



Ancestral Mexica Farming: A Comparative Yield Analysis from the 1500s

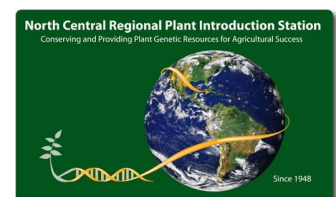
SARE Grant FNC19-1161

Pantaleon Florez III
Principal Investigator

Ashley Aranda
Research Specialist

Paola Ramírez Peña
Research Specialist

In partnership with:



“Any opinions, findings, conclusions, or recommendations expressed in this publication are those of the author(s) and do not necessarily reflect the view of the U.S. Department of Agriculture.”

Acknowledgements

This research study took place on Kaw and Osage Lands. More must be done to protect, bolster, and foster Indigenous sovereignty.

Special thanks to my elders and ancestors for being stewards of land and culture. I am ever thankful for these deep connections and I hold a deep respect for the 10,000 years of maize cultivation leading to this very day. Tlazocamati Cinteotl, Tlaloc, Quetzalxochitl. Tlazocamati Ometeotl.

Additional thanks to the folks at the Douglas County Sustainability Office and the Douglas County Agricultural Research Extension Office who wrote letters of support for this grant. This research would also not have been possible without the City of Lawrence (KS) Common Ground program's Incubator Farm or without NCR-SARE. Without the stewardship of the North Central Regional Plant Induction Center, we would not have had two of three samples we used in this study. Thanks as well to Omar Rodriguez, Sustainable Agriculture Specialist at The National Center for Appropriate Technology/ATTRA for assistance in seeking previous research. I look forward to continuing to build a sustainable future with you all.

Most incredible special thanks to Ash & Pao. I cannot imagine having done this without y'all. I'm thankful for your mentorship, guidance, grounding, hard work, and growth throughout the process.

TABLE OF CONTENTS

ABSTRACT	1
INTRODUCTION	1-2
LITERATURE REVIEW	2-4
METHODOLOGY	5
Selection of the Germplasm Samples	5-6
Sample Controls & Variables	7
Research Approach, Types of Data Collection/Analysis	8
FINDINGS	9
Sample Results	9
Climatic Impact	9-10
DISCUSSION	10
Quantitative	10-11
Qualitative	11-12
Paola Soyumi Ramirez Pena: Ethnography	12-17
Ashley Aranda - Pictoethnography.....	18-27
Ashley Aranda - Ethnography	28-41
Pantaleon Florez III - Ethnography	41-46
Research Limitations	46-47
REFERENCES	48-49
APPENDIX A: Excerpts from the Florentine Codex	50
APPENDIX B: Weather Variables	51-52

ABSTRACT

Access to Mexica ancestral knowledge is currently undergoing a renaissance in its availability to the public. The Florentine Codex, written between 1545 and 1590, is one of the most authoritative accounts of Nahua (Aztec) life shortly after the Landing at Veracruz by Spanish Conquistadors. Book 11 of the series is titled *Earthy Things* and contains information on indigenous foods and maize planting methodology. This study will provide a comparative yield analysis between this account and current no-till best practices. Additionally, this study will provide two University of Kansas undergraduate researchers an experience for hands-on learning and an introduction to farming. Additional goals of the study include increasing maize crop diversity, increasing public access to Indigenous foods, and beginning to investigate potential scalability and marketability for Mexica products. The North Central Regional Plant Introduction Station (NCRPIS) in Ames, Iowa has provided the germplasms for this study based on this NCR-SARE research proposal.

INTRODUCTION

The Florentine Codex is a Mexica ethnographic research study by a Spanish Franciscan friar named Bernardino de Sahagún from the mid-late 1500's. Sahagún completed this work with the knowledge and help of Nahua/Mexica people. These people had been former students of Sahagún at the Colegio de Santa Cruz en Tlatelolco. This was the very first and is the oldest European institution of Higher Education in the Americas. The original codex is still being held in The Laurentian Library in Florence, Italy. The codex was taken into their collection in 1791, and bibliographer Angelo Maria Bandini

published a description of it in Latin in 1793. Over two hundred years later, Arthur J. O. Anderson and Charles E. Dibble would translate the work into English.

Earthly Things (Book 11) was the main focus of this research study. This book details the planting and cultivation methods for maize production of the Mexica. Finding previous research on this exact topic proved somewhat difficult, leading the research team to believe this to be underexplored in practical application. Similar studies are outlined in the literature review. This paper will then explain the research methodology including descriptions of the maize germplasms used and type of data collection and analysis. The findings of the comparative yield analysis are in the following section, and they are accompanied by a breakdown of the climatic conditions of the growing season. Finally, the paper concludes with quantitative (scientific, social, and economical) discussion, qualitative (ethnographic and picto-ethnography) discussion, as well as research limitations.

LITERATURE REVIEW

When conducting the initial literature review for this study, previous NCR-SARE research utilizing Nahua methods of growing maize was not found. However, A Study of Open Pollinated (OP) Corn (FNC00-301), indicated that non-hybridized maize “tends to have a higher quality as farmers have been saying for decades.” They concluded that “[their] initial survey of OP corn [found] that many OP corn varieties were higher in protein, some were higher in fat, and a few were higher in other mineral constituents and lysine than commercial hybrid corn.” This is helpful in early stage market analysis in understanding current nutrient and thought trends of open-pollinated maize. This also

falls in line with what Yoli Tortilleria has described to me as a desirable product for their factory.

As an additional prerequisite for this grant, ATTRA --the National Sustainable Agriculture Information Service formerly known as Appropriate_Technology Transfer for Rural Areas -- was contacted. After agricultural experts at ATTRA checked their databases, they provided me with an article titled “Comparing Maize Paleoproduction Models with Experimental Data” by R. Kyle Bocinsky and Mark Varien (2017). This paper reports on the results of the Pueblo Farming Project where researchers and members of the Hopi tribe planted four experimental gardens of Hopi maize using traditional methods. As Bocinsky & Varien were hoping to improve agricultural productivity models, they noted that “perhaps more important are the quotidian acts of the farmer not addressed in this study.” They go on to indicate that further research is required in the following three key areas: ethno-agricultural research, formal agronomic field trials, and “[engaging] more deeply with the paleoclimate community” via employing tools from precision agriculture. They also conclude that “culturally-informed experimental farming studies [are] essential for understanding the challenges and adaptations of ancestral farming communities.”

Additionally, Abo-Habaga & Ismail (2002) conducted a study called “Effect of Maize Planting Methods on Plant Regularity and Yield Crop” that analyzed three maize planting methods. In this study, the test groups were: 1) seed planting on a flat surface and construct the rows during cultivation 2) construct the rows at first and plant the seeds on the rows & 3) construct the rows and planting the seeds at the same time. Abo-Habaga & Ismail concluded that Method 1 was most productive in terms of plant uniformity, yield,

and germination rate, and fastest seedling emergence. While Method 1 somewhat resembles the cultivation methods mentioned in the Florentine Codex, this definitely differs. This study, as in Bocinsky & Varien (2017), does not account for the details of the quotidian acts of the farmer.

In a paper by Vikkie Stea (1985) titled High-yield Corn from Ancient Seed Strains, Stea investigates the resilience of ancient maize varieties. In that paper, Stea interviewed then Director of the Talavaya Center, John Kimmey, who noted that “many valuable seed strains were in danger of extinction.” This project aims to assist in maintaining maize diversity and increasing accessibility to a more diverse maize population. Additionally, Kimmey stated that older varieties of maize “are drought resistant, require little or no fertilizer, and adapt well to climatic changes.” These conditions are exemplified in third-world agriculture, and research on planting methodology as in this proposal could prove beneficial to third-world farmers.

Research studies that have employed the specific methods from the Florentine Codex were not found. A facsimile of this codex was made available for modern researchers in 1979, but an English translation with full images has only become available to the public since 2012. Researchers of the former release were likely more focused on broader anthropological and historical implications opposed to enacting and experimenting with the knowledge in the texts. This may explain a lack of in-depth investigation into the indigenous methods of cultivating maize found in the Florentine Codex.

