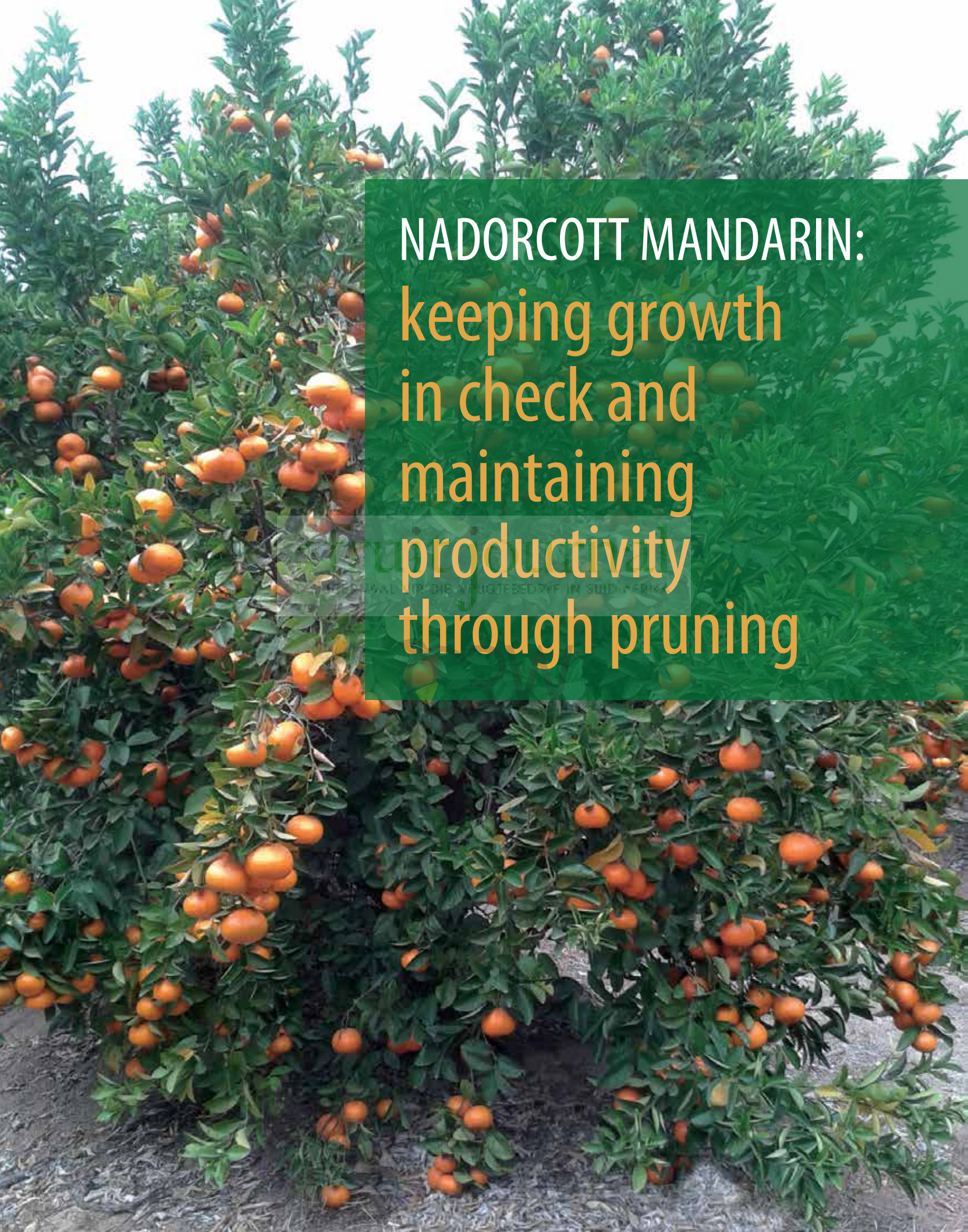




NADORCOTT MANDARIN:
keeping growth
in check and
maintaining
productivity
through pruning

Left: A high yielding Nadorcott tree.

REGINA CRONJÉ, CHRISTO HUMAN AND INNOCENT RATLAPANE

ARC-Tropical and Subtropical Crops, Nelspruit

A three-year pruning trial in the warm Lowveld investigated pruning strategies for Nadorcott mandarin trees of different ages.

Nadorcott is a popular late mandarin cultivar, owing to its good eating quality and excellent bearing capacity. However, managing Nadorcott, especially its alternate bearing and tree size, is a challenge. This is due to its characteristic vigorous vegetative growth, upright tree structure with long shoots, alternate bearing, as well as its late and long harvesting period. Pruning can be an important orchard management tool to manipulate both tree growth and bearing patterns.

