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## Sustainable agriculture in temporary and permanent crops in Portugal

Nina Iris Verslype St.B.Sc.<sup>a\*</sup>, Raphael Miller de Souza Caldas St. B.Sc.<sup>a</sup>, José Machado D. Sc.<sup>b</sup>  
Fernando Miguel Granja Martins D.Sc.<sup>c</sup>, Helena Maria Fernandez D.Sc.<sup>c</sup> and José  
Inácio Rodriguez D.Sc.<sup>c</sup>

<sup>a</sup>Departamento de Agronomia, Universidade Federal Rural de Pernambuco, Recife, Brazil

<sup>b</sup>Departamento de Tecnologia Rural, Universidade Federal Rural de Pernambuco, Recife, Brazil josemachado@ufrpe.br

<sup>c</sup>Instituto Superior de Engenharia, Universidade do Algarve, Faro, Portugal

\*E-mail: nina\_iris20@hotmail.com

### ABSTRACT

Portugal is located in the southwest of Europe, bordered to the north and east by Spain and the south and west by the Atlantic Ocean and has a total area of 92,090 km<sup>2</sup>. It offers most of its territory, temperate climate and from May to September are the months when higher temperatures in summer, depending on the geographic distribution, very high. In this work, the objective is to study the main temporary and permanent crops with an indication to organic farming. The study was conducted during the months of January to May 2016 and were held consultations with census data and scientific articles and these data were crossed for discussion. The data of production, area of cultivation were intertwined with organic farming possibilities and possibilities available for openings boundaries according to the adjustment of culture temperature, photoperiod and precipitation. Portugal has a very favorable climate for diverse cultures. Investing in organic farming can result in benefit food quality adding more value to the products, resulting in higher GDP consequently help the organic farmer.

**Keywords:** agriculture in Portugal , permanent crops in Portugal , temporary crops in Portugal , production in Portugal .

### INTRODUCTION

Portugal , located in the central coordinates 8 °13 '28 "W , 39 23' 59" N, is located in southwestern Europe , bordered to the north and east by Spain and the south and west by the Atlantic Ocean and

has a total area of 92,090 km<sup>2</sup> ( SILVER , 2011) . It consists of the districts of Aveiro, Beja , Braga , Bragança , Castelo Branco , Coimbra , Évora, Faro , Guarda , Leiria , Lisbon, Portalegre , Oporto,

Santarém , Setúbal , Viana do Castelo, Vila Real and Viseu ( Figure 1).

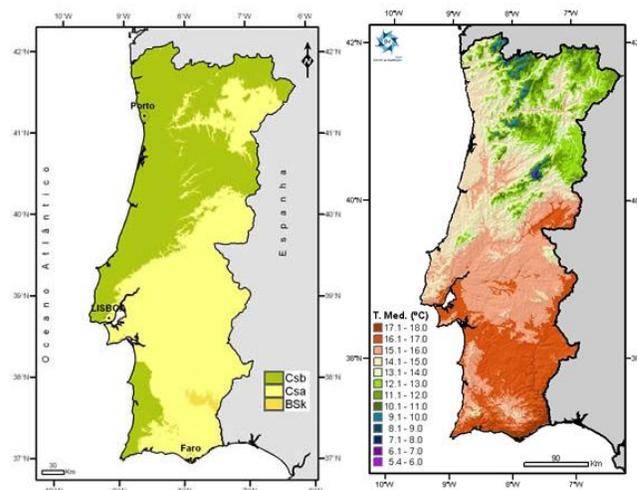
**Figure 1** – Location of Portugal and division of their districts. Source: Authors , 2016.



1- Viana do Castelo, 2- Vila Real, 3- Bragança, 4- Porto, 5- Aveiro, 6- Viseu, 7- Guarda, 8- Coimbra, 9- Castelo Branco, 10- Leiria, 11- Lisboa, 12- Santarém, 13- Portalegre, 14- Setúbal, 15- Évora, 16- Beja, 17- Faro e 18- Braga.

