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Fruit Growth Characteristics of Rose Hips (*Rosa* sp)

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Abstract

This study was carried out to determine the fruit growth characteristics of two rose hip (*Rosa*) species selected from wild population in Tokat region of the Northern Anatolia, Turkey. Shrubs were propagated by cuttings and planted in 2000 at the Research Station of the Horticultural Department of Agricultural Faculty of Gaziosmanpaşa University, Tokat, Turkey. Fruit weight, fruit diameter, fruit length, fruit flesh percentage and seed weight of genotypes belonging *Rosa dumalis* and *Rosa jundzillii* were investigated in the study. Fruit samples were picked up weekly from full flowering to optimal harvest time for measurement and weighing. As a result, fruit development characteristics of species measured exhibited single sigmoidal curve except seed weights. In general, developing of measured properties were fast until last 3-4 weeks, then became stable or slightly decreased. Results obtained in 2011 were higher than the results obtained in 2010 in both genotypes.

Keywords: *Rosa*, Fruit growth, Sigmoid, Curve, Fruit diameter, Fruit flesh

Contents

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1. Introduction

Growth, most commonly, means an irreversible increase in size [1]. Growth is occurred by dividing and increasing of cells. Therefore, increasing and dividing of cells are two important processes for fruit development during growing period. Fruit development begins from full blooming and continues to harvest time. The developing young fruit uses nutrient from plant at the first stage of growth period. Then, fruit partly produces own energy requirement by photosynthesis. But this production is not enough for optimal fruit development. That's why, young fruit continues to feed from plant at the all stages of development and maturation processes [2]. Fruit growth is influenced by some genetic factors such as cultivar/variety, rootstock, age, biennial bearing, the position of the flower on spur, cultural factors such as pruning, defending against pests, thinning, irrigation and nutrition, exogenous hormone applications and environmental factors such as temperature, light, soil, moisture, wind and gases [3]. The length of developing period may be short or long depending on fruit species. The length of this period varies from ten to twenty-week for many deciduous fruit species. For example, this period is sixty-week for Valencia orange cv. while it is only three-week for strawberries. During the developing period fruit volume increases several times when compared with its initial weight and volume [4, 5].

Some parameters, such as fruit fresh/wet weight, fruit volume increasing, fruit diameter etc. are used for determination of fruit development. Selected properties are measured from full blooming to harvest time for a certain time intervals. Developing rate varies during fruit growing period depending on some factors. Fruit development is expressed by growth curves. Growth curve shapes can change related to species/cultivars, ecological conditions, and cultural practices. Fruit species are divided two main groups related to growth curve shapes as single and double sigmoid. Apple, pear, orange, banana, strawberry, avocado, mango, etc. show single sigmoidal curve. Peach, apricot, cherries, olive, currant, grape, fig, raspberry, blackberry etc. show double sigmoidal curve. Some researches [3, 6, 7] were conducted on development of mentioned fruit species but there is no research on rose hip fruit development.

Understanding of fruit development helps us to use of fertilizing management, pruning, growth regulators, fruit thinning and shedding fruit weight, fruit diameter, fruit length and fruit flesh ratio, and size prediction [5, 8]. It is desirable that the growth progress of plant know under orchard conditions in real time for many practical reasons. While on the one hand growers may better fine-tune management practices, on the other hand, the ability to forecast average fruit weight at harvest is of great value for markets [9]. In light of this information, the aim of this study is to determine the fruit growth by measurement of some pomological characteristics of two rose hip species. As far as we know that this is the first study conducted on fruit growth characteristics of rose hips.

2. Material and Methods

This study was carried out on two selected rose hip genotypes belonging to *Rosa dumalis* (Accession Number: AR-11) and *Rosa jundzillii* (Accession Number: YL-04), grown in the research station of the Horticultural Department of Agricultural Faculty of Gaziosmanpaşa University, Tokat, Turkey, during two years (2010 and 2011). Accessions were selected from wild rose hip population in the Tokat region of the Northern Anatolia [10].

Shrubs were propagated by hardwood cuttings and planted on their own roots at a spacing of 3 x 3 m in the research and treatment station in 2000. The soil texture of area is silty clay, and pH is slightly alkaline. The rose hip bushes were pruned in January or February (dormant period) of each year with removal of dry, old or low shoots. The plants were fertilized with mineral nutrients and manure together with drip irrigation at regular intervals during the vegetation period. Mean fruit weight (g), fruit diameter and length (mm), fruit flesh percentage and seed weight (g) of studied species were measured.

