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Effects of Star Bio-stimulant on the Growth of Cowpea {*Vignaunguiculata (L.)MERR.*} Planted in Soils from Makoda and Dambatta Local government areas of Kano State

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ABSTRACT

A plant bio-stimulant is any substance or microorganism applied to plants with the aim to enhance nutrition efficiency, abiotic stress tolerance and/or crop quality traits, regardless of its nutrients content.A research was conducted to determine the effect of bio-stimulant on the growth of Cowpea *(Vignaunguiculata L.*). Soil samples were collected from two local Government area of Kano state namely: Dambatta and Makoda (Sudan savanna). The result showed that across the soil there was no significant difference in the height of cowpea at week four of planting whereas a significant difference was observed in the Spad value. At week eight the result also showed that cowpea plant treated with bio-stimulant in Makoda was significantly higher in terms of height, similarly for SPAD values. The least value in terms of height and chlorophyll content was recorded in control 1 and 2.The results also showed that; the mean number of nodules was found to be higher in Cowpea inoculated with bio-stimulant (8.90) followed by the Cowpea inoculated with bio-stimulant and fertilizer (7.10) and the least root noodles was counted in control 1 (4.1). For root length, significant difference was detected at both week four and eight (7.6 and 16.2) in cowpea plant treated with bio-stimulant in Makoda soil sample respectively. There is need to inoculate Cowpea since there was significant difference between the treatments.

KEYWORDS: *Soil, Cowpea, Inoculation, bio-stimulant, Nitrogen, Height, Root, Nodles, Spad Values*

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INTRODUCTION

Agricultural growing practices have been evolving towards organic, sustainable or environmental friendly systems. The aim of modern agriculture is to reduce inputs without reducing the yield and quality. These goals can be achieved by breeding programs but would be species specific and time consuming. The identification of organic molecules able to activate plant metabolism may allow an improvement in plant performance in a short period of time and in a cheaper way. Bio-stimulants are plant extracts and contain a wide range of bioactive compounds that are mostly still unknown. These products are usually able to improve the nutrient use efficiency of the plant and enhance tolerance to biotic and abiotic stresses.Microbial bio-stimulants include mycorrhizal and non-mycorrhizal fungi, bacterial endo-symbionts (like *Rhizobium*) and Plant Growth-Promoting Rhizobacteria. Thus, microorganisms applied to plants can have a dual function of bio-control agent and of bio-stimulant, and the claimed agricultural effect will be instrumental in their regulatory categorization.

The ability to form symbiotic relationships with members of the plant family Fabaceae is a unique feature associated with bacteria belonging to the family *Rhizobiaceae*. The number of symbiotic relationships that can form between rhizobia and hosts is restricted and vice versa (3)Rhizobia elicit on their host and the formation of nodules in which they fix nitrogen (2) and (4) provide the plant with ammonia for growth (7).

Despite the widespread distribution of leguminous crops, many soils remain void of rhizobial strains (1). Concluded that under local conditions nodulation may not occur with introduced plants due to the lack of suitable *Rhizobium* strains.

A plant bio-stimulant is any substance or microorganism applied to plants with the aim to enhance nutrition efficiency, abiotic stress tolerance and/or crop quality traits, regardless of its nutrients content. By extension, plant bio-stimulants also designate commercial products containing mixtures of such substances and/or microorganisms. Many bio-stimulants improve nutrition and they do so regardless of their nutrients contents. Bio-fertilisers, which we propose as a subcategory of bio-stimulants, increase nutrient use efficiency and open new routes of nutrients acquisition by plants. Bio-stimulants are plant extracts and contain a wide range of bioactive compounds that are mostly still unknown.

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MATERIAL AND METHOD

Collection of Soil Samples

Thirty two Soil samples from eight different locations were collected in sterilized polythene bags from the two study site, and were taken to the Soil Science Laboratory for physicochemical analysis.

Sample Preparation

Sub-samples from the bulk soil samples collected were air-dried in the laboratory for four days. The sub-samples were gently crushed with porcelain pestle and mortar and pass through a 2mm sieve to remove debris and coarse fragments. Weighing of the soil samples was carried out using an electric weighing balance.

Laboratory Analysis of the Soil samples

The fine earth separates (<2mm soil portion) was labeled and stored in polythene bags for
Physicochemical analysis.

Determination of the Effects of Star Bio- stimulant on the Growth of Cowpea

Sterilization of Pots

One thousand five hundred (1,500) pots were washed with water and detergent. The pots were air dried and then sterilized using an autoclave at 121^0C for 15 minutes

Preparation of Cowpea Seeds

The seeds were selected and rinsed in 95% ethanol for 10 seconds to remove wax material and trapped air. Thereafter, the seeds were soaked in a solution of 1% sodium hypochlorite for 3-4 minutes; this was followed by rinsing with sterile water four to five times to remove residual disinfectant.

