THE QUANTITY OF WOOD ELIMINATED THROUGH CUTTING ACCORDING TO THE CULTIVAR AND THE SHAPE OF THE HEAD AT CERTAIN NECTARINE TREE CULTIVARS FROM THE R.S.F.G CONSTANŢA

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Abstract
The purpose of this paper is to highlight the manner in which the annual growths influence the quantity of wood eliminated through cutting, taking into account the cultivar and the shape of the head as far as the nectarine tree is concerned. Due to the fact that the planting distances and density of the trees per hectare varies in accordance to the shape of the head it is highly important that we know the volume of work as well as the quantity of wood eliminated through cutting. The research took place at the RSFG Constanta over a period of 4 years and the studied nectarine cultivars were the following: Cora, Delta, Romamer 2 and Crimsongold; there were 4 shapes of the head and 4 planting distances: Tatura 6/2 m (833 trees/ha), Vertical cordon 4/1.5 m (1666 trees/ha), Veronese Vase 4/3 m (833 trees/ha) and Improved Vase 4/3.5 m (714 trees/ha). The study revealed the following: taking into account the shape of the head, the largest quantity of wood eliminated through cutting was recorded by the Vertical cordon in all the studied years (2008-2011); the quantity of eliminated wood is directly correlated with the Veronese Vase and the Improved Vase shapes in the sense that these two shapes are the most advantageous for the four cultivars, whereas the Vertical cordon requires extensive cutting works. The statistical analysis of the quantity of wood eliminated through cutting (t/ha) over the 4 studied years revealed the fact that the Cora, Delta, Romamer 2 and Crimsongold cultivars with the Vertical cordon shape of the head ensured a positive significance, while the other shapes ensured a negative significance from a statistical point of view.

Key words: cutting, technological links, vigour, Prunus persica

INTRODUCTION

Taking into account the year 2000, as far as crop systems were concerned, there were more and more discussions across Europe regarding the typology and productive efficiency of tree plantations as well as the realisation of an ideal tree model which intercepts and fully valorises the incident light, irrespective of the fact that the planting density would grow up to 20,000 trees/ha (Cepoiu, 2006). The same author states that this kinds of plantations names "full field" or "tuto campo" include cultivars with compact heads, short sprouts and thick leaves, rich in mesophyll and chlorophyll which ensure an increased productive efficiency as compared to standard cultivars from current intensive and super-intensive orchards. Romania's pedo-climatic diversity offers favourable conditions to a wide variety of tree species, but the global climatic changes bring forward new criteria for the zoning of species and elements which are to be applied. In this context the choosing of the cultivar-parent stock combination, of the adequate shapes of the head, of the planting distances, of the technology of maintaining and fertilisation of the soil and tress and of the applied phyto-sanitary treatments must be a major preoccupation (Lespinasse et al, 1998). The extension of summer cuttings, the development of nectarines and of certain peach tree cultivars with highly pigmented fruit (Fideghelli et al, 1991) as well as other factors have determined a genuine race between specialists (both researchers and farmers) concerning the realisation of various shapes of the head which would correspond the environmental and socio-economic demands. The purpose of this paper is to highlight the manner in which the annual growths influence the quantity of wood eliminated through cutting, taking into account the cultivar and the shape of the head of certain nectarine tree cultivars and the

number of branches remaining in every tree after cutting in the studied years 2008-2011.

MATERIAL AND METHOD

The research took place at the Research Station for Fruit-Growing Constanta (RSFG) in the period 2008-2011 and the biological material consisted of the Cora, Delta, Romamer 2 and Crimsongold cultivars. In the spring of 2002, when the trees were in full ripening period (year VI since planting) an experience was organised at the RSFG, experience based on two experimental factors: Factor A – the cultivar, with 4 categories: a1 = Cora, a2 = Delta, a3 = Romamer 2, a4 = Crimsongold and Factor B – the shape of the head and the planting distance considered together, with 4 categories: b1 = Tatura, 6/2m = 833 tress/ha, b2 = Vertical Cordon, 4/1.5m = 1666 trees/ha, b3 = Veronese Vase, 4/3m = 833 trees/ha, b4 = Improved Vase, 4/3.5m = 714 trees/ha. Given the fact that the region is semi-arid, the nectarine tree culture developed under an irrigated regime. The experience was performed on a calcareous chernozem (CZka), with a claylike texture, a low alkaline pH (8.2) in its entire profile. As far as the technology that has to be applied to the nectarine tree is concerned, there were no differences; it was applied in the same manner irrespective of the cultivar, the shape of the head or the planting distance.

