S U M M A R Y

Doctoral thesis entitled **„The optimization of production structure on microzone level, in Botoşani county (Romania)”**, comprises an introduction, 7 chapters and references.

Chapter 1 which has as object **„Theoretical aspects regarding agricultural optimization process”** and it is based on references study, which comprises 241 titles, whom 74 from specialized foreign bibliography.

The approched aspects in this chapter are as fallows:

- in the first part are presented aspects regarding the optimization concept starting from the premise that in agriculture like in entire national economy, the optimization presumes besides economic balance the carrying out of maximum efficiency, both in comparison with material, human and financiar resources use and the extent of agricultural produces demand meeting on the market;

- in the second part is revealed at large the three factors categories which influenced the process of agricultural production optimization:

a) natural factors;

b) economic and organizatory factors;

c) social factors.

- in the last part, the material and research method in the process of agricultural production optimization, are distinguished. In the classic methods group were identified:

- ✓ *multiple variants method;*
- ✓ *planning method;*

and in the modern methods group of operational calculus:

- ✓ *mathematical programming method;*
- ✓ *the balance method of links between agricultural branches.*

In chapter 2 was carrying out a bibliographical research with exhaustive nature, regarding the studies undertaken by different researchers (*Chavas J.P., Fawson C., Candler W., Howitt R.E., Mc Fadden D., Merce E., Moschini G., Otiman P.I., Paris Q., Pope R.D., Shumway C.R., etc*) in the field of agricultural production optimization.

Also, starting with the premise that agricultural production systems are dynamic, were identified and described the main methods and the main proceedings in agricultural production optimization:

- ✓ nonparametric programming;
- ✓ positive mathematical programming;
- ✓ multiple optimal solutions in linear programming;
- ✓ multilevel programming;
- ✓ multiobjective programming.

It follows from this study the importance of mathematical programming within optimization work papers and the stages which must be done to carrying out this process.

Chapter 3 approaches the aspects regarding the material and research method.

To the same effect, there were presented the 10 microzones from Botoşani county (Romania), with their administrative structure and were identified the three microzones judged as representatives for the researched area (Siret, Botoşani and Prut) where it was done the optimization process.

On research methodology level were revealed aspects concerning agricultural production optimization and technical - economic analyse.

Regarding the methodology of agricultural production optimization were presented the three phases which must be covered:

- ✓ present situation analyse;
- ✓ drawing up the perspective development framework of the microzone;
- ✓ drawing up the economic and mathematical model of crops structure optimization.

Technical and economic analyse models for the researched phenomena structure on constitutive elements, presented in this chapter were:

- ✓ comparison method;
- ✓ division method;
- ✓ balances method;
- ✓ statistical grouping method.

In the fourth chapter it is presented an analyse of natural, economic and social potential of Botoşani county.

Natural conditions study in considered area has like purpose the favourability range evaluation for a serial crops, to cover the demand of food products and the disponibilities for their valorisation on internal and external market.

As result of analysing the period comprised between 2000-2004, it resulted that in Botoşani county because of fequent drought periods in may – june, it is necessary the irigation and the afforestations extension.

In regard of the economic potential of Botoşani county, are presented a serial aspects concerning the arable land, subsoil mineral resources, ponds for fishing, dams for irigations and reservations with tourist`s potential.

Researched social aspects within chapter 4 were: working population in the agriculture of Botoşani county, net monthly income in Botoşani county agriculture and the structure of total consum expenses from researched area.

Concerning working population in agriculture, has been found that a continuous decreasing in the period 2002-2004, reaching the share of 48.2% in 2004.

In the same period, in Botoşani county, net monthly income in agricultural sector has been situated under net monthly income on economy level, except year 2004 when it was registered a share of 128.1%.

The analyse of total consum expenses structure on a household from Nord-Est region, revealed two phenomenon:

- ✓ in the period 2002-2004 the share of incomes destinated to acquisition of food products decreased from 57.2% (2002) to 52.9% (2004),
- ✓ in the same period, alocated sums for medical care and education have a low share of 3-4%.

Chapter 5 proposes in first part the presenting of some aspects in respect of importance of entering into force of laws 18/1991 and 1/2001, upon organizatory structure development on agriculture level in Botoşani county.

According to art. 8 of law 18/1991, seting down of private property right upon the lands which were in the co-operatives farms patrimony, was made by reconstruction of proprety right or constitution of this right.

