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ANALYSIS OF THE PROFITABILITY THRESHOLD FOR CABBAGE CULTURE IN CONVENTIONAL AND ECOLOGICAL AGRICULTURE SYSTEM -estimates 2019 / 2020-

BEREVOIANU ROZI LILIANA¹

Summary: *The prices of horticultural products fluctuate depending on a number of factors, such as perishability, storage possibilities, insufficient supply for a certain assortment, quality, etc., which can stimulate or reduce the incomes of agricultural producers. The paper aims to substantiate from a technical-economic point of view a system for elaborating production costs and estimating capitalization prices, the degree of profitability of the cabbage crop in the field, so that in the conditions of optimizing production structures, technologies applied and the financial support provided, to achieve high economic efficiency, in line with the performance of the European Union. The results of scientific research can have a positive influence on agricultural producers who can adapt their existing resources and capacities at the farm level to obtain high yields.*

Keywords: *economic efficiency, profitability threshold, cabbage culture*

JEL classification: *Q12, Q14, Q57*

INTRODUCTION

Cabbage, with the scientific name *Brassica oleracea*, the Crucifere family, also known as *curechi*, is one of the oldest vegetables grown by man. Originally from the Mediterranean area, it was cultivated by the Greeks and Romans, then spread to Europe in the ninth and twelfth centuries. It is a biennial plant with green, red (purple) or white (pale green) leaves grown as an annual vegetable crop for its densely leafy heads. It is eaten as a raw salad, assorted or simple, as a culinary preparation in combination with or without meat, as well as pickled or canned. Cabbage juice, with a high content of sulfur, chlorine, calcium, iodine and iron, consumed raw and without salt has therapeutic effects in combating duodenal ulcer, cleansing the stomach lining and intestines, being indicated in the treatment of anemia and osteoporosis.

In Romania, the most favorable regions for cabbage cultivation are represented by the river meadows in the hilly area of Transylvania, Moldova, in the plain area in the south and west of the country (especially for extra-early solarium and early field crops). The cultivation of this plant is an advantageous activity from an economic point of view due to the large crops that can be obtained per hectare. Because there are several varieties of cabbage, each with different growing seasons (early, summer and autumn crops), cabbage cultivation can ensure a high yield per hectare, which can lead to a rapid income for growers of this plant in spring to autumn. This is due to the fact that the expenses per unit area are relatively low, some works, from establishment to harvest, can be completely mechanized and the cabbage is harvested over a long period of time of the year. Cabbage is a perishable product during transport, temporary storage and recovery.

MATERIALS AND WORKING METHODS

In order to make the estimates regarding the analysis of the profitability threshold for the cabbage crop, we started from the production framework technology that includes all the measures and agrofytotechnical, agrochemical and phytosanitary works applied. The analysis of the revenue and expenditure budget is based on the production technologies used and is an element of economic appreciation of the activity through the final indicators: cost, profit, profitability. The structure of the revenue and expenditure budget refers to the detailed presentation of the elements related to the value of production, intermediate consumption, production cost, net income, as well as the gross product and subsidies granted.

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RESULTS AND DISCUSSIONS

Cabbage cultivation technology in the field - conventional system and ecological system

A. Precursor crops

	Conventional system	Ecological system
Very good	- perennial legumes (alfalfa and clover in the first year after weeding); - annual legumes (peas, beans); - solano-fruity vegetables (tomatoes, peppers, eggplants, etc.).	
Good	- root vegetables (carrot, parsley, celery, beetroot, etc.); - pumpkin vegetables (cucumbers, squash, melons, etc.);	
Media	- bulbous vegetables (onions, garlic, leeks)	
Against	- cabbage vegetables (cabbage, cauliflower, etc.)	

B. Fertilizer application

	Conventional system			Ecological system
Organic fertilizers		Soil fertility status	T / ha	
		Low	35-40	
		Average	25-30	
		Hi	20-25	
		high	0-20	
Chemical fertilizers	- It is administered depending on the varieties used (summer cabbage or early cabbage)			Synthetic chemical fertilizers are not applied in organic technologies. Instead, organically produced fertilizers are used, applied in the periods and doses recommended by the relevant scientific research.
	Soil fertility status	Phosphorus P₂O₅ kg / ha	Potassium K₂O kg / ha	
	Low	100-170	100-125	
	Average	75-150	75-100	
	Hi	50-100	50-75	
	high	0-75	0-35	

The basic fertilization with organic / chemical fertilizers is performed with the tractor of 55-75 HP in the unit with the machine for administering organic / chemical fertilizers.

