

RESEARCH ABOUT CROWN TYPE INFLUENCE ON ECONOMIC EFFICIENCY IN SUPERINTENSIVE APPLE CROPS

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ABSTRACT

In the present study we aimed to resolve some aspects of the use of suitable varieties and forms of crown Oltenia area.

Apple varieties 'Florina' and 'Idared' grafted on M₉ at a density of 1904 trees/ha generates expenses and income, so depending on variety and depending on the type of crown used. During the 12 years of cuts fruition expenditure reached 23 250 lei / ha (Fus Fougères) to 24 950 lei/ ha (Solen), the variety 'Florina' and variety 'Idared', were located between 22 831 lei/ha (Fus Fougères) and 24 460 lei/ha (Cruce Dubla 2). Average annual operation, depending on the type of crown (both varieties) oscillates between 27 358 lei/ha (Vertical axis) and 34 227 lei/ha (Fus Fougères) and revenues between 35 900 lei/ha (Cruce Dubla 1) and 42 845 lei/ha (Solen).

INTRODUCTION

In the last 3-4 decades, the world has intensified its activity establishing superintensive apple crops in order to increase fruit production and ensure consumer needs.

The investment for the establishment of such plantations is great but it can be recovered in a short time as the application of advanced technologies ensure early entry trees bearing fruit and the average exceed 60-80 t / ha (Sadowski et al. 2005; Pesteanu, 2005). In order to achieve such plantations, it requires the use of suitable crown forms of high plant density per hectare (2000-5000) and the support systems of such plants. Crown shape is modified by cutting, bending branches and selective removal by cutting the green, to increase light penetration inside the crown (Costes et al., 2006).

With the changing architecture crown habitus changes and plant (Lauri et al., 2009), and also the living conditions of pests (Simon et al., 2007).

Pruning and training fruit trees is aimed primarily at regulating and controlling growth and fruiting, and the development of trees in combination with local environmental conditions and cultural characteristics, in order to yield a high quality of apples (Willaume et al., 2004; Jung and Choi, 2010).

Worldwide, are the dominant forms of crown as slender spindle, palmettes, palmettes with oblique arms, etc., but in certain areas of culture (France, Netherlands, New Zealand) occurred specific types of crown architecture (Tatura Trellis, Tessa , etc.).

MATERIAL AND METHODS

The experience was amplified at Research Station on Fruit Growing Valcea, in a plantation established in spring 2002, with apple tree grafted on M₉ rootstock. Planting was done at a distance of 3.5/1.5m (1905 plants/ha). The experience is polifactorial type 2x8 (variety, forms the crown), with four repetitions, each experimental plot from 6 trees.

Factor A - variety: 'Idared' and 'Florina'.

Factor B - form of crown: Fus Fougères, Ax Vertical, Solen, Valcea 1, Cruce Dubla1, Cruce Dubla 2, Tatura Trellis, Tessa.

There has been calculated the costs generated by cutting training and fructification depending on the shape of the crown in two varieties and investment expenditure and operating a plantation of apple varieties superintensive 'Florina' and 'Idared' This work represents results in doctoral thesis "Researches about the response of some apple varieties to different models of crown in superintensive plantations"

RESULTS AND DISCUSSIONS

Apple varieties 'Florina' and 'Idared' grafted on M₉ to a density of 1904 plants/ha generates expenses and incomes, depending by variety and the type of crown used. To 'Idared' variety the expenses with formation cuts in the first three years ranged between 1490.00 lei/ha (Vâlcea 1) and 1898.5 lei/ha (Cruce Dubla 1). Differences between forms of crown were up to 0.135 lei/tree, in the three years of the formation of the crown (Table 1).

The fructification cuts on 12 years ranged from 22831 lei/ha (Fus Fougères) and 24460 lei/ha (Cruce Dubla 2), resulting on tree and year an amount of 0.999 lei (Fus Fougères) and 1.07 lei/ tree /year to Cruce Dubla 2.

