

## *Effects of the discovery of vitamin C on the paprika industry and the economy of the southern part of the Hungarian Great Plain*

This rather mundane topic seems to be somewhat out of line with the topics covered during the Szent-Györgyi memorial year of 2012, and the 2014 Open University, Szeged, since it deals with the economic effects of the scientific activities of the world-renowned scientist, influential professor and one of the most prominent rectors of the University of Szeged on the daily lives of paprika producers living in Szeged, around Szeged, and in Hungary as a whole. In addition to his activities in the fields of science, public life and cultural diplomacy it is probably justified to study this aspect of Albert Szent-Györgyi's life, too. This endeavour was encouraged by two articles published in contemporary daily papers. One of them was written in March 1933 and came out in *Szegedi Napló*. The title of that article called this rather new substance – hardly known to the general public – “Szeged vitamin”. The article also revealed that the University of Kolozsvár (currently Cluj-Napoca in Romania), which was moved to Szeged in 1921, had just started to repay the city all the funds it had provided beyond its own possibilities to become the host city of the university. In the last sentence the author pointed out that the vitamin C related discovery of Albert Szent-Györgyi envisioned an inestimable boom, which would solve the daily problems of the city's producers for years to come. Four years later, after getting to know about Albert Szent-Györgyi's Nobel Prize in the autumn of 1937, rector József Gelei claimed that the triumph of Hungarian paprika could be attributed to Szent-Györgyi's vitamin related research. These two articles also make us realise that Albert Szent-Györgyi's scientific discovery in the autumn of 1932 brought significant financial benefits to the residents of the city too.

### **Paprika production and processing in Szeged**

The history of spice paprika production and processing in Szeged goes back much earlier than 1932. It was first grown in the area in the 18th century, and several of its properties helped it become a popular spice in Hungarian cuisine. Its colour, aroma and flavour, as well as its high vitamin content all contributed to the growing use of paprika in Hungarian dishes. Subsequently it was Albert

Szent-Görgyi who pointed out one of its beneficial properties, namely that extensive paprika consumption alone can offset – at least to a certain extent – the dangers of the unhealthy, one-sided diet of the Hungarian population due to the many useful vitamins and other nutrients it contains. The former include vitamins B, C, E and pro-vitamin A, while the latter include capsaicin, which helps the absorption and digestion of fatty and heavy food. In Szeged larger-scale paprika production started in the 18th century, primarily in the southern and southwest regions (Alsóváros, Alsótanya, Rösztke, Szentmihály). The Pálffy brothers introduced a technical breakthrough in the paprika industry of Szeged in the second half of the 19th century: they developed the technology of modern, large, steam-operated paprika mills. The publication of a cookbook (featuring a nice, huge paprika pod on the cover page) at the turn of the 19th and 20th century is also credited to them. Another name worth mentioning is that of Mrs. János Kotányi. She also started her career in Szeged. She opened her first spice shop in the city in 1880, one year after the great flood. A year later she acquired a paprika mill in Szeged, and a few years later she opened paprika shops in Budapest and then in Vienna. Finally, at the turn of the century she opened her own paprika mill in Vienna, but even then she mostly processed paprika grown in Szeged.



János Kotányi's paprika mill

Paprika processing in Szeged had become industrialised by the turn of the 19th and 20th century, and the technology remained practically unchanged for the next 50 years. The harvested paprika pods were threaded into strings so that they could undergo post-harvest ripening when hung from porches.



Threading paprika pods into strings



Paprika market on Valéria tér (current-day Bartók Béla tér)

These long strings were sold on Valéria tér (currently Bartók tér), practically in the heart of the city, to entrepreneurs processing the paprika. They employed women experienced in paprika splitting to chop up the pods, which were then ground in the mills. In Szeged the livelihood of entire families depended on the paprika industry.



Sale of paprika strings on Valéria tér (currently Bartók Béla tér)



The process of paprika splitting

Valéria tér was considered to be a wholesale market for paprika trade. Paprika retailers sold their products at another market, in Széchenyi tér, next to the City Council. This was called *literös* market in the local dialect, where customers could buy ground paprika by the litre.



Szeged – Paprika market in Széchenyi tér

## Economic difficulties in Szeged

Szeged's economy reached a significant turning point in the 1920s. The previously flourishing city was confined to a rather small “cage” by the Treaty of Trianon, since it lost most of its economic catchment area due to the territorial adjustments. It must be noted that until 1920 the catchment area of Szeged lay only to the south of the city, and since these territories were annexed from Hungary, Szeged practically lost its economic catchment area. In addition, thousands of refugees remained in the city, and caring for them remained an unsolvable task for the city leaders for almost a decade.

Problems were aggravated by the fact that in the 1920s further investments were undertaken by the city leaders. The first such project was the construction of the Votive Church, which started back in 1880, but was halted during the turbulent years of the Great War. Construction was resumed at a higher speed only after the end of the war. The rural narrow gauge railway line was constructed in the middle of the 1920s. Although it subsequently contributed to the development of the city and the surrounding villages, it created almost unconquerable budgetary problems for the local government in the years of construction. As I have already mentioned, from 1921 on the city took enormous sacrifices to relocate the University from Kolozsvár to Szeged. Beginning in 1926, the city undertook further university related construction projects. This was the time when the construction of the university's teaching hospitals and the buildings for theoretical research and education was started in Dóm tér.

This required significant contribution from the city. These factors jointly led to the unprecedented indebtedness of Szeged by the middle of the 1920s, and only very optimistic economists could believe that the city would be able to repay its debts in the 1920s. In this situation the city with daily financial problems could do only one thing: it had to drastically raise the land rents, which was detrimental to small producers. The annual rent of one acre of arable land increased to an amount equalling 1-1.2 tons of wheat in value. This means that around 60% of the expected produce had to be used for paying the rent, which put an almost unbearable burden on farmers. For tenants the only way out of this grip was the production of commodities more valuable than wheat, and paprika was thought to be a good solution. Some small producers took out loans to purchase new lands for production, while others in a more difficult situation did the same to alleviate their daily financial problems. As a result, by the end of the 1920s indebtedness plagued not only the city, but paprika producers and processors too.