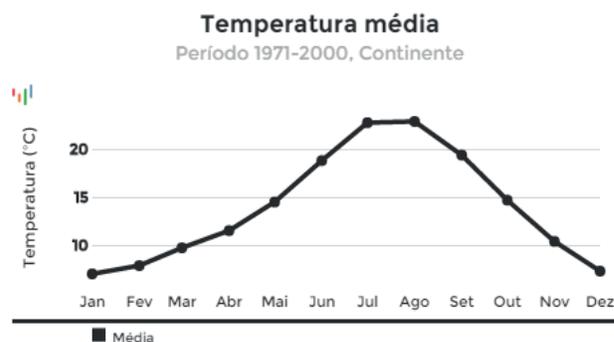
Rectangular shape, its largest population is in the coastal part of the country, mainly in the districts of Lisbon and Porto. Portugal continental features in most of its territory , temperate climate , type C in the Köppen classification , verifying the Subtype Cs ( temperate climate with dry summer ) and Csa varieties ( temperate climate with hot , dry summers ) , Csb ( temperate climate with dry and mild summer) and BSk (cold steppe climate of the mid-latitude ) ( IPMA , 2011) . The average annual temperature ranges from 7 ° C in the highlands of the interior north and center and 18 ° C in the south coast ( IPMA , 2016) . The country is characterized by presenting in its northern part colder temperatures, mainly due to the rugged terrain in the south milder and warm temperatures in the summer, due to the influence of the Mediterranean and in the center with intermediate temperatures north -south , as can be seen in Figure 2 .

**Figure 2** – On the left climate of Portugal on Climate Köppen classification and the right average annual temperature in the country. Sources: IPMA , 2011 and 2016 .



From May to September are the months when higher temperatures in summer, depending on the geographic distribution, very high , and providing diverse cultures that require higher temperatures. From October to April occur lower temperatures mainly between November and February , reaching even to snow in the Serra da Estrela, in the Guarda District , reaching harm diverse cultures and favoring others that require less light and cold temperatures , as Figure 3 .

**Figure 3** – Temperatures monthly average of Portugal. Source: IPMA , 2015 .

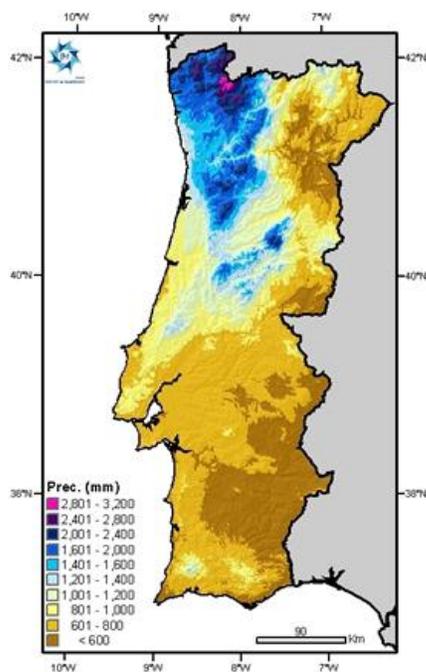


In addition to temperature and photoperiod , rainfall is another important factor, especially where there is irrigated agriculture.

The northern mountainous regions have higher precipitation, especially in Viana districts of Braga ,

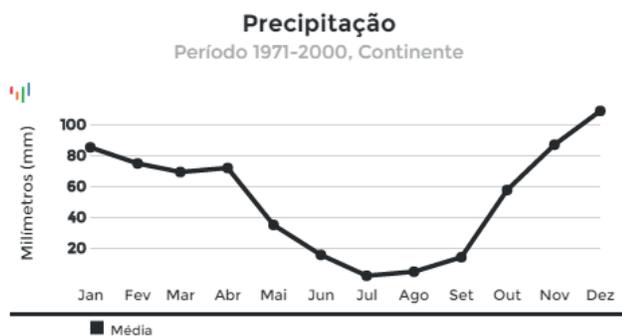
Porto, Aveiro, Vila Real, Viseu and Guarda and Coimbra West Southwest . Unlike in the northern part , Braganca , Northern Guard , the White Castle Southeast and in the South , Portalegre , Évora and Beja present very low rainfall , requiring more tolerant crops to water stress and irrigation use , as shown in Figure 4 .

**Figure 4** – Distribution of average annual rainfall of Portugal . Source : IPMA , 2016 .



The months of higher temperatures are those that occur less rainfall and months of higher intensity of rainfall occurs between October and April , according to Figure 5 .

**Figure 5** – Average monthly precipitation of Portugal . Source: IPMA , 2015 .



Knowing the rainfall distribution , temperature and photoperiod and also existing cultures can establish possibilities of opening new frontiers for the cultivation of permanent and temporary crops in mainland Portugal. In this work , the objective is to study the main temporary and permanent crops , including organic farming , the country and expansion of possibilities for its cultivation in various districts so that you can make experimental activities for inclusion of agricultural plants to the country or expanding them , allowing increased in agricultural production in the country , creating more jobs and local socioeconomic development

## MATERIALS AND METHODS

The study was conducted during the months of January to May 2016 data Consultations on census institutes and scientific articles and these data were crossed for discussion. The data of production, area of cultivation were intertwined with organic farming possibilities and possibilities available for openings boundaries according to the adjustment of culture temperature, photoperiod and precipitation.

