SEASONAL CHANGES OF GLUCOSE, POTASSIUM AND RUBIDIUM IN 'GORDAL SEVILLANA' OLIVE IN RELATION TO FRUITFULNESS

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Abstract

Fruitfulness influences the partitioning of assimilates in olive during the reproductive phase. Seasonal changes of the concentration of glucose, potassium and rubidium in different organs indicated that the current-year growth was the main sink in the de-fruited bearing shoot while the fruit was in the fruiting shoot. Normal fruit of 'Gordal Sevillana', a cultivar with normal and parthenocarpic fruits, showed higher rate of growth and content of assimilates and mineral nutrients than parthenocarpic fruit from 15 days after full bloom (FB+15) to harvest. Consequently normal fruit was the strongest sink in this period. Those data suggest that the sink strength and therefore the assimilates partitioning is a major factor in regulating fruit set in olive.

1. Introduction

The fruit is the main sink from FB+40 to harvest in olive as most dry matter of the bearing shoot accumulates into it (Suárez, 1987). The accumulation of nutrients indicates, on the other hand, the sink strength of the different organs. Several nutrientes are relevant in that respect.Glucose is the most abundant sugar in olive fruit. Potassium is the mineral nutrient most abundant in the phloem (Hocking, 1980) and it is related to phloem transport (Malek and Baker, 1977) and carbohydrate accumulation. Rubidium is used like a potassium transport marker in plants and it has high mobility in the phloem (Hocking, 1980).

The present paper shows the seasonal changes of glucose, potassium and rubidium in fruiting and de-fruited shoots of 'Gordal Sevillana'. This cultivar produces normal and parthenocarpic fruit which shape, size and growth are different.

2. Material and methods

One profusely bloomed tree of 'Gordal Sevillana' was selected and two secondary branches were tagged on it. One was kept untouched, i.e. with fruiting shoots, and the second was de-fruited by inflorescence removal before full bloom.

Two low-pressure injections of RbCl 50 mM were applicated to the main scaffold at FB. Samples of leaf, shoot and fruit containing one gramme of fresh weight were taken from each secondary branch 5 , 25, 45, 75, 105 and 135 after FB. These samples were frozen in liquid nitrogen and remained at -20°C until analysis.

Twenty cc of ethanol 80% (v/v) were added to the frozen samples and homogenized with a Polytron during 5 to 10 seconds. The homogeneized was filtered and the filtrate was employed for the analysis. Glucose was measured by GOD-PAP method (Merckotest, n'. 3395). The determination of potassium and rubidium was made with an atomic absorption spectrophotometer Perkin Elmer mod. 603.

3. Results

Normal and parthenocarpic fruit showed different patterns of nutrient accumulation in relation to fruit weight (figure 1). Normal fruit accumulated nutrients more quickly starting by 25 days after full bloom when its growth was very rapid. Parthenocarpic fruit showed a smaller rate of growth (weight) and accumulation of nutrients than normal fruit.

Seasonal changes of glucose, potassium and rubidium were different in fruiting and de-fruited shoots (figure 2). The highest concentration of rubidium in leaf and shoot was reached by FB+15 in the fruiting shoot (figure 2A) and FB+25 in the de-fruited shoot (figure 2B). The normal fruit attained its maximum rubidium concentration by FB+25 while it was reached by FB+45 in the parthenocarpic fruit. Potassium concentration was similar in the shoot and leaf in both kinds of shoot (figure 2C and 2D); there was neither difference between normal and parthenocarpic fruit. Oppositely, glucose concentration showed a different pattern in normal and parthenocarpic fruit while the pattern was the same in leaves and shoots (figure 2E and 2F). Glucose concentration only increased after FB+45 in normal fruit while it raised from FB+5 to FB+45 and then decreases slowly until harvest (FB+135) in parthenocarpic fruit.

