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Full Length Research Paper

Effect of Manure and Urea on Growth and Yield of Okra plant and some Nutritional elements in Bara area – North Kordofan State

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The study was carried out in the nursery of the ministry of agriculture in Bara city in North Kordofan State in the period between June to August (2015). The aim of the study was to investigate the effect of chemical fertilizer (urea) and organic fertilizer (manure) on the growth and yield of okra plant (Umhejarat) and some nutritional elements content in the soil and okra horns. The effect was studied by measurement and analysis of three types of soils (non-fertilizing soil, fertilized with urea and fertilized with manure). Three samples of the soil were taken from three depths (0-20, 20-40, 40-60cm) before the addition of fertilizers and planting of okra to determine the nutritional elements in the soil (as control). A randomized complete block design with three factors was used. 5.0 kg of urea and 300 kg of manure /150 m^2 were used. The characters studied include plant height, the number of leaves and number of horns. Sodium, nitrogen, calcium, iron, magnesium, potassium and phosphorus were determined in the dried powdered form of horns and in the three depths in the three types of the soil. The results showed that fertilizing types had a significant effect on the most parameter measured in the study. It was observed that using manure significantly increased the plant height, the number of leaves, number of horns, the content of the elements, the pH, and the yield. The study results showed a significant difference between the elements calcium, magnesium, potassium, nitrogen and phosphorus determined in the three depths of the soil in the three types of the soil but no significant difference was found between the elements determined in the dried powdered form of the horns in the three types of the soil. The study recommends further study to evaluate the effect of different levels of organic fertilizer on okra plant.

Keywords: Okra, Manure, Urea, Bara area.

INTRODUCTION

The increasing population requires the production of much food with good quality in a short time away from epidemics and with less cost of money. For this reason, the study of fertilizers became a major topic (problem) and very important in the last years in the world (Arij –1998). Okra (Hibiscus – esculents) belongs to malvalence family, and its homeland is a hot area in Africa especially Sudan, but now spread all over the world and well used in many parts of Asia and America (Mohammed *et al*., 2003). Okra in Sudan is considered to be one of the most common vegetable crops that spread and used or consumed (Khaleil, 1988). Okra has high nutritional value as it contains carbohydrates, proteins, and minerals salts. Okra horns in some nations are used as an alternative to coffee, also stems. Old horns fibers are used in papers industry. Okra is grown for its greenhorns which are used in different forms: dried, cooked, frozen and canned. Okra horn is considered as one of the rich fibers vegetable and middle in its contents of protein, carbohydrates, and phosphorus. The greenhorn of okra contains 88.9% water, 36 kilocalories, 2.4% protein, 7.6% carbohydrates, 0.3% oil, 0.092% calcium and 0.051% phosphorus (Abdelelah,1980).

Techniques tools should be followed in all steps of

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growing such as irrigation, fertilizing rates, protecting and curing tools of insect in an appropriate time and period. Okra is considered as one of summer crops which needs very long hot growing season because the seeds grow at 35°C and do not grow at less than 15°C. The cold season tends to weaken the flowering and fruits and deform the horns. Some kinds of okra are very sensitive to light period and others are not. The flowering buds may fail to complete the growing when the period of light is more than eleven hours per day for certain kinds of okra. Okra is grown in almost all states of Sudan and it is very well grown in muddy soils because of fertility and good in airing, also is well grown in yellow soil (Hassan, 1989). Okra can be grown in heavy soils and in sandy soils if there are good organic or chemical fertilizers. It is advisable that okra not to be grown in acidic soil (Abdelmawla, 1979).

There are a few researches on fertilizing application fields on okra plant in Sudan because okra plant roots enter deep in the soil and absorb the nutritional elements (Hamid *et al*., 1998), for this reason, there are some recommendations to use liquid organic fertilizer and urea fertilizer for two periods. First after 15 days from growing and the second after one month (30 days) from the first period (Elrawi *et al*., 1980). In (Gazera project) the planted area is very big about 2845 faddan in season (89 – 1990). The production of the farmers in the research farms in Gazera state (6 – 8) tons for one faddan (Mohammed and Mamoon, 1995). Okra plants by seeds directly in permanent sandy soil in holes by rate of four seeds in one hole; the distance between the holes is about 20 cm. The field irrigated by irrigation method after planting directly (Abdelgawad, 1989). The viscous materials in okra join with cholesterol and acidic material which carry the poisons out of the body (Abdelelah 1980).

