BIOCHEMICAL ASPECTS OF SCION – ROOTSTOCK INTERACTION ON SOME APRICOT CULTIVARS IN FIRST VEGETATION YEAR

ASPECTE BIOCHIMICE PRIVIND INTERACŢIUNEA DINTRE ALTOI ŞI PORTALTOI LA UNELE SOIURI DE CAIS AFLATE ÎN PRIMUL AN DE VEGETAŢIE

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Abstract. *The purpose of the determinations was to emphasize some modifications in the relation scion – rootstock in the case of four varieties of apricot tree (Tudor, Umberto, Goldrich, NJA42) grafted on Prunus cerasifera and Armeniaca vulgaris stock. We performed biochemical analyses regarding the accumulation of nitrogen, soluble glucides and content of gross protein in the grafted combinations in the first vegetation year. The results showed differences regarding the transport of nitrogen and soluble glucides on the level of the grafting area.*

Key words: scion, rootstock, nitrogen total, soluble sugars.

Rezumat. *Determinările au avut ca scop evidenţierea unor modificări în relaţia altoi - portaltoi la patru soiuri de cais (Tudor, Umberto, Goldrich, NJA42) altoite pe portaltoi de Prunus cerasifera şi Armeniaca vulgaris. S-au efectuat analize biochimice privind acumularea azotului, a glucidelor solubile şi a conţinutului de proteină brută la combinaţiile altoite aflate în primul an de vegetaţie. Rezultatele au scos în evidenţă diferenţe privind transportul azotului şi a glucidelor solubile la nivelul zonei de altoire*.

Cuvinte cheie: altoi, portaltoi, azot total, glucide solubile.

INTRODUCTION

The incompatibility to grafting shown by some apricot tree combinations on certain rootstocks represents an economic issue and an important phenomenon that must be taken into account during the selection process (Ermel and colab., 1995). Generally, the trees are products of the combination between a scion and a rootstock. In order for this combination to be successful, it requires a good joining between the scion and the rootstock. (Errea and colab., 2001). Some varieties of apricot tree grafted on rootstocks of *Prunus cerasifera* show incompatibility symptoms.

In order to emphasize the early incompatibility phenomenon, both different biochemical and physiological processes have been studied on the level of the grafting area, as well as different compounds and mineral substances that are transported through the joining area. In this context, we have also studied the transport of the carbohydrates reserves that are extremely important for the development of the trees with falling leaves in the initial growth stages (Gaudillere

and colab., 1992). For example, it can be noticed that in the case of young plum trees, the content of carbohydrates is influenced by the used rootstock, but also by the vegetation season (Gaudillere and colab., 1992).

The grafting also influences the transport of the minerals from the root to the stalk and to the leaves that, at their turn, interact with the assimilation and the distribution of carbon and finally, influence the biomass ratio between the root and the stalk. It can be noticed that in the case of the combinations of peach tree/plum tree, the availability of the carbohydrates in the roots and the assimilation of the nitrogen greatly depends on the compatibility between the scion and the rootstock (Yano and colab., 2002). Thus, the compatibility between the scion and the rootstock is essential for the production and the use of the carbohydrates and nitrogen reserves which reflects the strength of the plant and the economic efficiency.

MATERIALS AND METHODS

The experiment was conducted on the experimental field from "Ion Ionescu de la Brad" Agricultural Sciences and Veterinary Medicine University, Iasi from „Vasile Adamachi" S.D.E. The used biological material originated in the collection of the Faculty of Horticulture, consisting in four varieties of apricot tree (Tudor, Umberto, Goldrich, NJA42) grafted on a rootstock of *Prunus cerasifera* and *Armeniaca vulgaris*. The analyses were done in 2009 in June, July and September, the plating material being in the first vegetation year.

Three sets of biochemical analyses were done that aimed at the content of soluble glucides (through Schoorl method), total nitrogen and gross protein (through Kjeldahl procedure) on the level of the grafting area.

