

Evaluation of Old Apple Cultivars Grown in Central Transylvania, Romania

Ioana MITRE¹⁾, Viorel MITRE¹⁾, Marin ARDELEAN¹⁾, Radu SESTRAS¹⁾, Adriana SESTRAS²⁾

¹⁾ University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca, 3-5 Manastur St., 4000372 Cluj-Napoca, Romania; mitreviorel@yahoo.com

²⁾ Fruit Research and Development Station, 3-5 Horticultorilor St., Cluj-Napoca, Romania; asestras@yahoo.com

Abstract

In Romania, in this rather long period of transition, there are still many fruit tree orchards with old (classical) varieties which do not entirely meet the nowadays market and consumer's criteria. Since these orchards cannot be replaced overnight, in this study it have observed the main yielding and quality characteristics of several well known apple varieties grown in Central Transylvania (Romania), in order to preserve the germplasm and evaluate the possibility to grow some of the best ones for particular or spot markets. According to data registered in this orchard, Jonathan had the most vigorous growth, expressed by the crown and trunk diameters, while 'Starkrimson' had the weakest vigour. The largest fruits were found in 'Golden Delicious' (186.5 g) and the smallest fruits in 'Jonathan' (117 g) and 'Wagener' (119 g). The highest fruit yield was harvested in 'Wagener' (60.0 kg/tree), while the other "classical" varieties ('Jonathan', 'Kaltherer Böhmer', 'Starkrimson') yielded significantly less than the mean of experiment. The yield index (fruit yield/trunk section area) was comprised between 0.251 kg/cm² in 'Wagener' and 0.099 kg/cm² in 'Jonathan'. Fruit quality was very good in 'Kaltherer Böhmer' and 'Jonathan', good in 'Golden Delicious' and accepTab. in the other two tested varieties. It can be concluded that valuable growing, yielding and fruit quality characteristics can be found in these old apple varieties which make them attractive both as germplasm sources and as commercial varieties for particular and spot markets.

Keywords: apple, varieties, germplasm, spot market

Introduction

In spite of the fact that, in Romania, it is quite noticeable a continuous updating of apple assortment to the requirements of the EU markets, there are still quite a lot of apple orchards containing almost exclusively old apple varieties which obviously are far from the nowadays requirements of farmers, consumers and industry (Sestras, 2004; Mitre, 2008).

The renewal of apple assortment, in Romania, seems to be a slow and difficult process due both to the high costs of a new apple orchard (Rohan *et al.*, 2002) and the mentality of farmers and consumers. For many of these ones, especially in Transylvania, the best apple cultivars are still considered 'Jonathan', 'Golden Delicious', 'Starkrimson', 'Gustav', 'Kaltherer Böhmer' etc. Such an attitude is based only partially on farmers and consumers poor knowledge of the new apple cultivars grown in EU but mainly on the fact that some of the old apple varieties have become well adapted to the soil and climatic conditions of Central Transylvania producing good yields and highly appreciated fruit quality.

The experiments presented in this paper aimed at evaluating the old apple cultivars grown in Central Transylvania concerning their yielding and quality characteristics. Such data could be useful in maintaining the best old cultivars in the apple assortment of this zone and/or preserving them

as germplasm collections for future needs of apple breeding programs.

Materials and methods

In an 21-23 year old apple orchard located in Central Transylvania, Romania (S.C. Pomicola Batos), five old cultivars ('Jonathan', 'Golden Delicious', 'Starkrimson', 'Wagener' and 'Kaltherer Böhmer') were analyzed concerning their main yielding and fruit quality characteristics. The planting distance was 4×3 m (830 trees/ha) and the observations were performed on 150 trees chosen at random in each cultivar. All five cultivars had been grafted on MM 106 and trees were shaped as multistaged palmete.

Accurate data were recorded in three years (2001-2003) concerning tree height, crown diameter, trunk diameter, mean length of annual shoots, fruit weight (g) and fruit yield (t/ha). The quality of fruits was evaluated both as fruit content in dry matter, sugar, titrable acidity, C vitamin and as average scores for commercial traits (fruit size, fruit shape, skin color). Results of sensorial analyses performed by a group of 32 students were also computed as average scores (1 = poor expression of trait; 3; 5; 15 high expression of trait).

