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Research Article

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Bridges between family farming and organic farming: a study case of the Iberian Peninsula

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Abstract: The aim of this work was to identify procedures adopted by family farms in the centre and north of Portugal and Galicia (Spain), and to verify whether they resemble those used in organic farming. A checklist was prepared in Portuguese and Spanish and applied personally to managers of family farms. The participation was voluntary and 125 valid responses were collected.

The results show that farmers included in the study owned small family farms where labour is mainly performed by the family, and tended to adopt, in general, good agricultural practices, many of which are common to organic farming, such as crop rotation, avoidance of GMO or avoidance of phytoregulators. However, they failed to adopt some important practices, including the use of seeds inoculated with mycorrhizae, composting, biological and biotechnical control or avoidance of chemical control for plant protection. It was further concluded that gender and age of the farmers did not significantly influence the type of agricultural practices, contrarily to the level of education and region, which were significantly associated with many of the cultural interventions investigated.

Keywords: Family farming; Technical itinerary; Checklist; Cultural practices

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1 Introduction

Family farming presents a means of guaranteeing agricultural and forestry production, as well as fishing and grazing, based on small holdings managed by a family and essentially dependent on self-employed family labour. Recently, family farming has been identified as a central element in public debate, owing to its key role in the rural world. The United Nations declared 2014 as the International Year of Family Agriculture, recognizing its economic, environmental, social and cultural importance, and providing an opportunity to strengthen its role as a sustainable production system, furthermore ensuring food security (Correia et al. 2017; FAO, 2014a).

Despite their recognized importance, there is not much documented information about the contribution of family farms to local development and food security (Graeub et al. 2016). The State of Food and Agriculture (SOFA) report (FAO, 2014b) states that there are approximately 500 million family farms in the world, responsible for producing 80% of the world's food, which is surprising and provides evidence for the unquestionable role of these agricultural systems in helping cope with world hunger. Nevertheless, this information was based on the analysis of data collected as part of the agricultural census held in 2000, and from only 30 countries. This highlights the need to look at these activities more closely and to obtain more recent information. Graeub et al. (2016), analysed a larger range of data from the international agricultural census held in 2010, including 105 countries and territories that together represent 85% of the world's food production. They found that family farms constitute more than 98% of all farms and work on 53% of agricultural land, meeting 36–114% of the domestic caloric requirements. Hence, family farming is seen as having a substantial and even critical role in providing the world's food needs.

The survival of mankind and planet Earth has become more complex in recent years due to many factors, such as the world's growing population and consequently the increase in the demand for more food, water and energy.

Related to these, the limited arable land for expanding food production and the increasing pressures on natural resources also pose challenges that need to be rapidly addressed. Furthermore, all these factors are enhanced by climate change that is altering the world at a rapid and increasing rate, producing some potentially irreparable damage (Jones et al. 2017; Wheeler and Braun 2013).

Sustainable farming systems, such as organic farming (OF), are based on principles that aim to protect health and the environment and ensure the well-being of present and future generations. The underlying practices are grounded in sustaining and improving the health of soils, plants, animals and humans, and focus on ecological systems and cycles, while protecting the common environment and living organisms (Sajadian et al. 2017).

Organic farming aims at producing food with minimal environmental impact and is one of the food sectors that has experienced the fastest growth. Nevertheless, it still represents less than 1% of global area dedicated to agriculture and less than 5% of retail sales in most high-income countries. However, people are becoming more interested in organically farmed goods, and in high-income countries most people consume organic food, if not regularly, at least occasionally (Seufert et al. 2017; Willer and Lernoud 2015).

Strengthening the proximity of family farmers to organic farming might create opportunities for improving agricultural practices that are, in general, adopted by small farms and that have great impact on the foods produced and on the environment, especially in regards to crop protection (Correia et al. 2017).

