

## **TOMATO PRODUCTION OF A HUNGARIAN SMALLHOLDER FARMER: CASE STUDY**

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**Abstract.** *The study took place on the farm of a small producer in Kiskunfélegyháza. Production takes place under block system plastic tents. The sensitive points of local technology, the types and quantities of tomatoes produced were examined. In assessing the situation of the producer, special emphasis was placed on the examination of sales opportunities. Data were collected from the documentation of the farm and by an interview with the farmer. Based on the experience, a SWOT analysis was performed. Round, truss and cherry tomato varieties are produced at the farm. The season of their production lasts from April to the middle of December. Most of the tomato sold at the Wlosale Market at Budapest and the the local farmers' market. A short supply chain could create more livable, less polluting areas where there is a direct link between producer and consumer. The huge margin created by retailers and wholesalers can be eliminated. A much fresher product can get on the table of consumers, as the product can be purchased locally. Although selling to direct customers requires more time and effort than selling the goods in larger batches, this is offset by the higher available price. Direct contact with consumers provides immediate feedback on how customer needs change, making it easier to adapt to local demand.*

**Keywords:** *tomato production, varieties, smallholder, horticulture, logistics*

### **INTRODUCTION**

Tomatoes are our biggest surface-grown vegetable in competition with peppers in Hungary, so they can be found in every product range, from small to multi-handed to wholesalers, to direct sales. For tomatoes, the shortest possible product path is very important, as it loses its freshness sooner than, for example, cucumbers or potatoes.

Tomato growing under protected cultivation conditions can have a number of costs depending on the production standard. With modern technology, all costs are higher than production at a lower standard. During the production under foil tent, the following are expensive: propagating material, foil, heating, irrigation, fertilizer, plant protection, soil medium, CO<sub>2</sub>, although this gas is most common in modern greenhouses. Furthermore, wages appear as a cost, as well as professional advice, the use of which is unfortunately not widespread in Hungary, although it could have a huge impact on yield averages if the help of competent professional consultants is sought (NÉMETH et al., 2014).

On the other hand environmental impact of production is more and more important issue in horticulture. For example the risk of eutrophication is high and the methodologies currently used to measure the amount of fertilizer emission to the groundwater are only approximate. The high energy demand was lower than 17% in the multi-tunnel greenhouse and lower than 4.9% in glasshouses due to the replacement of growing medium (TORRELLAS et al. 2012). The study of DIAS et al. (2017) showed that the highest environmental impacts in Ontario greenhouse tomato production come from heating with fossil fuels. The application of willow biomass for heating could decrease this negative effect, but may increase the demand for arable land to produce the biomass needed than is required for produce tomato in the field.

The fruit production process has been influenced by the plant management system, with double-stemmed plants producing 80% more fruits per plant and 45% more per square meter than single-stemmed plants. The highest average production per plant (5.3 kg) and the highest production per square meter (13.2 kg) were also obtained by double-stemmed plants; the result is confirmed by the double locus of flowers on the plant. The average fruit weight of

the double-stemmed plants (121.0 g) was slightly lower than that of the single-stemmed plants (122.5 g), however, this result cannot be used as an argument that the single-stemmed plants clearly provide higher yield growth (HOZA et al. 2018).

The basis of the import policy of domestic retail chains is that they are able to obtain a significant amount of imported goods if they do not find enough vegetables in Hungary to serve the needs of large customers. In such cases, when they are imported and bought cheaply compared to domestic prices, and are also offered on the counters compared to Wholesale Market prices, it can significantly curb the demand for vegetables in the Wholesale Markets. Usually, the largest import volume arrives in the winter, which is completely achievable, because then the replanting of vegetables takes place, for example in the case of tomatoes, so there is no harvest, but the store chains have to maintain the whole year supply (SERES et al. 2012).

Producer organizations' competitors are wholesale markets, which are more difficult to compete in a number of respects. Wholesale markets are difficult to control and opaque, while producer organizations have to comply with food quality, labor, and accounting standards (POPP et al., 2008). Many times, these administrations have been unduly complicated, making it difficult to operate. The fruit and vegetable sector is fundamentally difficult to review and difficult to regulate, in contrast, producer organizations have been over-regulated (BARANYAI – TAKÁCS, 2017).

The rapidly expanding sector of interest to producers, processors, retailers and consumers is fresh vegetables, characterized by health benefits and convenience. These vegetables are an opportunity for small farms in south-eastern European countries, which can offer a wide range of species and varieties, as well as additional services such as minimal processing (e.g. cleaning, cutting, packaging), especially for the vegetables they sell directly (NICOLA - PIGNATA, 2017).

Implementing well-thought-out competitiveness strategies along the product value chain is key to poverty reduction. This could facilitate the transformation of tomato production from self-sufficient to market-oriented production. It follows that the government needs to explore public-private partnerships that allow farmers to access and take full advantage of available technologies such as newly bred seeds and other inputs. These partnerships would involve the mass sourcing and local production of raw materials; and encouraging private investment in market-related infrastructure to integrate smallholder farmers into the value chain (OCHILO et al. 2019).