REZULTS AND DISCUSSIONS

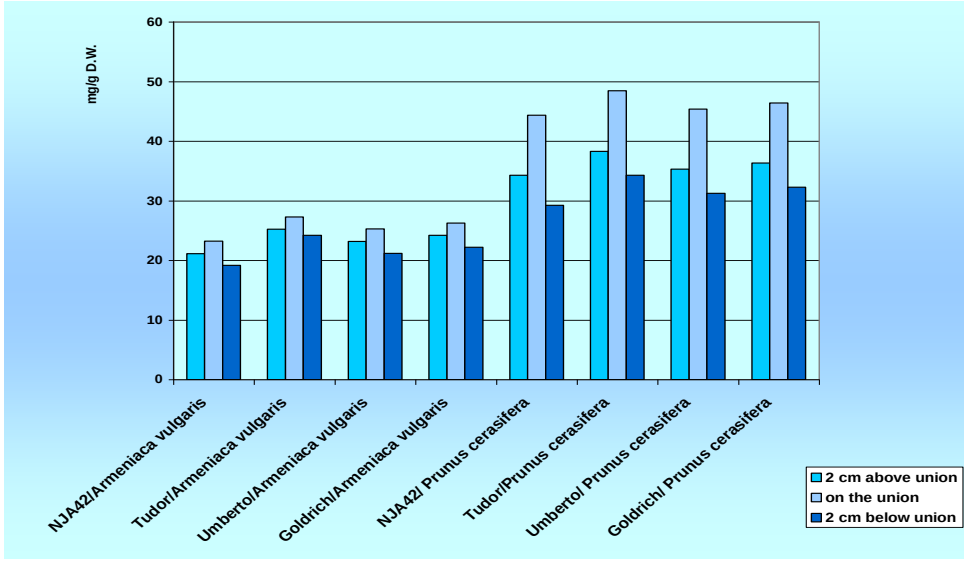
Following the grafting process, the physiological influence between the partners determines the synthesis potential of the scion, as well as the distribution of the substances in the organs of the tree.

The glucides are substances synthesized during the photosynthesis process that through oxidation are transformed into fatty acids that represent the basic compounds in the formation of the protein substances. The distribution of the carbohydrates in the young trees implies the production of glucides in the photosynthetic organs, the further translocation through the floem on the level of the growth and storage organs.

Following the analysis of the obtained data (fig.1) both for the varieties grafted on *Armeniaca vulgaris*, and on those grafted on *Prunus cerasifera*, it can be noticed a higher quantity of soluble glucides in the grafting area. For the variant grafted on the rootstock *Armeniaca vulgaris* (rootstock known as being compatible with the 4 studied varieties), the average content of soluble glucides per variant in the scion has values close to those of the rootstock.

The highest content of soluble glucides on the level of the grafting area has been emphasized for the Tudor variety (27,28 mg/g DW) followed by the Goldrich variety (26,27 mg/g DW). The smallest value of the content of soluble

glucides on the level of the grafting area has been registered for NJA42 variety of 23,21 mg/g DW. For the varieties grafted on *Prunus cerasifera* (rootstock known as being incompatible with the 4 studied varieties), in the scion, the content of soluble glucides is higher than in the rootstock but smaller than in the grafting area. This fact suggests that in the joining area of the two partners there are some barriers in the anatomical structure that hinder the transport of the photoassimilates towards the rootstock. Because these deficiencies have been noticed on both variants, we can say that the transport of the soluble glucides towards the root is disturbed by the grafting itself which determines the retention of glucides on the level of the joining area.



DW – dry weight

Fig. 1. Sugar content average values on 'NJA42', 'Tudor', 'Umberto', 'Goldrich' apricot cultivars