C. Soil works

	Conventional system	Ecological system
Work done in the fall		
Soil mobilization (Rolling on)	- for the abolition of the previous crop, the crushing of plant residues and the loosening of the soil for leveling. - it is executed with the tractor of 55-75 HP in the unit with the disc harrow and the adjustable harrow. - epoch: immediately after the liberation of the land from the previous culture. - working depth: 7-12 cm.	
Maintenance leveling	- to ensure the optimal conditions for irrigating the crop. - is performed with the unit consisting of a tractor of 55-75 hp and leveler.	
Basic fertilization	- with organic / chemical fertilizers - it is executed with the tractor of 55-75 HP in the unit with the machine for administering organic / chemical fertilizers.	- with organic fertilizers. - it is executed with the tractor of 55-75 HP in the aggregate with the machine for administering organic fertilizers.
Deep plowing (28-30 cm)	- for loosening the soil and incorporating fertilizers - is executed with the aggregate consisting of a tractor of 55-75 HP, plow and star harrow	

subsoiling (deep loosening)	<ul style="list-style-type: none">- it is recommended to run once every 3-4 years, especially on heavy soils.- it is executed with the tractor of 55-75 HP in the unit with the soil loosening machine.	
Work done in the spring		
Preparation of the germination bed	<ul style="list-style-type: none">- to ensure a soil suitable for planting seedlings- is performed with the unit consisting of a tractor of 55-75 hp and combine	
Soil herbicide	<ul style="list-style-type: none">- It is made with authorized substances and according to the recommendations of specialists in the field	
Open gutters	<ul style="list-style-type: none">- for modeling the soil- it is executed with the unit consisting of a tractor of 55-75 HP and the machine for opening gutters- working depth: 18-20 cm.	
Soil modeling	<ul style="list-style-type: none">- to ensure the conditions for planting seedlings.- it is executed with the aggregate consisting of a 55-75 hp tractor and the soil modeling machine.	

D. The establishment of culture

	Conventional system	Ecological system
Planting season	<ul style="list-style-type: none"> - for early cultivation it is established that the plants are not affected by late spring frosts (a temperature of 8 degrees Celsius is recorded in the soil). Thus, planting is carried out between the last decade of March and the first decade of April. -for summer cultivation, planting is carried out between the second decade of April and the first half of May. - for autumn cultivation the planting is carried out between the second decade of June and the first decade of July 	
Plant density	<ul style="list-style-type: none"> - for early cultivation: 50-60 thousand plants / ha - for summer cultivation: 45-50 thousand plants / ha - for autumn cultivation: 30- 45 thousand plants / ha 	
Planting technique	<ul style="list-style-type: none"> - manual for early cultivation, manual or mechanical for summer and autumn crops 	
Depth to plant	<ul style="list-style-type: none"> - it is up to the first normal leaf 	

E. Culture maintenance

	Conventional system	Ecological system
General works		
watering	<ul style="list-style-type: none"> - immediately after planting with a watering rate of 200 m³ water / ha 	
Filling in the blanks	<ul style="list-style-type: none"> - it is made with seedlings of the same age and variety. - 4-7 days after planting (performed manually) 	
Facial fertilization	<ul style="list-style-type: none"> - can be associated with phytosanitary treatments. - is carried out with the 40-45 HP tractor in the unit with the phytosanitary treatment machine 	
	<ul style="list-style-type: none"> - During the vegetation, it is recommended to apply complex fertilizers, in the first stages of growth, until the beginning of fruiting and during fruiting. 	<ul style="list-style-type: none"> - Specific products made in an ecological regime are used, in doses recommended by the specialized technical research.
Weeding in the vegetation	<ul style="list-style-type: none"> - it is recommended to perform it as many times as necessary, manually or mechanized. - it is executed with the tractor of 40-45 HP in the unit with the vegetable cultivator. 	
Crop irrigation	<ul style="list-style-type: none"> - is carried out whenever it is mainly needed during the fruit-growing period. - drip watering is recommended, constantly ensuring the water needs of the plant. 	