METHODOLOGY

Selection of the Germplasm Samples: This research study investigated three different varieties of maize. The three samples are referred to as Guanajuato 31, Michoacan 333, and Organic Blue Corn. Each of these samples is broken down into two groups: Florentine and Conventional No-Till. The latter serves as a control group. The Guanajuato 31 and the Michoacan 333 samples were obtained via the North Central Regional Plant Introduction Station's (NCRPIS) Germplasm Resources Information Network (GRIN; Ames, Iowa) on the basis of conducting this research. These two samples contained 100 and 200 seeds respectively. 300 seeds were used in the Organic Blue Corn sample.



Guanajuato 31 (NCRPIS PI 483517) is taxonomically *Zea mays* L. subsp. *mays*, and was collected in the state of Guanajuato in Mexico. The improvement status of Guanajuato 31 is listed as a landrace. The primary race of this maize is listed as Elote Cónico. The oil concentration

value is 5.9 which is within the 3.26-6.22 range of 87% of NCRPIS accessions. Resistance to the first generation of european corn borers has been observed. Ears of this variety ranged between 6-8" with plants reaching 8-9'.



Michoacan 333 (NCRPIS PI 484092)

is taxonomically *Zea mays* L. subsp. *mays*, and was collected in Michoacán de Ocampo, Mexico. The improvement status of Michoacan 333 is listed as cultivated material. The morphology of this maize is described as Floury, Dent, and Flint.

The oil concentration value is 6.7 which is higher than the 3.26-6.22 range of 87% of NCRPIS accessions. Observations of Michoacan 333 being mostly susceptible to the first generation of european corn borers have been made. Ears of this variety ranged between



6-7" with plants reaching 8-9'.

Organic-blue corn is taxonomically *Zea mays* L. subsp. *mays*, and was purchased from a commercial seed vendor. The morphology of this maize is described as Floury. The seeds were listed as USDA Certified Organic. The seed vendor describes this variety as a “[r]eliable blue corn for blue flour [with] 7-8" ears [that have] good kernel

configuration and excellent tip fill.” These plants are said to reach a height of seven feet.

This is also an open pollinated variety with 105 days to maturity.

Sample Controls: To utilize no-till and no fossil fuel practices, we employed jab-planters. This allowed the research team to accurately plant to a consistent and correct depth. Row spacing was also standardized and equal between samples. Though the 2018 growing season did not allow for much in the way of controlled watering due to excess precipitation, the samples were each treated the same in watering practices utilizing drip tape irrigation in the few instances it was needed. The samples were planted in North/South oriented rectangles (forming a 100, 200, and 300 square foot blocks) so as to provide the same amount of light for each sample. The plantings between the three samples were conducted 3-5 weeks apart from one sample to the next to help avoid cross-pollination. Finally, all of the samples were provided with the same amount of OMRI listed organic 12-0-0 feather meal for fertilization.

Sample Variables: For the planting itself, the only variables will be in cultivation methods. Cultivation methods from the Florentine Codex (Full passage: APPENDIX A) were used on one sample, and no-till best practices as listed by the University of Nebraska-Lincoln's Institute of Agriculture and Natural Resources (Cropwatch) were implemented on the other.

The main difference in cultivation as listed in the Florentine Codex relates to hilling the maize at different stages of growth throughout the growing season. The first hilling is described as follows: "Then [the maize kernel] is gathering moisture; then it swells; then the grain of maize bursts; then it takes root. Then it sprouts; then it pushes up; then it reaches the surface; then it gathers moisture; it really flies. Then it forks, it lies dividing; it spreads out, it is spreading out. And they say it is pleasing. At this time it is hilled, the

hollow is filled in, the crown is covered, the earth is well heaped up”. The second hilling is done in the pre-silk stage once the maize has “become succulent”. The final hilling is done once the tassels have formed.

Research Approach: This research study utilizes mixed methods. Neither the quantitative, nor the qualitative aspects of this study outweigh each other. Quantitative measurements include: yield, and potential profitability and scalability. The qualitative measures of this study include: autoethnography and picto-ethnography.

Types of Data Collection: Weather data in the range from first planting until last harvest for air temperature, relative humidity, wind speeds, soil temperature at 2” & 4”, and solar radiation were collected by utilizing Kansas Mesonet Historic Weather data. Harvesting occurred in stages just as in planting. This resulted in staggered harvests where crops were then weighed by their respective sample groups. Autoethnographic accounts from the primary investigator and one of the research specialists were collected. Additionally, a picto-ethnography was provided by another research specialist.

Types of Data Analysis: The main quantitative measure of this study is a comparative yield analysis. The resulting data consists of a comparison of the weights between planting methods and a yield percentage difference for each sample. Data concerning the number of people reached by this study through events and classes was also collected.

FINDINGS

Sample Results

Guanajuato 31: The Florentine sample yielded 1.99 lbs (0.9 kg) of maize while the Conventional No-Till sample yielded 1.74 lbs (0.79 kg) for a total yield of 3.73 lbs (1.69 kg). The Florentine sample produced 6.7% more maize. Additionally, the Guanajuato sample produced one ear of Huitlacoche. This ear grew on the Florentine sample in one of the edge rows and yielded 0.44 lbs (0.2 kg) of Huitlacoche. Huitlacoche -- also known as Corn Ear Smut or Mexican truffle -- is caused by *Ustilago maydis*. “*Ustilago maydis* infects growing maize and teosinte plants” (NCBI, 2017) and it can form galls on all above-parts of *Zea mays*.

Michoacan 333: Both the Florentine and Conventional No-Till samples experienced multiple dramatic wind and flood events. This sample was most impacted because of the timing of the planting and the sample location in the field. Of the 200 seed sample, only a few twisted and tattered stalks of maize were able to produce. Each sample fared equally, totaling 0.40 lbs (0.18 kg). This planting only reaped a total of 681 seeds.

Organic Blue Corn: The Florentine sample yielded 14.85 lbs (6.74 kg) of maize while the Conventional No-Till sample yielded 13.37 lbs. (6.06 kg) for a total yield of 28.22 lbs (12.8 kg). The Florentine sample produced 2.6% more maize.

Climatic Impact: Rainfall was particularly heavy for this season. Precipitation surpassed average annual rainfall for Lawrence, Kansas by September 19th. The duration of the maize growing season saw a total of 40.54” of precipitation. Strong gusts of wind blowing through the maize research plots characterized this growing season. Appendix B provides soil temperatures (2 & 4 inches depths), air temperatures, wind speeds, solar radiation, and

humidity for the duration of the maize season. These measurements were taken from the nearest K-State Mesonet station in Silver Lake, Kansas.

DISCUSSION

Quantitative

Quantitatively, this initial comparative yield analysis demonstrates promising potential gains over current no-till planting practices. The Guanajuato sample showed the most drastic and statistically significant difference in production between the Florentine and Conventional No-Till samples. Hilling multiple times enabled better overall stability. As this was a relatively turbulent growing season, the hilling in the Florentine sample did seem to assist crop vigor. The plants from the Florentine samples were generally less battered after the storms they endured. This is likely due to the fact that the brace roots of the Florentine stocks were able to sink into the hilled earth more quickly and deeply than the other unhilled samples over the growing season. Brace roots are also known to be able to extract water and nutrients from the soil once contact has been established. This was also likely beneficial to the Florentine sample.

Socially, this research project reached 778 people. 343 of these people were reached via in-person and online presentations. An additional 435 people were engaged culinarily with the blue corn through free community meals. Maseualkualli Farms already had a food security program in place before starting this research project. The Unsuspended Food Program gets food where it needs to be and then fundraises on the back end. This food first, funds second model utilized the maize grown from the blue corn

sample in *pozole* and *esquites* in free community meals. With a small amount of huitlacoche produced, the research team also made *huitlacoche empanadas con queso oaxaca*.

