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Assessment of Tomato Peels Suitable for Producing Biomethane within the Context of Circular Economy: A GIS-Based Model Analysis

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Abstract: Biomass is seen as one of the most dominant future renewable energy sources. In detail, agro-industrial by-products represent a cheap, renewable, and abundant feedstock useful for several new products, including biochemical, biomaterials, and above all biogas, which are taking on an ever-increasing role in Italy. In this context, the tomato chain was analysed aiming at estimating the amount of processed tomato and the related waste production as a new suitable resource for producing biofuel as a new frontier within the context of a circular economy. Due the importance of the tomato industry, this research aims at filling gaps in the knowledge of the production and yield of the by-products that are useful as biomass for energy use in those territorial areas where the biomethane sector is still developing. This aim could be relevant for planning the sustainable development of the biomethane sector by reducing both soil consumption for dedicated energy crops and GHG emissions coming from the biomass logistic supply. The achieved results show the localization of territorial areas highly characterized by this kind of biomass. Therefore, it would be desirable that the future policies of development in the biomethane sector consider the availability and the distribution of these suitable biomasses within the territory.

Keywords: tomato peels; biomethane; GIS; circular economy; bioresource policy; territorial analysis; agro-industrial by-products

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1. Introduction

In a world where climate change is the most imminent environmental issue, it is well known that global warming is due to the large-scale anthropogenic emission of greenhouse gases (GHGs). Global warming and GHGs cause increased adverse weather conditions which are dangerous for agriculture and food security [1]. Scientific evidence underlines that almost all natural, biological, and physical processes are reacting to climate changes in Europe and around the world [2]. The agri-food chain generates many different sources of GHG emissions at all stages from manufacturing and distribution of inputs used at farm level to food processing and preparation, distribution, and waste disposal [3,4].

The agri-food chains produce substantial quantities of residues that, if not properly used, become wastes that contribute to disposal problems, aggravating environmental pollution and disposal costs [5,6]. These residual biomasses constitute a reserve of elements and compounds that should be used in new production cycles, according to the principles of circular economy [7–9].

Within the European agri-food sector, the tomato paste manufacturing industry represents one of the main food industries [10]. In detail, every year this industry generates a big amount of tomato residues, in many cases considered as wastes, and is responsible for disposal problems and environmental pollution [11]. The World Processing Tomato Council (WPTC) argues that worldwide, between 2017 and 2019, about 36,000,000 metric tonnes were processed, with Members in Mediterranean Region (AMITOM) contributing almost 16,000,000 metric tonnes, corresponding to 44% of the total amount processed, which could be potentially about 2,400,000 metric tonnes of residual material in Europe [12]. Currently, tomato-processing residues, especially peels, do not generate many benefits for industries, in particular contributing to storage and preservation issues. In fact, the accumulation of these residues, predominantly in the warm periods, promotes uncontrolled anaerobic fermentation leading to environmental problems [13,14]. To avoid added costs related to disposal processes, tomato manufacturing companies often give their production residues for free to other companies that generally use them for feeding livestock [15] or in agriculture as a soil amendment [16,17].

As one of the most popular vegetables in the world, in addition to being served as a fresh vegetable, tomato is also consumed in the form of various processed products, such as paste, juice, sauce, puree, and ketchup [18]. Generally, in processing these products, tomato residues are produced, which consist mainly of peels and seeds as well as a small amount of pulp. The disposal or utilization of tomato residues is an unavoidable problem and is extremely important for the food industry [19].

Several research studies, focusing on the valorisation of residues in tomato industry, were found in the literature that have shown the possibility of obtaining a high amount of valuable chemicals by specific processes, like phenols, lycopene, and ascorbic acid [20–22]. A wide array of waste-based biorefineries for obtaining new products has been proposed and investigated [23,24]. Additional interests involve tomato residues, leading to different energy applications; i.e., anaerobic digestion [25,26], fuel [17], or the production of bio-based products (i.e., carotenoids and polyphenols) [27–29], biodegradable film [30], bio-lacquer for metal food packaging [31], new classes of green surfactants [32], levulinic acid [33].

In detail, as demonstrated by Rossini et al. [22], characterisation of tomato processing residues from an energy perspective highlights a good energy content that could increase interest in the energy valorisation process. In this regard, anaerobic digestion (AD) of agricultural by-products (e.g., animal slurry, food waste, food processing residues) has been recognized by several studies [34–36] as a suitable and effective solution to produce renewable energy by means of a cogeneration system (electricity (EE) and thermal energy (TE)) [37–39]. In detail, the exploitation of biomass for producing biogas by anaerobic digestion (AD) shows high potential to meet the challenges of sustainable and green energy [40,41].

At present, large quantities of agro-industrial by-products have no market and are destined for the landfill or, as in the case of cereals straw, remain in the fields after harvesting operations [42,43]. Such biomasses are suitable to be used in anaerobic digestion plants [44] and could be used to replace food crops for energy production [45]. In this context a new way of doing business has been introduced by the European Commission: the bio-economy, i.e., an economy using biological resources from the land and sea as inputs to food and feed, industrial and energy production. Such an economical system is then based on the so-called biorefinery, i.e., an industrial model based on the use of renewable raw materials for the generation of sustainably created products [46,47]. In this context, food wastes represent a cheap, renewable, and abundant feedstock for sustainable production of a wide range of products, that are taking on an ever-increasing role in the Italian market [48].

In this context, the tomato chain was analysed, by detailing the transformation process with the aim of estimating the quantity of processed tomato and the related waste production as a new suitable resource for producing biomethane as new frontier within the context of a green economy.

Nowadays, data on the exact amount of these residues is very limited, given the commercial sensitivity of this data for all the producers. This lack of official data related to the amount of waste in terms of volume, and especially to the spatial localisation of the sites where these wastes are produced, is a key factor that has over the years limited the reuse, exploitation, and valorisation of the wastes for sustainable processes. In this regard, geographical information system (GIS) tools have been worldwide recognised as useful tools to allow performing analyses of feedstock supply and logistics [49,50].

