

HYFER UREA MAX FERTILIZER EFFICACY TEST ON BANANA

Banana is the oldest fruit of tropical countries and regarded as Adam's fig or fruit of heaven. The plant is heavy feeder crop and requires high quality of nutrients which most supplied through fertilization to obtain optimum yield on sustainable basis.

HYFER UREA MAX FERTILIZER, the latest addition in the MJ Multilines Inc. roster of fertilizers is a mixture of fertilizer nitrogen, humic acid, and mycorrhiza. The blend buffers the effects of urea on soil ammonia oxidizers and potential nitrification thereby increasing the fertilizer nitrogen use.

Humic acid in the fertilizer mixture is a powerful fungi promotant including mycorrhiza being the missing link in the soil. It stabilizes nitrogen and improves nitrogen efficiency thus making it an ideal additive with urea. Humic substances are safe to environment and all living organisms. It acts as soil amendment, strengthens root development, chelates cations in the soil and, promotes growth of living cells (auxin-like growth stimulant).

Mycorrhiza plays a very important role in a plant's rhizosphere or rooting system. Mycorrhiza fungi allow plants to draw more nutrients and water from the soil. It also increases plant tolerance against environmental stress, promotes aggregation and, stimulates microbial activity.

Mycorrhiza exhibits mutual relationship between fungus and roots of higher plants. Such association enhances the absorption of required nutrients available in the soil. Mycorrhizal infestation generally result results in the substantial increase in the absorption surface area of the root and as well as the soil volume available for absorption. Furthermore, mycorrhiza provides resistance to pathogens by direct competition to resources provide stabilization to environmental stress.

Objectives

For label expansion purposes, HYFER UREA MAX FERTILIZER in coordination with by Fertilizer and Pesticide Authority (FPA), the Agro Tiger Philippines Inc. would like to:

- a. Study the effects of HYFER UREA MAX FERTILIZER on the yield components of banana that will serve as the basis in granting product label expansion.

Site Description

The experimental site is located in Brgy. Tinampaan, Cadiz City 63 kilometers away from Bacolod City, going north of Negros Occidental. The place is almost kilometers away from the national road, and adjacent to the biggest Solar Plant in the country. The place has two pronounced seasons, the wet and dry. The dry season is from late December to early parts of May. Rainy season starts in June reaches its peak in September and ends in October. The area is bound by Himogaan river on its western side which is the source of irrigation water the whole year round for the growing of rice and other cash crops. The site is provided with small canals that empties extra water to Himogaan River. Precipitation is the lowest in April, with an average of 63mm. In October, the precipitation reaches its peak, with an average of 298mm. At an average temperature of 28.7 degrees Celsius, May is the hottest month of the year. At 26.0 degrees Celsius on average, January is the coldest month of the year.

Selection of Crop Variety:

The Cavendish variety was used in the study.

Time of Study:

The study commenced October 2018 and ended September of 2019.

Research Design and Experimental Lay-Out:

An area of approximately two thousand five hundred (2,500) square meters was laid out using a Randomized Complete Block Design (RCBD) and was further divided into four (4) blocks. Each block has 2 meters space between plots and two meters path between blocks.

Lay-Out:

(please see separate sheet)

Treatments:

The following treatments were used in the study:

T1 – Control (No Fertilizer)

T2 – 250-230-340 kgs/ha of NPK

T3 – 125-115-170 kgs/ha of NPK

T4 – 125-115-170 kgs/ha of NPK + 2 bags of HYFER UREA MAX FERTILIZER per ha.

T5 – 2 bags of HYFER UREA MAX FERTILIZER per ha.

T6 – 250-230-340 kgs/ha of NPK + 2 bags HYFER UREA MAX FERTILIZER per ha.

Land Preparation:

Experimental site was plowed twice as deep as possible and harrowed twice to pulverize, flatten the soil and knockdown the weeds. A ripping equipment was used in one pass to provide aeration to soil.

Planting/Transplanting:

The site planted with Cavendish banana was divided into six treatments and four replications. Each plot contained twenty five bananas with a planting distance of 2 meters between rows and 2 meters between hills. One seedling was placed in 12-inch prepared holes for proper infiltration and aeration.

Fertilization:

The base of the plant was cleared from any debris before the application of fertilizer. Inorganic fertilizers and HYFER UREA MAX FERTILIZER were applied according to designated treatments, basally, and every month thereafter until the ninth month.

