International Institute of Social Studies
Erasmus

Working Paper
No. 653

Plants and their peasants: a more-than-human approach to plant breeding and seed politics in Brittany, France

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January 2020

[*] ISS MA Research Paper Award winner for the academic year 2018-2019

ISSN 0921-0210

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Table of Contents

Abstract

This research paper investigates the articulation of agriculture, plant breeding science and capitalism through the lens of semences paysannes (peasant seed) in Brittany, France, using Anna Tsing's concept of "scalability". From the early to mid-19th century, the French state instituted an industrial, productivist agricultural paradigm, based in part on a system of seed standardization and certification which illegalized seed produced by farmers. Today, peasant farmers are pushing back, asserting their right to select and produce their own seed as part of the larger movement for peasant agriculture. Evolutive, heterogeneous, freely reproducible peasant seed is viewed as politically transformative, capable of rebuilding barriers to accumulation in agriculture that were broken down with the modernization process and the spread of hybrid seed.

While challenging capitalist appropriation of the seed is central to the movement, the question of how and to whom to sell produce remains fraught. This paper focuses on a group of farmers who have entered into a contract with multinational supermarket chain Carrefour to sell their vegetables produced from semences paysannes at premium prices and with an exclusive label. Using ethnographic material based on 5 weeks of fieldwork with farmers in northern Brittany, this paper questions if the biological specificities of semences paysannes guarantee their resistance to capitalist appropriation and accumulation. By analysing Carrefour's incorporation of vegetables from peasant seed, it is possible to understand how biological barriers to appropriation at the input stage of agriculture can produce value for supermarket capital. However, producing peasant seed reintroduces the unpredictability of plant life onto the farm, countering the way modern plant breeding has suppressed the liveliness of nature. In conjunction with organic practices, seed production help constitute farms as multispecies refugia, connecting farmers and plants in caring relationships and helping to address environmental harm wrought by industrial agriculture. Peasant seed production also necessitates collaboration between farmers, building a form of autonomy that is collective rather than individualistic. Thus, peasant seed production retains its subversive potential in the way it transforms farmer livelihoods and production practices, both materially and affectively.

Keywords

Peasant seed, peasant agriculture, plant breeding, scalability, appropriation, capitalism, industrial agriculture, human-plant relationships, vegetal political ecology.

List of Figures

Acronyms

BAGAP	Biodiversité, AGroécologie et Aménagement du Paysage
INRA	Institut National de la Recherche Agronomique
OBS	Organisation Bretonne de Sélection
PPB	participatory plant breeding
RSP	Reseau Semences Paysannes

Plants and their peasants
A more-than-human approach to plant breeding and seed politics in Brittany, France

1 Introduction

1.1 The problem of nature and the problem of capital

I ventured out after dinner on a walk, not intending to visit the greenhouse complex, but I was drawn there: its presence was unavoidable in this small, rural town on the northern coast of Finistère, a region in Brittany, France. The imposing glass structures loomed out of the gathering night, stretching across hectares. The biomass heat chimneys were empty of smoke and the red LEDs used to ripen the fruits were off. I stepped closer and peered through the glass walls. Inside, row after row of identical tomato plants, suspended a few feet above the ground, rooted not in soil but in white bags with black lettering: liquid food, a tightly calibrated mix of the nutrients needed to produce the ubiquitous round, red fruit we are accustomed to eating year-round. The plants looked tortured, their main stems and branches twisted and trussed up to a support beam overhead. The day before, on a different farm only a few kilometers away, I had spent hours picking tomatoes with a young farmer who specializes in rare, old varieties. There, in a second-hand high tunnel edged with wild carrot and lambsquarters, the differences between the tomato plants had occupied all my senses: leaf size and shape, growth habit, fruit color, texture and taste. Over a hundred varieties, some only represented by a single plant, their histories as rich and diverse as their appearance. We tasted different varieties, and he compared the flavor to strawberries or honey, mentioning how the taste evolves over the course of the season. Here, in front of the heated greenhouses, I felt equally overwhelmed by the extent of uniformity: each plant the mirror image of the one next to it, row after row of clones. Were the tomatoes I touched and tasted and smelled yesterday really the same species as the ones here? What processes, scientific, political, economic, led to such different ways of being *Solanum lycopersicum*? And how can two such different farms, both growing tomatoes, coexist within a kilometer of each other?

Hectares of heated greenhouses, enclosed broiler chicken and hog operations, monoculture soybean fields characterize our modern agri-food system. These systems of production all seek to address the "problem of nature" (Boyd, Prudham and Schurman, 2001): the fact that crop plants and animals are unpredictable, unruly and lively. Their maturation and growth obey temporalities outside of our full control; they are exposed to the vagaries of weather, pests and disease; their metabolism and genetics are not fully manipulatable. Agricultural production is based on natural functions, but these very processes present formidable "barriers to accumulation", impeding the development of capitalist relations in agricultural production (Mann and Dickinson, 1978; Mann, 1990). In order to turn metabolic processes into

engines of value, steps must be taken to limit and control the liveliness of plants and animals, making agricultural production more factory-like and the accumulation of capital smoother.

The uniform genetics and commodified seed of the F1 hybrid (explained in chapter 2) provided the material foundation for the "scalability" of the industrial farming "project" (Tsing, 2012; Tsing, 2015b). Anna Tsing defines scalability as "the ability of a project to change scales smoothly without any change in project frames" (2015b, p.38). From the colonization period onwards, European and North American state planners and capitalists were infatuated with the idea of progress and expansion without the messiness of diversity– the proliferation of a standard model of production across vastly different ecologies and cultures, exemplified by the plantation and the factory (ibid.). Projects of all kinds "emerge from the practical activities of making lives", human and other-than-human, and are world-making through these everyday practices (ibid, p.22). For my purposes, a "project" is a set of concrete steps taken toward accomplishing a goal. Capitalism acts as a frame for industrial agricultural projects, imposing the logic of standardization and rationalization in order to extract value from the intertwined labor of human and extra-human nature in the most efficient manner possible (Scott, 1998; Moore, 2015). Within this logic, nonscalable systems were understood to be flawed, in need of transformation to scalable models (Tsing, 2012, p.509).

The development of industrial monoculture is the essence of a scalability project. Uniform, hybrid seed (and therefore plants) meant standard planting, cultivation and harvest techniques; standard practices meant the same machines could do most of the work on every farm and acreage could expand without changing the basic framework or relationship between "project elements": seed, machine, inputs, land. This standardization made the place-based knowledge and skill of the farmer largely irrelevant, increasing their reliance on agro-input manufacturers rather than accumulated knowledge of their specific climate, crops and practices.

Suppressing the unpredictability of nature makes farms scalable, creating profits for capitalists through the appropriation of value, but it also makes ecological ruins (Tsing, 2015b, p.40). These ruins proliferate almost as fast as scalable projects: ocean eutrophication from agricultural runoff, pesticide poisoning in wild animals and humans alike, superweeds and pests evolving tolerance to herbicides and livestock antibiotics, climate change contribution and loss of biodiversity from massive land conversion to monoculture (Weis, 2010; Borel, 2018; FAO 2019; Van Hove and Leraud, 2019). Farmers sink deeper into debt, under the weight of loans for machinery, infrastructure, and inputs (McMichael, 2013; Petrick and Kloss, 2013; Critchlow, 2015; Pamuk, 2019). Farm workers are subject to increasingly grueling work environments, from the field to the slaughterhouse, their bodily movements and work routines violent in their repetitive mindlessness (Barndt, 2002; Pachirat, 2013). Agricultural plants and animals become increasingly machine-like: hogs with bedsores from inactivity and immune systems so fragile they can never go

outside; rice with an altered photosynthetic pathway that increases its growth rate and efficiency (Rizal *et al.*, 2012; Blanchette, 2019b, 2019a).

In the face of increasing technological and capital intensiveness in agriculture, the unpredictability of nature persists and proliferates: *E. coli* outbreaks, mutated swine flus, superweeds. These examples of the "revolt of extra-human nature" expose vulnerabilities in our food system, inherent contradictions in capital's attempts to control and endlessly appropriate value created by the "free" labor of nature (Moore, 2015, p.121). This research paper looks at a subtle manifestation of the unruliness of nature: peasant seed. Rather than erupting wildly out of the enforced spaces of monoculture, peasant seed persists because of the care and attention of humans, on the margins and interstices of industrialized production – it is the product of an encounter between human and extra-human nature. Peasant seed has become the focus of much political-environmental debate and action, as it presents a potential alternative solution, not to the "problem of nature", but rather the problem of *capital* in agriculture: ever-increasing farm size and input-intensivity; the "input treadmill" which destroys farmer autonomy and resilient agro-ecosystems.

In France, the area of my field work, *semences paysannes*[1] (peasant seed) is the name given to seed propagated, selected and saved by farmers, on farms, without the protection of intellectual property rights (Reseau Semences Paysannes, 2013). The creation, use and circulation of peasant seed rebuilds barriers to accumulation that were broken down in the process of agricultural industrialization, by biologically decommodifying the seed, adapting plants to organic and low-input farming practices, and retaining reservoirs of genetic diversity from which farmers can select plants adapted to changing ecological conditions. By using peasant seed, farmers decrease their reliance on seed and agro-input companies and increase their autonomy, as individual farmers and through collaborations with other peasant seed producers, small seed companies and plant breeders. As hybrid seed built the foundation for factory farming, so can peasant seed act as the material foundation for small-scale, agroecological peasant farming and food system.

As elsewhere, the policies that modernized French agriculture and plant breeding in the first half of the 20th century sought to eliminate both "unproductive" peasant farmers and the diverse varieties upon which they relied. In France, a movement has developed in reaction to the marginalization of peasant seed, which cannot be freely exchange or sold under French law[2], widespread ecological degradation due to industrial agriculture and the devalorization of the *paysan*[3] (peasant) identity and lifestyle (Demeulenaere and Bonneuil, 2010; Demeulenaere, 2013, 2014). The term *semences paysannes,* or peasant seed, differs from the previously used *semences de ferme* (seed reproduced on farm), directly linking the struggle over seed to the promotion of peasant farming as an alternative to industrial agriculture (Demeulenaere, 2012, p.62).

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[1] See Appendix 2 for full definition.

[2] For the legal status of *semences paysannes,* see Appendix 1.

[4] Defined in Appendix 2.

The Reseau Semences Paysannes (RSP) is the national locus of this initiative, regrouping over 90 local associations of farmers, gardeners, consumers, scientists, retailers, bakers, chefs and concerned citizens. The RSP opposes the use of F1 hybrids and GMOs, centering the role of peasant farmers and amateur gardeners in maintaining the cultural and biological diversity that sustains agriculture. They link the *rusticité* (rusticity, non-modernity), diversity and non-reliance on external inputs to food sovereignty in France, drawing discursive and practical connections between biology and politics and pushing for changes in French seed law. Many farmers in the RSP work with plant breeders in participatory plant breeding (PPB), co-designing experiments and projects that seek to develop varieties for low-input, sustainable agriculture, conserve and cultivate biodiversity and farmer independence and rethink concepts in corporate-led plant breeding(Sperling *et al.*, 2001; Chiffoleau and Desclaux, 2011; Pimbert, 2011).

Concurrent with the decommodified and autonomy-supporting open pollinated peasant seed, many members of the movement stress that peasant vegetables should be sold in *vente directe* or direct marketing, without an intermediary between farmer and consumer. This method of commercialization allows farmers to capture more of the value produced by their labor, avoiding the unpredictable and often low prices paid by supermarkets or wholesalers. *Vente directe* also contributes to rural development, builds consumer-producer trust and addresses food scares and phytosanitary crises (Dufour and Lanciano, 2012). However, in northern Brittany, farmers producing peasant seed and vegetables are immersed in one of the most industrialized, high-volume, export-oriented regions of fresh vegetable production in Europe; selling in direct marketing is neither feasible for the volume they produce nor possible given regional infrastructure. I worked with farmers who are members of a sub-group of the RSP which focuses on peasant seed production and exchange, called Kaol Kozh, and of BioBreizh, an organic grower's cooperative. Some farmers have entered into a contract with the multinational supermarket chain Carrefour to sell their peasant vegetables at higher prices and with the label, "*Graines des Paysans"* (which also translates as peasant seed).

This relationship demonstrates that, although the biology and social relations around peasant seed may present a barrier to accumulation and a boon for farmer autonomy, this is not necessarily true of the fruit or vegetable that peasant seed produces. In the partnership between Carrefour and the group of Kaol Kozh/BioBreizh farmers, the heterogeneity of open-pollinated, peasant vegetables creates value for supermarket capital. Biological barriers to appropriation/accumulation at the input stage of agricultural production (non-uniformity of vegetables and non-commodified seed) can act as sources of value for the opposite end of the agro-food chain: appropriation can occur without scaling. However, alternative conceptions of the plant as an organism and farmer-plant relationships formed through peasant seed production are politically transformative. These relationships can help address the ways in

which industrial agriculture and capitalist appropriation have come to harm both peasant farmers (by reducing their autonomy, creativity and skill) and plants (by compromising their ability to adapt and reducing overall agrobiodiversity). Thus, peasant seed can act at once as a "patch", an unplanned space in which value produced under non-capitalist relations is appropriated (Tsing, 2015b) and a "refuge" in which caring forms of human-plant relationality are practiced and diversity is nurtured (Haraway, 2015; Tsing, 2015a).

1.2 Research questions

Main question

Do the social relations and biological characteristics that produce and reproduce *semences paysannes* make them resistant to scaling, and therefore appropriation? If so, how? If not, why not?

