# THE ECONOMIC ANALYSIS OF AGRICULTURAL ENTERPRISES IN SUSTAINABLE DEVELOPMENT ASPECT.

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## ABSTRACT

*The economic analysis of chosen plant production in big agricultural enterprises in sustainable development aspect is the aim of the paper. The results of the research indicated, that it is possible to use environmentally friendly technologies if economic motivation system stimulating their development is created. These technologies can be characterised by low level of direct costs with profitable indexes at the same time. The advantage of using such technologies is profitable index of production with obtaining middle yields which is essential from the point of view of food over-production and obtaining more healthy food.*

## INTRODUCTION

In the market economy conditions, usefulness of some technologies is veryfied by economic results through the maximum profit principle. However using the principle in existing model of agriculture development – brining considerable successes on one hand – brought about serious threats to environment on the other hand. This fact caused, that governments of the European Union countries, where the problem occured strongly, and other organisations like The Council of Europe and Organisation for Economic Co-operation and Development took a decision to modify Common Agricultural Policy. Particular recommendations of modified CAP to limit negative results of the intensive way of agricultural production, leading to environmental problems, will accomplish their tasks if they are based on a wide system conception of preservation of nature and community development. In recent years such thinking is popularized in a new idea called sustainable development. (Ryszkowski 1998, Runowski 2000, Ziętara 2000).

Initial analysis show that the problem concerns Poland, too. First of all, the phenomenon occurs in big, transformed state farms, which are in leasing today. These enterprises are well managed, using high advanced technologies, particularly in plant production. Therefore, the economic analysis of chosen plant production in big agricultural enterprises in sustainable development aspect is the aim of the paper.

## METHODOLOGY

The research was conducted in 1998 in four big agricultural enterprises. All kinds of technologies used in plant production were analysed. Results of three plants analyses from the following groups: root plants – sugar beets; oil plants – rape; cereals – winter wheat, were shown in this paper.

The data were taken from special technological cards including the following informations: name of technological operations, types of machines, work time, quantity of work in hectares and tons, efficiency of machine aggregates, used materials, plant area and yield. The estimation of incomes and total costs of all kinds of technologies was the next step of the analysis.

The results of the research, according to the paper aim, were presented in many-sided attitudes. Labour and tractor inputs and frequency of particular technological operations from the point of view technological reductions were shown in the table 1. Technological reductions lead to less soil compaction and finaly lead to increase of energetic efficiency of plant production and decrease of soil erosion (Watts and Dexter 1994, Kozicz and Wielicki 1997, Wielicki i Wajszczuk 2000).

Fertilization and chemical control level indexes were presented in the table 2 with reference to issue of introduction of harmful substances to the soil. And finally, chosen economic indexes (like: unit cost of production; gross margin; profitable index; BEP index) were presented in the table 3.

The analyses of these indexes can help to indicate technologies which are harmful to environment as little as possible, but profitable for producers at the same time.

## RESULTS

### The analysis of sugar beets technologies

The analysis of sugar beets technologies showed that the lowest labour and tractor inputs took place in C- farm – about 10-20% less than in A-, B- and D- farms

(table 1). But if we consider particular technological operations we will recognize that the lowest labour and tractor inputs indexes occur in cultivation+sowing phase, fertilization phase and chemical control phase, all in A- farm. It was because of the highest effectivness equipment used in A- farm. Also the quantity of technological operations was the lowest in A- farm, which was important from the point of view of soil compaction.