## RESULTS AND DISCUSSION

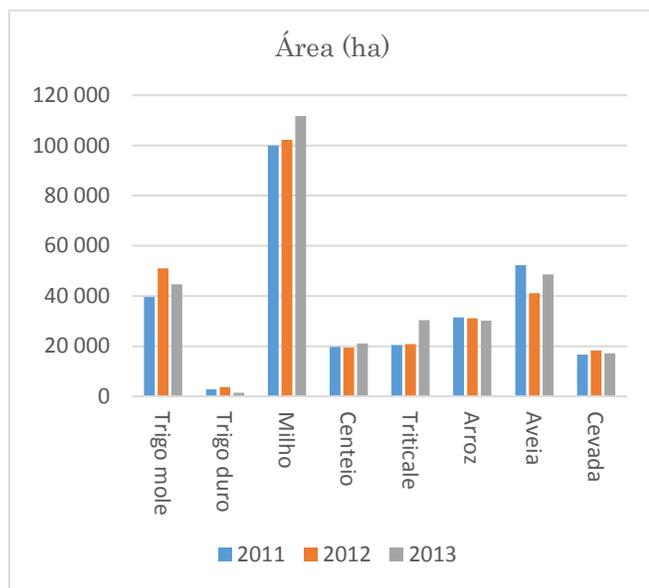
### 1. Temporary crops

Temporary crops have short lifetime , usually under 2 years , subject to replanting after harvest , as they are uprooted from the ground for a new planting is done ( CARMO , 2015) . The main agricultural products of short phase are: wheat ( soft and hard ) , corn, rye, tricalhe , rice, oats, barley, beans, chickpea , potato , tomato and sunflower (Figures 6 and 7).

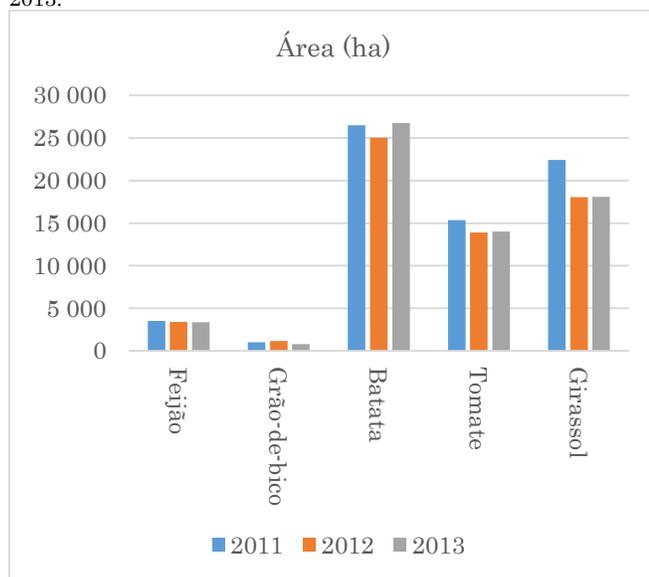
Production of maize , the main source of carbohydrates in the food world , appears first reaching an area of 100 000 ha in the years 2011 to

2013 with a significant increase every year. Oats and wheat appear then with areas above 40 hectares. Other crops exceeds 20 hectares, except barley, sunflower, tomato, chickpea and beans.

**Figure 6** – Areas in hectares of plantation of the main agricultural products in continental Portugal in the years 2011-2013.

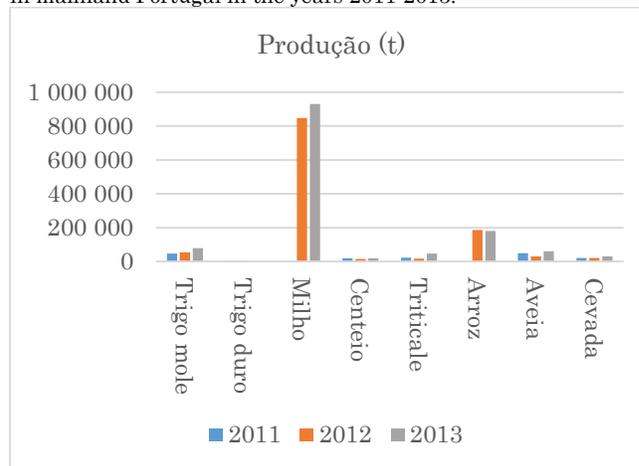


**Cont. Figure 6** – Areas in hectares of plantation of the main agricultural products in continental Portugal in the years 2011-2013.