Fruits were randomly sampled from each shrub. The fruit and seed weight and flesh ratio, and diameter and length values of the fruits were examined in order to form growth curves. Physical characters were measured weekly in 2010 and 2011 from full bloom to optimal harvest time. 30 fruits with three replicates per species were measured or weighed for determination of growth curves of each studied physical character**.**

3. Results and Discussion

Growth curves of the species and the years associated with studied characteristics were presented in Figure 1a-d, 2a-d, 3a-d, 4a-d and 5a-d.

A linear fast growth was recorded in fruit weights of species in both years from full bloom to last 3-4 weeks. Growth during last 3-4 weeks was stable or decreased slightly. Fruit weights of both species were higher in 2011 than 2010 (Figure 1a,b,c,d).

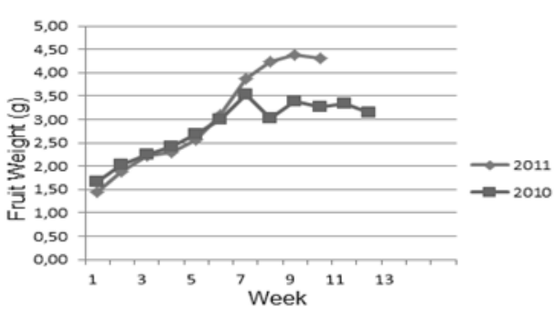

Figure-1a. Fruit weight developing of *R.dumalis* in 2010-2011
Source: Unpublished Data

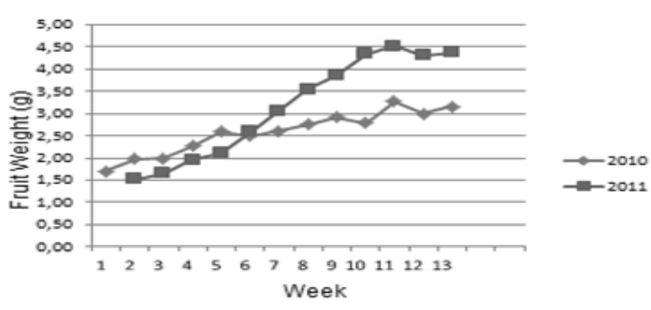

Figure-1b. Fruit weight developing of *R. jundzillii* in 2010-2011
Source: Unpublished Data

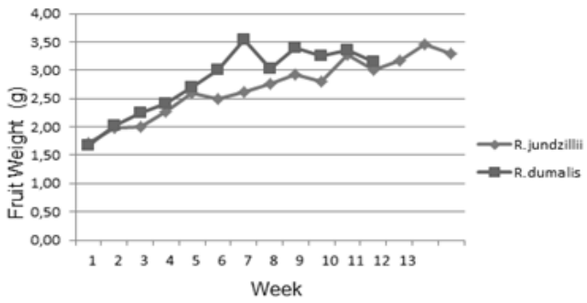

Figure-1c. Fruit weight developing of *R.dumalis* and *R. jundzillii* in 2010
Source: Unpublished Data

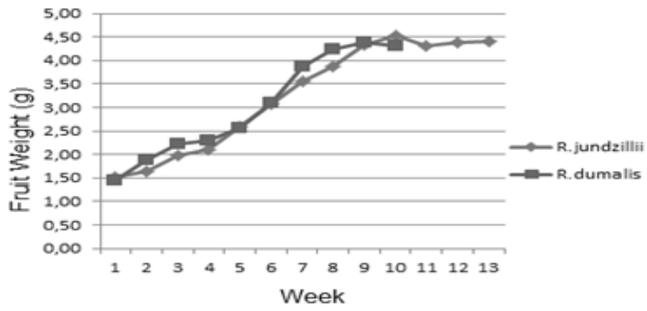

Figure-1d. Fruit weight developing of *R.dumalis* and *R. jundzillii* in 2011
Source: Unpublished Data

Velocity of fruit flesh were similar in both species and years (Figure 2a,b). Fruit flesh percentage of *Rosa dumalis* was higher than *Rosa jundzillii* in both years (Figure 2c,d).

