

Soil temperature key to crop survival

We are slowly warming up from the record breaking low temperatures of early February. Although it is too early to assess the damage on many crops, reports on damage to different crops are appearing in news reports. The growing tip or crown of most winter crops, including winter wheat, is below soil surface. In northern latitudes, where sub-zero temperatures occur every year, winter survival of crops doesn't depend on how cold the air temperature was but on whether the soil had a snow insulation to keep soil less cold. Therefore, soil temperature plays an important role in winter survival winter crops.

Over the period, a range of tillage practices of different intensities has evolved. Conventional deep tillage is slowly leading into reduced tillage practices. No-till is a practice of directly planting into stubble of the previous crop with benefits like reduced wind erosion, soil moisture evaporation and sand blasting injury to seedlings. However, soil compaction, which is a major concern in the animal dominated agriculture in the region, is limiting adoption of no-till here.

In the relatively newer strip till practice, farmers till a narrow strip of 5-7 inches wide and 6-8 inches deep and typically apply fertilizer at the same time at the bottom of the furrow. Thus, strip till is a no-till variation that leaves

about 80 percent of the soil undisturbed and may integrate benefits of both no-till and conventional tillage for better crop production.

Combining tillage with stubble management offers additional benefits. Typical stubble in no-till is short and most of the crop residue lays flat on the ground. If taller standing stubble is left in the field with very little flat stubble on the ground, it will alter energy dynamics and create a favorable microclimate for crops, while conserving water by trapping snow, increasing ponding time, and reducing evaporation. Height and number of stems per unit area influence the effectiveness of tall standing stubble management.

Our question at the Agricultural Science Center at Clovis was how conventional tillage, strip tillage with short stubble (6 inches), no-till with short stubble, and no-till with tall stubble (12 inches) influenced soil temperatures at 2- and 12-inch depths. Stubble height treatments were created by harvesting

grain sorghum at different heights. Sensors were installed in December 2010 to monitor soil moisture and temperature at 15-minute intervals. At the 2-inch depth, soil temperatures during the cold spell were below freezing with all four treatments. However, no-till tall stubble maintained the warmest temperature of about 22° F and strip till with short stubble had the lowest temperature of 12° F with others in between. Reduced wind and more snow trapped might have helped soil under tall stubble stay warmer. At the 12-inch depth, temperature fluctuation was smaller and the lowest temperature (28° F) was observed under strip till with short stubble. The tall stubble treatment was the only treatment with above freezing temperature at this depth. Keep in mind that there is always a time lag and coldest soil temperatures are not always recorded on the day we experience coldest days above ground. This suggests that tillage and stubble management may have an effect on freeze damage on our crops.

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