DOWNLOAD PDF CORN ORIGIN HISTORY TECHNOLOGY AND PRODUCTION

Chapter 1 : Corn: Origin, History, Technology, and Production - C. Wayne Smith, Javier BetrÃ¡n - Google E

Your all-in-one guide to corn. This book provides practical advice on planting techniques and rates, seed production, treating plant diseases, insect infestation and weeds, harvesting, processing, and worldwide utilization. This is the fourth, and final, volume in the series of comprehensive.

Maize plant Photos by Molly Fogleman Maize, commonly referred to as corn in the United States, has been considered a unique plant since the time that the indigenous peoples of the Americas developed it to be their staple food. It is central to many sacred mythologies and creation stories which are still honored today 1 , 2. Maize is the most important feed grain in the US because of its efficient conversion of dry substance to meat, milk and eggs, compared to other grains 8. There are 5 main endosperm types grown in the US: However, breeding of new Corn Belt Dents varieties currently utilizes 8 , 11 , It is estimated that maize yields industrial products 9 and that there are more than items in US supermarkets that contain maize 5. The maize plant is truly unique among the cereals. Maize is thought to be derived from teosinte, an ancient wild grass from Mexico and Guatemala 8. This allows for cross pollination and the large scale production of hybrid corn which is based on the exploitation of heterosis or hybrid vigor 8 , broad morphological variation 10 , and genetic plasticity and diversity 12 , Maize is able to take advantage of sunlight better than most other major cereal crops and grows more rapidly because of the size and distribution of its foliage It has high productivity due to its large leaf area 10 and has one of the highest photosynthetic rates of all food crops 5. The high yield of maize compared to other cereal crops is possible because of the low position of the ear, where it is able to capture a greater proportion of the nutrients. This is unlike the other cereals whose seeds are found high up on the plant stalk. The ear is covered with a husk leaf, shielding the kernels from pests and accidental dispersal, unlike other cereals where individual grains are covered with bractea Because of the husk leaves preventing the maize plant from dispersing its seed, some consider maize a human invention because it can not reproduce without the aid of humans 1. This exact trait prompted Arturo Warman to refer to maize as "a human offspring, our plant kin" If you are a breeder or researcher and are familiar with the general information of this page, please refer to Gramene Zea Statistics and Queries. These have been developed to make your time with Gramene more efficient. Gift to the World. Gramene Reference ID 2. The Story of Corn. Gramene Reference ID 3. Gramene Reference ID 4. Origin, History, Technology, and Production. Wiley Series in Crop Sciences. Gramene Reference ID 5. Maize in the Third World. Gramene Reference ID 6. Technological Opportunities and Priorities for the Public Sector. Gramene Reference ID 8. Corn and Corn Improvement: American Society of Agronomy, Inc. Gramene Reference ID

Chapter 2 : Maize - Wikipedia

This book providespractical advice on planting techniques and rates, seed production,treating plant diseases, insect infestation and weeds, harvesting,processing, and worldwide utilization. This is the fourth, andfinal, volume in the series of comprehensive references on themajor crops of the world.