The main aim of pruning is to improve light penetration throughout the tree canopy, in order to produce strong bearing branches that can bear fruit of a good size and quality. Tree shape and light conditions affect the microclimate inside the tree, which in return influences emerging time and strength of shoots and flowers, as well as fruit quality parameters such as colour and size (Suzuki et al., 1973; Tucker et al., 1994; Verreynne et al., 2004; Khurshid and Krajewski, 2010). The type of bearing branch – strong or weak – will determine the type of inflorescence it will bear, as well as the fruit set potential. Strong bearing branches are thick and produce mainly leafy inflorescences, which have a high fruit set rate and produce a good fruit size, whereas weak bearing branches have the opposite effect (Krajewski and Pittaway, 2000; Khurshid and Krajewski, 2010). This applies especially to mandarins and oranges. Furthermore, there is an interaction between crop load, carbohydrate levels and alternate bearing (Goldschmidt, 1999; Iglesias et al., 2003; Van der Merwe, 2012), which can be positively influenced by correct pruning.

In order to determine the effect of various pruning methods on flowering, yield, fruit quality, starch reserves and alternate bearing patterns, a project on Nadorcott mandarin trees of different ages was initiated in 2014.

Different pruning approaches for different tree ages

The study was conducted between 2014 and 2018 on young and old Nadorcott trees on a commercial farm in the warm Lowveld region of Mpumalanga, near Nelspruit. The trial on young trees (one and three years old at trial initiation) included three treatments, namely two selective hand-pruning treatments according to either the pyramid or open vase shape, and a control, which was

not pruned until trees touched each other in the row. The trial on old trees (eight years old at trial start) consisted of six treatments including selective pruning by hand (light and severe after harvest, or light after fruit drop only), mechanical pruning after harvest, a combination of hand and mechanical pruning in alternate years, as well as a control (farm practice). Pruning was carried out immediately after harvest (July/ August), after fruit drop (one treatment only), and in January (water shoot control). Data collection included the total amount of removed plant material, tree height before and after pruning, stem circumference at harvest, leaf starch content, return bloom, yield and fruit size.

Nadorcott tree structure

It was observed that Nadorcott shoots branch into several second order shoots, of which one is bigger than the rest. This stronger branch then extends and branches further into third order shoots, and so forth (Fig. 1). When this stronger branch bears fruit, it creates an overhang, which does not only cause shade on itself and opposite trees, but also uneven fruit colouration (Fig. 2). Removing these bigger branches was often enough to achieve the desired tree shape, especially for younger trees, and it improved light penetration considerably in Nadorcott mandarin.

Pruning of young trees

Early shaping of newly established, non-bearing trees stimulated vigorous vegetative growth, and the desired tree shape was lost within less than a year, especially for the open vase treatment. Until trees have filled their allocated space in the row, selective removal of branches (branches crossing each other, as well as strong water shoots) appears sufficient and holds enough benefit for that tree age.

For pruning of young, bearing trees ($\geq$ three years old), removal of big branches was essential to improve light penetration and fruit quality, and a pyramid-like shape was easiest to achieve and maintain (Fig. 3). It reduced overhangs and improved light penetration most efficiently. Pruning from the first year of bearing reduced yield, compared with unpruned trees. However, no early on-set of alternate bearing was observed in pruned trees (pyramid and open vase), compared with unpruned trees, which showed a clear



Fig. 1 Typical Nadorcott shoot growth: multiple shoots with one being longer and stronger than the rest.

alternate bearing pattern (Fig. 4). This indicated that moderate pruning of young trees to form a productive canopy with strong bearing branches might reduce alternate bearing in this cultivar.

Pruning of old, overgrown trees

Due to the overgrown stage of the trees, pruning was very challenging and more branches had to be removed in the first year than initially planned. As with the young trees, the more severe the pruning, the stronger the re-growth and the greater the impact on yield, fruit size and return bloom. Moderate pruning after harvest (selective removal of medium and few big branches) appeared most beneficial in the long-term, without a significant impact on yield, return bloom and fruit size. Therefore, a good balance between the removal of bigger and smaller branches, all of which inhibit light to enter the canopy, is necessary to regain or maintain good cropping of older trees (Tucker et al., 1994). Selective hand pruning after fruit drop was also beneficial, when used in combination with light pruning after harvest (i.e. removal of strong water

