EFFECT OF CHEMICAL WEED CONTROL ON YIELD AND QUALITY OF TOMATOES

By

NADIA MAHMOUD OMAR

B. Sc. (University of Ain Shams)

DISSERTATION

Submitted in partial satisfaction of the requirments for the de

MASTER OF SCIENCE

in

Horticulture

UNIVERSITY OF AIN SHAMS

1972

Approved :

A. L. El-Tom

A. T. Hegazy

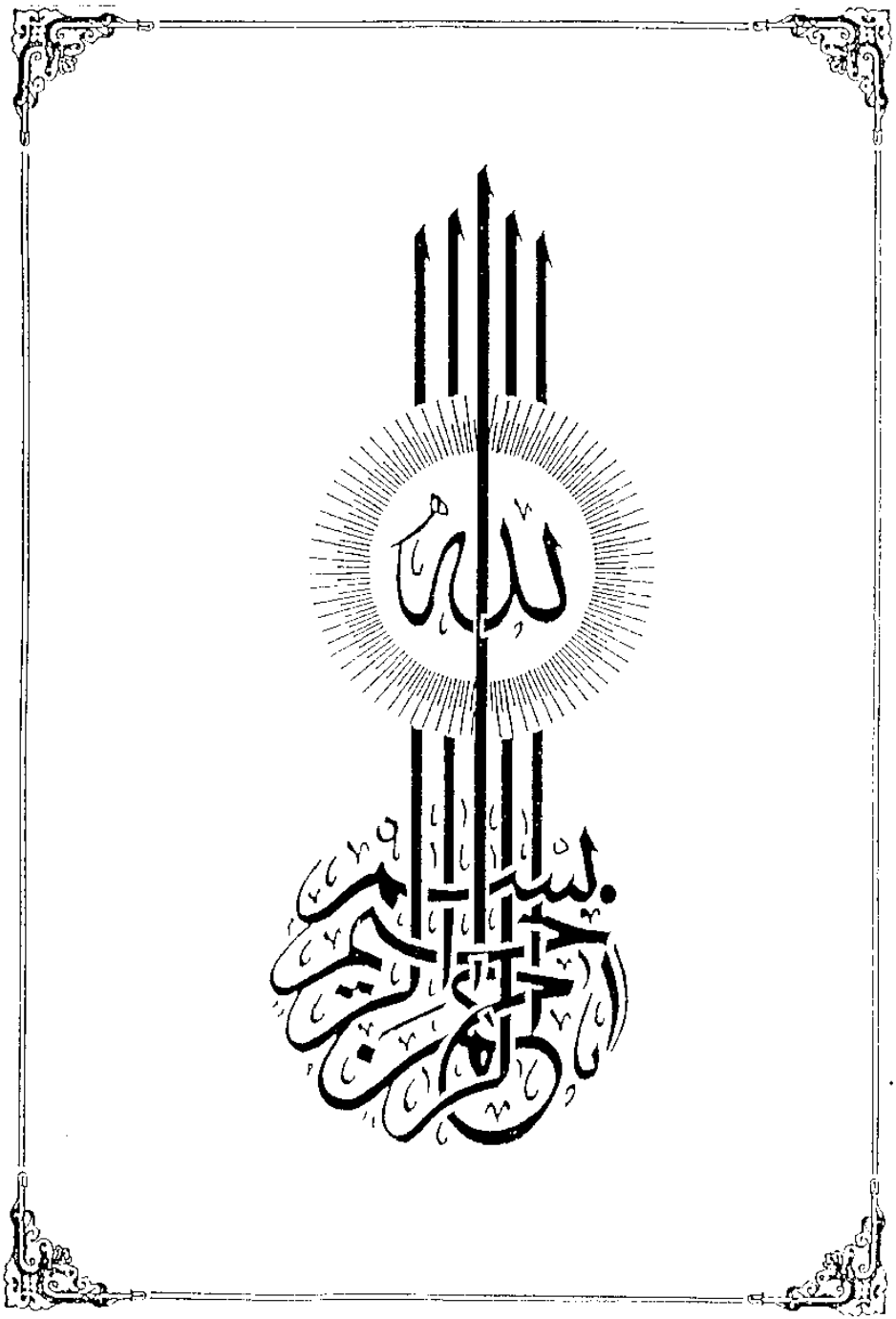
Comittee in charge

Date : .....

ACKNOWLEDGEMENTS

I wish to express my sincere thanks to professor Dr. M. Abdel-Maksoud, Dr. M. El-Motaz Billah and Dr. A. S. Abdel-Kader for suggesting, planning and their helpfull supervision during this study.

I am also greatly indebted and thankfull to professor Dr. [illegible] M. El-Nabawy , Dr. M.R. Abou-Hussein and Dr. M. S. El-Beltagy for their kind help and efforts granted in critically reading the manuscript.



