Breeding Apples: Stories of Loss and Hope in Times of Crises

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The owners of the well-known Stark Bro's nursery in Missouri received a sample of three golden apples in April 1915.[1] They immediately recognized their potential as the perfect dessert apple – one that was even still in good shape in the spring and complemented well the red-coloured apple *Delicious*, which the nursery already had in its assortment and was later renamed *Red Delicious*. Eventually, in the fall the same year, Paul Clarence Stark set off on what he later called "The Trail of the Golden Apple": a 1000-mile railroad trip and a 20-mile horseback ride through the West Virginia mountains with the aim of finding the tree growing the tasty apples. When Stark arrived at the farm of the Mullins who had sent him the sample, no one was at home, but he entered the small orchard anyway. He later wrote:

> Back of the house I saw an orchard. But – here came the dismal disappointment! Every tree I could see was nothing but wild seedlings – miserable runts. Dejected and sick at heart, I turned around to leave – when – I SAW IT! There, looming forth in the midst of the small, leafless, barren trees, was a tree with rich green foliage as if it had been transported from the Garden of Eden. The tree's boughs were bending to the ground beneath a *tremendous crop of great, glorious, glowing golden apples*! [emphasis in the original, A.P.] I started for it on the run. (Stark 1919a)

Still, he was afraid that the tree might be just a regular *Grimes Golden*, a common variety of the time. But when he reached the tree, he realized that the fruits had a much bigger size:

1 Paul Clarence Stark depicts his journey to West Virigina searching for the origin of the Golden Apple in his article "The Trail of the Golden Apple" (1919a). He does not give an exact date of the apple sample's arrival, but just speaks about "one April day some years ago". The letter attached to the sample, however, is dated 20 October 1914 (cf. Stark Bro's website: Little Old Letter: Big History. Online. Available at: <https://www.starkbros.com/growing-guide/article/little-old-letter-big-history> [Accessed 14 May 2024]). This gives reason to assume that Stark received the three apples in April 1915.

> I came closer and I saw the apples were 50 per cent larger than Grimes Golden. I plucked one and bit into its crisp, tender, juicy-laden flesh. Eureka! I had found it. The long sought for *perfect* [emphasis in the original, A.P.] yellow apple had been discovered. The "Trail of the Golden Apple" had reached a successful end. (ibid.)

This is how the official "discovery story" of the *Golden Delicious* goes, today one of the most widely cultivated apple varieties in the world. The *Golden Delicious* did not originate from a systematic cross-breeding but was a chance seedling whose seed the Mullins had obtained from a peddler in the late 19th century. The parents of the *Golden Delicious* are suspected of being *Grimes Golden* and *Golden Reinette*, a variety first mentioned in 1795 and presumably originating from continental Europe. After the "discovery", Stark paid off the Mullins for the tree, the surrounding land and the care work. He had a cage built with a battery-operated alarm system protecting his biocapital, the precious *Golden Delicious*, to prevent others from taking scion wood for propagation (Stark 1919b).

While the original tree reportedly died in 1958, millions of its clones continue living all over the planet. Their signature is the golden-green colour, an abundant harvest, an aromatic taste, a long storage life – and an enormous susceptibility to apple scab! Apple scab is a dreaded fungal disease in professional orcharding caused by the fungus *venturia inaequalis*. Harmless to humans, but in the case of a heavy infestation, it can affect the growth of the fruit and lead to scabbing and cracking of the fruit skin. However, the *Golden Delicious* has been used extensively in breeding programmes. Along with the varieties *Jonathan*, *Cox's Orange Pippin*, *Red Delicious* and *McIntosh*, it counts as the "big five", the five "founding clones" of modern apple breeding (Noiton and Alspach 1996). The *Golden Delicious* is, among others, mother of the varieties *Elstar*, *Pink Lady*® and *Jonagold*, father of *Gala*, and grandparent of *Jazz*™, *Envy*™ and *Honeycrisp*, and great-grandparent of *Cosmic Crisp*®. Besides inheriting the desired characteristics, such as taste and yield, many of these varieties are also prone to apple scab, among others, and in need of frequent applications of pesticides (Peselmann 2023). The serious consequences of the extensive use of synthetic chemical pesticides particularly for the environment, such as the loss of biodiversity, have been broadly documented (Leopoldina 2018, 2020). Criticism of existing breeding practices is voiced by pomologists, such as the publicly known German pomologist Eckart Brandt, who writes on his website:

> This [the susceptibility, A.P.] is, above all, the legacy of the Golden Delicious, which represents a kind of "fall from grace" in the history of modern apple culture. It has been crossed over and over again, and in some modern varieties, it appears up to 5 times in the family tree up to the great-grandparent generation. (Brandt n.d., translation by A.P.)

