Seasonal Price Index: Soft White Wheat

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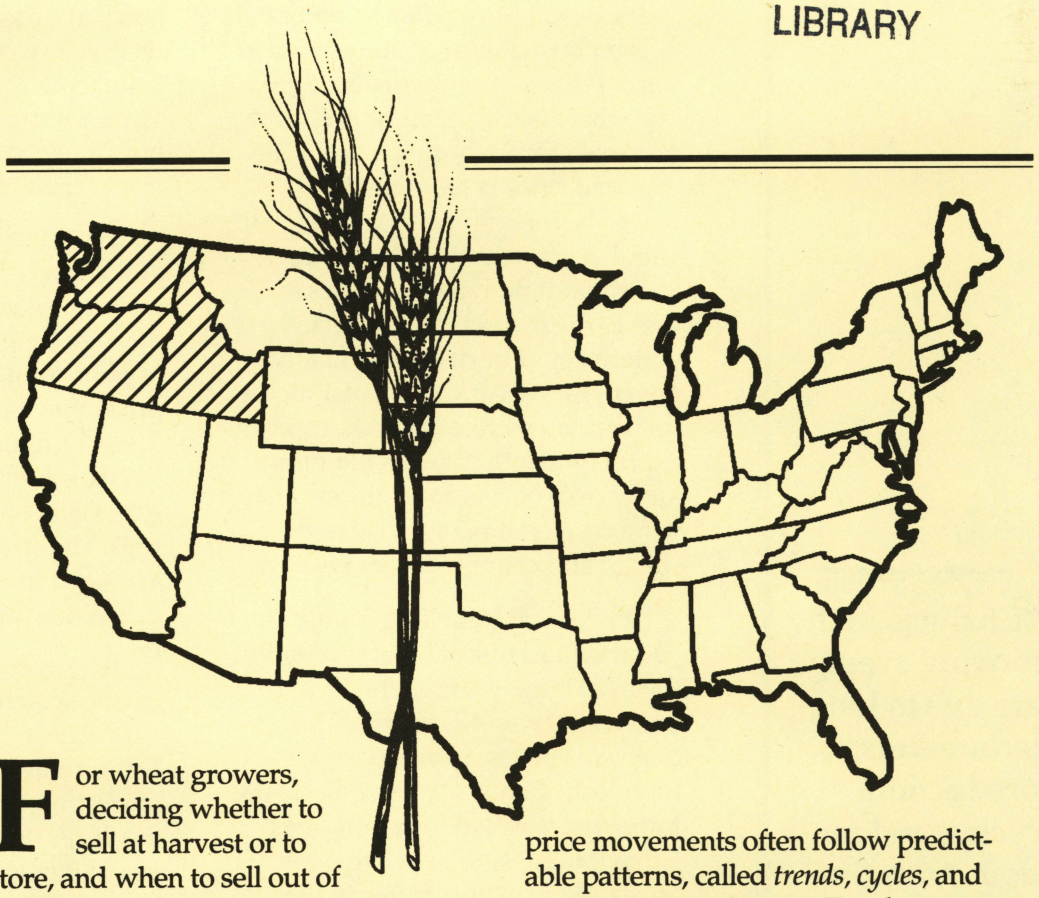

For wheat growers, deciding whether to sell at harvest or to store, and when to sell out of storage, can greatly impact profits. For example, the Portland white wheat cash price at harvest in August 1979 was $4.45 per bushel. The May 1980 price was $3.91 per bushel. Obviously, growers profited more from that crop if they sold at harvest rather than storing and selling in May. More recently, the Portland price was $2.68 per bushel in August 1986 but increased to $3.09 per bushel in May 1987. If storage costs were less than 41 cents per bushel, it was profitable to store the crop and sell it in May.

Many unpredictable supply and demand forces affect wheat prices, but price movements often follow predictable patterns, called *trends*, *cycles*, and *seasonal price movements*. *Trends* are general upward or downward price movements that occur for long periods of time. *Cycles* are regularly occurring price movements over several years that typically reflect supply expansion and contraction in an industry. *Seasonal price movements* are price changes from one month to the next, within a given year.

Seasonal price analysis focuses on these monthly price movements that occur within a given year. Understanding seasonal prices won't give a grower the power to always pick the highest price, but it can lead to more profitable timing-of-sales decisions.