Sub-questions

- What is the relationship between the process of scaling and the development of industrialized agriculture, with respect to seed and plant breeding?
- (How) does the production of *semences paysannes* rethink concepts in modern plant breeding science in order to descale plants?
- (How) does the relationship between peasant farmers and Carrefour supermarket complicate the definition of scaling and its relationship to appropriation?
- (How) do farmers and plants practice new forms of interspecies relationships through *semences paysannes?*

1.3 Methodology and methods[4]

I chose an ethnographic orientation for my research because I am interested in how plants and people interact and how meanings are made from those interactions – meanings that are locally specific but intertwined with global dynamics. Understanding the relationship between "global" and "local" involves the strategy of "tacking between whole and part" (Cerwonka and Malkki, 2007, p.14): moving back and forth between theoretical concerns (rationalization of nature under capitalism, human-non human relationality) and societal processes (seed regulation, biodiversity loss, changing farmer livelihoods) to clarify the way they play out in specific spaces.

Although the "problem of nature" is a universal concern in cultivation and extraction-based industries, "a nuanced understanding of the problem of nature in its varied and variable manifestations requires that nature-based industries be analyzed on their own terms and in specific historical and regional contexts."(Boyd, Prudham and Schurman, 2001, p.156). The history of

[4] Based on final essay for Ethnographic Methods (Rezvani, 2019).

the modernization of plant breeding and agriculture in Brittany produced the current constellation of socio-environmental problems that threaten peasant livelihoods and environmental wellbeing. Using an ethnographic approach allowed me to ground theoretical concerns, such the relationship between capitalism and nature and the concept of scalability, in this local context. Those details in turn opened up the possibility of problematizing some of these broad, abstract concepts.

The ability to generalize from the local to global rests on the generation of rich, descriptive field data and the purposive selection of both setting and case (Atkinson and Hammersley, 2007; Cerwonka and Malkki, 2007, p.27). I chose to work with Kaol Kozh because things that would make their case "non-representative" in positivist research (Atkinson and Hammersley, 2007, p.7) speak to the aforementioned theoretical concerns. Kaol Kozh and BioBreizh farmers, through their engagements in seed saving, peasant identity politics and the branding of peasant seed, presented a compelling case to study the complex push and pull between scaling and descaling. The development of analytical categories (scaling, barriers to accumulation, interspecies care) began before field work and informed my lines of questioning. The articulation of autonomy by farmers in the field helped ground these categories to a political vision. I was then able to define scaling and descaling by looking at peasant seed practice/politics through the lens of Tsing's work on scalability.

I worked on 7 different farms for periods ranging from one day to six, conducting participant observation, semi-structured interviews and informal conversations with farmers, observation of farming and seed selection/saving practices, participation in meetings with wholesalers, and tours of Kaol Kozh's demonstration garden and the organic wholesaler's warehouse**.** The coordinator of Kaol Kozh put me in touch with farmers and gave me access to the association's archival materials. I also visited the BAGAP (*Biodiversité, AGroécologie et Aménagement du Paysage*) lab at INRA (*Institut National de la Recherche Agronomique)* to interview plant breeders (most of whom were women) who had worked with Kaol Kozh farmers. Five out of seven farmers were men, two were women, all were of white-European descent and above the age of 30. This speaks to the overall demographic trend in French agriculture: just over 20% of farm managers are women, and those working on farms tends to be older than the general working population (European Commission, 2017). The involvement of the rest of the family in the farm varied: five out of seven farmers had spouses; of those, only one did not have off-farm employment. Of the remaining two farmers, one had never been married and ran the farm with one salaried employee, and the other was widowed and ran the farm with her son.

2 The world as plantation?

2.1 The frame: capitalism, appropriation and the practice of scaling

The tomato greenhouses in Plouescat were so visually arresting because they could have been anywhere: Nigeria, the UK, Kentucky, the Netherlands. This is the definition of scalability: a project that can be replicated in vastly difference socio-ecological contexts without any change in design or framework. A project can only change scales and contexts smoothly if its constitutive elements can be manipulated separately, remaining "self-contained" and "oblivious to the indeterminacies of encounter" (Tsing, 2015b, p.38). Tsing cites Portuguese sugarcane plantations in colonial Brazil as the paradigm of a scalability project. Sugarcane was not native to Brazil and had no natural pests or symbiotic allies. Enslaved Africans, uprooted from their homeland, arrived also removed from relationships – both plant and human thus became forcibly alienated, abstracted labor. Forested land was cleared, creating an empty slate on which to piece together these interchangeable units. This model proliferated across the colonized tropics, showing "how alienation, interchangeability, and expansion could lead to unprecedented profits" for European capitalists (Tsing, 2015, p.40). Sugar in turn fed rapidly expanding working populations in the metropole, the cheap calories on which another scalability project functioned: the industrial factory (Mintz, 1985).

Factories and plantations sought to standardize heterogenous and place-based systems of production in order to fit them into the frame of expanding global capitalism, "envisioning the world through the lens of the plantation"(Tsing, 2015b, p.40). In this vision, nature is made to work cheaply through "projects to control, rationalize, and channel potentially unruly human and extra-human sources of unpaid work/energy" (Moore, 2015, p.95). These unruly natural processes like gestation, ripening, fermentation, germination, and conversion of solar energy to sugars through photosynthesis present formidable "barriers to accumulation" in nature-based industries (Mann and Dickinson, 1978; Boyd, Prudham and Schurman, 2001). Mann and Dickinson(1978) suggest that "the peculiar nature of the productive process in certain spheres of agriculture is incompatible with the requirements of capitalist production and, therefore, makes these spheres unattractive for capitalist penetration" (1978, p.467). They distinguish particular periods in agricultural production when the product is "abandoned to the sway of natural processes" (Marx 1967 p.243, quoted in Mann and Dickinson 1978 p.472) as "production time". This is distinct from "labor time," wherein human labor acts on and transforms the material in question. Intervals of production time are necessary to the creation of the commodity but produce no surplus value (ibid.). As the goal of capitalist production is to maximize exchange value, and value (according to Marx) is only created by human labor, capitalist penetration of agriculture turns on the ability to minimize the ratio of production time to

labor time, thereby increasing the amount of profit and potential for capital accumulation.

Technologies and processes that increase labor time are those that standardize the unruly natures of non-humans, speeding up or rendering more predictable and regular natural processes. The use of clonal propagation of sugarcane by European planters is one such technology, creating uniform, industrialized organisms "undisturbed by reproduction" (Tsing, 2015b, p.39). The development of inbred-hybridization was another such process of surmounting barriers to accumulation by reducing the uncertainty involved in "production time". In inbred-hybridization, two highly homozygous (inbred) parent lines with desirable traits are crossed to produce an offspring (the F1 generation) which expresses the desired dominant traits in the parent lines and is comparatively high-yielding. Hybridization also ensures that all offspring in the F1 generations are genetically identical (Acquaah, 2012).

Genetically identical plants enable standardized production techniques; larger plantings with uniform maturity and mechanized harvests. High levels of nitrogen fertilizer sped up the maturation process and thus time to market. These factors created a large, dense monoculture with fast, luxuriant growth that attracts insect pests and disease, necessitating the use of pesticides (Scott, 1998; Delmond, 2006). Machines, synthetic fertilizers and pest protection introduced new vectors of accumulation, increasing farmer dependence on inputs created not on the farm but by agribusiness firms. Goodman, Sorj and Wilkinson (1987, p.7) refer to this as "appropriationism" a process by which certain elements of the agricultural production process are appropriated by industrial firms, transformed into uniform, reproducible commodities and reincorporated into agriculture as inputs. Through appropriation of agricultural inputs, industrial capital "reduce[s] or weaken[s] the importance of nature in rural production, so as to increase the social manipulation of this sphere" (Mann, 1990, p.43).

F1 hybridization is another form of appropriationism, the biological commodification of seed itself. The high yield of F1 hybrids plummet in the F2 generation, as heterozygosity is reduced, and genetic predictability breaks down, as the exact mix of traits in parent lines is rescrambled, producing many defective or "off-type" plants. This loss of predictability and yield meant that farmers, who traditionally saved seed from one generation to the next, selecting the best individuals to propagate, could no longer do so. The reproducibility of seed, which constituted a "biological barrier to its commodification", was surmounted and farmers had to return to the seed company each year for new stock (Kloppenburg, 2004, p.11). By removing the production of seed from the space of the farm, where ecological interactions and farmer selection processes create a non-uniform input, seed companies instead produced a standard seed for all farms and farmers. F1 hybridization rationalized and commodified a portion of the agricultural process, breaking down barriers to accumulation and progressing toward scalable farms.

Ecosystems and farms are built on connections: among plants, soil, weather and climate; between insects and animals, including humans. Making

farms scalable to appropriate value entails breaking these connections, eliminating the possibility of meaningful interactions that might alter the project frame (Tsing, 2015b). Cutting off connection takes work: clearing forests, hybridizing crop plants, enslaving entire populations. This work creates ruins, landscapes blasted by the rampant extraction of value in the form of soil fertility, biomass and human-plant labor. However, these landscapes can also host organisms that confound the logic of scalability: Tsing takes the example of the matsutake mushroom, which emerges in the ruins of industrial forest plantations in the north-western United States. These mushrooms are eminently unscalable: matsutake have never been successfully domesticated or cultivated, and their rhythms of reproduction and fruiting remain mysterious and unpredictable.

Can the idea of nonscalability be applied to peasant seed, fruits and vegetables, even though they are domesticated and cultivated plants that thrive in the constructed environment of the farm, existing only through and because of human control and maintenance? To apply these concepts to domesticated food crops, it is necessary to see scalability not as a binary, with sugarcane and mushrooms representing the two poles, but to investigate the work required to make living things scalable: the practice of *scaling*. Understanding what makes a project like industrial agriculture scalable entails seeing *how* each project element is made to stand alone, and therefore how Nature is made to work cheaply and efficiently. In the case of vegetable production, a crucial dimension of scaling is the process of plant breeding.

2.2 The project: industrializing agriculture in France

Imagining a scalable plant

> Conceptualizing the world and making the world are wrapped up with each other-at least for those with the privilege to turn their dreams into action.
>
> Anna L. Tsing (2012, p.506)

Early capitalism excelled at inventing new ways of seeing the world, from cartography to standard time (Moore, 2015). These new ways of seeing and imagining rationalized and standardized nature, underwriting processes of material scaling that sought to tame its unruliness in service to value appropriation. Similarly, intellectual shifts in the science of genetics and plant breeding in early 20th century Europe enabled the scaling of plants, creating new ways of seeing and understanding them as isolated, individual organisms; this was part of "a larger cultural shift in the ways in which identity, efficiency, and connectedness of living beings through time and space were reframed within a quest for industrial rationalization" (Bonneuil and Thomas, 2010, p.538).

In the mid-1800s, Louis de Vilmorin, French plant breeder and seedsman, first demonstrated that desirable traits can be retained from parent to offspring in wheat by selecting the best single grains from the best plants and growing

them in isolation over many generations (Berlan, 2001). Vilmorin's wheat remained identical to earlier generations in all respects, setting the stage for later "pure line" and pedigree breeding methods. In pure line breeding, only sustained selection of a single type would retain the desirable traits; if left to mix and adapt in farmer's fields, crops would naturally "deteriorate" as traits recombined and expression changed in relationship to changing environment (Berlan, 2001, p.514).

The fixation on purifying the character and habit of individual crops was based on changing understandings of heredity, evolution and the gene-environment relationship: rather than interaction driving evolution, isolation became the principle object of inquiry, and scientists "sought for new typological units reinforcing stability and fixity" and methods of "disciplining plants into a stable 'inner' genetic identity" (Bonneuil, 2008, p.86; Bonneuil and Thomas, 2010, p.541). Plants shifted from populations or groups of individuals, constituted by a shifting environment and acted on by a variety of forces, with the accumulation of such influences felt throughout the entire plant body; to individuals, the locus of heredity delimited to the gametes, divorced from the "sum total of ancestral influences" and disciplined by the unchangeable "unit": the gene (Bonneuil, 2008, p.86).

This shift in scale of focus, from entire plant to genes, housed within the gamete (the pollen and ovum, which unite to form the seed), was a critical moment in transforming the practice of scaling plants. With the rediscovery of Mendelianism, which isolated the gene as the basis of heredity, plant breeders imagined that they had arrived at the smallest scale, the foundational unit from which variation was controlled and determined. By creating purified parental lines, expressing a single desired trait (usually yield), breeders could propagate this trait across entire lineages of "self-replicating" organisms. Later, in the "modern synthesis" that brought together genetics and evolutionary biology, Mendelianism and the discovery of the structure of DNA chromosomes, "each of these scales [gene, plant, population] is another expression of self- enclosed genetic inheritance… they are neatly nested and scalable. As long as they are all expressions of the same traits, research can move back and forth across these scales without friction"(Tsing, 2015b, p.140). Bonneuil and Thomas (2009) stress that this type of research was not simply a refinement of previous techniques and tools, steps forward in a unidirectional process toward more and more "scientific" methods and "improved" plants: rather, this vision is an expression of a particular socio-historical moment, involving a specific idea of the world and the place of humans and non-humans within it. This way of seeing plants[5], people and ecosystems as interchangeable units linked science to capitalist power, shaping a vision of human progress as the expansion and proliferation of scalability projects based on self-identical units.

[5] This 'way of seeing' has a dark past: numerous scholars link state-led modernization of genetics and plant breeding to eugenic thought. See Flitner (2003) for links to social Darwinism in 1920s-30s United States, Soviet Unions and Germany; Saraiva (2010) for a discussion of wheat breeding in Fascist Italy and Camprubí (2010) on rice in Francoist Spain.