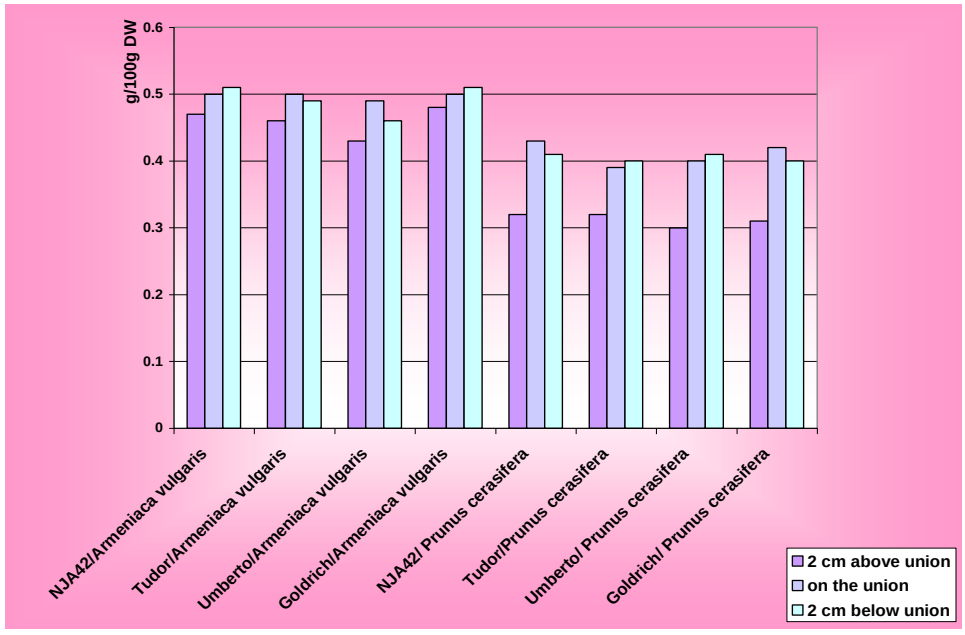
The minerals necessary for the nutrition of the plants are extracted under inorganic form from the soil through the roots and they are accumulated in different tissues and organs. Following the analysis of the ash obtained through the calcinations of the tissues of the plants, we can determine quantitatively and qualitatively the content of minerals accumulated in the vegetal organisms.

Among the minerals, nitrogen has the greatest influence on the growth and productivity of the plants. It holds the main role in several biological and physiological processes of plants. Nitrogen is part of the composition of several main organic compounds such as enzymes, hormones, phenolic compounds, pigments, nucleic acids, etc. The nitrogen deficiencies have a higher impact on the photoassimilation processes than the deficiencies of other nutrients because it enters in the composition of the chlorophyll molecule that plays a decisive role in photosynthesis.

Regarding the content of total nitrogen (fig.2), both for the variant grafted on the rootstock *Armeniaca vulgaris*, and for the variant grafted on *Prunus cerasifera*, the highest values have been registered in the rootstock and in the joining area.

In the case of the variant grafted on *Armeniaca vulgaris* the highest quantity of total nitrogen obtained on the level of the rootstock has been shown by NJA42 and Goldrich varieties of 0,51 g/100g DW. On the variant grafted on *Prunus cerasifera* the highest content of total nitrogen has been obtained for Umberto and NJA42 varieties, respectively 0.41 g/100g DW. On the level of the grafting point, the maximum value has been 0.50 g/100g DW for the variant grafted on *Armeniaca vulgaris*, respectively 0.43 g/100g DW for the variant grafted on *Prunus cerasifera*).

In the scion, the content of total nitrogen has minimum values, for the variant grafted on *Armeniaca vulgaris* the values range between 0,48 g/100g s.u. for Goldrich variety and 0.43 g/100g DW for Umberto variety. Regarding the variant grafted on *Prunus cerasifera* the highest value has been obtained for Tudor and NJA42 varieties of 0.32 g/100g DW, and the smallest value for Umberto variety of 0.30 g/100g DW. Thus, regarding the circulation of nitrogen, a nitrogen retention can also be noticed on the level of the grafting area that can be caused by not such a good recovery of the ligneous vessels.



