SOJABOON WEBWERF OPDATERING 2021
SOYBEAN WEBSITE UPDATE 2021

This study is an update to the previous study ended in August 2020. It is subdivided into the following categories:

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Acronyms to know that commonly show up on soybean variety lists:

- CEC: cation exchange capacity

- CHU: corn heat units

- IDC: iron deficiency chlorosis

- MG: maturity group

- PRR: phytophtora root rot and stem rot

- RM; relative maturity

- SCN: soybean cyst nematode

1. AGRONOMY

1.1 SEED HANDLING

1.1.1 BASF introduces new soybean seed treatments

----- offer protection against early-season risks.
Vault IP Plus seed treatment, Poncho XC seed treatment, and Relenya seed treatment, all recently registered by the U.S. Environmental Protection Agency (EPA). These products are now commercially available through local retailers for use in the 2021 soybean growing season.
Vault IP Plus seed treatment is the new standard to inoculate and protect soybean seed.
Annual inoculation from Vault IP Plus is beneficial to soybean fields planted early, in wet and dry soils where native rhizobia may die off or be less effective, ------.
Plus, the seed treatment's dual biofungicide component provides effective protection against soilborne diseases including Fusarium and Rhizoctonia -----.
Vault IP Plus is also designed with the lowest application rate in the category leaving room for other treatments and 40% reduced packaging, ------.
Poncho XC seed treatment is the latest addition to the Poncho family of products. -----now available for soybeans, -----.
Poncho XC delivers immediate efficacy against damaging early season insects such as aphids, bean leaf beetles, thrips, and white grubs. Its systemic mode of action protects the entire plant, supporting healthier plant establishment. It also provides a consistent yield benefit across a wide range of geographies and environments, ------.
Powered by Revysol fungicide, Relenya can be added to a base fungicide foundation to boost disease protection under Fusarium and Rhizoctonia pressure. When partnered with a base package, Relenya will also boost yield potential under varied levels of disease pressure, -----.
Vault IP Plus, Poncho XC, and Relenya join ILEVO and Obvius Plus seed treatments to create a comprehensive portfolio of early-season soybean solutions.
https://www.agriculture.com/news/crops/basf-introduces-new-soybean-seed-treatments
October 13, 2020

1.1.2 Corteva Gearing Up for 2022 By Launching Two New Products

------ new product comes from Pioneer and is an insecticide seed treatment. Called Lumiderm, the product features the active ingredient cyantraniliprole and shields soybean seedlings against twice the number of insect species as other seed treatments, -----. ------can also be used on cover crops.

Lumiderm will be released in limited grower testing quantities in 2021 and be fully available for use during the 2022 planting season.

The second product is Resicore XL herbicide for corn.

https://www.croplife.com/crop-inputs/corteva-gearing-up-for-2022-by-launching-two-new-products/

August 18, 2021

1.1.3 Syngenta Canada launches Vayantis corn and soybean seed treatment

- Contains a new, highly effective mode of action with no known cross-resistance

- Provides the most comprehensive Pythium control in corn and soybeans

- Provides wide-ranging Phytophthora protection in soybeans as part of Vayantis IV seed treatment

------ launch of Vayantis®, a next-generation fungicide seed treatment that provides comprehensive Pythium protection in corn and soybeans.

Vayantis contains picarbutrazox, a new active ingredient from a novel chemical class with no known cross-resistance in soybeans or corn. Compared to competitor fungicide seed treatment chemistries, picarbutrazox provides higher efficacy on Pythium pathogens at lower use rates. ------even under heavy disease pressure.

Vayantis will be available in a Vayantis IV seed treatment co-pack. The co-pack combines picarbutrazox with three additional modes of action providing protection against Phytophthora and other key early-season diseases.

https://www.syngenta.ca/syngenta-in-the-news/syngenta-canada-launches-vayantis-corn-and-soybean-seed August 6, 2021

1.2 HERBICIDES / FUNGICIDES / INSECTICIDES

1.2.1 Herbicide-Resistance Management — Cover Crops Edition

Cover crops can supply erosion control as well as water and weed management — all issues your soy checkoff has investigated for years to make you more profitable. According to the 2017 Census of Agriculture, there was a 50% increase in cover crops planted between 2012 and 2017.

Bill Johnson, Ph.D., has teamed up with the Take Action program, ------- said that cover crops can be used for a variety of reasons, including nitrogen fixation, nutrient management or soil structure improvement.------- it's considered to be one of the small hammers that weed scientists will recommend for some weed species.

Johnson encourages farmers to consider specific weed problems when selecting cover crops and designing management objectives. Physical weed suppression is possible with high biomass cover crops but requires special management tactics that may or may not fit your farm management system.

In this episode of "Inside Weed Management" from Take Action: Pesticide-Resistance Management, brought to you by the soy checkoff, Johnson explains different ways to suppress weeds using cover crops.

https://www.unitedsoybean.org/hopper/herbicide-resistance-management-cover-crops-edition/

June 24, 2021

1.2.2 Smart Herbicide Application Starts with Broadcast Nozzles

------- selection of proper broadcast nozzles is nevertheless crucial to help ensure your herbicide applications are effective. The type of product delivery depends on which broadcast nozzle is used.

Applicators should choose their nozzle sections based on their rate controllers, or how they plan to apply the herbicide, which can include pressure-based rate controllers and pulse width modulation controllers.

After an applicator has chosen their rate controller, they can determine their nozzle types and droplet size. Droplet size, weather and boom height are all factors that, if not used correctly or taken into consideration, can cause drift and off-target movement, which increases the risk of damage to sensitive neighboring crops.

----- in order for applicators to maximize the droplet for herbicide delivery, a balance between mitigating drift while also achieving the desired deposition and coverage is needed to make the herbicide work. Although those three might not always go hand in hand, applicators can also use other factors such as their spray volume, weed density, boom height and environmental conditions to be successful.

https://www.unitedsoybean.org/hopper/smart-herbicide-application-starts-with-broadcast-nozzles/

January 9, 2021 *(Video included)*

1.2.3 Understanding Off-Target Drift: Temperature Inversion

Before you start herbicide applications -----.Ensuring there is no temperature inversion to affect the application? This one can be tricky. ------ like not spraying during a temperature inversion.

According to Mandy Bish, extension specialist at the University of Missouri, a temperature inversion is a condition when the air near the earth's surface is cooler than the air above it. This type of weather results in a stable air mass which can suspend herbicide droplets in the air.

----- knowing how air flows in a field, and understanding when an inversion can form, will help applicators be more aware of the potential for off-target movement.

In this episode of "Inside Weed Management" from Take Action: Pesticide-Resistance Management, brought to you by the soy checkoff, Bish explains what a temperature inversion is and how it can result in off-target movement of herbicides.

https://www.unitedsoybean.org/hopper/understanding-off-target-drift-temperature-inversion/

April 22, 2021

1.2.4 Soy Growers Appreciate Dicamba to Remain Weed Control Option

-----Environmental Protection Agency (EPA) has announced it will reregister dicamba for 2021 and future use.

https://soygrowers.com/news-releases/soy-growers-appreciate-dicamba-to-remain-weed-control-option/ October 27, 2020

1.2.5 Cultural Tools for Your Weed Management Strategy

------ you keep herbicide-resistant weeds out of your fields by building one management practice on another.

Resistant weeds have been around for years. The unfortunate reality is they are here to stay. Farmers must adapt management strategies to lessen the effects these weeds have on their soybeans.

“For years, chemicals were the go-to method for weed control,-------. Yet over-reliance on a limited set of chemical controls has led farmers to the current situation: severe herbicide resistance in many problematic weed species, with no new chemistries coming any time soon.”

------ researchers have found that an integrated weed management strategy is effective for managing resistant weeds. Integrating cultural methods such as crop rotation and tillage can reduce reliance on herbicide applications. The list of options is more extensive, however, and branches out to include ecological methods that many farmers may not have considered for effective control.

Hierdie artikel beklemtoon die nuwe omvattende benadering tot onkruidbeheer met skakels na verskeie inligtingsbronne wat die aspekte oor wye spektrum dek en behoort volledig gebruik te word tav. bevindings en aanbevelings.

Die beheer van die onkruidsaadbank word aangespreek ook na aanleiding van eerstehandse kennis opgedoen in Australie wat reeds jare ondervinding daarin het.

Skakels na 10 relevante aspekte word gegee.

https://www.unitedsoybean.org/hopper/cultural-tools-for-your-weed-management-strategy/

January 29, 2021

2.1.6 Bayer launches Delaro® Complete fungicide, delivering a powerful multi-mode of action solution for corn, soybean, and cereal farmers

----- Crop Science division of Bayer announced that Delaro® Complete has been registered for use in Eastern Canada on corn, soybeans and cereals. The new foliar fungicide delivers effective and consistent control of major corn, soybean, and cereals diseases.

“Delaro Complete adds to the proven performance of Stratego® PRO for even better control of the most important corn, soybean, and cereal diseases.” says Eric Comte, Soybean & Pulse Crop and Campaign Marketing Manager, Bayer. “The addition of Fluopyram is ideal for high disease pressure situations and offers residual protection, giving farmers an extra edge heading into the end of the season.”

Delaro Complete has three modes of action (Groups 3, 11, 7) that work in tandem for added protection. In soybeans, Delaro Complete protects against all major soybean diseases as well as providing enhanced suppression of white mould.

https://www.cropscience.bayer.ca/News/2021/Bayer-launches-Delaro-Complete-fungicide?overviewId=4B8E36F2-C34D-42B1-8573-8894864C8229 May10, 2021

2.1.7 Bayer announces 2021 availability for XtendFlex® soybeans, offering Canadian growers strong yields and increased flexibility in weed control

Further to the recent U.S announcement about final regulatory approval for XtendFlex® soybeans, the

Crop Science Division of Bayer has announced that XtendFlex soybeans will be available in Canada for 2021. The latest addition to the Roundup Ready® Xtend Crop System, the XtendFlex soybean trait technology offers industry-leading tolerance to glyphosate, dicamba, and glufosinate. With tolerance to three herbicides, XtendFlex soybeans allow growers flexibility in herbicide choice while also providing the high-yielding performance they need.
https://www.cropscience.bayer.ca/News/2021/2021-availability-for-XtendFlex-soybeans?overviewId=4B8E36F2-C34D-42B1-8573-8894864C8229 January 26, 2021

2.1.8 First new biotech for soybeans in 20 years

The end of July 2021 saw the South African regulatory authority approve a new genetically modified (GM) soybean trait for the first time in almost 20 years.

Intacta® Roundup®Ready2 Pro (Intacta® RR2 Pro) is only the second GM soybean trait to be approved for cultivation in South Africa. The first one was Roundup Ready soybean (GTS 40-3-2), which was approved on 1 August 2001 – almost two decades ago to the day.

-----providing soybean growers with insect protection from feeding damage caused by certain Lepidopteran soybean pests like *Helicoverpa armigera* (African bollworm). The fact that it has glyphosate tolerance for weed management and is able to reposition the herbicide-tolerant trait on the DNA of the plant adds possible yield increase to its attributes.
https://sagrainmag.co.za/2021/10/04/first-new-biotech-for-soybeans-in-20-years/ October 4, 2021

2.1.9 The U.S. EPA announces new 5-year registration for XtendiMax® herbicide, Bayer's low-volatility dicamba product

The new registration follows launch announcement for XtendFlex® soybeans and enables full potential of industry-leading Roundup Ready® Xtend Crop System

------ U.S. Environmental Protection Agency (EPA) announced a new 5-year registration for XtendiMax® herbicide with VaporGrip® Technology,-----.

The new EPA-approved product label for XtendiMax herbicide includes some changes to further ensure growers can use the product successfully. The EPA stated "*To manage off-site movement of dicamba, EPA's 2020 registration features important control measures,* -----.

For more information, visit www.RoundupReadyXtend.com.

https://media.bayer.com/baynews/baynews.nsf/id/The-US-EPA-announces-5-year-registration-XtendiMax-herbicide-Bayers-low-volatility-dicamba-product?Open&parent=news-overview-category-search-en&ccm=020 October 27, 2020

2.1.10 Kyber™ Soybean Herbicide Officially Launches

New Preemergence Herbicide Has 3 Effective Modes of Action, Including a Group 15 Active

Ingredient

------- announces the launch of Kyber™ herbicide for the 2021 season. The new crop protection product is a pre-emergence soybean herbicide with three effective modes of action, including a Group 15 active ingredient. Kyber herbicide is an excellent addition to a program approach for broad-spectrum control of resistant broadleaf and grass weeds.

Kyber herbicide comes in a liquid premix. In addition to a Group 15 mode of action, it also contains active ingredients from Groups 14 and 5. The solution provides strong control of some of the toughest weeds farmers face, including waterhemp, Palmer amaranth and common ragweed. Each mode of action in Kyber herbicide controls resistant weeds individually, and combined together, they provide a comprehensive solution. The herbicide also has extensive residual activity, lasting four to six weeks, even going beyond six weeks in the right conditions.

For growers planting Enlist E3® soybeans, Kyber herbicide will fit very well in their weed management plans. Kyber will serve as a strong preemergence and can be followed by a planned postemergence application of Enlist Duo® herbicide or a tank mix featuring Enlist One® herbicide. The Enlist technology and Kyber herbicide offer a powerful program approach against troublesome weeds.

To learn more about Kyber herbicide, visit KyberHerbicide.com on Corteva.us,

https://www.corteva.us/press-releases/Kyber-Soybean-Herbicide-Officially-Launches.html

October 6, 2020

2.1.11 BASF starts global registration for new and environmentally friendly insecticide active ingredient

Regulatory dossiers for Axalion™ insecticide submitted in Australia and Korea

Axalion™ active ingredient developed by BASF is the company's latest insecticide innovation. With its novel mode of action, it helps farmers safeguard their yield without negatively impacting soil and water organisms or birds. Axalion will be registered for use in a broad range of crops in the fruits and vegetable markets, including grapes and potatoes. Additional row crop uses extend to soybeans and other legumes, cotton and cereals.

Pending regulatory approvals, BASF expects first market introductions of Axalion-based product formulations as early as 2023 in Australia and Korea, 2024 in India. The company anticipates market introductions in the European Union in 2026.

https://www.basf.com/global/en/media/news-releases/2021/01/p-21-104.html January 12, 2021

2.1.12 BASF receives registration for Veltyma fungicide with new active ingredient Revysol

BASF Canada Agricultural Solutions has received registration from Health Canada's Pest Management Regulatory Agency (PMRA) for Veltyma™ Fungicide. Veltyma contains the unique active ingredient Revysol® which is the first and only Isopropanol-Azole, a unique chemistry discovered and developed

by BASF, that provides broader, stronger, and longer control against various diseases on multiple crops. Veltyma will be available for purchase in the 2022 growing season.

Veltyma is registered for use on multiple crops including potatoes, corn, wheat and soybeans.

Veltyma contains the active ingredients Pyraclostrobin (Group 11) and Mefentrifluconazole (Group 3) – also known as Revysol. Revysol's unique molecular structure binds target enzymes more powerfully than other Group 3 products on the market, providing best-in-class performance on a broad spectrum of diseases, including some disease strains that have become resistant to other Group 3 fungicides. It also contains Pyraclostrobin, which provides proven plant health benefits for increased growth efficiency, better management of minor stress, and greater yield potential.

https://www.potatonewstoday.com/2021/09/14/basf-receives-registration-for-veltyma-fungicide-with-new-active-ingredient-revysol/ September 14, 2021

2.1.13 Corteva Agriscience Announces New Global Brand for Naturally Derived Spinosyn Insecticides

Qalcova™ active and Jemvelva™ active headline Corteva's growing portfolio of sustainable innovations

Corteva (NYSE: CTVA) announced today that it is implementing the new global brand names of Qalcova™ active (pronounced "kal-KO-vuh") for spinosad, and Jemvelva™ active (pronounced "jem-VEL-vuh") for spinetoram, demonstrating Corteva's commitment to building best-in-class, sustainable solutions for farmers. Together, these two naturally-derived active ingredients — both Green Chemistry Challenge Award winners — provide farmers worldwide with effective insect control options for more than 250 crops, including fruits, vegetables, soybeans, corn, rice and others.

Produced through a proprietary natural fermentation process, Qalcova, the active ingredient in products including Entrust® organic insecticide and Success® insecticide, and Jemvelva, the active ingredient in Radiant® and Delegate® insecticides and other brands, belong to a class of insecticidal chemistry (Group 5) that does not show cross-resistance to other classes of chemistry.

https://www.corteva.us/press-releases/corteva-announces-new-global-brand-for-naturally-derived-spinosyn-insecticides.html March 23, 2021

1.3 COVER CROPS, TILLAGE, SOIL PREPARATION

1.3.1 Cover Crop Resources to Help You Plan This Fall

------ soy checkoff provides resources that get you from planting to termination.

Species Selection

Cover crop species selection largely depends on the desired outcomes, including:

- Reduced erosion and protection of soil from wind and rain.
- Improved organic matter and biodiversity in the soil.
- Decreased nutrient loss from leaching and runoff.
- Improved infiltration of water into the soil profile.
- Habitat for beneficial insects and fungi.
- Weed suppression.

If there is more than one reason to plant a cover crop, make a list of priorities and select a species or mix of species that addresses the primary goal. Weed suppression is one of the most highly reported reasons growers use cover crops, second only to soil health. As herbicide-resistant weeds become an increasing concern, cover crops can be an additional tool for implementing integrated pest management strategies.

The Soybean Research & Information Network *(SRIN)* funded by the soy checkoff, provides additional resources to manage cover crops in its Cover Crops Resource Library, including a Cover Crop Selector Tool, a Do's and Don'ts page and helpful Cover Crop Decision Tools.

Cover Crop Establishment

Building biomass and ground cover is critical in a cover crop if weed suppression is the goal. To do that, consider the planting date, planting method and seeding rate in a cover crop management plan. All three factors contribute to the successful establishment of cover crops that can improve weed suppression.

Weather — specifically temperature and precipitation — also has significant impact on the establishment and growth of a cover crop. More controllable, and also significant to cover crop establishment, is seed quality. Test seed for germination, and screen for weed seed to avoid potential contamination.

SRIN's Cover Crops Overview page also includes useful information on seeding methods and ground covers.

