The Role of Nitrogen Fertilizer on the Growth Performance of Garlic (Alliums Sativum L.) at Wolaita Sodo University

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Abstract
Gaelic is a potential vegetable crop in Ethiopia in general and wolaita in particular. However, there was no much information on agronomic practice especially abut fertilizer application in the area .The field experiment was conducted using a local variety is called Nechshinkurtat Wolaita so do university experimental sit to see the growth performance of garlic to different rate of nitrogen fertilizers .Four level of nitrogen rates (0 kgN/ha, 50 kg N/ha, 100kgN/ha, 150 kgN /ha).The plots were arranged in Randomized Complete Block Design (RCBD)'with three replication. Growth parameters such as plant height ,leaf length ,fresh weight, dry weight were collected and analyzed by using SPSS software .The result of the study showed that application of 100 kg N/ha significantly increased the growth of garlic than other treatment s .The application rate of 100 kgN/ha significantly enhanced leaf length .This study further confirms the role of nitrogen fertilizers in increasing growth in garlic production .Form the result of the study application rate of 100 kgN/ha may be recommended for growth of garlic particularly in the study area .This would greatly benefits of farmers in area where supply of nitrogen fertilizer is low and cases where farmers cannot afford the cost of high fertilizer input .further research had to be conducted to evaluate the effect of nitrogen fertilizers on the growth.

Keywords: Nitrogen fertilizer, growth, performance Garlic

1. INTRODUCTION

Garlic (Alliums s.) belongs to the family Alliaceous, other crop in this family are onion (Alliumscepa L) and Leek. Garlic is the second most widely cultivated bulb crop after onions. It is an erect annual herb that can reach height of 75-90cm and growth during dry and mild winter season (Brewster, 1994). Garlic is believed to have originated in central Asia (India, Afghanistan, China, Russia etc.). And spread to other parts of the world through trade and colonization (Tindal, 1986). The production of garlic stood at about 10 million tons per annum which is only about 10% 5that of bulb onions (FAO, 2007). Garlic is among the most important bulb vegetable which is used as spice and flavoring agent for goods (Valise et al, 1997).

It is widely used around the world for its pungent flavor as seasoning or condiment. It is fundamental component in many or most dishes of various countries in the world including Ethiopia. Garlic adds a test to goods as well as it helps to make them more palatable and digestible. It is an important ingredient in the leading cuisine around the world. In Ethiopia, garlic is used while preparing foods, particularly some kinds of stew and in making dried foods storage (Rubatzky and Yamagch, 1997).

All part of the plant has a use. The cloves are used as seed, for consumption (row or cooked and for medicinal purpose. The leaves, stems (Scape) and flowers (bulbils) on the head (Spathe) are also edible and are most often consumed while immature and still tender .The papery protective lavers of skins over various parts of the plant and the roots attached to the bulb are the only parts not considered palatable (Kero, 2010).

Garlic contains different use full minerals, vitamins and may other substance used for heath of human beings. It is also contains more than 200 chemical compounds such as allicin, allin and ajoene, alliance, peroxides and MyrosinaseAgene contribute to anticoagulant action of garlic thus, garlic can right fully be called one of nature's wonders because it in habits and kills bacteria, fungi parasites, lower blood pressure, blood cholesterol and blood sugar, prevents blood clotting, protects the liver and exhibits to more property (Sovoua and Sova, 2004).

There are many biotic and a biotic factors that contribute for the low productivity of garlic in Ethiopia some of the major causes of low garlic yields are decaling soil fertility, insufficient and inefficient use of fertilizers resulting in severe nutrient depletion in the soils, in appropriate agronomic practices, absence of proper pest and disease managements etc. (Teweldebrhan, 2009,

WorkuandDejen, 2012). Availability of nitrogen is a prime importance for growing plant as it is amajor and indispensable source of protein and nucleic acid molecules (NaruKaetal, 2005).

Objective: To determine the effect of nitrogen fertilizer on the growth performance of garlic.

