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The vegetable processing industry in Portugal: Successes and failures

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Résumé. Quelques exemples de succès et d'échecs de l'industrie des légumes au Portugal. *Les succès et les échecs de l'industrie de transformation des légumes au Portugal sont analysés ici à travers quatre exemples : le concentré de tomate, les pois surgelés, les haricots en conserve, divers légumes surgelés. La recherche, la quasi-intégration des agriculteurs par contrat, l'adaptation des variétés au climat, la récolte mécanique sont des facteurs essentiels du succès. Cependant, l'industrie peut aussi être approvisionnée en complémentarité avec le marché des produits frais dans le cas de légumes à haute valeur ajoutée et cueillis à la main.*

Abstract. The vegetable processing industry is different from the fresh market. The success of this industry depends on a number of factors related to existing farming systems but not necessarily on the climate. Four recent examples illustrate the variable results of the vegetable processing industry in Portugal: (a) success of tomato paste production owing to effective collaboration between growers, processors, and research organizations; (b) rapid growth during the 1970s of the frozen pea industry which is well adapted to small-scale farming along the northwestern coast; (c) failure of pea bean canning owing to poor adaptation of the crop to local farming systems; (d) start-up of the frozen vegetable industry with processors facing some difficulties in raw material supply. These examples show the importance of factors such as farmers' integration, research on new crops and their adaptation, and competition between processing and the fresh market. Crop suitability to established farming systems is a basic requirement. In most situations vegetables for processing need fully mechanized cropping operations. Processing can be combined as a complementary activity to the fresh market by using the surplus of high value hand-picked vegetables and fruit.

Key words. Vegetables – Processing – Industry – Portugal.

Introduction

Portugal has a long tradition of vegetable production for the fresh market that represents approximately 20% of the national agricultural value added (Rolo et al., 1985). Per capita vegetable consumption (including potato) is 220 kg (Portas and Costa, 1980). This high consumption is partly due to a favorable climate that allows year-round production of most commodities. Per capita consumption of processed vegetables at 4 kg is rather low. But it is expected to increase as Portugal attains the same level of economic development as in other Western European countries. Proccessed vegetables are commonly used in these societies with limited time for preparation of meals.

It would be useful to know whether Portugal can depend on local production to satisfy the growing demand for processed vegetables in the domestic market. The country has abundant natural and human resources for growing fresh vegetables, but they may not be adequate to meet the specific requirements for processed products.

Fresh vegetable production is based on the proximity of a market or on conditions that ensure supply at a certain time of the year. In contrast, processed vegetables can be easily transported over long distances and stored for out-of-season consumption. The vegetable processing industry does not depend on geographic location or climatic shift. Processing competitiveness is related to the capacity to produce good quality at low price during the most suitable period of the year.

Interaction between fresh vegetables growers may be limited because of the variable market size and wide range of commodities; moreover, growers have to rely on their own ingenuity to supply the right product at the most favorable price. The processing industry needs more coordination. Planning, constant supply of raw materials, and uniform choice of cultivars are the rule. A processing plant is not viable without a minimum cropped area, which implies contracting and coordination between growers and processors.

There are several reasons for the success or failure of vegetable production for processing in countries having good expertise and long experience in growing vegetables for the fresh market. Listing some of these reasons is not relevant to this seminar which aims to discuss and compare national experiences. This paper describes some of the successes in vegetable processing in Portugal: tomato paste, frozen peas, canned pea beans, and other frozen vegetables. Each analysis seeks to explain the specific problems related to vegetable processing as an alternative to the fresh market.

I. – Tomato for processing

Portugal is a major producer of tomato for processing and the fifth largest exporter in the world. The history of the sector in Portugal is a good example of success due to collaboration between growers, processors, and research institutions. It is outlined in the review of the tomato processing industry by Portas et al. (1986), on which some of the following observations are based.

Production of tomato paste in Portugal started in 1939 in the Tagus valley using surplus from supplies to the fresh market. In 1939 about 300 ha were planted producing 800 t of paste *(Table 1)*. Difficulties in marketing and poor product quality slowed down subsequent development. By 1956 a joint effort by the national fruit and vegetable board, JNF; private processors including H.J. Heinz and Campbell Soup; and extension officers from the Ministry of Agriculture succeeded in transferring technology that rapidly improved field and processing productivity. Competitive prices and excellent quality increased demand and led to subsequent expansion. Between 1956 and 1966 yields rose from 27 t/ha to 40 t/ha and total production from 25 000 t to 800 000 t of fresh fruit *(Table 1)*.