Develop maize inbreds and populations with improved quality and processing properties for foods, feeds, and industrial products. Develop Quality Protein Maize QPM lines, hybrids, and populations with improved food and feed quality, and competitive yield. Introduce and introgress exotic alleles to increase the genetic base of germplasm used by maize breeding programs. Apply molecular techniques to study the genetics and to facilitate the selection of economically important traits in corn. Project Methods Temperate and exotic tropical and subtropical germplasm will be used to generate segregating breeding populations from which inbred lines will be develop through pedigree breeding. Evaluations and selection of inbreds will be conducted in Texas environments for adaptation, maturity, grain yield in hybrids, tolerance to stresses, resistance to mycotoxins, nutritional value lysine content , standability, grain color and kernel hardness and integrity. Selected inbreds will be crossed with appropriate testers and classify in heterotic groups. The resulting experimental hybrids will be evaluated at representative testing locations across the major corn production regions of Texas. In addition, inbreds and hybrids will be evaluated under drought stress environments induced by limiting irrigation or late planting, and under inoculation with Aspergillus flavus. Performance under stress and across environments will be used to identify superior genotypes. We will use winter nurseries to accelerate the development of inbreds. Molecular fingerprinting data will be used to classify inbreds and to choose parental lines for breeding populations. Adequate populations F2, recombinant inbred lines, near isogenic inbred lines will be developed to identify QTLs for important physiological traits drought tolerance , resistance to biotic stresses aflatoxins , and quality traits protein quality, hardness. During the crop year we continued selection, evaluation and characterization of diverse maize germplasm to identify inbred lines with reduced preharvest aflatoxin accumulations, reduced affects from abiotic stress, adaptation to the Southern U. The breeding nursery consisted of approximately yellow maize breeding plots, each of white and QPM breeding plots red and blue breeding plots, and genetics plots photoperiod sensitivity, perennialism, etc. Breeding plot primary selection criteria were 1. From these selections a total of plots derived from approximately ears of promising breeding and genetics material was sent to the winter nursery in Weslaco, TX. Additionally, plots were planted in two isolation blocks SS, NSS to create testcross hybrids for further evaluation. Multilocational hybrid yield trials were planted across south and central Texas and the evaluation under inoculation with Aspergillus flavus aided in further characterization of these lines. Over the life of this project, in addition to breeding, testing and training activities, two QTL mapping studies were conducted on a recombinant inbred line population derived from a cross between B73o2o2 temperate opaque 2 line with high aflatoxin accumulations and CML a tropical adapted line with low aflatoxin accumulation. The first QTL study evaluated inbred lines per se. The second study conducted in and evaluated hybrid testcrosses of this same material as both a QTL study genetics and a breeding line study each planted in three locations. In College Station and Weslaco stress was applied by withholding irrigation. In Corpus Christi, the trial was planted late due to lack of sufficient soil moisture and to induce late season drought and heat stress but eventually abandoned because the drought became to severe. Data on aflatoxin, grain yield, plant and ear height, flowering time, lodging, oil, starch, protein, were taken and identified the most promising of these lines. Texas and US corn producers, corn breeding companies and corn seed companies, students, and the public. This is the final report for this project. TEX and has changed focus to reflect a new primary investigator Murray. Impacts Throughout the life of this project at least six students were trained and educated. Over 90 inbred lines were developed and deemed to have sufficient improvements or novel characteristics to warrant release. Five QTL were identified for aflatoxin resistance and 26 QTL were identified for starch oil and protein across different environments that could be incorporated into producers inbreds and hybrids through marker assisted selection. Corn Performance Tests in Texas. Quantitative Genetics and Maize Breeding for Texas. Multilocation trials across south and central Texas and evaluation under inoculation with Aspergillus flavus have aided in characterization of these lines. Approximately testcrosses were planted at multiple locations across the southern U. Multiple traits grain yield, test weight, moisture, maturity, plant and ear height, root and stalk lodging were evaluated at each location to aid in determining the most adapted germplasm for these growing environments. Several hybrid testcrosses in the yellow trials exhibited adaptation similar to that of the commercial checks used to compare. These germplasm are derived from crosses which include tropical and subtropical sources and exhibit long tight husks and hard flinty endosperm. Two nurseries were utilized during to advance breeding generations and to make selections. The regular season nursery in College Station consisted of breeding rows divided between yellow, white and qpm germplasm and lines. The off season nursery at Weslaco consisted of rows for advancing generations and creating new hybrid combinations. Approximately inbred lines representing a wide range of maturity early, medium and late , kernel texture hard vs. The most promising germplasm was selected by traits such as maturity, stalk and root soundness, kernel texture and color. Texas environments tend to be a transitional area for exotic germplasm. This transitional area allows for the introgression of tropical alleles which could not be accomplished in more temperate areas. We are searching for new alleles for reducing preharvest aflatoxin accumulations, adaptation to Texas environment, kernel texture and foliar disease resistance; this transitional area has allowed us to tap into the tropical germplasm