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Effect of Microdosing Techneque on Maize at Shambat, Sudan

A Dissertation Submitted To the Sudan University of Science and Technology in Partial Fulfillment of the Requirements for Degree of B.Sc. in Agriculture (Honors)

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الآية

قال تعالي

(وَهُوَ الَّذِي أَنْشَأَ جَنَّاتٍ مَعْرُوشَاتٍ وَغَيْرَ مَعْرُوشَاتٍ وَالنَّخْلَ وَالزَّرْعَ مُخْتَلِفًا أُكُلُهُ وَالزَّيْتُونَ وَالرُّمَّانَ مُتَشَابِهًا وَغَيْرَ مُتَشَابِهٍ كُلُوا مِنْ ثَمَرِهِ إِذَا أَثْمَرَ وَآَتُوا حَقَّهُ يَوْمَ حَصَادِهِ وَلَا تُسْرِفُوا إِنَّهُ لَا يُحِبُّ الْمُسْرِفِينَ)

صدق الله العظيم

سورة الأنعام الآية(141)

DEDICATION

Calm down to my father

And my lovely Mother

And beloved brother who

Was strongly support me

And all my brothers

And sisters and to all of

My professors Department of crop

Science and to my friends

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First of all I am so grateful and thankful to AIIAH who give me the strength to complete this work successfully . I really want to express my great thanks to my supervisor **Dr .Yassin Mohmad Dagash** for his continuous guidance, encouragement and help . Also my thanks extended to all the Teachers in Dept. of Agronomy,College of Agricultural Studies

Table of Contents

List of Tables

Title **Page No.**

List of Figures

CHAPTER ONE

INTRODUCTION

Maize [Zea mays L.] or cron is the most important cereal crops in sub sa haran Africa and with rice and wheat one of the three impartant cereal crops in the world .Maiza is high yielding easy to process readiydigested and cheapar than other cereal . it is also a vesatile crop , growing across a range of agricliatological zane . Every part of the maize plant has economic value: the grain, leaves, stalk, and cob can all be used to produce a large variety of food and non – food product . it is grown in Sudan all over the country especially at rivers banks ,but now is gaining importance in livestoch feed and consideered one of the promissing crops in, the sudan. Maize ,like other cereal s ,is fertlizer loving crop. Most of the cultivation expenses go to additiian of different typea of fertilizers..

Land degradatian afected more than half of Africa, Leading to loss of an estimated 42 billion and 5 Billion hectars of productive land each year. The majority of farmland produce poor yields due to poor farming [techneque] , nutrient deficiency and irreguler watering [ICRISAT ,2009]. The microdose technology is the application of small mineral fertilizar dose in the seed hole when sowing or next to the seeding after emargence [10 days after sowing]. The advantage of this technology are[Agricultral Technolog,Burkina afaso 2010}**:-**

1.To locate the fertilizer near the root to obtain high concentration area which make assimilation of nutrients easier

2.To Lmit phosphorus fixatian phenomena by the soil

3.To increare the efticienty of fertilizer use

4.To minimize production costs

5.To improve small produces incorne

6.To incrcase the number of mineral fertilizer

However TCRTSAT[2009] mentianed some difficulties as : 1-The technology is time consumig laborious and dificult to cover That each plant gets the right dose

2.Access to fertilizer is in suficent flow of informatian and training to farmerr and in appropriate policies.

3-The adoption of the technology reguires supportive and complementary institution of innovation as well as input and out put martet linkages .

As mentianed by many researherr tle technology uses about one-tenth of the amount typically used on wheat and one – quarter. the amount used on corn on nutrients such as phosphorus , potassium of ten double yield s[Bationo et al,2015and Bielders, 2015).

The main objectives of this work are to use the microdose technegue to help in reducing the cost and to determine the optiman microdose level under shambat condition.