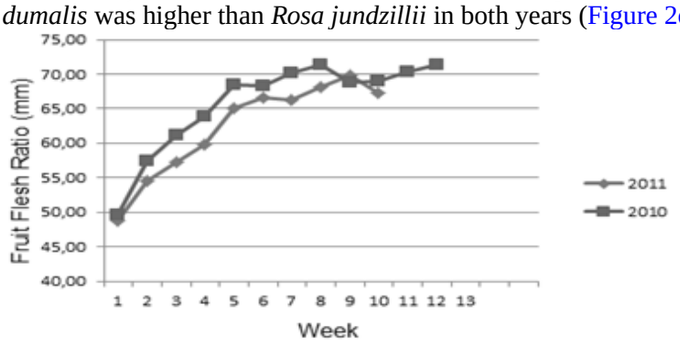

Figure-2a. Fruit flesh ratio developing of *R. dumalis* in 2010- 2011

Source: Unpublished Data

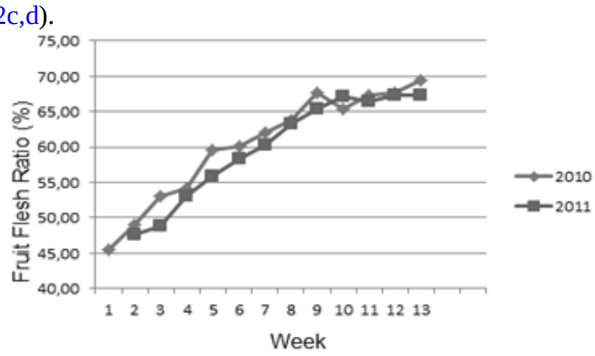

Figure-2b. Fruit flesh ratio developing of *R. jundzillii* in 2010-2011
Source: Unpublished Data

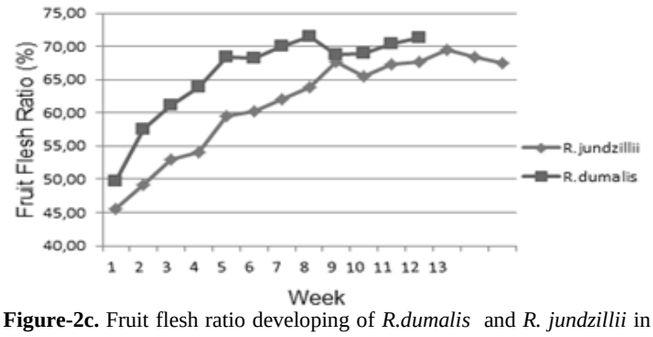

Figure-2c. Fruit flesh ratio developing of *R.dumalis* and *R. jundzillii* in 2010
Source: Unpublished Data

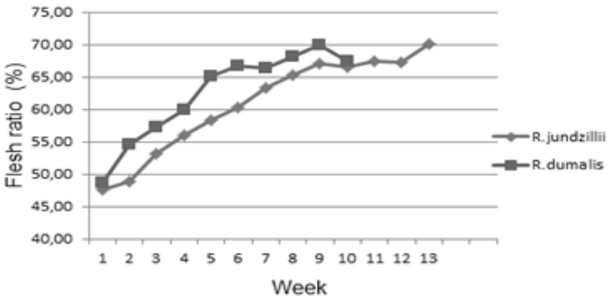

Figure-2d. Fruit flesh ratio developing of *R.dumalis* and *R. jundzillii* in 2011
Source: Unpublished Data

Fruit diameter growth of *R. dumalis* were fast in the beginning weeks in both years (Figure 3a). Fruit diameter of *R. jundzillii* in 2011 were faster and more regular than 2010 (Figure 3b). Fruit diameter of *R. dumalis* was higher than *R. jundzillii* in 2010 (Figure 3c) but were similar and closer in 2011 (Figure 3d).

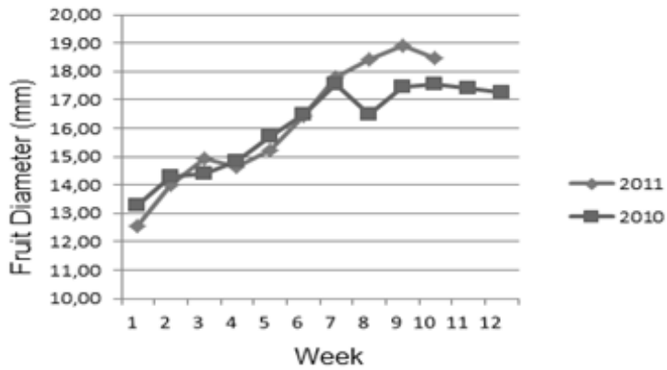

Figure-3a. Fruit diameter developing of *R. dumalis* in 2010-2011
Source: Unpublished Data