This research aims, by using GIS tools, to fill the gap in the knowledge of the production, localisation, and yield of tomato residues to support producers in waste valorisation actions, i.e., for producing energy in a sustainable way.

In detail, this study represents the first step urgently needed for planning the valorisation of new biomasses that could be used as feedstock for existing biogas plants or for developing new ones in a sustainable way, in the context of the bio-economy as introduced by the European Commission.

2. Materials and Methods

A methodology for investigating the suitability of using tomato residues as biomass to produce biogas from anaerobic digestion process was discussed. In this regard, statistical tools were adopted, and a GIS analysis was carried out. In detail, the QGIS software (ver. 3.10.11), an open-source GIS software, was used since it is a valuable decision support tool suitable to collect, organise, analyse, and localise geographical data.

Firstly, by adopting Italian statistical tools, the cultivated area and the productions were analysed in order to establish the trend of dataset for the Italian and Sicilian tomatoes sector, from 2016 to 2020. Data were acquired from the national ISTAT database. Then, by using spatial analysis GIS tools, both the production areas within the study area, and the most representative Sicilian tomato industries were localised.

A specific methodology was developed (Figure 1) in order to quantify the tomatoes processed, the related tomato processing residues and, therefore, the potential biogas production. In detail, tomato processing residues production was computed by using specific face-to-face surveys at the processing industries involved in the analysis and data available from annual statistic tools. Finally, the potential biogas production was estimated based on the amount of computed tomato processing residues. The methodological approach and the used materials are detailed in the following sub-sections.

2.1. Case Study

The study area for this research was Sicily (Italy), the largest island in the Mediterranean Sea (Figure 2). In this territorial area, as in all Mediterranean areas, by-products from the agri-food industry (i.e., tomato peels, citrus pulp, olive pomace, and whey), wastes from livestock farming (mainly dairy and beef cattle), and agricultural crop residues (i.e., field residues and process residues) are available to produce renewable energy from anaerobic digestion process [51]. Here, the traditional paradigm based on the use of dedicated energy crops (mainly maize silage) to produce biogas can be changed.

Sicily is the Italian region which has the largest Utilized Agricultural Area (UAA), equal to over 1.387 million hectares which are equivalent to 10.8% of the national UAA [52].

The horticultural sector is an essential production chain for the agricultural economy of the region. Within this sector, Sicily occupies an important place in Italy, both in terms of production volumes and cultivated area.

In the last 5 years (from 2016 to 2020), with reference to horticultural production area (both horticultural open field crops and greenhouses), in Italy an average of 350,000 ha/y were cultivated, while in Sicily a little less than 60,000 ha/y (about 17%) were cultivated.

In Sicily, greenhouses horticultural cultivations are mainly concentrated in the province of Ragusa, in the southern coastal area, where more than 56% of the Sicilian greenhouse surface is located [41].

As regards greenhouse cultivations, the most common species are, in this order: tomato, zucchini, bell pepper, eggplant, and watermelon. Whereas, for open field productions, the most cultivated species are, in this order: artichoke, tomato, melon, cauliflower, and lettuce.

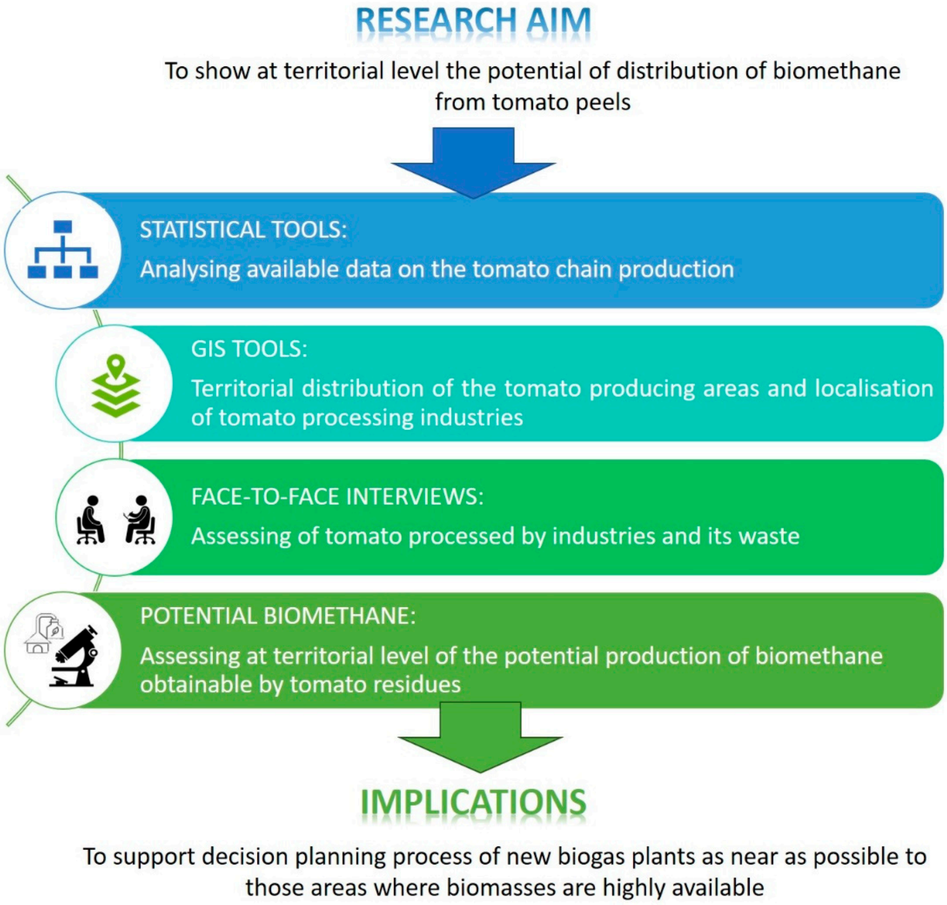


Figure 1. Flowchart of the developed GIS-based methodology.