Herbicide Carryover to Cover Crop

After cover crop planting, farmers can face a few challenges, with one being herbicide carryover from the cash crop. It's important to know which cover crop species are most sensitive to carryover. Some residual herbicides applied during the cash crop planting typically interfere less with cover crop establishment than postemergent-applied herbicides, as there is more time for the active ingredients in the herbicide to degrade.

In addition, soil characteristics and weather patterns should be considered when planning cover crop management. Risk of herbicide carryover tends to grow with increasing organic matter and clay content of soils. However, research indicates that warmer temperatures and increased rainfall lead to increased rates of herbicide degradation.

Understanding herbicide characteristics for chosen cover crop species is critical to successful establishment.

SRIN offers various university resources on this topic, including a webinar from the University of Nebraska: “Influence of Soil Management Practices on Weed Control, Herbicide Fate and Crop Productivity.”

Cover Crop Termination

The last step in maximizing cover crop benefits is to use the right method and timing of termination to ensure maximum cash crop yields. Cover crops can be terminated before or after cash crop planting, depending on crop rotation and grower preference

SRIN offers additional information on termination, including winterkill, herbicide applications and tillage, to help farmers make solid management decisions for their farms.

In addition to the resources above, there are a variety of podcasts and webinars to help farmers manage every stage of a cover crop program. Penn State University’s assistant professor of weed science, John Wallace, Ph.D., recorded a podcast to discuss the benefit of weed control with cover crops.

https://www.unitedsoybean.org/hopper/cover-crop-resources-to-help-you-plan-this-fall/

August 6, 2021

1.3.2 A Conversation with an Agronomic Adviser on Improving Soil Health

---- having healthy soil isn’t simple.-------there are four major factors that make for healthy, productive — and sustainable — soils: microbes, carbon, drainage and structure.

Feeding soil microbes

Farmers can get an idea of soil microbial activity and soil fertility potential through regular soil tests. ------feeding the beneficial microbes in the soil, and not the ones that attack crop plants, -----. “But, since we can’t see below the ground and we depend on tests that give us an indication of what’s below, we need to be careful that we use good data and research to enhance soil microbes.”

Microbial activity is one of the keys to soil health and fertility.------ closely monitor our precision soil sample results, looking at base saturation balance to ensure we have the right structure to build a home for the microbes, along with air and water holding capacity. ---- closely monitor the Humus Organic Matter to see how our practices are encouraging the microbial life and improving nutrient turnover in the soil.”

The soy checkoff has invested in research to better understand various soil microbes, including which microbes may be likely to cause high- or low-yielding soybeans.

Enhancing soil carbon

Cover crops can offer improvements in plant and soil health, soil erosion and water quality. They can also help reduce nutrient loss — which is crucial for microbial activity. ----- look at cover crops from

two angles: the first is to suppress weeds, so we don't have as much dependence on herbicides, and the other is to provide a highly carbonaceous material that will support and sustain microbial growth, ------.

------ soy checkoff investments have enabled research on cover crops in multiple regions. Researchers assessed how cover crops impact soil health, and the ideal seeding mixes for biomass production and increased yield. Cover crops can also sequester carbon, a greenhouse gas, from the atmosphere ------.

Improving soil drainage

Drainage helps ensure the soil has aerobic rather than anaerobic conditions,-----. ----- anaerobic conditions, ------ little to no soil oxygen, and aerobic microbes need oxygen.

Controlled drainage systems, such as tiling or ditches, can also help reduce the loss of crucial nutrients, such as phosphorus and nitrogen.

Checkoff investments examining how systems like tiling can positively affect overall soil and crop health revealed that controlled drainage helps reduce runoff and erosion, contributing to clean water.

Maintaining soil structure

---- certain tillage practices on your fields can severely disrupt the soil habitat, which includes earthworms, microbials and organic material, -----.

In contrast, no-till, reduced or conservation tillage practices maintain soil structure for the microbes in the soil and leave crop residue on top of the soil. Conservation tillage and no-till can reduce soil erosion, which improves water quality — and they can also reduce fuel and equipment use.

There will always be pros and cons to any ag practice; it's a balance,-----.

----- end result of any soil enhancement practice should be to ensure that the soil microbial population is sustained or even enhanced. With any of these practices, we can enhance the soil environment, but we have to be absolutely sure that our pros outweigh our cons."

https://www.unitedsoybean.org/hopper/a-conversation-with-an-agronomic-adviser-on-improving-soil-health/ May 20 2021

1.3.3 No-Till Practices in Vulnerable Areas Significantly Reduce Soil Erosion

-----soil erosion is a naturally occurring process, agricultural activities such as conventional tilling exacerbate it. Completely shifting to no-till would reduce soil loss and sediment yield by more than 70 percent, says Sanghyun Lee, doctoral student in the University of Illinois's Department of Agricultural and Biological Engineering.
"A comprehensive modeling framework to evaluate soil erosion by water and tillage" is published in Journal of Environmental Management. For more information, read the University of Illinois article(link is external).

https://nifa.usda.gov/announcement/no-till-practices-vulnerable-areas-significantly-reduce-soil-erosion

January 28, 2021

2. BREEDING AND GENETICS

2.1 *BREEDING COMPANY NEWS*

In vorige jare was daar gewoonlik n artikel wat samevattend al die nuwe kultivars van die verskillende saadmaatskappye vir die komende jaar gelys het. Vanjaar was sodanige lys nie beskikbaar nie en is by die verskillende maatskappye verwysings na sodanige bronne gegee.

2.1.1. Bayer CropScience / Monsanto / Asgrow

2.1.1.1 Bayer's Unmatched R&D Investment Powers Industry-Leading Crop Science Portfolio

Commercialized ten new formulations and more than 430 new hybrids and varieties across corn, soybeans, cotton and vegetables. Three biotech trait projects advance to launch phase / Advanced eight new small molecule crop protection actives / Leading soybean pipeline to offer the greatest weed control flexibility, premium genetics.

-----announced pipeline project advancements and newly unveiled research in a dedicated research and development (R&D) pipeline update for the Crop Science division. Bayer's annual investment of 2 billion euros in Crop Science R&D is nearly double the spend of the company's next closest competitors.

Key-phrase excerpts from the fairly lengthy article:

Delivering an industry-leading R&D pipeline in scale, productivity, and value

-----product launches including ten new crop protection formulations, and three biotechnology traits advancing to the launch phase. These include Intacta 2 Xtend soy, which has gained all regulatory approvals and is expected to launch in Brazil by the end of the year. ------ enhancement of the Intacta franchise will support farmers ----- with multiple modes of action for insect control.

Leading the development of next-generation biotech traits

------to provide farmers with flexibility in weed control, through next generation soybean traits.

-----developed the first five-way stack of herbicide tolerance for soybeans. Currently in Phase 3 of development, this trait offering adds to XtendFlex's three tolerances with another two modes of action; tolerance to HPPD and its own proprietary 2,4-D tolerance. In Phase 2 of the pipeline there is an additional mode-of-action coming to convey PPO herbicide tolerance. Additionally, the third generation of insect control in soybeans will further enhance the Intacta franchise and help farmers continue to increase yields while reducing the use of insecticides.

Optimizing large and diverse germplasm library with advanced breeding technologies

Through advanced breeding tools and Bayer's large germplasm library, 430 new hybrids and varieties across corn, soy, cotton and vegetables have been deployed.

Advancing new approaches in small molecule development

Bayer's new herbicide mode of action for post-emergence weed control has advanced to Phase 3. This molecule has the potential to unlock greater weed control flexibility, as it allows use in various market segments, opens new opportunities for herbicide tolerance trait systems in major crops and enables the continued use of conservation- and no-till systems, which improve carbon sequestration and soil health.

------ core competencies in fermentation, formulation, field testing and grower support, Bayer is also actively developing exciting new biologic options------.------ the newest addition to the Serenade

product family, Serenade Soil Activ. ------ improves ease of use for farmers, with lower use rates. Bayer expects this new product to deliver biologic growth in expanding markets, including launching in the U.S. and Australia ------.

Unlocking opportunities for new business models, powered by data science

----industry-leading Climate FieldView digital agriculture platform is now being used on more than 150 million subscribed acres across the world. ------ logging information from planters, sprayers and combines, helps farmers make data-driven decisions and evolve Climate FieldView's models to optimize yields. Bayer is better integrating the data into its R&D process, enabling aligned testing to reflect how its customers farm, helping inform advancement of key projects it is developing. FieldView's Seed Advisor has continued to help farmers improve productivity by optimizing seed placement recommendations.

https://media.bayer.com/baynews/baynews.nsf/id/Bayers-unmatched-RD-investment-powers-industry-leading-Crop-Science-portfolio March 12, 2021

2.1.1.2 2022 SEED GUIDE

*Google '*2022 Seed Guide Breakheart Seed' *and open the website. Scroll several pages down to* 'Soybeans'*(6 pages) with characteristics of each available XTENDFLEX and XTEND variety as well as its Liberty Link and Enlist E3 varieties with the 14 new ones marked with a red flag* 'New'.

https://www.greatheartseed.com/wp-content/uploads/2022_GHS_SeedGuide.pdf August 2021

2.1.1.3 New DEKALB Asgrow Products Announced For 2022 Planting

Twenty-four new Asgrow XtendFlex soybean products are being launched in the U.S. for 2022, raising the total number to 71 varieties for next growing season. XtendFlex, the latest soybean technology from Bayer, is a triple-stacked soybean trait containing tolerance to dicamba, glyphosate and glufosinate to provide more flexibility to help control tough weeds.

----- the 2022 product lineup also features resistance to the top soybean diseases, including white mold, Phytophthora, brown stem rot and iron deficiency chlorosis.

For more information, farmers can contact DEKALBAsgrow.com/SeedFinder.

https://cropproducer.com/new-dekalb-asgrow-products-announced-for-2022-planting/

August 16, 2021

2.1.1.4 Solvay completes acquisition of Bayer's global seed coatings business

The acquisition strengthens Solvay's existing seed care portfolio in bio-based, seed-applied solutions; enables reinvestment opportunities for Bayer.

https://media.bayer.com/baynews/baynews.nsf/id/Solvay-completes-acquisition-of-Bayers-global-seed-coatings-business July 1, 2021

2.1.1.5a Bayer takes steps to make carbon sequestration a farmer's newest crop opportunity

Bayer to reward growers to generate carbon credits by adopting climate-smart practices and creating a new revenue stream on-farm / The initiative makes Bayer the first company to develop a transparent, science-based and collaborative approach to a carbon market in agriculture.

Beginning this month, Bayer will start rewarding farmers in Brazil and the U.S. for generating carbon credits by adopting climate-smart practices – such as no-till farming and the use of cover crops – designed to help agriculture reduce its carbon footprint and greenhouse gas (GHG) emissions.
Soil is one of the most effective ways of sequestering carbon. Incentivizing farmers to embrace no-till, precision nitrogen use or cover crops helps further sequester carbon into the soil, reduce fossil fuel usage and reduce greenhouse gases. While today farmers get rewarded solely for their food, feed and fiber production, those participating in the Bayer Carbon Initiative will have the opportunity to be rewarded for their best farm management practices and other sustainability efforts as well.
The company is also collaborating with partners such as Embrapa in Brazil to build a viable carbon market for farmers.
The program's 2020/2021 season will include approximately 1,200 farmers in Brazil and the U.S.
https://media.bayer.com/baynews/baynews.nsf/id/Bayer-takes-steps-to-make-carbon-sequestration-a-farmers-newest-crop-opportunity?Open&parent=news-overview-category-search-en&ccm=020
July 21, 2020

2.1.1.5b Bayer launches its decarbonization program for agriculture in Europe

In line with the political objectives of the EU Green Deal, the program's main goal is to fight climate change by establishing carbon farming practices at farmers' level with benefits for the entire agricultural value chain / Program kicks off with over 25 farmers across seven countries in the EU and beyond: France, Spain, Belgium, Denmark, Germany, United Kingdom and Ukraine.
The new European Carbon Program recognizes the pivotal role growers and their land can play in helping to create lasting, positive environmental impacts and is an integral part of Bayer's sustainability commitments specifically aimed at reducing field greenhouse gas (GHG) emission by 30% in 2030.
https://media.bayer.com/baynews/baynews.nsf/id/Bayer-launches-its-decarbonization-program-for-agriculture-in-Europe June 29, 2021

2.1.1.6 Bayer, Corteva in 'two-dog battle' over U.S. soy market

Bayer AG is launching a new genetically modified soybean in the United States, striking back against rival Corteva Inc ------. Bayer's new XtendFlex soybeans and Corteva's Enlist E3 soy are shaping up to be the most popular with farmers in the coming years, ----.
Each seed tolerates three chemical herbicides so farmers can destroy weeds without damaging their crops, as weeds grow increasingly resistant to the once-universal glyphosate herbicide.
The article discusses the use of these two soybean systems in dealing with weed control and the role court decisions and appeals played regarding the use of the controversial herbicide Dicamba.
https://www.reuters.com/article/us-usa-soybeans-seeds-focus-idUSKBN2BW1IE April 9, 2021

2.1.1.7 CLAAS TELEMATICS offer easy data management to help simplify farming operations

Climate FieldView™, the flagship product of The Climate Corporation (Bayer's digital farming arm), and CLAAS TELEMATICS can now be connected through the CLAAS API (application programming interface) to enable easy data exchange for field-specific, site-specific documentation.

https://media.bayer.com/baynews/baynews.nsf/id/Climate-FieldView-CLAAS-TELEMATICS-offer-easy-data-management-to-help-simplify-farming-operations?Open&parent=news-overview-category-search-en&ccm=020 May 6, 2021

2.1.1.8 Industry leading digital farming platform Climate FieldView™ launches in South Africa

The Climate Corporation, Bayer's digital agriculture arm, expands its global footprint to advance data-driven innovation for farmers around the world ------as its first expansion onto the African continent. South African farmers now have access to industry-leading data science capabilities and digital tools, and can digitize their operations. To get started, customers can connect field data through the Climate FieldView™ Drive device, a piece of hardware that farmers can insert into a diagnostic port in the cab of their precision equipment. It uses bluetooth technology to stream agronomic data from the equipment before being synced with their FieldView account. Farmers can also upload data generated by their equipment directly into their FieldView account through the Data Inbox tool, which does not require the use of the FieldView Drive.

All FieldView users have full control of their farm data. They choose if, how and when to share their agronomic information. If they feel it benefits their operations, farmers can choose to share their insights with a trusted agronomic partner to help make data-driven business decisions.
For more information, visit www.climate.com.
https://media.bayer.com/baynews/baynews.nsf/id/Industry-leading-digital-farming-platform-Climate-FieldView-launches-in-South-Africa?Open&parent=news-overview-category-search-en&ccm=020
March 31, 2021

2.1.1.9 Bayer's unmatched R&D investment powers industry-leading Crop Science portfolio

Commercialized ten new formulations and more than 430 new hybrids and varieties across corn, soybeans, cotton and vegetables. Three biotech trait projects advance to launch phase / Advanced eight new small molecule crop protection actives / Leading soybean pipeline to offer the greatest weed control flexibility, premium genetics
-----announced pipeline project advancements and newly unveiled research in a dedicated research and development (R&D) pipeline update for the Crop Science division. Bayer's annual investment of 2 billion euros in Crop Science R&D is nearly double the spend of the company's next closest competitors.
Key-phrase excerpts from the fairly lengthy article:
Delivering an industry-leading R&D pipeline in scale, productivity, and value
-----product launches including ten new crop protection formulations, and three biotechnology traits advancing to the launch phase. These include Intacta 2 Xtend soy, which has gained all regulatory approvals and is expected to launch in Brazil by the end of the year. ------ enhancement of the Intacta franchise will support farmers ----- with multiple modes of action for insect control.
Leading the development of next-generation biotech traits
------to provide farmers with flexibility in weed control, through next generation soybean traits.

developed the first five-way stack of herbicide tolerance for soybeans. Currently in Phase 3 of development, this trait offering adds to XtendFlex's three tolerances with another two modes of action; tolerance to HPPD and its own proprietary 2,4-D tolerance. In Phase 2 of the pipeline there is an additional mode-of-action coming to convey PPO herbicide tolerance. Additionally, the third generation of insect control in soybeans will further enhance the Intacta franchise and help farmers continue to increase yields while reducing the use of insecticides.

Optimizing large and diverse germplasm library with advanced breeding technologies

Through advanced breeding tools and Bayer's large germplasm library, 430 new hybrids and varieties across corn, soy, cotton and vegetables have been deployed.

Advancing new approaches in small molecule development

Bayer's new herbicide mode of action for post-emergence weed control has advanced to Phase 3. This molecule has the potential to unlock greater weed control flexibility, as it allows use in various market segments, opens new opportunities for herbicide tolerance trait systems in major crops and enables the continued use of conservation- and no-till systems, which improve carbon sequestration and soil health. ------ core competencies in fermentation, formulation, field testing and grower support, Bayer is also actively developing exciting new biologic options------.------ the newest addition to the Serenade product family, Serenade Soil Activ. ------ improves ease of use for farmers, with lower use rates. Bayer expects this new product to deliver biologic growth in expanding markets, including launching in the U.S. and Australia ------.

Unlocking opportunities for new business models, powered by data science

----industry-leading Climate FieldView digital agriculture platform is now being used on more than 150 million subscribed acres across the world. ------ logging information from planters, sprayers and combines, helps farmers make data-driven decisions and evolve Climate FieldView's models to optimize yields. Bayer is better integrating the data into its R&D process, enabling aligned testing to reflect how its customers farm, helping inform advancement of key projects it is developing. FieldView's Seed Advisor has continued to help farmers improve productivity by optimizing seed placement recommendations.

https://www.3blmedia.com/news/bayers-unmatched-rd-investment-powers-industry-leading-crop-science-portfolio March 12, 2021

2.1.1.10 Bayer Crop Science 2021 Grants4Ag Awardees

Bayer makes annual financial awards to selected scientists.

From protecting plants with beneficial bacteria to detecting disease through drones and AI, these 24 scientists have outstanding innovations to help farmers protect crops. Hereunder information on the scientists and how their research will impact Bayer's vision of #HealthForAll, #HungerForNone -.

