DETERMINING CROPS ECONOMIC EFFICIENCY USING CROP BUDGETS FOR THE NORTH-EAST REGION OF ROMANIA

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Abstract

The paper aims to highlight the necessity of using the crop budget as a comprehensive tool in determining the crop related expenditure - stage that precedes economic efficiency calculation. The drawn up form comprises two interconnected elements that communicate through associated formulas. We designed a table with specific data based on recommendations from the economic literature that reflects the entire production process in agriculture, results being used to determine the crop economic efficiency items represented also as tabular form. The tables made in Microsoft Excel can be used for any crop, with characteristic changes related to technology, any value change in the crop budget resulting in changes for the economic efficiency sheet. Thus it can be viewed and recorded immediately the economic effects of production variation with one or more units. There are taken into account the expenses regarding mechanical and/or manuals operations and materials used as well as the income from primary and secondary production, highlighting the main economic indicators associated. In calculating the efficiency there were taken into consideration also the subsidies - elements with significant weight in the structure of total revenue for a particular crop, related to the specific conditions of the North-East region of Romania. The form can be used in agricultural management as a tool for analysis of the various technological options applicable for the same crop in order to ensure the highest level of economic efficiency and establishing the level of production necessary to achieve a minimum outcome aimed under the specific circumstances.

Key words: crop budget, economic efficiency, total expenses, production cost, net profit

Unlike the companies from other sectors of the economy agricultural production presents a wide range of features that need to be taken into account since they have a strong influence on the production process in time and space *(*Brezuleanu S., 2009*)*.

These features needs to be studied in order to understand their social an economic impact. In order to achieve this objective the analyse must take into consideration also the benefits.

Romanian agriculture benefit, like other Member States, and other forms of support, including semi-subsistence restructuring, community support from structural funds for investment in agricultural and other economic activities in rural areas, substantial support for rural development and environmental protection (Ungureanu G. *et al,* 2013).

In agriculture as in any oher domain it is needed to be determined the economic efficiency. It indicates and justify continuing the agricultural activity and adding new investments regarding future development.

Economic efficiency is linked to profit as the difference between the value of marketable production and total production costs, which relate to factors that the entrepreneur has to purchase on the market (explicit costs), being a ratio between the economic result realized with this effort (Ştefan G. *et al,* 2006).

Development and modernization of agricultural holdings will be achieved through the expansion, improvement and rational use of material and technical resources that are acting in the complex process of obtaining and supply of agricultural products (Brezuleanu S. *et al,* 2010).

One of the most important and common tool that precedes economic efficiency calculus is represented by the crop budget.

Crop budget is a table in which there are presented in chronological order of performing, all work processes and all works referring to production technology, indicating optimal periods for their execution and determining, based on norms adapted to local conditions the necessary amount of work resources (tractors, machinery, vehicles, equipment, seeds, fertilizers, etc.), workforce, production expenses in order to obtain agricultural production with minimum costs per product unit (Ciurea I.-V. *et al,* 2001*)*.

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Crop budgets can be used to provide an estimate of overall profitability and resource requirements (land, machinery, labor). Budgets also can be used to estimate borrowing needs and cash flow for the farming operation (Greaser G. *et al,* 1994).

The economic efficiency calculation uses analysis of the specific costs for the inputs necessary for the production process.

Cost analysis is a technique for enterprise performance evaluation that helps at reflect the usage of material and human potential of the company and identify cost reduction of existing stocks in the company (Chiran A. *et al,* 2012).

Enterprise budgets represent estimates of receipts (income), costs, and profits associated with the production of agricultural products. The information contained in the enterprise budgets can be used by agricultural producers, extension specialists, financial institutions, governmental agencies, and other advisers making decisions in the food and fiber industry (Greaser G. *et al,* 1994).

There is no guarantee that resources will be fully employed or that they will be used in the most efficient way *possible (Sloman J., 1999)* but a well-structured plan of expenditure and income and may increase the level of functioning towards optimum.

MATERIAL AND METHOD

The paper used an aeconomic model in order to illustrate the way it can be customized and applied to every crop considering the specific technology. The drawn up model comprises two interconnected elements that communicate through associated formulas. It was designed a table with specific data based on recommendations from the economic literature that reflects the entire production process in agriculture, results being used to determine the crop economic efficiency items represented also as tabular form.

