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Agronomy Advice

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Mid- and Late-Season Yield Enhancing Management Practices for Corn

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The 2008 corn production and marketing season is unique. On one hand, it is the most expensive corn crop ever planted, and on the other, it has the potential to be the most profitable due to strong market price. If input costs continue to increase, profit margin will be back to previous years, except with more risk.

So for this year, we have strong prices relative to input costs, thus any production increase can be more easily paid for. Corn growers have been asking whether there are any mid- and late-season yield enhancing management practices that can be applied.

Recommended practices versus Trends

To begin this discussion we have to be careful about practices that can be recommended versus practices that intuitively may trend to greater yields, but are not statistically significant and thus cannot be recommended. These trends produce responses too small to be statistically significant.

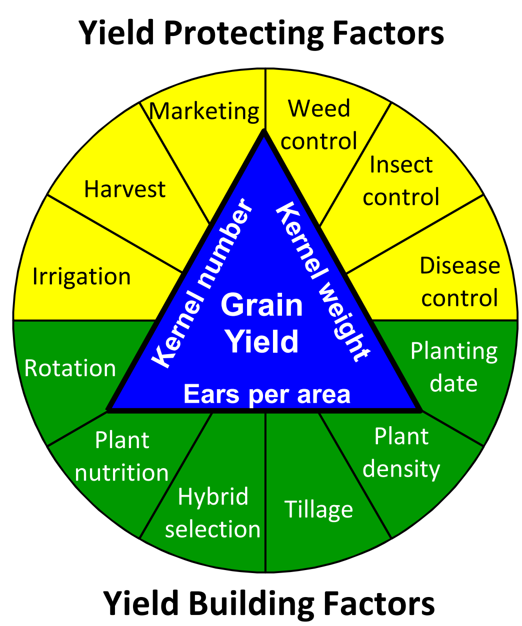
In agronomic research it is very difficult to detect treatment differences less than 5%. So in a 200 bu/A yield environment, that means at least 10 bu/A is required before statistical differences can be detected. What about trends less than 10 bu/A? At today's prices a difference of even 5 bu/A can pay for many inputs. Is there any guarantee that a trend will make a difference on your farm?

Past experience

In the 1980's, European farmers spurred on by government subsidies attempted to maximize grain yield. Numerous pre- and planting-season practices were recommended such as hybrid/variety selection, seed treatments, crop rotation, soil testing and fertilizer application, N stabilizers, tillage, and pest control. Mid- and late-season production practices included:

- Irrigation
- Split-applications of N
- Foliar fungicides
- Scouting
- Plant growth regulators
- Chelated micronutrients
- Tramlines
- Early harvest to prevent ear droppage

Each management practice decision interacts with other practices, but the overall goal was to maximize yield due to the economic climate. Even small yield changes could be paid for through government subsidies. Eventually subsidies were removed and "Maximum Economic Yield" concepts were developed.



Major management objectives for enhancing corn yield

Corn grain yield consists of the components:

1. Ear density,
2. Kernel number per ear (row number x kernels per row), and
3. Kernel weight.

These yield components are determined at different times during the life cycle of a corn plant. Once corn is midway in development (R1 – Silking) the potential number of ears and kernels is determined. At this stage the major management objectives are to:

1. Promote kernel set and grain filling by preventing stress during pollination and embryo cell division (VT-R2)
2. Protect leaves, the photosynthetic factory for kernel filling (ear leaf and upper leaves)

Irrigation

Water stress around flowering and pollination delays silking, reduces silk elongation, and inhibits embryo development after pollination. Moisture stress during this time reduces corn grain yield 3-8% for each day of stress (Table 1). Moisture or heat stress interferes with synchronization between pollen shed and silk emergence. Drought stress may delay silk emergence until pollen shed is nearly or completely finished. During periods of high temperatures, low relative humidity, and inadequate soil moisture level, exposed silks may desiccate and become non-receptive to pollen germination.

Table 1. Estimated corn evapotranspiration and yield loss per stress day during various stages of growth.

Growth stage	Evapotranspiration	Percent yield loss per day of stress (min-ave-max)
	inches per day	%
16 leaf to tasseling	0.33	2.5 - 3.2 - 4.0
Pollination (R1)	0.33	3.0 - 6.8 - 8.0
Blister (R2)	0.33	3.0 - 4.2 - 6.0
Milk (R3)	0.26	3.0 - 4.2 - 5.8
Dough (R4)	0.26	3.0 - 4.0 - 5.0
Dent (R5)	0.26	2.5 - 3.0 - 4.0
Maturity (R6)	0.23	0.0

derived from Rhoads and Bennett (1990) and Shaw (1988)

Water stress during grain-filling increases leaf dying, shortens the grain-filling period, increases lodging and lowers kernel weight. Water stress during grain-filling reduces yield 2.5 to 5.8% with each day of stress (Table 4). Kernels are most susceptible to abortion during the first 2 weeks following pollination, particularly kernels near the tip of the ear. Tip kernels are generally last to be fertilized, less vigorous than the rest, and are most susceptible to abortion. Once kernels have reached the dough stage of development, further yield losses will occur mainly from reductions in kernel dry weight accumulation.

Severe drought stress that continues into the early stages of kernel development (blister and milk stages) can easily abort developing kernels. Severe stress during dough and dent stages of grain fill decreases grain yield primarily due to decreased kernel weights and is often caused by premature black layer formation in the kernels. Once grain has reached physiological maturity, stress will have no further physiological effect on final yield (Table 1).

Premature death of leaves results in yield losses because the photosynthetic 'factory' output is greatly reduced. The plant may remobilize stored carbohydrates from the leaves or stalk tissue to the developing ears, but yield potential will still be lost. Death of all plant tissue prevents any further remobilization of stored carbohydrates to the developing ear. Whole plant death that occurs before normal black layer formation will cause premature black layer development, resulting in incomplete grain fill and lightweight, chaffy grain. Grain moisture will be greater than 35%, requiring substantial field drydown before harvest.

Split-applications of N

The seasonal pattern of nutrient uptake in corn is similar to that of dry matter accumulation. A nutrient supplied to the plant when rapidly growing is the most effective way to utilize nutrients. By VT, about 65% of the nitrogen has been taken up by the plant, so N application at this time can be of benefit and contribute to yield. Nitrogen is translocated from vegetative plant parts to the developing grain later in the season. This translocation can result in nutrient deficiencies in the leaves unless adequate nutrients are available to the plant during that period.

Foliar fungicides

In general, a fungicide application is not recommended on **resistant** hybrids. On **susceptible** hybrids, a fungicide application may be warranted if disease is present on the third leaf below the ear leaf or higher on 50 percent of the plants at tasseling. With **intermediate** hybrids, a fungicide need only be applied if conditions are favorable for disease development. Spray if disease is present on the third leaf below the ear leaf or higher on 50 percent of the plants at tasseling, and the weather is warm and humid, and the field has a history of Gray Leaf Spot and/or Anthracnose, and >35 percent corn residue is present.

Previous decisions: Will they come back to haunt you?