The performed determinations focused on the quantity of wood eliminated through cutting which was calculated by means of weighing the wood for each variant and was expressed in kg/tree. An analysis of the variance of the vigour of the trees was carried out, expressed through the quantity of the wood eliminated through cutting in kg/tree and t/ha. Given the fact that the planting distances and the density of the trees per hectare vary according to the shape of the head, it is important to know the workload as well as the quantity of wood eliminated per hectare.

RESULTS AND DISCUSSIONS

According to the shape of the head, the largest quantity of wood eliminated through cutting was recorded by the Vertical Cordon in all studied years (2008-2011), followed by the Tatura, while the lowest values were recorded by the Vases. Each cultivar recorded significant variations according to the shape of the head. The Veronese Vase and the Improved Vase are advantageous shapes for all four cultivars, whereas the Vertical Cordon requires a large cutting volume in order to be maintained in the limits of the shape (Figure 1).
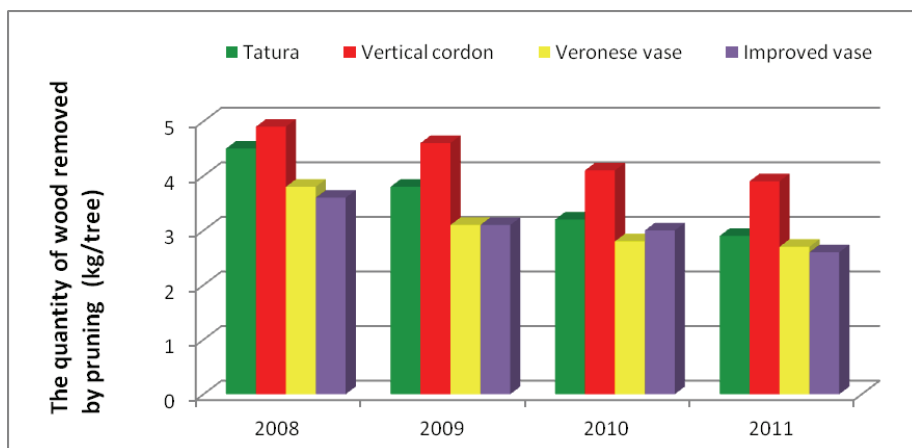

Figure 1. The quantity of wood removed by pruning according to the shape of crown the period 2008-2011

During the four studied years, the largest quantity of wood eliminated through cutting was recorded by the Cora cultivar, Vertical Cordon shape and the Crimsongold cultivar, Vertical Cordon shape (5.10 kg/tree), while the lowest value was recorded by the Romamer 2 cultivar, Improved Vase shape (3.20 kg/tree) (Figure 2).
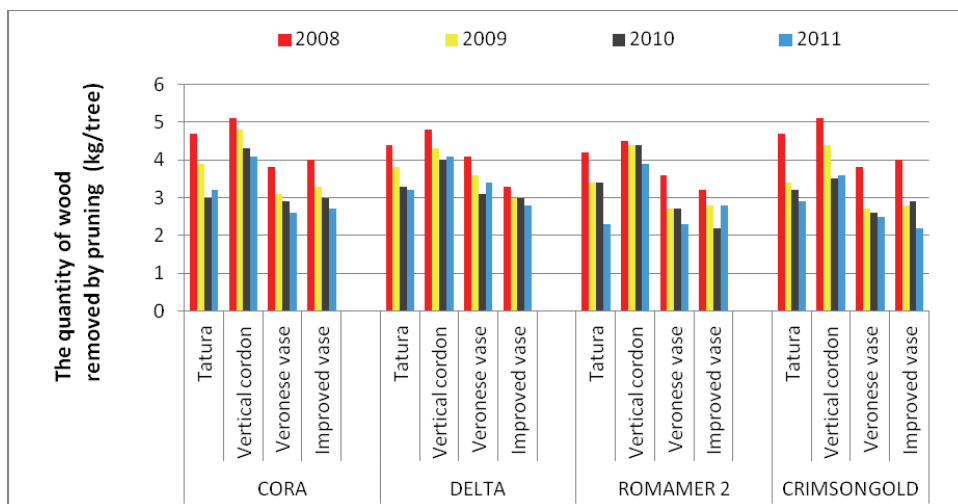

