# Modeling of the Connection Between the Ecological Farming and Farm Sizes under Hungarian Conditions

**Istvan Takacs and Katalin Takacs-Gyorgy**

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# MODELING OF THE CONNECTION BETWEEN THE ECOLOGICAL FARMING AND FARM SIZES UNDER HUNGARIAN CONDITIONS

**Dr. PhD Takács, István**
**Dr. PhD Takács-György, Katalin**
Szent István University, Faculty of Social and Economic Sciences
Gödöllő, Hungary

## ABSTRACT

Nowadays, the spread of ecological farming occurs in an ever-accelerating rate in Europe. In the beginning of the 1990s, this process started in Hungary too. Primarily, horticultural bio-product have appeared on the market; however, farms, which can be regarded as a sample, formed out relatively fast, and made products qualified as plough-land bulk goods, first of all for export, but a stratum in Hungary also starts to interest for these products.

In our research, we looked for an answer to the question, how the economic condition system of ecological production forms out in Hungarian circumstances, on which farm sizes farming can be made profitably.

We stated by adapting the earlier model researches that current farm sizes in Hungary, are too small yet, so that one could make profitable production, at the same time, farmers, who affiliate in time, may reach extra sales revenues in comparison to the traditional (factory-) farming, by producing bio-products, which, however, can ensure the capacity of living of such farms, which were in unliveable under the earlier circumstances.

Simultaneously with the spread of ecological farming, this advantage will decrease, therefore the time factor has an important role, at the same time, the capacity expansion not confirmed with consumers' demands, takes this income advantage away.

Under Hungarian circumstances, according to the present conditions – depending on the extent of the bio extra price – the income level covering the costs, reduces the profitable farm size from about 100 ha to 20-60 ha. This gives hope for farmers, whose farm size is considerably smaller (under 10 ha) that the farm size, on which profitably production can be made, is in a relatively reachable distance. To realize this, the state should definitely urge the farms on this, by the available direct and indirect tools.

## INTRODUCTION

Agriculture in the world is at a crossroads again. The development of agriculture in developed countries became consumer-controlled, which would requires that we should take the consumers' demands into consideration increasingly. The impact of some animal diseases (BSE, foot-and-mouth disease) becomes stronger through mass communication, causing a shocking impact in circle of consumers. At the same time, the news of different gene-manipulated foods impresses frighteningly, in consequence of which, the distrust against products handled in this way, increases in some circles of – chiefly well-to-do – consumers. These factors started to transform the consumers' demands, for which the producers will have to give an appropriate answer.

In countries with developed agriculture, the agricultural production became industry-like ("factory farming"), it could become very effective in a technological, economic sense; at the same time, - partly in consequence of efficiency – it became able to produce such a surplus, from which the internal markets should have been protected, on the other side to attempt to carry away the surpluses in an appropriate way to place them onto external markets. These things have given the governments of the EU and the USA plenty to think about; moreover, it became the source of skirmishes on the world market with different intensity, the stage of which is WTO currently, earlier it was GATT.

This dual impact formed an important chance for ecologic farming, which is, in a certain aspect, a modern approach, at the same time the reincarnation of traditional farming procedures of the past on a higher technology standard, through which, we want and also are able to reduce the load deriving from artificial materials, and concerning the consumers. These things mean a new challenge both for the agronomists and for the ecologists.

The ecological production spread first in connection to horticultural products made for fresh-consumption, at the same time, consumer demands for organic products (bio-wheat, bio-milk, bio-eggs) appeared in connection to agricultural bulk goods too.

The production of product belonging to this circle had a high demand of living labour and remained generally so, at the same time, expenditures on living labour decreased considerably in case of bulk products, first of all because of the technological development. Of course, the effects of the development of biological fundamentals (improving species) and that of increasing the expenditures of production (supplement of artificial nutritives in large portions, chemical plant protection), cannot be neglected too.

One of the aim of ecological production is to stop taking in artificial materials, (according to some point of views only reducing them), therefore the production technologies went through an important transformation, the technical conditions of which are more or less given, at the same time, the demand of hand labour of production may increase in case of producing bulk goods too. [HERMANN – PLAKOLM, 1993]

The transformation of the structure of imports, the exclusion of some kinds of them, goes with the decrease of the outputs. The revenue failure deriving from this, can be compensated by extra revenues (bio-extra price) during the sale. [JÁRÁSI, 2000]

Taking these factors into consideration, we looked for the answer to the question, under which economic-social conditions the ecological production becomes profitable in an economic sense, namely, under which circumstances the requirement system of sustainability can be ensured, based on the Hungarian conditions. In correspondence to this, our objectives were as follows.

- Identifying the factors of the model
- Calculating the farming size (the profitable farm size)
- Comparing the traditional and the ecological farming
- Decreasing, transforming the inputs, - in this way reducing the environment load, indirectly meeting the environmental requirements, examining its impact on how it influences the profitable farm size.

