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Volume 8 Annual 2024

Our Driving Force

What Delivering VALUE BEYOND YIELD® Means for You

PLUS

- Carinata Offers Off-season Opportunities
- 2024 Market Outlook
- Healthy Soils, Healthy Crops
- Omega-3 Canola Production System: A Game Changer

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As someone deeply involved in the agri-food industry with a strong passion for sustainability and innovation, I've had the opportunity to closely observe Nuseed's unique approach to advancing seed technology.

What sets Nuseed apart, from my perspective, is its steadfast focus on the downstream marketplace and its dedication to delivering value beyond mere yield.

At Nuseed, the shift towards larger identity-preserved value chains and the delivery of novel oils to downstream customers isn't just a strategic move, it's a fundamental philosophy that drives the entire organization. Rather than solely concentrating on seed production, Nuseed is committed to optimizing grain and oil production across all its platforms, with a sharp focus on the global value chain and trade functions. This approach brings forth new opportunities, enabling Nuseed to form global partnerships, spot emerging market trends, and customize its offerings to meet the changing demands of end-use customers.

One of the most exciting aspects of Nuseed's emphasis on the downstream marketplace is the plethora of new opportunities it brings forth. Through close collaboration with regional teams and other business units, Nuseed is actively shaping its value chain to cater to the increasing demand for its proprietary products, like the Nuseed Omega-3 Canola Production System and Nuseed Carinata. By effectively managing risk, optimizing trade-related costs, and nurturing strategic partnerships, Nuseed is paving the way for sustainable growth while ensuring the quality and traceability of its products throughout the value chain.

Furthermore, Nuseed's connection from commodity grain to end-users offers tangible benefits for growers like you and the people you feed. By developing products that go beyond the initial seed sale, Nuseed isn't just empowering farmers; it's also meeting the evolving needs of consumers in a rapidly changing market landscape. From R&D trials to regulatory compliance and logistics, Nuseed's comprehensive approach streamlines the entire process, making it more efficient, transparent, and ultimately more sustainable.

In addressing the challenges of the agri-food system, Nuseed draws upon its global expertise in commodity grain handling to drive meaningful change. Through investments in seed technology solutions that tackle climate change and promote soil health, Nuseed is at the forefront of innovation, challenging conventional wisdom and advocating for a more sustainable future for agriculture.

Chantelle Donahue
Global Lead, Value Chain & Trade

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GLOBAL REACH, LOCAL IMPACT

Nuseed is providing VALUE BEYOND YIELD® as it continues to prove itself a valuable partner for growers looking to innovate on their farms.

Nuseed's footprint extends across four global regions, each with unique strengths and capabilities.

The company's localized approach acknowledges regional differences and taps into specific market opportunities. The company has a proven track record of developing and delivering successful crops tailored to meet the diverse needs of its customers.

"When you think of Nuseed, think of seeds solving global challenges," says Brent Zacharias, Group Executive for Nuseed.

Nuseed is the seed technologies platform of Nufarm Limited, a global agriculture innovator. Nuseed has evolved into a trusted partner for farmers seeking sustainable, innovative and high quality products.

The company operates commercial seed businesses in Australia, Europe, North America and South America. Nuseed's commitment is encapsulated in its mission to deliver VALUE BEYOND YIELD, providing customers with more than just seed.

Navigating the challenges and opportunities faced by Nuseed as a newer player in North America, Zacharias stresses the dynamic nature of agriculture, where each year presents unique hurdles that, when addressed strategically, can transform into success stories.

Nuseed has now established several global innovation centers, all focused on solving global megatrends with plant-based solutions.

"We really are not just focused on putting more bushels in a grower's bin but making those bushels worth more and mean more to new downstream markets," adds Roger Rotariu, North American Marketing Lead for Nuseed.

"We don't see anything but growth for the next decade."

Rotariu is confident in the opportunities for farmers in the seeds and cropping decisions they make, emphasizing the significance of Nuseed's impact on the industry.

Nuseed Carinata

Before joining Nuseed, he served as North American Cereals and Seed Treatment Strategic Manager and Canadian Marketing Manager at Nufarm. He knows the ins and outs of how the company functions and why it's become such a major player in the world of farming.

