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A Profitable Alternative for the Spanish Southeast: The Case of Production of Figs in Greenhouses

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Abstract: Spain is one of the main fruit and vegetable export centers, as it allocates more than 80% of its total production to foreign trade. In recent years, the stable demand for fruit and vegetables has been affected by the incorporation of third countries outside the European Union, which compete by marketing the same portfolio of products. This situation causes farmers to have to look for other crops to expand the current supply. However, the introduction of alternative crops leaves aside the environmental importance in order to choose a profitable and sustainable alternative for farmers from the economic, logistical and social point of view. The key strategy must be to increase the range of products with new crops that are both profitable and sustainable, especially given the difficulties encountered in agricultural practices, such as pollution from chemical products, water scarcity, and waste generation. In this context, the need arises to propose national crops that can complement the necessary supply and avoid negative externalities. For this reason, the objective of this study is to demonstrate the profitability of the sustainable production of figs inside greenhouses so that the agricultural sector may invest in this alternative crop to complement the supply of intensive horticulture in southeastern Spain. Therefore, this analysis seeks to answer the initial question, Can fig cultivation be a profitable alternative to the current model of agriculture in the Almeria region? The field test consisted of cultivating 11 national varieties of biforous fig trees under greenhouse conditions. The chosen location was the Spanish southeast, specifically an experimental farm in the province of Almeria, and the selected dates were the years 2018–2020. The results indicate that the intensive cultivation of early figs and figs is a good alternative since it both allows the recovery of the investment from the fourth year, depending on the selected variety, and contributes favorably to sustainable agricultural production.



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1. Introduction

The European Union (EU) is one of the main world exporters of agri-food products [1]. However, in many territories, the most important aspect is not the economic value of the exported products, but the social dimension of the workforce dedicated to agriculture, which is especially sensitive in certain European territories. Specifically, it is estimated that the European agricultural sector provides more than 20 million regular jobs [2]. The representativeness of the European agricultural sector is due to the good climatic conditions of certain countries, especially in the south, as a consequence of, for example, the “know-how” accumulated over decades by agricultural producers, the good quality of their products, and the support of the Common Agricultural Policy (CAP) [3–5]. Likewise, the agri-food trade carried out by the EU is varied, since exports range from cereals, vinegar, and liquors, to vegetables or fruits [6]. Among European countries, Spain stands out for

having a powerful marketing system, since it has the most intensively irrigated land in Europe and exports more than 70% of its agricultural production to the rest of the EU [7,8].

Spain is characterized by having a high-yield intensive agricultural model and registering more than 80% of produce exported [9–11]. The productive importance is based on the intensive greenhouse cultivation of eight products: bell peppers, tomatoes, zucchini, cucumbers, aubergines, green beans, melons, and watermelons.

The balance between supply and demand for fruit and vegetable products has enabled a stable price to be maintained for the past few decades. However, the present situation is significantly different. Dependence on foreign trade has led to a change in cost structure, primarily as a result of the increase in the cost of importing petroleum products, which are in great demand in intensive agriculture [12,13]. In this sense, petroleum products (e.g., plastics for greenhouse covers, pesticides and insecticides, and plastic boxes for transporting vegetables and fruits) are necessary to develop agricultural activity and their price increase directly affects costs. As for production, all the costs that do not correspond to inputs, such as labor, remain constant and, therefore, are assumed not to increase [14]. In the case of tomatoes, the reduction in the harvested area is mainly attributable to the decrease in the margin per unit of product sold, since the average sales price is maintained, competition from third countries is stronger, and there is an increase in production costs in Spain [15].

In terms of demand, sales of fruit and vegetable products are characterized by a downward trend in the prices of the main products [16]. Year after year, the result of agricultural activity tends to be reduced due to an increase in the cost of inputs and the decrease in average sale price. What is more, several horticultural production areas have been consolidated in countries beyond the European Union with consistently growing export activity to the detriment of production inside the EU. This is the case for North Africa and Turkey, which are the most relevant examples [17–20]. From a commercial standpoint, the concentration of supply in only eight products and more than 3.5 million tons of annual production, together with the growing supply from countries outside the Union, justifies the fall in the margin per unit of product sold [21–23].