Thus, it is crucial to understand the types of agricultural practices that constitute the technical itinerary of family farmers, in order to assess their closeness to, or deviation from, organic farming. The documentation of the technical and technological operations carried out at each stage of the technical itinerary can be performed by application of questionnaire surveys, of higher or lower complexity. The use of checklists facilitates the data collection among farmers, and particularly family farmers, because it is a simplified questionnaire, which reduces the need for the participant to give complex responses (Amaro 2007; Kuiper 2000; Zoraida 2005).

This work aims to contribute towards the characterization of agricultural practices used by family farmers in some municipalities of the centre and north of Portugal and Galicia in Spain. Additionally, it aims to evaluate the resemblance of technical itineraries to the practices and principles of organic farming. This methodology will allow identification of the technical and technological procedures adopted by family farms, and to what extent they coincide with those adopted in organic farming.

2 Materials and Methods

2.1 Instrument

This study was based on the application of a checklist prepared for small farmers who fitted the definition of family farming, aimed at identifying the technical and technological procedures adopted at such farms. For that, a short questionnaire based on a checklist (a simplified questionnaire, which reduces the need for responses by the participant) was prepared. A checklist consists of a simple list of statements (actions) or characteristics for which is indicated whether they are present (or desirable). For each individual item, a mean value or percentage of adoption (presence) of each binomial variable is obtained (Kirakowski 2000; Kuiper 2000).

The checklist was constructed on the basis of the technical itinerary adopted by farms engaged in organic farming, complemented with information from technical and scientific documents (Amaro 2007; Strohbehn 2015). Technical itineraries are “technical and theoretical technological models” that identify (i) the ordered set of cultural operations, (ii) the ordered set of agricultural tasks that are necessary to perform each of the cultural operations identified, and (iii) each of the technologies that are adopted to carry out each agricultural task (Amaro 2007; Zoraida 2005). The checklist was structured in seven parts:

- **I. Socio-demographic characteristics:** age, gender, education level
- **II. Farm description:** place, area, number of workers
- **III. Crop selection (CS):** crop diversity, use of regional varieties, consociations, diversity of varieties, presence of farm nursery, use of seed inoculated with mycorrhizae, use of GMO
- **IV. Soil management (SM):** crop rotation, use of fallow land, use of organic animal manure, use of green manure, cover crops, composting
- **V. Soil preparation (SP):** presence of weeds, manual mobilization, tillage using plough, disc plough, cultivator (dragged teeth)
- **VI. Green interventions (GI):** tutoring, bud pruning, removal of leaves, fruit thinning, use of phytoregulators

VII. Plant protection (PP): biological control, chemical control, physical control, genetic control, cultural control, biotechnical control, use of preventive measures

The checklist was prepared in Portuguese and Spanish for use in municipalities in both countries.

2.2 Data Collection

The checklist was applied to 125 managers of farms with a size of up to 2.5 hectares, who use mostly household labour and whose income is mostly from farming activity. The farms were situated in Portugal (Viseu – 30, Braga – 30, Barcelos – 30) and Spain (Pontevedra – 16, Padron – 19), and were selected by convenience according to type, dimension and place.

Data collection occurred by personal interview between November 2015 and February 2016.

2.3 Data Analysis

In the data analysis, basic descriptive statistics were used for exploratory evaluation. To investigate the relationships between some of the variables under study, crosstabs and chi square tests were used. The coefficient Cramer's V was used to assess the strength of the significant relations found between some of the variables at study. This coefficient varies from 0 to 1, and its interpretation is as follows: for $V \approx 0.1$ the association is considered weak, for $V \approx 0.3$ the association is moderate and for $V \approx 0.5$ or higher the association is strong (Witten and Witte 2009).

For all data analysis, the software IBM SPSS (version 24) was used and the level of significance considered was 5% ($p < 0.05$).

3 Results and Discussion

3.1 Socio-demographic characteristics

This study involved 125 participants, of which 68.8% were men and 31.2% were women. The geographical distribution was: 24.0% for Barcelos, Braga and Viseu, 15.2% for Padron and 12.8% for Pontevedra, resulting in a total of 72% for Portugal and 28% for Spain.

