Ames- 19 May 2004- The U. S. Corn Yield Trend is the “best” straight line through the yield record of the past 30 years. The 2004 trend yield is 141.2 Bu/a (Figure 1). Historically the most likely yield is 2% greater than the trend and represents the yield that may be expected with “normal” weather conditions. The most likely yield is not to be considered as a highly reliable indicator as the standard deviation associated with the trend line plus 2% yield is 10.1%. The mid-May weather and soil moisture assessment indicates a near normal growing season in the U. S. Corn Belt and a most likely yield of 144 Bu/a. By way of information the U. S. Corn Yield for 2003 was exactly trend + 2%. (The 2003 trend was 139.4 Bu/a and the final yield estimate was 142.2 Bu/a or exactly “trend + 2%.”)

![Figure 1. U. S. Corn Yield for the 30 years from 1974 through 2003. The trend line yield for 2004 is computed from the regression equation by inserting the year as the “x” value. Data are from “QuickStats” in www.usda.gov/nass](image-url)

Potential Yield
Analysis of the extreme high and low yields over the 30 year period indicates that the highest yield likely to be realized with ideal conditions is 158 Bu/a and the lowest is 100 Bu/a with drought approximating the extremes experienced during the period. The historical record (current weather and soil conditions not considered) indicates a 60% probability of the yield falling in the range of 127-155 Bu/a (the probability of being 155.1-158 Bu/a is 23% and of being below 127 Bu/a is 17%).

Soybean
The U.S. Soy Trend for 2004 is 39.7 Bu/a. The median historical yield exceeds the trend by 1% and the mode exceeds the trend by 4%, the standard deviation is 8.4% of the trend. So the most likely yield (assuming near normal weather) for 2004 is 40.1 to 41.3
Bu/a (a little shy of the 1994 record of 41.4 Bu/a). Based on the past 30 years, we would expect the U.S. soy yield with ideal conditions to be 48 Bu/a, and with as bad as it gets to be near 35 Bu/a.

Figure 1b. U. S. Soybean Yield for 1974 through 2003.

Soil Moisture at Planting

IOWA: Iowa soils were at or above normal subsoil moisture content at planting time in most counties. The mid-April survey showed favorable moisture in most counties and subsequent rain has been generally (but not totally) favorable.

Soil Moisture for Spring, 2004

Figure 2. Iowa Subsoil moisture as of Mid-April 2004. Soil capacity is about 10 inches of plant available water.
U. S. MOISTURE: The estimated subsoil moisture available to crops at planting time was estimated to be near normal in most of the Corn Belt with some areas considered to be too wet (Figure 3). Historically corn yield has exceeded the trend more than 50% of the time when subsoil moisture was reported to be normal or above at planting time.

![Crop Moisture Index by Division](http://www.cpc.ncep.noaa.gov/products/analysis_monitoring/regional_monitoring/cmi.gif)

El Niño and La Niña

There has not been a “wide spread” drought observed in the U. S. Corn Belt during an El Niño event. During such an event the likelihood of an above trend yield is near 70%. Conversely, seasons dominated by La Niña conditions have greatly increased risk of drought (http://www.agron.iastate.edu/courses/agron508/classes/503/lesson2/2.2.2.html).

Most El Niño outlook assessments indicate that the 2004 growing season may experience weakly El Niño like conditions (http://www.elnino.noaa.gov). As of mid-April the situation is not sufficiently established to justify the forecast for El Niño conditions, accordingly the probability of yields typical of an El Niño years are not currently included in this assessment. However, the outlook for “El Niño like” was considered sufficiently strong as to normalize the impact of the advancing 19-year “Benner” cycle.

The erratic behavior of the SOI (Southern Oscillation Index) during the past 4 months is seen as indicative of the Madden-Julian Oscillation (MJO), not of a waxing and waning El Niño (Fig. 4). The MJO is often associated with a 2 to 4 week dry period followed by 2 to
4 weeks of wet weather. The MJO dominated the summer of 2001 and resulted in several weather “scare” type opportunities of marketing of crops.

![Southern Oscillation Index & 'SOI Phase'](image)

Figure 4. The SOI has been on the low (El Nino) side of average for much of the past 2+ years. Since November of 2003 there has been an apparent MJO event in progress.

19-Year Cycle

Two serious droughts are anticipated during the period of 2005-2010 according to the “Benner Cycle” reported first in 1885. The cycle conforms to the observed 17% probability of widespread drought in a randomly selected year. However, the cycle treats the probability as non-random. During the past 200 years the cycle as correctly accounted for the occurrence of one moderate drought in a series of 12 or 13 years followed by two droughts within a window of 6 years, ([http://www.agron.iastate.edu/courses/agron508/classes/503/lesson2/2.2.1.3.html](http://www.agron.iastate.edu/courses/agron508/classes/503/lesson2/2.2.1.3.html)). Extrapolation of Mr. Benner’s chart beyond the year 2000 indicates that the high risk (1 in 3) of drought occurs in the 2005-2010 series of years. It should be noted that non-drought years, and even very high yield years often are observed during the high-risk times. A serious drought has occasionally developed a year previous to the initial year specified as high-risk, these have been during La Niña conditions as nearly as can be determined. Because La Niña is not anticipated during the 2004 growing season the risk of widespread “Benner Cycle” drought is dismissed as a minor uncertainty.
Wide Spread Drought Origin

Drought in the western Corn Belt has three basic types. Widespread drought is considered as Type III and can extend from the eastern coast to Nebraska and beyond. The 17 widespread droughts observed in the past 100 years were first noted in the vicinity of South Carolina with the exception of the 1954 drought that appears to have initiated in Canada (just east of Michigan). Although March 2004 was very dry in the southeastern U. S. the conditions do not indicate the initiation of widespread drought at this time.

