

Preliminary Evaluation of Productivity and Fruit Quality for Seven Peach Rootstocks in Chile

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Fruit productivity and quality of eight years peach and nectarine cultivars (Rich Lady, Ryan Sun, Ruby Diamond and Venus) grafted onto Cadaman-Avimag, Viking, Atlas, GxN 15, GF 677, MRS 2/5 and Nemaguard (control) rootstocks were evaluated. A Split Plot experimental design was used, with each rootstock/scion combination as an experimental unit. Total yield, fruit size distribution, number of fruit, and fruit weight were recorded. Fruit quality parameters including soluble solids concentration (SSC), blush color development, and flesh firmness were also measured. On average, Cadaman yielded the greatest fruit weight and number of fruit, compared with the control, followed by GxN 15, Atlas and GF 677 to a lesser degree, while Viking was similar to the Nemaguard control, and MRS 2/5 yielded less than the control. There were no great differences between the rootstocks and the control with respect to fruit size and weight, although the most vigorous, Cadaman and GxN 15, were significantly higher (190.1 and 197.2 g, versus 179.5, respectively). For fruit quality parameters, Viking had the highest accumulation of SSC with respect to Nemaguard and MRS 2/5 had the highest percentage of blush color compared with the control. For flesh firmness at harvest, GF 677 was the firmest and MRS 2/5 was the softest.

Abstract

Keywords: Flesh firmness, Fruit quality, Fruit size, Peach rootstocks.

INTRODUCTION

Peach and nectarine cultivation holds a traditional place within Chilean agricultural production. In 2010 there were a total of 14,951 ha of peach trees and 6,038 of nectarines, reaching export production volumes of nearly 47,000 and 60,000 tons, respectively.

In spite peaches and nectarines species are very important in Chile, the export volume and the area planted have gradually decreased in the last few years. This is primarily due to the inadequate postharvest life of the cultivars and to the out of date combinations of scion and rootstock varieties which, in addition to inappropriate training and orchard management, have negative effects on orchard productivity and fruit quality. The principal manifestation of these errors is in problematic final fruit quality, expressed in physiological disorders of the fruit at the time of consumption, causing disappointment and rejection by consumers (Sotomayor and Castro, 2004).

Vigour is one of the main characteristics transferred from the rootstock to the scion, and the rootstocks can be from very vigorous to dwarfs (Caruso *et al.*, 2001; Loreti and Massai, 2006).

In general, peach/almond hybrid rootstocks give the higher vigour to the grafted cultivars and in the contrary, peach/plum hybrids confer some dwarfing characteristics to the peach or nectarine orchards. (Iglesias *et al.*, 2004; Massai Loreti, 2004). In this respect, Reighard established in 2008 that Cadaman Avimag rootstock showed a high vigour in field conditions with peaches, increasing yield as well. On the other hand the same author pointed out that dwarfing rootstocks were a new and interesting alternative in modern peach growing, emphasized the MRS 2/5 as a rootstock having the ability of reducing vigour as far as 70%.

Usually the rootstocks that give a high vigour to the peach trees also improve fruit production and individual fruit weight, due to the production of long shoots and well formed flower buds. In peach trees, the rootstocks Cadaman, GF 677, GxN 15 and Nemaguard are examples of this (Guidoni *et al.*, 1998; Albás *et al.*, 2004; Loreti and Massai, 2006).

Fruit quality is a basic factor inside the fruit production and there is considerable influence of the rootstock in this aspect. (Corelli-Grappadelli and Coston, 1991; Remorini *et al.*, 2006). On the other hand Guidoni *et al.*, (1998), make know that peach/plum hybrids, being capable as rootstocks of dwarfing trees, assign to the fruits a higher amount of photosynthates, advancing so their maturity. Loreti and Massai (2006) indicated that the low vigour rootstock MRS 2/5 improves color, size, firmness and soluble solids in their fruits.

Thus, the present study seeks to improve one of the factors contributing to this problem, which is the correct choice of rootstock for the selected cultivar and its adaptability to different edaphoclimatic conditions, in order to decrease the problems associated with the quality and heterogeneity of Chilean peaches and nectarines. The objective of this project was to evaluate the productivity and quality aspects of peaches and nectarines grafted onto seven rootstocks under study, during the 2008/2009 season.

MATERIALS AND METHODS

The experimental orchard with different combinations of scion and rootstock was planted in Paine at the Univiveros Experimental Nursery (Latitude: 33°48.728'S, Longitude: 70°43.351'W), Metropolitan Region. Two peach cultivars (Rich Lady and Ryan Sun) and two nectarine cultivars (Ruby Diamond and Venus) were grafted onto the six rootstocks under evaluation: Atlas, Cadaman-Avimag, GF 677, GxN 15, Mrs 2/5 and Viking, with Nemaguard as the control.

