The necessity of drawing up the annual production plan and the importance of establishment crop structure for next agricultural year

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THE NECESSITY OF DRAWING UP THE ANNUAL PRODUCTION PLAN AND THE IMPORTANCE OF ESTABLISHMENT CROP STRUCTURE FOR NEXT AGRICULTURAL YEAR

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Summary: *Planning represents establishment and substantiate the objectives, accomplish tasks and necessary resources for appropriate period plan (of perspective, annual, quarterly, monthly). Drawing up annual production plan into a ferm is required primarily for evolution or involution recorded by economical phenomenes, which directly determines the operation of the farm.*
After determining the annual production plan can establish structures and cultures for the next agricultural year using modeling and simulation methods. Following the application of modeling and simulation methods in a farm resulting optimal dimensions of business operations with profit maximization in terms of economic efficiency increased.

Keywords*: production plan , resources, technical and economic indicators, modeling and simulation.*

INTRODUCTION

Economic situation of the year depends on the decisions made about what crops will be set up in the spring and the judicious use of the land, the culture plan drawn up.

In the decisions we take, there are some mandatory directions that we have to consider, such as:

- The crop in the previous year, according to which we must establish what cultivate to ensure a good crop rotation, knowing that the right choice of prior plants is the cheapest way to combat weeds, diseases, pests

- Restoring soil water reserves after a highly dry autumn and a started winter with little rainfall , which obliges us to orient of crops with less water, so resistant to drought;

-Establishing the structure of crops for the next agriculture year is important because activities must be dimesnsionate optimally to ensure a positive result of the exercise with minimal expenses.

MATERIALS AND METHODS

For establish the annual plan of crop one material is indispensable, this is the data sheet technological , this is a document in which they are listed in chronological order all agricultural work (manual and mechanized) - being executed for a certain culture.

Technological sheet helps us to determine: need for agricultural machinery and equipment, the need for manual labor and mechanized, the necessary raw materials and the necessary financial resources setting will help us in forecasting average production to be obtained in culture respective.

In the technological sheet are found only direct costs.

To determine the structure of crops for next agricultural year we used two methods of modeling and simulation:

1) Method logical variants -Method modeling and simulation of activities within a company and serves to determine the optimal structure of company activities in order to profit maximization. To use this method starts from the surface and consumption, the method consists in building the "x" alternatives taking into account the consumption indicator lines is considered bigger and consider indicators that are restrictive.

   These variants were made using calculations necessary human days in months and to the economic and financial cultures, all this information was obtained from annual production plan.

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Tables variants have changed crops in rotation surfaces, respecting restrictions to choose, what brings the greatest profit.

2) Linear programming optimization method size and structure of farm crops

- Parts of the mathematical model
    a. lens- function may be to maximize profit or minimize costs
    b. technical and economic-matrix coefficients
    c. Resources
    d. non-negativity condition (CNN)-any activity of the company must be greater than 0

3) The mathematical model to optimize the size farm.

After determining the activities and resources, creating the mathematical model and algebraic form of a matrix can build notepad file by using the file we run the simplex to determine first solution and dual solution.The optimization algorithm using farm size SIMPLEX- that schedule is represented by a number of determinants, calculations, signs, conditions and restrictions.

RESULTS AND DISCUSSION

Making a model of annual production plan

The annual plan production on a farm is a support to farmers, it helps to better management of activities in society. : Development plan is done taking into account several criteria:

- The favorable land available for different culture
- Crop rotation
- Impact on soil and the environment
- Net profit (per parcel and per holding)
- Restrictions in preparing crop rotation

Knowing the cost of the necessary human resources, materials and equipment, consequential helps anticipation of such holding planned and will be able to ensure the optimum functionality.

Whereby the Company issued annual production plan is fictitious located in Prahova - Ciorani ,cultures prevalent for this area are: wheat and rye, maize, sunflower, sugar beet, potatoes and vegetables.

