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FRUIT QUALITY PARAMETERS OF FIVE PEAR CULTIVARS IN WESTERN KOSOVO

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Abstract

This field experiment was designed to assess the quality of the pear fruits through some parameters in five different cultivars: 'Willaim', 'Abate Fettel', 'Passe Crassane', 'Cure' and 'Santa Maria'. The experiment was conducted during 2013 on a pear orchard of 10 ha, in the first year of production. Quality parameters investigated in a trial in Western Kosovo were diameter, height, weight, firmness and the sugar content. The survey was carried out in four repetitions, where the results were statistically processed by ANOVA test. The results showed that, the larger diameter of fruit, was reached on avarage on Passe Crassane cultivar (81.86 mm), while Abate Fettel cv. showed the highest values of the height (147 mm) whereas, the highest weight performed Passe Crassane cv. (290 g), the highest values of the firmness of the fruit were found on William cv. (7.79 kg/0.5 cm^2), finally the highest values of the sugar content of the fruit showed Abate Fettel cv. (16.38).

Key words: *pear fruit, diameter, height, weight, firmness, sugar content*

1. INTRODUCTION

Production of pear fruit (*Pyrus communis* L.) is of particular importance for the economy of a country. According to FAO in 2011, 22,511.100 million tons of pears are produced in the world.

Compared to 2001, when total production of pear fruit was 15,265,782 tons, the production in recent years is estimated to have an increase of 40%. China is considered as the main country of pear production with 15,945,013 tons. A total of 2 million tons is produced in EU countries, while the main producer is Italy Ferraj & Thomaj (2014).

About 1562 tons of pear fruit has been produced in Kosovo in 2012 according to MAFRD 2013.

Pear fruit is adaptable to continental climate and grows in the areas with minimum temperature down to -25 °C and maximum up to 35 °C. For the cessation of relative calmness of buds pear fruit must meet some requirements towards low temperature (<7 °C) achieved depending on the cultivar from 600 to 1000 hours Çakalli & Thomai (2005).

Kosovo has a medium continental climate with a coastal influence which breaks through the valley of the White Drin and apparently softening the elements of continental climate.

The longeval average temperature in Kosovo is 10.3 °C, whilst the vegetation temperature is 16.5 °C. On the other hand the coldest month is January (-0.9 °C) and the hottest one is July with 20.1 °C.

As to precipitation the annual quantity is 744.8 mm, whereas during vegetation the quantity is 346.7 mm which brings up the need to intervene with supplemental irrigation Zajmi (1996).

When it comes to the conditions when the research took place for the region of Klina, respectively Budisalc village, then the longeval average temperature is 10.6 °C and the vegetation temperature is 16.9 °C.

As to precipitation the annual quantity is 822 mm, whereas during vegetation the quantity is 366.8 mm Zajmi (1996).

Pear is more resistant to drought compared to apple Beci *et al.* (1988).

Pear does not grow well in clay soils as it turns yellow quickly. It fits well in Sandy-clay and thick sandy nutritious soils, whereas it dwarves in dry soils and it dies in lime soils. The requirement for soil type depends on the rootstock Shqahu (2007).

Zajmi *et al.* (2007), show that in practice there is a considerable number of methods for determining the maturity of the fruit, in order to respond to customer requests and processing industry. In practice mainly used are these methods: the number of days of full flowering until fruit picking (harvest), the total amount of temperature from

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full flowering until harvesting, separation of the stalk of the fruit from the branch, changing of the colour of the fruit, the changing of the seed colour, the determination of fruit firmness with (penetrometer) - spectrophotometric method, determination of the presence of starch.

A great number of authors write about the methods for determining the optimal moment of fruits but we are mentioning the authors Trillot *et al.* (2002); Zajmi *et al.* (2007), who point out that one of the methods for determining fruit firmness is penetrometer.

Both authors Vaysse & Landry (2004) provide various data for the fruits of several cultivars, among them are William and Passe Crassane which we used in our experiment.

Two other authors Ferraj & Thomaj (2014) provide information on the characteristics of these fruits presenting the fruits of William cultivar as big in size, narrow shaped and yellow colored, and the fruits of Abate Fettel cultivar as big in size, extended and arched in one side. Additionally they presented the fruits of Passe Crassane as big in size, spherical and round shaped, whilst the fruits of Santa Maria cultivar are estimated as average.

According to Vaysse & Landry (2004) the ratio between the diameter and the average weight of a William Cultivar fruit is as follows: 60/65 mm = 102 g, 65/70mm = 139 g, 70/75mm = 174g, 75/80 mm = 220 g, 80/85 mm = 251 g.