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CIS 1007

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Seasonal price patterns differ between perishable and nonperishable commodities. A nonperishable crop like wheat is harvested, stored, and marketed throughout the year. The expected price behavior pattern would be for prices to rise continually after harvest to reflect storage costs and dwindling wheat supplies available to the market. This expected price pattern could be disrupted in any given year by various events, such as: unexpected increases or decreases in export demand, changes in timing and size of new crop additions to inventory, adjustments in carry-over stocks, and changes in storage costs.

Prices for storable agricultural commodities follow a pattern within the marketing year that tends to repeat itself every 12 months. The tendency for prices during certain months to be high or low reflects the impact of seasonal forces on price behavior. These seasonal forces can be attributed to export patterns, seasonality in domestic demand, production timing, and the marketing practices of growers.

It is useful to isolate the seasonal component of price variation from underlying, longer-run trend and cyclical price fluctuations. Measuring these seasonal price variations would enable growers to take advantage of seasonal price movements. Growers would be able to include expected seasonal price movements as part of the planning process when making crop marketing decisions or reviewing marketing strategies.

Seasonal Index Calculation Method

The seasonal price index is a statistical tool often used to analyze seasonal price patterns. A price index expresses one price as a ratio of another price. A seasonal price index measures the price for a particular month relative to a selected base price. The base price usually represents an average price. Thus, the seasonal price index shows how a particular month's price deviates from the average.

Average monthly price data received at Portland, Oregon, for soft white wheat were collected for the period July 1976 through June 1992 (table 1). This series is used to compute the averages or base prices needed to calculate index numbers. These individual index numbers, called *specific seasonals*, measure the effect of seasonal forces on each month for each year. The specific seasonals can then be averaged to create a 15-year average index of seasonal price variation.

The average price chosen as the base for the specific seasonals should reflect the nature or characteristics of the crop being analyzed. For example, using a marketing year average price implies that the year's crop is entirely sold within that year. Since stocks of nonperishable crops like wheat are often carried over from 1 year to the next, the base used for the index should reflect this carryover. Using a *centered moving average* reflects that wheat sold during a given month includes the current harvest and stocks from preceeding harvests.

Changes in the moving average are due to long-term trends, production cycles, and random price fluctuations. Since seasonal fluctuations are smoothed out of the moving average, it can be a base to measure the effect of seasonality for each month (fig. 1).

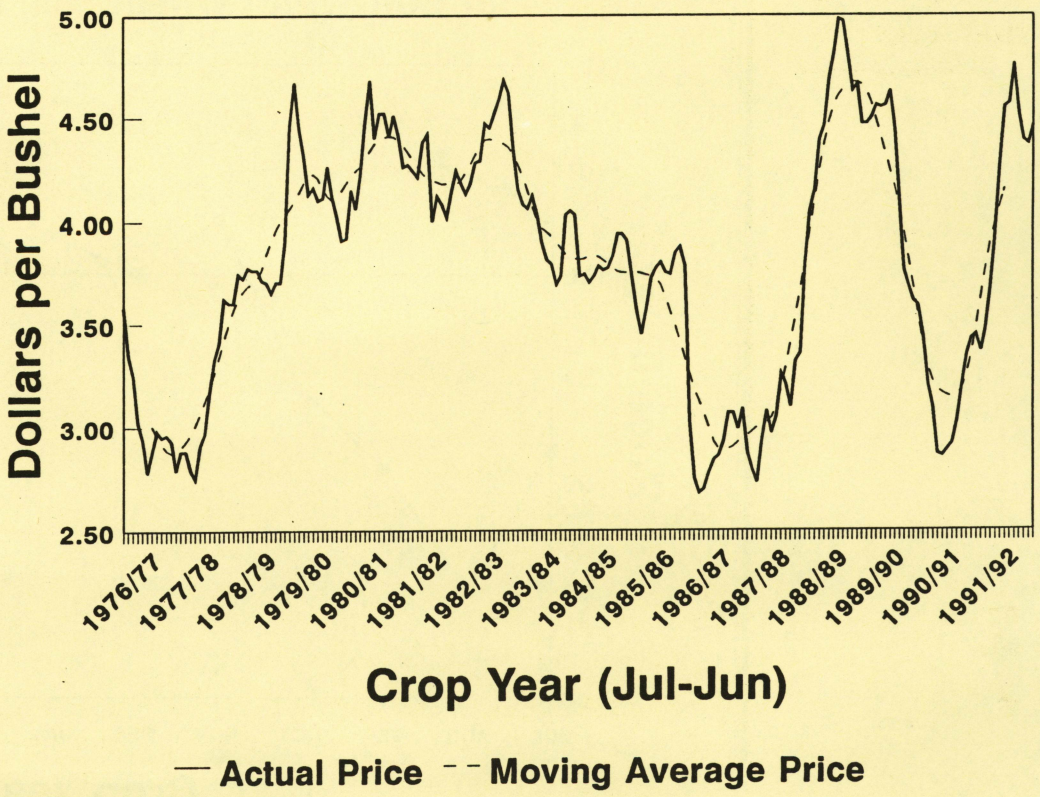
The Portland wheat cash price series presented in table 1 illustrates the computation of a centered moving average. Prices for the first 12 months (July through June of the 1976-1977 marketing year) are totaled. Since the center of the 12-month total is not associated with a specific month (that is, it falls between the sixth and the seventh months, December and January), a second 12-month total is

