

Cadastral valuation of lands dedicated to perennial plantings: features and practice

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Abstract. The article considers the issue of cadastral valuation of agricultural lands used for perennial plantations (orchards). Unlike other agricultural crops, orchard crops occupy the land for a long period of time, therefore, the planting expenditures are capital. The purpose of the study is to define the features and adapt the existing methodology for cadastral valuation of lands occupied by orchards considering the actual return on the evaluated land plot and the distance factor that affects the increase in cost and decline in return depending on the location of the plot in relation to the main markets. The example (plots are located in the Bezenchugsky district of the Samara region) shows that the costs of orchard plots are 2.73 and 2.93 rubles per square meter, respectively. Quality characteristics of the first plot are better, but it is located further from the centre of the region.

1 Introduction

Land plots of conditionally permitted use are agricultural lands unfit for tillage but used for cultivation of technical crops, perennials, berries, tea, grape and rice [1-3].

Perennials of the Samara region are represented by relatively small industrial orchards and berry-fields (except for the horticultural societies that are not considered in this paper). The real estate market lacks of such objects, so it is not possible to estimate the market value using the comparison approach [4, 5].

2 Methods and Materials

In this case, we can consider the formation of the market value of lands from two angles:

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- using the cost approach, similar to the principle of estimation of lands of the third and fourth types of permitted use;
- using the income approach [6-8].

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- using the cost approach, similar to the principle of estimation of lands of the third and fourth types of permitted use;
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We can evaluate land plot occupied by orchards using the same algorithm as in the evaluation of agricultural lands, where there is a need to determine:

- the yield per unit;
- the product value;
- the costs per unit of cultivation and maintenance of soil fertility;
- the unit revenue;
- the unit rent (entrepreneur's expenditures and profit excluded)
- the unit cadastral value of lands occupied by perennials;
- the cadastral value of land plots [9-12].

The general formula for calculation of the value of the land occupied by the orchard is:

$$UCV = Income/K_o \tag{1}$$

where K_o is the capitalization ratio.

$$Income = Y \cdot Pr - Cost - EP \tag{2}$$

where *Income* is the net income for the crop, rubles;

Y – yield during the heavy bearing season, rubles/ha;

Pr is the sale price, rubles/kg;

Cost – costs of cultivation and harvesting during the economic life period, rubles/ha;

EP – entrepreneur's average profit in agriculture, rubles/ha [13-18].

3 Results and Discussion

Evaluating lands dedicated to perennial plantings, we need to consider the time factor that reflects the period of expenditures uncovered by production. For example, modern apple orchards have a 15-18 years economic life period, and it takes trees 4-6 of those years to fruit. The last years of this period are characterized by a decrease in yields. At the end of the economic cycle of the orchard, there is a need to remake it or to eliminate it in order to vacate the land. This approach considers the income generated by the soil fertility and fixed assets, which include fruit trees, and results in an overvaluation of land [19-22].

Table 1. Costs and revenues from raspberry cultivation in the Samara region, rubles.

Article	Costs	
	per 1.4 ha	per 1 ha
Electricity	18 750.00	13 392.86
Fertilizers	2 352.00	1 680.00
Plant protection agents	9 240.00	6 600.00
Combustibles and lubricants	41 931.00	29 950.71
Salary	178 901.00	127 786.43
Allowance	62 615.35	44 725.25
Other	36 000.00	25 714.29
TOTAL	349 789.35	249 849.54
2011 gross yield	64.00	Cwt

Price	75.00	Rubles/kg
Revenue	480.00	Thousand rubles
Revenue per 1 ha	342.86	Thousand rubles

Tables 1 and 2 show the generalized economic calculation of a 1.4 ha raspberry field set out on chernozem soil (based on data for farms using the modern Polish technology for growing raspberry and strawberry). The data is at 2011, however, considering the fact that the plantings were watered, we can assume that yield was the same in the dry 2010 year.

Table 2. Calculation of the value of land occupied by perennials (raspberry field).

Indicator	Value
Net income, sprinkler system depreciation included, rubles	93 007.61
Annual depreciation, rubles	12 500.00
Net income before depreciation	80 507.61
Net income 7 years, rubles/ha	563 553.25
Annual revenue to the eight-year cycle, rubles/ha	70 444.16
Capitalization ratio	0.10
Land value, rubles/ha	704 441.56
Land value, rubles/square meter	70.44

Raspberry bears fruit in the second year after planting. Plantation works for 8 years. Irrigation is required.

When the 5-6-years production cycle is ended, the arable land is sowed with other field crops.

It is better if the preceding crop is spring cereal or if the land was left fallow.