Weaknesses predicted for 2050 must be added to the aforementioned, which point to the need for a considerable increase in food production to meet the demand of the population [24]. Finally, to make agricultural production in Spain more sustainable, the strengths of the circular economy (CE) must be utilized in the management of agricultural waste, the substitution of non-biodegradable materials, or the implementation of sustainable practices in the agricultural sector [25–28]. In this context, the Ellen MacArthur Foundation (EMF) defines the term CE as “an economic closed-loop system in which raw materials, components, and products maintain their quality and value for as long as possible and where systems are powered by renewable energy sources” [29]. Alternative crops must be favored to improve the profitability of farms and to try to fill a new market niche [30–32]. The redefined CAP favors the diversification of production in response to the growing market demand while ensuring sustainable actions and the preservation of natural resources [33,34].

In this scenario, the strategy of expanding the range of products offered by Spain is promising, given that reducing the supply of fruits and vegetables with surplus production is not the solution [35] when considering that the decreased surface area in Spain would be quickly counteracted by the increase in third-country producers. The key strategy must be to increase the range of products with new crops that are both profitable and sustainable, especially given the difficulties encountered in agricultural practices, such as pollution from chemical products, water scarcity, and waste generation [36–39]. Hence, it is necessary to present models that solve environmental problems and are sustainable over time. It is here where the idea of having a national product, figs, arises as an alternative to strengthen the country's economy without having to resort to the incorporation of other foreign products that requires their importation and thus implies direct dependence on other countries. For this, the following research is presented with the aim of answering the initial question, Can fig cultivation be a profitable alternative to the current model of agriculture in the Almeria region?

2. Theoretical Background

2.1. Implications of the Agricultural Sector in Sustainable Development

In 2015, the United Nations (UN) 2030 Agenda for Sustainable Development Goals (SDG) was an important stimulus for action plans in favor of the sustainability of the planet and people. This impulse is reflected in 17 objectives and 169 goals that cover three areas: social, environmental, and economic [40]. In the three disciplines mentioned, the most challenging issue today is the eradication of poverty in the world within the framework of sustainable development [41]. In this way, agriculture, which is considered a fundamental pillar to satisfying human demand, has to introduce new actions and alternatives that contribute to achieving said objective through the provision of food [42].

The current situation of biodiversity loss, scarcity of water resources, high pollution, and increased use of plastic have prompted the approval by the European Union of action plans that contribute favorably to the environment [43]. Therefore, the improvement of sustainability in agriculture should be considered a priority, since new practices are required that advocate CE, reuse, reduction, and recycling of the inputs used, amongst other actions [44].

If we want to compare the current situation in agriculture in the chosen study area with the role of sustainability, certain characteristics and changes in the present production model must be mentioned. Initially, the sector was made up of family farms that satisfied demand using only the work of the local families themselves. However, the increase in labor requirements has caused, over the years, an undoubted increase in the workforce [45], resulting in a growth in population and immigration. In this context, the current Almeria family business model is being altered by a greater concentration of the greenhouse area per farm unit to ensure the demand for food. This situation in turn generates advantages, such as greater professionalism and an undoubted increase in the workforce and specialization due to the increase in labor requirements [45]. The Almeria family business model currently has a commercial structure, of a social nature, capable of accumulating knowledge, interests, innovations, or techniques that respect the environment, among all the members of which it is composed [46]. Hence, the agricultural production sector is incorporating sustainable and ecological processes more and more frequently that improve the environmental situation. From an environmental point of view, in Almeria, the location characteristics discussed in the previous section favor quality agricultural production with less energy use than other similar agricultural systems. In addition, farmers show a growing interest in favoring and progressing toward a more sustainable and environmentally friendly future. This is the reason why more and more processes in agriculture that may contribute to this objective are identified as integrated production or biological control. This framework promotes the identification of alternative crops in Almeria's agricultural activity to help improve the current situation of farmers at an economic level and, in turn, ensure economic, environmental, and social development. In this sense, the study of fig profitability as a crop is considered an opportunity for sustainable development, since the farmers' knowledge of the costs and benefits derived from the cultivation of figs may improve their organization and favor the allocation of financial resources for the inclusion of circular and sustainable practices in the short and long term. In addition, the versatility of the crop would allow the population to settle in the territory, which is currently at risk of abandonment, and where desertification can pose an additional problem from the point of view of sustainability [47–49].

2.2. The Cultivation of the Biferous Fig Tree

From a nutritional point of view, the beneficial characteristics of this fruit, together with the growing demand for food, drive its current production. This fruit is considered a nutritious food with a high contribution of vitamins and antioxidants. As a consequence, the consumption of figs is considered in balanced nutrition as a favorable energy intake for human health [50–53]. The climatic conditions in Turkey make this country the main producer of fresh and dried figs, although the majority of exports are made to countries in Europe. There is a difference between the consumption of fresh figs and dried figs.

