Food researched: Apples
Focus: The advancement and politics of apple breeding
Elizabeth Kimberly

“Creating Delectable Cultivars: The Politics of Apple Breeding”

Objective(s)

I first set out to research advancements within the apple industry over the past two centuries. I was quickly overwhelmed by the many aspects of apple production and chose to focus my research on apple breeding. Thus, this paper seeks to briefly describe the history and advancement of breeding apples (internationally and at the University of Minnesota, specifically) and understand what has influenced the motivations of the industry. Additionally, I plan to describe the current process of apple breeding at the University of Minnesota and examine what their goals and priorities encompass. Furthermore, I hope to shed light on the current politics of breeding apples. In my research I found much discussion regarding apple patents, the lack of funding for breeding, and whether apple breeding can be overdone. I plan to explore these controversies and understand how they have shaped the apple industry today.

Summary of Findings

Background

“When you bite into it the cells shatter. The bursting of the cells fills your mouth with juice.” In his New Yorker article titled ‘CRUNCH’, John Seabrook describes the experience of eating a SweeTango apple, a recently cultivated variety at the University of Minnesota. The SweeTango joins 6,000 other cultivars that are bred in regions worldwide, from Siberia to Indonesia (Hancock et al.). World production of apples exceeds 57,000 million tons but bred varieties such as ‘delicious’, ‘golden delicious’, ‘granny smith’, ‘fuji’, and ‘gala’ make up more than 60% of the world’s production (Hancock et al.).

Since their domestication in the mountains of central Asia some 4,000 years ago, apples have transitioned from a peculiar, undesirable plant to a ubiquitous commodity (Seabrook). Apples arrived in the Americas in the 16th and 17th centuries, when they were appreciated for food and drink, but moreover as a source of sugar and alcohol (Hancock et al.). Their versatility, growing potential, and nutritious qualities were quickly realized and apple orchards spread across the country. By the early 20th century, the United States and Canada were the two largest apple producing nations in world and innovative ways to maximize yields and make the fruit more appealing, like breeding apples, were rapidly advancing.

The University of Minnesota breeding program was developed with the goal of breeding fruit cultivars that can thrive in Minnesota’s unpredictable and extreme climate (Luby, 507). Peter Gideon, known as the “father of breeding on the prairies” introduced the first apple cultivar of the region (Luby et al., 25). Demonstrating unprecedented
potential, his ‘Wealthy’ apple variety catalyzed the beginning of the breeding program. Soon after its development, the Minnesota legislature granted the program an appropriation, in which expenses were used to form an experimental farm in 1878 (Luby, 507). Power conflicts over control of the program arose. University administrators disapproved of Gideon’s leadership while Gideon felt he did not receive sufficient recognition for his efforts (Luby, 25). Despite this, the breeding program expanded under the leadership of many different individuals and has released 26 different apple varieties and gained international recognition for its cold-hearty fruits (Henry).

Breeding Apples Today

Why breed apples? Creating new cultivars is an intensive and lengthy process, demanding significant funding, time, and effort. However, according to Jim Luby, a professor of horticultural science at the University of Minnesota, breeding new varieties is seen as an opportunity to increase consumption of this “health-promoting” food and the industry has seen much success. The overarching goals of modern apple breeding programs are to increase the marketability of the fruit and increase production efficiency by reducing costs and maximizing yields (Hancock et al.). Developing pest resistant varieties is an additional focus.

Each year, 15-20,000 trees embark upon the breeding process. To begin, breeders select for fruit and tree traits. Luby describes this process, “We are simply crossing different apple trees with one another as bees have done for a long time - except we choose which parents to mate and we select among the offspring in addition to the forces of Mother Nature.” Because crispiness is the most valued apple quality, a desirable fruit texture is prioritized, followed by flavor (sweetness, acidity, aroma), and appearance (color, smoothness, shape) (Seabrook, Luby). Additionally, resistance to disease, tree shape, and winter hardiness are selected traits in trees (Luby). Ideally, breeders combine the best traits of two parents into a unique offspring. David Bedford from the University of Minnesota describes the unpredictability and experiential nature of breeding, "Some apples look great but don't pass those traits on while others are not so great-looking but make good parents" (Seabrook). Trait selection involves significant understanding of the apple genome so genes can be manipulated.

Once traits are selected and parents are crossed, the trees take 5-10 years to produce fruit (Luby). The next stage involves tasting 300-500 apples a day and the most promising trees (~1/300) are selected, cloned, exposed to various controlled environments, and evaluated for the next 10-15 years (Luby, Seabrook). Ultimately, only one in twenty thousand apples become a new variety (Luby).

The significant investments involved in breeding apples and the infrequent success speak to the many challenges faced by programs. Because of the many interrelated genes, it is nearly impossible to achieve a balance between desirable fruit qualities and resistance to multiple diseases and pests (Hancock et al.). For example, according to Luby, many of their hardiest genotypes are of low quality in other aspects (507). However, despite these challenges, the University of Minnesota breeding program has prospered. The Honeycrisp variety was recognized as one of 25 innovations that changed the world and it became the third most profitable invention produced at the University of Minnesota, bringing in more than ten million dollars in royalties (Seabrook).
Breeding Politics: The Disadvantages of Domestication

“I saw apples with the hue and heft of olives or cherries, next to glowing yellow Ping-Pong balls and dusky purple berries. I saw a whole assortment of baseballs, oblate and conic, some of them bright as infield grass, others dull as dirt,” describes Michael Pollan as he explores the New York State Agricultural Experiment Station’s apple orchard. His words shed light on the manipulative power of breeding and the debate of apple domestication. Are we interfering too much with nature’s ways by creating unnatural varieties?