Excerpts of the research that should be beneficial to soybeans are given hereunder:

2.1.1.10.1 Developing technologies to destroy harmful microbes in the field

From moldy fruit to Salmonella, microbial pathogens provide a great challenge for food waste, quality and safety. By targeting biofilms and the cell walls of microbes, Dr. Bryan Berger

(University of Virginia) is developing special proteins to remove these harmful pathogens that cause illness and create waste.
Our lab designs biological solutions to address challenges in health, agriculture, environmental science and industrial biotechnology.
With the Bayer Grants4AG award, we will pursue design of proteins that target microbial polysaccharides, and use them to remove microbial pathogens such as *Salmonella, Aspergillus* and *Botrytis* in pre- and post-harvest agriculture applications. Polysaccharides play a key role in microbial cell wall structure and biofilm, both of which contribute to how microbes survive on biotic and abiotic surfaces to cause both human illness and crop loss.
https://www.halo.science/blog/developing-technologies-to-destroy-harmful-microbes-in-the-field/

2.1.1.10.2 Protecting soybean plants sustainably with beneficial bacteria

Today, agriculture relies on agrochemicals to fight pests, but their adverse environmental effects are of increasing concern. To combat this, Dr. Eduardo Rodriguez (Institute of Molecular and Cell Biology of Rosario) is researching Streptomyces bacteria in order to harness their power to protect soybean plants from pests in a greener way.

Our research program is focused on crop yield improvement and disease control while recovering soil health. Microbiological control of plant diseases is based on the suppression of populations of plant pathogens by beneficial organisms. Streptomyces bacteria are part of the plant-associated microbiota that can colonize plant tissues, and they have shown biocontrol potential against fungal phytopathogens of different crop species like soybean, rice and other vegetables. In this context, we have selected particular Streptomyces species that induce a defense response that protects the soybean plants from further infection by different fungal pathogens. Understanding the mechanism underlying this protection will help to develop new technologies for the agriculture industry.

https://www.halo.science/blog/protecting-soybean-plants-sustainably-with-beneficial-bacteria/

2.1.1.10.3 Using fungi as biocontrol agents against specific plant pathogens

Through the bioactive molecules they produce, fungi hold great potential in solving problems across the spectrum, from agriculture to health. To break down the complexity of their metabolic pathways, Dr. Elizabeth Skellam (University of NorthTexas) is developing methods to synthesize these molecules with hopes of protecting crops from pathogens.

------using transcriptional regulator manipulation or heterologous expression techniques, so that we can identify the full range of bioactive molecules that a single strain of fungus can produce. This knowledge is fundamental when considering the use of fungi as biocontrol agents against specific plant pathogens, as we need to be certain that no toxic molecules are produced that cause more damage than the pathogen itself. ----intend to characterize all of the small molecules produced by a potential biocontrol agent by using metabolic engineering techniques to bypass specific environmental conditions. ----there are still plenty of novel biosynthetic pathways to be discovered. Due to the impact of fungal bioactive molecules on human health, understanding how and why these molecules are

synthesized is important when considering domesticating fungus for specific uses either in agriculture or even food production.

This project aims to understand the full secondary metabolite potential of *Sarocladium zeae*, a fungus that may protect corn from pathogenic fungi such as *Aspergillus flavus* and *Fusarium verticillioides*. If *S. zeae* produces no toxic compounds of its own, this fungus has the potential to be used as a biocontrol agent to prevent infection of corn by mycotoxin producing fungi,

https://www.halo.science/blog/using-fungi-as-biocontrol-agents-against-specific-plant-pathogens/**2.1.1.10.4 Detecting asymptomatic disease through drones and AI**

----- to translate basic science discoveries we make on established and emerging diseases and insect pests into applications. These include tools to screen plants for resistance and to accurately detect plant disease or insect attack in a timely manner. In this project, we want to develop the use of near infrared spectroscopy-based (NIR) sensors mounted on small unmanned aerial vehicles (sUAV, AKA drones), coupled with artificial intelligence approaches, to detect asymptomatic plants that are infected or under attack by "reading" their chemical fingerprints associated with physiological changes due to infection. Professor Enrico Bonello, Plant Pathology, Ohio State University

https://www.halo.science/blog/detecting-asymptomatic-disease-through-drones-and-ai/

2.1.1.10.5 Investigating strategies to control recombination in plant genomes

Recombination allows us to combine useful traits from domesticated and wild strains that are better adapted to the changing climate. We are interested in both control of recombination frequency and location along the chromosomes. Professor Ian Henderson, University of Cambridge.

https://www.halo.science/blog/investigating-strategies-to-control-recombination-in-plant-genomes/

2.1.1.10.6 DNAzymes as treatment for viral diseases in agriculturally relevant crops

RNA-cleaving DNAzymes can reduce the levels of RNA with high specificity, which leads to a great potential in therapeutic applications targeting viral infections in humans and crops. We study the structure and activity of DNAzymes to obtain insights into their mechanism of action. Our goal is to develop DNAzymes that target viral RNA of agriculturally relevant crops and contribute to fight plant diseases. Dr. Ingrid Span, Heinrich Heine University, Germany

https://www.halo.science/blog/dnazymes-as-treatment-for-viral-diseases-in-agriculturally-relevant-crops/

2.1.1.10.7 Improving agricultural technologies through the targeting abilities of aptamers

Beyond the double helix, DNA and RNA molecules can fold into many different shapes like aptamers, short sequences that can stick to specific target molecules. Hoping to make use of this specificity, Dr. Maria DeRosa (CarletonUniversity) is investigating the potential of aptamers for more sustainable agricultural technologies.

------ seek to develop biosensors and “smart” materials based on aptamers–short synthetic DNA or RNA sequences that specifically bind to a diverse variety of targets from small molecules to whole cells. Our goal is to discover new aptamer sequences, understand their binding properties and apply them to help solve problems in a wide range of fields including health, environment and agriculture.

https://www.halo.science/blog/improving-agricultural-technologies-through-the-targeting-abilities-of-aptamers/

2.1.1.10.8 Investigating the ecology and evolution of microorganisms to improve soil amendments for farming

Focusing on the soil microbiome, Dr. Megan Rúa (Assitant Professor, Wright State University) is researching how microorganisms interact with each other and with plants to help farmers develop new tools for growing crops.

-------- use a variety of techniques including laboratory, greenhouse and field investigations as well as experimental procedures such as advanced techniques in genomics and data analysis. ------ important for understanding how we can improve plant performance when plants are experiencing biotic or abiotic stresses, such as pathogen infection or nutrient limitation.

https://www.halo.science/blog/investigating-the-ecology-and-evolution-of-microorganisms-to-improve-soil-amendments-for-farming/

2.1.**1.10.9 Harnessing the power of AI and robotics for crop monitoring**

Aiming to help farmers maximize productivity and produce quality, Dr. Sigfredo Fuentes (Associate Professor, The Melbourne University) is developing drone-mounted and AI-powered sensor technologies to monitor pests and diseases in crops. Our research applies these principles to agriculture, food and animal sciences, integrating digital sensors with robotics and AI technology. For this project, the focus was on implementing newly developed, low-cost electronic noses and machine learning to detect pests in crops, using the integrated sensors as a payload of unmanned aerial vehicles (UAV).

https://www.halo.science/blog/harnessing-the-power-of-ai-and-robotics-for-crop-monitoring/

2.1.1.10.10 Detecting pests and plant disease with low-cost AI technology

Sivam Krish, CEO and Founder at GoMicro

With just a smartphone and a clip-on magnifier, Dr. Krish (Sivam)(CEO and Founder GoMicro) seeks to protect crops, reduce food waste, and ensure food quality by bringing AI technology to the mainstream.

----, enabling anyone with a smartphone to build and deploy high accuracy diagnostics AI Engines. While much of AI research produces quality results in the lab, they fail miserably when implemented in the field due to variations in imaging conditions. ----- solved this problem by building a low-cost, phone-attachable, clip-on magnifier that works on any cellular device. It creates lab quality imaging

conditions, making it possible to create high accuracy diagnostic apps with a very small number of training images. We have tested this technology successfully for assessing pests, plant disease, fresh produce quality, and seafood quality.

https://www.halo.science/blog/detecting-pests-and-plant-disease-with-low-cost-ai-technology/

2.1.1.10.11 Finding natural materials to replace synthetic herbicides

Reflecting on the environmental impacts of synthetic herbicides, the hunt is on for natural materials to replace them. By studying plant species grown for crop rotation and living mulch, Dr. Yinghui Mu (South China Agricultural University) is searching for new bioherbicides by analysing how these plants inhibit weed growth.

------also use ryegrass and white clover as living mulch crops coexisting with spring corn. We found living mulch can inhibit weeds in the field, and the residue decomposed under rotary tillage can also inhibit the germination of weed. After the residue is returned into the soil with the rotary, some material is released and inhibits the germination of the weed. We are trying to find that material and see if it can be used as a bioherbicide.

https://www.halo.science/blog/finding-natural-materials-to-replace-synthetic-herbicides/

2.1.1.10.12 Protecting farm workers and improving efficiency through advanced robotics

To protect farm workers and improve the efficiency and traceability of pesticide application, Yulia Poroshenko (Founder) of Agrohub, along with Oleg Prihodko (SenseAgro) and Alexander Alfimov (CPCS), are developing Robomix, an automated pesticide-mixing robot.

With the help of Robomix, farmers will be able to raise the efficiency of pesticide application through the complete automation of the process and ensure full traceability as well as precise accounting of the pesticides used. More importantly, farmers will be able to protect the workforce and eliminate any possible injuries related to pesticide poisoning,

https://www.halo.science/blog/protecting-farm-workers-and-improving-efficiency-through-advanced-robotics/

2.1.1.10.13 Using a deep learning model to predict and select disease-resistant plants

------ uses advanced DNA sequencing technologies and statistical models (mixed-linear model and machine learning) to identify DNA markers and genes associated with disease and yield-related traits in crops. However, complex traits such as grain yield are hard to predict, as they are often controlled by a large number of small effect genes with complicated interactions. Genomic selection is a new breeding tool for predicting and selecting complex traits of an individual plant from high-density DNA markers spread across the entire genome. Yongle Li, University of Adelaide- Waite Campus

https://www.halo.science/blog/using-a-deep-learning-model-to-predict-and-select-disease-resistant-plants/

2.1.1.10.14 Investigating nematode-bacteria interactions to develop better biopesticides

The infestation of nematode-bacteria symbiont (e.g. *Steinernema carpocapsae* and *Xenorhabdus nematophila*) could kill insect host (e.g. *Bactrocera dorsalis*) very effectively, normally within 24 hours. The product of metabolism released by *X. nematophila* is highly noxious to insect hosts. We want to explore the infestation biomarker of nematode-bacteria symbiont by taking *Bactrocera dorsalis* as a research model.

------ assumed there should be an effective bioactive substance released by nematode-bacteria symbiont. The key biomarker released by nematode-bacteria symbiont is the key compound of insect death. ------ would have potential application for development of novel biopesticides.

Dr. Zihua Zhou, Associate Professor China Agricultural University

https://www.halo.science/blog/investigating-nematode-bacteria-interactions-to-develop-better-biopesticides/

https://www.halo.science/blog/bayer-crop-science-2021-grants4ag-awardees/ June 2021

2.1.2. BASF

2.1.2.1 New Soybean varieties for 2022

Google: BASF 14 new Enlist E3 soybean varieties *and open website. Click on highlighted '*Enlist E3 soybean varieties,' *click on '* Explore Enlist E3, *scroll down to and click on* 'Explore Xitavo'*scrolldown to view varieties of Maturity Group 0* (MG0) *as indicated in the brown coloured windown on the top right hand side. Click on the arrow in this window to open sites to each group up to MG4.*

https://www.basf.com/us/en/media/news-releases/2021/09/basf-paves-the-way-with-14-new-enlist-e3-soybean-varieties-for-2.html September 15, 2021

or

https://www.xitavosoybeanseed.com/xitavo-varieties.html September 15, 2021

2.1.2.2 BASF paves the way with 14 new Enlist E3 soybean varieties for 2022 planting

BASF has expanded its Xitavo™ soybean seed portfolio with the addition of 14 new high-performing Enlist E3® soybean varieties. Xitavo soybean seed is owned by MS Technologies and is exclusively distributed by BASF.

Xitavo soybean seed will be available in 31 varieties covering relative maturities from 0.1-4.7. Xitavo soybean seed includes the Enlist E3 triple-stack herbicide tolerant trait, providing tolerance to Liberty® herbicide, a novel 2,4-D choline formulation and glyphosate. Yield trials in 2020 showed Xitavo varieties outperforming the test mean by an average of nearly 106% ------.

- **XO 0602E:** A top yielding soybean with high standability is hard to find. This variety has top-notch standability and outperforms the competition. It yields 108.3% of the test mean. Bred for Western geographies with a strong agronomic package.[1]

XO 1632E: An agronomic leader, this variety offers an excellent disease package with 3a Phytophthora root rot (PRR), good iron deficiency chlorosis (IDC), sudden death syndrome (SDS) tolerance and brown stem rot (BSR) resistance. It yields 106.9% of the test mean.[1]

- **XO 2472E**: Above average IDC, SDS with BSR resistance and 1k PRR gene. This variety stands out with a 107.1% yield advantage above the test mean with broad acre adaptability.[1]

- **XO 3402E**: Taller variety with great standability. This variety has a market-leading defense package and yielded 104.3% above the test mean.[1]

For more information, visit XitavoSoybeanSeed.com

ttps://www.basf.com/us/en/media/news-releases/2021/09/basf-paves-the-way-with-14-new-enlist-e3-soybean-varieties-for-2.html September 15, 2021

2.1.2.3 BASF and The SCN Coalition join forces as part of soybean cyst nematode action month

BASF Agricultural Solutions and The SCN Coalition have designated October as SCN Action Month to provide growers with the information needed to make sound, successful agronomic decisions to defend against this devastating pest.

Soil testing is the foundational element for managing SCN," said Greg Tylka, Iowa State University nematologist and spokesperson for The SCN Coalition. "Once SCN is detected, it will always be there at some level. It might be 3 or 4 bushels per acre, or it might be 23 or 24 bushels per acre. But you won't know until you test your soil.

https://www.basf.com/us/en/media/news-releases/2021/10/basf-and-the-scn-coalition-join-forces-as-part-of-soybean-cyst-n.html October 4, 2021

2.1.2.4 Corteva Agriscience and BASF Canada collaborate on weed control

Corteva Agriscience and BASF Canada Agricultural Solutions (BASF) have announced a collaboration and joint approach to weed control by recommending the combined use of Liberty 200 SN and Enlist herbicides on Enlist E3TM soybean acres.
The combination will work especially well on weeds like waterhemp and Canada fleabane, that are now glyphosate resistant in many soybean fields. By using this combination on the same acre, farmers can access improved weed control while helping sustain the long-term efficacy of both herbicides,----.

Liberty 200 SN herbicide contains a unique mode of action that helps to control tough glyphosate resistant weeds and its unique formulation, designed for glufosinate ammonium tolerant soybeans, including Enlist E3 ,will make it an excellent tank mix partner for Enlist 1 for improved post emerge weed control."

https://www.realagriculture.com/2021/05/corteva-agriscience-and-basf-canada-collaborate-on-weed-control/ May 12, 2021

2.1.2.5 Bosch and BASF establish joint venture for digital technologies in the agricultural sector

Bosch and BASF Digital Farming have signed a 50:50 joint venture (JV) agreement to globally market and sell smart farming solutions from a single source in the future. ------ founding of a new company based in Cologne, ----.

Bosch brings to the JV significant capability in hardware and software, as well as digital services for planning and decision making in field crops. BASF Digital Farming with its xarvio™ Digital Farming Solutions provides an automated, real-time, field specific agronomic decision-making engine for weed management that is powered by the digital xarvio platform for crop optimization. It provides farmers with field zone specific advice on how to produce crops in the most sustainable way.

Spraying and saving

The first two products to be launched will be a version of the Intelligent Planting Solution (IPS) system, with enhanced digital intelligence for seeding and fertilizer prescriptions, and Smart Spraying. The Smart Spraying solution combines Bosch's camera sensor technology and software with xarvio' s crop optimization platform. Both products have been tested extensively in real growing conditions. Smart Spraying shows up to 70 % herbicide volumes reduction in experimental stage. The solution is expected to be launched with a limited number of machines in 2021.
https://www.basf.com/global/en/media/news-releases/2020/11/p-20-361.html November 12, 2020

2.1.3.1 BrettYoung

2.1 3.1.1 Distinct by Design: Signum Soybean with Bio-Inducer Technology

What makes Signum Soybean Distinct by Design, and what sets it apart from other products on the market, are two novel technologies that provide a significant boost in on-seed and liquid inoculant performance. These technologies are developed by Rizobacter – BrettYoung's partner in biologicals.

Bio-Inducer Technology

----- Bio-inducer Technology accelerates the communication between the plant and rhizobia, resulting in earlier and more efficient nodulation and nitrogen fixation. Signum Soybean inoculant contains Bio-Induced rhizobia which are produced using chemical compounds to mimic the chemical signals plant roots release in the soil. This activates the bacteria to begin the nodulation process, shortening the time needed to start forming nodules.

Osmo Protector Technology

Signum Soybean inoculant additionally benefit from Osmo Protector Technology, another Rizobacter innovation -----. With Osmo Protector Technology, the bacteria in Signum Soybean are produced through a longer, stress-inducing manufacturing process that strengthens their cell walls. This makes them stronger and able to survive longer on-seed. They're also better equipped to withstand chemical stresses from seed treatment and environmental challenges, like the temperature extremes and drought conditions

https://www.brettyoung.ca/west-canada-seed-crop-inputs/blog/distinct-design-signum-soybean-bio-inducer-technology February 22, 2021

2.1.4. Cargill

2.1.4.1 Cargill introduces new revenue stream for farmers as part of 10 million acre regenerative agriculture commitment

Cargill RegenConnect™ links farmers to the emerging carbon marketplace and helps scale the voluntary adoption of regenerative agriculture practices

One year ago, Cargill made a commitment to advance regenerative agriculture practices across 10 million acres of land in North America by 2030,------. Cargill RegenConnect™, a new regenerative agriculture program that pays farmers for improved soil health and positive environmental outcomes, including payment per metric ton of carbon sequestered. The new program connects farmers to the growing carbon marketplace and will help scale the voluntary adoption of regenerative agriculture practices.

Farmers enrolled in Cargill RegenConnect™ will implement regenerative agriculture practices of their choosing beginning this fall into the next planting season. Practices that will qualify include cover crops and reduced- or no-tillage.

