First results from a study aimed at quantifying the effects that ridges have on the yield and fruit quality of 'Hass' avocado

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ABSTRACT

This project aims to establish what effect ridging has on a series of phenological and production related aspects of avocado orchards. To do this, a randomized block designed trial was established near Modjadjiskloof in Limpopo province. The trial consists of four ridge heights (0, 400, 800 & 1200 mm) that were replicated 13 times. Each replicate plot contains 7 'Hass' trees. At the end of the first growing season, the ridges were found to have compacted to half the size they were directly after construction (approximately 0, 200, 400 & 600 mm). Although there were, as yet, no differences observed between the different treatments, certain interesting trends relating to orchard topography were recorded. The mean stem diameter, tree height and canopy width of the trees located in the upper reaches of the orchard were found to be, respectively, about 50%, 20% and 66% greater than those in the lower reaches. Trees located in the higher lying part of the orchard were further found to have significantly more hail damage than those in the lower part of the orchard. Interestingly, in this case the ridge heights did play a role. In the higher reaches of the orchard, the 400 mm and 600 mm treatments were found to have more hail damage than the 0 mm and 200 mm treatments. This was the first important observation made during the study and it has spawned hail damage prevention trials with a novel approach.

INTRODUCTION

Although ridges are increasingly used by the South African avocado industry, little research has been done on the perceived advantages of the procedure. Nor are there any research based guidelines regarding the optimal size for the ridges. The present study aims to generate this information. It will cover topics such as the influence ridges have on orchard management practices, the phenological characteristics of the tree, the epidemiology of root rot infections, the yield and fruit count distribution, as well as the storage potential and the ripening characteristics of the fruit.

MATERIALS AND METHODS

The trial is being performed on the farm Hansfontein in the Modjadjiskloof district. A satellite image of the trial site is shown in Figure 1, while the appearances of the orchard during construction, directly after planting and during recording of the first set of data, are shown in, respectively, Figures 2 to 4.

The orchard is planted on a southeast facing slope. The bottom of the orchard is located at approximately 1 160 m above sea level while the top of the orchard is at 1 170 m above sea level.

The orchard specifications are shown in Table 1, while the randomized plot design details are shown in Table 2. Table 3 lists the reductions in ridge height that occurred due to compaction from the time of construction of the ridges until planting.

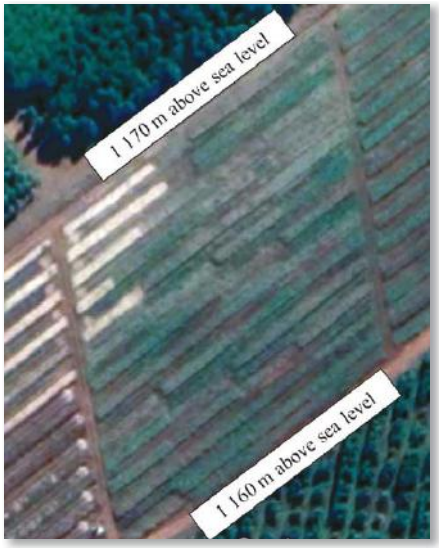

Figure 1. Satellite image of the trial site during the period between construction and planting when the ridges were allowed to settle and soil enhancements were performed.

The following readings were taken during March 2019:

- The tree height
- The diameter of the stem at approximately 300 mm above soil level
- The diameter of the canopy
- A general appearance score was allocated to each tree
- Since the orchard was subjected to hail during the 2018/19 growing season, each tree was also appraised for hail damage.

RESULTS AND DISCUSSION

No statistically significant variation was recorded in tree size between the different sized ridges after the first season. The results were somewhat confounded by hail damage that necessitated the replanting of severely damaged trees. However, telling differences were, nevertheless, recorded between the top and bottom sides of the orchard.

The stems of the trees in the highest lying rows were approximately 50% thicker than those in the lower lying rows (Fig. 5) while they were also approximately 20% higher (Fig. 6). When omitting the rows located next to the service roads, the top lying trees' canopies were two thirds wider than those located at the lower end of the orchard (Fig. 7). The above trends were further reflected in the general appearance scores of the trees (Fig. 8).

Interesting trends were observed in so far as the hail damage scores of the trees are concerned. Although the higher lying trees were found to have more hail damage than the lower lying trees (Fig. 9), the trees planted on the two highest ridges (400 mm and 600 mm) had more hail damage than those planted on the lowest ridge (200 mm) and on flat soil. This is the first important observation to emanate from the study which, in turn, spawned hail damage prevention trials with a novel approach.

It is envisaged that valuable information will be generated by the present study, not only pertaining to ridges, but also in so far as the effects that orchard outlay, climate and management practices have on 'Hass' production and fruit quality.

ACKNOWLEDGEMENTS

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Figure 2. Appearance of the trial site during the construction of the ridges.

Figure 3. Transition zone between two plots with different ridge heights, showing the two dripper lines. This will be increased to 3 lines at the end of 2019. The figure further shows where a tree has been removed due to hail damage. It was replaced shortly afterwards.

Figure 4. Appearance of the experimental orchard during March 2019. The photograph was taken from the lower south-eastern service road in a south-westerly direction.

Table 1. Specifications of the orchard in which the trial was laid out.

