**INVESTIGATOR:** Prof. Ben K. Banful, PhD
Department of Horticulture,
Kwame Nkrumah University of Science and Technology, Kumasi

**DATE**: 12TH JUNE, 2024

**Effects of MICROFERTILE bio-stimulant on growth, yield and fruit shelf life of cucumber**

Ben K. Banful

*Department of Horticulture, Kwame Nkrumah University of Science and Technology, Kumasi, Ghana*

## INTRODUCTION

Cucumbers are the fourth most widely `cultivated vegetable crop around the world after tomatoes, cabbages, and onions. It is grown for consumption because of its richness in nutrients. Nutritionally, 100 grams of raw cucumber (with peel) contains 95% water, 16 calories and a supply of essential nutrients, notably vitamin K at 16% of the daily value. Cucumber may be eaten raw or can be prepared with other vegetables as salad. Increasing the use of cucumber can help reduce the risk of heart diseases as well as hydrate the body especially in the tropics. It can also be used to decrease the risk of diabetes and also for better bone health due to its high vitamin K levels. Despite these benefits of cucumber, its' production is still low due to nutrients constraints as well as the efficiency of use of the applied fertilizers. The use of fertilizers is indispensable in alleviating nutrient constraints and is important in soil fertility management for improved crop production. However, most fertilizers are not optimally utilized by crops. The declining trend of cucumber yields can however be reversed, and production tremendously increased if strategies to increase the efficiency of use of the applied fertilizers, albeit in small quantities, are implemented. The use of bio-stimulants/growth activators has become one of the significant strategies presently being implemented to increase the physiological efficiency of plants to applied fertilizers. These bio-stimulants/growth activators, which are organic in nature, enhance plant growth and development when applied in small quantities (du Jardin, 2015). They enhance the plant's physiological system by improving cell division and cell enlargement resulting in better chlorophyll content and increased yield. Further, they increase plant nutrient uptake leading to enhanced fruit set, fruit numbers, fruit quality and general crop performance. Although bio-stimulants has been found very useful in vegetable crops production in several Latin American countries, its use in Ghana is very limited.

The objective of the study was to determine the effects of different rates of MICROFERTILE bio-stimulant on the growth, yield and fruit shelf life of cucumber.

## METHODOLOGY

### Experimental location

The study was conducted at the Department of Horticulture, KNUST in buckets placed in the open from March to May, 2024. The site is in the semi-deciduous forest zone with elevation of 186m above sea level (ASL) and has a bimodal rainfall distribution. The major rainy season starts in late March and ends in mid-July. There is a short dry spell from mid-July to mid-September followed by the minor rainy season from mid-September to mid-November. The mean annual rainfall is 1500mm. The mean minimum and maximum temperatures are $21^{0}$C and $31^{0}$C respectively. The mean annual relative humidity is about 60% at noon and 95% in the morning. The soil used is ferric Acrisol.

### Experimental design and crop management

The experimental design was a randomized complete block design (RCBD) with three replications. There were four treatments which comprised (i) 225ul MICROFERTILE/plant (6.3 l/ha) (ii) 270ul MICROFERTILE/plant (7.5 l/ha) (iii) 310ul MICROFERTILE/plant (8.6 l/ha) and (iv) 4g SOA Liquified/plant (111.1 kg/ha) as control.

All treatments received 8g NPK as basal application two weeks after planting. Application of MICROFERTILE bio-stimulant was done two times, four weeks after emergence (WAE) and at flowering. For each MICROFERTILE treatment, half rate was applied at each of the two stages i.e. 4 WAE and at flowering. For the control, a top dressing using 4g of SOA was applied at the stage of flowering.

Each treatment had 8 buckets giving a total of 32 buckets in a block and 96 buckets for all the three replications.

Topsoil was sieved and steam sterilized after which the plastic buckets with dimensions (60 cm diameter and 60 cm depth) were filled with topsoil of weight 18.6kg. Three drainage holes were made under each bucket to ensure adequate drainage of excess water from the buckets.

Seeds were sown on 24th March, 2024. Acetastar (a systemic insecticide) was applied at the rate of 100 ml per 15 l water at fortnightly intervals against Lady bird and crickets. To prevent the incidence of fungal diseases, Bonzeb fungicide was applied at the rate of 20ml per 15litre of water at two weeks interval. Bamboo sticks of about 3m high were used to stake the plants in each bucket at 5 weeks after sowing. Harvesting of fruits was first done on 9th,16th and 23rd May, 2024.

Data were collected on plant height, number of leaves, number of days to 50% flowering, number of flowers, number of aborted flowers, number of fruits, number of damaged fruits, mean fruit weight (kg/plant), fruit yield (t/ha) and fruit shelf life.

