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Weather and Wheat Yields

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Market Report	Yr Ago	4 Wks Ago	4/25/03
Livestock and Products*, *Average Prices for Week Ending			
Slaughter Steers, Ch. 204, 1100-1300 lb Omaha, cwt	$64.54	$78.87	$77.97
Feeder Steers, Med. Frame, 600-650 lb Dodge City, KS, cwt	*	89.23	89.00
Feeder Steers, Med. Frame 600-650 lb, Nebraska Auction Wght. Avg	89.08	94.00	95.81
Carcass Price, Ch. 1-3, 550-700 lb Cent. US, Equiv. Index Value, cwt	104.10	119.15	122.85
Hogs, US 1-2, 220-230 lb Sioux Falls, SD, cwt	31.00	34.00	39.50
Feeder Pigs, US 1-2, 40-45 lb Sioux Falls, SD, hd	37.50	*	*
Vacuum Packed Pork Loins, Wholesale, 13-19 lb, 1/4" Trim, Cent. US, cwt	95.90	90.35	101.58
Slaughter Lambs, Ch. & Pr., 115-125 lb Sioux Falls, SD, cwt	57.50	96.00	95.25
Carcass Lambs, Ch. & Pr., 1-4, 55-65 lb FOB Midwest, cwt	142.62	194.06	193.60
Crops*, *Cash Truck Prices for Date Shown			
Wheat, No. 1, H.W. Omaha, bu	2.86	3.42	3.49
Corn, No. 2, Yellow Omaha, bu	1.84	2.23	2.28
Soybeans, No. 1, Yellow Omaha, bu	4.49	5.70	5.90
Grain Sorghum, No. 2, Yellow Kansas City, cwt	3.34	4.07	4.09
Oats, No. 2, Heavy Minneapolis, MN , bu	1.93	1.99	1.83
Hay*, *First Day of Week Pile Prices			
Alfalfa, Sm. Square, RFV 150 or better Platte Valley, ton	115.00	127.50	127.50
Alfalfa, Lg. Round, Good Northeast Nebraska, ton	70.00	77.50	77.50
Prairie, Sm. Square, Good Northeast Nebraska, ton	80.00	115.00	117.50

* No market.

It is well recognized that at particular times in the growing season weather can be a critical determinant of crop yield. Here we report research which identifies those periods and quantifies their impact. This research can be useful in understanding the yield impacts of the often discussed and debated issue of climate change. A shift in climate may change the level and variability of temperature and precipitation in critical crop growing stages. To better understand how climate change would impact crop yields, identifying those critical growing stages and quantifying their impact on yield is important.

If crop growth models estimated in this way perform well, estimated crop yields can be projected during the growing season. Midway through a crop growing season, for example, recently observed weather data for the current growing season could be combined with average conditions for the remainder of the growing season to estimate yield. Moving toward crop maturity, predicted yields would be expected to be increasingly accurate. In this report we examine research related to crop modeling for Nebraska wheat production.

We estimated the average wheat yields for each crop reporting district of Nebraska for the 1956-2001 time period using climatic factors to explain yield. For each crop reporting district, using all counties and all weather stations in each county, the impacts of temperature and precipitation in five wheat growing stages were estimated. The periods included 1) Presowing (April-August of previous year), 2) Sowing (September-October of previous year), 3) Dormancy (November of previous year to February of current year), 4) Vegetative (March-May),

and 5) Reproductive (June-July). We also included a time variable to explain factors such as varietal improvement and improved cultural practices. Clearly there are other factors which influence wheat yields, such as hail and pest outbreaks which are difficult to quantify.

Clearly the response of wheat yields to weather varies across Nebraska. The impact of weather variables differs not only in magnitude but in direction depending upon the crop reporting district. However, here we are reporting only the results for one crop reporting district (Northwest).

Temperature for this region was found to be statistically significant in only the Reproductive Stage and was negative (higher temperature-lower yield). On the other hand, precipitation was found to be important and positive for the Presowing and Vegetative Stages. These results are not unexpected for this region. The impacts of climate variables vary in importance and significance by district, and in one case (reproductive temperature) was significantly positive for another district (Eastern Nebraska).