However, even more concerning is the decreasing genetic diversity of apples. Most of the apples we grow today have the same five or six parents and this genetic similarity has allowed pests to evolve ways to “overcome whatever resistance the apples may have once possessed” (Pollan). To reconcile this, scientists have found ways to help the apple evolve artificially by selecting desirable, pest-resistant traits through apple breeding. However, artificial trait selection has prevented apples from naturally evolving with their environment and has led to decreased fitness. Thus, many people worry that apples are becoming dependent on our artificial evolution and breeding and that without continued efforts, the survival of the apple will be jeopardized. Pollan states, “The story of the modern apple, which has become utterly dependent on us to keep its natural enemies at bay, suggests that domestication can be overdone.” This raises some questions: are our efforts to make the most desirable and ideal apples actually detrimental to apple populations? Are we losing sight of some crucial steps that must be taken to secure a successful future for apples?

Breeding Politics: Open versus Managed Varieties

Bringing in more than ten million dollars in royalties, the Honeycrisp apple paved the road to success for the University of Minnesota breeding program. Perfectly crispy and sweet, the Honeycrisp is sought after in stores internationally. Honeycrisp was initially commercialized as an open variety and could thus be grown and sold by anyone. However, with this minimal management, breeders have no control over growing methods. According to Dennis Courtier at the University of Minnesota, “in recent years farmers have let quality assurance go by the wayside” and “there have been a lot of really bad Honeycrisps coming to market” (Baker). The decline in quality is largely due to an abuse of proper growing methods: Honeycrisps are meant to be grown in climates similar to Minnesota’s but many growers are eager to produce them elsewhere. As the quality varied, consumer enthusiasm for Honeycrisps has declined and the brand has suffered (Seabrook).

It took three decades to develop the Honeycrisp and those involved in its cultivation are concerned. “It’s like Nabisco releasing a baked wheat chip and saying, ‘O.K., you can take this, make it to your own standards, and when you're done call it a Triscuit’” says David Bedford in response to the recent decline in Honeycrisp’s quality. Of particular concern is the program’s dependence on royalties to support their continued breeding efforts. With significant budget cuts and a lack of state funding, the program thrives on income generated from successful cultivars like Honeycrisp. Simply put, damaging the Honeycrisp brand could have detrimental effects on the entire breeding program.
To reconcile this threat, many breeders have begun privatizing their business to make a profit. For example, as the state funding for the program decreases, the University of Minnesota has resorted to patenting and managing apple varieties and restricting who can grow them. The story of the SweeTango exemplifies these efforts.

With Honeycrisp as its mother and Zestar (another successful cultivar) as its father, the SweeTango epitomizes apple genetic excellence. “It had sunburned shoulders, yellow sides, and a splash of green around the stem bowl, and it was freckled with ‘lenticels’, through which it was imperceptibly breathing” (Seabrook). To protect its quality and increase earnings, the university branded, patented, and trademarked their beloved creation. John Seabrook reflects on these actions: “as a piece of intellectual property, it has more in common with the apple on my laptop than the one I used to carry in my lunchbox”.

Exactly how did management of the SweeTango work? To begin, outside companies applied to be the chief controller of the SweeTango in which they would be responsible for establishing a consortium of growers. As a helpful ally to the university in the development of the SweeTango, Pepin Heights Orchard, in Lake City, Minnesota was granted this responsibility (Seabrook). Thus, growers accepted into the consortium have to agree to follow precise growing methods and selling restrictions enforced and regulated by Pepin Heights Orchard (Seabrook). Furthermore, apples are closely inspected before they can be sold under the SweeTango name and the University ensures that only the highest quality apples make it to the supermarket shelf (Seabrook). Growers also have to pay the University a significant amount of their profits (a “royalty”) (Seabrook).

Resentment quickly surfaced among growers not apart of the consortium. Should the university be allowed to manage a product that was developed with public funding and tax-payer support? (Siegle) Should growers have to be issued a license by the breeders to grow a variety? Should growers be obligated to pay “royalties” to breeders for the number of apples the sell? Is patenting desirable apple varieties the best way to protect their brand name and ensure high profits?

Growers, who depend on profitable apples like the Honeycrisp, didn’t find this exclusive management fair. Because they now had to compete with the SweeTango apple, growers opposed the success of the variety and saw it as a threat to their own success. Even more, frustrated growers saw these restrictive actions as a violation of public policy (Herzog). According to growers, the university policy ensures “results of university research will have the maximum possible beneficial effect for Minnesotans and the larger public” (Herzog). Their indignation led them to sue the university in 2010 (Great Debate).

Wolter, from the University, defends the program’s actions, "Our apple breeding program has been in place since 1908, and it's not inexpensive or quick to develop a new apple. It's a significant investment and we're looking for ways to fund it and keep it going in the future." (Herzog). Additionally, James Luby sees patenting to continue because it will produce profits to fund future breeding efforts (Siegle).

Conclusion

From a nutritious afternoon snack to a way of life, apples have woven their way
into the daily lives of people worldwide. Initially considered distasteful and used solely as a source of sugar and alcohol, the apple has truly found a valued identity today. However, the cultivation of the apple has elicited some disagreement. Is there validity in the argument that domestication is harmful to apple populations’ fitness? Will breeding programs continue to produce flawless apples and how will they manage successful varieties in the future? Will apples be victims of their own success? What’s next on the apple innovation agenda? Only time will tell. Until then, enjoy the bursting of apple cells in your mouth, cherish the crispiness, and appreciate how far the apple has come.

Sources


Luby, James. E-mail interview. 16 May 2012.


