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The Silver Bullet for Yield

The following was written by Dr. Dennis Egli UK Professor Emeritus in the UK Department of Plant and Soil Sciences.

This is the time of the year when contest-winning corn and soybean yields are announced. Some of the winners set records for the highest yield ever – yields that can be as much as 3 or 4 times the average U.S. yield. Yields that high suggest the silver bullet syndrome – what single management practice was responsible for that extraordinary yield? The unspoken idea behind the silver bullet syndrome is - if we can identify a silver bullet, we can increase everyone's yield.

The production of yield by a crop community, such as a field of corn or soybean is complex, starting with all the cycles, reactions, and processes responsible for plant growth. The system requires a supply of raw materials (mineral nutrients, water, and carbon dioxide), solar radiation to provide the energy to run the system, and the appropriate temperatures. Yield, then, is the integration of this system over the 100 to 120 or more days the crop takes to reach maturity. Identifying one aspect of this system, a silver bullet, which can be manipulated to increase yield dramatically is not easy.

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Historical yield growth of corn and soybean was a result of genetic improvement (better varieties or hybrids) and improvement in crop management. Genetics removed negative plant characteristics such as a tendency to shatter and lodge or disease susceptibility, and improved the plant's inherent productivity. Management improved the crop's environment by controlling weeds, fertilizing, irrigating to avoid drought stress, manipulating planting dates, row spacing, and plant population, and controlling disease and insect infestations. These activities remove negative aspects from the crop's environment, pushing it closer to the perfect environment that will maximize yield. However, the closer the crop is to the perfect environment, the less room there is for improvement.

These improvements resulted in a steady increase in corn and soybean yields in the US of 1.9 and 0.5 bu/acre/year, respectively, based on trend lines from 1980 to 2023. These steady improvements don't provide much support for a role for a silver bullet – a single change that drastically increased yield.

We have a good idea of what it takes to produce high yields. High yield starts with the latest variety that has high-yield potential, good agronomic characteristics, and broad-spectrum disease and nematode resistance. Growing this variety in fertile soil with high water holding capacity using recommended management practices such as planting dates, populations, and row spacings. Fertility levels, good weed, disease, and insect control provide the foundation for high yields. Unfortunately, weather conditions and the water supply have the final say, and they cannot be manipulated unless irrigation is available. These management practices have evolved over many years and are the result of detailed field experimentation, testing, and verifying individual practices in many environments.

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It is worth noting that there are probably greater opportunities to improve the efficiency of these systems than to increase yield. Principally because of new technologies – precision agriculture, see and spray systems, drones, remote sensing, etc. Efficiency doesn't necessarily increase yield, but it can improve the all-important bottom line.

Chasing the silver bullet can distract producers from the use of tried-and-true best management practices known to provide high-yield potential. It can lead to excess and unnecessary fertilizer or pesticide applications that not only reduce profits but can contribute to pollution that may ultimately lead to unwanted governmental regulation. Overuse of pesticides may encourage the development of resistance that reduces their effectiveness.

In my opinion, the search for a silver bullet that will lead to a much higher yield is futile. It is worse than futile if it distracts producers from applying best management practices. If a silver bullet is found, it will be more likely to come from careful, detailed laboratory and field research than from haphazard trial and error efforts in farmer's fields. Producers will be better off focusing on applying well-understood best management practices as efficiently as possible to improve their bottom line and keep their bankers happy.

Upcoming Event: there will be a Tobacco Production and GAP Meeting on Wednesday, February 7, 2024, beginning at 6:00 pm at the Daviess County Cooperative Extension Office.

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