When it comes to sugar expressed in percentage the same authors provide data about William cultivar saying that sugar content should range from 11 - 15%, while for the coexistence measured with penetrometer both authors point out that it should range from 8.8 - 7.5 kg/0.5 cm^2.

Concerning the ratio between the diameter and the average weight of Passe Crassane cultivar fruit the same authors provide the following data: 60/65 mm = 139 g, 65/70 mm = 151 g, 70/75mm = 220g, 75/80 mm = 236 g, 80/85 mm 286 g, 85/90 mm = 343 g, while for sugar content they emphasized that it ranges from 12 - 14%. Regarding coexistence the said authors present data concerned that this parameter should range from 7 - 6 kg/0.5 cm^2.

Ivica Mratinić (2000) stated that according to the weight the fruit of William cultivar aligns among the cultivars with average to big size fruits weighing about 180 g.

This author states that Abatte Fetterl cultivar has moderately large to larger sized fruits with average weight of 170-220 g, and Cure cultivar weighs from 200-300 g. Regarding Passe Crassane cultivar he specified that the fruits are of variable weight from 150-750 g, while according to Mratinić Santa Maria cultivar weighs about 250 g.

The author named Stančević (1980) provides data that the weight of pear fruits varies according to the yield scale, seniority of the tree, soil prolificacy (fertility) and climatic factors and as such he mentions a value of 140 - 250 g. As to the length of fruit it ranges from 80 – 107 mm (average 90 mm) and its width is from 60 - 78 mm (average 70 mm).

This author mentions that William cultivar is moderately large up to large in size and weighs 180 g, and that Abate Fettel cultivar has an average weight from 170 to 220 g (average 190 g), and the moderately large fruit is 88 – 120 (average 102) high and 60 -76 mm (average 68 mm) wide. Specific fruits weigh up to 350g.

In relation to Cure cultivar, Stančević (1980) alleges that the fruit ranges from 180-250 gram, but some fruits may reach up to 400 g. The height of fruit is 95 - 125 mm, whilst the width is 55-85 mm. Passe Crassane cultivar weighs about 200 gram, whereas the fruits range from 150 - 200 – 300 - 400 gram). An average fruit is 60 – 75 mm (average 67 mm) high, and 65 – 75 – 85 (average 75 mm) wide.

As to William cultivar Bajrović *et al.* (2000) mentions that it has an average fruit size of 180 g, while Passe Crassane is 200 grams, and Cure is 250 grams.

Štampar *et al.* (2009) stated that William cultivar has large sized fruits weighing from 160-260 g. Abate Fettel has moderately large to large sized fruits of 180 - 320 g, Passe Carassane has large to very large sized fruits from 200-340g

Gvozdenović (2007) wrote about the William cultivar that it is moderately large to large sized. As to Abate Fettel it has large sized fruits and Passe Crassane has large to very large sized fruits.

Veličković (2002) stated that William has moderately large to large sized fruits (180 g), and Abate Fettel has moderately large to large sized fruits 190 g, Passe Crassane has large to very large sized fruits 150-750 g, Santa Maria has large sized fruits 250 g, and lastly Cure cultivar has very large sized fruits from 200 – 300g.

2. RESEARCH FACILITY, MATERIAL AND METHOD OF WORK

2.1 Research Facility

The research was conducted in a pear orchard of 10 hectares located in the Budisalc village in Klina, Kosovo. Standard cultural care and technology was applied in the entire orchard including drip irrigation and hail protection using an anti-hail net.



Photo 1 - Orchard where the research took place

2.2 Material

Five cultivars were evaluated under the research reported here: 'Willaim', 'Abate Fettel', 'Passe Crassane', 'Cure' and 'Santa Maria'. All cultivars are grafted onto sub grafting BA 29 Zajmi *et al.* (2011).

Planting distances were 3.5 m between rows and 1.3 m distance in the row.

2.3 Method of work

Our research refers to specific ecological conditions of Dukagjini region.

The experimental design included four repetitions of each cultivar and five trees per repetition, totalling 100 trees. Samples analysed consisted of 5 fruits per tree or 100 fruits per cultivar, totalling 500 fruits. Samples were taken on different dates depending on the harvesting time; i.e. for cv. 'Santa Maria' was harvested on August 27, 2013, for cv. 'William' on September 05, for cv. 'Abate Fettel' on September 09, for cv. 'Cure' on October 06, for cv. Passe Crassane' on October 24.

Fruit diameter was determined by slide-gauge tool, making measurements on the size of the fruit equator. Fruit height was determined as well by slide-gauge tool, by performing measurements on the highest point of the fruit (the tail dimpling and floral dimpling). Fruit weight was determined by analytical scales. Fruit firmness was determined by digital penetrometer twice per fruit: on the sunny side and the shaded side along the greatest transversal. Fruit sugar content was determined by refractometer.