Table 1. Fertilization scheme on the duration of the experiment

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Treatments	Amount of Fertilizer/Ha/Yr	Application of Fertilizer/Month for 10 months	Application of Fertilizer/Month for 10 months/plot (100m ²)
T1=Control (No Fertilizer)	no fertilizer	no fertilizer	no fertilizer
T2=Full RR (250-230-340)	10 bags/ha 18-46-0 6.95 bags/ha 46-0-0 11.33 bags/ha 0-0-60	1 bag/ha 18-46-0 0.70 bag/ha 46-0-0 1.33 bag/ha 0-0-60	0.5 kg/ 18-46-0 0.35 kg/ 46-0-0 0.67 kg/ 0-0-60
T3=1/2 RR (125-115-170)	5 bags/ha 18-46-0 3.48 bags/ha 46-0-0 5.67 bags/ha 0-0-60	0.50 bag/ha 18-46-0 0.35 bag/ha 46-0-0 0.57 bag/ha 0-0-60	0.25 kg/ 18-46-0 0.18 kg/ 46-0-0 0.34 kg/ 0-0-60
T4=1/2/ RR (125-115-170) + 2 bags HYFER UREA MAX Fertilizer/Ha	5 bags/ha 18-46-0 3.48 bags/ha 46-0-0 5.67 bags/ha 0-0-60 20 bags HYFER UREA MAX Fertilizer /Ha/yr	0.50 bag/ha 18-46-0 0.35 bag/ha 46-0-0 0.57 bag/ha 0-0-60 2 bags/ha HYFER UREA MAX Fertilizer	0.25 kg/ 18-46-0 0.18 kg/ 46-0-0 0.34 kg/ 0-0-60 1 kg/ HYFER UREA MAX Fertilizer
T5=2 bags HYFER UREA MAX Fertilizer/Ha	20 bags HYFER UREA MAX Fertilizer /Ha/yr	2 bags/ha HYFER UREA MAX Fertilizer	1 kg/ HYFER UREA MAX Fertilizer
T6=Full RR (250-230-340) + 2 bags HYFER UREA MAX Fertilizer/Ha	10 bags/ha 18-46-0 6.95 bags/ha 46-0-0 11.33 bags/ha 0-0-60 20 bags HYFER UREA MAX Fertilizer /Ha/yr	1 bag/ha 18-46-0 0.70 bag/ha 46-0-0 1.33 bag/ha 0-0-60 2 bags/ha HYFER UREA MAX Fertilizer	0.5 kg/ 18-46-0 0.35 kg/ 46-0-0 0.67 kg/ 0-0-60 1 kg/ HYFER UREA MAX Fertilizer

Cultivation and Weeding:

Cultivation was done when the roots of plants had already established in the soil.

Weeding had been performed as necessary especially during rainy months.

Pest and Disease Control:

Close monitoring of pests and disease infestation was done at the beginning up to the end of the experiment. Bunchy top, Sigatoka and aphids infestation and other pests and diseases were taken care of at once.

Water Management:

The area is equipped with irrigation facilities to supply water when plants are under stressed.

Harvesting:

Harvesting was done 11-12 weeks from shooting and when the diameter of the second hand of the bunch was be 45 cm.

Gathering Data:

The data gathered were the following:

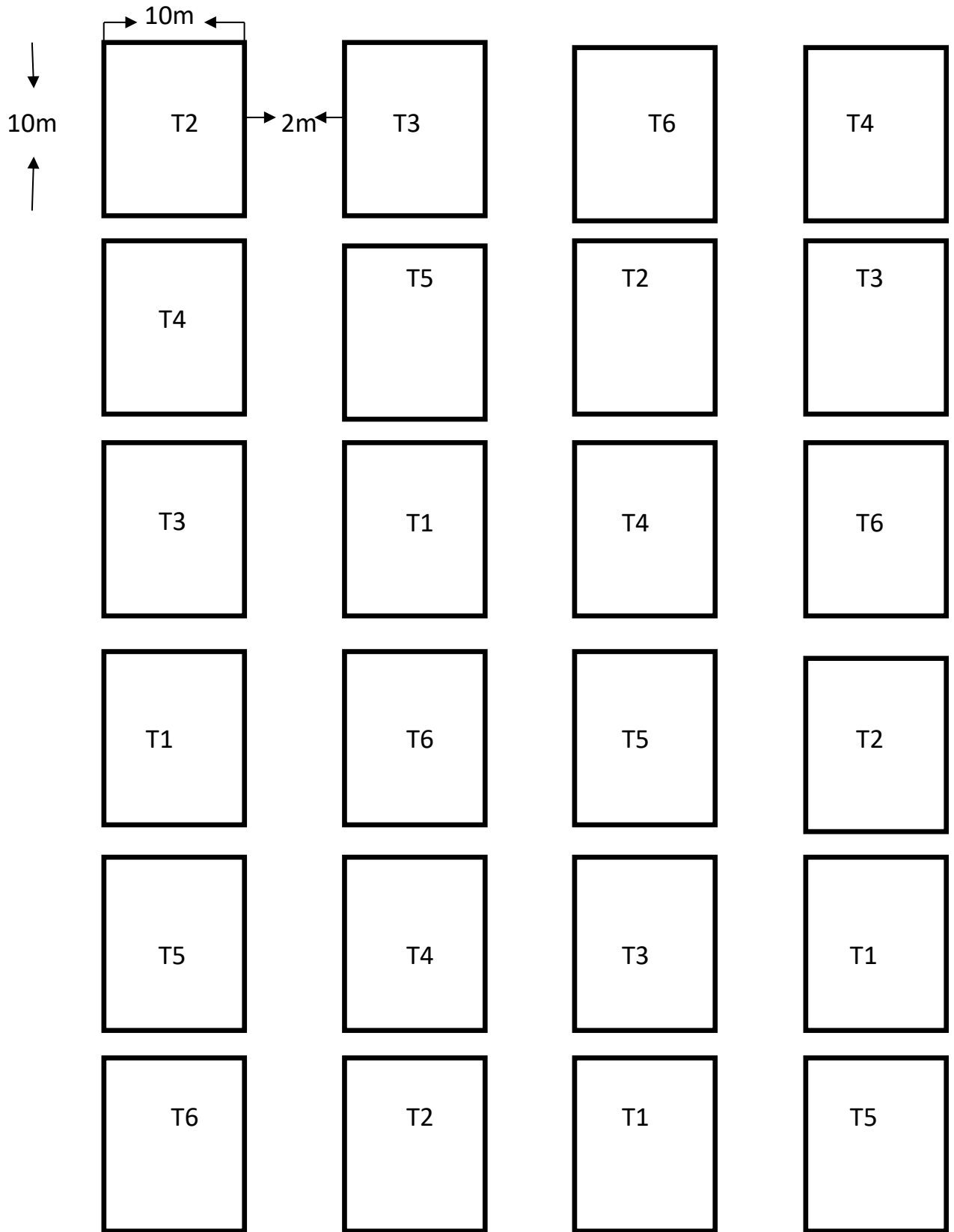
- a. Average Fruit length (inches) this was obtained by measuring the middle finger of the middle hand from the base to the top of the fruit
- b. Average Fruit Girth (cm) this was done by taking the size of the middle finger of the middle hand

