DIVERSIFOOD

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Collective Management of Maize Landraces in France and Italy

Abstract

In industrialized countries, maize culture is associated with the use of hybrid varieties and industrialized agriculture. Despite the homogeneity of maize landscapes, alternative models of maize production exist. This comparative study is based on farmers collectives from Aquitaine (France) and Veneto (Italy) that manage maize landraces. Since the early 2000s, the Aquitaine group adopted maize landraces from different regions of the world while Veneto groups recovered the "historical" and local maize landraces. In Italy, maize landraces are mainly used for human consumption while in France animal feed represents their principal usage. Each group has developed different strategies to define, distinguish and legitimatize their work on maize landraces within a broader context dominated by commercial hybrids. The Aquitaine and Veneto groups display very different organizational functions, practices, and visions. This diversity reflects different productive systems and priorities. The Aquitaine group focuses on the development of maize diversity and related knowledges. The Veneto groups are strongly influenced by the cooperative organization and framers' main interest is the quality of maize for the polenta flour and its commercial value. These different paths shaped farmers' attachment to maize as well as their approach to its conservation and breeding. They also influenced the connection established by farmers with local history and with the history of agricultural homogenization modeling different meanings of farmers' seed.

Table of Contents

Table of Figures

1 Introduction

Maize (*Zea mays*) is a multipurpose crop and the first grain in worldwide production reaching more than a billion metric tons per year. Europe is the third largest maize consumer and the fourth producer after the USA, China and Brazil[1]. Maize has an ambivalent reputation in the context of global agriculture. During the Green Revolution, maize culture became associated with standardized agricultural practices and with the use of homogenous hybrid varieties provided by seed companies. A symbol of agricultural industrialization, in the 1990s maize was associated with the GMO controversy (Quist & Chapela 2001) and more recently with risks related with synthetic biology (Reeves *et al.* 2018). However, maize landraces continue to hold a preeminent place as a farmer crop, ensuring food security to farmers in developing countries. In Europe, hybrid maize is mainly considered a feed crop for the livestock sector. However, maize landraces are now playing an increasing role in high-quality food systems based on agrobiodiversity and on local supply chains. The genetic diversity is crucial for developing new varieties adapted to specific uses and agroecosystems, contributing to the development of a more resilient and sustainable agricultural paradigm (Veteläinen, Negri & Maxted, 2009)

Maize, carried from Mexico and Mesoamerica to Europe, has been cultivated for centuries in different regions giving origin to a complex interracial mixture (Brandolini and Brandolini, 2009; Mir *et al*., 2013; Cassani *et al.* 2017; Ardenghi *et al.* 2018). In Europe, there are strong regional differences in the cultivation of maize, resulting from the use of maize, agroecological condition, commercial valorization and agricultural policies. Many small farmers in Europe still cultivate maize open-pollinated varieties which have the highest genetic variation. In France and Italy, maize landraces are cultivated within family farming and produced without irrigation, often a farmers' choice. Maize open-pollinated varieties have a lower production potential compared to the hybrids farmed in the main agricultural European districts with water management. Although less productive, these genetic materials are increasingly important for those farmers who are searching for varietal solutions for sustainable agriculture. In 2000, because of the growing interest in crop diversity for low input and organic agriculture, in addition to the risk of contamination with genetically modified maize, some French farmer groups started to collect local varieties and foreign maize landraces (Bio d'Aquitaine 2001; RSP 2014; Collectif 2015). This effort marked the beginning of a new strategies on plant breeding and maize seed management in France, especially in the Dordogne region. In Italy, in 2000, the Veneto region launched a project to protect and preserve the ancient cereal varieties of Veneto that were under threat of genetic erosion. Agronomists, farmers and chefs were involved in this project devoted to the

[1] World of Corn 2018. http://www.worldofcorn.com/#/

reintroduction of local maize landraces with vitreous grains, which make them particularly suitable for polenta.

In France, Italy and elsewhere, the reintroduction of landraces and the selection and conservation of open-pollinated varieties have been accompanied by the development of evolutionary breeding and "dynamic management" of crop diversity (Goldringer *et al.* 2001, Enjalbert *et al.* 2011; Conseil and Chable 2009; Ceccarelli & Grando 2007). These experiences, together with those of other parts of the world, allowed to rethink the question of the delegation of innovation to researchers and the exclusion of farmers from this process (Chiffoleu and Desclaux 2006; Bonneuil *et al.* 2006). From the perspective of the history of science and technology and environmental history, scholars have studied the organisms' industrialization, focusing on agricultural modernization related to the development of commercial breeding (Bonneuil & Thomas 2009; Fenzi 2017). Since the 2000s, a multitude of projects have been established in Europe based on a system of relations and circulation of knowledge and seeds (Bocci 2009; Demeulenaere and Bonneuil 2011; Chable *at al.* 2014).

A growing amount of scholarly works have stressed the need to understand and highlight the importance and the complexity of European informal seed systems (Veteläinen *et al.* 2009, Bocci *et al.* 2012; Chable *et al.* 2012; Halewood *et al.* 2012). At the same time, the European Union has been engaged since 2004 in the implementation of Article 6, on the sustainable use of plant genetic resources, of the International Treaty on Plant Genetic Resources for Food and Agriculture.[2] Thus, there is the need to find the right balance between formal and informal seed systems (Bocci 2009; Lorenzetti & Negri 2009), taking into account the needs of farmers involved in on-farm conservation and in participatory and/or decentralized plant breeding.

Crop diversity and farmers' seed networks are precious assets for the transition to sustainable models of production and consumption in a globalized world. This project aims to identify, understand and put into perspective different experiences of farmer management (conservation, multiplication and breeding) of maize landraces.

2 Objectives

The main objective of this project is to study, in a comparative perspective, the dynamic management of maize in two collectives from Aquitaine and Veneto, both practicing decentralized breeding of maize landraces. On the one hand, we studied the organization and functioning of the selection, conservation and diffusion of maize, both at the community and at the individual level, showing the rules and the forms of organization implemented in

[2] www.planttreaty.org

each group. On the other hand, we identified the motivations and values supporting and shaping each collective dynamic. Our mission was to retrace the connections between practices, narratives and imaginaries on maize as a historical process. We revealed the complex relationship with the history of different productive patterns, which determines the place given to maize into each collective. At the same time, we showed that maize landraces continue to evolve in relation to cultural, social and environmental conditions, especially according to farmers' choice and network.

The overall aim is to trace, in a more situated framework, the development of two different maize management strategies. This represents an opportunity for each group to analyze its own practices and improve its ability to share different knowledge productions. The synergy between different epistemological backgrounds and values is key for the success of participatory projects on biodiversity-based agriculture (Couix & Hazard 2013; Hazard et al. 2018). Finally, this project aims to mutualize and give greater prominence to the innovative practices on cultivated biodiversity. These results could be useful for future collaborative research and programs devoted to the development of virtuous seed systems. In other words, to enhance practices that generate diversity and maintain landraces under conditions of evolution through the re-appropriation and development of new knowledge.

3 Methodology

This study, based on farmers' collectives from one region in France (Aquitaine) and one region in Italy (Veneto), aimed to identify key practices and motivations related to the culture of maize landraces. We conducted a survey based on participant observation during different phases of maize culture: including harvest, selection in the field and at the farm, storage for conservation, and seed preparation. Several meetings and special events were attended as well. Additionally, the survey included a semi-structured questionnaire, which we used to interview 47 farmers. In Aquitaine, we asked 48 farmers involved with the "Maison de la semence" group if they would participate in the survey. When possible, we conducted face-to-face interviews. We visited 17 farmers in loco and 12 accepted to fill out the questionnaire online. We had 29 replies in total (60,4%). In Italy, we approached 17 farmers belonging to the maize Marano consortium and 11 belonging to the maize Sponcio consortium. We could meet in person with 10 of them and we had 18 total replies (64,2%). We collected information about the history of groups, uses of maize, agricultural practices, motivation and concerns associated with farmers' decisions to grow maize landraces. We analyzed the group organization related to plant breeding, conservation, and seed supply. We also identified some bottlenecks limiting the development of maize landraces and we identified which maize characteristics are considered desirable and which undesirable for marginal areas, low-input agriculture or specifics needs.

Our comparative analysis also included interviews with technicians, breeders, and historians involved with the collectives, as well as archival research conducted at the International Historical Library “La Vigna” in Vicenza, Italy. Moreover, the data obtained from the 2017-2018 survey have been integrated with other unpublished information collected during previous field work and historical research conducted since 2013.

One important step was to prepare the first version of this report in French and in Italian in order to discuss the results directly with the actors involved in this survey, including farmers, technicians and association members. Data analysis and visualization were performed using Prism version 7 (GraphPad Inc), R version 3.5.1 (Comprehensive R Archive Network (CRAN) project (http://cran.us.r-project.org), and with R studio Version 1.1.453

4 Theoretical framework

In this project, we studied the management of maize landraces through what has been achieved with them and communicated about them. Rather than characterizing the object itself - maize landraces - or identifying agricultural practices, we focused on what sociologists defined as «attachements» (Hennion 2013). This implies investigating the relationship between the object (maize) and the development of forms of commitment: farmers are "spokespersons for their object" (Hennion 2013:18). We analyzed the process involving at the same time maize seed management, farmers’ concerns, values and priorities. We studied in parallel two different maize seed systems, following how each group of farmers has produced specific forms of “qualification” (Allaire 1995) of maize landraces. For example, we detailed what attributes farmers give to maize landraces to distinguish them from commercial hybrid seeds. The specificities of farmers' crop diversity management can be analyzed as a process of “seed qualification” (Hecquet 2013). Corentin Hecquet (2019), in his thesis on the construction of an ecological justice on non-industrial seeds, proposed also to use the concepts of “justification” (Boltanski & Thévenot 1991) and of “investissement de forme” (Thévenot 1986).

In the case of management of maize landraces, we are facing the effort to establish new "stable references". If the doxa of agricultural modernization was based on the efficiency of commercial seed standardization, the new framework is based on autonomy through reproducible heterogenous seeds. The notions of justification and “investissement de forme” are useful to reflect on how new methodological approaches, ethical references and forms of commitments have been established.

We studied these processes in a corollary of actions and meanings. We focused not only on the functioning of the groups, but also on the construction of specific maize “qualifications.” We analyzed the farmers lexical choice to define maize landraces, as well as the choice to add and remove attributes or to invent new ones. Aditionally, we investigated the ability to

produce equivalences with particular values (mutual aid and autonomy), or to develop an antagonist discourse (diversity vs homogenization) in a context dominated by industrial agriculture.

This study draws inspiration also from studies analyzing different approaches to crop diversity conservation and selection (Demeulenaere & Bonneuil 2005; Rivière 2015) and seed exchanges (Thomas et al. 2011; 2012). Furthermore, we studied the development of new knowledge and the re-introduction of knowledge once marginalized (Demeulenaere and Bonneuil 2010), investigating the links between landraces, environment and territory (Bocci & Chable 2008). This work has also benefited from works exploring the motivations for farmers to choose landraces despite the availability of commercial varieties (Perales et al. 1998; Fenzi et al. 2017), and from studies analyzing the history of agriculture modernization as it pertains to plant breeding and its relationship with genetic resources conservation and agricultural research (Bonneuil & Hochereau 2008; Fenzi 2017; Bonneuil 2019).

5 France – the AgroBioPérigord Group

5.1 Origins - the trip to Guatemala

The association AgroBioPerigord, which works to develop organic agriculture in the Dordogne region, began their work on what they call 'population maize' – maize open-pollinated varieties – in 2001. In the early 2000s, seed production was the focus of intense debate in France and across Europe, due to new regulations on GMOs and the risk that hybrid maize could be contaminated by transgenic maize. A voyage to Guatemala in 2000 by Bertrand Lassaigne, a farmer member of the association, marked the symbolic beginning of this work. Lassaigne brought back 11 varieties of maize: "It was the problem of GMOs that got us thinking about seeds. We thought it would be impossible to find maize seeds that weren't hybrid, and I decided to go and check with the Mayans."[3] His experience and ideas opened up the path to what would ultimately be a large-scale collective process. In 2001, he planted Guatemalan open-pollinated varieties of maize in a large field on his farm. This field, which AgroBioPerigord group called a "platform" or "showcase", would become a fundamental tool in the development of actions around population maize. After the first sowing in 2001, AgroBioPerigord's collection of maize grew rapidly, expanding to include populations from Latin America, various European countries, as well as the Centre de Ressources Biologiques (Centre for Biological Resources, or CBR) for maize in Montpellier.[4] Samples from each population have been conserved off-site (*ex situ*) and periodically sowed. Moreover, the great diversity of maize populations gathered over the years has been increasingly maintained under evolutionary condition in farmers' fields (*on-farm*). The end of the platform in 2018 as the single location for the sowing of the collection is now reinforcing this decentralizing tendency, which is based on the involvement of multiple farmers.

5.2 The showcase/platform, a broad sample of the diversity of maize.

Between 2003 and 2017, AgroBioPérigord organized open days where other farmers could visit the collections *in situ* (platform) and *ex situ* (*Maison de la semence*, or 'Seed house') and get to know the group's work. The platform thus had a fundamental visual dimension, presenting the full range of the work, and highlighting the availability of materials for testing and cultivation. Valérie Abatzian, a technician hired in 2002 by the association to do the initial work on the collections, explained in an interview: "It was incredible. There were probably a hundred farmers, and in that moment, I suddenly understood who I was working

[3] Bertrand Lassaigne, Octobre 2014.

[4] Bio d'Aquitaine (2001) and AgroBioPerigord (in press) "D'une initiative locale à un essaimage national, l'histoire du développement du maïs population en France". Regards croisés sur la diversité du maïs, rencontres France-Mexique 2014.

for. It was a very important moment of recognition for all the time we'd spent in the fields."[5] The participants in these events, some of whom had already grown "ancient" or "local" varieties of maize, were interested in gaining knowledge of different varieties from other regions. They were looking for open-pollinated varieties, which are therefore "reproducible", with characteristics that differ from those that they would usually see in hybrids. The farmers were also interested in a hardier maize that could be grown with limited inputs and water. Bertrand Lassaigne explained that "producing hybrids organically and getting the same results as with hybrids using conventional methods was very difficult. For the yield objectives that we had – that is, 120q/ha – we had to use a lot of organic fertilizer and water. The result: there were a lot of weeds. That meant we needed a lot of labor and our lives were crazy. Between the costs of the seeds, the costs of transportation for the organic fertilizer and all the production costs, producing 120 q/ha was costing us 100q/ha. Something had to be done."[6] In response to the demand from farmers for open-pollinated seed varieties that would minimize production costs, AgroBioPérigord decided to test the maize varieties on the platform by growing them without irrigation. Bertrand Lassaigne explained: "At one point we decided to stop irrigating the platform, and sometimes there were plots that were atrocious. Later, even in drought years, there were populations that did very well. When farmers visited the platform and saw the state of the maize, they couldn't believe that we hadn't irrigated them."[7]

At the outset, the role of the platform was fundamental for raising awareness and for communicating with farmers on the subject of population maize. The AgroBioPerigord collection contains more than a hundred varieties of maize, and each year around 80 have been planted on the platform. Most of the batches of maize seeds that AgroBioPerigord collected or received as donations consisted of small quantities of seed. The farmers explained that these populations were often "degenerated" and poorly adapted to local conditions. As with the Guatemalan varieties, those from Europe often required a prolonged process of mass selection. The story of Grand Roux Basque (GRB) maize offers one example. This population, which originated in the Basque country, gave very poor results, with more than 70% of plants lodging. With a seed pool drawn from several separate sources, farmers worked on the problem of lodging as well as on other criteria. The batch from the INRA (French National Institute for Agricultural Research), for example, yielded ears that weren't red. The population of GRB that was selected in Dordogne was then widely distributed. Bertrand Lassaigne explained that "the funny thing is that AgroBioPerigord brought Grand Roux Basque to the Basque country, where it had almost disappeared!"[8] At the beginning,

[5] Valerie Abatzian, January 2015.