Pacific Decadal Oscillation (PDO)

The deviation of sea surface temperature from normal in the large area (roughly) north of Hawaii is referred to as the PDO. When the water is warm as during the past 3 winters, a high-pressure area over Colorado is favored. The Colorado high pressure is associated with Type I drought and was significant during the past 3 years. The impacts of this drought are mainly west of a line from central North Dakota to central Iowa to Kansas City to Dallas, TX. Although the risks of drought from this event are likely to dominate a period of 10 or more years, it is not uncommon to have “near normal” years within the period. At this time the sea surface conditions (www.elnino.noaa.gov) appear to be near normal and the chance for normal May and June weather in the Type I area seems favorable. I do not have sufficient data to give a percentage risk associated with the current conditions, and have assumed normal based on visual observation of the sea surface temperature and general weather maps.

Alaska Gulf Low

Low pressure persisting in the Gulf of Alaska (Persistent Pacific Negative Anomaly) is clearly associated with a reduction of precipitation north of a line from Kansas City to Chicago, IL. This is the subject of ongoing research at Iowa State University. Low pressure that developed in June 2003 impacted the weather that adversely influenced soy yield in the western Corn Belt during the past year. We know the risk of this event is highest during La Niña years but do not know how to forecast it otherwise, accordingly the risk of this low developing is included in the 2004 yield outlook even though there is no impending condition. Conversely, a high-pressure ridge in the Gulf of Alaska is often associated with above normal precipitation in the impacted area.

Arctic Lobes

The number of “lobes” observed around the Artic Circle (long waves on the artic front) is a reasonable indicator of weather perturbations in the U. S. Corn Belt. A 3-lobe condition tends to be associated with unchanged general conditions (stormy areas remain stormy, drought areas remain in drought, etc.). A 4-lobe condition is often associated with an alternation of moist and dry months in the Corn Belt. Regular progression of storms throughout the season is expected when the configuration includes 5 or more lobes. The lobes are best evaluated by inspection of the 700mb hemispherical map (omit the observations) http://weather.uwyo.edu/upperair/uamap.html. The pattern that will dominate the season is often apparent by mid-April and it appears that the 4-lobe condition is most likely for the spring and early summer of 2004.
Bermuda High Pressure

The semi-permanent high-pressure area that dominates the region east of Florida during the summer time is known and the Bermuda High Pressure. This consistent feature of the climate is responsible for the existence of the Corn Belt; otherwise the region would be desert. When the Bermuda High Pressure area falters, drought results. A functional index (Reman Index) of the air flow associated with the condition of the “High” was developed at Iowa State University: http://www.mesonet.agron.iastate.edu/~windmill/Rlpage.html. The index (365 day view) is below the mid-April value of 2003 but is considered to be sufficiently near normal as to indicate normal odds of having favorable spring rains.

Summary

The transition from the low-risk of drought (1 in 12) years of the Benner Cycle to the high-risk years (1 in 3) increases the chance of widespread drought from less than 17% to something on the order of 22%. The anticipated El Niño-like condition through the 2004 season was seen as neutralizing this risk factor. Should an El Niño event emerge the most likely corn yield will increase from the currently computed 144 Bu/a to about 148 Bu/a. The timing of the 4 to 6 week wet and dry periods appears to not be a detriment to crop production as of mid-May. This analysis does not consider the uncertainty associated with a possible Soybean disease invasion of the U. S. production area.

According to the Corn and Soy balance sheets (by Dr. Wisner) the likely Dec./Nov. Chicago price for the most likely yields as given above is: Corn @ 144 Bu/a $2.70 (the market closed May 14 at $2.85) and Soybean @ 41.2 Bu/a $4.50 (the market closed May 14 at $7.14).

–Elwynn
Dr. Elwynn Taylor

Iowa State University professor, Elwynn Taylor’s vision of mega-trends in technology, climate and society opens the horizons of our enigmatic world. His extensive knowledge and understanding of the world around us enlightens and entertains professional and general audiences. His insightful presentations are immediately useful in the management of business and life. Few can explain the complexities of our world in a manner as clear, concise, and pleasant, as does Dr. Taylor.

Dr. Taylor received his doctorate in Biology from Washington University in St. Louis. Scholars internationally recognize his expertise in the interactions of the biological and the physical environment. Widely requested for banquet, convention and technical keynote presentations, audiences value his affable and informative delivery. He is the recipient of the “Excellence in Extension Education” and “Excellence in Economic Education” awards. He received the Iowa Regent’s professional achievement award.

Business or leisure, student or professional, you will benefit from the common sense approach Dr. Taylor has delivered by press, presentations, and radio over more than 30 years. His interviews in the Wall Street Journal on impacts of Drought and Flooding, his New York Times article on heat and Astroturf, his full-color half-page photograph of Arches Monument in the St. Louis Post-Dispatch, and his down-to-earth weather outlooks in Country magazine express the scope of his understanding and experience.

He is a consultant to state and national planning and climate (flood and drought) response committees and agencies. He consults to numerous financial, legal, and agricultural firms and agencies. In 2003 he received the “Distinguished Service to Agriculture” award presented by the Iowa Farm Bureau (joining 3 other Iowa State University professors in this honor: William G. Murray (1987), Neil E. Harl (1992), and Louis Thompson (1995)).

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