Grown mostly in monocultural plantations, apples such as *Elstar*, *Golden Delicious* or *Pink Lady* are for many the epitome of the loss of varietal diversity through agroindustrial standardization processes under capitalist modes of production, a crucial characteristic of what Donna Haraway and others call the Plantationocene (Haraway 2015). Thus, the stories about humans and apples in the 20th and 21st century can be told as ones of loss and genetic impoverishment. But it is the apple's particularity, namely, its enormous genetic variability, enabling the adaptation to diverse environments and climatic conditions as much as large geographic areas, that also raises hopes and promises on how to encounter changing ecological conditions due to anthropogenic climate change.

My paper deals with modern apple breeding as a particular form of human-plant relationship[2] and asks how the interspecies "making" and "growing" (Hallam and Ingold 2014) of a new variety is narrated in Western scientific and legal discourse as much as in breeders' everyday life talks and even in forms of vegetal storytelling. My perspective is, thereby, largely influenced by current studies relating to the vegetal or plant turn (Ernwein et al. 2021) within the humanities. Following the animal turn, the vegetal turn is a more recent attempt to overcome the longstanding plant blindness (Wandersee and Schussler 1999) in the humanities and develop new perspectives on human-plant relationships. Fighting a widespread picture of plants as passive, insentient, immobile and lacking willpower in Western academia and society at large (Lewis-Jones 2016), the vegetal turn aims at an ontological redefinition of plants as agentive beings (Elton 2021) and broadening and intensifying our perception of how plants and humans interact with one another as "companion species" (Haraway 2003) in different historical, geographical and social contexts. Their shared (hi)stories have inspired more-than-human storytellings (Fenske and Norkunas 2017; Gagliano et al. 2017; Jacobs and Kranz 2017; Laist 2013; Stobbe et al. 2022) and an exploring of vegetal narrative cultures "emerging when (1) plants co-author and shape narrative practices, (2) plant stories partake in the creation of multispecies societies, and (3) plant articulations are embedded in narrative contexts" (Middelhoff and Peselmann 2023).

The Shared History of Humans and Apple Trees

> "It is remarkable how closely the history of the apple tree is connected with that of man." (Thoreau 1862: 513)

In one of his last essays titled *Wild Apples*, American naturalist, essayist, poet and philosopher Henry David Thoreau (1817–1862) describes domestic apples – *Malus domestica* – which were brought to North America by European settlers[3] as "the most civilized of all trees":

> It has been longer cultivated than any other, and so is more humanized […]. It migrates with man like the dog, the horse and the cow: first, perchance, from Greece to Italy, thence to England, thence to America; and our Western emigrant is still marching

2 This paper is based on my research project "Äpfel handeln. Eine Multispecies Ethnographie ländlicher Ökonomien" [Becoming with Apples. A Multispecies Ethnography in Rural Economies] (2022–2024), funded by the Deutsche Forschungsgemeinschaft (DFG, German Research Foundation) – Project number 469261901. <https://www.phil.uni-wuerzburg.de/en/european-ethnology/team/dr-arnika-peselmann/> [Accessed 31 May 2024].

3 Canadian novelist Helen Humphreys has traced the complex history of apples and European settlement in her book "The Ghost Orchard" (2017).

> steadily toward the setting sun with seeds of the apple in his pocket, or perhaps a few young trees strapped to his load. (ibid.: 514)

One of the Western emigrants depicted here was John Chapman, who travelled through the Midwest of the USA at the beginning of the 19th century. Chapman went down in US history as one of the most famous "frontiersmen" under the name "Johnny Appleseed", who had his pockets full of seeds of the non-endemic *Malus domestica* (Bühler 2009). He repeatedly planted small orchards along the way and as soon as the seedlings developed into young apple trees, he sold them to settlers moving west who grew apple trees on their newly acquired land.[4] Together with the European settlement movement, the apple also penetrated further and gave rise to new agricultural landscapes and the cultivation of what was understood by contemporaries as the "wilderness", demonstrating the apple's involvement in the claiming of territories and colonial endeavours (Besky and Padwe 2015; Humphreys 2017).

Other than in Thoreau's short summing up, however, the shared history of humans and cultivated apples is much older and geographically more widely spread: The origins of *Malus domestica* lie in wild forms that are native to Central Asia, including the forests around the former Kazakh capital of Alma-Ata (*Kazakh*: father of the apples). There is molecular genetic evidence that it is related to the wild apple *Malus sieversii*, which was first botanically described in 1833. In contrast to other wild apples, which are sometimes only the size of cherries, *Malus sieversii* is large-fruited, sweet and has fruit colours ranging from red to yellow to green, making it very similar to today's cultivated apples (Hanke and Flachowsky 2017: 187–188). The domestication of *Malus sieversii* took place in the Central Asian high mountains of Tien-Shan. From there, the apple spread westwards, repeatedly hybridizing with other wild forms. Around 4,000 years ago, a form of apple corresponding to extant domestic apples appeared in the Near East, at a time of first recorded uses of grafting (Cornille et al. 2012), a horticultural technique to propagate the very same variety.[5] Apple plants crossed the Hellenistic world in Antiquity, and the Romans, who further refined cultivation technologies, spread them throughout Europe. There, hybridization with the native wild apple, *Malus sylvestris*, a small, astringent apple took place on a local scale. The Neolithic and Bronze Age inhabitants were already making use of the latter variety (ibid.). Medieval monasteries and the gardens of European nobles became places of apple cultivation and breeding. There were descriptions of 120 apple varieties in the 17th century, and by the end of the 19th century, which is considered the "heyday of orcharding culture" (Böge 2003: 50), in which an urban bourgeoisie was organized in pomologists' associations and devoted to systematization, description, breeding and pruning techniques (ibid.), more than a thousand varieties were known (Hanke and Flachowsky 2017: 186). Systematic plant breeding gradually began to develop