MATERIALS AND METHODS

Soil samples

Soil samples were taken by auger instrument from three depths (0- 20, 20- 40, 40- 60 cm) and each sample (4.0gm) was kept in a separately labeled bag made of cloth.

Okra horns samples

Okra horns samples were collected by human hands and kept dried milled in bags.

The experiment

The experiment was carried out between June and August 2015 under irrigation system in North Kordofan in the nursery of the ministry of agriculture in Bara using urea (bought from the ministry of agriculture) and manure (prepared in the nursery) as fertilizers.

Experimental design

The experiment was conducted in a Randomized Complete Block Design (RCBD) with three replications. The fertilizing treatments consisted of three types (no fertilizer, urea, local manure). One kind of okra (Umhejarat) has been used in the experiment. The fertilizers were added three weeks later after planting. 5.0 kg of chemical fertilizer (urea) and 300 kg of manure per 150 m^2 were used.

Soil and horns samples preparation for analysis

4.0 gm of each soil sample and horns were dissolved in distilled water and transferred to a 40.0ml volumetric flask and completed to the mark with distilled water. The pH was controlled by the addition of hydrochloric acid. 4.0ml from each soil sample and horns solutions were used to determine the nutritional elements by spectrophotometer.

Sowing

Seeds were sown on lines in the spacing of 20 cm between holes, four seeds were placed in each hole. The irrigation began two days later after planting and continued until the start of harvesting. The plants were thinned to two plants per hole.

Characters studied

Plant height

The plant height was measured from the ground level to the top of the plant (in cm) by the ruler.

Number of leaves

The number of leaves was calculated in every experiment unit (plot) every week and the average was taken.

Number of open flowers

The number of open flowers was calculated in every experiment unit (plot), every week and the average was taken.

Number of horns

The number of horns was calculated in every experiment plot, every week and the average was taken.

RESULTS AND DISCUSSION

The concentrations of the nutritional elements in the soil before planting okra and without fertilizer in different levels of depth are presented in table 1. Table (1) showed the low content of nitrogen and this explains the needs of the soil for nitrogen. The pH of the soil is neutral as shown in table (1) and this is an indication to approximate similarities of the anions and cationic concentrations. It is clear from tables (1,2,3) there is an increased in the pH as the depth increased and this indicates the increases of alkalinity as going down in the soil.

The concentrations of nutritional elements in the different depths of the soil after the addition of urea and planting the okra are shown in table (2). There is a significant difference between the elements concentrations in the different depths. The elements concentration are increased as the depth increased. There is an increased in phosphorus, nitrogen and potassium concentration as shown in table (2) compared to that in the control (table1) but there is a decrease in magnesium and calcium concentration as shown in table (2) compared to the control (table 1). The increase in elemental concentrations may be due to the addition of urea and the decrease may be due to the absorption by okra. It is clear from table (2) the pH is affected by the addition of the urea but not significant.

The effect of manure on elemental concentrations and pH in different levels of depth is depicted in table (3). There is an increased in the concentrations of the elements phosphorus, nitrogen, potassium and the pH compared to those in the control (table 1) and this increase is also clear as the depth increased and this increment is due to the addition of manure. Calcium and magnesium concentrations were decreased compared to the control and this may be due to the absorption by the okra plant.

There is a significant difference between the plant height in the three treatments. There is a high increased in the plant height in the soil treated with the manure compared to that treated with urea and the control. Hadil (2012) showed that fertilizing okra by organic and chemical fertilizers exhibited a significant difference between plant height, also we found that the stem height in the five weeks was 16.17 cm in control (stem without fertilizing) and 24.17cm in treated plant with urea. This in agreement with that shown by Abdelgawad (1989) found that increasing the quantity of nitrogen increase the height of the plant. The maximum plant height for the three treatments was shown in table (4) for five weeks.

The numbers of leaves in witness and after the addition of manure and urea were shown in table (5). The maximum numbers of leaves in the three types were found in the fifth week as shown in table (5). This indicated that the local manure increased the green growth and assisted the absorption of nutritional elements that is found in the soil. Hadil (2012) showed no significant difference between the numbers of leaves. The mean number was 6.8 leaves in the witness and 6.7 leaves in the treated plant with urea. This indicated that no significant effect of adding urea to plant during the period of plant growing until the fifth week. This result is in agreement with that found by Adam (2002). Daro (2000) and Abuagon (2000) found that no significant difference in the number of leaves.