## MATERIAL AND METHODES

The base of the researches is given by the model researches made in the middle of the 1990s. With deterministic mathematical models we examined, in which conditions the agricultural enterprises, which form out during the system change in Hungary are able to make profitable conditions, what farm size is necessary, which can ensure the conditions of a durable existence. [HAJDÚ et al., 1993; TAKÁCSNÉ GYÖRGY – TAKÁCS, 1994.]

The mathematical model formed out previously gives the base of the examinations, which we adapted by validating dissimilarity deriving from the differences between the traditional and the ecological production.
The model describes the transformation process defining the outputs of the activity depending on the change of inputs and factors effecting from the economic environment. (Figure 1)
The analysis of the structure of price-costs-coverage-profit (PCCP) gives the base to the analysis of the break-even point

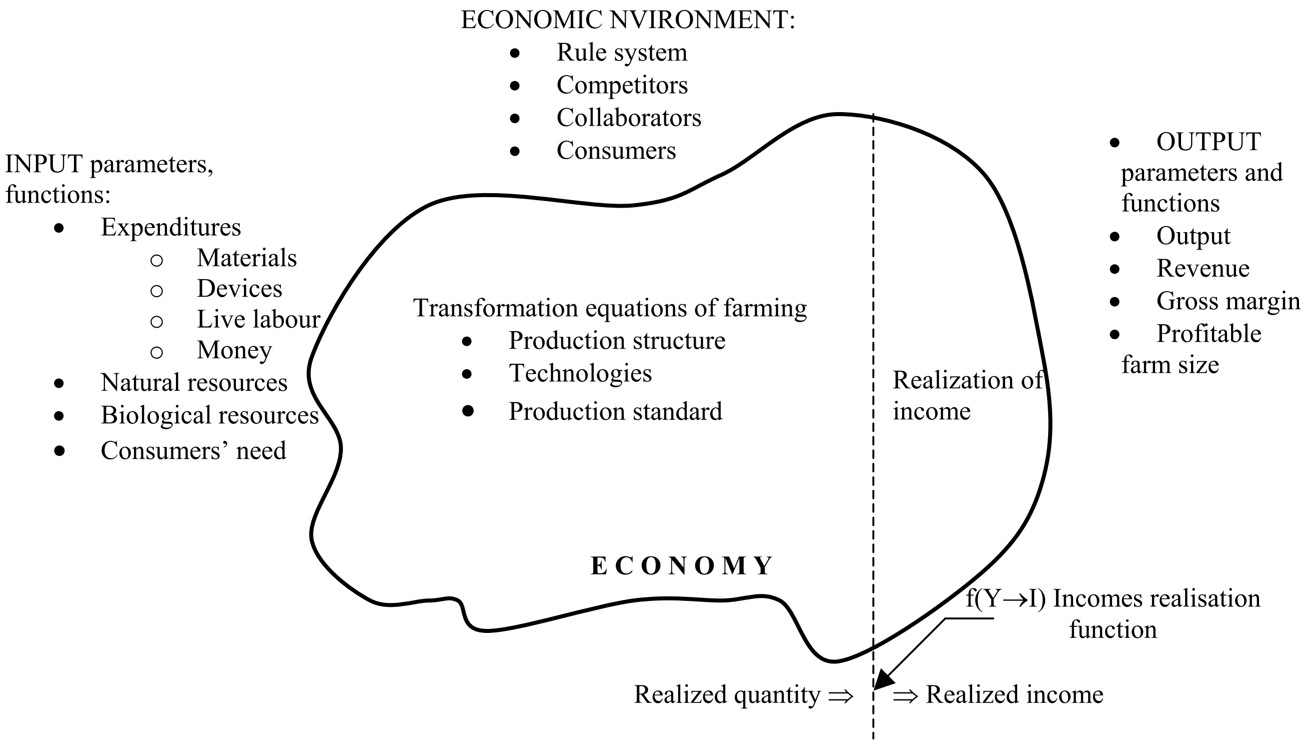



Figure 1 System of the parameters of the model

In case of the simplest PCCP model it is true that costs and the sales revenue can be described by a linear connection. At the break-even point (at the production size, where the sales revenue just covers the total production costs) the condition is true:

$$C_t(q_{BEP}) = R(q_{BEP}) \text{ where}$$

$C_t(q)$ = production cost function [currency unit], $C_t(q) = C_F + c_v \cdot q$ in which
$C_F$ = fix costs, $c_{v=}$ (variable) cost proportional to producing one unit of product (the incline, direction tangent of the production cost function [currency unit/unit], q = volume of production
$R(q) = p \cdot q$, R(q) = sales revenue function [currency unit], p = average price of one unit of product (the incline, direction tangent of the sales revenue function [currency unit/unit],

BEP = break-even point

$C_t(q_{BEP})$= total costs at the break-even point, and $R(q_{BEP})$ = sales revenue at a profitable farm size

The profitable farm size in case of the linear model:

$$q_{BEP} = \frac{C_t}{p - c_v}$$

The difference $p - c_v$ is a gross margin realized by producing one unit of product.