The participants were between 21 and 82 years of age, with an average of 57±11 years. Results from the Portuguese and Spanish agricultural census revealed that the farmers' age was, on average, 63 years in Portugal and 56 in Spain (INE, 2017; INEBase, 2017), which is within the range of ages of the farmers studied here. The average age was just slightly higher for men (58±11 years) than women (55±12 years). The farmers from Viseu were the oldest on average (64±8 years), followed by Pontevedra (59±12 years), Barcelos (57±10 years), Padron (52±11 years) and finally Braga, which had the youngest farmers (51±11 years).

The level of education was generally low, being on average 3±3 years of schooling. This is in accordance with data from the national census, which reveals that, on average, farmers have a basic education and that 88% and 85%, in Portugal and Spain, respectively, have only practical agricultural training (European Union, 2013; INE, 2017; INEBase, 2017). A considerable part of the respondents (17.1%) had no education at all, and the majority had between one and four years of school (56.9%). In addition, 25.2% of participants had five to nine years of schooling, and only 0.8% (one participant) had completed the 12th grade (the highest grade in secondary school).

3.2 Farm description

Table 1 shows the sizes of the farms included in the study. Most of the farms were between 1.5 and 2.0 ha (35%), and only a small percentage were over 2 ha (3.3%). Furthermore, the prevalence of very small farms, with less than 0.5 ha, was apparent, representing 22% of all farms. The average size was found to be 1.20±0.69 ha, but important differences were observed according to municipality, with farms from Barcelos and Viseu being the biggest (1.58±0.39 and 1.57±0.41 ha, respectively) and farms from Pontevedra and Padron the smallest (0.17±0.16 and 0.40±0.44 ha, respectively). Despite the average farm size in Spain being almost twice that of those in Portugal (23 ha in Spain and 12 ha in Portugal) (European Union, 2013; INE, 2017), the farms from Spain included in the study were considerable smaller compared to those from Portugal. In India, family farms have, on average, a gross cropped area of 1.4 ha (Agarwal 2018).

According to Lowder et al. (2016), there are more than 570 million farms in the world, the majority of which are small and family-run. Around 12% of the world's agricultural land is comprised of small farms (with areas of up to 2 ha), while 75% of the world's agricultural land is worked by family farms. This highlights the great importance of family farms and small farms to global food growth (Lowder et al., 2016). This is a global reality, further exem-

Table 1: Farm dimension by municipality and country

Farm dimension (ha)	Frequency (%)	Municipality (Country)	Average dimension (ha) (mean±sd)
[0.0 – 0.5]	22.0	Viseu (PT)	1.57±0.41
]0.5 – 1.0]	20.3	Braga (PT)	1.48±0.48
]1.0 – 1.5]	19.5	Barcelos (PT)	1.58±0.39
]1.5 – 2.0]	35.0	Pontevedra (SP)	0.17±0.16
]2.0 – 2.5]	3.3	Padron (SP)	0.40±0.44
Total	**100.0**	**Global**	**1.20±0.69**

plified by Poland, where the dominant agricultural practice is family farming (Kołtun et al., 2015).

Family farms are small, and it has been reported that larger farms tend to become industry-driven and separate from the economies of local communities. Farmers with small landholdings contest, however, that a farm might be considered a family farm regardless of its size, as long as the ownership and decision-making remained with individuals with family or marriage bonds (Bronson et al. 2019).

The number of permanent workers on farms varied from a minimum of one to a maximum of four: 20.0% of the farms had only one worker, 60.0% had two, 17.6% had three and 2.4% (three farms) had four workers. This excludes possible hiring for seasonal work. In fact, in Mediterranean countries such as Portugal, Spain and Italy, between 47.9 and 50.9 percent of farm labour is performed by the family and the number of permanent workers hired to work on the farm is on average very small (far less than one per farm) (FAO, 2013). These numbers confirm that the farms studied here fit within the concept of family agriculture, most of them being operated by members of the household instead of hired workers (Correia et al. 2017). According to Gong et al. (2019), the average number of labourers in family farms in China is four.