Table 1. Cultures were grown in the plan at the company analyzed

No.	**Culture**	**Previous Year**		**Year Plan**		**Next Year**	
		ha	**%**	**ha**	**%**	**ha**	**%**
1	Pease	4	6.25%	**5**	**7.81%**	3	4.68%
2	Wheat	28	43,75%	**29**	**45.31%**	30	46,88%
3	Maize	18	28,12%	**14**	**21,88%**	19	29.68%
4	Sunflower	14	21,87%	**16**	**25%**	12	18,76%
	Total	64	100%	**64**	**100%**	64	100%

With technological sheet for each crop we Calculation of man days in months and cultures, data were extracted from column No. 11 and based on the work carried ha is possible that day man will be represented in the same month several times, in this case the data obtained are gathered in that month multiplied by the total number of hectares for each crop

Table 2. Calculation of man days per month and culture

No.	**Month**	**Total holding**	**Wheat 29 ha**	**Maize 14 ha**	**Sunflower 16 ha**	**Peas 5 ha**
1	January	-	-	-	-	-
2	February	2,9	2,9	-	-	-
3	March	7,065	-	-	5,28	1,785
4	April	75,804	23,9	3,024	48,48	0,4
5	May	42,42	-	42,42	-	-

6	June	96,42	4,64	42,42	48,96	0,4
7	July	10,43	3,48	-	-	6,95
8	August	27,57	21,17	-	6,4	-
9	September	51,42	2,9	48,02	-	0,5
10	October	63,13	6,09	55,44	1,6	-
11	November	-	-	-	-	-
12	December	-	-	-	-	-
13	Total	377,16	65,08	191,32	110,72	10,035

Source: own processing -conform sheet technology

After achieving this table I found that analyzed holding permanent workers will have 2 and 4 laborers (for the whole year) which is employed only where required to do so months (April, June, September, October).

Still using sheet technology have established and the necessary normal day of mechanized and the demand for tractors, data were extracted from column No. 7, according to the work carried ha are likely day of mechanized be represented in the same month several times in this case the data obtained are gathered on the month and multiplied by the total number of hectares for each crop and divided to 8 (this being the number of hours worked per day)

Table 3. Establishing the necessary days and the necessary time mechanized tractors

No.	**Month**	**Total holding**	**Wheat 29 ha**	**Maize 14 ha**	**Sunflower 16 ha**	**Peas 5 ha**
1	January	-	-	-	-	-
2	February	1,381	1,381	-	-	-
3	March	6,525	-	-	5,128	1,397
4	April	7,948	1,359	5,467	0,888	0,234
5	May	0,56	-	0,56	-	-
6	June	6,251	3,292	0,87	1,744	0,345
7	July	20,072	8,856	-	5,596	5,62
8	August	1,892	1,892	-	-	-
9	September	17,819	11,662	2,814	-	3,343
10	October	17,932	8,098	4,834	5	-
11	November	-	-	-	-	-
12	December	-	-	-	-	-
13	Total	80,38	36,54	14,544	18,356	10,939

Source: own processing -conform sheet technology

Using the table above we found that we needed one tractor to be completely independent of equipment outside the company.

Table 4. The needs of diesel per hectare

No.	**Month**	**Total holding**	**Wheat 29 ha**	**Maize 14 ha**	**Sunflower 16 ha**	**Peas 5 ha**
1	January		-	-	-	-
2	February	1,527	1,527	-	-	-
3	March	30,293	-	-	16,021	14,272
4	April	26,786	1,29	21,206	3	1,29
5	May	2,2	-	2,2	-	-
6	June	13,979	4,62	2,979	4,29	2,09
7	July	66,614	16,266	-	-	50,348
8	August	27,008	1,968	-	25,04	-
9	September	78,724	27,66	9,974	-	41,09
10	October	63,028	14,263	26,659	22,106	-
11	November	-	-	-	-	-
12	December	-	-	-	-	-
13	Total	310,159	67,594	63,018	70,457	109,09

Table 5. Requirement retributions per hectare

No.	Month	Total holding	Wheat	Maize	Sunflower	Peas
1	January	-	-	-	-	-
2	February	4,1	4,1	-	-	-
3	March	32,4	-	-	17,6	14,8
4	April	140,9	3,3	8,9	125,4	3,3
5	May	125,4	-	125,4	-	-
6	June	261,9	6,6	125,4	126,6	3,3
7	July	62,5	5,0	-	-	57,3
8	August	47,3	30,7	-	16,6	-
9	September	128,4	0,4	124	-	4
10	October	175,5	8,4	163,1	4	-
11	November	-		-	-	-
12	December	-		-	-	-
13	Total	978,4	58,5	546,8	290,2	82,9

Source: own processing -conform sheet technology

The need for retributions is shown in column no.13 of sheets technological and represents the amount of money spent on certain activities per hectare.