pool to potentially access new alleles for these traits. Development of corn germplasm utilizing both tropical germplasm with its stress tolerance and kernel qualities and temperate germplasm with its high yield potential and known heterotic response, should help bring desirable allele combinations to Texas corn growing regions. Kind support was provided with collaborators Dr. Thomas Isakeit and Dr. Through field days and site visits, Texas corn producers were introduced to research, germplasm, and outputs conducted under this project. This project will be replaced with project Tex Impacts Several potential quantitative trait loci QTL for reduction of aflatoxin, oil, protein and starch were identified in a recombinant inbred line population testcrosses. Multilocation evaluations across south and central Texas and evaluations under inoculation with Aspergillus flavus have aided in better characterization of these germplasm. Approximately experimental hybrids and testcrosses were evaluated across several Texas and Southern U. Considering overall performance, we have selected the best material for continuation in the program as parental lines. Most of this germplasm has subtropical or tropical origins, exhibiting hard endosperm and long and tight husks. We again had two breeding nurseries during , one regular season nursery at College Station plots and an off season nursery at Weslaco plots. Approximately inbred lines representing a wide range of maturities early, intermediate and late , adaptation topical, subtropical and temperate , color white and yellow , quality lysine content and kernel characteristics flint, dent were screened in the nurseries. The most promising germplasm in the nurseries were classified by traits such as maturity, kernel texture, cob color, lodging and plant and ear heights. We are searching for new alleles to aid in reductions of mycotoxins aflatoxins and fumonisin contamination, adaptation to the Texas environment, kernel attributes, disease resistance; exotic germplasm has aided in this search. Texas environment tends to be a transitional area for tropical and temperate germplasm. This transitional area allows for the introgression of alleles from tropical sources which otherwise could not be accomplished in the more temperate areas. Temperate types of corn tend to provide known heterotic response, high yields and stalk strength, while subtropical and tropical corn ten to provide good stress tolerance and kernel quality. The development of inbreds utilizing both sources of germplasm should help bridge the gap of genetic flow between the gene two pools of genetic materials. Isakeit, Gary Odvody, W. Aflatoxin Elimination Workshop The Southeast Region Aflatoxin Trial. Maize lipoxygenases govern production of conidia and mycotoxins by Aspergillus flavus and Fusarium verticillioides. We have conducted multilocation testing across the major corn production regions of Texas and evaluated germplasm under drought stress and inoculation with Aspergillus flavus, fungi responsible of aflatoxin contamination in corn. Approximately experimental hybrids and testcrosses were evaluated across several Texas environments to identify the most adapted germplasm to the local conditions. Different traits yield, maturity, moisture, test weight, lodging, ear and plant height, cob and grain color, texture, disease resistance, etc. We have selected the best material in these trials considering its overall performance, local adaptation, and quality. Most of these inbreds have subtropical or tropical origin and hard endosperm e. In these evaluations we have collaborated with other public programs and agencies, international centers, and private seed companies. As in previous years, during year we had two nurseries, one during the regular season summer at College Station 4, plots and one off-season winter at Weslaco plots. An approximate of inbred lines representing a wide range of maturities early, intermediate and late , adaptation tropical, subtropical and temperate , color white, yellow, orange , quality lysine content , and kernel characteristics flint, dent were screened in these nurseries. Traits such as early vigor, maturity, adaptation, plant and ear height, grain color, cob color, texture, disease resistance, and ear characteristics were recorded and ultimately used to classify and select the most promising germplasm for our program objectives. We are searching for new alleles in exotic germplasm for resistance to mycotoxins, tolerance to drought and heat, high test weight, high proportion of hard flinty endosperm, kernel integrity with kernels free of fissures or stress cracks, white cobs, and nutritional value for food or feed. Transitional areas between tropical and temperate areas, such as Texas, represent excellent opportunities to incorporate, combine and introgress exotic germplasm in temperate material and vice versa. By developing inbreds adapted to Southern U. There are several lines in advance stages of testing that will be proposed for release during Impacts With the development of this material we expect to contribute to the diversity of corn germplasm in the U. Aflatoxin accumulation and associated traits in QPM maize inbreds and their testcrosses. White, Thomas Isakeit, Chris M. Molnar, and James B. Relationships among responses to Fusarium and Aspergillus ear rots and contamination by fumonisin and aflatoxin in maize Zea mays. Breeding exotic maize germplasm. Proceedings of the Arnel R. Hallauer International Plant Breeding Symposium. Breeding corn germplasm for agronomic performance and reduced aflatoxin contamination Multilocation evaluation of aflatoxin accumulation and agronomic performance of maize hybrids in Texas. Mapping of QTL for response to aflatoxin accumulation. Heterosis and genetic diversity of tropical inbreds under stress and optimal conditions. Drought Conference, Keystone, Colorado, April Agronomy abstracts, Indianapolis, IN. Interaction between host plant genotypes and A. As in previous years, during year we had two nurseries, one during the regular season summer at College Station 5, plots and one off-season winter at Weslaco 4, plots. Breeding corn germplasm for agronomic performance and reduced aflatoxin contamination. Multilocation evaluation of aflatoxin accumulation in yellow maize hybrids.