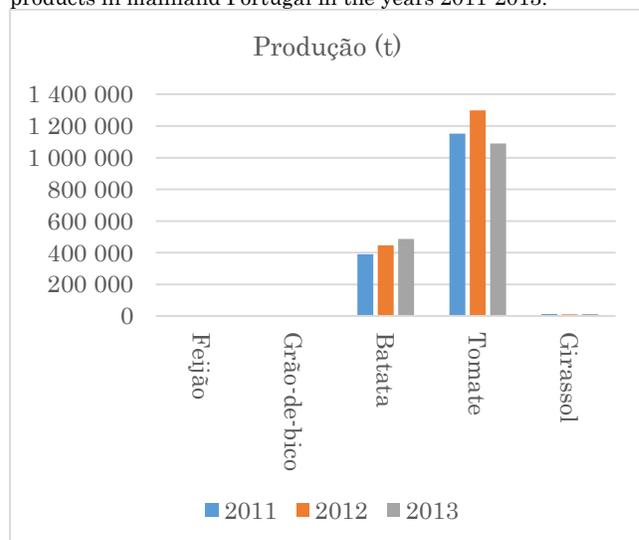


In terms of production, the tomato crop also reaches the top spot with values greater than 1 million tons, followed by corn with values exceeding 900 tons and potato with values above 400 tons. Other crops do not reach 200 tons.

**Figure 7** – Production in tonnes of the main agricultural products in mainland Portugal in the years 2011-2013.



**Cont. Figure 7** – Production in tonnes of the main agricultural products in mainland Portugal in the years 2011-2013.

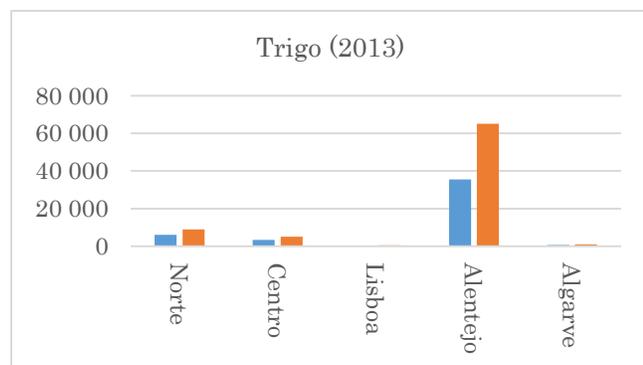


Wheat production in the country is very important, especially in the Alentejo region, characterized by warmer temperatures and low rainfall. In Brazil, it is planted in the cooler regions, such as the states of Parana, Santa Catarina and Rio Grande do Sul with production over 6 million hectares. According Guarientti et al. (2004) wheat grows best at temperatures between 30 and 35 degrees latitude in the northern and southern hemispheres, in moderately dry climate moderately humid, temperate. The climate for wheat is soft winter, hot summer with high solar radiation, with some heavy rainfall not to damage the flowers and fruits.

Portugal is totally out of latitudes 30-35°, but shows areas with the characteristics described by Guarentii et al. (2004), especially in producing regions of Alentejo, Centre and North. the extension is possible and improvement in genetic quality, including cultivars already tested in Brazil, to achieve warmer regions, for example, Algarve. The current production of wheat is still well below the world average, since Portugal is a country with crops turned to wine, citrus and olive. However, with research bodies initiative it is possible to obtain genetic variety that can adapt to regions not yet explored the culture, as shown in Figure 8.

Being an extensive culture is rarely used in organic farming, but the use of beneficial products to plant and harmful micro-organisms may be alternatives to reduce the incidence of illness, including use of lichens in cultivation, as the work done by Coelho- Junior (2013), where strawberry cultivars behaved better together using the species *C. verticillaris* and *C. salzmannii* cultivation.

**Figure 8** – Production (t) (blue) and area (ha) (orange) of wheat in Portugal in 2013, distributed in the North, Centre, Lisbon, Alentejo and Algarve.



Maize is widely grown in the country. Its production is around 920 million tons grown in an area of 155,000 hectares, spread over four regions of the country except the Algarve. The Alentejo is currently the region where more produces the largest source of carbohydrates with values that exceed the 510 million tonnes (Figure 9).