Orchard design aspects	Specification
Cultivar	Hass
Rootstock	Dusa
Experimental block size	1 ha
Mean elevation	1 165 masl[1]
Soil type	Hutton
Plant spacing	3.5 m x 7 m
Irrigation type	Pressure compensating drippers
Number of dripper lines per row	2 (to be increased to 3 during 2019)
Dripper spacing	500 mm
Dripper delivery	1 l/h

[1] masl = m above sea level

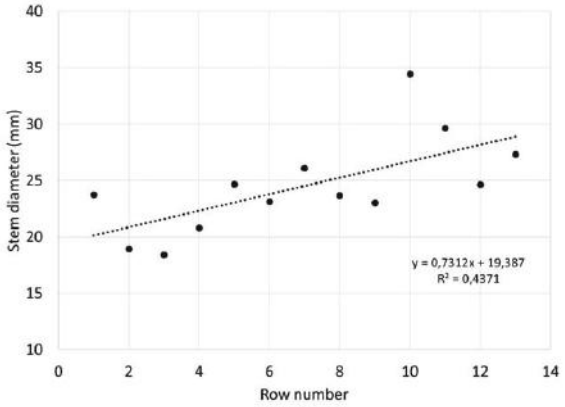

Figure 5. Relationship between mean stem diameter and row number during March 2019. (Row 1 is located at approximately 1 160 m above sea level while row 13 is at approximately 1 170 m above sea level.)

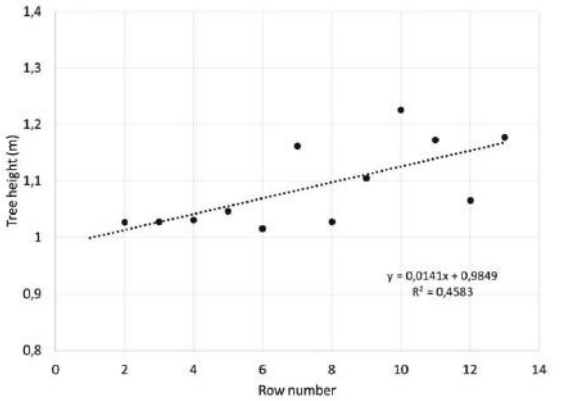

Figure 6. Relationship between mean tree height and row number during March 2019. The reading from the bottom row was not included. (Row 1 is located at approximately 1 160 m above sea level while row 13 is at approximately 1 170 m above sea level.)

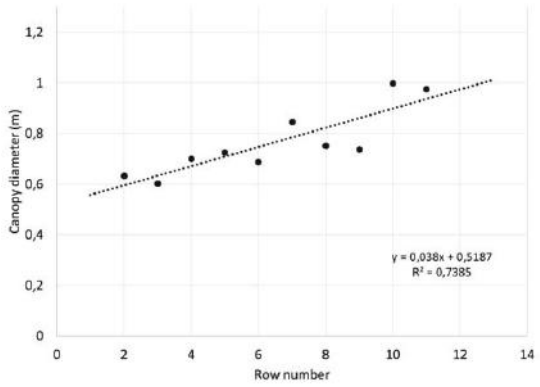

Figure 7. Relationship between mean canopy diameter and row number during March 2019. The readings taken in the bottom and top two rows were not included. (Row 1 is located at approximately 1 160 m above sea level while row 13 is at approximately 1 170 m above sea level.)

Table 2. Design specifications of the trial block.

Trial design aspects	Specification
Number of treatments	4
Number of replicate plots per treatment	13
Number of rows	13
Number of plots per row	4
Number of trees per plot	7
Total number of plots	52
Total number of trees	364

Table 3. Approximate reduction in ridge height that took place between construction and the end of the first growing season.

Approximate ridge height (mm)	
Upon construction	**March 2019**
0	0
400	200
800	400
1200	600

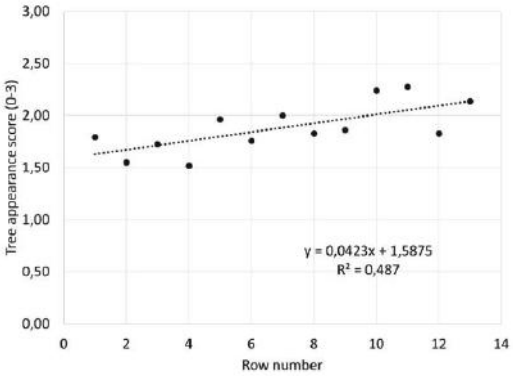

Figure 8. Relationship between the mean appearance scores of the trees and row number during March 2019. (Row 1 is located at approximately 1 160 m above sea level while row 13 is at approximately 1 170 m above sea level.)

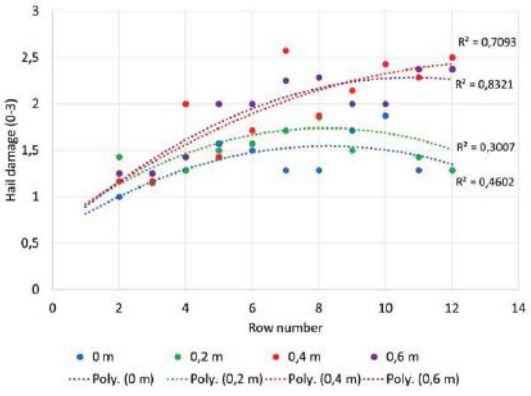

Figure 9. Relationship between the mean hail damage scores of the four ridge heights and the row number during March 2019. The readings taken in the bottom and top rows were not included (Row 1 is located at approximately 1 160 m above sea level while row 13 is at approximately 1 170 m above sea level.)

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