The planting distance was 4.5 x 3.0 m, with a density of 741 trees/ha. The orchard was conducted with an open vase training system and had drip irrigation. The experimental design used was Split Plot, divided into blocks with a 7 x 4 factorial distribution, using each rootstock/scion combination as an experimental unit. Seven years after plantation of the orchard, the total yield per tree (kg), fruit size and number of fruit per tree were evaluated at harvest. In addition, using a random selection of 20 fruit from each tree, fruit quality was measured with: polar and equatorial

diameter (mm), soluble solids concentration ($^{\circ}$ Brix), blush color (%), and flesh firmness (lb). Data was analyzed using an Analysis of Variance and a Tukey-Kramer means separation test with a p-value of 0.05. Data in percentage (blush color) were arcsin transformed prior to statistical analysis.

RESULTS AND DISCUSSION

The use of different rootstocks with peach and nectarine trees affected production and fruit quality. For the total yield per tree, the Table 1 shows that vigorous rootstocks such as Cadaman and GxN 15, followed by Atlas and GF 677, have the highest average yields in this study, surpassing those of less vigor, such as Viking and Nemaguard (control), relegating Mrs 2/5 to the lowest production category, being this results in coincidence with Albás *et al.*, (2004) and Loreti and Mas-sai (2006). The trend is similar for total fruit number as well, with Cadaman having the greatest average number, and Mrs 2/5 the least. For individual fruit weight, no significant differences were seen between treatments.

In spite that there should be a direct connection between fruit weight, number of fruit per trees and yield in the experiment, there were some natural fruitlet drops and climatic events between fruit set and harvest that should altering partially this probable relation.

Table 2 shows that in fact the less vigorous rootstocks had higher fruit quality according to the parameters analyzed in this study. Viking (11.0° Brix), along with Mrs 2/5 (10.9° Brix) and Nemaguard (10.8° Brix), GF 677 (10.8° Brix) and Cadaman (10.5° Brix), had the greatest accumulation of soluble solids. On the contrary, GxN 15 (9.8° Brix) and Atlas (10.1° Brix) showed lowest values. A very close performance was mentioned by Reighard (2000) for some of the rootstocks in the USA. For blush color, Mrs 2/5 yielded the most highly colored fruit (78.3%), together with Atlas, Nemaguard and GF 677; the less coloured fruit were for GxN 15 and Cadaman, vigorous rootstocks for peaches. This agree with Reinghard *et al.*, (1997) in respect to Nemaguard and GF 677 behaviour for colour development. For flesh firmness, the rootstocks with lower vigor had the lowest values at harvest, as they matured before fruit harvested from the more vigorous trees. GF 677 was the rootstock with the firmest fruit at harvest (9.3 lb), but similar to Cadaman and Atlas; Mrs 2/5 showed the softest (7.3 lb). Together with Nemaguard (7.5lb), Viking (7.9 lb) and being Atlas (8.1 lb) similar to all rootstocks studied. These results closely agree with the studies of Guidoni *et al.*, (1998,) that found rootstocks enhancing vegetative development induced a delay in maturity.

CONCLUSIONS

Peaches and nectarines on vigorous rootstocks (Cadaman, GF 677, Atlas, GN 15) had greater productivity (kg) and number of fruit than Nemaguard and that the other rootstocks (Viking, MRS 2/5). On the contrary, less vigorous rootstocks (MRS 2/5, Viking) had similar or better results for fruit quality parameters than Nemaguard and the more vigorous rootstocks. Evidence from this trial indicated that some of the new rootstocks can effectively overcome Nemaguard performance.

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Tables

Table 1. Yield weight, fruit number and fruit weight depending on rootstock.

| Rootstock | Yield weight(kg) | N° of fruits | Fruit weight(g) |
|---------------------|------------------|--------------|-----------------|
| Atlas | 69.abc | 462.0 ab | 182.0 a |
| Cadaman | 84.8 a | 511.6 a | 190.1 a |
| GF 677 | 63.5 abc | 384.3 ab | 190.3 a |
| GxN 15 | 78.0 ab | 452.0 ab | 197.2 a |
| MRS 2/5 | 41.5 c | 258.9 b | 180.5 a |
| Nemaguard (control) | 52.9 bc | 361.5 ab | 179.5 a |
| Viking | 55.6 bc | 352.5 ab | 178.5 a |

*Means followed by the same letter are not different according Tukey-Kramer test at p.0.05

Table 2. Soluble solids, flesh firmness and blush color depending on rootstock.

| Rootstock | Soluble solid (°Brix) | Blush color (%) | Flesh firmness (lb) |
|---------------------|-----------------------|-----------------|---------------------|
| Atlas | 10.1 bc | 72.5 ab | 8.1 abc |
| Cadaman | 10.5 abc | 62.2 b | 8.9 ab |
| GF 677 | 10.8 ab | 67.3 ab | 9.3 a |
| GxN 15 | 9.8 c | 66.4 b | 8.4 abc |
| MRS 2/5 | 10.9 ab | 78.3 a | 7.3 c |
| Nemaguard (control) | 10.8 ab | 71.9 ab | 7.5 bc |
| Viking | 11.0 a | 68.5 ab | 7.9 bc |

*Means followed by the same letter are not different according Tukey-Kramer test at p.0.05.
Data in percentage were arcsin transformed prior to statistical analysis.