	- is carried out from the establishment of the culture until the end of the vegetation period, once or twice a week, depending on the nebulosity and the weather / atmospheric humidity conditions. - 1.5-2 liters of water / plant are administered at a pressure of 1-1.2 atmospheres and during the formation and intensive growth of fruits the doses can be increased.	
herbicides	- it is recommended before opening the gutters, with herbicides specific to the crop. - it is executed with the tractor of 55-75 HP in the unit with the herbicide machine.	
Fighting diseases and pests	- the most common diseases in cabbage cultivation in the field are: hand, seedling fall, cabbage hernia, black rot on cabbage leaves, fusarium wilt, bacterial leaf spot, wet rot. - pests of vase culture: crucifer fleas, cabbage bedbugs, cabbage fly, gray cabbage lice and cabbage stalks. - it is executed with the tractor of 40-45 HP in the unit with the machine for phytosanitary treatments	
	Chemical control can be achieved with the help of approved fungicides and insecticides and in the dose recommended by specialists	Specific products made in an ecological regime are used, applied in the periods and doses recommended by the specialized technical research.

F. Production evaluation

Conventional system	Ecological system
<ul style="list-style-type: none"> It is done after the formation of the head, collecting samples from areas of 8 square meters for each sample. It is determined: <ul style="list-style-type: none"> no. of existing plants (Ntp); no. of heads formed (Nc) on total samples; average weight of a head (Gc) - in kg total area of the samples (Sp) <p>Calculation formula:</p> $\frac{Q_{kg} / ha}{=} = \frac{Nc \times Gc}{Sp} \times 10,000$	

G. harvesting

Conventional system	Ecological system
- harvesting is done manually, requiring staggered harvests, as the heads reach maturity for consumption - production varies depending on the variety and technology applied: 20-30 t / ha for early cultivation, 35-40 t / ha for summer cultivation and 50-70 t / ha for autumn cultivation.	- harvesting is done only manually - the estimated productions are about 20-25% lower than in the conventional system

1. Structure of production costs - estimates for the production year 2019/2020

Table 1: Structure of production costs for field crop of seed potatoes - estimates for the crop year 2017/2018

Culture	Culture system	Production (kg / ha)	Total agrotechnical expenses		Mechanized works		Manual works		Materials and materials	
			lei / ha	%	lei / ha	%	lei / ha	%	lei / ha	%
Cabbage	conventional	30000	48.474	100	1490	3.1	9650	19.9	37.334	77.0
	ecological	24000	53.052	100	1425	2.7	8780	16.5	42.847	80.8

Source: Own calculations

From the data presented in table 1 it is observed that for the cabbage cultivation in the field was estimated a production of 30t / ha in conventional system and for the ecological system by 20% lower. The total agro-technical expenses had a value of 48,474 lei / ha in the conventional system, while for the ecological system they were approximately 8% higher. Also, the expenses with the materials and materials used had the highest share of the total expenses of 77.0% in the case of cabbage grown in the field in conventional system and of 80.8% in the case of cabbage grown in the field in organic system. Expenditures on manual works have a share of only 19.9% in the conventional system and 16.5% in the ecological system (Table 1).

2. Comparative analysis (conventional and ecological) of revenue and expenditure budgets for cabbage in the field - estimates for the production year 2019/2020

The analysis of revenue and expenditure budgets is based on production framework technologies, input prices for unfinished production and the production of the plan year.

Table 2: Revenue and expenditure budget for cabbage cultivation in the field, conventional and organic system - estimates for the production year 2019/2020

indicators	UM	Conventional 30,000 kg / ha	Ecological 24,000 kg / ha
A. Value of production	lei	66751.0	73482.2
B (+). subsidies	lei	580.3	2649.1
C (=) Gross product	lei	67331.3	76131.2
D (-) Total expenses	lei	55625.8	61235.1
I. Variable expenses	lei	43326.5	49506.1
II. Fixed expenses	lei	12299.3	11729.1
E (=) Taxable income	lei	11125.2	12247.0
F (=) Net income + subsidies	lei	10592.9	13671.4
G. Taxable income rate	%	20.0	20.0
H. Net income rate + subsidies	%	19.0	22.3
Production cost	lei / kg	1.85	2.55
Domestic market price predictable	lei / kg	2.2	3.0

Source: Own calculations

○ Cabbage in the field - conventional system

At an estimated average production of 30000 kg/ha, a production value of 66751 lei/ha is achieved, and by adding to it the subsidy of 580.3 lei/ha, a gross product of 67331.3 lei/ha is obtained.

Variable expenditures represent 77.9% of the total agro-phytotechnical expenditures. Of these, the value consumption of raw materials and materials has a share of 79.9%. With a proportion of 22.1% of total expenditures, fixed expenditures are represented by 78.4% of value consumption with permanent labor.