Cargill has partnered with leading carbon measurement firm Regrow to make it easy for farmers to Measure, Report and Verify (MRV) carbon outcomes using in-field data, remote sensing and crop and soil health modeling.

In a study of 100 farmers across nine states conducted by The Soil Health Institute and supported by Cargill, researchers found that soil health management systems increased incomes for 85 percent of farmers growing corn and 88 percent of farmers growing soybeans. The average income for corn growers increased by $52 per acre and $45 per acre for soybeans. Additionally, farmers reported reduced average costs to grow corn by $24 per acre and soybeans by $17 per acre.

Additional details regarding Cargill's full suite of farmer programs can be found at CargillAg.com.

https://www.cargill.com/2021/cargill-introduces-new-revenue-stream-for-farmers

September 16, 2021

2.1.4.2 Cargill, Frontline International partner to bring automated cooking oil management system to the foodservice industry

New Kitchen Controller™ oil management system uses real-time data to more consistently and profitably cook fried foods

Cargill has joined with Frontline International to develop the Kitchen Controller™ end-to-end, automated oil management system.

The Kitchen Controller system simplifies cooking oil management by automating the oil filtering and replacement process. At the heart of the system, a fry vat sensor gathers oil quality data. The data is then analyzed by the Kitchen Controller proprietary software and fed to a touchscreen pad. Kitchen

staff use the green, yellow and red on-screen indicators on the touchpad to take action with the oil. This helps to ensure consistency and quality of fried foods and improves profitability.

Learn more about Kitchen Controller oil management system here.

https://www.cargill.com/2021/cargill-frontline-international-partner-to-bring-automated

May 17, 2021

2.1.4.3 Cargill invests in start-up Bflike to help food manufacturers and retailers offer a new generation of plant-based meat and fish alternative products

Proprietary technology creates plant-based alternatives that look, feel and cook like their animal-based counterparts

------Cargill is investing in Bflike, a start-up created by BOX NV, which is poised to be a new technology leader in the rapidly evolving meat and fish alternatives categories.

This ground-breaking technology results in plant-based meat and fish alternative products that are virtually indistinguishable from their animal-based counterparts, with similar visual appearance (both raw and cooked), texture, mouthfeel, melting behavior and cooking performance.

https://www.cargill.com/2021/cargill-investment-bflike May 22, 2021

2.1.4.4 Cargill enters alliance to convert soybean and corn farmland in USA to organic production

----- Cargill has joined an alliance with organic research organisation Rodale Institute and chicken producer Bell & Evans ----. ---- growth of Bell & Evans' organic chicken business had led to an increased need for US grown organic-certified corn and soybeans for use in its organic chicken feed, ----. ----- entered into a sourcing agreement with Cargill to exclusively secure its organic grain and increase domestic organic grain supply.

---- Cargill would encourage US farmers to convert land from conventional to ----- organic management through subsidised organic crop consulting services provided by the Rodale Institute. The aim of the Bell & Evans Organic Grain Initiative was to convert 20,234 ha (50,000 acres) of US corn and soybean farmland to certified organic production over the next five years.

https://www.aboissa.com.br/en/news/latest-news/2697-cargill-enters-alliance-to-convert-soybean-and-corn-farmland-in-usa-to-organic-production March 11, 2021

2.1.5. Corteva Agriscience/Dow DuPont/ Pioneer Hi-Bred International

2.1.5.1 Corteva and Symborg Agreement Expands Farmer Access to Microbe-based Nitrogen Fixation Product

Corteva Agriscience and Symborg, an expert in microbiological technologies, announced today a multi-year agreement around a microbe-based nitrogen fixation product in the United States, Canada, Brazil and Argentina.

-----Symborg is providing an exclusive distribution license to Corteva for the endophytic bacterium *Methylobacterium symbioticum*, which works with the plant to secure needed nitrogen from the atmosphere.

The Corteva product, to be branded as Utrisha™ N nutrient efficiency optimizer, works in natural field conditions, adapting to the plants' growth needs and helping to sustainably maximize crop yield potential. It will be available for a broad range of crops, including field and row crops, sugar cane, and turf and ornamental, as well as range and pasture.

Utrisha™ N, a BlueN™ technology powered by Symborg, will provide value through integrated nutrition management efficiency and enhancing yield potential and sustainability, in line with the Corteva Agriscience 2030 Sustainability Goals.

https://www.corteva.ca/en/about-corteva/media-centre/corteva-and-symborg-agreement-expands-farmer-access-to-microbe-based-nitrogen-fixation-product.html April 19, 2021

2.1.5.2 Corteva Agriscience Launches Conkesta E3® Soybeans in Brazil

Technology part of Enlist® weed control system,

Conkesta E3® soybeans incorporate broad lepidopteran insect protection in strong genetics as part of the Enlist® weed control system, which offers maximum flexibility and superior control of broadleaf weeds and grasses. received authorization by the European Union Commission, which enables grain produced from Conkesta E3® soybeans grown in Brazil to be exported to the European market for food and feed use. The technology has been previously authorized in several other export markets, including China -----.

Conkesta E3® soybeans are tolerant to Enlist® Colex-D® and Enlist Duo® Colex-D® herbicides — both contain 2,4-D choline with Colex-D® technology that provides near-zero volatility and reduced drift potential — and also are tolerant to glyphosate and glufosinate herbicides. Conkesta E3® soybeans additionally incorporate two Bt proteins (Cry1F and Cry1Ac) for the management of the main caterpillar pests in soybean crops

https://www.prnewswire.com/news-releases/corteva-agriscience-launches-conkesta-e3-soybeans-in-brazil-301361451.html August 24, 2021

2.1.5.3 Corteva Announces Expansion of Corteva Carbon Initiative for 2022 Crop Year

Joint Effort with Indigo Ag Enhances Corteva's Carbon Initiative with Expanded Access and

Eligibility While Increasing Long-Term Profit Potential for U.S. Farmers

https://www.corteva.us/press-releases/corteva-carbon-initiative-2022-crop-year.html

August 26, 2021

2.1.5.4 Corteva Agriscience Signs Agreement with Andermatt to Provide U.S. Farmers New Biocontrol Solutions

Corteva Agriscience and Andermatt USA announced today a multi-year agreement for two technologies that will benefit U.S. farmers. Andermatt USA is the U.S. subsidiary of Andermatt Biocontrol AG, global pioneers in producing microbiological products for biological pest control.

As part of the agreement, Corteva receives an exclusive license to a bioinsecticide based on the naturally occurring insecticidal virus, *Helicoverpa armigera nucleopolyhedrovirus*. The active ingredient targets larvae of African cotton bollworm, corn earworm and other *Helicoverpa* species. The unique technology allows efficient and sustainable control of these pests, which damage crops including soybeans, cotton, sorghum and corn.

(The second technology is a biofungicide for potatoes, fruits and vegetables.)

https://www.corteva.us/press-releases/new-biocontrol-solutions.html July 14, 2021

limate-strategy-inaugural-sustainability-report.html June 2, 2021

2.1.5.6 Corteva Agriscience Collaborates with Elemental Enzymes on Abiotic Stress Mitigation Technology

Agreement further expands Corteva Agrisciences's biological portfolio of proven

biostimulant, biocontrol and pheromone solutions

Corteva Agriscience and Elemental Enzymes, a life sciences company that develops novel biotechnology and enzymes solutions, announced today a multi-year global agreement around a unique abiotic stress mitigation technology.

Through the agreement, Corteva receives an exclusive license to Elemental Enzymes's Waterflux® technology. The optimized osmoprotectant blend provides plants with small organic molecules that help crops overcome abiotic stressors such as soil salinity, drought, and extreme temperatures, helping keep them productive and healthy.

Corteva will offer this technology through a family of products to be branded under the name Sosdia™ Abiotic Stress Mitigator/Biostimulant. Two different products and formulations will be offered for a broad range of crops, including specialty and row crops,------- . Pending appropriate registrations, Corteva will launch the products globally, excluding Australia and New Zealand territories.

https://www.corteva.us/press-releases/corteva-provides-farmers-abiotic-stress-mitigation-techonology.html June 1, 2021

2.1.5.8 DroneDeploy Joins Forces with Corteva to Bring Scalable, Best-In-Class Analytics to Farmers

By Integrating Corteva Agriscience's Best-in-Class AI and Machine Learning Directly into its Platform, DroneDeploy Helps Give the Agriculture Industry a Boost in Productivity

------ leading enterprise drone data platform DroneDeploy announces a collaboration with one of the world's largest pure-play agricultural organization, Corteva Agriscience to bring improved management decisions to farmers . DroneDeploy provides streamlined data capture and analysis capabilities for Corteva's fleet of more than 600 drones and is now the first third-party company approved to license Corteva's proprietary Stand Assessment Artificial Intelligence (AI) and machine learning technology.

DroneDeploy most recently leveraged Corteva's proven machine learning algorithms to build its new Stand Assessment solution. Stand Assessment is a complete flight, capture, analysis and reporting workflow designed to determine crop emergence for early-stage fields.

https://www.corteva.us/press-releases/DroneDeploy-Joins-Forces-with-Corteva-to-Bring-Scalable-Best-In-Class-Analytics.html February 9, 2021

2.1.5.10 Instinct NXTGEN™ Nitrogen Stabilizer Launches for 2021 Growing Seaso

The newest formulation of Instinct® nitrogen stabilizer offers improved handling and a lower use rate

Corteva Agriscience announced the launch of Instinct NXTGEN™ nitrogen stabilizer, an enhanced formulation of Instinct® nitrogen stabilizer with improved handling and a lower use rate. The new product has received registration from the U.S. Environmental Protection Agency, as well as label approvals in key states, and is now available for purchase.

Specific improvements include lower viscosity for better overall handling during early spring applications and a lower use rate of 24 ounces per acre versus 37 ounces per acre for better blending when mixing with urea.

"The lower use rate of Instinct NXTGEN nitrogen stabilizer allows for simplified mixing with urea by preventing clumping, stickiness and clogged machinery."

Instinct NXTGEN nitrogen stabilizer contains Optinyte® technology, which assures up to eight weeks of unrivaled protection of urea, UAN and liquid manure during fall, spring and sidedress applications.

The Optinyte technology in Instinct NXTGEN nitrogen stabilizer has been shown to:*

- Increase average yield by 5.2% when used with spring applications
- Lessen greenhouse gas emissions by 51%
- Promote 28% greater soil nitrogen retention
- Reduce leaching by 16%

To learn more about Instinct NXTGEN™ nitrogen stabilizer, visit InstinctNitrogenStabilizer.com on Corteva.us.

https://www.corteva.us/press-releases/Instinct-NXTGEN-Nitrogen-Stabilizer-Launches-for-2021-Growing-Season.html August 10, 2020

2.1.6 Limagrain Zaad South Africa

Geen webwerf met nuwe sojaboonkultivars vir 2021/22 nie

2.1.7. Syngenta

2.1.7.1 Syngenta Canada enters biological control market with new corn and soybean seed treatment

- Draco™ offers partial suppression of seed rot and seedling blight caused by Rhizoctonia solani and root knot nematode in corn and soybeans, plus soybean cyst nematode in soybeans

- Provides an additional mode of action against target pests

- Available on seed for the 2022 growing season

Draco features the bacteria *Bacillus licheniformis* and *Bacillus subtilis.*

https://www.syngenta.ca/syngenta-in-the-news/syngenta-canada-enters-biological-control-market-with-n April 20, 2021

2.1.7.2 Swift federal action needed to close the agri-food sector's digital divide

'The most important farming implement of the 21st century is not the seeder or the combine, but broadband internet.'
Trevor Heck, president of Syngenta Canada, recently penned an opinion piece in The Hill Times, Canada's Politics and Government Newspaper.

- You can downoad the full article here.

https://www.syngenta.ca/syngenta-in-the-news/swift-federal-action-needed-to-close-the-agri-food-sect March 17, 2021

2.1.7.3 Understanding the new NK soybeans naming convention

NK®	**07**	**-**	**A7**	**E3**
All traited NK soybean varieties launching for the 2022 growing season will feature the "NK" text associated with the variety name. This standardized approach will apply to all future traited soybean varieties	Indicates maturity group and relative maturity (RM) within the group, on a scale from 0-9 (0 = early; 9 = late).		Randomly designated letter and number used to differentiate between varieties with the same RM.	Indicates herbicide technology: E3 = Enlist E3™ X = Roundup Ready 2 Xtend® Randomly designated letter and number

NK®	**07**	**-**	**A7**	**E3**
introduced to the NK portfolio.				= Roundup Ready 2 Yield®

So, by studying the name, you learn that NK®07-A7E3 is an earlier maturity variety with Enlist E3™ herbicide technology ------.

https://www.syngenta.ca/agronomy/new-nk-naming-convention July 15, 2021

2.1.7.4 Syngenta NK Soybean varieties for 2022

Google '2022 Syngenta NK soybean varieties' *and click on '*2022-nk-seed-guide.pdf-syngenta US' *scroll down about 29 pages to reach the section of 20 pages on soybeans.*

https://www.syngenta-us.com/seed-guides/_assets/2022-nk-seed-guide.pdf July 2021

2.1.7.5 Saadmaatskappye Suid-Afrika

2.1.7.5 Saadmaatskappye in Suid-Afrika

Webwerwe oor nuwe kultivars vir 2022 is nie gevind nie. In September 2020 het GraanSA webwerf n Mini-fokus vir sojabone gehad 'Cultivars and technology for the new season' by:

https://sagrainmag.co.za/2020/09/08/cultivars-and-technology-for-the-new-season/

waarin die kultivars insluitend nuwe kultivars van Pannar, Corteva, Pioneer, Agri-Seed, Agricol/GDM vir die komende 2021 seisoen behandel is asook verwys na die nuwe tegnologie INTACTA van Bayer.

Dié is nie herhaal vir 2022 nie en sodanige inligting is beskikbaar op die webwerwe van die onderskeie saadmaatskappye waarvan die van Pannar (https://www.pannar.com/), Pioneer(https://web.facebook.com/pioneerseedsa/videos/our-p61t38r-soybean-hybrid-is-ideal-for-dryland-and-irrigation-it-is-also-a-very/363087698292042/?_rdc=1&_rdrv, Sensako(https://www.sensako.co.za/NewsArticle.aspx?id=46) , Agricol(https://www.agricol.co.za/agricol-products/soybeans-don-mario/) gevind is.

2.2 HIGH OLEIC SOYBEANS

2.2 Innovative Seed Trait Delivers on Consumer Preference and Farmers' Bottom Line

With funding and partnership support from the soy checkoff, the Missouri Soybean Merchandising Council is leading the effort to build momentum for SOYLEIC™, a non-GMO soybean variety containing high oleic trait technology.

The SOYLEIC trait technology was developed after over a decade of research. Seeds carrying SOYLEIC are going into approximately 40,000 acres across 14 states from Georgia to Minnesota this growing season. In addition, a new website, soyleic.com, is now available as a one-stop shop for information for farmers, researchers, chefs and health-conscious consumers.

To learn more about the non-GMO high oleic soybean trait technology and opportunities to try SOYLEIC, visit soyleic.com.

https://www.unitedsoybean.org/hopper/innovative-seed-trait-delivers-on-consumer-preference-and-farmers-bottom-line/ June 2, 2021

2.3 BREEDING FOR RESISTANCE

None

2.4 SELECTION TECHNIQUES

2.4.1 Improving U.S. Soy Quality, Resilience

Gene Editing to Increase Soy Protein Content

Michael Lassner, Amfora Inc.

This project addresses challenges posed by increasingly hard-to-control and herbicide-resistant weeds in U.S. soybean fields. Using CRISPR gene-editing technology, researchers are working to equip soybeans with previously unused herbicide-tolerance traits.

Unlike herbicide-tolerance traits currently available to farmers, this new technology does not introduce non-plant genes. This approach could lessen the regulatory issues associated with GMOs.

This project addresses challenges posed by increasingly hard-to-control and herbicide-resistant weeds in U.S. soybean fields. Using CRISPR gene-editing technology, researchers are working to equip soybeans with previously unused herbicide-tolerance traits.

Unlike herbicide-tolerance traits currently available to farmers, this new technology does not introduce non-plant genes. This approach could lessen the regulatory issues associated with GMOs.

Using CRISPR to Generate Non-Transgenic Herbicide-Resistance Traits in Soybeans

Feng Qu, Ohio Agricultural Research and Development Center

This project addresses challenges posed by increasingly hard-to-control and herbicide-resistant weeds in U.S. soybean fields. Using CRISPR gene-editing technology, researchers are working to equip soybeans with previously unused herbicide-tolerance traits.

Unlike herbicide-tolerance traits currently available to farmers, this new technology does not introduce non-plant genes. This approach could lessen the regulatory issues associated with GMOs.

Potential outcomes include a seed variety containing three new herbicide-tolerance traits.

https://www.unitedsoybean.org/hopper/improving-us-soy-quality-resilience-1/ September 10, 2020

2.5 BREEDING FOR DROUGHT AND HEAT TOLERANCE

2.5.1 Soybeans that 'Sweat' Less Tolerate Drought More

Avat Shekoofa, assistant professor with the Department of Plant Sciences, University of Tennessee Institute of Agriculture ------ long-term research,-------measures water loss, wilting and leaf temperature in soybeans to identify lines that handle drought conditions well.

----soybean varieties demonstrate a wide range of water loss at different growth stages, -----.

----- observed that some soybean varieties wilt much more slowly than others under drought conditions. ----- these slow-wilting soybean varieties yielded 22 to 29% more than fast-wilting varieties that lose water more quickly. Wilting scores and canopy temperatures dropped at different rates, indicating how well the soybeans can bounce back ------. Yield results correlated with recovery rates.