4 As a measure against land speculation, the state of Ohio had decreed that at least 50 apple or pear trees had to be planted in order for newcomers to be allowed to keep their land (Pollan 2003: 17).

5 Grafting a tree is a vegetal instead of a sexual reproduction, whereby tissues of plants are joined so as to continue their growth together. The rootstock usually defines the trees growth, and the scion wood its leaves, blossoms and fruits. Known since ancient times and historically documented already among the Phoenicians, grafting reproduces genetically identical apples in an almost unlimited number.

at the end of the 19th century.[6] It was boosted especially by the rediscovery of Mendel's theory of heredity, which had already been formulated in the 1860s. This replaced earlier agricultural plant breeding carried out by the selection done by practitioners who were said to have the special talent of a "breeder's eye" (Wieland 2004: 112). Nearly all commercial apple varieties today originate from systematic plant breeding. There is only one among German breeders who managed to place a variety onto the market who claims on his website that his variety called *Fräulein* is a chance seedling: one "that has been not bred in a laboratory" but was created "by the principle of nature" and "inspired by bees" (Fräulein n.d.). The breeder tries to promote his variety as a particular "natural" product by decentring the human share in making a new apple. Other breeders, however, take pride in choosing the most promising apple partners to create extraordinary offspring.

Becoming with Apples

As defined in Western sciences, cultivated plants are distinct from wild forms as they are bred from wild species, grown and cared for by humans to serve them as either crop, medicinal or decorative plants (Miedaner 2014). In the case of apples, their reproductive processes are manipulated to meet human needs, initially through selection, later through controlled cross-breeding and, finally, by means of biotechnological processes (Hanke and Flachowsky 2017). However, a post-human reading of the cultivation of plants objects to a linear and one-sided process that is accompanied by a steady increase in human control, right up to interventions in the DNA. Instead, human-(cultivated) plant relations are interpreted as a mutual domestication (Cassidy 2007: 2). Thus, the settling down of early arable farmers is often described as a human adaptation to the site-specific location of plants. The development of knowledge, practices and technologies in dealing with plants can also be understood as a multispecies "becoming with" (Haraway 2008: 244), including the emergence of specific professions: Embedded in colonial politics and world voyages, plants which were unknown to the European public aroused botanical interests and monetary desires alike and led to the emergence of plant collectors or even plant hunters (Hielscher and Hücking 2002). Georg Dieck (1847–1925) was a German botanist, plant collector and founder of an extensive arboretum. He describes an apple plant with an extraordinary feature in his catalogue of plant novelties from 1891:

> A most remarkable wild apple […]. It is widespread in both the wild and cultivated state in western and northern Asia but is apparently still undescribed. I received and still receive it from Kashgar and from the plateau in Talgar in south-western Siberia. […] Apart from the green-red leaves, EVERYTHING [emphasis in original, A.P.] on this tree is red, bark and wood, blossom and fruit. Even the flesh of the pleasant-tasting fruit, which resembles a small sina apple, is dark rose-red! (Dieck 1891: 16, translation by A.P.)

6 Systematic fruit breeding instead means that the parent generation is determined in advance and the pollen from the father are transferred to the mother's flower stigma by hand. To avoid cross-pollination by insects, the pollinated flower is then bagged.

Dieck had received this "most remarkable" apple from the Russian lawyer Vladislav Niedzwetzky, who had assumably been exiled to Vernoe (now Almaty) and indulged his passion as a naturalist there. While the cultivated forms had already been given names in the local languages, such as the variety *Kisil Alma* which translates into red apple, Dieck intended:

> [...] to name this wild plant after my esteemed patron, Mr. Medwitzky [sic!], President of the Court, who collected it for me along with many other beautiful trees and shrubs [...] in southwestern Siberia. (ibid.)