The profitability of the old type of plastic tunnels would be relatively low, overhead costs would continue to decrease significantly, and the profitability index would be close to zero. The analysis of efficiency indicators shows an improving rate of return on direct costs. There is no significant difference in profitability between the block-based plastic tunnel and the modern greenhouse, so a profit of almost the same can be achieved with the unit cost (DOROGI - APÁTI, 2019). In traditional plastic tents, tomato production can be continued with the most modest economic parameters, even if it has the lowest capital requirements. Due to the relatively low unit yields and average prices, as well as the poor efficiency of live labor, production is uneconomical, so this is by no means a recommended method of production. Therefore, only the block-based plastic tunnel and the modern greenhouse, in which the economic parameters are acceptable, can be an alternative. Block-based foil houses show better values in terms of return on capital invested, mainly due to their lower capital requirements, while modern greenhouses have a much more favorable income-generating capacity. However, there is no significant difference in the payback time of these two production facilities. Together with investment subsidies, modern greenhouses clearly show the best picture. As

investment aid and yield levels have a decisive impact on the economy, the efficient use of subsidies and the achievement of high, professional production standards (specific yields) are in any case a key issue for competitive production (DOROGI, 2019).

One of the work restrictions is risk assessment, as in addition to economic risk, there is also risk from biotic and abiotic factors, although the climate risk of pests and diseases has been minimized in this system. Therefore, the need to evaluate other species as well as to control production functions that clarify the production potential of systems for different input combinations should be emphasized (MACHADO NETO et al., 2018).

In Australia, greenhouse tomato production is predominantly targeted at the fresh vegetable market. Cultivation under protected conditions allows for yields and efficiencies that cannot be achieved by field production, which contributes to rapid expansion. However, indoor production reduces the potential for the use of natural insect or wind pollinators. Alternative methods are needed to improve flower pollination and yield as well as product quality (DINGLEY et al. 2022).

The goal of the short supply chain is partly environmental awareness, so the greenhouse gas emissions of various vegetables have been studied. For many vegetables, transportation was the most valuable, with tomatoes being the production itself, due to the heating and lighting of the greenhouses (CARLSSON-KANYAMA, 1998).

Producers use more channels, but a dominant space can be observed. It is nothing more than a producer market. These markets are the most important for producers in terms of turnover. Producers can sell to producers within 40 kilometers of the market (and Budapest), and it is important that the person in the county where the market is organized produces. Organizers are usually non-governmental organizations (BENEDEK - FERTŐ, 2015).

In the course of the study, the general presentation of a small or medium-sized family farm specializing in the cultivation of tomatoes under protected conditions (block of plastic foil tents) was aimed at, with special regard to the factors causing difficulties in production and sales opportunities.

## **MATERIAL AND METHODS**

The examined horticultural farm is located on the outskirts of Kiskunfélegyháza in Bács-Kiskun County. It can be said that this area is significant in vegetable production. There are plenty of mid-range farms in the area. Considering the examined farm, there are no other greenhouse farms in the 2 km radius, which is an advantage for them in that they do not get pests from other greenhouses. The main profile is tomato production, in addition to grow pumpkins. Their tomato production area is 5500m<sup>2</sup> (Figure 1). Production takes place in blocks of double-foil tents. In the past, their production surface consisted of 5 foil tents, but knowing the advantages of the foil block theory, it now consists of only 3 foil blocks, so they have developed in this field.

Data were collected from the documentation of the farm and by an interview with the farmer. Based on the experience, a SWOT analysis was performed. The photos were made by Adam Szabo.

## **RESULTS AND DISCUSSIONS**

They work in a long culture, so their seedlings are planted in January and the stock is kept until December. As a long culture, production takes place even in winter, they work with heated foils. There are two boilers available, one heated with wood chips and the other with coal. Indoor storage is used to store fuels.

They work with a wide range of varieties, growing the general round tomato and the truss tomato (Figure 2) on the largest surface. On a smaller surface, they deal with tomato specialties, i.e. cherry tomatoes. There is a growing demand for cherry tomato varieties year after year, so they have taken away their production area from round tomatoes so that they can produce even more cherry tomatoes, thus adapting to market demand.



Fig. 1. Plastic foil blocks

They cultivate without soil, not working with the usual coconut blanket, but placing the plants in coconut fibre cubes in a growing bucket (Figure 3) to create a suitable medium for them. The coconut cubes need to be replaced every two years. Their working principle is that by placing the finished coconut cube in the bucket and then pouring the right amount of water into it, the coconut refuses and fills it, thus creating the perfect, not too hard medium for the incoming plants. After two years, the growing medium used is applied to the family's arable land to increase the organic matter content of the soil.

The nutrient solution of the plant is solved with a specially programmable nutrient solvent. Dripping spikes are inserted at the root of the plant, which is connected by a capillary tube to the PVC tube in which the nutrient solution flows. (The price of fertilizers for the production of nutrient solution is constantly increasing, especially for calcium-based fertilizers.)