CONTENTS

INTRODUCTION

Tomato is a major vegetable crop in the A. R. E. It ranks first in regard to tonnage and acreage among the other vegetable crops.

The summer and autumn are the major seasons for planting tomatoes. The crop of the first season is locally consumed and partially canned. The autumn crop (Nili crop) covers both local consumption and export. Not only the quantity of yield is important, but also the quality of fruit is highly important.

The climate prevailing in both seasons is temperate at least for the major part of the tomato growth life. Also is the case with weeds. The weeds are considered as pests which seriously reduce the productivity, and quality of the yield, subsequantly the production cost will be rained. The normal method of weed control in the local tomato plantation is the hand pulling and hoeing. The outstanding potentialities of Egyptian soil and climate for producing high quantities of tomatoes especially for export necessitate taking into consideration the quick increase in [illegible] accompanied by the inadequacy of skilled [illegible] laborers.

Recently, the chemical weed control, by herbicides,

is used in the agricultural advanced contries.

This study was undertaken to investigate the relative effectiveness of three commercial herbicides namely, Treflan, dymid and vegiben on weed controlling ability in both direct- seeding and transplanting tomato plants cultivated in both summer and autumn seasons. The effect of these herbicides in modulating some growth phenomena of tomato plants, yield amount and quality and some fruit charecteristics during storage were also studied.

REVIEW OF LITERATURE

I . History:

Weed control is one of the most important agricultural practices and in many cases requires large amounts of hand labour. Scientists were looking for new chemical subestances to be used as herbicides since 1890 when they first recommended the use of sulfuric acid to kill mustard in small grain farms (Crafts and Robbins, 1962). Through the past several years, weed control by chemicals has been extensively developed. While the introduction of 2,4-D and its analogues brought in one of the most revolutionary and dramatic development in the history of agriculture, and as these compounds make up the greatest bulk of herbicides being used, there are many other compounds that fill important niches in the over-all field of weed control. Some of these are hormone like in their effects, other have entirely different modes of action.

II. Effect of some herbicides on weed control in cultivated tomato plants:

1. Effect of Treflan:

Treflan is one of the [illegible] belonging to the toluidines group (dinitroaniline derivatives) and the active [illegible], i.e. Treflan is trifluralin. (Crafts and Robbins, 1962).

The herbicide was first described by Alder et al. (1960) and introduced as herbicide by Elanco Products Company in 1960 . Recently it is used as pre-planting and /or Pre-emergence herbicide in many field and vegetable crops including cotton, soybean, lima bean, peas, carrots, snap beans (Pieczarka et al. , 1962; Guse and Schwer,1964; Hicks and Fletchall, 1964). Many investigators pointed out the ability of trifloralin to control weeds in cultivated tomato when Treflan has been used by different methods of applications as well as different doses. Biro (1969) applied treflan as pre-planting herbicide at the rate of 0.26 - 0.38 ml. /sq. m. and was soil incorporated. The auther found that Treflan was effective for immediate and resedial weed control. Similar results has been obtained by Lotta (1968). Casarini et al. (1966) indicated that Treflan pre-planting applications were highly effective against grass weeds in particular. Using Treflan at sowing time, Noll (1963) found that 1 Lb / acre when incorporated in soil gave satisfactory weed control. On the other hand after planting applications were practiced. successfully by [illegible] et al. (1968) who obtained best weed control [illegible] soil formulation of trifluralin incorporated [illegible]. Soil incorporated pre-emergence application [illegible] several workers to be most efficient in

weed control (Pieczarka et al., 1962; Casarini and Silvestri, 1968; Lotta, 1968). Pieczarka et al. (1962) recommended application doses from 0.5-2.0 Lb/acre to be most effective especially on annual grasses and broad -leaf weeds. Whereas Cararini and Silvertri (1968) indicated that such application must be applied after 4 days from sowing to be more effective. In transplanting cultivation method of tomato plants, both Long and Stark (1965) and Long(1968) obtained good weed control allover the growing season by appling Treflan as pre-transplanting herbicide at the rate of 0.5-0.75 Lb/ acre and was incorporated in soil . On the contrary, post-transplanting application was applied by Wascom and Hegwood (1966) . They were working on loamy soil and applied trifluralin in 16 inches bands over the rows one day after transplanting and irrigation was practiced 2 days after the treatments with 5 inches of water. The two outhers indicated that, in both autumn and spring seasons, trifluralin at 2 and 4 Lb/acre gave excellent control of weeds in an assessment of 3 weeks after the treatments.

The herbicidal effect of trifluralin appeared as a stunting agent for the root growth of plants. (Standifer and Th[illegible], 1965; Standifer et al. 1965, Anderson et al.1967; Bayer [illegible]. 1967; Talbert, 1967; Oliver and Frans,1968).