Following those discussed above will be calculated expenses, revenues and financial results for the entire farm.

Table 6. Distribution of expenses per per hectare per crop area

No.	Activity	Surface	Direct Expenses		Indirect Expenses		Total expenses	
0		**ha**	**ha**	**Surface**	**ha**	**Surface**	**ha**	**Surface**
1	Wheat	29	3.293,1	95.499,9	131,72	3.820	3.424,82	99.319,9
2	Maize	14	3.241,8	45.385,2	129,67	1.815,41	3.371,47	47.200,61
3	Sunflower	16	2.923,9	46.782,4	116,96	1.871,30	3.040,86	48.653,70
4	Peas	5	4.097,4	20.487	163,90	819,48	4.261,30	21.306,48
5	Total	-	-	**208.154,5**	-	**8.326,18**	**-**	**21.6480,7**

Source: own processing -conform sheet technology

Direct expenditures are drawn from technological sheet and indirect costs represent 4% of direct expenses. Analyzing the structure of total expenditures reveals that the highest values were recorded by Expenditures of the wheat crop lei 99319.9. At the opposite pole pea crop, accounting value of 21306.48.

Table 7. Calculation economic and financial results

No.	Activity	Surface	Production (tonnes)		Production Cost	Sale Price	Revenue	
0		ha	ha	Surface				lei/ Surface
1	Wheat	29	5	145	684,96	700	3.500	101.500
2	Maize	14	6	84	561,91	650	3.900	54.600
3	Sunflower	16	4	64	760,21	1.400	5.600	89.600
4	Peas	5	4,5	22,5	946,95	1.200	5.400	27.000
5	Total	-	-	-	-	-	-	**272.700**

Expenses		Profit / loss without subsidies		Profit / loss with subsidies	
lei/ha	**lei/Surface**	**lei/ha**	**lei/ Surface**	**lei/ha**	**lei/ Surface**
3.424,82	99.313,9	75,17	2.186,1	779,17	22.596,1
3.371,47	47.200,61	528,52	739,39	928,52	12.999,39
3.040,85	48.653,7	2.559,14	40.946,3	2.691,14	43.058,3
4.261,29	21.306,48	1.138,70	5.693,52	1.270,70	6.353,52
-	**325.123,5**	**-**	**56.225,32**	**-**	**85.007,32**

Source: own processing -conform sheet technology

In the annual production plan we have the following steps:
• Establishing crop
• The location of the crop in the previous year plan, the planyear and the following year plan
• Establishing the necessary mechanized and manual ruledays
• Evaluation of prices and tariffs
• Calculation of revenue and financial results at farm leveland for each activity

Development of *a model to optimize* the size and structure of farm crops by methods of modeling and simulation

Multiple logical method variants - is the construction of "x" variants that are given values each activity so as to comply with certain requirements on total arable area, crops to rotation requirements, the availability of labor. This is a method of modeling and simulation and is designed to determine the optimal structure of company activities in order to obtain maximum profit.

Variant logic no.1

		Profit		**consumption man days / ha**		**consumption m.d/surface**		**available man days**		**available m.d.consumption /surface**	
Activity	Surface	ha	Total	Month	Total	Month	Total	Month	Total	Month	Total
Wheat	28	779,17	21.816,93	0.16	1.5	4.48	42				
Maize	18	928,52	16.713,5	3.03	13.66	54.54	245.88				
Sunflower	14	2.691,14	37.676,02	3.06	7.02	1.12	98.28				
Peas	4	1.270,70	5.082,81	0.08	2.007	12.24	8.028				
Total	64		**81.289,26**			72.38	394.188	46	414	-26.38	19.812

Variant logic no.2

		Profit		**consumption man days / ha**		**consumption m.d/surface**		**available man days**		**available m.d.consumption /surface**	
Activity	Surface	ha	Total	Month	Total	Month	Total	Month	Total	Month	Total
Wheat	29	779,17	22.596,1	0.16	1.4	4.64	40.6				
Maize	14	928,52	12.999,39	3.03	13.66	42.42	191.24				
Sunflower	16	2.691,14	43.058,3	3.06	7.02	48.96	112.32				
Peas	5	1.270,70	6.353,52	0.08	2.007	0.4	10.035				
Total	64		**85.007,32**			96.42	354.195	46	414	-50.42	59.81