- c. Average number of fingers developed per hand
- d. Average number of hand developed per bunch
- e. Average bunch weight (kg)
- f. Average hand weight (kg)

Statistical Analysis:

Yield data that were generated were analyzed using the Analysis of Variance (ANOVA) for Random Complete Block Design (RCBD). Least Significance Difference Test (LSDT) was used to test the level of significance among treatments means.

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RESULTS AND DISCUSSION

Fig. 1 Experimental Lay-out

	Ave: Numt Fingers/ Hand	(cm)	(cm)	ber of /Bunch	Hand Weight (kg)	Bunch Weight (kg)
1	13.69 d	21.50 d	11.31 e	6.78 c	1.64 e	16.33 e
2	17.13 b	25.40 b	12.55 c	8.26 ab	2.85 c	24.03 b
3	15.44 c	22.50 c	11.94 d	7.70 b	2.30 d	18.94 d
4	18.18 a	27.25 a	13.61 a	8.54 a	3.49 a	25.08 a
5	15.56 c	22.75 c	12.10 d	7.80 b	2.64 c	19.96 c
6	18.38 d	27.25 a	13.21 b	8.41 a	3.23 b	25.00 a
CV (%)	2.43	2.43	2.07	4.87	2.41	5.48

Table 2. Summary on yield means of banana applied with HYFER UREA MAX fertilizer.

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Average Number of Fingers/Hand

The average number of fingers counted per hand was significantly affected by the varying levels of Hyfer Urea Max Fertilizer Application. An average fruit count of 18.38 per hand, remarkably superior by 1.25 fruits compared to bananas treated with 250-230-340 kg/ha of NPK (T2) alone. T2 bananas gave an average of 25.7 fingers per hand.

A comparable number of fingers per hand were noted from areas applied with 2 bags per hectare of Hyfer Urea Max Fertilizer in combination with 250-230-340 kg/ha of NPK and those treated of the same number of bags per hectare of Hyfer Urea Max Fertilizer plus 125-115-170 kg/ha of NPK (T4).

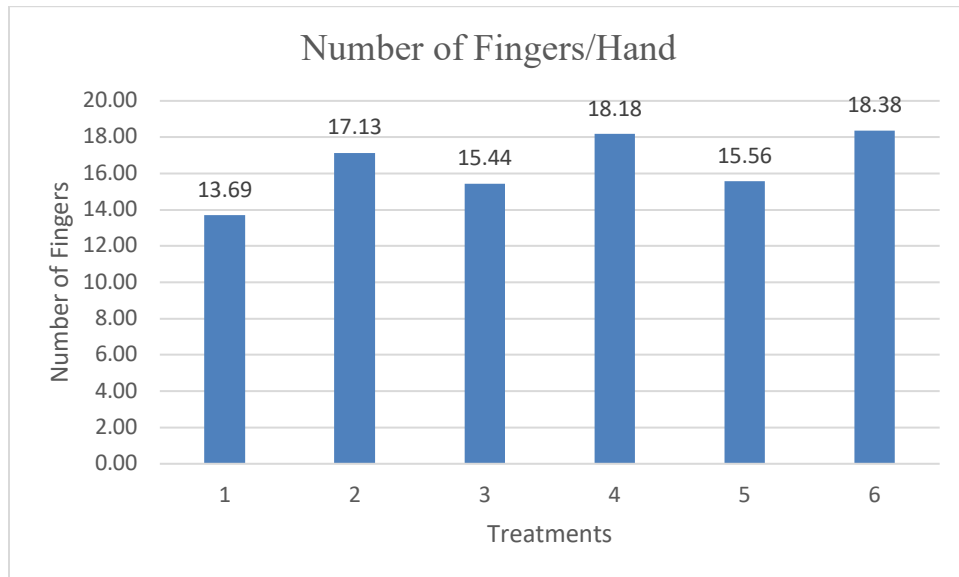


Figure 1. Number of fingers of banana applied with HYFER UREA MAX fertilizer.

The latter treatment (T4) recorded an average of 18.18 fingers per hand, significantly better by 2.74 fingers against those obtained from plants applied with 125-115-170 kilograms per hectare of NPK (T3) alone. T3 plants registered average of 15.44 finger per hand.

Among treatments, control plants obtained the lowest count of 13.69 banana fingers per hand.

Average Finger Length (cm)

The longest middle-hand finger was 27-44 centimeters exhibited by bananas applied with 250-230-340 kg/ha of NPK plus 2 bags per hectare of Hyfer Urea Max Fertilizer (T6), significantly longer by 1.73 centimeters against fruits measured from site fertilized with 250-230-340 kg/ha of NPK (T2) alone which registered an average of 25.71 centimeters. Fruits taken from plots treated with 2 bags per hectare of Hyfer Urea Max Fertilizer (T5) revealed a comparable fruit length of 22.90 and 22.37 centimeters along with plants fertilized with 125-115-170 kg/ha of NPK (T3) alone. The former treatments showed a significant length difference of 1.75 centimeters over the fruits of unfertilized banana, while the latter recorded a significantly shorter fruit length of 5.62 centimeters compare to fruits obtained from area fertilized with the same amount of traditional fertilizer in combination with 2 bags per hectare of Hyfer Urea Max Fertilizer (T6).