The same law mentioned that the appropriate land varys between 0.5 ha for a each person in right and maximum 10 ha for each family, in arable land equivalent.

By entering into force of law 1/2000, it has been made a partial seting to rights, by reconstruction of proprety right within the limit of 50 ha for each physical person.

In the second part of chapter 5 are presented the evolution and trends from organizatory structures and agricultural production field, registered in researched area.

It was established that in researched microzones the biggest share of land under crops is cultivated in individual agricultural exploitations, with limits between 71.6% in Prut microzone and 93.7% in Siret microzone.

Chapter 5 ends with presentation of aspects concerning the evolution of food products prices on peasant market in Botoşani town and Dorohoi town from Botoşani county.

The sixth chapter treats in the first part a diagnosis study regarding the resources from agricultural sector of concerned microzones.

In the second part of the same chapter we done the crops structure optimization.

To reach this objective, which assume the knowledge of principal technical and economic indicators in present situation for main crops, we used some aspects, as fallows:

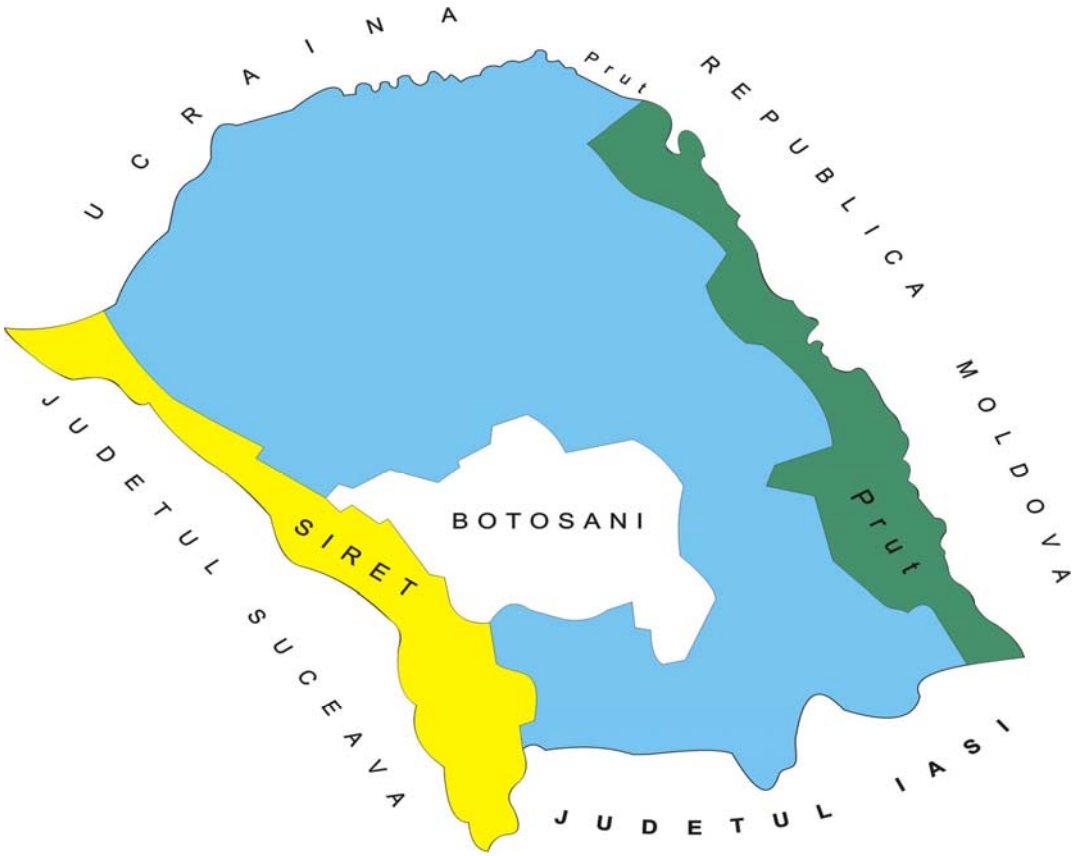
- agricultural area structure on categories;

- arable land structure on crops groups;

- the average yield;

- unit cost and sale average prices;

- gross profit and gross profit ratio, on crop species;



Geographical location of Siret, Botoşani and Prut microzones

Under ecological aspect, in concerned microzones are meet favourable pedoclimatic conditions for cereals, sunflower and forage crops, fact which allows covering forage resources for animals breeding.