This project was economically successful. The tools provided for this study are now available to people who are launching their farm businesses at the Incubator Farm in Douglas County (Lawrence, KS). These tools have helped multiple farmers plant more efficiently, and they were appropriate for the actual work that needed to be done for the study. As far as sales outlets, the blue corn had many venues. Farmers market and local restaurant/meal sales brought in the majority of income from the blue corn. Social media presence about the study encouraged people to interact with me both on social media and in-person at the farmers market. This economic benefit likely extended to some of the other vendors at market, as well.

Qualitative

This study aimed to include the ethnographic accounts of the ag researchers. We have provided four qualitative sections. The first is an ethnographic account by research specialist Paola Ramírez Peña. The second is a picto-ethnographic account of the project by Ashley Aranda. This is followed by Aranda's ethnographic account of the study. The final section is an ethnographic account by the principal investigator. Each research team member took a different approach to provide not only multiple perspectives but to also provide multiple modes of conveying their experiences with this project.

This project was designed to be a means of reclamation in the field of agricultural sciences and culinary arts. The research team recognizes our ancestors and mentors who

have stewarded maize and other crops for thousands of years. The achievements of our ancestors that we benefit from today can best be repaid in a sustainable continuation of their work in both scientific and cultural ways. We must continue to make and tell our own stories as well as those of our ancestors.

Paola Soyumi Ramirez Peña: Ethnography



INTRODUCTION

I first met Pantaleon at the first annual Latinx mixer for the University of Kansas' Latin American Student Union. I was on the executive board of the organization at the time and helped coordinate the event with the intended purpose to connect current students with Latinx alumni, faculty, and staff mentorship. Pantaleon was the only alumni that showed up. Our quick introductory conversation ended with him inviting us to

visit Maseuakulli Farms, The Peoples' Farm. In the week following our meeting, I interviewed him for an assignment for my environmental sociology class and I learned more about his work and education background.

At the time of the interview, Pantaleon was applying for a research grant to conduct a comparative analysis of indigenous corn farming vs. contemporary growing practices.

When his research proposal was accepted, he offered me a position on the farm. I accepted, reminding him that my farming experience was almost nonexistent. I grew basil and rosemary indoors for cooking, but I had a narrow understanding of the investment of intense labor, time, and spiritual practice that farming involves. Now, almost a year into our research and my farming experience, I am so grateful to have accepted the opportunity to work alongside Panta and Ashley in a restorative relationship with the land that has yielded me physical and emotional health, legacy, and new-found skills.

Health Impacts

I am a type-1 diabetic and have to make a concerted effort to eat healthy foods and exercise in order to regulate my blood-sugar levels and maintain a healthy body. Maseualkualli Farms facilitated these efforts by offering me access to organically grown seasonal fruits and vegetables and by working my muscles through no-till farming. Before the farm, I forced myself to go to the recreation center on campus once a week and



felt miserable doing so. I did not like having to work-out with machines and having nothing to show for it at the end besides sweat. Exercising through farming on the other hand put me into a meditative relationship with the land which had tangible results like a clear plot of land, seeds planted, and harvesting a crop. The high blood-sugar levels that had been affecting my energy and mood were regulated by the physicality of farming,

producing positive effects on my physical and mental health. Within a month into farming I reported better moods, felt more energized, and my doctor noticed weight loss.

The emotional health component has been difficult to write, partially because it leaves me very vulnerable. Mostly though, it is difficult to capture the restorative magic of farming which evades words and definition, but I will try to honor the changes I experienced. I come from a family and culture in which respecting the value in all living things is primary. I feel intimately connected to trees, toads, grass, fire, pets, and other people. Enacting violence onto any of those entities is enacting violence onto myself. This is not a mantra, nor is it a mystical understanding of the world, it is a mundane truth that I have known since I was a young child. Living within an American context that prioritizes capital, individualism, and exploitation of resources to maximum capacity creates a perpetual sorrow that is inescapable. Though I try to live in alignment with my values, systems outside of myself force my complicity by eliminating all other options. I believe that systemic revolution is the only way to achieve ethical consumption and creation. I also believe that marginalized people deserve joy and reprieve today. Like right now, not in some distant changed world. The farm was a safe-haven in which I knew I could exist wholly by interacting with intention and releasing the pretense of this is the way things have always been the outside world relies on. In recollection, the space feels blessed, almost science-fiction, but I know it is real. I know because my fellow farmers, Ashley and Pantaleon, experienced it too.

The farm was a work space, of course, but it also became a place for meditation, therapy, gratitude, and a sort of worship. In every session I saw a new way to be. There

was teaching and learning outside of the rigidity of a closed classroom and despite Pantaleon's formal position as our boss, the teaching and authority was fluid. All forms of intelligence were valued and we were able to engage in conversations ranging from horror films to graduate school to racial dynamics in the city. There were regular check-ins where we could release stress through physical engagement, conversation, and comradery. The majority of my day was spent indoors in classrooms and offices, but the farm gave me a chance to see the sky and feel the weather. In my lowest moments of the semester, I knew I had Pantaleon and Ashley to count on and the farm to retreat to.



Learning New Skills

As I mentioned earlier, I had little to no previous understanding of farming when I started as a researcher under Pantaleon. Through his teachings, I learned how to prepare a patch of land by turning the soil, pulling up weeds, and leveling the land. I learned best practice for holding the tools and to understand the versatility of a double eye hoe, installing water drip systems, and alternatives to chemical weeding.

I learned about the properties of the different crops we planted including: how much distance to place between seeds, what seasons are best for different crops, duration until first harvest to assess investment, and what makes good compost. Through my relationship to the farm, I grew interested in food security and have researched it in relation to college students. According to a survey from UC Berkeley, thirty eight percent of undergrads and twenty-seven percent of graduate students deal with food insecurity (NPR). In researching ways to become a food security advocate, scholarship suggested that community gardens produce more for less: less individual labor, less individual cost, and less land used. This means that efforts like those at Maseualkualli Farms can be a great resource for students “who are parents, low-income or who identify as LGBTQ, as well as those who are first-generation college students” which suffer a higher risk of food insecurity (NPR). Since acquiring all these skills and knowledge, I have a greater appreciation of the laboring hands that produce all food items and try to shop locally when possible.



In continuation of this work, I became an intern for the Sustainability Department for Lawrence and Douglas-County. In this position, I have compiled data on single-use plastics, helped showcase local food system initiatives, attended climate rallies in our state capital, and am coordinating this year’s 20th annual Earth Day celebration.

Legacy

When we received the seeds, we met at the public library to sort the brightest and plumpest seeds for planting. During this meeting, we learned about the origins of the seeds we were to cultivate and the importance of corn in ancestral Mexico and contemporary United States. According to Sánchez González et al., most corn today can be traced back 9,000 years to a Mexican grass called teosinte. When I first held the Guanajuato seeds, I busted into tears. As a first-generation American, I felt a constant void of ancestral identity, because of Spanish colonization, historical erasure of Mexican contributions to society, and my parent's migration through deserts and rivers to the United States. I was moved to tears, because it felt like meeting an old relative.

The seeds were a metaphorical and literal connection to an ancestry I feared was irreversibly lost. The connection was to ingenious geneticists that provided one of the central crops of continental American diets and agricultural economies. It was with the culture forging matriarchs that ran households with maiz as a source of sustenance, shelter, and artistry. It was a connection to contemporary elders, a point for recipes, conversation, and story-telling with relatives in Mexico and my immediate family in Kansas. Through the ancestral seeds and farming practices, I became inducted into a long-standing culture built around maiz. I became a steward for the crop and therefore a steward of our culture. It drove me to tears, because I realized that despite years of uprooting through colonization, state-sanctioned borders, and attempts to erase us from the narrative, we are still here.





















