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Will Longer Growing Seasons Increase Crop Productivity?

As I have previously written about, our grain prices are a hot topic of discussion. Every farmer wants to make as much profit as possible. Dr. Dennis Egli, UK Professor Emeritus, discusses productivity and growing seasons.

The growing season is usually defined as the days from the last freeze (32°F) in the spring to the first freeze (32°F) in the fall. Since climate change is increasing air temperature, the growing season is getting longer. The increase in length is a result of both the last freeze in the spring occurring earlier and the first freeze in the fall occurring later.

Does a longer growing season increase crop productivity? A longer growing season increases the time available for crop growth and the solar radiation available when temperatures are suitable for crop growth. With those increases, one would think that crop yields might go up – right? Unfortunately, it is not that simple.

Yield is directly related to the length of the growing season if yield is the total above-ground plant (forages for example). The longer the crop grows, the higher the yield, so longer growing seasons could increase productivity of these crops.

The time–yield relationship in grain crops is more complicated. Grain crops start growing vegetatively, then they flower and shift to reproductive growth when seeds form and grow to their mature size. Yield is essentially zero at the beginning of the seed-filling

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period; all of the yield is produced during seed filling. The events (vegetative growth, flowering and seed set) prior to seed filling are important, but they are only preliminary to the main event.

There is variation in the length of the total growth cycle (vegetative and reproductive growth) within and among grain crop species. A recent survey of literature identified soybean varieties that took from 86 to 144 days to reach maturity. Corn showed similar variation (78 to 149 days).

Longer-duration grain crop varieties utilize more of the longer growing seasons, but they do not necessarily produce higher yield. Yield will increase only if the seed-filling period (when yield is produced) increases in step with the total growth period.

Selecting varieties with longer total growth durations will increase the seed-filling period and yield only until the total growth duration reaches 100 to 110 days. The seed-filling period then stays the same as the total growth duration increases to a maximum. A variety that matures in 144 days will have the same seed-filling period and yield as one that matures in 110 days, but it will have a longer vegetative growth period. The extra vegetative tissue produced by the late-maturing variety will not necessarily contribute to higher yield.

Growing a full-season variety will use more of the growing season and produce more vegetation but it will not necessarily convert the extra time (and extra solar radiation) into higher yield. The full-season variety will spend the same amount of time producing yield (i.e., growing the seeds) as an earlier variety. Grain crops are just not very efficient at converting time into yield.

If yield was directly related to the total growth duration, yields should increase from North to South across the Corn Belt as the growing season increases. Varieties grown in the South have longer durations than those in the North, but yields are not higher, even in irrigated fields. The longer-season varieties cannot convert the extra time into yield.

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One way to use the extra potential productivity provided by a longer growing season is with double cropping. Growing two crops in one year (two seed-filling periods in one year) uses more of the potential productivity. Growing soybean after a winter wheat crop increases the total yield per year, but it is only possible when the growing season is long enough to accommodate the second crop. Double or triple cropping is especially important in the tropics where the growing season is 365 days long. The higher temperatures associated with climate change will probably move double cropping north in the US.

The warming associated with climate change will no doubt continue to produce longer growing seasons. Unfortunately, the only way to capitalize on this change in potential productivity is through double cropping. Growing varieties that take longer to mature will use more of the growing season, but they will not necessarily produce higher yields.

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