Variant logic no.3

		Profit		**consumption man days / ha**		**consumption m.d/surface**		**available man days**		**available m.d.consumption /surface**	
Activity	Surface	ha	Total	Month	Total	Month	Total	Month	Total	Month	Total
Wheat	23	779,17	17.921,05	0.16	1.4	3.68	32.2				
Maize	19	928,52	17.642,03	3.03	13.66	57.57	259.54				
Sunflower	16	2.691,14	43.058,3	3.06	7.02	48.96	112.32				
Peas	5	1.270,70	6.353,52	0.08	2.007	0.4	10.035				
Total			**84.974,9**			110.61	414.095	46	414	-64.61	-0.095

Variant logic no.4

		Profit		**consumption man days / ha**		**consumption m.d/surface**		**available man days**		**available m.d.consumption /surface**	
Activity	Surface	ha	Total	Month	Total	Month	Total	Month	Total	Month	Total
Wheat	**19**	779,17	14.804,34	0.16	1.4	3.04	26.6				
Maize	**20**	928,52	18.570,56	3.03	13.66	60.6	273.2				
Sunflower	**16**	2.691,14	43.058,3	3.06	7.02	48.96	112.32				

Peas	**8**	1.270,70	10.165,63	0.08	2.007	0.64	16.056				
Total			**86.598,84**			113.24	428.176	46	414	-67.24	-14.176

I realized logical variants using tables 2 and 5, the tables have changed variants crops in rotation surfaces, respecting restrictions to choose, what brings the greatest profit. Thus, we obtained the 4th variant as the best option. With this variant, a profit of 86598.84, conducted by two workers for 23 days per month during 9 months.

Linear programming method to optimize the size and structure crop farm

Linear programming is directed to a particular class of optimization problems which are often found in the economic applications. These problems consist of maximizing or minimizing a linear function called objective function, whose variables must satisfy:
• relations system data in the form of equations and / or non-strict linear inequalities, collectively restrictions;
• requirement to take only non-negative numeric values (≥0).

Components of the mathematical model:
1. The objective function, which is to maximize profit or minimize costs
2. The technical and economic matrix coefficients
3. resources
4. The condition of non-negativity

Table 8. Activities and resources

					resources
Activity	**Wheat**	**Maize**	**Sunflower**	**Peas**	64ha
Profit	779,17	928,52	2691,1	1270,7	
consumption man days / year	65,08	191,32	110,72	10,035	
consumption man days june / ha	4,64	42,42	48,96	0,4	
consumption mechanized days/year	36,54	14,54	18,35	10,93	
consumption mechanized days june/ha	3,29	0,87	1,744	0,345	
retributions	58,5	546,8	290,2	82,9	16000

- **algebraic form of the mathematical model**

O.F =profit= surface
*O.F=779,17*x1+928,52*x2+2691,1*x3+1270,7*x4*

L1 SURFACE TOTAL = X1+X2+X3+X4 ≤ 64 Ha
L2 STRAW SURFACE = X1 ≤ 32 Ha
L3 SURFACE.SUNFLOWER (25%) = X3 ≤ 16Ha
L4 SURFACE MAIZE(30%) = X2 ≤ 20Ha
L5 SURFACE VEGETABLES (15%) = X4 ≤ 11Ha
L6 consumption man days / year = 1,4x1+13,66x2+7,02x3+2,007x4 ≤414
L7 consumption man days june / ha = 0,16x1+3,03x2+3,06x4+0,08x4 ≤ 46
L8 consumption mechanized days/year = 3,22x1+1,63x2+1,11x3+2,18x4 ≤ 414
L9 consumption mechanized days june/ha = 0,11x1+0,602x2+0,109x3+0,069x4 ≤ 46
L10 retributions = 58,5x1+546,8x2+290,2x3+82,9x4 ≤ 16000

- **matrix form of the mathematical model**

O.F.. [779,17;928,52; 2691,1;1270,7]

L1	1	1	1	1	≤	64
L2	1	0	0	0	≤	32
L3	0	0	1	0	≤	16
L4	0	1	0	0	≤	20
L5	0	0	0	1	≤	11

Following the completion of two forms, algebra and matrix, a mathematical model can be built using notepad file which can run simplex algorithm, used to optimize the size of the farm to reach maximum profit. After running the program will give two solutions:

a) **PRIMARY** solution - this is reflected in the structure and activities are eaten each restriction placed

My example is done for a unit with an arable area of 64 ha which is manual labor two workers standing for 23 normal days per month for nine months and has two machines for 23 normal days per month period of 9 months.