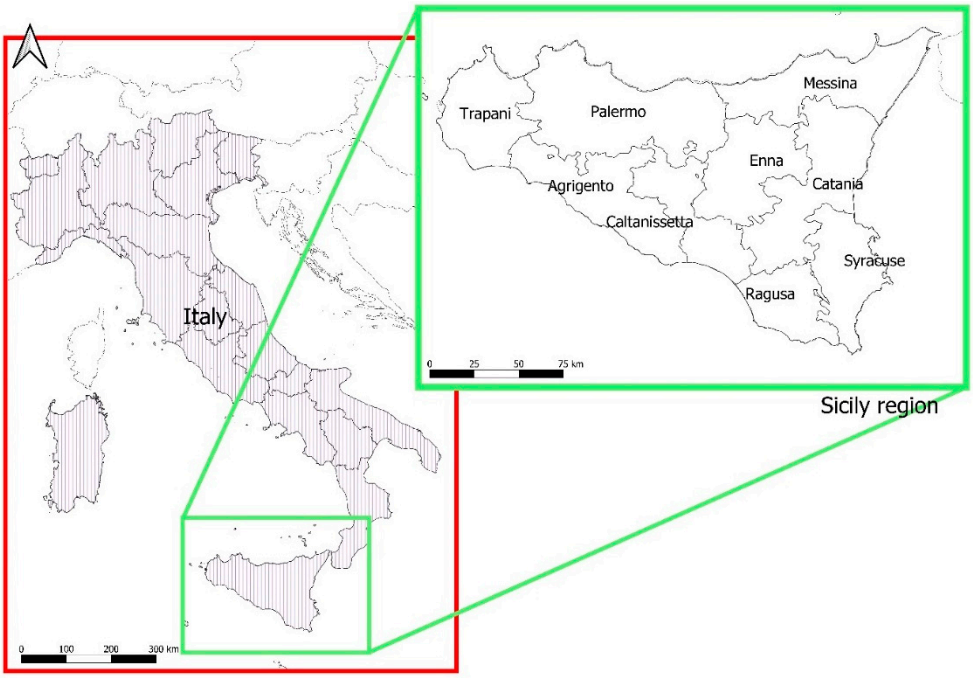


Figure 2. Geographical position of the selected study area.

2.2. Data Analysis

In the study described in this paper, an extensive database was implemented based on the ISTAT database (years 2016–2020) to quantify tomatoes production by GIS analysis.

The base maps used in the GIS included the Regional Technical Map (RTM 2008) as a base map for producing thematic maps, and the administrative boundaries provided by the Sicilian region Web Map Service.

By elaborating data on agricultural sector, provided by the ISTAT database, the most productive provinces were identified and localized on GIS software. In detail, QGIS software was used to perform all the GIS analyses; by combining data provided by the base maps, data acquired from the database, and by adopting the Jenks tool available in the QGIS software, several maps were produced.

Firstly, a territorial distribution of the tomatoes producing areas was obtained, by classifying the Sicilian provinces based on the maximization of variance among the different classes. Then, with the aim of estimating the processed tomato and its waste production, all the tomato processing industries interviewed were located by using their GPS coordinates.

All the principal tomato processing industries sited in Sicily were identified and surveyed, in order to quantify the tomatoes processed and the obtained residual amount, which could be considered available for energy purposes (i.e., flow production). A tailored questionnaire was produced and given to each industry to find out the main structural characteristics, the production targets, and the amount of the processed tomatoes and residual products with reference to those which can be used as potential fuels.

Due to the pandemic condition, it was impossible to interview the managers of the tomato processing industries at length, and the Covid-19 emergency made further company visits impossible. Thus, the owners only filled in the first section of the developed questionnaire, related to production flow. In detail, data about the amount of tomatoes processed, in terms of product input and peels disposed (net of plastics and other packaging), were acquired.

The data collected by the survey, referring to the time interval 2019–2020, was anonymously elaborated in order to specifically estimate the quantities of residual products and their spatial location within the study area.

The last step of the data analysis and of the elaboration was the estimation of the potential biomethane obtainable from the amount of tomato residues recorded through the face-to-face interviews. The theoretical biomethane potential (*BM*) was computed by using the following equation (Equation (1)):

$$BM = A \cdot Y \tag{1}$$

where A is the amount of tomato residues (expressed as tons of fresh matter) and Y is the biomethane potential yield for tomato residues which was considered equal to 33.13 Nm^3/ton of fresh matter, as reported by Calabrò et al. [53] who performed Biochemical Methane Potential (BMP) tests to predict potential biogas.

At the end, *BM* was adopted for assessing territorial distribution within Sicily by mapping tomato residues potential. Moreover, by taking into account the coefficient of tomato processed (obtained as mean value of the data collected), the highest potential production was estimated.

3. Results and Discussion

By analysing the available data from ISTAT database [54] related to the horticultural production within the study area, the most productive horticultural greenhouses species are, in order, tomato, zucchini, eggplant, bell pepper, and watermelon, while the most productive horticultural open field crops species are, in order: tomato, melon, artichoke, cauliflower, and lettuce.

Considering Italian tomato production of about 92,000 hectares, an average value from 2016 to 2020, Table S1 contained in Supplementary Materials shows that Sicily is the third largest Italian region in terms of cultivated horticultural open fields area, after

Emilia-Romagna and Apulia, with about 12,000 hectares (on average from 2016 to 2020). In the same period, Sicily is the largest Italian region in terms of horticultural greenhouses cultivated area (about 3000 ha of the total 7300 hectares in Italy).