Cutings expenses (1-15 years) to 'Idared' variety ranged from 24490.4 lei/ha (Fus Fougères) and 26310.2 lei/ha (Cruce Dubla 2). Within these expenses, the cutings costs represent between 5.9% (Valcea 1) and 7.27% (Cruce Dubla 1), the rest are spendings with fruition cuts during 12 years of operation.

Differences between spendings with cuts to different types of crown are relatively low (1815.8 lei), especially if they are related to the total number of years (15 years) resulting differences of maximum 121.05 lei/ha between the crowns with minimal and maximum costs.

Fruit amount, produced by 'Idared' apple variety, aggregated on 12 years was 338900 t/ha (Cruce Dubla 1) and up to 408600 t/ha (Solen), with a maximum difference of 69700 t/ha between different types of crown.

Hence, result a different value of apple production (1.2 lei/kg) of 406680 - 490320 lei/ha, depending by the shape of crown.

The ratio between the aggregate production value and spendings with formation and fructification cuts, on 15-year period is between 15.58 (Cruce dubla 1) and 18.88 (Solen).

The higher is ratio between the production and cuts expenses, all the more the type of crown is suited to this variety (Solen, Tatura Trellis, Ax Vertical and Fus Fougères).

At 'Florina' variety (Table 2), formation cuts are different from those of the 'Idared' variety due the higher growth vigor.

Formation cuts ranged between 1350.5 lei/ha (Valcea 1) and 1990.0 lei/ha (Cruce Dubla 2), resulting an amount of 0.236 lei/tree/year to 0.348 lei/tree/year.

During on 12 years period of fructification cuts, the spendings ranged between 23250 lei/ha (Fus Fougères) and 24950 lei/ha (Solen). The percentage of cost at formation cutting from the total expenditure of the cuts to 'Florina' variety, have ranged between 5.39% (Valcea 1) to 7.41% (Cruce Dubla 2).

The value of formation cutings for the 8 types of crown are very close between the two varieties at the same type of the crown.

Aggregate fruit production (on 12 years) to 'Florina' variety is 379100 t/ha (Double Cross 1) up to 448300 t/ha (Solen).

Between summed average yields of fruit of both types of crown are differences from 32 725 t/ha (2727 t/ha/year) and this is due to genetic influence between varieties and the shape of the crown.

The apple production value to 'Florina' variety, summed up on the 12 years is between 448 200 lei/ha (Tessa) and 537 960 lei/ha (Solen).

The ratio of aggregate production value (12) and total expenditure with cuts is between 17.12 (Cruce Dubla 2) and 20.70 (Ax Vertical).

The highest ratios are to: Ax Vertical (20.7), Solen (20.09), Fus Fougères (19.73) and Tatura Trellis (19.63), those being the most productive forms of crown to 'Florina' variety.

Although, at 'Idared' variety, these ratios are lower than to 'Florina' variety, still stands the same types of crown as best (Solen, Ax Vertical and Tatura Trellis).

In Table 3 are shown investment and operating expenditure to both varieties, over 3 + 12 years depending by the type of crown.

Total expenditure (investment and operation) related to the annual average, varies from one crown, to another.

The highest expenditures were recorded to the Fus Fougères type of crown (34 227 lei/ha) and the lowest to Ax Vertical (27 358 lei/ha).

Differences between average annual costs of crown types are close together, except the crown Fus Fougères which is much higher.

Of the total annual expenditure, only 2 063-2197 lei/ha in average, are made with the cuttings (1.08-1.15 lei/plant), representing 6.0 to 7.1% from these.

Average annual production of fruits ranged from 29 917 kg/ha (Cruce Dubla 1) to 35 704 kg/ha (Solen), and the average value of that annual production between 35900 lei/ha (Cruce Dubla 1) to 42845 lei/ha (Solen).

Average yield and production value is the average of both varieties.

Average production costs were between 0.81 lei/kg (Ax Vertical) and 0.99 lei/kg (Cruce Dubla 2).

Type of the crown presents an influence on apple production, a fundamental criterion for superintensive plantation.

Compared to the average of variants (32 309 kg/ha), the biggest positive influences were obtained by crown types: Solen (110.5%), Ax Vertical (104.5%), Tatura Trellis (104.2%) and the negative influences were realized to: Cruce Dubla 1 (92.6%) and Tessa (94%).

