

RESEARCH ON QUALITY OF FRUITS FROM SOME MICROZONES FROM OLTENIA

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Abstract. *Under the environmental conditions of the South of Romania and especially the microzones of culture from Oltenia, the qualitative performance of apple and plum fruits are dependent of cultivar and culture technology. The quality parameters of the fruits and trade competition take place in terms of modern technology, by applying on time and correctly all the technological measures. Depending on the growing technology used the apple cultivars Florina, Jonathan, Golden Delicious, Starkrimson, Jonagold and Idared have achieved in Rm. Vâlcea and Horezu microzones average fruit yields between 12.7 t/ha and 28.3 t/ha. The plum yields in the two microzones varied between 10 to 25 t/ha in case of Tuleu gras and Agen 707 cultivars, depending on culture technology applied. The nitrate and nitrite contents in apple fruits analyzed did not exceed the permissible limits, the average level of 33.67 mg/kg fresh product being about 1.8 times lower than the maximum level allowed by law. Lead content of fruits fall in the range from 1.6 to 20.5 mg/kg, with an average of 9.56 mg/kg, which is 1.05 times lower than permissible limits and for cadmium analysis the values recorded were 0.55 mg/kg, which is about nine times less than the permissible limit.*

Key words: micro zone, technology, nitrates, nitrites, lead, cadmium.

1.Introduction

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Apple and plum are fruit tree crops that provide the majority of fruit in Romania. Their importance lays in the food value of the fruits, in their high productive potential, pronounced ecological plasticity, the suitability to various growing technologies [1], [2].

The values of the fruits are due to their quality given in terms of both chemical composition of morphological elements but also in toxic waste in terms of fruits, due to the growing technologies applied [3].

The nutritional and healthy role of fruits remain directly related to the ecological zone in which they are grown and the technologies applied [6].

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Fruits obtained in different ecological zones are distinguished from each other, in each micro zone the soil and climatic and biotic factors having an important role [4],[5].

Often, there is also the negative impact of pollutants, with repercussions on the chemical composition of fruits [3].

In this paper the results of research conducted at SCDP Vâlcea in terms of analyzing the fruit quality of apples and plums from some micro-areas of Oltenia are presented.

Seven microzones of fruit growing in Oltenia were established depending on environmental conditions, the assortments of species and cultivars and growing technologies [3].

2. Materials and methods

Apple orchards were established in 1998 with trees grafted on M9 rootstock, the planting distances used were 4.0 by 1.20 m. In case of plum, the rootstocks used were Otesani 8 and Otesani 11, the planting distances being 4.0 by 2.0 m.

Qualitative values of apple and plum fruits in the ecological and technological conditions from Rm.Vâlcea and Horezu fruit growing basins were established on basis of assessment of qualitative morphological parameters, chemical composition and toxic residues in fruits.

Fruit quality in terms of toxic residues from pesticides and heavy metals was determined by chemical analysis conducted in laboratories of Polytechnic University of Bucharest and University of Agricultural Science and Veterinary Medicine using methods of spectrometry and atomic absorption through gas - chromatograph. The presence of cadmium, lead, mercury, copper, iron and zinc were determined, as well as heavy metals and pesticide residues resulting from alpha - HCH, 1,2,3,4 (5) - Tetrachlorobenzene, 1, 2, 4 - Trichlorbenzene, Pentaclornitrobenzen, HCB, Gamma-HCH, PCB.-28,52 (heptaclorfenil), Beta - HCH, etc.

3. Results and Discussions

The fruit quality under the morphologically aspect (size, weight, uniformity, color fruit, etc) is strongly influenced by the applied fruit tree growing technology in the orchard. The behavior of some apple cultivars grown in the two microzones of Oltenia is presented in the Table 1.

Productivity of apple cultivars is high when the orchard culture technology is appropriate. The apple yields achieved here are similar to those obtained in fruit growing areas from E.U. countries.

Depending on the technology, used differences within the same cultivar can be observed regarding the average weight of the fruits.

With the exception of fruits from Golden Delicious and Jonathan cultivars, all other apple cultivars achieve equatorial diameter over 70 mm (diameter requested on E.U. markets) for the 78% to 80% of the total number of fruits when trees are grown in orchards where the soil between rows is tilled and kept free of weeds. In the conditions of orchards with intervals between rows covered with grass and without irrigation, the fruit yields are diminished with 8-12%, as well as fruit size.

Into the above-mentioned two locations, the fruits of the apple cultivars are more intensely colored than the fruits obtained in the basins from plains area.