Intensified average marks of evaluation for main crops in Siret, Botoşani and Prut microzones

Microzone	Crop								
	Winter wheat	Barley	Maize grains	Potato	Sunflower	Sugar beet	Vegetables		Lucerne
							Cryophilics	Thermophilics	
Siret	66	66	64	84	64	80	73	62	87
Botoşani	49	48	37	42	37	41	51	47	66
Prut	63	61	61	60	53	61	72	71	106

Technical and economic coefficients introduced in the mathematical and economic optimization model had been calculated relying on expenses estimates, on norms of materials and labour force consumption, on costs and saling prices of food products.

Economic and mathematical model restrictions refered to follow aspects:

- *integral utilization of eligible arable land, according to negociations with EU,*
- *providing a minimum crops rotation,*
- *carrying out of minimum quantities of food products,*
- *non-negativity restrictions.*

The objective functions were two as follows:

- *gross profit maximization,*
- *production expenses minimization.*

The solving of economic and mathematical optimization model was achieved by linear programming method, using an specific informatics programme.

Within the frame of the three mathematical programmes, land restrictions were established in accordance with arable land structure negociated by Romania with European Union, before adhering. To the effect of up mentioned, starting with year 2007, main crops shall not overstep registered levels from reference year 2002.

To achieve an accurate optimization, it was applied proportionality principle, by relating crop production from the three microzones with those from national level.

Eligible arable land on national level shall be *7012666 ha* and the crops with the biggest share shall be grains maize, winter wheat, sunflower and barley.

The list of technical and economic coefficients on microzone level

Var. code	Variable	Microzone								
		Siret			Botoşani			*Prut*		
		Average yield (kg/ha)	Average saling price (euro/kg)	Total expenses per ha (euro)	Average yield (kg/ha)	Average saling price (euro/kg)	Total expenses per ha (euro)	Average yield (kg/ha)	Average saling price (euro/kg)	Total expenses per ha (euro)
x_1	Winter wheat	4500	0.11	400	3300	0.11	310	4300	0.11	385
x_2	Barley	4500	0.10	390	3200	0.11	300	4200	0.10	375
x_3	Grains maize	7900	0.09	460	4800	0.10	370	7900	0.10	510
x_4	Autumn potato	21000	0.17	2000	10500	0.23	1900	15000	0.17	2100
x_5	Sunflower	3800	0.19	440	3200	0.21	340	3200	0.19	420
x_6	Sugar beet	78400	0.02	1045	40000	0.02	735	59800	0.02	910
x_7	Soya bean	2000	0.21	365	2000	0.22	395	2500	0.21	450
x_8	Total vegetables	20000	0.28	2400	15000	0.30	2200	23000	0.28	2700
x_9	Hay lucerne	6000	0.07	350	4600	0.09	320	7400	0.07	440
x_{10}	Maize for silage	45000	0.01	300	40000	0.01	285	42000	0.01	265

Principal technical and economic indicators in present situation (V_0)

Indicator	M.U.	Microzone		
		Siret	**Botoşani**	**Prut**
Cultivated arable land, whom:	ha	19856	26823	22860
1. Total grains cereals	ha	13961	20690	16502
- winter wheat	ha	3521	2861	3418
	%	17.7	10.7	15.0
- barley	ha	79	162	81
	%	0.4	0.6	0.3
- maize	ha	10361	17667	13003
	%	52.2	65.8	56.9
2. Grains leguminous crops	ha	2	35	220
- soya bean	ha	2	35	220
	%	0.01	0.1	1.0
3. Total technical crops	ha	1666	2359	4089
- sunflower	ha	900	1802	3783
	%	4.5	6.7	16.6
- sugar beet	ha	766	557	306
	%	3.9	2.1	1.3
4. Total alimentary crops	ha	2210	1914	1201
- autumn potato	ha	1310	976	600
	%	6.6	3.6	2.6
- total vegetables	ha	900	938	601
	%	4.5	3.5	2.6
5. Total forage crops	ha	2017	1825	848
- hay lucerne	ha	1980	1792	833
	%	10.0	6.7	3.6
- maize for silage	ha	37	33	15
	%	0.19	0.1	0.1
Total production expenses	mil. euro	12.41	12.84	13.05
Total incomes	mil. euro	12.07	12.60	8.85
Gross profit or total loss	mil. euro	-0.34	-0.24	-4.20
Gross profit ratio or loss ratio	%	-2.7	-1.9	-32.2

The two variants obtained as a result of optimization were compared with V_0, registering a serial modifications on crops structure level :

- in comparison with variant V_0, coresponding to present situation, variant whom the loss on microzone is between 0.24 and 4.20 millions euro, in variant V_1 gross profit on microzone registers levels between 5.28 millions euro (Botoşani microzone) and 6.59 millions euro (Prut microzone) ;

- because of great expenses for seting up and taking care of autumn potato and sugar beet crops, variant V_1 causes the elimination of these crops from the arable land of all three microzons ; also soya bean crop from Botoşani microzone suffer the same removing process from crops structure.