The perfection of inbred-hybridization was based on these intellectual shifts, representing another leap forward in the practice of scaling plants to make them into "stand alone assets" (Tsing, 2015b, p. 5). For perhaps the first time, the mysteries of plant behavior were made legible and seemingly controllable, therefore scalable. Legibility in turn enabled the creation of a concrete, legally enforced definition of a plant "variety." This allowed plant breeders to designate their pure lines as taxonomically distinct from one another. In France, this official definition facilitated the entry of new varieties into the official French catalogue of species and varieties (*Catalogue officiel des espèces et variétés,* created in 1932) (Bonneuil and Hochereau, 2008). In the post-World War-II period, the French state institutionalized a "Fordist-republican" regime of plant legibility by creating an enforcing a definition of "*la variete qui convient"* (the proper variety): each crop species had an ideal type against which all specimens could be judged, a definition to which state-employed plant breeders conformed (Bonneuil, 2008; Bonneuil and Thomas, 2009). This official definition of professional breeder-created varieties made them distinct from "impure", genetically heterogenous farmer varieties, which fell outside the limits of legibility set by varietal definition. They were denied entry into the catalogue and could therefore not be exchanged legally. This "ontology of 'genetic modernism'" enabled "the constitution of the genetically homogeneous cultivar as a scientific object, a market commodity, and a state policy object", transforming the intellectual landscape and eventually, the French countryside itself (Bonneuil and Thomas, 2010, p.536).

Creating a scalable farm

France emerged from World War II battered and economically fragile. In the post-war period, the state focused on rebuilding the nation's productive power, beginning with attaining national self-sufficiency in agricultural production (Gevers, Rijswick and Swart, 2019). State planners turned their attention to the countryside, which was still dominated by small-scale, diversified, subsistence-based production. The creation of scalable plants allowed state planners to imagine scalable farms: units of agricultural production that were predictable and controllable from the smallest scale, the genes of the plant (Bonneuil and Thomas, 2010). The transformation of land, seeds and other crucial elements of farming from *patrimonie* (heritage, tied to a specific social and geographical location) into interchangeable "*outils de production"* (placeless, uniform tools of production) was the basis of the shift to a production and export-based agricultural economy, which planners hoped would lift the country out of its post-war slump (Bonneuil and Hochereau, 2008).

France used aid from the Marshall Plan to reinforce existing agricultural cooperatives, banks, and crop insurance and social security schemes (Gauvrit, 2012). The 1960 and 1962 *lois d'orientation agricoles,* credited with modernizing French farming, increased the budget for agriculture by ten-fold between 1954 and 1964 (De Kerorguen, 2016). Young farmers were trained in the ways of modern agriculture, supported by donated machines, cheap loans and training in the United States. Older farmers were encouraged to transition out of

agriculture, to be replaced by the young, modern « *exploitant agricole »,* a term which replaced *paysan*, now viewed as synonymous with backward by the new generation of farmers (Gauvrit, 2012). The small parcels of the land owned by aging farmers were consolidated in the process of *remembrement,* consonant with the idea that larger farms, bigger tractors, "improved" hybrid varieties and the higher yields they brought entailed modernization (De Kerorguen, 2016). The modernization of French agricultural was marked by a fundamental shift in ideology, an emphasis "technoscientific rationalization" and production for productions sake (Deléage, 2013).

The policies largely succeeded in their stated goals: between 1954 and 1976, the number of active farmers halved and the number of large farms (over 100 ha) increased from less than 1% to over 15% (Gauvrit, 2012). The growth of farmer's unions and access to credit provided improved seed and fertilizer at low prices (Cleary, 1989). The creation of the Common Agricultural Policy in 1962 guaranteed prices for strategic commodities, organized markets and managed export of surplus, pushing farmers to produce more of institutionally valued commodity-crops (Zobbe, 2001).

My field work took place in Finistère, a region on the northern coast of Brittany, France. Long considered France's most 'backward' region, Brittany was dominated by subsistence-based peasant farming, primarily using family and hand labor, well into the 1960s (Canévet, 1980; Renard, 2005; Gambino, 2014). In the early 1960s, fierce protests by young farmers in Finistère galvanized the application of the *lois d'orientation agricole*, hastening the rupture between pre-war peasant agriculture and the post-war productivist paradigm (Renard, 2005; Deléage, 2013). Fed up with being underpaid for their produce by unscrupulous buyers who controlled calibration, weights and measures that determined prices, farmers organized the *Société d'intérêt collectif Agricole* in St-Pol-de-Leon (now called the Sica de St-Pol), a decentralized cooperative which allowed them to organize the regional market and collectively determine prices.[6]

The creation of the Sica St-Pol set in motion the region's rapid ascent from France's backwater to one of the country's top agricultural regions. Recognizing that their bargaining power rested on controlling the entire production of the region, the Sica succeeded in petitioning the state to intervene: in 1967, remaining independent producers were compelled to join the collective market (Laurentin, 2012). In the following years, the Sica elaborated into different bodies: Cerafel (created in 1965), which controls a common regional market; Prince de Bretagne (1970), the brand under which Sica produce is sold, and Brittany Ferries, a freight company to deliver produce across the English channel and stimulate tourism (Cerafel, 2019).The Sica pushed for state money to build roads and power lines, create a deep port in

[6] Sica is the largest agricultural cooperative in Brittany. BioBreizh is a 100% organic cooperative with about 60 members, created in the early 2000s, following a lawsuit in which the farmers who went on to found BioBreizh contested the obligation to pay dues to the Sica even though they were not members. They won the lawsuit and the right to create their own cooperative.

Roscoff for large shipping vessels and fund a university in Brest (Sica St-pol, 2019). The Sica also created the Organisation Brettone de Selection (OBS) in 1970, which conducts varietal development, testing and seed multiplication for cooperative members. Later, stations for varietal testing and laboratory-based work for plant breeding like molecular marking were created(Sica St-pol, 2019). These latter organisations were instrumental in introducing and popularizing hybrid varieties in the area.

With the support of the state and the addition of hybrid seed, farm machinery, synthetic fertilizer, agro-technical know-how, an organized market, infrastructure, and the fiery ideology of modernity, the scalability project of industrialized agriculture in northern France took root. Brittany quickly became one of the primary agricultural regions in France, generating 8.7 billion euros from agriculture in 2018(Chambres d'Agriculture Bretagne, 2019). The Sica de St-Pol now counts 850 farmers as members, producing 230,000 tons of vegetables amounting to 194 million Euros in sales in 2019 (Sica St-pol, 2019).

2.3 Seeing plants differently: vegetal political ecology

Seeing capitalism as a frame and industrial agriculture as a project can seem like a totalizing perspective: greenhouses, plantations and monocultures march across the landscape, devouring connected and healthy ecologies, transforming them into alienated components and feeding them to the machine of appropriation. Tsing highlights that, although capitalism and its control of nature is hegemonic, it is never a totality: she calls for "a theory of nonscalability" that historicizes scalability projects in order to denaturalize them and imagine alternatives[7] (2012, p.505). Her avatar of nonscalability, the matsutake, emerges in the ruin of capitalist scaling, while mine, peasant seed, persists within its heartland. Both confound scaling in and through their relationships with humans. Finding these interstitial spaces of difference and interspecies relationship, even within the frame of capitalism, requires a different "art of noticing" (Tsing, 2015b). In producing peasant seed, farmers practice a specific form of attention to plants, one that looks beyond yield to notice the plant's health, longevity, comportment, interesting or novel traits, interactions with other living things, and potential to evolve. In a similar way, understanding peasant seed as a potential foil to infinitely scalable hybrid vegetable varieties involves looking closely at the ways plants live, grow, interact and reproduce – understanding these capabilities not as mere programmed genetic functions but as potentially world-making in their consequences. This "art of noticing" lays the groundwork for a different relationship to the liveliness of plants, one that sees it not as a problem to be solved through scaling, the imposition of sameness, but as the material basis for a different form of agriculture: each off-type cauliflower or bicolored

[7] See also the writings of J.K. Gibson-Graham on the unevenness of capitalism and the economy as a "zone of cohabitation and contestation among multiple economic forms"(2006, p.xxi)

tomato not as an aberration or "off-type", but a manifestation of the potential for difference, divergence and creativity contained in each plant.

Jake Fleming (2017) devised the concept of "vegetal political ecology", connecting the actions of plants to broader resource politics in his study of "the politics of graftability". He argues that, the "small biological determinism" of graftability in the mixed nut-fruit forests of Kyrgystan creates a non-hierarchical and illegible resource politics which engages trees and humans as relatively equal partners (2017, p.33). This argument runs the risk of oversimplifying the complicated relationships between plant reproduction and growth, human manipulation of these processes, and how value is created and appropriated through these manipulations– as well as the social-historical context in which all of this occurs.

While remaining cautious of oversimplification, I argue that seeing plants as agential opens up ways to imagine agriculture otherwise: to think about how humans and plants, through collaborative efforts like the creation of peasant seed, may cultivate and rebuild barriers to accumulation that were progressively broken down in the process of agricultural modernization. Just as making scalable plants rested on ontological shifts in how genes, organisms and populations were viewed, imagining descalable plants, capable of supporting rather than compromising peasant farmer autonomy, entails a new way of seeing, one which takes plants seriously as actors with a role to play in alternative futures. This also involves seeing the human-crop plant relationship not as one of pure domination and control, but as a potential partnership *against* the capitalist appropriation of intertwined farmer-plant labor (explored in chapter 6).

3 What makes peasant seed?

> We are working towards a world with many small to medium sized farms with many people working on them. Our work is to try and go to this world by seeds. Others will enter the boat by different doors, but we're going in the same direction.
>
> INRA plant breeder (Interview 27 July 2019)

While modernity-minded state planners, plant breeders and young farmers in 1960s Brittany imagined a rational, production-oriented agriculture based on scalable plants, modern-day peasant farmer-seed producers in the region, and the plant breeders with whom they work, base their imaginaries of alternative agriculture not purely on a certain type of seed, but on the relationships through which it is constituted.

Using interviews with plant breeders and farmers, as well as secondary material on the principles of organic plant breeding, this chapter outlines what distinguishes peasant seed from hybrid seed or "scaled" seed. Using Tsing's concepts of *diversity* and *encounter* clarifies how ideas of the plant-person-ecosystem relationship within organic/participatory plant breeding oppose the logic of scalability and the project of industrial farming. In *semences paysannes,* crop plants are *made* in an active process of human intervention: the choice to reject manipulations of the seed that support capitalist penetration, like hybridization, is founded on a political project, showing how "social struggles…. make obstacles of the specific conditions of agricultural production" (Mann, 1990, p.45). Details from farmer selection and seed production demonstrates how putting these principles into practice has political impacts: in selecting and adapting plants to organic cropping conditions, producing seeds on-farm and collaborating with other farmers and plant breeders, farmers address appropriation of the seed and work toward rebuilding barriers to accumulation. In this relationship between seed/plant and peasant farmer, the limits and capacities of the plant are neither natural facts nor obstacles to be surmounted – rather, they are recognized and respected as what makes the plant itself. This process and negotiation of boundaries makes peasant seed not "unscalable" but actively "descaled", a concept that will be elaborated further in chapter five.

3.1 Encounter

> The only way to create scalability is to repress change and encounter. If they can't be repressed, the whole relation across scales must be rethought.
>
> Anna L. Tsing (2015b, p.142)

Over the roar of the seed-threshing machine, into which we fed cauliflower *porte-graines*[8], a farmer renowned for his work with *Brassica* varieties explained his view: he said the gene-focused method of plant breeding, which looks to link a desired trait to a gene and introduce only that gene to a new variety, creates a *plante déséquilibrée* – a plant in disequilibrium, which will manifest new weaknesses and susceptibilities to disease because it is treated as a bundle of isolated parts rather than a whole being. A plant breeder in the BAGAP lab at INRA who works with peasant farmers echoed this idea:

> From our research we realize that hereditary information is not genetic information. Genetic information is *part* of the hereditary patrimony. But there are microorganisms, epigenetic information... New developments in microbiology have demonstrated that there are also microorganisms on the seed, inside of the seed, and they are transmitted to the other generation. And if we are producing the seed in one place and the plant in another place, it is a stress for the plant. (27 July 2019)

Confounding the logic of scalability in plant breeding developed in the early 20th century, the fundamental unit of manipulation in organic breeding is not the gene, but the entire plant, in interaction with its environment – the individual gene makes no sense outside of its interaction with all other processes and organisms. Through collaborations in participatory plant breeding (PPB) projects, the techniques, concepts and experiences of peasant farmers and organic plant breeders have cross pollinated, shaping a type of varietal creation fundamentally different from top-down, corporate breeding. Central to organic plant breeding is the integrity of the crop plant at multiple levels: as a living being, as a plant with a typical nature (plant-typic), as a species with its own genetic variation and potential to express characteristics specific to the species (genotypic) and as phenotype, with an appearance in balance with its environment (phenotypic) (Lammerts Van Bueren and Struik, 2004). Any intervention into the life of the plant in the form of breeding or propagation must respect these levels of integrity, enhancing rather than limiting the ability of the plant to interact with the environment and adapt (ibid.). In practice, this means that breeding techniques that violate the cell boundary or manipulate genes of the crop, such as tissue culture, protoplast fusion and genetic modification are prohibited. Plants grown for seed are grown in soil, without the use of chemical inputs, and are allowed to complete the natural cycle of reproduction.

In industrial agriculture, both plants and animals are treated as interchangeable units of production, considered in their aggregate rather than as individuals with lives, emotions and needs (Porcher, 2011; Carrington, 2016; Weis, 2018). The passivity and silence of plants works against the application of ethical notions to their breeding: techniques that parse and separate the cells, genes, and tissues of plants are often left unproblematized, and plants are rarely considered for their intrinsic worth (Federal Ethics Committee on Non-

[8] Defined in Appendix 2

Human Biotechnology ECNH, 2008; Marder, 2016; Kallhoff, Paola and Schörgenhumer, 2018). For organic plant breeders and peasant seed producers, abiding by these "self-imposed, deliberately chosen limits to the freedom of manipulating, overruling, or violating nature and its resources" (Lammerts van Bueren and Struik, 2005, p.481) is an ethical obligation that has material consequences: because many modern varieties and hybrids, bred for conventional agriculture, are propagated using *in vitro* culture, respecting plant integrity in breeding means creating entirely new varieties, using different techniques and methods.