"WHEN YOU THINK OF NUSEED, THINK OF SEEDS SOLVING GLOBAL CHALLENGES."

Emphasizing the company's commitment to innovation and sustainability, Rotariu emphasizes Nuseed's three core pillars — seeds and grains, nutritionals and renewables — as the foundation of its success and unique business model.

"Our seeds and grains regional teams have become the supply chain for our nutritional and bioenergy platforms. It's a different way of doing things, and it speaks to how innovative we really are in this space."

Feeding the Pipeline

Nuseed is so innovative, he says, because it is constantly developing new solutions to address global challenges such as food security, human nutrition, and climate change.

Nuseed uses advanced technologies and techniques such as molecular/genomic breeding, marker-assisted selection, and trait integrations to create superior crops with high yields, improved nutritional benefits, and enhanced climate adaptation.

Some of its innovative seed products are:

• Nuseed Carinata: A non-food certifiable cover crop that is grown for sustainable low-carbon energy feedstock. It reduces emissions when used to replace fossil fuels and removes carbon from the air, restoring it to help regenerate soil as it grows between main crop rotations.

• Nuseed Omega-3 Canola: The first land-based plant source of essential omega-3 fatty acids. It supports sustainable growth for aquaculture, healthier oceans, and nourishes

Nuseed Omega-3 Canola

fish with advanced omega-3 oil that doesn't demand additional farmland or add pressure to marine resources.

• Nuseed Sunflower: Nuseed offers a sunflower hybrid for every field and every market. Their North America-based nurseries are the breeding ground for superior sunflower hybrids. Nuseed's sunflower portfolio goes beyond the conventional, offering a range of products that cater to diverse market needs. The company provides high-quality seeds for various applications, including oil and confection products.

Nuseed has a strong focus on very specific value-added end-use markets meant to deliver VALUE BEYOND YIELD to its customers.

"Nuseed is a global agriculture innovator that is unlocking the potential of plants to solve important global challenges," says Mark Jackson, General Manager for Nuseed Americas.

"We're helping growers monetize the carbon markets, providing better cash flow, a stronger balance sheet, and increased profitability per acre. It's about more than just selling seed; it's about sustainable growth."

Highlighting Nuseed's focus on sunflower and canola, Jackson details the growth potential in these commodity crops. "In sunflower, we're looking to expand our market share by showcasing our superior genetics. We cover all aspects, from oil products to confection products, offering versatility that sets us apart."

For canola, Jackson notes Nuseed's recent entry into the North American market, emphasizing the company's commitment to introducing new canola genetics: "We're not just repeating the same genetics. We're bringing in unique traits that have proven successful in other regions, such as blackleg resistance."

The World of Nutritionals and Bioenergy

Nuseed Nutritional offers plant-based oil products from from the Nuseed Omega-3 Canola Production System, which is the world's first plant-based source of total Omega-3 nutrition with advanced plant technologies. Nuseed Nutritional has two products: Aquaterra and Nutriterra.

Aquaterra supports sustainable growth for aquacultures, healthier oceans, and nourishes fish with advanced Omega-3 oil that doesn't demand additional farmlands or add pressure to marine resources.

Nutriterra delivers an ocean of nutrition within a canola seed, including DHA, EPA, and ALA. Nuseed Nutritional is committed to providing consumers with healthy and sustainable alternatives to wild fish stocks, which are declining and need protecting, Jackson notes.

Discussing the nutritional aspect of the product, particularly the significance of

omega-3, Jackson says Nuseed Omega-3 Canola is the first trait that brings long-chain fatty acids, including Omega-3 DHA, into a land-based plant, helping preserve fish stocks and contributing to human health at the same time.

“It's not just about fish health but also human health. We're enabling farmers to use their land for traditional crops while contributing to a non-commodity, yet essential, market."

On the renewables front, Jackson elaborates on the partnership with bp for its Nuseed Carinata product.

"It's all about renewable fuels and carbon sequestration. Carinata serves as an industrial oil for jet fuel production, meeting the growing demand for sustainable alternatives. We're in markets that typically don't see a canola-based product, and the growth potential is enormous."