Figure 2. The quantity of wood eliminated through cutting according to the cultivar and the shape of the head, 2008-2011

The vigour of the trees expressed through the quantity of wood eliminated through cutting (kg/tree)

Following the variance analysis carried out regarding the vigour of the trees (expressed in the quantity of wood eliminated through cutting – kg/tree) during the four studied years, significantly positive differences were recorded by the Cora cultivar, Vertical Cordon shape (all four studied years, 2008-2011), the Crimsongold cultivar, Vertical Cordon (2008, 2009) and the Romamer 2 Vertical Cordon shape (2010, 2011) (Table 1). The Vertical Cordon recorded a significantly positive difference in comparison to the other shapes in the years 2009, 2010 and 2011, while in 2008 the Vertical Cordon shape was distinctly significantly positive.

In 2008 the Delta and Romamer 2 cultivars, Improved Vase shape of the head displayed significantly negative differences; the same happened in 2009 and 2010. The Romamer 2, Veronese Vase and Improved Vase were highly significantly negative, while in 2011 the Romamer 2, Tatura and Veronese Vase

shapes and the Crimsongold cultivar, Improved Vase displayed distinctly significantly negative differences. The other cultivars and shapes of the head presented significantly negative differences.

The vigour of the trees expressed through the quantity of wood eliminated through cutting (t/ha)

Following the variance analysis carried out regarding the vigour of the trees expressed through the quantity of the wood eliminated through cutting (t/ha) during the four studies years, significantly positive differences were displayed by the Cora cultivar, Vertical Cordon shape and the Delta cultivar, Vertical Cordon shape. The Crimsongold cultivar, Vertical Cordon shape displayed significantly positive differences in the years 2008 and 2009, while the Romamer 2 cultivar, Vertical Cordon shape presented the same type of differences in the years 2009 and 2010 (Table 2). The other cultivars and shapes of the head displayed significantly negative differences. The Vertical Cordon displayed a significantly positive difference in comparison to the other shapes in the years 2009, 2010 and 2011.

Table 1. The vigour of the trees expressed through the quantity of wood eliminated through cutting (kg/tree) in the period 2008-2011

