Portuguese dairy farming systems

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Abstract

Milk production is responsible for about 11% of global agricultural output in Portugal. Two regions, which together represent less than 10% of the land area of the country, contribute to 80% of Portuguese milk production: the Azores islands and the Northwest (NW) mainland area. The two systems are strongly specialized on milk production, but differ in terms of land use and intensity of inputs applied. The Azores dairy farming system houses 33% of national dairy livestock and is responsible for 30% of the annual 1,900,000 Mg Portuguese milk production. In this system, four-fifths of the surface area of dairy farms are occupied by permanent grasslands which are grazed all year round. Grazing is complemented by maize and ryegrass silage obtained from the remaining one-fifth of the farmland area. The more intensive NW dairy system is based on a double-cropping forage system (zero-grazing) that uses maize as a summer crop and Italian (annual) ryegrass as a cover crop in winter. This region is responsible for more than 50% of national milk production and holds 45% of national total of dairy cows. The high silage yielding potential and the annual use of up to 3.5 Mg concentrate feed per dairy cow allow animal stocking rates of 4-7 LSU ha^{-1}. This farming system may generate large N losses, particularly by nitrate leaching. Environmental issues currently play an important role driving changes and adaptation measures to improve system sustainability to comply with legal regulations. These modifications are being accompanied by very fast changes in farm structural characteristics; between 1993/1994 and 2009/2010 the number of dairy holdings has been reduced by more than 85% and the number of cows per farm has increased proportionally. The main problems affecting the Portuguese dairy sector at present are evaluated and possible solutions are suggested to face the upcoming challenges.

Keywords: intensive dairy systems, sustainability, NW Portugal, Azores

Introduction

In the last decade, Portuguese total milk production has shown some fluctuations with an average value of about 1,900,000 Mg $year^{-1}$ and a slight tendency to decrease in the last years (Figure 1). Milk production represents a value of ca. 750 M €, i.e. 27% of animal production output and 11.4% of total agricultural output (GPP, 2013). In 2012/2013, milk production deliveries were 1,843,000 Mg (1.27% of EU27 production) providing only 91.2% of the national quota. In the same period, there were 7,436 dairy holdings with a total of 242,000 dairy cows. Animal average productivity was 7,615 kg milk cow^{-1} $year^{-1}$. In 2013, in terms of trade balance, Portugal showed a degree of self-sufficiency of 94% for the whole set of dairy products, with 108, 51 and 75% being the respective values for the classes 'milk and cream', 'yoghurt' and 'cheese'.

Portuguese dairy production is concentrated in two main regions – the Azores islands and the Northwest (NW) mainland area, which house, respectively, 33 and 45% of the national dairy livestock and occupy together an area that accounts for less than 10% of the national territory (Figure 2). In the Azores, dairying is based on permanent grasslands grazed all year round, while the more intensive NW dairy system is a zero-grazing system based on maize and annual ryegrass silage. Due to its more intensive production, the NW system is responsible for more than 50% of milk production.

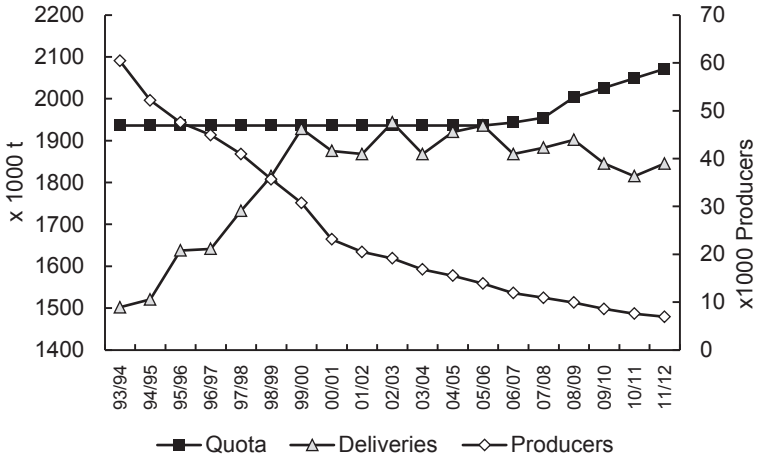

Figure 1. Recent evolution of Portuguese milk deliveries and numbers of producers (adapted from Cardoso, 2014).