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Chapter 3 : C Production For Sale - Thanksgiving Dinner Ideas

Description Your all-in-one guide to corn. This book provides practical advice on planting techniques and rates, seed production, treating plant diseases, insect infestation and weeds, harvesting, processing, and worldwide utilization.

Evolution is always slow and gradual. Maize cobs uncovered by archaeologists show the evolution of modern maize over thousands of years of selective breeding. Even the oldest archaeological samples bear an unmistakable resemblance to modern maize. But at the DNA level, the two are surprisingly alike. They have the same number of chromosomes and a remarkably similar arrangement of genes. In fact, teosinte can cross-breed with modern maize varieties to form maize-teosinte hybrids that can go on to reproduce naturally. Scientists study teosinte-maize hybrids and their offspring through the process of genetic archaeology. This process helps geneticists understand what is happening at the DNA level to make teosinte and maize so different. By combining clues from genetics and the archaeological record, scientists have pieced together much of the story of maize evolution. The Difference Between Teosinte and Maize is About 5 Genes One of the first scientists to fully appreciate the close relationship between teosinte and maize was George Beadle. In the s, Beadle studied teosinte-maize hybrids and showed that their chromosomes are highly compatible. Later, he produced large numbers of teosinte-corn hybrids and observed the characteristics of their offspring. By applying basic laws of genetic inheritance, Beadle calculated that only about 5 genes were responsible for the most-notable differences between teosinte and a primitive strain of maize. Using more-modern techniques, another group of scientists analyzed the DNA from teosinte-maize offspring. They too noticed that about 5 regions of the genome which could be single genes or groups of genes seemed to be controlling the most-significant differences between teosinte and maize. In recent years, geneticists have used advanced molecular-biology tools to pinpoint the roles of some of the genes with large effects, as well as many other regions across the genome that have had subtle effects on maize domestication. Changes to Single Genes Can Have Dramatic Effects The earliest events in maize domestication likely involved small changes to single genes with dramatic effects. We know the events were early because there is little variation in these genes between maize varieties, suggesting that modern varieties are descended from a single ancestor. That the small changes had dramatic effects also explains the sudden appearance of maize in the archaeological record. Small Changes Add Up Over Time Later changes in the evolution of modern maize involved many genes perhaps thousands with small effects. These minor changes include the following: Types and amounts of starch production Ability to grow in different climates and types of soil Length and number of kernel rows Kernel size, shape, and color Resistance to pests These examples fit with the traditional view of evolution as gradual change over time. Local groups of farmers selected for characteristics that they preferred, and that worked best in their particular environment. Over thousands of years, selective breeding generated the broad diversity of corn varieties that are still grown around the world today. More maize is harvested each year than any other grain. The thousands of maize varieties grown around the world provide food for people and livestock. The ancestry of corn. Scientific American, 1 ,

Chapter 4 : NativeTech: Native American History of Corn

Your all-in-one guide to corn. This book providespractical advice on planting techniques and rates, seed production,treating plant diseases, insect infestation and weeds, harvesting,processing, and worldwide utilization.