Conventional plant breeding works from the principle of wide adaptation, in which plants are bred, selected and grown for seed under "ideal" conditions on research stations and seed multiplication farms, with high levels of irrigation, fertilizer, and pest protection. Farming environments must then replicate these conditions in order to achieve similar yields (Dawson and Goldringer, 2011). Hybrid seed or seed produced off-farm has no genetic "memory" of place – it is remade anew each generation, and gene-environment interaction is intentionally minimized (or eliminated, if cell fusion under laboratory conditions is used). This inability to adapt and evolve from generation to generation violates the plant's integrity by interrupting its life cycle and removes it from "nonscalable sites of interspecies encounter" (Tsing, 2015b, p.142). In contrast, breeding for low input conditions stresses place-specific adaptation, the interaction of the plant's genotype with its environment (Ceccarelli, 1989). Rather than transforming the farm to match the high input, mechanized conditions of the research station, organic plant breeding works from the principle that each farm is ecologically unique, and plants should be able to adapt to these conditions. One farmer explained to me that he saves seed because plants "learn" and "remember" the agroecosystems in which they are grown, adapting over generations to specific soil and climate regimes. This adaptation makes them more nourishing for human consumption and more resilient in themselves, as plants.

In the first few seasons after his transition to organic production, one farmer had an outbreak of aphids in his artichokes. A consultant recommended an organic treatment, but this farmer chose to avoid treatment altogether, relying on the resilience of his plants and existing resistance in the population to carry the crop through. In the end, only a portion of the crop was lost, and he was able to continue propagating his artichoke from the resistant individuals. He had a similar experience with mildew in his broccoli seedlings, but by planting those that were less affected, he was able to propagate resistance into the next generation. By learning to coexist with rather than eliminate disease[9], farmers adapt varieties that become resistant through their interaction with environments, rebuilding barriers to appropriation by decreasing their reliance on off-farm inputs.

[9] See Klaedtke, Mélard and Chable (2018) for a discussion of European phytosanitary regulations on seed and the different understandings of seed/plant health advanced by peasant seed producers

In contrast, the director of plant breeding at the Organisation Bretonne de Sélection (OBS) explained their view on disease resistance:

> In the 1960s, there were collections made of local farmer varieties. We work from those varieties, work with each population to develop pure lines. This is the base of our genetic resources. We can always resow a population, re-do a screening to find a gene of resistance. If not, we call a gene bank to find characters that interest us, usually genes for resistance to a disease. (8 August 2019).

Resistance is reduced to the action of one gene rather than the interaction between plant and environment over generations. Rather than an evolving, lively and generative entity, farmer/population varieties are viewed as a static "base of genetic resources" that can be pulled from the freezer and screened for a few key traits.

3.2 Diversity

> Scalability banishes meaningful diversity, that is, diversity that might change things.
>
> Anna L. Tsing (2015b, p. 38)

Within peasant seed practice and organic plant breeding, diversity occurs at multiple scales: Although "monocultures usually mean one crop species growing over a large space…monocultures can exist at multiple levels, from the species to the variety to the gene" (Dawson and Goldringer, 2011, p.79). Peasant varieties are population varieties, meaning that individual plants of the same generation and same variety have small genetic differences – what appears to be a uniform stand of wheat or a field of cauliflower in fact contains vastly more genetic diversity than a field of hybrids. This "hidden" diversity struck me during the hours spent planting cauliflower on Rene and Malou Lea's farm: hundreds of young plants passed through my hands as we transplanted, most with relatively similar leaf shape and color, growth habit and comportment. Still, I knew each one contained a slightly different mix of genetic and hereditary information – each plant at once an individual and a member of a population, whose adaptive ability depended on this subtle diversity.

Intravarietal heterogeneity is the material basis of farm resilience: in a dry year, some plants will produce better while other will succumb to thirst; under pest pressure, some plants will suffer while others will resist better. Farmer selection also acts on this diversity: farmers usually choose several specimens as *porte-graines*, let them go to seed, and save that mix of seed for the next generation. Retaining and propagating intravarietal diversity over plant generations rebuilds barriers to appropriation (and thus accumulation) by reducing farmer's reliance on seed companies and the inputs necessary to protect genetically homogenous varieties, which are more vulnerable to devastation by pest and disease.

The barriers to accumulation rebuilt by plant diversity are not purely biophysical, and they must be sustained by more than individual acts of on-farm selection. Agrobiodiversity and heterogeneity are deeply politicized in peasant seed practice; they are the locus around which peasant seed producers and plant breeders collaborate and agitate. Within the French regulatory system for seed, varieties must be distinct, uniform and stable (DUS) to be legally registered in the *Le catalogue officiel des espèces et variétés* (Official catalogue of species and varieties). Registration in the catalogue then allows seed from a variety to be legally bought and sold. Uniformity is assessed by the number of "off-types" in a planting, or plants that do not conform to the written definition of a variety's appearance, submitted when it is registered. Stability is a function of the crop's uniformity over multiple generations – the appearance of the crop cannot evolve or change over time (Plant Variety Rights, 2013). These criteria eliminate peasant varieties, which are heterogeneous and evolving. Many plant breeders and scholars blame these standards for the dramatic drop in crop agrobiodiversity and the gradual disappearance of peasant varieties, displaced by uniform hybrids (Bonneuil *et al.*, 2007; Corporate Observatory Europe, 2013; Mammana, 2014; Rossmanith, 2015). Conformity to DUS standards and registration in the official catalogue also gives plant variety rights to the breeder, a form of intellectual property rights that confer exclusive rights to produce, package, market, import and export the variety to the breeder for 25-30 years (GEVES, 2019). Thus, homogeneity underlies the commodification and privatization of the seed, enabling accumulation in the realm of plant breeding and seed production.

Representatives of the seed industry often claim that the system of seed registration has *increased* agrobiodiversity, citing the over 3.200 vegetables already registered, with 150 additional varieties added each year (Masbou, 2017). However, the narrow focus on numbers elides the fact that most varieties are protected by plant variety rights, with breeding material overwhelmingly maintained by a few large seed companies.[10] A proliferation of varieties does not mean they are accessible to or reproducible by farmers. Further, varieties whose registration is not renewed each year (with a large fee) are allowed to lapse from the catalogue, and if no one maintains them, they may fall out of use and go extinct. Many peasant seed producers stress that the definition of plant life is that it is in flux, constituted through its response to the changing environment, and varieties must be in cultivation in order to retain this capacity to respond. They reject the obsession with fixing and stabilizing a plant's identity and the Catalogue system on which it is based. The

[10] While the FAO states that about 75% of agrobiodiversity has been lost since the 1900s (2004), the seed industry claims that "although the visible diversity in farmers' fields may have been reduced, the diversity of valuable genes has been increased by introgression of new materials" (International Seed Foundation, quoted in Wolff, 2004). Goldringer et. al. (2012) propose an alternative measurement for agrobiodiversity which takes into account loss of intra-varietal diversity, using wheat in France as an example. As with the unit of manipulation in plant breeding, the scale at which biodiversity is seen, measured, valued has an intrinsic political dimension.

corporate breeding paradigm, represented in Brittany by the OBS, has a fundamentally different perspective on the plant variety:

> A variety can have a career that is twenty years, or five, six years, because it hasn't found its market. The variety is correct but nothing more. It's a factor of competition… if we can't commercialize it at a sufficient scale. Because even if the variety is created, you have to follow certain regulations for quality: germination, testing for stability. So at the minimum you have to cover your costs. At the moment you can't cover your costs, it means the producers have found a different, more interesting variety, and the other one is taken off the market. (OBS director, 8 August 2019)

Rather than seeking to proliferate and nurture as many varieties as possible, allowing them to evolve and change, the life and death of a plant lineage is reduced to a factor of supply and demand. F1 hybrids are created through a combination of desired genes under ideal, laboratory conditions, defined by and maintained in genetic stasis, and readily exterminated when their (economic) value is no longer demonstrable.

For the farmers I worked with, the maintenance of agrobiodiversity becomes political through its links to peasant identity and autonomy – the freedom of peasant farmers to select from and manage plant diversity, as opposed to the top-down creation and destruction of plant varieties. These farmers said they engaged in seed production in order to distance themselves from large seed companies. They connected the transition from population to hybrid varieties with the shift from *paysan* to *exploitant agricole* – and the way that this shift in vocabulary reflected a shift in relationship between farmer and plant as well as a devaluation of the farmer's *métis* – emplaced skill and knowledge (Scott, 1998). Cultivation of biodiversity is never an individual act: maintaining resilient population varieties requires incorporation of new genetic material from other varieties, produced through different "encounters" on another farm. Producing *semences paysannes* thus compels farmers to interact and collaborate, sharing seeds, ideas and practices, building a form of peasant autonomy that is collective rather than individualistic.

This collaboration also extends to participatory projects with plant breeders, many of whom work at the BAGAP lab at INRA. Corporate-led breeding programs are able to scale up because they focus on the smallest scale, the gene, in order to achieve isolated, distinct goals: yield and resistance. Through this focus, they suppress input from varied actors with a stake in the creation of new kinds of plants: farmers, soil scientists, microbiologists, grocers, consumers, pollinators. Participatory breeding programs incorporate this diversity of input from different stakeholders and cannot exist without it: currently, breeding programs in the BAGAP lab bring together breeders, growers who specialize in "orphan" grains like buckwheat or spelt and bakers or pasta-makers who transform these grains into high-quality products (Vindras-Fouillet *et al.*, 2016). Contrasting this approach and the gene-focused perspective, one BAGAP plant breeder stated

> They are working only on genes; they don't want all the other kinds of information. The way of thinking of the plant and the reading is very partial. But for the chemical company it is good, because the plant will have plenty of diseases. In the other system they don't need all these other kinds of people, but we are considering all kinds of information. And we cannot develop large breeding companies because we *need* to remain local. (27 July 2019).

From the level of the root microbiome to political organization, diversity constitutes these encounters and connects each level in such a way that a singular logic cannot be propagated from the smallest scale to the highest. Relying on place- and farmer-specific adaptation emphasizes the power of encounter in challenging the frame of industrial agriculture – encounters between plants, weather, soil microbiota, beneficial insects and pests, climatic shifts. While Tsing highlights a similar form of multispecies encounter in the complex exchange of nutrients between matsutake and trees that maintains forest ecosystem health and resilience, humans enter the encounter later, as forest managers or mushroom pickers. In the case of peasant seed, the human is a central actor in the encounter: plant evolution is channelled and directed in a complex dance among environment, gene, rhizosphere, epigenetic factors, and farmers' acts of selection on these expressions of gene-environment interaction, based on their ideas of plant health, beauty or economic function.

This is the material process of "descaling" plants: instead of banishing encounter to make plants interchangeable, interdependence, interaction and genetic diversity are used as tools in breeding, making plants irretrievably of a place and a product of relationships. Combined with a commitment to avoid plant variety protection and patents on life-based innovations (Lammerts van Bueren and Struik, 2005), the collaborative practices of peasant seed production and organic plant breeding have the potential to counter the appropriation of the seed both biologically and legally. Descaling is a way of thinking about plants through encounter and diversity, but also a way of creating fundamentally different kinds of plants, through processes and research frameworks that cannot be scaled up. These resilient, descaled plants then form the foundation of autonomous peasant farms.

4 *Semences paysannes* in the supermarket

Among the farmers I worked with, methods of commercialization are as politically polarizing as the division between population varieties and hybrids. *Circuits longs,* food distribution and marketing with multiple steps and actors are placed in opposition to *circuits courts,* direct marketing, without intermediary between consumer and producer. Many farmers and activists within the RSP maintain that the fruits and vegetables from peasant seed should only be sold in *ciruits courts:* their heterogeneity make them incompatible with supermarket standards, which demand perfectly uniform, unblemished, produce available year-round, at low prices. These standards discipline farmers into industrialized modes of production, involving uniform hybrid varieties, infrastructure like heated greenhouses for year-round production, chemical crop protection to avoid any unsightly blemishes and ever-expanding acreage to accommodate economies of scale; systems that provide opportunities for capital penetration through reliance on inputs and unpredictable markets (Scott, 1998; Freidberg, 2007; Mr. Mondialisation, 2017). Instead of engaging with *circuits longs*, activists say, peasant farmers who wish to regain their autonomy should seek out or create "alternative" economic spaces in which the diversity of their produce is valued rather than suppressed.

However, some of the farmer-members of Kaol Kozh and BioBreizh have recently signed an agreement with multinational supermarket chain Carrefour to sell their vegetables from peasant seed at higher prices, with an exclusive label that reads "*Graines de Paysans"* (peasant seed). A controversial ad campaign called "*marchés interdits*" (forbidden markets), calling attention to how French law prohibits the exchange of peasant seed, accompanied the agreement. Is it contradictory for vegetables from peasant seed to be sold in the supermarket, that paradigmatic space of capitalist retail, force for homogeneity and industrialization in farming? Understanding this dynamic involves looking beyond purely material barriers to accumulation (crop plant heterogeneity and low-input adaptation) and into the social relations that influence the circulation and sale of peasant vegetables.

4.1 Patches and chains

Using Anna Tsing's notion of the "patchiness" of capitalism helps understand the presence of vegetables from *semence paysannes* in the supermarket. Tsing maintains that, although scalability projects help expand the frame of capitalism and its goal of extracting value from nature, the frame itself encompasses and depends on patches, spaces outside of rationalization and standardization. Abandoned industrial forests that sustain matsutake blooms and informal picker economies/socialities are one of these "patches". If we look at capitalism without assuming a totality, we can understand that "*the concentration of wealth is possible because value produced in unplanned patches is appropriated for capital*" (2015b, p.5). According to Tsing, modern-day capitalism

operates not by imposing a singular rationality across entire supply chains, but by coordinating and translating the value of key commodities through different spaces that comprise the chain. Through processes of translation, value produced by ecological processes is "salvaged" by lead firms without needing to control the conditions of production (ibid, p.128). Through the production of peasant seed and vegetables, the farmers with whom I worked created a "patch" in which plants and people remained outside of direct capitalist control, while still creating value that is appropriated by supermarket capital.