Analysis of variance (LSD test) was used to show the significance of differences between the five old apple cultivars and the mean of experiment considered as control.

Tab. 1. Evaluation of growing and yielding characteristics in five old apple cultivars

Cultivars	Height of trees (m)	Crown diameter (m)	Trunk diameter (cm)	Fruit weight (g)	Yield (t/ha)	Prod. index (kg/cm ²)
'Golden Delicious'	3.6 ^a	2.6	17.5	186.5 ^c	34.9	0.175
'Jonathan'	4.2	2.9 ^b	19.9	117.0 ^a	25.7	0.099
'Starkrimson'	3.7 ^a	1.9 ^a	15.2	127.5	29.9	0.195
'Wagener'	4.5 ^b	2.3 ^a	17.4	119.5 ^a	49.8	0.251
'Kaltherer Böhmer'	4.1	3.6 ^b	17.6	170.0 ^b	28.2	0.140
Mean (Control)	4.0	2.7	17.5	144.1	33.7	0.170
LSD 5% =	0.3	0.2	5.3	25.1	2.9	0.088

Results and discussion

Data presented in Tab. 1 show that 'Jonathan' expressed the most vigorous growth in trunk diameter (19.9 cm) while 'Kaltherer Böhmer' showed the largest crown diameter (3.6 m). 'Starkrimson' showed the weakest growth both in trunk and crown diameter.

The biggest fruits were noted in 'Golden Delicious' (186.5 g) while the smallest ones were found in 'Jonathan' (117.0 g) and 'Wagener' (119.5 g), the differences between these two pairs of cultivars being significant for $P_{5\%}$.

The highest fruit yields were harvested in 'Wagener' (49.8 t/ha) while the other "classical" cultivars yielded significantly less than 'Wagener' and than the mean of experiment. Under the environmental conditions of S.C. Pomicola Batos, in 2001-2003, the fruit index (yield/trunk section) was comprised between 0.251 kg/cm² in 'Wagener' and 0.099 kg/cm² in 'Jonathan'. It is worth mentioning that similar results were obtained by Eccher *et al.* (2006) with 'Wagener' in Lombardy region and Burak (2004) with 'Jonathan', 'Golden Delicious' and 'Starkrimson', in Turkey and Lombardy.

Fruit content, in the main favorable compounds, presented in Tab. 2 reveals the fact that 'Kaltherer Böhmer' is again situated on the top, with high content of DM% (14.25) and the highest sugar (12.18) and C vitamin (8.16) contents.

'Starkrimson', a variety still widely grown in Transylvania and in the neighboring countries (Burak, 2004; Toth, 2005; Susuri *et al.*, 2000; Nidžovic *et al.*, 2000) was noted with the lowest sugar and C vitamin contents. Such results

are a good proof that some of the old apple cultivars are quite acceptable as far as the fruit content in DM, sugar, acidity is considered while others are far from showing such favourable contents.

Results on commercial traits of fruits, for the five old apple cultivars evaluated in Central Transylvania are presented in Tab. 3. Based on sensorial assessments of fruit quality performed by a group of 32 students each experimental year, it can be stated most of the tested cultivars ('Golden Delicious', 'Jonathan', 'Kaltherer Böhmer') have shown an appropriate commercial fruit quality, expressed by fruit size, shape and skin color, the mean scores (2001-2003) being very close to the top level. Unfortunately, 'Wagener' (the best yielding cultivar) was assessed with the poorest scores for these commercial traits (Tab. 4). The results of organoleptic assessment of fruit flesh, presented in Tab. 4, show roughly the same trend as that described above for fruit size, shape and skin color. The best scored cultivars are 'Jonathan' and 'Kaltherer Böhmer', which scored significantly higher than the other three cultivars and the mean of experiment (control) for all fruit flesh traits taken into consideration. Very close to these two varieties ranked 'Golden Delicious' while 'Wagener' (the best yielding cultivar) was awarded with the lowest scores.