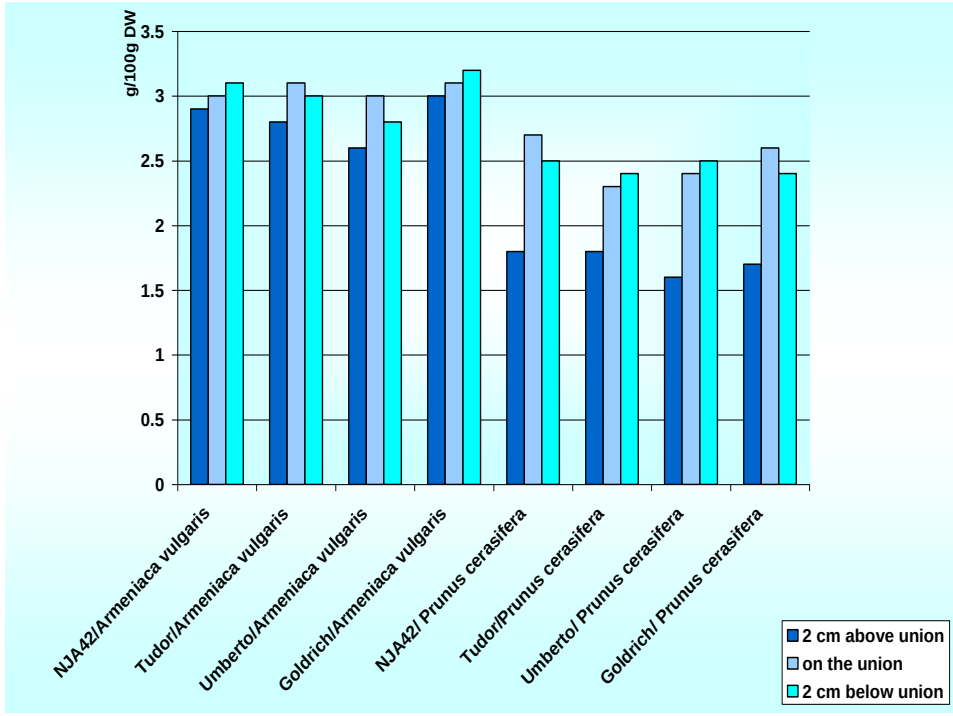
DW – dry weight

Fig. 2. Nitrogen content average values on 'NJA42', 'Tudor', 'Umberto', 'Goldrich' apricot cultivars

The determinations regarding the total content of gross protein (fig. 3) for the studied varieties have shown, in the case of the variant grafted on *Armeniaca vulgaris*, a higher average gross protein content both on the level of the rootstock and on the grafting point and in the scion. For this variant, higher values of the total content of gross protein in the rootstock have been registered for Tudor variety (3.25 g/100 g DW).

On the level of the grafting area in the case of the varieties grafted on *Armeniaca vulgaris*, the content of gross protein ranges between 3.19 g/100 g DW for NJA 42 variety and 2.63 g/100 g DW for Umberto variety. In the scion, the content of gross protein has smaller values than in the rootstock and the joining area. Here, the values range between 2.61 g/100 g DW for Goldrich variety and 2.06 g/100 g DW for NJA 42 variety.

For the variant grafted on *Prunus cerasifera* the highest content of gross protein has been obtained in the joining area (2.69 g/100 g DW) for NJA 42 variety. In the rootstock, the content of gross protein has been higher than in the scion. Thus, the analyses regarding the total content of gross protein on the level of the grafting area emphasize the existence of an impediment on this level that determines the uneven distribution of the proteins in this area of the trees.



DW – dry weight

Fig. 3. Crude protein content average values on 'NJA42', 'Tudor', 'Umberto', 'Goldrich' almond cultivars

CONCLUSIONS

The biochemical analyses done on the apricot tree varieties in the first vegetation year, grafted on the two rootstocks (*Armeniaca vulgaris)* known as being compatible with the studied varieties and *Prunus cerasifera* – incompatible) emphasize the existence of some barriers on the level of the grafting area that hinder the circulation of the synthesis compounds and the minerals on this level. This hypothesis aims at the not so perfect continuity of the leading Liberian and ligneous vessels from the joining area.

Thus, it can be explained the retention from the grafting area, both of the soluble glucides and the proteins that are synthesized in the aerial part of the trees (transported through the liberian vessels), and of the nitrogen that is transported through the ligneous vessels from the roots to the aerial part of the tree.

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