The roots were misshapen, swollen and lacking lateral roots . The root system of resistant plants showed only the lack of lateral roots in the area of soil treated with Treflan. The primary root was not affected and would grow out of the treated zone and then developed lateral roots normaly. As little as 1/4 Lbs./Acre was sufficient to block lateral root growth. The lateral roots that did manage to develop off the main root were short, brittle and ended in club- like tips (Anderson et al. 1967). There fore, sensitive plants were apparently controlled by the prevention of normal root systems . Those plants with large taproots appeared to be able to outgrow the effects of the herbicide while plants with weak taproots or fibrous root system were not able to grow out of the treated zone and were rapidly killed (Standifer and Thomas, 1965; Anderson et al., 1967). The action of trifluralin appeared to be basically that of a mitotic poison. Mitotic abnormalities occured along with an increase in differentiation, and a rapid loss of the meristematic tissue (Bayer et al., 1967). Cells adjacent to treated cells did not show the abnormal mitosis. Certain cells also showed large increase in the amount of radial expantion. It was especially pronounced in the cortical tissue. The roots, therefore, exhibited the typical growth response.

colchicine treated roots (Anderson et al., 1967; Bayer et al., 1967; Negi et al., 1967; Normand et al., 1968; Schultz, 1968). An interesting aspect of that mitotic poisoning effect was the selective repression of mitotic activity in the pericycle. The vascular cambium, like the primary root tip was not affected by this herbicide. This selective action was not understood. It could be a matter of differential uptake or a basic metabolic difference between pericycle cells and other meristematic cells (Bayer et al., 1967). Trifluralin appeared to inhibit RNA and protein synthesis in roots. Such treatment of shoots, however, did not show this inhibition as seen in roots (Schultz, 1968). Translocation studies indicated that trifluralin did not appear to be translocated upwards from the roots (Standifer and Thomas, 1965).

2 . Effect of Dyrid:

Dyrid is another herbicide which can be considered as a member of the acylanilines group (acetamide derivatives) according to the chemical herbicidal classification of Crafts and Reiber 1962). The [illegible] is in [illegible] ([illegible] et al., 1965).

in cultivated tomato plants, many investigators concluded that diphenamid inspirited weed control with different relative effectiveness in both direct-seeded and / or transplanted tomatoes when herbecidal application conducted at different times of tomato growing season. When Diphenamid used as pre-planting herbecide, Long and Stark (1965) found that 2 Lb/ acre from such herbecide incorporated in soil before sowing gave full season weed control. In other experiments higher doses were needed to obtain the previous result such as 6 Lb/ acre (Hamson, 1964), 9 Lb /acre (Ross, 1964), 8-16 Lb/ acre (Lange et al., 1965) . In all previous experiments , incorboration of diphenamid in soil was effective in inspiriting the activity of the herbicide. The selective herbicidal activity of Diphenamid on weed control based mainly on some weeds such as Amaranthus retroflexus, Chenopodium album, Datura stramonalis Eragrostis Ciliianensis, Echino chloacrus - galli and Ipomoea nederacea (Hamson, 1964 ; Ross, 1964; Long and Stark, 1965). On the other hand, Hamson (1964) indicated that Diphenamid was less effective against Solanum nigrum and Ross (1964) indicated such less effectiveness against Hibiscus trionum . In pre-emergence applications of Diphenamid, [illegible] Lb/ acre were found to be the most effective in weed control depending upon the of [illegible], soil type, and [illegible]

(Ahrens, 1963; Noll, 1963, Everett and Burgis, 1964; Murphy, 1964; Orseniго and Hayslip, 1964; Talbert, 1965; Taylorson, 1965; Thomas, 1965; Chambers et al., 1966; Shubert et al., 1966; Frank and Waywell, 1970). The selective herbicidal effect of diphenamid in pre-emergence applications was best on annual weeds especially pigweed (Amaranths sp.) and Crabgrass (Digitaria sp.) , but such effect was inconsistent with broad-leaf weeds (Orseniго and Hayslip, 1964; Talbert, 1965; Frank and Waywell,1970). Everett and Burgis (1964) indicated that diphenamid had no effect on Bermuda grass (Cynodon dactylon). Post-emergance application of diphenamid has been recommended by Chambers (1969) as an outstanding herbicidal treatment, but the results of many experiments such as Shubert (1971) indicated that the [illegible] such application of diphenamid depends upon [illegible] the effectiveness of Post-emergence application of diphenamid increased with relative [illegible] low light intensity. [illegible] pre-treatment [illegible] but [illegible] were [illegible] when [illegible] of [illegible] (Talbert, 1965; Ahrens, 1963; Shubert et al., 1966; Talbert, [illegible], 1965; Frank and Waywell, [illegible]