Within the selected interval, overall, as shown in Table S1, the areas cultivated with horticultural open field crops registered a slight decrease (average −8.7%) in all regions except Piedmont where there was a great increase (+66%). On the other hand, as for greenhouses tomatoes production, there was no general trend in the last five years. There were regions (such as Calabria and Lazio) that have recorded a strong increase, others a severe decrease (e.g., Veneto), and still others have remained more or less stable.

From 2016 to 2020, Sicily was approximately stable for both open field and greenhouse tomatoes.

Table S2 in Supplementary Materials shows the Italian production of tomatoes and the trend of evolution, from 2016 to 2020. Our elaborations on the ISTAT dataset shows that Sicily is the fifth largest Italian regions in terms of open field tomato production, after Emilia-Romagna, Apulia, Lombardy, and Campania. In particular, in the last five years, about 215,000 t/y of tomatoes were produced as open field crops in Sicily.

Furthermore, as for greenhouse tomatoes production, Sicily is the largest Italian region: an average of about 200,000 t/y were produced from 2016 to 2020. This amount represents over the 37% of the total Italian production of tomatoes produced in greenhouses.

For all regions, the trend was also considered, starting with 2016 as baseline. Referring to the tomatoes produced in open fields, there was no general trend in the analysed series: some regions have recorded an increase (i.e., Lazio and Piedmont), others a decrease (e.g., Apulia and Tuscany), and still others have remained stable.

Table S3 in Supplementary Materials shows the trend of the investigated period and the mean values of the tomatoes cultivated area, subdivided for the cultivation of open field tomatoes and greenhouses ones, for the nine Sicilian provinces.

Regarding open field production areas, within the selected time interval, leaving out the data for the province of Caltanissetta which is an outlier, the areas dedicated to tomatoes open field production registered an increase (+4.4%), rising from 10,830 hectares to 11,307 hectares. However, there is no common generalized trend: some provinces have recorded a contraction of areas (Trapani) while others have recorded a marked increase (first of all Ragusa), but most provinces kept their areas stable.

Instead, considering data for all provinces related to greenhouse horticulture, the cultivated areas were stable from 2016 to 2020. Only the province of Trapani recorded a marked decrease in greenhouse tomato cultivated areas.

Tomato is the most common species cultivated in Sicilian greenhouse structures [46]. More than 75% of the cultivated area in Sicilian greenhouses for tomatoes is in the province of Ragusa, in the south-east area of the island: 2000 hectares of the total 2454 hectares.

Table S4 in Supplementary Materials shows the tomato production obtained in the Sicilian cultivated areas, detailed for each province, and for greenhouse and open field cultivations. Moreover, a trend analysis for the period from 2016 to 2020 was reported.

As for Sicilian cultivated area, for horticultural open fields crops production, Caltanissetta data are outliers and cannot be considered.

In the selected interval, overall, the production of open fields horticultural crops registered a marked increase (+21.2%), rising from 182,640 t/y in 2016 to 221,435 t/y in 2020. The increasing tendency is for all provinces, except Trapani where a decrease of 1200 hectares (about 27 percentage points) has been registered from 2016 to 2020.

Referring to greenhouses tomatoes productions, a diversified condition was registered. In particular, three provinces showed a stable trend in the interval considered; three provinces registered a slight increase and three provinces a marked decrease. Overall, therefore, production was reduced by about 15%, decreasing from 204,634 t/y in 2016 to 173,673 t/y in 2020.

As reported by Selvaggi and Valenti [41], for the cultivated area, tomato is the most productive horticultural greenhouses species. Moreover, referring to open field crops, even if tomato is not the species with the most area in open field, it is the species with the most production in open field, among all the horticultural ones.

Regarding surface area, Ragusa is also the province where the greatest Sicilian production of tomatoes in greenhouses structures (about 80% of the total) is mainly focussed.

Agrigento is the province with the highest production of tomatoes in open field areas: on average 86,900 tons of tomatoes per year are harvested (about 39%of the total Sicilian production in open field).

The above reported data, related to the Sicilian tomatoes producing areas, were organised and elaborated showing their territorial distribution within Sicilian provinces by providing a GIS map.

Firstly, data recorded by ISTAT were adopted for localising the distribution of cultivated areas dedicated to tomato production, by showing them at territorial level. Then, by using a tailored tool, i.e., the Jenks tool available in QGIS software, all data were used for producing a GIS map by grouping the Sicilian provinces in three different classes for their cultivated areas differences maximisation. Figure 3 shows the distribution of territorial areas highly dedicated to tomato cultivation. In detail, on average from 2016 to 2020, the provinces of Palermo, Agrigento Caltanissetta, and Ragusa were those with the highest concentration of surface area dedicated to tomato cultivation (Figure 3), considering both open field cultivations and greenhouse ones.