Principal technical and economic indicators in 2010 (V_1) – Minimum expenses

Indicator	M.U.	Microzone		
		Siret	**Botoşani**	**Prut**
Cultivated arable land, whom:	ha	19856	26823	22860
1. Total grains cereals	ha	12716	17803	15030
- winter wheat	ha	6300	8500	7200
	%	31.7	31.7	31.5
- barley	ha	790	1000	900
	%	4.0	3.7	3.9
- maize	ha	5626	8303	6930
	%	28.3	31.0	30.3
2. Grains leguminous crops	ha	200	0	230
- soya bean	ha	200	0	230
	%	1.0	0.0	1.0
3. Total technical crops	ha	2380	3200	2700
- sunflower	ha	2380	3200	2700
	%	12.0	11.9	11.8
- sugar beet	ha	0	0	0
	%	0.0	0.0	0.0
4. Total alimentary crops	ha	1000	1000	800
- autumn potato	ha	0	0	0
	%	0.0	0.0	0.0
- total vegetables	ha	1000	1000	800
	%	5.0	3.7	3.5
5. Total forage crops	ha	3560	4820	4100
- hay lucerne	ha	1980	2680	2280
	%	10.0	10.0	10.0
- maize for silage	ha	1580	2140	1820
	%	8.0	8.0	8.0
Total production expenses	mil. euro	10.10	10.76	11.53
Total incomes	mil. euro	16.42	16.04	18.12
Gross profit or total loss	mil. euro	6.32	5.28	6.59
Gross profit ratio or loss ratio	%	62.6	49.1	57.2

- in variant V_2, eliminated crops from crops structure in all three microzones are barley and soya bean;

- hay lucerne is also elimiated from crops structure in Siret microzone, and in Prut microzone has a share of only 1.8% ;

- gross profit ratio obtained in variant V_2 is higher only in Siret and Prut microzones, in comparison with variant V_1, with values comprised between 0.6 – 4.1 percentage points ;

- crops which are reaching the maximum ceiling imposed by the negociations between Romania and European Union, are winter wheat, grains maize, sunflower and sugar beet.

Principal technical and economic in 2010 (V_2) – Maximum profit

Indicator	M.U.	Microzone		
		Siret	Botoşani	Prut
Cultivated arable land, whom:	ha	19856	26823	22860
1. Total grains cereals	ha	13576	16593	16300
- winter wheat	ha	5676	5893	7200
	%	28.6	22.0	31.5
- barley	ha	0	0	0
	%	0.0	0.0	0.0
- maize	ha	7900	10700	9100
	%	39.8	39.9	39.8
2. Grains leguminous crops	ha	0	0	0
- soya bean	ha	0	0	0
	%	0.0	0.0	0.0
3. Total technical crops	ha	3310	3880	3070
- sunflower	ha	2380	3200	2700
	%	12.0	11.9	11.8
- sugar beet	ha	930	680	370
	%	4.7	2.6	1.6
4. Total alimentary crops	ha	1390	1530	1250
- autumn potato	ha	390	530	450
	%	2.0	2.0	2.0
- total vegetables	ha	1000	1000	800
	%	5.0	3.7	3.5
5. Total forage crops	ha	1580	4820	2240
- hay lucerne	ha	0	2680	420
	%	0.0	10.0	1.8
- maize for silage	ha	1580	2140	1820
	%	8.0	8.0	8.0
Total production expenses	mil. euro	11.58	12.05	12.65
Total incomes	mil. euro	19.31	17.71	19.96
Gross profit or total loss	mil. euro	7.73	5.66	7.31
Gross profit ratio or loss ratio	%	66.7	47.0	57.8

In the third part of chapter 6 are presented aspects concerning the fundamenting of livestock production structure on microzone.

As part of this step, it takes into account the lowest cost for each forage ration, and in the same time the necessary of nutritive elements for feed and obtaining high productions on each animal specie.

