant difference ($p>0.05$) in the chlorophyll content of lettuce plants that received the different treatments. The highest was recorded in plants treated with Vital-05 applied at 165 ml/15 l while the lowest was recorded in plants that did not receive any liquid fertiliser (Table 3). Vital-05 applied at 50 ml/15 l produced a significantly lower chlorophyll content compared to the application rate of 100 ml/15 l and 150 ml/15 l (Table 3).

Table 3. Effect of different rates of Vtal-05 and GeoOrganic on the fresh weight and chlorophyll content of lettuce plants.

Treatments (/15 l)	Number of leaves/ plant	Leaf weight /plant(g)	Root weight)/ plant(g)	Total weight/ plant(g)	Chlorophyll content/plant (µmol/m^2)
Vital-05:75 ml	12.5a	88.0b	3.2b	97.0b	5.7a
Vital-05:150.0 ml	16.0b	140.0c	5.3c	159.0c	14.6b
Vital-05: 165 ml	16.5b	143.0c	5.5c	161.0d	15.0c
GeoOrganic: 1000 ml	15.5b	141.0c	4.9c	160.0d	15.0b
Control	9.5a	95.0a	2.0a	81.0a	4.6a

Means followed by same alphabets are not significantly different.

C. Effect of Vital-05 and GeoOrganic liquid fertilisers on weight of dry leaves, dry roots and dry total plant weight.

VI. Dry leaf weight

There was significant difference ($p>0.05$) in the weight of dry leaves produced by lettuce plants that received the different treatments. The highest was produced by plants treated with Vital-05 applied at 150 ml/15 l while the lowest was produced by plants that did not receive any treatment (Table 4).The difference in dry weight of leaves produced by plants treated with Vital-05 applied at 100 ml/15 l and 150 ml/15 l and the reference fertiliser was not significant (Table 4).

VII. Dry root weight

There was significant difference ($p>0.05$) in the weight of dry roots produced by lettuce plants that received the different treatments. The highest dry root weight was produced by plants treated with Vital-05 applied at 150 ml/15 l while the lowest was produced by plants that did not receive any treatment. The difference in weight of the dry roots produced by plants treated with Vital-05 applied at 100 ml/15 l and 150 ml/15 l and the reference fertiliser was not significant (Table 4).

VIII. Dry total weight

There was significant difference ($p>0.05$) in the dry total weight of plants produced by lettuce plants that received the different treatments. The highest was produced by plants treated with Vital-05 applied at 150 ml/15 l while the lowest was produced by plants that did not receive any treatment. The difference in dry total weight produced by plants treated with Vital-05 applied at 100 ml/15 l and 150 ml/15 l and the reference fertiliser was not significant (Table 4).

Table 4. Effect of different rates of foliar fertiliser on the weight of dry leaves and roots and total dry weight of lettuce plants.

Treatments(/15 l of water)	Leaf weight /plant (g)	Root weight /plant (g)	Total weight /plant (g)
Vital-05:75 ml	4.2b	0.6a	4.8a
Vital-05:150.0 ml	8.6c	3.0b	11.5b
Vital-05: 165 ml	8.9c	3.1b	11.7b
GeoOrganic: 1000 ml	8.5c	2.9b	11.0b
Control	3.2a	0.5a	3.9a

Means followed by same alphabets are not significantly different

ASSESSMENT OF THE TRIAL

- Vital-05 liquid fertiliser applied at 100 ml/15 l and 150 ml/15 l was able to improve the growth of lettuce and increased the number of leaves, chlorophyll content, fresh leaf, root and total plant weight and also the dry weight of leaves and roots of lettuce plants compared to the plants that were not treated with the product.
- For cost-effective use, Vital-05 liquid fertiliser is recommended to be applied at 100 ml/15 l (2.7 l/ha in 400 l) of water for the cultivation of lettuce in Ghana.

Fig.1 Lettuce plants treated with Vital-05 applied at 50 ml/15 l

Fig. 1. Lettuce plants growing on a plot treated with Vital-05 applied at 100 ml/15 l

Fig. 3. Lettuce plants grown on a plot treated with Vital-05 applied at 150 ml/15 l.

REFERENCE

Uchida, R (2000). Plant Nutrient Management in Hawaii's Soils, Approaches for Tropical and Subtropical Agriculture J. A. Silva and R. Uchida, eds. College of Tropical Agriculture and Human Resources, University of Hawaii at Manoa.