Ashley Aranda - Ethnography

FALL 2018

I was born and raised in Los Angeles, California. Neither Lawrence, where Maseualkualli Farms is located, or Wichita, where my immediate family resides, has truly felt like home. I consider myself an Angeleno, my Chicano father was born there, and my mother migrated there as a young child from Guatemala. All these places are worlds apart, but they're mine. It's been an ongoing struggle to recognize them as such, but through making meaningful choices with my time, and a community that I've curated, things are always improving. I also recognize that the land I have had the pleasure of being a part of will never truly belong to me, as they should rightfully belong to the Tongva, Osage, Kaw (Kansas), Wichita, and Sioux peoples. The land must be returned.

At this time, I was the president of KU's Latin American Student Union. The role was important to me because I wanted to create a space that was centered on our joy in the midst of what to me was the still new and unforgiving university environment. At this point, I was a toughened junior armed with my own mental compilation of university resources, vaults and safes. I understood them as straw beds and thin blankets, but like those before me, I knew kindling when I saw it. I knew a club wasn't going to save me, but it was what I had to work with.

Looking back, I was desperate for the fire and warmth of community. I wanted to be understood as my whole self, as the sum of my places and peoples. I wished for the celebration that I had expected college to be, that I had been promised up until the beginning, only to accumulate more grief as time went on. The language I was gaining for

white supremacy and the holds it had on my life moved time so quickly that I felt I had to outrun that destructive pace. I was burning off at the top of my game, my classes bored and muted me, my college administration and professors and fellow students failed me as a femme scholar of color when it came to de-centering the Western eye or decolonizing the curriculum and style of our classrooms. I kept busy, and I had achieved despite such frenzied energy, but things felt more and more futile as I grew. My friends were experiencing the same things on different frequencies, but with the same overwhelming intensity just as constantly and consistently - the understanding being that anyone new likely felt the same shattering pressure.

I held on for my friends. I held on for their hopes and their intentions and their kindness. I held on for the future introduced to me through the work of colleagues like Jameelah Jones, Anthony Boynton, Stacy Swearingen-White, Imani Wadud, Gisele Anatol, Fuko Ito, and Soyumi Paola Ramirez-Peña as well as educators like Bree Newsom Bass and Eve L. Ewing. I held on so I could make things like Hanif Abdurraqib, Morgan Parker, Fatimah Asghar, Safia Elhillo and Jonny Sun had made. I held on for the content. It was because of folks like these that I understood that I would have to be the change I wanted to see. I knew I wasn't alone in consistently believing that people deserve better simply for the sake of being people. I could be queer, brown, and loved, I could be supported, constructively challenged and taught. These were new conceptions of life for me. Sometimes they still are. I hold on now for my mentors Christopher Perreira and Emily Ryan, and especially for Pantaleon, all who nurture me beyond the institution we've shared.

Paola asked me, during another dark and windy evening filled with many sighs and jokes and hopes for LASU, what I thought we needed. She might've meant it more broadly, but I took it to mean our Latinx community on the whole, and I remember the words leaving my heart almost immediately. I thought we needed a connection to the land. My heart was hurting for home, for my grandmother's garden. I come from a heritage of herbal healers, worship in public parks, and citrus trees. All I want sometimes is unrestricted access to these comforts and pillars. Sometimes my spirit says things before my brain recognizes that I need or want to.

Months passed and my outlook continued to morph and bubble. I needed ideas and grounding to believe I could make it to a future that would satisfy me, to quell the dissatisfaction with my dreams, so I hustled to plan a rushed mixer for Latinx alumni to meet current students, staff and faculty. It wouldn't amount to much in terms of an event with the experience that I had, but it is something I'm truly proud of. I don't call the work I do hard work, so I struggle to recognize myself, even retrospectively. I am genuinely impressed by our collective ability to pull this, and a whole on campus baile among other programming, off. In the end, I couldn't be disappointed, because we managed to reach at least one alum.

He'd reached out through Facebook for details, and showed up because he lived in town. When the event winded down, Pantaleon introduced himself to me, and I couldn't believe the sheer power of manifestation before me. I feel as if I said "Wow." a lot, with my hands behind my head for balance. He was graceful, humble and sweet. It felt like a conversation with family. Everything he described about himself and the work he was

doing felt in sync with the philosophy I wanted to align myself with, and it's more than a blessing to have a best friend who felt the same way. Environmental justice and equity in public education, as supported by the arts, are my priorities, and I know this because of Pantaleon. Upon the first conversation I had with him, I felt I could do absolutely anything I wanted, no matter how fluid or unprecedented. He invited us to the farm, and I knew that's where I needed to be. Upon being asked to assist with the research, I didn't think twice.

WINTER 2018

Within that same period, I was studying art history, and working at the front desk of the university art museum as a part of their visitor experience team. My pride kept me around, and not for the better. I couldn't wear my emotions without folks feeling like they were entitled to my internal state because I was a greeting face. The museum had begun MASS (Museums as Site for Social Action) training, which consisted of a half hour portion of monthly all staff meetings as well as mandatory visitor experience department training but nothing changed. I continued to educate folks about DEI efforts that I had educated myself on for free, at the expense of my time for other work duties or ideas, homework, or art. Folks who made six figures a year praised my generosity and intelligence as I made \$9 an hour, without paid breaks. Unspoken power dynamics were sustained, and the museum received millions of dollars in gifts in the time period I worked for them, for various endeavors. Some of which were beneficial to established artists of color or queer or indigenous artists, but there were still nights and mornings that I didn't know where my next meal was coming from.

I love art. I have a lot of memories of drawing and critiquing and analyzing from a very early age, I have always admired animation and costume and crafts. I loved that people, plural, were involved in all kinds of ways. Art was the cherry on top scoops of science and math and language and history, but pretty and incandescent, something that required mastery of many things. Dedicated spaces to art were not where I expected to be in college, and I held onto the notion once it became available to me very fiercely. It was either this or environmental studies - which had proven to be very white and middle class or with a lot more rural experience. I didn't want to do English, because I didn't want to feel restricted - I wanted knowledge that felt "new", and American Studies felt violent as a concept. Journalism seemed akin to martyrdom, and there were too many hoops for anything else.

I wanted to prove that art was mine too, that I was going to have it if it killed me. The problem was, it was killing me. Physiologically, I was in bed and by myself for days on end - I would only leave the dorm for work and class because I was losing hope in the company I found myself in. Socially, I had patience and care for few people, and I was finding myself at the opposite end of my intentions: distanced and tired. Overall, I was depressed, lonely and drifting because it appeared there was less to hold on to. No history for me, no imagination for me, no space, no heart and no one cares.

When Maseuallualli came into my life, it finally clicked that maybe I too, was entitled to articulate exactly what I wanted, without existing solely in opposition to something [namely, whiteness and its artistic priorities] that I didn't even care to know as intimately as I've been forced to. I had to let go of the idea that making myself suffer, that

yearning for the satisfaction of earned rest rather than deserved rest, by intentionally making myself as busy and as engaged as I could push myself to be, was going to be the only way to get what I wanted, and again, this was a long and fragile process. I didn't have to be somewhere, just cause nobody else like me was there. I could walk outside, and not fear that I was abandoning my only path to success - because when you're supporting yourself without a broad safety net, the decisions or chances feel like life or death. I could just... leave. Leave them to decompose naturally, because these things aren't sustainable anyway.

And so I did. With the promise of the grant for the ancestral corn study, I knew I had much more leeway than with my student hourly job, and that small gift of freedom from spring semester costs gave me the opportunity to pivot. When the semester ended, I went home, and after an emotionally tumultuous conversation with my parents, they affirmed that I had the right to change my mind. My family at home struggled with the conception that I could be having a difficult experience on a university campus, the land of the free and plentiful so to speak, but they loved me enough to be present during this vulnerable metamorphosis. It feels silly that this should be such an affair, but I had been swimming in several cavernous pools of fear for a very long time. I was ashamed of taking even more, and needing so much, that I felt undeserving of care. But in reality, this was a major act of self care. It was a very visceral recognition of who I was and who I wanted to be, and what kind of work makes me happy.