4.2 Creating value: peasantness, diversity, militant consumerism

Capitalist markets function through the process of commodification: divorcing things from their lifeworld in order to make them objects of exchange, cleansed of previous relations (Marx, 1959; Tsing, 2015). Alienated labor, workers who have no ownership over the labor process or product, enables this severing of ties. The product that emerges is not valued for its "physical properties and the material relations arising therefrom"; rather they acquire value through their exchange for money (Marx, 1959). Commodification is thus also a type of scaling – it eliminates meaningful encounters between worker and product in order to make things commensurable and interchangeable. Vegetables labeled "*Graines de Paysans"* therefore present a strange puzzle. The seeds themselves are not the product of a labor relationship that is alienated: farmers feel a strong affective and ideological attachment to this work, and seeds are not produced for sale, but for on-farm use.

Unlike most other European countries, smallholder peasant agriculture persisted well into the 20th century in France, and the work of farming is a not-so-distant reality to many French families. This proximity means that the peasant is a figure which consumers trust: possessed of a unique agrarian *métis*, peasants' produce is inherently of good quality, produced in environmentally sound conditions (Freidberg, 2004). The use of the phrase "*Graines de Paysans*" also capitalizes on the re-politicization of the term "*paysan.ne"*. Farmers have reclaimed the word, using it to define a type of agriculture that is not anti-modern but anti-modernization; that produces to nourish peasants, eaters and the land, rather than agribusiness. The mission of peasant agriculture is touches upon farmer autonomy, dignified employment, and thriving rural communities and economies, linking "the identity of producers, their relationship with their work, with society and with the living world" (Demeulenaere and Bonneuil, 2010, p.73; Confederation Paysanne, 2018b). Peasant seed links these goals to seed production, centering on the capacity of farmers to take back this critical input and perceive it as a holistic relation between farmer and plant, through which the farmer reappropriates an almost-lost skill and takes a stand against corporate power (Demeulenaere and Bonneuil, 2010).

Figure 1
***Marches interdits* promotion**

Sournce: https://blogcomco3.wordpress.com/2017/10/10/carrefour-et-son-marche-interdit-incroyable-operation-de-communication/

However, Carrefour's invocation of peasant agriculture glosses over several of these critical issues. Rather than highlighting the impact of "forbidden" seed on peasant livelihoods, the "*marches interdits"* campaign centers on the lack of consumer choice: consumers are "deprived" of thousands of different kinds of fruits and vegetables because French law prohibits the sale of their seeds. Reducing agrobiodiversity to a matter of consumer choice frustrates the attempts of farmers to politicize diversity and connect it to wider socio-political issues. Consumers and retailers can also become political actors without having to fundamentally change their behavior or relationships: shoppers still have the convenience of a large supermarket, which sells both local, aesthetically pleasing, high-quality peasant vegetables and out-of-season or tropical produce sourced through Carrefour's other supply chains. Carrefour benefits from the higher prices obtained by peasant vegetables without having to change its relationships to other farmers, receiving a boost to its image as an ethical, eco-conscious supermarket. In theory, purchasing is turned into a "militant" act that expresses one's discontent with the current state of seed law, conflating the role of citizen and consumer (Gunderson, 2014).

In addition to the ad campaign, Carrefour also mounted a Change.org petition calling attention to decree 81-605 of May 1981, which prohibits the sale and free exchange of peasant seed. The petition called on the French government to simplify the law and open up the official catalogue to heterogeneous seed, allowing peasants to commercialize their seeds in direct sale, in order to "to bring the peasant seed production model into the law, so

that the consumer can have free access to these products. Thus, the standard model [industrial agriculture] and the peasant model can coexist, different but equal in law"[11]. Carrefour thus advocates incorporating peasant seed into the flawed system of catalogue registration rather than seeking to challenge it as an outdated relic of post-war agricultural modernization. By claiming that productivist and peasant forms of production can coexist, Carrefour denies the radical political project of peasant seed, which seeks to supplant rather than accommodate industrial agriculture.

By claiming that its actions in publicizing the plight of French peasants and biodiversity helped push recent changes in organic regulation that opened the catalogue to heterogeneous seed, Carrefour elides the fact that its global supply chains help reinforce those very same produce quality standards in developing countries, oppressing far-off and racially different peasants and workers(ITUC, 2016; GRAIN, 2017; CHRB, 2018). The biodiverse *patrimoine* of France and the work of *French* peasants in maintaining it is advertised, valorized and supported by higher prices and extra funding, ignoring the fact that peasants in other countries have been protecting and sustaining biodiversity under Western duress for decades. Threats to local seed systems in former French colonies in Africa are mounting under the pressure of seed corporations, which seek to harmonize national seed regulation with Western systems, facilitating the free movement of corporate seed (La Via Campesina and GRAIN, 2015; de la Perrière and Prat, 2019). While the struggles of the farmers I worked with are real and pressing, I was unsettled by the lack of mention of a global peasant seed movement, or of the inequalities between peasants in different places. During and after my field work, I was left with open questions: is the ability of some farmers to (re)claim the moniker "peasant" perhaps dependent on the de-peasantization of others? Is the possibility of proliferating unscalable spaces dependent on the increased integration of others into tightly controlled corporate supply chains (Dolan and Humphrey, 2000; Friedmann, 2005; McMichael, 2012)? Does the glorification of French peasant farmers and traditional vegetable varieties defend a "Eurocentric rural imaginary" against migrants or those viewed as outsiders – what DuPuis and Goodman (2005, p.360) call an "unreflexive", exclusionary localism?

4.3 Appropriating value: translation, stories, *étiquettes*

Appropriating value from the peasant seed "patch" relies on acts of "translation". The value of matsutakes is translated from Oregon forests through independent buyers, bulkers, exporters and middlemen, all the way to Japanese consumers. In the process of grading and sorting based on quality, the mushroom, a product of encounter between tree and mycelium, picker and fungal fruiting body, is made legible as inventory, making the accumulation of capital possible even without scalable production conditions (Tsing, 2015b,

[11] https://www.change.org/p/quand-la-loi-appauvrit-la-biodiversité-et-notre-alimentation-changeons-la

p.70). Relationships between farmers and supermarkets also rely on acts of translation, but rather than relying on only middlemen, members of Kaol Kozh created a label for their vegetables that indicates their origins in *semences paysannes.*

The creation of this label was a subject of debate among members of the RSP, including some members of Kaol Kozh. The label was intended to allow farmers to valorize their seed work, as some retailers were becoming interested in the practice and wanted to feature vegetables from peasant seed in their stores. RSP members wanted to forestall someone else capitalizing on this interest by creating their own label with a different, perhaps less stringent definition of *semences paysannes.* Notes from internal meetings[12] emphasized that the use of the label should not be only for commercial gain but must stress the political dimension of *semences paysannes:* that they are "non-industrializable".

Matsutakes become commodities as the relations of their production are effaced in their transit across the globe, through various supply chain actors. In contrast, the value of vegetables from peasant seed turns on making transparent certain parts of the productive process. Because the difference between an organic vegetable from hybrid seed and one from peasant seed is not visually apparent to the consumer, carrying the political message through the supply chain and ensuring that farmers are well remunerated for their seed work turns on making explicit their origin in peasant seed. Based on a common definition of *semences paysannes*, Kaol Kozh spearheaded the creation of a *cahier des charges,* a list of rules and best practices farmers must follow in order to use the label[13]. Before the contract with Carrefour, the label, a yellow band or round sticker that read *Legumes issues de semences paysannes* (vegetables from peasant seed) was used mostly with national organic supermarket chain Biocoop. Based on the contract, Carrefour uses not this typical yellow label, but a grey circle that states *Graines de Paysans en exclusivité chez Carrefour* (Peasant Seed, exclusively at Carrefour).

The farmers I worked with have leveraged their unique position as French peasants in order to negotiate relaxed standards for homogeneity for their produce. Beneficially for Carrefour, the practice of peasant seed production does not have to be enforced through supply chain standards: monitoring is undertaken voluntarily by peasants themselves, out of a sense of political/ecological duty. Farmers have organized their own forms of auditing, visiting each other's farms to make sure farmers follow these self-created standards. This willingness to both create and abide by standards makes the appropriation of value from the peasant farmer-seed relationship much smoother for Carrefour, which do not have to directly oversee and manage it. This lack of oversight by lead firms is a hallmark of "patchiness" in supply chains (Tsing, 2015b).

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[12] Accessed through the archives of Kaol Kozh, with permission of the association's coordinator.

[13] See Appendix 3 for rules governing use of the label.

I witnessed an act of supply chain translation in a meeting of the coordinator and an intern of Kaol Kozh with employees of a regional organic produce wholesaler. The meeting concerned a variety trial of onions from peasant seed. The intern had spent the previous months gathering seed from farmer-members, growing a small number of each variety, and harvesting, weighing, counting and grading the onions to compare them. On the day of the meeting, he prepared a blind taste test of the seven onion varieties (cooked and raw) along with a wooden crate of ideal specimens to present to the wholesaler. In a hot, tiny conference room, the taste test proceeded in concentrated silence, the wholesaler employees contemplatively munching bits of onion and marking down their impressions of taste and aesthetic qualities on scales of 1 to 5. The meeting finished with the coordinator of Kaol Kozh "unveiling" the story of each variety: its name, culinary use, regional/historical origin and the farmer who cultivated it.

The employees expressed their enthusiasm for both the onions and the project of peasant vegetables, saying that these brief, catchy "stories" about regional/culinary history would be invaluable in marketing them, making the idea of peasant seed comprehensible to the consumer. The Kaol Kozh coordinator linked developing this market and consumer awareness to the material proliferation of peasant vegetables and diversity. However, wholesaler employees mentioned that the sheer number of different vegetables and stories would confuse or overwhelm consumers; they wanted no more than one or two peasant varieties to be released every year. I wondered how this linkage between marketing the "stories" and nurturing vegetable diversity would play out if farmers decided to grow only those varieties Poder was interested in selling, and if those varieties numbered only one or two a year. Varieties should be resown every year to maintain their capacity to evolve with environmental conditions – if they were shelved because of lack of consumer interest, this would be compromised. And is releasing only two varieties a year any different than the one or two hybrid varieties of each vegetable that currently dominate supermarket shelves? Sitting in this meeting, I was faced with a fundamental disconnect between a political project that links plant diversity with farmer livelihoods and self-determination and a system that, even with the best intentions, is built on regularity, uniformity and selling a product to the consumer.

After the meeting with marketing and sales employees, I visited the warehouse: a cavernous space, the temperature of a refrigerator, full of loud, fast-moving carts and trolleys and conveyor belts, supervised by workers bundled in warm layers and cargo pants. While the previous meeting centered on translating the value of vegetables from *semences paysannes* through their stories, the warehouse work centered on making inventory in a material sense. The warehouse manager matched his workspace's hectic pace, yelling explanations at me in rapid-fire French, half-running as we traced the path of vegetables through the warehouse.

I stopped to observe a tall stack of cauliflower crates, and the warehouse manager shouted in disapproval – the crates were missing *étiquettes*, the label

with the name of the farmer, farm, crop type, and lot number. The manager decried this oversight on the part of the farmer, stating that without an *étiquette*, *traçabilité* (traceability) is impossible – and traceability is demanded by supermarket buyers. I experienced the importance of *traçabilité* on the farms as well: after harvest, during packing time, I was instructed numerous times not to forget the *étiquette*, to affix it clearly and securely on each crate. Moving through the warehouse, I saw boxes of "*tomates ancienne mélange"* (traditional variety mix tomatoes) that I had harvested and packed on a farm the day before. Seeing them here, neatly packed, ready to be shipped to a supermarket in Rennes or Lorient, I was struck by how readily the work I and the other farmworkers put into making these crates fell away. A whole day of picking tomatoes, arranging them neatly and attractively in the crates, mixing shapes and colors and sizes just so, sorting, weighing and grading, generating an enormous amount of waste from defective tomatoes, and all that remained to trace the process was the all-important *étiquette*.

Figure 2
***Tomates ancienne mélange* in the Poder warehouse**

Labelling and branding show how appropriation can work with or without changes in plant biology. Tsing observes that, for matsutakes, "commodities accelerate to market tempos only when earlier ties are severed" (2015b, p.37) and acts of translation create "purified" inventory (ibid, p.127). Rather than severing previous ties, making vegetables placeless, the peasant seed label links vegetables to their places and practices of origin in order to make these origins a source of value. The source of the value of peasant vegetables is not the masking of the conditions of production, as is typical of commodities under capitalism, but the specific way in which those very conditions, and the relationships and political missions that underlie them, are mobilized by Carrefour. In this relationship, value is appropriated even from an unscalable "patch", showing that barriers to accumulation are not only based on the material properties of seed and plants themselves but the ways in which those properties are translated by different actors along the chain. The biological capacities of plants become useful to capitalists not only through their control, but through their representation.