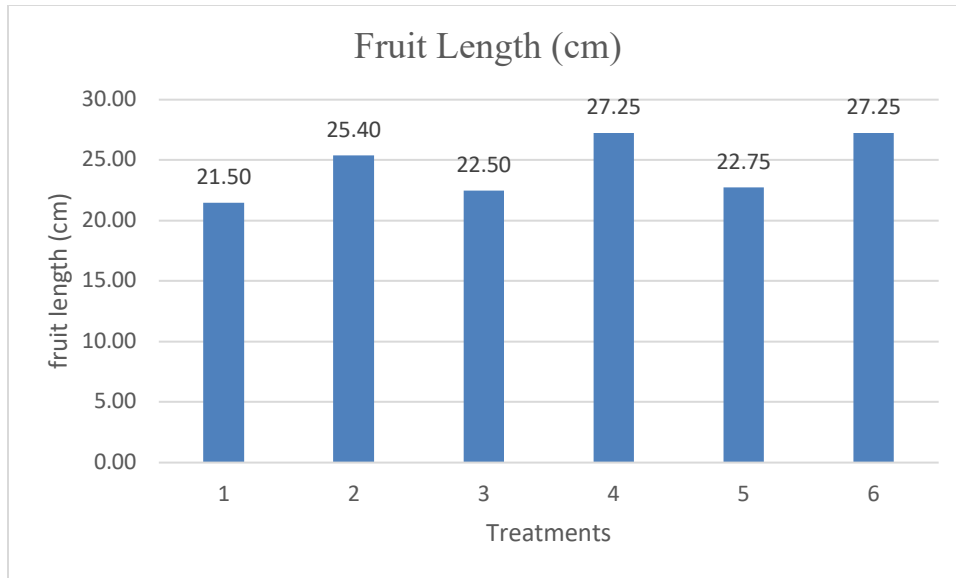


Figure 2. Fruit length (cm) of banana applied with HYFER UREA MAX fertilizer.

Average Fruit Girth (cm)

The biggest girth was 13.61 centimeters taken from the middle hand finger of bananas fertilized with 125-115-170 kg/ha of NPK in combination with 2 bags per hectare of Hyfer Urea Max Fertilizer (T4) with a significant difference of 1.67 centimeters over fruits measured from area treated with 125-115-170 kg/ha of NPK (T3) alone. T3 bananas registered an average fruit girth of 11.94 centimeters.

Bananas applied with 250-230-340 kg/ha of NPK mixed with 2 bags per hectare of Hyfer Urea Max Fertilizer obtained an average finger girth of 13.21 centimeters, significantly bigger by 0.66 centimeters against the plants grown in area applied with the same conventional fertilizer (T2) alone.

The use of 2 bags per hectare of Hyfer Urea Max Fertilizer showed a significantly superior finger circumference of 0.78 centimeters over control fruits, which recorded 12.09 centimeters and 11.31 centimeter fruit circumference respectively.

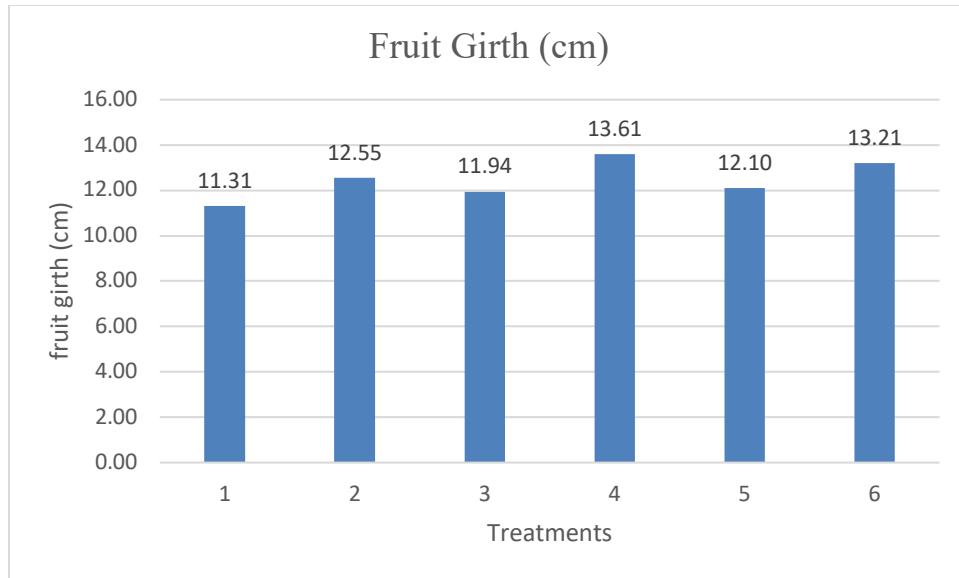


Figure 3. Fruit girth (cm) of banana applied with HYFER UREA MAX fertilizer.

Average Number of Hands per Bunch

Unfertilized bananas at harvest showed an average number of 6.78 hands per bunch, significantly inferior by 1.18 hands against bananas fertilized with 2 bags per hectare of Hyfer Urea Max Fertilizer (T5) which obtained an average of 6.78 and 7.80 hands per bunch respectively.