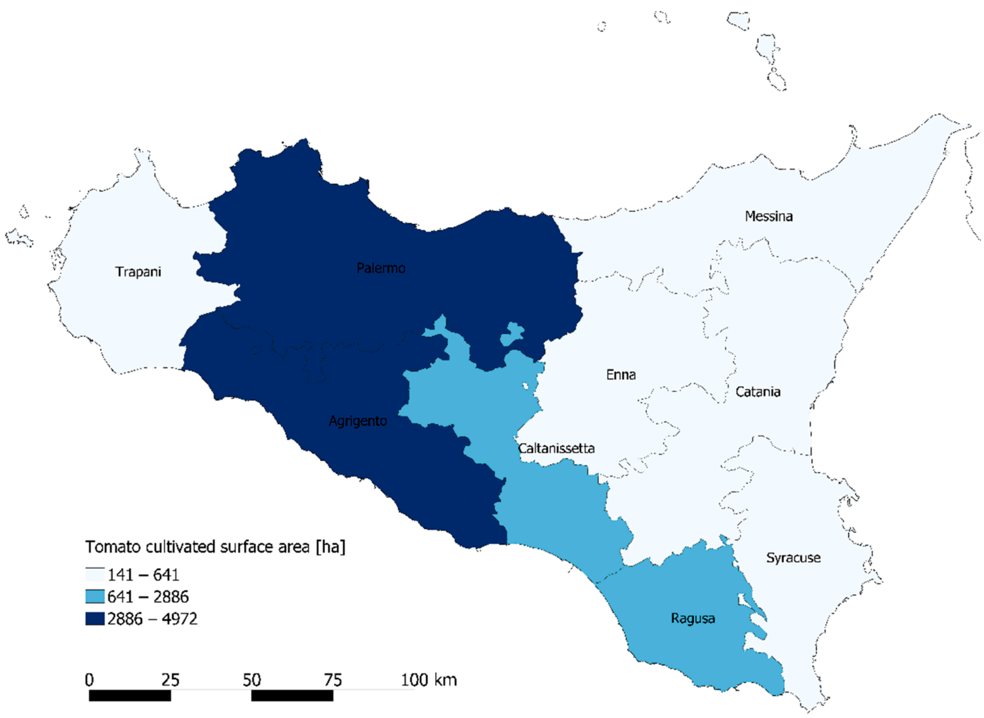
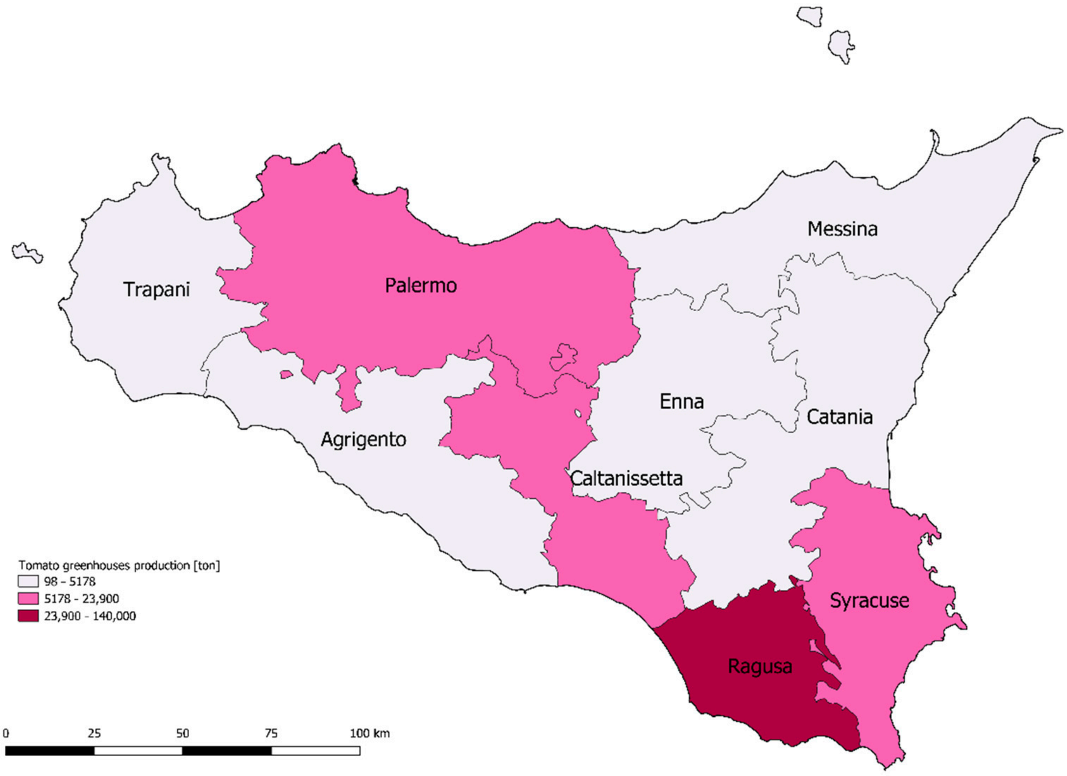
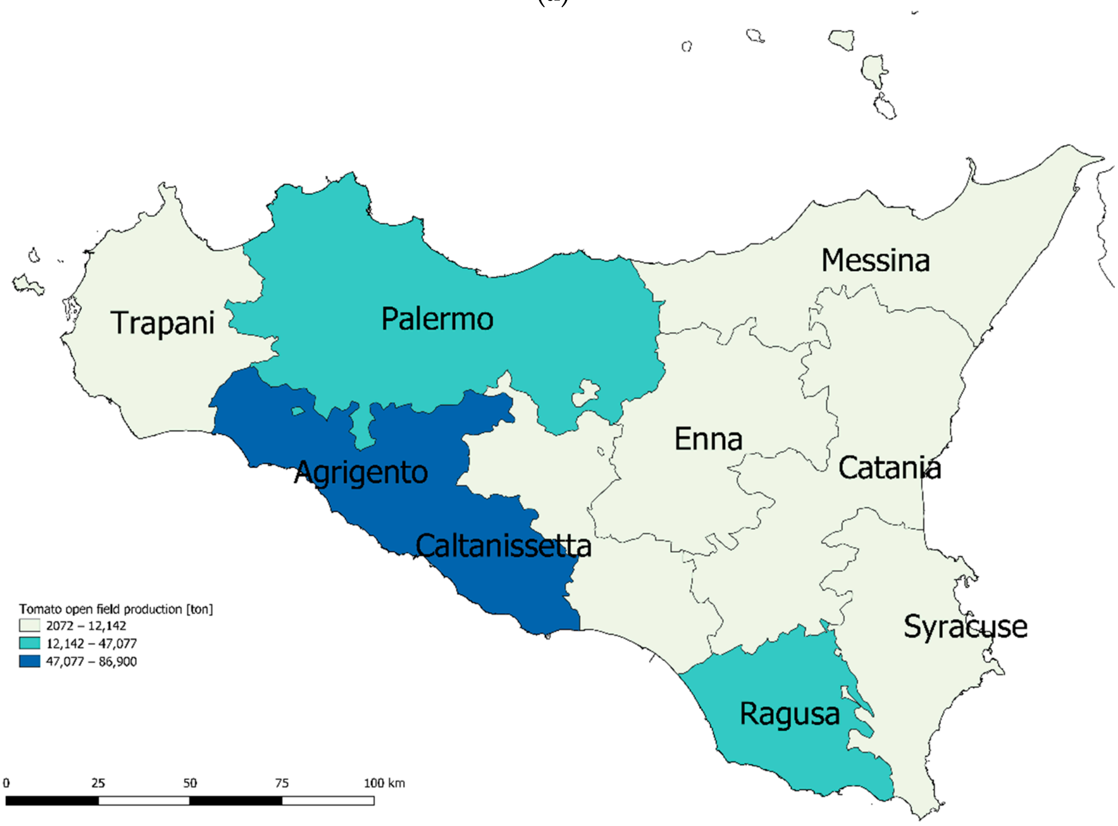