SPRING 2019

Once notified of the grant's award, we met at the Lawrence Public Library. On the table before us, Pantaleon had placed teosinte and the packets of corn seeds, and in the winter morning light everything was beautiful. The seeds were soaked in these soft but opaque washed berry colors, and they were smooth to the touch. We counted them out like kindergarteners, cooing and squawking as he explained the more formal intentions of the study.

The thing about Paola is, I am never afraid of learning in front of her. After a lifetime of a public education where my instructors felt disrespected by my emotional intelligence or quickness, Paola gives me the time and consideration of a fellow child. I knew that I could trust Pantaleon, when he was able to give me that same loving energy, after only hours of knowing him. The difference it makes when one is trained to educate, versus thrust, is exponential. My uncle Panta, as I refer to him now, knows exactly how to make you care, how to simplify the science and the reasoning, and how to admit his own limits. He exhibited all of this that gentle morning, and so I wasn't surprised when Paola started crying or when my cheeks throbbed from smiling and my throat tightened with the urge to cry as well. I'm not exaggerating when I say that I had waited my whole life, for an experience like that. As he explained how much we would be compensated for our time, it proved to me how simple it was to care for the needs of those from whom we require labor. \$18 an hour, \$6 over the living wage of \$12 in Lawrence. Double what I had been making for two years. It is a dream to have the privilege of knowing that your labor is directly helping others, without risking your own security, while being able to learn more

how to care for the Earth and each other, as needs evolve. Pantaleon was the first person who made this idea tangible for me.

The day we first came to the farm, it was blustery and icy pink in the sky. We wore thick dark pants and socks, and we sweated through them while Panta pointed to every single plant on the farm and named or guessed it as prompted. We placed multicolored pansies in paths he prepared for us quietly, asking curious whispers over the cool morning wind, but respecting the moment for what it was: the beginning of an era.

SUMMER 2019

I understand I've said more with my hands out of the dirt rather than in it, but sometimes prayer is personal.

In order to work on the farm, I had to stay for the summer in Lawrence, which was something I hadn't done until that point. I lived in a small and creaky bird egg blue house on Rhode Island Street with a generous Chilean American (I love you Isabel!), north facing windows and the corpses of several dozen junebugs. Space is precious to me, I don't take it for granted after having it slipped from underneath me so often - and so the home I had while working on Maseaulkualli is a necessary inclusion. If it were not for this sublease, and it's proximity to the campus clinic and the grocery store, I would not have been able to stay healthy - or I wouldn't have been able to try to.

Summer days on the farm began early to beat extreme heat, and spring's close wasn't easy. I'd wake each morning in my yellow bedroom, and I'd ask myself why and I'd see Panta's brown dirt covered feet and Pao's cupped palms in my mind's eye, and I'd haul

my humbled body up. I felt especially heavy on those mornings, I've always been a heavier body, but there's nothing like physical labor to remind you how much gravity you've been allocated. I'd quietly thump all over the house getting ready, and then I'd wait for Paola's sapphire beetle-like car to barrel approximately ten feet past the porch to drop myself in and zoom off together. Some mornings we'd moan and groan about the lack of sleep, others were quiet and reflective, and some were just plain silly.

It was a season of transition in Pantaleon's life, and Paola and I were continuously restless with our time in Lawrence. The electricity of our lives colliding was such a forceful energy that it made sense to me that the first task at hand was metaphorically and physically clearing the land: making space for something new to come, to be. Clearing wild growth is physically intensive, and while I expected this, there was something cathartic about cutting it all away. The sound of the hoe snipping at chunks of root, the soft flutter of dirt flying off and the insects' chime floated over the farm as the sun roved. We traded Panta stories about his life, history and heritage for ours. He taught us chemistry like common sense, but never in a condescending tone. He repeated instructions with patience, and reminded us to take breaks and drink water often. Hours flew by as we plotted the sample sizes out, leaving wide brown squares like bedroom carpets spread before us. Maseaulkualli became a maze of medicine and nutrition before our very eyes as fruit swelled ripe and the sunflowers slowly bloomed.

The thing about paradise on Earth is that it's still Earth. I was in a car accident the winter before, and having suffered whiplash and terrible tension throughout my strained student's body, I was in enough pain to warrant weekly chiropractor visits. While farming,

I'd feel invincible. Strong and filled with so much sunlight that pain and discomfort would wait till I'd get home. My shoulders, stomach and soles struggled to support my veracity, aching with impatience for my energy, my hunger to keep up with my slightly smaller friends, who were my teammates. I didn't want to be perceived as lazy, or as unwilling, or as incompetent based on my body's look, behaviors and limits - and these are difficult feelings to hold around those who are otherwise there for your other innermost vulnerabilities.

As much as I could hope to keep these issues private, my body demanded more from me as the summer stretched on. I couldn't concentrate on anything, I couldn't practice or utilize skills of any kind that would have benefitted from the sabbatical that I thought I was making for myself. I would show up, do what had to be done, and have little stamina for anything else. I didn't understand or have compassion for my body, and so when I wasn't trying to sleep or keep myself alive and clean, I rushed to recuperate.

A physician in Lawrence at a private practice recommendation heard me out for maybe fifteen minutes as I uncomfortably offered my concern about my PCOS and deep disinterest in life, prescribed me Wellbutrin (a potent antidepressant) and instructed me to lose weight with the help of the medication. Counseling and Psychological Services at Watkins Health Clinic on KU's Lawrence campus diagnosed me with major depression and severe anxiety after I asked my counselor if I could be evaluated for ADHD. The chiropractor clicked me back into place every now and again as I was wrapping up the case of the accident. I was as interested in my flesh and bones as a used car.

Wellbutrin took weight, my appetite and my ability to keep food down with it, my birth control (for PCOS symptoms) and fatigue neutralized my libido, and I became hardened like the drying soil. I resented myself, I resented having needs, and I resented life at where it had left me: on the edge of revolution, but unable to enjoy it. I couldn't eat, I couldn't socialize easily, I couldn't do online classes or make art or do much beyond basic hygiene.

Most of my funds went to rideshares and groceries and quick food and medicine, as I struggled to figure out what in the world I needed but in hindsight, I needed help. I simply didn't know that I was entitled to ask for it, without having to know what it was, even though I was surrounded by the availability. I also believed that because I was in a position of privilege as a college student, that my situation was not the kind that deserves community investment - which is completely counterintuitive to me now but that's one of the benefits of this work we did - the gift of recognition. I don't blame my past self for not knowing what to ask for, I love her for continuing to hold on anyway, trying to communicate it as best as she could, and for trying every single day in that time of my life.

As we planted, and watched the ears rise as a family, I could see us trying to give each other the room to grow the way we did each stalk, desperately trying to not demand as much from the others as the world demands of us. I forgive us for that paradox of priorities, it only speaks to how much we cared for one another, as a small and only so free community. In the end, we always showed up for each other.

I don't remember how Paola was able to coax me out, of if I was confessing, but sitting with the balance of a dancer and her back to a row of sunflowers, she says: "Take your arms. Now stretch them far and wide, opening them up and taking a breath."

I listened, and my hands hovered nervously out at my sides, my elbows bouncing unsteadily.

"Now wrap them around yourself, and give yourself a big hug. And say, I love you Ashley, I love you."

I couldn't finish without bursting into tears. I felt deeply embarrassed, and not because I was in front of Paola, but because I'd emotionally neglected myself. I did not love myself, I did not like myself, I merely tolerated my individuality but otherwise hated existing so self aware. I felt the wide span of my supple upper arms, the eczema tickled by the sun and grass, and cried at how big and small I felt at the same time. I choked through several repetitions of "I love you Ashley." until I sobbed it out and Paola hugged me too. Panta continued to work in the distance, giving us the space so few people are loving enough to afford us. I felt loved beyond an understanding that sometimes still eludes me.