Table 1. Number of processors, acreage, yield, and production in the Portuguese tomato sector

Year	Number of processors	Area (ha)	Average yield (t/ha)	Quantity delivered by producers (t)	Tomato paste (t)
1939	1	300	21.3	6 400	800
1945	4	900	26.9	25 000	3 000
1956–1960	9	1 500	25.6	38 800	6 600
1961–1965	15	6 100	35.5	219 100	39 900
1966–1970	31	20 800	35.4	733 500	135 900
1971–1975	27	23 100	33.0	758 500	139 700
1976–1980	26	19 800	37.8	551 100	94 900
1981–1982	26	15 600	28.3	441 300	72 600
1983	24	19 900	24.1	480 000	90 000
1984	24	19 500	36.3	707 800	123 800

Source: Portas et al., 1986

The Mediterranean summers offer favorable conditions for growing tomato; they are dry and warm, but not too hot for good fruit set and color.

During the expansion period (1956–1966) tomato cultivation spread beyond the Tagus valley to Alentejo and to the northern and western regions of Portugal. Many new canneries were built; processing capacity continued to increase during 1966–1970, until it exceeded supply of raw material. The crop was

introduced in marginal areas with lower productivity and quality. Increased competition for supply of raw material and a fluctuating market leveled production at values lower than the peak in the early 1970s *(Table 1)*. The social and economic turmoil following the radical political changes in 1974–1975 led to a further decline.

According to Portas et al. (1986) the factors that contributed to the expansion of production areas and increase in the number of processing plants were: (a) suitable climate and cheap labor; (b) the need for alternative crops in the new irrigation systems; and (c) interest of multinational food companies in developing the industry.

Research also contributed to the success of the industry. In 1970 a research project was established under the leadership of the University of Evora with funds provided by the national board for scientific and technological research, JNICT, in cooperation with the agricultural division of H.J. Heinz in Portugal. The priorities of the project were: identification of the most suitable locations for tomato crops, testing of new varieties and irrigation techniques, and improvement of farm mechanization. Some of the most significant achievements of the project were: (a) introduction of modern cultivars with firm fruit and concentrated harvest; (b) reduction of manual harvests from 4–5 to 2 with bulk transport; and (c) design and construction of mechanical harvesters, some of which are even exported.

Tomato growers have contracts with processors that enable them to obtain financial assistance from banks. Prices are standardized throughout the country; competition between canneries for raw material supply is therefore based on transport subsidies. Initially, as contracts were based on acreage, produce from a tomato crop contracted to a processor could be sold to several others. In the past only an estimated 80% of the fruit was sold to the processing plants (Portas, personal communication), the remaining 20% was delivered to the fresh market, specially in areas with early production. Contracts were subsequently drawn up on the basis of tonnage to check the practice of delivery to the fresh market and non-contracting canneries. This ensured supply of the required quantity of raw material. Such deliveries to the fresh market will continue until the need for mechanical harvesting and labor costs make sorting of fruit for the fresh market unprofitable.

The high subsidies granted by the European Economic Community (EEC) between the mid-1970s and 1987 for tomato processing in its member countries penalized imports from Portugal. The industry survived owing to the high quality and low cost of tomato paste produced in Portugal.

Portugal's entry in the European Community (EC) in June 1986 had a positive effect on the development of its tomato sector. The Portuguese quota of 120 000 t of tomato paste (equivalent to 600 000 t of fresh fruit) was filled in 1988 and 1989 and a new quota of 160 000 t was negotiated for 1990. Tomato production is flourishing once again, but high costs and labor shortage are threatening growers who have not fully mechanized their operations.

II. – Frozen peas

Within 7 years, Portugal, once a net importer of frozen peas, has become self-sufficient and an exporter. The pea processing industry ranks second in importance to tomato.

During the 1960s frozen peas sold in Portugal were largely imported despite low consumption. The freezing industry was almost inexistent; small quantities of low-quality, hand-picked peas intended for the fresh market were frozen by artisanal methods (Frazão, 1985).

In the early 1970s consumption rose rapidly. A government decision to cut imports prompted the development of a pea freezing industry to supply the domestic market.

Pea processing started in the coastal area north of Lisbon near Lourinha, and Aveiro. The mild winter and cool spring are suited to the nonirrigated pea crop which is harvested in June before the warm July-September period. Moreover, the region has several fishing harbors and dynamic fish freezing enterprises that are interested in diversifying into horticultural products.

The JNF supported the establishment of the pea freezing industry in the region by transferring technology to both growers and freezing plants. The industry developed rapidly and within 7 years (1973–1980) Portugal became self-sufficient although domestic consumption doubled *(Table 2)*. Production and consumption of frozen peas decreased slightly during the 1980s partly due to the introduction of other frozen vegetables on the market.

