

THE STRUCTURE OPTIMIZATION OF CEREAL GRAINS CULTURE IN IASI COUNTY (CASE STUDY IN SUBURBAN AREA OF IAȘI)

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Abstract

Crop structure is determined according to market requirements and pedo climatic conditions of the area. Depending on the optimization criteria, the crops will be optimal when it ensures the achievement of maximum profitability, in terms of assure quantity and assortment, to meet the requirements of the national economy for agricultural products, the full use of land and other means of production and also in the conditions of respect the plant culture restrictions regarding the share in crop rotation. Critical in optimizing the structure of crops is the economic efficiency, and made profits. The economic efficiency is in continuously changing due to raw materials and production goods changing prices. From here is the necessity of optimizing the structure of crops in each cycle of agricultural production. The main indicators used in optimizing the structure of crops are yield per hectare, cost of production to the surface unit, gross profit per hectare, the unit cost, of costs in 1000 lei income rate of return. Linear programming method presents the great advantage that allows choosing the optimal structure variant of a multitude of possible variations. Given the large volume of calculations, the linear programming technique involves mandatory, the use of electronic computing. Optimizing the structure of crop through linear programming requires drawing up the economic-mathematical model, including variables, restrictions, the purpose function and free terms. The purpose function can be represented by maximizing the effectiveness (gross profit or economy expenditure) or minimize the effort (total spending or intermediate spending). The considered restrictions are: the total area cultivated with cereals, minimum and maximum area occupied by grains, the average obtained production. The case study was conducted in suburban area of Iași, which includes the following communes: Valea Lupului, Lețcani, Bîrnova, Ungheni, Tomești, Victoria, Aroneanu, Reditu, Popricani, Miroslava, Ciurea, Schitul Duca, Holboca. The average bonity note of arable land is 55 points AETA, which corresponds to an area favorable for grain culture.

Key words: optimization, linear programming, cereal grains, suburban area

The structure of crops is among the technologies of production, the main component of plant culture. By the structure of crops we understand the share occupied by each culture or vegetal branch in the total cultivated area. Structure is optimal when cultures ensures the obtaining of

maximum yield in terms of quantity and assortment, to meet the requirements of the national economy in agricultural products, the full use of land and other means of production and in terms of respect the plant culture restrictions of sequence in time and space of the culture.

The optimal structure of the crops undergoes changes due to the following influences:

- the national economy demands;
- the market demand for agricultural products in general;
- the insurance level of the company with the technical-material base;

- the productive potential of land, which by pedo-ameliorative measures may modify the favorability for different cultures;
- level of assuring with employment and their qualifications degree;
- rotation restrictions;
- central fund of agricultural products through which the state intervenes to ensure the processing industries with raw;
- materials and the company with needed agricultural goods (2, 6).

MATERIAL AND METHOD

The research has been conducted in the county of Iasi, in suburban area of Iasi and targeted the optimizing areas cultivated with cereals, using linear programming, which shows the great advantage that allows choosing the optimal variant structure of a multitude of possible variations. Given the large volume of calculations, the linear

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programming technique, involves mandatory the use of electronic computing.

Optimizing the structure of crop through linear programming requires drawing up the economical-mathematical model, including variables restrictions, the purpose function and free terms. The purpose function can be represented by maximizing the effectiveness (gross profit or economy of expenditure) or minimize the effort (total spending or intermediate spending).

The variables of the model for optimizing the structure of cereal crops in suburban area of Iasi will be represented by: wheat, barley, oats and corn.

The restrictions taken into account were:

- total area cultivated with cereals;
- minimum and maximum area occupied by cereals;
- an average yield obtained;
- the consumption of man-days;
- material costs per hectare.

The optimization criteria are the achievement of the objectives pursued:

- the maximization of profits;
- the minimization of costs.

RESULTS AND DISCUSSIONS

The suburban area of Iasi includes the following communes: Valea Lupului, Lețcani, Bîrnova, Ungheni, Tomești, Victoria, Aroneanu, Rediu, Popricani, Mirosłava, Ciurea, Schitul Duca, Holboca. The bonita notes of arable land is 55, which corresponds to an area favorable for cereals culture (*table 1*).

In favorable areas for to the culture of cereals, can be obtained the following average productions (*table 2*):

Table 1

General data on Suburban area of Iasi

Suburban area of Iasi	
Predominant soil (new names)	Cambic chernozem, Gleic chernozem
The annual average temperature (°C)	9
Precipitations (mm)	400 – 500
Arable bonita notes	55
Total arable surface -2011 - ha	32518
The total surface cultivated with cereals	17285
Autumn wheat	Favorable area
Corn	Favorable area

Table 2

The average production that can be obtained in Suburban area of Iasi

Crt. no.	Culture	The average production (kg/ha)
1	Wheat	3500
2	Barley	4000
3	Oats	2500
4	Corn	4000

The economic - mathematical model matrix to optimize the structure of cereal crops in suburban area of Iasi is shown in *table 3*.

Following the analysis of climatic and economic conditions from suburban area of Iasi, had been established the following technical-economical indicators that can be achieved by cultivating cereals grain (*table 4*).

After resolving the economical-mathematical model has results two variants (*table 5*).