Malus niedzwetzkyana, i.e. the official botanical name, rapidly made its way via the well-known Berlin-based Späth nursery into the Royal Gardens in Kew, and across the ocean into the New York Botanical Garden as much as into private gardens. What can be demonstrated here is not only the well-connected plant trade at the turn of the century, but also the naming practices which are done in accordance with Swedish biologist Carl Linnaeus' (1701–1778) binomial nomenclature: the first part defines the generic name and the second the species name, usually in Latin grammatical forms. A third element, often written in a different font, is the author citation, i.e. the person who first published the botanical name and a description of the plant in agreement with the requirements of the International Code of Nomenclature for Algae, Fungi, and Plants, a set of rules whose historical predecessors date back to 1867. This highly formalized act of ordering vegetal beings according to Western scientific taxonomies receives increasing criticism in the context of world voyages as part of European expansion, colonial exploitation and hegemonic knowledge production for overwriting Indigenous/local plant knowledge and taxonomies[7] and even giving names with racist, sexist and colonial origins.[8]

It is unknown whether there was a local name for *Malus niedzwetzkyana* or not, such as Dieck assumes it. The practice of naming a plant, or, in this case, rather a plant species, can be considered as an act of appropriation and gaining social capital within the botanic scientific community. But it also relates people and plants in a way that can be considered as a form of interspecies kinship making, an act of baptizing, often accompanied by great human admiration and even emotional attachment to vegetal beings. Dieck's botanical denomination including his surname is part of the extraordinary, red-fleshed apple species whose cultivated relatives spread – as attractive breeding partners – across Europe and the world.

7 The museum exhibition "Tiny Unpredictable Material Objects. Postcolonial Perspectives on Plants in the Georg Forster Herbarium (1772–75)", curated by Susanne Wernsing and presented at Göttingen Forum Wissen in 2022, critically scrutinizes the narrative of discovering the world by European naturalists, such as Georg Forster (1754–1794): "His botanical preparations, drawings, and publications follow the standards of botany, which became a science in the course of the 18th century. They refer to the 'indigenous' knowledge of Polynesian societies that was overwritten in the process" (exhibition website: <https://www.forum-wissen.de/en/tiny-unpredictable-material-objects-postcolonial-perspectives-on-plants-in-the-georg-forster-herbarium-1772-75/> [Accessed 12 January 2024]).

8 There is an increasing call to start decolonizing botanic collections and gardens, such as in Sidney's botanic garden (Summerell 2022).

The Beginnings of Systematic Fruit Breeding – Collecting and Sharing Apple Genes

The beginnings of systematic fruit breeding can be found in state research institutes in England and the USA in the outgoing 19th century. In Germany, the German Pomologists' Association had already advocated an apple breeding programme in 1912, but it was not implemented until 1929 at the Kaiser Wilhelm Institute for Breeding Research in Müncheberg, Brandenburg, which had been founded a year earlier. The aim of the programme was to increase the yield and fruit quality, as well as resistance to late frosts and widespread diseases, such as apple scab (Peil et al. 2011: 112) – all criteria which still apply to current breeding aims (Hanke and Flachowsky 2017: 190).

To this end, collections were also made of landraces and wild species, which were expected to provide relevant genetic material for breeding. One of these collecting activities was the large-scale German Hindu Kush Expedition in 1935 to Central Asian gene centres, i.e. regions where wild forms of cultivated plants occur. Plant genetic samples of cereal and vegetable plants, nut and fruit trees and, above all, legumes were collected there. Entangled in biopolitics, particularly the autarky policies of the National Socialist regime at that time and accompanied by "racial studies" of the local human population,[9] these expeditions must be viewed critically in relation to the exploitation of plant genetic diversity and also of local plant knowledge, often referred to as biopiracy (Flitner 1995).[10]

Breeding with apple species that are considered 'wild' is challenging as not only desirable traits, such as disease resistance or the adaptability to extreme temperatures, are inherited but possibly also a strongly astringent taste or a tiny fruit size. The Russian botanist and fruit breeder Ivan Michurin (1855–1935) was one of the first who started successfully cross-breeding large, sweet, cultivated varieties with wild forms. He developed the technique of backcrossing to get rid of unwanted characteristics of the wild form.[11] Due to the apple plants' very own temporality, backcrossing is extremely time- and resource-consuming. Larger breeding programmes with wild species in Germany are, therefore, carried out by the state-funded Julius Kühn Institute for Breeding Research on Fruit Crops[12] in Dresden-Pillnitz. The institute also makes its cultivars avail-

9 During the Nazi era in Germany, the proximity of plant breeding and studies of so-called racial hygiene becomes clear, *inter alia*, in the "racial studies" with body and facial measurements that were carried out on local populations during this expedition and were intended to contribute to the question of the "homeland of the Aryan race" (Flitner 1995: 74).

10 To fight off the unauthorized usages of sources from nature and/or traditional plant knowledge, particularly from countries of the Global South and in unequal power relations, the Nagaya Protocol as part of the UN Convention on Biodiversity has been implemented aiming at "the fair and equitable sharing of benefits arising out of the utilization of genetic resources" (Convention of Biological Diversity n.d.).