Positive influence, reflected in high yields, quality fruits and lower expenditure was found to both varieties of apple. The best behavior had types of crown: Solen, Ax Vertical and Tatura Trellis.

CONCLUSIONS

Types of crown influence spending cuts since the early years. In the first 3 years of training cuts cultivar 'Florina' ranged between 1350.5 lei/ha (Valcea 1) and 1.990 lei/ha (Cruce Dubla 2), and the variety 'Idared' s ranged from 1490 lei/ha (Valcea 1) and 1898.5 lei/ha (Cruce Dubla 1). After 3-4 years after planting, pruning fruiting become dominant.

During the 12 years of cuts fruition expenditure reached 23 250 lei/ha (Fus Fougères) to 24 950 lei/ha (Solen), the 'Florina' and 'Idared' variety, were located between 22 831 lei/ha (Fus Fougères) and 24 460 lei/ha (Cruce Dubla 2).

Average annual operation, depending on the type of crown (both varieties) oscillates between 27 358 lei/ha (Ax vertical) and 34 227 lei/ha (Fus Fougères) and revenues between 35 900 lei/ha (Cruce Dubla 1) and 42 845 lei/ha (Solen).

Production costs (lei/kg) range between 0.81 lei/kg (Ax vertical) and 0.99 lei/kg (Cruce Dubla 2).

Depending on the production of fruits, their quality and lower costs were noted by a superior reaction, forms of crown: Solen, Ax vertical and Tatura Trellis.

Table 1

The expenses generated by formation and fructification cuttings depending by the shape of crowns to 'Idared' variety - (1904 plants/ha)

No	Crown shape	Cuttings expenses ha (lei)		Total expenses with cuttings/ha (lei) year I-XV		Fruits production – total Year IV-XV (t/ha)	Total production value	Ratio between the production value and cuttings expanse
		Formation cuttings year I-III	Fructification cuttings year IV- XV	Total cost/ha	Which of: % costs with formation cuttings			
1	Fus Fougères	1659.40	22831	24490.4	6.77	366300	439560	17.95
2	Ax vertical	1640.30	23900	25540.3	6.42	378600	454320	17.79
3	Solen	1812.50	24150	25962.5	6.98	408600	490320	18.88
4	Valcea1	1490.00	23750	25240.0	5.90	367500	441000	17.47
5	CruceDubla 1	1898.50	24200	26098.5	7.27	338900	406680	15.58
6	CruceDubla 2	1850.20	24460	26310.2	7.03	368200	441840	16.79
7	TaturaTrellis	1730.10	23750	25480.1	6.79	387400	464880	18.24
8	Tessa	1716.20	24060	25776.2	6.65	355300	426360	16.54
MEAN		-	-	-	-	371350.00	-	-

Table 2

The expenses generated by formation and fructification cuttings depending by the shape of crowns to 'Florina' variety - (1904 plants/ha)

No	Crown shape	Cuttings expenses		Total expenses with cuttings/ha (lei) year I-XV		Fruits production – total Year IV-XV (t/ha)	Total production value	Ratio between the production value and cuttings expanse
		Formation cuttings year I-III	Fructification cuttings year IV-XV	Total cost/ha	Which of: % costs with formation cuttings			
1	Fus Fougères	1780.20	23250	25030.20	7.11	411600	493920	19.73
2	Ax vertical	1646.30	23400	25046.30	6.57	432000	518400	20.70
3	Solen	1825.40	24950	26775.40	6.82	448300	537960	20.09
4	Valcea1	1350.50	23700	25050.50	5.39	385000	462000	18.44
5	CruceDubla 1	1704.50	24360	26064.50	6.53	379100	454920	17.45
6	CruceDubla 2	1990.00	24850	26840.00	7.41	382900	459480	17.12
7	TaturaTrellis	1790.10	23900	25690.10	6.97	420200	504240	19.63
8	Tessa	1706.40	24150	25856.40	6.60	373500	448200	17.33
MEAN		-	-	-	-	404075.00	-	-

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