CHAPTER TWO

LITERATURE REVIEW

Soil is an important factor in crop production and its degradation is one of the limiting factors for sustainable agriculture FAO.(2004) . With the ever-increasing population, soil fertility management by long fallow periods is practical soil fertility management method under intensive continuous cropping is also no longer feasible due to scarcity, high cost Akinrinde and, Okeleye (2005). And the numerous sde effects on the soil. Sanchez et, al .Sanchez, et,al (2002), reported soil That fertility depletion in small holder farming is the fundamental biophysical root cause of stagnant per capital food production in Africa. The shortage of fertilizer additions has resulted in enormous nutrient depletion and a reduction in yields, due to shortages in nutrients for plant growth. The rate of nutrient depletion has increased over the last 20 years and most of the losses of nitrogen from the soil have occurred since 1985 SheldrickWF(2004). Currently, gross nitrogen losses from cultivated African soils exceed 4.4 Tg yr-1while the annual consumption of mineral fertilizer is 0.8 TG (excluding South Africa) Sanchez et al.(2004). The sub optimal application of fertilizers to agricultural soils and the removal of nutrients in farm produce and erosion losses and the reduction in soil organic matter due to the farming systems, result in mining of nutrientsfrom the soil(Nyamangara .Enhancing et al (2001) degradation and a reduction in crop yields. The reduction in crop yields affects food security on the continent and contributes to high levels of poverty, Galloway et al. (2004). Optimization nitrogen use to sustain life, and to minimize the negative impacts of nitrogen on the environment and human health is far most important. N use efficiency (NUE), which is considered an important factor in the management of N applications in crop productivity, is expressed as the ratio between the grain yield and the total N accumulation(Rehman et al 2011). . Beatty et al (2010) suggested the NUE in cereals should be improved through the optimal management for the N applications as well as through use potential varieties to increase the crop yield. N applications are the most significant factors that can limit NUE and maize productivity. The assessment of the suitable N applications is a vital concern for the increase of N uptake efficiency (Norwood .et al ، 2000).

Maize (*Zea mays* L) ranks as one of the worlds' three most important cereal crops. It is cultivated in wider range of environments than wheat and rice because of its greater adaptability. Currently, its global production area is about 140 million hectares, of which approximately 96 million hectares in the developing countries. Although 68% of the world maize area is in developing countries, 46% of the world's maize production of 602 million tons (FAO, 2003) is produced in other area. (Ahmed 2010) Corn (*Zea mays*) among the crops, is an important in temperate climatic region, because of the increasing demand for food andlivestock feed. Nitrogen and phosphorus are essential nutrients for plant growth and development   in corn(Wua,.,et, al 2005). Large quantities of chemical fertilizer are used to replenish soil N and P, resulting in high costs and severe environmental contamination(Dai,,et, al 2004),Awodun,.,et,al2000) .Nitrogen is a major limiting nutrient for crop production. It can be applied through chemical or biological means. Over application can result innegative effects such as leaching, pollution of water resources, destruction of microorganisms and friendly insects, crop susceptibility to disease attack,acidification or alkalization of the soil or reduction in soil fertility. thus causing irreparable damage to the overall system. Phosphorus is second only to nitrogenin mineral nutrients most commonly limiting the growth of terrestrial plants. Ironically, soils may have large reserves of total P, but the amounts available to plants is usually a tiny proportion of this total. The low availability of P to plants is because the vast majority of soil P is found in insoluble forms, and plants can only absorb P in two soluble forms, the monobasic (H2PO4-) and the dibasic (HPO42-) ions (Glass, et al 1989).To address the problem of soil fertility, which is a greater constraint to food production than drought across much of sub-Saharan Africa, scientists at ICRISAT have developed a precision-farming technique called 'Microdosing'. Microdosing involves the application of small, affordable quantities of fertilizer with the seed at planting time or as top dressing 3 to 4 weeks after emergence. This enhances fertilizer use efficiency instead of spreading fertilizer over the field, and improves productivity. Rather than asking how a farmer can maximize her/his yields or profits, microdosing asks how a farmer can maximize the returns to a small initial investment – that might grow over time, turning deficits into surpluses (ICRISAT 2009).Therefore ,Fertilizer micro-dosing is the localized placement of small amounts of mineral fertilizer (4 grams of fertilizer) in the planting hole at sowing, or at the base of newly emerged plants, instead of spreading fertilizers evenly across the field. Use of improved planting pits (a rainwater harvesting technique that incorporates use of organic matter) instead of sowing seed in raised earth mounds encourages infiltration of rainwater and increases soil moisture levels.

