

THE INFLUENCE OF SOLUBOR LEAF SPRAY ON FRUIT PRODUCTION IN AVOCADO

P J Robbertse and A Coetzer

Margaretha Mes Institute, University of Pretoria, Pretoria 0002

F Bessinger

Soil and Irrigation Research Institute, P/Bag X79, Pretoria 0001, South Africa

ABSTRACT

The influence of boron on fruit-set and fruit production in avocado were studied. Although not convincingly, we found that fruit-set and fruit production were improved by spraying trees with Solubor (2 g/l) at the early stages of flowering. The results are discussed in relation to the position of the tree along a slope in the experimental grove and the influence of nitrogen on boron levels in the leaves.

INTRODUCTION

Although the primary biochemical role of boron in plants is not yet fully understood (Teasdale & Richards, 1990), the influence of boron on different aspects of plant growth and reproduction is well documented. It was demonstrated by Vasal (1963) that boron has a major influence on pollen tube growth and Robbertse *et al.*, (1990) found that boron also influences the directionality of pollen tube growth. For optimal pollen tube growth in avocados, the boron concentration in the flowers needs to be about 100 mg.kg⁻¹ (Robbertse & Coetzer, 1988). From this it can be derived that a certain concentration of boron in the plant is required prior to flowering for proper fertilisation and fruit-set. The question is, how much. Since the boron content in plants is traditionally determined by leaf analyses, one of the objectives of this study was to determine the boron content of avocado leaves prior to flowering and to relate this to fruit production. We also wanted to know whether the boron concentration in the leaves could be supplemented by spraying with a boron containing solution.

In this paper we report on the effect of boron on fruit-set and fruit production as obtained in a field experiment that was done over a period of two years.

MATERIALS AND METHODS

Mature trees in a commercial grove at the Westfalia estate were used. Forty randomly chosen trees were divided into four groups, on which different treatments were applied. In the first group (treatment A), the trees were sprayed once to drip off with Solubor (2 g/l at the stage of inflorescence bud break. In the second group (treatment B), trees were sprayed twice with the same solution, first at bud break and again at anthesis of

the first flowers on the panicles. In the third group (treatment C), the trees were sprayed once at anthesis of the first flowers on the panicle. In the control (treatment D), the trees were not sprayed. Leaf samples for boron analysis were taken at intervals from the youngest mature leaves on each tree. Leaves were washed in distilled water before drying. Samples of whole inflorescences from each tree were also taken for boron analysis. Fruit-set was determined by marking ten flowering branch ends around the circumference of each tree and counting the number of fruits on these ends five months after flowering. The total fruit production per tree was also recorded.

RESULTS AND DISCUSSION

The boron analyses of the leaves are presented in Figure 1. Leaves sampled on 11/09/89 were from the previous summer flush, about five months ago, and contained low boron concentrations. The Solubor spray of 25/06/89 had very little influence on the boron content. The spring flush leaves sampled on 28/11/89 had higher boron concentrations which were significantly affected by the Solubor sprays of 14/06/89 and 11/09/89. As the leaves aged until 14/06/90, the boron concentration decreased again. There were no obvious differences in the boron concentrations of leaves from the different treatments sampled on 16/08/90. These were four-month-old summer flush leaves and compared with the control, the Solubor spray of 14/06/90 had no effect. Contrary to the 1989 results, the boron concentration of the spring flush leaves sampled in 12/90, was not affected by the August spray, except for treatment C.

Results of the boron concentration of the inflorescences, fruit-set and fruit production are given in Figure 2. Boron concentration of the inflorescences was only determined during the 1989/90 season and samples were taken on 11/08/89, after the Solubor spray of 25/06/89. At this stage only treatments A and B were sprayed and both had significantly higher boron concentrations compared to the unsprayed treatments C and D. The fruit-set results of the 1989/90 season were discarded due to poor sampling. Although not statistically significant, fruit production, determined on 16/08/90, was the highest in treatment A, which compares favourably with the boron concentration of the inflorescences. Fruit-set for the 1990/91 season was the highest in treatments B and C which received the later Solubor spray. The reason why the results of the two seasons differ, may be ascribed to the fact that flowering during the 1990/91 season started a few weeks later than during the 1989/90 season, which means that the first spray in the first season was comparable with the second spray of the second season. Natural fluctuations in the boron concentration of the leaves during the season must also be kept in mind (Koo & Young, 1972, and 1977).

