

## The Efficiency of Tree Crown Form – Improved Bush for the Fruit Stone Species

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**Abstract:** Scientific investigations are carried out in different countries in order to elaborate new tree crown forms or to improve the existing ones with the purpose of increasing the productivity of plum, apricot and cherry plantations and reduce the expenses for their cultivation. The goal of the accomplished investigations was to increase the productivity of plum, apricot and cherry plantations and the economic efficiency of fruit trees trained according to a new type of crown form – improved bush. It was established that the studied crown form is more efficient compared with the existing ones. Despite the fact that capital investment for the establishment of plantations with trees trained according to improved bush is higher, the term of return on it is shorter. The obtained annual profit and profitableness level for the plum and cherry production were the highest in the variant of improved bush with 5 branches and constituted respectively 50,43-57,93 and 38,06-56,58 thousand lei/ha with a profitableness level of 281-317 and 158-170%. The most efficient variant of apricot production was obtained in the plantations with trees trained according to improved bush with 4 branches, where the recorded profit was of 45,55-61,66 thousand lei/ha and the profitableness level of 387-403%, depending on the variety.

**Keywords:** apricot, cherry, crown form, efficiency, plum, production cost, profit, profitableness

### INTRODUCTION

According to the concept of fruit growing development in the Republic of Moldova, the strategic direction in the evolution of this branch consists in the efficient cultivation of the existing orchards with an unexhausted productive potential and their gradual replacement with new type of plantations, based on a modern assortment and advanced technologies, which ensure yearly fructification, high yield of qualitative fruits both for the national and international markets. An important role in increasing the production of fruits is given to fruit stone species. By 2015, it is expected to obtain a global yield of stone fruits species up to 234 thousand tons or the average production of 7,72 t/ha (Rapcea *et.al.*, 2002).

One of the ways to achieve this objective is to intensify the cultivation of fruit stone species by increasing the number of trees on a unit of surface, fact that can be done by training trees according to improved bush type of tree crown (Cimpoies, 2000; Coroid, 2000; Ghena and Braniște, 2003; Vatamaniuc and Donică, 2000).

In this context, the study of the economic efficiency of fruits production in the plantations of fruit stone species where trees were trained according to improved bush type of tree crown is of special interest.

### MATERIAL AND METHOD

In 2005, in order to determine the efficiency of training trees of fruit stone species according to improved bush type of tree crown, it was set up an experiment including 1-year-old plum, apricot and cherry trees trained according to improved bush within the Didactic Experimental Station „Criuleni”.

The plum trees have been trained according to improved bush model with 3, 4 and 5 branches and planted at a distance of 5×2 m. The witness group included trees trained according to mixed pyramid and planted at a distance of 6×4 m.

The apricot trees have been planted at a distance of 5×2 m and trained according to improved bush crown type with 4, 5 and 6 branches. The witness group included trees trained according to dwarf pyramid and planted at a distance of 6×4 m.

The cherry trees have been planted at a distance of 5×2 m and trained according to improved bush type with 3, 4 and 5 branches. The witness group included trees trained according to spaced out leveled pyramid and planted at a distance of 6×4 m.

The experiment was founded in 3 repetitions. Each repetition represented 8-10 trees.

The economic efficiency of capital investment and fruit production was calculated based on the real expenses and average price of fruit sale (Shestopal, 1985).

## RESULTS AND DISCUSSIONS

Return on capital investment is one of the main indices in plantation management. In order to accelerate the return on investment volume and production consumption it is necessary to reduce the period before tree fructification.

This index is influenced by the sum of capital investment for plantation establishment and all the operations carried out during the growth period till the first economically efficient harvest.

Data obtained (Tab. 1) prove that capital investment for the establishment of a plantation including trees trained according to the existing recommendations, regardless the species, was the same and constituted 40.80 thousand lei(MD)/ha (lei- Moldavian currency).

Due to the fact that in the plantations with trees trained according to improved bush crown type their density was higher, the capital investment increased too for their plantation. Therefore, in order to establish a plum plantation with trees trained according to mixed pyramid the capital investment constitutes about 40.80 thousand lei/ha, while for pruning trees according to improved bush, the expenses varied between 52.24-52.33 thousand lei/ha depending on the number of branches.

It was established a tendency of increasing the capital investment while increasing the number of branches. Thus, for plantation establishment of apricot trees trained according to improved bush with 4 branches the capital investment constituted 52.36 thousand lei/ha while forming the improved bush with 6 branches it was of 52.59 thousand lei/ha. This can be explained by additional expenses to form the improved bush depending on the number of branches.

Despite the fact that the capital investment for the establishment of a plantation with trees trained according to improved bush model was higher than for the establishment of a plantation with trees trained according to the existing recommendations, the term of return on capital investment is shorter in the first case. Thus, the term of return on capital investment for the establishment of a plum plantation with trees trained according to mixed pyramid is 1.85 years while for the establishment of a plantation with trees trained according to improved bush crown type, it varies between 1.03-1.45 years depending on the number of branches.