11 That means the cultivar is crossed again with the cultivated part of the parent generation. Groundbreaking at Michurin's time, backcrossing is counted as standard in breeding with wild forms today (Hanke 2014).

12 The German state Julius Kühn Institute for Breeding Research on Fruit Crops in Dresden-Pillnitz conducts regular collection journeys to Central Asia, but with the permission of and in close cooperation with the local research institutes, such as the collecting in the North Caucasus region in 2011 (Hanke et al. 2012).

able to non-state breeders. Dirk Matthis,[13] who works for a private breeding programme, told me in our interview:

> We do not work with wild forms ourselves as it would take us too long to pimp up the cultivars again to reach marketability. Of course, with wild forms you can cross in resistances or tolerances but it takes forever to have them marketable again, 40 years is realistic. (Dirk Matthis, Interview 27 April 2023)

In order to obtain "their material", as the relevant plant parts for propagation are usually referred to, private breeders have access to the German Genebank for Fruit Crops, co-ordinated by the Julius Kühn Institute, or they use breeder networks and pomological associations. Private fruit breeder Reinhard Schomberg-Klee, whose fascination with red-fleshed apples of the *Malus niedzwetzkyana* species is also reflected in his breeding, received his first material from a British breeder he met via the internet. As soon as he had some cultivars ready to be published online, Schomberg-Klee, in turn, was contacted by a South African fruit company which was about to establish their own breeding programme and was interested in cooperation to broaden plant genetic resources:

> The problem is that the gene pool in South Africa is relatively small. For example, at the state institute, my colleague had access to 200 apple varieties. Just what the settlers, the Boers, the English have brought in […] But here in Europe, we have gene banks with 2000 varieties. (Schomberg-Klee, Interview 15 May 2023)

The cultivation of apples in South Africa is a legacy of the European colonization and started commercially in the late 19th century, exporting apples particularly to the United Kingdom. By now, the South African apple industry plays a key role in the country's agricultural economy and fresh apples are among the top ten agricultural export commodities.[14] Through the collaboration of Reinhard Schomberg-Klee with the fruit company which started in 2009, genes of the *Malus niedzwetzkyana* species also made it eventually to South Africa. However, a tragic turn came about because the wild forms are meanwhile threatened by extinction in their place of origin due to the loss and degradation of habitat from agricultural expansion and genetic erosion, i.e. grafting of commercial varieties and hybridization (IUCN 2007).

Opening the Apples' Miracle Box

In opposition to Thoreau's assumptions that, in contrast to wild apples, cultivated and "humanized" apples are just like "a harmless dove" (1862: 514), breeding with cultivated apples is also a challenging, time- and resource-consuming act with uncertain outcomes: It usually takes 15 to 20 years from pollination to the market launch of a new variety. The

13 I have anonymized my research partners in this article unless they explicitly requested to be named with their real name. The interviews were conducted in German and translated by me for this chapter.

14 Referring to the first quartal 2023, see NAMC (2023).

reasons lie in not only the plant's life cycle – the long juvenile phase before bearing the first fruits – but also the pronounced heterozygosity causing offspring with widely unpredictable characteristics. Heterozygosity means that an apple plant requires a different variety, i.e. a pollinator variety, blossoming at the same time, and an insect partner (or sometimes just the wind) to pollinate a blossom and grow a fruit. The fruit then contains approximately ten seeds, all unique in their genetic composition and, therefore, could establish a new variety. This enables a tree to produce offspring with countless variations in characteristics. In Stark's diary entry, the *Golden Delicious* stood out from its siblings, a crowd of "barren and leafless trees" (Stark 1919a).

When I walked with breeder Reinhard Schomberg-Klee through one of his test sites, I immediately understood what he meant by referring to the breeding process as "opening a miracle box", where "you need to be open and just see what comes out" (Schomberg-Klee, Interview 15 May 2023). The sibling trees from one pollination sometimes barely resembled each other: one towering high, the next small and bushy, some bursting with health, others infested by mildew, one with deep red foliage, another lush green, and one even with thorns. These shoot thorns are signs of a de-domestication, as he told me:

> Sometimes genes are triggered or those that have long disappeared show up again somewhere. So, it can happen that apples revert to their original form. Wild apples and also pears have shoot thorns as protection against predators, such as roe deer. But they have lost them in the course of domestication. (Schomberg-Klee, Interview 15 May 2023)

Looking at apple plants in a post-human perspective as "storied matter" (Oppermann 2018), the appearance of thorns can be read as if the long-shared history of apple trees and humans is shaken off and the DNA-stored script for another, more menacing multispecies relationship is activated. One that once became obsolete by the diverse defence mechanisms humans created to protect 'their' apple trees.