	Szeged	Kalocsa
1891	1100	?
1892	585	?
1893	1036	?
1894	2164	?
1895	1330	?
1896	1375	?
1897	1128	?
1917–1925	1208	532
1926	2072	849
1927	1151	818
1928	1266	546
1929	2302	645

Spice paprika growing lands before the economic crisis (acres)

## Paprika production and trade in the 1920s

In the 1920s paprika production in Szeged reached record levels. If we look at the figures only, we can witness an unprecedented success: while in 1918/19

only 1,000 tons of paprika was produced in Szeged, production between 1920 and 1926 grew from 1,600 tons to 2,630 tons. Seeing this boom, paprika production was also started in other, more distant regions, estates, as well as in areas of the Szeged paprika growing regions that had been annexed to the Kingdom of Serbia, Croatia and Slovenia (Horgos /Horgoš/, Martonos /Martonoš/).

Év	Produced	Processed
	paprika (t)	
1920–21	1600	1380
1921–22	1200	1020
1922–23	1300	1150
1923–24	2000	1395
1924–25	2630	1620

Paprika production in Szeged in the first half of the 1920s

The problem of Szeged based paprika producers and processors was caused by the fact that although the quantity of crops increased, trading opportunities became less and less predictable. On the one hand, neighbouring countries, which were considered as a domestic market for Szeged based producers before the Great War closed their doors to products from Hungary, including Szeged-grown paprika. On the other hand, by the 1920s the Spanish paprika industry had significantly invigorated, which meant that in regions further away from Hungary the cheaper Spanish paprika turned into an almost unbeatable competition. This fierce competition significantly restricted the export possibilities of Hungarian paprika. Consequently, trading difficulties became permanent, and the paprika buy-up prices strongly fluctuated depending on momentary supply and demand. The problem was further aggravated by the fact that the land structure around Szeged was rather unfortunate. Paprika was grown by dwarf- or smallholders, and the average paprika growing land around Szeged was one acre per family. Approximately 7,000 families around Szeged were involved in paprika production. This means that if we take into account paprika producers and wage labourers too, it affected the livelihood of around 15,000 families if the buy-up price of paprika rose or fell by a few fillers (*small change coin in Hungary – translators note*).

	Szeged	Kalocsa
1910–12	10	36
1915–20	185	36
1925–29	492	36
1929–30	787	36
1930–31	713	36
1931–32	733	36

Number of paprika processors in Szeged and Kalocsa before the economic crisis

## Paprika trade crisis

The expansion of paprika production was halted by the global economic crisis, which hit the paprika industry of Szeged the hardest in 1931. From 1931 on dozens of articles in Szeged based newspapers called for action to save Szeged-grown paprika, which had become almost impossible to sell abroad. An article in *Délmagyarország* highlighted that action was needed in connection with 200 railway carriages full of paprika. This amount equalled 2,000 tons, i.e. nearly two thirds of Szeged's paprika production. The trading problems with paprika were aggravated by the behaviour of the National Bank of Hungary (NBH). As it turned out, when producers managed to sell their crops abroad NBH was not willing to convert the foreign currency to Hungarian currency, and it did not authorise those affected to sell the foreign currency they owned by themselves. This completely paralysed paprika exports, since sooner or later traders ran out of forints, and were no longer able to pay producers and processors.

Five days later the press reported that in the wake of the actions taken by Sándor Popovits, president of NBH, the bank converted the schilling revenues from paprika exports at an exchange rate of 80 fillérs, and would continue to do so in the future. However, this was not the end of the problems with currency conversion. On 13 March 1932 the press reported that finance minister baron Frigyes Korányi wrote to Kuno Klebelsberg that the National Bank of Hungary had in theory authorised to use the foreign currency revenues from paprika exports to offset the pengő claims payable for goods imported from abroad.

In 1932 the crisis deepened even more. The problem was caused by the fact that crop levels were record high due to the favourable weather conditions,

but its sale was even more difficult than usual. According to the papers, a delegation of 500 travelled to Budapest in order to save Szeged-grown paprika, because this quantity was impossible to sell. It was in 1932 that salami and paprika exporter Márk Pick sent a letter to the director of the Institute of Chemical Experiments, in which he wrote about paprika lawsuits in Germany launched on the basis of allegations that butchers had added too much paprika to their salamis. In his letter he asked Ernő Obermayer to get paprika acknowledged as a spice and not as a food colorant. Then they would be able to raise the interest of foreign markets in paprika. Since the sale of the paprika produce did not go smoothly, the affected producers and processors were unable to meet their loan repayment obligations. By 1933 85% of the producers had so much debt that was impossible to repay. This meant that only 15% of the paprika producers were debt-free. The paprika crisis jeopardised the entire agriculture of Szeged, and indirectly the economy of the entire region, as well as the local credit and financial institutions.

	1929	1930	1931	1932	1933
Ausztria	303,4	349	386	412	339
Csehszlovákia	143	187,7	200	289	154
Franciaország	0,9	1,5	1,4	1,8	1,4
Hollandia	0,8	1,4	1,4	2,1	4,1
Kanada	0,1	0,4	1,7	0	13,1
Lengyelország	19,9	22,9	17	19,2	20
Nagy-Britannia	2,7	0,9	1,9	2	24,3
Németország	108,5	128,9	111	135	109,8
Tunézia	0	0	0	0	16,1
USA	17	29,8	23,2	65,6	371,4

Hungarian spice paprika exports to 10 countries in the years of the economic crisis (tons)

## Measures aimed at the restriction of production

By 1933 the situation had stretched to breaking-point. In the first step lands available for paprika production were downsized in 1934 by Decree 1890/1934 M E (and the enforcing Decree 52.000/1934): an area was assigned for paprika production in the vicinity of Kalocsa and Szeged, and spice paprika could

exclusively be grown there. The production of spice paprika was banned in other areas of the region, where only other types of paprika could be grown. Even within the smaller growing area only those producers could receive production licences who (whose business predecessors) had been involved in the production of spice paprika in the “confined area” for at least three years between 1926 and 1933, even if with interruptions. In this year paprika was produced by 7,245 farmers on 7,168 acres in the Szeged area, and by 5,612 farmers on 3,850 acres in the Kalocsa area.