Empowering Growers Through Knowledge Sharing

Addressing the significance of knowledge-sharing initiatives, such as Nuseed's Sunflower University, Nuseed Omega-3 Canola Production System University and Nuseed Carinata University events, Jackson emphasizes their role in empowering growers.

Each event takes place annually and gets growers together to hear a variety of speakers and network with one another and with representatives from Nuseed.

"Mother Nature is always changing. We want to maximize the value for the grower, not just in terms of seed but in the entire complex of growing the best crop. Our universities cover equipment, processes and maximizing land potential."

Jackson acknowledges Nuseed's dedicated agronomy team, including Alison Pokrzywinski for sunflower, Shane Naslund for canola and Logan Dyer for carinata.

"Our team is at the forefront, ensuring growers have the knowledge to produce quality crops, whether it's commodity canola or sunflower, or a specialized product like Nuseed Carinata or Nuseed Omega-3 Canola."

Logan Dyer, R&D Agronomist, Nuseed

Nuseed's Agronomic Expertise

Nuseed's ability to offer growers agronomic knowledge is based on its innovation, experience and collaboration with various partners. Nuseed's staff members have good agronomic knowledge because they are well connected with local farmers and have deep expertise in the cultivation and harvesting of the crops they work with.

Nuseed also collaborates with strategic industry partners around the world to build robust contract supply chains from field to end-use, ensuring quality, sustainability, and traceability of their products. Nuseed's staff is passionate about unlocking the potential of plants to help solve global challenges like food security, human nutrition and climate change.

• Alison Pokrzywinski is the Nuseed Sunflower Product Development Manager for North America. She is responsible for promoting new sunflower hybrids through on-farm trials, public trials and training of sales staff. She has a Bachelor of Science in Agricultural Business from the University of Minnesota Crookston and a Master's in Plant Science from North Dakota State University. She is passionate about sunflower production and innovation and has led several training sessions for Nuseed growers on topics such as ultra-early sunflower genetics, desiccant use and double cropping opportunities.

• Shane Naslund's extensive experience and expertise in agronomy, particularly with canola, helps him enlighten growers on the crucial role soil health plays in modern agricultural practices. As a seasoned Commercial Agronomist, Naslund brings a unique perspective shaped by his years of working with various crops and addressing the specific needs of growers in North Dakota and Montana.

• Logan Dyer is a R&D Agronomist for Nuseed. He has been working with Nuseed since 2022 and is responsible for research and commercial agronomy for Nuseed Carinata, with a dedicated focus on feedstock production and the widespread adoption of *Brassica carinata* for sustainable aviation fuel. He has a Master of Science in Crop & Soil Science from the University of Georgia. Through his work, he aims to contribute to a more sustainable future by promoting the cultivation of Nuseed Carinata as a viable solution for reducing carbon emissions in aviation while supporting agricultural resilience and economic growth.

HEALTHY SOIL IS CRUCIAL

NUSEED'S SUNFLOWER, CANOLA AND CARINATA PRODUCTS DEPEND ON AND CONTRIBUTE TO HEALTHY SOILS.

In the heart of North Dakota, where agriculture plays a pivotal role in shaping the landscape, Nuseed Agronomist Shane Naslund is championing sustainable farming practices. As a seasoned expert working with canola growers, Naslund emphasizes the importance of soil health and sustainable cultivation techniques.

Naslund, who resides in Bismarck, N.D., finds himself at the crossroads of conventional and no-till farming methods. He notes, "There are still many farms in North Dakota practicing straight-up conventional tillage. However, in the northern and western regions, where moisture conservation is crucial, a significant number of farmers are adopting no-till practices to enhance organic matter."

One of the most intriguing aspects Naslund highlights is the visible impact of these practices on the fields he works with. "It's really exciting to see fields with 3-4% organic matter, and I was on a farm this spring with a no-till field for 10 consecutive years, boasting about 5.5% organic matter. It's a testament to the positive outcomes of sustainable farming," he adds.

Naslund's expertise primarily revolves around canola, dealing exclusively with canola growers. When asked about the challenges faced by canola farmers, he explains, "Canola being a tiny seed, the focus is on topsoil moisture, especially in the first inch of soil. With canola seeded at a shallow depth, maintaining soil moisture and fostering organic matter through no-till practices is crucial."