Figure 3. Distribution of tomato cultivated surface area within the Sicily region.

Since it could happen that the most productive areas do not match the most cultivated areas, tomato production was also analysed considering both the horticultural open field crops and horticultural greenhouses (Figure 4a,b). Results of the elaborations showed a different distribution within Sicilian provinces and confirmed Agrigento and Palermo as the most productive provinces considering the horticultural open field crops (Figure 4b), and Ragusa province (Figure 4a) as most productive province taking into account the horticultural greenhouses. Furthermore, the distribution of the horticultural cultivated areas allows the identification of two different areas for horticultural production located in the south-west and in the north-east of the island for greenhouses and open field crops, respectively.



(**a**)



(**b**)

Figure 4. Tomato production distribution within Sicily region. (**a**) Tomato greenhouse production. (**b**) Tomato open field production.

Since the research paper was focussed on analysing the agri-food sector, next step was related to the analysis of tomato processing industries. All the main Sicilian industries were directly interviewed in order to acquire information related to the amount of processed tomato and the amount of tomato residues produced (Table 1).

Table 1. Tomato processed by industries involved within Sicily region.

Sicilian Tomato Processing Industries	Site (Province)	Processed Tomato [t/y] *
1	Palermo	1250.00
2	Enna	7263.00
3	Ragusa	2000.00
4	Ragusa	100.00
5	Ragusa	1200.00
6	Ragusa	3118.00
7	Syracuse	1000.00
8	Syracuse	200.00

* Two-years average values (by direct interviews).

Therefore, considering their GPS coordinates, all the tomato processing industries involved were located in a GIS map, as shown in Figure 5.

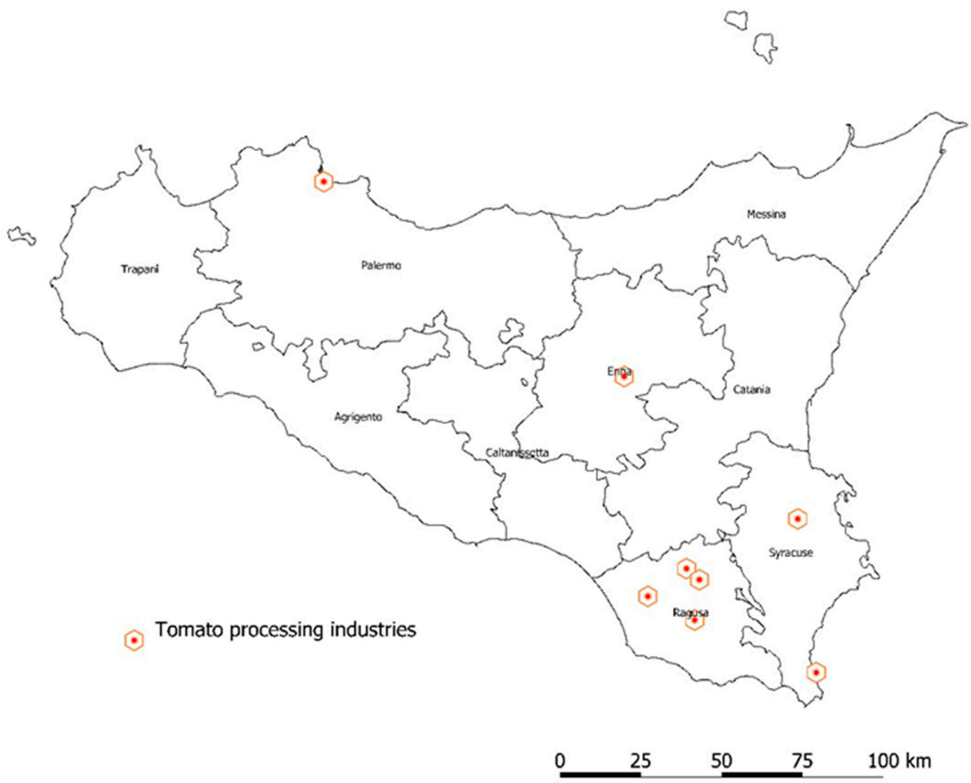


Figure 5. Tomato processing industries localisation within Sicily region.

With the aim of estimating the amount of tomato processed residues and to map their distribution at territorial level, data obtained by face-to-face interviews were elaborated prior to their use in GIS software. Eight tomato processing industries were located, and the average amount of tomatoes processed by each one was estimated considering the data observed after the surveys. For every industry the percentage of tomato wastes producible was estimated by elaborating data coming from the surveys. Obtained data related to the production flows were elaborated by using a tailored GIS tool (i.e., Heatmap plugin) for developing a heat map based on the amount of tomato processed (Figure 6).

