SEASONAL FRUIT GROWING OF KIWIFRUIT

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ABSTRACT

Hayward cultivar is one of the most important commercial kiwifruits (*Actinidia deliciosa*). It is a woody fruit that grows in shrub or tree form in tropical and subtropical regions. It is widely grown in all countries that have favorable ecological conditions, namely Italy, France, the United States, South Africa, Chile, Italy, and Turkey. In its homeland, China, the average winter temperature is 0 °C, the annual average is 20–22 °C, and annual precipitation is 750 mm. Ideal conditions are an average daytime temperature of 4.5 °C in winter and 13.30–13.9 °C in summer, 130–163 mm average annual precipitation, and 76–78% relative humidity. This study was carried out to establish the seasonal growth curves of kiwifruit. Together with, kiwi vines age effect was also evaluated. The trial was carried out in an orchard in Kocaeli, Turkey, 2.8 km from the sea at an altitude of 6 m (35°27.6′ N). Fruit measurements (width, thickness and length) were taken throughout the growing season and draw growing lines. The kiwifruit growth curve was characteristically a double sigmoid that reflects two growing phases, fast and slow. Kiwifruit development was affected by many factors such as temperature, light. Plant age was also a factor that affects fruit quality based on how the accumulation of dry substance and sugar vary with age. Age also affected the fruit size and weight.

Keywords: Kiwifruit, growing curve, Kocaeli, fruit growing

INTRODUCTION

Kiwi fruit is one of the most important fruit species. It belongs to *Actinidiaceae* family that grows in tropical and subtropical regions. Kiwifruit grown in too many countries all around the world, including Italy, France, the United States, South Africa, Chile, Italy and Turkey. Hayward variety has a high commercial value because of this, we used this cultivar in our study.

Kocaeli province has a place in kiwifruit production with its favorable climate. It is popular for farmers because of long-storage life and less careful needs in cultivation. It is suitable for ecological agriculture too (Drzewiecki et al., 2016). Kiwifruit growth curve was characterized as a double sigmoid that has a two growing phase as fast and slow growing phase

(Bebbington et al., 2009). The age of the tree effects the fruit growing line (Andrzejewska et al., 2015).

To determine the seasonal growing period help producer in kiwifruit cultivation. It is therefore the aim of the study was to determine the draw fruit growing curves in a season.

2. MATERIAL AND METHOD

The study was conducted in the kiwi orchard of Kocaeli Provincial Directorate of Agriculture and Forestry for 3 years, between 2017 and 2019. All measurements were made in the laboratory of Horticulture Department of the Kocaeli University Faculty of Agriculture.

"Hayward" female kiwi variety vines 12 and 25 years old and pollinator was Matua variety was planted at intervals of 4x4 m, a T-wire training system was applied. Applications such as tillage, irrigation, fertilization, and pruning are carried out regularly. Winter pruning is carried out.

The climate of Kocaeli has a transitional climate between the Mediterranean climate and the Black Sea climate. When the climate data for many years are assessed, the annual average temperature is 14.8°C. There has been a rainfall of 668.8 mm. as total annual rainfall. The average relative humidity is 79.2%.

In March 2017 before flowering, 6 Harvard kiwi trees (three for each 25 and 12 -year-olds) were selected to best reflect the condition of the garden. In each selected trees, two branches were selected in each direction, north, south, east and west. The directions of branches were marked by tying raffia in different colors. Observations were made in the same trees in each working year.

RESULTS AND DISCUSSION

Fruit set in kiwi plants occurred in the first week of June. A rapid development was recorded in the first 60 days after fruit set that fruit width, thickness and fruit length increased rapidly in this period. Fruit enlargement was showed slowly but continuous line until harvest time. Fruit size increased in 2018 compared to other years, while fruits remained smaller in 2017. 12-year-old plants fruit length increased in 2017 while fruit width increased in 2018

Rounded shaped fruits were obtained in 2019 because of increasing thickness. Larger fruits were harvested from 25-year-old kiwi plants in 2018 and from 12-year-old kiwi plants in 2019. 25 years old kiwi fruit length was statistically larger than 12 years old ones (66,17 cm and 61,26 cm, respectively) (Figure 1).

The biggest fruit were harvested in 2017 from younger kiwi plants. In this year, fruit length curve showed two tap point and double sigmoidal type clearly. This growth character was also defined in previous studies (Snelgar et al, 2005). Fruit growing parameters were

affected with the climatical conditions, while the length of fruit more changeable parameter compare with thickness.