Picture 1. The measurements were carried out by these instruments

3. RESULTS

Table 1. Complete Parameters of the Fruit at harvesting time.

Cultivars	Diameter of Fruit (mm)	Height of Fruit (mm)	Weight of Fruit (g.)	Firmness of Fruit (kg/0.5 cm^2)	Sugar of Fruit (Brix %)
‘’Santa Maria’	65.21	103.03	195.18	4.96	16.37
‘William’	66.12	93.90	183.00	7.79	14.58
‘Abate Fettel’	71.38	147.00	269.00	7.06	16.38
‘Cure’	61.18	82.81	253.50	6.05	14.70
‘Passe Crassane’	81.86	77.24	290.00	6.70	14.04
LSD 0.05	4.3974	0.0897	0.3065	0.5465	0.3147
0.01	6.1652	0.1257	0.4298	0.7662	0.4412

Our research results are presented in Table 1 where it is clearly seen that Passe Crassane has reached higher values in fruit diameter expressed in mm (81.86 mm), whilst Cure cultivar resulted with the lowest values (61.18 mm). On the other hand Abate Fettel cultivar reached the highest values in the height of fruit (147.00 mm), whereas Passe Crassane came up with the lowest values (77.24 mm). Regarding the weight of the fruit the highest values are reached by Passe Crassane cultivar (290 g.) compared to William cultivar (183 g.). William cultivar reached higher hardness values 7.79 kg/0.5 cm^2, compared to Santa Maria cultivar that reached the otherwise (4.96 kg/0.5 cm^2). When it comes to sugar content in the fruit, Abate Fettel cultivar reached the highest values (16.38), while Passe Crassane cultivar turned to have the lowest ones (14.04).

Results obtained from the measurements indicate that hereditary properties of cultivars were introduced and that Kosovo has favorable climate for the cultivation of pear fruit, respectively the cultivars under our research.

Based on the variance analysis between cultivars some statistical differences of significant level were observed in all parameters researched, such as: fruit diameter, fruit height, fruit weight, fruit hardness and sugar.

Our results do not match the results of the authors regarding the correspondence of diameter versus weight in William cultivar. According to our results the diameter is 66.12 mm, while the weight is significantly higher compared with the aforementioned authors Vaysse & Landry (2004) 139 g.

As far as fruit hardness and sugar is concerned this parameter corresponds with the authors Vaysse & Landry (2004).

As to Passe Crassane cultivar our data regarding the ratio between the fruit diameter and weight, sugar content and fruit hardness totally correspond with the data provided by the authors Vaysse & Landry (2004).

Our results are consistent with the data provided by Mratinić (2000) in relation to the fruit weight of the following cultivars William, Cure, Passe Crassane. On the other hand our data concerning Abate Fettel cultivar do not match with those given by Mratinic, because the fruits in our case reached higher weight (169 g). This is due to the fact that it is the first year of production and usually the fruits achieve higher weight.

Our results correspond with the data of the author Stančević (1980) regarding the fruit weight of William cultivar. Also, they correspond with the fruit weight and fruit width of Abate Fettel and Cure cultivars.

In the case of Passe Crassane cultivar our results correspond with those of Stančević (1980) when speaking about the fruit weight, height and width.

In regards to the fruit weight of William and Cure cultivars, our results correspond with the author Bajrović *et al.* (2000), but they don't correspond with Passe Crassane cultivar.

4. CONCLUSIONS

Based on our yearly research carried out under agro-ecological conditions of Budisalc facility –Klina, in an area of 10 ha, in the first year of production by applying common technology for pear fruit cultivation, we can draw the following conclusions:

- All parameters researched for the quality of fruits, such as: fruit diameter, fruit height, fruit weight, fruit hardness and fruit sugar (Brix), whose values are statistically processed by analysis of variance on William cultivar as well as Abate Fettel, Cure, Santa Maria and Passe Crassane cultivars, indicate that hereditary properties of cultivars and the impact of rootstock showed up under agro-ecological conditions of Budisalc region.
- Based on the variance analysis between cultivars some statistical differences of significant level were observed in all parameters researched, such as: fruit diameter, fruit height, fruit weight, fruit hardness and sugar.
- In most cases, our results are consistent with the results of a large number of other authors who have dealt with similar research in the past.
- Taking into consideration the values of the parameters researched and their compliance with a large number of authors, we can freely assume that Kosovo has very favorable climatic and land conditions for the cultivation of pear fruit in general.

Based on the results obtained by analysis of variance it can be ascertained that significant differences on the fruit diameter, fruit height, fruit weight, and sugar (brix) content were observed, but no differences existed in the case of fruit hardness.

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