

INVESTIGATION REGARDING THE EFFECTIVENESS OF NITROGEN SOURCES
AND CONCENTRATION ON PLANT CHARACTERISTICS IN TOMATO
(*LYCOPERSICON ESCULENTUM*)

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*This Dissertation is dedicated to The Islamic Development Bank (IDB) and to my Beloved Family
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ABSTRACT

Tomato is one of the most popular and widely grown vegetable crops in the world. The tomato crop is highly responsive to nitrogen (N) fertilizer application. These studies were conducted to assess the effects of nitrogen sources and concentration on plant characteristics of semi-determinate and determinate types of tomato at Dusan campurean UTM. Data for plant height, number of leaves, leaf branches and nitrogen content of leaves were recorded. After 12 weeks, strong effects of urea and ammonium nitrate were observed on plant height, number of leaves, leaf branch and nitrogen content in the leaf of indeterminate and semi-determinate respectively. Results indicated that the best responses of indeterminate and semi-determinate plant height was 120cm and 85cm in 1.2 N g concentration of urea and ammonium nitrate respectively. The effect of nitrogen sources on a number of leaves has been evaluated, the highest number of leaves found in indeterminate variety was 82 with urea treatment while semi-determinate was 71 with ammonium nitrate. Moreover, leaf branches and nitrogen uptake for the both varieties have different responses for nitrogen source, the highest percentage of nitrogen in indeterminate and semi-determinate was 3.31 %, 4.86% while that of leaf branches were 18, 17 respectively in high level of nitrogen concentration of urea and ammonium nitrate. Since both varieties have different genetic backgrounds, they respond differently to nitrogen sources. It is therefore suggested that urea and ammonium nitrate would be better source of nitrogen in indeterminate and semi-determinate types of tomato, rather than ammonium sulphate.

ABSTRAK

Tomato adalah salah satu tanaman sayur-sayuran yang paling popular dan ditanam secara meluas di dunia. Tanaman tomato adalah sangat responsif terhadap aplikasi baja nitrogen (N). Kajian-kajian ini telah dihubungkan untuk menilai kesan sumber nitrogen dan kepekatan pada ciri-ciri tumbuhan jenis separa tentu dan tak boleh tentu tomato di Dusan Campuran UTM. Data bagi ketinggian tumbuhan, bilangan daun, dahan daun dan kandungan nitrogen pada daun telah direkodkan. Kesan kuat urea dan ammonium nitrat telah direkodkan pada ketinggian tumbuhan, bilangan daun, dahan daun dan kandungan nitrogen dalam daun jenis tak boleh tentu dan separa tentu. Keputusan menunjukkan bahawa tindakbalas terbaik terhadap ketinggian tumbuhan jenis tak boleh tentu dan separa tentu adalah 120cm dan 85cm dalam kepekatan tinggi urea dan ammonium nitrat. Kesan sumber nitrogen terhadap bilangan daun telah dinilai dan ia menunjukkan bilangan tertinggi daun didapati dalam varian tak boleh tentu adalah 82 dengan rawatan urea manakala varian separa tentu adalah 71 dengan rawatan ammonium nitrat. Selain daripada itu, dahan daun dan kadar serapan nitrogen untuk kedua-dua jenis varian mempunyai tindakbalas yang berbeza terhadap sumber nitrogen iaitu 3,3160%, 4,8622% manakala dahan daun pula adalah 18, 17 pada kadar nitrogen yang tinggi didalam urea dan ammonium nitrat. Oleh kerana kedua-dua jenis varian mempunyai latar belakang genetik yang berbeza, mereka bertindak balas secara berbeza terhadap sumber nitrogen. Oleh sebab itu, dicadangkan bahawa urea dan ammonium nitrat sepatutnya menjadi sumber nitrogen yang lebih baik dalam varian tak boleh tentu dan separa tentu tomato berbanding ammonium sulfat.

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CHAPTER 1

INTRODUCTION

1.1. Introduction

Tomato (*Lycopersicon esculentum*) belongs to the Solanaceae family and is one of the most important vegetables worldwide. The world production of tomato in 2001 was about 105 million tons of fresh fruit from the estimated 3.9 million hectares. As it is a relatively short time crop and gives high yield, it is economically attractive and the area under cultivation is increasing rapidly (shankara Niaka *et al.*,2005).

More recently, there has been transformed attention given to the antioxidant content of tomatoes because many epidemiological studies suggested that regular use of fruits and vegetables, including tomatoes, can play an important role in preventing cancer and cardiovascular problems (Rao,1999).

Epidemiological studies describe an inverse relation between a diet rich in tomatoes and tomato products and the incidence of cardiovascular disease and several types of cancer .