The issue of labor also causes problems for them, as is the case in most horticultural enterprises. Unreliability and inadequate work are common. They have hourly pay, which can cause problems for employees. At the national level, but also in most of the horticulture in Kiskunfélegyháza, performance-based wage is used, which is a good decision, but here they do not dare to make this change, because they feel that it would cause a migration among their employees. Aging is a problem, with few young people taking up manual work in horticulture. More retirees are working at their farm, and replacing them could be a challenge in the future.



Fig. 2. Truss tomato in high season



Fig. 3. Growing medium in buckets

Biological plant protection is used in their greenhouses when sprayed, even with an agent that is environmentally friendly, and spraying is tailored to their pickings so that the proper health waiting time is complete.

Tomatoes are mainly sold on the wholesale market in Budapest and on the local producers' market on Wednesdays and Sundays. For market days, they start harvesting the day before. Many gardeners don't work on the weekends, so the products are prepared for the Sunday market on Fridays. So here they offer a day fresher tomatoes.

There have been significant developments in the economy over the last 2 years. With the help of a tender, they managed to install a solar park, which, based on their experience so far, fully covers the power supply of horticulture. Power consumption is high due to the electric lighting insect traps and plenty of pumps. The other major development was that the height of one of the greenhouses was significantly increased. The internal height of the foil tent increases, so the tomato can grow much higher, the plant has to be released less often, and most of the work is much more comfortable, so it is much more economical in terms of labor costs. The atmosphere is much higher, the humidity is more optimal, the plant feels better, which is also reflected in the yield averages.

Another step forward was to replace their truck with a larger total weight. The state has begun to deal strictly with the sanctioning of overweight vehicles. They approach the wholesale market via the M5 motorway, where they have to go through a scale that measures the weight of the vehicle. This must not exceed the total permissible weight. This investment was also justified for them.

The construction of a processing hall was also realized with the help of a tender. This hall is currently used as a tomato sorting room and storage room. The freshly picked tomatoes are stacked on pallets in the greenhouses, which are then taken to the said sorting room by means of a tractor. Class I tomatoes are only weighed as they are fully prepared (Figure 4). Further grading of tomatoes during picking in the greenhouse in the rows due to lack of space is not possible, so they are done in the grading room. 9-11kg of tomatoes are placed in a tray, depending on the variety (Table 1.). A maximum of 40 trays of finished product are loaded on a pallet and loaded onto the truck.



Fig. 4. Class 1 round tomatoes on tray

Table 1

Quantity of products during the year

Type	The beginning of the season (April-May) tray/week	High season (May August) tray/week	End of season (September-mid-December) tray/week	Varieties
Round tomato 11kg/tray	100-200	350-400	100-150	Marvallance Siranzo
Truss tomato 9kg/tray	100-150	300-350	50-100	Aruba Avalentino
Cherry tomato 6kg/tray	50-100	150-200	25-78	Gustafano Genery Imperozo

### SWOT-analysis

The situation of the farm is demonstrated through a SWOT analysis, especially with regard to the short supply chain.

#### Strengths

- In terms of strengths, the owner's work ethic is above average.
- Generational change promises to be relatively easy because the farmer's son will gradually take over management of the farm after completing his university studies.
- This profession is aging, so competitors may decline in the future.
- The expertise of the farmer and his son is in favor of strengths.
- The effort to build a short supply chain and take advantage of the opportunities offered by online space.
- They reach a significant returning customer both in the Wholesale Market and in the local producer market, as well as sales directly from the farm.

#### Weaknesses

- They cannot provide a product to consumers all year round.
- Failure is common in their heating system.
- They have to deliver tomatoes on a relatively long route to their main outlet, the Wholesale Market. This is a weakness due to spatial location.

### **Opportunities**

- Striving to build direct food chains. We can offer fresher tomatoes in stores to our direct consumers.
- Better use of the available labor in the area could mean opportunities for development and even an increase in production area in the future.
- It is possible to react quickly to new special varieties and to enter the market early with them.

### **Threats**

- Large multinational retail chains require the same product throughout the year.
- The presence of giant horticultural businesses in the market and their price depressing effect.
- Continuous increase in input prices.
- Slow return on investment.

### **CONCLUSIONS**

A short supply chain could create more livable, less polluting areas where there is a direct link between producer and consumer. The huge margin created by retailers and wholesalers can be eliminated. A much fresher product can get on the table of consumers, as the product can be purchased locally, which is not hundreds of miles traveled.

Although selling to direct customers requires more time and effort than selling the goods in larger batches, this is offset by the higher available price.

Direct contact with consumers provides immediate feedback on how customer needs change, making it easier to adapt to local demand.

Farmers are in constant competition with multinational companies trying to keep prices low, making it difficult for smaller producers to sell their products at profitable prices.

The long-term operation of this direct sales channel requires a huge change in consumer attitudes. The product produced is there, it is created only waiting to be consumed in the right place, ie locally. It is recommended for consumers to buy a local Hungarian product directly from the producer. In this way, they contribute to the survival/development of Hungarian producers, and fresh, high-quality products can be put on their own tables.

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