[6] Bertrand Lassaigne, October 2017.

[7] *Ibid*.

[8] *Ibid*.

the AgroBioPerigord team strived to ensure that their conservation work would maintain the "purity" of the seeds in the collections as much as possible. Most of these populations were planted on the platform on small areas of land. Valerie Abatzian explained the extensive technical work involved in avoiding cross-fertilization: "we protected the female flowers with bags; then we harvested the pollen and we mixed it to carry out the pollination manually."[9] Once again, in order to keep the varieties from mixing, it was common practice to use only the central part of the rows for each variety: "There were very few individuals, and with this system we were taking part in the degeneration of the population."[10] Very quickly, the AgroBioPerigord collective revised its conservation strategies, dividing the tasks of conservation and multiplication among farmers through experimentation contracts.

Since the first group tour of the platform, interest in population varieties has grown continuously. Requests for seed have been growing as a result (Fig 1). To respond to all these requests, the AgrobioPerigord team had to work to develop the technical aspects of the platform and improve the management of the seed batches. Elodie Gras, the coordinator of the AgroBioPerigord maize group, explained that to be able to offer farmers good advice on what variety to adopt, the group had to find answers to increasing numbers of questions, increasingly precise and differentiated according to farmers' needs and expectations. The production of knowledge on varieties became one of the fundamental tasks of the association.

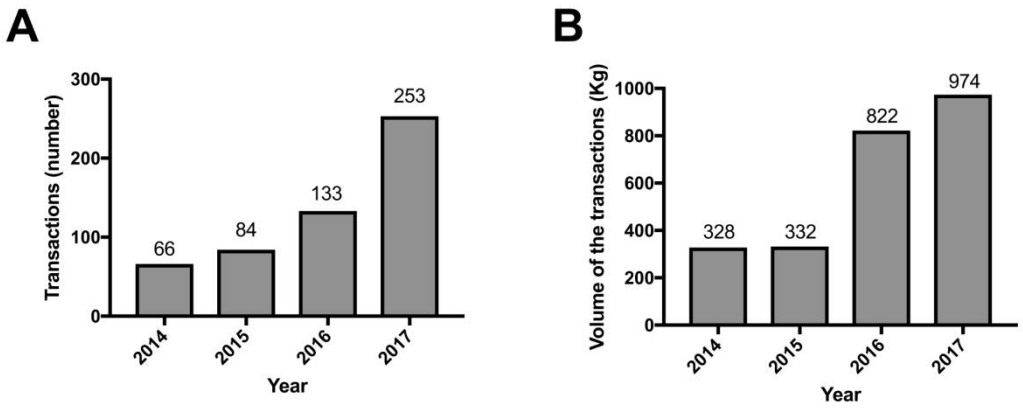

Figure 1 Number of seed transactions (A) and volumes of transactions (B) between 2014 and 2017.

[9] Valerie Abatzian, January 2015.

[10] Bertrand Lassaigne, October 2017.

5.3 The *Maison de la Semence*, collective management of maize diversity.

In 2006, the creation of the *Maison de la Semence* within AgroBioPérigord marked an important step in the developing exchange of population maize, as well as in the platform's work of characterization and experimentation. The *Maison de la Semence* plays a fundamental role in coordinating the actions. It is a "collective organization of farmers and gardeners around the development of crop diversity through the dissemination and exchange of seeds and knowledge within participatory systems." [11] Armand Duteil, a farmer who is very involved in the *Maison de la Semence*, explained in 2013: "There's always a tension: it's important to keep productive varieties, the ones that will keep the system alive, and at the same time, there's this awareness of the need to maintain other, rarer populations. Conservation in the fridge isn't possible in the long term, we have to organize things on the farms."[12]

The principal mission of the *Maison de la semence* is to share with farmers the whole available range of maize diversity, as well as new specific knowledge on population maize that has been acquired. The work on the platform on characterizing different populations, associated to the data from the experimental plots, helps the group to advise farmers choosing among the wide range of available varieties. Farmers test the chosen variety over multiple cultivation cycles, and moreover, they can continue to test others. They are provided with technical support in the work of selection, which can go as far as the development of a new population which, if it is donated to the *Maison de la Semence*, can then become a part of the range of populations available to other farmers. The *Maison de la Semence* team devotes a great deal of effort to research on methodologies for selecting and creating new populations. On the one hand, their task is to develop more precise and systematic mass selection techniques on experimental plots, such as the "Brazilian" protocol or the various stratified visual selection protocols. On the other hand, they must develop simpler mass selection methods allowing populations to be improved directly *on farm*. Another selection and conservation strategy implemented by the team of farmers and technicians consists of mixing varieties. The Lavergne variety was the first mixture of population maize varieties to emerge from the platform. Subsequently, the practices of producing new "*créations paysannes*" (farmers' creations) combining different populations has become increasingly important. Moreover, a new variety can always then be improved or crossed with other varieties. In the Lavergne case, for example: "Once in a while, when I find something interesting, I put it in!"[13]

[11] AgroBioPerigord 2013. See also Collectif (2015).

[12] Armand Duteil, February 2013.

[13] Bertrand Lassaigne, October 2017.

According to the members of the association, the role of the *Maison de la Semence* has been in constant evolution since the beginning. Given that AgroBioPérigord works with farmers who practice organic farming, initially farmers using conventional methods were indirectly excluded. Recently, however, farmers working with conventional methods have made requests for population maize seeds. The collective decided to accept these requests. They realized that this would allow them to expand the scope of thinking on population maize and peasant seeds, integrating perspectives other than those of organic farmers.

Each farmer making a first request for seeds takes part in a training course. The goal of this course is to prepare the farmer for knowledge required to use population maize, which differs from what is needed with commercial hybrids. This initiation also integrates the farmers into the group dynamic of the *Maison de la Semence*. Farmers who request seed must also sign an experimentation agreement and commit to returning seeds to the *Maison de la Semence*. These "seed returns" from farmers are key to that group dynamic. The AgroBioPerigord team receives, stores, and distributes an enormous panel of batches of seed, using a labeling system that ensures their traceability.[14] Seed returns allow the group to gather a stock that will then be available for the following year, to be distributed to other farmers. While initially, the quantities provided to farmers were just enough to test the variety in a small area, the association can now provide significant quantities of seed, although the amount generally does not exceed 12 kilograms.[15] Material restrictions, such as limitations on the space available for storage, limit the group's ability to manage large quantities of seed. The available stocks can also vary depending on the returns from farmers the previous year. The mission of the *Maison de la Semence* is not to act as a seed supplier, providing farmers with seed for each sowing. The fact that the group works with small quantities of seed is thus not only due to logistical limitations; it also reflects the choice to work within a framework of exchange and experimentation[16].

This system of collective management of maize diversity thus ensures that the many varieties within the system are conserved on different farms, while centralizing the coordination of various tasks within the *Maison de la Semence*: distributing different varieties, seed returns, conserving seed stocks in optimal conditions, as well as characterization and experimentation. While the production of knowledge on maize is increasingly decentralized, the systematization and transmission of information remains a responsibility of the AgroBioPérigord team. Every year, they publish a report presenting the results of the collective's experimental trials. Additionally, they publish special reports on particular themes, as well as monographs on topics such as biodiversity and selection techniques. More recently, the use of maize in the human diet has taken on increased

[14] *Op. Cit. AgroBioPerigord* (in press).

[15] This allows 0.5ha to be sown at a density of 75,000 seeds/ha. Op. Cit. AgroBioPerigord (in press).

[16] Op. Cit. AgroBioPerigord (in press).

importance, and has been featured in a number of publications (Agrobio Périgord, 2016 ; Dessimoulie & Walter, 2017).

While initially the spotlight was on the conservation of agricultural biodiversity and on the "materials" available in the network, thinking within the group progressively shifted toward the study of the behavior of these varieties, and to the systematization of information about them. Now, as the central showcase has disappeared, giving way to multiple plots/showcases on individual farms, efforts have been even more centered around the collective management of trials. Discussions are now focused on the quest to establish a better-defined framework for varietal improvement to be applied to a more limited number of criteria. The objective is to observe the effects of mass selection practices on the most heritable characteristics, in order to obtain more measurable results.[17] With the arrival of two new agronomists in the AgroBioPerigord group in 2016, the work of selection and the systematization of information on the collection is now in full swing. Thanks to its participation in both national and international projects, the group is constantly improving its processes as well as its knowledge on population maize.

5.4 From the search for knowledge on maize to the construction of a new identity

AgroBioPerigord's work on maize has often been elaborated in connection with the concepts and initiatives of the *Réseau Semences Paysannes* (Peasant Seed Network), an association created in 2004 which links together 90 associations throughout France[18]. This relationship has later enabled the expansion of the collective's work on maize by "mutualizing the ideas and problems confronting the collective at the national level."[19] Exchanges with farmers in other countries are another source of inspiration. The study trip to Brazil organized in 2004, the *Rencontres Internationales des Maisons des Semences Paysannes*, an international congress in 2012 in Boulazac,[20] and the many exchange days, such as those organized with Mexican farmers and researchers in Paris and in Périgueux in 2014, and with Italian farmers and researchers in 2015, proved to be important moments. The farmers explained that these encounters with other groups brought them new knowledge on the plant and on selection and conservation techniques. Previously, following the introduction of hybrid maize and the disappearance of open-pollinated varieties, farmers had no choice but to buy new seeds

[17] See the work of Jérôme DURY and Robin NOEL and the CASDAR project.

[18] https://www.semencespaysannes.org/

[19] *[Ibdem.]*

[20] Réseau Semences Paysannes (2014)

every year. As a result, some had lost the knowhow associated to the cultivation of population maize, or had never learned to do the selection themselves.

The group's exchanges and projects, including DIVERSIFOOD, shed light on various aspects of maize farming, while also creating opportunities to widen conversations around its recent (re)introduction on farms. The establishment of a shared “grammar” on maize made it possible to describe the different actions and experiments undertaken within the group; this in turn enabled shared work on the issues of characterizing, selecting, and promoting population maize. The search for seeds and for information on technical questions led to the constitution of a new identity around maize. Maize is the staple food in Mexico, where it has an important role in collective identity. It is very important for food security in rural parts of Brazil, and has a prominent place in the gastronomy of the north of Italy. In France, in contrast, maize is mainly used as animal feed, and has never previously been openly associated to a local identity. In Europe, when it was grown on small farms for domestic uses and introduced into food preparation, maize was viewed as a form of dietary degradation (Flandrin, Montanari 1996). Although there are strong historical links between this plant and certain regions in France (Cararetto 2005 ; Carraretto & Beigbeder 2018), maize cultivation has always been subject to controversy. The place and reputation of maize has changed with political circumstances and the different phases of agricultural modernization. In 16th-century Europe, maize was seen as a foreign plant, sometimes understood as dangerous, and then as a grain for poor peasants (Braudel 1979; Cazzola 1991). In the postwar period, maize was transformed as a vector of modernization, under the influence of the development of commercial hybrids (Ducos & Joly 1993). In the Aquitaine region, in the late 1950s, as hybrid varieties almost completely replaced local ones, maize became the symbol of the homogenization of the agricultural landscape (Bonneuil & Thomas 2009) and the "end of the small farmer" (Mendras 1967). Considered as the hallmark of rural modernization, the use of maize in industrial agriculture then made it a target for criticisms of agricultural modernization (Brunel 2012).

This ambivalent inheritance from previous ways of conceiving the productive and dietary role of maize, derived from the imaginaries of postwar agricultural modernization, was not appropriate to define the work undertaken by the collective. What they needed was to constitute a new image of maize based on its recent introduction onto farms seeking autonomy and recognition for farmers' seeds. This collective work, conceived as a way of sharing seed, experimentation, and knowledge around maize, became the means for formulating this new vocabulary. The AgroBioPerigord group thus had to work on multiple fronts simultaneously: structuring technical work where the relevant knowhow was lacking, while generating new botanical and social representations of maize.

The efforts of the collective were thus also assembled around an iconographic and lexical space that needed to be filled. Undertaking this vast task required them to devise new

expressions and definitions. The term "population maize", which was adapted from population genetics, became part of the everyday language of the collective. It was necessary to devise means for describing individual farmers' experiments with population maize. The process undertaken for this purpose culminated in the construction of a new maize imaginary. The group had to distance itself from the image of maize associated to the hybrid maize, and, at the same time, construct a new image which drew on the experiences of the Dordogne collective as well as those of other groups. Problematizing some of the concepts linked to the cultivation of hybrids required understanding and analyzing the associated dogmas. For example, the group had to set aside the view of **maximizing heterosis as the exclusive methodology** for improving maize, and thus introduce different protocols for **mass selection as legitimate techniques**. This process also led to a closer examination of the limitations of concepts such as homogeneity and productivity as universal values in plant selection. In the emerging new semantic framework, the terms "biodiversity", "heterogeneity", "exchanges", and "*création paysanne*" replaced the standard reference terms for commercial seeds such as "homogeneity" and "stability". The wide morphological diversity of ears of corn (shape, size, colour) and maize plants (colour of the stem, height, ear insertion) created a need for greater lexical precision, to allow farmers to recognize and select certain characteristics (positively or negatively).

In parallel to the development of new selection practices and the enrichment of the day-to-day vocabulary needed to characterize the biological variations in the plant, another very important dimension was the readoption of suitable machines and tools. One example is the reintroduction of the corn picker, which harvests full ears. The harvesting of commercial hybrids is generally carried out using harvesters which remove the kernels from the ears directly in the fields, or forage harvesters, for ensilage. As hybrids came to dominate, these machines were sold off, and French corn pickers found a second life in eastern Europe, where they were still sought after. Now, corn pickers are returning to French farms growing population maize through the second-hand market. But they are a rare, and thus costly, commodity. A similar story happened with the issue of drying maize. As another consequence of the industrialization of maize cultivation, beginning after the war, all post-harvest processes, including drying, came to be handled by the cooperatives. And beginning in the 1960s, the selection and production of seed and the management of stocks of grain corn were no longer handled on farms. The farmers stressed that they not only sold off the machines, they also lost their knowledge of the different phases of work with maize. Finding small grain dryers, either electrical or gas-powered, is thus very difficult. Some farmers have been forced to transport their harvested corn over long distances to be dried. Now one of the solutions that the members of the collective have found is the reintroduction of cribs, structures made of iron with metal grills that were once used to dry and conserve maize (Figure 2). Recently, cribs and machines for removing the kernels from the cob have been reintroduced onto the farms that grow population maize.

Figure 2. Cribs

5.5 The adoption of population maize: choosing autonomy in a collective context.

The farmers interviewed do not share all of the same agricultural practices. Twenty-one are organic farmers and eight are conventional farmers, conservation agriculture, or some other type of farming. Their production varies widely with their different specializations (milk, meat, grain, eggs, foie gras, etc.). Farmers with cattle use most of their agricultural surface area as pasture (Fig. 3).