To get maximum profits can grow on the 64ha area: 32 hectares of wheat, 20 hectares of maize, 16 hectares sunflower and 11 hectares peas. Of the four selected crops were grown only 2.61 hectares of maize, 11 hectares over the surface of peas and corn 16 hectares.

The contribution activities in this holding is as follows: the 2.61 ha planted with maize intake of 2426.68 lei (2.61 * 92.52) fl.soarelui area has 16ha planted with a contribution of 43,057.60 lei (16 * 2691.10) on 11ha planted peas are obtained 13977.70 lei (11 * 1270.70).

VARIABILE PRIMALE:

Variabila:	Denumire:	Marime :	Valoarea in Func. Ob.:	Aport la Func. Ob.:
X 2	Porumb	2.61	928.52	2426.68
X 3	Floarea Soa	16.00	2691.10	43057.60
X 4	Mazare	11.00	1270.70	13977.70

Variabila:	Denumire :	Cantitatea ramasa:	Cantitatea initiala :	Cantitatea consumata:
L 1	suptot	34.39	64.00	29.61
L 2	SUP PAI	32.00	32.00	0.00
L 3	SUP Pb	17.39	20.00	2.61
L 6	ZO TOT	243.90	414.00	170.10
L 7	ZMEC TOT	356.24	414.00	57.76
L 9	ZMEC IUN	41.92	46.00	4.08
L 10	RETRIBUTII	9015.84	16000.00	6984.16

b) **DUAL** solution - it contains only the resources that are consumed entirely

Interpretation dual solution

Restrictions that condition for chosen cultural :

- L4 SUPFls (16 ha),
- L5 SupMz (11),
- L8 JUN ZO (46),

which are wholly consumed in the multitude of restrictions, resulting in maximum profit. (resources of this solution are limiting factors) .

Noteworthy is that the value of 59461.98 O.F. product yield and 11ha * 28.87559lei + 16ha * 2.058,79+ 46 * 569.6442 lei

VARIABILE DUALE:

Variabila:	Denumire:	Valoare duala :	CANTITATE:	APORT marginal :
L 4	SUP Fls	2058.795	16	32940.72
L 5	Sup Mz	28.87559	11	317.6315
L 8	ZO IUN	569.6442	46	26203.63

VALOAREA FUNCTIEI OBIECTIV = 59461.98

- parameterization is achieved by modifying restrictive factors and aims to optimize its tasks efficiently in order to obtain maximum profit.
- By modifying restrictive factors in dual solution namely man days june (from 46 to 115 days ie from 2 to 5 workers) and man days / year (from 414-621, ie from 2-3 permanent workers)found that all four cultures were cultivated sunflower and pea areas being cultivated in toatalitate, corn surface area being cultivated in 88% - 17.62 ha, the area cultivated least 43.2% -13.83 wheat.

The contribution to the objective function for each crop being 10776.72 - wheat, 16362.50-corn, 43057.60-sunflower, 13977.70-peas. O.F.→ 84174.53

- I noticed it is that the value of O.F. increased from 59461.98 to 84174.53 after parameterization

CONCLUSIONS

The production plan of the farm includes all the results expected to be obtained on production sectors and categories of activities and material and human resources necessary to fulfill them.

For the preparation of production and business at farm level (vegetable farms) can also use the program AGR4 it allows updating all indicators, monthly or at any time, which is information realist "Today" in the act of operative management, increasing the effectiveness of the decisions.

Although both methods of modeling and simulation profit realized I recommend the method of modeling and simulation through linear programming, even if it does not bring a profit as high as the profit obtained by the method variants logical believe that this profit is made safe since it established more restrictions.

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