CHAPTER THREE

MATERIALS AND METHODS

3.1 Field experiment

A field Experiment was conducted at the Demonstration Farm of the College of Agricultural Studies University of Science and Technology , Shambat Sudan.(15.40 N.,32,32E., elevation 380m).The climate is semi-desert with a low relative humidity and annual rainfall rate of 150 mm and a mean temperatuure of(20.3C-36 .1C) and clay soil with a pH 7.5-8(Abdulhafeez2001).

3.2Treatments:

The teatments consisted of five treatment which were:

1. control (without fetilizer)
2. 1gm compound fertilizer microdosing

3.2gm compound fertilizer microdosing

4.3gm compound fertilizer microdsing

5.4gm compound fertilizer microdsing

3.3Source of seed:

Maize(Zea mays L.) local variety, were obtained from College of Agricultural Studies, Sudan Uninversity of Scince Technology "Shambat".

3.4 Land preparation:

The experimental site was disc plough, disc harrowed, and then followed by harrowing and riding up north –south. The spacing between ridges was 30cm. Four replication were divided into four plosts, each plot was 3X3m, consisting of three rows.Soil sample was taken before sowing ,and after hars esting to determine the amount of nitrogen. Crop was sown at first December 2015. The depth of seeds was 2cm with fertilizer in the same hole seeds were planted as per the treaments. Weeding was done two times after three weeks frrom sowing and after one month from the first hand weeding .Soil sample were taken before planting and after harvesting.

3.5 Data Collection:

When maize plant was at 50% flowering, the data were recorded.

3.6Plant height (cm):

Five plants of maize were randomly selected from each plot and the plant height was measured from soil surface to the tip of the flag leaf using ameasuring tape. Then the mean height was obtined.

3.5.2 Number of leaves per plant:

Five plants from each plot were taken and the average number of leaves per plant was counted.

3.5.3 Length of internodes(cm): Five plant from each plot were taken and the average length of inter nodes per plant was meas

3.5.4 Stem diameter(Cm):

Five plants from each plot were taken and the diameter in the middle of the plant was measured using a strip and aruler and then the mean stem diameter per plant w as estimated.

3.5.5 Forage fresh yield per plant(g)

At harvest five plants from each plot were taken and weighted.And the mean weight per plant wa

The three plant from each plot used for fresh weight were dried at the oven (80c) for 48 hours and then weighed and the average dry weigh per plant was recorded.

3.5.6 Statistical analysis:

The data were analyzed according to the standard statistical procedure for a randomized complete block design as described by Gomez and Gomez (1984) using MSTAT. C computer package.

CHAPTER FOUR

RESULSTS AND DISCUSSION

4..1plant heiglt (cm):

There was no significant differences between plant heiglt (Table1). However The microdose 3gm gave The higest plant heiglt (181.97 cm)followed by microdose 4gm (197.80cm).(Table2).Microdose 1gm gave The lower height (143.63cm).The coefficient of variation (C.V)for the plant heiglt was 19.80% which was reasonable .The average percentage increase in plant heiglt was 24.59%.

4.2 leaves number:-(cm):

The number of leaves showed no significant differences between the microdose levels (Table1).The microdose levels were all had equal number as the control except 1gm microdose which gave highe .leaves number (Table 2).The percentage increase in leaves number was 13.45%. The coefficient of variation (C.V)of this parameter was 13.47 (Table 1) and figure 1

4.1.3 Stem diameter (cm):

There was nosignificant differences in stem diameter for the microdose leves (Table 1). Microdose 4gm gave the highest diameter (9.46cm) followed by the control (7.08Cm). The percent increase in the stem diameter was 33.61%(Table 2and figure 2).

TheCoefficient of variation for the microdose levels (C.V) was high (28.65%).