3.3 Agricultural practices versus region

Table 2 shows the adoption of agricultural practices in the different geographic areas covered by the study. The results show that, in general, a high percentage of the participating farmers complied with the use of diverse crops (100%) and regional varieties (98%), this trend being common for all areas (municipalities) studied. These are good agricultural practices, and the use of regional varieties is particularly important in OF, because it helps to preserve genetic diversity and minimizes the need for crop protection interventions due to higher resistance and better adaptation to local conditions such as climate or soil.

The majority of farmers used consociations (57%), a practice less commonly adopted by the farmers in the municipality of Braga (only 43%). On most farms, diversity of varieties was not commonly implemented (66%), except for farmers in the municipality of Braga (73% reported using diversity of varieties). According to Agarwal (2018), the use of land varies in India, with around-the-year cultivation by 74% and 34% of farmers in the districts of Kerala and Telangana, respectively.

Although farms with a nursery were the minority (39% globally), in some municipalities farmers valued this practice (Braga – 57%, Pontevedra – 63% and Padron – 53%). The use of seeds inoculated with mycorrhizae had not been adopted by any of the farmers in this study, despite being a particularly important practice to reduce the need for nitrogen. Symbiotic bacteria and fungi, abundant among a wide range of soil microorganisms inhabiting the rhizosphere, form crucial associations with plants that allows access to mobile nutrients in nutrient-poor soils, thus providing better growth (Ebrahim and Saleem 2017).

The use of GMO (Genetic Modified Organisms) is not allowed in OF and none of the farmers in the studied sample used them, which is an important feature of the study. About 95% of the plants used in OF were bred for conventional agriculture, and, because of that, might not be appropriate for OF. In fact, OF seeks more robust plants, and benefits from the recovery of lost assets in ancient varieties. For this purpose, rewilding is seen as a potential way of increasing genetic diversity and reintroducing wild qualities, that might have a positive impact on OF crops (Andersen et al. 2015).

All practices included in SM are considered good practices, with particular interest for OF. Most farmers used crop rotations (82%), organic manure (97%) and

Table 2: Agricultural practices by municipality

	Municipality	Viseu		Braga		Barcelos		Pontevedra		Padron		Global	
	Item	Yes (%)	No (%)	Yes (%)	No (%)	Yes (%)	No (%)	Yes (%)	No (%)	Yes (%)	No (%)	Yes (%)	No (%)
Crop Selection (CP)	a) Crop diversity	100	0	100	0	100	0	100	0	100	0	**100**	**0**
	b) Use of regional varieties[1]	100	0	100	0	100	0	94	6	95	5	**98**	**2**
	c) Consociations[1]	50	50	43	57	60	40	69	31	74	26	57	43
	d) Diversity of varieties[1]	7	93	73	27	20	80	19	81	47	53	**34**	**66**
	e) Presence of farm nursery[1]	17	83	57	43	23	77	63	37	53	47	**39**	**61**
	f) Use of seeds inoculated with mycorrhizae	0	100	0	100	0	100	0	100	0	100	**0**	**100**
	g) Use of GMO	0	100	0	100	0	100	0	100	0	100	**0**	**100**
Soil MAnagement (SM)	a) Crop rotation[1]	90	10	80	20	60	40	100	0	95	5	**82**	**17**
	b) Use of fallow land[1]	30	70	10	90	53	47	19	81	63	37	**34**	**66**
	c) Use of organic animal manure[1]	93	7	100	0	100	0	94	6	95	5	**97**	**3**
	d) Use of green manure[1]	100	0	100	0	100	0	88	12	95	5	**98**	**2**
	e) Cover crops[1]	20	80	13	87	10	90	56	44	53	47	**26**	**74**
	f) Composting[1]	0	100	0	100	0	100	6	94	11	89	2	98
Soil preparation (SP)	a) Presence of weeds[1]	3	97	10	90	17	83	81	19	90	10	**31**	**69**
	b) Hand tilling[1]	90	10	90	10	87	13	94	6	95	5	**90**	**10**
	c) Tillage	97	3	77	23	93	7	44	56	32	68	**74**	**26**
	c_1) Plough	30	70	33	67	20	80	13	87	26	74	**26**	**74**
	c_2) Disc plough[1]	37	33	67	33	60	40	87	13	84	16	**70**	**30**
	c_3) Cultivator (dragged teeth)	17	83	40	60	30	70	6	94	42	58	**28**	**72**
Green Interventins (GI)	a) Tutoring[1]	77	23	77	23	93	7	88	12	100	0	**86**	**14**
	b) Bud pruning [1]	27	73	3	97	3	97	44	56	42	58	**20**	**80**
	c) Removal of leaves[1]	70	30	23	77	23	77	81	19	58	42	**47**	**53**
	d) Fruit thinning[1]	20	80	13	87	10	90	25	75	37	63	19	81
	e) Use of phytoregulators	0	100	0	100	0	100	0	100	21	79	**3**	**97**
Plant Protection (PP)	a) Biological control[1]	0	100	0	100	0	100	0	100	26	74	**4**	**96**
	b) Chemical control	73	27	100	0	100	0	88	12	84	16	**90**	**10**
	c) Physical control[1]	100	0	33	67	63	37	94	6	95	5	**74**	**26**
	d) Genetic control	100	0	100	0	100	0	100	0	100	0	**100**	**0**
	e) Cultural control[1]	67	33	40	60	80	20	100	0	100	0	**73**	**27**
	f) Biotechnical control[1]	17	83	67	33	67	33	6	94	26	74	**41**	**59**
	g) Preventive measures[1]	27	73	67	33	50	50	100	0	95	5	**62**	**38**