Fresh figs are marketed for direct consumption and are characterized by having a short post-harvest life. In the case of dried figs, they are mainly considered as ingredients for jams and sweets, or typical dishes. The main difference between the latter and fresh figs is that, through a drying process, the latter lose up to 75% of their water content [54]. In this case, dried figs continue to maintain the same nutrients and beneficial substances as fresh figs [55], in addition to being easier to market due to the conservation process required. Hence, Turkey's fig production represents 27% and 53% of global fresh and dried fig production, respectively [56]. That is why Turkey's high specialization in this product, its high professionalism, and the standardization of its processes, make it one of the most efficient countries in the world. However, the existence of difficulties may affect the evolution of the production of figs in Turkey, being reflected in a nominal reduction in the next decade. Turkey only consumes 10–15% of the product in the domestic market, so a high representation of the production is introduced in the European markets. Among the threats found in Turkey is the lack of available land to expand production or rapid decay and short life of fresh figs. A situation that explains why, in the new decade of the 2020s, Turkey will reduce exports to European countries to start marketing them to its closest neighboring countries [54]. For this reason, it is considered an ideal time for Spain to promote the alternative production of figs in the southeast. Among the reasons that justify this affirmation are the advantageous position that this country holds in the production of figs (sixth position) and the climatic conditions that it possesses. In addition, the good knowledge about the operation of said crop in the territory can serve as a precedent to improve its weight in said market.

2.3. Characteristics of the Province in Which the Study Farm Is Located (Almeria)

Almeria is composed of numerous mountainous formations and coastal plains close to the Mediterranean Sea. The geological conditions and the altitude gradient throughout the territory vary depending on the location. In the case of the altitude gradient, values can range from 0–2% to more than 55%. Agricultural land is located in flat or gently sloping areas, ranging from 0% to 6% [57]. The climate of this area is conditioned by two fundamental elements: precipitation and temperature. Annual rainfall is scarce, at around 200 mm per year [58], while the average temperature on the coast is around 25 °C in the summer and 17 °C in the winter as a result of the influence of the sea. This Mediterranean climate is considered a competitive advantage [59] as Almeria is able to supply the rest of the world with non-seasonal horticultural products. Finally, other elements that make this Andalusian province a unique place are the humidity along the coast and its high sun exposure, which exceeds 3000 h per year. Figure 1 indicates the specific province in which the field trial has been carried out. In this context, it should be noted that the study has not been carried out in all of Almeria but in an experimental farm located in this province.

The main difference between the intensive and extensive agriculture models is the production process. In the former, technology, specialization, and maximization of production are chosen; while in the latter, more labor is required, and the yields are lower since it does not have a high degree of specialization. The Almeria region is characterized by the intensive production model. This model, which has been developing for several decades, represents the maximization of agricultural specialization and is deeply involved in foreign trade with high technological value [60]. The annual production of the 2019–2020 harvest campaign records a total of 3,721,000 tons produced. This value makes Almeria the main producer of vegetables in Spain [61]. In addition, 93.75% of this production belongs to crops grown under plastic. Almeria hosts more than 32,000 ha of greenhouses, which includes an increase of 506 ha from 2019 through 2020. Figure 2 shows the evolution of the greenhouse area over the years.

The data provided for each type of intensive crop regarding greenhouse area and the production in tons allows for the calculation of yields for the eight main products grown in Almeria. These data objectively express whether productivity per crop has decreased,

increased, or remained stable, over the last three years. Figure 3 shows the evolution of these crops over the time horizon analyzed and their annual productivity values.