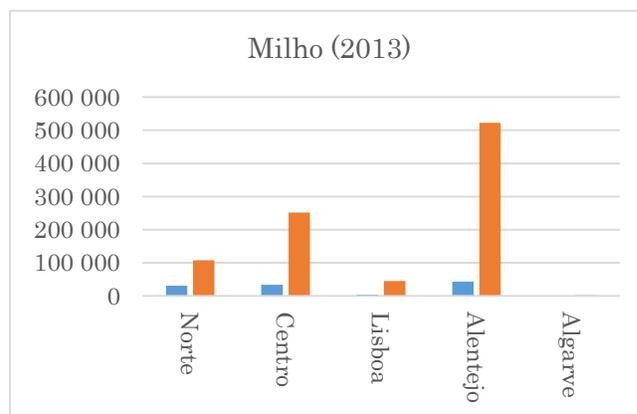
Despite its tropical origin, Peru and Mexico, is grown in different latitudes and different climatic situations, it presents a great genetic diversity, from purple, yellow, red, white and colored to the small and large grains. It is grown from Canada and Russia to Argentina, depending on their genetic variety available, but in places with average temperatures below 19°C in the day and 12°C at night is unable to produce.

Its rainfall varies from 250 mm to 5000 mm per year, and can expand production to all regions of Portugal, except the cooler north.

What is striking in this statistic (Figure 9) is that the Algarve does not present a significant corn production, and therefore, a place conducive to the cultivation, especially in relation to temperature rather favors the cultivation. The low annual rainfall occurring in the Algarve does not seem to be a limiting factor, as above 250 mm is still a factor ideal for cultivation.

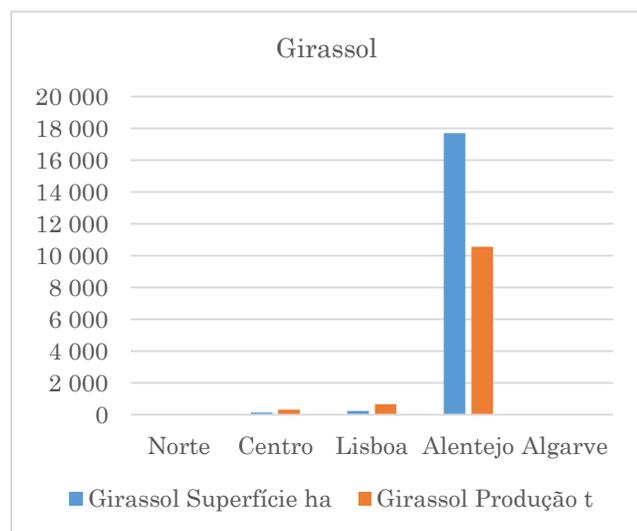
How a culture of easy handling and has several genetic materials available, especially in the major producing countries, is needed in Portugal more improved breeding techniques that can be studied genotypes suitable for this crop, particularly in the Algarve region where decrease the possibilities of the indiscriminate use of pesticides.

**Figure 9** – Production (t) (blue) and area (ha) (orange) of maize in Portugal in 2013, distributed in the North, Centre, Lisbon, Alentejo and Algarve.



Sunflower has desirable agronomic characteristics and it has been a good choice for producers, as a short cycle crop (90-130 days), with wide adaptability to different latitude conditions, longitude and photoperiod, tolerating temperature ranges that vary between 8 and 34 ° C, and have a greater tolerance to drought, requiring between 200 and 900 mm, where 200 mm should be well distributed to 70 days (Verslype et al., 2015). In mainland Portugal in 2013, Alentejo was the region that had the highest area cultivated with 17693 ha and was also the largest producer with 10,566 tons of sunflower, followed by Lisbon and center with less than half the production of Alentejo. While Algarve and the northern region showed no acreage or sunflower production, as can be seen in (Figure 10). How is a culture that needs a well-balanced fertility possibilities as sheep and cattle manure may help diminish the use of chemicals for their fertilization.

**Figure 10** - Production in tons and area in hectares in the year 2013 in the sunflower (girassol). Fonte: Author, 2016.