The plant grows to a heightâ€¦ Corn was first domesticated by native peoples in Mexico about 10, years ago. Native Americans taught European colonists to grow the indigenous grains, and, since its introduction into Europe by Christopher Columbus and other explorers, corn has spread to all areas of the world suitable to its cultivation. It is the most important crop in the United States and is a staple food in many places. The corn plant is a tall annual grass with a stout, erect, solid stem. The large narrow leaves have wavy margins and are spaced alternately on opposite sides of the stem. Staminate male flowers are borne on the tassel terminating the main axis of the stem. The pistillate female inflorescences, which mature to become the edible ears, are spikes with a thickened axis, bearing paired spikelets in longitudinal rows; each row of paired spikelets normally produces two rows of grain. Varieties of yellow and white corn are the most popular as food, though there are varieties with red, blue, pink, and black kernels, often banded, spotted, or striped. Each ear is enclosed by modified leaves called shucks or husks. Many industrial varieties of corn are genetically modified for resistance to the herbicide glyphosate or to produce proteins from Bacillus thuringiensis Bt to kill specific insect pests. In addition, some strains have been genetically engineered for greater drought tolerance. Ears of corn Zea mays. Dent corn is characterized by a depression in the crown of the kernel caused by unequal drying of the hard and soft starch making up the kernel. Flint corn , containing little soft starch, has no depression. Flour corn, composed largely of soft starch, has soft, mealy, easily ground kernels. Sweet corn has wrinkled translucent seeds; the plant sugar is not converted to starch as in other types. Popcorn , an extreme type of flint corn characterized by small hard kernels, is devoid of soft starch, and heating causes the moisture in the cells to expand, making the kernels explode. Improvements in corn have resulted from hybridization, based on crossbreeding of superior inbred strains. Although it is a major food in many parts of the world, corn is inferior to other cereals in nutritional value. Its protein is of poor quality, and it is deficient in niacin. Diets in which it predominates often result in pellagra niacin-deficiency disease. Its gluten elastic protein is of comparatively poor quality, and it is not used to produce leavened bread. It is widely used, however, in Latin American cuisine to make masa , a kind of dough used in such staple foods as tortillas and tamales. Given that corn flour is gluten -free, it cannot be used alone to make rising breads. In the United States corn is boiled or roasted on the cob, creamed, converted into hominy hulled kernels or meal, and cooked in corn puddings, mush, polenta , griddle cakes, cornbread , and scrapple. It is also used for popcorn, confections, and various manufactured cereal preparations. Cellulosic ethanol , which is made from nonedible plant parts such as agricultural waste, has a smaller impact on the food chain than corn ethanol, though the conversion technology is generally less efficient than that of first-generation biofuels. Many parts of the corn plant are used in industry. Cornstarch can be broken down into corn syrup , a common sweetener that is generally less expensive than sucrose ; high-fructose corn syrup is used extensively in processed foods such as soft drinks and candies. Stalks are made into paper and wallboard; husks are used as filling material; cobs are used directly for fuel, to make charcoal , and in the preparation of industrial solvents. Corn grain is processed by wet milling, in which the grain is soaked in a dilute solution of sulfurous acid; by dry milling, in which the corn is exposed to a water spray or steam; and by fermentation , in which starches are changed to sugars and yeast is employed to convert the sugars into alcohol. Corn husks also have a long history of use in the folk arts for objects such as woven amulets and corn-husk dolls.

Chapter 5 : Zea Introduction

Your all-in-one guide to corn. This book provides practical advice on planting techniques and rates, seed production, treating plant diseases, insect infestation and weeds, harvesting, processing.