In 2021, this research is expanding to include a wider range of maturity groups, as well as high oleic soybean varieties. Soybean lines that show slow-wilting traits are being incorporated into breeding efforts to develop and improve drought-tolerant soybean varieties.

https://soybeanresearchinfo.com/research-highlight/soybeans-that-sweat-less-tolerate-drought-more/ Augustus 16, 2021

2.5.2 EEAOC

Brassinosteroid and brassinosteroid-mimic differentially modulate Arabidopsis thaliana fitness under drought

Brassinosteroids (BRs) are widely used to promote plant growth/development and alleviate environmental stresses' adverse effects. However, its low stability in the field precludes large-scale application, challenging research, and more stable and cost-effective analogues. The most commonly used is 24-Epibrassinolide (EBL), yet, due to its high production cost, the study of cheaper molecules with similar/higher activity constitutes a priority. In this study, we analyzed, under drought, the effects of EBL and DI-31, a synthetic functional analogue, through a physiological and biochemical approach in Arabidopsis thaliana wild-type plants

These findings confirm the DI-31 practical value as growth-promoter and defence-enhancer, with stronger and longer-term activity than EBL, constituting an environmentally-friendly and cost-effective alternative to increase plant fitness under drought, precluding large biomass penalty.

https://www.researchgate.net/publication/352143207_Brassinosteroid_and_brassinosteroid-mimic_differentially_modulate_Arabidopsis_thaliana_fitness_under_drought September 2021

2.6 FUTURE SELECTION GOALS

None

3. INTERESTING SUBJECTS BEING CONDUCTED ON SOYBEANS

3.1 United Soybean Board

Strategic Objectives

Meal

The soy checkoff will help develop, communicate and capture the full value of U.S. soybean meal in feed, food and industrial applications.

Oil

The soy checkoff will build preference for U.S. soybean oil in the food and industrial markets differentiating U.S. soybean oil through promotion, as well as research. Research will showcase the functionality and versatility of U.S. soybean oil, specifically as it relates to high oleic soybean oil.

Sustainability

The soy checkoff will effectively enhance and communicate U.S. soy sustainability performance so that buyers and end users prefer U.S. soy as the best raw material choice to meet their own sustainability and social responsibility goals. As part of this goal, USB will drive a coordinated sustainability message across the entire value chain.

https://www.unitedsoybean.org/objectives-initiatives/ Date; 2021

3.2 Soybean Growers Approve 2021 Resolutions

------ recognize the role that climate and conservation will play in policy discussions in 2021, from thoughtfully addressing development of public and private ecosystem services markets to promoting precision agriculture technology as a tool to improve environmental stewardship while providing economic returns for growers."

Among the approvals are resolutions supporting:

- Trade Promotion Authority (TPA) reauthorization
- A sufficiently-funded Commodity Credit Corporation (CCC) account to ensure timely benefits to farmers
- A strong farm safety net and crop insurance program, including support for expanding double crop soybean coverage
- Federal efforts to boost precision ag technology availability and grower adoption
- Increased federal funding to provide conservation technical assistance to growers
- USDA's Natural Resource Conservation Service's definition of soil health
- Development of voluntary carbon markets that incentivize agricultural conservation
- Significant increases in rural infrastructure funding
- Changes to the traditional gas tax to reflect the increase in EVs/hybrids on the road to support the Federal Highway Trust Fund
- Identifying additional funding mechanisms for rural broadband investment and deployment
- Increased utilization of higher-blend biodiesel to lower emissions and improve air quality
- Reducing barriers and increasing access to improved genetics and crop protection tools that lead to improved environmental outcomes

https://soygrowers.com/news-releases/soybean-growers-approve-2021-resolutions/

February 25, 2021

3.3 Research reported on USB website

3.3.1 Data

Research data can be accessed by opening the USB website, left click on: Tools and Resources *and click on:* Research Database.

1.2.1 On the window Search for Research Projects *follow the instructions to open projects back to 2010 categorized in 34 categories (click on arrows) with full access to details on each project (left click on project name).*

1.2.2 On the Research Highlights *window left click on either* Soybean Research and Information Network *or* More *to open colour illustrated 'manuals' to identify and manage*

1.2.2.1 21 Soybean Pests (of animal origin) eg.worms, beetles

1.2.2.2 20 Soybean Diseases eg. moulds, bacteria, virus

https://www.unitedsoybean.org/

or

https://www.soybeanresearchdata.com/

3.3.2 Research Highlights

Go to Soybean Research and Information Network (SRIN) *, click on* Resources*, click on* Research Highlights *and open selected projects from the scroll down list. The articles report on the projects in more popular style. At the end of each article click on* National Soybean Checkoff Research Database *to open the* Project Details *and scroll down to* Project Summary *to obtain a more scientific version of the project and progress made.*

https://soybeanresearchinfo.com/resources/research-highlights/ 2021

3.4 USDA-ARS Research results

3.4.1 National Programs

Google USDA ARS *to open their website, click on* 'Research', *scroll down to* 'Search for an ARS project' *type in* 'soybeans*' in window next to* 'Search for:' *scroll down to* 'SEARCH*'* to open list of 48 projects. *To obtain details and short resume of the Objective and Approach of each, click on the title of the project.*

3.4.2 Publications

Directly below 'Search for an ARS project' (refer to above 3.4.1) *click on* 'Search for an ARS scientific manuscript' *and again* 'soybeans' *in the window and click on* SEARCH *to open list of 153 publications of which the first 13 were made during the timespan of this report.*
Click on the title of the publication to get access to details thereof as well as an Interpretive Summary *and a* Technical Abstract *of which some excerpts are reported hereunder:*

3.4.2.1 Growth chamber and greenhouse screening of promising in vitro fungal biological control candidates for the soybean cyst nematode (Heterodera glycines)

Interpretive Summary: This study evaluated the ability of 10 fungi shown to produce compounds in liquid filtrates that are toxic to nematode and 10 fungi that directly parasitized the eggs of the SCN in petri-plate assays to control reproduction of the SCN in more realistic growth chamber and greenhouse plant assays. Results showed that three isolates performed as well as several commercially available biological control products on the market at much lower spore application rates. This research identified promising candidate for development as biological control agents for this plant parasitic nematode. 4/23/2021

3.4.2.2 Diverse rotations mitigate the mutual suppression of corn and soybeans through the rhizosphere

Technical Abstract: *Concluding sentence reads:* These results support a microbial mechanism behind the production benefits of diverse rotations, and suggest the development of a microbial "syndrome" specific to corn-soybean rotations that reduce production potential. 4/23/2021

3.4.2.3 Attenuation-only method for moisture sensing in granular materials

Interpretive Summary: ------ the limited use of this promising technology is related to the cost, which remains relatively high and the complexity of calibration of devices using this technology. In this

paper, a simplification was introduced to lower the cost and simplify the calibration process. 3/25/2021

To validate this concept of measurement, measurements were performed on wheat, corn, and soybeans at 23 oC and microwave frequencies ranging from 7 Gigahertz to 12 Gigahertz. Results show that moisture content in wheat, corn , and soybeans can be predicted with standard errors of calibration between 0.65% and 0.78% for wheat, 0.34% and 0.59% for soybeans, and 1.01% and 1.45% for corn.

3.4.2.4 Soybean trypsin inhibitor and urease activities and their correlations as affected by heating method, duration, sample matrix and prior soaking

Interpretive Summary: This study confirms some previous findings, offered a few new findings, and clarified conflicting results among some reports. More importantly, it offers some new guidelines to the feed industry. For some soy products (such as defatted and toasted soybean meal) UA can be used as a reliable heating index, but for other soy products (such as low fat and full-fat soybean products heated by different methods), it is not reliable and thus TIA measurement is required. 7/6/2021

3.4.2.5 Agronomic performance of high oleic, low linolenic soybean in Tennessee

Interpretive Summary Analysis indicated no yield drag or other negative agronomic traits associated with the high oleic low linolenic soybean lines evaluated in this study. 7/6/2021

3.4.2.6 Comparative analyses of transcriptional responses of Dectes texanus LeConte (Coleoptera: Cerambycidae) larvae fed on three different host plants and artificial diet

Interpretive Summary: Over 500 genes were expressed at significantly higher levels in insects feeding in soybeans compared to the other two plants, including those involved in breaking down plant cells walls and those involved in breaking down plant toxins that are produced by soybeans in response to insect feeding. The ability of the insects to break down these toxins is probably what allows them to continue feeding in soybeans. These results provide a list of gene candidates that could be targeted to reduce the insect's ability to detoxify soybean defense compounds and reduce damage from this pest in soybean fields.

3.4.2.7 Utilizing consumer perception of edamame to guide new variety development

Technical Abstract: Both screening and validation studies illustrate the significant role of consumer sensory data in support of genotypes targeted for domestic (U.S.) production.

3.4.2.8 Transcriptome profiling reveals the spatial-temporal dynamics of gene expression essential for soybean seed development

Interpretive Summary: ------- the study provides a comprehensive depiction of the regulatory program underlying seed development at a gene, pathway and network level, and develop a set of new hypothesizes for future investigations. The new knowledge generated from the study also enhances our ability to develop effective strategies to improve soybean seed quality and yield, and eventually increase competitiveness of US soybean in world soybean market and US soybean farmers' income. 6/16/2021

3.4.2.9 First report of the production of mycotoxins and other secondary metabolites by macrophomina phaseolina (Tassi)goid isolates from soybeans (Glycine max L.) symptomatic with charcoal rot disease

Interpretive Summary: A study was conducted to measure the production in culture of known mycotoxins and other secondary metabolites by 89 isolates of M. phaseolina from soybean plants symptomatic for charcoal rot. Six mycotoxins and other metabolites were observed at relatively high frequencies (19.1 to 84.3% of cultures), including the previously reported mycotoxins, botryodiplodin and mellein, as well as four previously unreported substances, namely kojic acid, moniliformin, orsellinic acid and cyclo[L-proline-L-tyrosine]. In addition, the study identified an additional nine previously unreported metabolites that were observed at relatively low frequency (<5% of cultures), including cordycepin, emodin, endocrocin, citrinin, gliocladic acid, infectopyron, methylorsellinic acid, monocerin, and N-benzoyl-L-phenylalanine. Further studies are needed to investigate possible effects of these mycotoxins and metabolites on pathogenesis by M. phaseolina and on food and feed safety, if any of them are found to contaminate the seeds of infected soybean plants at toxic levels. 6/16/2021

3.4.2.10 Soybean aphids per plant among soybean lines containing various rag genes

Interpretive Summary: Several genes with resistance to soybean aphid, known as "Rag" genes, have been identified in soybean. Virulent strains of soybean aphid may overcome the resistance and colonize soybeans having one or more Rag genes. So, it is important to classify virulent strains of soybean aphids in evaluating soybean lines in order to develop cultivars with durable resistance. The files presented here report the number of soybean aphids on soybean lines that differed in the Rag genes they contained. Because of their distinct virulence profiles, it would be good for future research to test resistant soybean against both of these colonies to ensure broad-specturm control of soybean aphid in the development of future soybean culitvars. 8/5/2020

3.4.2.11 Kentucky farmers' supportiveness of tactics for the enhancement of pollination and IPM in soybeans

Technical Abstract: Beneficial insect conservation in agriculture is often studied in the context of integrated pest management (IPM). For instance, vegetative field edges provide valuable habitat and changing the timing of insecticidal sprays decreases risk for pollinators and other beneficial insects.

Our survey data indicate that Kentucky soybean growers already use several IPM approaches such as crop rotation, no-till soil management, and limited insecticide application for when pests were abundant. Growers believed that nationally, farmers can influence pollinator populations and that a portion of the soybean yield is due to pollinator activity within crop fields. However, they were less willing to maintain tree lines as habitat for pollinators and other beneficial insects out of concern for increased spread of weeds and insect pests. Given these data, we need to evaluate the perceived and actual trade-offs of weed and pest management in future on-farm conservation efforts for beneficial insects such as pollinators.

3.4.2.12 Application of near infrared spectroscopy for determination of relationship between crop year, maturity group, location, and carbohydrate composition in soybeans

Interpretive Summary: Near infrared spectroscopy (NIRS) is a rapid nondestructive method to determine basic composition of grains and other agricultural products including soybeans.

The evaluation of total carbohydrates, including the non-digestible sugars, was determined by prediction using NIR calibration models. The models were used to evaluate sugar composition of 2300 soybean samples and an additional 700 samples for validation. Relationship between sugars and the agronomic traits of the soybeans were determined. This work demonstrates that NIRS is a suitable rapid method to determine sugars in large numbers of soybeans, and that crop year, maturity group, and location had a significant effect on the sugars in soybeans. NIR is being used in laboratories, breeding programs, at grain elevators and processing plants, and this will aid breeding programs and nutritional assessments for human food and animal feed uses.

3.4.2.13 Mining QTL for elevated protein and other major seed composition traits from diverse soybean germplasm

Technical Abstract: Improving the seed protein of soybean without negatively affecting yield and oil content is an important goal for soybean breeders. A population consisting of 132 recombinant inbred lines (RILs) was developed between an elite breeding line, G00-3213 and a plant introduction, PI 594458A with elevated protein content.

QTL(quantitative trait loci) analysis from four environments identified 19, 12, 9, 3, and 4 QTL for protein, oil, sucrose, cysteine, and methionine, respectively. The QTLs identified on chromosomes (Chrs) 5, 6, and 13 for protein and on Chr 9 for sucrose were consistent with the BSA results. QTLs for protein identified on Chrs 6, 13, and 15 were detected in multiple environments, and a QTL on Chr 10 for methionine content was detected in all but one environment. The results of this research can provide additional genomic resources for genetic improvement of seed composition and help breeders to better understand the impacts of environment on these QTLs. 8/6/2021

https://www.ars.usda.gov/research/publications/find-a-publication/?q=soybeans&field=all&search=Search August 2021

3.5 Soy Checkoff Investments Work to Increase Profitability for U.S. Soybean Farmers

-----leaders approved 181 new checkoff-funded projects, with a total budget allocation of $78M, for the 2022 fiscal year, starting October 1, 2021. “Every dollar we invest in the soy checkoff returns over $12 in added value to our product.

Visit unitedsoybean.org to learn about key investments made on behalf of soybean farmers.

https://www.unitedsoybean.org/hopper/soy-checkoff-investments-work-to-increase-profitability-for-u-s-soybean-farmers/ July 15, 2021

3.6 Consumer Research Unpacks Protein Perceptions

The United Soybean Board (USB) released new consumer data shedding light on consumer perceptions

around protein. More than half of consumers (56%) say it is extremely or very important that plant-based proteins be complete, offering nutrition comparable to animal protein.

The vast majority of consumers recognize that protein is important to maintaining a healthy and balanced diet, with 82% of consumers ages 50 and under agreeing that it is extremely or very important.

The study also found the following:

- While the majority of U.S. consumers (79%) eat meat, 65% of the population is open to eating plant-based "flexitarian-friendly" food, with higher numbers reported among younger generations.
- Just under half (44%) identify as omnivores, eating meat including seafood and chicken on a regular basis and eating plant-based foods on occasion.
- About one in six consumers (16%) identify as "flexitarian," described as choosing plant-based foods on most occasions but not excluding meat from their diet entirely.
- Openness to plant-based foods is strong across all demographic groups; however, younger consumers (50 and under) are significantly more likely to identify with an eating style that includes plant-based foods (72%), as compared to 55% of older consumers.

ySoy protein provides the highest percentage of protein per calorie compared to other plant protein sources," said Keenan McRoberts, Ph.D., vice president of science and program strategy for USB.

https://www.unitedsoybean.org/hopper/consumer-research-unpacks-protein-perceptions/

July 28, 2021

3.7 High Oleic Calculator

Open United Soybean Board website, click on: Tools and Resources, *click on:* Tools and Calculators*, scroll down and click on:* High Oleic Calculator *to open website with info on procedures and benefits of producing high oleic soybeans.*

http:www.soyinnovtion.com/calculator_Date: 2021

3.8 United Soybean Board Partnership Launches Pilot Phase of Sustainably Grown U.S. Soy Mark

New mark offers opportunities to differentiate products made with sustainably grown U.S. soybeans.

U.S. soy is taking a big step to make its mark as a global leader in sustainability. From January 19 through March 19, the United Soybean Board is teaming up with partners from *Soylent* and *DuPont* Nutrition & Biosciences in a pilot program identifying their products and ingredients as being made with sustainably grown U.S. soy.The companies will use the new Sustainably Grown U.S. Soy mark, ----.

The Sustainably Grown U.S. Soy mark is based on a national system of sustainability and conservation

laws and regulations and farmer participation in the U.S. Farm Program. It seeks to increase demand for soybeans grown by U.S. farmers who commit to practices such as conservation tillage, cover crops and responsible nutrient management (e.g., right source, right rate, right time and right place). The Sustainably Grown U.S. Soy mark applies to those soybean acres grown under best practices on-farm.

To learn more about the Sustainably Grown U.S. Soy mark, please visit *www.sustainableussoymark.com*.

https://www.unitedsoybean.org/hopper/united-soybean-board-partnership-launches-pilot-phase-of-sustainably-grown-us-soy-mark/ January 19, 2021

3.9 Bringing the Findings to the Farmers: Soybean Research & Information Network Makes Research Accessible

The soy checkoff's latest collaboration brought Qualified State Soybean Boards (QSSBs) together to maximize the results of checkoff-funded research projects in the most effective way possible: bringing

The soy checkoff's latest collaboration brought Qualified State Soybean Boards (QSSBs) together to maximize the results of checkoff-funded research projects in the most effective way possible: bringing the findings to farmers. The redesigned Soybean Research & Information Network (SRIN) website — soybeanresearchinfo.com — was launched through a joint effort by the North Central Soybean Research Program (NCSRP) and the United Soybean Board (USB) to give farmers a virtual resource full of information and toolkits for more efficient soybean production.

This is a one-stop shop for all the information the checkoff has discovered through farmer investments regarding key problem areas in production, such as tolerance and resilience. Each article on the SRIN website provides insight and explanation on the research findings and links directly to the study in the overall database for further exploration.

Hierdie webwerf het skakels na aktiwiteite in die sojabedryf.

https://www.unitedsoybean.org/hopper/bringing-the-findings-to-the-farmers-soybean-research-and-information-network-makes-research-accessible/ July 19, 2020

3.10 A new decade and new data at SoyBase, the USDA-ARS soybean genetics and genomics database

Abstract

SoyBase, a USDA genetic and genomics database, holds professionally curated soybean genetic and genomic data, which is integrated and made accessible to researchers and breeders. The site holds several reference genome assemblies, as well as genetic maps, thousands of mapped traits, expression and epigenetic data, pedigree information, and extensive variant and genotyping data sets. SoyBase displays include genetic, genomic, and epigenetic maps of the soybean genome. Gene expression data is presented in the genome viewer as heat maps and pictorial and tabular displays in gene report pages. Millions of sequence variants have been added, representing variations across various collections of

cultivars. This variant data is explorable using new interactive tools to visualize the distribution of those variants across the genome, between selected accessions. SoyBase holds several reference-quality soybean genome assemblies, accessible via various query tools and browsers, including a new visualization system for exploring the soybean pan-genome. SoyBase also serves as a nexus of announcements pertinent to the greater soybean research community. The database also includes a soybean-specific anatomic and biochemical trait ontology. The database can be accessed at https://soybase.org.

https://academic.oup.com/nar/article/49/D1/D1496/6017360?login=true December 2, 2020

3.11 USDA-NIFA and NSF Invest $220M in Artificial Intelligence Research Institutes

U.S. Department of Agriculture's National Institute of Food and Agriculture (USDA-NIFA) and the U.S. National Science Foundation (NSF) announced a $220 million investment in 11 new NSF-led Artificial Intelligence Research Institutes. The new investment builds on the first round of seven Artificial Intelligence (AI) Research Institutes funded in 2020, totaling $140 million.