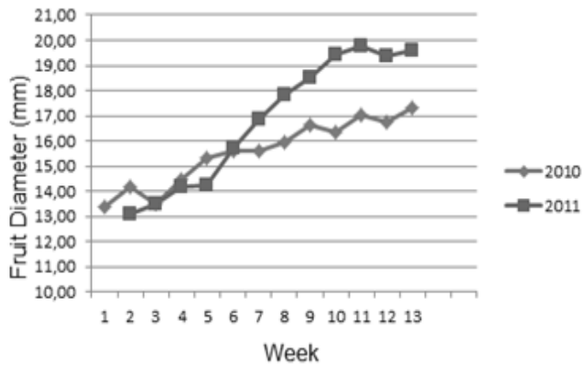

Figure-3b. Fruit diameter developing of *R. jundzillii* in 2010-2011
Source: Unpublished Data

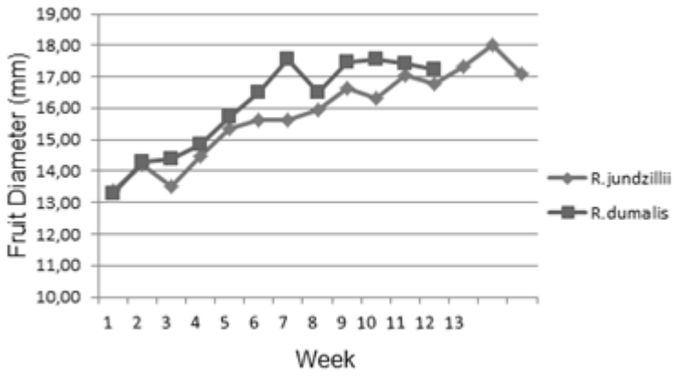

Figure-3c. Fruit diameter developing of *R.dumalis* and *R. jundzillii* in 2010
Source: Unpublished Data

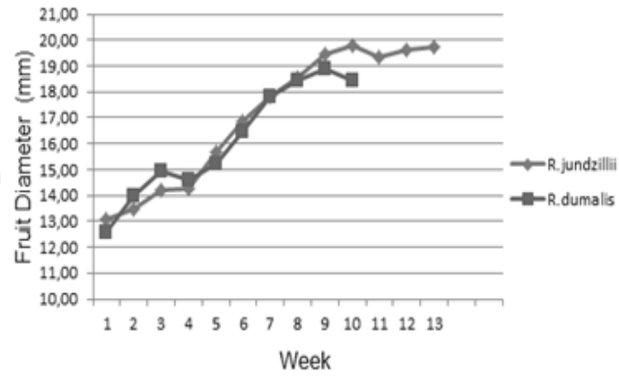

Figure-3d. Fruit diameter developing of *R.dumalis* and *R. jundzillii* in 2011
Source: Unpublished Data

Fruit length developments of *R. dumalis* and *R. jundzillii* were higher and more regular in 2011 than 2010 (Figure 4a and Figure 4b). Fruit size development of *R. dumalis* showed a faster improvement (Figure 4c) in 2010 when species compared. However, a closer or similar development occurred in 2011 (Figure 4d).

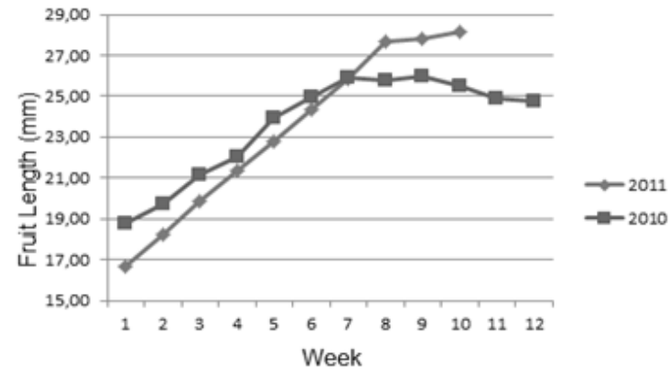

Figure-4a. Fruit length developing of *R. dumalis* in 2010-2011
Source: Unpublished Data