**Table 1. Labour inputs indexes and quantity of technological operations.**

| Specification | Labour inputs indexes and quantity of technological operations | | | | | | | | Total** |
|---|---|---|---|---|---|---|---|---|---|
| | Cultivation +sowing | | Fertilization | | Chemical control | | Harvest | | |
| | Work hours per hect. | Fre-quen-cy | Work hours per hect. | Fre-quen-cy | Work hours per hect. | Fre-quen-cy | Work hours per hect. | Fre-quen-cy* | Work hours per hect. |
| **Sugar beets** | | | | | | | | | |
| Farm A | 3,50 | 6 | 1,87 | 2 | 1,00 | 3 | 18,29 | 2 | 34,66 |
| Farm B | 4,70 | 6 | 4,06 | 5 | 1,64 | 5 | 13,80 | 1 | 34,20 |
| Farm C | 4,42 | 5 | 3,99 | 5 | 1,68 | 3 | 7,44 | 1 | 27,53 |
| Farm D | 4,93 | 6 | 3,95 | 4 | 1,21 | 3 | 10,05 | 1 | 30,14 |
| **Rape** | | | | | | | | | |
| Farm A | 1,40 | 2 | 1,88 | 2 | 0,67 | 2 | 1,44 | 1 | 5,39 |
| Farm B | 1,75 | 2 | 2,25 | 3 | 0,67 | 2 | 1,70 | 1 | 6,37 |
| Farm C | 2,66 | 4 | 2,20 | 4 | 1,20 | 3 | 1,86 | 1 | 7,92 |
| Farm D | 2,33 | 5 | 2,19 | 4 | 0,81 | 2 | 6,31 | 2 phases | 11,64 |
| **Winter wheat** | | | | | | | | | |
| Farm A | 2,42 | 4 | 1,88 | 2 | 0,67 | 2 | 2,95 | 2 | 7,92 |
| Farm B | 2,59 | 3 | 2,68 | 4 | 1,01 | 3 | 3,77 | 2 | 10,05 |
| Farm C | 2,75 | 4 | 2,20 | 4 | 0,80 | 2 | 3,50 | 2 | 9,25 |
| Farm D | 2,50 | 5 | 2,20 | 3 | 0,80 | 2 | 4,01 | 2 | 9,51 |

* 1 – means only main crop harvest ** in case of sugar beets including stable manure

2 – means main crop and by-product harvest

Source: Own calculations.

Based on fertilization analysis (table 2), the most advantageous index from the point of view of preservation environment was used in C- farm – 312,16 kg/ha, it was also characterised by the lowest unit cost. But due to low content of pure element, in this technology the transport and labour costs of fertilization were the highest compared with other technologies.

Considering the introduction of harmful substances to the soil and their unit cost, we should promote technology used in A- farm.

**Table 2. Fertelizers and chemical control indexes in the analised technologies.**

| Specification | Fertilization | | Chemical control | |
|---|---|---|---|---|
| | NPK quantity in kg/ha | Costs in zl/ha | Quantity of harmful in kg/ha | Costs in zl/ha |
| **Sugar beets** | | | | |
| Farm A | 380,25 | 484,00 | 1,9240 | 341,68 |
| Farm B | 470,45 | 404,90 | 2,0960 | 529,68 |
| Farm C | 312,16 | 289,52 | 1,8850 | 685,81 |
| Farm D | 366,75 | 369,60 | 1,9564 | 782,41 |
| **Rape** | | | | |
| Farm A | 380,25 | 484,00 | 3,4720 | 253,87 |
| Farm B | 378,05 | 332,40 | 3,1875 | 100,84 |
| Farm C | 418,63 | 407,94 | 2,1835 | 192,84 |
| Farm D | 290,25 | 365,70 | 0,8830 | 187,92 |
| **Winter wheat** | | | | |
| Farm A | 364,95 | 450,70 | 7,5425 | 258,95 |
| Farm B | 357,55 | 257,75 | 7,6875 | 202,65 |
| Farm C | 217,98 | 203,90 | 4,7000 | 302,21 |
| Farm D | 220,85 | 234,12 | 6,5354 | 306,57 |

Source: Own calculations.

Considerations above on profits of particular technologies were verified by indexes in table 3. From the point of view of an entrepreneur, the best economic indexes, he obtains using technology of B- farm, where the both gross margin index (3,89 zl/dt) and profitable index (139%) were the highest. The quantity BEP index is relatively low and show, that there is some possibility to reduce some inputs, for example: the level of fertilization (the highest index), chemical control (the highest index). But when we consider environment preservation we should use technology of A- farm, which is characterized by the lowest direct costs index and relatively high gross margin (second place – 3,56 zl/dt), and also good profitable index (second place – 129%). Also in this case, the quantity BEP index shows, that there is some possibility to reduce some inputs. It seems that, In food over-production conditions, it is very important to promote such technologies characterized by middle level of yields but profitable index at the same time.