The use of 2 bags per hectare of Hyfer Urea Max Fertilizer in combination with inorganic fertilizer in full dose (T6) and half dose (T4) rate showed a comparable number of hands per bunch of 8.41 and 8.54 respectively, the former treatment revealed a remarkably better number of hands by 0.25 compared to the use of conventional fertilizer alone (T2). The latter treatment showed a significantly better count by 1.76 count per bunch against those applied by 125-115-170 kg/ha of NPK (T3) alone.

The lowest average hands per bunch count was shown by control plants of 6.78, significantly inferior by 1.18 hands against with those applied with 2 bags per hectare of Hyfer Urea Max Fertilizer which revealed a hand count of 7.80 per bunch.

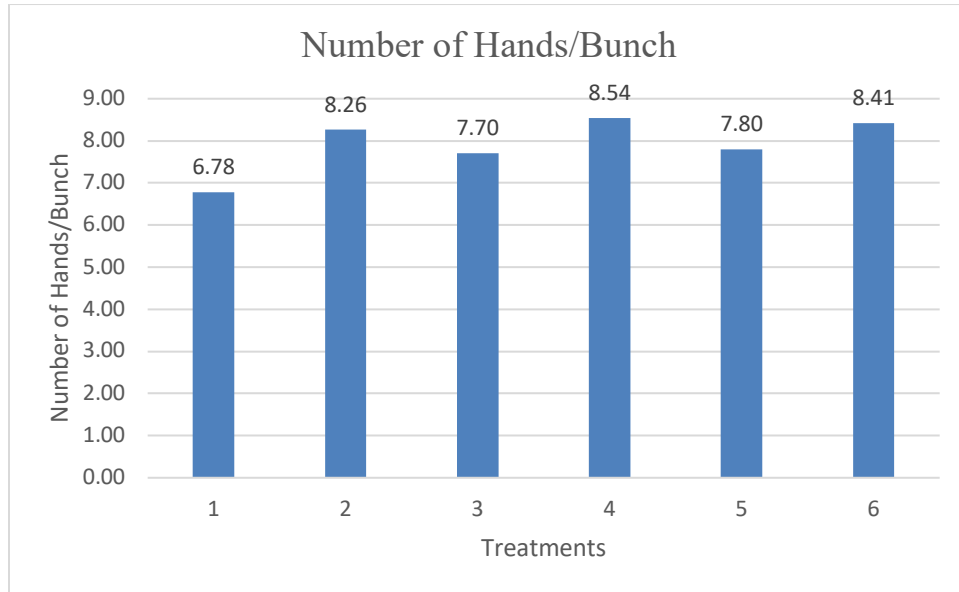


Figure 4. Number of Hands/Bunch of banana applied with HYFER UREA MAX fertilizer.

Average Hand Weight (kg)

The heaviest hands were recorded from site treated with 125-115-170 kg/ha of inorganic fertilizer plus 2 bags per hectare of Hyfer Urea Max Fertilizer (T4) with a remarkable weight advantage of 1.19 kg against the average hand weight of fruits from plots applied with 125-115-170 kg/ha of inorganic fertilizer (T3) alone. T4 plants obtained an average hand weight of 3.49kg while T3 plants registered an average 2.30kg hand weight.

Among the treatments the lowest average hand weight was 1.64kg weighed from unfertilized banana rows, significantly higher by 1.00kg compared to hands obtained from area fertilized with 2 bags per hectare of Hyfer Urea Max Fertilizer (T5).

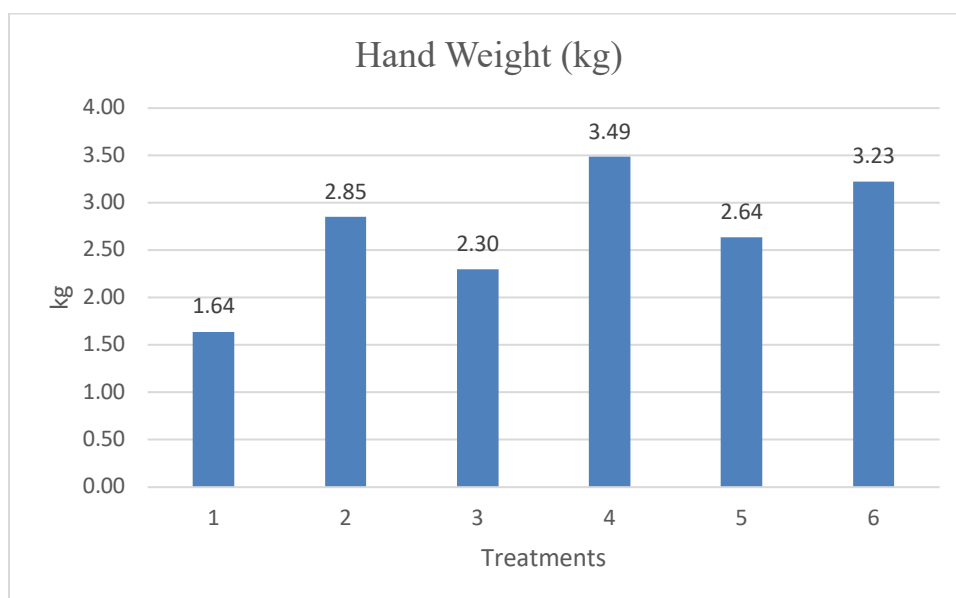


Figure 5. Hand weight (kg) of banana applied with HYFER UREA MAX fertilizer.