[1]Practices particularly recommended in organic farming.

green manure (98%), and these results were similar for all municipalities studied. A high proportion of the farmers did not use fallow land (66%), probably due to small farm size with limited cultivatable area, forcing farmers to use the whole available area for cultivation. The practice of cover crops and composting, which are of most interest in OF, were not much used by the participating farmers (only 26% used cover crops and 2% used composting). Most farmers in India, owning small farms managed individually, use fertilizers (98.8%), but a smaller fraction use manure (24.3%) (Agarwal 2018). The application of organic fertilizer is considered a suitable method for promoting the transition from the paradox of "increasing the yield" to "improving the quality and safety of agricultural products", helping to achieve a greener development of agriculture (Lu et al. 2019).

In relation to SP practices, use of hand and mechanical tillage were common to most of the farmers (90% and 74%, respectively), in all municipalities. Tillage, using a disc plough, was the most used technique (70%). Tillage practices influence the biomass and composition of the microbial communities present in the soil, being achieved either directly or indirectly by means of changes in thermal and physical conditions (Pires et al. 2017). Tillage methods impact soil characteristics, namely soil aggregates, while at the same time influencing soil bacterial communities (Wang et al. 2019). Soils provide numerous ecosystem services, such as climate regulation and maintaining fertility. However, the extent of these services depends greatly on the ability of soil microbial communities to carry out the necessary natural soil processes (Bünemann et al. 2018; Drobnik et al. 2018; Zhang et al. 2019).

The presence of weeds, which is common in OF and particularly interesting as they constitute ecological infrastructures, was not tolerated by the great majority of farmers in the municipalities in Portugal (Viseu, Braga and Barcelos), but highly acceptable to those in the municipalities in Spain (Pontevedra and Padron). The use of plough and cultivator were practices used by only a minority of the farmers (26% and 28%, respectively), a trend common for all municipalities. This is a positive indicator, because they contribute to the destruction of soil. Therefore, the small farms studied here, although not assumed to be OF, tended to avoid these practices, resulting in environmental advantages and facilitating conversion. The draught resistance force of the plough includes three components, which are related to the properties of the soil, the speed of ploughing and the shape of the mouldboard surface. Hence the use of this technique will have an impact on soil quality (Bulgakov et al. 2019).