Real life produces different values from this. The increase of capacity cannot be continuous, the performing ability of each device has an upper limit in a physical sense, there above this, to increase the capacities again, an investment is necessary, which causes a break of the $C_t(q)$ function, and the production cost function continues from a higher cost value. The behaviour of the variable costs is generally not liner to. At the same time, the function R(q) is not linear as well. The increase of the volume leads to fullness of the market, the payment ability in the layer that was drawn in newly, is already lower, therefore the realizable average cost decreases too, which reduces the realized revenue on a unit of product.

By taking these factors into consideration, the created so called pessimistic function helps to examine the problem of appearance on markets of different fullness. In this model, the increase of the production costs is exponential.

$$C_t(q) = f\left(C_F, c_{v_0}, \kappa_k^q\right), \ (\kappa > 1),$$

and the change of sales revenue (depending on the realization) can be described with the function,

$$f(Y \rightarrow I) = R(q) = f\left(p_0, q^{\kappa_á}\right), \ (0 < \kappa_á < 1)$$

which has a type of power, where

$c_{v0}$ = basis variable cost
$\kappa_k$ = a constant, characterizing the reaction of cost
$p_0$= basis unit price
$\kappa_á$ = a constant characterizing the reaction of unit prises

In consequence, R(q) and $C_t(q)$ function have two points of intersection at the capacities $q_{BEP1}$ and $q_{BEP2}$
At the sizes mentioned above

$$C_t\left(q_{BEP_1}\right) = R\left(q_{BEP1}\right)$$

and

$$C_t\left(q_{BEP_2}\right) = R\left(q_{BEP2}\right)$$

respectively.

It is not possible to solve the equations in an algebraical way (because the replacement lead to a transcendent equation, therefore the marginal capacities can be take with iteration.

The conditions of profitable production stand in this range, namely, the capacity of a profitable operation (q) is in the

$$q_{BEP_1} \leq q \leq q_{BEP_2}$$

range.

The profit increases to a certain volume in the range, then it decreases, therefore the model can be optimised for the maximal profit. The condition of the optimal production size shall be where the profit is maximal, which occurs at the point, where the first derived function of the profit function is zero, and the second derived one is negative, namely

$$\frac{\partial P(R, C_t)}{\partial q} = \frac{\partial R(q)}{\partial q} - \frac{\partial C_t(q)}{\partial q} = 0,$$

namely

$$\frac{\partial R(q)}{\partial q} = \frac{\partial C_t(q)}{\partial q}$$

and

$$\frac{\partial^2 P(R, C_t)}{\partial q^2} = \frac{\partial^2 R(q)}{\partial q^2} - \frac{\partial^2 C_t(q)}{\partial q^2} < 0$$

namely

$$\frac{\partial^2 R(q)}{\partial q^2} < \frac{\partial^2 C_t(q)}{\partial q^2}.$$

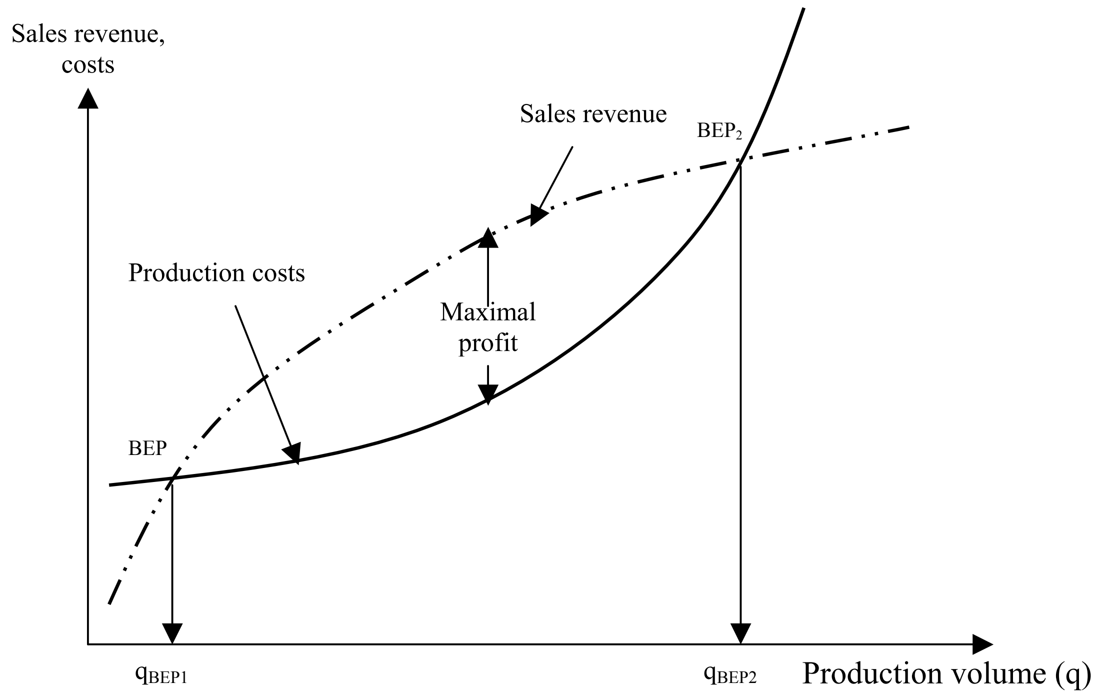



Figure 2. The structure of the pessimistic model

During our examinations, in different versions, we gave the following connection for the profitable size of farming from the basic conditions of the model for the smallest income level of an enterprise:

$I_{min} \geq f(R(q,s,t), C_{mv}(q,m), C_{lab}(I,q), A(c), C(fr), O(u(q),l), Sm(q), Cg(q))$, ahol

- $I_{min}$= minimal income of a farmer [currency unit]
- R(q,s,t)= sales revenue of a farm depending on volume, production structure and the time of sales [currency unit]

$C_{mv}(q,m)$= direct material costs of production , cost of services of material character [currency unit]

$C_{lab}(I,q)$= cost of live labour depending on the entrepreneur’s minimal income need and the volume [currency unit]

A(c)= depreciation, depending on the level of capital tie-up [currency unit]

C(fr)= cost of usage of foreign resources (cost of interest) [currency unit]

O(u(q),l)= variable cost of machine operation, depending on capacity utilization and the standard of devices [currency unit]

Sm(q)= costs of temporary services, paid work [currency unit]

Cg(q)= overall costs of the enterprise, cost of the management (include some special costs: controlling fee, fee of certificate etc.) [currency unit]

In order to characterize the production model, we will present some features of technologies and the versions of product pattern as follows (Tables 1-3). [SIEBENEICHER, 1993.; SELÉNDY, 1997.; SÁRKÖZY – SZŐNYI, 2000.]

During building the model, because of different habitat conditions, (Table 4 ) we took different machine labour utilization into consideration. Each machine connection means different labour performance by labour operation because of different relief and soil conditions. Therefore during the periods of time available in agro-technological sense, different quantities of labour can be fulfilled, and the extent of the cultivatable land area depends on this. In addition to this, the reachable average yields are also different. (Table 5) [TAKÁCSNÉ GYÖRGY, 1995.]

Table 1 Production-technological operations of some plough-land plants in the model

| **Operations of plant cultures** | | | |
|---|---|---|---|
| **Wheat** | | **Maize** | |
| **Traditional** | **Ecological** | **Traditional** | **Ecological** |
| Spreading artificial dung | Stercoration | Spreading artificial dung | Stercoration |
| Ploughing | | Ploughing | |
| Making seed bed | | Making seed bed | |
| Sowing | | Sowing by seed | |
| Top-dressing | - | Top-dressing | - |
| | | Within-the-row cultivation | |
| Plant protection | | Plant protection | |
| Harvesting | | Harvesting | |
| Carrying grains | | Carrying cobs/grains | |
| Making bales | | Drying | |
| Carrying bales | | Stem rest operations | |
| (Grain drying) | | (Grain drying)) | |
| Stubble ploughing | | Stubble ploughing | |

Table 2: Basic models of plough-land plan production

| **Mark** | **Character** |
|---|---|
| **of model versions** | |
| 01 | Bread-grain production I. |
| 02 | Bread-grain production II. |
| 03 | Eared cereal and maize production I. |
| 04 | Eared cereal and maize production II. |
| 05 | Technical crops production I. |
| 06 | Technical crops production II. |
| 07 | Cattle breeding, with mass fodder production I. |
| 08 | Cattle breeding, with mass fodder production II. |
| 09 | Pork or poultry production with, hard food I. |
| 10 | Pork or poultry production with, hard food II. |

Resource: TAKÁCSNÉ GYÖRGY, 1995.

Table 3: Modelable sowing structure

| **Economic plant** | **Sowing structure** | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **Mark of the model** | | | | | | | | | |
| | **01** | **02** | **03** | **04** | **05** | **06** | **07** | **08** | **09** | **10** |
| | (%) | (%) | (%) | (%) | (%) | (%) | (%) | (%) | (%) | (%) |
| Autumn wheat | 35 | 35 | 35 | 25 | 25 | 35 | 30 | 30 | 20 | 30 |
| Rye | | | | | | | | | 5 | |
| Barley | 15 | | | | | 10 | | | 5 | 10 |
| Spring barley | | 10 | | 10 | 10 | | | | | |
| Maize | 20 | 25 | 35 | 30 | 25 | 25 | 15 | 15 | 40 | 20 |
| Green pie | 5 | | | 10 | 5 | | | | | 10 |
| Seed pie | | 10 | 10 | | | | | 5 | 10 | |
| Lupin | | | | | | | | 5 | | |
| Sugar beet | | | 10 | | | 15 | 10 | | | |
| Sun-flower | 10 | 20 | 10 | 10 | 10 | | 10 | | 10 | 10 |
| Potato | | | | | 15 | | | | | 10 |
| Silage maize | | | | | | | 20 | 30 | | |
| Lucerne (hay) | 15 | | | 15 | 10 | 15 | 10 | 15 | 10 | 10 |
| Trefoil (green) | | | | | | | | | 5 | |
| Field beet | | | | | | | 5 | | | |

Resource: TAKÁCSNÉ GYÖRGY, 1995.