The tables made in Microsoft Excel can be used for any crop, with characteristic changes related to technology, any value change in the crop budget resulting in changes for the economic efficiency sheet. Thus it can be viewed and recorded immediately the economic effects of production variation with one or more units. Economic efficiency analysis utilised values from the crop budget regarding the expenses and adding information regarding the income, the taxes or the subsdidies.

The crop budget - as an important tool in creating an agricultural activity overview ensures identifying details that can lead to a positive or a negative economic result. The current model uses data according to North-East Region conditions and the entry data are as a rough guide indicating that it is a functional model.

RESULTS AND DISCUSSIONS

In order to fill in the drawn up spreadsheet containing the table form of the crop budget there was needed to identify the entry data: crops included in the production plan of the farm, the area occupied by each crop, the previous crop, the total production and the yield of each crop (primary production and secondary production), technological works in chronological order of their execution, times of execution and duration of the work, the means the works are executed (mechanical, manual), the cost of mechanical works, irrigation norms and cost of irrigation water, the cost of of manual work per category, taxes for the CAS, unemployment, risk and insurance, specific depreciation, the materials needed in technological process, the supply expenses share and the share of indirect expenses (general and common).

The crop budget can be applied only on a crop at the time, the process being needed to be restarted and separated once we add a new crop.

Elaborating the crop budget consist in following the following main steps:

- identifying the specific crop;
- recording into the spreadsheed data regarding the area and the yield. The yield is planned in relation to the variety, soil fertility, fertilizer quantities applied, etc.;
- specifying technological works in their execution order, adding optimum execution period and the duration of each work;
- determining for each work the volume of work, the sums required for its execution, materials needed and their cost;
- calculating for manual works in relation to the volume the number of z.o. The wage fund results by multiplying the number of z.o. necessary for carrying out the work with tariff per z.o. according to work category.

The model uses as example values characterizing North-East Region *(figure 1).*

Figure 1 **Development regions of Romania**

There are taken into account the expenses regarding mechanical and/or manuals operations and materials used as well as the income from primary and secondary production, highlighting the main economic indicators associated. In calculating the efficiency there were taken into consideration also the subsidies - elements with significant weight in the structure of total revenue for a particular crop, related to the specific conditions of the North-East Region of Romania. The evolution of area cultivated and production recorded for maize crop in this region indicate the level of importance at the national level considering that North-East Region owns 16.7% from the total maize production *(table 1)*.

Table 1

The evolution of area cultivated and production recorded for maize crop in North-East Region in comparison to the others regions and to the national level

Region		U.M	Year				
			2011	2012	2013	2014	2015
TOTAL COUNTRY	Area	to	11717591	5953352	11305095	11988553	8984743
	Production	ha	2589667	2730157	2518268	2512809	2604475
NORTH-WEST	Area	to	1060818	648234	1094982	1226272	873385
	Production	ha	239673	237459	256501	265360	276771
CENTER	Area	to	675837	406965	644116	789254	647428
	Production	ha	144772	160100	149846	153338	160834
NORTH-EAST	**Area**	**to**	**1966518**	**977220**	**2057116**	**2261309**	**1497386**
	Production	**ha**	**463941**	**494583**	**453051**	**455280**	**475646**
SOUTH-EAST	Area	to	2454524	839806	2055168	2127758	1565550
	Production	ha	515777	500112	481659	469681	471829
SOUTH-MUNTENIA	Area	to	2381534	1388692	2519407	2449250	2032933
	Production	ha	479875	544146	484636	462541	499903
BUCHAREST - ILFOV	Area	to	38721	12555	48989	52475	47324
	Production	ha	8663	7305	10387	9804	11081
SOUTH-WEST OLTENIA	Area	to	1569294	604181	1475745	1444982	1066284
	Production	ha	386455	414269	346643	349284	360465
WEST	Area	to	1570345	1075699	1409572	1637253	1254453
	Production	ha	350511	372183	335545	347521	347946

Data provided by National Institute of Statistics

After the general results were obtained by automatic calculation using the entry data filled in the model, the next step is to draw the economic efficiency table that consist in data from the crop budget but also new element needed to determine the crop profitability.

The model can be extended adding the lease in case the entrepreneur does not own land or he wants to extend his cultivated area. In this case the expenditure is modified and the final economic result is influenced.