The adoption of Green Interventions (GI) varied among the different municipalities. Although most of the farmers did tutoring (86%), this trend being common to all municipalities, the opposite was true for pruning of buds or fruit thinning, with just a minority adopting these practices (20% and 19%, respectively). The removal of leaves, a practice adopted by about half (47%) of the farmers, differed between municipalities, being common in Viseu, Pontevedra and Padron (70%, 81 and, 58%, respectively), in contrast to Braga and Barcelos (only 23% in both). The use of phytoregulators, not allowed in OF, was only reported by a very small number of farmers (3%), and this trend was common for all municipalities, again indicating similarity of action with OF practices.

The plant protection techniques (PP) adopted most commonly by farmers were genetic control (100%), chemical control (by 90%), physical control (74%) and cultural control (73%), most of which are allowed in OF, except for chemical control. Preventive measures were adopted by 63% of farmers, with great discrepancies among the municipalities, varying from 100% of farmers in Pontevedra to only 27% of farmers in Viseu. Biotechnical and biological control, measures particularly recommended in OF, were adopted by a minority of farmers (47% and 4%, respectively). However, an important difference regarding biotechnical control was found between the municipalities of Braga and Barcelos, where most of farmers used it (67% for both), and the municipalities of Viseu, Padron and Pontevedra, where just a few farmers used it (17, 26 and 6%, respectively). In India, owners of small farms tend to use pesticides in their crops (86.6%), similarly to what was observed for the farms in the present study, where 90% used chemical control.

Statistical associations for the variables crop diversity, use of seeds inoculated with mycorrhizae, use of GMO and genetic controls were not further pursued, because they did not differ among different regions.

3.4 Agricultural practices according to sociodemographic and geographic characteristics

The adoption of agricultural practices and principles similar to those of organic farming were related to geographic and sociodemographic variables (Table 3).

In group CS, the use of regional varieties and consociations were not significantly related to any of the variables tested (gender, age, level of education or municipality). However, the use of diverse varieties was significantly related to age and municipality, meaning that these two variables influence the use of diverse varieties. Although the associations were significant in both cases, the association was weak to moderate for age (V = 0.261) but strong for municipality (V = 0.542) (with Braga being the municipality where the practice is adopted most often and with the youngest farmers). The presence of a nursery on the farm was moderately associated with age (V = 0.289), level of education (V = 0.268) and municipality (V = 0.385). Farmers from Pontevedra, which were older and more educated, were those who more often had a nursery on the farm. Practices related to SM were not associated with gender or age, i.e., these variables did not influence the

Table 3: Association between family farming technical practices and sociodemographic and geographical characteristics

