Lexar® EZ Lumax® EZ

Protecting Yields with Superior Weed Control Solutions

Based on Dr. Swanton's research, any weed present in the field when the corn plant emerges has potential to cause significant, permanent yield damage. Therefore, early-season weed control with an effective pre-emergence herbicide is a vital part of yield protection.

As the number of growers choosing glyphosate-tolerant corn hybrids increases, it is important to remember glyphosate alone does not protect yield. The highest-yielding, most agronomically sound herbicide program for glyphosate-tolerant corn is either a two-pass program of:

- Lexar® EZ or Lumax® EZ herbicide followed by Halex® GT herbicide tank mixed with atrazine (AAtrex® 4L or AAtrex Nine-O® herbicides)*. If atrazine cannot be used, add a dicamba product (e.g. NorthStar® herbicide).
- Lexar EZ or Lumax EZ followed by Touchdown Total® herbicide tank mixed with Callisto® Xtra* herbicide
- Lexar EZ or Lumax EZ followed by Callisto GT plus atrazine*

*This combination can be applied up to 12-inch corn.

A pre-emergence application of Lumax EZ or Lexar EZ will significantly reduce weed populations throughout the growing season because of the highly effective residual control they deliver. If a post-emergence application of Halex GT, Touchdown Total or a Callisto brand herbicide is necessary, Lumax EZ or Lexar EZ widens the window for the application, allowing growers greater flexibility.

About the Researcher

Clarence J. Swanton, Ph.D.
Professor of Weed Science, Department of Plant Agriculture
University of Guelph, Ontario, Canada

Since 1985, Dr. Clarence Swanton has been a distinguished member of the faculty at the University of Guelph in Ontario. He first joined the university as an assistant professor of weed science and then was promoted to professor in 1996. His achievements at the university have included serving as the first chair of the Department of Plant Agriculture from 1998 to 2004, publishing 144 papers and three book chapters, and co-authoring *Weed Ecology in Natural and Agricultural Systems*.

His latest research focuses on the development of integrated weed management systems for field and horticultural crops. Selected areas of study have included weed and crop modeling, weed biology and ecology, economics of weed management, and managing weeds with herbicides.

The Weed Science Society of America (WSSA) has recognized his work through such prestigious awards as the 2006 Paper of the Year, the 2005 Fellow Award and the 2002 Outstanding Researcher Award. He also was elected a Fellow of the Canadian Society of Agronomy in 2002.

Dr. Swanton obtained his bachelor's degree in botany from the University of Toronto, his master's degree in agrometerology from the University of Guelph, and his doctorate in plant ecology from the University of Western Ontario.

Optimum Yield Protection in Corn

Begins at emergence...

syngenta®

For more information, visit CallistoPlantTechnology.com, FarmAssist.com or contact the Syngenta Customer Center at 1-866-SYNGENT(A) (796-4368).

GS 404.30002 (1/14) SLC 3692C 01-2014

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Research Revolutionizes the Importance of Early-Season Weed Management

As the demand for corn continues to rise, growers and others in the agricultural industry are constantly looking for ways to address these growing needs. One important way to meet this demand is to optimize corn yields through effective herbicide treatments. The performance of a corn hybrid is heavily determined by when weeds are eliminated. The earlier in the season weeds are removed, the more likely corn will reach its ultimate yield potential. Early-season weed management, along with season-long weed management, is essential to protecting the crop and capturing the highest value per acre at harvest.

A critical step toward yield protection is effective weed management that begins early enough in the season to prevent economic yield loss. Most research in the past has focused on the impact weeds present in the field after corn emergence have on yield. It is well documented that weeds exceeding two inches in height will compete with the corn plant for essential resources it needs to grow. However, research has discovered that competition for resources is not the only explanation for early-season yield loss.

Dr. Clarence Swanton, professor in the Department of Plant Agriculture at the University of Guelph in Ontario, has conducted cutting-edge research that addresses the impact of early-season weeds on yield. As one of the world's foremost authorities on integrated weed management systems, Dr. Swanton is unlocking the mystery of yield protection in corn and providing the agricultural industry a revolutionary way to examine early-season weed management.

Expanding Upon the Traditional Resource Competition Theory

Swanton began his research by observing and testing the traditionally held theory on weed-related yield losses in corn. It states that when weeds compete for moisture, nutrients and sunlight, the growth of the corn plant is negatively affected.