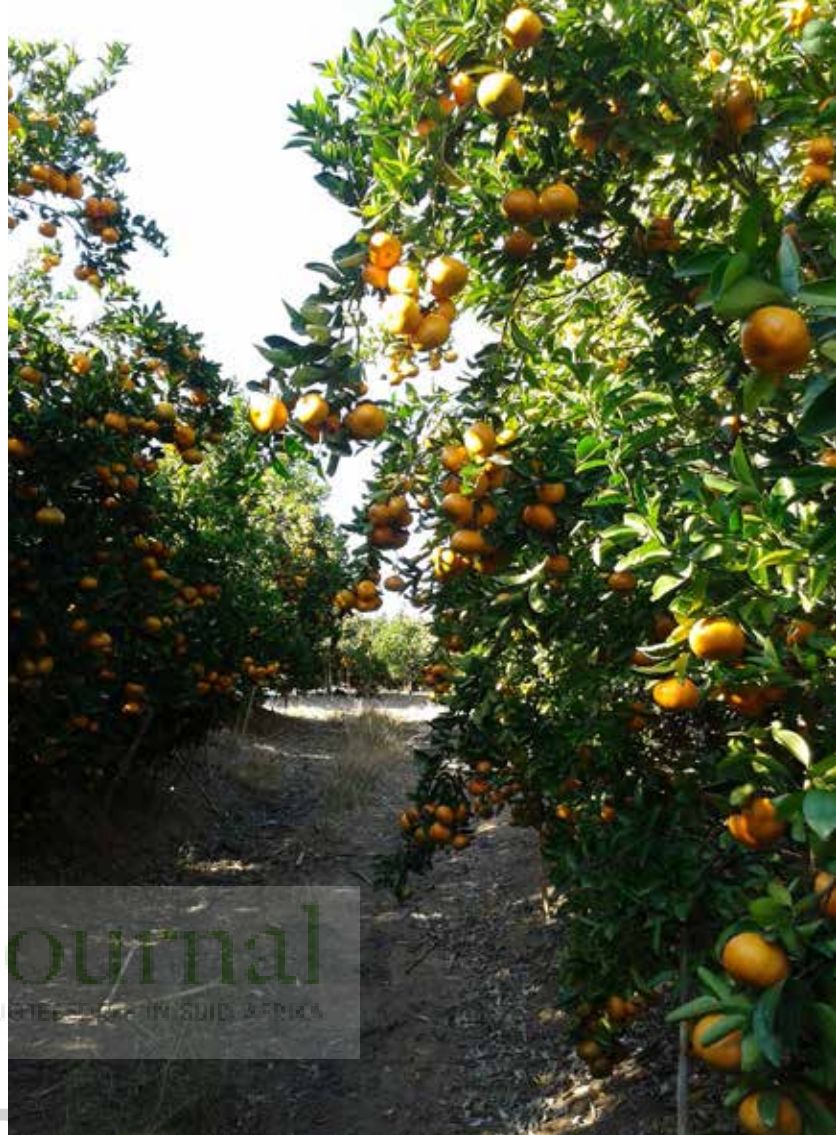


Fig. 2 Long upright shoots can lead to overhanging branches, which cause shading and poor fruit colour.

shoots only). Pruning after fruit drop could also be a means of fruit thinning in on-years. Selective hand pruning was more beneficial than mechanical pruning, as the latter caused a dense canopy with short and weak bearing branches. Mechanical pruning, combined with selective hand pruning in alternate years did not show any benefits for Nadorcott.

Over the three seasons, none of the treatments were able to reduce alternate bearing. Longer trial periods are necessary to determine which pruning strategy has the potential to reduce existing alternate bearing with time in older trees, and whether pruning before an expected on-year can reduce / minimize alternate bearing.

Conclusion

Considering all available results, it can be concluded that no pruning should be done in non-bearing trees, due to the vigorous re-growth. However, it is beneficial to remove strong water shoots and branches that cross each other, to build a strong framework. For young and older bearing trees, thinning of medium and big

branches is essential to improve light penetration and fruit quality.

A pyramid-like shape appeared to be most beneficial for Nadorcott, as it reduced overhangs that caused shading and reduced fruit colour. Selective hand pruning is preferred above mechanical pruning, although it should not be severe.

Mechanical pruning creates a dense canopy and is not recommended, therefore, as a pruning method after harvest. However, it can be considered for reducing tree height after fruit drop.

Besides pruning to address production sustainability and alternate bearing in Nadorcott, other management practices such as irrigation and fertilisation have to be adjusted, in order to reduce and minimize alternate bearing, especially for older trees that already show high alternate bearing.