Table 1. Summary of the ANOVA for maize microdose technology

Source of varity	Degree of freadom	Plant height(cm)	Leave of number(cm)	Node length(cm)	Stem diameter (cm)	Fresh weight(g)	Dry weigh(g)
Replication	3	0.35	0.58	1.22	1.22	4.95	2.72
Microdose	4	1.25**	1.49**	1.86**	1.86**	1.54**	1.43**
Error	12	-	-	-	-	-	-
Total	19	-	-	--	-	-	-
EMS	-	1049.05	3.326550	3.937	4.12158	4607.5	760.22
C.V	-	19.80	13.47	25.20	28.65	20.60	22.09
SE+-	-	22.903	1.2897	1.4031	1.4355	2.201	19.496

NS=not significant

*=significant (5%)

**=Highly significant(1%)

Table 2. Means of maize microdose technology.

Micodose fertilization	Plant hight(cm)	Leaves number(cm)	Stem dimter(cm)	Node length(cm)	Fresh weight(cm)	Dry weight(cm)
Control	146.05A	13.525A	7.0750AB	7.9325AB	368.13A	131.87A
1gm	143.63A	15.350AB	6.2925B	6.1825B	254.59A	135.88A
2 gm	166.55A	12.850AB	5.9975B	9.6875A	354.69A	141.99A
3gm	181.97A	13.550AB	6.6050AB	7.4950AB	312.06A	107.75A
4gm	179.80A	12.450B	9.4550A	8.0775AB	357.89A	106.69A

Means followed by The same letterforeachcolvmnare not significant according to LSD at 5% Level