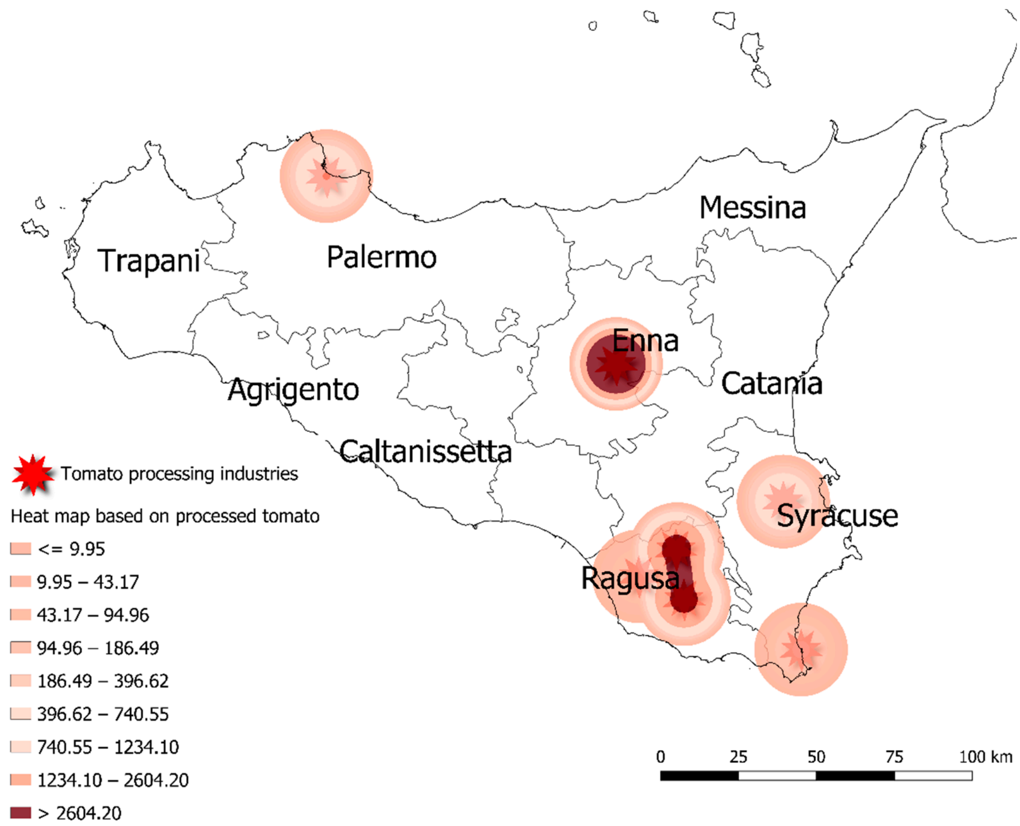


Figure 6. Sicilian tomato processing industries heatmap distribution, based on their flow production (Data obtained by direct interviews).

The heat map results, as reported in Figure 5, highlighted two big areas where processed tomato is highly concentrated. In this regard, the provinces of Enna and Ragusa were the two provinces where both the tomato processing industries are highly concentrated (i.e., Ragusa) and with the biggest flow production (i.e., Enna). Overall, the interviewed industries process about 16,000 tons of tomatoes per year as an average value of two years observed (2019 and 2020), equal to about 5% of the total tomato produced in Sicily.

From the observed data, about 1700 t of tomato peels are produced yearly by the most representative Sicilian industries. Thus, the index of conversion from processed tomatoes to residues is equal to about 10.3%.

Based on the index calculated as percentage, related to residue production obtainable by the tomatoes industries by considering all the tomato produced within Sicily such as tomato available to be processed, the amount of potential tomato residues producible was computed for each province, as reported in Table 2. For each province, the minimum and the maximum amounts of producible residues were estimated, considering the lowest and the highest indexes. In particular, the lower index observed was equal to about 5%. It was typical of industries with a low level of technology, which process tomatoes with traditional tools. Otherwise, the highest index was equal to 15%, and was observed in companies with a high level of technology. In fact, in order to obtain high quality tomato derivatives, new advanced tomatoes industries give up the complete pressing of the tomato fruits and aim to process greater volumes in less time. This results in an improvement in the quality of the finished product, but an increase in waste production.

Table 2. Potential tomato residues and biomethane produced by each Sicilian province.

Province	Potential Tomato Processed	Tomato Residues *		Biomethane Potentially Produced **	
	t/y	Minimum t/y	Maximum t/y	Minimum Nm^3/y	Maximum Nm^3/y
Agrigento	92,078.00	4603.90	13,811.70	152,527.21	457,581.62
Caltanissetta	26,810.00	1340.50	4021.50	44,410.77	133,232.30
Catania	4000.00	200.00	600.00	6626.00	19,878.00
Enna	2392.00	119.60	358.80	3962.35	11,887.04
Messina	10,098.00	504,90	1514.70	16,727.34	50,182.01
Palermo	63,556.10	3177.81	9533.42	105,280.68	315,842.04
Ragusa	179,300.00	8965.00	26,895.00	297,010.45	891,031.35
Syracuse	36,042.00	1802.10	5406.30	59,703.57	179,110.72
Trapani	4920.00	246.00	738.00	8149.98	24,449.94

* Considering 5% (lowest) or 15% (highest) of tomato processed. ** Applying the biomethane yield equal to 33.13 $Nm^3/t_{fresh\ matter}$.

Then, as last step of the research, the highest and the lowest potential biomethane production was estimated for each Sicilian province, by processing all tomatoes produced and recycling all tomato residues produced, using the above-reported Equation (1), as shown in Table 2.