The crop budget for maize *(table 2)* indicates resources utilised in the agricultural activity as detailed as possible offerind data regarding the norms for manual works, the diesel fuel consumption in standard conditions, aggregate productivity, the quantities of fertilizers based on necessary for the active substance previously determined etc.

The most common changes for the same crop reffers to the yield (that can vary from a year to an other, from a region to an other or from a farm to an other) and the price of main production determined by the demand and the supply in the market.

The form model may be added-up (using the crop budget and the economic efficiency analysis) with break-even analysis. The interconnected formulas lead to the fact that filling the crop budget form generates automatically economic efficiency calculation and break-even point production quantity. This will represent the topic for a future scientific paper.

Table 2

Crop budgets for maize, version with mechanical harvesting - 2016

Area: 100 ha Yield: main 8500 kg/ha Total production: main 850 t MECHANICAL HARVESTING
secondary 9500 kg/ha secondary 950 t

Work	Month/ ten-days period	U.M.	Vol.	Norm zo/UM	Manual works Total z.o.	Wage category	lei/ z.o.	**Wages (lei)**	Mechanical works Unit	Price ha/a.n.	conversion factor	Ha a.n	**Total (lei)**	Materials	Materials consumption onsumptio /ha	Total kg	Price lei/kg	**Total (lei)**	**Norm** per unit	z.a	**Price mechan**	**Wages mechan. (lei)**	**F.c.**	Diesel fuel consumpt. litres	**Total works (lei)**
1	2	3	4	5	6	7	8	**9**	10	11	12	**13**	14	15	16	17	**18**	19	**20**	21	**22**	**23**	24	**25**	**26**
Loading, transporting CF (PK)	IX/1	t	26	0,11	2,86	II	40	**114,40**	2RM2	370	0,05	5,0	**1850,00**	superphosphate	140	14000	1,6	**22400,00**	25	1,04	60	**62,40**	1,6	41,6	**24426,80**
Unloading CF (PK)	IX/1	t	26	0,11	2,86	II	40	**114,40**						potassium chloride	120	12000	1,8	**21600,00**							**21714,40**
Administer and serv. CF (PK)	IX/1	ha	100,0	0,06	6,00	III	45	**270,00**	Amazone	370	0,2	20,00	**7400,00**						14,5	1,79	65	**116,55**	2,6	260	**7786,55**
25 cm plowing + harrowing	IX/1	ha	100						PR-3-30	370	1,1	110	**40700,00**						3,9	25,64	65	**1666,67**	28	2800	**42366,67**
TOTAL PROD BEFORE SPRING					**11,72**			**498,80**					**49950,00**					**44000,00**		28,47		**1845,62**		3101,60	**96294,42**
Loading, transporting CF (N)	IV-1	t	16,00	0,11	1,76	II	40	**70,40**	2RM2	370	0,05	5,00	**1850,00**	urea	160	16000	2	**32000,00**	25	0,64	60	**38,40**	1,6	25,60	**33958,80**
Unloading CF (N)	IV-1	t	16,00	0,11	1,76	II	40	**70,40**																	**70,40**
Administer and serv. CF (N)	IV-1	ha	100	0,033	3,30	II	40	**132,00**	Amazone	370	0,1	10,00	**3700,00**						14,5	6,90	65	**448,28**	2,6	260	**4280,28**
Water transport and solution prep.	IV-1	mii l	1	0,09	0,09	IV	50	**4,5**	RCU-4	370	0,05	5,00	**1850,00**	water	1000	100000			60	0,02	60	**1,0**	1,6	1,6	**1855,50**
Herbicide and serv.	IV-1	ha	100	0,04	4,00	I	35	**140,00**	Technoma	370	0,25	25,00	**9250,00**	MISTRAL	1	100	165	**16500,00**	50	2,00	70	**140,00**	3,5	350	**26030,00**
Tillage and prep. Soil	IV-1	ha	100						LEMKEN	370	0,23	23,0	**8510,00**					**0,00**	11,5	8,70	65	**565,22**	7,5	750	**9075,22**
Loading, transporting grains	IV-2	t	2,00	0,11	0,22	II	40	**8,800**	2RM2	370	0,05	5,0	**1850,00**	STIRA	20	2000	15	**30000,00**	25	0,08	60	**4,80**	1,6	3,200	**31863,60**
Sowing +serv.	IV-2	ha	100	0,08	8,00	III	45	**360,000**	SPC-8	370	0,3	30,0	**11100,00**						16	6,25	70	**437,5**	7	700	**11897,50**
Mechanical and manual weeding I	V-1	ha	100	2,78	278,00	III	45	**12510,000**	CPU	370	0,2	20,0	**7400,00**						6,5	15,38	70	**1076,92**	4	400	**20986,92**
Mechanical and manual weeding II	VI-1	ha	100	3,03	303,00	III	45	**13635,000**	CPU	370	0,2	20,0	**7400,00**						12	8,33	70	**583,33**	3,5	350	**21618,33**
TOTAL TRIMESTRE II					**600,13**			**26931,100**				0,0	**52910,00**					**78500,00**		48,30		**3295,45**		2840,40	**161636,55**
Maize harvesting	IX-3	t	850					**0,000**	CLAAS	370	0,32	272,0	**100640,00**						100	8,50	70	**595,00**	3,5	2975	**101235,00**
Transporting grains	IX-3	t	850						2RM2	370	0,05	42,50	**15725,00**						25	34,00	60	**2040**	1,6	1360	**17765,00**
TOTAL CURRENT YEAR					**0,00**			**0,000**					**116365,00**							42,50		**2635,00**		4335	**119000,00**
																									0,00
GRAND TOTAL					**611,85**			**27429,900**				**592,5**	**219225,00**					**122500,00**		**119,27**		**7776,07**		**10277**	**376930,97**