Agronomic data were supplemented by botanical traits for a robust initial classification, then genetic, cytological , protein and DNA evidence was added. Now, the categories are forms little used , races, racial complexes, and recently branches. The combined length of the chromosomes is cM. Some of the maize chromosomes have what are known as "chromosomal knobs": Individual knobs are polymorphic among strains of both maize and teosinte. Barbara McClintock used these knob markers to validate her transposon theory of "jumping genes", for which she won the Nobel Prize in Physiology or Medicine. Maize is still an important model organism for genetics and developmental biology today. The total collection has nearly 80, samples. The bulk of the collection consists of several hundred named genes, plus additional gene combinations and other heritable variants. There are about chromosomal aberrations e. Genetic data describing the maize mutant stocks as well as myriad other data about maize genetics can be accessed at MaizeGDB , the Maize Genetics and Genomics Database. The resulting DNA sequence data was deposited immediately into GenBank , a public repository for genome-sequence data. Much of the maize genome has been duplicated and reshuffled by helitrons â€”group of rolling circle transposons. This randomly selects half the genes from a given plant to propagate to the next generation, meaning that desirable traits found in the crop like high yield or good nutrition can be lost in subsequent generations unless certain techniques are used. Maize breeding in prehistory resulted in large plants producing large ears. Modern breeding began with individuals who selected highly productive varieties in their fields and then sold seed to other farmers. These early efforts were based on mass selection. Later breeding efforts included ear to row selection C. Shull, , and the highly successful double cross hybrids using four inbred lines D. University supported breeding programs were especially important in developing and introducing modern hybrids Ref Jugenheimer Hybrid Maize Breeding and Seed Production pub. By the s, companies such as Pioneer devoted to production of hybrid maize had begun to influence long term development. Since the s the best strains of maize have been first-generation hybrids made from inbred strains that have been optimized for specific traits, such as yield, nutrition, drought, pest and disease tolerance. Both conventional cross-breeding and genetic modification have succeeded in increasing output and reducing the need for cropland, pesticides, water and fertilizer. The program began in the s. Transgenic maize Genetically modified GM maize was one of the 26 GM crops grown commercially in Origin of maize and interaction with teosintes Maize is the domesticated variant of teosinte. The difference between the two is largely controlled by differences in just two genes. This theory was further confirmed by the study of Matsuoka et al. It has undergone two or more domestications either of a wild maize or of a teosinte. The term "teosinte" describes all species and subspecies in the genus Zea, excluding Zea mays ssp. It has evolved from a hybridization of Z. In the late s, Paul Mangelsdorf suggested that domesticated maize was the result of a hybridization event between an unknown wild maize and a species of Tripsacum , a related genus. Teosinte and maize are able to cross-breed and produce fertile offspring. A number of questions remain concerning the species, among them: Zea originated, how the tiny archaeological specimens of â€” BC could have been selected from a teosinte, and how domestication could have proceeded without leaving remains of teosinte or maize with teosintoid traits earlier than the earliest known until recently, dating from ca. The domestication of maize is of particular interest to researchersâ€" archaeologists , geneticists , ethnobotanists , geographers, etc. The process is thought by some to have started 7, to 12, years ago. Research from the s to s originally focused on the hypothesis that maize domestication occurred in the highlands between the states of Oaxaca and Jalisco , because the oldest archaeological remains of maize known at the time were found there. Archaeobotanical studies, published in , point to the middle part of the Balsas River valley as the likely location of early domestication; this river is not very long, so these locations are not very distant. Stone milling tools with maize residue have been found in an 8, year old layer of deposits in a cave not far from Iguala, Guerrero. Doebley was part of the team that first published, in , that maize had been domesticated only once, about 9, years ago, and then spread throughout the Americas. Archaeological remains of early maize ears, found at Guila Naquitz Cave in the Oaxaca Valley , date back roughly 6, years; the oldest ears from caves near Tehuacan , Puebla, 5, B. Before Present [14] Maize pollen dated to 7, B. Maize was the staple food, or a major staple â€" along with squash , Andean region potato , quinoa , beans , and amaranth â€" of most pre-Columbian North American, Mesoamerican, South American, and Caribbean cultures. The Mesoamerican civilization, in particular, was deeply interrelated with maize. Its traditions and rituals involved all aspects of maize cultivation â€" from the planting to the food preparation. It is unknown what precipitated its domestication, because the edible portion of the wild variety is too small, and hard to obtain, to be eaten directly, as each kernel is enclosed in a very hard bivalve shell. In , George Beadle demonstrated that the kernels of teosinte are readily "popped" for human consumption, like modern popcorn. However, studies of the hybrids readily made by intercrossing teosinte and modern maize suggest this objection is not well founded. Spreading