The summer simmered away faster than I thought it would, and the stalks became higher than our heads easily. My sublease ended and Paola visited family in Mexico, and we would return for harvest.

FALL 2019

To take something from seed to stalk to seed once more is a kind of fulfilling I don't have words for. Harvesting the corn, tracing my thumb down the neat rows of colorful

kernels, I felt like what I imagine a parent must feel when they bring a child home. I tended this.

Huitlacoche is dark fungi that grows off the corn, and it's considered something divine, a delicacy. Pantaleon found it as we gently combed and counted through the growth. We met at his house, and we made a meal with it. It was magical because we had to use our collective knowledge of family recipes and cooking styles to work with an ingredient that isn't so common as it appears, and it was filling and hearty. It was also cleansing, to use every piece of the corn we could, to let it travel through my body with intention.

Some time after that, Pantaleon made a point of taking us to Yoli Tortilla's workspace in Kansas City, to reiterate that food systems are the work and intention of a wide span of people. We ate fresh tortillas with Mark and Marissa and their team of makers, and then we stopped for drinks at Ruby Jean's Juicery. For a full meal we stopped at Supermart El Torito Inc., where we had tacos at this small tienda surrounded by all kinds of people but also cultural comforts. We were becoming tired with the new season, but the communion we shared always felt like important and valuable time. While we were talking the day away, we tried something new that Paola wanted to share with us: a compliment circle. We held hands, all three of us grown folks at a supermercado, and affirmed the folks we were holding at our left and right. I still mean every word I said, and there are days where I find it hard to remember what was said to me, but this is a technique I've been able to use with my other relationships that I feel has both strengthened and tenderized

different bonds I have with people. I've been there for Panta and Paola, and I can love myself for that too now, and I can reach that love ever forward.

There is value in celebration and confirmation still, and interrupting consumption in these ways by interacting with producers that care, were lessons that I'm going to carry my whole life.

2020

It's now a year later, and though I haven't been able to hold their hands, I hope my Maseualkualli family knows that I think of them everyday. So much history has rumbled over us, yet I feel equipped. Should everything crumble, it is because of Maseualkualli that I feel ready to imagine and heal Earth. Everyone deserves food, justice, celebration, education, nutrition, medicine, equity, variety and life. Especially Black and Indigenous folks, persecuted Latinx people and the oppressed the world over. Even on days where I struggle to believe these things for myself, they're there, they're a part of me and they always will be now. The possibilities make me want to stay alive, and I don't know if this would've been possible without Maseualkualli. Amor eterno, inolvidable is the vision, as given by my ancestors, as guided by Pantaleon and Paola Soyumi, and as instituted by me.

Pantaleon Florez III - Ethnography

This research study sought to improve market visibility and market opportunities for non-GMO, heirloom dent corn production. In the first year, members of the public were engaged in this research project via social media, by tabling at the Kaw Valley Seed Fair, through an event at the Lawrence Public Library, a research presentation to the Douglas

County Master Gardeners, a Q&A session for farmers considering applying for the SARE Farmer/Rancher Grant at the Douglas County Agricultural Extension Office, a Charla de Merienda at the University of Kansas (“Food Security in the Americas: A Community Conversation about Food Security and Sustainable Farm Practices”), and via the radio waves of KKFI (90.1 FM, Kansas City Community Radio). Excluding an estimate for listeners of the radio show, 343 people were engaged in a presentation on this research and about non-GMO dent corn production and product availability in year one. Additionally, a local tortilla company (Yoli Tortillaria) co-presented at the Lawrence Public Library to showcase their products and talk about their process and philosophy on traditional methods of producing stone-ground tortillas.

This study also sought to create improved culturally-relevant food accessibility. Though the samples and resulting produce were relatively small, the organic blue corn was utilized on six separate occasions:

- My favorite use was making *huitlacoche* empanadas with the research team.
- Some of what was produced was sold at the farmers market.
- Part of what was produced was donated to the University of Kansas Student Farm to be used as a seed crop.
- A portion was purchased to cook *pozole* for a community meal that fed 75 people. This community meal was done in conjunction with a Rebuilding East Ninth Street food security project where I served as the head chef. This experience was incredibly rewarding, and being able to connect my farming

to my cooking is something that has brought me further recognition and opportunity.

- A portion was used in a featured side dish called *esquites* as part of a 300 person meal I helped cook with the East Lawrence Neighborhood Association's Art Walk/Block Party and Sunrise Project (501c3). Places like Sunrise Project have been incredible for enabling a lot of safe and reliable food security work.
- A portion was sold to a restaurant for a *pozole* soup of the week that I designed as an assistant kitchen manager (~60 servings).

In addition to the reach of the study via presentations, this study provided the opportunity for a sizable culinary reach. **With these additional numbers, this research project reached a total of 778 people.**

In addition to getting people information about the maize itself, we placed heavy emphasis on teaching about the *nixtamalization* process while presenting. "The nixtamalization process is commonly utilized in the production of tortillas and other related maize-based food products. The maize kernels are cooked with alkali (i.e. lime) and steeped in the cooking water with subsequent washing, at least twice, ensuring the removal of any remaining organic components and excess alkali." (Cereal Grains for the Food and Beverage Industries, 2013). This process is incredibly important for making the maize bioavailable to the human body. Nixtamalization specifically corrects the present niacin deficiency in raw maize. History has shown us that without this process, people fall ill with pellagra. Europeans and European colonizers in the United States spent a few

hundred years not recognizing Indigenous preparation methods. This led to the pellagra epidemic in the United States that stretched on for 40 years, starting around 1906. This impacted 3 million people and killed at least 100,000. The majority of people who suffered were vulnerable populations such as children in orphanages and people in prison. Without recognizing the Indigenous knowledge of nixtamalization, many suffered.

Reaching so many people via this project went well beyond my expectations. Currently, access to Indigenous Mexica and Latinx food products is relatively limited in both Douglas County and Northeast Kansas. This is due in part because of Euro/Anglo-centric grocery stores (e.g. corporate agriculture) and food apartheid. Though culturally-specific grocery stores do exist in Douglas County, there isn't much integration of local Mexica and Latinx food products in big box grocery stores. A lot of the products on the shelf in these places do not reflect Mexica(n) foods. Reaching a point where these kinds of products will be organically integrated into larger box grocery outlets will take more time and further scaling up. Regardless of the current state, growing lesser known Mexica food products such as maize, pipiche, papalotl, jicama, and mexican mint marigold have created a deeper sense of community between myself and local Latinx communities here in Kansas, too. Latinx farmers market customers, restaurant owners, cooks, and grocers have seen more of what ancestral crops are possible to produce here in Northeast Kansas through this research and through my operation, Maseuallualli Farms. The rewarding feeling of nurturing culture away from its ancestral points of origin goes beyond description and is personally one of the biggest positive outcomes of this study.

The opportunity to work with Paola and Ashley was incredibly rewarding. Their accomplishments as researchers and their input as young mentors to me were invaluable. Seeing how they interacted with each part of the process showed me another way to look at the totality of this project. I am incredibly grateful for what they have taught me and for the community they provided. We need more opportunities for young folks to get involved in agriculture. I can attest to the eagerness of my millennial generation and to many in GenZ who want to find a pathway into agriculture that is sustainable and restorative to the environment. We need to be providing more opportunities for inwardly reflective Paolas and outwardly spoken Ashleys.

One of the most incredible moments during this study was when I noticed the *huitlacoche*. I have had many profound moments on the farm, and that day I felt my ancestors speaking loudly to me. I remember being exhausted and about to leave to go vend at the farmers market. I felt something tell me to go check on the research plots before I left. I started with the blue corn; strong as ever. I moved to the poor, wind battered, multiple times over flooded Michoacán patch; struggling as always. Then came the 9 foot Guanajuato sample; the maize of my ancestral lands. By far the strongest of the three at this point in the growing season, I noticed a stalk had fallen to the ground. Knowing storms were on their way, I propped it up against another; this ear was plump and stump-like compared to the others. I almost walked away but I felt the need to turn the ear around. With the husk facing outward, I looked at the inward facing side; it was open and the huitlacoche was looking back at me. I froze; thawed only by the rush of emotion that swiftly followed. The ancestors had sent a gift. I felt gratitude. A comforting

and cool breeze picked up. My heart was open and I felt closer to my ancestors. I felt deeply validated in my research. I felt a deep sense of purpose. This is the work I am supposed to be doing. Tlazocamati Cinteotl, Tlaloc, Quetzalxochitl. Tlazocamati Ometeotl.