In his conversations with farmers, Naslund emphasizes the significance of soil testing. "One hundred percent of the farms I work with conduct soil sampling. Timing is key, whether it's in the spring or fall, and understanding factors like snowpack, nitrogen levels, and soil depth are essential for tailored recommendations," he states.

Planting Nuseed canola can help soil health in several ways. Canola is a crop that can improve the soil structure and aeration, reduce erosion and weed growth. Canola also has a deep taproot that can break up compacted layers and add organic matter to the soil.

When delving into the role of organic matter in soil health, Naslund underlines its impact on soil structure and fertility. "Organic matter, especially in canola stubble, helps prevent runoff, maintaining soil structure. It's about preventing erosion and ensuring a stable seedbed for canola, which is seeded at a shallow depth," he explains.

As Naslund navigates the diverse farming practices of the growers he collaborates with, he acknowledges the variation in attitudes towards sustainable methods. "I work with a mix of farmers, some already well-versed in agronomy, while others need some education. It's rewarding to collaborate with them, considering factors like soil temperature, moisture, and timing for optimal seed placement."

Reflecting on innovative farming practices, Naslund shares insights from a farmer who utilizes two different seeding systems: "Comparing the impact on the same crop in the same field, it's fascinating to observe how machinery and seeding techniques influence outcomes. These experiences contribute to a deeper understanding of what works best for each farmer," he notes.

Naslund's approach stands out for its dedication to supporting farmers beyond mere sales. "My motivation is to assist farmers in enhancing their farm operations and bottom line. It's about fostering sustainable practices that benefit them in the long run."

Nuseed Carinata Enables Good Stewardship

In a landscape where agriculture intersects with sustainability, Logan Dyer sheds light on the perspectives of growers navigating the delicate balance between environmental stewardship and economic viability in the realm of Nuseed Carinata. As the agricultural industry witnesses a surge in sustainable practices, Dyer knows well the motivations and challenges faced by the farming community when it comes to this crop.

Dyer, southeastern R&D Agronomist for Nuseed in Tallahassee, FL, emphasizes the economic aspect driving the adoption of sustainable practices. Dyer works with Nuseed Carinata growers who have adopted the crop as an innovative option in their rotation.

"It's going to come down to the bottom dollar for our growers," he says. "Early adopters are typically those in tune with newer trends and ideas in agriculture, caring not only about profits but also about the long-term sustainability of their land."

Discussing farmers' outlook on sustainability, Dyer points out that many growers have a profound connection to the land they cultivate — making soil health a priority for them. "Nuseed Carinata, for example, is a contract crop grown and certified sustainable to help end-use customers meet their carbon reduction and sustainability goals."

"SOIL HEALTH IS A CRITICAL FACTOR IN ACHIEVING CONSISTENT PERFORMANCE."

"Whether owning or renting land for decades, these growers witness the effects of soil erosion, reduced yields, and the impact of intense storms on their crops," he explains. "They recognize the unsustainability of current practices and are striving to be stewards of their land, seeking solutions that promote better carbon sequestration in their regions."

Dyer acknowledges the financial incentives that come with sustainability efforts like ensuring good soil health, particularly in the context of reducing carbon reliance on large-scale industries. "The sustainable part of growing a crop for jet fuel and lessening the reliance on fossil fuels is a significant incentive for growers," he notes. "While profits matter, there's a genuine interest in making a positive impact on the environment. Growers understand that the long-term health of their land is interconnected with broader sustainability efforts."

Nuseed Carinata is an excellent option for enabling good soil health. The cover crop can:

- Break up compacted layers and add organic matter to the soil with its deep taproot.
- Reduce erosion and weed growth by covering the soil surface.
- Sequester carbon from the air and restore soil carbon as it grows.

Dyer also touches on the need for diversification in revenue streams. He shares a farmer's perspective on the economic challenges faced in traditional crops like cotton.