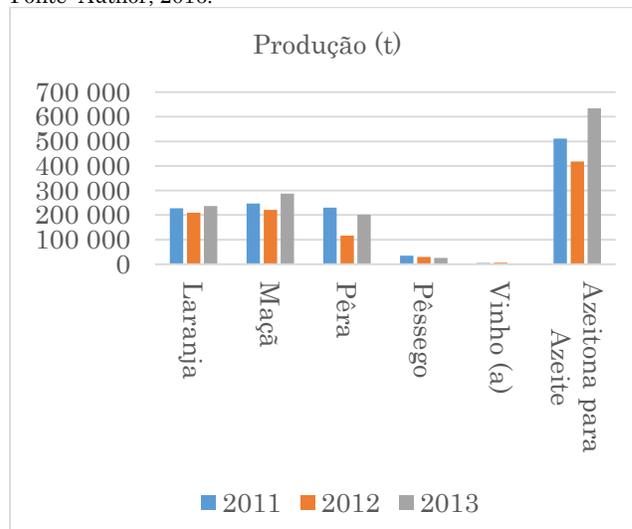


## 2. Permanent crops

Cultures that have a minimum of four years, are considered permanent crops, as they are subject to remain bound to the soil and provide more of a harvest or production (CARMO, 2015).

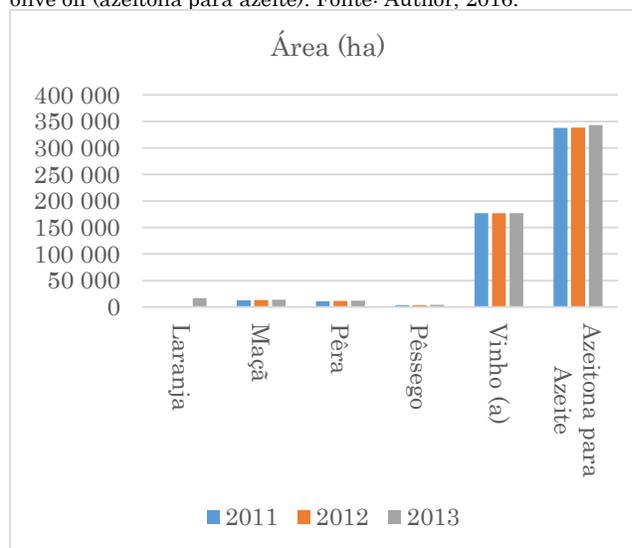
Of the land used in Portugal in 2011, only 7.8 % of land was destined for permanent crops (FAO, 2015). In mainland Portugal in the years 2011 to 2013, the area of permanent crops in hectares not varied widely, but the production in tons varied, as can be seen in (Figure 11 and 12).

**Figure 11**- Production in tons in the years 2011, 2012 and 2013 in the orange (laranja), apple (maçã), pear (pêra), peach (pêssego), wine (vinho) and olive to olive oil (azeitona para azeite) crops. Fonte: Author, 2016.



(a) 10<sup>3</sup>hL

**Figure 12**- Area in hectares in the years 2011, 2012 and 2013 in Portugal, for the permanent crops of orange (laranja), apple (maçã), pear (pêra), peach (pêssego), wine (vinho) and olive to olive oil (azeitona para azeite). Fonte: Author, 2016.



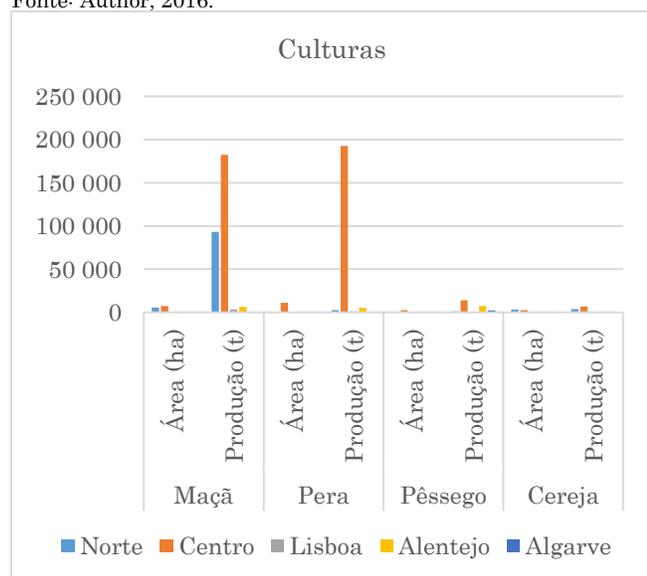
(a) 10<sup>3</sup>hL

The olive plantation for oil production, was the one with the largest arable area in hectares in Portugal, in the years 2011, 2012 and 2013, when