Item	Variable	Gender c^2, *p-value* Cramer´s V	Age c^2, *p-value* Cramer´s V	Level of Education c^2, *p-value* Cramer´s V	Municipality c^2, *p-value* Cramer´s V
Crop Selection (CS)	b) Use of regional varieties	0.922, *0.337* 0.086	5.440, *0.142* 0.209	2.992, *0.393* 0.156	5.280, *0.260* 0.206
	c) Consociations	0.202, *0.653* 0.040	4.411, *0.220* 0.188	4.588, *0.205* 0.193	6.046, *0.196* 0.220
	d) Diversity of varieties	0.739, *0.390* 0.077	8.497, ***0.037*** 0.261	2.795, *0.424* 0.151	36.666, ***0.000*** 0.542
	e) Presence of farm nursery	2.875, *0.090* 0.152	10.415, ***0.015*** 0.289	8.816, ***0.032*** 0.268	18.483, ***0.001*** 0.385
Soil Management (SM)	a) Crop rotation	4.396, *0.036* 0.188	3.663, *0.300* 0.171	6.434, *0.092* 0.229	17.105, ***0.002*** 0.370
	b) Use of fallow land	0.414, *0.520* 0.058	3.154, *0.369* 0.159	2.711, *0.438* 0.148	21.637, ***0.000*** 0.416
	c) Use of organic animal manure	1.874, *0.171* 0.122	1.919, *0.589* 0.124	32.204, ***0.000*** 0.512	3.889, *0.421* 0.176
	d) Use of green manure	1.394, *0.238* 0.106	0.295, *0.961* 0.049	4.349, *0.226* 0.188	9.846, ***0.043*** 0.281
	e) Cover crops	0.770, *0.380* 0.078	1.332, *0.721* 0.103	28.917, ***0.000*** 0.485	21.878, ***0.000*** 0.418
	f) Composting	0.007, *0.936* 0.007	0.295, *0.961* 0.049	6.034, *0.110* 0.221	8.582, *0.072* 0.262
Soil Preparation (SP)	a) Presence of weeds	0.005, *0.944* 0.006	3.630, *0.304* 0.170	57.169, ***0.000*** 0.682	68.816, ***0.000*** 0.742
	b) Hand tilling	3.234, *0.072* 0.161	0.690, *0.876* 0.074	0.716, *0.869* 0.076	1.112, *0.892* 0.094
	c) Tillage	1.742, *0.187* 0.118	2.139, *0.544* 0.131	24.099, ***0.000*** 0.443	39.720, ***0.000*** 0.564
	c_1) Plough	0.202, *0.653* 0.040	3.026, *0.388* 0.156	3.133, *0.372* 0.160	3.188, *0.527* 0.160
	c_2) Disc plough	0.426, *0.514* 0.058	1.333, *0.721* 0.103	7.998, ***0.046*** 0.255	5.943, *0.203* 0.218
	c_3) Cultivator (dragged teeth)	0.681, *0.409* 0.074	0.883, *0.830* 0.084	0.707, *0.871* 0.076	9.743, ***0.045*** 0.279
Green Interventions (GI)	a) Tutoring	0.790, *0.374* 0.079	0.971, *0.578* 0.126	6.732, *0.081* 0.234	8.583, *0.072* 0.262
	b) Pruning of buds	0.149, *0.699* 0.035	2.715, *0.438* 0.147	19.626, ***0.000*** 0.399	22.693, ***0.000*** 0.426
	c) Removal of leaves	0.379, *0.538* 0.055	2.659, *0.447* 0.146	15.351, ***0.002*** 0.353	28.287, ***0.000*** 0.476
	d) Fruit thinning	0.057, *0.811* 0.021	1.897, *0.594* 0.123	15.891, ***0.001*** 0.359	6.474, *0.166* 0.228
	e) Use of phytoregulators	0.074, *0.786* 0.024	1.264, *0.738* 0.101	12.270, ***0.007*** 0.316	23.054, ***0.000*** 0.429
Plant Protection (PP)	a) Biological control	0.304, *0.581* 0.049	2.974, *0.396* 0.154	15.467, ***0.001*** 0.355	29.057, ***0.000*** 0.482
	b) Chemical control	0.446, *0.504* 0.060	1.359, *0.715* 0.104	5.156, *0.161* 0.205	16.151, ***0.003*** 0.359
	c) Physical control	0.557, *0.455* 0.067	4.860, *0.182* 0.197	9.577, ***0.023*** 0.279	45.134, ***0.000*** 0.601
	e) Cultural control	0.365, *0.546* 0.054	5.340, *0.149* 0.207	24.745, ***0.000*** 0.449	30.732, ***0.000*** 0.496
	f) Biotechnical control	0.128, *0.720* 0.032	4.715, *0.194* 0.194	10.828, ***0.013*** 0.297	33.412, ***0.000*** 0.517
	g) Preventive measures	0.000, *0.992* 0.001	5.819, *0.121* 0.216	16.296, ***0.001*** 0.364	36.303, ***0.000*** 0.539

manner in which the farmers managed the soil. However, the level of education was found to be strongly associated with the use of organic animal manure (V = 0.512) and with the use of cover crops (V = 0.485). The effect of municipality was significant (with moderate to strong associations) in the adoption of crop rotations (0.416), cover crops (0.418), the use of fallow land (0.416) and green manures (0.281). Further, the level of education was found to significantly influence most SM practices, with moderate to strong associations for cover crops (V =0.485) and a strong association for organic animal manure (V = 0.512). In fact, the farmers from Braga and Barcelos, which were less educated, always used organic animal manure, while farmers from Pontevedra, which had higher levels of education, adopted other techniques to maintain the soil fertility, such as cover crops (which also reduce problems with weeds and erosion), crop rotations and composting.