Table 1. Average monthly prices received at Portland, Oregon, for Pacific Northwest soft white wheat, 1976-92.

	Jul	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
1976-77	3.58	3.35	3.25	3.02	2.94	2.78	2.88	2.98	2.95	2.96	2.93	2.79
1977-78	2.88	2.88	2.79	2.75	2.91	2.97	3.17	3.33	3.41	3.62	3.60	3.60
1978-79	3.74	3.72	3.77	3.76	3.76	3.70	3.70	3.65	3.70	3.70	3.91	4.46
1979-80	4.67	4.45	4.31	4.13	4.16	4.10	4.11	4.26	4.12	4.02	3.91	3.92
1980-81	4.15	4.06	4.22	4.48	4.68	4.40	4.52	4.52	4.41	4.51	4.41	4.26
1981-82	4.27	4.24	4.21	4.38	4.42	4.00	4.12	4.08	4.02	4.14	4.24	4.18
1982-83	4.13	4.18	4.28	4.29	4.47	4.45	4.52	4.59	4.68	4.62	4.35	4.15
1983-84	4.08	4.06	4.12	4.03	3.90	3.81	3.79	3.69	3.73	4.03	4.05	4.03
1984-85	3.73	3.74	3.70	3.73	3.78	3.76	3.77	3.83	3.94	3.94	3.91	3.73
1985-86	3.57	3.45	3.57	3.72	3.77	3.80	3.75	3.74	3.85	3.88	3.78	3.03
1986-87	2.75	2.68	2.70	2.78	2.84	2.86	2.93	3.07	3.07	2.99	3.09	2.87
1987-88	2.79	2.73	2.94	3.08	2.97	3.05	3.26	3.21	3.10	3.32	3.36	3.79
1988-89	4.05	4.15	4.39	4.46	4.68	4.81	4.98	4.97	4.81	4.63	4.66	4.47
1989-90	4.47	4.50	4.56	4.55	4.56	4.63	4.44	4.11	3.76	3.68	3.61	3.59
1990-91	3.44	3.21	3.10	2.87	2.86	2.89	2.92	3.03	3.20	3.35	3.43	3.45
1991-92	3.37	3.48	3.67	3.91	4.28	4.55	4.57	4.76	4.52	4.39	4.37	4.46

Note: Monthly average prices for soft white wheat are published in Grain Market News, Pacific Northwest Weekly Edition, by Livestock and Grain Market News Branch, Livestock Division, U.S. Department of Agriculture, Portland, Oregon.

Fig. 1. Actual Price Versus the Moving Average Price for Soft White Wheat, 1977 to 1992.



computed. This second total consists of months two through thirteen (August 1976 through July 1977), and is centered between months seven and eight (January and February). These two 12-month totals are added and divided by 24, the number of months used in calculating both totals. This average is centered on the seventh month (January), and is used as the base for that month. This process of totaling monthly prices, centering the totals, and computing the average is tabulated for each month in table 1.

Specific seasonals for each month can now be computed as a percent of the actual price to the moving average. For example, the Portland price for January 1977 was $2.88 per bushel (table 1). The centered moving average computed for January 1977 was $3.01 per bushel. The specific seasonal is the ratio of $2.88 to $3.01 converted to a percentage (2.88/3.01 = 0.957 x 100 = 95.7%). This means that the price received in January 1977 was 4.3 percent lower than the moving average. The specific seasonals for soft white wheat from July 1976 through June 1992, are listed in table 2 (see page 7).