4. Discussion

Partitioning of assimilates is related to fruitfulness due to changes in source-sink relationship during the reproductive phase (Wardlaw, 1980). In olive new vegetative growth and developing fruits are the major sinks in the fruit bearing shoot. Our results show that new shoot growth is a subsidiary and alternative sink in respect to growing fruit as evidenced by concentration of glucose, potassium in fruiting and de-fruited shoots (figure 2). Therefore fruit sink strength determines the partitioning of assimilates in the bearing shoot and has to play a major role in competition among fruits.

Normal fruit is a stronger sink than parthenocarpic fruit (figure 1). Fruits sink strength probably depends on seed development and fruit size. Mineral nutrients and assimilates contents were similar from FB to FB+25 in normal and parthenocarpic fruit. Nutrients accumulated at a slower rate in parthenocarpic than in normal fruit after this time (figure 1), which could be related to ovules degeneration reported in parthenocarpic fruits by FB+25 (Rapoport et al., 1988). Differential size of the fruit was the major factor accounting for the differences in nutrients content from FB+25 to harvest. On the other hand rubidium concentration until 25 days after FB was higher in normal than in parthenocarpic fruits in contrast to potassium and glucose concentration that was similar in both kind of fruits. Whereas the later are continuously traslocated to the demanding sinks rubidium was only suply by injection at FB. Those data might also explain the smaller competitive ability of parthenocarpic fruits previously repported in olive (Rallo et al., 1981).

Acknowledgement

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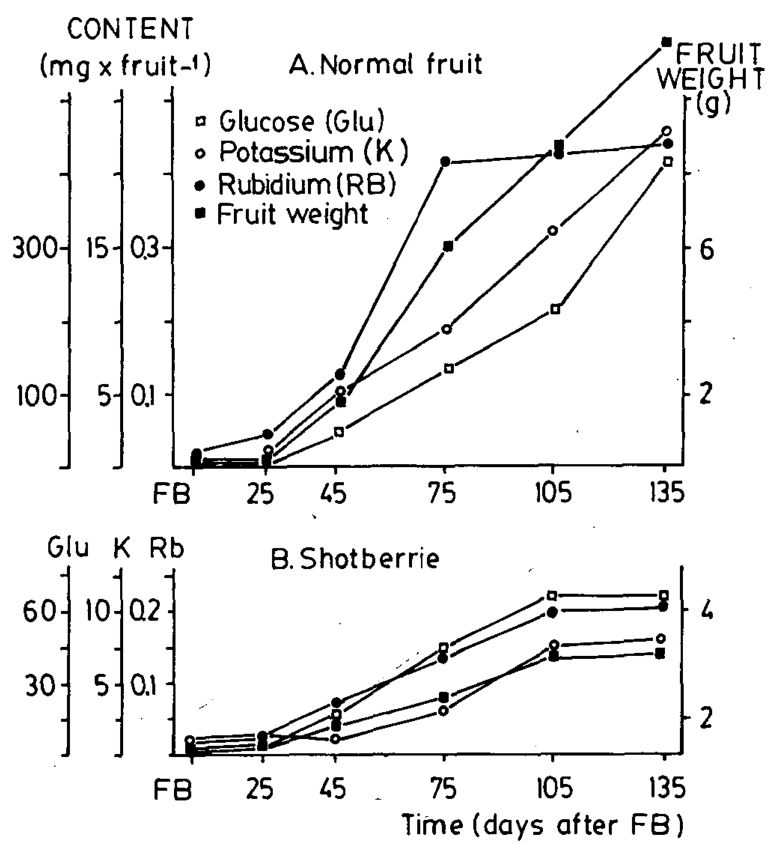

Figure 1 - Seasonal changes of fruit weight and content of glucose, potassium and rubidium in normal and parthenocarpic fruit (shotberries) in olive.