Demarcation of areas for paprika production (1934)

In the second step Decree 1900/1934 M E forced producers to join cooperatives for the reduction of production, and the operation of such cooperatives was supervised by the minister of agriculture. One third of the board members were also appointed by the minister. If objected by the minister, the cooperatives had to change their resolutions. Although these decrees were objectionable in terms of private law, they proved to be economically progressive, because they tried to turn the anarchy of production into a reasonable system. In contrast with the rights of the individuals they tried to put an emphasis on the benefits of the community.

In 1936 a decree was passed to regulate the sale of paprika as well. Pursuant to Decree 4650/1936 m E (and the enforcing Decree 26.500/1936 F m) producers and paprika processors could only sell their produce to the cooperative centre specified by the minister of agriculture, and that centre was mandated to buy the entire annual produce. In other words, spice paprika could only be purchased at designated places by designated cooperatives. Paprika ground by the producers themselves or processing entrepreneurs in supervised mills could only be purchased by the local cooperative. The buy-up price was intended to be raised through the centralisation of the paprika trade. Consequently, the Cooperative of Kalocsa and Szeged based Paprika Producers was set up, and was joined by all paprika producers. The same aim was served by the rule that allowed paprika processing only by those having a trade licence. Later spice paprika trade was delegated to the so called Hangya (Ant) Cooperative, which set up the Central Cooperative for the Sale of Hungarian Spice Paprika for the completion of these tasks. This move was not received with unanimous applause. According to the bitter but witty criticism of a contemporary newspaper article: “What phylloxera is to grapes, scale insects are to fruits Ant is to paprika”. In 1935 and 1936 buy-up prices dropped below the 1934 level.

According to the general opinion of contemporary state and supervisory organisations, the only solution to this problem was the curtailment of paprika production, and the centralisation of processing and trade. However, in reality the production, processing and exports of spice paprika in Szeged underwent a wonderful growth beginning in the mid 1930s.

## **Researching the medicinal effects of Szeged-grown paprika**

From 1928 on, grass-root non-governmental organisations and movements started in scientific circles wanted to draw the attention of the public to the medicinal effects and high quality of Szeged-grown paprika. An excellent opportunity for this was the 2nd International Herbs Conference, which was organised in Szeged in the autumn of 1928, and was attended by 75 foreign and 30 Hungarian experts. Having arrived at Szeged railway station, they visited three paprika processing plants by bus. Then the participants of the conference visited the Tisza steam-powered paprika mill to study how paprika was ground. Then they travelled to Szentmihály to observe the paprika fields. The Szeged based newspapers enthusiastically reported on the event which spread the reputation of Szeged-grown paprika.

Géza Váradi, a Szeged born teacher living in Miskolc contacted the mayor of Szeged in 1930 and offered his help to improve the sales figures: this paprika had nothing to do with the old, extremely pungent Szeged-grown paprika, therefore it could be advertised abroad as sweet paprika close to the foreign taste. He emphasised that the omission of spice paprika from meals containing fatty dishes would directly lead to problems. This opinion was in sharp conflict with the subject of the paprika lawsuits launched in Germany. Finally he asked that Szeged-grown paprika be scientifically analysed by the University of Szeged. This could in turn confirm the validity of the medicinal observations made by the local people. The Mayor's Office recognised the significance of Váradi's action. In the first place the city's authorities submitted a request to the minister of agriculture, asking him to subject paprika to chemical analysis and have its clinical value determined. However, the minister turned Szeged's request down saying that it was beyond his scope. Then the city asked the Medical Faculty of the University of Szeged to analyse paprika. This time the Medical Faculty responded to the city's request. They wrote that they were happy to undertake the task, and that the necessary investigations and research activities had already started in the institutes of the Medical Faculty. They also wrote that they were expecting to see favourable results, and would then publish them in scientific journals. They also authorised the city in advance to use the scientific findings to be published in its brochures to be produced for the promotion of Szeged-grown paprika.

Due to the great interest in paprika, Mária Várady and Mária Koturnya completed a study on the effects of capsaicin in 1931 after conducting many tests on animals. The authors concluded that the substance, which is toxic if taken in large quantities, has a beneficial effect on the secretion of gastric juices and digestion if administered in small doses. In 1932 László Tokay proved that "the colorant in paprika is not toxic" and "Szeged-grown sweet paprika, which is used as a spice, is not toxic even when consumed in larger amounts than usual".

### **Albert Szent-Györgyi's scientific results based on Szeged-grown paprika**

Examinations surrounding the medicinal effects of Szeged-grown paprika include the discovery of Vitamin C by Albert Szent-Györgyi in 1932, and his experiments with Szeged-grown paprika. In the spring of 1932 Szent-Györgyi could prove the beneficial effects of vitamin C, and then during the following autumn he managed to synthesise vitamin C from Szeged-grown paprika.

In 2005, János Marton compiled an excellent study in which he collected the different versions of the story of the first successful experiment for the synthetisation of vitamin C from paprika. 1) One summer evening green paprika was served with the dinner. Since Szent-Györgyi did not like it, he angrily tossed it aside. After dinner it occurred to him that he should take it to his lab to analyse. 2) During the same evening meal his daughter asked him if paprika contained vitamin C. 3) The dinner was attended by a boring guest, and Szent-Györgyi escaped his company by saying that he had to examine the paprika. 4) According to a friend's recollections, his guest that evening was Professor József Tomcsik, head of the National Institute for Public Health. They had paprika too with their meal. Suddenly Szent-Györgyi jumped to his feet and collected all the paprika pods he could find in the house. He hurried to his laboratory and worked with his wife until morning. 5) In 1983 Albert Szent-Györgyi made the following recollections: "One evening my wife served bread and butter with paprika for supper. To tell you the truth, I was quite tired of it, but I did not have the courage to ask for something else. And then, while I was sitting at the table with the bread and butter in my hand I remembered that paprika was the only plant I had not tested... And I acted immediately. My flat was in the same building as the laboratory. At midnight I already knew that paprika was a true reservoir of ascorbic acid." 6) According to Ilona Banga's statement made in 1983: "It happened during a summer evening meal that the Professor arrived at our table brandishing a thick green paprika in his hand. He said his wife had served it for supper, and suggested that we should check whether it contained a reducing agent that was present in lemon. We immediately prepared a iodine/starch solution. Then we crushed the pericarp of the cut up paprika in a dish, strained its juice through a cheesecloth, and started titrating it right away. We were pleased to see that it indeed consumed the iodine solution, and turned the blue iodine/starch solution into a clear liquid. In two paprika seasons we managed to produce 5 kg of crystallised substance." 7) According to a statement made by Sándor Szalay in 1984: "One Sunday evening, after I returned from a rowing trip on the River Tisza, and I was eating in the kitchen, Szent-Györgyi entered with a Bulgarian plant grower, who was carrying a large bag of green paprikas on his back. The Professor asked me to help. We ground and centrifuged the paprika. Half an hour later it turned out that paprika juice contained much more vitamin than the juice of pressed cabbage." There is one common point in all the seven recollections, i.e. that the analysis of paprika was initiated by Professor Szent-Györgyi. However, it is assumed that the test could not be conducted in the summer months, but