2. MATERIALS AND METHODS

2.1. Description of the Study Area

The experiment was conducted at horticulture research filed in WolaitaSodo University. WolaitaSodo University is 390 kmaway from Addis Ababa;it has altitude of 1800m asl, longitude of $60^0$49'north and latitude of $37^0$45' East it is the area the annual mean. Temperature is 20^0c of the annual mean rain fall is 1212mm. The soil of the area is loam types (Wolaita Sodostudent hand book, 2009).

2.2. Experimental Material

The materials was use during the experiments area local garlic clove, meter, rulers, peg, axes, watering cans, spades, rakes, fork, weighting balance calculator, fertilizer (UREA).

2.3. Experimental Design and Treatment

The experimental was conducted in randomized complete Block Design (RCBD) with three treatments and three replications. This design is aimed at removing variability in experimental plats and reduces experimental error to precisely see the difference between treatments. The total experimental area was (7x4.8) m^2 having the total area 33.6m^2 which was divided in the three homogenous blocks or replication and each blocks contains complete set of treatments which was allocated to the plot within each block at random plots or beds in a block was equal to the number of treatment and one treatment was replicated three times.

T_1= 0 kgN/ha, T_2=50kgN/ha, T_3 =100kgN/ha, T4=150 kgN/ha

Table 1.Detail of fertilizer treatment used in this study.

Treatment code	Treatment
T1	Control
T2	50kg N/ha
T3	100KgN/ha
T4	150KgN/ha

2.4. Experimental Procedure

Garlic variety locally called "local Nechshinkurt collected from the local farmers (market) around Sodo Town. The clove was soaked with water before sowing. A garlic seedling was later thin to one plant per stand. The treatment [three level of nitrogen] was applied two weeks after planting through side placements. Weeds were controlled through hand .Weeding to reduce competition for space, water, light and nutrient between the crops and weed. The field border was kept clean to minimize encroachment by insects and rodents.

2.5 Data to be collect

Growth related parameters such as plan height, leaf number per plant and leaf length was recorded at different stages of crop growth and development. Garlic crop is characterized by three growth stages; sprouting stage (20-30, days) from sowing, shoot growth stage. From the end of sprouting until 40 days after sowing and bulb growth stage, during the inductive stage (from sprouting up to 90 days and during morphogenetic stage (80-170) and harvest (maturity stage (Arguello et al, 2000).Data was collected three weeks after the treatment. The data was recorded at three growth stages or the plant at sprouting stage, shoot growth stage and bulb growth stage. The parameter was determined in the following ways.

Plant height: this was taken from a sample of three randomly selected garlic plants marked with in each plot; aruler measuring the height from the ground level to the top most leaf.

Number of leaves per plant: visual counting of leaves on the three randomly selected plants was made and number was recorded for each plant. The mean value was then calculated for each plot.

Leaf length: this was again taken from three randomly selected garlic plants marked with in each plot. A ruler was used for measuring the length from the point leaf attached to its leaf sheath up to the end tip of the leaf.

Fresh weight: was measured from three samples at maturity stage by using weighing balance.

Dry weight: was measured from three sample plant by oven draining.

2.6. Data Analysis

The raw data of each parameter per plot was recorded and analyzes using analysis of their variance (ANOVA).

The data was anal sized wing SAS software. Fishers distribution (F- calculated) will be calculated from the data profanity of 5% will be used to calculate the tabulated value of F (F-tab) and committing of type one error. The treatment means will be separated using the least significant difference (LSD) at 5% level of probability.

3. RESULT AND DISCUSION

Application of nitrogen fertilizer had significant effect on the growth of garlic at sprouting and shoots growth stages (table 2).

Table 2: Effect of different rate of nitrogen on growth parameters

Parameter	T1=0 kg N	T2=50kgN	T3=100kg N	T4=150 kg N	LSD at 5%	CV
Plant height	14.63	19.46	21.59	22.22	1.9	14.9
Number of leaves	18.66	21.5	22.07	21.9	1.23	7.4
Leaf length	88.54	112.78	117.84	110.25	7.6	10.4
Fresh weight	20.02	20.75	25.29	29.7	4.7	30
Dry weight	12.12	22.36	26.37	22.13	2.23	15.1

Plant Height: The data recorded in table2 showed that plant height increased the treatment at all stages of growth. There were significantly affected by different rate of fertilizer application.

