BARD

PROJECT NO. I - 1068 - 86

FINAL REPORT

**Assimilation and Sugar Translocation in
Transplants of Vegetable Crops: Study of
Limiting Factors and Means for Enhancement
of Post-Transplantation Recovery**

J.
B. Aloni, R. Daie, R. Wyse

3

630.72
BAR/ALO
2nd copy

1991

000000201926

35786

Standard BARD Cover Page for Scientific Reports

Date: June 23, 1991BARD
P.O. BOX 6
Bet Dagan, ISRAELBARD project No. I-1068-86Rהמספרים הנרשמים
למדעי החקלאות
בית דגן

Title

ASSIMILATION AND SUGAR TRANSLOCATION IN TRANSPLANTS OF VEGETABLE CROPSSTUDY OF LIMITING FACTORS AND MEANS FOR ENHANCEMENT OF POST TRANSPLANTATION
RECOVERY.Investigators' Names
(Principal listed first)

Investigators' Institutions

BENY ALONIA.R.O. THE VOLCANI CENTERJALEH DAIERUTGERS UNIVERSITY, U.S.A.ROGER WYSERUTGERS UNIVERSITY, U.S.A.Project's starting date: AUGUST 1986Type of Report: 1st Annual 2nd Annual Final x_____
Signature
Principal Investigator_____
Signature
Institution's Authorizing Official

630.72 ; 635 ; 581.522.2 ; 635.6 ; 635.64 ; 581.13
BAR/A20 581.11 ; 581.133.45 ; 581.134

2nd copy

Table of content

	<u>Page</u>
Cover page.	1
Table of content.	2
Abstract	3
Objectives of the original proposal.	4
The differential response of pepper and tomato transplants to transplantation.	5
Water relations, photpsynthesis and assimilate partitioning in leaves of pepper (<i>capsicum annuum</i>) transplants:	
Effect of water stress after transplantation:	9
Effect of nitrogen supply on carbohydrate partitioning of pepper seedlings and transplant development.	15
Effect of heat stress on the development, root sugars, acid invertase and protein profile of pepper seedlings after transplantation.	43
Effect of growth regulators on pepper transplants sensitivity to heat stress.	66
The sensitivity of tomato and pepper transplants to heat stress, applied to the roots in hydroponic system.	71
Description of the cooperation.	75
Research achievement.	75
<u>Research done in the U.S.</u>	77
Abstract.	78
Research accomplishment.	80
Drought-induced adjustment in carbohydrate metabolism and partitioning of source leaves.	85

Abstract (ISRAEL)

Various vegetable crops undergo growth stunting when transplanted from block type nursery trays into the open field. This phenomenon occurs in bare-root-transplants too. This growth stunting (transplanting shock) may affect yield timing, fruit set and quality of the fruits. In the present research we have studied the effects of various environmental stresses at the time of transplantation of pepper and tomato seedlings with the aim of revealing metabolic processes which are limited by the stresses and therefore cause the growth stunting phenomenon. The experimental strategy was as following; seedlings were grown in Speedling type trays up to a stage at which they were at appropriate size for transplantation. They were transplanted into large pots and then subjected to different stresses for up to 14 days. Prior and during the stress, several measurements, related to sugar partitioning and metabolism and protein changes were carried out. The following principal findings were obtained:

Short term water stress after transplantation inhibited photosynthesis and translocation to the shoot growing zones. These processes were not fully reversible if water stress intensity exceeded certain threshold. Nitrogen stress, applied before transplantation did not affect assimilate transport but shift sugar metabolism towards starch biosynthesis and accumulation.

Heat stress applied after transplantation caused decrease in invertase activity in the roots. The heat treatment caused changes in leaf protein synthesis towards accumulation of heat related proteins, these proteins were not synthesized in the roots under similar stress conditions.

We also examined the effect of GA and paclobutrazol which are known to change shoot to root ratio on morphological as well as on biochemical parameters in pepper transplants.

