Genebanks: Not just seed and plants

THE OSCAR WILL SEED COMPANY COLLECTION: A CASE STUDY IN AGRICULTURAL HISTORY

Outline

- Purpose of a crop genebank
- Brief review the history of maize
- Maize collections efforts in the United States
- Maize at The North Central Regional Plant Introduction Station
- Oscar H. Will and George F. Will
- The Role of the Three Affiliated Tribes
- The Oscar Will Seed Company Collection
- Conclusion

Purpose of a Genebank

- Preserve genetic profile of material maintained at the genebank.
- Preserve the actual material by insuring the quality of the seeds by monitoring viability.
- Record/preserve passport data associated with each accession.
  - What is passport data
  - Problems with passport data

Types of Material in Crop Genebanks

- Wild and Weedy Relatives of Crop plants
  - Reservoirs for insect and disease resistance
- Landrace material
  - Genetically variable population
  - Adapted to local growing conditions such as soil, climate, cultural practices, diseases and pests
  - Selected for and maintained for its distinct properties.
  - Cannot compete in yield with modern varieties.
  - May also be called a “Folk variety”
- Cultivars
- Inbred lines

Short Review of the History of Maize

- Archeological evidence suggests domestication prior to 6,000 years ago.
- Molecular evidence indicates that maize was domesticated some 9,000 years ago.
- First domesticated in the Balsas River drainage in the state of Oaxaca, Mexico.
- Two paths of dispersal
  - Through western and northern Mexico into the SW USA then into the eastern US and Canada
  - From the highlands to the lowlands of Mexico to Guatemala, The Caribbean Islands, the lowlands of South America and then to the Andes Mountains

Maize Classification

- Classification is based on ear morphology.
- The ear consists of the cob and kernels in situ
- Maize is grouped according to a classification scheme called “race”
- Anderson and Cutler defined race “as a group of related individuals with enough characteristics in common to permit their recognition as a group”
- Prehistoric maize information usually comes from cob fragments.

North American Maize Races

- Northern Flints*
- Great Plains Flints and Flours
- Pima-Papago
- Southwestern Semidents
- Southwestern 12 Row
- Southern Dents*
- Southeastern Flints and Flours
- Derived Southern Dents
- Corn Belt Dents*

Maize Collection In the USA

- Brown and Goodman “unlike that of most other countries, much of the indigenous corn of the USA was replaced by hybrids prior to the implementation of an organized program of germplasm preservation”
- J. Allen Clark referring to the races of maize of the Americas “They represent one of the irreplaceable agricultural resources of this hemisphere”

The North Central Regional Plant Introduction Station

- One of four regional Plant Introduction Stations within the National Plant Germplasm System (NPGS)
- The oldest of the stations. Opening in 1948
- Maintains around 50,000 accessions of crop plants and their wild and weedy relatives
- Both seeds and plant material is maintained
- Maintains passport data on GRIN (Germplasm Resources Information Network) relational database

Native American Landrace Maize at NCRPIS

- Maize accounts for around 20,000 accessions at the NCRPIS
- 240 have a traceable affiliation to a Native American tribe based on passport data.
  - Oscar Will Company collection
  - Hugh Cutler collection (Missouri Botanical Garden)
  - William Brown collection (Pioneer Hi-Bred)
- There are more within the collection but the passport data does not contain enough information to support a direct link to a tribe.

Oscar H. Will

- Oscar Will was born in Pompey, New York in 1855.
- Came to Bismarck, North Dakota to work with Major Edward Fuller in 1881.
- Fuller ran a nursery business benefitting from the Timber Act of 1878.
- Oscar Will took over the business in 1885.
- Started to acquire and improve corn hardy in the upper Midwest.
- Seed Company in operation from 1885 thru 1959.
- Died in 1917

George F. Will

- Son of Oscar Will.
- Born in 1884.
- Attending Harvard studying Botany and Anthropology
- As a junior participated in an archeological dig of the Burgois Double Ditch site near Mandan.
- Graduated in 1906.
- Returned to Bismarck to run the company with his father.
- Recognized as “probably the foremost student of the Mandan” (Atkinson and Wilson 1915 page 34).
- Died in 1955

Material Used in this Investigation

- Summery of the Oscar Will Seed Company Catalogues as provided by Fred Schneider. Over 180 varieties of corn offered over the 74 years of existence.
- Corn Among the Indians of the Upper Missouri by George F. Will and George Hyde, first published in 1917. Described over 104 varieties of corn.
- Corn in Montana by Atkinson and Wilson. 1915.
- NPGS Plant Introduction Books and the GRIN database.