To achieve investment goals, NSF partnered with USDA-NIFA, U.S. Department of Homeland Security (DHS), Google, Amazon, Intel and Accenture.

These innovation centers will speed our ability to meet critical needs in the future agricultural workforce, providing equitable and fair market access, increasing nutrition security and providing tools for climate-smart agriculture." ------will support 11 institutes spanning seven research areas in AI: Human-AI Interaction and Collaboration, AI for Advances in Optimization, AI and Advanced Cyberinfrastructure, AI in Computer and Network Systems, AI in Dynamic Systems, AI-Augmented Learning, and AI-Driven Innovation in Agriculture and the Food System.

Below are descriptions of the 11 new AI Research Institutes which illustrates a future development in US agriculture.

The USDA-NIFA Institute for Agricultural AI for Transforming Workforce and Decision Support (AgAID). Led by Washington State University, ------ will integrate AI methods into agriculture operations for prediction, decision support, and robotics-enabled agriculture to address complex agricultural challenges. The AgAID Institute uses a unique adopt-adapt-amplify approach to develop and deliver AI solutions to agriculture that address pressing challenges related to labor, water, weather and climate change.

The USDA-NIFA AI Institute for Resilient Agriculture (AIIRA) Iowa StatUniversity.

-------will transform agriculture through innovative AI-driven digital twins that model plants at an unprecedented scale.-----enabled by advances in computational theory, AI algorithms, and tools for crop improvement and production for resiliency to climate change . ----- AIIRA will promote the study of cyber-agricultural systems at the intersection of plant science, agronomics, and AI; power education and workforce development ------.

NSF AI Institute for Collaborative Assistance and Responsive Interaction for Networked Groups (AI-CARING). Georgia Institute of Technology (Georgia Tech). ----- seek to create a vibrant, fully

developed discipline focused on personalized, longitudinal (over months and years) collaborative AI systems that learn individual models of human behavior and how they change over time,------ better collaborate and communicate in caregiving environments. ------ help support a growing population of older adults sustain independence, improve quality of life, and increase effectiveness of care coordination-------. ----- partially funded by Amazon and Google.

NSF AI Institute for Advances in Optimization. Led by Georgia Tech. ------ will revolutionize decision-making on a large scale by fusing AI and mathematical optimization into intelligent systems---------.create pathways from high school to undergraduate and graduate education and workforce development training for AI in engineering that will empower a generation----.----create a sustainable ecosystem for AI, combining education, research, entrepreneurship, and the public at large.

-----partially funded by Intel.

NSF AI Institute for Learning-Enabled Optimization at Scale (TILOS). University of California San Diego, in collaboration with five other universities------aim to "make impossible optimizations possible" by addressing the fundamental challenges of scale and complexity. ------ will be applied in several technical focus areas vital to the nation's health and prosperity, including semiconductor chip design, robotics and networks. ----- agenda is accompanied by plans for workforce development and broadening participation at all academic levels,------. ------partially funded by Intel.

NSF AI Institute for Intelligent Cyberinfrastructure with Computational Learning in the Environment (ICICLE). Ohio State University. ------ build the next generation of cyberinfrastructure that will make AI easy for scientists to use -----.------bringing in scientists from multidisciplinary backgrounds to create----- national cyberinfrastructure that is ready to "plug-and-play" in areas of societal importance, such as "smart foodsheds", precision agriculture and animal ecology.

NSF AI Institute for Future Edge Networks and Distributed Intelligence (AI-EDGE). Ohio State University. ----- leverage the synergies between networking and AI to design future generations of wireless edge networks-----.------ensure that these networks are self-healing and self-optimized. ------ making AI more efficient, interactive, and privacy preserving for applications in sectors such as intelligent transportation, remote health care, distributed robotics and smart aerospace. ------will help establish U.S. leadership in next-generation edge networks and distributed AI -----.
T----- partially funded by DHS.

NSF AI Institute for Edge Computing Leveraging Next-generation Networks (Athena). Duke University. ----- focus on developing edge computing with groundbreaking AI functionality -----. ----- world-class, multidisciplinary team of scientists, engineers, statisticians, legal scholars and psychologists from seven universities, Athena will transform the design, operation and service of future systems from mobile devices to networks. Athena is committed to educating and developing the workforce, cultivating a diverse ------next generation of edge computing and network leaders whose core values are driven by ethics and fairness in AI. ------- knowledge transfer, translating emerging technical capabilities to new business models and entrepreneurial opportunities.
------ partially funded by DHS.

NSF AI Institute for Dynamic Systems. University of Washington. ------ innovative research and education in fundamental AI and machine learning theory, algorithms and applications specifically for safe, real-time learning and control of complex dynamic systems. ------ towards data-enabled ethical, efficient, and explainable solutions for real-time sensing, prediction, and decision-making challenges across science and engineering.
---partially funded by DHS.

NSF AI Institute for Engaged Learning. North Carolina State University**.**t------ advance natural language processing, computer vision and machine learning to build narrative-centered learning environments, embodied conversational agents, and multimodal learning analytics to yield transformative advances in STEM teaching and learning.-----a nexus for in-school and out-of-school STEM education innovation, empowering and engaging diverse learners and stakeholders to ensure that AI-driven learning environments are ethically designed -----. fully funded by NSF.

https://nifa.usda.gov/press-release/usda-nifa-and-nsf-invest-220m-artificial-intelligence-research-institutes July 29, 2021

3.12 NIFA Invests $7M in Digital Agriculture Technologies

To propel Midwest farming practices to the next generation of digital agriculture technologies, the National Science Foundation's Cyber Physical Systems program and the USDA's National Institute of Food and Agriculture (NIFA) recently awarded a 5-year, $7 million grant to researchers led by engineers from Iowa State University and the University of Illinois Urbana-Champaign. The award launches the COALESCE—short for COntext Aware LEarning for Sustainable CybEr-agriculture systems—Cyber-Physical System, which will focus on operations of farm managing like sensing, modeling, and decision-making at the level of individual crops. In other words, by focusing on crop stressors at the individual levels, farmers can focus their resources and attention; thus, reducing the cost of labor, use of crop inputs such as herbicides and fertilizers, and water.

The research team will share its findings with farmers by directly working with agricultural producer groups. Another goal of this project is to attract the next generation of farmers, who will benefit from automated farming systems ------.

https://nifa.usda.gov/press-release/nifa-invests-7m-digital-agriculture-technologies June 2, 2021

3.13 Biodiesel Breakthrough: Making a Difference One Gallon at a Time

The National Biodiesel Board, supported in part by your soy checkoff, is on a mission to continue building demand for this domestically produced green fuel, **----- .**

Our vision is to exceed 6 billion gallons by 2030, potentially doubling the market from where it stands today at 3 billion gallons. And, with investments in feedstocks, to reach 15 billion gallons by 2050." Contrary to popular belief, these benefits don't come at the expense of performance. When compared with diesel fuel, B20 — a 20% blend of biodiesel with diesel fuel — provides similar fuel economy, horsepower, torque and haulage rates.
---- the National Biodiesel Board in partnership with Trinity Consultants conducted and published a groundbreaking study that demonstrates biodiesel's positive impacts on Americans' health.

Key findings from this research on just 13 sites across the country show substantial community health improvements that can be quantified in reduced medical costs and health care benefits, including:

- 340 premature deaths prevented annually.
- 46,000 fewer sick days used per year.
- A 45% reduction in cancer risk when B100 is used in heavy-duty trucks such as semis and an 86% reduced cancer risk when biodiesel is used for home heating oil.
- 17,000 fewer lung problems per year as a result of using biodiesel to heat homes.
- 203,000 fewer or lessened asthma attacks per year based on vehicle use of B100.
- And $3 billion in avoided health costs annually.

https://www.unitedsoybean.org/hopper/biodiesel-breakthrough-making-a-difference-one-gallon-at-a-time/ June 28, 2021

3.14 Checkoff Study Shows Soybean Meal Increases Weight Gain and Feed Efficiency in Growing Pigs //

A soy checkoff-funded animal health study presented at the International Conference on Swine Nutrition confirms the value of soybean meal as a primary protein source in swine diets.

Within the last 20 years, soybean meal (SBM) inclusion levels in pig diets have become heavily dependent on pricing. This is at the detriment of overlooking the value of SBM beyond its primary attributes as a source of amino acids. Shifting diets to higher inclusion levels of crystalline amino acids and distillers dried grains with solubles (DDGS) — a 35% increase between 2000 and 2017 — hinders soy's beneficial components, such as isoflavones, saponins and phenolic antioxidants. These vital compounds improve immune responses, provide anti-inflammatory benefits and enhance growth performance of pigs exposed to viral disease challenges.

Presented at the International Conference on Swine Nutrition on Aug. 11, results from a soy checkoff-funded study, "Evaluation of the Potential Benefit of Soybean Meal on Gain and Feed Efficiency of Growing Pigs," among several other independently evaluated, unbiased studies confirmed an economic return and direct and positive relationship between SBM and improved total weight gain and feed use efficiency in developing pigs.

This checkoff-supported study points out that formulating for least cost doesn't always add up to maximum profit, ----.

In a recent article in National Hog Farmer, Eric van Heugten, Ph.D., at North Carolina State University, who's a collaborator on the project, reported that grower pigs starting at about 85 pounds fed a reduced SBM diet had a 2.46-pound lower body weight at the end of the study compared to pigs fed the higher SBM diet, even after balancing for amino acids. And replacing SBM with lysine·HCl (plus other crystalline amino acids) reduced final body weight by 5.71 pounds.

Given this direct negative effect when switching pig diets over for a short period of time and reducing SBM inclusion, some nutritionists indicate there may be a SBM level below which growth and feed conversion are compromised that could be impacted by growth phase and health status. Resulting considerations for SBM use contribute to high-quality diets, reduce swine stress levels and enhance animal performance, biology and gut health.

"These experimental outcomes accentuate the importance of soybean meal on growth and feed efficiency for growing and finishing pigs. The applied work takes a step further by estimating minimum soybean meal inclusion levels to maximize growth and potential economic returns for pig farmers," said **Keenan McRoberts, Ph.D., vice president of science and program strategy for USB**. "Consequently, this foundational applied work establishes a new starting point for soybean meal use and value in pig rations — work that must be advanced further, together with industry partners, to evaluate implications under different production systems and seasons.

https://www.unitedsoybean.org/hopper/checkoff-study-shows-soybean-meal-increases-weight-gain-and-feed-efficiency-in-growing-pigs/ August 11, 2021

3.15 Amino Acid Helps Shore Up Defenses of Swine

Jay S. Johnson, an animal scientist with ARS's Livestock Behavior Research Unit in West Lafayette, Indiana, and his Purdue University collaborators are investigating L-glutamine as a natural alternative to using dietary antibiotics.

A third round of feeding trials conducted by a team of USDA Agricultural Research Service (ARS) and university scientists has again shown that a dietary supplement called L-glutamine can naturally promote growth and wellness in pigs.

Highlighted results of a paper published in *Translational Animal Science* are below:

- As with prior trials, L-glutamine-treated pigs performed similarly to those in the antibiotics group, and both of these groups fared better than piglets given non-supplemented feed.
- The study results indicate that the increased weight gain and other benefits of treating piglets with L-glutamine above the original .20 percent test can be as profitable as using dietary antibiotics.
- 0.40 percent L-glutamine was the optimal supplementation level for improving pig welfare and performance immediately after weaning and transport, while 0.80 percent appeared to offer the most long-term economic benefit.

https://www.ars.usda.gov/news-events/news/research-news/2020/amino-acid-helps-shore-up-defenses-of-swine/ November 19, 2020

3.16 USDA Study Reveals Airborne Fungus Can Trigger Plant Growth

The U.S. Department of Agriculture's (USDA) Agricultural Research Service (ARS) today announced that a harmless airborne fungus*, Cladosporium sphaerospermum* strain TC09 *(*TC09), can dramatically accelerate plant growth if a germinating plant is near the fungus as it emits volatiles or gases.
The effects of TC09 were largely correlated with the duration of exposure. Visual observation indicated that plants with TC09 exposure for 10 days exhibited substantially more vigorous growth, thicker stems, larger leaves, and a more robust root system relative to plants without fungal exposure. Results also showed that treated plants flowered 20 days sooner and pepper plants yielded up to 213 percent more fruit that was ready for harvest three weeks earlier than untreated controls.
-----showed that TC09 does not induce defense or stress responses in exposed plants. Scientists hope to identify the specific volatiles and gases that stimulate plant growth in future research.
https://www.ars.usda.gov/news-events/news/research-news/2020/usda-study-reveals-airborne-fungus-can-trigger-plant-growth/ September 23, 2020

4. INNOVATIONS

4.1 Soy Innovation Challenge Winners Deliver Next-Generation Ag Technolo----fully funded by NSF. -----

farmers at the forefront of profitability

The Yield Lab Institute, in partnership with the United Soybean Board (USB), Syngenta, Amazon Web Services (AWS) and the ICL Group,------ announce the winners of the Soy Innovation Challenge.

Regrow (formerly FluroSat) – Provides full crop-cycle analytics for sustainable and profitable agriculture

Ecosystem Services Market Consortium – Launching a national ecosystem services market to provide farmers with compensation for the economic and social benefits from their land stewardship practices

SoilMetrics – Provides software services for farmers to understand current greenhouse gas emissions and evaluate options for reducing them

Genesis Feed Technologies – Platform that increases the market value of U.S. soybeans across the supply chain by revealing the economic impact of their high-quality nutritional profile

SLUcode — Improves crop yield and maximizes profit by predictive analytics of seed quality and environmental stress, and by turning every pixel to actionable crop intelligence using the latest artificial intelligence/machine learning and cloud computing.

Soy Carbohydrate Value — A collaborative cross-functional team working together to extract value from the waste soybean carbohydrate fraction. The effort is based on techno-economic analysis of processes to convert the carbohydrates into valuable industrial chemicals.

Sustainable Open Soy (SOS) — A free-for-farmers blockchain that traces U.S.-grown soy from origin to the end-consumer product. It allows farmers, brands and retailers to demonstrate commitment to sustainability, while accelerating trust and transparency throughout the soy industry. SOS is a joint venture between The New Fork and the U.S. Farmers and Ranchers in Action

https://www.unitedsoybean.org/hopper/soy-innovation-challenge-winners-deliver-next-generation-ag-technologies/ March 3, 2021

https://www.unitedsoybean.org/hopper/soy-innovation-challenge-selects-seven-finalists-that-enhance-sustainability-and-disrupt-the-soy-value-chain/ October 13, 2020

4.2 Gene Editing May Improve Digestibility of Soy Protein

(Dr. Bo Zhang, an assistant professor in the School of Plant and Environmental Sciences at Virginia Tech University.)

-------- minimizing the presence of anti-nutritional factors to develop soybeans with highly digestible protein. -----research addresses several anti-nutritional factors, including trypsin inhibitors, low test weights, the raffinose family of oligosaccharides and phytic acid. ------ focusing on reducing the concentration of trypsin inhibitors in soybean seeds.

----- soybeans are heated as the first step of the crushing process to inactivate trypsin inhibitors," .----- that requires a lot of energy,------.

Developing soybean varieties with a low concentration of trypsin inhibitors will improve soybean meal quality and reduce energy needs of soybean processing.

Precise Management of Trypsin Inhibitors

Trypsin inhibitors serve as part of the natural defense system for soybeans,-----. ------ want to reduce trypsin-inhibitor content in soybean meal without compromising plant defenses." Genetic research revealed that different genes control the concentration of trypsin inhibitors in plant tissues and soybean seeds. ----- working to keep trypsin inhibitors in soybean leaves, stems and flowers to maintain poor digestion for pests. At the same time, we want to minimize trypsin inhibitors in the soybean seeds that will be harvested and processed into soybean meal, so the meal can easily be digested in animal feed."

----- team used CRISPR-Cas9 technology to edit a gene named Kunitz Trypsin Inhibitor 3, or KTI 3. This gene impacts the concentration of trypsin inhibitors just in developing soybean seeds, without impacting the rest of the plant."This precision would not be possible with traditional cross-breeding," ----. -----collected the first generation of seeds following the gene editing. These seeds will be grown in 2021, and by the end of the season, the team will determine if this approach is successful. Any individual plants from these soybean seeds that demonstrate noticeably different concentrations of trypsin inhibitors in plant tissues and seeds will be further purified over generations----.----- would become available to other public breeding programs.

Stacking Protein Digestibility Traits

Zhang's research has also developed advanced genetically engineered soybean lines with low phytate and low raffinose family of oligosaccharides, addressing other anti-nutritional factors. Their next steps include developing soybean varieties that combine these and other traits to address multiple anti-nutritional factors.

----- Virginia Tech has released a soybean variety, 'Barrack,' that produces high protein content, high sucrose content, which provides high-quality energy and low trypsin inhibitor concentration. This low

trypsin inhibitor trait impacts the whole plant, meaning the soybean meal digests more easily, but the variety does not have a strong natural defense system-----.

https://soybeanresearchinfo.com/research-highlight/gene-editing-may-improve-digestibility-of-soy-protein/ September 19, 2021

4.3 Grow ing Potential for Soy Plastics

---- plants,----- purchased from retail outlets come in plastic pots. ----- made with petroleum-based plastics that will take centuries to decompose.