rather between early October and mid November during the high harvesting season. The fact that the analysis was conducted in October was also confirmed by Albert Szent-Györgyi in the lecture he gave at the 19 December 1933 meeting of the Central Committee for Medical Further Training: “All of my experiments were futile. But coincidence came to my aid again. During an evening meal in October I did not like the paprika I was eating. I angrily tossed it away from my plate. Then it occurred to me that I had not examined paprika yet. I took the paprika fruit from the dinner table to the laboratory, and I worked all night. In the morning I was surprised to discover that paprika contains an extremely large amount of vitamin C.” The successful extraction of vitamin C from paprika was first reported in *Szegedi Új Nemzedék* on 4 December 1932: “The prominent scientist is in constant search of plants that contain plenty of vitamin C. This is why he started to analyse the chemical composition of Szeged-grown tomato-shaped paprika this past October, and after a few days of work at the laboratory he made a major discovery.” In response to the journalist’s question: ‘How long have you been analysing the chemical composition of Szeged-grown paprika?’ Professor Szent-Györgyi reiterated: “Unfortunately, only since October. And since then, despite that the end of autumn was drawing near, we have processed 2,000 kg of paprika.”

So first he extracted vitamin C from the Szeged-grown tomato-shaped paprika, and then he purchased two tons of paprika in order to conduct a large-scale laboratory experiment. At that time almost everybody in the institute was cleaning paprika. The whole institute looked like a family farm, which tried to produce paprika juice for sale on the market. However, instead of producing for sale at the market, they produced half a kilo of crystallised vitamin C. On 26 October 1933 the Medical Department of the Friends of Franz Joseph University held a scientific session, where Albert Szent-Györgyi gave the second talk under the title *Tests carried out on vitamin C*. In this talk he mentioned that “the half a kilogram of vitamin C produced in Szeged preceded a large-scale international research project, which on the one hand clarified the chemical structure of ascorbic acid, and on the other hand it confirmed that the substance is indeed a vitamin. The very last step in the process was the synthetisation of vitamin C, which provided an ultimate proof to all the claims made so far. For the time being the laboratory in Szeged is involved in the production of a larger quantity of vitamin C, which serves as a tool for a large-scale international clinical experiment, the aim of which is to clarify whether or not vitamin C can be used for clinical purposes.



Paprika centrifuge in operation

Based on the descriptions, Albert Szent-Györgyi's recollections, and the technical literature of the second half of the 1930s paprika processing must have been carried out the following way: apart from the colleagues of the institute women highly experienced in splitting pungent Szeged-grown paprika were also involved in the work. We also know that the pungent paprika juice occasionally splattered into the women's eyes, and sometimes they needed Albert Szent-Györgyi's help to flush the juice out of their eyes. The quantity of the paprika used, as well as the timing and difficulties of processing all indicate that the large amount of vitamin C was extracted from Szeged-grown paprika in the institute led by Szent-Györgyi late in the autumn of 1932.



Vitamin C synthesised from Szeged-grown spice paprika

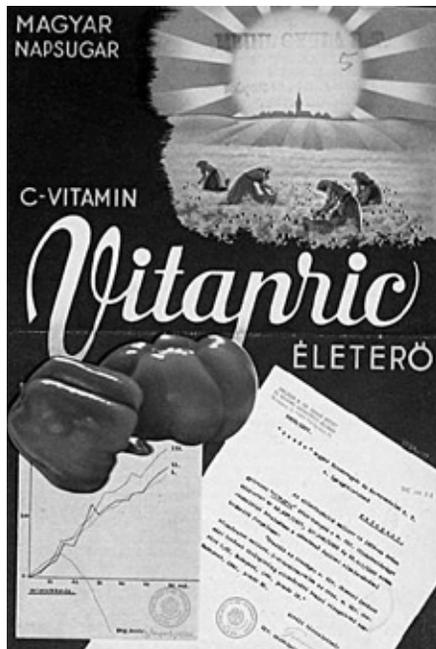
## World fame, first economic effects

Albert Szent-Györgyi, who reported his successful paprika experiments for the first time in a newspaper article dated 4 December 1932, emphasised the economic impacts of his discovery: “I hope that this discovery will lead not only to the general consumption of fresh paprika internationally, but large factories will also use paprika as a raw material for the production of pure vitamin C. As far as I know, the Budapest based Chinoin factory has already processed thousands of kilograms of paprika for this purpose. Several Swiss and English chemical factories have contacted me about its production, and I have no doubt that these factories will try to produce vitamin C on a mass scale.”

The discovery of Albert Szent-Györgyi was first put into the international limelight in 1933. In April the professor set out to Stockholm, and then continued to promote Szeged-grown paprika and his discovery of vitamin C in many west European countries, including Sweden, Denmark, England, France and the Netherlands. The articles reporting on the professor’s international tour also mentioned the economic effects of the discovery. In the same article Szent-Györgyi pointed out that all Swedish newspapers had written about

Hungarian paprika in connection with the scientific research: “All Swedish newspapers have written about Hungarian paprika in connection with my scientific research, and the words ‘Hungarian paprika’ appeared in bold on the front pages of the newspapers. My lecture was received with special interest everywhere, especially the part in which I talked about the rich vitamin content of the paprika, since this is the only thing that makes the mass production of pure vitamin possible. I think that paprika will be an outstanding export product when canned appropriately. It is possible that the effect of my analyses will be felt on the paprika market already this year.”