Research Limitations

2019 Climate Conditions: The 2019 growing season was hard on a lot of farmers across the nation. March and April of 2019 saw two major storm systems that wrecked farm production in two very hash ways. For people utilizing tractors for soil preparation and planting, many were not able to get their maize crops in the ground before full coverage crop insurance deadlines expired. These major storm systems that crashed mainly down upon the central United States also led to much lower production than usual. “The storms of March 13 and April 10 were so intense that they reached the criteria to be identified as bomb cyclones” (Wet Weather And Flooding Are Testing U.S. Agriculture, 2019). These conditions meant that the soil was ripe for extremely high levels of volumetric water content (VMC). This is a ratio that compares the ratio of inches of water to inches of soil. This resulted not only in flooding and eventual erosion, but it also leads to oxygen-deficient soil. While seeds can withstand some levels of saturation, periods of time greater than 48 hours can cause severe growth consequences. The main limitation here was seen in the Michoacan 333 sample.

Size & Scale: Sample sizes of the Guanajuato and Michoacan samples were limited by the amount of seed provided by NCRPIS. However, a successful seed crop was collected from both samples. As for the 300 square foot sample, we felt that we could utilize the same methods and cultivate on a much larger scale. Despite the smaller planting, we were still

able to accompany 375 community meal plates with the blue corn that was produced and also sell some at the farmers market. Crops produced with NCRPIS seeds are also not allowed for food consumption. Due to this designation, I am seed banking what was produced from the Guanajuato and Michoacan samples. However, I did select seed from the Guanajuato sample to further develop the strain. This crop was successfully raised and harvested in 2020.

Sample Spacing and Cross-Pollination: In the book “*Corn Among the Indians of the Upper Missouri*” George Will describes 14 different maize varieties that were being stewarded by the Mandan Nation of North Dakota. Their plantings were said to be about 600 ft (182.9 m) apart. Additional research by Westerfield & Eason (2019) indicates that different varieties should be planted at least 500 ft (152.4 m) apart for all corn varieties; and up to 1200 ft (365.8 m) amongst supersweet and multi-gene varieties. Due to land access limitations, none of the samples were positioned between 500-600 feet apart. With that said, the positioning of each sample to the other as well as the direction of regional winds were taken into account. The Guanajuato 31 sample was 75 ft (22.9 m) to the east of the Michoacan 333 sample. Winds on the farm during the time of the year pollination occurs are north to south. The Michoacan 333 sample was positioned 200 ft (61 m) north of the Organic Blue Corn sample. To further limit cross pollination, the samples were also planted 3-4 weeks apart.

REFERENCES

“A Study Of Open Pollinated Corn.” Project Coordinator Frank J Kutka, et. al, *Sustainable Agriculture Research and Education (SARE) Grant Management System*, United States Department of Agriculture, SARE Project #: FNC00-301, 2000.
projects.sare.org/sare_project/fnc00-301/.

Arendt, Elke, and Emanuele Zannini. *Cereal Grains for the Food and Beverage Industries*. Woodhead Publishing, 2013.

Bocinsky, R. Kyle and Varien, Mark D. "Comparing Maize Paleoproduction Models with Experimental Data," *Journal of Ethnobiology* 37(2), 282-307, (1 July 2017).
<https://doi.org/10.2993/0278-0771-37.2.282>

Ebrahim, Ismail Z. “Effect of Maize Planting Methods on Plant Regularity and Yield Crop .” *Journal Agricultural Science*, Mansoura University, 27(3): 1833 - 1839, 2002.

Foerster, Jim. “Wet Weather And Flooding Are Testing U.S. Agriculture.” *Forbes*, Forbes Magazine, 19 Apr. 2019,
www.forbes.com/sites/jimfoerster/2019/04/19/continued-wet-weather-tests-the-us-ag-industry/.

“Historical Weather: Silver Lake.” *Kansas Mesonet*, Kansas State University, 2020,
mesonet.k-state.edu/weather/historical/.

NCBI. “Ustilago Maydis (ID 70).” *National Center for Biotechnology Information*, U.S. National Library of Medicine, 2017, www.ncbi.nlm.nih.gov/genome/?term=Ustilago%2Bmaydis.

Nebraska Extension: Cropwatch, University of Nebraska Institute of Agriculture and Natural Resources, cropwatch.unl.edu. Accessed Jan. 2020.

“Preventing GMO Contamination in Your Open-Pollinated Corn.” Edited by Tor Janson and Steve Carlson, Seed Savers Exchange Blog, Seed Savers Exchange, 9 Dec. 2013,
blog.seedsavers.org/blog/preventing-gmo-contamination-in-your-open-pollinated-corn.

Sahagún Bernardino de, and Compilers Dibble & Anderson. *Florentine Codex: Earthly Things (The Universal History of the Things of New Spain)*. Vol. 11 of 12, University of Utah Press, 2012.

Sahagún, Bernardino de, and Indigenous Speakers of Coatepec Nahuatl. Florentine Codex: Earthly Things (The Universal History of the Things of New Spain). Vol. 3 of 3, Colegio De Santa Cruz De Tlatelolco, 1577.

Stea, Vikkie. "High-yield Corn from Ancient Seed Strains." Christian Science Monitor, p. 29., 1985.

Westerfield, Robert R, and Nathan Eason. "Growing Home Garden Sweet Corn." UGA Cooperative Extension Circular, no. 905, Updated Oct. 2019.

REFERENCES: Paola's Ethnography

Andrews, Michelle. "For Many College Students, Hunger 'Makes It Hard To Focus'." NPR, NPR, 31 July 2018, www.npr.org/sections/health-shots/2018/07/31/634052183/for-many-college-students-hunger-makes-it-hard-to-focus.

Sánchez González, José de Jesús, et al. "Ecogeography of Teosinte." PloS One, vol. 13, no. 2, 2018, p. e0192676.

APPENDIX A: Excerpts from the Florentine Codex

Maize in the ear selected for planting

The best seed is selected. The perfect, the glossy maize is carefully chosen. The spoiled, the rotten, the shrunken falls away; the very best is chosen. It is shelled, placed in water. Two days, three days it swells in the water. It is planted in worked soil or in similar places.

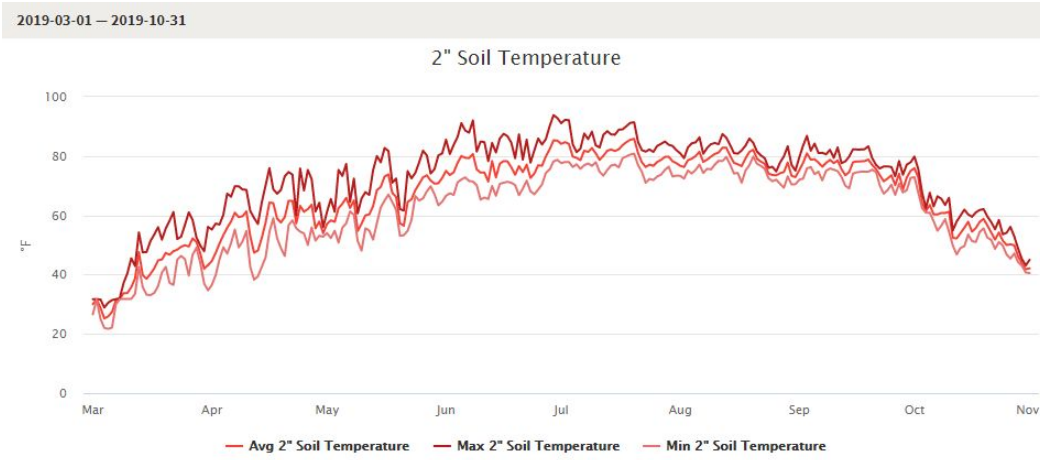
First a hole is made. The land is sought where there is moisture. The grains of maize are tossed in. If there is no moisture, it is watered. At the same time it is covered over with soil, and the soil which is placed on it is pulverized. Then it is gathering moisture; then it swells; then the grain of maize bursts; then it takes root. Then it sprouts; then it pushes up; then it reaches the surface; then it gathers moisture; it really flies. Then it forks, it lies dividing; it spreads out, it is spreading out. And they say it is pleasing. At this time it is hilled, the hollow is filled in, the crown is covered, the earth is well heaped up.