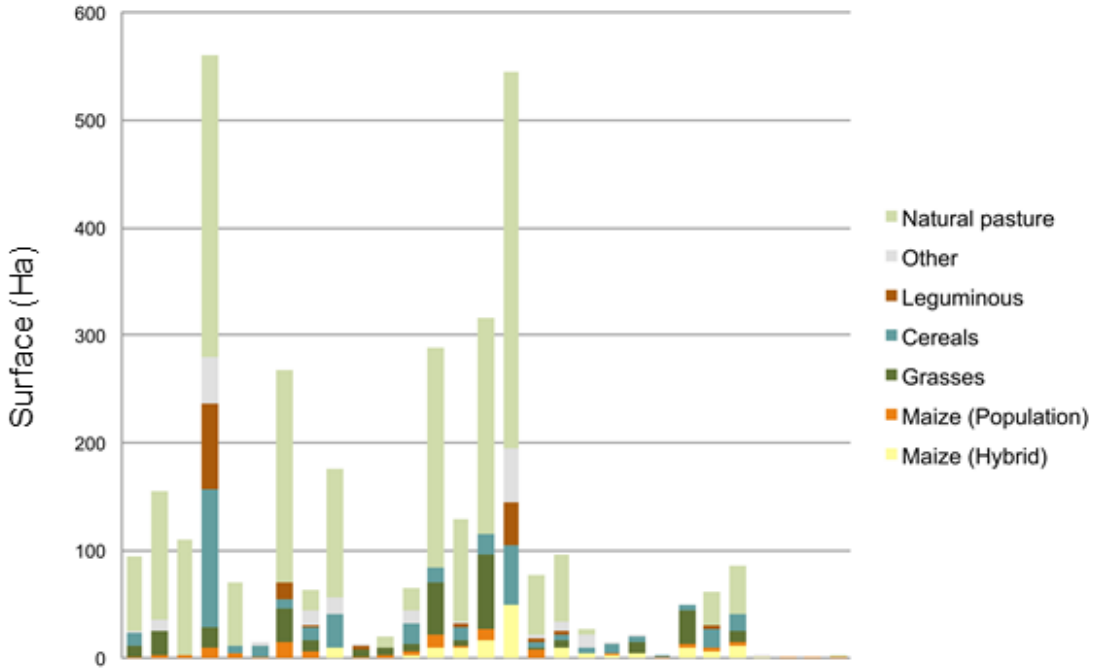

Figure 3. Surface area in hectares devoted to different crops

There are, however, similarities in terms of work organization on the different farms, given that in each case the labor is mainly provided by the family itself. Moreover, farmers working with population maize share certain cultivation practices. Most of the farmers (24/29) grow population maize without irrigation. Eighteen use manure, five use organic fertilizers, and six use chemical fertilizers. All of the farmers practice mechanical weeding, while only four also use chemical herbicides.

Maize is generally used directly on the farm, but six of the farmers indicated that they had sold population maize as well. On the other hand, nine said that they had been obliged to buy maize from the outside to meet the needs of their farm. Eight of these had bought hybrid maize, explaining that population maize is very difficult to find. Recently, there has been a movement to reintroduce population maize into the cuisine of southwestern France. Ten of the farmers interviewed said that they hoped to promote the use of population maize as food. Some of the producers had already sold grain maize or corn meal to restaurants, private individuals, or to Biocoop (an organic supermarket chain).

With respect to the adoption of population maize and the replacement of hybrids, eight of the farmers had completely replaced hybrid maize with population maize in the areas previously allocated to it. Seven further farmers produced population maize on around 30% of the land devoted to maize (Fig 4). And nine of the farmers who still produce hybrid maize indicated that they would consider progressively replacing it with population maize. Only six

of the farmers had never grown hybrid maize, and instead had directly adopted population maize. A large majority of the farmers (23) explained that the next time they are seeking population maize seeds they will request them from the *Maison de la Semence* and/or other collectives, while only four said that they did not expect to seek other seeds in the future because they are already satisfied with the ones they are currently growing. Despite the diversity of cultivation practices and uses of maize, it is crucial for maize farmers to be part of a collective of farmers, to divide the tasks linked to the management, selection, and conservation of the seeds.

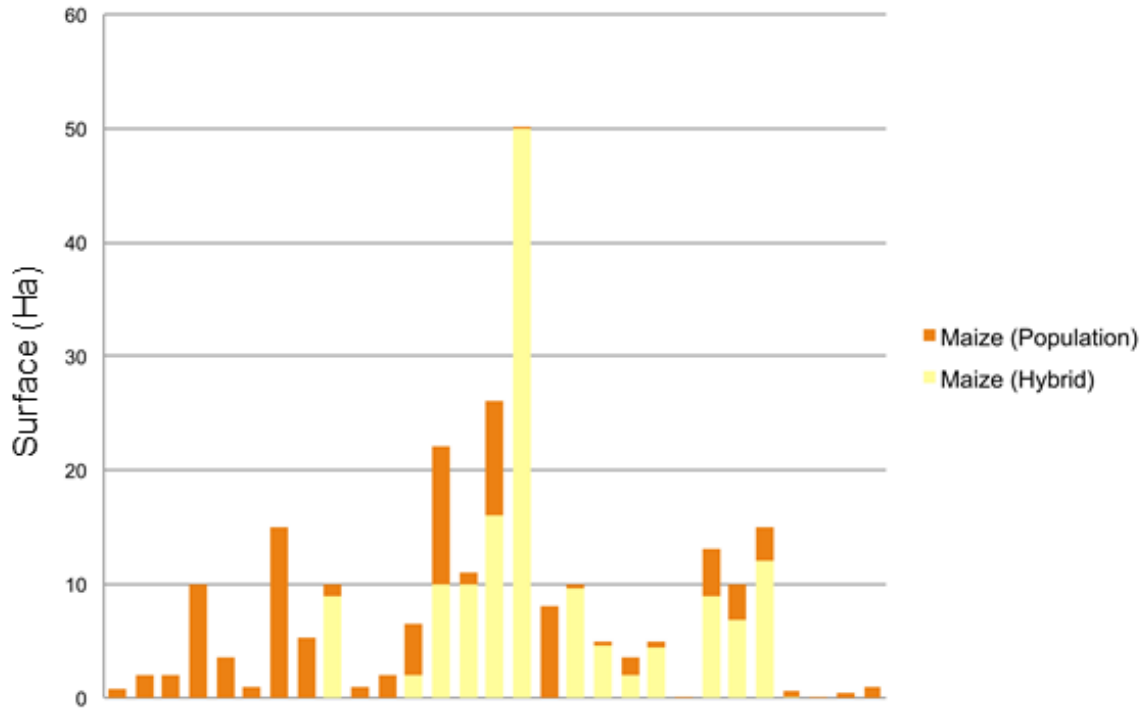

Figure 4 Hectares seeded with population maize (orange) and hybrid maize (yellow).

Management through a network means that even if at the scale of individual farms, most farmers only "care for" a single variety, at the scale of the group of farmers who were interviewed, the number of varieties grown is very large (Fig 5).

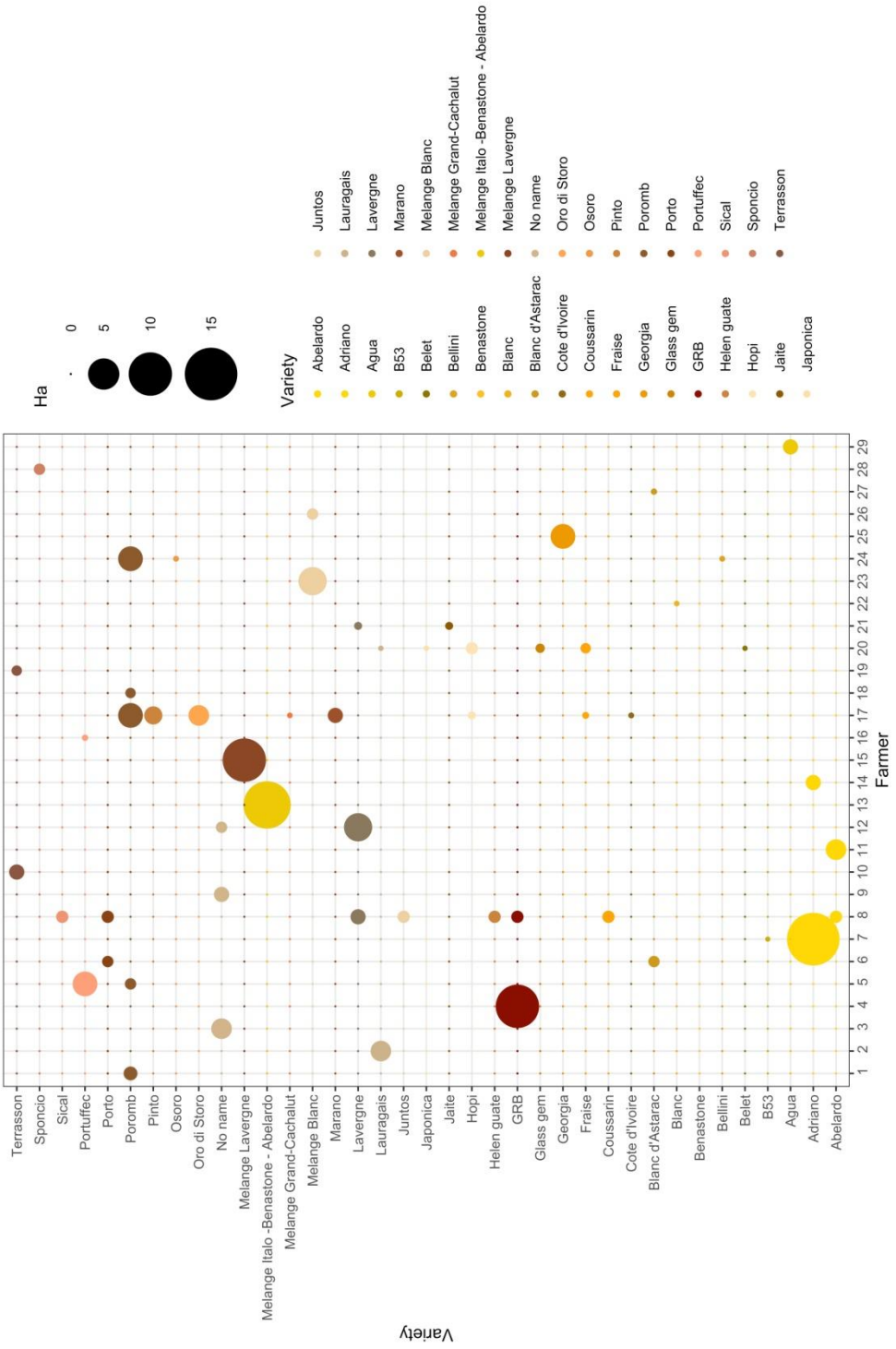

Figure 5 Varieties of population maize (ha).

The low productivity of population maize with respect to hybrids is seen as one of its weak points. The mean yield of grain corn reported by the farmers from population maize was between 26 and 47 q/ha. However, the principal problem they identified is seed management, and in particular selection, drying, and storage (Fig. 6).

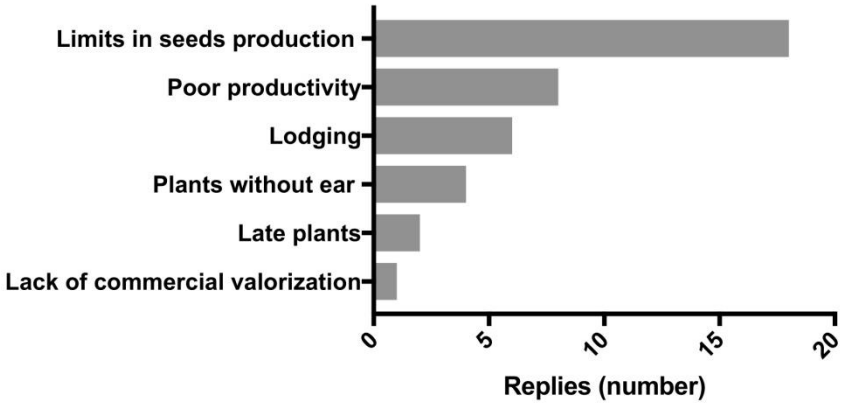

Figure 6 Principal limitations of population maize. Answers to the open question: "What do you see as the main limitations of population maize?"

5.6 The choice of population maize.

The farmers considered the various tasks associated to the seed management (conservation and multiplication) the most limiting aspect of growing population maize. These long and laborious practices, not yet fully mastered, nonetheless allow the farmers to have reproducible seeds. The farmers indicated that having "their own seed" was the principal motivation for their work with population maize, and it explains the conservation of these types of maize on their farms (Fig. 7 Left). On the questionnaire, we asked the farmers what were the agronomic, cultural, and political reasons that influenced their decision to grow population maize (Fig. 7). The list of possible responses was formulated through a consultation with 10 farmers (French and Italian). In most cases, the questionnaire was used as a guide in conducting personal interviews with the farmers. Most reported that the chief agronomic reason for adopting population maize was to have their own seed, and thus to be able to grow and reproduce it from one year to the next (Fig 7 Left). Using their own seed also allows them to save on the cost of seeds, and, the farmers explained, to avoid being dependent on the private sector, in particular the cooperative and seed companies (Fig 7 right). Many also cited the better nutritional quality of population maize and the possibility

of offering consumers a different product as important factors. Higher protein content motivated some farmers' interest in population maize for animal feed[21]. Population maize is valued as feed for goats, and has come to be used widely on farms with dairy cows as well.[22] Population maize yields high-quality ensilage, as the plants develop good quantities of biomass and remain green for extended periods.

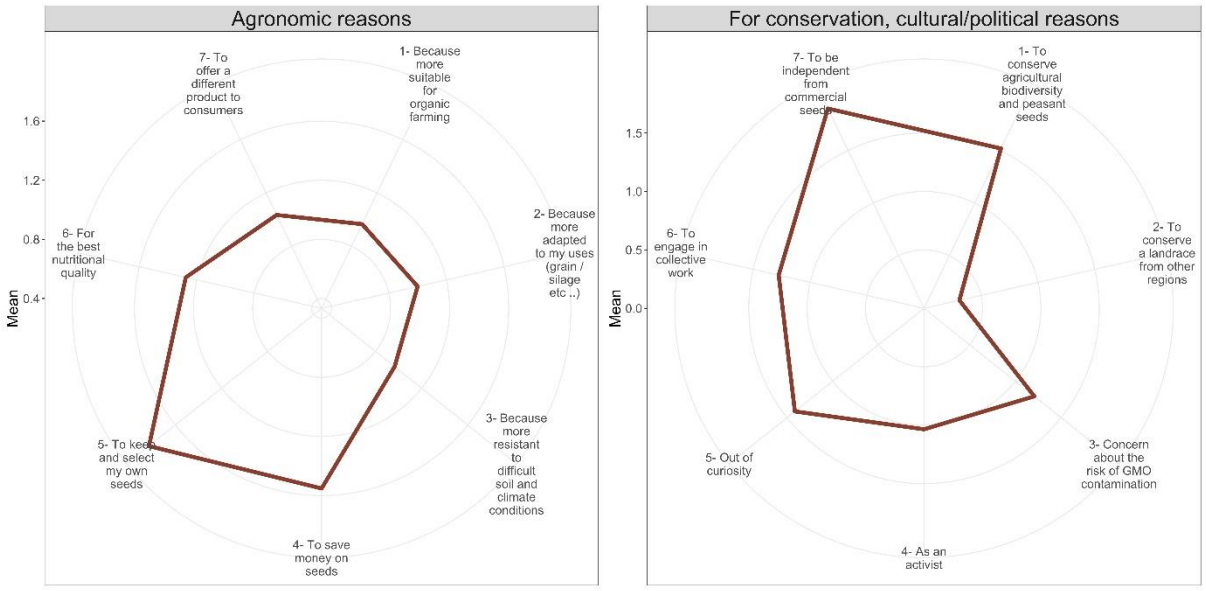

Figure 7 Main reported reasons for the decision to grow population maize. Answers given for agronomic (Left) and cultural/political (Right) reasons. Mean importance attributed to each by farmers, blue line: Main (= 2) less important (=1) not relevant (= 0).