Development of Seedlings

Water agar was prepared by dissolving 10g of dehydrated medium in 1litre of water followed by sterilization in an autoclave at 121^0Cfor 15 minutes. The prepared seeds obtained above were then allowed to germinate on the water agar for 2-3days. Seedlings with good root development and free from contamination were selected and planted at 2cm depth in an experimental pot containing the soil sample. The setup was watered daily (Somasegaran, and Hoben, 1985).

Preparation of the inoculants

Fifteen mile (15ml) of the Star Bio-stimulant was dissolved in 300ml of sterile Distilled water and then mixed by using magnetic stirrer for twenty (20) minutes.

Preparation of Fertilizer Solution

A 1M solution of Fertilizer (NPK) was prepared in the laboratory by adding 200g of N800ml of sterile distilled water; the content was mix until it dissolved. Then 200ml of distilled water was added to make it 1Liter.

The determination of the effects of Star Bio stimulant was carried out in the screen house. The set up was watered daily and after seven days of transplanting, forty pots were selected and grouped into four,10 pots each as plus Star Bio-stimulant (+S),plus Fertilizer (+F), 1ml each of star bio-stimulant plus Fertilizer were added as (+SF) and control (C) which were left un-inoculated and the set up was watered daily respectively.

Determination of Chlorophyll Content of the cowpea

The chlorophyll content of each plant was measured at 4^{th} and 8^{th} weeks of planting using SPAD chlorophyll meter. The chlorophyll content of the two uppermost leaves of each plant was measured and in each leaf three readings were taken. This was done by clamping the meter over the leafy tissue of the cowpea, and chlorophyll content reading was received in less than 2 seconds.

Measurement of Plant Height

The height of each Cowpea plant were measured at 2^{nd}, 4^{th}, 6^{th} and 8^{th} weeks using a meter rule and recorded respectively.

RESULT AND DISCUSSION

RESULTS

Table 1: Effect of Soil Location on Chlorophyll Content and Plant height at Week 4 and Week 8 for Cowpea Plant Treated with different Treatments

Soil Location	Height (cm)		Chlorophyll Contents (SPAD	
	4 weeks	8 weeks	4 weeks	8 weeks
Dambatta A	13.35^{a}	16.22^{a}	44.59^{d}	54.11^{b}
B	13.68^{a}	16.76^{a}	44.13^{d}	52.88^{bc}
C	13.60^{a}	17.27^{a}	44.09^{d}	53.97^{b}
D	13.62^{a}	16.36^{c}	46.49^{c}	53.97^{b}
Makoda A	13.49^{a}	17.59^{c}	47.89^{b}	53.75^{b}
B	13.64^{a}	17.49^{bc}	51.99^{a}	58.41^{a}
C	13.15^{a}	17.36^{ab}	47.90^{b}	51.54^{c}
D	13.09^{a}	16.67^{c}	45.77^{c}	49.14^{d}
LCD	0.61	0.55	1.13	2.20

Table 2: Effect of Biostimulant, Biostimulant + Fertilizer and Fertilizer on Chlorophyll Content and Plant Height at week 4 and 8 for Cowpea Plant Variety Grown on Soil Collected from Dambatta and Makoda Local Governments of Kano State

Soil Location/Treatments		Height (cm)		Chlorophyll Contents (SPAD)	
		4 weeks	8 weeks	4 weeks	8 weeks
Dambatta	**Biostimulant**	13.66^{b}	18.44^{a}	46.9^{b}	57.75^{a}
	Bio + fertilizer	13.81^{b}	17.78^{ab}	46.85^{b}	55.38^{ab}
	Fertilizer	13.64^{bc}	17.12^{b}	45.75^{bc}	55.21^{ab}
Makoda	Biostimulant	14.22^{a}	18.54^{a}	50.69^{a}	57.94^{a}
	Bio + fertilizer	13.33^{bcd}	17.31^{b}	50.57^{a}	55.98^{ab}
	Fertilizer	12.94^{d}	15.72^{c}	46.48^{bc}	53.80^{b}
	Control 1	13.14^{cd}	15.77^{c}	44.73^{c}	46.71^{c}
	Control 2	12.85^{d}	15.02^{c}	45.81^{bc}	45.11^{c}
LCD		0.64	0.92	2.00	3.20

Table 3: Effect of Biostimulant, Biostimulant + Fertilizer and Fertilizer on Number of Noodles and Root Length of Cowpea Grown on Soil Collected from Dambatta and Makoda Local Governments of Kano State