Tomato and pepper transplant which differ in their sensitivity to transplanting shock are also different in their responses to drought as well as to heat stress.

Overall, the results of this research indicate that various stresses at pre or post transplantation stages decrease pepper plant development, although by different mechanisms. These mechanisms are not related to sugar loading and transport in the plant but most likely to the sugar metabolism in the sink organs.

Objective of the original proposal

This research proposal had three principal objective:

1. To determine the dynamics of carbon fixation and allocation in control and transplanted tomato and pepper plants.
2. To determine the effect of stress treatments on various components of sugar transport, allocation and remobilization in order to reveal blocking point along the assimilate translocation path.
3. To study possible assimilates remobilizing effects of phosphate and GA as means for enhancement of transplant recovery.

In the course of the research we have deviated from the above objectives in the following points:

1. Pepper transplants became our main objective therefore most of the experiments were performed on pepper. The comparison between pepper and tomato was carried out at some stage but not in all.
2. We have studied nitrogen fertilization rather than phosphate nutrition, since it appeared, in preliminary experiments, that nitrogen is more important factor in transplant nutrition.
3. We have studied the effect of GA and paclobutrazol on pepper transplants, since these two PGRs were found to modify the growth pattern of these transplants.

Presentation of the data

The Israeli part and the American part are presented separately. Part of the data which were obtained in the present study by the Israeli collaborators were summarized as published papers and will be presented in this report as such.

The unpublished data will be given here as separate experiments, each with its title, experimental design, results and main conclusions. The Americans preferred to describe their part of the research in brief and to enclose the publishable data in the form of a manuscript.

Body of the research

The differential response of pepper and tomato transplants to transplantation.

In order to establish experimentally (what has been known in practice), the different sensitivity of tomato and pepper seedlings to transplantation shock we carried out the following experiment: Pepper of the " Maor" cultivar (the only cultivar used for export in Israel) and tomato M-82 (used for processing and mostly starts in the field from transplants) were sown into Speedling type trays with hole width of 1 and kept in the greenhouse untill the seedlings were at appropriate size for transplantation. That period of time was approximately 20 days for tomato and 40 days in pepper. At the time of transplantation we measured root and shoot fresh and dry weights. The seedlings were transplanted into 10 liter pots filled with tuff (volcanic ash) and were irrigated with half Haogland solution untill termination of the experiment. Part of the seedlings were water stressed by withholding irrigation untill the forth day from transplantation at which irrigation was applied throughout the experiment. Both the development of the seedlings and the plants after transplantation were carried out in a greenhouse with minimum and maximum temperature of 20°C and 30°C respectively and natural light intensity which at midday was approximately $1000 \text{ E cm}^{-2} \text{ sec}^{-1}$.

Results

Fig.1 shows that pepper seedlings are slower in initial development after transplantation, particularly in the first four days. Root fresh and dry wieghts were hardly increased until the eighth day from transplantation.

The differential capacity of pepper and tomato seedlings to resume growth after transplantation was seen after both seedling species were water stressed during the first four days.

Fig.1 show that while in tomato both leaves and roots resumed increment in fresh and dry weights, the roots and the leaves of pepper hardly recovered untill 16 days from the resumption of irrigation. These results indicate that in pepper transplants certain recovery processes are limited , particularly under stress conditions.

Legends of figures

Fig. 1. The effect of transplanting pepper seedlings, into non- stress (control) and water stress conditions on the increment of fresh and dry weights of their leaves and roots. Water stress was applied by withholding irrigation during the first four days after transplantation. Irrigation was resumed at the end of the forth day (see arrow).

LEAF FRESH WEIGHT Control

LEAF DRY WEIGHT Control

LEAF FRESH WEIGHT Water stress

LEAF DRY WEIGHT Water stress

ROOT FRESH WEIGHT Control

ROOT DRY WEIGHT Control

ROOT FRESH WEIGHT Water stress

ROOT DRY WEIGHT Water stress

Fig. 1