"The price of cotton hasn't really gone up in 20 years, and when you factor in the cost of

advanced harvesting equipment, it's clear that diversification is essential," he says. "Farmers recognize the need to mitigate risks and are exploring alternatives like carbon sequestration through contract crops like Nuseed Carinata to supplement their income. Farming is about mitigating risk, and the astute farmers understand this. They recognize the importance of diversifying crops to ensure sustainable economic growth."

Sustainable Sunflower

For Alison Pokrzywinski, the relationship between sunflower, soil health, and the evolving landscape of crop development is an intricate one.

"Depending on the part of our business, soil health plays a varying role. With Nuseed Omega-3 Canola and Nuseed Carinata, there's a significant emphasis on it. Sunflower, being a commodity crop, involves a different dynamic," says the Sunflower Product Manager for Nuseed based in North Dakota.

She highlights the unique aspects of sunflower as a commodity crop, stating, "Sunflowers are used for a much larger purpose and can be utilized in various products."

Growing sunflowers can contribute to soil health in several ways. Sunflowers are known for their deep taproots. The roots can grow down deeper than six feet! This makes it great for reaching subsoil nutrients such as nitrogen while also improving the soil structure and aeration by breaking up compacted layers and adding organic matter. Since sunflowers are typically harvested later, they help to keep the ground covered, protecting from weeds and erosion throughout late summer and early fall.

A highly adaptable crop, sunflowers do well in the heavy clay soils of the Red River Valley and also in more marginal ground as you head west. They have a medium tolerance to saline soils and while not as good as barley, growers have seen good success.

"I had a customer once that precision planted all of his saline areas in a field in sunflowers and the other areas in soybeans. It looked really funny, but he was very excited that something grew and he was able to get a crop in those areas of that field," she says.

In discussing the sunflower portfolio, she reveals exciting developments for 2024. "We're introducing two new hybrids: N4H490 E and N5H493 CL. The latter is our first high oleic conoil sunflower, meeting specific processor requirements. The former, Express, is our first hybrid with advanced downy mildew resistance."

Nuseed tests its sunflower products in the areas they will be grown to ensure they perform well under various soil types and conditions.

"Soil health is a critical factor in achieving consistent performance," she adds.

"Different crops in rotation contribute diverse elements to soil health. Each crop adds something unique, making crop rotation an essential practice for overall soil health."

The Importance of Organic Matter

Soil expert Keith Paustian says it's critical to maintain vegetation on the ground rather than leaving soil bare. Paustian, Professor and Soil Researcher at Colorado State University, has spent his career touting the benefits of this approach, ranging from erosion control to carbon fixation and the enhancement of soil organic matter.

"In general, having vegetation on the ground is crucial for controlling erosion, fixing carbon, and adding organic matter to the soil. This not only contributes to CO^2 drawdown but also plays a pivotal role in supporting soil microbiology, nutrient recycling, and overall soil structure," says Paustian.

The concept of soil health, according to Paustian, has evolved into a broader understanding of the necessity for healthy soils in functioning ecosystems. He stresses the interconnectedness of biological, chemical, and physical soil properties, emphasizing their collective role in creating a conducive environment for living organisms and nutrient recycling.

"There's a renewed emphasis on soil health, not just in our industry but also in politics. It's becoming increasingly important, and we're witnessing a growing demand for attention to soil health," notes Paustian.

Paustian's insights come at a time when soil health is gaining prominence globally. The term has indeed become a political focal point, with Canada's Senate conducting a nationwide soil health study. In the United States, Farmers for Soil Health — a recipient of a climate-smart funding grant from the United States Department of Agriculture — is currently enrolling farmers across 20 states in a new program meant to bolster soil health. The group is providing a $50 USD per acre incentive distributed over three years to participating producers.

Paustian acknowledges the escalating challenges posed by climate extremes and growing demands on land use systems. He highlights the resilience of soils as a keystone in adapting to changing conditions. Additionally, Paustian underscores the role of soils as significant carbon repositories, expressing optimism about the potential to increase carbon storage and contribute positively to climate mitigation and sustainability.

Paustian says there's a need to scale up research and development activities. He emphasizes the importance of exploring new crop varieties with larger and deeper root systems. While acknowledging some progress, he notes that attention to breeding plants for increased carbon storage in soils is a relatively new area of focus.