Table 3.a

The economic - mathematical model matrix to optimize the structure of cereal crops in Suburban area of Iasi

Crt. No.	Restrictions	Wheat for consumption	Wheat for seed	Barley for consumption	Oats for consumption	Corn for consumption	Corn for seed	Sign	Free term		U.M.
									V1	V2	
1	Maximum area cultivated with cereals	1	1	1	1	1	1	=	17.473	17.473	ha
2	The maximum area cultivated for wheat consumption	1						≤	5.000	5.000	ha
3	Minimum area cultivated for wheat. consumption	1						>	2.500	2.500	ha
4	The maximum area cultivated for wheat seed		1					≤	700	700	ha
5	Minimum area cultivated for wheat seed		1					>	220	250	ha
6	The maximum area cultivated with barley			1				≤	2.300	2.300	ha
7	Minimum cultivated barley			1				>	250	250	ha
8	The maximum area cultivated with oats				1			≤	1.000	1.000	ha

Table 3.b

The economic - mathematical model matrix to optimize the structure of cereal crops in Suburban area of Iasi

Crt. No.	Restrictions	Wheat for consumption	Wheat for seed	Barley for consumption	Oats for consumption	Corn for consumption	Corn for seed	Sign	Free term		U.M.
									V1	V2	
9	Minimum cultivated oats				1			>	130	130	ha
10	The maximum area cultivated with maize for consumption					1		≤	13.000	13.000	ha
11	Minimum cultivated for corn. consumption					1		>	5.000	5.000	ha
12	The maximum area cultivated with maize for seed						1	≤	1.050	1.200	ha
13	Minimum cultivated for corn seed						1	>	300	300	ha
14	The average yield for wheat. consumption	1						=	3.600	3.600	kg/ha
15	The average yield for wheat. seed		1					=	4.000	4.000	kg/ha
16	Average yield in barley			1				=	4.000	4.000	kg/ha
17	Average production in oats				1			=	1.900	1.900	kg/ha
18	The average yield for corn. consumption					1		=	4.000	4.000	kg/ha
19	The average yield for corn. seed						1	=	3.850	3.850	kg/ha
20	FO1 – TOTAL COSTS	1,90	2,50	1,90	1,70	2,40	2,93	→	MIN	MIN	mii lei/ha
21	FO2 – TOTAL GROSS PROFIT	0,22	0,82	0,66	-0,66	0,44	5,35	→	MAX	MAX	mii lei/ha

Table 4

The main technical – economical indicators in initial variant (V0)

Culture	Surface hectare	The average production – kg/he	The total production - tones	Total income per he -lei	Total income - lei	Total costs per he -lei	Total costs – lei	Gross profits per he–lei	Total gross profit – lei
Wheat for consumption	2948,00	3600	10613	2,12	6262	1,90	5601	0,22	660
Wheat for seed	0	4000	0	0,00	0	0,00	0	0,00	0
Barley	226	4000	904	2,56	579	1,90	429	0,66	149
Oats	124	1900	236	1,05	130	1,70	211	-0,65	-81
Corn for consumptions	14175	4000	56700	2,84	40257	2,40	34020	0,44	6237
Corn for seed	0	3850	0	0,00	0	0,00	0	0,00	0
TOTAL	17473	-	68452	2,70	47227	2,30	40261	0,40	6965

Table 5

The main technical - economical indicators resulting after maximizing the total gross profit (V1)

Culture	Surface hectare	The average production – kg/he	The total production - tones	Total income per he - lei	Total income -lei	Total costs per he -lei	Total costs lei	Gross profits per he–lei	Total gross profit – lei
Wheat for consumption	5000	3600	18000	2,12	10620,00	1,90	9500,00	0,22	1120
Wheat for seed	220	4000	880	3,32	730,00	2,50	550,00	0,82	180
Barley	2300	4000	9200	2,56	5888,00	1,90	4370,00	0,66	1518
Oats	1000	1900	1900	1,05	1045,00	1,70	1700,00	-0,66	-655
Corn for consumptions	8653	4000	34612	2,84	24575,00	2,40	20767,00	0,44	3807
Corn for seed	300	3850	1155	8,28	2483,00	2,93	879,00	5,35	1604
TOTAL	17473	-	65747	2,59	45341,00	2,16	37766,00	0,43	7575

The main technical - economical indicators resulting after minimizing the total costs (V2)

Culture	Surface hectare	The average production – kg/he	The total production - tones	Total income per he lei	Total income - lei	Total costs per he -lei	Total costs – lei	Gross profits per he- lei	Total gross profit – lei
Wheat for consumption	2500,00	3600,00	9000,00	2,12	5310,00	1,90	4750,00	0,22	560,00
Wheat for seed	700,00	4000,00	2800,00	3,32	2324,00	2,50	1750,00	0,82	574,00
Barley	2300,00	4000,00	9200,00	2,56	5888,00	1,90	4370,00	0,66	1518,00
Oats	130,00	1900,00	247,00	1,05	136,00	1,70	221,00	-0,65	-85,00
Corn for consumptions	10793,00	4000,00	43172,00	2,84	30652,00	2,40	25903,00	0,44	4749,00
Corn for seed	1050,00	3850,00	4043,00	8,28	8691,00	2,93	3077,00	5,35	5615,00
TOTAL	17473,00	-	68462,00	3,03	53001,00	2,29	40071,00	0,74	12931,00

CONCLUSIONS

In suburban area (V0), at present time, the area cultivated with cereals is 17473 ha. The total costs are up to 40,3 million lei and gross profit was 6,97 million lei.

In V1 with the purpose function to maximize the total gross profits, total costs were lower with 0,25 million and gross profit is higher with 0,61 million.

In V2, which were aimed the minimizing of the total costs of production, had been registered a reduction of 0,19 mil, with a gross profit of 12,931,000 lei (+ 186%).

Of the two types of optimization can be recommend the first variant, because, can be realize a higher profits comparing V0 with V2.

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