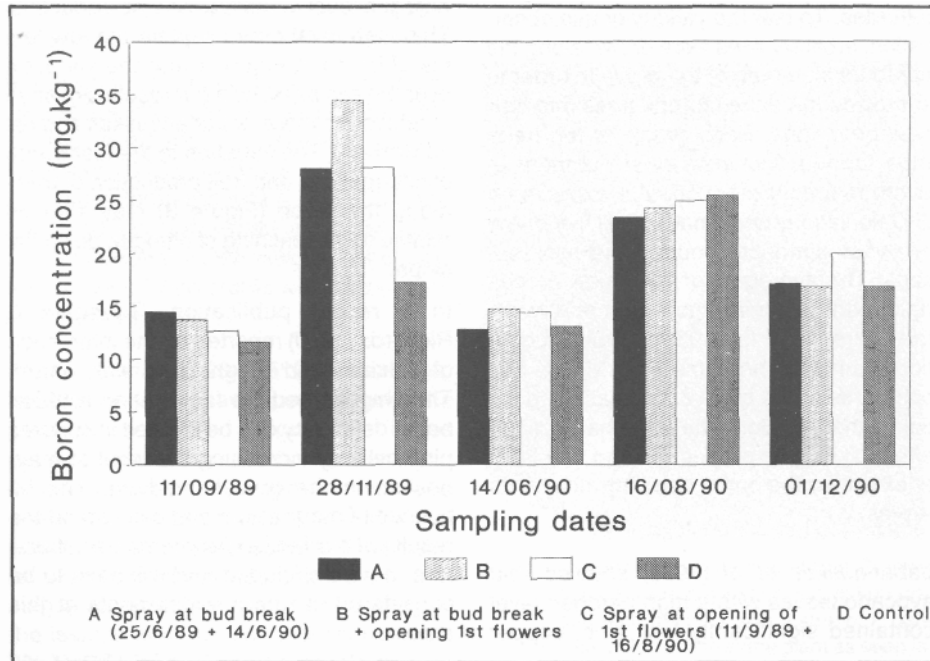


Fig 1 Boron concentration of mature Hass avocado leaves from latest flush sampled at intervals after spraying with Solubor (2 g/l): A — at inflorescence bud break (26/6/89 and 14/6/90); B — at bud break as for A and again at anthesis of first flowers as for C; C — at anthesis (11/9/89 and 16/9/90).

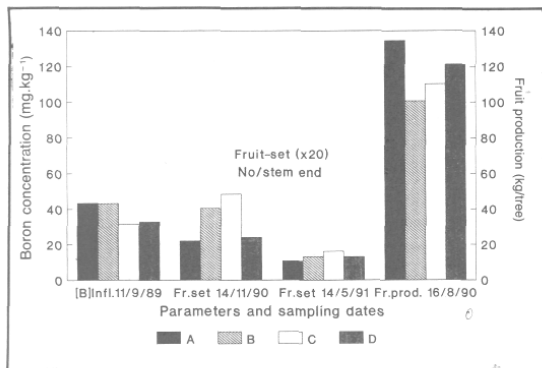


Fig 2 Boron concentration of inflorescences, fruit-set and fruit production of Hass avocado sampled at different intervals after spraying with Solubor (2 g/l): A — at inflorescence bud break (26/6/89 and 14/6/90); B — at bud break as for A and again at anthesis of first flowers as for C; C — at anthesis of first flowers (11/9/89 and 16/8/90); D — was not sprayed.

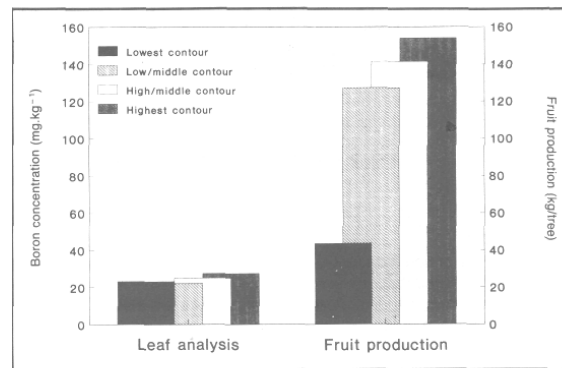


Fig 3 Average boron concentration of mature Hass avocado leaves sampled at intervals from latest flush over a period of two seasons and average fruit production per tree along contours in the grove.

The grove used for the field experiment was planted at a north-facing slope. When comparing the parameters of the individual trees, we noticed that the boron concentration as well as the fruit production of the trees at the lower end of the slope seems to be lower than that of trees from higher altitudes. To test the validity of this observation, arbitrary lines were drawn along the contours on a map of the grove in order to subdivide the experimental trees into four new groupings. Each group of ten

trees thus formed, included even numbers of each treatment mentioned in experiment 2. Calculations were made of all five boron analyses conducted during the two seasons. The averages for each new combination are given in Figure 3 in relation to the averages of the 1989/91 fruit production figures of the same trees. From this comparison it is quite clear that the position of the tree along the slope had a major effect on its fruit production and to a lesser extent on the boron concentration of its leaves.

Labanauskas *et al.*, (1958) showed that avocado leaves with a high nitrogen level contained significantly less zinc, copper and boron than leaves with less nitrogen. A nitrogen-zinc relationship in avocado leaves was also reported by Lahav *et al.*, (1990). In another paper Labanauskas *et al.*, (1961) reported a reduction of boron in ageing avocado leaves that was related to the nitrogen concentration in the leaves. In the first year of their experiment the nitrogen levels in the soil was high and the boron concentration in the leaves remained at a constant low level (< 30 ppm). In the third year of their experiment, there was a decrease in the nitrogen level and the boron concentration in young leaves increased to between 50 ppm and 60 ppm before decreasing to 30 ppm in fully matured leaves. In our experimental grove, the nitrogen level in the leaves was about 2%. This high level could explain the low levels of boron in Figure 1 and the variation over the two seasons if our results are seen in relation to those of Labanauskas and his co-workers. The variation in the leaf-boron concentrations and fruit production of trees along the slope (Figure 3) may also be related to the leaching of nitrogen down the slope.

In a recent publication, Teasdale & Richards (1990) reported on the interaction of calcium and magnesium with boron. They highlighted the fact that an artificial boron deficiency can be created in cultured pine cells by increasing the level of magnesium in the growth medium. The influence of magnesium and calcium on the results of our field experiments can, therefore, not be excluded and will have to be considered in future experiments of this nature.

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