Soil Location/Treatments		Number of Noodles		Root Length (cm)	
		4 weeks	8 weeks	4 weeks	8 weeks
Dambatta	Biostimulant	2.60^{a}	6.70^{b}	6.89^{ab}	15.50^{ab}
	Bio + fertilizer	2.40^{a}	6.80^{b}	6.10^{bc}	14.80^{bc}
	Fertilizer	2.50^{a}	5.10^{c}	5.60^{bcd}	14.20^{c}
Makoda	Biostimulant	2.80^{a}	8.90^{a}	7.60^{a}	16.20^{a}
	Bio + fertilizer	2.70^{a}	7.10^{b}	6.00^{bcd}	15.10^{b}
	Fertilizer	2.60^{a}	6.20^{b}	5.10^{cde}	14.60^{bc}
	Control 1	2.10^{b}	4.10^{d}	4.10^{e}	11.60^{e}
	Control 2	2.30^{b}	4.70^{c}	4.80^{de}	12.11^{d}
LCD		0.50	0.92	1.20	1.00

DISCUSSION

Cowpea height and Chlorophyll Content per soils

Based on the result obtained in table 1, at week four statistically plant height was not significantly different across the soil samples but chlorophyll contents was significant (P< = 0.05) for Makoda site B with 51.99 SPAD value. This site or location was significantly higher when compared with all the other sites. The least value was recorded in Dambatta site C with 44.09 SPAD value. However at week eight the plant height was statistically significant (P<=0.05), site A, B and C. these were significantly higher when compared with other sites, the least value was recorded in Dambatta site A (16.22) likewise for Chlorophyll content the result shows significant different (P<= 0.05), in which Makoda site B shows the highest SPAD value (58.41). Least SPAD value was also recorded in Makoda site D. The result shows that there is a correlation between plant height and SPAD value (Chlorophyll content) of cowpea. This might be due to the organic carbon content, higher nitrogen content and finer texture at Makada B than the remaining soil samples.

Plant height and Chlorophyll content (Spad values) of the Cowpea per treatments

The `effect of bio-stimulant, bio-stimulant with Fertilizer and Fertilizer on chlorophyll content and plant height at week four and week eight for cowpea grown on soil collected from Dambatta and Makoda as shown in table 2 was significant. At week eight the result shows that cowpea plant treated with bio-stimulant in Makoda was significantly higher in terms of height, similarly for chlorophyll content. The least value in terms of height and chlorophyll content was recorded in control 1 and 2. This findings agreed with the work of (5) who reported that application of Bio-stimulant enhance crop growth and productivity through mitigating against biotic and abiotic stresses. In another studies done on *Cajanuscajan*,*Vigna radiate* and *Dolichosbiflorus*where application of bio-stimulators at very low concentrations led to higher germination and growth compared to control (6).

Number of Nodules and Root length per Treatments

In terms of root length the result shows significant difference in week four whereas the treatment were not significantly different for root nodles as shown in table 3, but at week eight root noodles was significant (P<= 0.05) for bio-stimulant in Makoda location with (8.90). However least root noodles was counted in control 1 (4.1). For root length, significant difference was detected at both week four and eight (7.6 and 16.2) in cowpea plant treated with bio-stimulant in Makoda soil sample respectively.

CONCLUSSION

Based on the result obtained, inoculation significantly influences the performance of the Cowpea since; there was significant difference between the treatments. From the result at eight week, the height of the plant and chlophyll content (Spad values) of the cowpea inoculated with bio-stimulant statistically was the highest followed by those inoculated with both bio-stimulant and inorganic Nitrogen fertilizer and the control has the least mean height and spad values. Also the cowpea inoculated with bio-stimulant has the highest number of nodles and taller root length followed by those treated with bio-stimulant and inorganic Nitrogen fertilizer with non-inoculated (Control 1 and 2) having the lowest values respectively. Generally soil collected from Makoda perform significantly better than soil samples collected from Dambatta.

RECOMMENDATION

The increase in the use of bio-fertilizer would reduce the need for chemical fertilizers thereby reducing the devastating effect on the environmental. Based on the result obtained in this research, the following recommendations are made:

- There is need to be producing inoculants using our indigenous rhizobia, in order to avoid producing inoculants that is less effective in our farms.
- Farmers should be encouraged to use inoculants to increase their agricultural yield
- There is need for Government to create public awareness on the benefits of using inoculants and the effects of chemical fertilizers on our Environment.
- Further researches should be carry out to compare the benefits of using inoculants over the use of chemical fertilizers.

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CONFLICT OF INTEREST

The author has no any conflict of interest.

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