Variant	Shape of the head	2008			2009			2010			2011		
		kg/tree	Diff. comp. to the average	Significance	kg/tree	Diff. comp. to the average	Significance	kg/tree	Diff. comp. to the average	Significance	kg/tree	Diff. comp. to the average	Significance
CULTIVAR													
a1. CORA													
a1b1	b1.Tatura	4.7	+0.5	*	3.9	+0.3	-	3.0	-0.2	-	3.2	+0.2	-
a1b2	b2.Vertical Cordon	5.1	+0.9	***	4.8	+1.2	***	4.3	+1.1	***	4.1	+1.1	***
a1b3	b3.Veronese Vase	3.8	-0.4	o	3.1	-0.5	o	2.9	-0.3	-	2.6	-0.4	-
a1b4	b4.Improved Vase	4.0	-0.2	-	3.3	-0.3	-	3.0	-0.2	-	2.7	-0.3	-
	Average	**4.4**	**+0.2**	**-**	**3.8**	**+0.2**	**-**	**3.3**	**+0.1**	**-**	**3.2**	**+0.2**	**-**
a2. DELTA													
a1b1	b1.Tatura	4.4	+0.2	-	3.8	+0.2	-	3.3	+0.1	-	3.2	+0.2	-
a1b2	b2. Vertical Cordon	4.8	+0.6	**	4.3	+0.7	**	4.0	+0.8	***	4.1	+1.1	***
a1b3	b3. Veronese Vase	4.1	-0.1	-	3.6	0.0	-	3.1	-0.1	-	3.4	+0.4	-
a1b4	b4. Improved Vase	3.3	-0.9	000	3.0	-0.6	o	3.7	+0.5	*	2.8	-0.2	-
	Average	**4.2**	**0.0**	**-**	**3.7**	**+0.1**	**-**	**3.5**	**+0.3**	**-**	**3.4**	**+0.4**	**-**
a3. ROMAMER 2													
a1b1	b1.Tatura	4.2	0.0	-	3.4	-0.2	-	3.4	+0.2	-	2.3	-0.7	oo
a1b2	b2. Vertical Cordon	4.5	+0.3	-	4.4	+0.8	**	4.4	+1.2	***	3.9	+0.9	***
a1b3	b3. Veronese Vase	3.6	-0.6	oo	2.7	-0.9	000	2.7	-0.5	o	2.3	-0.7	oo
a1b4	b4. Improved Vase	3.2	-1.0	000	2.8	-0.8	oo	2.2	-1.0	000	2.8	-0.2	-
	Average	**3.9**	**-0.3**	**-**	**3.3**	**-0.3**	**-**	**3.2**	**0.0**	**-**	**2.8**	**-0.2**	**-**
a4. CRIMSONGOLD-2													
a1b1	b1.Tatura	4.7	+0.5	*	3.9	+0.3	-	3.2	0.0	-	2.9	-0.1	-
a1b2	b2. Vertical Cordon	5.1	+0.9	***	4.8	+1.2	***	3.5	+0.3	-	3.6	+0.6	*
a1b3	b3. Veronese Vase	3.8	-0.4	o	3.1	-0.5	o	2.6	-0.6	oo	2.5	-0.5	o
a1b4	b4. Improved Vase	4.0	-0.2	-	3.3	-0.3	-	2.9	-0.3	-	2.2	-0.8	oo
	Average	**4.4**	**+0.2**	**-**	**3.8**	**+0.2**	**-**	**3.1**	**-0.1**	**-**	**2.8**	**-0.2**	**-**
SHAPE OF THE HEAD													
b1	b1.Tatura	4.5	+0.3	-	3.8	+0.2	-	3.2	0.0	-	2.9	-0.1	-
b2	b2. Vertical Cordon	4.9	+0.7	**	4.6	+1.0	***	4.1	+0.9	***	3.9	+0.9	***
b3	b3. Veronese Vase	3.8	-0.4	-	3.1	-0.5	o	2.8	-0.4	o	2.7	-0.3	-
b4	b4. Improved Vase	3.6	-0.6	oo	3.1	-0.5	o	3.0	-0.2	-	2.6	-0.4	-
		X=4.2 **DL 5% =0.4** **DL 1% =0.6** **DL 0.1% =0.8**			**X=3.6** **DL 5% =0.5** **DL 1% =0.7** **DL 0.1% =0.9**			**X=3.2** **DL 5% =0.4** **DL 1% =0.6** **DL 0.1% =0.8**			**X=3.0** **DL 5% =0.5** **DL 1% =0.7** **DL 0.1% =0.9**		

Table 2. The vigour of the trees expressed through the quantity of wood eliminated through cutting (t/ha) in the period 2008-2011