In the case of cattle and ewes, in view of establishing the economic and mathematical model, were calculated INRA indicators: yield kg/ha, DS/ha, PDIN/ha, and PDIE/ha.

Because of important cattle livestock from Siret and Botoşani microzones, the necessary of maize for silage and pasture green grass, weighs the most in forages balance.

Annually forages necessary per total animal species, on microzone

No. crt.	Specification	M.U.	Microzone		
			Siret	Botoşani	Prut
1	Pasture green grass	t	38089	36041	21560
2	Hill hay	t	6398.4	6056.6	3624.9
3	Hay lucerne	t	13909	18096.7	11140.4
4	Maize for silage	t	64168.8	74554.6	45126.8
5	Grains maize	t	14654	17063.1	12657.4
6	Grains barley	t	4161	3394.5	2956.5
7	Sunflower grist	t	2012.7	2060.1	1553.4
8	Soya bean grist	t	2273.2	2459.4	1802.4
9	Wheat husk	t	7791.9	9412.6	6381.6
10	Fats	t	176.5	209.7	171.8
11	Fish meal	t	88.3	104.9	85.9
12	Monocalcic phosphate	t	17.34	16.32	9.69
13	Dicalcic phosphate	t	213.13	206.74	174.6
14	$CaCO_3$	t	124.83	101.84	88.7
15	Fodder chalk	t	509.2	605	495.5
16	L Lysin	t	124.83	101.84	88.7
17	Urea	t	63.73	114.98	71.28
18	Zoofort	t	213.13	206.74	174.6

The biggest necessary of grains maize, soya bean grist, wheat husk and hay lucerne is in Botoşani microzone, because of large livestocks of cattle and poutry.

In the case of grains barley situation is changing, this time Siret microzone presenting the biggest necessary, because of large swine livestock.

Dimension and fodder base structure per total species, on microzone

No. crt.	Specification	Microzone					
		Siret		Botoşani		Prut	
		ha	%	ha	%	ha	%
1	Pasture green grass	1905	10.9	1802	7.1	1078	8.2
2	Natural hayfield	1280	7.3	1212	4.8	725	5.5
3	Hay lucerne	2320	13.2	3935	15.6	1507	11.4
4	Winter wheat	5773	32.9	9509	37.7	4948	37.6
5	Barley	925	5.3	1061	4.2	704	5.3
6	Grains maize	1857	10.6	3557	14.1	1604	12.2
7	Maize for silage	1462	8.3	1865	7.4	1075	8.2
8	Sunflower	885	5.0	1074	4.2	810	6.1
9	Soya bean	1137	6.5	1230	4.9	722	5.5
Total		**17544**	**100**	**25245**	**100**	**13173**	**100**

In the last part of chapter 6, are treated aspects of general optimization of agricultural production in concerned microzones.

Animal livestocks on microzone, consistent with general optimization

Animal specie	Microzone		
	Siret	Botoşani	Prut
Cattle – total, whom: - milch cows - meat cattle	14000 6800 7200	13300 6400 6900	8000 3800 4200
Ewes	12156	14896	21700
Swine	11400	9300	8100
Poultry	186000	221000	181000

As result of general optimization, cattle livestock shal reach maximum level imposed by national ceiling negociated with EU.

Swine and poultry species shall remain to constated level in year 2004, considered an optimum one.

Concerning ewes, the livestocks from Siret and Botoşani shall register follow levels in comparison with maximum ceiling:

- 62.6% in Siret microzone,

- 42.6% in Botoşani microzone.

As result of general optimization, crops structure registered some modifications. Thus, at the level of variant V_1, whom it was follow the carrying out minimum expenses, there are distinguished a serial aspects:

- the share of grains maize crop had reduced in comparison with V_1 of crops structure optimization, except Prut microzone, where it is increased with 7.5 percentage points;

- concerning gross profit ratio, registered an increase of 1.2% only in Prut microzone, the rest of microzones registered a decrease of 0.1-0.3%.

Economic indicators from the variant V_2, where it was follow carrying out the maximization of profit, also presented a serial modifications in comparison with crops structure optimization:

- increase of winter wheat share at 23.0% in Botoşani microzone, as result of general optimization;

- gross profit ratio as result of general optimization registred an increase of 0.5 percentage points in Prut microzone and a stagnation in Siret and Botoşani microzones.

Doctoral thesis ends with conclusions, recommendations and references.