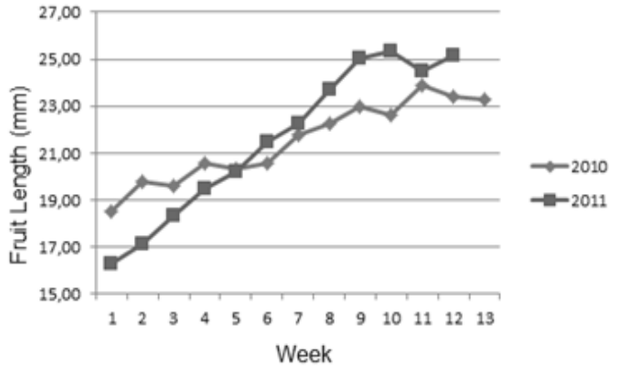

Figure-4b. Fruit length developing of *R. jundzillii* in 2010-2011
Source: Unpublished Data

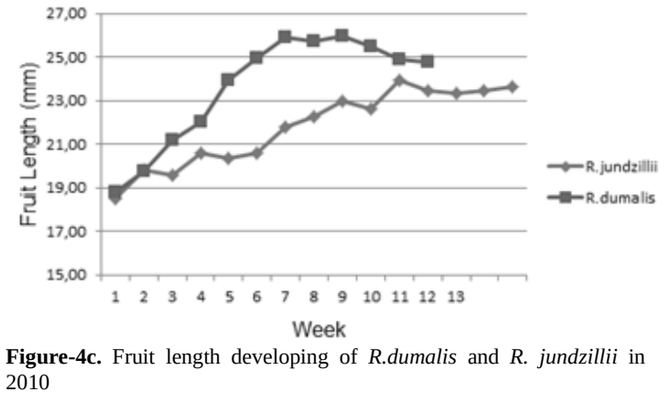

Figure-4c. Fruit length developing of *R.dumalis* and *R. jundzillii* in 2010
Source: Unpublished Data

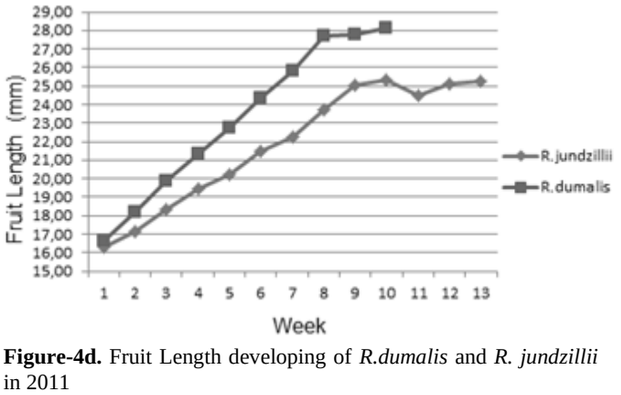

Figure-4d. Fruit Length developing of *R.dumalis* and *R. jundzillii* in 2011
Source: Unpublished Data

Seed weight of genotypes exhibited an irregular development depending on year and species (Figure 5a,b,c,d).

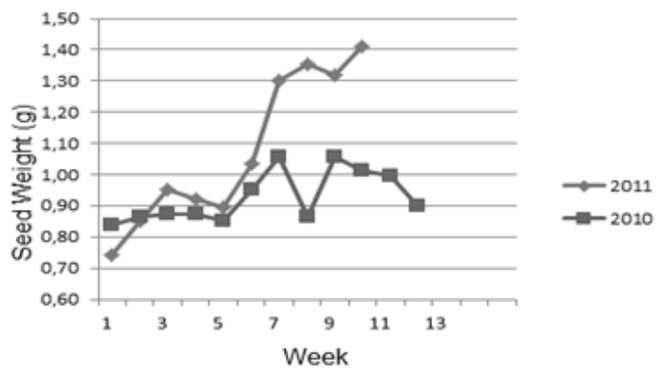

Figure-5a. Seed weight developing of *R. dumalis* in 2010-2011
Source: Unpublished Data

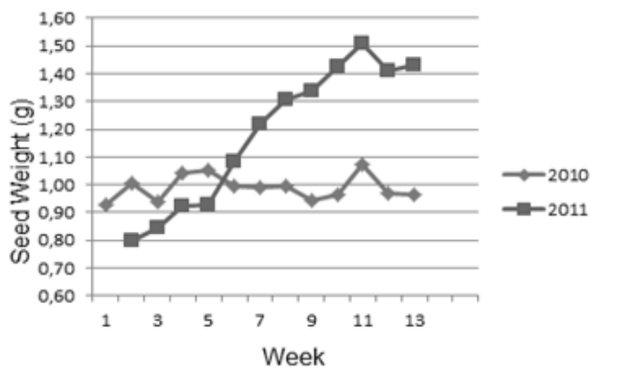

Figure-5b. Seed weight developing of *R. jundzillii* in 2010-2011
Source: Unpublished Data