A little less than a year after vitamin C was synthesised from Szeged-grown paprika, a type of canned paprika with high vitamin C content was produced under the name Vitapric. The newspaper article, which was the first to report on the successful industrial production, emphasised that enormous export possibilities would open up. It claimed that arable lands would be utilised to the maximum, the threat of paprika overproduction would be eliminated, and the product would boost paprika production in the Szeged area. In November 1933 it was reported that “a Hungarian cannery has come out with canned paprika, which is already marketed in Sweden. It has an enormous significance. Paprika has come into fashion abroad, and demand is on the rise”.



The contemporary poster of Vitapric

From that time on paprika was regarded as a dietary supplement, and the marketing of various types of canned paprika also contributed to enhanced paprika production and sale. The significance of canned paprika was also highlighted in Lajos Armentano's research project, which was completed in 1940. "However, various types of paprika are listed as rich sources of vitamin C. It can be found in especially high quantities in green and tomato-shaped paprika. In connection with this I was especially eager to find out how this typical Hungarian produce could be used to cover our vitamin needs in winter. The question seemed to be easy to answer, since several factories in Hungary manufacture canned food from tomato-shaped paprika, which is then marketed under various names (Vitapric, Pritamin, etc.). At our clinic I tried the product called Pritamin, which contains 0.6 g % vitamin C according to the manufacturer; this ratio was confirmed by our direct analyses too ... Canned paprika products manufactured in Hungary retain their vitamin C content even during storage and preservation, therefore they are a very important source of vitamin. For example, as little as 10 g (a level teaspoon) of Pritamin is enough to meet the daily needs, and 50 g Pritamin a day can eliminate deficiencies caused by serious infections in 9-10, or maximum 14 days."

In 1935 another significant experiment was carried out: researchers managed to breed non-pungent paprika from Szeged-grown pungent paprika on a larger scale. Before 1935, producers both in Szeged and Kalocsa were only able to grow paprika that was rather pungent according to the Hungarian standards, however, on the international market less pungent spice paprika was in demand: "They realised it a long time ago that if their paprika was not pungent, they would have considerably larger selling opportunities on the world market." In order to produce non-pungent paprika, Ernő Obermayer tried to breed a less pungent, high-yielding, modern Hungarian paprika species by the cross pollination of Spanish and Hungarian paprika varieties. The successful breeding and large-scale production of completely non-pungent spice paprika boosted demand for Szeged-grown paprika so much that after a few years non-pungent species dominated the paprika fields. In 1938 protective measures had to be taken in Szeged in the interest of the original, pungent paprika. However, ground paprika made from non-pungent paprika fruits could not fully reach the qualities (flavour, aroma and colour) of the old noble sweet paprika processed by way of splitting. Therefore, in the first year major educational and lobbying activities were needed so that more and more fields were planted with non-pungent paprika seedlings in Szeged, too.

## Further scientific results related to Szeged-grown paprika

It came to light in November 1933 that during his research in Szeged, József Gagyí successfully used vitamin C to treat animals suffering from the deadly diphtheria. An extremely small amount of vitamin C, extractable from a few paprika pods, is sufficient for the complete eradication of diphtheria that otherwise leads to death in 4 or 5 days. Animals treated with vitamin C do not only survive the fourth day, but they also show the signs of some weight gain.

Károly Waltner, the professor of the Paediatric Teaching Hospital of Szeged completed his comprehensive examinations regarding the carotene content of paprika for medical use by 1934. He found that the vitamin A content of 1 g of freshly ground paprika was 20 vitamin units, i.e. identical with raw carrots, twice as much as cooked carrots, four times more than butter, 13 times more than salad and fifty times more than cow's milk.

László Berkesy, who studied the effect of paprika on gastric functions, also finished his research in 1934. According to his conclusion, "the use of paprika as a spice should not be generally prohibited for patients with stomach problems. It should be banned only for patients suffering from hyperacidity, and in the case of hypoacidity it is suitable to stimulate the secretion of gastric juices. This is all the more so because we have not met any patient, not even one with hyperacidity, who showed the signs of undesirable stomach agitation". This annulled the former accusations made about paprika.

In 1934 József Ambrus also analysed the physiological effects of paprika: paprika causes increased blood flow to the skin, the stomach and the mucus membranes of the intestines. It enhances the secretion of digestive juices, increases intestinal peristalsis, and due to its emulsifying and hydrotropic properties it improves the gall bladder functions, too. This provided a scientific proof to the popular observation according to which Hungarian people use paprika mainly to season lard, fatty meat and stew dishes in order to facilitate the absorption of fats.

On 25 October 1934 several talks were held on the identification of latent vitamin C deficiencies at the meeting of the Medical Department of the Friends of the University of Szeged Association.

A few medical therapies led to miraculous recoveries, which significantly improved the international acknowledgement of paprika and vitamin C extracted from it, and magical enthusiasm evolved around it. When Professor Szent-Györgyi gave lectures in Belgium in 1935, he was asked to treat the Prince of Liège, the younger son of the king of Belgium. The young prince was suffering from a constant fever, and his doctors were unable to treat his condition. Szent-Györgyi prescribed him crystallised vitamin C, and

the prince soon recovered. Due to the unexpected success Szent-Györgyi was declared a medical genius, and the recognition of vitamin C rose spectacularly.

The fame of paprika was further increased due to the fact that it was found to contain other useful elements, too, i.e. so called bioflavonoids (so called vitamin P), which were extracted from Szeged-grown paprika by Szeged based researchers. However, it subsequently turned out that although this substance has very good medicinal effects (it can efficiently be used to cure a type of haemophilia), it cannot be regarded as vitamin.

Szeged-grown paprika also played an important role in the selection of the winner of the Nobel Prize in chemistry in 1937 (as it had been predicted by Szent-Györgyi). The prize was awarded jointly to Norman Haworth (1883-1950) and Paul Karrer (1889-1971). The former was awarded for his research related to vitamin C extracted from Szeged-grown paprika. In the winter of 1932-33 Albert Szent-Györgyi sent Haworth, who was working at Birmingham University, a portion of previously extracted crystallised vitamin C, which helped him make vitamin C discoveries. In other words, Szeged-grown paprika made it possible to recognise the high natural vitamin C content of paprika, and it also contributed to the exact analysis of the vitamin, as well as the description of its structure and physiological effects.