Conclusions

Several of the old apple cultivars still grown in Central Transylvania, show a high yielding potential as well as favorable commercial, chemical and sensorial characteristics of fruit.

Tab. 2. Fruit content in the main favorable compounds of five old apple cultivars

Cultivar	Dry matter (%)	Sugar (%)	Titration acidity (%)	C vitamin (mg)	Sugar/Acidity ratio
'Golden Delicious'	14.70	10.12	0.30 ^{ooo}	7.92	33.7
'Jonathan'	15.22	11.40 ^c	0.41 ^{oo}	7.10	27.8
'Starkrimson'	14.68	9.71 ^a	0.52 ^o	6.78 ^a	18.7
'Wagener'	15.47	9.83 ^a	0.63 ^{oo}	7.50	15.6
'Kaltherer Böhmer'	14.25	12.18 ^{oo}	0.48	8.16 ^b	25.4
Mean (Control)	14.86	10.65	0.47	7.49	22.7
LSD 5% =	2.97	0.72	0.04	0.5	
LSD 1% =	4.08	0.99	0.05	0.8	
LSD 0.1% =	5.62	1.36	0.07	1.1	

Tab. 3. Commercial traits of fruits in five old apple cultivars

Cultivar	Fruit size (score 1-3)		Fruit shape (score 1-3)		Skin color (score 1-5)		Overall score
	Mean	s%	Mean	s%	Mean	s%	
'Golden Delicious'	2.8'	9.8	2.9'''	7.7	4.4	9.5	10.1
'Jonathan'	2.4	22.8	2.7''	10.1	4.8'''	5.7	9.9
'Starkrimson'	2.2°	20.3	2.1°°	26.1	4.6	9.1	8.9
'Wagener'	2.0°°°	17.7	2.0°°	17.7	3.4°°°	12.3	7.4
'Kaltherer Böhmer'	2.9''	7.7	2.5	14.1	4.9'''	4.6	10.3
Mean (Control)	2.5	-	2.4	-	4.4	-	-
LSD 5% =	0.3		0.2		0.2		
LSD 1% =	0.4		0.3		0.3		
LSD 0.1% =	0.5		0.5		0.4		

Tab. 4. Sensorial assessment of fruit flesh in five apple cultivars

Cultivar	Skin color (score 1-3)	Flesh consistency (score 1-3)	Juiciness (score 1-5)	Taste (score 1-15)	Flavor (score 1-5)	Overall score
'Golden Delicious'	2.7	2.7	3.8	13.9'	3.9	23.2
'Jonathan'	2.9''	2.8''	4.7'''	14.3''	4.7'''	29.4
'Starkrimson'	2.3°°	1.6°°°	3.0°°°	11.0°°°	2.7°°°	20.6
'Wagener'	2.5	2.4	2.8°°°	10.6°°°	4.5''	22.8
'Kaltherer Böhmer'	2.8'	2.9'''	4.8'''	14.8'''	4.7'''	30.0
Mean (Control)	2.6	2.5	3.8	12.9	4.1	
LSD 5% =	0.2	0.2	0.4	0.9	0.3	
LSD 1% =	0.3	0.3	0.6	1.2	0.4	
LSD 0.1% =	0.4	0.4	0.8	1.7	0.5	

'Jonathan', 'Kaltherer Böhmer' and 'Golden Delicious' proved to be the best ranked cultivars as far as their commercial, chemical and organoleptic fruit traits were concerned with total scores for sensorial assessment of 39.3; 40.3 and 33.3; it is not surprising that the fruits of these cultivars are highly appreciated by consumers from areas of their traditional growing.

'Wagener' showed the highest yielding potential (49.8 t/ha) which makes it quite interesting for spot markets (industrial processing). Nevertheless it is worth maintaining this cultivar in germplasm collections as a potential genitor for high yielding capacity.

There is no doubt that some of the old apple varieties should be maintained in the apple cultivar assortment as long as they are preferred by growers and consumers. Their gradual replacement seems inevitable but they should be still maintained in germplasm collection as potential genitors for high yielding ability and quite favorable fruit quality traits.

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