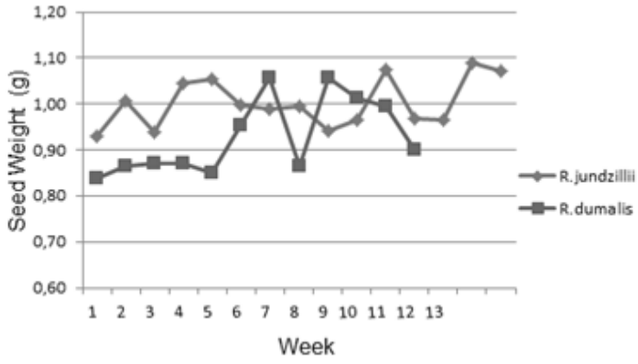

Figure-5c. Seed weight developing of *R.dumalis* and *R. jundzillii* in 2010

Source: Unpublished Data

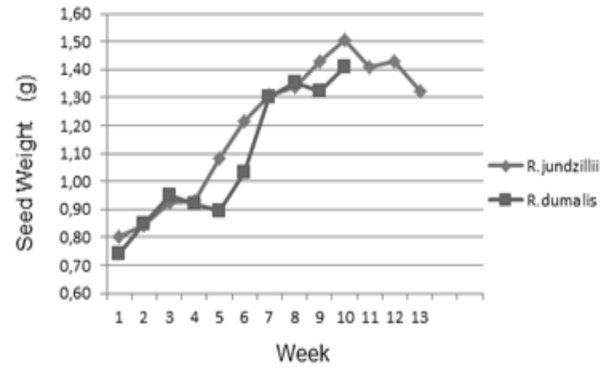

Figure-5d. Seed weight developing of *R.dumalis* and *R. jundzillii* in 2011

Source: Unpublished Data

Measured properties of *R. jundzillii* in the second year were higher than the result of the first year as determined for *R. dumalis*. It was concluded that the fruit load per bush and ecological conditions affected the fruit weight and other parameters. As a matter of fact, fruit growth is influenced by some genetic, cultural and environmental factors [3]. The fruit growth of persimmon indicated that fresh weight measurements exhibit the general sigmoid curve pattern for a typical botanical berry, with only slight deviation Schroeder [8]. Filiz [6] investigated the weight, volume and size developing of peach from full bloom to harvest. In the growth rate of measured characteristics occurred rapid increase during the initial weeks, but towards to the last weeks this rate continued to decrease. Öz [7] reported that fruit diameter and length of kiwifruit increased rapidly in first 4-5 weeks but developing rate decreased gradually after that time.

Growth investigations of various fruits based on diameter, weight or volume indicate that each botanical fruit type exhibits a characteristic mode of development, depending somewhat upon its basic morphology. Thus the stone fruits, as typified by the peach or cherry, follow a general pattern of dimensional growth which consists of three rather distinct periods from flower to mature fruit. Rapid growth of all tissues characterizes the first period. Very little grown can be detected during the second or “rest” period during which the endocarp hardens. The third period is marked by a very rapid increase in size as fruit maturity is approached. The apple and pear, pomes, exhibit a different type of dimensional growth, which is nearly constant in rate during the entire period of fruit development. Citrus fruits, such as lemon or orange, each of which is morphologically a specialized berry, the hesperidium, exhibits a continuous increase in volume throughout the season, provided water is available. Shrinkage of citrus fruits may occur during the growing season when a water deficit occurs within the plant. The fig, morphologically a fleshy receptacle which contains many true botanical fruits, achenes, follows the growth pattern of the stone fruits with two periods of size increase based on diameter measurements. The olive, a drupe, however, has three periods of increase in volume. Fresh fruit weight and fruit length increases in the pericarp of the date, a berry, are represented by simple "S" curves which reach a maximum in late summer, sometime before full fruit maturity, and fall off as maturity is attained [8]. While the rose hip is similar in some of the trends exhibited by these fruits, it is distinct in others.

4. Conclusion

It can be stated that fruit growth characteristics of species measured exhibited the single sigmoidal curves in two years except seed weights. Seed weight growth curves formed the irregular patterns depending on year and species. Developing rate of fruit weight, fruit diameter, fruit length and fruit flesh ratio were fast up to last 3-4 weeks. Results of two species obtained in 2011 were higher than the results of 2010, in general. This means that fruit development characteristics can be affected by environmental factors as well as genetic and maintenance conditions.

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