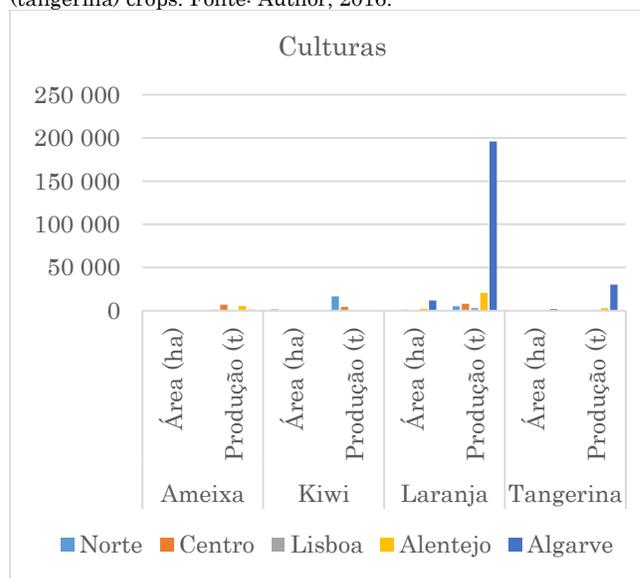
compared with other permanent crops (Figure 11). The olive cultivation area varied between 338 048 and 342 982 ha in the years 2011 through 2013, showing an increase of 4934 ha. In terms of acreage, permanent crops that were more acreage was respectively grapes for wine, orange, apple, pear and peach, which had the lowest acreage, as can be seen in (Figure 12).

In continental Portugal are also grown as permanent crops apple, pear, peach, plum, kiwi, orange, almond, chestnut, walnut, cherry and tangerine. In 2013, Brown held the largest cultivated area in hectares from these crops, with 35,010 ha, followed by almond, orange, apple, pear, cherry, peach, walnut, tangerine, kiwi and plum with 1632 ha and the smallest planted area in hectares among these cultures (Figures 11 and 12). Figure 13 demonstrates the cultivated area in hectares and the production of permanent crops in each region of Portugal. The North region has the largest area planted chestnut within Portugal in 2013, with 18,853 ha, followed by Algarve, Centro, Alentejo and Lisbon.

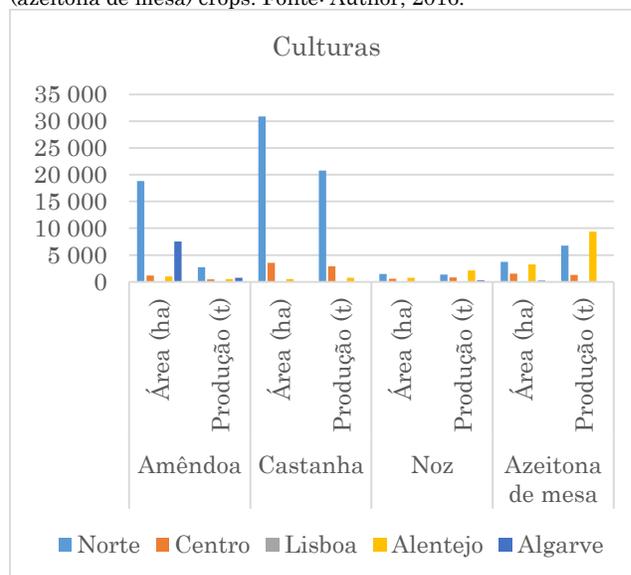
**Figure 13** - Area in hectares and production in tons in the years 2011, 2012 and 2013 of apple (maçã), (pera), (pêssego) crops. Fonte: Author, 2016.



**Cont. Figure 13** - Area in hectares and production in tons in the years 2011, 2012 and 2013 of (ameixa), (kiwi), (laranja), (tangerina) crops. Fonte: Author, 2016.



**Cont Figure 13**- Area in hectares and production in tons in the years 2011, 2012 and 2013 of (amêndoa), (castanha), (noz), (azeitona de mesa) crops. Fonte: Author, 2016.