Table 4. Significant features of three production levels applied in the model

| Circumstances of farming | |
|---|---|
| **Mark** | **Features of areal category** |
| "A" | - hilly. habitat category IV., VI |
| "B" | - hilly,. habitat category II., III |
| "C" | - with good ecological features, flat, medium-bound soil,. belongs to habitat category I |

Resource: TAKÁCSNÉ GYÖRGY, 1995.

Table 5. Available average yields built in the model, on different production levels

| Plant | Average yield | | |
|---|---|---|---|
| | Production levels | | |
| | "A" | "B" | "C" |
| | (t/ha) | (t/ha) | (t/ha) |
| Autumn wheat | 3,5 | 4,5 | 5,5 |
| Rye | 1,8 | 2,5 | 2,8 |
| Barley | 3,0 | 3,5 | 4,2 |
| Spring barley | 3,0 | 4,0 | 5,0 |
| Maize | 4,5 | 5,5 | 6,5 |
| Green pie | 3,0 | 3,8 | 4,5 |
| Seed pie | 1,8 | 2,2 | 2,5 |
| Lupin | 1,5 | 2,0 | 2,5 |
| Sugar beet | 30,0 | 38,0 | 45,0 |
| Sun-flower | 1,8 | 2,2 | 2,5 |
| Potato | 20,0 | 30,0 | 35,0 |
| Silage maize | 20,0 | 30,0 | 40,0 |
| Lucerne (hay) | 5,0 | 7,0 | 9,0 |
| Trefoil (green) | 15,0 | 20,0 | 25,0 |
| Field beet | 65,0 | 75,0 | |

Resource: TAKÁCSNÉ GYÖRGY, 1995.

## RESULTS

To transform the model and ensure the aspects of ecological farming, we had to take several factors into consideration. In comparison ton the traditional farming, we had to accentuate the following main differences – inputs, transformation process, factors influencing the realization – in the model.

- The ecological farming demands a change in technological paradigm, the most important characters of which are the following.
  - During production a crop rotation must be ensured, therefore the proportional of the plants in the sowing structure and the appropriate association of green crops must be restricted. Production in monoculture must be excluded. The appropriate crop rotation and plant associating may contribute to sustaining the

fertility of soils, and may hinder some plant diseases, as well as the spreading and pullulate of pests.

  - To ensure the nutritive needs of plants, organic dung must be used instead artificial ones, the dispersing of which demands a technical change and makes ploughing necessary.
  - The quantity of organic dung to be dispersed depends on the nutritive content of soil, and the nutritive need of the plant to be produced. Organic dung decays in 3-4 years therefore farmers must be reckoned with a durable impact. Its quantity is 25-30 tons/ha. To improve the state of soil, dispersing lime can be used, however, this can occur with apparatuses suitable for dispersing artificial fertilizer. In nutritive supply the appropriately selected green corps have a role too, for example the papillonaceae with supply the soil with nitrogen.
  - There are no important changes in tillage, ploughing dominates; subsoil tillage gets a more important role in improving the state of soil.
  - The most important changes are in plant protection. It was reduced in factory farming nearly to chemical plant protection. The toolbar of protection against mycoses, pests, weeds widens in ecological farming, of role of chemical protection changes, it is pushed into the background in a less extent. The typical protection produces are the following:
    - The role of mechanical protection increases in weed-killing, (hoeing, weed combing) it replaces the chemical protection, which became almost exclusive, but it can contribute to protection against some pests (e. g. insect traps) The following factors have a role in forming out the device system:
    - The agro-technique may hinder the multiplication of different pests in soil, first of all by using crop rotation and by an appropriate selection of tillage methods.
    - With biological tools, nature clears away the unwanted organizations by utilizing the possibilities in the food-chain of the eco-system; at the same time, they can contribute to the improvement of soil state and to stabilizing yields.
    - Chemicals made in an artificial way, are excluded from the chemical tools, they are replaced by plant brews and inorganic materials to be found in nature. Machines developed for dispersing compounds in a small quantity, are not necessary to disperse them; at the same time, the usage of them may not increase the load of environment, therefore the machines must meet the stricter environmental requirements.
  - Harvest drying and storage do not mean a considerable difference between tradition of ecological farming. Tools available in case of traditional farming are suitable for producing ecological products.
- Devices must be changed to meet the requirements mentioned above; this means the widening of the circle of devices, only few devices are stop to use. Main features of devices belonging to farms:
  - Power-machine
    - Universal tractors

