STOWARZYSZENIE EKONOMISTÓW ROLNICTWA I AGROBIZNESU
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ECONOMIC SIZE AND INVESTMENT RETURN IN THE HUNGARIAN SECTOR OF VEGETABLES FORCING

WIELKOŚĆ EKONOMICZNA A ZWROT Z INWESTYCJI W WĘGIERSKIM SEKTORZE PĘDZENIA WARZYW

Key words: farm size, vegetable forcing, investment return, model
Słowa kluczowe, wielkość gospodarstwa, pędzenie warzyw, zwrot z inwestycji, model

Abstract. The paper aims to analyze relations between the farm size and return from investment in the vegetable forcing sector in Hungary. The most favourable results were gained in the case of plastic foil covered greenhouses heated by thermal water without pumping back, which met the requirements of practice at 1 ha farm size. The variations of the plastic foil covered greenhouses heated by thermal water with pumping back, coal or wooden chips were regarded as suitable concerning risk taking when the size reached or exceeded 3 ha. The versions of glasshouses heated by thermal water resulted in acceptable profits on 3 ha while their vegetable forcing models heated by coal or wooden chips on 5 ha or more.

Introduction

During the preparation of my doctorial dissertation, I have had the basic purpose of creating practice-oriented vegetable-forcing models of comprehensive and realistic characters that do not require soil and meet the requirements of the 21st century – thus applicable in size-economic research tasks.

The objectives of my research were the following:

- working out vegetable forcing models without soil that are suitable for long cultured (all year long) production and also provide continuous employment. They are also capable of creating constructions by considering the possible alternatives of heating that are easily comparable on 0.5, 1, 3, 5 and 10-hectare size,
- evaluating vegetable forcing models without soil with the help of the break-even point, size, capacity use and investment-related calculations (NPV, IRR) by modelling the changes in production costs and revenue with the help of sensitivity tests,
- examining the efficiency of the heating alternatives and income generating capacity with the help of the vegetable forcing models created as a construction and depending on farm sizes.

It was not my objective during the research to analyse investments regarding liabilities from an accounting aspect and to evaluate the impact of subsidies as well as the proportion of own and external capital on the farm size.

For the researchers and experts in practice the question of optimal company size and efficiency linked to it has always been a great dilemma. Nowadays it has become evident that a bigger size would mean a more efficient solution in the case of all activities.

Material and methods

During my research task I was driven by the aim of creating thorough, easily understandable and practice-oriented models to examine the question of size economy in vegetable forcing.

The respondents of my interviews were such professionals who head Hungarian leading farm sin vegetable forcing. These farms are also competitive on a European level. They can provide such technological, market, economic and labour organising data that can serve as a positive example for gardeners engaged in vegetable forcing.

The problems pointed out by the practising professionals were in connection with the fact that the old fashioned greenhouses of the present day can limit the increase in yield. The success of production depends on the climate that prevails during forcing whose prerequisite is the application of the proper production system that meets the requirements of the 21st century.

Two types of production systems were considered when compiling my models: modern plastic foil covered and glasshouses with huge room and a height of 4.5-5 m.

Furthermore, in my models I have also defined the farm sizes that are most widespread in practice based on the compilation of the preliminary results so the:

- 0.5 hectare,
- 1 hectare,
- 3 hectare,
- 5 hectare,
- 10 hectare farm sizes have become the basis of my cost-benefit analysis.

Taking the Hungarian endowments into consideration I have chosen five methods of heating:

- thermal water (without pumping back),
- thermal water (with pumping back),
- coal,
- wooden chips,
- natural gas.

Constructions with the combination of production systems and heating methods were created in 10 varieties. The ten varieties on 5 types of farm sizes resulted in 50 types of model variations.

The use of constructions were tested on green pepper for stuffing, tomato and cucumber among the forced vegetables as the listed ones represent approximately 70% of the production value in Hungary.

The 150-model varieties were supplemented by 30 types of mixed models that are more risk-resistant based on the more diversified production system.

The mixed models were examined on the basis of the following proportions in case of the green pepper, tomato and cucumber:

- on 3 hectares 1:1:1,
- on 5 hectares 2:2:1,
- on 10 hectares 4:4:2.

Together with the mixed models altogether 180 vegetable forcing models were the subject of my analyses that also represent the possible modifications in the future. While calculating investment and production costs net prices were considered.

During my research the following methods were used for data processing and examining the size economic questions of vegetable forcing:

- determining the theoretical capacity utilisation,
- calculating break-even sizes and their sensitivity examination,
- return on investment and risk sensitivity examination,
- examining manufacturing costs in relation to constructions and farm sizes,
- the impact of heating performance on operating profit per construction and farm size.