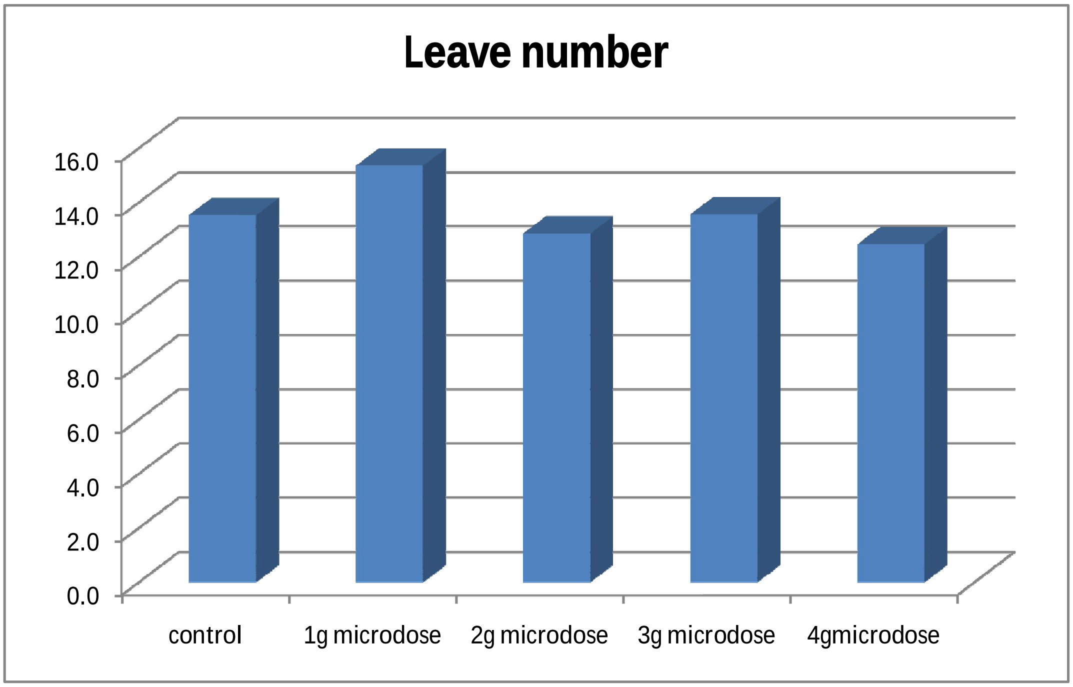

Fig 1:Leaf of maize/plant Micro dose Technology

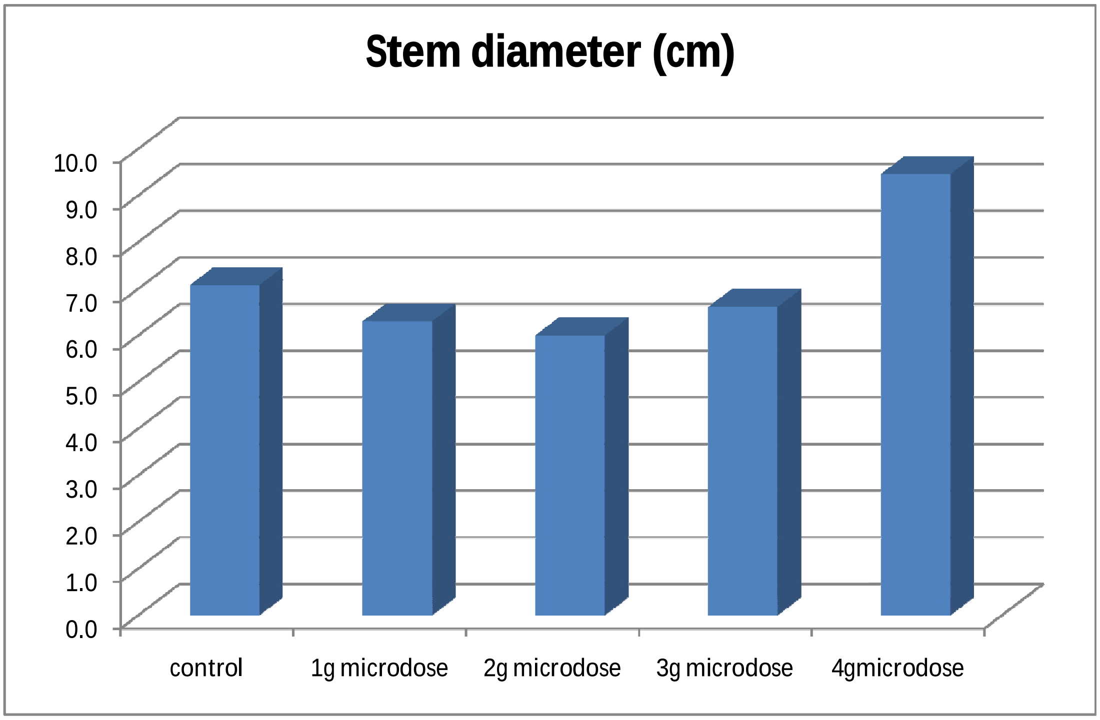

Fig 2. Stem diameter (cm)of maize Micro dose Technology

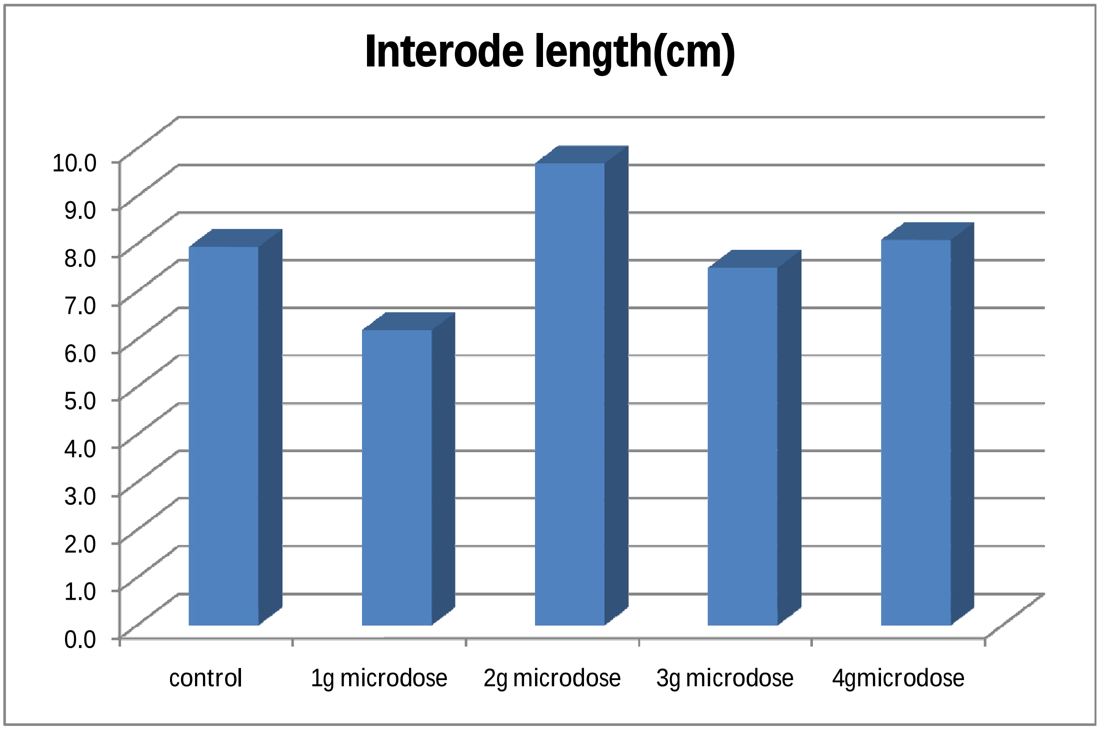

Fig 3. Internode lenth(cm)of maize Micro dose Technology

4..4 Internode length (cm):

There was no significant differences for the length of the internode for maize microdose level (Table 1).Microdose 2 gm had the hight internode length (9.69cm) while microdose 1gm gave the low est internode length (6.18cm).The percent increase in the internode length was 22.19%(Table 2 and fig.3) The coefficient of variation (C.V) was 25.20%

4.5 Fresh weight (gm):

The fresh weight per plant was not significant for the microdos level (Table 1).The control gave the highest fresh weight(368.13gm) while microdose 1gm had the lowest 254.59gm) (Table2). The range of the fresh weight is similar except for the microdose 1gm .The coefficient of variation was 20.60%(Table 1)

4.6 Dry weight (gm)

There was no significant differences between the dry weight per plant bfor maize microdose levels (Table 1).Microdose 2gm had the highest dry weight (141.99%) whiele microdose 4gm had the lowest (109.69gm) (Table2). The percent increase in dry weight per plant was 7.67%.The coefficient of variation(C.V)for the dry weight per plant was 22.09%(Table 1) .