- Machines of tillage
    - Subsoil ploughs
    - Ploughs working in medium depth (possibly throw-over plough)
    - Rotary cultivators
    - Combined cultivators
    - Within-the-row cultivators
    - Weed combs
  - Sowing machines
    - Sowing machines for eared cereals
    - Precision drills with adjustable row distance and with exchangeable sowing discs for smaller farms
    - Special precision drills for larger farms
  - Broadcasters
    - Hanging broadcaster (for dung)
    - Hanging or trailing centrifugal spinner broadcaster
  - Machines of plant protection
    - Hanging or trailing plough-land spraying machines
  - Mechanization of harvest is not refunded in case of one farm, therefore it must be bought as a service
- The role of hand labour increases in case of ecological bulk goods too, not only in case of horticultural products. The market is willing to buy organic products on a higher price. According to a survey made in Germany, 70% of the consumers would be willing to pay at least 20% more for these products. According to our presumption, a less part of consumers is willing to pay a higher extra price than this, therefore we can reckon with a value higher than this in case of current product volumes, at the same time, this value will decrease when the output increases. It is necessary to examine the digressive change in revenues, when we examine the forming out of a profitable farm size.
- To increase the output over a limit, it is necessary to procure new devices, which results in increasing capital tie-up. The cost function has to manage it. The change in fix costs will shift the break-even point.

By taking the factors mentioned above into consideration, the model examinations were repeated in case of ecological farming too.

A farm size servable by on device did not change basically. (Table 6), as the extra demand for capacity deriving from modifying the technology formed in such a period of time, when the utilization of a power-machine is otherwise low, and in case of nutritive supplement the dispersion of artificial fertilizer will be replaced by stercoration.

However, to widen the device stock, by 20% more extra investment is necessary, and it increases the value of depreciation by the same extent, which has a large proportion among the fix costs. (Table 7.)

The operation of devices being necessary because of the technology increases the machine operation costs – according to our calculation – by 10%.

Costs of nutritives and that of plant protection agent decrease. The own-made dung represents a certain value too, and if one has to buy it, then it – together with the delivery costs – means a considerable sum. It is not expected that costs of plant protection agents useable to ecological farming will deviate from that of synthetic agents in a large extent. However, when making model examinations, we calculated for both cost factors, that by 30% less expenditure are necessary than in case of factory farming.

Table 6. The change of land extent cultivatable with power-machine categories in case of different production structure (hectares)

| Mark of production version | Power-machine of 20 kW | | | Power-machine of 60 kW | | | Power-machine of 120 kW | | |
|---|---|---|---|---|---|---|---|---|---|
| | A | B | C | A | B | C | A | B | C |
| 01 | 51 | 61 | 71 | 100 | 119 | 138 | 158 | 188 | 219 |
| 02 | 61 | 72 | 84 | 111 | 132 | 153 | 161 | 191 | 222 |
| 03 | 58 | 69 | 80 | 110 | 131 | 152 | 176 | 209 | 243 |
| 04 | 54 | 64 | 75 | 107 | 127 | 147 | 182 | 217 | 251 |
| 05 | 54 | 64 | 74 | 86 | 102 | 119 | 196 | 233 | 271 |
| 06 | 48 | 58 | 68 | 95 | 113 | 131 | 154 | 183 | 212 |
| 07 | 60 | 72 | 83 | 114 | 136 | 158 | 184 | 219 | 255 |
| 08 | 59 | 70 | 81 | 111 | 132 | 154 | 166 | 197 | 229 |
| 09 | 51 | 60 | 70 | 106 | 126 | 146 | 165 | 196 | 227 |
| 10 | 56 | 67 | 78 | 106 | 126 | 146 | 199 | 237 | 275 |

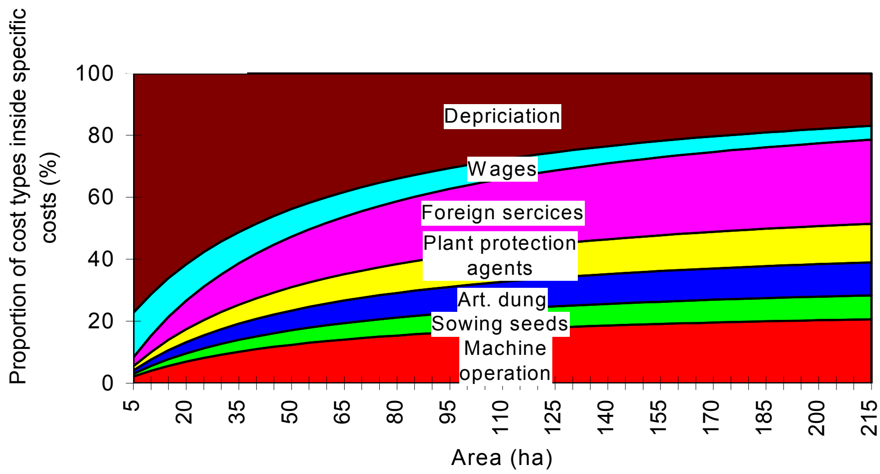
Resource: TAKÁCSNÉ GYÖRGY, 1995.

The live labour demand of production increases in a considerable extent. We reckoned with duplicating of live labour for a farm averagely, which causes the expenditure on wages to increase by 100%. The change in cost factors takes effect on total cost in a different extent in case of different production volume (capacity utilization). When the capacity utilization is low, then the proportion of fix costs determines the cost structure in such an extent, that a considerable change in variable costs does not make a considerable change in total costs. (Figure 3)

To indicate the impact of each factors, the indicator called degree of reaction is useable well, which shoes in this case, how many percent change of total cost 1 percent change of a cost factor will result in. It can be seen that in case of a very low level (2%) of capacity utilization, only 0,01-0,03% total cost change can be expected after 1% change of variable costs, at the same time, in case of 100% capacity utilization, only 0,1-0,3% change will occur.