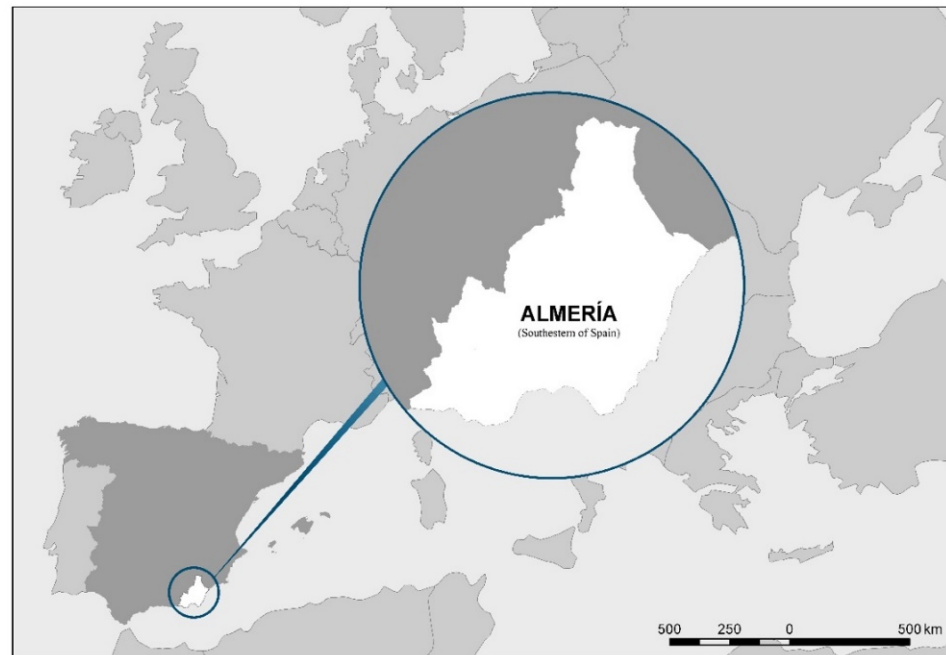


Figure 1. Province where the experimental farm of the study is located. **Source:** Own elaboration.

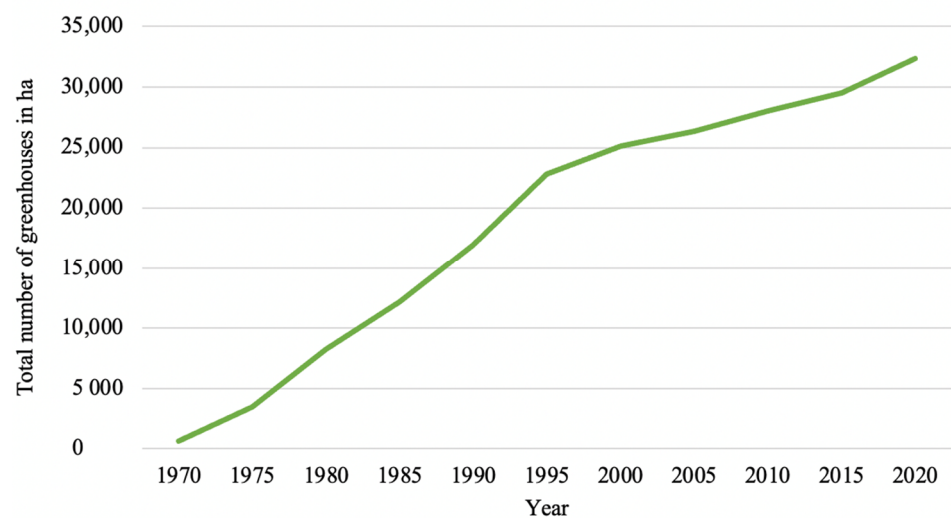


Figure 2. Total number of greenhouses in hectare (ha) in the province of Almería. **Source:** Own elaboration based on data available in the Provincial Delegation of the Ministry of Agriculture of the Andalusian Regional Government in Almería and the Andalusian Cartographic Base [62–64].

Green bean and cucumber crops are the products that stand out the most for their increase in productivity in the three years analyzed (2018–2020), while watermelon and tomato experienced a decrease in productivity. As for the economic component, the production value reaches 2.3 billion euros, 2.2 billion of which were obtained from intensive agriculture [66]. These production figures explain why the average agricultural GDP in Almería represents around 20% of productive activities [67,68].