Following previous trends, gender or age were not associated with any of the practices of SP, and therefore neither gender nor age significantly influenced the farmers' choices in terms of soil preparation. However, the level of education and municipality were found to significantly influence most of the practices in SP, so that education was strongly associated with the presence of weeds (V = 0.682) and tillage (V= 0.443). Similar results were found for the association between municipality and presence of weeds (V = 0.742) and tillage (V = 0.564). Pontevedra and Padron were the two municipalities where most farmers accepted the presence of weeds in their fields. The use of tillage was reported more often in Viseu. The use of a disc plough was moderately associated with the level of education (V = 0.255), and moderately associated with the use of a cultivator (V = 0.279). Farmers from Pontevedra and Padron preferred to use the disc plough instead of a cultivator or plough, revealing a better awareness of the negative effects of those agricultural tools.

In relation to practices in group GI, once again neither gender nor age were significantly associated with any of the practices studied, but level of education and municipality were significantly related to most of them. Level of education was moderately associated with bud pruning (V = 0.399), removal of leaves (V = 0.353) and fruit thinning (V = 0.359). On the other hand, municipality was strongly associated with pruning of buds (V = 0.426) and removal of leaves (V = 0.476). These practices, which contribute to improving the environment surrounding plants, reduce the conditions that favour diseases and improve fruit quality, were more often adopted in Pontevedra and Padron, where the farmers had higher levels of education and training.

Finally, PP practices were not significantly influenced by gender and age, contrary to level of education or municipality, which were significantly associated with practically all PP practices. Level of education was strongly associated with cultural control (V = 0.449) and moderately associated with preventive measures (V = 0.364), biological control (V = 0.355), biotechnical control (V = 0.297) and physical control (V = 0.279), while being weakly associated with chemical control (V = 0.205). The associations for municipality were, in general, greater than for level of education, meaning that for these practices the influence of the geographical area was much stronger. Municipality was strongly associated with physical control (V = 0.601), preventive measures (V = 0.539), biotechnical control (V = 0.517), cultural control (V = 0.496) and biological control (V = 0.482), and moderately associated with chemical control (V = 0.359). Cultural control and preventive measures, two practices that are central in organic farming, were common in Pontevedra and Padron and practiced by more educated farmers; on the other hand, chemical control was adopted by all farmers from Braga and Barcelos, where less educated and trained farmers were responsible for farm decisions.

The variables crop diversity, use of seeds inoculated with mycorrhizae, use of GMO and genetic control were not calculated because this item is a constant.

4 Conclusions

This work allowed characterization of the agricultural practices of a group of family farmers, situated in the north of Portugal and in Galicia, Spain. The results allow the conclusion that these farmers, owning small pieces of land (under 2.5 ha), tend to adopt many practices common to organic farming, particularly the use of crop diversity, regional varieties, consociations, avoidance of GMO, crop rotations, organic animal manure, green manure, manual and mechanic mobilization of the soil, use of disc plough but avoidance of cultivator and plough, tutoring, avoidance of phytoregulators, and physical, genetic or cultural control and use of preventive measures in terms of plant protection strategies. Practices particularly recommended, or mandatory, for OF, but less commonly reported by these farmers, included the use of seeds inoculated with mycorrhizae, use of cover crops and composting, tolerating the presence of weeds that may work as ecological infrastructure, and use of biological and biotechnical control. The use of chemical control was one of the practices adopted by almost all farmers that needs to cease with conversion to organic farming, probably being the issue that is most difficult to change due to the risks involved in terms of crop losses.

Regarding the influence of geographical and socio-demographic factors on the behaviour of farmers, it was concluded that gender and age did not influence agricultural practices, but level of education and municipality were frequently significantly associated with many of the cultural interventions investigated. Consequently, level of education and location of farms are important factors for planning support measures and programs, so as to disseminate training activities aimed at promoting a higher adoption of good practices in family farming and/or convergence towards organic farming.

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