Farmers raising poultry are very satisfied with the palatability of population maize, which is notably due to the small size of the kernels of some population varieties with respect to hybrids. The taste and nutritional properties of population maize have motivated some farmers to adopt it for human consumption. In contrast, reasons linked to the agronomic behavior of population maize, such as being "better suited to organic farming", were not indicated to have played an important role. The choice to grow maize under more rustic

[21] http://www.adage35.org/wp-content/uploads/2010/11/Ma%C3%AFs-pop-fin-de-prog-publi-FRAB-mai-2014.pdf

[22] On the case of the adoption of population maize for dairy cattle, see the work of other collectives, the ADDEAR 42 in the Loire department and the CIVAM 44 in the Loire-Atlantique department.

conditions, in particular without irrigation and with limited inputs is also among the reasons for its introduction onto farms, but it is not seen as a central aspect.

The answers given to the questions on the cultural and political reasons for the adoption of population maize once again highlight how important it was to farmers to have their own seed (Fig 7 right). Here, the main motivation cited was autonomy with respect to commercial seed. The second was the choice to work on the theme of farmers' seed (*semences paysannes*) and the conservation of agricultural biodiversity. Most of the farmers indicated that curiosity as well as the risk of contamination of commercial varieties with GMOs were the main initial drivers. However, a majority of the farmers did not see their approach in terms of an open commitment to activism. Another reason many indicated as important was the possibility of being part of a collective. The choice to grow population maize is linked both to a quest for autonomy and to the establishment of a network both for material resources (seeds) and for intellectual ones (knowledge, visions, values). The objective is to share both knowledge and seed, which are simultaneously generated at the individual and collective levels, within a circle of peers.

Thus far, we have detailed the importance of being part of a collective in order to exchange both seeds and knowledge on population maize. Among the chief motivations behind the choice to grow population maize is the "conservation of agricultural biodiversity and farmers' seeds". However, the farmers did not identify the formulation of "conserving landraces from other regions" as a significant element in explaining their choice (Fig 7 right). The main reason motivating the adoption of population maize was the possibility of working with "one's own seed." Over time, with the efforts that farmers devote to selection, the population maize that each received at the outset is increasingly "personalized." In this case, the farmers expressed a clear desire to "conserve" it. Some farmers explained that, despite a lack of both space and time, they grew and expanded their population just in order to avoid losing the seed. The other parts of the study, and the work of the *Maison de la Semence* shed further light on these results.

5.7 To each their own seed

The work of AgroBioPerigord ensures that the population varieties and knowledge developed on the farms of each of the members can be shared by the collective. In this context, the different varieties of maize are treated not as "genetic resources", but as particular seeds with a history. The MDS attempts to keep a history of each population, in order to improve knowledge on the agronomic behaviour of each variety. In this context, it is important to record the name of the farmer and the variety the farmer grows, for how long and in what pedoclimatic conditions, etc. The work of the team thus indirectly creates a kind of collective memory based on the genealogy and trajectory of these varieties. In some

cases, farmers develop a new population, to which they give a new name. If it is shared within the collective and adopted on other farms, this population will then go on to be "personalized and shaped" by the other farmers in turn, in a dynamic which is potentially endless. Figure 9 shows a reconstruction of the origin of some of the varieties grown by the farmers interviewed for this project, on the basis of interviews and AgroBioPérigord documentation.

Farmers take care of their own variety, make autonomous choices, and adapt the seeds to their environment and according to their own preferences. Armand Duteil explained that: "My father brought Oro di Storo back to the farm after a trip to Italy. It had yellow, orange, and red ears. We didn't know much about this variety, and we thought they were separate varieties, so we planted them separately to avoid crosses. But even separately they yielded the same proportion of colours. In fact it was all one variety. After that I gave up the yellow ones when I was selecting them, because the colour is too classical, it reminds me of hybrids. Also I noticed that I was harvesting more of the orange ones than the red ones. Unconsciously I don't much like the homogeneity of the red kernels. The golden/orange colour is beautiful, but now I force myself to take some red ones too."[23]

Maize populations can show adaptations to local environmental conditions, but also the traces of farmers' selection practices, particularly in color, timing, and height. The part of the questionnaire that focused on selection choices offers an idea of the range of the possible choices (Fig. 8).

5.8 Saved seeds to be grown, not "genetic resources" to be conserved *in situ*

At the very beginning of the history of population maize in Dordogne, priority was given to the collection of different landraces, in the context of a search for alternatives to hybrid seeds for use in organic agriculture. All varieties of population maize were welcome, and could be included in the group's exchange, selection, and conservation activities. Farmers took an interest in the issue of the conservation of agricultural diversity as a living dynamic in seed management. For most, the idea of *in situ* conservation of maize varieties was not the main motivation. They were not interested in becoming the "guardians of genetic resources." The conservation of the Maison de la Semence's various batches of seeds was not an objective in itself, as it would be in a botanical garden or a germplasm bank. To stir real interest in conservation, the maize populations adopted and selected by farmers must become a "unique" variety for each of them: maize that represents the result of a major time investment in observation, selection, drying, and storage. The conservation of farmers' seeds, in the case of maize in Dordogne, involves a twofold dynamic: the possibility of understanding a maize population as "one's own" population, and the desire to take part in

[23] Armand Duteil, October 2017.

the collective work of dissemination and conservation. As the histories of maize in Dordogne show, an exotic variety can become local, and vice versa: every exotic variety was once a local variety somewhere in the world. The geographical origin of the seed thus provides important information, and farmers often wish to conserve a "foreign" variety by conserving its distinctive and original characteristics. However, once again, in this situation farmers choose to conserve a variety with which they have a specific relationship.

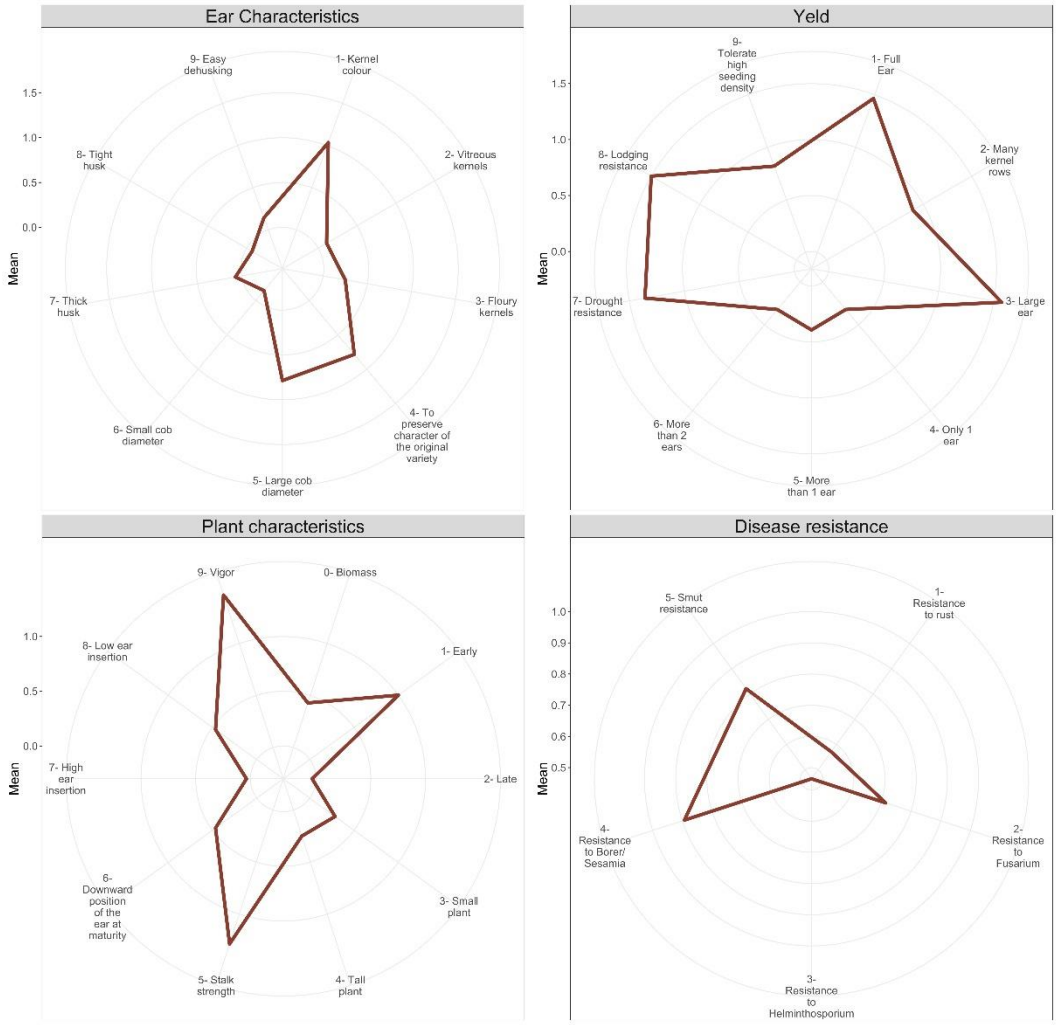

Figure 8 Selected characteristics. Mean of the selection criteria chosen by the farmers, blue line: Very positive (= 2) Positive (= 1) None (= 0) Negative (= -1)

5.9 Of Maize and Men

Over more than 15 years, the farmers and coordinators of the AgroBioPerigord association have experimented with different ways of working both at the individual and network scales. The structure of these multiparticipant processes is determined by the need to share seeds and knowledge, but also by the need to give shape, identity, and value to each actor's work with population maize.

AgroBioPerigord's first initiatives were devoted to the work of recovering and studying the platform's population varieties. After the initial 11 Guatemalan maize varieties, dozens of varieties from Europe and the rest of the world arrived in Dordogne: "With the maize from Guatemala we started from the fundamentals. There was a spectacular side, which we didn't intend or think of, that set off a new dynamic. People wanted to bring us their ancestors' maize. I think it wouldn't have been the same if we'd started with seed from here."[24] People who learned about the work of AgroBioPerigord brought what they had, what they found. "The names came after; at the beginning we called it Spanish, Italian, Brazilian, Portuguese."[25]

The effect of these maize varieties, arriving from everywhere and brought together thanks to the work of the *Maison de la Semence*, was above all to change the approaches and images associated to maize cultivation. These population varieties often had no name, their characteristics largely unknown, and they were poorly adapted to the photoperiods and pedoclimatic conditions in Dordogne. The work involved was immense: characterizing them, naming them, "domesticating" them, and distributing them to different farms. Adopted on farms and subjected to different selection pressures, these varieties continued to transform over time. On each farm, what started as a given "variety" of population maize became unique, "someone's seed." AgroBioPérigord's work is marked by an open-ended series of "adoptions" and transformations, more than it is by conservation as such. To see this, it is enough to look carefully at the ways in which the different varieties have made their way into the collective (Figure 9). The history of the group's work on maize highlights the crossing of these varieties, and the impossibility of maintaining an attachment to conservation criteria based on the dichotomy between local and exotic. Not only the geographical, but also the "human" origin of maize populations remains very important information. It allows a maize population to be identified within the collective. However, the origin of a given variety does not reflect what it will subsequently become. According to the farmers, having "one's own seed" is the most important aspect of the work with populations. It is thus the botanical and human trajectory taken by these varieties that makes work with population maize a unique experience, at once personal and collective.

[24] Bertrand Lassaigne, October 2017.

[25] Valérie Abatzian, January 2015.

Name	History	Beginning
Chavito	*Création paysanne* (Farmers' creation). Guatemalan maize accidentally crossed with another population of French white maize.	2003
Abelardo	Name of the Spanish intern who provided the seed. This maize was selected on his family's biodynamic farm in the Valencia region of Spain.	2003
Italo	Donation from a family of Italian origin. Maize which originated in Italy, but was previously cultivated in the Lot-et-Garonne department	2003
Ruffec	Donation from a farmer in the village of Ruffec (Charente)	2002
Lavergne	*Création paysanne*, a [mixture] of 12 varieties. Selected on a plot named Lavergne on the Ribeyrolles farm in Dordogne. This is the first mixture of population varieties.	2004
Benastone	*Création paysanne*, mixture. Selected on a plot named Benastone on the Ribeyrolles farm.	2005
Sical	Donation from from a family of farmers on the "Sical" rancho in Guatemala.	2001
Juntos	*Création paysanne*, 28 varieties from the platform, 2 varieties from Périgord, a Brazilian variety, a Moroccan variety, one from the north of France. Juntos means "together", because it is a mixture.	2010
Porto	*Création paysanne*, mixture of different seed batches originally from Portugal.	2003
Agua	Derived from the Agurtzan variety from Guipuzcoa in the Basque country, which had been donated by the association Ekonekazaritza. A transcription error led to one batch being called "Agua". It has been differentiated from the original, and has maintained this name.	2003
Hélène Guaté	Named "Hélène" after the Guatemalan woman who brought Bertrand Lassaigne to the village where he harvested the maize varieties included in this mixture. It contains the varieties Don Victorio and Don Jorge, after the names of the farmers who gave them to him, and Indio, as the name of this donor is unknown.	2005
Coussarin	Donation from a member of the Dordogne Chamber of Agriculture. His mother cultivated this maize, which she called Coussarin, in Beaumont.	2007
Roux Basque	Basque country, Various farmers, INRA,	2002
Georgia	*Création paysanne.* The name was given in honour of the daughter of the farmer who did the selection.	2013

Belet	*Création paysanne* (Dordogne). Crossing of a late variety, sown early in the season with two earlier Portuguese varieties. This second sowing was carried out because many plants had failed. The late plants that survived the second sowing crossed with the early ones. Belet is the name of the plot on the Ribeyrolles farm.	2005
B53	*Création paysanne*, Dordogne, mixture	2005
Blanc d'Astarac	Name of a village between the Gers and Hautes-Pyrénées departments.	2002
Grand Cachalut	Donation from a farmer in Auch, in the Gers department, whose family had conserved this maize	2007
Poromb	Donation from a farmer in Gers, but the maize originates from Romania.	2008
Adriano	Brazilian protocol, 12 varieties from the platform. The name Adriano is in honour of the selector Adriano Canci, who helped the association to establish the "Brazilian protocol."	2008
Hopi	Name of the maize of the Hopi Indians of northeastern Arizona, United States. Donation from a German seed bank.	2007
Lauragais	Donation from a farmer who had obtained it from another farmer in the Lauragais region, southeast of Toulouse.	2012
Jaite	*Création paysanne* grown and selected in the Basque country	2006
Oro di Storo	Donation received during a trip to Italy by a farmer who brought it back to his farm. Storo is a municipality in the Trentino-Alto Adige region.	2014
Portuffec	*Création paysanne* by a farmer in the Vienne department, Jacky Debin. This is a directed cross, by castration, between Ruffec and a maize from Portugal (Porto) which had been given to the farmer in 2003.	2008

Figure 9 the origin and the story of some of the varieties grown by the farmers

6 Italy - Marano and Sponcio Consortium.

6.1 The recovery of local maize in Veneto: the Marano and Sponcio landraces.

In the immediate post-war period, hybrid maize was introduced in Italy with American cooperation and support of the Italian government (Bernardi 2014). Spreading rapidly over the North of Italy, it considerably changed the agricultural landscape and gradually led to the disappearance of landraces (Lorenzoni e Salamini, 2007). In Italy, interest in maize's genetic resources and the first systematic *ex-situ* collections of landraces developed in parallel to the spread of hybrids. Agronomists and breeders feared that the local genetic material might get lost. In the 1950s, geneticist and breeder Luigi Fernaroli at the Maize Experimental Station in Bergamo was responsible for organizing a concentrated effort to collect maize all over Italy. By the end of the 1950s, the Station in Bergamo had already established a collection that exceeded 500 varieties (Fenaroli 1969). Soon the Nazareno Strampelli Institute of Agrarian Genetics and Experimentation in Lonigo (IGSA) added several more collections.