Average Bunch Weight (kg)

The biggest bunch has an average weight of 25.08 kilograms harvested from plots applied with 125-115-170 kg/ha of inorganic fertilizer in combination with 2 bags per hectare of Hyfer Urea Max Fertilizer (T4), comparably of the same weight with those taken from areas treated with the same full dose of inorganic fertilizers alone (T3) which registered an average of 18.94 kilograms bunch weight.

Bananas treated with 2 bags per hectare of Hyfer Urea Max Fertilizer (T5) recorded an average bunch weight of 19.96 kilograms, significantly heavier by 2.53 kilograms against unfertilized ones which recorded an average of 16.32 kilograms weight at harvest.

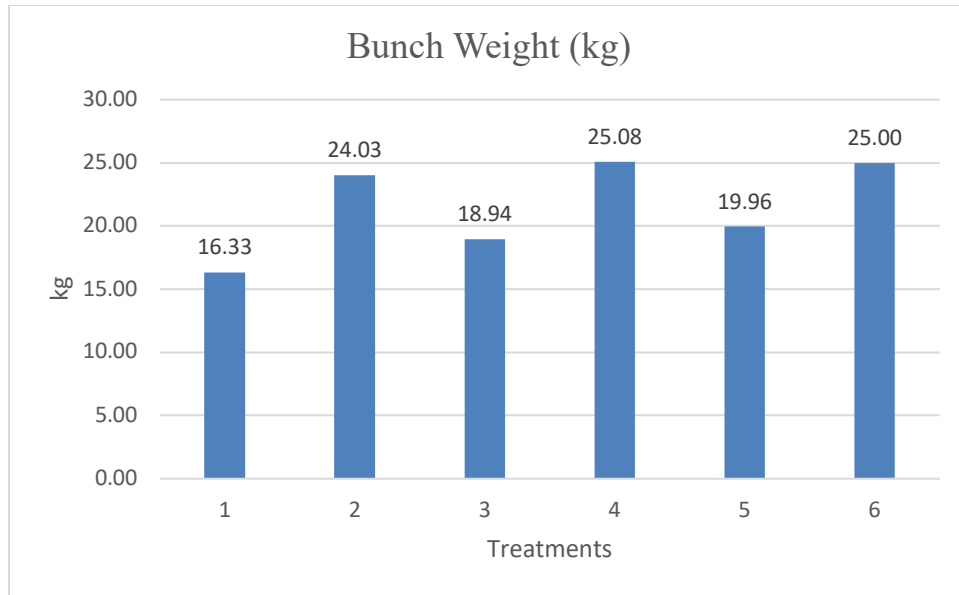


Figure 6. Bunch weight (kg) of banana applied with HYFER UREA MAX fertilizer.

CONCLUSION AND RECOMMENDATION

The yield parameters of Cavendish banana were significantly influenced by the application of varying levels of fertilizer. The use of 2 bags per hectare of Hyfer Urea Max Fertilizer alone, the addition of the same amount of Hyfer Urea Max Fertilizer to the inorganic fertilizer's recommendation revealed a remarkable increase in the average fruit length, average fruit girth, average number of hands per bunch, and average hand and bunch weight over the control rows.

Base on the findings that the combination of 2 bags per hectare of Hyfer Urea Max Fertilizer to the recommended inorganic fertilizer scheme consistently showed superior findings influenced in all the yield parameters measured, the said fertilizer rate is highly recommended for banana production.

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Appendix Table 1. Number of fingers/hand of banana applied with HYFER UREA MAX fertilizer.

Treatments	Replication				Total	Means
	I	II	III	IV		
1	13.50	14.25	13.00	14.00	54.75	13.69
2	17.50	16.50	17.50	17.00	68.50	17.13
3	15.50	15.75	15.00	15.50	61.75	15.44
4	18.50	18.20	18.00	18.00	72.70	18.18
5	15.50	15.00	15.75	16.00	62.25	15.56
6	18.50	18.25	18.25	18.50	73.50	18.38
Total	99.00	97.95	97.50	99.00		
Means	16.50	16.33	16.25	16.50		

Grand Total					393.45	
Grand Mean						16.39

Appendix Table 1a. Analysis of variance on the number of fingers/hand of banana applied with HYFER UREA MAX fertilizer

Sources of Variance	Df	Sum of Squares	Mean Squares	F value	Pr>F
Rep	3	0.287813	0.095938	0.6	0.6244 ns
Trt	5	66.24844	13.24969	82.97	<.0001**
Error	15	2.395313	0.159688		
Total	23	68.93156			

CV= 2.43%

Appendix Table 2. Fruit length (cm) of banana applied with HYFER UREA MAX fertilizer.

Treatments	Replication				Total	Means
	I	II	III	IV		
1	22.00	21.00	21.50	21.50	86.00	21.50
2	25.60	26.00	25.00	25.00	101.60	25.40
3	23.00	22.00	22.50	22.50	90.00	22.50
4	26.00	27.00	28.00	28.00	109.00	27.25
5	22.50	22.50	23.00	23.00	91.00	22.75

6	27.50	28.00	26.75	26.75	109.00	27.25
Total	146.60	146.50	146.75	146.75		
Means	24.43	24.42	24.46	24.46		
Grand Total					586.60	
Grand Mean						24.44

Appendix Table 2a. Analysis of variance on the fruit length (cm) of banana applied with HYFER UREA MAX fertilizer.