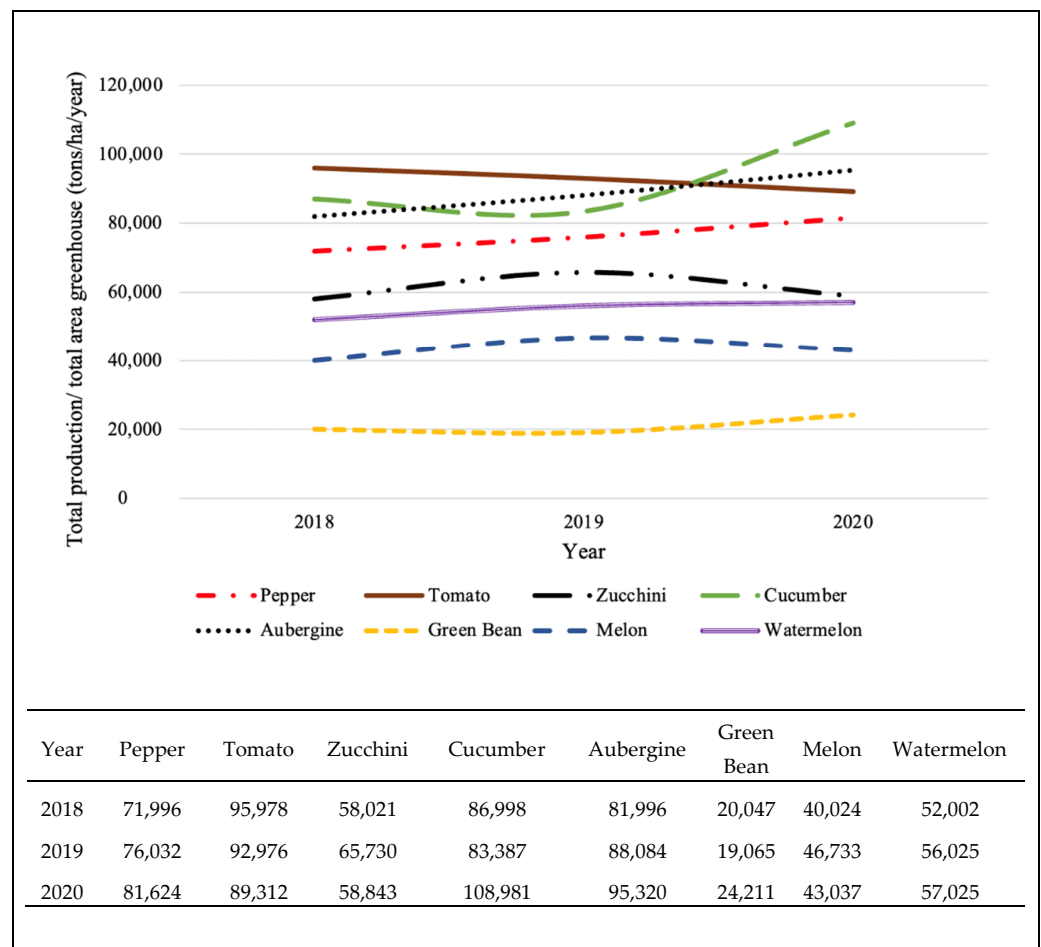


Figure 3. Annual yield for each crop analyzed (tons/ha/year) and annual productivity values. **Source:** Elaborated by the authors based on data provided by the Provincial Delegation of the Department of Agriculture, Regional Government of Andalusia [65].

3. Material and Methods

Structure analysis:

The detailed characteristics of the structure in which the study was carried out are as follows:

- **Place of study:** The investigation has been carried out at the Experimental Farm Foundation of the University of Almeria—Anecoop, which is located in “Los Goterones” in Almería, Latitude 36°51' N and Longitude 2°17' W, at an altitude of 90 m above sea level (msn).
- **Details of the structure:** The structure used is a U4 multi-tunnel type greenhouse measuring 1800 m². The greenhouse, which was oriented E-W, has a height of 4.50 m to the gutter and 5.70 m to the ridge. Inside the greenhouse, there are 5 tunnels measuring 8 m wide by 45 m long and a three-layer plastic roof.
- **Characteristics of the chosen varieties:** The vegetal material used were fig trees (*Ficus carica*, of various cultivars). In this sense, a total of 11 varieties were cultivated. Seven of them with green skin color and a spherical shape (in Tables 1 and 2 mentioned as variety “1”, “3”, “4”, “5”, “6”, “7” and “8”); three black-skinned and oblong (in Tables 1 and 2 cited as variety “P”, “Si” and “C”); and one yellowish green and greenish yellow and spherical (called “Mi” in Tables 1 and 2).
- **Environment:** Using the infrastructure indicated above, the average temperature during the study was 19.2 °C and the average relative humidity was 74.0%. In addition, the greenhouse had zenithal ventilation in the five tunnels.

- Irrigation system: Drip irrigation was used with discharge emitters of 3 L/h with a density of 1.6 drippers/m². Nutrition was carried out through irrigation water.
- Period of time analyzed: Between September 2018 and December 2020.

