Small Grains 101: Wheat
Spring 2011, MOMCC Conference

I. Introduction of speakers and the purpose of this talk:
-Origins of wheat and main classifications:

A. What is wheat?

Wheat is a member of the grass family, *Poaceae*, one of the largest and most important plant families, which also includes rice and sugar cane. There are about 600 genera and perhaps ten thousand species of grasses.

Wheat is any of the cereal grasses of the *Triticum* genus. It has an inflorescence (group of cluster of flowers on a branch) that is a *spike*, an unbranched, indeterminate inflorescence with sessile flowers arranged along an axis. Each spikelet may have several florets with grains that may be hard or soft, white, red, or purple. The grain includes the embryo and a largely starch endosperm covered by layers. It is an annual plant.

B. What is the History of Wheat
1. Early Origins

Wheat is one of the first cereals known to have been domesticated, and wheat's ability to self-pollinate greatly facilitated the selection of many distinct domesticated varieties. The archaeological record suggests that this first occurred in the regions known as the Fertile Crescent, and the Nile Delta. These include southeastern parts of Turkey, Syria, the Levant, Israel, and Egypt. Recent findings narrow the first domestication of wheat down to a small region of southeastern Turkey, and domesticated Einkorn wheat at Nevalı Çori—40 miles (64 km) northwest of Gobekli Tepe in Turkey—has been dated to 9,000 B.C. However evidence for the exploitation of wild barley has been dated to 23,000 B.C. and some say this is also true of pre-domesticated wheat.

Genetic analysis of wild *einkorn* wheat suggests that it was first grown in the Karacadag Mountains in southeastern Turkey. Dated archeological remains of einkorn wheat in settlement sites near this region, including those at Abu Hureyra in Syria, confirms the domestication of einkorn near the Karacadag Mountain Range. The earliest carbon-14 date for the einkorn wheat remains at Abu Hureyra is 7800 to 7500 years BCE. Recent genetic and archeological discoveries indicate that both *emmer* wheat and *durum* (hard pasta wheat) also originated from this same Karacadag region of southeastern Turkey. Remains of harvested emmer from several sites near the Karacadag Range have been dated to between 8800 and 8400 BCE, that is, in the Neolithic period.[13]

Cultivation and repeated harvesting and sowing of the grains of wild grasses led to the creation of domestic strains, as mutant forms ('sports') of wheat were preferentially chosen by farmers. In domesticated wheat, grains are larger, and the seeds (spikelets) remain attached to the ear by a toughened rachis during harvesting. In wild strains, a more fragile rachis allows the ear to easily shatter and disperse the spikelets. Selection for these traits by farmers might not have been deliberately intended, but simply have occurred because these traits made gathering the seeds easier; nevertheless such 'incidental' selection was an important part of crop domestication. As the traits that improve wheat as a food source *also* involve the loss of the plant's natural seed dispersal mechanisms, highly domesticated strains of wheat cannot survive in the wild.

Cultivation of wheat began to spread beyond the Fertile Crescent after about 8000 BCE. Jared Diamond traces the spread of cultivated emmer wheat starting in the Fertile Crescent about 8500 BCE, reaching Greece, Cyprus and India by 6500 BCE, Egypt shortly after 6000 BCE, and Germany and Spain by 5000 BCE. "The early Egyptians were developers of bread and the use of the oven and developed baking into one of the first large-scale food production industries." By 3000 BCE, wheat had reached England, and Scandinavia. A millennium later it reached China.

2. Wheat comes to the United States:

-1607-1608: English wheat is documented as having been grown in the Virginia colonies, but did not do well in the sandy loamy soil.
-1660: Black stem rust appeared in New England and made wheat growing difficult and uncertain. Rye and corn would take up the slack. Commercial wheat production would not pick up until after the revolution.

C. What are the major kinds of Wheat?
1. Wheat Genetics:
Wheat genetics is more complicated than that of most other domesticated species.
-Some wheat species are diploid: with two sets of chromosomes,
-Some are polyploids: with four sets of chromosomes (tetraploid) or six (hexaploid).

- Einkorn wheat *(T. monococcum)* is diploid.

  Tetraploid wheats (e.g. emmer and durum wheat) are derived from wild emmer, *T. dicoccoides*. Wild emmer is the result of a hybridization between two diploid wild grasses, *T. urartu* and a wild goatgrass, such as *Aegilops searsii* or *Ae. speltoides*. The hybridization that formed wild emmer occurred in the wild, long before domestication.

- Hexaploid wheats evolved in farmers' fields. Either domesticated emmer or durum wheat hybridized with yet another wild diploid grass *(Aegilops tauschii)* to make the hexaploid wheats: spelt wheat, and bread wheat (Hancock 2004).

2. Species of Wheat:

There are many botanical classification systems used for wheat species. The name of a wheat species from one information source may not be the name of a wheat species in another. Within a species, wheat cultivars are further classified by wheat breeders and farmers in terms of growing season, such as winter wheat versus spring wheat, by gluten content, such as hard wheat (high protein content) versus soft wheat (high starch content), or by grain color (red, white, or amber) (Bridgwater 1966).

Major cultivated species of wheat

Common wheat or **Bread wheat**—*(T. aestivum)*. A hexaploid species that is the most widely cultivated in the world.

Durum—*(T. durum)*. The only tetraploid form of wheat widely used today, and the second most widely cultivated wheat.

Einkorn—*(T. monococcum)*. A diploid species with wild and cultivated variants. Domesticated at the same time as emmer wheat, but never reached the same importance.

Emmer—*(T. dicoccon)*. A tetraploid species, cultivated in ancient times but no longer in widespread use.

Spelt—*(T. spelta)*. Another hexaploid species cultivated in limited quantities.

Classes used in the United States are:

- **Durum** – Very hard, translucent, light-colored grain used to make semolina flour for pasta. Whole food
- **Hard Red Spring** – Hard, brownish, high-protein wheat used for bread and hard baked goods. Bread Flour and high-gluten flours are commonly made from hard red spring wheat. It is primarily traded at the Minneapolis Grain Exchange.
- **Hard Red Winter** – Hard, brownish, mellow high-protein wheat used for bread, hard baked goods and as an adjunct in other flours to increase protein in pastry flour for pie crusts. Some brands of unbleached all-purpose flours are commonly made from hard red winter wheat alone. It is primarily traded by the Kansas City Board of Trade. One variety is known as "turkey red wheat", and was brought to Kansas by Mennonite immigrants from Russia.
- **Soft Red Winter** – Soft, low-protein wheat used for cakes, pie crusts, biscuits, and muffins. Cake flour, pastry flour, and some self-rising flours with baking powder and salt added, for example, are made from soft red winter wheat. It is primarily traded by the Chicago Board of Trade.
- **Hard White** – Hard, light-colored, opaque, chalky, medium-protein wheat planted in dry, temperate areas. Used for bread and brewing.
- **Soft White** – Soft, light-colored, very low protein wheat grown in temperate moist areas. Used for pie crusts and pastry. Pastry flour, for example, is sometimes made from soft white winter wheat. NE U.S.A.

Red wheats may need bleaching; therefore, white wheats usually command higher prices than red wheats on the commodities market.