Results

The formation of break-even size and capacity use in the models. Examining the tables, it can be seen that even values around 70% can be experienced in the case of 1 ha farm sizes except the constructions heated by natural gas but most values are still about 80-90%. First it is the 3 ha farm sizes where we can experience that the average capacity use values decrease to 70-80%, which shows a much more unfavourable value, i.e. around 60% in the case of constructions heated by thermal water.

By increasing the sizes, the percentage values can obviously improve regarding 5 and 10 ha equipment.The extremely high costs of greenhouses heated by thermal water without pumping back can most of all be covered by farms bigger than 3 ha, which is also reflected in their capacity use values. As in this case thermal water is pumped back to the layer where it derives from, that is why it is one of the heating methods based on renewable energy which must by all means be considered in the future.

Another renewable energy source is heating by wooden chips, which can also have potentials regarding the endowments of Hungary and it shows a value of approximately 70-75% depending on the ways of utilisation in the case of 3 ha or bigger farm sizes.

The constructions heated by coal show an acceptable 75-80% value on 3, 5 and 10 ha farm sizes. Due to the rising price of the coal and its environmental polluting impacts a decrease of this type of heating method can be envisioned in the future.

The sensitivity examination of vegetable forcing models based on break-even sizes. Among the 1 ha models the constructions heated by thermal water show a much more favourable picture. However, the new horticultural farms with thermal wells and pumping back cannot even be termed as risk takers even here as it is only under favourable economic circumstances that they reach the revenue level of 25% or a slightly higher one. In case of the plastic foil constructions heated by wooden chips, similar data can be experienced that allows us to conclude that the 1 ha-size farms do not meet the requirements in practice.

In case of heating by coal more favourable data are gathered that can also be seen in the utility modes of green pepper, tomato and cucumber.

The advantages of size economics can first be felt in the case of the 3 ha model farms. Depending on the heating method, the highest proportion of break-even sizes reaching 25% revenue level or even exceeding it can be noticed. Regarding the constructions heated by thermal water, even in the pessimistic cases – decrease of revenues and increase of production costs – we can find favourable values.

In the case of the 5 ha size model farms the decrease in the break-even size can be seen to a greater extent in the unfavourable economic climate but this value primarily depends on the heating method. Concerning tomato forcing without soil and heated by wooden chips we can experience that the 5% decrease of the revenue and keeping the production costs at a certain level can result in an acceptable break-even size.

Due to the size economics advantages, the 10 ha size farms show the best values which can refer to their higher risk-taking role in the long run.

To sum it up, concerning plastic foil covered greenhouses it is the 3, 5 and 10 ha sized farms depending on the heating and utilising methods that are more risk-takers while meeting the requirements. Due to the high investment costs of glasshouses, only the bigger 5 and 10 ha-sized farms reflect favourable break-even sizes deriving from the advantages of size economics.

The investment-efficiency and risk sensitivity examinations of vegetable forcing models. On the basis of my examinations in case of the 1 ha sized plastic foil covered greenhouses, only the constructions heated by thermal water without pumping back had favourable results. In these cases the IRR value of approximately 10-15% was the most common while other constructions reached a result of below 10%.

Concerning 3 ha size farms both constructions either heated by thermal water with pumping back or by wooden chips performed well and it was only in one single case when both of them had worse results. The greenhouses covered by plastic foil and heated by coal had an IRR value of below 10% three times at this farm size category.

Assessing the investment results of glasshouses we can notice that in case of the 3 ha size only the data of the constructions heated by thermal water without pumping back ranked well and IRR values of below 10% were primarily typical of the other ways of heating.

In the plastic foil covered greenhouses of 5 ha size favourable rankings are noticeable in case of all heating methods and most IRR values of greenhouses heated by thermal water or wooden chips belong to classes of 15-20% or even above 20%. Among the constructions heated by coal and covered by plastic foil only 2 data showed a value of below 10%. Concerning the results of greenhouses it is still the constructions of low cost and heated by thermal water that show suitable figures. In my examinations among the 10 ha vegetable forcing models all plastic foil covered ones produced a favourable IRR value without exceptions and it holds true in the optimistic, realistic and pessimistic points of view alike without exceptions. The most common values were between 15-20% so belonged to IRR Class II.

In my glasshouse investment models it was only the constructions heated by thermal water which produced such values that can ensure their efficiency in the long run.

The examination of manufacturing costs in line with the constructions and farm sizes. Reducing manufacturing cost and increasing farm sizes can be seen in all constructions and ways of utilisation. However, there can be differences in the pace of decrease.