Plum is a fruit tree crop with growing tradition and of interest and perspective being adapted to specific ecological conditions of Romania and with a rich and varied assortment of cultivars. The fruit production is closely linked to the assortment of cultivars, with rootstocks used and with technological elements used into the orchards (Table 2).

The plum yields fluctuate between 10 and 25 t/ha under the condition of intensive culture technologies and growing on suitable soils for this crop. Soils with deficiencies (regosols) and particularly rich in clay and wet reduce the fruit yield up to 4 to 8 t/ha. The orchard culture technology favorably influences the morphological characteristics of the fruit.

The plum cultivars Tuleu gras and Agen 707 reach appropriate fruit size and weight over 40 g making them suitable for sale on the E.U. market as table plums. Into the two micro-areas mentioned before the ecological conditions are favorable for plums and using adequate orchard management measures make them competitive with those from other countries.

The quality parameters of fruits are linked with the growing techniques and their correct use. The fruit quality and safety are dependent on their content in chemicals like heavy metals such as cadmium, lead, mercury, copper, iron and zinc. Of particular importance for human health is the presence of toxic residues in fruits from some substances, pesticides or herbicides.

In case of fresh fruit samples the content in residues as: heptachlor, heptachlor - exnoxid, beta - endosulfan, PP - ADT, PCB - 180 have been analyzed, the values obtained non-exceeding the maximum allowed content. Maximum levels for pesticide residues and heavy metals in apple and plum fruits, according to E.U. directives, are presented in Table 3.

Nitrates and nitrites are natural components of soil organic matter and nitrogen mineralization from plant and animal origin.

Nitrogen mineralization is primarily due to existing microorganisms in the soil. Nitrates have low toxicity and can deliver digestive disorders when ingested in large amounts (up to 10 g in single dose). Nitrites are less toxic than the nitrates and are found in small amounts in foods as a natural product. Their concentration can increase to dangerous levels by the action of nitrate-reducing microorganisms. The results obtained by spectrophotometer regarding the content of nitrates and nitrites in the fruits of seven apple cultivars show no exceeding of permitted limits. In the case of nitrates, the values obtained are in the range from 17.28 to 54.56 mg NO₃/kg fresh apples, with an average of 33.07 mg NO₃/kg (Table 4).

The fruit content of nitrates and nitrites in case of the 7 apples cultivars analyzed the limits allowed by law were not over passed, the average value obtained being of 33.07 mg nitrite/kg fresh product, which is about 1.8 times less than the maximum allowed by Romanian law.

Out of data obtained regarding the concentration of lead and cadmium it appears that, the maximum values recorded are much lower than the maximum permissible limit (Table 5). Thus, the lead values fall in the range of 1.6 to 20.5 mg/kg, with an average of 9565 mg/kg, or about 10.5 times less than admitted values. For cadmium, the range varies from 0.55 µg/kg to 14.15 µg/kg, with an average of 5.285 µg/kg, which is approximate 9 times less than the maximum allowable level.

It appears that in the fruit harvested from orchards located near heavily traveled road car the cadmium doses are slightly higher than in the other samples, but are inside the allowed limits.

Table 1. Behavior of several apple cultivars grown in different micro-zones and with different culture techniques

No.	Cultivar	Culture system between rows	Rm. Vâlcea		Horezu – Oteşani	
			Average yield (t/ha)	Average fruit weight (g)	Average yield (t/ha)	Average fruit weight (g)
1	Florina	Tilled interval	28.3	182	21.4	192
		Seeded interval	25.6	161	18.1	178
2	Generos	Tilled interval	20.3	185	18.1	220
		Seeded interval	18.7	172	15.1	188
3	Jonathan	Tilled interval	15.6	153	16.4	140
		Seeded interval	14.1	134	14.3	135
4	Golden Delicious	Tilled interval	18.0	168	13.7	176
		Seeded interval	14.3	161	9.4	160
5	Starkrimson	Tilled interval	15.3	179	10.8	184
		Seeded interval	12.7	158	7.1	162
6	Jonagold	Tilled interval	19.6	196	18.3	188
		Seeded interval	16.5	178	14.2	165
7	Idared	Tilled interval	18.7	185	18.5	207
		Seeded interval	16.4	171	15.7	185

Table 2. Behavior of several plum cultivars grown in different micro-zones and with different culture techniques

