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Effect of Weather Conditions on Yields at Lahoma, Oklahoma

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Introduction

The long term experiment #502, at the Lahoma Research Station, achieved record wheat grain yields in 2003, 2008, and 2009 with maximum yields exceeding 73 bu/ac. Prior to 2003, maximum yields were 65 bu/ac, and this occurred in 1988. In order to better understand the cultural and environmental conditions that led to these high yields, a comprehensive evaluation of the 2003, 2008, and 2009 crop years was performed, specifically added evaluation of precipitation patterns and planting dates. The objective was to identify common factors responsible for the high yields observed in these particular years. Conditions that were common in all three years included ample early season precipitation, more even distribution of precipitation throughout crop development, and planting dates between the last week of September and the first week of October.

Many site and location specific factors influence yield level, and these are known to change year-to-year, as is observed in Figure 1, at the Lahoma Research Station. Yield levels ranged from 27 bu/acre, in 2001, to 89 bu/acre in the exceptional years of 2003 and 2008. Particular characteristics that were common in 2003, 2008 and 2009, were ample moisture at planting, early planting, and even precipitation distribution through the year. This in turn guaranteed a more uniform germination and growth, thus, improving yields. Long-term experiment #502 at Lahoma provides a complete background of site and climatological history, making it possible to evaluate conditions that lead to more than normal grain yield levels. Yields were more than 20 bu/ac higher in 2003, 2008, and 2009 compared to the 15 year average from 1994 to 2009. Data was obtained to establish a baseline or an average collected from the Oklahoma Mesonet Station, located at the Lahoma Research Station. Once baseline data was established, average weather patterns for the years in question were examined to identify climitilogical aspects responsible for these unusually high yields.

When evaluating the precipitation trends from the years 2003, 2008 and 2009 (Figure 2), a similar pattern emerged. All three years had adequate moisture at planting, a more even rain distribution throughout the season, and precipitation during flowering and grain fill when the demand for water is essential. During the winter, the crop has a lower demand for

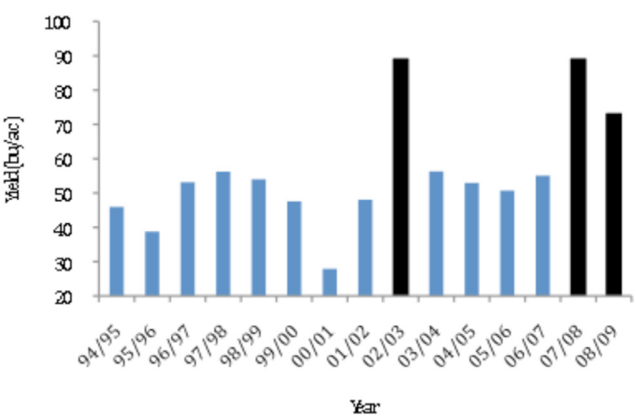

Figure 1. Lahoma #502 Average grain yields from 1994 to 2009, with 2003, 2008 and 2009 highlighted in black.

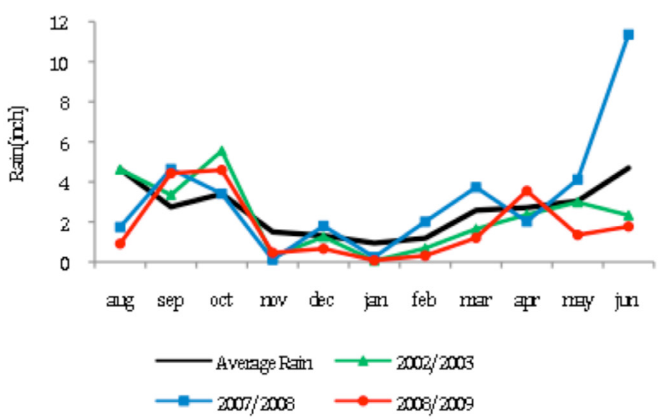

Figure 2. Precipitation patterns representing the exceptionally high yielding years (2003, 2008, and 2009) and the average.

water, since growth is interrupted due to low temperatures. Therefore, lack of water during winter does not affect yield significantly. The planting dates for all three years were early, between the end of September, and early October. For 2003 winter wheat was planted September, 24. At this same time abundant rainfall was also received, which was able to fill the soil profile and resulted in a homogeneous germination and consequently a crop with less field variability. Furthermore, after the winter season, precipitation was frequent until harvest. The 2008 crop year was planted on October, 9 and similar to 2003; adequate precipitation in August and September was received providing surface and subsurface soil profile moisture Furthermore, the 2008 crop showed plentiful rain at the end of winter and throughout the spring. Wheat in 2009 was planted on September, 30 and the rainfall resembled that received in 2003 and 2008, with the exception of reduced May rainfall level. This may explain the 16 bu/ac reduction in yield from that observed in 2003 and 2008, but still 19 bu/ac above the average. All years in question indicated that if the crop is planted early with ample precipitation near planting, the likelihood of achieving maximum yields goes up.

For this location a 50 bu/ac yield is considered a good year. In years where yield levels have been near or below 50 bu/ac it is likely that one of the following occurred; 1) an early planting date was not realized; 2) adequate moisture at planting was not received; 3) temperatures during flowering were excessive; and 4) adequate moisture from flowering to grain fill was not received. In those years when two or more of these conditions are not met, yields are expected to be significantly lower.

In conclusion, this study showed that combinations of factors are responsible for the outstanding years of 2003, 2008 and 2009. Early planting dates (end of September to early October) combined with early precipitation (August, September and October), and an even distribution of rain during key growth stages, especially from stem elongation to grain fill are likely responsible for exceptional yields. Overall this study showed that ample precipitation at or near planting was very similar, for 2003, 2008, and 2009, and that combined with an early planting, these factors contributed to the very high yields recorded. It is extremely important to utilize the information provided by Mesonet Stations (http://agweather.mesonet.org/) to better understand weather conditions, thus, improving management practices, avoiding losses and enhancing yield.

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