The numbers of horns in the control and after the addition of manure and urea were shown in table (6). The maximum numbers of horns were found in the fifth week. The addition of manure increased the number of horns compared to the urea and the control. Hadil (2012) found significant difference in the number of horns. The mean number of horns in plant that treated with urea is (9.96) horns and (7) horns in the control. Hadil (2012) found no significant difference in horn height. She found the height of horn is 16cm for plant treated with urea and 14 cm in the control.

The elemental concentrations in okra horns were shown in table (7). The type of fertilizer has no effect on the element content in the horn as shown in table (7), this means that the plants take the required amount of the element regardless of the fertilizer used.

CONCLUSION

Analysis of the soil control indicated that the nitrogen content is low in the soil this means that the soil requires the addition of fertilizer to complete the required amount of nitrogen to the plant. The elemental concentration in okra horn indicated that the soil content of elements is enough for okra to grow. The content of horn of element was not affected by the quantity of fertilizers used. From the study results the manure is better than urea for growth and yield of okra plant.

Table 1. The nutritional elements concentrations (ppm) and the pH of the control soil

Depth level of the soil (cm)	P	N	K	Mg	Ca	PH	Fe	Na
0 – 20	14	0.011	0.714	8.122	3.612	6.92	13.23	0.912
20 – 40	21	0.013	2.412	10.160	4.817	7.01	15.41	3.134
40 – 60	36	0.028	4.291	11.292	6.282	7.011	18.22	5.925
Mean	23.667	0.017	2.472	9.858	4.904	6.980	15.620	3.324

Table 2. The nutritional elements concentrations (ppm) and pH in different levels of depths of the soil after the addition of chemical fertilizer (urea) and planting the okra

Depth level of the soil (cm)	P	N	K	Ca	Mg	PH	Fe	Na
0 – 20	38	0.182	1.545	0.421	7.790	7.07	14.43	1.32
20 – 40	45	0.201	2.861	1.782	8.125	7.12	16.22	3.45
40 – 60	47	0.271	2.901	1.821	11.15	7.21	19.23	4.21
Mean	43.333	0.218	2.436	1.341	9.022	7.133	16.627	2.993

Table 3. The effect of organic fertilizer and planting okra on elemental concentrations (ppm) and pH in different levels of depth

Depth level of the soil (cm)	P	N	K	Ca	Mg	PH	Fe	Na
0 – 20	48	0.242	2.612	1.372	5.171	7.17	15.21	3.16
20 – 40	52	0.281	3.421	5.662	11.426	7.22	19.53	5.11
40 – 60	54	0.286	3.902	2.75	12.812	7.84	23.41	5.91
Mean	48	0.242	2.612	1.372	5.171	7.17	15.21	3.16

Table 4. Plant height (cm) in the control and after the addition of urea and manure measured in five weeks.

Measurement time	Weeks				
Treatment	**1**	**2**	**3**	**4**	**5**
Control	8.50	10.82	12.30	14.40	16.20
Urea	12.30	14.64	16.82	22.40	25.18
Manure	16.22	17.12	20.17	23.86	27.42

Table 5. The number of leaves in the control and after the addition of urea and manure counted in five weeks.

Measurement time	Weeks				
Treatment	**1**	**2**	**3**	**4**	**5**
Control	4.2	5.46	6.10	10	16.80
Urea	4.80	5.87	6.014	10	16.92
Manure	4.94	5.88	6.32	10	16.88

Table 6. Number of horns from the beginning of the flowering period in the control and after the addition of manure and urea counted in five weeks.

Measurement time	Weeks				
Treatment	**1**	**2**	**3**	**4**	**5**
Control	1.25	2	3.5	4	5.75
Urea	2	3.75	6	6.75	7
Manure	3.5	7.75	9.75	9.75	9.95

Table7. Elemental concentrations (ppm) in okra horns

Sample	P	K	Mg	Fe	Na	N	Ca
Control	0.121	0.001	3.271	3.718	0.031	0.0517	0.054
Fertilized with urea	0.023	0.001	3.095	3.0815	0.031	0.731	0.071
manure	0.030	0.001	3.291	3.863	0.031	0.912	0.091

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