Table 2. Production, import, export, and consumption (in tons) of processed peas in Portugal

Year	Production (t)	Import (t)	Export (t)	Consumption (t)
1973–1974	1 076	3 670	2	4 681
1975–1976	3 124	2 339	41	5 422
1977–1978	5 100	2 585	39	7 646
1979–1980	9 750	1 123	234	10 639
1981–1982	8 750	n.a.	291	n.a.
1983–1984	5 475	n.a.	n.a.	n.a.
1985–1986	7 896	175	5	8 066
1987–1988	6 200	181	4	6 377

Sources: Frazão, 1985; IROMA/INGA (personal communication)

The success of pea cultivation in a region with smallholdings, poor mechanization, and traditional agriculture can be attributed to several reasons: (a) restrictions on pea imports to support the Portuguese industry; (b) contracts based on standardized prices between growers and processors so that growers are guaranteed purchase of their produce at a preset price and can therefore avail of short-term financing when needed; (c) trained extension staff giving recommendations on the choice of varieties and crop production technology; (d) suitability of pea crops to the existing farming systems as they can be grown at competitive prices in small plots with a low level of mechanization.

The main component of the farming system in the pea-growing area is the milk cow, which feeds on maize in summer (June-October) and grass in winter (October-February). Spring potato (February-June) is the traditional cash crop. Pea could replace potato as the cash crop without changing the system. Pea offers other advantages: (a) no irrigation is needed; (b) sowing can be done with very simple drilling machines; (c) the crop leaves some nitrogen in the soil; (d) harvesting is cheap and does not require sophisticated equipment, as the peas are shelled at the processing plant.

Since import restrictions were the major factor for the development of the sector, fears were expressed about its survival in an open market once Portugal joined the EC. However, the improved quality and low production cost of Portuguese peas, and the high cost of transporting frozen peas from Western Europe still make pea freezing profitable in Portugal.

III. – Canned pea beans

During the tomato boom in the 1960s H.J. Heinz, one of the leading tomato canneries, attempted to introduce pea bean processing in Portugal (Weber de Oliveira, personal communication). Pea beans are a popular food in England and are mostly imported from the United States. The objective of the company in growing and processing pea bean in Portugal was to diversify supply of raw material and to extend the processing period of the tomato cannery. A minimum annual input of 1000 t of pea bean was needed for this new activity to be successful (Weber de Oliveira, personal communication).

The main tomato-growing regions along the Tagus valley and in Alentejo were not suitable for pea bean. The warm summer induced poor quality because moisture content at harvest was 6–7% compared with 13–14% in coastal regions with a cool summer. Aveiro, located on the northwest coast, was the site selected for the pea bean industry. (This was one of the regions where cultivation of pea for processing was introduced subsequently.) Pea bean is known in the Aveiro region and suited to the local climate.

Experiments were conducted to test new varieties with concentrated harvest and to improve crop production technology. The tests showed high productivity and quality. However, despite good crop adaptation, availabity of contracts, and a ready market, the industry did not develop and the project was soon abandoned.

Unlike pea, growers did not accept pea bean because it was difficult to adjust it to the dominant farming system. Pea can easily replace potato but substitution of pea bean for maize would modify the balance of the farming systems. It requires a high income to purchase the maize needed to feed milk cows. The cannery could not afford to pay such a high price for the raw material if it had to remain competitive in export markets. The need for irrigation in June and July increased production costs. Early planting was tested but the crop still needed to be irrigated once or twice.

The pea bean project shows that good productivity and quality, stable contracts, and demand are not enough for an industry to succeed. Poor adaptation to the prevailing farming system can lead to excessively high production costs.

IV. – Other frozen vegetables

New freezing plants were established following the success of the frozen pea industry during the 1970s and the growth in consumption of frozen vegetables. Initially, pea freezing plants also processed fish; the new processing plants no longer processed fish, so that other vegetables were needed to extend the pea processing season. Difficulties in finding alternative commodities and the slow down of the Portuguese economy during the 1970s raised serious financial problems for the new processors.

Increased consumption of frozen vegetables led to renewed interest in the development of the frozen foods industry in the early 1980s. In 1986 the Luso American Development Foundation (FLAD) funded a collaborative R&D project involving national agricultural organizations (IAPA, INIA) and the processors (Fragoso, personal communication).

Major outputs of the project were: (a) a market study that identified the most appropriate commodities for export; (b) selection of varieties for better yields and freezing quality; (c) improved crop production techniques; and (d) transfer of technology to growers and processors.