The need to preserve maize crops in good conditions in regions that experience cold and wet autumns and winters has led to the presence in Italy of a wide number of local maize populations; their kernels are vitreous rather than floury (Bressan *et al.,* 2003). Apart from conservation reasons, farmers preferred vitreous maize varieties for cooking *polenta* because of their nutritional quality. As a farmer from Veneto, a pioneer in organic farming in his region who preserved landraces in his farm, explained during a meeting: "Rather than having vitreous kernels, like in the varieties used for polenta, the commercial seeds found in stores almost always have floury kernels, which are only suitable for animal food and display a stark genetic homogeneity. The rationale for large seed companies was to provide a limited number of varieties that were suited for homogenous farming conditions, which could be controlled using chemical products and artificial irrigation"[26]

In the 1990s, in Europe, the networks for crop diversity conservation and spread started implementing theirs actions at the local level [27]. In Veneto, the Strampelli Institute launched a regional project to protect and preserve the "ancient cereal varieties of Veneto." The agronomist and geneticist Silvio Pino took part in the project, which was financed by the province and in 2000 began looking for local maize landraces in the area: "Instead of using our collections in the germplasm bank, we wanted to find out what crops farmers were still growing. We went looking in farms and were sometimes joined by people who knew the

[26] Guido Fidora, February 2013.

[27] See the history of the European movement on agricultural biodiversity known as the *Let's Liberate Diversity*: https://liberatediversity.org/ and its partners like Rete Semi Rurali http://www.semirurali.net/ or Reseau Semences Paysannes: https://www.semencespaysannes.org/.

area well. We were trying to collect information on people who might still own some ancient varieties; we even went asking around in mills and schools".[28]

His research focused mainly on foothill and mountain areas because these are richer in crops that cannot be traced back to commercial varieties. The highest number of seed accessions were collected in the provinces of Belluno, Treviso and Vicenza. Thanks to this project, the Strampelli Institute collected more than 60 seed samples of open-pollinated maize varieties of white, yellow and red grain maize. All the sampled collected were being added to the previous collections dating back to the 1950s. The Institute was responsible for the characterization of the collected material, describing each new accession based on its morphological, agronomic and qualitative traits (Bressan *et al.*, 2003). Some collections have been multiplied while others have been preserved for later reintroduction in the area, as was the case for the *Marano* and *Sponcio* maize varieties as well as the *Bianco Perla* (White Pearl Maize).

Silvio Pino explains that the intention was to implement a strategy based on the collaboration between different parties: research institutes or schools, leading the conservation and experimentation efforts; farmer groups, interested in introducing the local maize seeds in their farms; and consortia and cooperatives, responsible for the organization of seed distribution, transformation processes and commercialization. For every maize variety, there was supposed to be an institute to oversee its conservation and technical monitoring. Thus, the *CRA-Maize Research Unit of Bergamo* (CRA-MAC) in Bergamo and the Strampelli Institute supported the cooperative for *Marano* and *Sponcio* maize. Furthermore, agreements with schools were established whereby these would participate by "adopting" a maize and taking care of its conservation and multiplication. Today, the Agricultural Institute "A. Della Lucia" in Feltre, in the province of Belluno, is responsible for *Sponcio*, while the Agricultural Institute Domenico Sartor in Castelfranco Veneto (TV) oversees *Bianco Perla*.

6.2 History of the *Marano Vicentino* maize

Towards 1890, a member of an influential family in *Marano Vicentino*, Antonio Fioretti, crossed the maize variety *Nostrano di Marano*, a low and early-maturing maize, with the *Pignoletto d'oro* variety, originally from the Rettorgole area, which is a late-maturing, vitreous maize almost red in color. Nello Fioretti, the grandchild of Antonio Fioretti, explains that "after the first crossing, my grandfather performed massal selection for twenty years with the objective of combining the quality of *Pignoletto* to the productivity of *Nostrano*, which was primarily characterized by having multiple ears on one plant".[29] Year after year,

[28] Silvio Pino, October, 2017.

[29] Nello Fioretti, October, 2017.

thanks to massal selection, Fioretti succeeded in fixing some traits such as color and yielding capacity of at least two ears per plant. The *Marano* plant is considered by farmers to be very "elastic:" Environmental conditions permitting, the plant can grow and bring to maturity multiple ears on the same plant.

In 1924, the *Marano* variety was still almost unknown among experts. In following years, its popularity grew progressively. *Marano*, thus, is described as a variety of limited dimensions, rarely exceeding 2 m in height, with multiple ears that are slightly cylindrical and small with a white cob. The spyral-patterned kernel rows lend a very specific appearance to the ear. The seed is vitreous, small and round with an intense orange pigmentation (Zapparoli, 1939).

After the death of Antonio Fioretti, the sons took over the management of seed selection until the mid-30s when the Provincial Inspectorate of Vicenza started supporting seed distribution in the area (Zaccaria 2012). The family farm continued its seed production, but its marketing is entrusted to the *Consorzio Agrario Cooperativo* (Cooperative Agricultural Consortium) of Vicenza. In 1940, the *Marano* variety earns the government State Stamp and thereafter the Maize Farmer Section of *Marano del Marchio* is established in Thiene, in the Vicenza province; the section was responsible for seed production and its varietal purity as well as its placement on the national market. In the proceedings of the national conference on hybrid maize held at the Strampelli Institute in Lonigo on February 21, 1954, it is noted that the *Marano* variety covered approximately 40,000 hectares in Veneto and Friuli Venezia Giulia (16,3% of all maize grown); 7,500 of these all in the Vicenza area (Montanari 1954: 39). Farmers recall that in the *Marano* area, centered around the Fioretti farm, farmers were forced to grow *Marano* maize to prevent pollination by other varieties. "The Fioretti family practically forced to sow the *Marano* variety because they were doing the breeding and hence it was not allowed to sow hybrid varieties. As soon as the Fioretti family stopped managing the seed selection, many breathed a sigh of relief. Those who raised animals could sow hybrid maize, thus introducing the hybrids".[30] In the 1950s, institutions started increasingly supporting hybrid maize, causing tensions between the Fioretti family and the Strampelli in Lonigo: "There were heated exchanges between the Strampelli, who were promoting the new hybrids, and my uncle, Daniele Fioretti, who was an agronomist and held the itinerant chair in agriculture for the Vicenza Inspectorate".[31]

Despite its widespread cultivation in Veneto, in the 1960s *Marano* was almost completely replaced by hybrid varieties. Maize had generally lost its central place in the human diet and hybrid varieties were commonly used in the zootechnical sector because of their higher productivity. Yet, *Marano* maize has been widely used to develop pure lines and later to generate hybrid maize such as those in the Italo series (Ita = Italia – Lo = Lonigo), developed

[30] Laura Ferretto 2017

[31] Nello Fioretti 2017

in the decade between 1960 and 1970. In the catalogue of the *Società Italiana Sementi* (SIS), hybrid varieties, comparable to *Marano* maize, can still be found.[32]

6.3 The recovery of *Marano* Maize

The re-introduction of Marano maize started in 1999 and was the result of the work and commitment of three groups: the Nazareno Strampelli Institute of Agrarian Genetics and Experimentation of Lonigo that developed the technical aspects necessary for its reintroduction, the farmers in the area who had an interest in its recovery, and the chefs and food professionals in Schio, a municipality in the Marano area, who were looking for a polenta made with high-quality corn flour. Currently, Marano maize is grown in 24 different farms spread on the high plains, an area that covers municipalities such as Marano Vicentino, Malo e Schio, all in the Val Leogra and in the foothills of the Vicenza province[33].

Once different populations of Marano had been recovered, it was necessary to define its characteristics for the purposes of breeding, seed multiplication and redistribution. Marco Sartore, whose farm serves as the point of reference for the history of organic farming in the region, says: "I remember the endless discussions over every single ear, trying to determine what the main traits were supposed to be"[34]. Silvio Pino, the agronomist in charge of the recovery work, remembers that farmers were interested in understanding what was the "real *Marano*." This led to a historical and bibliographical research based on old documents and pictures: "In the end, we tried to reconcile all the farmers' recollections with the seed populations collected. We found a maize that matched quite well the description of *Marano* maize that we had reconstructed. Everybody was interested in understanding which population resembled most closely the *Marano* description; no one wanted to preserve simply the most productive."[35]

The Consortium for the protection of *Marano Vicentino* was established in 1999 in conjunction with the recovery efforts related to this maize variety. The objective is to protect this population and to promote the flour it produces. A farmer observes: "The consortium was created to prevent farmers from stopping to work together once the seed have been recovered. The ability to work together is poor; we are all individualists; it's the mindset of the North-East"[36]. *Marano* maize had already been registered with the *Ente*

[32] http://www.sisonweb.com/images/allProdotti/Mais%20Corniola%202015.pdf

[33] https://www.provincia.vicenza.it/ente/la-struttura-della-provincia/servizi/agricoltura/pubblicazioni/il-radicchio-di-marano

[34] Marco Sartore, February, 2013.

[35] Silvio Pino, October 2017.

[36] Anonymous, February 2013.

Nazionale Sementi Elette (National Agency for Selected Seeds) in the 1940s; however, the Fioretti family later failed to maintain the registration current. Following the establishment of the Consortium, *Marano* maize was once again entered in the register with the name *Marano Vicentino*. The registration in the catalogue of varieties was done in the name of the farmers who had formed the consortium for the protection together with the restaurateurs in Schio. Furthermore, the cooperative established in 2013 also organized the transformation and sale of the product: "One of the major challenges was to follow one single commercial policy. The farmers who are overproducing want to lower the price so as not to have any unsold quantities, which would primarily benefit the vendors. The cooperative was created to manage all these challenges. It collects the whole production and redistributes the flour with one single trade policy to protect all producers. It may decide to lower the price or to follow a different trade policy based on the harvesting year. It seems to us that this system works".[37]

After the harvest, the cooperative buys the maize and manages the drying and milling, also ensuring a uniform packaging. Production can oscillate dramatically from year to year, ranging from 20 up to 45 quintals per hectare. In 2013, for instance, production reached a total of 1400 quintals; yet, typically, it tops at 500. Every partner buys back his part of flour from the cooperative and is responsible for its sale, using the common name and the single price. Packaged polenta flour is also sold at the collective outlet point at the *Cantina Sociale* (Winemaker's Cooperative) in Malo. The consortium also established the product specifications, defining cultivation criteria. However, different agricultural practices coexist within the group; specifically, the consortium represents both organic and conventional farmers. For this reason, organic farmers grind their maize separately and package it with the organic logo. The *Marano* consortium does not own a mill and thus relies on an industrial mill; yet, in consideration of the artisanal vocation of this product, the consortium is evaluating the purchase of a mill.

6.4 Selection

Most of the maize fields in the *Marano* production area, the plains around Vicenza, are sown with hybrid maize; hence, farmers cannot use their plots for conservation or selection. The *Marano* protection consortium ensures the conservation of the maize variety, by sowing every year an isolated field located in the mountains, a so-called *campo seme* (seed field): "The ears produced in the seed field are the ones used to preserve genetic continuity year after year"[38]. Multiplication takes place in a different field, located in the hills, hence still ensuring a good protection from external pollen. It is from this production that all farmers take their seeds. Every year seeds from the *campo seme* in the mountains are used to sow

[37] Marco Sartore, February 2013.

[38] Giandomenico Cortiana, October, 2017.

the field in the countryside. Consortium members, thus, manage different selections, one for conservation and one for production.

Farmers have long appreciated *Marano* in the past because it can grow multiple ears on the same plant. However, these are small-sized ears, which during harvesting can be easily lost by the harvester. With the advent of mechanization, this became a problem, which probably contributed to its abandonment. Indeed, one of the breeding criteria adopted by the consortium dictates the selection of plants that have "only" two larger-sized ears. Other criteria reflect the effort to reduce lodging: farmers select smaller plants with low-ear insertion. Thus, a first selection on the plant is performed in the "seed field", where cross strategies are applied every ear to prevent inbreeding (Fig. 10A). Once selection in the field is completed, a second selection is performed on the farm both on the seeds destined for the "seed field" and those stemming from the hill field, which are used for sowing and production. The criteria adopted have contributed to the define the *Marano* maize traits. There should be 14 or 15 kernel rows of about 17 cm in length; the color should be vitreous orange; the cob should be white; and the kernel rows may display a spiral arrangement and should be full, with kernels all the way to the top of the ear (Fig. 10B). The Consortium's president, Giandomenico Cortiana, explains that these criteria cannot always be applied all at the same time: "Genetic variability is quite vast, but we try to stick to certain tracks"[39]. This work is accomplished collectively in the farm of one of the partners. Here, seeds are also prepared by discarding the end parts, at the top and the tail of the ear, and by feeding the cobs into a machine for shelling (Fig. 10C). Seed sacks for distribution contain a "*dose*," a measurement unit (4 kg) which can cover the sowing of a *campo vicentino*, the typical size field in the Vicenza area (Fig. 10D). One *campo vicentino* usually measures 3865 smq, almost 0,4 hectares.

[39] Giandomenico Cortiana, October, 2017.

Figure 10 Main phases in seed selection and preparation.

6.5 History of the *Sponcio* maize

Sponcio literally means "beaked ear" (stinging kernel) and is a variety belonging to the *Rostrato* maize, which is characterized by a protruding beak in the apical section of each caryopsis. Many maize varieties in the Belluno area belonged to Rostrata Group (Ardenghi *et al.* 2018). Contrary to the case of *Marano*, no bibliographical references are available for *Sponcio*, which could provide more detail on the morphological and agronomic traits. The main reason behind the concept of reviving *Sponcio* maize is tied to its vitreous grain, which makes it particularly suitable for *polenta*; furthermore, thanks to the reconstructed collective memory, its distribution was traced back to the mountain area around Belluno. When the project of recovering maize landraces started in 1999, *Sponcio* had already disappeared from these areas. Silvio Pino and Stefano Sanson from the Feltre Agrarian Institute succeeded in recovering it from a farmer in the Fonzaso area. The oral histories and the few written sources recovered were used to understand which was the "true" *Sponcio*. It was discovered that this maize variety, thanks to the decade long breeding carried out by farmers in the valleys, has a strong stalk and is therefore able to withstand lodging, making it well-suited for polycultures with climbing beans. The ear is large and orange in color, with beaked kernels and a thin, white cob.

