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Specialized Weather Information for Arkansas Agriculture

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SPECIALIZED WEATHER INFORMATION FOR ARKANSAS AGRICULTURE

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The advent of meteorology into the field of agriculture has been of fairly recent occurrence in the United States and even more recent in Arkansas. In the past, the link between agriculture and weather, if indeed there has been a link, has been between the climatologist and agriculturist, rather than between the meteorologist and the agriculturist. Even more discouraging was the tendency for the agriculturist to be his own meteorologist or climatologist, and to ascribe to so-called abnormal weather conditions aberrations in his data which may or may not have been weather induced. An even more serious shortcoming was the omission of such weather information entirely. This was perhaps inevitable, since the meteorologist or climatologist was almost always physically located at an airport station and not at the University or Experiment Station. This lack of communication is now being broken down by the assignment of Weather Bureau Agricultural Meteorologists to Universities and Agricultural Experiment Stations.

In the Weather Bureau itself, the fields of climatology and agricultural meteorology have unique, but often overlapping, interests in relation to their potential contributions to the field of agriculture. Long and sometimes heated discussions, on more or less a philosophical plane, have taken place between agricultural meteorologists and climatologists to try to define somewhat precisely the effective role of each in what they may contribute to agricultural technology. These discussions often generate more heat than light, but there has come to pass an understanding that each has a role to play in a study of the complex interrelationships that are present in a climatological-plant complex or a meteorological-plant complex. I think that climatology plays the lead in the broad definition or description of the environmental characteristics peculiar to certain plant or animal species, whereas the agricultural meteorologist will have to more specifically describe these climatic characteristics in meteorological terms as they apply to a particular crop or animal.

With increasing technology, the proliferation of specialists in all fields becomes almost overpowering, and the fields relating to weather and agriculture are no less prolific, ranging from bio-climatologists to bio-meteorologists to mico-climatologists to micro-meteorologists **ad infinitum.** With or without a specific definition of their roles, each has something to contribute to understanding some aspects of crop-weather relationships.

After these few introductory remarks, almost imperceptibly defining the limits within which we might work, I should describe briefly

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the organization of the Mid South Weather Project as it concerns Arkansas.

Historically, the most voracious user of specialized weather information has been the aviation industry. But in 1958, farm organizations and a few Congressmen sensed the value that such a specialized weather service might have for agriculture and funds were raised to begin a pilot weather project at Stoneville, Mississippi. After three years, during which time the service was well received by agricultural interests in Mississippi, the service was expanded to include NE Louisiana, West Tennessee, the Missouri Bootheel and eastern and southern Arkansas. In January, 1963, the service was further expanded to include the entire state of Arkansas.

The staffing of the Arkansas project consists of one individual. Basically, the service has four phases:

1) Specialized weather forecasts originate in a central forecast center at Memphis. In addition to the usual terminology in the body of the forecast, an agricultural advisory is added, which spells out the forecast in more precise terms, and gives drying conditions, percent sunshine, amounts and coverage of precipitation, wind direction and speed, dew intensity and duration and dew-point ranges.

2) Special weather reporting stations are added to the weather network during the growing season to give additional observations of air temperature, rainfall and soil temperature.

3) A special weather teletype network is available for radio and TV stations at a nominal monthly charge. Forecasts, climatological summaries, radar reports, agricultural weather advisories, soil temperature forecasts, harvest weather forecasts, hourly weather and other items pertinent to agricultural interests are immediately available to these subscribers for dissemination to users in the area. This type of mass dissemination of weather information is a vital link in the servce between the meteorologist and the user . . . in this case the cotton planter, the soybean and rice producer, the orchardist, the vegetable producer, the broiler and cattle industry.

4) The initiation of technical studies to investigate plant-weather relationships. Of necessity, these studies must primarily be slanted toward attempting to solve, or partially solve, practical economic problems that beset the individual grower. They are essentially applied, rather than basic in nature.

During its short and often rigorous life, a plant is constantly exposed to a changing environment. The change is as much induced by the growth of the plant itself as by day to day changes in meteorological conditions. The emerging seedling, unprotected from direct insolation from the sun, is exposed to a harsh combination of weather elements. Heavy rainshowers may pack and seal the soil so that the seedling has difficulty emerging initially. Surface soil temperatures on a clear warm day may rise to 125° F. and fall to 50° F. during the night. Severe weather, common during the spring months, may spawn hail and high winds to further damage the emerging seedling. As the season progresses and the plant grows, it is subject to the same violent weather types, but the growth also results in modifications in temperature and humidity within the plant canopy itself. The effective radiating surface shifts from the soil surface to the top of the canopy. Shading within the canopy, plus proximity to a moist soil surface, will cause the maximum temperature to shift from the soil surface to the top of the canopy, with an actual temperature "inversion" resulting within the canopy. This resulting stable condition may have important implications in such diverse events as the resultant dispersion of an insecticide spray or the dissemination and transport of spores within the plant canopy. Differences of as much as 20° F. were noted in 1963 at the six-inch level between irrigated and non-irrigated soybeans. Humidity differences in excess of 40% were noted between the same levels on a hot, sunny day in August. It is difficult to imagine that such divergent temperature and humidity regimes do not effect quite profound changes in insect behavior or micro-organism responses, and, indeed, physiological responses in the plant itself.

The contributions which meteorology can make to agricultural technology are broadly twofold:

1) The operational implications of the short range forecasts are of paramount importance. This is where the Agricultural forecaster at Memphis comes into the picture. The day-to-day decisions on spraying, the application of defoliants or planning haying operations can be seasoned and weighed with the forecast in mind. I should say here, the "latest" forecast in mind. Nothing is as perishable as a forecast, and if the planter uses the 4 a.m. forecast instead of the available 10 a.m. forecast, he is discarding the latest thinking on the current weather situation, and biasing his decision on obsolete information. The responsibility for the improvement of the short-range and the five-day forecast is in the realm of the dynamic and synoptic meteorologist and is out of our hands. Researchers at the General Circulations Laboratory at Washington are attacking this problem using computer and mathematical techniques.

2) The second realm, and the one which is often less appreciated, is that in which the agricultural meteorologist tries to detect the major contributor, in a series of complex weather-plant relationships, to a certain end result in the plant. These first clues may well result in an empirical solution and may be concerned with isolating parameters which are **not** controlling the end result. He can then focus his attention on the elements most pertinent to the problem at hand. Field studies on cotton, soybeans and rice have been, or will be initiated and it is anticipated that these studies will result in practical applications.

The phrase "team effort" or "team approach" possibly has been over-worked recently, but that is essentially what is needed to partially solve, or at least to gain some insight into the complex factors which go to make up the end product of yield or quality that is desired. Such an effort has been a long time coming in really bringing agriculture and weather together, but at least now some halting steps have been taken in that direction.