The rest of the production infrastructures, air conditioning, irrigation system, technical advice, and land preparation expenses, are the same as for the rest of the traditional horticultural crops in Spain.

Cost analysis:

The technical characteristics of the productive infrastructures for obtaining the economic data in terms of investment cost and their corresponding amortizations are as follows:

- The use of water, fertilizers, phytosanitary products, labor, tutors, auxiliary insects, and crop residue management have been monitored during the field trial and represent the primary data on the cost of fig and early fig production in a typical greenhouse in Spain.
- The price data for figs and early figs have been obtained from the FAOSTAT website regarding information over the last five years. Data on the sale of products in Spanish wholesale market networks establish an average selling price of 3.26 euros for farmers and 1.60 euros per kg for early figs and figs, respectively.
- Time horizon considered. Income and expenses generated from the moment the planting took place in September 2018 until the field trial in module U4 was completed in December 2020 have been taken into account.

The structure of income and expenses followed to determine the income statement of the fig tree crop was obtained from the records provided by the Experimental Farm Foundation of the University of Almeria—Anecoop. This is where the study was carried out and data were provided by the main portals for the price quotations of fruit and vegetable products. To specify the costs attributable to each production activity, the data provided by Agrosegueros—España, S.A. were used [16,69].

Table 1. Income and expense structure of the biferous fig crop. January 2018 to December 2020 and 3- and 4-year projections.

Essay Result January 2018 to December 2020	Var 1	Var 3	Var 4	Var 5	Var 6	Var 7	Var 8	Var “P”	Var “Si”	Var “C”	Var “Mi”	Horticultural Alternative 5
Total annual incomes (€·ha⁻¹)	34.067	65.024	54.765	28.704	47.021	51.834	41.790	95.352	99.463	30.044	38.400	281.560 €
<i>Early fig production (kg)</i>	6.165	9.338	11.862	3.828	8.388	9.785	7.248	22.264	23.250	4.836	7.726	
<i>Fig production (kg)</i>	8.570	21.216	9.874	9.954	12.073	12.230	11.142	13.970	14.520	8.760	8.106	
Total variable cost (€·ha⁻¹)	78.191	94.479	93.232	74.557	91.764	95.756	86.939	136.683	136.683	74.812	81.631	194.971 €
Technical assessment (€)	694	694	694	694	694	694	694	694	694	694	694	772 €
Soil preparation (€)	3.839	3.839	3.839	3.839	3.839	3.839	3.839	3.839	3.839	3.839	3.839	11.575 €
Covering and structure (€)	12.297	12.297	12.297	12.297	12.297	12.297	12.297	12.297	12.297	12.297	12.297	11.846 €
Seeds and seedling production (€)	10.000	10.000	10.000	10.000	10.000	10.000	10.000	10.000	10.000	10.000	10.000	14.689 €
Growing and development until harvesting of early figs (€)	14.909	14.909	14.909	14.909	14.909	14.909	14.909	14.909	14.909	14.909	14.909	32.898 €
Harvesting of early figs season (€)	17.612	26.677	29.786	10.936	23.962	27.954	20.706	50.637	50.637	13.816	22.072	31.380 €
Harvesting of figs season (€)	18.840	26.063	21.706	21.882	26.063	26.063	24.494	44.307	44.307	19.257	17.820	91.811 €
Total fixed costs (€·ha⁻¹)							49.373					53.693 €
Soil maintenance (€)							4.613					5.140 €
Covering and structure (€)							9.231					10.287 €
Energy and fixed supplies (€)							3.646					4.063 €
Insurance, management and financial services (€)							8.028					8.947 €
Equipment and irrigation system (€)							23.856					25.256 €
Total expenses	127.564	143.853	142.605	123.931	141.137	145.130	136.313	186.056	186.056	124.185	131.004	248.664 €
Net profit (€·ha⁻¹)	−93.497	−78.829	−87.840	−95.226	−94.116	−93.296	−94.523	−90.705	−86.594	−94.141	−92.604	32.896 €

Source: Own elaboration based on field research in module U4 of Toresano Sanchez and Camacho Ferre and Honoré et al. [16,69].

Table 2. Income and expense structure of the biferous fig crop. January 2018 to December 2020 and 3- and 4-year projections.

