



Maturity time for some local and introduced pear cultivars in Sweida governorate depending on some environmental, physical and chemical characters

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Abstract: Maturity date was set for some introduced pear cultivars in Sweida governorate Coscia, Comice, Anjou and the local pear cultivar Meskawi depending on full bloom date, days after full bloom, quantity and quality characters of the fruits (the average of fruit weight, firmness of flesh fruit, total soluble solids, tetratable acidity and total sugar). The results showed that the full bloom data was mid of April, except Comice, which was the earliest full blooming cultivar, at the first of April. The cultivars divided according to their maturity time to early cultivars like Meskawi (mid of July) the fruits needed (101 days) from full bloom to ripen. Mid cultivars like Coscia (mid of August) the fruits needed 117 days to ripen. Late cultivars like Anjou (late of September) the fruits needed 166 days to ripen, very late cultivars like Comice (mid of October) the fruits needed 189 days to ripen. Quantitative and qualitative characteristics of the fruits showed that Comice cultivar has the highest firmness of flesh fruits (6.6 kg/cm²) and the highest tetratable acidity (0.527%) at the level 0.01, there were no significant differences among the four cultivars in total soluble solids at the level 0.01, while Meskawi achieved the highest total sugar percentage (16.7%) at level 0.01. The average of fruit weight was between (190g) in Comice and (66.3g) in Meskawi with significant differences between all varieties. As a result, we could determine the maturity date depending on some environmental, physical and chemical characters.

Key words: pear, full bloom date, maturity time, day after full bloom, firmness, tetratable acidity.

Introduction

The genus *Pyrus* belongs to the subfamily Pomoideae, of Rosaceae family. It includes 22 species distributed in Asia, Europe and South Africa. Historical studies showed that the precise origin of European pear is still unknown, but in Asia is north of Iran and North Caucasus and the western slopes of the Himalayas⁽¹⁾. *Pyrus yriaca* (Boiss.) is one of the main pear species that widely distributed in Syria, Palestine and Lebanon⁽²⁾. Many genotypes from this species and related cultivars distribute in different regions of Syria from semi-arid to humid areas within different altitudes from 200 to 1800 m above the sea, and it spreads in the rocky areas and land lime stone^(3,4). China produced the highest production in the world, followed by United States, Italy, Argentina and Turkey⁽⁵⁾. In Syria, the total area planted with pear in 2010 about 4032 hectares and the production was about 21386 tons, Damascus Countryside governorate planted the highest area under cultivation (2308 hectares) and in production (14823 tons) followed by Sweida governorate⁽⁶⁾. Bartlett cultivar makes up 75% of the world's production and cultivated areas⁽⁷⁾. Although there are about two thousands of *P.*

communis cultivars, the worldwide production of this species based on a few cultivars, like Williams, Conference, Passe Crassane, D. Jules Guyot, Beurré Anjou and Beurré Bosc⁽⁸⁾.

⁽⁹⁾ Studied some of Syrian pear genotypes depending on morphological characters like tree vigor, leaf descriptions, anatomical characters for leaves and biochemical markers. Four pears cultivars evaluated in terms of growth, yield and fruit quality ⁽¹⁰⁾. ⁽¹¹⁾ Evaluated some of pears cultivars in Syria through determining flowering time, maturity time, in addition to accurate morphological characterization for shoots, leaves, flowers and fruits beside fruit chemical analysis.⁽¹²⁾ ⁽¹³⁾ Used bloom phenology, full bloom date, maturity time, yield, fruits size and fruit chemical characters to evaluate new pear cultivars in Spain and California. ⁽¹⁴⁾ Used a group of characters to evaluate some European pears cultivars like bloom date, ripen date, post-harvest quality and consumer sensory. Fruits maturity is determined by list of environmental, chemical and physical characters, from the environmental characters days after full bloom ⁽¹⁵⁾. Determination the optimum harvest date is very important for the preservation of the quality of pears during storage ⁽¹⁶⁾. ⁽¹⁷⁾ Fined that delayed-harvest fruit were larger in size ($\approx 20\%$ increase in weight), had lower flesh firmness ($\approx 17\%$ decrease), lower titratable acidity content ($\approx 20\%$ decrease), but there were no significant difference in soluble solids content.

In Syria, despite the existence of a group of local pear cultivars, in addition to the newly introduced cultivars by the General Commission for Scientific Agricultural Research that varies in ripen date, fruits characters, yield and tolerate environmental and biological stresses, these cultivars didn't find their way to consumers ⁽¹¹⁾.