A suitable calendar for year-round production of freezing vegetables was established by integrating the experience of processors in domestic and export markets *(Table 3)*. Field experiments were conducted

to improve variety adaptability and cropping techniques for nine commodities. However, despite good quality and a market need, the industry could not be developed because raw material could not be supplied at competitive prices.

Table 3. Calendar for year-round production of vegetables for processing

Commodity	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Cauliflower		x	xx	xx								
Pea				x	xx	xx						
Strawberry					xx							
Broad bean				xx		xx	xx					
Green bean						x	x	xx	xx			
Sweet corn								xx	xx			
Sweet pepper								xx	xx	xx		
Broccoli	xx	x									xx	xx
Spinach	xx	xx										xx

xx - regular season; x - extended season
Source: IAPA/FLAD, 1989

The coastal area is the most important region for production of frozen vegetables. It has a suitable climate and most freezing plants are located along the coast. But vegetable cultivation—unlike pea crops—requires major changes in the existing farming system, which tends to increase production costs. The price offered by processors for some commodities was insufficient in relation to the cost of production in scattered and inadequately mechanized smallholdings.

Broccoli, cauliflower, and sweet pepper do not require mechanical harvesting. But competition with the fresh market reduces supply to processors. Sweet pepper could be moved to areas suitable for processing tomatoes, but growers prefer tomato to sweet pepper because of higher income and fewer production problems.

Green bean requires mechanical harvesting. Competition with the fresh market does not exist since the varieties used for processing are not suitable for fresh consumption. Processors are supplying growers with mechanical harvesters, making the crop economically viable.

Small, low-quality strawberries that are unsuitable for the fresh market are used for strawberry paste and bulk frozen fruits. Individual quick freezing (IQF) is a promising method for export markets (Palha, personal communication). However, it may not be economically viable since IQF products require hand-picked high-quality fruit and the price paid by processors for such fruit is lower than that obtained on the fresh market. Thus, the fresh market and processing industries complement each other.

It is interesting to compare the strategies used by different processors to overcome these supply problems. All of them use contracts based on fixed prices.

The **first group** of processors concentrates on fish and pea freezing as major activities to which other commodities may be added occasionally. Green bean is one such option for which growers are provided with small-scale harvesting machines in an attempt to improve quality without raising production costs.

The **second group** of processors is exclusively interested in frozen vegetables, including peas. It is highly dependent on commodity diversification and crop mechanization to lower production costs. The

processors have serious difficulties in purchasing enough raw material when the fresh market prices are high, in spite of the contracts signed with growers. Processors in this group try to contract fully mechanized crops to lower production costs and to reduce competition with the fresh market.

The **third group** is represented by the cooperative that uses freezing as a complementary activity to the fresh market for most commodities. This type of cooperative processes surplus due to overproduction of vegetables. The price paid to growers is based on the quality of the product and time of delivery; the same average price is paid for fresh market and processing vegetables. This strategy may be interesting for fresh market growers with surplus production, but it is not very effective for developing a vegetable processing industry because of the unstable quality and price of raw material. When yields are low and fresh market prices rise, the cooperative has serious difficulties in processing the minimum quantity required to supply domestic and export markets.

V. – Final remarks

The four cases of the vegetable processing industry in Portugal show that availability of good quality raw material at low prices is a key factor of success.

Pea and green bean crops usually require large areas and fully mechanized operations. Fresh market and processing are distinct activities and belong to different farming systems. However, in certain conditions, vegetables for processing can be grown on small farms with a low degree of mechanization if the crop is suited to the farming system.

Fresh market and processing can be combined as complementary activities for other commodities. Broccoli and sweet pepper, for instance, do not require mechanical harvesting and the surplus from the fresh market can be used for processing. However, competition with the fresh market can reduce the supply of raw material for processing when fresh market prices are high and there is no surplus production.

In the case of asparagus and small fruit (e.g., raspberry, loganberry, and sometimes strawberry) fresh market and processing must be combined. The high cost of hand-picking makes it unprofitable to produce a crop exclusively for processing. To be a viable and profitable enterprise in this case, crop production should combine sale of high-quality produce at fluctuating prices to the fresh market with that of lower-quality surplus at stable prices to processors.

The increasing demand for high-quality frozen fruit and vegetables offers some opportunities for processing hand-picked commodities. In this case an efficient combination of fresh market and processing is needed. Crop diversification would extend the processing season and freezing would be a suitable alternative for fresh market surplus if dual purpose varieties are used.

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