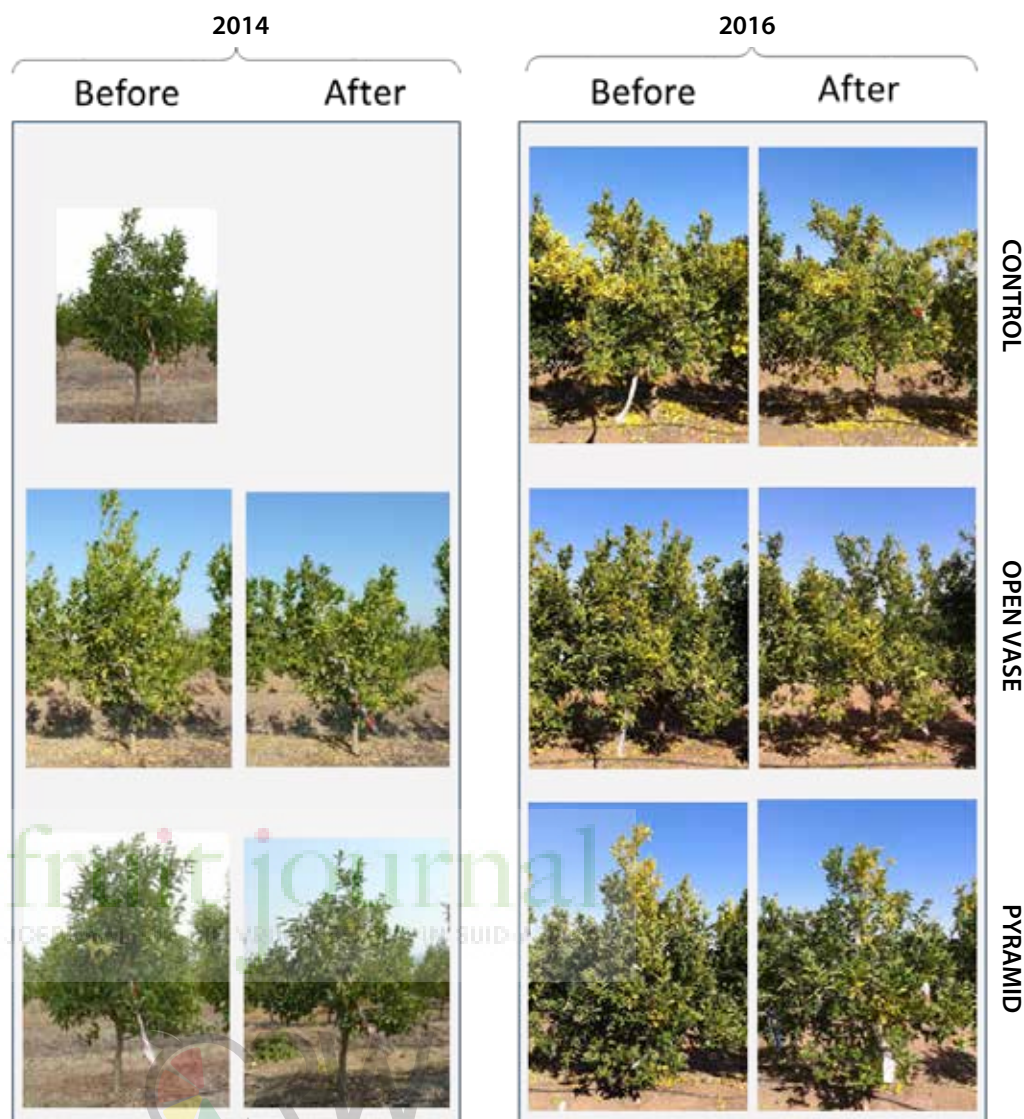


Fig. 3 Tree shape of young Nadorcott trees before and after pruning in year one and three.

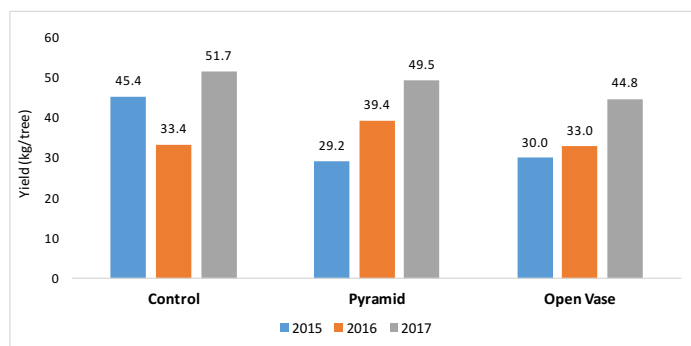


Fig. 4. Effect of various pruning treatments on yield of young Nadorcott trees at harvest time in July 2015, 2016 and 2017.

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