Size economics becomes more emphasised in case of the technologies of higher investment cost. This strong decrease in manufacturing cost is especially marked between 0.5 ha and 1 ha as well as from 1 ha to 1 ha sized farms. It can be also noted that the value of manufacturing costs decrease to a smaller extent in case of the farm sizes above 3 ha (5 and 10 ha).

The impact of different heating methods on operation costs in the vegetable forcing models without soil. One of the highest expenses of vegetable forcing is energy, especially heating. Our dependence on import regarding fossil energy resources puts the farms dealing with vegetable forcing without soil at a disadvantageous situation. By utilising domestic green and thermal energy resources this dependency could significantly be reduced and from this aspect Hungary has excellent endowments. That is why I regarded it important to examine the efficiency and income generating capacity of the single heating methods per construction in line with farm sizes and with the help of the created vegetable forcing models.

As comparing different heating methods is only possible alongside similar dimensions, an indicator was worked out. The indicator shows the formation of pre-tax profit per m^2 on 100 Watt heating performance (Fig. 1-3).

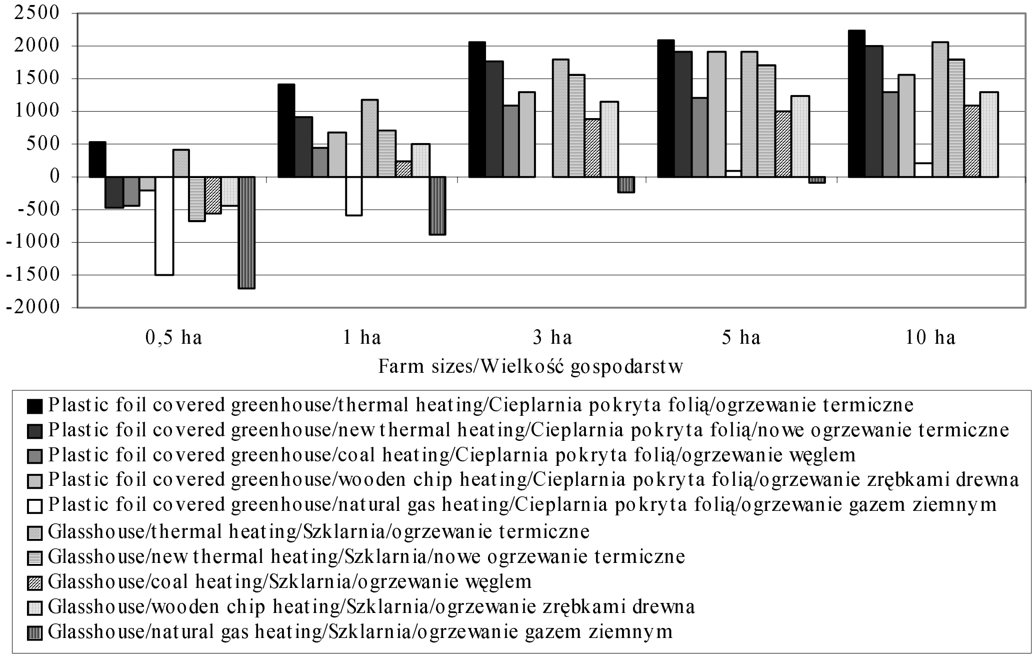

Figure 1. The formation of the operating profit per m^2 on 100 Watt heating performance in case of green pepper forcing without soil on different farm sizes
Rysunek 1. Tworzenie zysku operacyjnego z m^2 na 100 Watt wydajności ogrzewania w przypadku zielonego pieprzu pędzonego bez gleby w gospodarstwach o różnej wielkości
Source: own study
Źródło: opracowanie własne