Once the specific seasonals are calculated for each month, a 15-year average *seasonal price index* is calculated (table 2). This average represents the seasonal variability in price that growers could

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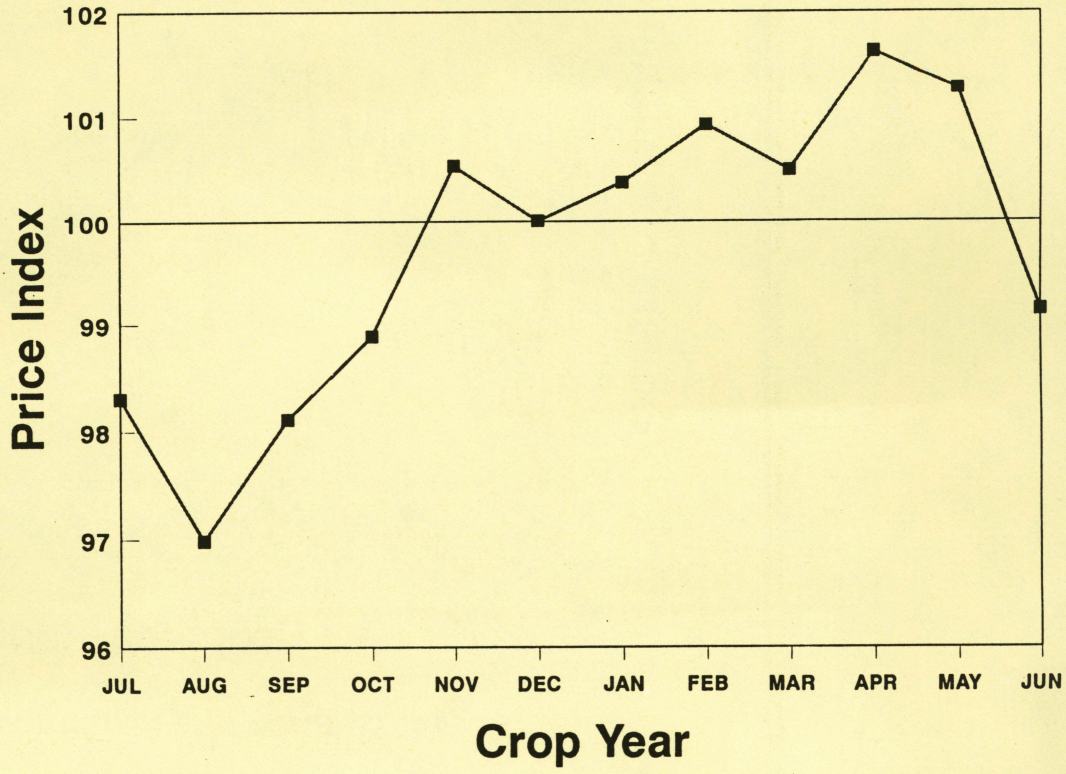
Fig. 2. Fifteen-Year Average Seasonal Price Index for Soft White Wheat.



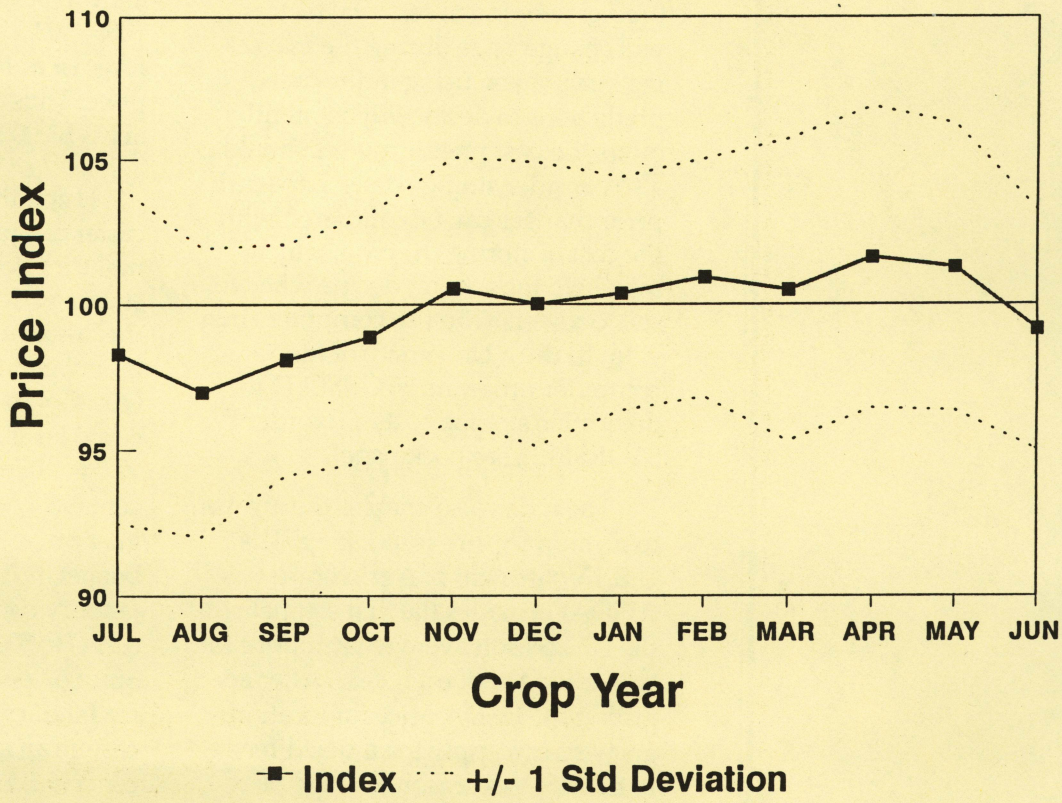
expect for that month. Index departure or deviation for any particular month from the average (the average is 100 percent) indicates the effect of seasonal variation on price for that month. Figure 2 graphs the index.