This research aimed to determine the best maturity time for some pear cultivars cultivated in the Scientific Agricultural Research Center in Sweida depending on environmental, physical and chemical characters.

Materials and methods:

This research carried out at the Agricultural Scientific Research Center in Sweida during 2013-2014, which is located at 1550m altitude, with annual rainfall 525mm/year, the soil is clay poor in organic material (1.2%) and nitrogen, rich with phosphorous, PH 6.5-6.8.

Plant material: 15 years-old of three introduced pear cultivars Coscia, Comice and Anjou in addition to one local pear cultivar Meskawi were studied, which grafted on the wild rootstock *Pyrus communis*, and it has a range of important agricultural and marketing qualities.

Environmental Characters:

1-Days after full bloom (DAFB): by calculate the days from full bloom until harvest maturity.

Physical characters:

1-Fruit weight: 25 fruits from each replicate in each cultivar were used, and then calculate the average of fruit weight.

2-Firmness of fruit flesh: the firmness of fruit flesh was achieved using penetrometer (mod FT 327) for 10 fruits from each replicate and cultivar. Two opposite sides of the peel removed. The firmness of flesh fruit estimated by kg/cm².

Chemical characters:

1-Total soluble solids: which measured by digital refractometer (Schmidt + Haensch Refractometer), using enough fruits juice from each replicates in the device⁽¹⁸⁾.

2-Tetratable acidity: by titration with Sodium Hydroxide NaOH (0.1N) and phenolphthalein to see pink color and permanence⁽¹⁹⁾, the tetratable acidity for each replicate calculated using the followed formula:

Size of NaOH used $\times 0.1 \times 0.067 \times 100 / \text{size of taken juice}$

The principal organic acid in pear is malic acid (0.067)

3-Total sugar: by taking 50ml of fruit juice+ 7ml HCL and left for the next day in 4°C. then NaOH (5N) is added till the pink color appear, the size complete with distilled water to 100ml, heated fehling solution is titrated till the blue color became pink. The total sugar estimated by the formula:

$(\text{Glucose index} \times 2500) / (\text{size of used juice} \times 1000)$

Glucose index calculated by titrated fehling solution with typical glucose then use the formula: size of used glucose $\times 10^{(20)}$.

4-Starch evaluation: by using Iodine Potassium Iodide (IKI), the color turned to blue if there is enough starch in the fruit. The IKI solution was prepared as 1g KI + 0.5g I dissolved in 100 ml distilled water. The fruits were sliced in half using a sharp knife, and then dipped in IKI solution. The distribution of the blue color shows the degree of ripen.

Statistical analysis: Experiment carried out using randomized complete block design 4 cultivars X 3 replicates X 3 trees in each replicate.

One-way anova test was used to compare between means on level 0.01 by SPSS 17 program.

Results and Discussion

1-Environmental Characters

Full bloom date: the studied cultivars varied in bloom date, Comice cultivar was the earliest in full bloom date which bloomed in 5th of April, followed by Meskawi cultivar in 11th of April, while Anjou and Coscia bloomed in 18th of April (table 1). The present results are almost in agree with the previous investigation⁽¹²⁾ for Coscia and Comice cultivars and with⁽¹¹⁾ for Meskawi, Cossia and Anjou but it did not agree for Comice. The full bloom date helps to determine number of days needed to fruit ripen.

Days after full bloom: The results revealed that the studied cultivar showed high variance in maturity time, Meskawi cultivar needed (101) days to ripen, the fruits ripen in 20th of July. Coscia cultivar needed (117) days to ripen. Anjou needed (166) days and Comice needed (189) days to ripen (table 1). Depending on the obtained results, the studied cultivars were divided into four groups depending on maturity-time, early cultivars ripen in July like Meskawi, midcultivars ripen in August like Coscia, late cultivars ripen in September like Anjou, very late cultivars ripen in October like Comice. Maturity time for Comice and Anjou in our study were in agree with the previous investigations of⁽⁷⁾ and with⁽¹¹⁾. Comice was the earliest in blooming date but the latest in maturity time, so there is no relation between blooming date and ripen date.

2-Physical Characters

Fruits weight: Table (2) showed that the studied cultivars varied in the average of fruits weight, the highest average of fruits weight was in Comice cultivar (190g), followed by Anjou (166.6g), then Coscia (94.2g), and Meskawi, which significantly revealed the lowest fruit weight (66.3g).⁽²¹⁾ Studied the average of fruit weight for some pear cultivars, the average of fruit weight in Anjou was (174g) slightly higher than ours. These results in parallel with⁽¹¹⁾ where the cultivars divided for four groups according to the average of fruit weight: small to medium fruits like Meskawi, medium fruits like Coscia, medium to big fruits like Anjou, big fruits like Comice. This helps to provide different fruit size in markets to satisfy different consumer taste.