It matters who is doing this "unveiling" (Guthman, 2009) of the commodity; how origins are made relevant or apparent: the slight change in wording from the yellow label (vegetables from peasant seed) to Carrefour's exclusive brand that names the peasant seed *itself* is politically significant. By using *Graines de Paysans,* words meaning "peasant seed" on the label (rather that *légumes issues de semences paysannes,* meaning "vegetables from peasant seed" the label used with other supermarket chains), Carrefour obscures the difference between the commodified product of the seed (the vegetable) which has less political significance, and the seed itself. In the process, Carrefour intrudes upon and extracts value from what was previously a space of unscalability, of resistance to the industrial food system, and a mode of un-alienated labor - the encounter between farmer and crop plant in the production of *semences paysannes.*[14]

4.4 Potential in patches

Many of the farmers with whom I spoke stated that they view the partnership with Carrefour as a way to spread awareness of peasant seed and communicate its importance to the consumer. One farmer mentioned that most consumers think that, if the vegetable is organic, it also comes from peasant seed – they are unaware that most organic vegetables are also hybrids. Labeling their vegetables as *Graines de Paysans* publicizes and valorizes their work in producing seed, stewarding biodiversity, and reducing their dependence on seed companies, allowing consumers to perform an "*acte militante"* (militant action)

[14] In representing the seed and the farmer, Carrefour obscures the fact that alienated wage labor (farmworkers) are central to the production of the vegetables even on peasant farms. This points to the tension around wage/migrant labor in Europe (ECVC, 2003; Archambault and Desmazieres, 2014) and the invisibility of farmworkers even in the production of "ethical" food (Gray, 2013; Besky and Brown, 2015)

with their purchase. Bringing local, traditional, organic vegetables into the supermarket increases their accessibility to consumers who cannot afford an AMAP (*Association pour le Mantien d'une Agriculture Paysanne)* or farmer's market or don't live near one. Other farmers stated that producers who thought that peasant seed production was backwards or took too much time and effort now see the added value these vegetables can accrue and are thinking about producing seed. Rather than viewing this as the reduction of *semences paysannes* to a question of economics, they see the label as pushing more farmers to rediscover seed production. Engagement with supermarkets on different terms has direct benefits for their political goals, potentially proliferating patches of peasant seed production in France. Still, some remain cautious. The contrast is only for five years, a farmer reiterated: after that, who knows what could happen.

This lack of confidence demonstrates that power imbalances between supermarkets and farmers will take more than one agreement to shift. Despite these imbalances, value doesn't flow only in one direction, out of unscalable patches and into supermarkets. In addition to paying higher prices and buying guaranteed quantities of vegetables, Carrefour has pledged over 100.000EUR per year to Kaol Kozh to develop peasant-seed oriented activities of the association's choosing. Kaol Kozh has rented an old barn in the coastal town of Roscoff and planted a large demonstration garden. Varietal trialling for carrots, onions is underway, with future trials planned. A large, complex varietal development program *Brassica* crops without the use of cytoplasmic male sterility (CMS)[15] is also in progress. The funding is used to pay a coordinator, who visits farmers, organizes workshops and meetings with retailers and manages communications. The lack of oversight from Carrefour allows the definition and regulation of peasant seed practice to remain in farmers hands; they cited this as critical to their relationship with the supermarket.

Are supermarkets necessary to maintain patches, just as patches help sustain supermarket capital? Kaol Kozh has opened itself up to reliance on the Carrefour Foundation's generosity, depending on their funding for their activities. The partnership is fraught and uneasy, and the future remains uncertain. Still, peasant seed has persisted since the dawn of agriculture, despite attempts by seed industry to stamp it out, and I do not doubt that the farmers I worked with will continue to produce their own seed, with or without the financial support of Carrefour. The next chapter looks to complicate the idea of "patches" by looking at this attachment to seed practice, focusing on relationships between farmers and their plant varieties.

[15] Defined in Appendix 2

5 Cultivating refugia

Following Tsing (2015a), Donna Haraway defines refugia as "spaces from which diverse species assemblages… can be reconstituted after major events [like floods, fires or clear cutting]"(Haraway, 2015, p.159). Although it is originally a term from population ecology/biology, refugia are not only spaces of untouched, wild biodiversity: they can be found in the heart of capitalist supply chains. Relationships between farmers and plants, forged in the production of peasant seed, create "patches" from which value can be appropriated, but they also act as "refugia" for interspecies relationships that do not conform to purely productivist logics (Tsing, 2015; Haraway, 2015; Puig de la Bellacasa, 2015). Distinguishing their organic, peasant farms as spaces of recuperation turns on putting into practice forms of multispecies relationships that cultivate "response-ability" in both humans and crop plants (Haraway, 2008). Chapter 3 investigated ways of conceptualizing plants in organic plant breeding and peasant seed production. This chapter looks into how those ways of understanding become ways of *interacting* with plants, framing descaling as a concrete material practice with political effects. By integrating seed production into their farming, farmers must reckon with the unpredictability of plants at different points in their lifecycles, challenging hyper-efficient, productivist industrial models of agriculture that seek to control plant liveliness.

5.1 Relationships of refuge

Even as they avoid certain forms of plant manipulation that violate the integrity of plants, the relationship between farmers and the crops they reproduce for seed is never devoid of power: domesticated plants are intrinsically manipulated and controlled, kept from degrading back to natural forms that may serve their own reproductive or ecological needs but not those of humans (Mendum, 2009). In her work on domesticated dogs as companion species, Donna Haraway asserts that this "instrumental intra-action itself is not the enemy; indeed… work, use, and instrumentality are intrinsic to bodily webbed mortal earthly being and becoming"(2008, p.71).

The production of *semences paysannes* involves having the power to direct the course of a variety's evolution – by selecting certain plants to propagate for seed, the farmer determines what form future generations will take, based on the genetic material they inherit, while eliminating other potential lineages by *not* choosing some plants as *porte-graines*. This interference in reproduction and sexuality is a powerful, "non-innocent" form of interaction. But by selecting and evolving varieties over time, farmers allow the plant to live beyond a single generation, extending the life of the plant beyond the individual and ensuring its "ongoingness" (Haraway, 2015). I understand selection as a practice of caring for plants by allowing them to propagate themselves and evolve, while recognizing that they serve a purpose: nourishment of humans. When integrated with organic production practices, this form of care locates the

purpose of plants beyond food by acknowledging that they also participate in complex webs of caring for other non-humans: pollinators, soil fungi and bacteria, even disease organisms and pests.

Many of the farmers with whom I worked had collaborated with organic plant breeders in the past, and the ideas of naturalness, plant integrity, and prohibited breeding techniques were integral to their practice. I see the interaction between care/respect for plants and instrumental use most clearly in this subscription to voluntary limits on manipulation. One example is banning the practice of cytoplasmic male sterility (CMS), a hybridization technique used for *Brassica* species (most often cabbage). Because the introduction of cytoplasmic male sterility often involves protoplast fusion or an interspecies cross (between the Ogura radish and the desired cabbage variety), the technique was banned from organic plant breeding based on its violation of species integrity and the cell boundary (Billmann *et al.*, 2008; FiBL, 2015; Nuijten, Messmer and van Bueren, 2017). Eschewing CMS hybridization formed the impetus for the original collaboration between an INRA organic plant breeder, cited in chapter 3, and Kaol Kozh farmers in the early 2000s: the lack of cauliflower and cabbage seed without CMS made farmers realize that they must create their own varieties if they wished to stay true to their ethical responsibility toward plants *and* build their own autonomous seed supply. In developing non-CMS varieties, these farmers transformed ethics from "a rule-based activity" (an abstract set of guidelines) to a "propositional, worlding activity" – a relationship in practice, combining instrumental and caring practices (Haraway and Kenney, 2015).

5.2 Response-ability

Ethical limits on plant manipulation inform a set of practices that cultivate "response-ability" in farmers and their crop plants. "Response-ability" is "that cultivation through which we render each other capable, that cultivation of the capacity to respond" (Haraway and Kenney, 2015, p.230). To respond to another living being is to "to hold in regard… to look back reciprocally, to notice, to pay attention" (Haraway, 2008, p.19). This mutual response is the foundation of interdependence, in which non-conspecific partners (like farmers and crop plants) adjust to one another's ways of being and doing in order to work together (ibid.).

When I asked her why she produced and worked with her own seeds, one farmer responded:

> For me, good seeds are not something tampered with, with genes inserted in their DNA, manipulated artificially, sectioned, I don't know what. We think that it is a plant that grows from these seeds, but for me it's like a robot; it's programmed for such and such thing but it's completely useless [lost, wasted], the roots can't associate with mycelium. These plants are not adaptive, they are poor. (27 August 2019)

Where hybrids are mute, unresponsive and robotic, demanding only a standard set of inputs and actions; population varieties are heterogeneous and thus demand more varied, creative responses by farmers. Cultivating the capacity for response means opening up space for negotiations between farmers and plants "in which a central portion of the process consists of coming to understand what a given plant or population of plants may choose to offer up" (Mendum, 2009, p.319). Some of the most exciting moments of my fieldwork were those when plants chose to offer up something surprising, beautiful or novel. One evening, I was inside, working on notes, when the farmer burst in grinning, telling me he had made "*une belle découverte*" (a beautiful discovery) while harvesting. He presented a perfectly bicolored tomato, one half deep brown-red, the other bright yellow-green – the entire thing soft and ripe.

Figure 3
« *Une belle découverte* »

The fruit had come from a variety represented by a single plant, whose name the farmer had lost. In the next few days, he showed everyone who came by the farm the magic tomato, promising to save seed and watch the plant to see if later fruits showed the same curious beauty.

On another day, I was seated on the back of the tractor, engaged in the deeply meditative work of planting cauliflower. My mind had wandered into other territories, lulled by the feeling of soft loamy soil, the rhythmic action of taking a seedling from the tray in front of me, tucking its roots into the earth, reaching up for the next, over and over. Suddenly, the tractor lurched to a halt and the farmer driving jumped out, half-running toward the squash field next to the one we were planting. I looked up as he beckoned me over, pointing to a round yellow squash which stood out from the field full of dark green ones. He immediately began pulling off male flowers, explaining that he didn't want this rogue yellow plant to cross-pollinate with the green ones. I joined him in emasculating the yellow squash, and we buried the offending male flowers in the dirt. He handed me his pocketknife and had me carve my name into a sizable yellow fruit, telling me he would send me seeds if it turned out that they bred true (the offspring turned out yellow as well).

Figure 4
Emasculating squash

I was startled by the decisiveness of the action, abruptly ending this plant's ability to pollinate and propagate itself. I thought that the farmer did it to keep the purity of his green squash, but I realized that by emasculating this *individual* squash plant, ensuring it didn't cross pollinate, he was ensuring its potential to propagate later generations of yellow squash: he was caring for a *variety* (or potential variety) by recognizing that its uniqueness was compromised by its sibling (green-fruited) plants. In this careful maintenance of the reproductive boundaries between varieties, this farmer was maintaining and generating diversity. Through noticing what their plants did, their acts of creativity and liveliness, these farmers were "respond[ing] to an invitation or recogniz[ing] one when it is offered" (Haraway, 2008, p.22), involving themselves in the evolution and reproduction of their crop plants in a way that doesn't avoid or deny the instrumentality of their relationship. Farmer-variety relationships show that "to be in a relation of use to each other is not the definition of unfreedom and violation" but can provide new ways of working (together) for both plants and farmers (ibid, p.74).

By integrating the production of seed into the cycle of farm activities, producers of *semences paysannes* come to know plants at a point in their life cycle that many farmers never experience, as most crops are harvested for sale and consumption before they have reached the reproductive or seed bearing phase. *Porte-graines* become a different sort of plant, demanding a different kind of care. Plants gone to seed must be visited and watched, the rate at which seed is developing or drying must be monitored in order to time harvest and avoid premature dropping of seed. A farmer's understanding of weather and other living creatures on the farm changes: a rainy day might be wonderful for germinating lettuce, but terrible for harvesting lettuce seed; a songbird might eat caterpillars off of cabbages in their plant stage but decimate a crop of bean seed. On the day we processed cauliflower seed, I noticed that the dried plants had a thin film of dead aphids coating the flower stems. I asked the farmer, and he mentioned that in their seed phase, *Brassica* become more vulnerable to different kinds of disease and pests: as plant energy is now directed into the demanding activity of producing the next generation, defence against herbivory or disease becomes secondary.

These ways of knowing plants at different stage in their life cycle, of manipulating and interacting with them, may seem mundane or technical, but I was astounded at the level of intimacy and accretion of experience with plants as living things with bodies and habits irreducible to genetic programming that they indicated. The farmers with whom I worked rarely articulated their work as a form of care, instead explaining it in terms of a desire to have well-adapted plants free from corporate control, but I couldn't help but see how those political or economic goals were based on a deep respect for and everyday engagement with plants – an intertwining of the instrumental and affective that makes agriculture such a fascinating practice through which to study interspecies interaction and ethics.

In human-*Brassica* interactions, care does not mean leaving the plant alone and letting it evolve freely, but instead entails an intense involvement, a

demanding mode of attention, an "intra-action through which entities, subjects and objects, come into being" (Haraway, 2008, p.71). Many farmers highlighted the *Brassica* family as particularly difficult to work with. *Brassica* species are allogamous[16] – notoriously promiscuous, they cross pollinate with all other species within the large, diverse family: cabbage, cauliflower, broccoli, radishes, turnips and wild relatives. Keeping *Brassicas* for seed demands a vigilance that autogamous (self-pollinating) crops do not require, both in terms of the wider landscape and within the variety itself. For one farmer, working with *Brassicas* entailed a complex balance: enough genetic diversity to avoid consanguinity, which leads to inbreeding depression and unhealthy crops, but not so much that the variety becomes *too* heterogeneous, unpredictable and unmarketable. To achieve this balance, he kept a clear picture in his mind of the ideal form of the plant, selecting and directing the population toward that type. Making an analogy with animal breeding, he said that he could "*donner du sang" (*give blood) from one line to another by making intentional crosses, using isolation cages and pollinating flies. Another farmer described his process for selecting his cabbage and cauliflower *porte-graines*, describing with minute detail the way a certain variety's outer leaves folded like a *bec de canard* (duck's beak). While it is possible to see these more directed and intentional processes of selection as evidence of greater human mastery or control over crop plants, I see it instead as farmers recognizing the unique capacities (outcrossing, interbreeding) and needs[17] (balance between consanguinity and diversity) of *Brassicas* – a recognition based on years of knowledge and intimate involvement with individual plants as well as varieties and lineages over (plant as well as human) generations.