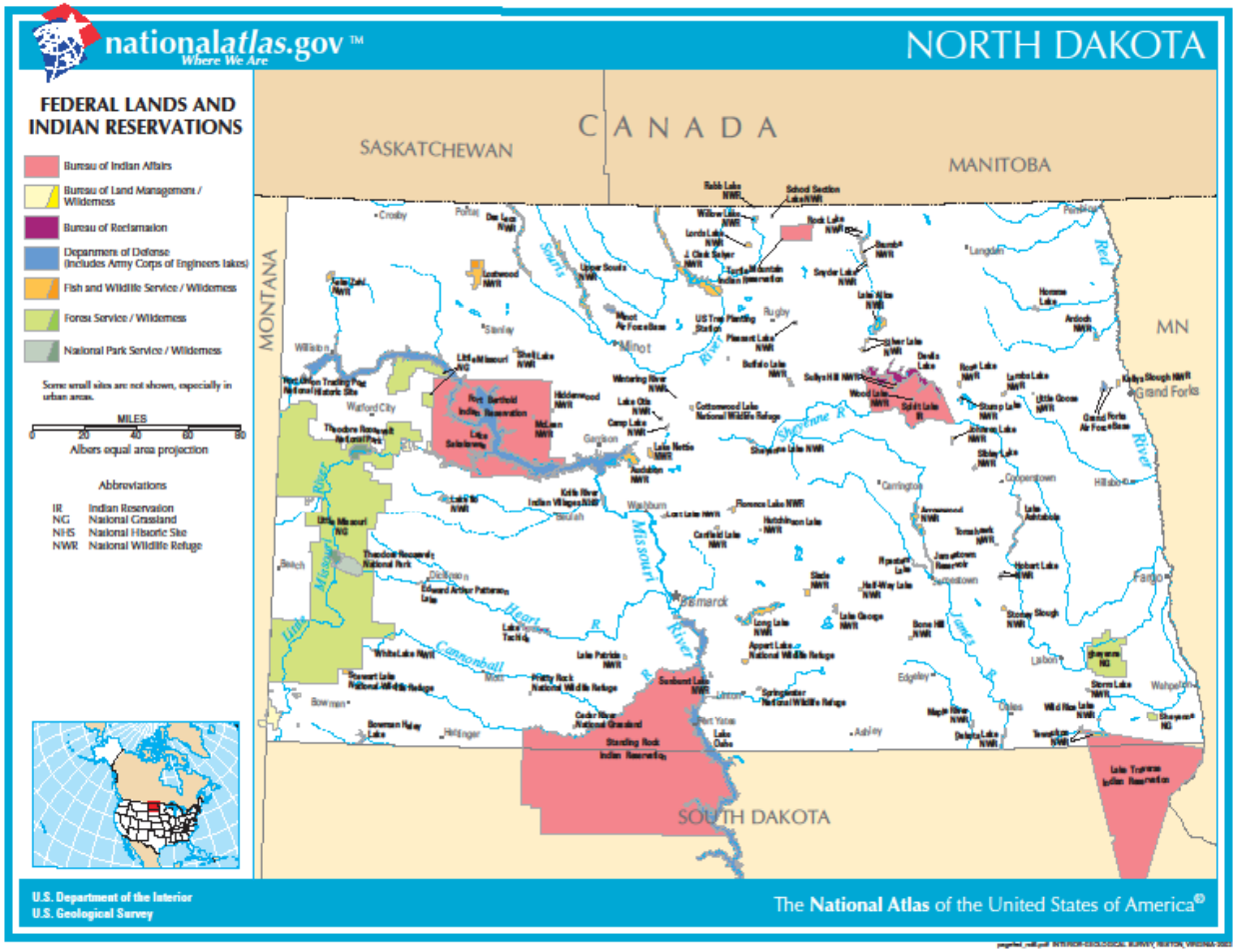
Native American Tribes

- Arikara
- Hidatsa
- Mandan
- Iowa
- Otoe
- Pawnee
- Ponka
- Sioux
- Chippewa
- Winnebago
- Iroquois
- Navajo
- Hopi
- Zuni
- Cherokee
- Wichita
- Sac and Fox