This negative impact on growth can significantly reduce yields, depending on the corn plant's stage of growth. Studies have shown yield loss is highly correlated to corn growth stage and time of weed pressure. For more than 10 years, researchers have agreed that to prevent yield losses of five percent or greater, growers must keep their corn weed-free from the third- to eighth-leaf stages of development. **Research also has shown that yield reduction caused by early-season weed competition is permanent and cannot be overcome by controlling weeds later in the season.**

Can these yield losses be attributed solely to the traditional theory of resource competition? Extensive research conducted by Swanton suggests not. Through his studies, Swanton observed yield reductions in soil with abundant moisture and nutrients and in situations where the weeds were not large enough to deprive the corn seedling of light. He concluded the actual mechanism of competition had to be something else, and this something else was **causing irreversible damage if weeds were present at corn emergence** – an even earlier timeframe than previous studies indicated.

Shedding Light on Yield Loss

To determine the source of the impact of weed competition, Swanton focused his research on the factors influencing root growth. He knew the presence of early-season weeds reduce essential crop root development, which, in turn, may reduce yield. Taking into account the corn plant's physiology, he hypothesized **a change in light quality caused by weeds emerging at the same time as the corn plant was the true inhibitor of healthy root development.**

Within early-emerging corn seedlings there are light-sensing compounds called phytochromes that can detect subtle shifts in the reflected light around them. When weeds simultaneously emerge with the crop, phytochromes within the plant cells detect the red- to far-red light that is reflected off the weed leaf surface onto the corn plant, triggering the corn plant to adopt a shade-avoidance growth strategy. This natural defense mechanism causes the plant to grow taller stalks and wider leaves to better compete for light. But because plants have a limited growth capacity, reallocating more carbon and other resources into above-ground growth leaves fewer resources for root growth, which will compromise yield potential.

Putting Shade-Avoidance to the Test

To test the effect of reflected light on corn growth, Dr. Swanton and his research team planted two sets of corn seedlings in individual pots. The first set of seedlings was surrounded by flats filled with vermiculite to simulate light reflection from bare, weed-free soil. The second set was placed next to flats containing grass sod to simulate light reflection from a weedy field. All other conditions, including adequate nutrients for ideal growth, were consistent for both pots so the only variable was light reflection.

Effects on Plant Growth

Swanton noted that when compared to weed-free seedlings, corn plants grown in weedy conditions demonstrated the following shade-avoidance characteristics:

- 17 percent taller
- 45 percent greater leaf area
- 40 percent more dry leaf weight
- 12 percent higher top growth relative to root growth

At first thought, it may seem that a plant that is taller and fuller is better, healthier and higher yielding, but this is not the case. Swanton found that this upward growth comes at the expense of root development. The strong root system is essential for corn plant development throughout its life cycle; and optimum yield is compromised because of the energy shift to produce shoots instead of roots. This discovery may also explain why plants facing early-season weed competition can never reach their full yield potential – even if weeds are removed post-emergence and sufficient nutrients are available. A smaller root system struggles to support the plant, but also isn't developed enough to respond in unfavorable growing conditions such as water stress.

Impact on Leaf Orientation

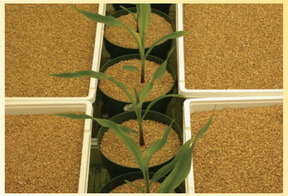
Swanton's research also showed shade-avoidance impacted the direction or orientation of leaf growth.

Under weed-free conditions, a higher percentage of leaves grew perpendicular to the row, resulting in more rapid canopy closure, better growth and more effective suppression of weeds between rows. However, weedy conditions caused the corn plants to sense competition from a change in light reflection and to produce more leaves that grew parallel to the row, resulting in a slower canopy closure and reduced ability to shade out weeds.

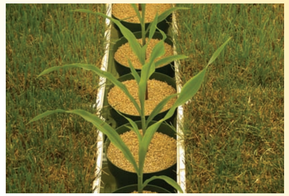
Drawing Conclusions Based on Research

As a result of his innovative early-season weed research in corn, Swanton has drawn the following conclusions:

- Damage from weeds occurs earlier in the life of the corn plant than previously thought.
- Corn plants can detect the presence of weeds as soon as they emerge.
- Uncontrolled weeds that emerge with the crop can cause substantial, irreversible yield loss to corn, which cannot be overcome through later-season, post-emergence control.
- Early-season weed management is important because weeds alter the light-quality environment of developing corn seedlings.
- In response to changes in light quality, the corn seedling initiates a set of shade-avoidance responses, which fundamentally change the way it grows.
- As part of shade avoidance, the plant increases its carbon allocation to above-ground growth and reduces its relative root production. It also shifts its leaf orientation by reducing the amount of leaves perpendicular to the row.
- Controlling weeds early, before root growth is affected, is a critical step toward maximizing yield potential in corn, which affirms the need for effective pre-emergent herbicides.



Surrounded by flats filled with vermiculite.



Surrounded by flats containing grass sod.

Light reflection in a weed-free field.

Light reflection in a weedy field.

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