The ***Sponcio*** maize is now grown by about twenty farmers belonging to the Fiorita agricultural cooperative in the valleys around Feltre. The Fiorita cooperative was established in 1977 to create purchasing groups for agricultural materials. Then, in 1995, the milk crisis triggered an extensive restructuring process of the zootechnical sector that saw the closure of small farms. The crisis forced the cooperative to rethink its production strategies towards greater diversity and a more direct relationship with consumers. Farmers, hence, started to

revive local cereal varieties (spelt and barley) to produce Dolomites' beer; however, they also introduced new crops such as potatoes, beans, and *Sponcio*. In 2004, the Feltre Agrarian Institute and Fiorita cooperative decided to form a protection consortium for *Sponcio*. The Sponcio consortium is responsible for ensuring the protected designation of origin, for the conservation, multiplication and distribution of *Sponcio* seeds for the Belluno valley, which comprises 25 municipalities. Contrary to the case of *Marano*, conservation and multiplication for *Sponcio* take place directly in the plots of Feltre Agrarian Institute and of certain producers enrolled in consortium. Thanks to the mountain area of production, the problem of hybrid varieties is limited. The Sponcio Protection Consortium, equipped with an independent management committee, is concerned with the management of the seeds and with the correct labeling during the transformation and marketing phases. The Fiorita cooperative and the Sponcio consortium oversee with the entire process, from harvesting to sale: "We are wedged between competing maize, the *Marano* towards Vicenza and the *Bianco perla* in the plain. Farmers decided that it would be ineffectual to go their separate ways. So, the whole production is harvested, collected and dried all together. The cooperative also deals with the commercialization of the flour"[40]. The participants include about 20 farmers, who cultivate one hectare each, yielding about 25/35 q/ha. Production totals about 500 quintals of flour per year. Grinding is performed in a 18th-century mill, originally a watermill that is today electrically operated, in the village of Villa Bruna near Belluno (Fig. 11). Over the years, the mill has been continuously running and since 2017 it is under full management by the cooperative. The milling of the grain is performed gradually to stock the cooperative's stores and salespoints. As is the case for the *Marano* maize, it produces a semi-wholemeal flour rich in oil; to control quality, there is a concerted effort to distribute the flour within three months from packaging.

[40] Eugenio Garlet, October, 2017.

Figure 11 Mill of Umin in the village of Villa Bruna in the Feltre municipality, Belluno.

6.6 *Sponcio*: a conservation variety

In 1998 the EU proposed a new directive[41] in order to conserve plant genetic resources by promoting a new legal framework for marketing landrace seeds. The EC directive 98/95 establish, for the addition of a section that includes "conservation variety" in the official catalog, a legitimate place for varieties that were not recognized in the official catalog of varieties. The introduction of the new concept of "conservation variety" allows farmers to

[41] https://eur-lex.europa.eu/eli/dir/1998/95/oj. A Directive "require EU countries to achieve a certain result but leave them free to choose how to do so. EU countries must adopt measures to incorporate them into national law (transpose) in order to achieve the objectives set by the directive" https://ec.europa.eu/info/law/law-making-process/types-eu-law_en

market not only the products of these varieties but also the seeds of varieties under threat of genetic erosion. This directive's objective was implemented by other directives aiming to protect agricultural species through the development of *ad hoc* seed market and *on farm* conservation systems (Bocci 2009). At the European level, there was a push toward seed policies more suited to organic and biodynamic models of agriculture. In 2008 a new directive, the 2008/62/EC, was published defining the methods and terms for the commercialization for agricultural landraces and varieties, including potatoes.[42]. In 2009 the Directive 145 allowed to include the horticultural species among conservation varieties and introduced another legal framework for the so-called "amateur varieties" and for the varieties without intrinsic value. Moreover in 2010, the directive 60 regulated the marketing of seed mixtures of fodder crops.[43]

Notwithstanding the European action, the implementation of the directive has proven extremely complex and is yet to be implemented in many countries. The principle of "conservation variety" was introduced in Italy by the Rete Semi Rurali together with other organizations and this process culminated with his approbation in a Legislative Decree in parliament in 2007[44]. Italy was the first European country which implemented a regulation for the conservation varieties following the new directives 2008/62; 2009/145 and 2010/60. According to the 2008 directive "conservation varieties" include ecotypes and cultivar of agricultural interest. Plants could be autochthonous or not, provided they existed in the local agro-ecosystems for at least fifty years. The threat of genetic erosion faced by these populations should be recognized and, consequently, they should no longer be cultivated on the entire national territory but preserved in institutes or by individual farmers or amateurs. Furthermore, there should be a concerted effort to demonstrate their economic, scientific, cultural or landscape value.[45] In order to prevent frauds, several rules have been recognized as mandatory. Concerning the conservation of these varieties, the seed must be reproduced in the zone of origin or diversification of each variety. There are also quantitative restrictions on seed production for the market and each conservation variety should have a traceability system. The directive on conservation variety gives the opportunity to recognize different seed systems and develop a more suited market for these heterogenous and farmer varieties. The efficacity and the benefit on crop diversity depend on the implementation at the national level (Lorenzetti *et al.* 2009; Bocci 2012). Each country can adapt the European directives on the conservation varieties establishing its own regulations. Several limitations have been identified, if the procedure is interpreted in a restrictive way or misunderstood,

[42] https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:162:0013:0019:EN:PDF

[43] https://www.semirurali.net/files/9/.../Guida-ai-sistemi-sementieri.pdf

[44] *Ibdem*

[45] http://www.gazzettaufficiale.it/eli/id/2008/05/26/08A03391/sg

this could cause a lack of inscriptions and a lack of the revitalization of these heterogenous varieties in the market.

The Sponcio Protection Consortium decided to take advantage of this legal framework and registered *Sponcio* as a "conservation variety." The application to register the *Sponcio* was initially submitted to the Agricultural Ministry in 2005 by the Strampelli Institute. In 2015, the Sponcio Protection Consortium submitted a new request in compliance with the current legislation and only this one was finalized in 2017, once the Veneto region took the lead on it. *Sponcio* is the only maize variety that is currently registered as a conservation variety in Veneto. Its successful registration was welcomed by farmers because it allows them to officially commercialize the *Sponcio* seeds. However, the establishment of a legitimate space for the variety in the catalogue of varieties, while providing certain benefits, it might also lead to a limitation of agrobiodiversity, by defining what is permissible and what is not. Stefano Sanson, an agronomist who was especially involved in the registration effort, voiced his anxiety: "Were the Veneto region to implement the directive fully, every existing variety in the area would have to be registered in order to be grown and sold. Would that mean that anything not formally fitting into this framework would be considered illegal?"[46].

6.7 The adoption of local maize landraces within an entrepreneurial framework

The cultivation of *Sponcio* and *Marano* is carried out in plots that rarely exceed one hectare and are mostly located in the area of production. Both cooperatives, though accepting admission application from new members, do not have any interest in expanding production capacity. Currently, the expansion of the market is not possible, and these flours are mainly limited to local consumption. The demand and distribution of the Marano and Sponcio seeds, despite some minor fluctuations, tend to remain stable (Fig. 12).

[46] Stefano Sanson, October, 2018.

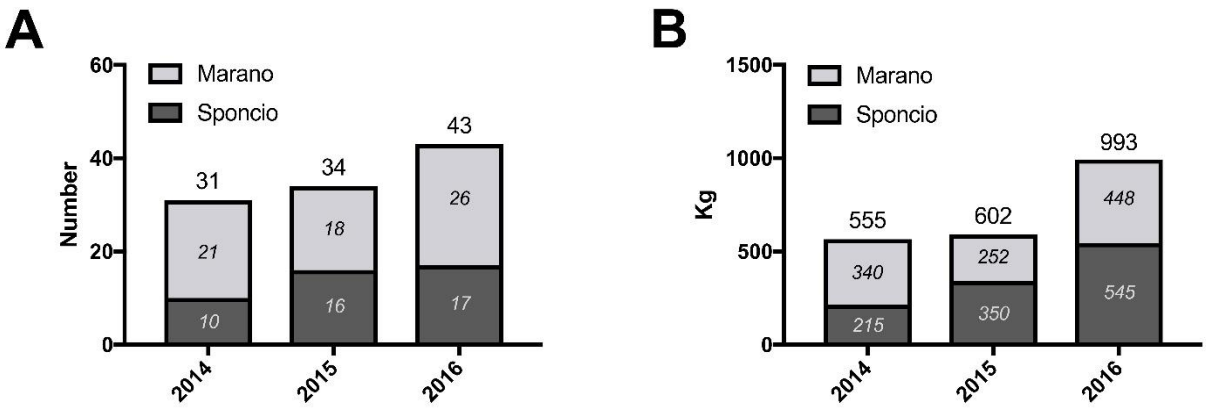

Figure 12 Number of seed transactions (A) and volumes of transactions (B) between 2014 and 2017.

Compared to the Aquitaine group, *Sponcio* and *Marano* group farmers often tend to perform another wage-earning activity not connected to their agricultural business. Farmers integrated *Marano* and *Sponcio* crops to diversify production and as a source of supplemental income. During a meeting on the subject of maize attended by several collectives, Renato Ballan, leading a group of farmers who preserve a specific species of white maize, *Bianco Perla*, observed: "The cultivation of maize is a form of entrepreneurship; it should not be a choice born out of nostalgia for a forlorn time and it should complement other activities. We commit to producing a high-quality flour and we aim at establishing a direct relationship with the consumer"[47]. Similarly, Stefano Sanson put the emphasis on the economic and nutritional importance, which he believes are key for any conservation strategy related to these varieties: "We are glad that the group [related to *Sponcio*] today paves its own path and that our didactic and conservation project spurred a beautiful entrepreneurial initiative. The conservation of biodiversity has certainly its aesthetic reasons but it's worth preserving mainly because of its high quality. Crop diversity conservation is ensured if you can market and eat it".[48]

Responding to questions regarding the main agronomic reasons behind their adoption of local maize, farmers cited the desire to offer a different and better product to their consumers (Fig 13, left panel). Like their French counterparts, *Marano* and *Sponcio* farmers affirm that the most important cultural reason supporting this choice is the opportunity to do their part in the conservation of peasant seeds. Differently from the French case, though, *Marano* and *Sponcio* farmers do not ascribe much importance to more political reasons such as concern over GMOs or independence from commercial seeds (Fig. 13, right panel). Still,

[47] Renato Ballan, March, 2018.

[48] Stefano Sanson, October, 2018.

farmers in both Italian collectives as well as in the French one responded that involvement in a collective group was a significant factor in their choice of sowing a local maize variety.

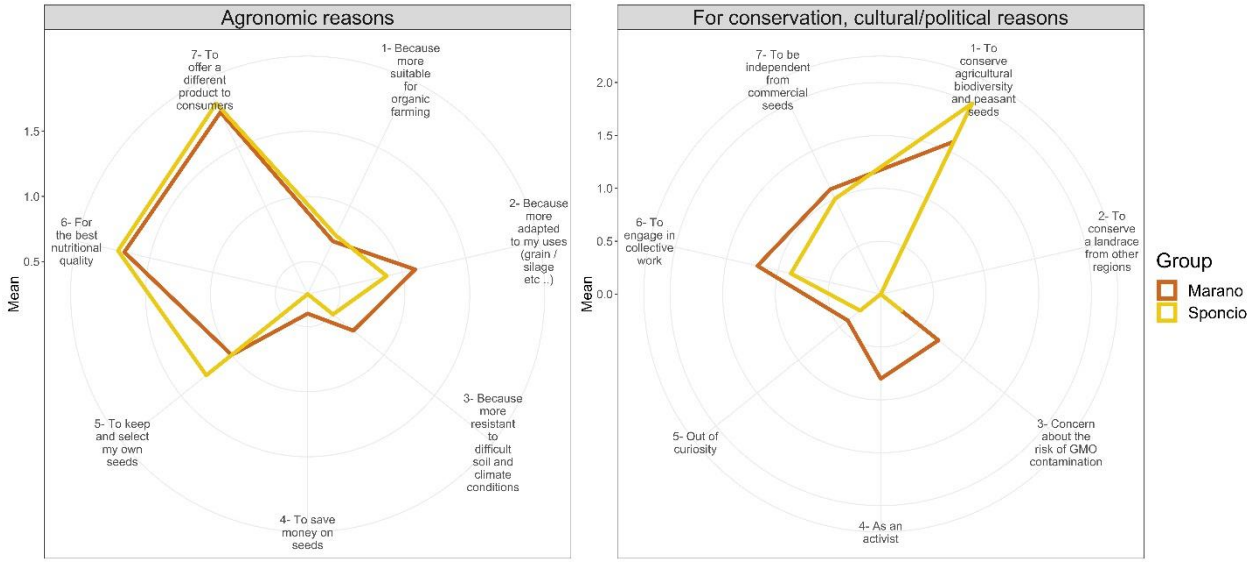

Figure 13 Main reported reasons for the decision to grow population maize. Answers given for agronomic (Left) and cultural/political (Right) reasons. Mean importance attributed to each by farmers, blue line: Main (= 2) less important (=1) not relevant (= 0).

Most farmers (12/18) manage their farm using conventional methods. As they explain, due to the size of the farms, averaging less than 20 hectares, the costs for a conversion to organic farming and its certification would be too high. Eleven farmers claim they rely on chemical weed. Specifically, in the case of *Sponcio*, mechanical processing is not always possible due to the mountainous area of production, which includes steep inclines and a rocky soil. Most farmers use organic fertilizers, in the case of breeding farms, specifically, manure. The two varieties of maize (hybrid and local) are managed entirely separately and differently. Hybrid is used directly in the farm as forage crop or sold to others farmers as animal feed, while local maize is sold through the cooperative organization. Although the productivity of local maize is not a central objective for the cooperative, the farmers do mention the low productivity of local maize as its main limitation (Fig. 14). Contrary to the farmers in the Aquitaine group, these farmers are not particularly attached to "their" seed. In fact, the conservation, selection, multiplication and dissemination of seeds is entirely managed by the Sponcio Consortium. For this reason, they don't describe these activities as "demanding" and limiting.

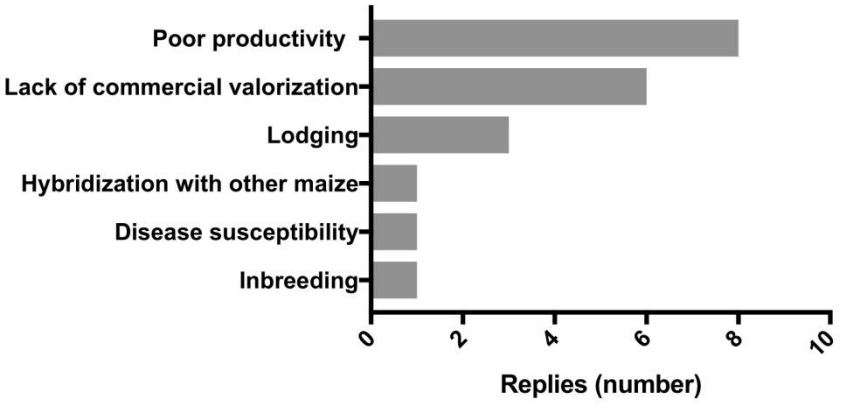

Figure 14 Principal limitations of population maize. Answers to the open question: "What do you see as the main limitations of population maize?"

