Using Weather Risk Tools To Protect Corn

Let's look at how weather risk management tools can help farmers protect revenue from a corn crop in the US.

From the early vegetative stage to the dough stage, drought can severely affect the development of water-dependent crops such as corn, and thus the profits derived from the crop after harvest. Although the extended hours of sunshine which normally accompany the lack of precipitation enhance photosynthesis and encourage the roots to grow downward in search of moist soil, extreme drought can cause plant nutrient stress and may cause serious yield loss. A weather derivative can be designed to provide financial compensation during such drought years.

Effects of drought on Ohio corn yield during growth*

Stage of Development	%Yield production
Early Vegetative	5-10
Tassel Emergence	10-25
Silk Emergence, Pollen Shedding	40-50
Blister	30-40
Dough	20-30

*After four consecutive days of visible leaf wilting source: Ohio Agronomy Guide, 1988

While the soil must provide corn plants with enough water to offset that lost through transpiration, excess precipitation can dramatically affect the yield and quality of the harvest. A weather derivative can provide financial compensation if excess precipitation causes flooding and ponding of the soil, which would restrict the amount of oxygen available to the root system, reduce nutrient uptake and possibly lead to nitrate leaching and an increase in disease incidence.

Although excess rainfall can be detrimental to plants, its effects are worsened when combined with warmer-than-average temperatures as biochemical processes are sped up. Warm water also contains less dissolved oxygen than cold water. In fact, temperature is the most influential climatic condition during the corn plant development phase.

Corn yield may be reduced by as much as 1.5 bushels per acre for each day the temperature reaches 95°F or higher during pollination and grain fill. Corn plants are less injured by high temperatures if there is adequate soil moisture, but a short drought could be enough to significantly diminish this vital water supply. Immature corn also can be severely affected when temperatures fall below 32°F, as loss of leaves caused by freeze damage will delay plant development and ultimately reduce yield.

Temperature Influence on Corn Crops

44°C	High-end adverse temperature
35 °C	Growth begins to decrease when temperature rises above this point.
25°C - 33°C	Optimal daylight temperature
17°C - 23°C	Optimal nighttime temperature
20°C - 22°C	Optimal average temperature throughout growing season
13°C	Optimal average air-temperature for spring planting
0°C	Low-end adverse temperature

How weather risk products can help mitigate financial loss – A Midwestern corn grower estimates a potential loss of $30,000 per day on days the temperature exceeds 95°F, and a potential loss of $20,000 per day when the temperature falls below freezing. During the period from April 15 through October 31, five days with an average temperature below freezing are expected, and three days with an average temperature above 95°F are expected.

If the corn grower uses a weather risk management product to offset that risk, here's how it might work: Over the specified period, if 5 days with an average temperature in excess of 95°F occur, and 7 days of below freezing temperatures occur, the grower will receive a total payment of $100,000 (5-3 x $30,000 + 7-5 x $20,000) excluding the premium. With weather exposure covered by a derivative, yield-related financial volatility can be significantly reduced. The earnings of the grower are then stabilized and minimum levels of financial income guaranteed before the crop is sold. Overall, profit forecasting will be more predictable and accurate, and the strengthened risk management portfolio, combined with more transparent accounts, will result in a lower cost of debt from financial institutions. With profit levels stabilized, and business management decisions can be made with greater confidence.