Thorns do not only generate throwbacks in the breeding rhythm, but are also unwanted in cultivated apple plants as they make harvesting more difficult. This particular tree will be sorted out, i.e. plucked out and thrown onto the compost, in the selection process, similar to sick ones and also those which turned out green instead of red:

> Here are various babies again. When breeding red-fleshed apples, the *niedzwetzkyana* type, 50 per cent of the seedlings have turned out red, the others green. I would actually have to take away the green ones now and only continue to cultivate the red ones, but since this is a columnar apple, I will continue to cultivate both for now. (Schomberg-Klee, Interview 15 May 2023)

Selection does not always seem an easy task after caring for a plant over several years and is sometimes postponed when affections towards seedlings, the "babies" (Chao 2018), or curiosity about how an apple will evolve comes into play.

Finding the Perfect Apple

It is usually just one or very few seedlings in the breeding process which stand out from thousands of nameless or just numbered, sorted out and destroyed young plants. These selected ones must meet several criteria that are crucial in today's highly competitive and globalized fruit market. When I joined breeder Dirk Matthis as he was applying pollen to a blossom, he cut one of the flowers open to show me how the damages of frost can be recognized. The flower turned out to be undamaged but was now lost for the breeding programme. Looking at his colleague, he said with a twinkle in his eye: "Oh, oh, what if exactly this blossom would have been it? The one with the perfect apple?" (Field notes, 27 April 2023). The "finding" of a suitable seedling, the "perfect apple" is like "hitting the jackpot" or a "hard-earned miracle", which is how Johan Nicolai, the breeder of the popular *Kanzi* variety described it in a newspaper interview (Böhme 2018: 74). The story of Nicolai's Kanzi is less elaborate and widespread than Stark's diary entry on finding the *Golden Delicious*. Still, it has some similarities: Nicolai remembers that one of his employees rushed excitedly into his office one day with the words, "I have found the apple of our lives" (ibid.: 77), an apple which caused a sensual explosion, a crunch in the mouth as if you had "bitten into a small water bomb with apple juice" (ibid.).

However, the selection does not usually take place spontaneously, but is a lengthy process that begins before the first fruit is borne with the assessment of the tree's shape, foliage and health. As soon as fruits are hanging on the tree, they are evaluated in terms of, for example, taste, consistency ('crispiness') and colour, including test eating with consumers. When a decision is made, the selected cultivar is appointed for registration and licensing.[15] A licence grants a breeder the plant breeders' rights, an intellectual property right valid in the case of tree species for 30 years "to market propagating material (plants, parts of plants, seed) of the protected variety, or to produce, import or store it therefor" (Federal Plant Variety Office n.d.). The use of protected varieties to breed a new variety, however, does not require authorization. The plant breeders' rights are meant as a way to compensate the often decades-long breeding work and provide incentives "for the necessary breeding progress in view of future climatic challenges" (German Federal Ministry of Food and Agriculture 2019, translation by A.P.). Laura A. Foster, however, challenges Western law and legal concepts in her study on plants as inventors, in terms of their plant-blindness and the human exceptionalism in Western patent law based on the narrative of the individual human genius. She invites people to engage in a thought experiment I would like to propose here as well: what could be learned from attending to plants not as raw material but as inventors and producers of knowledge, resulting, *inter alia*, in the production of certain substances, or, in this case, apple fruits with particular characteristics (Foster 2023; also Braun 2019)

15 In Germany, "anyone who breeds or discovers a new plant variety can apply for national plant breeders' rights for all varieties of plants at the Federal Plant Variety Office under the Plant Breeders' Rights Act (SortG). Plant breeders' rights can be obtained if a plant variety is new, distinct, uniform, stable and designated by a suitable denomination." (Federal Plant Variety Office n.d.)

Food Storytelling – The Making of a New Variety

Turning a cultivar with only a selection number into a variety acquires several steps: granting it a variety name and sometimes even a brand name; a pedigree including its vegetal family tree as much as its human breeders; clarifying the ownership; and developing a whole marketing concept to transform a nameless cultivar into an individual apple plant persona with its very own biography. With reference to Slavoj Žižek's reading of Marx's commodity fetishism concept, Jón Þhor Pétursson states in his study on the consumption of organic apples that it is not only the commodity – the apple – which is fetishized but also its "making of" (2013: 21–22). The story of the *Golden Delicious* is an early but long-lasting example; the one of the *Pink Lady* is more elaborate, providing not only information on the variety's breeding history but also on its life cycle and the horticulture measurements carried throughout the year, not least about its nutritious values and the strict quality assessments (Pink Lady n.d.).