Conclusion

As shown in the tables and figures there was no consistency in the microdose levels for the different parameters .This miglt be becanse of the small amount added.

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Appendix

Table 1.plant height (cm):

Source	DF	SS	MS	F	p
Re	3	1090.1	363.37	0.35	0.7924
Teatment	4	5263.1	1315.79	1.25	0.3405
Error	12	12588.6	1049.05		
Total	19	18941.9			
C.V	19.80				

Table 2.leaves number (cm):

Source	DF	SS	MS	F	P
Re	3	5.7695	1.92317	0.58	0.6404
Teatment	4	19.7620	4.94050	0.49	0.2675
Error	12	39.9180	3.32650		
Total	19	65.4495			
C.V	13.47				

Table 3.Inter node length (cm):

source	DF	SS	MS	F	P
Re	3	5.0345	1.67815	0.43	0.7378
Teatment	4	25.3537	6.33842	1.61	0.2352
Error	12	47.2497	3.93748		
Total	19	77.6379			
C.V	25.20				

Table 4: stem dimeter (cm)

source	DF	SS	MS	F	P
Er	3	15.05337	5.01789	1.22	0.3457
Teatment	4	30.6008	7.65021	1.86	0.1831
Error	12	49.4590	4.12158		
Total	19	95.1135			
C.V	28.65				

Table 5farsh weight.

Source	DF	SS	MS	F	P
ER	3	68372.3	22790.8	4.95	0.0206
Teatment	4	28383.9	7096.0	1.54	0.2578
Error	12	50694.0	4608.5		
Total	19				
C.v	20.60				

Table 6. Dry weight :

Source	DF	SS	MS	F	P
Er	3	6203.0	2067.66	2.72	0.0911
Teatment	4	4348.1	1087.02	1.43	0.2833
Error	12	9122.7	760.22		
Total	19	19673.7			
C.V	22.09				