Sources of Variance	Df	Sum of Squares	Mean Squares	F value	Pr>F
Rep	3	0.014167	0.004722	0.01	0.9984 ns
Trt	5	133.3763	26.67525	60.45	<.0001 **
Error	15	6.619583	0.441306		
Total	23	140.01			

CV= 2.71%

Appendix Table 3 Fruit girth (cm) of banana applied with HYFER UREA MAX fertilizer.

Treatments	Replication				Total	Means
	I	II	III	IV		
1	11.50	11.00	11.25	11.50	45.25	11.31
2	12.75	12.70	12.25	12.50	50.20	12.55
3	11.50	11.75	12.50	12.00	47.75	11.94
4	13.75	13.50	13.50	13.70	54.45	13.61
5	12.13	12.00	12.25	12.00	48.38	12.10
6	13.50	13.10	13.00	13.25	52.85	13.21

Total	75.13	74.05	74.75	74.95		
Means	12.52	12.34	12.46	12.49		
Grand Total					298.88	
Grand Mean						12.45

Appendix Table 3a. Analysis of variance on the fruit girth (cm) of banana applied with HYFER UREA MAX fertilizer.

Sources of Variance	Df	Sum of Squares	Mean Squares	F value	Pr>F
Rep	3	0.1118	0.037267	0.56	0.6498 ns
Trt	5	14.50133	2.900267	43.55	<.0001 **
Error	15	0.999	0.0666		
Total	23	15.61213			

CV= 2.07%

Appendix Table 4. Number of hands per bunch of banana applied with HYFER UREA MAX fertilizer.

Treatments	Replication				Total	Means
	I	II	III	IV		
1	6.75	6.25	7.00	7.12	27.12	6.78
2	8.50	8.80	7.75	8.00	33.05	8.26
3	7.25	7.80	8.00	7.75	30.80	7.70
4	8.90	8.75	8.00	8.50	34.15	8.54
5	7.70	7.75	7.50	8.25	31.20	7.80
6	8.50	8.80	8.25	8.10	33.65	8.41
Total	47.60	48.15	46.50	47.72		

Means	7.93	8.03	7.75	7.95		
Grand Total					189.97	
Grand Mean						7.92

Appendix Table 4a. Analysis of variance on the number of hands/bunch of banana applied with HYFER UREA MAX fertilizer.

Sources of Variance	Df	Sum of Squares	Mean Squares	F value	Pr>F
Rep	3	0.1118	0.03726667	0.56	0.6498 ns
Trt	5	14.50133333	2.90026667	43.55	<.0001 **
Error	15	0.999	0.0666		
Total	23	15.61213333			

CV= 4.87%

Appendix Table 5. Hand weight (kg) of banana applied with HYFER UREA MAX fertilizer.

Treatments	Replication				Total	Means
	I	II	III	IV		
1	1.50	1.80	1.75	1.50	6.55	1.64
2	3.00	2.80	3.10	2.50	11.40	2.85
3	2.20	2.40	2.50	2.10	9.20	2.30
4	3.40	3.25	3.80	3.50	13.95	3.49
5	2.50	2.75	2.80	2.50	10.55	2.64
6	3.20	3.00	3.50	3.20	12.90	3.23
Total	15.80	16.00	17.45	15.30		

Means	2.63	2.67	2.91	2.55		
Grand Total					64.55	
Grand Mean						2.69

Appendix Table 5a. Analysis of variance on hand weight (kg) of banana applied with HYFER UREA MAX fertilizer.

Sources of Variance	Df	Sum of Squares	Mean Squares	F value	Pr>F
Rep	3	0.42614583	0.14204861	6.52	0.0049 ns
Trt	5	8.84177083	1.76835417	81.12	<.0001 **
Error	15	0.32697917	0.02179861		
Total	23	9.59489583			

CV= 5.54%

Appendix Table 6. Bunch weight (kg) of banana applied with HYFER UREA MAX fertilizer.

Treatments	Replication				Total	Mean
	I	II	III	IV		
1	15.80	16.00	17.00	16.50	65.30	16.33
2	24.50	24.00	23.50	24.10	96.10	24.03
3	19.50	18.75	19.00	18.50	75.75	18.94
4	25.10	24.70	25.50	25.00	100.30	25.08
5	20.10	18.75	21.00	20.00	79.85	19.96
6	24.50	25.00	25.00	25.50	100.00	25.00
Total	129.50	127.20	131.00	129.60		

Means	21.58	21.20	21.83	21.60		
Grand Total					517.30	
Grand Mean						21.55

Appendix Table 6a. Analysis of variance on the bunch weight (kg) of banana applied with HYFER UREA MAX fertilizer.

Sources of Variance	Df	Sum of Squares	Mean Squares	F value	Pr>F
Rep	3	1.2379167	0.4126389	1.52	0.2506 ns
Trt	5	268.3983333	53.6796667	197.43	<.0001 **
Error	15	4.0783333	0.2718889		
Total	23	273.7145833			

