A STUDY OF "FROST-DAMAGED" WHEAT IN OKLAHOMA

EARLY in April of 1952 a series of rapid weather changes caused marked structural changes in wheat plants, which were in the boot to heading stage. For a time it was feared that the crop might be greatly reduced, but it subsequently recovered to such an extent that Oklahoma went on to produce a bumper wheat crop of 107,115,000 bushels, the largest in its history.

During the first 3 days of April, maximum temperatures ranged from the high 60's to the middle 80's with daily minimum temperatures in the high 20's to lower 60's. During the next 3 days, there was a slight general drop in temperature. On April 7 there was a sharp rise in the maximum temperatures, followed by readings as high as 96 degrees on April 9. Most weather stations reported temperatures in the high 70's to high 90's in this period (table 1). On April 10, the temperature dropped sharply to a low of 15°F at Beaver in the Oklahoma Panhandle and to the middle 20's to low 30's in most other sections of northern and western Oklahoma. Apparently, the unusually high temperatures, followed by the sudden and sharp drop in temperature accounted for the changes in the wheat plants.

The crop was in an advanced stage of development at the time of the freeze, and thus was not in the best condition to cope with adverse weather. Early varieties were heading and later varieties were in the boot at this time. The much-publicized "freeze-damage" to the 1952 wheat crop followed.

Sites and Varieties Under Observation

The writers surveyed a portion of the affected areas of Oklahoma to obtain a clearer understanding of the results of the unusual temperature fluctuations. This survey encompassed an area from Stillwater and Okeene on the South, Ponca City on the East, Burlington Flats (north of Cherokee) on the North, and Woodward Field Station on the West. Within these boundaries lies the heart of Oklahoma’s hard red winter wheat producing land.

Gross Field Observations

Where injury clearly existed, for example, in the Chero-kee area, some fields had 5% and others up to 50% damaged stems 1 month after the "freeze" date. In the same area it was difficult to find any early-stem injury.

In another section of the surveyed area checks were made on selected fields, there were broken-over stems on the initial observation date. On the second visit (May 29) 10% of broken-over stems were observed, leading to fear that the crop might be greatly reduced, but it was not. On the third visit (June 5) no increase in observable damage was found. The crop went on to produce large yields which contributed to the 107,115,000 bushel crop in Oklahoma.

Structural Changes in "Frost-Damaged" Wheat

The "freeze" resulted in several striking changes occurring in the affected plants: (1) Many secondary tillers were produced in some of the wheat varieties, (2) heads were partially sterilized and, (3) slight to severe damage was done to stems.

Production of secondary tillers.—At the time of the "freeze," some early varieties and hybrids showed extensive production of secondary tillers. As a result, the heads varied widely in length and in stage of maturity. For a given plant, part of the tillers might be at an advanced stage of maturity straw and kernels when one-half or more of the stems were still green and very short. In some cases, the entire tiller did not exceed 3 to 4 inches in length.

Head injury.—This type of injury was rare. In many fields observed during our several surveys, however, the injury was similar to that reported by Gregory and Beeson (1) for Indiana and Livingston and Swinbank (2) and Livingston (3) in Nebraska. The part of the head might show sterility. Also, as shown in figure 1, as the dome of the head was not completely emerged, the head was quite dense and deformed.

Stem injury.—The most characteristic damage observed in Oklahoma was that on the stems. Most stem areas were covered by the sheaths and reached from the first to the fourth nodes. The first observation in stem structure was a change from a bright opaque condition. Healthy parts of the stem, when held up to the light, whereas the injured parts were dull and nearly opaque. Either as an expression of exposure to the rapidly altered temperature, or in an advanced stage of the initial injury, large portions of the stem were seen to be involved. All or part of the stem between 2 or more joints might be affected. Cases either due to the weight of the head and unaffected stem areas were covered by the sheaths and extended from the first to the fourth nodes. The first observed modification in stem structure was a change from a bright opaque condition. Healthy parts of the stem, when held up to the light, whereas the injured parts were dull and nearly opaque. Either as an expression of more than late-seeded or later-maturing varieties. Early-seeded varieties seemed to be more heavily damaged than late-seeded or later-maturing varieties.

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