By deducting the total expenses from the value of the production, a taxable income of 11125.2 lei/ha results, finally obtaining a net income of 10012.6 lei/ha and a net income rate of 18%.

As a suggestive synthetic indicator for the degree of economic efficiency with which the cabbage crop is obtained in the field - conventional system, the production cost of 1.8 lei/kg is calculated by dividing the total costs by the estimated average production.

Obtaining the profitability of the cabbage crop in the field, becomes profitable by establishing a predictable domestic market price of 2.2 lei / kg, calculated by multiplying the production cost by a coefficient of 1.2.

○ Cabbage in the field - ecological system

For an estimated average production of 24000 kg/ha, a production value of 73482.2 lei/ha corresponds, and by adding to it the subsidy of 2649.1 lei/ha, a gross product of 76131.2 lei/ha is achieved.

Variable expenditures, occupying a share of 80.8% of total expenditures, are represented in proportion of 82.6% of value consumption of materials and materials. Constituting 19.2% of the total expenses, the fixed expenses are formed in a percentage of 74.8% of the value consumptions with permanent labor force.

By subtracting the total expenses from the value of production, a taxable income of 12247 lei/ha is obtained, finally resulting in a net income and a net income rate of 11022.3 lei/ha and 18% respectively.

Being a synthetic indicator representative of the level of economic efficiency with which the cabbage is grown in the field in an ecological system, the production cost of 2.5 lei/kg results from the reporting of total costs to the production expected to be obtained.

The profitability of the crop is achievable by establishing the foreseeable internal market price of 3 lei/kg, calculated by applying a coefficient of 1.2.

CONCLUSIONS

- From the data presented in table 3 it is highlighted that the value of the production obtained in the two cropping systems exceeds the value of the expenses made by 20%. Variable expenditures occupy a share of 77.9% in the conventional system and 80.8% in the ecological system of the total expenditures, the difference being represented by the fixed expenditures.

- Materials and materials hold a proportion of 62.2% and 66.8% of the total resources consumed, respectively, and the permanent labor expenses make up 78.4% and 74.8% of the fixed expenses, respectively. Representative synthetic indicator for the level of economic efficiency of expenditures per product, the production cost is 1.9 lei / kg in conventional system and 2.6 lei/kg in ecological system, mainly due to a lower average production by 16.4%.

- The average capitalization price per unit of product is 2.2 lei/kg in conventional system, and in ecological system of 3 lei/kg.

- The rate of return achieved was 20% in both conventional and organic systems, the production of cabbage in the field being economically efficient. The break-even point refers to the physical or value level of the production at which the expenses incurred are fully covered by the income achieved by capitalizing on the production, respectively the level from which the crop starts to be profitable. Thus, the field cabbage crop is considered profitable in conventional system starting from the average production of 15800 kg/ha corresponding in value with the amount of 35048.4 lei, and in ecological system this threshold is 11700 kg/ha in physical units and expressed in value with 35947.4 lei.

Table 3: Synthesis economic indicators for field crop of seeds for seeds, conventional and ecological system - estimates for the crop year 2017/2018

Nr. crt.	Synthetic economic indicators	UM	Conventional system	Ecological system
1	Average production per hectare	t / ha	30.0	24.0
2	The value of production per ha	lei / ha	66751.0	73482.2
3	Production costs per ha	lei / ha	55625.8	61235.1
4	Variable expenses	lei	43326.5	49506.1
5	Raw materials and materials	lei	34633.6	40912.1
6	Permanent labor costs	lei	9649.6	8779.9
7	Fixed expenses	lei	12299.3	11729.1
8	Production cost	lei / kg	1.9	2.6
9	Capitalization price	lei / kg	2225.0	3061.8
10	Profit or loss per unit of production	lei / ha	11125.2	12247.0
11	Profit or loss per unit of product	lei / kg	370.8	510.3
12	Profitability rate	%	20.0	20.0
13	Profitability threshold in value units	lei	35048.4	35947.4
14	Profitability threshold in physical units	to	15.8	11.7
15	Exploitation risk rate	%	52.5	48.9
16	Security index (Is)		0.5	0.5

Source: Own calculations

- The exploitation risk rate is a synthetic indicator that estimates the existing risk in case of not realizing the expected production. In the field of cabbage cultivation, this indicator is 52.5% in the conventional system, respectively 48.9% in the ecological system.
- The security index expresses the existing security margin by achieving that culture, which increases in line with the value of the security index. This synthetic indicator for cabbage cultivation in the field 0.5 for the two cultivation systems, conventional and organic.

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