Profit and Loss Estimations 3rd Year	Var 1	Var 3	Var 4	Var 5	Var 6	Var 7	Var 8	Var "P"	Var "Si"	Var "C"	Var "Mi"
Total annual incomes (€·ha⁻¹)	51.159	97.115	81.842	43.131	70.535	78.049	57.104	142.749	148.679	44.877	57.290
<i>Early fig production (kg)</i>	9.283	13.749	17.606	5.788	12.583	14.860	7.448	32.841	34.559	7.138	11.399
<i>Fig production (kg)</i>	12.820	32.082	14.998	14.885	18.107	18.163	20.137	21.894	22.096	13.256	12.349
Total variable cost (€·ha⁻¹)	42.863	53.524	52.853	40.443	51.901	54.622	47.682	82.609	81.969	40.565	45.090
Total fixed costs (€·ha⁻¹)							21.944				
Total expenses	64.807	75.468	74.797	62.387	73.845	76.565	69.626	104.553	103.913	62.509	67.033
Net profit (€·ha⁻¹)	-13.648	21.648	7.045	-19.255	-3.310	1.484	-12.522	38.196	44.766	-17.632	-9.744
Profit and loss estimations 4th year	Var 1	Var 3	Var 4	Var 5	Var 6	Var 7	Var 8	Var "P"	Var "Si"	Var "C"	Var "Mi"
Total annual incomes(€·ha⁻¹)	61.392	116.538	98.212	51.759	84.641	93.661	75.000	171.298	178.415	53.854	68.749
<i>Early fig production (kg)</i>	11.140	16.499	21.128	6.946	15.099	17.833	12.910	39.409	41.471	8.566	13.679
<i>Fig production (kg)</i>	15.384	38.498	17.997	17.862	21.729	21.795	20.192	26.273	26.515	15.907	14.819
Total variable cost (€·ha⁻¹)	46.104	58.212	57.431	43.360	56.348	59.424	54.461	91.049	90.409	43.506	48.636
Total fixed costs (€·ha⁻¹)	49.373										
Total expenses	21.944	21.944	21.944	21.944	21.944	21.944	21.944	21.944	21.944	21.944	21.944
Net profit (€·ha⁻¹)	-6.655	36.383	18.838	-13.545	6.350	12.294	-1.405	58.306	66.062	-11.596	-1.831
Accumulated results estimations until 4th year	Var 1	Var 3	Var 4	Var 5	Var 6	Var 7	Var 8	Var "P"	Var "Si"	Var "C"	Var "Mi"
Accumulated net profit (€·ha⁻¹)	-113.800	-20.799	-61.957	-128.027	-91.076	-79.518	-108.449	5.797	24.234	-123.369	-104.179

Source: Own elaboration based on field research in module U4 of Toresano Sanchez and Camacho Ferre and Honoré et al. [16,69].

4. Results and Discussion

After two years of growing perennial fig trees in a greenhouse representative of intensive agriculture in Spain, the project's profit and loss account have been calculated since the expenses and income obtained from the field trial are now known. This study has also made it possible to draw up a three and four-year result projection starting two years into the trial as the trees have already completed a large part of their growth phase. Tables 1 and 2 shows the results obtained in the greenhouse cultivation trial of biferous fig trees.

The table is divided into two parts, the first being the study carried out between January 2018 and December 2020, and the second a projection for the following two years with the data that were collected. To adequately understand the results, it is important to distinguish between the results obtained for each variety per year studied and for accumulated balance. This is due to the fact that, from the third year, varieties with positive results in the annual study begin to be registered, but in the accumulated results account they continue with losses.

Both the income and the costs derived from production have been differentiated between figs and early figs. To calculate the total income for each of the cultivated varieties, prices have been consulted on the FAOSTAT website. This decision makes it possible to provide real results about the price situation in the market and, therefore, not base prices on unsubstantiated hypotheses. Moreover, the economic results of this trial have been compared with those obtained for other crops grown under the same conditions, which have been recently published [16] based on official price quotes for fruit and vegetables, as well as the areas and production dedicated to each crop [70].

At the same time, production costs have been divided between fixed costs and variable costs. Fixed costs are all those costs that are necessary to carry out the agricultural activity and that do not depend on the type of product that is being grown. In the case of variable costs, the total amount obtained after being monitored throughout the cultivation process was included.

All varieties suffered losses in the 27 months studied (September 2018 to December 2020). However, there are notable differences in the outcome depending on the variety. Thus, Padrino (P) and Sierra (Si) are the varieties with the lowest losses at the beginning of the crop.