Variant	Shape of the head	2008			2009			2010			2011		
		t/ha	Diff. comp. to the average	Signif.	t/ha	Diff. comp. to the average	Signif.	t/ha	Diff. comp. to the average	Signif.	t/ha	Diff. comp. to the average	Signif.
A. CULTIVAR													
a1. CORA													
a1b1	b1.Tatura	3.91	-0.49	-	3.25	-0.63	-	2.50	-0.97	-	2.66	-0.60	-
a1b2	b2.Vertical Cordon	8.49	+4.09	***	7.99	+4.11	***	7.16	+3.69	***	6.83	-3.57	***
a1b3	b3.Veronese Vase	3.16	-1.24	-	2.58	-1.30	-	2.41	-1.06	-	2.16	-1.10	-
a1b4	b4.Improved Vase	2.85	-1.55	-	2.35	-1.53	-	2.14	-1.33	-	1.92	-1.34	-
	Average	**4.60**	**+0.20**	**-**	**4.04**	**+0.16**	**-**	**3.55**	**+0.08**	**-**	**3.39**	**+0.13**	**-**
a2. DELTA													
a2b1	b1.Tatura	3.66	-0.74	-	3.16	0.72	-	2.75	-0.72	-	2.66	-0.60	-
a2b2	b2. Vertical Cordon	7.99	+3.59	***	7.16	+3.28	***	6.66	+3.19	***	6.83	+3.57	***
a2b3	b3.Veronese Vase	3.41	-0.99	-	2.99	-0.89	-	2.58	-0.89	-	2.83	-0.43	-
a2b4	b4.Improved Vase	2.35	-2.05	o	2.14	-1.74	o	2.64	-0.83	-	1.99	-1.27	-
	Average	**4.35**	**-0.05**	**-**	**3.86**	**-0.02**	**-**	**3.65**	**+0.18**	**-**	**3.57**	**+0.31**	**-**
a3. ROMAMER 2													
a3b1	b1.Tatura	3.50	-0.90	-	2.83	-1.05	-	2.83	-0.64	-	1.91	-1.35	-
a3b2	b2. Vertical Cordon	7.49	+3.09	**	7.33	+3.45	***	7.33	+3.86	***	6.49	+3.23	**
a3b3	b3. Veronese Vase	2.96	-1.41	-	2.25	-1.63	-	2.25	-1.22	-	1.91	-1.35	-
a3b4	b4. Improved Vase	2.28	-2.12	o	1.99	-1.89	o	1.57	-1.90	o	1.99	-1.27	o
	Average	**4.06**	**-0.34**	**-**	**3.60**	**-0.28**	**-**	**3.49**	**+0.02**	**-**	**3.07**	**-0.19**	**-**
a4. CRIMSONGOLD													
a4b1	b1.Tatura	3.91	-0.49	-	3.25	-0.63	-	2.66	-0.80	-	2.41	-0.85	-
a4b2	b2. Vertical Cordon	8.49	+4.09	***	7.99	+4.11	***	5.83	+2.30	**	5.99	+2.73	**
a4b3	b3. Veronese Vase	3.16	-1.24	-	2.58	-1.30	-	2.16	-1.31	-	2.08	-1.18	-
a4b4	b4. Improved Vase	2.85	-1.55	-	2.35	-1.53	-	2.07	-1.40	-	1.57	-1.69	o
	Average	**4.60**	**+0.20**	**-**	**4.04**	**+0.16**	**-**	**3.18**	**-0.29**	**-**	**3.01**	**-0.25**	**-**
B. SHAPE OF THE HEAD													
b1	b1.Tatura	3.74	-0.66	-	3.12	-0.76	-	2.68	-0.79	-	2.41	-0.85	-
b2	b2. Vertical Cordon	8.11	+3.71	**	7.61	+3.73	***	6.74	+3.27	***	6.53	+3.27	***
b3	b3. Veronese Vase	3.18	-1.22	-	2.60	-1.28	-	2.35	-1.12	-	2.24	-1.02	-
b4	b4. Improved Vase	2.58	-1.82	o	2.20	-1.68	-	2.10	-1.37	-	1.86	-1.40	-
		X=4.40 DL 5% =1.70 DL1% =2.36 DL0.1% =3.25			X=3.88 DL 5% =1.70 DL1% =2.36 DL0.1% =3.25			X=3.47 DL 5% =1.49 DL1% =2.06 DL0.1% =2.84			X=3.26 DL 5% =1.49 DL1% =2.06 DL0.1% =2.84		