Seasonal Index

The seasonal index provides information growers may find useful. First, the difference between the highest and the lowest monthly index is 4.6 percent. This indicates that the effects of seasonal forces on Portland white wheat price can be expected to vary over a relatively narrow range. This implies that seasonal factors minimally impact soft white wheat prices during most years.

Standard deviations of the monthly seasonals provide a second important piece of information (bottom of table 2): they indicate how much the 15 specific seasonals vary around their average. For months with smaller standard deviations, the individual seasonals are closely bunched around the average. Larger standard deviations indicate wider ranges in the specific seasonals for that month. Statistical theory states that two-thirds (or 67 percent) of the specific seasonals are within a zone of one standard deviation on either side of the average (fig. 3). Smaller standard deviations

Fig. 3. Standard Deviation Zone Around the Seasonal Price Index for Soft White Wheat.



mean a narrower band or zone around the average.

The standard deviation can be used as an indicator of the index number's reliability. Smaller standard deviations suggest that the monthly average index number is a relatively reliable estimate. Larger standard deviations imply less reliability because of a wider spread in that month's data.

Using the Index

Growers can use the index to compare alternative strategies for marketing their wheat. In general, growers can expect the best prices during February, April, and May (fig. 2). July, August, and September typically have below normal seasonal prices. Although price conditions change from year to year, the price index suggests that soft white wheat price will peak during April.

"The index also enables the grower to do simple price forecasting."

Growers can also use the index to predict how much seasonal factors will change price during the marketing year. When using index-based predictions to decide which month offers the best price, growers should also consider storage costs. Expected price changes can be compared with the cost of storing the crop, which may help the grower decide when to sell. Growers who use computers may want to use a University of Idaho computer program, STORSELL, to determine storage costs. (To order STORSELL, see back page).

The index also enables the grower to do simple price forecasting. The U.S. Department of Agriculture (USDA) provides the first estimate of the U.S. season average farm price for wheat in May of each year. After adjusting the USDA price for location, growers can apply the index directly to the USDA's season average price forecast to develop a monthly price forecast for Portland. For example, assume the USDA estimate is $3.00 per bushel. Since the Portland price averages 55 cents more than the USDA average farm level price, the expected season average Portland price is $3.55 per bushel. Multiplying the $3.55 forecast by each monthly index (in decimal form) provides a price forecast for each month. Using the index numbers from table 2, the price forecast for July would be $3.50 per bushel ($3.55 x 0.983). The January price forecast would be $3.56 per bushel ($3.55 x 1.004).

Another forecasting method allows the grower to use the current price and the index to predict prices for future months. For example, assume the price for soft white wheat in August is $3.00 per bushel, and the grower wants to forecast the January price. The August price index is 97.0 and the January index is 100.4. Using a ratio of the August price index to the January index, the expected price change between August and January can be calculated 100.4/97.0 = 1.035 x 100 = 103.5. The price in January can be forecast at 103.5 percent of the August price. Thus, the forecasted price for January is $3.00 x 1.035 = $3.11 per bushel.