The beneficial effect of paprika consumption on the female menstrual cycle was studied and confirmed by a German doctor, Margarete Raunert, who visited Hungary.

## **The Nobel Prize in physiology, 1937**

In 1937, upon learning that he had been awarded the Nobel Prize, Albert Szent-Györgyi acknowledged in almost all of his interviews and talks that he owed the results of his examinations to Szeged-grown paprika.

After it became public on 28 October 1937 that the Nobel Prize in physiology had been awarded to Professor Szent-Györgyi in Stockholm, he received plenty of letters of congratulation and salutation from the most diverse members of Hungarian public life. From among them, the letter written by the Board of the Hangya Cooperative on 30 October raised special economic correlations. “Honourable Sir, we the undersigned, the central board of the Hangya Cooperative, as well as all the rural cooperatives under our supervision, and especially the board of the Central Hungarian Spice Paprika Trading Cooperative would like to congratulate you with deepest respect on your global success achieved by winning this year’s Nobel Prize. The farm-

ing communities of the cooperatives are filled with special joy and pride, since through you, who have received the award of the highest acknowledgment available to any scientist, the role of the Hungarian land, and that of the fruit that Hungarian peasants grow with their own sweat has significantly improved. We are forwarding to you the good luck wishes of all cooperative members, and ask God to bless your scientific work, which has proved to be invaluable for the entire mankind, and has brought fame to our country.”

Some ten days later, on 9 November, the chairman of Hangya Cooperative, Elemér Balogh, royal counsellor, member of the Upper House, wrote a letter to the professor. “My Honourable Friend, Please allow me to sincerely congratulate you on the high award you have received, crowning your scientific work and results. We are proud of you and we truly wish to share in your joy. This award has turned the world’s attention to vitamin C. I am not familiar with its method of production or use as a medicine. Therefore, please do not take it as an offence if I suggest as a layman if steps should be taken for its large-scale production and for a relevant international patent. This could improve the livelihood of paprika producers in the Szeged region, and would enhance our economy and exports, and consequently bring new acknowledgement to Hungary. This idea has come into my mind after the Government entrusted the institute I head with the supervision of paprika production and trade. However, we have a subsidiary company (Hangya Ipar Rt.) which is engaged in the manufacturing and marketing of industrial products too. With their involvement we could establish vitamin C production, and if this would require capital, we could make that available too. Being an altruistic company, we would be involved in this matter only from the economic and moral aspect, and not from the business side. If my suggestion would reverberate in you, then general director Mr. Frigyes Wünscher and myself would be very happy if you could visit us (at IX. kerület Közraktár utca 30.) during your stay [in Budapest] – in any case upon preliminary notice – in order to discuss this matter.”

The letter of salutation written by the Cooperative of Spice Paprika Producers in Szeged and the Szeged region on 29 November 1937 also shed a light on the economic effects of the vitamin C related scientific discovery. “Honourable Mr. Professor, At the election meeting held on 16 November 1937 the members of the Cooperative of Spice Paprika Producers in Szeged and the Szeged region decided with unanimous enthusiasm to congratulate you on winning the world’s most prestigious award, the Nobel Prize for your scientific work. We Hungarians, Szeged residents and paprika producers are proud of you, Mr. Professor, since you have demonstrated and proved to the world the Hungarian genius, the Hungarian spirit, the superiority of Hungarian

research and culture, as well as the Hungarian desire to live, and has thus brought fame and glory to Hungary. Our life has become more meaningful, our eyes have become brighter, our perseverance will increase, and our work may be more successful, because through the epoch-making discoveries and scientific results of yours the world's attention has again turned to Hungarian paprika. We hope that this would contribute to the increased and improved distribution of the Hungarian spice paprika abroad, and may even make our bread bigger and whiter. May God bless your work and research. We too wish you, Mr. Professor, strength to continue your activity for a long time, and similarly to the successes you have achieved bring value to the scientific life and the Hungarian people. May God bless you!"

The letters of salutation and congratulation include the 20 December letter written by the Committee responsible for determining whether or not a paprika has the distinctive Szeged features (the Committee). "The Committee has decided to congratulate you, honourable Mr. Professor in acknowledgement of your world renowned and significant work that you have completed through your epoch-making activities related to vitamin C extracted from paprika. By attaching the summary of the related minutes please allow me Mr. Professor to reiterate the sincere and respectful salute to the pride of our city and country, and at the same time let me pray for God's blessings on you and on your work. Honourable Mr. Professor, please accept my distinguished salutation as an expression of my deep respect."

In November 1937, Rector József Gelei wanted to use public donations to buy a villa for Albert Szent-Györgyi, whose world renowned scientific discovery led to the growth of Hungarian paprika exports. In his proposal he explained in detail that the economic effect of the discovery more than justifies the construction of the villa from public funds, since in the past two years the professor had brought 2 million pengős worth profit to the country, which was a multiple of the cost of the villa in New Szeged. Based on the decision of the assembly the lord lieutenant (főispán in Hungarian), the mayor, the upper class members and the representatives of the city went to Budapest to have negotiations with finance minister Tihamér Fabinyi and minister of culture Bálint Hóman. The basic idea was to construct a house on a lot to be given by the city as a gift, and to share the costs of construction equally between Szeged and the state, and to give the house to the world renowned professor as a joint gift.

Two weeks later Albert Szent-Györgyi was elected honorary citizen of Szeged. In his salutation speech mayor Dr. József Pálffy pointed out the following: "Professor Szent-Györgyi got to know and understand the Hungarian land, the especially nutritious soil of Szeged near the Szeri puszta (steppe). He ploughed it with the plough of soul and knowledge, and following what his

soul told him he bent down and lifted the fruit of the Szeged soil, paprika, which shimmered like ruby. And it was this paprika that helped you rise and achieve the highest scientific award”. In his response Albert Szent-Györgyi emphasised that the aim of his productive intellectual work was not only to conduct scientific research, and to implement and practice the concepts of education on a daily basis, but also to facilitate the daily lives of people engaged in physical work: “I am happy if my work could at least to some extent express the gratitude of science and the university towards the city, and chance so ordained it that my modest endeavours are the next example showing that science not only brings you laurels, but that today’s abstract achievements can come to the aid of toiling farmers already tomorrow, and that intellectual work is an indispensable brick in a nation’s house, just like the farmers’ work.”.