Fruits were completed 70% of size in the first 30 days of maturation period (69%, 68% and 76% for fruit width, thickness and length respectively). Increasing of fruit width and thickness was clear (approximately 20%) until 60th day of growing period, while was slower for fruit length (about 10%). Fruits were reached their final size (95%) on 110-120 days after full blooming. In the last 4-6 weeks of growing period, fruits were completed the last 5% part of their final size (Figure 2). A regular size increasing intervals was observed until harvest.

In previous studies, throughout the growth period, the fruit weight of Hayward showed a single S shape (standard sigmoidal growth) (Burdon et al., 2017). In the first rapid growth period (first 60 days) fruits completed 70% of their size. In the second part of growth 10-20% of fruit growing was completed, so finally stagnant growth period was observed until harvesting time. It was found that fresh weight was increased especially in the first 30 days (Yu-Fei et al. 2021) while was suggested a rapid development with a rapid longitudinal diameter increase of fruit in first 20-35 days intervals after anthesis. In this study, kiwifruit development followed a sigmoidal pattern with two rapid growing phases that in agreement with previous studies (Richardson et al. 2011 Bebbington et al 2009).

Similarly, Hayward kiwi fruits was completed 62,46% of their development in the fast-growing period in the 75 days after fruit set in this study. According to our observations, the last 4-6 weeks were the most affective period on fruit quality parameters that irrigation was the best treatment increasing the fruit quality. Fruits have reached to commercial harvesting maturity at the first half of November. Fruits had been harvested on 23rd of November in 2017, 9th November 9 in 2018, and 13rd of November in 2019 at commercial harvesting criteria. Harvesting date, kiwifruit shape and quality has affected by ecological conditions. In 2018, fruit width increased and more rounded fruits were obtained as a characteristics of Hayward cultivar (Hosseinzadeh et al.,2013). In 2019, the thickness of the fruit increased, and the fruits became flat. Larger fruits were harvested from 25-year-old kiwis in 2018 and from 12-year-old kiwis in 2019. It was found that fruit size was increased especially in the first 30 days.