The examination of a low capacity utilization is interesting, because a large part of Hungarian enterprises (95% of the farmers) makes his activity on a land area less than 10 hectares (this is more than 30% of the total land area), which results in 5-10% average capacity utilization in case of devices with different performance.

Figure 3 Change of cost factors depending on farm sizes in case of farming mad by a power-machine of 120 kW




Resource: TAKÁCSNÉ GYÖRGY, 1995.

Table 7 Degree of reaction, when a cost factor changes by 1% and the extent of change of cost factors during the model examinations (%)

| Cost factor | | Degree of reaction | | Change of cost feature (%) |
|---|---|---|---|---|
| | | at a size of 5 ha | at a size of 215 ha | |
| Variable costs | Machine operation | 0,022 | 0,206 | +10 |
| | Sowing seeds | 0,008 | 0,077 | 0 |
| | Nutritives | 0,011 | 0,106 | -30 |
| | Plant protection agents | 0,013 | 0,125 | -30 |
| | Foreign services | 0,029 | 0,271 | 0 |
| Fix costs | Wages | 0,144 | 0,045 | +100 |

The profitable farm size and the gross margin depend on the forming of the revenues. The change in cost factors results in the increase of total costs, in which, however, the proportion of the variable costs decreased, and that of the fix costs increased. From the side of costs it would result in increasing the profitable farm size, if the revenues are unchanged.

The decrease of yields influences the formation of the gross margin unfavourably because of the decrease of the input standard of ecological production. This decrease of yields, according to surveys made on several farms, may reach a value about 20%. The so-called bio-extra price (an extra price granted when ecological products are sold) may compensate it. The extent of the bio-extra price changes depending of the fullness of the market. According to the model calculation, the sum of revenue obtainable from an area unit, is 88%-160% of the traditional (factory-) farming, in case of 10-100% bio-extra price.

Table 8. Change of cost factors of ecological production in comparison to the traditional production

| Area | Capacity utilization | Effect of change of cost factors (traditional = 100%) | | | Change (traditional = 100%) | | Distribution of cost factors | |
|---|---|---|---|---|---|---|---|---|
| | | Total | Variable | Fix | Variable | Fix | | |
| | | | of total | | | | | |
| ha | % | | | | | | | |
| 5 | 2,3 | 129,4 | 7,8 | 121,6 | 94,0 | 132,6 | 6,0 | 94,0 |
| 50 | 23,3 | 114,8 | 44,2 | 70,6 | 93,8 | 133,6 | 38,5 | 61,5 |
| 100 | 46,5 | 108,5 | 59,8 | 48,7 | 93,8 | 134,5 | 55,1 | 44,9 |
| 150 | 69,8 | 105,4 | 67,9 | 37,5 | 93,8 | 135,5 | 64,4 | 35,6 |
| 200 | 93,0 | 103,5 | 72,6 | 30,8 | 93,8 | 136,5 | 70,2 | 29,8 |
| 215 | 100,0 | 102,9 | 73,6 | 29,3 | 93,8 | 136,8 | 71,5 | 28,5 |

Table 9. Change of proportion of gross margin depending on the change of bio extra price, on the basis of forming gross margin in case of traditional (factory-) farming of 30% and 35% respectively, in case of an 20% average yield decrease.

| Bio-extra price (%) | Sales revenue (traditional =100%) |
|---|---|
| | (%) |
| 10 | 88 |
| 20 | 96 |
| 30 | 104 |
| 40 | 112 |
| 50 | 120 |
| 60 | 128 |
| 70 | 136 |
| 80 | 144 |
| 90 | 152 |
| 100 | 160 |

Production standard over the average

The extent of the available extra price decreases simultaneously with the increase of supply, this takes effect on the profitable farm size unfavourably. The formation of the profitable farm size is presented for the model version 01, on figure 4, assuming average natural facilities. The basis of comparison is the traditional production, which ensures a 30% gross margin averagely. The curves describing the realizable income levels in case of different bio-extra prices, were defined in comparison to this.