**Table 3. The chosen environmental – economics indexes charakterized the analised technologies.**

| Specification | Yield | Direct costs | Gross margin | | Profitable index | Quantity BEP index |
|---|---|---|---|---|---|---|
| | dt/ha | zł/ha | zł/ha | zł/dt | % | dt/ha |
| **Sugar beets** | | | | | | |
| Farm A | 440,0 | 3 184,51 | 1 567,49 | 3,56 | 129 | 342,04 |
| Farm B | 535,0 | 3 269,74 | 2 080,26 | 3,89 | 139 | 385,83 |
| Farm C | 550,0 | 3 397,64 | 1 904,36 | 3,46 | 125 | 440,57 |
| Farm D | 464,0 | 3 858,81 | 980,71 | 2,11 | 102 | 455,07 |
| **Rape** | | | | | | |
| Farm A | 31,0 | 1 720,13 | 1 054,37 | 34,01 | 139 | 22,29 |
| Farm B | 33,5 | 1 680,28 | 1 317,97 | 39,34 | 151 | 22,15 |
| Farm C | 39,9 | 1 813,95 | 1 597,50 | 40,04 | 150 | 26,52 |
| Farm D | 36,7 | 2 467,24 | 835,03 | 22,75 | 109 | 33,73 |
| **Winter wheat** | | | | | | |
| Farm A | 59,0 | 2 050,07 | 722,93 | 12,25 | 117 | 50,60 |
| Farm B | 60,0 | 1 756,54 | 823,46 | 13,72 | 124 | 48,20 |
| Farm C | 64,3 | 2 140,45 | 1 074,55 | 16,71 | 120 | 53,51 |
| Farm D | 53,0 | 1 962,34 | 475,66 | 8,97 | 101 | 52,47 |

Source: Own calculations.

**The analysis of rape and winter wheat technologies**

From a data analysis of table 1 it follows that the lowest labour and tractor inputs were connected with technologies of A- and B- farms in case of rape, and of A- and C- farms in case of winter wheat. These technologies can be charackerized by a large number of technological reductions in cultivation, fertilization and chemical control phases lead to less soil compaction and finaly lead to increase of energetic efficiency of plant production and decrease of soil erosion.

If we consider the level of fertilization and chemical control (table 2), the most attractive, from the point of view of environment preservation, were technologies used in D- farm in rape and in C- farm in winter wheat. These technologies were characterized by the lowest level of fartilization and the lowest level of introduction of harmful chemical substances to the soil.

On the grounds of economic analysis (table 3) can be find that, when were used technologies of B- farm, obtained the best economic results (profitable index – 151% in rape and 124% in winter wheat). But from the other hand, these technologies were harmful for environment – the highest level of fartilization and introduction of chemical substances to the soil.

Considering environment preservation aspect and business of producer, based on this analysis, we should decide to select technologies of C- farm, both in case of rape

and in case of winter wheat. There are high profitable indexes (respectively – 150% and 120%), and the highest gross margin indexes both on unit area and unit production. The indubitable advantage of technologies of C- farm is the lowest level of introduction of harmful substances to the soil.

## CONCLUSIONS

1. The results of the research indicated, that it is possible to use environmentally friendly technologies if economic motivation system stimulating their development is created.
2. These technologies can be characterised by low level of direct costs with profitable indexes at the same time.
3. The advantage of using such technologies is profitable index of production with obtaining middle yields, which is essential from the point of view of food over-production and obtaining more healthy food.

## REFERENCES


Kozicz J., Wielicki W., (1997): Energetic inputs and energetic efficiency of sugar beets production. PTPN, Wydz.Nauk Rol. i Lesn., Tom 83: 57-68.

Roszkowski A., (1999): New ideas. Nowoczesne Rolnictwo, 5/99.

Runowski H., (2000): Sustainable development of farms and big agricultural enterprises. Rocz.Nauk.SERiA, Tom II, Zesz.1:94-102.

Ryszkowski L., (1998): Principles of environment preservation. Przegląd Komunalny, Dodatek specjalny, 7/98:20-22.

Watts C.W., Dexter A.R. (1994): Traffic and seasonal influences on the energy required for cultivation and on the subsequent tilth. Soil Till. Res. v. 31 (4): 303-322.

Wielicki W., Wajszczuk K. (2000): The soil compaction influence on energetic efficiency of sugar beets production. The 69$^{th}$ EAAE, Sustainable Energy, Wageningen University, The Netherlands:464-474.

Ziętara W. (2000): Sustainable development of agricultural areas. Rocz.Nauk.SERiA, Tom II, Zesz.1:5-7.

**Biographical Sketch**

In 1987 I graduated Agricultural University of Poznan and in the same year I started to work at Department of Agricultural Economics and Management. In 1997, I obtained a doctorate. My general area of my doctor`s thesis concerned to economic aspect of transport in farms enterprises. My actual scientific area:

- agricultural economics and farm management,
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I am 40 years old. I am married. I have two children.

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