Table 3. The quantity of wood removed through cutting (kg/tree) and the number of branches remaining in the tree after cutting in the studied years 2008-2011

CULTIVAR	Shape of the Head	2008		2009		2010		2011	
		Quantity of wood eliminated through cutting (kg)	No. of branches remaining in the tree after cutting	Quantity of wood eliminated through cutting (kg)	No. of branches remaining in the tree after cutting	Quantity of wood eliminated through cutting (kg)	No. of branches remaining in the tree after cutting	Quantity of wood eliminated through cutting (kg)	No. of branches remaining in the tree after cutting
CORA	Tatura	4.70	69	3.90	79	3.0	79	3.20	83
	Vertical Cordon	5.10	98	4.80	90	4.30	93	4.10	85
	Veronese Vase	3.80	87	3.10	89	2.90	92	2.60	87
	Improved Vase	4.0	85	3.30	91	3.0	87	2.70	96
Average/cultivar		**3.45**	**85**	**3.77**	**87**	**3.3**	**88**	**3.15**	**88**
DELTA	Tatura	4.40	70	3.80	86	3.30	89	3.20	88
	Vertical Cordon	4.80	88	4.30	92	4.0	92	4.10	87
	Veronese Vase	4.10	91	3.60	87	3.10	89	3.40	79
	Improved Vase	3.30	89	3.0	94	3.70	78	2.80	85
Average/cultivar		**4.15**	**85**	**3.70**	**90**	**3.52**	**87**	**3.40**	**85**
ROMAMER 2	Tatura	4.20	82	3.40	96	3.40	96	2.30	83
	Vertical Cordon	4.50	93	4.40	112	4.40	113	3.90	101
	Veronese Vase	3.60	88	2.70	97	2.70	97	2.30	79
	Improved Vase	3.20	92	2.80	86	2.20	89	2.80	93
Average/cultivar		**3.87**	**89**	**3.32**	**98**	**3.17**	**99**	**2.82**	**89**
CRIMSONGOLD	Tatura	4.70	69	3.90	79	3.20	83	2.90	87
	Vertical Cordon	5.10	98	4.80	90	3.50	96	3.60	88
	Veronese Vase	3.80	87	3.10	89	2.60	79	2.50	83
	Improved Vase	4.0	85	3.30	91	2.90	94	2.20	79
Average/cultivar		**4.4**	**85**	**3.77**	**87**	**3.05**	**88**	**2.8**	**84**
Average/shape of the head	**Tatura**	**4.5**	**73**	**3.8**	**83**	**3.2**	**87**	**2.8**	**84**
	Vertical Cordon	**4.9**	**94**	**4.6**	**96**	**4.1**	**99**	**2.9**	**85**
	Veronese Vase	**3.8**	**88**	**3.1**	**91**	**2.8**	**89**	**3.9**	**90**
	Improved Vase	**3.6**	**88**	**3.1**	**90**	**3.0**	**87**	**2.7**	**82**
								2.6	**88**