Figure 4 Changing of profitability (profitable farm size) with different proportion (10-100% of an extra price), in case of gross margin of 30%

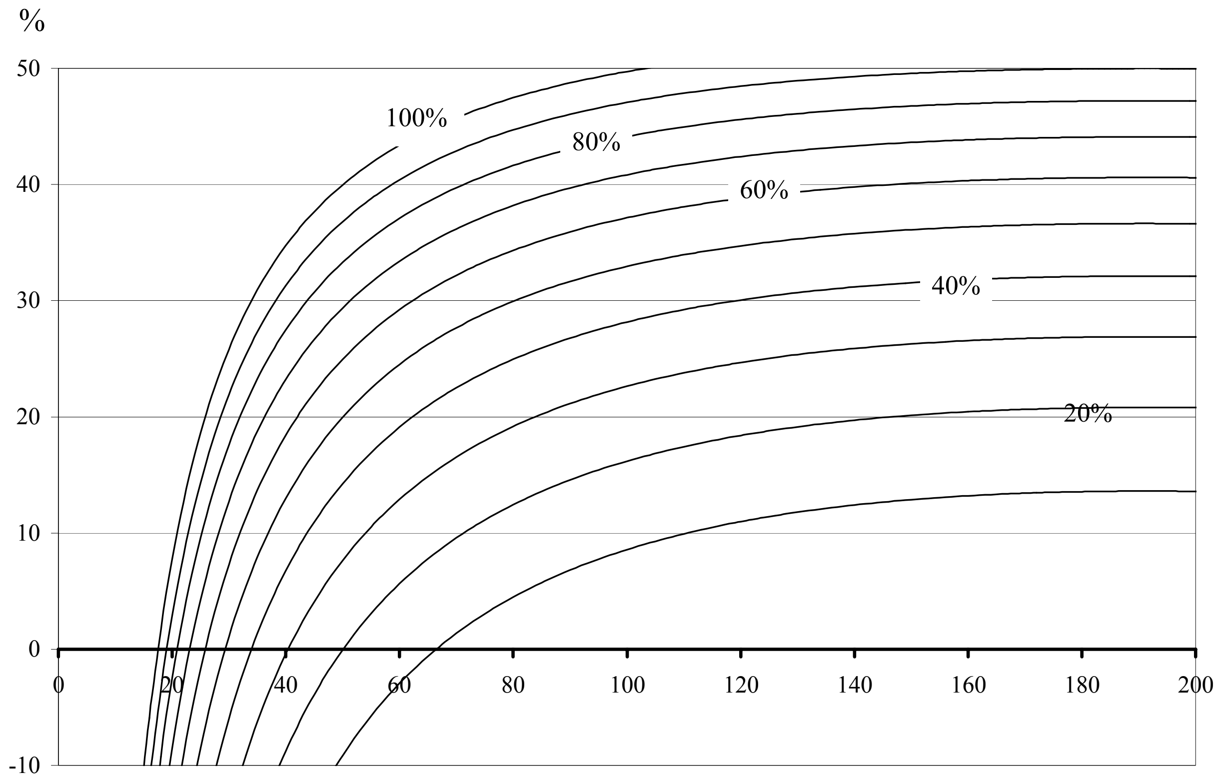



Figure 4 Changing of profitability (profitable farm size) with different proportion (10-100% of an extra price), in case of gross margin of 30%

Against the profitable farm size without t extra price, 10% extra price decreases the profitable farm size considerably, by one third. If the extra price increases, the profitable farm size decreases by degrees, however, the extent of the decrees is not proportional to the increase of the extra price. If 100% extra price could be reached, then a farm size of about 20 hectares would cover total costs of farming.

## CONCLUSION

At the end of the XX. century, the consumers' customs went through important changes. In the focus of the technical-technological development, the unlimited increase of efficiency became the key-question. At the same time, the ideology of sustainable agriculture spreads increasingly, which intends to take the ecological, social and economical aspects of development into consideration equally. But the ideology of bio-production is the rebirth of the thought “back to the nature”. The placing of production onto new bases is urged, -in addition to this, almost in a tragic manner - by animal diseases taking effect on the human too (e. g. BSE) and the epidemics thinning livestock. The fact, that factory farming has been pushed into the background can be felt in all Europe. Forecasts predict the spectacular ground gaining of the bio production.

The farm structure formed in Hungary in consequence of the system change, established a very good base to drive the factory farming onto an ecological way. The inputs were – first of all for financial reasons – considerably reduced, chiefly the utilization of artificial fertilizers and that of synthetic plant protection agents decreased primarily. However, the forcing expenditure reduction may cause a conscious change of strategy in farming.

In our researches, we looked the answer to the question, in which economic conditions the ecological farming can be a sally-point to small farmers. We gave the answer by examining the factors, which take effect on the profitable farm size, and the formation of the profitable farm size.

We have to emphasize the factor, that farmers, who started ecological production in time, may utilize the extra income realizable in this period, which the more substantial consumers are willing to pay for goods that satisfy their demands. In this case, only a less propitiation of the extra revenue is necessary to compensate the yield decrease, its larger proportion makes savings and farm development possible. The period of time can be a preparation to that one, when, by increasing the bio-product volume; the realizable extra price will expectably decrease. However, this will not make any problems until a certain limit, but may start a farm concentration, which increases the value of fix capital, but is necessary to establish the conditions of sustainable farming.

However, the spreading of bio farming can only be expected in case of applying active conscience-forming, and direct economical urging tools. The role of the government in this cannot be neglected.

By taking the facts mentioned above into consideration, it can be stated, that – based on the current farm structure – the system of ecological farms can be formed out, which will integrate them into the economic system of the EU, and which fits to the endeavours in the EU by decreasing the environmental load, an so defending the environment.

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