It is particularly the owners of so-called club varieties who, in fighting for the limited supermarket shelf spaces, invest in the "immaterial labor of food storytelling" (Pétursson 2013: 17). The idea behind club varieties, a concept that has emerged over the last 15 years and was introduced as a tool to counter falling fruit prices, is that varieties are not only licenced but also trademarked. They are being grown and marketed in a production and marketing club with access to grow the variety limited to club members (Brown and Maloney 2009). Producers profit from the strong marketing efforts of the club and the generally higher sales prices. However, these prices can only be achieved if an apple meets the high-quality standards of the club. An apple that fails to do so, because its colouring contains too little red, for example, may not be sold under the brand name, but only under the variety name. A hoped-for *Kanzi* then becomes a *Nicoter*, and a *Pink Lady* is then only a *Cripps Pink*. All farmers in a club are strongly bound to the licensor. That means if farmers withdraw from the contract, they no longer have the rights to continue cultivating their fruit trees and sell the fruits.[16] The club variety concept can be understood as a further step into standardizing the production of food crops as much as propertizing vegetal beings, while, at the same time, underlining the singularity of a variety. Therefore, apple breeding and recent variety marketing can be interpreted as a form of "post-industrial economy of singularities", as described by Andreas Reckwitz (2017).

Broadening the Gene Pool – Old Varieties for New Problems?

In order to counter the club variety phenomenon and develop robust varieties apt to their regional climate conditions, fruit growers in the traditional orchard region *Altes Land*, by the Lower Elbe River in Northern Germany, have joined forces and started a breeding initiative that has already launched first varieties onto the market (Züchtungsinitia-

16 These contractual conditions have caused a farming couple in Southern Tyrol who had bought an orchard quite a lot of trouble: They were not allowed to sell the *Pink Lady* apples growing at their newly acquired farm because they missed out on buying the club membership along with the property. In the end, they were forced to cut down the trees (Fulterer 2020).

tive Niederelbe n.d.). Another breeding programme has been initiated by organic fruit growers throughout Germany, who intend to offer their new varieties as a common good (Züchtungsverein apfel:gut). Their central concern is to expand the gene pool by a particular breeding scheme crossing one modern variety with an old one[17] and by excluding the "big five". One variety that made it into the breeding programme is *Red Moon*, a red-fleshed variety first described in 1915 by Michurin, who had crossed *Malus niedzwetzkyana* with an *Antonovka* apple, a chance seedling from the early 19th century, deeply rooted in Russian traditional cuisine as much as literature.[18]

What makes *Red Moon* an attractive breeding partner is not only its extraordinary colour and interesting genetic make-up, it also comes with a high amount of anthrocyanes, water-soluble vegetal pigments of the phonologic group which possess anti-diabetic, -cancer, -inflammatory, -microbial and -obesity effects, and helps to prevent cardiovascular diseases (Khoo et al. 2017: 2; Sadilova et al. 2006). The increasing interest in healthy lifestyles and the popularizing of scholarly findings on plant's health-promoting capacities having turned some crops into "superfoods" (McDonell and Wilk 2022, who had a critical approach to superfoods) and have also transformed human perceptions and narratives of apples: it is not only about an ecstatic sensual experience, as described by Paul Lawrence Stark. It is the apples' effect on human bodies helping to fight off diseases, often caused by a modern Western diet in the first place. This discourse has even been fuelled since modern breeding practices are suspected of having broken the millennia-old bond between apples and humans by sacrificing the edibility of apples to their aesthetics: Polyphenols, secondary plant substances that are responsible for an astringent taste and enzymatic browning of sliced apples, among other things, have been increasingly bred out (Kschonsek et al. 2018). A low polyphenol content, however, is presumably connected with the complex development of an apple allergy from which an increasing number of people are suffering (Becker et al. 2021).

Apple Breeding in Times of Climate Change – Technical Fix and Plant Ethics

The human perception of apples has long since transcended epidermis and core housing and arrived at the molecular level: The genome of an apple was fully sequenced in 2010, and in 2017, a Canadian biotech company was the first one to bring genetically modified apples onto the US and Canadian market under the trademark Arctic® Apples. The name was given due to the white shining colour of the fruit flesh, which does not turn brown after a gene was introduced that reduces the levels of enzymes responsible for oxidation (Canadian Food Inspection Agency 2017). No genetically modified apple variety has been

17 During my field research, I encountered different definitions of what counts as an 'old variety': some considered varieties from chance seedlings found before 1900 as old, others included varieties from systematic cross-breeding before the Second World War. What unites all definitions is that the "big five" should not occur in the family tree.

18 *Antonovka* apples are mentioned in Anton Chekhov's 1880 published story "The Little Apples" and in 1900, Ivan Alekseyevich Bunin even wrote a short story called "Antonovka Apples" (Lewis 2023).

approved in the European Union (EU) so far. It became clear in my conversations with breeders and farmers that they either objected to techniques involving genetically modified organisms (GMO) or they were reluctant to employ it even it was legally permitted due to the lack of GMO acceptance in society: "in the end we would be stuck with GMO varieties" (Field notes 24 August 2023).