The term of return on capital investment depends on the number of branches but it also depends on the biological properties of the species. For the establishment of plum and apricot plantations where trees are trained according to improved bush, the term of return on capital investment reduces while increasing the number of branches. Therefore, the term of return on capital investment in the plum plantations where trees were trained according to improved bush method with 3 branches was of 1.45 years while for the trees trained according to

improved bush with 5 branches it was of only 1.03 years. In the apricot plantations where trees are trained according to improved bush, the term of return on capital investment is shorter when the tree crown is formed of 4 branches.

Tab. 1

Economic efficiency of capital investment in the plum, apricot and cherry plantations depending on the variety and crown form, the years 2005-2011, the age of trees – 7 years, DES “Criuleni”

Species	Crown form	Number of branches, pieces	Total capital investment, thousand lei/ha	Profit on 1 leu of capital investment, lei	Term of return on capital investment, years
Plum	Mixed pyramid (M)		40.80	0.54	1.85
	Improved bush type	3	52.24	0.69	1.45
	Improved bush type	4	52.29	0.87	1.15
	Improved bush type	5	52.33	0.96	1.03
Apricot	Dwarf pyramid(M)		40.80	0.69	1.44
	Improved bush type	4	52.36	0.87	1.15
	Improved bush type	5	52.48	0.81	1.23
	Improved bush type	6	52.59	0.83	1.20
Cherry	Mixed pyramid (M)		40.80	0.43	2.31
	Improved bush type	3	52.24	0.66	1.52
	Improved bush type	4	52.29	0.71	1.40
	Improved bush type	5	52.33	0.73	1.37

Despite the fact that capital investment was higher for the establishment of plantations where trees have been trained according to improved bush crown type than for those trained according to the existing recommendations, the profit for 1 leu of capital investment was higher in the first case compared with the second one. Thus, the profit for 1 leu of capital investment for the establishment of plum plantations with trees trained according to mixed pyramid constituted 0.54 lei while for the trees trained according to improved bush, it was of 0.69-0.96 lei, depending on the number of branches.

Therefore, the capital investment for the establishment of plum, apricot and cherry plantations with trees trained according to improved bush is higher than their establishment with trees trained according to the existing recommendations, but the profit for 1 leu of capital investment is higher and the term of return on capital investment is shorter.

The analysis of economic efficiency of fruit production (Tab. 2) proves that it depends a lot on the studied factors.

The value of global production depends mostly on the variety than on the species. Thus, in the plantations with trees trained according to the existing recommendations, the value of global production was higher for the plum variety Stanley, apricot variety Krasnoshekiy and cherry variety Erdi Böttermo. If, for example the value of global production in the apricot plantations of Bucuria variety with trees trained according to dwarf pyramid was of 38.39 thousand lei/ha, then this index in the plantations established with trees of Krasnoshekiy variety was of 50.85 thousand lei/ha.

Regardless the species and variety, the value of global production was higher in the plantations including trees trained according to improved bush compared with those where trees were trained according to the existing recommendations. If, for example, the value of global production was of 45.02 thousand lei/ha in the plantations of Erdi Böttermo cherry variety where the trees were trained according to mixed pyramid then in the plantations where trees were trained according to improved bush it varied between 74.26-88.40 thousand lei/ha, depending on the number of branches.

The value of global production also varies depending on the number of branches, but this peculiarity is strictly linked to the biological features of the species. In the plum plantations this index increases while increasing the number of branches. For example, in the cherry plantations of Erdi Böttermo variety with trees trained according to improved bush with 3 branches the value of global production was of 74.26 thousand lei/ha while for the trees trained according to improved bush with 4 and 5 branches this index constituted respectively 86.43 and 88.40 thousand lei/ha. In the apricot plantations, the value of global production was higher, regardless the variety, when trees were trained according to improved bush with 4 branches.

Tab. 2

Economic efficiency of fruit production in the plum, apricot and cherry plantations in the fructification period depending on the variety and crown form, the average for the period 2009-2011, the age of trees 5-7 years, DES "Criuleni"