to the north Around 4, B. In particular, the large-scale adoption of maize agriculture and consumption in eastern North America took place about A. Native Americans cleared large forest and grassland areas for the new crop. Its root system is generally shallow, so the plant is dependent on soil moisture. As a plant that uses C4 carbon fixation , maize is a considerably more water-efficient crop than plants that use C3 carbon fixation such as alfalfa and soybeans. Maize is most sensitive to drought at the time of silk emergence, when the flowers are ready for pollination. In the United States, a good harvest was traditionally predicted if the maize was "knee-high by the Fourth of July ", although modern hybrids generally exceed this growth rate. Maize used for silage is harvested while the plant is green and the fruit immature. Sweet corn is harvested in the "milk stage", after pollination but before starch has formed, between late summer and early to mid-autumn. Field maize is left in the field until very late in the autumn to thoroughly dry the grain, and may, in fact, sometimes not be harvested until winter or even early spring. The importance of sufficient soil moisture is shown in many parts of Africa , where periodic drought regularly causes maize crop failure and consequent famine. Although it is grown mainly in wet, hot climates, it has been said to thrive in cold, hot, dry or wet conditions, meaning that it is an extremely versatile crop. Maize provided support for beans , and the beans provided nitrogen derived from nitrogen-fixing rhizobia bacteria which live on the roots of beans and other legumes ; and squashes provided ground cover to stop weeds and inhibit evaporation by providing shade over the soil. Modern technique plants maize in rows which allows for cultivation while the plant is young, although the hill technique is still used in the maize fields of some Native American reservations. When maize is planted in rows, it also allows for planting of other crops between these rows to make more efficient use of land space. In North America, fields are often planted in a two- crop rotation with a nitrogen-fixing crop, often alfalfa in cooler climates and soybeans in regions with longer summers. Sometimes a third crop, winter wheat , is added to the rotation. Many of the maize varieties grown in the United States and Canada are hybrids. Often the varieties have been genetically modified to tolerate glyphosate or to provide protection against natural pests. Glyphosate is an herbicide which kills all plants except those with genetic tolerance. This genetic tolerance is very rarely found in nature. In the midwestern United States, low-till or no-till farming techniques are usually used. In low-till, fields are covered once, maybe twice, with a tillage implement either ahead of crop planting or after the previous harvest. The fields are planted and fertilized. Weeds are controlled through the use of herbicides , and no cultivation tillage is done during the growing season. This technique reduces moisture evaporation from the soil, and thus provides more moisture for the crop. The technologies mentioned in the previous paragraph enable low-till and no-till farming. Weeds compete with the crop for moisture and nutrients, making them undesirable. Harvesting Harvesting maize, Jones County, Iowa Before the 20th century, all maize harvesting was by manual labour , by grazing , or by some combination of those. Whether the ears were hand-picked and the stover was grazed, or the whole plant was cut, gathered, and shocked , people and livestock did all the work. Between the s and the s, the technology of maize harvesting expanded greatly. For small farms, their unit cost can be too high, as their higher fixed cost cannot be amortized over as many units. This involved a large numbers of workers and associated social events husking or shucking bees. From the s onward, some machinery became available to partially mechanize the processes, such as one- and two-row mechanical pickers picking the ear, leaving the stover and corn binders, which are reaper-binders designed specifically for maize for example, Video on YouTube. The latter produce sheaves that can be shocked. By hand or mechanical picker, the entire ear is harvested, which then requires a separate operation of a maize sheller to remove the kernels from the ear. Whole ears of maize were often stored in corn cribs , and these whole ears are a sufficient form for some livestock feeding use. Today corn cribs with whole ears, and corn binders, are less common because most modern farms harvest the grain from the field with a combine and store it in bins. The combine with a corn head with points and snap rolls instead of a reel does not cut the stalk; it simply pulls the stalk down. The stalk continues downward and is crumpled into a mangled pile on the ground, where it usually is left to become organic matter for the soil. The ear of maize is too large to pass between slots in a plate as the snap rolls pull the stalk away, leaving only the ear and husk to enter the machinery. The combine separates out the husk and the cob, keeping only the kernels. When maize is a silage crop, the entire plant is usually chopped at once with a forage harvester chopper and ensiled in silos or polymer wrappers. Ensiling of sheaves cut by a corn binder was formerly common in some regions but has become uncommon. Worldwide maize production For storing grain in bins, the moisture of the grain must be sufficiently low to avoid spoiling. If the moisture content of the harvested grain is too high, grain dryers are used to reduce the moisture content by blowing heated air through the grain. This can require large amounts of energy in the form of combustible gases propane or natural gas and electricity to power the blowers. Maize production â€” [82].