The minimum plant height was recorded in control (T1) at (14.63cm).The maximum plant height was recorded in (T4) at (22.22cm).

Number Of Leaves: The results presented in table 2 showed the trend observed in the of leaves produce by plant at different stages growth .The numbers of leaves increased across the treatments at all stages of growth. There were no significant different in the number of leaves per plant among the treatments. The minimum number of leaves was recorded in the control (T1) at (18.66cm).The maximum number of leaves was recorded in (T4) at (22.07cm).

Leaf Length: The results presented in table2 showed that the effect of different rates of nitrogen fertilizer on leaf length of garlic. There were significant differences in the leaf length among treatments. Leaf length was significantly affected by different rate of nitrogen application. The

minimum leaf length was recorded in (T1) at (88.54cm). The maximum leaf length was recorded in (T3) at(117.8cm).

Fresh Weight: The results presented in table 2 showed that the effects of different rate of nitrogen fertilizer on fresh weight of garlic. There were significant differences in fresh weight among the treatments. Fresh weights were significantly affected by different rate of nutrient combinations. The maximum fresh weight was recorded in (T4) at (29.7cm). The minimum fresh weight was recorded (T1) at (20.02cm).

Dry Weight: The result presented in table 2 showed that the effect of different rate of nitrogen fertilizers on dry weight of garlic .There was significant difference in the dry weight among the treatments. Dry weight was significantly affected by different rate of nitrogen fertilizers. The maximum dry weight was recorded in (T3) at (26.37cm). The minimum dry weight was recorded in control (T1) at (12.12cm).

4. CONCLUSIONS AND RECOMMENDATION

This study further confirms the role of nitrogen fertilizers increasing growth in garlic production. From the result of the experiment, the application rate of nitrogen fertilizer significantly influenced the growth of garlic. This was evidently particularly in leaf length and fresh weight of the plant. The maximum leaf length was produced with the application rate of 100kgN/ha. This can be attributed to the fact that nitrogen promote vegetative growth in garlic (NaruKa etal,2005).

Availability of nitrogen is prime important for growing plants as it is a major and indispensable constituent of protein and nucleic acid molecules. It is an integral part of chlorophyll molecules which are responsible for photosynthesis .An adequate supply of nitrogen is associated with vigorous vegetative growth.

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APPENDIX

Appendix 1: analysis of variance plant height affected by nitrogen fertilizer rate

Source of variance	df	Ss	ms	Fcal	Ftab at 5%	.
TRT	3	12	4	4.9^{x}	4.76	
Rep	2	118.5	59.25			
Error	6	5.7	0.95			
Total	11	136.2				

CV=14.9, LSD=1.9

Appendix 2: analysis of variance of leave numbers affected by nitrogen fertilizer rate.

Source of variance	df	Ss	Ms	F_{cal}	F_{tab}at5 %	.
TRT	3	2.6	.0.8	3.2^{ns}	4.76	
Rep	2	30.6	15.3			
Error	6	.1.6	.0.27			
Total	11	.34.8				

CV=7.4, LSD=1.23

Appendix 3: analysis of variance of leaf length affected by nitrogen fertilizer rate.

Source of variance	df	Ss	Ms	Fcal	Ftab at5%	.
TRT	3	.167.9	55.97	5.4^{x}	4.76	.
Rep	2	351.3	175.7			
Error	6	.91.6.	.15.3			
Total	11	.610.8				

CV=10.9%, LSD=7.6

Appendix 4: analysis of variance of plant fresh weight affected by nitrogen fertilizer rate

Source variance	df	Ss	Ms	Fcal	Ftab at5%	.
TRT	3	17.9	5.9	$.7.4^{x}$	4.76	.
Rep	2	340.4	170.2			
Error	6	35	5.8			
Total	11	393.2				

CV=30%, LSD=4.7

Appendix 5: analysis of variance of plant dry weight affected by nitrogen fertilizer rate.

Source of variance	df	ss	Ms	Fcal	Ttab at5%	.
TRT	3	4.4	1.47	.1.07^{ns}	4.76	.
Rep	2	258.1	129.1			
Error	6	8.2	1.37			
Total	11	270.7				

CV=15.1%, LSD=2.23