As shown in Table 2, 80% of biomethane potentially produced in Sicily by reusing tomato residues comes from the provinces of Ragusa, Palermo, and Agrigento. In detail, about 43% could be potentially produced within the province of Ragusa (ranging from about 300,000 to 900,000 Nm^3/y), about 22% could come from Agrigento province (ranging from about 150,000 to 450,000 Nm^3/y), and about 15% from Palermo province (ranging from about 100,000 and 300,000 Nm^3/y); the other Sicilian provinces contribute the remaining 20%.

On average, 1.4 million Nm^3 per year of biomethane could be produced within Sicily if all the tomatoes produced are processed.

Data related to the biomethane potential production were reported in QGIS software, producing a GIS map in order to show the potential distribution of the biomethane at a territorial level. In detail, as reported in Figure 7, on average, the provinces of Ragusa, Agrigento, and Palermo showed the highest yearly potential for biomethane production, with about 600,000, 300,000, and 200,000 Nm^3, respectively.

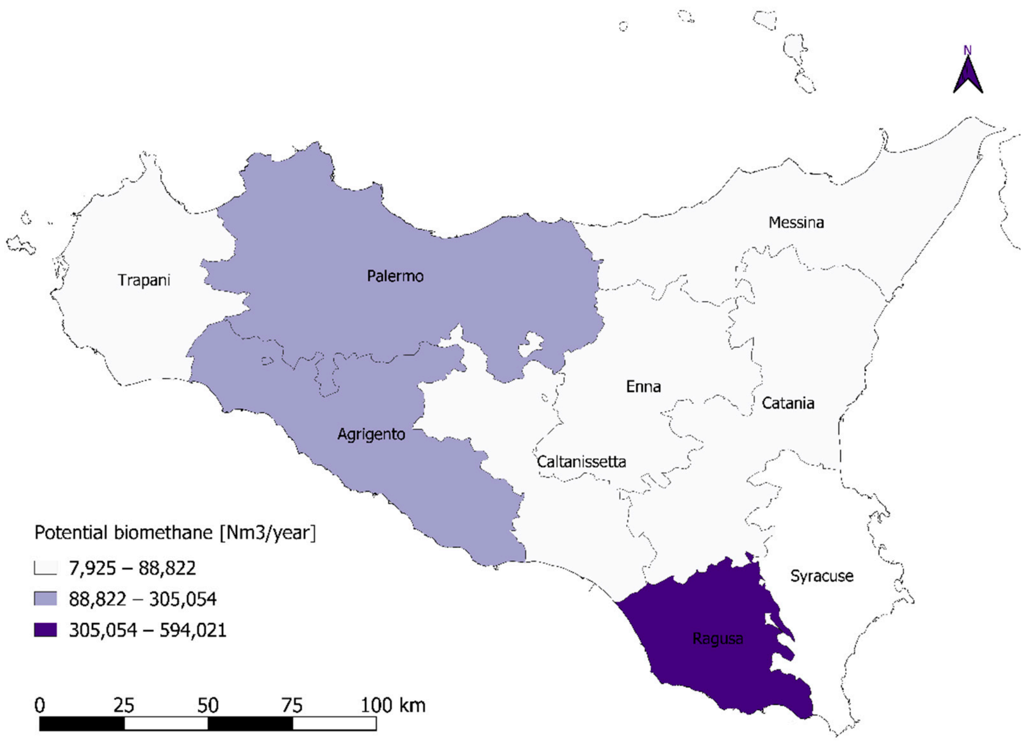


Figure 7. Distribution within Sicily region of the average potentially available biomethane by processing all the produced tomatoes.

4. Conclusions

The agri-food chains generate by-products that represent a potential source of value for other companies and, above all, for society. They constitute a reserve of elements and compounds to be used and exploited through new production cycles, according to the principles of circular economy. Frequently the exploitation of these residual materials is complex, due to the availability often being concentrated in few months and the difficult management of a rather unstable material. Moreover, no official information is provided by the EU. This study was carried out by combining data recorded from a statistic database and GIS-based maps, allowing the fulfilment of the proposed aim of the research. In detail, the tomato chain was deeply investigated by elaborating data related to the tomato cultivation surface area and its production to produce GIS maps.

The developed GIS-based model contributes to fill the gap in the knowledge of the production, localisation, and yield of tomato residues to support producers in waste valorisation actions, i.e., for energy purposes.

The achieved results could be useful for planning new biogas plants by locating them as near as possible to those area where biomasses are highly produced.

This condition is relevant for a sustainable valorisation by paying attention to the transport costs during the logistics and supply phase of these residues. In this regard, a further study, which is in progress, is fundamental for a detailed analysis of those territorial areas to help localise new biogas plants by paying attention to the road network analysis. This could help local authorities promote suitable planning for improving the biomethane/bioenergy sector by reducing the environmental impact within the context of a green economy. This strategy implies a shift from "cradle to grave" to "cradle to cradle" waste management with an increasing decrease in waste generation through eco-innovation and the use of new business models, a concept that would be good for the environment, society, and the economy.

Supplementary Materials: The following are available online at https://www.mdpi.com/article/10.3390/su13105559/s1, Table S1: Italian cultivated area for tomatoes (ha) and trend of evolution (%), Table S2: Italian production of tomatoes (t) and trend of evolution (%), Table S3: Sicilian cultivated area for tomatoes (ha) and trend of evolution (%), and Table S4: Sicilian production of tomatoes (t) and trend of evolution (%).

Author Contributions: Conceptualization, F.V.; methodology, R.S. and F.V.; software, F.V.; validation, F.V.; investigation, R.S. and F.V.; data curation, R.S. and F.V.; writing—original draft preparation, R.S. and F.V.; writing—review and editing, R.S. and F.V.; visualization, B.P. and S.M.C.P. All authors have read and agreed to the published version of the manuscript.

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