"In terms of crop genetics, there's ongoing research to enhance organic matter in soils for carbon mitigation. The Salk Institute is at the forefront of basic research on genes controlling root morphologies," says Paustian. He also points out that efforts to breed plants with high yields and increased carbon storage are still in their early stages.

Paustian highlights the broader scope of research, including systemic approaches such as crop rotations and cover crops. He is interested in innovative strategies that go beyond individual crops, emphasizing the need for technology and innovation at both the system and plant levels.

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SEEING GOLD

North American sunflower and canola marketing opportunities remain strong.

The news is all good for both the sunflower and commodity canola markets in Canada and the U.S. oil and other markets for these crops were very strong in 2023, and the outlook for both is looking robust into 2024 as well.

For sunflowers, the Russian invasion of Ukraine in February 2022 greatly reduced projected harvest volumes, causing global markets to heat up quickly. "Prices shot up for all commodities," explains John Sandbakken, Executive Director of the National Sunflower Association. "The price of sunflower seed went up to $43/hundredweight (cwt)."

While things have since returned to normal, the sky-high prices being offered early in 2022 prompted many U.S. growers to plant sunflowers, which increased acreage substantially. "However, we also had a snowstorm in April in the Northern Plains," says Sandbakken, "which prevented planting of other crops and some producers switched to sunflowers. Overall, acreage went up 30% over the previous year."

Sunflower profits in 2022 were also bolstered by the fact that it was a perfect growing year in the U.S. Yield in pounds per acre was the second-highest on record, so high that stocks carried over well into 2023. Growing conditions in 2023 were also good, particularly good in North Dakota and Minnesota. In these states, record yields were seen and at least one grower in Minnesota reached 4,000 pounds per acre.

Overall acreage was down 20% in 2023 compared to 2022, but that's still up 10% from 2021. Sandbakken notes that, "a lot of growers planted sunflowers in 2023 because they did well with them in 2022. Yield projection was down somewhat compared to 2022 as of early November 2023 when there was 50% harvested, but we'll see when it's all in the bin."

The crop quality was also excellent in 2023 with very high seed oil percentage achieved. "We always promote sunflowers by pointing out it's the only commodity that pays a premium by oil content," says Sandbakken. "Anything over 40% earns a price premium. Oil content has been increasing the last three years in particular due to agronomic research and new hybrids."

Addressing Multiple Market Needs

Demand for sunflower oil has shown excellent growth over the last seven years, with use by the North American food industry up by almost 70% over that period. Food product firms increasingly prefer sunflower oil because it performs well in various manufacturing processes, its non-GMO status provides a 'clean' label, and it's healthy, with both high-oleic and NuSun® mid-oleic oil profiles available.

Sunflower oil has also made inroads in food processing due to shifts in soybean and canola oil use. While these oils remain the biggest competitors facing sunflower oil, there has been a global increase in using soybean and canola to make renewable fuels.

The National Sunflower Association has also completed extensive yearly promotional

DEMAND FOR SUNFLOWER OIL HAS SHOWN EXCELLENT GROWTH OVER THE LAST SEVEN YEARS, WITH USE BY THE NORTH AMERICAN FOOD INDUSTRY UP BY ALMOST 70% OVER THAT PERIOD.

campaigns for sunflower oil with food processors in the U.S. and Canada, which keeps it top-of-mind.

A consumer ad campaign is also run yearly by the association, focused on boosting 'confection' snack consumption.

"We are seeing growth in the domestic confection market every year, especially in-shell," Sandbakken says. "Exports are also still strong to Canada, Spain and Mexico but there has been competition in Mexico and Spain, so there's been a focus on Canadian and U.S. markets. And while the demand for bird seed is not as high as the extreme demand during the pandemic, it's still very good."

Looking ahead to 2024, Sandbakken expects continued slow but steady growth in demand in oil and confection markets. He says a 20-25% increase in acres will be required just to keep up with oil demand, and another 10-20% increase will be needed for the growing confection market.

Canola Markets

Commodity canola oil demand has also experienced steady growth over the last few years, with the last two being particularly strong in both the food oil and biofuels markets, reports Tom Hance, a representative of the U.S. Canola Association.