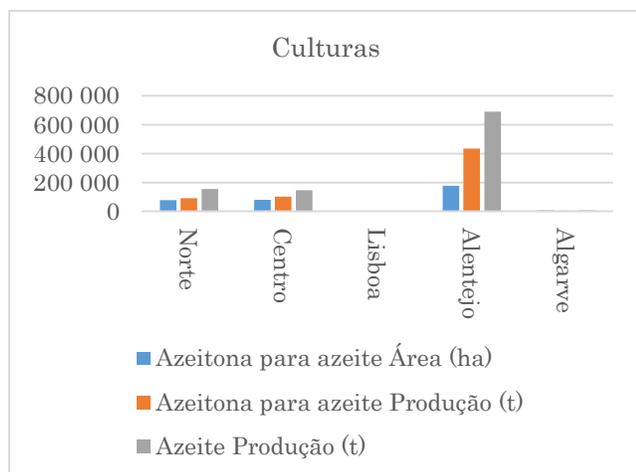


In mainland Portugal in 2013, the region had the highest acreage in hectares of olive was Alentejo with 177288 ha, followed by the Centre region with 79,644 ha, northern region with 76 897 ha, Algarve region with 8557 ha, and the region with the smallest area cultivated olive was Lisbon with 596 ha, which is compared with the cultivated area in Alentejo is only about 0.34%. Production in tons of these regions had similar values with the planted area, with Alentejo region with the highest

production in tonnes to 433,929 t, followed by the Central region with 102 020 t, region North 91,862 t, Algarve 5825 tea region with the lowest production in Lisbon with 574 tons was t, as can be seen in (Figure 14).

While production in tonnes of oil was also higher in the region of Alentejo with 689,261 t, followed by the North with 155,742 t, t Centro147060, Algarve with 7348 t and Lisbon with 440 t. When compared to olive oil in tons with the planted area and olive production, the North has lower production than the central region, thus surpassing the Centre region of 8681 t in the production of oil (Figure 14).

**Figure 14** - Production in tons and area in hectares in the year 2013 in the crop of olive to olive oil (azeitona para azeite). Fonte: Author,2016.



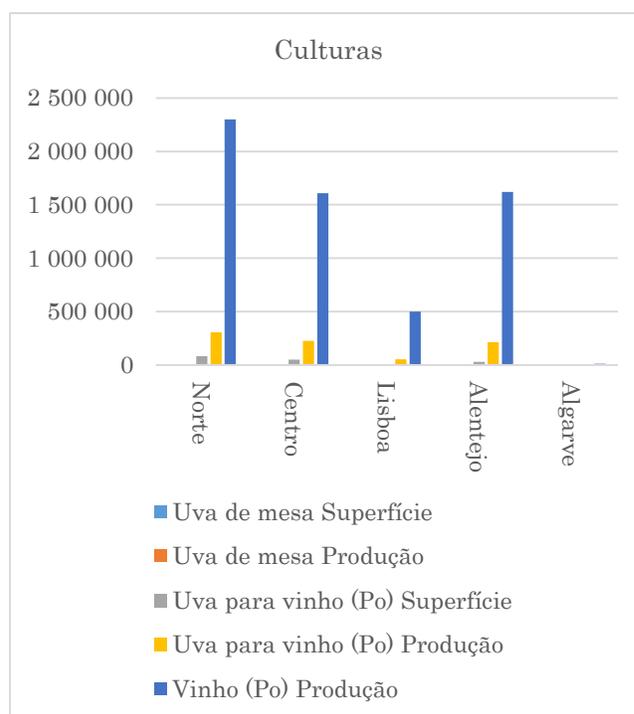
In mainland Portugal in 2013, the region had the highest cultivated area in hectares of table grape was Alentejo with 908 ha, followed by the Central region with 864 ha, Algarve 384 ha, Lisbon 215 ha and the North with 137 there is. Production in tons of these regions showed consistent values with the planted area, with Alentejo's largest table grape producer with 8265 t and North region the smallest producer with 369 t, as can be seen in (Figure 15).

While the planting of grape intended for wine production, is higher than for table grapes. The northern region has the largest area of cultivation

and production, with respectively 83,117 ha and 306,406 t, followed by the regions of Centro, Alentejo, Algarve and Lisbon (Figure 15).

For permanent crops is interesting the possibility of using lichens or their extracts, such as barbático acid together as cultivation. This association may help to decrease the use of pesticides and improve soil conditions soil helping the farmer Portuguese (COELHO-JUNIOR, 2013).

**Figure 15** - Production in tons and area in hectares in the year 2013 for the permanent crop of grape (uva). Fonte: Author, 2016.



## CONCLUSIONS

Portugal has a very favorable climate for diverse cultures, but is little explored due to give importance to other economic aspects , as pro example tourism. Investing in organic farming can result in benefit food quality adding greater value to products and resulting in higher GDP consequently help the organic farmer. The use of organic substances such as lichens were tested in strawberries and may be used in other crop processing the resulting product.

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