How are warm and dry conditions affecting wheat and corn development?

Conditions have been dry throughout May for much of Manitoba, and the beginning of June is forecasting above average temperatures with little precipitation. Since crop production is maximized with adequate levels of precipitation and moderate temperatures, the lack of rainfall and hot temperatures are worrying. Drought stressed cereals will move through crop development stages faster than those not experiencing drought stress. Heading may be earlier than usual due to a shorter vegetative phase.

Impact of Heat and Drought Stress

In seedlings water usage is relatively low due to limited leaf area and low rates of evapotranspiration. However, young plans do not have well developed root systems and cannot extract water available deeper in the profile. When a young crop does not have enough water, the first response is to conserve what water there is by closing its stomata, which stops growth. Hot and dry conditions may also cause wilting, which reduces the plants ability to photosynthesize and can negatively impact yield.

When a crop is experiencing any kind of stress the first thing to consider is which yield component is most actively developing at the time of stress (See Table 1). This will determine what kind of impact the stress will have on a plant. In spring cereals, drought stress early in the season can result in fewer tillers as the tiller buds may remain dormant, while drought stress at anthesis results in fewer, lighter kernels. Heat and water stress can also reduce the size of the spikes that develop and may result in the loss of established tillers. A study conducted to evaluate the effects of nitrogen, temperature, growth stage, and duration of moisture stress on yield of spring wheat found that temperature was the most important factor affecting yield and protein, and moisture stress was least important (Campbell, et al. 1981). Optimal temperature for spikelet development was found to be near 22^{o}C (Campbell, et al. 1981).

The yield components of corn are fixed later in the season compared to spring cereals, making corn less susceptible to yield loss from water stress during the vegetative stage than wheat (Ransom 2012). In both spring cereals and corn, the development of adventitious roots can be impacted by dry soil conditions, which will negatively impact the crops ability to access water and nutrients. In corn, this can result in floppy or rootless corn.

Table 1. Yield components of wheat and corn most affected by environmental stress at various growth stages.

Wheat			Corn	
Growth Stage	**Yield Component**		**Growth Stage**	**Yield Component**
Emergence and Tillering	Tillers per plant		V5-7	Number of kernel rows
Late tillering to early flowering	Spike survival per plant		V9-VT	Number of potential kernels per row
Stem elongation to boot	Number of spikelets per spike		VT-R1	Number of potential kernels that are fertilized
Mid stem elongation to early dough	Number of kernels per spikelet		R2-R3	Kernel number to be filled. Stress at R2 and R3 can cause fertilized kernels to be aborted.
Milk to maturity	Kernel size		R4-R5	Kernel size

Sources: Slafer and Rawson (1994) and Ohio State University Extension

Reseeding Decisions

Crops that were seeded into adequate moisture are reporting good emergence, while in some areas a lack of timely rains have resulted in lower than optimal plant stands. An optimal plant stand for spring wheat is 23-28 plants/ft^2, in some areas there are reports of much lower plant stands due to dry soil conditions. Cereals are able to compensate for low plant stands with increased tillering, and research conducted at the Crop Diversification Centres in 2018 and 2019 found that spring wheat, barley, and oats had relatively stable yields over plant populations ranging from 15-39 plants/ft^2.

In the first week of June a reseeding decision should take into account the plant stand of the crop, moisture available for germination and emergence, and yield potential of the crop at the late seeding date. Spring wheat, barley, and oat seeded in the first week of June had an average relative yield of 71%, 64%, and 76%, respectively, compared to the same crops planted in the first week of May (Figure 1). Corn yields for June planting dates are not reported due to limited data.

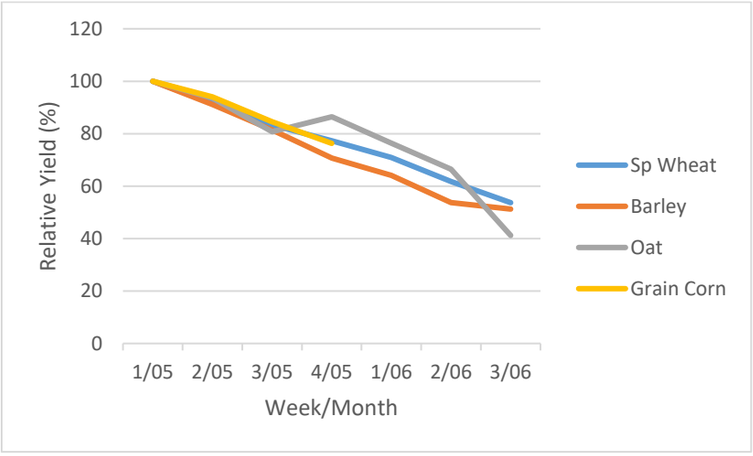

Figure 1. Average relative yields reported to MASC during each sowing week for spring wheat, barley, oat, and grain corn grown in Manitoba for the period of 2010-2019. Data source: Manitoba Agricultural Services Corporation Seeded Acreage Report.

References

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