The selection of *Marano* and *Sponcio* is carried out according to common criteria like the plant's strength, pigmentation and the shape of the kernels. However, there are some important differences relating to the typical characteristics used for the selection of each variety (Fig. 15). For the *Sponcio* variety, contrary to *Marano*, the ear should be large and plants with one single ear are selected; for *Marano*, instead, plants with multiple ears are selected. The *Sponcio* group seems more focused on the systematic evaluation of the variety's resistance to diseases.

For both groups present in Veneto, the management of the local maize population revolves around the entire transformation process, which starts with the harvesting, goes through the drying and milling phases to ultimately end with the sale. Mycotoxins represent the main problem for the *Sponcio* and *Marano* groups; these are toxic substances for humans and animals alike, produced by pathogenic fungi and molds in maize. The monitoring of mycotoxins falls under the responsibility of the producer and of the mill where the grain is processed into flour. If traces are found that exceed the maximum level allowed,[49] it is mandatory to dispose of the grain or flour. Thus, maize management for human nutrition requires much stronger controls compared to the zootechnical sector. Working in a system organized in cooperatives helps containing the costs of sampling and tests.

[49] Mycotoxins: maximum level (µg kg-1) of Aflatoxins B1 produced by the fungi Aspergillus per maize grain destined for food consumption = 5; for poultry and pigs = 20; for dairy cows =5. https://www.politicheagricole.it/flex/cm/pages/ServeBLOB.php/L/IT/IDPagina/9703

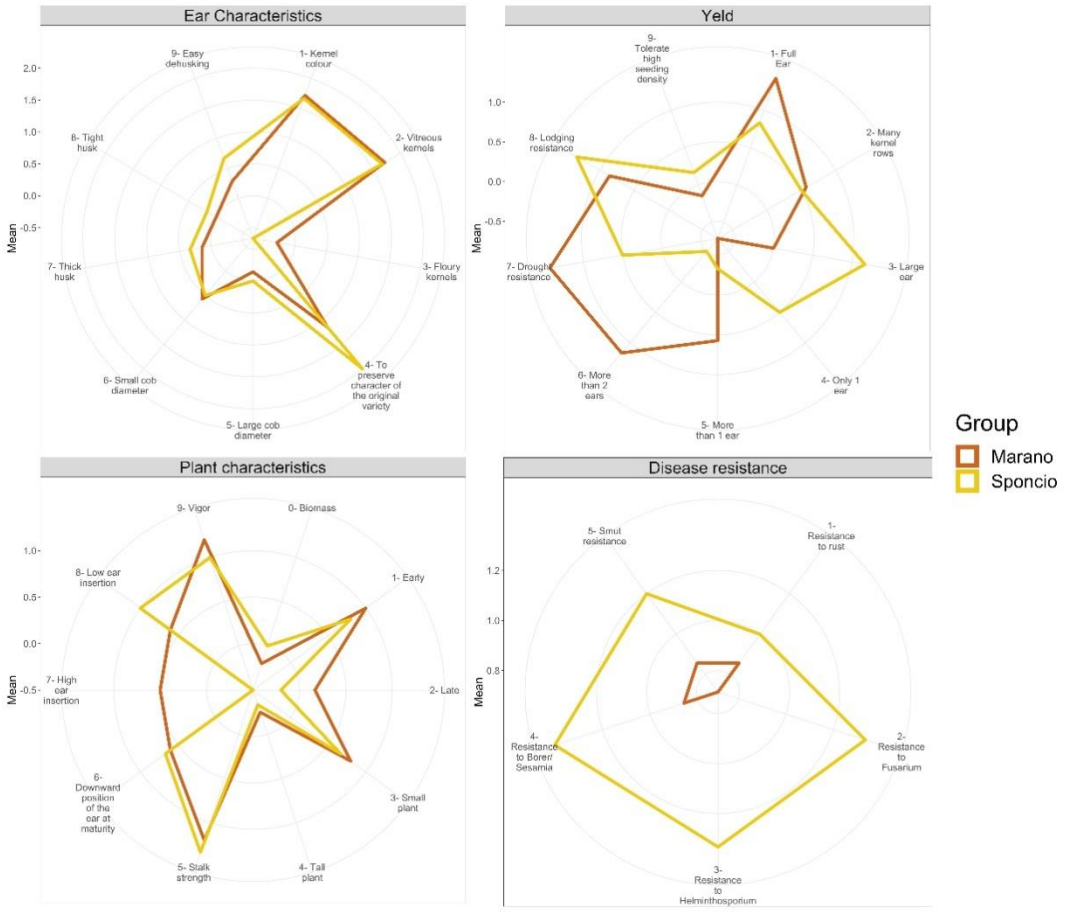

Figure 15 Selected characteristics. Mean of the selection criteria chosen by the farmers, brown line = *Marano*; yellow = *Sponcio*; Very positive (= 2) Positive (= 1) None (= 0) Negative (= -1)

Initially, consortia could rely on the support of the Strampelli Institute or of the Consiglio per la Ricerca in Agricoltura e l'Analisi dell'Economia Agraria (CREA – Research Council in Agriculture and Agricultural Economics Analysis) in Bergamo. In the last few years, these institutes, which were already in crisis, saw their activities further reduced and the former was nearly closed. There is no technical support service available for farmers growing non-hybrid maize any longer. The only activity still being carried out, albeit to a much lesser degree, is the conservation of maize collections in the germplasm bank. Thanks to the efforts of certain professors, some agricultural schools, like the one in Feltre, have recently introduced *in-situ* conservation and multiplication of a few older varieties. With the reintroduction of maize cultivation in farms, the issues of breeding and genetics of maize populations have become of central importance for the *Marano* and *Sponcio* groups. Yet, public programs for breeding and experimentation are still totally lacking.

6.8 Valorization through "authenticity:" a tool for survival but also a limitation.

Albeit taking different paths, both groups for *Sponcio* and *Marano* decided to register the two varieties in a catalogue, which by recognizing them would allow their commercialization. Yet, registration into a catalogue, according to some farmers, inevitably leads to certain incoherent attitudes and practices on the part of institutions in terms of cultivated diversity. To a certain extent, the concept of variety and of its use, as is understood in the registers including the one for conservation varieties, harkens back to a *fixistic* notion of commercial varieties as *homogenous* and *stable*. Stefano Sanson explains that in many aspects what the registration really implies is still unclear: "Right now, the cooperative distributes the seeds to the farmers free of charge. To supply enough seeds for all those demanding them, will it be necessary to conform production? To sell the seeds? Additionally, should seed diffusion be limited and controlled or rather opened to the full?"[50]. To complicate matters further, the collectives responsible for the protection are supposed to preserve varietal purity and to be appropriately equipped to function as a sort of seed industry. They should be able to provide seeds perfectly matching the registered variety and its characteristics. This could restrict farmers' autonomy in managing seeds, hence affecting the collective system and even negatively impacting the evolution process of the populations. How to define "conservation varieties" and non-industrial seeds, in general, is still an open question, one that is crucial for the future development of agrobiodiversity laws.

Initially, farmers were looking for the "true" *Marano* or the "true" *Sponcio*; in the years since, their viewpoint has started to evolve due to the difficulties faced in managing these maize populations. AS Giandomenico Cortiana and Stefano Sanson explain: "We're concerned about inbreeding; we would like to find a way to increase the genetic base of our maize without losing the fundamental characteristics of the different ecotypes." The groups acknowledge that initially they were determined to preserve the purity of the seed variety through a very rigid breeding process. However, this management led to decreased genetic variability. In the last few years, farmers have been trying to revise this strategy, favoring more evolutionary approaches to conservation. Giandomenico Cortiana is implementing breeding strategies that facilitate the genetic flow between materials "with different evolutionary stories." Kristian Casanova and Stefano Sanson believe that this is the right direction for the future of *Sponcio* as well, in order to prevent the loss of the variety.

Both local maize consortia have drawn up, independently, their "production protocol." This served to define the morphological traits of maize as well as its typicity, establishing its area of production and thereby assuring a semi-exclusive use for the cooperative. Furthermore, the protocol led to the creation of common regulations for the cultivation and transformation of maize. Finally, it served to regulate its commercialization through specific

[50] Stefano Sanson, October 2018.

labeling that helps distinguishing the product and tying it clearly to the consortium's farmers. By defining the variety's traits and its relation to the production area, both the protocol and the registration in the catalogues have helped establish and "fix" the distinctive uniqueness of the product, essential to its survival. Yet, the protocol is determined by the group and regulations can always be rewritten and discussed. On the contrary, the registration in national catalogues requires conformity to wider regulations that cannot be as easily changed.[51] In the specific case of maize in Italy, the registration in the catalogues might impose criteria that "could come into conflict with the biological reality of the variety which is not stable"[52]. "*Marano* changes; we cannot stabilize it and we should not restrict its genetic base; on the contrary, we need more sources of diversity"[53]. There are, thus, different logics at play here; first, there's the supply chain managed by the collective according to the protocol and for the purpose of commercialization; secondly, there's the registration in the catalogues that requires conformity to national and supranational norms based on a particular view of the conservation of genetic resources, and finally, there is the farmers' *de facto* management of diversity, which requires flexibility in agricultural practices and in conservation and breeding choices.

For a landrace to stand out from a multitude of landraces, it is necessary to define and spotlight its distinctive traits and its ties to the local nutritional and geographical history. Transformation is a natural process for a maize population; therefore, proving and showing its "authenticity" is necessarily a contradiction-rich process. The effort to establish ties to the geographical area, to tradition and to specific groups seems to have encountered the same difficulties that emerged in the UNESCO promotion of "Intangible Cultural Heritage". In the case of the UNESCO program, these issues mainly arose in relation to non-Western art. In terms of cultivated biodiversity, the same considerations may be applied: how can a variety be attributed to a specific group and a limited area, when it is the result of a collective work that can hardly be defined in terms of time and space? As is the case for the UNESCO "Intangible Cultural Heritage" program, there is also the issue of which means are available to an organization to qualify for these categories. Those able to bring to completion the registration process are the ones with more means and a better organization, indirectly preventing other forms of "Intangible heritage" to emerge.

[51] See the case of IGP (Papa 2002; Torre 2002).

[52] Stefano Sanson, October 2018.

[53] Giandomenico Cortiana, October 2017.

6.9 A 'culinary identity and the construction of "typicity"

Since its introduction in the 15th Century, maize in Europe has always been identified as a crop for poor peasants, generally despised for human consumption (Braudel 1979). Between the 18th and 20th Century, Pellagra, a serious illness resulting from nutritional deficiencies associated with a corn-based diet, became an endemic presence in some poor regions of Europe. The strong link between corn, famine and disease certainly did not facilitate the emergence of a corn culinary culture in Northern Italy. Although corn was the staple food in the Northern regions of Italy until the first post-war period, it did not represent the region's identity food. As Nello Fioretti recalls, "When hybrid maize varieties were introduced, they were not considered worse in terms of taste; no one really thought about it and there did not seem to be major differences; so, people started to use them. It was only later, with the development of a more sophisticated culinary culture, that differences started being noticed."[54]

Only once the specter of famine and *pellagra* had passed, in the second half of the 20th Century, new values like tradition and conviviality finally could be associated with maize (Gasparini 2002). As Danilo Gasparini, an historian and member of the protection consortium for *Bianco Perla*, observes: "We know very well that peasants in Veneto were not eating polenta for its identity value but out of necessity. The first thing they tried to do with maize was bread"[55]. Starting in the 1970s, according to the records of Statistics National Institute, maize is no longer used in the Italian food diet. All cultivated maize was destined to livestock and the consumption of polenta was only residual and local (Gasparini 2002). In the 1980s, the role of corn in human diet started to change: it was no longer the food of the needy but rather a source of conviviality and festivities. Contrary to what might be expected, the recovery of local landraces was not part, at least initially, of this transformation process whereby maize developed into a regional and identity food. According to Silvio Pino, an agronomist in charge of the reintroduction of landraces in Veneto, and his recollection of the first attempts to promote local varieties: "At the beginning of the 1990s, we were producing *Marano* maize at the Strampelli institute, but it was not easy to distribute it, because people did not want it. Nobody was looking for this variety"[56]. The promotion of local maize started only when different parties, such as restaurateurs, farmers, researchers, and institutions interested in the reintroduction of maize in the fields and in the kitchens, finally joined together. It was not simply a matter of recovering local landraces that had disappeared; primarily, it required the establishment of a new connection between maize and the notions of quality and territory. There was no historical identity readily available to support the

[54] Nello Fioretti, October, 2017.

[55] Gasparini, March 2018.

[56] Silvio Pino, October, 2017.

promotion of local landraces. Once corn is accepted as a "typical" ingredient, local landraces progressively find their place in this new culinary culture. Although *polenta* is certainly associated with the narrative about the quality of local products, many polenta food festivals, the so-called *sagre*, to this day use flour made of hybrid maize.

Crucial in establishing the "quality" of a product are the processes that define which are the qualifying and disqualifying characteristics (Harvey *et al*. 2004). The topic of quality is not a recent invention; it has always been central to agricultural modernization. In the Fordist-productivist model as applied to agriculture, "quality" is defined by the necessary requirements for production optimization in the framework of a scale economy based on mass consumption (Allaire 1995, 2002). Quality is, thus, traditionally linked to standardization of agroecosystems and crop diversity. To be sure, this model persists but in the last decades it has undergone a process of "de-qualification," contributing to the emergence of new forms of quality. In these alternative models, value does not reside in the diffusion of technologies and dominant varieties but rather in the capacity to respond to specific demands. The evolution of the post-Fordist production model has led to the emergence of economies based on goods and services of differentiated qualities, corresponding to different value systems, to intangible qualities, which, in their own turn, have contributed to the development of new local regulations (Allaire 2002).

In the case of the *Marano* and *Sponcio* varieties, the actors involved in the efforts for its introduction and promotion relied mostly on the "typicity" argument. Before giving any consideration to the productivity capacity of these varieties, the main quality in evaluating industrial seeds, farmers were interested in learning their history and in understanding their ties to the area as well as their botanic characteristics. Evidently, the case of maize is not unique; other products from Veneto have undergone this same process driven by the determination to re-establish ties with the territory that had been lost, both in terms of geography and of the history of agricultural and food practices (Da Deppo 2013; Longo 2013). The definition of a maize as "typical" is the result of a long justification process that requires a realignment with different imaginaries and ways of valorization. The construction of maize "typicity" required a strong will on the part of all actors involved in the process of typification, for which it is essential to affirm the value of diversity. This means, for instance, showing that certain characteristics best convey the essence of an environment, as was done in the case of wine (Teil *et al.* 2011). For *Marano* and *Sponcio*, the issue of "typicity" was approached by researching the cultural and botanic ties between a variety and its specific area of production. Thanks to this research, farmers were able to create a space for the recognition of these productions in the geographical mosaic formed by other typical products within a globalized food system. Arguments employed in the qualification process of a product may vary. The process is intricate and collective, based on experiences and "justification" (Thévenot et Boltansky, 1991) that are in constant evolution. As Hennion suggests (2003), we should talk more about "attachments" and "practices" rather than rely

automatically on attributes like “taste” and “quality.” Initiatives related to maize are also the result of a reflexive and collective process, regulated by experiences and “mediations” under constant discussion. At the time of the revival of polenta as a regional and identity food, the emphasis was on the conviviality aspect and on regional recipes. Today, new additional arguments have emerged, such as the link between biodiversity and landraces or between these and healthier and fairer food products. Depending on the context, different representations, values and relations may prevail, which may arise in opposition of or as a result of discussions and disagreements (Sassatelli 2004).