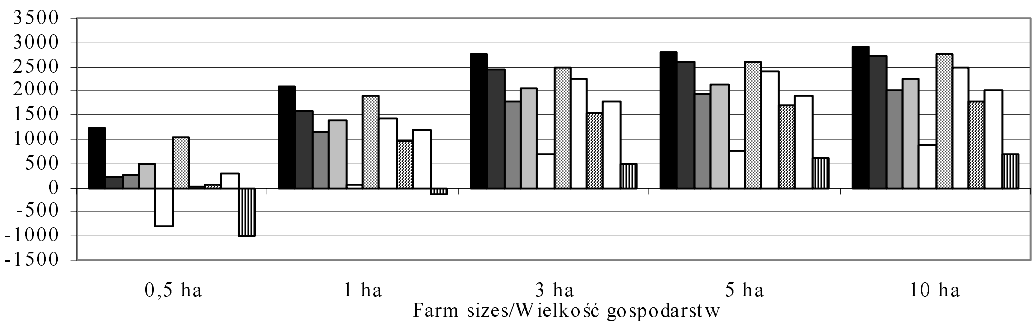

Figure 2. The formation of the operating profit per m^2 on 100 Watt heating performance in case of tomato forcing without soil on different farm sizes
Rysunek 2. Tworzenie zysku operacyjnego z m2 na 100 Watt wydajności ogrzewania w przypadku pomidorów pędzonych bez gleby w gospodarstwach o różnej wielkości
Explanations: see fig. 1/*Objaśnienia jak na rys. 1*
Source: own study
Źródło: opracowanie własne

Figure 3. The formation of the operating profit per m² on 100 Watt heating performance in case of cucumber forcing without soil on different farm sizes
Rysunek 3. Tworzenie zysku operacyjnego z m2 na 100 Watt wydajności ogrzewania w przypadku ogórka pędzonego bez gleby w gospodarstwach o różnej wielkości
Explanations: see fig. 1/*Objaśnienia jak na rys. 1*
Source: own study
Źródło: opracowanie własne

Conclusions and recomendations

The most favourable results were gained in the case of plastic foil covered greenhouses heated by thermal water without pumping back, which met the requirements of practice at 1 ha farm size. The variations of the plastic foil covered greenhouses heated by thermal water with pumping back, coal or wooden chips were regarded as suitable concerning risk taking when the size reached or exceeded 3 ha. The versions of glasshouses heated by thermal water resulted in acceptable profits on 3 ha while their vegetable forcing models heated by coal or wooden chips on 5 ha or more.

Among the 1 hectare farms favourable NPV and IRR results were gained only in case of the plastic foil covered constructions heated by thermal water without pumping back. Considering the 3 hectare farm sizes, the constructions in the case of the plastic foil covered constructions heated by thermal water with pumping back or wooden chips also performed well on the basis of investment efficiency indices while among the glasshouses only the construction heated by thermal water without pumping back. Among the 5 hectare farm sizes the plastic foil covered ones heated by coal and the glasshouses heated by thermal water accompanied the models previously regarded as favourable based on their NPV and IRR indicators. In case of the 10 hectare farm size all constructions and utilisations ranked favourably except natural gas regarding investment efficiency indicators.

Among the single constructions (equipment/heating method) in case of the 3, 5 and 10 ha farm sizes slight deviations were experiences regarding the value of the indicator. The advantages of size economics deriving from increasing farm sizes could first be pointed out in the case of the 3 ha vegetable forcing models but on the 5 and 10 ha model farms the value of the indicator rose only slightly when increasing the farm size.

The serious problem of small and medium sized enterprises is that they cannot make use of the positive changes happening at enterprises and they are not able to react to changes rapidly. All this can primarily be due to the errors in the managerial system and lack of efficient controlling. „Success" means recording information of the right volume and component and its processing meeting the needs of managers as well as data supply in

Time that also serves as a base for corrective measures. By means of controlling as an activity such maximum profit can be realised that does not ruin the future so it does not derive from the sales of businesses. Liquidity in the short run and financing in the long run can be ensured and, last but not least, (cost-) efficiency is realised on entrepreneurial level as well as in the subareas.

Widening the network of suppliers of multinationals can be an important area of the growth of small and medium sized enterprises. Cooperation with the multinationals can be advantageous for both parties as their production capacity can be increased without investment and they can make use of the elasticity of the small enterprises. The multinationals can get close to the market niches sometimes difficult to reach. The small and medium sized enterprises, on the other hand, can get information and export markets from the multinational companies and can also hold strong supplier positions, which can strengthen their management.

To sum it up, in Hungary the vegetable forcing based on thermal energy and renewable energy resources (wooden chips) has a future. Besides them, systems heated by energy from waste can also be significant. Regarding the points of view of size economics in vegetable forcing firstly it is the 3 and 5-ha size farms heated by geothermal energy and biomass that can reach such operating profit that can ensure the development of the branch with a great degree of certainty.

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Streszczenie

W artykule podjęto próbę określenia wielkości gospodarstwa optymalnej z punktu widzenia efektywności ekonomicznej w odniesieniu do gospodarstw warzywniczych na Węgrzech specjalizujących się w pędzeniu warzyw. Stwierdzono, że najlepsze rezultaty uzyskiwano przy produkcji pod folią, przy zastosowaniu do ogrzewania wód termalnych – jednak produkcja powinna odbywać się na powierzchni co najmniej 1 ha.

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