In the third year after transplanting the fig trees, it was estimated that five of the eleven varieties would offer positive results, although in the accumulated total of the time studied the balance remains negative. In the third year, the variety "Si" offered a positive result of 44,766 euros, followed by the variety "P" with 38,196, and variety 3 with 21,648 euros. The cumulative result for the first three years is negative for all varieties.

In the fourth year of cultivation, when the fig trees were fully grown, the annual results were positive in six of the eleven varieties and the accumulated results are already beginning to show positive for varieties "Si" and "P". Thus, from the 4th year onwards, this crop would start to be profitable and would register an annual net cash flow of 66,062 euros in the case of the "Si" variety, which has proven to be the most profitable in the trial.

The results show that the alternative cultivation of figs in the Almería region can be profitable. In this case, it is essential to understand that the economic analysis is not considering specific situations that can alter the economic results. In fact, the price of oil products that are essential to developing agricultural activity can increase at any time, as is currently happening. This is a situation that directly influences production costs and, therefore, the income statement for this crop.

Finally, it would be ideal to know the situation of the countries that are ahead of Spain in the production of figs (Turkey, Egypt, Morocco, Islamic Republic of Iran, and Algeria), not only to have them as a reference to progress in the production models, distribution and marketing but also to create synergies.

5. Conclusions

The research carried out provides information on the introduction of figs as an alternative crop in the Spanish southeast. Firstly, the main characteristics and benefits of figs have been described, as well as the main producing country, followed by the characteristics of the Almerian agricultural system to subsequently analyze whether the climatic conditions, location, and resources of the sector are suitable for the introduction of figs as an alternative to traditional protected horticulture. This analysis demonstrates the mature phase of fruit and vegetable production after analyzing the eight main crops in Almeria and the evolution in hectares of the greenhouse area. Finally, the study concludes with the establishment of a relationship between the principles of sustainability and agriculture in the Spanish southeast to understand the fundamental and revealing role that the latter will have in a future that is more respectful towards the environment.

After presenting a general view on the possibility of introducing fig cultivation in the southeast of Spain, the research has advanced towards the economic aspect, as farmers demand updated studies on profitability before incorporating a new product under greenhouse conditions. To do this, the methodology details the specific characteristics that have been chosen regarding location, climate, and time horizon, among other variables. In this case, to find out the viability of greenhouse fig production in Almeria, a field study has been launched comprising 11 varieties, 9 of which are native to southeastern Spain. Of the varieties studied, from the point of view of the type of fruit and yield, the native varieties Si and P are presented as real alternatives to traditional horticultural crops, as they succeed in recovering the investment in the fourth year of planting. These results provide useful information since they can be introduced into a greenhouse in the high-yield intensive production system in Almeria and expand the range of products currently offered to the northern European market. This decision has a positive influence not only on the economic aspect for farmers but also on other dimensions since it prevents agricultural production from being concentrated in specific months of the year by introducing new cultivation periods; it also ensures the permanence of population in areas at risk of abandonment, thus also preventing desertification. Finally, the profitable results obtained are a way to encourage the introduction of this alternative crop in Almeria production. A situation that will obtain positive results in the short term, not only because of the profitability of the product itself but also because of the possibility of introducing new practices in the cultivation process that make fig production even more profitable. In summary, the high degree of specialization in the region of Almería can favor the rapid incorporation of these crops, as well as the introduction of new and ecological greenhouse techniques that are already being used in other main greenhouse products, such as melon or watermelon.

In addition, due to the problems analyzed in the study of the competition of countries outside the EU to market the same portfolio of products, this type of field research is considered to shed light on what type of alternative crops should be introduced so that a negative predisposition on the part of farmers can be avoided. In this way, this research may contribute, in addition to promoting biodiversity in greenhouse cultivation areas, to encouraging the introduction and research of new alternative greenhouse crops that will contribute from economic, environmental, and social perspectives. These investigations may provide a better understanding of other products that can improve the economic and sustainable situation of farmers, in addition to favoring the rapid introduction of technological innovations in fruits and vegetables that demonstrate good performance. Therefore, future research should further this line of research, testing the success of other alternative crops in greenhouses, as well as introducing variations in climatic conditions, location, and time horizons to obtain more information about the validity of the study. This research also states that the provision of information to workers in intensive greenhouse horticultural production systems is favorable since it promotes the introduction of alternative crops and facilitates compliance with the SDGs, which opt for the development of agricultural systems in the CE framework.

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