5.3 Challenging the frame of industrial agriculture

Surmounting barriers to accumulation involved suppressing the unpredictability of nature, eliminating the traditional multifunctionality of the peasant farm. It reduced the farmer to a consumer of industrial products as inputs and furnisher of raw material for industry. This dynamic of farmer disempowerment through capital penetration into agriculture rested on the appropriation of the seed which was transformed into an input and a commodity through hybridization and genetic modification and institutionalization of intellectual property rights. Can the relationships between individual farmers and the varieties they maintain and produce for seed push back on the totalizing logic of capitalist appropriation of nature? By reproducing seed on-farm, the farmers with whom I worked develop new skills and recover ones that were almost lost in the process of agricultural modernization, taking pride in the moniker *paysan.ne,* the skill and connection to place it connotes. Seed production reintroduces an element of cyclicality

[17] For the definition of autogamous and allogamous in plant breeding/reproduction, see Appendix 2

[17] Plant "needs" as defined by their use in systems of cultivation, for human consumption

into farm processes, challenging the linear conception of farm functionality enshrined in productivist agriculture, in which the yield imperative "colonizes all other relations: every-day life, relations with other species, and politics"(Puig de la Bellacasa, 2015, p.699).

Reclaiming the skill of seed production makes space for farmer creativity. I saw this in one farmer's intensely focused and organized process of varietal development. He envisioned and worked toward creating a commercially viable, consistent, high-quality violet broccoli, working with unpredictable and variable populations in a difficult process which has taken five years. I saw it also in the speculative musings of another farmer on his ideal tomato variety: a combination of the velvety skin of a peach-type with the coloring of an *anananas* (a yellow-red stripe/tie-dye). The process of creating new varieties is imaginative and intellectually stimulating. It also requires material commitment, devoting time and space to something besides production of a saleable commodity. In her exploration of soil care, Puig de la Bellacasa cites these as forms of care that run counter to production-oriented temporalities, making time and space for practices that are "obscured or marginalized as 'unproductive'" under capitalist regimes of ever-faster and more efficient value extraction from nature (2015, p.695). Making time for these labor-intensive, "inefficient" practices also involves a different relationship to work, a different definition of what the farmer can and should do, reflected clearly in the reclamation of *paysan.ne*.

While all farming is necessarily a risky undertaking, part of the point of decreasing "production time" was to eliminate the riskiness of letting natural processes unfold on their own terms. Decreasing uncertainty and increasing control meant delimiting farmer and plant work to one thing only: producing higher volumes to increase the appropriation of value. Cultivating *semences paysannes* involves accepting a degree of uncertainty and risk in farming practices, which makes hyper-efficiency and streamlining less attainable. One farmer told me that he once lost an entire year's worth of cabbage seed when his neighbour's forage cabbage (which he couldn't see because it was behind a hedge) cross-pollinated his head cabbage (thankfully he had backstock of seed). On the same day the aforementioned farmer found the rogue yellow squash, his wife pointed out bare patches in the squash field: these were places where cabbage *porte grains* had been left to go to seed, taking up space that could have been devoted to the next crop and making tractor cultivation of the entire field in one clean sweep impossible. Another mentioned to me that the *oignon rose de Roscoff* that had been propagated over three generations in his family was "*peu mécanisable*" – difficult to mechanize. The smaller tops with less dry material meant that the large, rough mechanical harvesters used for hybrid onion varieties simply didn't work – the *oignon rose* demanded slower mechanical harvesters as well as more hand labor.

The little inconveniences and uncertainties introduced by the integration of seed production onto the farm seem minor, but as they began to accumulate in my conversations with farmers, I began to see how the intentional cultivation of these "small biological determinisms" (Fleming, 2017, p.26) has

the potential to alter farming practice. It rebuilds barriers to accumulation by forcing farmers to reckon with the liveliness and agency of plants, qualities that work against their subsumption into factory-like methods of cultivation. These uncertainties are a type of plant creativity that is nurtured rather than suppressed (within limits) in the creation and use of peasant seed. The view of plants as mute, passive and malleable, reducible to their genes, something to be grown in the most standard method in order to increase turnover and therefore profit, is challenged. Plants are allowed to grow in a measured, healthy manner, adapt to changing environments through encounters with other elements of the farm ecosystems, giving space for self-expression based on genetic heterogeneity, the hallmark of a population variety.

6 Conclusion

In this research paper, I attempt to understand if and how diversity / heterogeneity and production through encounter make *semences paysannes* resistant to scaling and appropriation, and therefore if their production constitutes rebuilding a barrier to capital accumulation in agriculture. I define scaling as the process of making "project elements" like farmers, plant varieties, farming practices, and landscapes interchangeable and uniform: a hallmark of industrialized agriculture. The practice of scaling encompasses several dimensions: conceptualizing the plant as a bundle of genes rather than an entirety constituted by its interactions with the environment, breeding the plant in order to minimize those interactions and maximize uniformity, and removing the practice of varietal development and seed production from farmers hands by legal and political-economic means. These methods of scaling standardize farming practice across swathes of Finistère and other regions across the world, enabling the production of massive volumes of uniform vegetables suited for sale in multi-actor supply chains, in which intermediaries and retailers capture much of the value from farmer, plant and farmworker labor.

Farmers and breeders who produce *semences paysannes* look to build a new agriculture from a different kind of seed, one that is actively descaled from its biology – understood only through its connections with soil, place, history, and specific farmers, *semences paysannes* are the opposite of interchangeable project elements. However, the relationship between Carrefour and Kaol Kozh farmers demonstrate that vegetables from *semences paysannes* are not inherently incompatible with capitalist forms of retail. In fact, that very formation through encounter with territory and peasant farmer, seized upon and commercialized, is turned into a source of value for the supermarket chain, constituting peasant seed production as a "patch". Paradoxically, biological barriers to accumulation at the production stage (non-uniform vegetables and non-commodified seed) can act as sources of value for the opposite end of the agro-food chain: appropriation can occur without scaling.

Even within the heartland of industrial agriculture, this group of farmers is working to create multispecies refugia, reformulating relationships with their crop plants through the maintenance of certain varieties for seed. In these relationships, farmers actively *descale* plants, building an autonomy that is not synonymous with individualism, but is rooted in dependence on both their plants and their fellow peasant seed producers. This kind of autonomy is economically risky, laborious and complex, but farmers take on these added response-abilities through an active choice and a sense of political urgency, rather than a compulsion to engage in productivist practices.

Silences and future directions

Who bears the risks and the increased labor of caring for seed and who captures the benefits? Worldwide, most seed-saving and subsistence-based, peasant agriculture is performed by women (Doss *et al.*, 2011; Verschuur, 2017; AFSA and GRAIN, 2018). Feminist perspectives on care work highlight how the unremunerated reproductive labor (like seed production) of women sustains the production of value in capitalist economies (Benería, 1979; Vogel, 1983; Federici, 2016). In the developing world, most seed is still sourced through "informal" networks, but the very same system of strict seed certification and intellectual property rights over seed enforced in Europe and the USA is increasingly threatening local seed economies, particularly through trade deals which mandate agreement to UPOV 91 (the Convention of the International Union for the Protection of New Plant Varieties, which codifies a system of IPR called plant breeder's rights) (La Via Campesina and GRAIN, 2015; Wattnem, 2016). The peasant farmers with whom I worked, who have succeeded in capturing recognition and economic returns for their work in caring for seed, are almost all male, white, from the global North and not engaged in subsistence-level production. This dynamic points to the persistence of the gendered and racialized division of power and labor, even within the global movement for peasant seed and agriculture, and the role of seed and supermarket capital in sustaining those divisions.

Seed politics thus demand a more deeply intersectional approach than this paper provided, paying attention also to the role of farm workers in producing "peasant" vegetables. While farmers may regain a sense of ownership and autonomy in their work by producing peasant seed, methods of vegetable production may still discipline and control workers in a similar way to "conventional" farms (i.e. repetitive, physically exhausting, underpaid, or unsafe labor). Gendered and racialized divisions of labor may persist on peasant farms, relegating female or non-French migrant workers to specific tasks based on ingrained perceptions of their abilities. The transformative vision contained in peasant seed practice/politics may or may not translate to the status of farm workers, and altered rhythms of work and relationships with plants in seed production may not make farmworker labor any less alienated or more fulfilling.

Thinking through the rationalization of plant life and farming practice under capitalist regimes of appropriation led me to wonder about the role of non-human labor in value production. Besky and Blanchette point out how the capacity for productive work has traditionally been reserved for humans, but that modern ecological and economic instability call into question this "strict conceptual division of the world into active working (human) subjects and passive worked-upon (nonhuman) objects" (2019, p.2). Greater numbers of scholars are looking critically into the constitutive nature of animal labor in capitalist modes of production (for example Kosek, 2010; Gillespie, 2014; Beldo, 2017). Expanding who we consider a labouring subject helps complicate our understandings of how capitalist economies function, "rendering non-human potentials as eventful, and as components in the

organization of economic activity in their own right" (Barua, 2019, p.664). This essay has shown that humans, through breeding and cultivation, play an important role in determining how plants labor, and the "kind" of plant in turn shapes human work with/on it. It is my hope that plant labor – either in the aggregate (as in the monoculture) or as parsed components (interesting or novel genes or phytochemicals)- may enter this discussion of the role of the non-human in value production.

Pulling out one thread makes one realize that it is all one tangled knot. I hope I may keep untangling knots and weaving new string figures in my future, in collaborations with other farmers as inspiring and devoted as those in Kaol Kozh.

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Appendices

1 Legal status of *semences paysannes* in France

The following is a translation/summary of the *Kit reglementaire* published by the Reseau Semences Paysannes in November 2017 cited as (Reseau Semences Paysannes, 2017)

For a beautiful, simple and complete description of the story of plant breeding, the official catalogue, seed regulation, peasant farmers and seed, intellectual property rights, GMOS… see the short graphic novel "Seed Stories", published by the Confederation Paysanne and the Reseau Semences Paysannes, available in English at https://www.eurovia.org/wp-content/uploads/2019/03/BD-anglais-format-web-3.pdf

Non-registered seed

Farmers can select, multiply, cultivate and sell produce from their own seeds that belongs to varieties not registered in the official catalogue.

Farmers may exchange their (non-registered) seeds as a form of *entraide* (mutual aid) if they belong to a variety that is not protected under a COV (*certificate d'obtention vegetal*) and if they are not produced under a multiplication contract with a seed company. Before August 2016, this right was reserved to farmers who were part of a GIEE (*Groupement d'Intérêt Economique et Environnemental*). Since the passage of *article 12 de Loi n° 2016-1087* (also called *la loi pour la reconquête de la biodiversité, de la nature et des paysages)*[18], it is no longer necessary to be part of a GIEE to exchange seed in the context of mutual aid.

> Note: mutual aid (*entraide agricole*) is defined as "a contract free of charge, even if the beneficiary reimburses the service provider all or part of the costs incurred by the latter". The contract is "realized between farmers in the exchange of services in labor or means of production"

Farmers may exchange seeds intended for scientific research, breeding, or conservation but only in small quantities (the precise quantities are not defined)

[18] Unfortunately, this law also put in place a new constraint: free exchanges of seed *even in the context of amateur/ non-professional production,* must respect phytosanitary regulations put in place for all seed. Because these phytosanitary regulations are adapted for industrial-style seed production, they are extremely onerous for both peasant farmers and amateur gardeners. This legal development presents yet another constraint on the diffusion of peasant seeds, and seed lots produced by farmers or artisan seed producers have already been retracted as "pathogen vectors" after external controls, following application of the new European phytosanitary regulation (Reseau Semences Paysannes, 2018).

Seed protected by intellectual property rights

For varieties protected by a COV, it is possible to exchange small quantities without having to pay royalties if the seeds are intended for a breeding project and the creation of a new, distinct variety and not for commercial multiplication. It is illegal to multiply seeds from a variety protected by a COV *unless* they are part of the list of 34 derogated species, which can be multiplied on farm if the farmer/multiplier pays a *contribution volontaire obligatoire* (CVO, voluntary-obligatory contribution). This form of royalty payment is not mandatory for small producers. For a discussion of the CVO, see the summary/opinion published by the Confederation Paysanne, (2014) available at https://www.confederationpaysanne.fr/sites/1/mots_cles/documents/Livret-CVO-Semence_web.pdf

Because the criteria for distinctness, uniformity and stability that form the basis for entry into the official French catalogue are almost identical with those governing the grant of a COV, most varieties in the catalogue are also protected by a COV. The COV grants the holder exclusive rights to multiply and commercialize the variety for 25-30 years, depending on the species.

For varieties protected by a patent (at the French national level), small quantities may be exchanged for research and experimental purposes. This exception does not apply for patents delivered at the European level (the majority of cases). In accordance with the August 2016 *loi sur la biodiversite*, France banned the patenting of "products derived from essentially biological processes", also called "*traits natifs*", or genes present in wild or cultivated plants in their non-manipulated state. However, it is still possible to patent novel genetic combinations created through "new breeding techniques" (NBTs), themselves not qualified as processes of genetic modification, at the European level (Inf'OGM, 2016; Radisson, 2016; Madre and D'Agostino, 2017).

Commercialization of seeds

In general, the legal context preferences the sale and exchange of varieties registered in the official catalogue. Registered varieties can be sold to any individual/group/company. Within the catalogue, there are four lists under which varieties can be registered:

List A: "certified seed", controlled for varietal purity and sanitary measures before commercialization

List B: "standard seed", for which germination quality and varietal purity tests are performed after commercialization

List C: "conservation varieties", vegetables and field crops belonging to traditional varieties, adapted and historically tied to a specific region/culture and threatened by genetic erosion

List D: varieties for which the harvest is destined for self-consumption/subsistence, without "intrinsic commercial value", suited for specific cultivation conditions (exclusively vegetable varieties)

Under French law 81-605 « Commerce des semences et des plants », commercialization is defined as:

> "sale, retention with the intention to sell, offer for sale and all forms of cession, all furnishment and transfer, with the intention of commercial exploitation of plants and/or seeds, whether it is remunerated or not"

The "intention of commercial exploitation" concerns the final user of the seed: if the farmer directly sows the seeds he has bought to grow and sell a crop (if the farmer buys them to cross or make selections, it is not qualified as commercial exploitation).