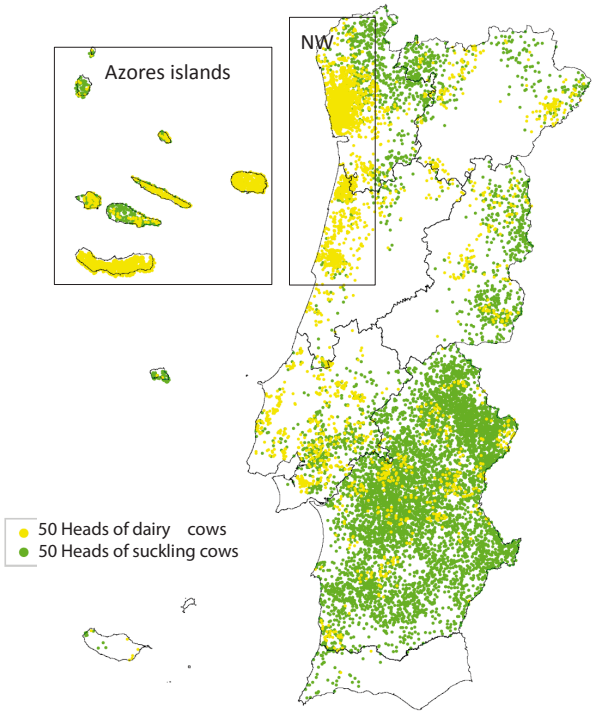

Figure 2. Distribution of dairy cows (dark spots) and suckler cows (light spots) in Portugal (INE, 2011).

The Northwest mainland dairy system

The Northwest dairy area of mainland Portugal comprises the coastal sub-regions of Entre Douro e Minho (EDM) and Beira Litoral (BL) (Figure 2). These regions are densely populated and land is a scarce and expensive resource. Forestry occupies about one-third of total area and land used by agriculture in the region represents 63% of the farm surface (INE, 2011). In general, soils on cropland areas are sandy loams derived from granite, deep (>1 m), well drained, and with a slope commonly less than 5%. The

altitude varies between 10 and 100 m.a.s.l. The annual rainfall varies between 1,200 and 1,700 mm with 80% of this total occurring between October and April.

In the last decades an intensive zero-grazing dairy farming system has been developed in the region based on two forage crops per year for silage making: maize (irrigated) and a winter crop consisting of annual ryegrass or a mixture of cereals with annual ryegrass. These crops allow high annual forage yields to be achieved, typically 20-24 Mg dry matter (DM) plus 7-9 Mg DM ha^{-1} for the maize and the winter crop, respectively. In the dairy counties, maize grown for forage occupies between 30 and 70% of agricultural land. Cows are fed with a total mix ration and kept 'indoors' all the year round, generally kept in covered and concreted cattle sheds where they are in a state of semi-freedom. The high forage yielding potential and the use of up to 3.5 Mg of concentrate feed per dairy cow allow animal stocking rates of 4 to 7 LSU ha^{-1} (including herd replacements). Cow-replacement rates are very high reaching, on many farms, values over 30%. In the majority of cases, the animal manure is stored directly in pits located beneath cattle sheds. Few farms have a central pit external to the cattle sheds. The storage capacity of liquid manure varies between 2 and 6 months. Slurry spreading to fields is mainly done twice a year just before the sowing of each crop (May and September/October), although application to the winter crop in February (top-dressed) has increased markedly in recent years. Slurry application may achieve amounts between 100 and 120 m^3 ha^{-1} yr^{-1} (equivalent to 300-360 kg N ha^{-1}). In addition to the slurry applied, the crops often receive mineral fertilizers at levels which may represent an extra annual input of 100-200 kg N ha^{-1} and up to 100 kg P_2O_5 ha^{-1}; these values are decreasing as a result of technical advice and information campaigns (De Roest *et al.*, 2008). In a 3-year study (2003-2005) based on farm surveys, Fangueiro *et al.* (2008) reported that the less-intensive and more-intensive dairy farms of the region showed annual N inputs, respectively, of about 620 and 1,060 kg N ha^{-1} and that the feed concentrates represented 64-73% of these inputs; milk deliveries accounted to 60-70% of the total outputs and farm N surpluses were estimated to range from about 400 to 610 kg N ha^{-1} yr^{-1}. Therefore, this cropping system may generate high environmental impacts due to large N losses, particularly by nitrate leaching on the most intensive farms. Trindade *et al.* (1997) found that annual nitrate leaching losses measured over a 2-year period from fields under a double-cropping forage system similar to that described above ranged from 154 to 338 kg N ha^{-1} yr^{-1}.