### Data Analysis

Data collected was subjected to ANOVA using Statistix software version 9.1 and the differences between the treatment means were separated using the Tukeys HSD at 5%.

## RESULTS

### Effects of MICROFERTILE bio-stimulant rates on plant height and number of leaves of cucumber

There were significant differences between the treatments for the plant height and number of leaves for cucumber (Table 1). For both parameters, plants treated with 7.5 l/ha MICROFERTILE were the tallest with the highest number of leaves, significantly different from all the other treatments. Plants with the shortest heights were recorded from the 8.6 l/ha MICROFERTILE treatment although they were not significantly different from those treated with 6.3 l/ha MICROFERTILE. In terms of leaves production, the least number of leaves were produced by the control plants although not different from those treated with 6.3 l/ha MICROFERTILE (Table 1).

Table 1. Effects of MICROFERTILE bio-stimulant rates on plant height and number of leaves of cucumber

| Treatments | Plant height (cm) 4 WAP | Plant height (cm) 6 WAP | Number of leaves 2 WAP | Number of leaves 4 WAP | Number of leaves 6 WAP |
|---|---|---|---|---|---|
| 225ul MICROFERTILE/plant (**6.3 l/ha**) | 40.17 b | 62.17 bc | 5.7 b | 13.0 bc | 17.7 c |
| 270ul MICROFERTILE/plant (**7.5 l/ha**) | 47.00 a | 70.00 a | 10.0 a | 23.0 a | 53.3 a |
| 310ul MICROFERTILE/plant (**8.6 l/ha**) | 39.17 b | 61.17 c | 6.7 b | 15.0 b | 20.0 b |
| 4g SOA Liquified/plant (**111.1 kg/ha**) as control | 41.17 b | 63.17 b | 5.7 b | 12.0 c | 16.7 c |
| **HSD 5%** | 3.341 | 1.079 | 3.26 | 2.45 | 1.56 |

**Effects of MICROFERTILE bio-stimulant rates on leaf chlorophyll content of cucumber**

There were significant differences between the treatments for leaf chlorophyll content of cucumber (Table 2). Plants treated with 7.5 l/ha MICROFERTILE had the highest leaf chlorophyll content from 2 WAP, significantly different from all the other treatments. The lowest leaf chlorophyll content was produced by the control plants treated with liquified SOA (111.1 kg/ha) (Table 2).

Table 2. Effects of MICROFERTILE bio-stimulant rates on leaf chlorophyll content of cucumber

| Treatment | leaf chlorophyll content (µmol $m^{-2}$) 2 WAP | leaf chlorophyll content (µmol $m^{-2}$) 4 WAP | leaf chlorophyll content (µmol $m^{-2}$) 6 WAP |
|---|---|---|---|
| 225ul MICROFERTILE/plant (**6.3 l/ha**) | 125.67 c | 132.67 c | 142.67 c |
| 270ul MICROFERTILE/plant (**7.5 l/ha**) | 132.67 a | 139.67 a | 149.67 a |
| 310ul MICROFERTILE/plant (**8.6 l/ha**) | 127.33 b | 134.33 b | 144.33 b |
| 4g SOA Liquified/plant (**111.1 kg/ha**) as control | 120.67 d | 127.67 d | 137.67 d |
| **HSD 5%** | 0.816 | 0.816 | 0.816 |

**Effects of MICROFERTILE bio-stimulant rates on number of days to flowering, number of retained flowers and number of aborted flowers of cucumber.**

There were significant differences between the treatments for the number of days to flowering, the number of retained flowers and the number/percentage of aborted flowers for cucumber (Table 3). For the number of days to 50% flowering, plants treated with 7.5 l/ha MICROFERTILE were the earliest to flower. On the other hand, plants treated with 6.3 l/ha MICROFERTILE were the latest to flower, although not significantly different from those of the control plants. In terms of number of retained flowers, plants treated with 7.5 l/ha MICROFERTILE produced the highest number of retained flowers, significantly different from all the other treatments. Conversely, for the aborted flowers, plants treated with 7.5 l/ha MICROFERTILE recorded the least number/percentage of aborted flowers, significantly different from all the other treatments (Table 3). The highest number/percentage of aborted flowers was recorded in plants treated with 6.3 l/ha MICROFERTILE, although not significantly different from plants treated with the 8.6 l/ha MICROFERTILE and the control (Table 3).