In 2023, there were record acres of U.S. canola production and increased imports of oil from Canada as well, for both food industry and biofuel uses.

"We are up over 2.3 million acres in the U.S. now, and it's hard to say how much production will increase in 2024 and beyond, but we've seen modest but steady growth," says Hance. "Planting of winter canola is growing in non-traditional regions such as the southern Great Plains, Pacific Northwest and southeast into winter wheat rotations and also into fallow ground. North Dakota has most of the production, but Idaho, Montana and Washington are growing."

The biggest driver of biofuel demand is the low-carbon fuel standard in California, where over 50% of the fuel is now bio-based. Hance notes that there is always uncertainty with potential change to the California standard, but at the same time, other states have also established these standards and more may follow.

At the national level, the Federal Renewable Fuel Standard for bio-based diesel helps grow the canola oil market, but Hance reports that its yearly requirement increases from 2023 to 2025 are not as aggressive as the industry would like.

"The increase for 2023 was less than what was produced for the year," he says. "There is also a federal tax credit, which is undergoing a shift from a flat-rate per gallon to a value based on carbon intensity beginning in 2025. Details are to be determined, and how the carbon intensity of canola will be measured is also still to be determined."

Canadian Canola Market

Canadian canola continues to be in strong demand, from the oil, to food products and biofuels. However, the Canadian canola industry has also very actively developed the market for canola meal for livestock and fish farming in North America and beyond. The meal contains large amounts of high-quality protein and is highly palatable for livestock. However, various food companies are also investigating how to fractionate the protein and develop different forms of it for inclusion in food products.

The Canola Council of Canada (CCC) reports that the dairy feed market in China for Canadian canola meal is poised for significant growth. Current use of Canadian canola meal in Chinese carp and tilapia farming is also strong, but growth is expected in that market as well. Shipments to that market started picking up about 10 years ago, and have risen every year. In 2023, that export market reached 1.8 million tonnes. Growth in demand for canola meal is also expected in the Thai and Vietnamese aquaculture markets.

Historically, roughly half of Canada's canola seed, about 600,000 tonnes on average each year, has been crushed in Canada and half has been exported for crushing to the U.S., China, Mexico, Japan and a few other countries, according to the CCC.

However, over the next two years, Canada's domestic crushing capacity will vastly increase, causing seed exports to drop substantially, due to the construction of new crushing plants. Four plants are being built by Viterra, Cargill and Ceres Global Ag Corp and Federated Co-operatives in the province of Saskatchewan and one may begin operation as soon as early 2024.

The canola oil produced at these crushing plants will be used mainly to manufacture biodiesel with the rest going to the food industry. The approximately four million tonnes of canola meal that will be produced at the new plants when they reach full capacity will go into livestock feed and aquafeed markets being continually developed by the CCC.

While acreage is not expected to grow much in Canada due to these new plants, production of seed currently sits at approximately 20 million tonnes per year. Looking at production trends, canola yields have doubled in the last 20 years and the CCC reports that by 2025, they're targeting increased yield to reach 26 million tonnes per year (52 bushels/acre at 22.7 kg/bu).

Navigating Global Headwinds: The Resilience of International Sunflower Crop Markets