Using this same procedure, the forecaster can use the standard deviation to make a price zone forecast. Since the standard deviation for January is 4.0 and the January index is 100.4, the index zone is between 104.4 (100.4 + 4.0) and 96.4 (100.4 - 4.0). Thus, the January price could be as much as 107.6 percent (104.4/97.0 = 1.076 x 100) or as little as 99.4 percent (96.4/97.0 = 0.994 x 100) of the August price. Assuming a price of $3.00 per bushel in August, the price forecast for January could range from $2.98 (3.00 x 0.994) to $3.23 (3.00 x 1.076) per bushel. Since 67 percent of the specific seasonals for January fall within this zone, the forecaster can assume that there is a 67 percent chance that the forecasted price will also fall within this range.

Table 2. Specific seasonals for monthly variation in the price of Pacific Northwest soft white wheat, based on average monthly prices received at Portland, Oregon, 1976-92.

Crop Year	Month											
	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
1976-77							95.7	100.8	101.1	102.5	101.9	96.8
1977-78	99.3	98.4	94.2	91.4	95.0	95.0	99.2	102.0	102.0	105.7	102.8	100.9
1978-79	103.3	101.7	102.4	101.7	101.2	98.6	96.4	93.4	93.5	92.6	97.0	109.8
1979-80	114.0	107.5	103.1	98.1	98.5	97.6	98.8	103.4	100.5	97.8	94.3	93.7
1980-81	98.5	95.8	99.0	104.3	107.9	100.7	103.0	102.7	100.0	102.4	100.5	97.7
1981-82	98.6	98.7	98.8	103.6	105.1	95.4	98.4	97.7	96.2	99.1	101.5	99.6
1982-83	97.6	97.9	99.1	98.3	101.8	101.3	103.0	104.7	107.1	106.1	100.7	97.2
1983-84	96.9	98.0	101.3	100.7	98.3	96.5	96.5	94.6	96.4	104.9	106.0	105.6
1984-85	97.8	98.0	96.6	97.2	98.8	98.7	99.5	101.6	105.0	105.1	104.3	99.5
1985-86	95.2	92.1	95.5	99.7	101.3	103.0	103.4	105.1	110.3	113.6	113.3	93.0
1986-87	86.3	85.8	88.1	92.9	97.0	98.9	101.5	106.2	105.7	102.2	105.0	97.1
1987-88	93.7	91.1	97.8	102.0	97.5	98.5	102.3	97.3	90.7	93.9	91.7	99.5
1988-89	102.4	101.3	103.5	102.1	104.5	105.5	108.1	107.2	103.2	99.1	99.8	96.0
1989-90	96.6	98.5	101.6	103.3	105.5	109.2	106.7	101.1	95.2	96.3	98.1	101.5
1990-91	101.2	97.5	96.2	90.1	90.4	91.7	92.9	96.2	100.4	103.0	102.2	99.0
1991-92	93.0	92.5	94.3	98.0	105.1	109.6						
Average Index	98.3	97.0	98.1	98.9	100.5	100.0	100.4	100.9	100.5	101.6	101.3	99.1
Highest Value		101.6	(April)									
Lowest Value		97.0	(August)									
Range of Index		4.6										
Standard Deviation	5.8	5.0	4.0	4.3	4.5	4.9	4.0	4.1	5.2	5.2	4.9	4.1

Note: Major changes took place in the wheat industry in the early to mid-1970s because of expanding world markets and an increase in world trade. The market for wheat in the 1980s and 1990s is significantly different from the market for wheat before 1975. To keep the index consistent with these changed marketing conditions, 15 years was used as the length of time over which to average prices.

By using the index and the current price, the producer can predict what effect seasonal factors will have on the price of soft white wheat in any given month. It is important to remember this prediction is based solely on seasonal factors. Such a prediction assumes no significant changes occur in supply and demand conditions.

Conclusions

The seasonal price index provides information on price movements within a given marketing year and the effects of seasonal factors on price. It can help growers plan marketing strategies and take advantage of seasonal price fluctuations. Growers can use the index to determine the best month to sell, based on seasonal variation. The index can also be used to forecast price changes based on seasonal factors. Predictions from a seasonal price index account for seasonal price variations only, and cannot be used to precisely predict prices in a constantly changing market. However, the index gives useful information about Pacific Northwest soft white wheat prices. This information can help producers improve marketing strategies.

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