Table 3 presents the calculation of the irrigation system depreciation. The calculation is similar to the one done when creating an irrigation system for an orchard [23-25].

Table 3. Calculation of the depreciation allowance.

Indicator	Value
Orchard area, square meters	2 000 000
Expenditures for hydraulic structures, rubles.	20 000 000
Unit costs, rubles/ square meter	10
The berry field area, square meters	10 000
Sprinkler system value, rubles	100 000.00
Depreciation period, years	8
Annual depreciation flow, rubles	12 500.00

The obtained result (70.44 rubles/square meter) exceeds the base land cost (before making a raspberry field) by several times, which confirms that the impact of fixed assets on the value of occupied land is significant.

We also offer to consider a similar example of calculation for an apple orchard (an intensive technology for dwarf rootstocks).

It bears fruit in the fourth year after planting. The orchard works for 15 years (since planting). Irrigation is required.

When the 5-6-years production cycle is ended, the arable land is sowed with other field crops. According to Table 4, it is better if the land is left fallow for a period of time.

Table 4. Costs and revenues from cultivation of an apple orchard in the Samara region, rubles.

Atricle	Costs	
	138 ha land plot	Per 1 ha
Electricity	86 810	629
Fertilizers	200 000	1 449

Plant protection agents	2 111 896	15 304
Combustibles and lubricants	857 808	6 216
Salary	2 485 205	18 009
Allowance	869 822	6 303
Other	1 566 000	11 348
TOTAL	8 177 540	59 258
2011 gross yield	15 870	Cwt
Price	20	Rubles/kg
Revenue	31 740	Thousand rubles
Revenue per 1 ha	230	Thousand rubles

The result presented in Table 5 is significantly higher than the cost of land occupied by an orchard. It should also be taken into account that garden trees are classified as fixed assets, and their value is partially transferred to the land value.

Table 5. Calculation of the value of land occupied by perennials (apple orchard).

Indicator	Value
Net income, sprinkler system depreciation included, rubles	170 742.46
Annual depreciation, rubles	12 500.00
Net income before depreciation	158 242.46
Capitalization ratio	0.10
Land value	1 582 424.61
Land value	158.24
Net income 11 years, rubles/ha	1 740 667.07
Annual revenue to the fifteen-year cycle, rubles/ha	116 044.47
Capitalization ratio	0.10
Land value, rubles/ha	1 160 444.72
Land value, rubles/square meter	116.04

As mentioned above (when calculating the value of lands of the third and fourth types of permitted use), the business value cannot be transferred to the value of land entirely.

Therefore, when calculating the value of lands of the second type of permitted use, we can use the approach similar to the one used when calculating the value of lands occupied by buildings and facilities.

Table 6. Calculation of the cadastral value of the land plot occupied by perennials in the Bezenchugsky district.

Plot number	Plot location	Permitted use	Area, m ²	The code	Distance to the regional centre, km
63:12:0301002:1	The Samara Region., Bezenchugsky district	For orchard	87700	2	30
63:12:0403004:1	The Samara Region., Bezenchugsky district	Under orchard	3779666	2	16

In addition to the synergistic effect of the land value, there is also a need to consider the factor of distance of the land plot to the regional centre.

Hence, the total market value of a land plot of the second type of use can be calculated using the following formula:

$$C_i = 1,2628 \cdot C_n \cdot (1 + Li) \tag{3}$$

where C_n is the market (cadastral) value of surrounding lands;

1,2628 is the synergistic effect ratio equal to the entrepreneur's profit margin;

L_i is the distance factor of the evaluated land plot to the regional centre.

Table 7. Calculation of the cadastral value of the land plot occupied by perennials in the Bezenchugsky district.

Plot number	Unit cadastral value of a vacant land plot, rubles/square meters	Entrepreneur's profit margin, %	Distance factor, %	Unit cadastral value of a land plot occupied by an orchard, rubles/square meters	Cadastral value of the land plot under evaluation, rubles
63:12:0301002:1	1.70	26.28	0.2734	2.73	239 751.16
63:12:0403004:1	1.68	26.28	0.3828	2.93	11 088 187.87

Tables 6 and 7 present the calculation of value of land plots of the second type of permitted use in the Bezenchugsky district.

4 Conclusion

The proposed methodology for cadastral valuation of agricultural lands dedicated to perennial plantings is based on the described approach. Moreover, there is a need to take account of the actual return of the land plot and the distance factor that affects the increase in cost and decline in return depending on the location of the plot in relation to the main markets. The example (plots are located in the Bezenchugsky district of the Samara region) shows that the costs of orchard plots are 2.73 and 2.93 rubles per square meter, respectively. Quality characteristics of the first plot are better, however, it is located further from the centre of the region.

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