Chapter 6 : Evolution of Corn

Corn Origin, History, Technology, and Production edited by C. Wayne Smith. This book is an all-in-one guide to corn! Corn: Origin, History, Technology, and Production provides practical advice on planting techniques and rates, seed production, treating plant diseases, insect infestation and weeds, harvesting, processing, and worldwide utilization.

Along with many other indigenous plants like beans, squash, melons, tobacco, and roots such as Jerusalem artichoke, European colonists in America quickly adopted maize agriculture from Native Americans. Crops developed by Native Americans quickly spread to other parts of the world as well. Over a period of thousands of years, Native Americans purposefully transformed maize through special cultivation techniques. Maize was developed from a wild grass Teosinte originally growing in Central America southern Mexico 7, years ago. These kernels were small and were not fused together like the kernels on the husked ear of early maize and modern corn. By systematically collecting and cultivating those plants best suited for human consumption, Native Americans encouraged the formation of ears or cobs on early maize. The first ears of maize were only a few inches long and had only eight rows of kernels. Cob length and size of early maize grew over the next several thousand years which gradually increased the yields of each crop. Eventually the productivity of maize cultivation was great enough to make it possible and worthwhile for a family to produce food for the bulk of their diet for an entire year from a small area. Although maize agriculture permitted a family to live in one place for an extended period of time, the commitment to agriculture involved demands on human time and labor and often restricted human mobility. The genetic alterations in teosinte changed its value as a food resource and at the same time affected the human scheduling necessary for its effective procurement. Maize in New England As the lifeways of mobile hunting and gathering were often transformed into sedentary agricultural customs, very slowly the cultivation of maize, along with beans and squash, was introduced into the southwestern and southeastern parts of North America. The practice of maize agriculture did not reach southern New England until about a thousand years ago. A Penobscot man described the transformation of maize for the shorter growing season of northern New England. Maize was observed to grow in a series of segments, like other members of the grass family, which took approximately one phase of the moon to form, with approximately seven segments in all, from which ears were produced only at the joints of the segments. Native Americans of northern New England gradually encouraged the formation of ears at the lower joints of the stalk by planting kernels from these ears. Eventually, as ears were regularly produced at the lower joints of the cornstalk, the crop was adapted to the shorter growing season of the north and matured within three months of planting. Native Americans of New England planted corn in household gardens and in more extensive fields adjacent to their villages. Fields were often cleared by controlled burning which enriched not only the soil but the plant and animal communities as well. Slash and burn agriculture also helped create an open forest environment, free of underbrush, which made plant collecting and hunting easier. Agricultural fields consisted of small mounds of tilled earth, placed a meter or two apart sometimes in rows and other times randomly placed. Kernels of corn and beans were planted in the raised piles of soil to provide the support of the cornstalk for the bean vine to grow around. The spaces in between the mounds were planted with squash or mellon seeds. The three crops complemented each other both in the field and in their combined nutrition. Native Americans discovered that, unlike wild plants and animals, a surplus of maize could be grown and harvested without harming their environment. Tribes in southern New England harvested great amounts of maize and dried them in heaps upon mats. The drying piles of maize, usually two or three for each Narragansett family, often contained from 12 to 20 bushels of the grain. Surplus maize would be stored in underground storage pits, ingeniously constructed and lined with grasses to prevent mildew or spoiling, for winter consumption of the grain. The European accounts of Josselyn in , indicate Native Americans used bags and sacks to store powdered cornmeal, "which they make use of when stormie weather or the like will not suffer them to look out for their food". Parched cornmeal made an excellent food for traveling. Roger

Williams in , describes small traveling baskets: Cornhusk bed mat; Iroquois. Rolled husks sewn with basswood cord. Braided and sewn in a coil. Fringe from spliced cornhusks left on one side. Native American Origins of Maize Many Native American traditions, stories and ceremonies surround corn, one of the "three sisters" maize, beans and squash. Even in New England there are many variations on how maize was brought or introduced to Native Americans here. Generally in southern New England, maize is described as a gift of Cautantowwit, a deity associated with the southwestern direction; that kernels of maize and beans were delivered by the crow, or in other versions the black-bird. Responsible for bringing maize, the crow would not be harmed even for damaging the cornfield. Other Algonquian legends recount maize brought by a person sent from the Great Spirit as a gift of thanks. Cornhusk, wool and basswood cord twined bag; Narragansett made in New England tribes from the Mohegan in Connecticut to the Iroquois in the Great Lakes region had rituals and ceremonies of thanksgiving for the planting and harvesting of corn. One ceremony, the Green Corn ceremony of New England tribes, accompanies the fall harvest. Around August Mahican men return from temporary camps to the village to help bring in the harvest and to take part in the Green Corn ceremony which celebrates the first fruits of the season. Many tribes also had ceremonies for seed planting to ensure healthy crops as well as corn testing ceremonies once the crops were harvested.

Chapter 7 : Corn production in the United States - Wikipedia

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Chapter 8 : Corn: Origin, History, Technology, and Production

In control samples the peaks were located at particle diameters of Âµm and 12 Âµm. These larger particles are commonly referred to as " corn meal " while the smaller sized particles are likely.

Chapter 9 : BREEDING & GENETICS OF CORN - TEXAS A&M UNIVERSITY

Corn or maize (Zea mays L.) is grown in virtually every country in the world today. So, it is fitting that Corn: Origin, History, Technology, and Production is one of the volumes in a series of comprehensive references on the four major crops of the world.