In Figure 1 the actual wheat yields for the Northwest district are shown along with only the simple trend of wheat yields. The predicted wheat yields are not included here. The influence of time is approximately one-fourth bu./year. Thus, using the results shown on this graph the "average" wheat yield increases across time.

It is frequently questioned if crop yield variability has changed across time. Using the data from Figure 1 we calculated how yields by decade deviated from the trend for the decades of the 1960s, 1970s, etc. Also, we calculated variability of yields for each decade using the standard deviation of yields relative to the trend. Crop yields for the 1960s were unusually low as well as the 1990s. However, the opposite occurred for the 1970s and 1980s. Interestingly, wheat yield variability was largely unchanged over the 1950-2000 time period. It was slightly higher in the 1960s but nearly constant in the following four decades.

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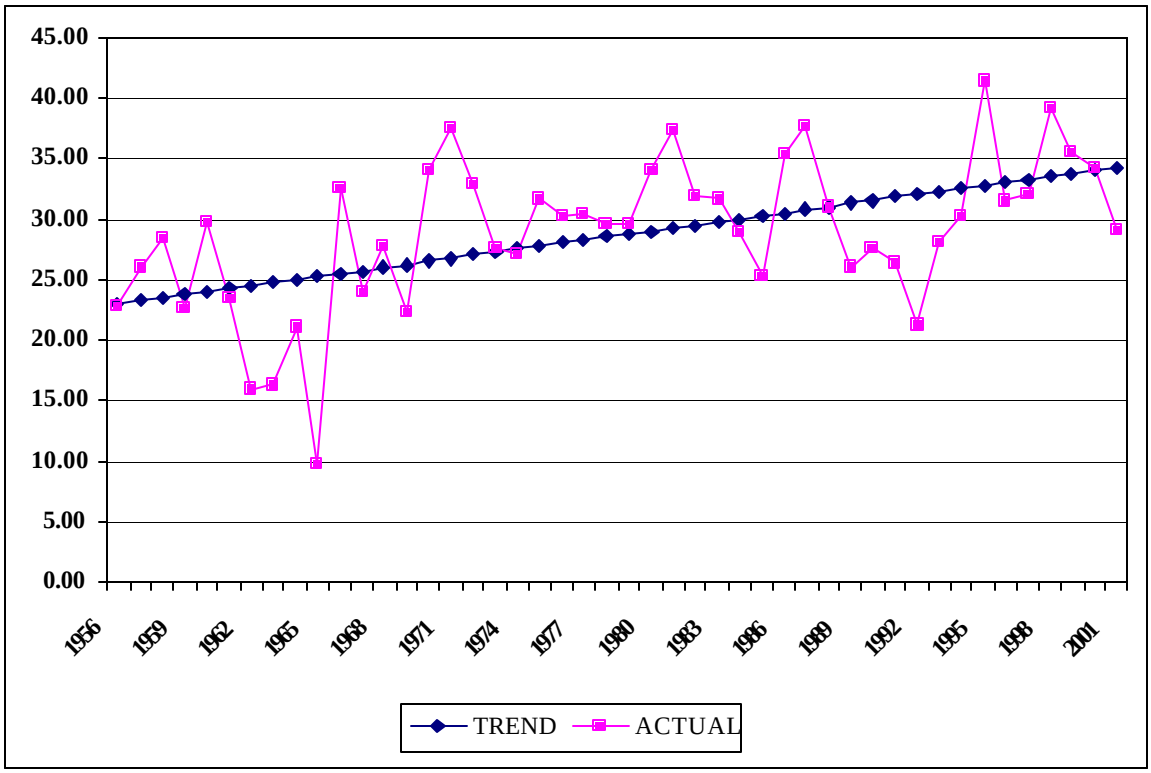

Figure 1. Wheat Yields - Nebraska Northwest