Brief Mandan, Hidatsa and Arikara History

- Practiced farming at the northern edge of effective agriculture.
- Mandan and Hidatsa are of the Siouan language group. Have co-existed as far back as 1787.
- Arikara are of the Caddoan language group and are closely related to the Pawnee.
- Small Pox decreased the populations drastically in the mid 1800's.
- The three tribes have co-existed since 1862.
- Now reside at Fort Berthold Reservation at the Three Affiliated Tribes.

North Dakota



Hidatsa Village in Winter by Karl Bodmer

Examples of Maize Descriptions from Historical Texts

- Buffalo Bird Woman's Garden: Agriculture of the Hidatsa Indians, as Told to Gilbert Wilson. 1917. Listed 9 varieties of Hidatsa corn.
- Original Journals of Lewis and Clark Expedition: 1804 - 1805
- Prince Maximilian von Wied. *Reise in das Innere Nord-Amerika in den Jahren 1832 bis 1834*. Listed 9 varieties of Mandan corn

Maize Accession Originating from the Oscar Will Company

- Two sets of accessions.
- Through J.A. Clark of the National Research Council of the National Academy of Sciences in March of 1954. 36 maize accessions. 19 of Native American affiliation.
- Through Dr. William Wiidakas of North Dakota State University in July of 1954. 18 accessions. 6 of Native American affiliation.

Mandan Red Clay

- **Mandan Red Clay**: first offered 1935; last offered 1939. PI 213807. The variety is listed as # 19 in Corn Among the Indians of the Upper Missouri "Clay Red: Flour corn, color dull purplish-red (about like the common purple-red lilac), with bluish tinge on some kernels. White cob, 8-rowed; ears about 6 1/2 in. long. (Scattered Corn gives it in her list as one of the old Mandan varieties) (Will and Hyde 1964 p302).

Nueta Sweet Corn

- **Nueta Sweet Corn**: first offered 1919; last offered 1959. PI 213796 and PI 219886. #20 in Corn Among the Indians of the Upper Missouri "Sweet Corn: Color red-brown when hard and dry. Ears 4 to 6 1/2 in. long; 10-rowed; white cob with a red ring about the edge of the pith. Very bushy and leafy; a heavy yielder, often 10 or 12 ears to a hill. Gives roasting ears in 50 to 60 days but dries more slowly than the other sorts. Never, or rarely, eaten green by the Indians. Called Wrinkled Corn by the Mandans and Gummy Corn by the Hidatsas. Grows 36 to 50 in. tall: ears borne 2 to 13 in. above ground; plants have 2 to 4 suckers, 1 to 2 ears and 1 to 2 nubbins. At Bismarck, 1916 (poor year for corn), some plants of this variety has 2 large ears and 2 nubbins. Ripe and hard, 1916, 105 days." (Will and Hyde 1964 p302).

Mandan Yellow Flint

- **Mandan Hard Yellow Indian Corn** (seed obtained from Scattered Corn Woman, Mandan): first offered 1914; last offered 1942. PI 213800. The variety is listed as # 15 in Corn Among the Indians of the Upper Missouri. "Hard Yellow: Flint corn, 8-rowed. A very pure strain and said by the Indians to be their earliest variety. Has 2 to 4 suckers; height of stalk 3 to 5 ft.; ears borne 6 to 17 in. above the gorund. Ripened at Bismarck, 1916, in 92 days. Has 1 to 2 ears and 1 nubbin per plant. (Will and Hyde 1964 p 301).