It is possible to sell/exchange varieties *not* listed in the official catalogue only to non-professional users (not for intentional of commercial exploitation)

New organic regulations 2021

Adapted/translated from Série / « Le marché au secours des semences paysannes ? » Printemps 2018 (Reseau Semences Paysannes, 2018)

In 2021, new laws concerning organic certification will enter in force, with two elements which relate to seed.

1. Legal commercialization of "heterogeneous biological material" according to a derogation procedure to the general regulatory scheme for seed.
2. The concept of "organic variety adapted to organic agriculture", presenting "large genetic and phenotypic diversity". Experimentation on creating a new category in the official Catalogue for these varieties, with more relaxed criteria for stability/homogeneity for these varieties.

Overall, these openings in the seed law look to enlarge the market for organic and heterogeneous seed and facilitate the diffusion of seed by a larger number of small producers.

The RSP objects to these legal changes on several grounds:

- They do not explicitly exclude "new GMOS" or "hidden GMOs" (seeds/varieties created using new breeding techniques, see above) – without this exclusion, seed industry giants can take advantage of the relaxed criteria to rapidly introduce new varieties created using ex. *in vitro* technologies, which they have not stabilized to the degree necessary to use a COV, but could instead use a patent on new genetic traits to protect/enclose the variety
- They do not alleviate other barriers to the diffusion of peasant seed, such as the obligation to register as a seed producer, identical maintenance of the "heterogenous material" declared and deposed as a sample at the time of registration, description of parent lines, phytosanitary regulation adapted to industrial seed production.
- They define "heterogenous material" in a purely technical manner, reducing them to the status of "genetic resources" or "material", rather than an expression of the co-evolution between peasant producer, land, plant variety (under collective, decentralized, place-based management)

2 Definition of key terms

Plant breeding terms

F1 hybridization: a breeding technique used to produce uniform plants. First, parent plants with desirable characteristics are selected. Then, these parents are self-fertilized over many generations to produce pure-breeding and highly uniform inbred lines and "fixing" the desired characteristic of the parent. During the inbreeding process, the yield and vigour of the plants decreases dramatically (sometimes to less than half open-pollinated varieties). However, yield and vigor are restored when two unrelated inbred lines are crossed (this phenomenon has been named "heterosis" or hybrid vigor). The desired characteristics that were fixed in the parent lines are then expressed in all offspring, resulting in a uniform and homogenous field.

Once various inbred parent lines are developed, new varieties can be made simply by testing out new crosses between parent lines. Because developing the inbred parent lines is technically difficult, time consuming and expensive, the development of F1 hybridization is largely limited to professional plant breeders with adequate time and resources. Farm-saved seed from F1 hybrids do not result in the same plant in the F2 generation, as random segregation and independent assortment of alleles scrambles the uniform gene pairings of the F1 (Haring, 2010; Allard, 2019).

Open-pollinated: an open-pollinated variety is a result of crossing (either intentional, by farmer/breeder or cross pollination by wind/insects/birds etc.) and selection of desirable offspring from the result population to propagate for seed. Open-pollinated varieties selected over many generations and isolated from crossing with other varieties will breed true to type, meaning farmers can save seed from one year to the next. They retain a degree of genetic heterogeneity even within one variety, meaning that each plant differs slightly from its siblings of the same seed generation. This intra-varietal diversity gives open-pollinated varieties a degree of resilience and adaptability in the face of climatic changes, disease and pest pressures and the needs of different farmers who save them for seed. (Haring, 2010; Riviere, 2015)

Autogamy: mating system in which plants self-pollinate. Transfer of pollen grains from anther (pollen-bearing organ) to stigma (portion of ovary where pollen is germinated) occurs in the same flower. Self-pollinated plants have only one parent and are highly homozygous, and therefore more likely to breed true for specific traits. They do not exhibit a high degree of inbreeding depression. Important crop species that are autogamous include peas, tomatoes, beans, rice and wheat (Acquaah, 2012; Allard, 2019).

Allogamy: mating system in which plants cross-pollinate (transfer of pollen grains from the anther of one plant to the stigma on a different plant). Cross pollination ensures a high degree of heterozygosity, and allogamous plants

exhibit a high degree of inbreeding depression when selfed (as in the production of hybrid parent lines). Outbreeding is maintained through various mechanism, such as self-incompatibility (genetically determined physiologically hindrance to fertilization, such that the stigma chemically rejects or is the wrong shape to accept pollen from the same flower), male sterility (male does not produce functional pollen; genetically or cytoplasmically determined), or dichogamy (maturation of pistils and stamen occurs at different times). Important allogamous crop species include the *Brassicaceae* (cabbage, cauliflower, broccoli, radish, canola, turnip, "Chinese" cabbages like pak soi and bok choy), *Cucurbitaceae* (cucumbers, squash, pumpkins, melons), corn, onions, carrot (Acquaah, 2012; Allard, 2019).

Cytoplasmic Male Sterility: a system of pollination control which prevents the maturation or function of the male sex organs (stamen), resulting in sterile or absent pollen. This makes removal of pollen or stamens unneccesary in the production of inbred parent lines in hybrid seed production, thus greatly reducing cost. Cytosterility is determined by the interaction between male sterile genes and factors in the cytoplasm of the female sex cells, and the inheritance of sterility is determined by the female parent. The production of F1 hybrid seed is the result of interplanting a sterile version of one variety with a fertile version – the former will be pollinated by the latter, and the resulting seeds are the F1 hybrid, which will be planted as a commercial crop. From the Encyclopedia Brittanica, Plant breeding (Acquaah, 2012; Allard, 2019)

***Porte-graine**:* (literally, seed-carry) a plant that is not harvested for its fruit or leaf and is instead left to flower at the end of the season (or the fruit is left to get large and produce mature seed), producing seed for the next year. *Porte graine* are treated differently depending on autogamy vs. allogamy (isolation or not), if intentional crosses are made or if plant is left to open pollinate. I use the French term for ease and clarity, because there is no single word in English.

Other important terms

Paysan.ne - Throughout this RP, I refer to the farmers with whom I worked as *paysan.ne* because that is how they self-identified. The spelling indicates that it can refer to either a male or female farmer, as nouns are gendered in French (-ne indicates female). Although the definition and use of the word peasant is debated both in academia and among farmers, I follow the explanation given to me by my interlocutors: a farmer with practical and affective links to a specific piece of land or territory, be they familial/generational or not, following environmentally sound practices with the primary aim to produce a high quality product that nourishes people, while maintaining a sound and viable livelihood that strives toward material and financial autonomy. This closely follows the definition given by the Confederation Paysanne, an

agricultural union in France that obtained 18,5% of votes to the chamber of agriculture in 2013 and counts 10.000 farmers as members, in almost every department of France including overseas territories. The "Conf" outlines six steps towards or factors of peasant agriculture: autonomy in on-farm decision making; control over production and distribution consistent with the needs and potentials of different territories; employment on numerous, human-scale farms and facilitation of new farmer entry; local development; healthy, accessible, high-quality food and environmental stewardship (Confederation Paysanne, 2018a). The Conf' views peasant farmers as key political actors and the transformation toward peasant agriculture as part of larger, collective social struggles against neoliberalization, free trade, agricultural megaprojects etc. The Conf is a founding member and participant in the European coordination of La Via Campesina, the global peasant organization.

Although the Conf' decries the use of "modern slavery" and supports the rights of migrant agricultural workers, the question of wage vs. family labor within the definition of peasant agriculture is left open. I also did not discuss the status of workers or use of non-family labor with my interlocutors, but recognize that this issue is central (and often neglected) in modern peasant studies.

Food sovereignty - According to the European Coordination of La Via Campesina,

> Food Sovereignty in Europe is part of the larger struggle for a more social and more democratic and citizen-centred development of policy. It is about developing food and agricultural policies with the direct participation of citizens, in ways that ensure a quality food supply, protect ecosystems and bring social justice to the entire food chain. Food Sovereignty means basing trade relations on solidarity, not competi- tion - the right to protect European markets but also the obligation not to interfere in the same process for other peoples – allowing trading partners to develop food policies and programmes for their own realities, free from dumping and external interference. Food Sovereignty implies using market measures, subsidies and supports to build food and agriculture systems that are in the interests of European citizens, without negative effects in third countries. (Anderson, 2018, p. 17)

Semences paysannes - According to the RSP, to be defined as *semences* paysannes*, seed or propagative material must be

1. Part of a population or group of dynamic populations**
2. Reproducible by the cultivator
3. Selected and multiplied without the use of technologies that violate the plant cell boundary; technologies that are accessible to the final farmer/user in fields, orchards, gardens and within the principles of organic and biodynamic farming
4. Renewed by successive multiplications of open pollination and/or mass selection, without forced self-fertilization over many generations

5. Freely exchangeable according to the rules defined by the collective that made them

   * *semences* comprises both seed and plant cuttings/root stock/vegetative propagation material

   ** population varieties are composed of individuals that express similar phenotypic characters but still retain a degree of variability, which permits them to evolve according to farming conditions of environmental pressures. They are defined by the expression of characters resulting from different combinations of various genotypes or groups of genotypes. A population variety is defined as an entity in view of its ability to be reproduced in accordance with agronomic practices and a specific environment.(Reseau Semences Paysannes, 2013)

3 Cahier des charges for use of semences paysannes labels

A *cahier des charges* is a set of rules/standards by which producers must abide in order to use a certain label or logo (such as organic) – this *cahier* defines the use of the label *Legume issus de Semences Paysannes* (translated from the October 2017 version, produced by Kaol Kozh)

1. Eligibility
   Producer must
   - Be a member of the RSP
   - Be engaged in a process of seed selection/multiplication recognized by the local organization of the RSP
   - Multiply on-farm at least one sexually reproduced (by seed) species if they wish to commercialize with the label their vegetables produced by seed (self-produced or bought according to the rules in this *cahier* ex. from a colleague or a seed company that is also a member of the RSP)
   - Multiply on-farm at least one asexually reproduced (by cutting or rootstock) species if they wish to commercialize with the label their vegetables produced by root/cutting (self-produced or bought according to the rules in this *cahier* ex. from a colleague or a seed company that is also a member of the RSP)
   - Respect other criteria in this *cahier* which will be verified according to a system of controls/inspections
2. Definition of *semences* paysannes*
   a. Part of a population or group of dynamic populations**
   b. Reproducible by the cultivator
   c. Selected and multiplied without the use of technologies that violate the plant cell boundary; technologies that are accessible to the final farmer/user in fields, orchards, gardens and within the principles of organic and biodynamic farming

d. Renewed by successive multiplications of open pollination and/or mass selection, without forced self-fertilization over many generations
e. Freely exchangeable according to the rules defined by the collective that made them

* *semences* comprises both seed and plant cuttings/root stock/vegetative propagation material

** population varieties are composed of indivudals that express similar phenotypic characters but still retain a degree of variability, which permits them to evolve according to farming conditions of environmental pressures. They are defined by the expression of characters resulting from different combinations of various genotypes or groups of genotypes. A population variety is defined as a entity in view of its ability to be reproduced in accordance with agronomic practices and a specific environment.

3. Primary origin of seed and tracability

In case of insufficient self-production, it is possible to use the label is the seeds are bought from an artisan seed producer who is a member of the RSP (for the time being). This is necessary in order to defend collective peasant rights of peasants over their seeds. The opening to other seed producers can be debated, particularly if the seed multipliers are members of the RSP.

Approved seed sources:

- The producer prepares a declaration with the origin of the seed, year and place of production, and where applicable, the primary origin of the seed.
- Self-production
- Exchanges between producers of the same member group of the RSP
- Exhcnages between producers of different member groups of the RSP
- Authorized purchase from an artisan seed producer that is a member of the RSP
- Seed from gene banks
- To debate: seeds from other seed companies (non-members of RSP) only if the name of producer is on the seed packet (as with seeds form Sativa, Kulturstaat, Croqueurs de Carottes)
- For seeds coming from outside: the producer must multiply them for one year on-farm (two for bi-annuals). For certain cases, the time of on-farm multiplication can be left to the determination of the local group (ex. potato, squash, pumpkin)

In the case of plant producers (for farmers who buy/produce seeds, then send them to a company off-site that grows them out as seedlings, then returns them to the farm for transplanting)

- Purchase seed from a producer (or group?): receipt for delivery or return

- Same criteria of eligibility and respect for *cahier* for grafts and root-stock.

4. Ratio of self-production
   No minimum percentage. The effort put toward selection/multiplication by the producer is assessed by the local RSP group who also governs use of the label (they will see if usage of self-produced seed is sufficient)
5. Exclusionary criteria
   - Biotechnology, including mixing with CMS hybrids. In case of doubt, also exclusionary.
   - Avoid to the extent possible duplicates (same variety self-produced as seed and purchased as seed), which must be clearly identified and marked with estimated volumes for each variety. Mandatory follow-up because verifications are often made after the fact.
   - A list of varieites to definitely avoid, in case of doubt it is recommended not to use the concerned variety. The UFS declared that they will respond invidually to producers who asked if the method of seed selection uses CMS or other biotechnologies.

6. Specification of *cahier des charges* by species
   To elaborate based on type of product progressively with requests (and with the producers who demand it)

7. Criteria for *cahier des charges*
   - Eligibility (see 1)
   - Control of purchasing receipts and seed stock
   - Control of relationship between seeds bought in year n-1 and seeds produced in year n
   - Stock of seed produced and exchanged (exchanged seed must have verification of with whom it was exchanged, how much)
   - Origin of seed
   - Verification of stock of labels (yellow band/sticker)
   - Demonstration of multiplication in progress (viewing of *porte-graines* in the field)
   - Control of the absence of biotechnologies

   Outside of survey times, the producer makes a declaration on their honor that they give the right to the local group to describe their practices.