The number of branches remaining in the tree after cutting

According to the shape of the head, in the studied years 2008-2011, the largest number of branches remaining in the tree after cutting was recorded by the Vertical Cordon shape of the head. The second place was occupied by the Veronese Vase and Improved Vase shapes, while the lowest number of branches remaining in the tree was recorded by the Tatura shape (Figure 3, Table 3).
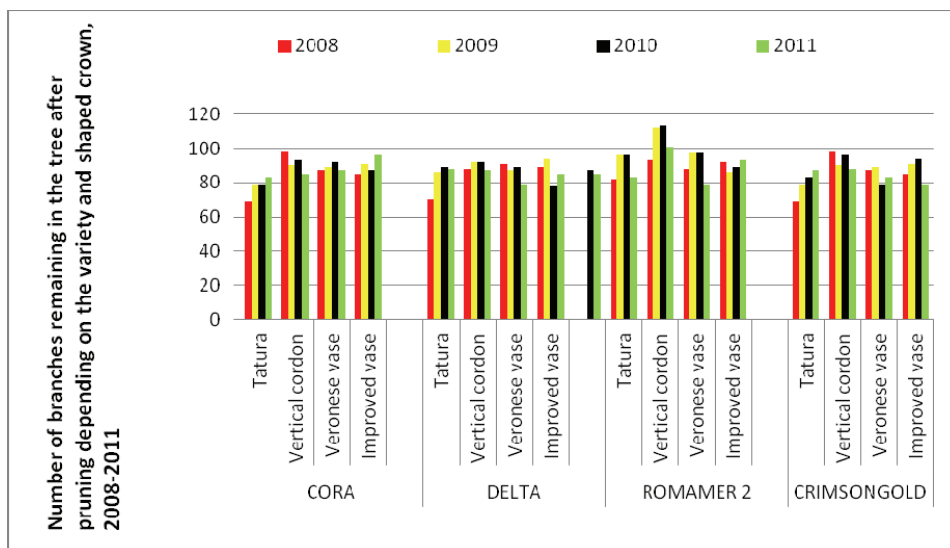

Figure 3. The number of branches remaining in the tree after cutting
according to the cultivar and the shape of the head, 2008-2011

In the studied years 2008-2011 the number of branches remaining in the tree after cutting according to the cultivar varies from one year to another, the Romamer 2 cultivar displaying a larger number of branches in comparison to the other cultivars (Figure 4).
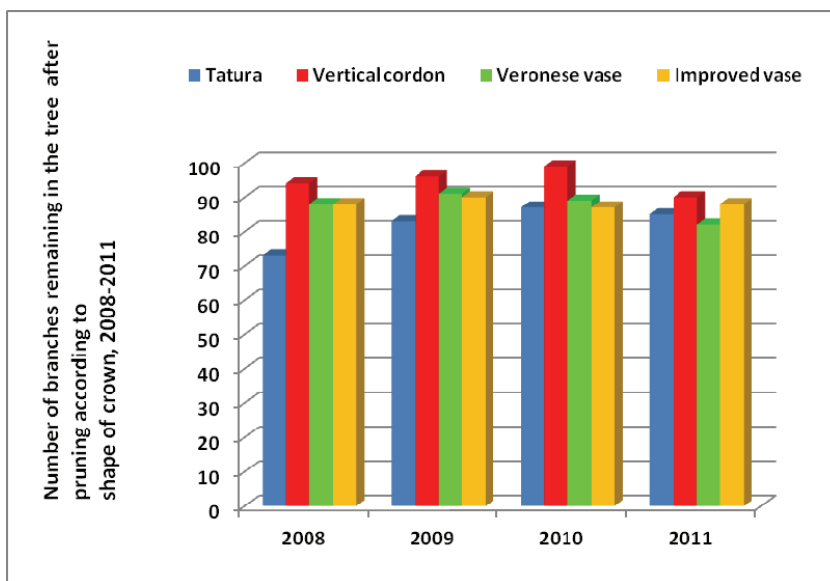
Figure 4. Number of branches remaining in the tree after pruning according to
shape of crown, 2008-2011

CONCLUSIONS

The largest quantity of wood eliminated through cutting per tree was recorded by the Vertical Cordon in all four studied years (2008-2011), while the Veronese Vase and Improved Vase displayed lower values.

As far as the cultivars are concerned, the Cora and Crimsongold cultivars, Vertical Cordon shape of the head displayed superior values, followed by the Romamer 2 cultivar.

The quantity of wood eliminated through cutting per surface unit was larger at all four cultivars having the Vertical Cordon shape of the head.

The number of branches remaining in the tree after cutting was larger at the Romamer 2 cultivar in comparison to the other cultivars. As far as the shape of the head is concerned, larger values were recorded by the Vertical Cordon shape, followed by the Veronese Vase and the Improved Vase. The lowest number of branches remaining in the tree was recorded by the Tatura shape.

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