Mandan White Flint

- **Mandan White Flint**: first offered 1930; last offered 1941. PI 213802. . The variety is listed as # 16 in Corn Among the Indians of the Upper Missouri. “Hard White : Flint corn. Perhaps a heavier yielder than the Hard Yellow and a little later. Ears often shaded pink.(Will and Hyde 1964 p301)

Mated Chief Speckled Mandan

- **Mandan Speckled Flour corn** (Fort Berthold): first offered 1931; last offered 1932. PI 213798. May be # 18 in Corn Among the Indians of the Upper Missouri Spotted Corn or “Buska” (Mandan name). Flint and flour of mixed colors. Grows 40 to 52 in. tall; has 1 to 5 suckers (occasionally none, 1 to 2 ears and 1 to 2 nubbins per plant. Ripe at Bismarck, 1916, in 93days.(Will and Hyde 1964 p301)

Cudu

- **Navajo Sacred or Cudei**: first offered 1932; last offered 1941. PI 222285. #80 in Corn Among the Indians of the Upper Missouri "Navajo Cudei or Scared Corn: A white flour corn with a purple cap or dot on each kernel - very odd. Very drought resistant. Produces large ears, some 12 in. long, 12- to 16-rowed and very light in weight, kernels round and usually rather small. Plants very leafy and bushy; in a dry year about 3 ft. high with ears borne close to the ground; 1 to 2 suckers; in a favorable year 60 to 80 in. high, ears 1 to 3 ft. on stalk. A heavy yielder. Ripened at Bismarck, 1914, in a heavy late soil, 115 days, and in 1916, 124 days. Lixokonkatit or "Black-eyed-Corn" A variety mentioned in the Skidi traditions as grown by the Pawnee in early times. Described as white corn with black spots on the kernels. Such a variety is now grown by the Navajo, who call it Cudei and consider it sacred. The dot or "eyes" on the white kernels are really dark purple" (Will and Hyde 1964 pp308-315).

“Improved” Varieties offered by Oscar Will

- **Northwestern Dent** (“Butcher” corn): first offered 1896; last offered 1959. PI 213776, PI 213788, and PI 219885. From Corn in Montana “Northwestern Dent is a corn of very doubtful origin. There are two theories concerning it; one that it is an old Indian corn which was raised very likely by the Indians of the Ohio River Valley; the other that it is a cross between a red flint, similar to King Philip, and a white dent. Mr. Will offered it first in his 1896 seed catalogue with the following description “**After many years of experimenting, great expense and much labor, we have at last succeeded in securing a Dent corn that will mature in North Dakota and the Northwest generally. Northwestern Dent is the result of acclimation and careful selection and improvement of what is known in some localities as the “Butcher” corn.** It follows the Gehu and Improved Pride of Dakota very closely.” (Atkinson and Wilson 1915 pp 76-80). Northwestern Dent accounts for 5% of the background of U.S. hybrid corn (Troyer and Hendrickson 1990)

- **Gehu**: first offered in 1889; last offered in 1959. PI 213778, PI 213792 and PI 219878. From Corn in Montana "Mr. L. D. Judkins, of Bismarck, North Dakota, crossed the Dakota White Flint with the Mercer Yellow Flint about 1887 or 1888. In 1889 Mr. Will bought all the seed from this cross and all rights to its introduction and sale. It was listed in the 1892 catalogue as follows **"This is a new hybrid flint corn of beautiful, bright, glossy yellow color. I claim it to be the earliest valuable field corn in the world and superior to all other varieties of flint corn for cultivation in the Northwest.** The name, Gehu, from the biblical man who "got there quick" (Atkinson and Wilson 1915 p60).

- **Will's Square Deal**: first offered 1906; last offered 1945. PI 219892. From Corn in Montana "This is a very early, hardy, northwestern corn. In 1900 Mr. Oscar Will sent to Ohio and secured a small quantity of the seed which was catalogued in that state as the **"earliest dent corn on earth".** It proved to be early enough in Bismarck, North Dakota to mature about half the ears, which were very large, growing on a stalk about 8 feet high" (Atkinson and Wilson 1915 p87).

Varietal Loss

- 1903 inventory of vegetable varieties available in the United States:
  - 434 varieties of Field corn
  - 307 varieties of Sweet corn.
- 2004 Catalogue review:
  - 177 varieties of Field corns
  - 65 varieties of Sweet corn

Summary:Why is this Material Important

- Best representation of Mandan corn available.
- Texts available to connect the accessions to the Native American Tribes from which the seed originated.
- Snapshot of history
- Northern material evolved in harsh, variable environment. Implications on future climate change.

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Bear Island Chippewa

ASSINIBOINE

Rainbow Flint