The model of conomic efficiency for the maize crop consist in values and indicators calculated with specific formulas *(table 3)*.

Taxes on the wage fund are calculated by applying rates unemployment fund, health insurance fund and tax on the amount representing the wage fund. Specific depreciation value is determined in relation to the asset value and useful life.

The share of expenditure for supply is calculated by applying a percentage of the value of the materials used. Summing up costs for mechanical works, irrigation, manual work, taxes on wages, materials (including supply costs) other expenses, direct costs are obtained.

To direct costs there is applicable the share of common and general expenditure and by summing them there are determined the production costs. After each quarter thare are made totals. There are calculated following indicators: cost of production per hectare and the cost per tonne of product. Expenditure per hectare results from the ratio of total production costs and area. The cost per unit of production is calculated reporting product costs for the main product to the planned quantity of products.

Table 3

Economic efficiency of maize crop, version with mechanical harvesting - 2016

Entry data			Obtained results		
1	Crop area (ha)	100.00	1	Total main production (tone)	850.00
2	**Yield for main production (kg/ha)**	**8500.00**	2	Total secondary production (tone)	950.00
3	Yield for secondary production (kg/ha)	9500.00	3	Fuels expenditure (lei)	51385.00
4	Total workforce consumption (z.o.)	611.85	4	Wages - total (lei)	35205.97
5	Wages for manual works (lei)	27429.90	5	Contribution on wages for manual works (lei)	4388.78
6	Mechanical works expenditure (lei)	219225.00	6	Contribution on wages for mechanical works (lei)	1244.17
7	Expenses for materials (lei)	122500.00	7	Total contributions (lei)	5632.95
8	Unit days (z.a.)	119.27	8	Unemployment fund (lei)	176.03
9	Wages for mechanizers(lei)	7776.07	9	Supplementary pension (lei)	528.09
10	Total diesel fuel consumption (liters)	10277.00	10	C.A.S. (lei)	7322.84
11	Fuel price (lei/l)	5.00	11	Health fund CASS(lei)	1830.71
12	The tax rate for manual works wages (%)	16.00	12	Total taxes (lei)	15490.63
13	The tax rate for mechanizers wages (%)	16.00	13	Supply expenses (lei)	18375.00
14	Unemployment fund (%)	0.50	14	T.V.A. (lei)	24500.00
15	Supplementary pension (%)	1.50	15	Depreciation(lei)	100000.00
16	C.A.S. (%)	20.80	**16**	**Total direct costs (lei)**	**527520.53**
17	Health fund - CASS(%)	5.20	**17**	**Other direct costs (lei)**	**79128.08**
18	Supply expenses (%)	15.00	18	Common expenses (lei)	26376.03
19	T.V.A. (%)	20.00	19	General expenses (lei)	52752.05
20	Irrigation(lei / ha)	0.00	**20**	**Total indirect expenses (lei)**	**79128.08**
21	Depreciation (lei / ha)	1000.00	**21**	**Total operating expenses (lei)**	**685776.68**
22	**The selling price of main production (lei/kg)**	**0.85**	**22**	**Income from main production (lei)**	**722500.00**
23	The selling price of secondary production (lei/kg)	0.10	**23**	**Subsidies**	**101992.00**
24	Share of common expenses (%)	5.00	24	Income from secondary production (lei)	95000.00
25	Share of general expenses (%)	10.00	25	Total income (lei)	919492.00
26	The tax rate on profits (%)	16.00	**26**	**Production cost (lei/t)**	**806.80**
27	Share of other direct costs (%)	15.00	**27**	**Total gross profit (lei)**	**233715.32**
28	**Subsidies per ha**	**207.5**	28	Tax on profit (lei)	37394.45
	Payments per hectare = value euro / ha year 2016 * Exchange rate	77.08	29	Net profit (lei)	196320.87
	Redistributive payment -5 to 30 ha	46.75	30	Net profit (lei/t)	230.97
	Greening payement	53.9	31	Profit per area unit (lei/ha)	1963.21
	Young farmers	29.77	**32**	**Net profit rate(%)**	**28.63**
	Diesel subsidies = 1 leu / l	10277	33	Work productivity (lei/z.o.)	1502.81
			34	Work productivity (z.o./kg)	0.001

