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Gambling with the Weather

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Raising a crop in Texas is a lot like playing poker. No matter how hard a farmer works or how much he knows about farming, he can still lose his shirt if his luck goes bad. The dealer deals prices, government regulations, surpluses competition, weather--and the farmer has no choice but to take what he is dealt.

Pick a card. Plunging temperatures destroy crops worth millions. Pick another. Plants wither and die for lack of rain. Pick again. Floods rip through fields. Again. Hailstorms smash crops to smithereens.

Odds are the farmer will not get a bad card every time, but his chances of drawing a few are very good in Texas.

Texas weather covers a wide range of extremes. Temperatures may plunge to minus 18 degrees in the High Plains and soar above the 110 degree mark in the Trans Pecos region. The average annual rainfall varies from below 8 inches in El Paso to almost 60 inches in Orange.

Several contrasting geological features influence Texas weather. Conditions in the Gulf of Mexico affect temperature and rainfall, not only along the coast, but throughout the state. Mountain ranges such as the Guadalupe, Chisos, Davis, Delaware and Chinati act as barriers to cold Arctic air which send temperatures plunging on one side of the mountains and leave them relatively unchanged on the other. These features and the interaction of the atmosphere with them contribute to the diversity in Texas' climate.

Weather results from variations in atmospheric temperature, pressure, wind and moisture. The latter three--pressure, wind and moisture--are all results of changes in temperature. As air is heated, primarily by contact with the warmer earth, it expands, becomes lighter and rises--a process known as convection.

Different types of surfaces absorb different amounts of heat from the sun. A dark, plowed field will absorb more heat than a grassy field. In the daytime, mountains absorb heat faster than adjacent valleys and lose it faster during the night. These differences in heating and cooling cause convection currents in the lower atmosphere which in turn create local winds and breezes.

On a much broader scale, large areas of atmospheric temperature are affected by continents and oceans. Massive bodies of air are formed by the warming or cooling effect of land and water. These vast bodies of air often cover hundreds of square miles and have fairly constant temperatures and moisture throughout a horizontal layer. They take days or weeks to form and move through the atmosphere determining weather thousands of miles from their conception.

Four types of air masses with conflicting characteristics invade Texas: maritime polar, continental polar, continental tropical and maritime tropical. These massive bodies of air have characteristics similar to the surface over which they are formed. Air masses forming over the Gulf of Mexico tend to be warm and humid while continental air masses forming over Canada or the Arctic are cold and dry.

Precipitation occurs when warm, moisture-laden air masses are forced upward and cooled. An air mass may be pushed up by another air mass or by a geographical barrier. When two air masses with differing temperatures collide, the dense cool air forces the warmer air to rise. If the water vapor is cooled below its dewpoint or more water vapor is added, rain will form. Geographical barriers such as mountain ranges also force warm air to rise where it is cooled by the atmosphere. These barriers are responsible for the relative abundance of evergreen vegetation in the Davis Mountains and its scarcity in the neighboring Trans-Pecos Region.

The boundary between two air masses is a "front." Fronts are characterized by an abrupt change in the weather such as a sudden plunge in temperature or a thunderstorm. The geographic position of Texas is a natural mixing bowl for conflicting air masses, and fronts are common occurrences throughout the state.

In addition to causing turbulent weather along their path, air masses can produce devastating results in an area where they normally do not reach. True continental Arctic air reaches Texas only occasionally, but its aftershock is often felt for months or years. Agricultural producers suffer severe economic losses, and consumers pay higher prices for food.

Late in December of 1983, a record-breaking freeze settled over Texas. Temperatures in the Dallas-Fort Worth area fell below freezing for a record 296 hours. Brownsville reported 20 degrees on December 25--the lowest recorded December temperature in 103 years. In addition to the longest cold snap in the state's history, Texans suffered a major hurricane and a drought in 1983. Even with hurricane-induced storms, most of the state received below average rainfall for the year.

Because the disastrous year was followed by an exceptionally dry spring, many agricultural producers either postponed planting or scrapped their production plans for 1984.

For the most part, farmers are at the mercy of the weather. They can do little to stop a flood or make it rain during a dry spell. They can't control the temperature or stop a hailstorm from ripping their crop to shreds. They can, however, become better managers if they follow the weather closely and take advantage of special forecasts and technical information which is available.

The Southwest Agricultural Weather Service Center (SAWSC) at Texas A&M University provides weather forecasts tailored to the agricultural producer in three states--Texas, Oklahoma and New Mexico. The advisories interpret past, present and predicted weather and relate its significance to agriculture. Periodically, the reports include 6-10 day forecasts and 30-day outlooks for the spring, summer, fall, and winter. The Center works closely with agricultural extension services in the three states which provide management advice for specific areas.

An extensive network of recording stations supplies soil temperature readings to the SAWSC. Because crops germinate between a specific temperature span, farmers can use the Center's 5-day soil temperature forecasts to make planting decisions. The observation stations also record evaporation rates, dew points and solar radiation data.

By recording daily soil temperatures, scientists can also determine the growth stage of a particular crop. With this information, scientists can use computer programs to determine the optimum time to apply mid season nitrogen.

"If a farmer applies fertilizer to his crop at the proper time, he will get a big increase in yield," Dr. Mickey Flynn says. Flynn is an agricultural meteorologist with the SAWSC. "Normally, growers would have to go out in the field and take samples to determine if their crop was ready to fertilize. Instead of going to all of that trouble, they can use temperature patterns to determine when to fertilize."

Meteorologists can also use temperature patterns for other types of prediction models such as pest management programs. Spraying for insects at the proper time can be critical, particularly if the insects emerge only for a brief period of time. Agricultural meteorologists at the Center work closely with extension entomologists to help farmers make better decisions about when to spray for insects. They have developed programs which analyze temperature patterns and predict when insects will emerge. Programs are now available for bollworms, tobacco bud worms, pecan nut casebearers and several others. In the future, scientists hope to expand these programs to include information on more insects detrimental to crops throughout the state.

"Our information goes primarily to radio stations." Flynn said. "Usually the forecasts are aimed at noon programs, but we do have an early morning forecast." In addition to radio, agricultural weather advisories are disseminated by television, wire services and the

National Oceanic and Atmospheric Administration (NOAA) radio and weather wire teletype service.

According to two independent studies, the avoidable agricultural weather losses in Texas each year total approximately six percent of the gross annual farm revenue. Even if SAWSC services are only 50 percent effective, Texas farmers can save between $100 and $200 million each year.

In March of 1978 for instance the Center advised growers in the Coastal Bend and Lower Rio Grande Valley to delay planting because of unseasonably cool soil temperatures. Farmers estimate they saved $5 to $10 million in replanting costs by following the Center's advice.

Although farmers have little control over Texas weather, they can manage their operations to minimize the risks by taking advantage of weather information which affects their crops. In the future, meteorologists hope to expand SAWSC services through computerization to provide more information which is targeted to smaller areas. As the Center's capabilities grow, farmers will have more information available to reduce the risk they take every time they plant a crop.