Cultivar	Planting distances (m)	Oteşani 8				Mirobolan galben		
		Cumulative yield on 9 years (t/ha)	Average yield (t/ha)	Significance from the mean		Cumulative yield on 9 years (t/ha)	Average yield (t/ha)	Significance from the mean (cultivar)
				Cultivar	Rootstock Oteşani 8 / Mirobolan galben			
Tuleu gras	5x1	115.4	12.82	0.98	4.20*	77.6	8.62	0.15
	5x2	104.0	11.55	-0.29	3.90*	68.9	7.65	-0.82
	5x4	109.0	12.11	0.27	2.90	82.9	9.21	0.74
	6x2	98.1	10.90	-0.94	1.49	75.7	8.41	-0.06
	Mean	106.6	11.84	-	-	76.3	8.47	-
Agen 707	5x1	103.6	11.51	1.35	4.96	59.0	6.55	-0.48
	5x2	93.6	10.40	0.24	3.21	64.7	7.19	0.16
	5x4	90.0	10.00	-0.16	2.30	69.3	7.70	0.67
	6x2	78.7	8.74	-1.42	2.07	60.0	6.67	-0.36
	Mean	91.5	10.16	-	-	63.3	7.03	-
Rootstock mean		99.1	11.00	-	-	69.9	7.75	-

Table 3. Maximum permitted levels for pesticide residues and heavy metals according to the UE Directives no. 90/642/CE and no. 86/362/EEC (mg/kg fresh fruits)

No.	Specification	Apple (fresh fruits)	Plums (fresh fruits)
1	Alfa HCH	0	0
2	Gamma HCH	0	0
3	PCB – 28	0.01	0
4	Heptachlor	0	0.01
5	PCB – 28	0	0
6	Aldrin	0	0
7	Epsilon HCH	0	0
8	Heptachlor epoxid	0.01	0.01
9	Beta-endosulfan	0.01	0.01
10	P.P – DDT	0.05	0.05
11	PCB – 180	0	0
12	HCB	0	0

X-PCB = Heptaclorobifenil

** Maximum levels in fruits for cadmium (0.05 mg/100 g p.p); lead (0.5 mg/100 p.p.m.); mercury (0.05 mg/100 g p.p) and copper (5.0 mg/100 p.p)

Table 4. Experimental data regarding the NO₃ and NO₂ contents in apples

Cultivar	Nitrate (ppm)	Nitrate (mean)	Nitrite (ppm)	Nitrite (mean)
Florina	40.67	39.46	0.46	0.38
	38.26		0.30	
Granny Smith	27.90	26.70	-	below detection limit
	25.50		-	
Sir Prize	24.59	24.85	0.50	0.535
	25.10		0.57	
Jonathan	55.38	54.56	0.80	0.84
	53.74		0.89	
Golden	40.83	39.62	0.65	0.70
	38.41		0.76	
Generos	30.60	29.02	0.65	0.67
	27.43		0.70	
Idared	16.26	17.28	0.77	0.755
	18.29		0.74	

Table 5. Experimental results regarding the Pb and Cd content in apples

No.	Cultivar	Pb concentration, ppb (µg/kg)	Cd concentration, ppb (µg/kg)	Dry matter (%)
1	Florina	4.9	12.5	13.17
2	Granny Smith	7.0	5.5	13.38
3	Sir Prize	20.5	14.1	10.85
4	Jonathan	6.0	1.7	14
5	Golden	17.3	1.9	16.43
6	Generos	9.6	0.72	14.22
7	Idared	1.6	0.55	12.02
8	LMA	100	50	

Conclusions

(1) In the environmental conditions in the South of Romania and in particular the microzones from Oltenia microzones the qualitative performance of apple and plum fruits are dependent on the cultivar and culture technology.

(2) The quality parameters of the fruits and trade take place in terms of modern technology, by applying timely and correctly all, the technological links.

(3) The content of heavy metals (cadmium, lead, mercury, copper, etc), nitrate (NO₃) and nitrite (NO₂), and other toxic waste (alpha-HCH, gamma - HCH, heptachlor, PCBs, etc.) in fruits were within the admitted levels by the Romanian legislation.

(4) Nitrate and nitrite content in apple fruits analyzed do not exceed the permissible limits, an average of 33.07 mg / kg fresh product of about 1.8 times lower than the maximum allowed by law.

(5) Lead values fall in the range from 1.6 to 20.5 mg / kg, with an average of 9.56 mg / kg, about 1.05 times lower and for cadmium analysis, values were 0.55 mg / kg to 14.1 mg / kg with an average of 5.28 mg / kg, about 9 times less than the maximum allowed.

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