Firmness of fruit flesh: Comice cultivar significantly achieved the highest firmness of fruit flesh (6.6 kg/cm²), but there were no significant differences among the rest three cultivars, Coscia (4.3 kg/cm²), Anjou (3.4 kg/cm²) and Meskawi (4.1 kg/cm²) as shown in Table (2). Firmness is an important quality attribute in pear, which reflect the maturity stage of fruits, firmness of fruit flesh decreases when fruits ripen⁽²²⁾.⁽²³⁾ Recommended to harvest pear fruits in range of firmness between (5-6 kg/cm²). These results are similar to⁽¹¹⁾ results except in Comice where the firmness was lower (2.30 kg/cm²).

3-Chemical Characters

Total soluble solids (TSS): there were no significant differences among the four cultivars in the percentage of soluble solids in fruits juice at level 0.01. Meskawi achieved the highest percentage (17.57%), followed by Anjou (16.2%), and then Coscia (15.82%), while Comice had the lowest percentage (15.8%) Table (2). Pear's juice contains sugars, other carbohydrates, acids, salts and amino acids, as pears mature, sugars become the main component of TSS ⁽²⁴⁾. Our results are almost like ⁽¹¹⁾ results, the percentage of soluble solids was in Meskawi 18.3% and in Coscia 15.5%.

Total sugar percentage (T.S): the results showed significant differences between the four cultivars, Meskawi had the highest percentage (16.75%) in comparison with the other studied cultivars, followed by Coscia, Anjou and Comice where there with no significant differences between them (Table 2). Fructose is the dominant sugar in pear followed by glucose and sucrose ⁽²⁵⁾.

Tetratable acidity (TA): the studied cultivars showed significant differences in the percentage of tetratable acidity at level 0.01, Comice had the highest percentage (0.527%), followed by Anjou which superior on Coscia and Meskawi where there were no significant differences between them. Malic acid is the principal organic acid; sugar and organic acid are important characters to evaluate pear's cultivars ⁽²⁵⁾.

Starch evaluation: the cultivars varied in starch percentage, it was (7) in Coscia and Anjou, (5) in Comice whereas it was totally absent in Meskawi fruits. Starch index to the optimum pear harvest date is 4-6 ⁽²⁶⁾.

Conclusions and Recommendations

1-The studied cultivars were varied in full bloom and maturity time, where the fruits presented for four months, which helps to provide pear's fruits for a long time in the markets.

2-The average of fruit weight was different in the four cultivars, Comice and Meskawi showed good physical and chemical characters in firmness and sugar percentage, which satisfies consumers taste.

3-The ability to determine the optimum maturity time for the studied cultivars depending on environmental, physical and chemical characters in the target area.

Therefore we recommend:

1-Publish and expand in cultivated areas of these cultivars to cover the markets for a longer period because its good marketing qualities.

2-Carry out researches to determine the optimum storage date and the storage system for these cultivars to maintain fruit's quality and quantity characters.

Table (1): full bloom date, ripen and days after full bloom for studied cultivars

Cultivars	Full bloom date	Ripen date	Days after full bloom
Meskawi	11 th /4	20 th /7	101
Coscia	18 th /4	12 th /8	117
Comice	5 th /4	15 th /10	189
Anjou	18 th /4	30 th /9	166

Table (2): average of fruit weight, firmness of flesh fruit, total soluble solids, total sugar, tetratable acidity, starch evaluation for studied pear cultivars

cultivar	Average of fruit weight (g)	Firmness of flesh fruit(kg/cm ²)	Total soluble solids (%)	Total sugar (%)	Tetratable acidity (%)	Starch
Meskawi	66.3 ^d	4.1 ^b	17.57 ^a	16.7 ^a	0.18 ^c	8
Coscia	94.2 ^c	4.3 ^b	15.82 ^a	14.0 ^b	0.18 ^c	7
Comice	190 ^a	6.6 ^a	15.8 ^a	12.2 ^c	0.53 ^a	5
Anjou	166.6 ^b	3.4 ^b	16.2 ^a	12.1 ^c	0.35 ^a	7
L.S.D 1%	2.15	1.53	1.57	1.74	0.05	

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