Variety	Tree crown form	Number of branches, pieces	Value of global production, thousand lei/ha	The cost of production, thousand lei/ha	Unitary cost, thousand lei/t	Annual profit, thousand lei		The level of production profitability, %
						1 ha	1 t of fruits	
Plum trees								
Kabardin-skaia Ranniaia	Mixed pyramid (M)		35.29	13.22	1.19	22.08	2.00	167
	Improved bush	3	52.22	16.16	0.99	36.06	2.21	223
	Improved bush	4	62.65	17.30	0.88	45.35	2.32	262
	Improved bush	5	58.35	17.93	0.84	50.43	2.36	281
Stanley	Mixed pyramid (M)		40.15	13.49	1.14	26.67	2.26	198
	Improved bush	3	62.83	16.92	0.92	45.91	2.49	272
	Improved bush	4	73.95	18.06	0.83	55.89	2.57	310
	Improved bush	5	76.23	18.29	0.82	57.93	2.58	317
Apricot trees *								
Bucuria	Dwarf pyramid (M)		38.39	10.07	1.23	28.33	3.47	281
	Improved bush	4	59.22	13.71	1.09	45.51	4.21	387
	Improved bush	5	56.26	13.49	1.13	42.77	3.57	317
	Improved bush	6	57.48	13.58	1.11	43.89	3.59	324
Krasno-shekiy	Dwarf pyramid (M)		50.85	11.16	0.98	39.69	3.51	355
	Improved bush	4	76.95	15.29	0.89	61.66	3.61	403
	Improved bush	5	70.97	14.82	0.94	56.16	3.56	379
	Improved bush	6	67.82	14.58	0.97	53.24	3.53	365
Cherry trees								
Uifehertoi Fiurtosi	Mixed pyramid (M)		33.25	15.59	3.19	17.66	3.61	113
	Improved bush	3	57.05	22.59	2.69	34.46	4.11	152
	Improved bush	4	61.13	23.80	2.65	37.34	4.15	157
	Improved bush	5	62.15	24.09	2.64	38.06	4.16	158
Erdi Böttermo	Mixed pyramid (M)		45.02	18.06	2.73	26.96	4.07	149
	Improved bush	3	74.26	27.66	2.53	46.60	4.28	169
	Improved bush	4	86.43	31.24	2.46	55.19	4.34	177
	Improved bush	5	88.40	31.82	2.45	56.58	4.35	179

\* The average for the period 2010-2011

The studied factors influenced also the cost of production. It was higher for cherry plantations and constituted, for the trees trained according to mixed pyramid 15.59-18.06 thousand lei/ha depending on the variety, compared with 10.07-13.49 thousand lei/ha for the plum and apricot varieties where the trees have been trained according to the existing

recommendations.

Regardless the species and variety, the production cost was higher in the plantations where trees were trained according to improved bush compared with those where trees were trained according to the existing recommendations. Thus, production cost constituted about 15.59 thousand lei/ha in the plantations where the cherry trees of Uifehertoi Fiurtosi variety were trained according to mixed pyramid while for the same variety where trees were trained according to improved bush, the value of this index constituted 22.59-24.09 thousand lei/ha, depending on the number of branches.

Production cost of plum and cherry plantations, regardless the variety, increased while increasing the number of branches, while for apricot plantations it is higher for improved bush type of crown form with 4 branches.

The value of global production and production cost has influenced significantly the annual profit. The latter as well as the level of production profitability was higher for fruit production in the plantations with trees trained according to improved bush, regardless the species and variety. Thus, the annual profit obtained from plum production in the plantations with Kabardinskaia Ranniaia variety trees trained according to mixed pyramid was of 22.08 thousand lei/ha, while in the plantations where trees were trained according to improved bush model it varied between 36.06-50.43 thousand lei/ha, depending on the number of branches. The level of production profitability was respectively of 167% and 223-281%.

The number of branches influenced significantly the obtained annual profit and production profitability level, but the influence of the number of branches on the value of these indices much depends on the species. The annual profit and profitability level of plum and cherry production in the plantations with trees trained according to improved bush crown type increased while increasing the number of branches. Therefore, the annual profit for the production of Kabardinskaia Ranniaia plum variety in the plantations with trees trained according to improved bush with 3 branches was of 36.06 thousand lei/ha and profitability level constituted 223%, while the value of these indices in the plantations where trees were trained according to improved bush with 4 and 5 branches constituted respectively 45.35 and 50.43 thousand lei/ha and 262-281%.

The annual profit and profitability level for apricot production, regardless the variety, were the highest for the variant of improved bush with 4 branches.

## CONCLUSIONS

Even if the capital investment for the establishment of plum, apricot and cherry plantations where trees are trained according to improved bush model is higher than their establishment with trees trained according to the existing recommendations the profit for 1 leu of capital investment is also higher and the term of return on capital investment is shorter.

Plum, apricot and cherry production is more efficient from the economic point of view in the plantations with trees trained according to improved bush. The obtained annual profit and profitability level for the plum and cherry production were the highest in the variant of improved bush with 5 branches and constituted respectively 50.43-57.93 and 38.06-56.58 thousand lei/ha with a profitability level of 281-317 and 158-170%. The most efficient variant of apricot production was obtained in the plantations with trees trained according to improved bush method with 4 branches, where the recorded profit was of 45.55-61.66 thousand lei/ha and the profitability level of 387-403%, depending on the variety.

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