With support from the North Dakota Soybean Council, researchers at NDSU are working to develop a novel bioplastic formulation that will incorporate soy-based fractions to improve the performance of the containers while remaining cost-competitive. The new containers will not only be fully biobased, degradable and provide inherent fertilizer for the plant's growth, but they will also promote health and fruit yield for plants such as tomatoes and peppers. -----work focuses on the engineering economics of developing a biomaterial blend that performs well and is cost-effective.

----- once plants growing in the biodegradable pots are ready to be transplanted into the soil, the garden pot can be crushed, and the debris can be placed in the hole where the plant is being transplanted. The pot will continue to fertilize as it breaks down. ------doing an optimization because we don't know what is the optimal soybean percentage that we should incorporate into the pot just yet."

-----companies are currently manufacturing biodegradable garden pots derived primarily from corn, but those pots lack the fertilizing benefits of soy.

NDSU is working with existing companies which currently make biobased pots, developing a formulation that adds the benefits of soy should flow easily into the manufacturing process.

https://soybeanresearchinfo.com/research-highlight/growing-potential-for-soy-plastics/

Augustus 9, 2021

4.4 NIFA Invests Over $2.3M for Small Business Innovation Research

Plant Production and Protection (Biology) - Small Business Innovation Research projects include:

A project from Argvegenix, LLC, St. Louis, Missouri, "Development of Novel Cover Crop, CoverCress, as a Sustainable Plant-based Protein Source for Food Applications," to demonstrate CoverCress as a new source of protein for the plant-based protein market.

https://nifa.usda.gov/press-release/nifa-invests-over-23m-small-business-innovation-research

May 18, 2021

5. PESTS

5.1 Putting a Stop to Soybean Cyst Nematode

Andrew Bent, a professor in the University of Wisconsin-Madison plant pathology department who studies the molecular basis of plant disease resistance, is one of the primary researchers leading the charge to discover new sources of resistance within the soybean plant. Bent says PI 88788 has worked well for the soybean industry for over 20 years. As use of varieties with this resistance source has increased, however, some nematode populations have evolved to overcome this mode of resistance and survive. Each year, SCN causes about $1 billion in lost revenue at the farm gate.

Bent and his colleagues, Brian Diers and Matt Hudson, proposed a research project to the checkoff to study the makeup of the resistance gene in the soybean plant. Through this research, they discovered Rhg1, the main genetic code responsible for SCN resistance in PI 88788 and many other sources of SCN resistance. ------- learned that Rhg1 is more complicated than anticipated — it turned out to be a cluster of three separate genes.

This information helps researchers like Bent and Diers identify different alleles within the sequence that control different forms of SCN resistance in the soybean plant. This research has created a breakthrough that has sped up the process of selecting new varieties that are SCN resistant and helps breeders at seed companies get one step closer to finding new varieties of soybeans that don't depend on PI 88788 for SCN resistance. ------ give breeders at seed companies access to the improved genetic markers they can use to select varieties that have improved SCN resistance from Rhg1. ------ this knowledge is now in the hands of industry researchers like Don Kyle, soybean breeding evaluation zone lead at Corteva. This gives breeders like Kyle a head start when developing new SCN-resistant varieties of soybeans.

New varieties of soybeans can take anywhere from five to 10 years to bring to market. Because of the investment of U.S. soybean farmers and the soy checkoff, discovering new SCN-resistant varieties has already been in progress for years, and new varieties are getting closer to being on the market every day.

For more information about this and other checkoff-funded research into SCN resistance, visit www.thescncoalition.com/resources/research-summaries.
https://www.unitedsoybean.org/hopper/putting-a-stop-to-soybean-cyst-nematode/ June 11, 2021

5.2 Studies on Dectes Stem Borer on Soybeans

a. Combatting the Dectes Stem Borer in Soybeans may Involve Key Plant–Insect Interaction

------- distinguished professor emeritus C. Michael Smith, is leading a multi-year research project, funded by Kansas Soybean Commission ---- to find solutions for better management of the soybean stem borer. . After an unsuccessful search for resistant soybean plant varieties, he and colleague Lina Aguirre are looking at the pest itself and its genetics to alleviate the problem.

The Dectes stem borer larvae are found inside the soybean stem and feed on the stem tissue during the summer. Then in the fall, the larvae create a girdle, or line of tissue, at the base of the soybean stem, sealing themselves into a cavity for the winter. After a summer of eating plant tissue and weakening the soybean stem's strength, the girdle weakens the stem even more. A good wind can then easily topple the plant, -----.

-----been working on silencing these particular genes-----. ---- we think we have some genes partially silenced. ----- transgenic soybeans in the greenhouse ready for the borers to feed on and we'll see if there's any affect," Smith says. "This is where our 'leap of faith' enters. We're hopeful that when the larvae eat this tissue, it turns off their digestive genes, making them unable to eat soybean tissue."

Many growers don't know they have a soybean stem borer issue as plant lodging in the field can be indicative of several things. Farmers often don't see the damage until it's too late and it's hard to document the loss when they don't know why the plant has lodged, Smith says.

"Insecticides for the Dectes stem borer are not cost-effective because their application timing is critical," Smith says. "The adult beetles are active on the plants for such a short period time. Once the larvae are inside the plants, aerial-applied insecticides can't reach them."

----- exploring the improvement of insecticide effectiveness by adjusting application timing by learning more about egg-laying and flight behavior of the adult beetle.

https://soybeanresearchinfo.com/research-highlight/combatting-the-dectes-stem-borer-in-soybeans-may-involve-key-plant-insect-interaction/ 2020

b. Development of Genetic, Chemical and Population-Based Tactics to Manage Key Kansas Soybean Insect Pests

Infestations of the soybean stem borer, Dectes texanus, in soybean have increased in area and intensity in soybean crops in Kansas since 1985. Larval feeding in stems causes severe (50-80%) lodging and related yield reduction. Management strategies remain limited. Commercial insecticides do reduce adult stem borer numbers, but several applications are necessary for effective results, making this option cost prohibitive. To date, no soybean varieties adapted to the Midwestern U.S. contain genetic resistance to stem borer larval damage, and there are few research programs on the soybean stem borer. The goal of this project is to develop techniques to manage stem borer damage to soybean in Kansas, as none currently exist. The hypotheses of the proposed research are that management of larval borer damage can be improved using both insecticidal and plant genetic control techniques. The methods used to improve borer management have been and continue to be the development of soybean plants resistant to borer larvae by inserting borer RNA into soybean plants to interfere (RNAi) with genes necessary for borer survival; to improve insecticide efficacy using soybean development and/or environmental cues to adjust insecticide application timing.

https://www.soybeanresearchdata.com/Project.aspx?id=53780 2020

5.3 Recent Checkoff Study Shows Rodents Don't Favor Soy-Based Plastics

A recent study funded by the soy checkoff, though, has proved that, contrary to popular belief, rodents don't favor soy plastics ---- .

https://www.unitedsoybean.org/hopper/recent-checkoff-study-shows-rodents-dont-favor-soy-based-plastics/ April 28, 2021

6. BIG DATA

6.1 NIFA Invests $15.5M in Food and Agriculture Cyberinformatics Tools to Boost

Agricultural Production

The U.S. Department of Agriculture's National Institute of Food and Agriculture (NIFA) invested a total of $15M in two key programs awarded through its Agriculture and Food Research Initiative (AFRI) Food and Agriculture Cyberinformatics and Tools (FACT). NIFA awarded 18 Food and Agriculture Cyberinformatics Tools grants(link is external) totaling $10.4 million to initiate research on big data analytics, machine learning, artificial intelligence, and predictive technologies needed to keep U.S. agriculture on the leading edge of food and agricultural production. NIFA also invested $5.1 million for 12 Nanotechnology for Agricultural and Food Systems grants(link is external) to support nanotechnology-based solutions that improve food production, nutrition, sustainable agriculture and food safety.

Big data and artificial intelligence will increasingly play a vital role in the future of agricultural technologies and innovation," said NIFA Director Carrie Castille .

https://nifa.usda.gov/press-release/nifa-invests-155m-food-and-agriculture-cyberinformatics-tools-boost-agricultural April 5, 2021

7. SUSTAINABILITY

7.1 Sustainability at the source: How Unilever is addressing deforestation, living wages, and regenerative agriculture

https://www.foodnavigator.com/Article/2021/09/30/Sustainability-at-the-source-How-Unilever-is-addressing-deforestation-living-wages-and-regenerative-agriculture September 30, 2021

7.2 Sustainability and Innovation: Agriculture in 2021 and Beyond

Liam Condon, member of the Bayer AG Board of Management and president of the Crop Science division, joined the soy checkoff's annual meeting to share his perspective on a post-COVID-19 future.

"Our base hypothesis is, we believe agriculture can feed a growing population without starving the planet,"------.

Innovation

Over millennia, we've had different transformations in agriculture," said Condon. "A lot is driven by technology — machinery, fertilizers, biotech seeds. The next transformation in ag is going to be based on data, based on the digital transformation."

----- digital transformation in agriculture allows farmers to make more informed decisions and adjust in real time. Sensors on equipment and on the ground or satellites in the sky allow farmers to bring their data to life in an entirely new, real-time way.

According to CropLife's Precision Agriculture Dealership Survey, from 2002 to 2013, only about half of dealers were offering variable rate (VRT) fertilizer applications. That number increased to 69% in 2015 and to 81% in 2019 and is now at 89%. VRT seeding recommendations also made a jump from 24% in 2013 to 69% in 2020.

Sustainability

-----agriculture, it's one of the few industries in the entire world where you can actually sequester carbon in the soil," Condon said. "You can actually make ag part of the solution to this challenge of reducing greenhouse gas emissions."

----- Bayer has been working for years to develop and validate a transparent, science-based and collaborative approach to a carbon market in agriculture. In the 2020-21 season, 1,200 farmers in Brazil and the U.S. are participating in the program where they are being assisted in implementing climate-smart practices and guided in carbon measurements.

With sustainability in mind, the checkoff and soy partner organization introduced the U.S. Soybean Sustainability Assurance Protocol to demonstrate the sustainability of U.S. soy to international and domestic customers.

The protocol is based on existing aggregated data collected from farmers nationwide who participate in national conservation programs. The information serves as proof that the U.S. soy crop is produced under a system of sustainability that includes everything from water conservation to energy use.

With new ideas that rely on an interconnected digital platform comes the need for reliable rural broadband.

Rural Broadband

------ the U.S. lacks sufficient rural broadband connectivity,-----. There are many underdeveloped parts of the world that have significantly better access to broadband.

The checkoff initiated the rural broadband study to better understand how and why farmers currently access the internet, including the implications access has on farm business decisions, economic viability and overall sustainability. According to "Rural Broadband and the American Farmer: Connectivity Challenges Limit Agriculture's Economic Impact and Sustainability," an alarming 60% of U.S. farmers say they do not have enough connectivity to run their businesses. .

If we don't get the U.S. up to speed on this, it will become a competitive disadvantage, ----.

Consumers and Farmers Looking Forward

The underlying future trend is that consumers are becoming more and more interested in not just what they eat, but also in where their food comes from and how it's produced.

------ remind the farmer-leaders of the checkoff that bridging the gap between farm and table is a team effort. The entire ag industry must work together to show consumers why innovation and sustainability are important to them and result in a healthier and more sustainable product for consumers.

Condon said, "Transparency is the currency of trust."

https://www.unitedsoybean.org/hopper/sustainability-and-innovation-agriculture-in-2021-and-beyond/
January 29, 2021

7.3 BASF strengthens innovation pipeline for sustainable agriculture

Follow the highlighted leads of this article to get BASF's total activities and approach - some excerpts hereunder.

With solutions launching throughout the next decade, the pipeline supports the company's aim to annually increase its sales share of agricultural solutions with substantial contribution to sustainability by 7%. By 2030, more than 30 major R&D projects will complement BASF's connected offer of seeds and seed treatment products, chemical and biological solutions, as well as digital services.

-----ambitious sustainability targets for its agriculture business by 2030 ----- farmers will be supported in reducing their CO_2 emissions by 30% per ton of crop produced. Further, the company strives to apply digital technologies on more than 400 million hectares of farmland cumulatively by 2030,-----. BASF remains committed to developing solutions that drive the transformation of the agricultural food system for the better.

In November 2020, BASF and Bosch signed a joint venture agreement to globally market and sell smart farming solutions from a single source in the future. Through the joint venture, which is subject to the approval of the relevant antitrust authorities, the companies plan to launch the Smart Spraying solution this year. The new technology recognizes weeds and allows a precise application of herbicides, which maximizes productive land-use and reduces the environmental impact by lowering the volume of herbicides applied. In addition, the new outcome-based business model xarvio® HEALTHY FIELDS provides farmers a tailored, optimized field- and season-specific crop protection strategy, -----.

BASF's connected offer further extends the development of herbicide-tolerant traits and chemical crop protection tailored to these traits. Combined with solutions to control weeds before they emerge, these enable no-till farming, which leads to less CO_2 released from the soil, reduces soil erosion and promotes humus buildup. -----.

Meeting growing demand for sustainably produced food

To continuously steer the product portfolio towards even more sustainable solutions, BASF applies the Sustainable Solution Steering method, which is unique in the industry and third-party audited, in the early stages of research and development.

------- advanced insecticides portfolio is one example of successful Sustainable Solution Steering. Axalion™ active ingredient developed by BASF, pending regulatory approval, is the company's latest insecticide innovation in this context. With its novel mode of action, it helps farmers safeguard their yield without negatively impacting soil and water organisms or birds. When applied according to the respective label instructions, Axalion based products will not impact beneficial insects. The new compound is also an essential tool in preventing insecticide resistance.

Innovation

------- innovation website *www.AgInnovation.basf.com*.

- Field Crops – Seeds and Traits

Nothing on soybeans

- Crop protection

Herbicides

In 2019, BASF received its first regulatory approval for and introduced Luximo®, a new and innovative herbicide active ingredient, to Australian farmers. Future regulatory approvals are anticipated in the UK and EU. BASF has also received regulatory approval for an additional new herbicide active ingredient in Australia and Canada: Tirexor® herbicide. A further regulatory dossier for Tirexor has been submitted in the U.S..

These new herbicides have been specifically developed to control resistant weeds – Luximo primarily for grass weeds and Tirexor for key grass and broadleaf weeds –-----.

To advance one of the industry's broadest herbicide portfolios, BASF will develop herbicides from a new class of PPO-inhibitor chemistry specifically to control large and small seeded broadleaved weeds, as well as a wide variety of warm and cold season grasses and sedges.

Fungicides

------latest fungicide innovation Revysol®, BASF will provide farmers in all regions with an essential tool to manage resistance and optimize their farm operations. First Revysol-based products have been introduced into the market in 2019/2020. Excellent products like Veltyma™ for corn and Revytek™ in soybean in the US -----. BASF is also planning to introduce a new technology in seed treatment based on **Revysol®** and marketed under **Relenya™** brand.

---- novel fungicide, **Pavecto®**, co-developed with Sumitomo Chemical, will offer an effective solution to control major diseases, including Septoria leaf blotch in wheat,-----.

The global initiative for regulatory approval of Pavecto has started with the submission of the regulatory dossier to the European Union (EU) in March 2018. Pending regulatory approval, BASF expects first market introductions of customized formulations containing Pavecto in the mid of the decade.

BASF also continues to grow its fungicide family with two new fungicides currently in early research. To meet the increased demand for biologicals, a next generation biofungicide is also in development.

Insecticides

BASF has received the first registrations in the Australia, Canada, China, Columbia, Guatemala, India, Mexico, Pakistan and in the United States for the new active ingredient **Inscalis®**. The new compound, co-developed with the Japanese company Meiji Seika Pharma Co. Ltd., offers farmers an essential tool to protect a wide range of crops from critical piercing and sucking insect pests.

Continuing the global expansion of the insecticide portfolio, BASF received regulatory approvals for Broflanilide in Australia, Canada, China, Columbia and the U.S.. Further registrations in India, Mexico

and other countries are expected. Broflanilide is a powerful and versatile insecticide to control chewing pests. Seed treatment applications based on Broflanilide, marketed under the **Teraxxa™**; brand, will target difficult to manage wireworms in cereal crops; with a launch planned in North America for the 2021 planting season.

Digital farming

Launched in 2020, **xarvio HEALTHY FIELDS** is a market first. It is an outcome-based digital farming solution that provides a field and season specific crop protection strategy that guarantees plant health at the start of the season for a fixed price. If the calculated crop protection strategy doesn't work, then the farmer is financially compensated. HEALTHY FIELDS is powered by advanced field zone specific crop production algorithms, which monitors, analyzes and executes the most efficient strategy for each field. The assured outcome of HEALTHY FIELDS is for winter wheat and winter barley. HEALTHY FIELDS is fully transparent, with every application recorded and documented to for fulfil legal requirements.

The second product is the **Intelligent Planting Solution** (IPS). This will link Bosch technology with xarvio digital intelligence to optimize the seeding process The agronomic intelligence of xarvio FIELD MANAGER will also generate zone-based seed recommendations for the IPS and by combining it with zone-based crop nutrition application maps from FIELD MANAGER further productivity can be achieved.

https://agriculture.basf.com/global/en/innovations-for-agriculture/innovation-at-a-glance.html

March 4, 2021

7.4 Bayer and SVG Ventures | THRIVE partner to tackle agriculture's grand challenge

Ventures | THRIVE, a leading global agrifood venture and innovation platform headquartered in Silicon Valley, is partnering with Bayer, one of the world's leading innovators in seeds and crop protection, to launch the *THRIVE | Bayer Sustainability Challenge*.
The Challenge will identify and accelerate emerging technology solutions that will help transform global agriculture to feed the world's growing population in a more sustainable way.

Agtech and foodtech startups and scaleups whose solutions embody the combination of the Bayer sustainability commitments and THRIVE's Global Initiative focus on the U.N. Sustainable Development Goals are invited to apply. Through this challenge, Bayer and THRIVE are seeking to identify and support the development of sustainable technologies that help reduce the environmental impact of crop protection, reduce field greenhouse gas emissions, and improve smallholder farmer access to agronomic knowledge, products, and services.

SVG Ventures | THRIVE is the leading global agrifood investment and innovation platform headquartered in Silicon Valley, and comprised of top agriculture, food & technology corporations, universities, and investors. With a community of over 5,000 startups from 100 countries, the THRIVE platform invests, accelerates, and creates unparalleled access for entrepreneurs to scale globally to solve the biggest challenges facing the food and agriculture industries. SVG's existing global partners include Media Partner Forbes and leading government, agriculture, and technology corporations such

as Corteva, Driscoll's, FCC, Kubota, Land O'Lakes, Trimble, Taylor Farms, Valmont, Yamaha Motor Ventures and Wilbur-Ellis.