CV= 2.41%

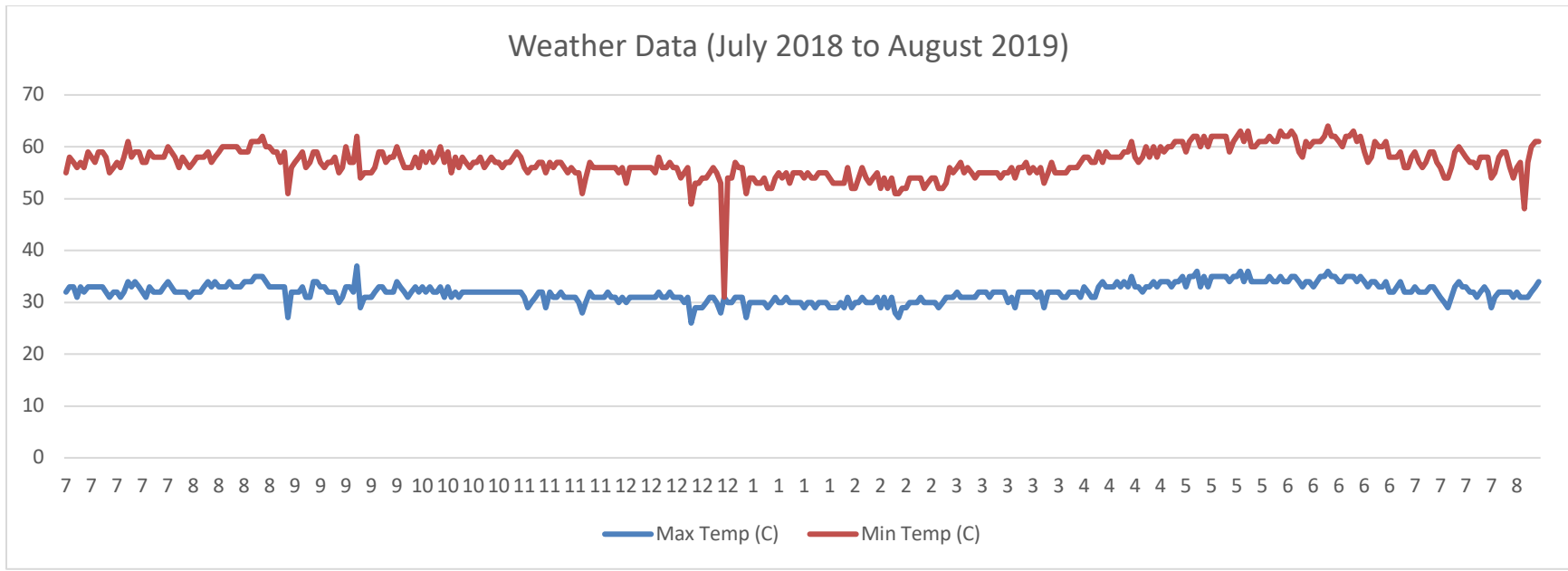


Figure 2. Weather data on maximum temperature (C) and minimum temperature (C) for the duration of the experiment (July 2018 to August 2019).

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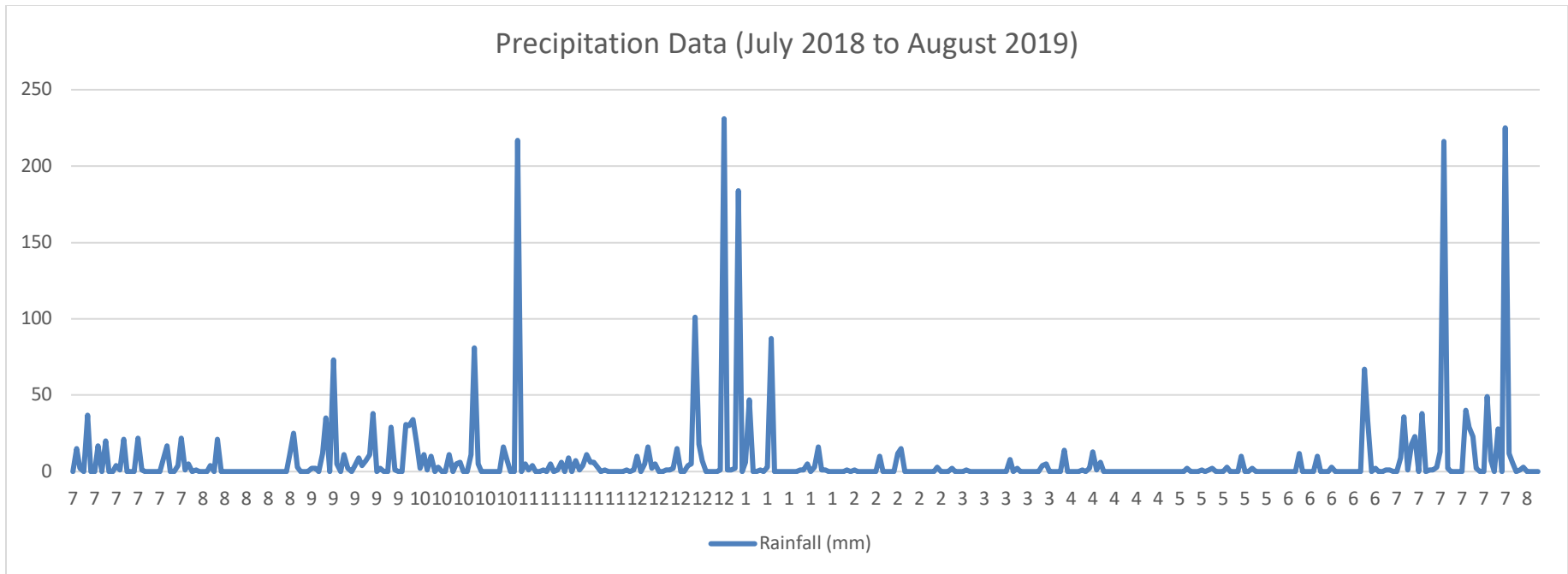


Figure 3. Precipitation data (mm) on the duration of the experiment (July 2018 to August 2019).

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