CONCLUSIONS

Crop budget represent an essential tool in determining economic efficiency in agricultural management regarding the vegetable sector. Drawing an organised and detailed representation of expenses related to specific agricultural works helps to identify the specific weaknesses in order to overcome them or to diminish their effects and to find the means to optimize the agricultural production process.

Minimizing expenses is one of the most important goals in any business. Achieving this goal may lead to competitive advantage and to economic increase. The model formed by the two related main tables explores a variety of ways to ensure this goal common to all companies at the global level.

The form can be used in agricultural management as a tool for analysis of the various technological options applicable for the same crop in order to ensure the highest level of economic efficiency and establishing the level of production necessary to achieve a minimum outcome aimed under the specific circumstances.

REFERENCES

Brezuleanu S. et al, 2010 - *Features and economic efficiency in agricultural systems in Iasi county after EU accession* , Lucrări Ştiințifice - vol. 53, seria Agronomie, Editura "Ion Ionescu de la Brad", Iași.

Brezuleanu S., 2009 - *Management în agricultură*, Editura Tehnopress, Iași.

Chiran A. , Gîndu E. et al, 2012 - *Crop structure optimization, the way to ensure economic efficiency in vegetal production (case study at S.C. AGRICOLA BEESARSEN S.R.L. Dochia, jud. Neamț)*, Lucrări Ştiințifice – vol. 55, seria Agronomie, Editura "Ion Ionescu de la Brad", Iași.

Ciurea I-V, Brezuleanu S. *et al,* 2001 - *Management. Aplicații practice în fermele agricole vegetale*, Editura "Ion Ionescu de la Brad", Iași.

Greaser G., Harper J., 1994 - *Enterprise Budget Analysis, Agricultural Alternatives*, Penn State College of Agricultural Sciences research, Pennsylvania, available on-line at http://whatcom.wsu.edu/ag/documents/enterbudgets/EnterpriseBudgetAnalysis.pdf

Sloman J., 1999 - *Economics*, Prentice Hall Europe, Hertfordshire

Ştefan G., Toma A-D al., **2006** - *Economie şi politici agroalimentare*, Editura Alfa, Iaşi.

Tuckwell C., et al, 2013 - *Farm financial tool: crop gross margin budget fact sheet*, Grains Research and Developement Corporation, Kingston, available on-line at https://grdc.com.au/GRDC-FS-FFT-CropGrossMarginBudget

Ungureanu G., Brezuleanu S. et al, 2013 - *Impact analysis of the Common Agricultural Policy on farmers income in North-East Region*, Lucrări Ştiințifice – vol. 56 (1), seria Agronomie, Editura "Ion Ionescu de la Brad", Iași.