Learn more at www.thriveagrifood.com.

https://media.bayer.com/baynews/baynews.nsf/id/SVG-Ventures-THRIVE-and-Bayer-partner-to-tackle-agricultures-grand-challenge?Open&parent=news-overview-category-search-en&ccm=020

April14, 2021

7.5 Corteva Agriscience Announces Enterprise Climate Strategy, Debuts Inaugural Sustainability Report

-----to join leaders in climate action and become a more carbon-efficient business. In its inaugural 2020 Sustainability Report released today, the company detailed a commitment to set science-based targets for its greenhouse gas emission reductions.

Corteva Agriscience intends to achieve this goal through a variety of initiatives, including taking steps to reduce energy usage, focus efforts in R&D, increase production efficiencies, and transition to renewable energy sources. As a next step, Corteva will validate these targets with the Science-Based Targets initiative (SBTi).

https://www.corteva.us/press-releases/corteva-announces-enterprise-climate-strategy-inaugural-sustainability-report.html June 2, 2021

8. USES FOR SOYBEANS

8.1 USDA Dietary Guidelines Support Consumption of Soy Products

Guidelines include soy-based products across four core element categories.

The Soy Nutrition Institute recently issued a summary statement about the latest USDA Dietary Guidelines for Americans, highlighting the inclusion of soy products in all three dietary patterns for healthy eating. The U.S.-style, vegetarian and Mediterranean-style dietary patterns recommend consumption of nutrient-dense foods and beverages throughout all stages of life. The guidelines define six core elements that make up a healthy dietary pattern — vegetables, fruits, grains, dairy, protein foods and oils — and soy-based products are included in four of the six core elements: dairy, oils, vegetables, and protein foods.

https://www.unitedsoybean.org/hopper/usda-dietary-guidelines-support-consumption-of-soy-products/

February 1, 2021

8.2 U.S. Soy Turf to Cover More Ground Than Ever in 2021

-----SYNLawn artificial grass -----. -----has installed 82 million square feet of U.S. soy-backed grass across 200,000 installations in the United States and 19 other countries since 2008. For 2021, North America's largest manufacturer of artificial grass is set to add more soy than ever to its products, which will increase its use of U.S. soy by 10%.

------ report the USDA released in July 2019, biobased products contributed $459 billion to the U.S. economy in 2016 (a 17% increase from 2014) and supported, directly and indirectly, 4.6 million jobs. ----research team estimates the reduction of fossil fuels and associated GHG emissions from biobased products is equivalent to approximately 12 million metric tons of carbon dioxide prevented in 2016.

https://www.unitedsoybean.org/hopper/us-soy-turf-to-cover-more-ground-than-ever-in-2021/

January 13, 2021

8.3 Biodiesel Breakthrough: Making a Difference One Gallon at a Time

The National Biodiesel Board, supported in part by your soy checkoff, is on a mission to continue building demand for this domestically produced green fuel, **----- .**

Our vision is to exceed 6 billion gallons by 2030, potentially doubling the market from where it stands today at 3 billion gallons. And, with investments in feedstocks, to reach 15 billion gallons by 2050."

Contrary to popular belief, these benefits don't come at the expense of performance. When compared with diesel fuel, B20 — a 20% blend of biodiesel with diesel fuel — provides similar fuel economy, horsepower, torque and haulage rates.

---- the National Biodiesel Board in partnership with Trinity Consultants conducted and published a groundbreaking study that demonstrates biodiesel's positive impacts on Americans' health.

Key findings from this research on just 13 sites across the country show substantial community health improvements that can be quantified in reduced medical costs and health care benefits, including:

- 340 premature deaths prevented annually.
- 46,000 fewer sick days used per year.
- A 45% reduction in cancer risk when B100 is used in heavy-duty trucks such as semis and an 86% reduced cancer risk when biodiesel is used for home heating oil.
- 17,000 fewer lung problems per year as a result of using biodiesel to heat homes.
- 203,000 fewer or lessened asthma attacks per year based on vehicle use of B100.
- And $3 billion in avoided health costs annually.

https://www.unitedsoybean.org/hopper/biodiesel-breakthrough-making-a-difference-one-gallon-at-a-time/ June 28, 2021

8.4 Recent Checkoff Study Shows Rodents Don't Favor Soy-Based Plastics

A recent study funded by the soy checkoff, though, has proved that, contrary to popular belief, rodents don't favor soy plastics ---- .

https://www.unitedsoybean.org/hopper/recent-checkoff-study-shows-rodents-dont-favor-soy-based-plastics/ April 28, 2021

8.5 Soy Protein Skin Wound and Burn Dressing

Project Summary

This is totally new and novel research proposal which will help patients, care providers and soybean farmers. With a message about the healing properties of soy protein. Our skin substitute

(OmegaSkinTM)is made of soy protein isolate and generates a high-tech biomedical platform resulting in an affordable, off-the-shelf, bioactive scaffold for wound and burn healing. Rolls or sheets of "skin" are manufactured by electroprocessing (a combination of electro-and blow-spinning) and packaged for use in the field or can be applied directly on an injury using our portable hand-held spin blower. Our studies in animal models indicate that electroprocessed soy-based wound matrices are gradually degraded and integrated into the host's dermis leading to neovascularization, deposition of new collagen and enhanced epithelization, superior closure and healing of full thickness wounds quickly with minimal to no scarring, with the added benefit of regenerating intact hair follicles and sweat glands.

Lead Principal Investigator: Joseph Connell. Neu Esse Inc a medical device develpoment company.

https://www.soybeanresearchdata.com/Project.aspx?id=53779 March1, 2021

8.6 **Asphalt Using U.S. Soybean Oil**

--- collaboration between ----- soy checkoff, the Iowa Soybean Association, Asphalt Paving Association of Iowa and a research team at Iowa State University resulted in a new biobased polymer for asphalt.

The polymer, formulated with high oleic soybean oil, provides a lower-cost and cleaner alternative to traditional binding agents used in asphalt. Plus, it can outperform petroleum and other product ingredients.

-----not yet released commercially, the product's potential applications could increase demand for high oleic soybean oil.

https://www.unitedsoybean.org/hopper/the-best-of-the-checkoff-in-2020/ January 15, 2021

8.7 Filling the Cracks with U.S. Soy

PoreShield, a soy-based concrete durability enhancer, lengthens the lifespan of roads and bridges by protecting the concrete pores from salt, ice and water damage. Developed from an innovative soy checkoff research collaboration, -----. Indiana Public Works is applying PoreShield to 330,000 square feet on 77 bridge decks -----. Purdue University -------partnered with the soy checkoff and ISA*(Indiana Soybean Alliance)* to research soy methyl ester as an environmentally friendly, longer-lasting alternative in concrete durability enhancers. PoreShield enhances the durability of concrete and provides more than 10 years of protection.

https://www.unitedsoybean.org/hopper/filling-the-cracks-with-us-soy/ October 21, 2020

8.8 Innovative Soy-Biobased Dust Suppressant Helps Clear Air and Deters Respiratory Issues

Soy checkoff research collaboration with the North Dakota Soybean Council created a soy-biobased dust suppressant that will drive soy demand, improve air quality and reduce dust-related health and safety risks in communities nationwide.

BioBlend Renewable Resources' EPIC EL dust suppressant is the latest industrial use product ----. North Dakota State University (NDSU) research engineer created the base chemistry that BioBlend is commercializing. BioBlend Renewable Resources will begin marketing EPIC EL nationwide in April 2021 -----.

-----EPIC EL is an odorless water-soluble product, it also offers environmental benefits compared to the salt-based mixtures commonly used to control dust that trigger concerns about soil leaching and equipment corrosion.

-----35% of the nation's roads, more than 1.3 million miles, are unpaved. Dust created by vehicles traveling on these roads equates to about one ton of lost gravel per vehicle per year.------ dust going up ----- goes onto the crops ------ into the homes ----- off the roadway----- have to replenish it. Maintenance is a major budget item. In North Dakota, about 66% of local roadway budgets are spent on the state's 60,000 miles of gravel roads.

https://www.unitedsoybean.org/hopper/innovative-soy-biobased-dust-suppressant-helps-clear-air-and-deters-respiratory-issues/ April 22, 2021

9. MARKET OUTLOOK

9.1 Global Agriculture Seed Treatment Market 2021 Future Developments – BASF, Syngenta, Monsanto Company, Bayer CropScience

https://springhillrecord.com/business/10924/global-agriculture-seed-treatment-market-2021-future-developments-basf-syngenta-monsanto-company-bayer-cropscience/ prachi October 1, 2021

9.2 Fungicides Market Projected to Reach $24.5 Billion by 2025, Key Players are BASF SE, Bayer AG, Corteva, Inc., Syngenta AG, Nippon Soda Co., Ltd., Isagro S.p.A, Nufarm

The development of biofungicides with least or no effect on the environment provides open opportunities for further growth of the fungicides market.

https://www.yournewsnet.com/story/44414165/fungicides-market-projected-to-reach-245-billion-by-2025-key-players-are-basf-se-bayer-ag-corteva-inc-syngenta-ag-nippon-soda-co-ltd-isagro-spa-nufarm July 29, 2021

9.3 Organic Soybean Protein Market Size 2021: In-Depth Manufacturers Analysis, Industry On Going Trends, Share Estimation, Global Growth, Developments, Future Investments, Supply and Demand Scenario, Regional Forecast 2027

------analytical view with complete information of product types, sales and revenue by region, including manufacturing cost analysis, industrial chain and market effect factors analysis. key players profiled in the report included are ADM, Cargill, CHS, DowDuPont, Yuwang Group, etc.

https://www.marketwatch.com/press-release/organic-soybean-protein-market-size-2021-in-depth-manufacturers-analysis-industry-on-going-trends-share-estimation-global-growth-developments-future-investments-supply-and-demand-scenario-regional-forecast-2027-2021-10-12

October 12, 2021

9.4 Oil becoming new driver for soybean industry

-----Mac Marshall, vice president of market intelligence for United Soy Board/U.S. Soybean Export Council. ----waves of announcements of new renewable diesel facilities being constructed around the country." ------. ------ has led to really aggressive bidding for soybean oil,"----.------ seen bean oil go up pretty substantially. ------ prices have come down but are still up about 40% relative to January. The new administration's emphasis on green energy helped set the pace of retrofitting existing infrastructure and expanding additional capacity. ------the rational for processing is fundamentally changing."

----meal has carried the water for value contribution in soybean, according to Marshall. Meal has typically accounted for 65% to 70% of the value of beans. From April until most recently both oil and meal have contributed about 50% each for their contribution to the crush. -----providing a lot of incremental value to soybean."

https://www.farmprogress.com/soybeans/oil-becoming-new-driver-soybean-industry

October 12, 2021

9.5 Cargill CEO MacLennan says plant-based will 'cannibalize' its protein business

----- company is preparing for a big shake-up in its business over the next few years, as consumer demand for the new generation of plant-based protein products **eats into market share** for meat from slaughtered animals.

Our analysis is that in […] three to four years, plant-based will be perhaps 10% of the market,"

-----Cargill doesn't expect China's domestic livestock feed industry **to become self-sufficient** anytime soon.

Cargill has been trying to increase its footprint in the plant-based protein space of late, anticipating the consumer shift away from animal protein. ------ key supplier of pea protein to plant-based patty maker Beyond Meat -----.-----expand its US soybean crushing capability.

Cargill has also launched its own range of plant-based meat alternatives in China.

https://agfundernews.com/cargill-ceo-maclennan-says-company-expects-plant-based-to-cannibalize.html June 9, 2021

regional-forecast-2027-2021-10-12

October 12, 2021

9.6 Argentine soybean production expected to rise

The U.S. Department of Agriculture expects farmers in Argentina to grow 51.5 million tonnes of soybeans in the coming marketing year, an 8.4 percent increase from the department's 2020-21 forecast. | Reuters / Benjamin Boroughs, the United States Department of Agriculture attaché in Buenos Aires. -------pegged exports at 6.5 million tonnes in 2021-22, ------.

https://www.producer.com/markets/argentine-soybean-production-expected-to-rise/ April 29, 2021

9.7 Is Argentina's soy boom over?

Die artikel behandel die tendens van afname in die produksie van sojabone teenoor mielies en koring in Argentinië en die finansiële *en agronomiese gronde daarvoor. Hieronder enkele sleutel uittreksels.*

This season, Argentina will plant the least amount of soy for a decade. Maize and wheat have begun to overshadow the oilseed, which has been grown less and less each year.

The peak came in the 2015/2016 season, when production hit 58.5 million tonnes.

For Argentina, export taxes are a key factor for farmers when deciding which crop to grow. Changes introduced by the government of Mauricio Macri (2015-2019), which saw the elimination of taxes on corn and wheat but left a 30% levy on soybeans in place, explain the changes.

With higher profit margins than soy, maize could be Argentina's new star crop.

"A lot of weed and pest problems were appearing due to non-rotation, which increased the pressure on the system. Resistant weeds are a total headache for farmers and require a lot of money to control,"

Soy monoculture has accelerated soil erosion, a problem that affects 36% of Argentina's land area.

https://dialogochino.net/en/agriculture/44411-is-argentinas-soy-boom-over/ July 13, 2021

9.8 BCR: Declining soy protein levels to cost Argentina crushers US$575m

https://www.feednavigator.com/Article/2021/08/20/BCR-Declining-soy-protein-levels-to-cost-Argentina-crushers- US-575 M

'Argentina's soy meal exports from the 2021 crop will lose US$575m, or 7% of their value, because of ebbing protein levels in harvested beans, according to a Rosario Board of Trade (BCR) study.'

The global standard for meal is 47 - 48% protein, but Argentina has had to cut its benchmark to 46.5%.

utm_source=copyright&utm_medium=OnSite&utm_campaign=copyright August 20, 2021

9.9 Repeat of La Nina raises risks for South American crops

Last year's La Nina contributed to a cascading series of problems that delayed soybean seeding in Brazil and slashed the country's second corn crop. A repeat of bad weather this year could support corn and soybean values during the North American winter and spring, which should also help keep wheat and canola prices elevated. | Reuters

---- United States Weather Service last week said the La Nina has reformed and there is an 87 percent chance of it continuing through the December-to-February period.

Forecast modelling issued in September from the International Research Institute for Climate and Society for the October to December period shows strong potential for dry weather in southern Brazil,

Uruguay and northern Argentina. Areas further north in Brazil could see a range from dry to normal to above normal rain, according to the models.

https://www.producer.com/markets/repeat-of-la-nina-raises-risks-for-south-american-crops/

October 21, 2021

9.10 Brazil Soy Benefitted From Good Weather During Early October

The weather in Brazil during the first half of October was very beneficial for soybean planting. Widespread rains improved the soil moisture in nearly all the major soybean producing areas of Brazil. As of late last week, the soybean planting in Brazil was 22% compared to 8% last year and 16% average. This is in direct contrast to October of 2020 when widespread dry weather delayed Brazil's soybean planting.

https://www.soybeansandcorn.com/articles/8982/ October 22, 2021

9.11 Economist's Angle: The Outlook for Growth in Chinese Soybean Demand

Concluding paragraph:

Rising incomes in China fueled the increase in meat consumption. This was joined with a simultaneous transition to commercial operations in the country that led to a massive increase in demand for feed. While China remains largely self-sufficient in corn, it quickly transitioned to importing soybeans. However, this growth is largely over: (1) China has largely transitioned to commercial animal operations, (2) per capita meat consumption is approaching developed-nation levels, and (3) population growth is slowing. Yet, dairy consumption in China is still increasing and has much potential. Although the growth in demand for dairy will likely be much less than for livestock, it would be on top of the levels that already occurred for livestock. As a result, China is expected to be a major importer of soybeans into the future, though growth will likely be at a slower pace.

https://soygrowers.com/news-releases/economists-angle-the-outlook-for-growth-in-chinese-soybean-demand/ December 3, 2020

9.12 ASA: 5 Big Reasons Why WISHH's Work Matters Right Now

----- big trends in five new reports demonstrate the untapped potential that the American Soybeanë Association's (ASA) World Initiative for Soy in Human Health (WISHH) program is helping capture for U.S. soybean growers to fill protein gaps in emerging and developing markets.

The article have links to the mentioned reports.

https://soygrowers.com/news-releases/asa-5-big-reasons-why-wishhs-work-matters-right-now/

August 12, 2020

9.13 Getting the same rise out of free from cake mixes

However, if you would like to share the information in this article, you may use the headline, summary and link below:

https://www.bakeryandsnacks.com/Article/2021/09/23/Getting-the-same-rise-out-of-free-from-cake-mixes

Today's consumers have a far more diverse set of wants and needs than ever before, but they still want an indulgent treat. And while they're expecting it to be vegan, gluten-free, egg-free, dairy-free or plant-

based, they are not prepared to compromise on the important bits, like taste and indulgence.

Consisting of a mixture of soy and wheat protein , other ingredients and some emulsifiers this product developed by R&D Company Nexus is egg-less and vegan and can be used in a wide variety of bakery products.

https://www.bakeryandsnacks.com/Article/2021/09/23/Getting-the-same-rise-out-of-free-from-cake-mixes?utm_source=copyright&utm_medium=OnSite&utm_campaign=copyright

September 23, 2021

10. OVERCOMING PERSONAL STRESS

None

Die volgense bronne is gebruik:

United Soybean Board (USB)

Committee on New Usages of USB

America Soybean Association (ASA)

USDA Agricultural Research Services (ARS) Beltsville, MD - Research results

National Institute for Food and Agriculture (NIFA)

Aktiwitete van Saad- en Chemikaliee-maatskappye:

Bayer CropScience/Monsanto

BASF

Cargill

Corteva (DuPont Pioneer/ Dow Agro Sciences)

Syngenta

Limagrain

K2 Agric

Nuutste verwikkelinge by Suid-Amerikaanse navorsingsinstansies:

EMBRAPA, EEAOC, INTA en INIA

Ondersoek by webwerwe met inligting oor Sojaboonolie en – meel, verhouding tussen hoë temperature en opbrengs by sojabone, enige ander betekenisvolle bydraes tot sojaboonontwikkeling.

jdup/1/11/21