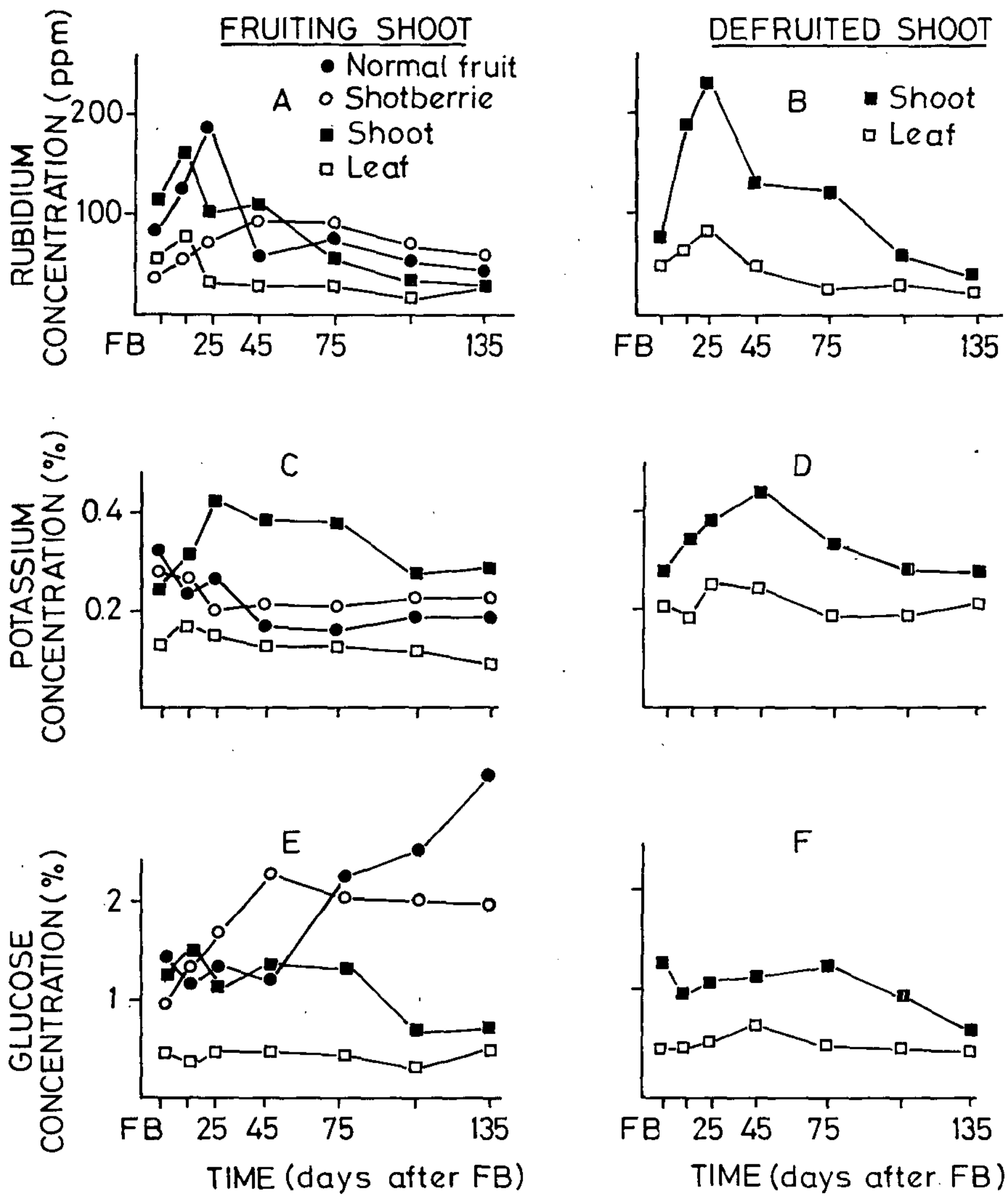

Figure 2 - Seasonal changes of concentration of glucose, potassium and rubidium in fruiting and de-fruited shoots of 'Gordal Sevillana' olive .