The EU Commission published a proposal in July 2023 to modify their existing GMO legislation that was passed in the European Parliament in February 2024 and now must be agreed to in negotiations with the EU member states: it provides for plants which have been generated by new genomic techniques, i.e. muta- or cisgenesis (the latter is best-known for the gene scissor CRISPR/Cas), that they should be exempted from labelling requirements.[19] Cis- in contrast to trans-genesis means that the modified organism contains only genetic material of the same species, for example, the resistance genes from a wild apple added into the DNA of a cultivated one. Several leading scholars in Germany in the fields of botany, molecular biology or agricultural sciences welcome the proposal as a long overdue revision of the current regulations. They agree with the EU Commission's argument that in view of the major challenges posed by climate change, leading to an increase in pathogens and abiotic factors, for example, drought stress, fast and efficient methods, such as new genomic techniques, are very necessary to breed resilient plants. In their opinion, this would also lead to fewer or no pesticides applications, making agriculture far more sustainable (Science Media Center 2023). Other scholars, however, such as Angelika Hilbeck, the head of the European Network of Scientists for Social Environmental Responsibility, described the EU proposal as "scientifically inacceptable": among other things, she states that new genomic techniques are anything but new. They have been employed outside the EU for many years with large financial support from the private and public sector but with few results. "Countless of these plants are still in laboratories and greenhouses, few make it outside into the field and nearly none to the market", she stated (Hilbeck 2023). Besides, she criticizes the "seemingly unwavering faith" that

> DNA is a programmable code and that organisms are the sum of their DNA-encoded parts, which can be subjected to human design at will. [...] This belief is so deeply entrenched that the commissioners and their scientific advisors felt empowered to invent a novel term – "predictable DNA". (ibid.)

In Hilbeck's assessment of the EU proposal, she objects to a reductionist and mechanized understanding of DNA's efficacy in a living organism, which is also reflected in metaphors borrowed from computer science, such as copy, paste, delete, code, programming and editing of genes or to switch them on and off. These show parallels to historic ontologies of plants and particularly animals as machines that can be traced back to Descartes and the Cartesian philosophy (Ingensiep 2019). The mechanization of plants in

19 The "Proposal for a Regulation of the European Parliament and of the Council on Plants obtained by Certain New Genomic Techniques and their Food and Feed, and amending Regulation (EU) 2017/625" was published on 5 July 2023 and can be retrieved from the official EU website: <https://food.ec.europa.eu/plants/genetically-modified-organisms/new-techniques-biotechnology_en> [Accessed 12 January 2024].

the discourse of today's molecular biology has raised ethical concerns regarding the implications this might have on plants' lives and, consequently, on whole ecosystems (Gerber and Hiernaux 2022: 13). Biologist and philosopher Sophie Gerber and her colleague Quentin Hiernaux, therefore, call for an utterly new perspective on plants and a relational ethic apt for vegetal beings:

> The diversity of life forms makes wide-ranging ethical strategies ineffective, especially if they are based on the universalization of a single criterion. Inevitably, such strategies will unduly relegate certain individuals from the sphere of ethical consideration, into the realm of machines and technical objects. (ibid.: 17)

They refer instead to the Swiss *Federal Ethics Committee on Non-Human Biotechnology* and their interest in respecting the dignity of living organisms: "'What is decisive for the respect of dignity is that an entity is not treated solely a means to an end' (CENH 2008), or, in other words, a being is respected when it is not treated like a machine." (ibid.)

Plants as Allies? – A Future Narrating of Humans and Apples

Classic systematic cross-breeding means treating plants as a means to a very concrete end given by "the vision" of a breeder (Kleinert 2020: 18), reflected in a breeding scheme and defined in breeding goals. I gained the impression in my encounters with breeders, however, that they had a rather realistic or even modest understanding of how much influence they actually have on the breeding process. Even though sometimes an act of "designing" (Germ. "*kreieren*") an apple was talked about, the most common phrase was "to find" or "to discover" one. In this perspective, it is the plant's merit to create 'the perfect apple', while the human contribution lies in the ability to recognize it – not to speak of the decade-long care work and the patience needed to endure the apple plants' temporality and the unpredictability of their offspring.

Considering the threats posed by climate change, the desire for faster and more effective breeding methods to grow more resilient plants seems very understandable and the promises of "predictable DNA" more than tempting. Opponents, however, warn that genetic engineering is only a short-term solution leading to an accelerated race between pathogens adapting and breaking implanted resistances, on the one hand, and a genetic technology rushing to insert new resistant genes, on the other. Instead, some breeders/orchard farmers, such as the ones of the *apfel:gut* association (apfel:gut n.d.), demand a slowing down of the breeding process to give the apple plants time "as a whole" to interact with their environment – climate, soil and pathogens, but also human care work – and, thereby, showing their robustness and adaptability. This holistic and relational approach to plants is a counter-narrative to the machine metaphor dividing the plant into small molecular pieces. The emphasis on the human-plant and multispecies relationships built along a breeding process might even raise associations to the increasingly powerful narrative of the plant-human conspiracy and ally-making in what Natasha Myers envisions as a Planthroposcene (2018). Even though a comparison might still be stretched too far when it comes to current commercial fruit breeding, new ways of becoming with plants are more necessary than ever.

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