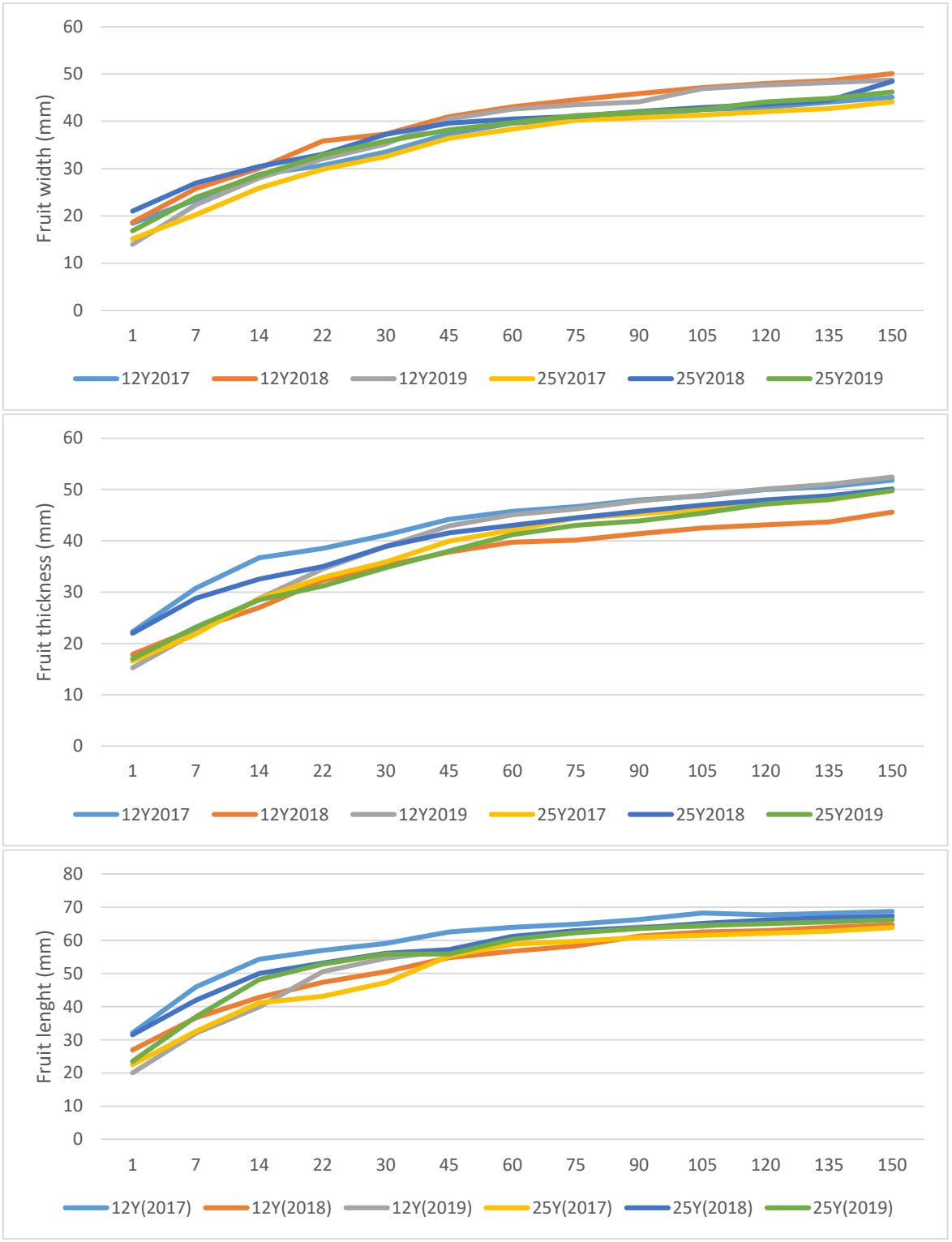


Figure 1. Fruit size variation of kiwi fruits during the 3 years growing period

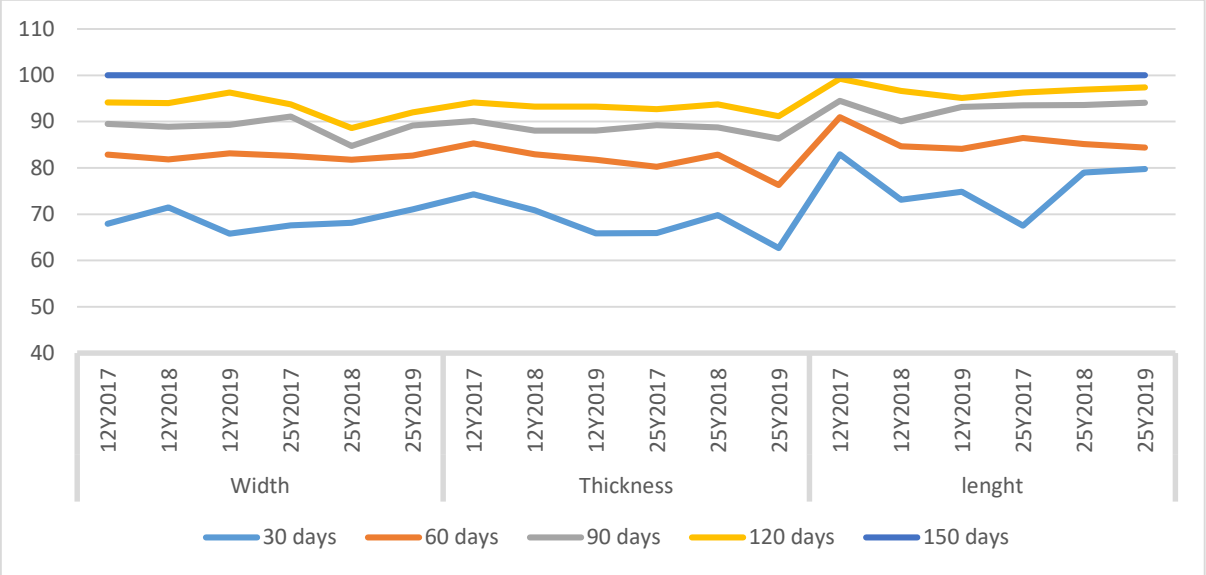


Figure 2. Enlargement of fruit (%) during the growing period after fruit setting

CONCLUSIONS

Kocaeli has a temperate climate influenced by the sea and mountains. Kiwi vines showed double sigmoid growing curves and the first peak was more prominent. The first 30 days after fruit set are very important in terms of yield. During this period, fruits complete nearly 70% of their growth. Fruits continue to grow and weight until harvest day, it is important to pay attention to cultural processes. The results of the study will support the cultural practices in kiwi plantations.

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