7 Aquitaine and Veneto: Different frameworks and imaginaries on maize landraces.

In Aquitaine and in Veneto, farmers have framed their efforts around maize differently; at the same time, they have attributed to different meanings and values to maize. In Veneto, local maize has become a means to reestablish ties to the area and the consumers. In Aquitaine, population maize is part of a larger project that strives to put the single farmer at the center of the production process. Equivalences established between the work done by the people, biodiversity, quality and the territory are not exactly the same. While there may be some shared arguments and motivations between the two collectives, the “investissements de forme’ (Thévenot 1986) and the justifications given (Thévenot et Boltansky, 1991) to describe each collective’s efforts around maize differ. As suggested by Corentin Hecquet in his dissertation, every seed project has followed an “investissement de forme spécifique’ (Hecquet 2019).

Table 16 and 17 schematically presents the main characteristics of the two groups. Figure 7 displays the results based on the responses given by the Aquitaine and Veneto group members to questions regarding the reasons that led farmers to introduce local landraces.

	AgroBioPerigord (France)	Marano - Sponcio (Italy)
Farmers interviewed	29	18
Organic	21	6
Conventional or other	8	12
Average agricultural area (ha)	84	18.7
Farmers doing other jobs	5	8
No irrigation	24	15
Organic fertilizers	23	14
Chemical fertilizers	6	11
Mechanical weeding	29	10
Chemical herbicides	4	11
Farmers having completely replaced hybrids for landraces	8	7
Farmers sowing at least 30% of landraces on the land devoted to maize.	7	4
Farmers who never grown hybrid maize	6	3
Average production (q/ha)	21-36	19-44
Farmers selling maize landraces	6	18

Figure 16 Group Characteristics

	AgroBioPerigord (France)	Marano - Sponcio (Italy)
Years of the beginning	2000	2000
Raisons at the beginning	Concern about the risk of GMO contamination	Regional program on traditional landraces
Landraces Origin	From European countries and Latin America.	Veneto
Landraces characterization at the beginning	Lack of information on varieties names, origins and agronomic performances.	Precise information based on historical documents, articles, photos.
Mode of conservation	On farm, broad genetic variability, mixtures.	In situ, attempt to conserve "in purity"
Landraces characterization now	New criteria, new terminologies and names for varieties. Work in progress. *Créations paysannes* (farmers' creations)	No relevant reconfiguration of the variety ideotype, rise of concerns about the conservation "in purity".
Landraces Conservation	Decentralized	Centralized
Seed Multiplication	Decentralized	Centralized
Seed for sowing	Centralized and Decentralized	Centralized
Usage	Animal feeding	Human alimentation
Focus on	Breeding approches Curiosity for crop and maize diversity Concern about GMO	Transformation Quality Commercialization
Values	To be independent To keep and select my own seed To save money on seeds	To offer a different product to consumers Tipicity
Principal limitations of landraces identified by farmers	Production of seeds (Conservation, multiplications, selection)	Productivity and lack of fair commercial valorization

Figure 17 Sketch of different paths.

In the **Aquitaine** group, each farmer is responsible for one kind of maize among a large choice (Fig. 19) and oversees its breeding and conservation. Maize production is thus strictly linked to members owning their own seeds; the collective collaborates to achieve this objective and share this principle within the group. For the French group, the dynamic engine driving the process has always been the curiosity to discover new varieties, even exotic ones, but not to preserve them as such. The breeding methods used and the management of the collections, including through crosses, contribute to unravel the argument that commercial varieties are "stable, homogenous, and distinct." This, however, does not prevent farmers from breeding new distinctive populations maize. Like in other cases within RSP, we are faced with a culture of "brassage génétique" [genetic mixing] (Demeulenaere & Bonneuil 2005). Within the Aquitaine collective, almost all phases, from breeding to conservation, are managed autonomously by the farmers. Being able to breed and preserve one's own seed is one of the main motivations driving farmers to adopt

population maize (Fig. 18). At the same time, the fact that all farmers work independently from each other, with limited equipment and an evolving knowledge, makes these phases particularly hard and time-consuming. This seed management strategy plays a crucial role, on the one hand, on farmers involvement and, on the other hand, represents its main limiting factor.

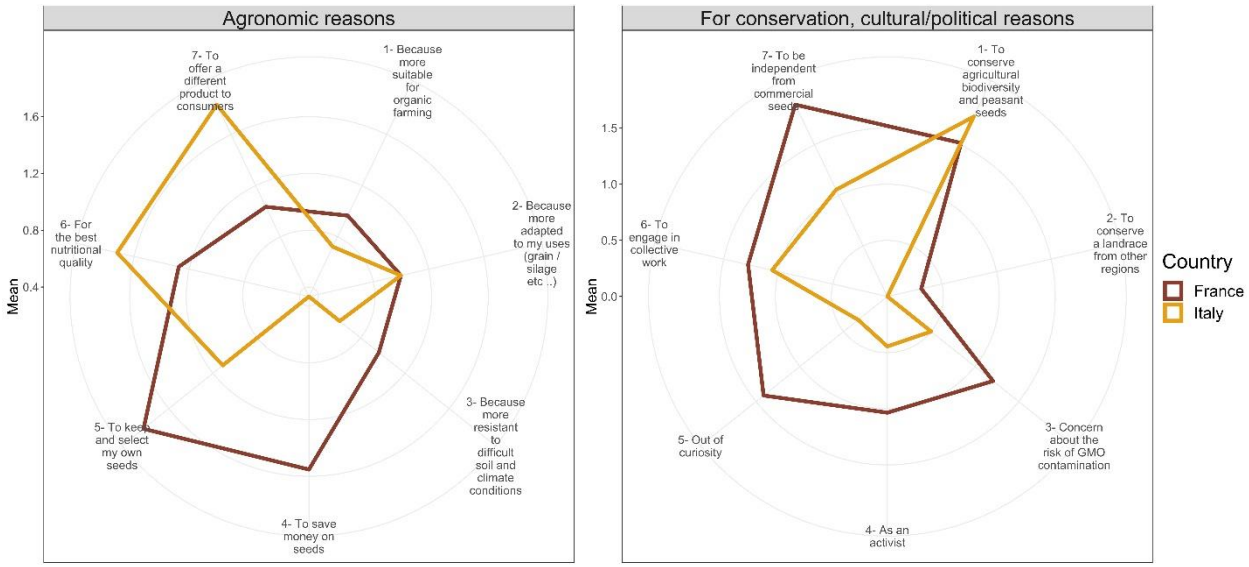

Figure 18 Main reasons for growing maize landraces in France (brown) and Italy (yellow)

In the **Veneto** collective, the issue of seed production is not viewed as problematic or even as central by single farmers. It is entrusted to few members in the consortium, who carry out all the phases: first, sowing in the "seed field" to ensure conservation; then, managing the multiplication process and finally drying and distributing seed lots to farmers. Within the local maize protection consortiums, seeds are not individually but collectively owned. Farmers growing *Marano* and *Sponcio* do not view themselves as "owners" of the seeds and do not see the need to oversee breeding and conservation processes individually. The objective is to organize collectively to produce a distinctive flour, which can best represent the specificities of the local maize variety. For the Italian group, the conservation of varietal purity, albeit viewed more critically in recent years, remains central point because it is the very underpinning of their efforts around maize. The reintroduction of *Marano* and *Sponcio* required a careful historical analysis through written and oral sources to reconstruct its evolutionary history and its ties to its area of production-selection. Therefore, the very concept of "**landrace**" can be interpreted differently. The AgroBioPérigord group put the emphasis on the concept of "semences paysannes" [peasant seeds] and on the term

“population maize” to highlight the heterogenous characteristics of the varieties and their plasticity in relation to the farming practices of single farmers. Conversely, in Italy, the discussion is centered around the term “local maize,” often also described as traditional, ancient and historical; the emphasis is hence on its typicity and its specific connection to the local gastronomy and environment.

The two collectives have pursued two distinct strategies of maize management and the plant has been molded accordingly and reinserted within the framework of a larger project. We are dealing with a vast repertoire of representations and values, mobilized by the French and Italian groups to construct a new identity for maize crops. These are different ways to construct “attachments” (Hennion & Teil 2003) to an environment, to things and practices. Yet, the objective of this study has not been to establish categories, but rather to trace the activities of these groups, showing how values, practices and specific attachments to maize where constructed. The significance of the work carried out for population maize or local maize is also found in the discussions and disagreements within the collectives. The two groups are constantly rethinking their practices, which will eventually lead to new ways of approaching the collective management of diversity, using it both concretely and strategically as a vehicle towards more universal values.

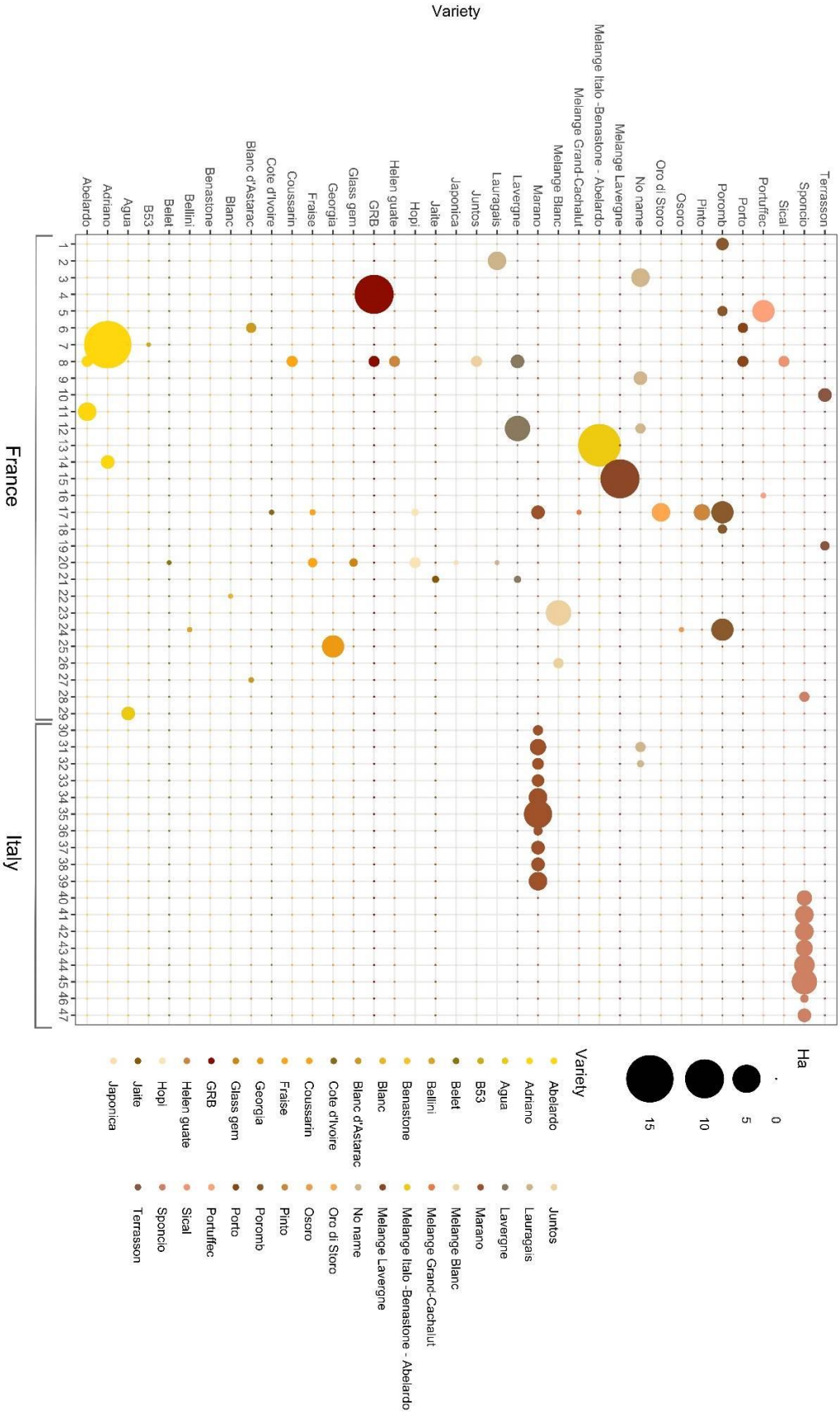

Figure 19 Maize varieties grown in the Aquitania and Veneto groups (ha).

8 Conclusion

Starting in the second half of the 20th Century, the introduction of hybrid maize varieties has greatly contributed to the marginalization of farmers into the role of "users" of seeds. This system resulted in a move away from evolutionary breeding practices, which in the past were performed by farmers, and towards a progressive homogenization of the varietal landscape. The spread of maize hybrid varieties, which cannot be re-sowed and thus need to be purchased anew every year, also caused profound changes in the management of seeds. The collectives in Aquitaine and Veneto offer us an example of new forms of management and qualification of seeds. New values have emerged that counter the homogenizing directions of the industrial food industry. Maize culture has been rethought within a system based on the socialization of the seeds, which opened a space for a richer repertoire of representations and practices in relation to the plant, as well as for new relations to the areas of production. In the French case, the recovery of maize is linked to the history of "maize varieties that come from afar," bearing not just "new genes" but also new ideas and approaches. In contrast to the Fordist division of the production processes, the main shared value within the Aquitaine group is that seeds be part of a selection, cultivation and transformation process that takes place on the same *ferme* [farm]. Every farm is simultaneously connected with others that share the same principle. Thanks to the coordination and technical support offered by AgroBioPérigord, seeds and the knowledge acquired are made available to all members in the group. In the case of *Marano* and *Sponcio*, it is the reconstruction of a historical link to the production area that marks the difference from the dominant model. The Italian response to the loss of a heritage or to its industrial reproduction was the re-establishment of maize management within single communities. The farmers know each other; they are neighbors, and, through the maize protection consortium, they oversee the management of both seeds and production. Both Aquitaine and Veneto groups created, a posteriori, a set of values for the peasant seeds, drawing from a different and at times opposing repertoire of representations and information. These values did not pre-date the creation of the group; on the contrary, they were constructed based on the group's priorities, their '*concerns*' (John Dewey), their interpretation of what constituted the work of the farmer. These experiences continuously change within a web of relations, imaginaries and of ways to ascribe meaning to the reintroduction of maize in their productive system.

These alternative practices, whereby farmers have retaken control of breeding and production processes, do not have to remain limited and isolated, in other words mere enclaves within a landscape still dominated by industrial agriculture. In these new spaces, where new forms of breeding can be performed, it's not a matter of achieving a total separation from the exterior, but rather of building and expanding a new system of relations, distribution, knowledge and seeds. To advance the construction of a sustainable agricultural

model, which is fair and diversified, it is necessary to bring together the different forms of competence and knowledge shared by the farmers and researchers who comprise the groups and are supported by institutions able to participate in experimentation, breeding and conservation efforts. The objective is not to reproduce models that are considered virtuous in a specific place, but rather to articulate and coordinate the heterogeneity that characterizes these experiences on a bigger scale. Agroecosystems should not be considered "diversified" just in terms of species and practices but also in terms of how we view diversity, its management, its relation to work and innovation.

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