This protective effect has been attributed to their high content of various dietary compounds, such as carotenoids and polyphenolic compounds, vitamin E, potassium and selenium, which exert different bioactive properties (Jacob *et al.*, 2010).

The synthetic antioxidant needs wide and expensive tests to ascertain their safety for food application. For this reason, there is interest in the use of naturally occurring antioxidant. A significant impact of globalization on horticulture has been an increasing demand for quality improvement and the wider adoption of quality standards for fruit, vegetable and salad commodities. Salad tomatoes must have a flavor, color and texture that satisfy the consumer's preference. At the same time they must be suitable for post-harvest handling and marketing, even over large distances.

The provision of nutrients to the plant in quantities that are optimal for their subsequent utilization is a primary aim of crop fertilizer programmers and, since both yield and quality are adversely affected by any deviation from this optimum, it is essential at all times to avoid an excess or lack of nutrients. Tomatoes were furrow irrigated every 7 to 14 days except after seeding and transplanting when sprinkler irrigation was used. The plant is divided into green leaves, stem and fruits. (J.cavero, 1997). With the increase in world population and improvement in the dietary habits, the consumption of vegetable has improved. People realize the importance of vegetables in their diet as vegetables have high nutritive value, which are vital for the body. Also in the present scenario the cultivable land area is decreasing day by day due to rapid urbanization, industrialization and shrinking land holdings. Therefore, vegetable production under low cost greenhouse technology is the best alternative to use the land and other resources more efficiently (Ganesan and Vijay R, 2003).

The tomato is rich in minerals, vitamins, essential amino acids, sugars and dietary fibers. The tomato crop is highly responsive to nitrogen (N) fertilizer application where N availability may be limited and time of the application is critical

(Taber, 2001). The current Tomato production system requires a high level of N and irrigation for optimum growth. These systems can pollute surface and ground water. An adequate N supply is critical for Tomato production. The tomato has a continuous N accumulation throughout its growth and Development.

The percentage of total N in tomato leaves drops steadily from the seedling stage to fruiting stage development. At the seedling stage, approximately 80% of the total N in the plant can be found in the leaves. Afterwards there is shift in N accumulation from the leaves to the developing fruit. At harvest, 24 % of the total N in the leaves and 69% in the fruit (Wilcox, 1993).

Tomatoes need adequate sun, water and warmth. In order to generate enough energy to produce fruit, the tomato plant needs at least seven hours of sunlight per day as well as appropriate spacing for the yield of tomato (Michael *et al.*, 2009).

1.2. Problem Background

Tomato is one of the most popular and widely grown vegetable crops in the world. The tomato crop is highly responsive to nitrogen (N) fertilizer application where N availability may be limited and time of the application is critical (Taber, 2001).

Nitrogen is a one of the major elements for plants growth and development that have an important role in plant nutrition and therefore is the yield-limiting factor for plant growth in many areas especially in low organic soils. N fertilizers often are mobility in soils and they can pollution soils and groundwater. Therefore,

management N fertilizer such as rate, type of N fertilizer, application time is very important (Direkvandi *et al.*, 2008).

Tomatoes are grown by using both conventional as well as organic fertilizers. The nutritional quality of organically and conventionally grown plants has been compared mainly in terms of macronutrients, vitamins, and minerals. The results of over 150 of these studies were reviewed by (Woese *et al.*, 1999); they found very inconsistent differences in the nutritional quality of these products.

Nitrogen can be available to plant roots in several different forms, these are nitrate, ammonium and organic forms mainly amino acids (Neuberg *et al.*, 2010) .

1.3. Problem Statement

Nitrogen is an integrated component of amino acid that make up protein and enzyme in all living organisms. It surrounds the magnesium atom in chlorophyll which captures the sun's energy. If tomato receives too little nitrogen, the plant will not grow properly. Leaves will turn yellow wilt. The plant will get leggy. If tomato exposed to much nitrogen will grow large, lush and become beautiful plants. Unfortunately, the nitrogen will keep the plant growing but not allow the plant to switch to its flowering stage, resulting in little or no fruit production.

The aim of this research is to investigate the effectiveness of nitrogen sources and concentrations on plant characteristics in different types of *Lycopersicon esculentum*.

1.4. Objectives

- 1- To determine the effects of nitrogen sources and concentration on plant characteristics in indeterminate and semi-determinate tomato.
- 2- To investigate the effects of nitrogen sources and concentration on nitrogen content in indeterminate and semi-determinate tomato leaves.

1.5. Scope of The Project

This research focuses on the effects of nitrogen sources and concentrations on plant characteristics indeterminate and semi-determinate tomato as well as nitrogen uptake. The nitrogen sources for this study are urea, ammonium nitrate and ammonium with concentration of 0.0, 0, 2,0.6 and 1.2 g/kg for each nitrogen source.

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