### **Hungary’s paprika exports following the scientific discoveries**

In the 1930s Hungarian paprika exports underwent major changes. From the middle of the decade the value of our exports not only reached the pre-crisis levels, but increased the average volume of the 1920s by three or four times. Hungary’s paprika exports totalled 2,450 tons in 1937, 2,770 tons in 1938, and 2,280 tons in 1939 despite the war conditions. In 1939 the revenues from paprika exports increased despite the shrinking volume: from 3,336,000 pengős in 1938 to 4,118,000 pengős in 1939. This enormous growth could be attributed to the world famous scientific discovery related to paprika. This was mentioned already in a 1935 article reporting the successful breeding of non-pungent paprika: “Hungarian paprika is a top class export product even though Spanish paprika represents strong competition on the global market, and its significance in foreign and domestic trade has grown especially in the past few years thanks to Professor Szent-Györgyi’s sensational research and discovery”.

In a January 1938 report Lajos Szekerke, head of Szeged’s tourist office wrote about Albert Szent-Györgyi and how his scientific discovery promoted Szeged-grown paprika, and what impact this had on tourism: “The globally renowned success of Professor Szent-Györgyi turned the attention and interest of the entire educated world to Szeged and paprika. Consequently, the agency of the Hungarian Tourist Board in England called for the publication of 10,000 copies of a new, multilingual brochure structured and printed in a state-of-the-art fashion exclusively for the presentation of the scientific research of Professor Szent-Györgyi in layman language, and to serve as an effective promotional material for Szeged-grown paprika.”

From 1939 Hungarian paprika exports declined compared to the extraordinary values of the years before. This was in part due to the fact that in the years following the end of the civil war Spanish paprika gained ground again on the American markets, while Hungarian paprika became increasingly isolated due to the war blockade. According to a report on paprika trade in 1940, “Exports have heavily declined. Exports to the German Empire increased from 375.5 tons to 735.1 tons, but exports to the US decreased. – This was largely caused by the fact that overseas transportation costs increased, and that exports to the US completely stopped after Italy joined the war. Exporters suffered enormous losses when they had to ship the goods that were stuck in the ports back to Hungary”.

From 1933 on neighbouring successor countries had a smaller share of the exports than the other countries. This process continued at such a speed that in 1937 Hungarian paprika exports to the neighbouring successor states hardly accounted for one fifteenth of Hungary’s exports to other countries. In the 1930s large quantities of Hungarian paprika were exported to the US, as well as to Austria, Bohemia, Germany, Algeria, Great Britain, Argentina, France, the Netherlands, Canada, Poland and Tunisia, but smaller quantities were also exported to Australia, South Africa, Egypt, India, Java, China, Norway, Italy, Peru, Switzerland, Turkey, New Guinea, Uruguay, etc.

Year	Production (t)	Consumption (t)	Export (t)	Exports including	
				successor states	other countries
1926	2470	1370	1100	740	360
1927	2920	1750	1170	850	320
1928	2980	1940	1040	620	420
1929	2280	1630	650	300	350
1930	2710	1960	750	360	390
1931	2870	2100	770	410	360
1932	3200	2220	980	610	370
1933	3240	2170	1070	310	760
1934	2470	2050	420	60	360
1935	2980	2320	660	60	600
1936	4160	1920	2240	30	2210
1937	4800	2250	3000	20	2980

Major performance indicators of Hungary’s paprika industry between 1926 and 1937

From the mid 1930s one of Hungary's largest markets was the US. Albert Szent-Györgyi travelled to the US to hold a longer series of lectures in the spring of 1939, and an article reporting on the continuous growth of paprika exports to the US came out in *Szegedi Napló* approximately at the same time. In 1937 Hungary exported 2.5 thousand tons of ground paprika to the US, which equalled 50% of the total paprika imports of the US. In 1938 exports grew even further, more paprika left the country, but for the same amount of money. Hungarian exports to the US then equalled 75% of the paprika imports of the US. These fantastic achievements, which were unprecedented in the Hungarian economy, were in part due to the fact that the Spanish civil war was fought between 1936 and 1939. By 1938 the Hungarian spice paprika enjoyed increasing demand not only in the US, but also in several countries of South America (e.g. Argentina, Uruguay). With such trading opportunities ground paprika produced in the Szeged region grew from 1,590 tons in 1929 to 3,240 tons in 1937, and its value exceeded 5 million pengős. And the size of lands sown with paprika increased year after year.

	Szeged	Kalocsa
1934	6851	5559
1935	5748	3808
1936	5600	4272
1937	5719	4402
1938	6949	5628
1939	6884	7056

Number of Szeged and Kalocsa based paprika producers in the second half of the 1930s

	Szeged	Kalocsa
1932-33	866	36
1933-34	625	36
1934-35	767	36
1935-36	772	183
1936-37	782	261
1937-38	870	269
1938-39	665	273

Paprika processors in Szeged and Kalocsa in the 1930s

	Szeged	Kalocsa
1934	3780	2235
1935	3525	1692
1936	3342	1615
1937	2900	1677
1938	3260	2457
1939	4431	2762

Spice paprika growing lands in the Szeged and the Kalocsa regions  
in the second half of the 1930s (hectares)

It is worth knowing that despite the publication of the fantastic scientific discoveries related to Szeged-grown paprika, paprika was still mainly considered as a natural food colorant in America, and was mainly sought after for industrial purposes. Therefore, in the case of paprika shipped to the US colour was of primary, and aroma and contents were only of secondary importance. Hungarian style paprika dishes could gain popularity in the American cuisine only slowly and only to a limited extent. This was due to the preference for making quick meals, as well as the quality of American lard: the aroma of Hungarian spice paprika can only be enjoyed to its maximum when fried in lard made the Hungarian fashion. Not even the Hungarian kitchen set up at the New York World Fair could help overcome this resistance despite the fact that Hungarian paprika exports were at their peak in these years.