Table 3. Effects of MICROFERTILE bio-stimulant rates on number of days to flowering, number of retained flowers and number/percentage of aborted flowers of cucumber.

| Treatments | Number of days to 50% flowering | Number of retained flowers | Number of aborted flowers (Percent of total flowers) |
|---|---|---|---|
| 225ul MICROFERTILE/plant (**6.3 l/ha**) | 30.3 a | 20.0 b | 11.3 a (36.1%) |
| 270ul MICROFERTILE/plant (**7.5 l/ha**) | 21.3 b | 39.7 a | 4.3 b (9.8%) |
| 310ul MICROFERTILE/plant (**8.6 l/ha**) | 27.7 ab | 21.0 b | 9.3 a (30.7%) |
| 4g SOA Liquified/plant (**111.1 kg/ha**) as control | 28.0 ab | 21.0 b | 10.3 a (32.9%) |
| **HSD 5%** | 6.71 | 1.63 | 2.45 |

**Effects of MICROFERTILE bio-stimulant rates on number of fruits, fruit weight, fruit yield and fruit shelf life of cucumber**

There were significant differences between the treatments for the number of fruits/plant, the number of damaged fruits/plant, fruit weight/plant, fruit yield/ha and fruit shelf life for cucumber (Table 4). Plants treated with 7.5 l/ha MICROFERTILE produced the highest number of fruits, significantly different from all other treatments. The least number of fruits was recorded in the control plants treated with liquified SOA (111.1 kg/ha). For damaged fruits, plants treated with 7.5 l/ha MICROFERTILE produced the lowest number of damaged fruits, significantly different from the other treatments.

In terms of fruit weight/plant as well as fruit yield/ha, plants treated with 7.5 l/ha MICROFERTILE produced the heaviest fruits, significantly different from all the other treatments. The lowest fruit weight and fruit yield were from the control plants treated with liquified SOA (111.1 kg/ha), although not significantly different from that treated with the 8.6 l/ha MICROFERTILE. Fruit yield from 7.5 l/ha MICROFERTILE plants was 291.7 % greater than that from the liquified SOA (111.1 kg/ha)-treated plants.

Shelf life was longest in fruits harvested from plants treated with 7.5 l/ha MICROFERTILE which was significantly different from the other treatments. The shortest shelf life was found in fruits from plants treated with 8.6 l/ha MICROFERTILE although they were not significantly different from those of the control plants treated with liquified SOA (111.1 kg/ha) (Table 4).

Table 4. Effects of MICROFERTILE bio-stimulant rates on fruit weight, fruit yield and fruit shelf life of cucumber

| Treatments | Number of fruits/plant | Number of damaged fruits/plant | Fruit weight/ plant (kg) | Fruit yield (t/ha) | Fruit shelf life (days) |
|---|---|---|---|---|---|
| 225ul MICROFERTILE/plant (**6.3 l/ha**) | 21.7 b | 6.0 a | 3.10 b | 86.11 b | 18.3 b |
| 270ul MICROFERTILE/plant (**7.5 l/ha**) | 29.3 a | 3.3 b | 4.70 a | 130.55 a | 23.3 a |
| 310ul MICROFERTILE/plant (**8.6 l/ha**) | 19.0 c | 5.7 a | 1.35 c | 37.50 c | 13.7 c |
| 4g SOA Liquified/plant (**111.1 kg/ha**) as control | 13.0 d | 7.7 a | 1.20 c | 33.33 c | 15.0 c |
| **HSD 5%** | 2.54 | 2.26 | 0.579 | 16.082 | 2.54 |

## CONCLUSIONS

- MICROFERTILE bio-stimulant application rate of 7.5 l/ha **(**270ul/plant) resulted in better vegetative and reproductive growth than the other foliar fertilizer rates and the liquified SOA.
- Application of 7.5 l/ha **(**270ul/plant) MICROFERTILE resulted in greater fruit numbers, heavier fruit weight and fruit yield as well as longer fruit shelf life. Fruit yield from 7.5 l/ha MICROFERTILE plants was 291.7 % greater than that from the liquified SOA (111.1 kg/ha)-treated plants.
- The study has clearly demonstrated that the application of 7.5 l/ha **(**270ul/plant) MICROFERTILE bio-stimulant is best for increased productivity of cucumber and other vegetables.

Plate 1: Staked cucumber plants of the MICROFERTILE Trial

Plate 2: Cucumber plants with many flowers.


Plate 3: A harvest of cucumber fruits from plants treated with 6.3 l/ha **(**225ul/plant) MICROFERTILE bio-stimulant.


Plate 4: A harvest of cucumber fruits from plants treated with 7.5 l/ha **(**270ul/plant) MICROFERTILE bio-stimulant.


Plate 5: A harvest of cucumber fruits from plants treated with 8.3 l/ha **(**310ul/plant) MICROFERTILE bio-stimulant.


- Plate 6: A harvest of cucumber fruits from control plants treated with liquified 111.1 kg/ha (4g/plant) SOA.