The average size of specialized dairy farms in the region is small (265 Mg milk per farm in 2013) (Cardoso, 2014) and the farm arable area is divided into several blocks separated from each other by roads or other obstacles, which represents a major constraint to grazing development. There is a lack of data at regional levels, but, considering global values for Portugal, changes in farm structure characteristics are occurring very fast. Between 1993/1994 and 2009/2010, the number of dairy holdings has been reduced by more than 85%. Between 2005/2006 and 2009/2010, only the number of farms that are producing more than 400 Mg milk yr^{-1} has increased, and in the farm-size class of less than 20 Mg milk yr^{-1} a decrease of 60% in the number of producers was observed; as a consequence, 50% of Portuguese milk production is assured by only 10% of dairy farms (CEGEA, 2012). Between 1999 and 2009, the average number of dairy cows per farm increased in the EDM and BL sub-regions, respectively from 11 to 34 and from 7 to 15 (INE, 2011). In 2005, the estimated average value of milk production per cow in the EDM sub-region was about 7,400 kg yr^{-1} while in the BL sub-region it was below 6,000 kg yr^{-1} revealing differences in the farmers' ability for farm and herd management and the existence of different farm conditions. In the well-managed and progressive farms the productivity of the cows is often above 9,000 kg milk yr^{-1}. Organic production is limited to a few farms (less than 10).

The Azores dairy system

Dairy farming in the Azores is based on permanent grasslands grazed all year round. In 2009, permanent grasslands covered 90% of the agricultural area (AA) and the remaining 10% of AA was mainly (90%)

maize for forage. The region's climatic conditions are especially suitable for all-year grass growth, with mild winters and moderate summer temperatures resulting only in a short drought period. Annual rainfall ranges from 900 to around 2,000 mm and average temperatures in January and July are 14 and 22 °C, respectively.

Farm activity includes milk and beef production although, on average, milk represents more than 80% of farm revenue. In 2009 there were 3,225 milk producers and the average dairy farm size was 20.8 ha, which was fragmented into 21 blocks (0.99 ha per block) and holding 31 dairy cows (less than 1.5 cows ha^{-1}). The average milk production per farm is 175 Mg yr^{-1}. Animal productivity in the Azores is smaller than in the NW region, showing in 2008 and 2012 values of 5,200 and 6,150 kg milk cow^{-1} yr^{-1} (GPSRAF, 2011; SREA, 2014). Milking is done in the grazing areas using mobile milking parlours. In the last years, building of fixed milking parlours has increased markedly as a consequence of changes afforded by land reparcelling projects promoted by the regional government. During milking, cows are supplemented with concentrate feeds and maize or grass silage but technical management of diets, herds and pastures needs to be improved. Use of concentrate feed is about 0.2 kg kg^{-1} milk and grazing is performed during winter preferentially on low altitude pastures; during summer high altitude pastures (over 800 m) are utilized by animals.

Advantages and disadvantages, threats and solutions for the Portuguese dairy sector

Advantages of Portuguese dairy production can be summarized as follows:

- high crop yielding potential of the NW and Azores regions, which ensures high forage productivity at the farm level;
- the competitive, up-to-date and well organized regional milk industry;
- producers receive strong support from dairy cooperatives at the technical level (labour and machine rental, technical support for fertilization, animal nutrition, reproduction and health) as well as at the commercial and administrative level (sale of concentrates at low prices, accounting services, investment projects, subsidy applications, etc.). The farmers' cooperative support is especially well organized in the mainland NW dairy region.

The disadvantages/weak points of Portuguese dairy sector are linked to:

- size and structure of farms: their location in areas with high population density which results in high land price (30,000 to 60,000 € ha^{-1}, in the NW region);
- in the Azores, technical management of the farms and herds is poor;
- high production costs compared to other producing countries; particularly in the NW region, animal feeding costs increased sharply in recent years due to rising concentrate-feed prices, which reduced the ability to compete internationally;
- high demanding national regulatory requirements in terms of food security, environment, animal welfare and licensing. Investments needed for the adaptation of farms to the entry into force of new environmental legislation;
- dairy industry limited capacity for price negotiation and excessive share of large retailers in the marketing margin; increasing pressure from the distribution sector in reducing the room for negotiation;
- peripheral status of Portugal relatively to major European markets, and in particular the insularity of the Azores, result in high transport and logistics costs.

Important threats to the Portuguese milk sector are the uncertainties linked to the ending of the quota system, increasing concurrence with other EU regions (mainly Spain) and consequently the reduction of the milk price.

The milk sector is certainly the best structured Portuguese agricultural chain and their national and regional organizations together with governmental support services are aware of the need to adapt the productive structure and they are committed to innovation. Envisaged solutions to improve sustainability of Portuguese dairy systems include:

- improved technical management of farms and herds to increase productivity and reduce production costs;
- reinforcement of farmers' organizations;
- diversification into innovative dairy products with higher added value for external and internal markets, and;
- increasing exports and strengthening the internationalization of the industry in addition to modifying the idea that export is a solution only for the disposal of surpluses.

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