	1934	1935	1936	1937	1938
Algéria	0	0	0	73,2	60,3
Argentina	0	0	6,6	135,8	217,1
Ausztria	150,2	217,8	220,7	189,9	284,4
Csehszlovákia	48	52,1	36,9	19,7	12,3
Franciaország	1,7	1,5	4,5	37,8	52,6
Hollandia	4,3	4,6	4,6	9,9	12,2
Kanada	0	0	0	6,6	48,8
Lengyelország	9,4	12	4,4	1,4	11
Nagy-Britannia	3,5	7,7	18,1	30,7	45,4
Németország	121,9	151,5	190,1	232,3	212,3
Tunézia	0,1	0	1	25,4	69,2
USA	62,6	190,2	540,7	1570,1	1559,9

Hungarian paprika exports to 12 countries in the second half of the 1930s (tons)

By 1940, the largest buyer of Hungarian spice paprika was Germany and the German army. This was largely due to the high vitamin C content of spice paprika, which – in sharp contrast with Albert Szent-Györgyi’s all humanistic and political convictions – was beneficial for the German army in world war II, since by consuming paprika products German soldiers could stay at sea in submarines much longer without developing scurvy. Szent-Györgyi used the profit from the sale of pritamin for the development of the Szeged based laboratory, which made it possible to pursue further state-of-the-art biochemical research.

In 1939, chemical engineer Ferenc Balla from Szeged “founded a cannery with his own strength, practically with his two hands with a view to process the crops of lands around Szeged, and to turn fruits and paprika into products that can be sold both on the Hungarian and on foreign markets. The plant has already started to operate in Liget utca with the name *Szeged Cannery*, and one of its most important tasks is the production of products containing vitamin C. ...Ferenc Balla experimented to develop a method with which a special product rich in vitamin C could be produced from the paprika fruit with the highest vitamin C content in Szeged, in the homeland of vitamin C. The cannery was developed in a special direction: to produce the tasty paprika purée called Papirit in tasteful packaging. This interesting product, which was about to undergo significant development, contained 0.487% of vitamin C according to the measurements of the National Chemical Institute and Central Chemical Experimental Station. In layman’s language this meant that a tablespoon of Papirit contained as much vitamin C as six lemons. The paprika extract could be used in various ways. It could be readily used for seasoning food after cooking (soups, meat dishes, vegetable stews, bread and butter, etc.) and due to its pleasant flavour and aroma it could be consumed on its own too. The innovative product of the young, Szeged based chemist enjoyed great demand not only in Hungary, but abroad too, and the increasing demand meant that the canned product would considerably inflate the value and exports of Szeged-grown paprika. The processing of paprika fruits on an industrial scale would presumably reach a new level of development, because more fruit paprika had to be produced for the canning industry.

It also happened in 1939 that Barna Györffy (the son of Szeged based professor dr. István Györffy) developed a pesticide containing colchicines, which made the leaves and the fruits of the paprika plants grow larger. As a consequence, the yield grew and the plants showed increased adaptation to the extreme conditions of the land on which they were grown. “Paprika that can be easily grown using colchicines treatment will revolutionarise paprika production. Its extremely large economic significance mostly lies in the fact

that it is very probable that the vitamin C content will considerably grow in the tetraploid paprika too, even if not by 100%.”

The international technical and chemical congress of agricultural industries was organised in Budapest between 10 and 20 July 1939, and one of its most significant advocates was Albert Szent-Györgyi. According to the original programme of the congress, the world-famous researcher of vitamins was to give a talk on his recent scientific research activities. According to newspaper articles published before the congress, “The talk to be given by the Nobel Prize winner professor looks interesting in all aspects, because he will also discuss the significance of the Hungarian soil in the cultivation of plants rich in vitamins”.

In 1942 the newspapers reported that vitamin C could be extracted from ground paprika with an even higher efficiency: “I spent years on finding the way to produce ground paprika that retains its vitamin content. This work led to results this spring for the first time. I could not only manage to produce ground paprika without a loss in vitamin content, but it also had a better flavour and aroma than the paprika produced the old way, and it showed surprising benefits while cooking, too. Its production, to which I submitted a patent application this past June, is very simple. If we can manage to transform paprika processing, and market this vitamin rich ground paprika as a national product, significant export possibilities will open up, the attainable prices will also be much more favourable, and the money will eventually be channelled back to the people farming the land.” However, at that time the economic interests too were subordinate to the war needs.



Szentmihály, the Lábdy paprika mill



The Lábdy family in the yard of their house in the 1930s

The discovery made by Albert Szent-Györgyi created not only an opportunity to escape smothering loan debts, but also secure and stable financial conditions for Szeged and the Szeged region. This historic economic success was cast into form in 1983, for Albert Szent-Györgyi's 90th birth anniversary: artist András Beck, who was living in Paris then, designed a coin the tail of which showed the formula of vitamin C, and two paprika pods to express how much the scientist owed to Szeged-grown paprika, and how much his discovery helped the people living in this area.



The anniversary coined designed by András Beck

The economic significance of Albert Szent-Györgyi's discovery was also acknowledged by István Szanyi István in his paper written in 1939: "The sensational discovery made by Nobel Prize winner Albert Szent-Györgyi, professor of the University of Szeged, i.e. that Hungarian paprika contains vitamin C in the largest quantities, had an extremely beneficial effect both on domestic consumption and exports. Professor Szent-Györgyi found that the Hungarian grown, tomato-shaped paprika fruit contained four times more vitamin C than lemon. The series of analyses he made proved that the fruit of spice paprika contains even more vitamin C. His discovery of the method of vitamin C (ascorbic acid) production benefited not only Hungarian spice paprika, but also the entire mankind." Sándor Farkasfalvy stated something similar in his paper in 1941: "Among the smaller agricultural industries a major position is taken by spice grinding, or rather the production of paprika mills, the grinding of excellent quality, vitamin rich sweet Hungarian paprika into red spice paprika, which has become the focus of worldwide attention in the wake of the vitamin related research activities of Nobel Prize winner Professor Szent-Györgyi.

Based on the production and exports data showed above it can be rightly stated that Albert Szent-Györgyi's finding about the vitamin C content of paprika belongs to scientific discoveries with the most significant economic effects. It contributed to the improved livelihood of the people living in Szeged and in the southern Great Plain for decades.