Also at this time beans are sown or cast. They say that at this time this [maize] once again begins to grow, also begins to branch out. Then it reaches outward; then it spreads out; then it becomes succulent. Once again at this time it is hilled. Then the corn silk develops; then the corn tassels form. At this time, once again it is hilled; it is, they say, the hatching of the green maize ear. Then an embryonic ear forms. Then the green maize ear begins to form; the green maize ear shines, glistens, spreads glistening. Its maize silk spreads blanketing the green maize ear; its maize silk spreads blanketing it. [The maize silk] spreads becoming coveted – spreads becoming desired. Then, it is said, the maize silk dries up, withers away.

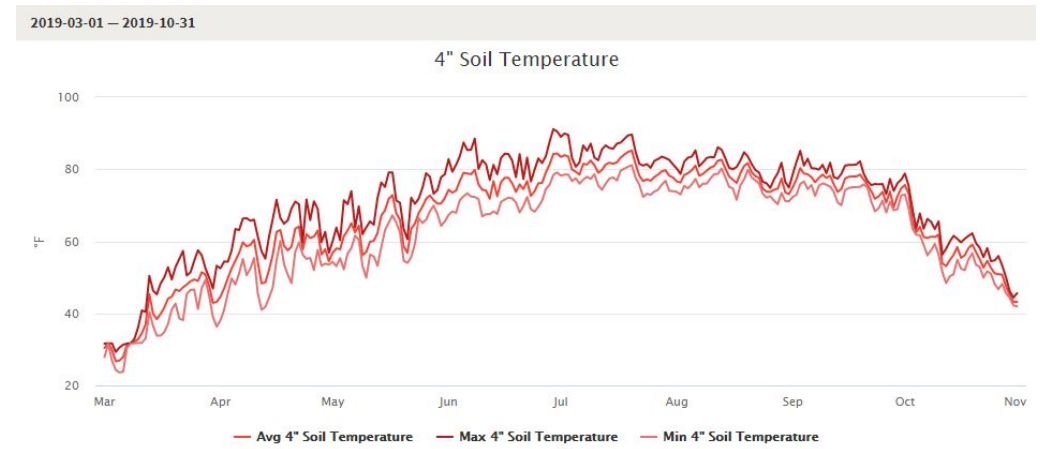
[The kernel] spread forming little droplets; it is said that they spread taking form. Then [the kernels] form milk; they spread forming milk. Then the surface [of the kernels] becomes evened. Then it becomes the *nixtamal* flower; now it is called *chichipelotl*. Then [the milk] thickens, at which time it is called *elotl*. Then, at this time, it begins to harden; it turns yellow, whereupon it is called *centli*.

APPENDIX B: Weather Variables

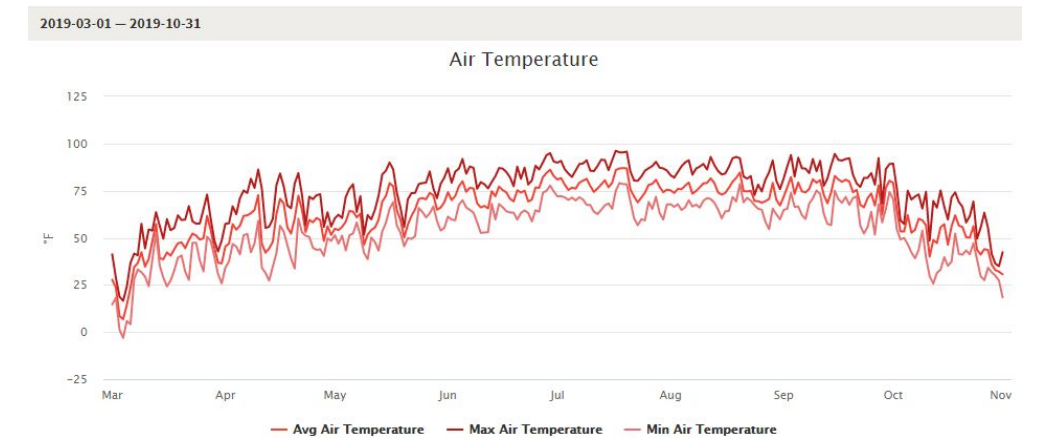
Soil Temperatures 2"



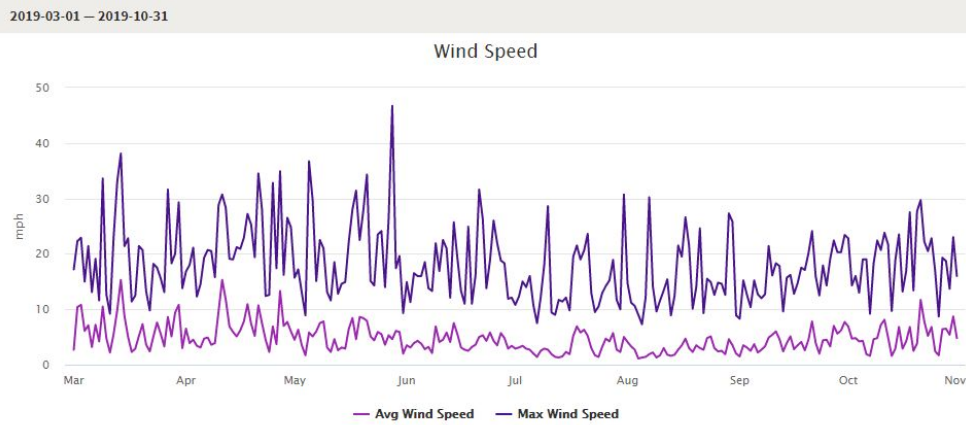
Soil Temperatures 4"



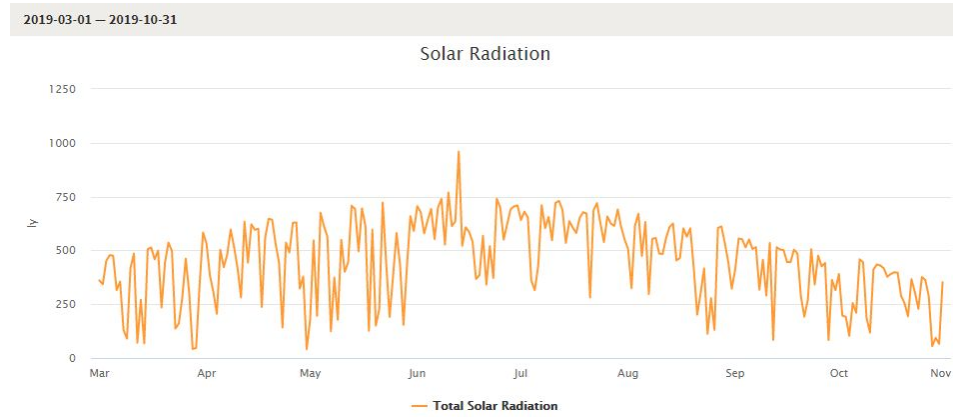
Air Temperatures



Wind Speeds



Solar Radiation



Humidity