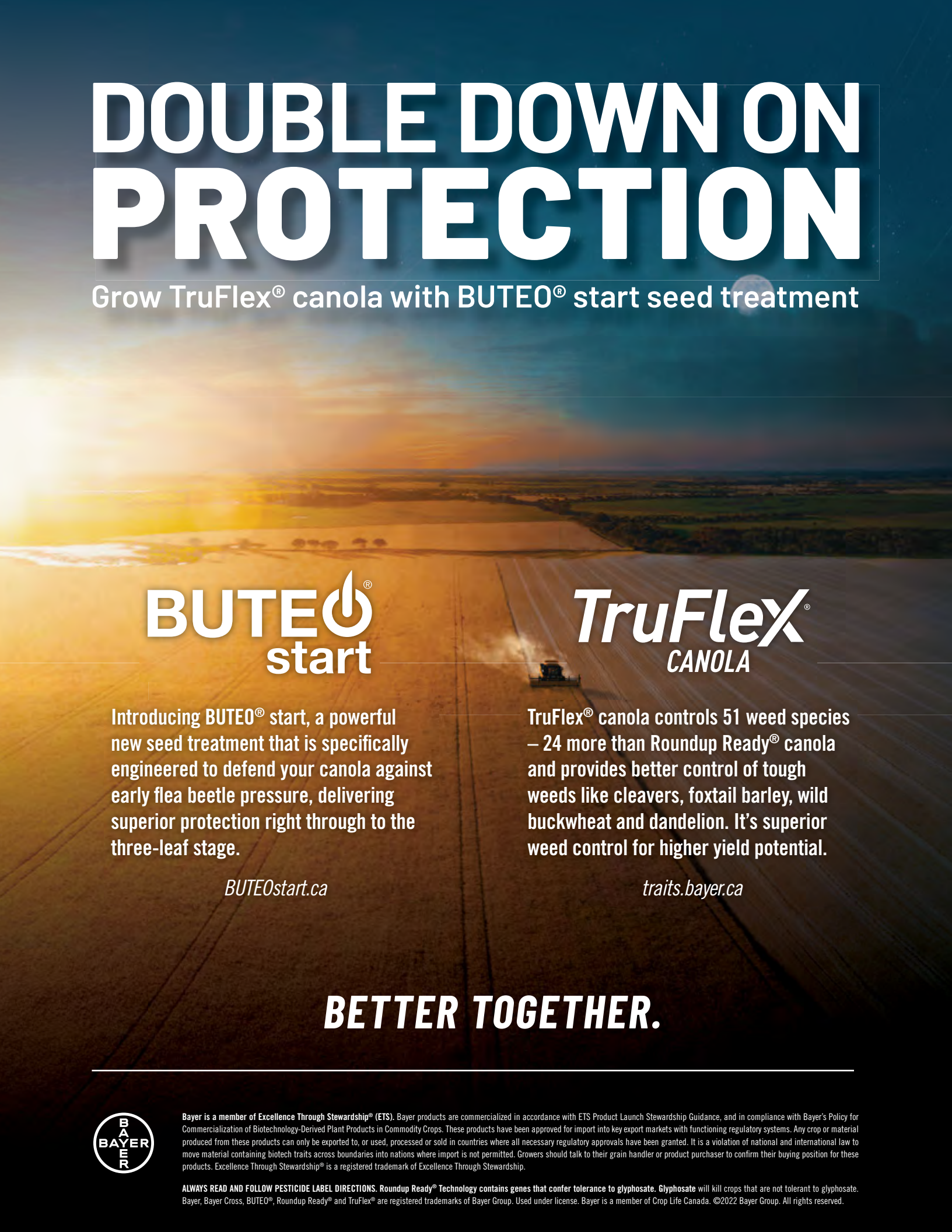
By: Patrick Dietrich

In the face of global challenges throughout 2023, the international sunflower crop markets have demonstrated remarkable resilience and adaptability. Factors such as product de-registration, delayed purchasing, and drought conditions have presented hurdles, yet progress in key growth initiatives remains evident. As the industry confronts challenges, a commitment to addressing global issues, including food sustainability, fuel transition, and climate change, remains unwavering.

One notable trend is the substantial growth observed in South Western/Central Europe, the U.S. and South America, effectively compensating for reduced volumes in Eastern Europe. This shift underscores the dynamic nature of the sunflower crop market, with regions responding differently to the multifaceted challenges presented.

A pivotal aspect of the industry's response lies in the dedication to sustainable research and development solutions and cutting-edge technology. This commitment not only empowers farmers but also resonates across the entire supply chain, benefiting channel partners and end-use customers alike.

Highlighting the industry's proactive stance, a strong pipeline of new products, coupled with the recent acquisition of Syngenta genetics, has fortified the Nuseed South America portfolio. This strategic move ensures a robust and diversified product offering, further cementing the industry's resilience and ability to navigate the complexities of the international sunflower crop markets.



OMEGA-3 CANOLA PRODUCTION SYSTEM: A GAME-CHANGER FOR HUMAN AND ANIMAL HEALTH

It's hard to believe a tiny canola seed could help change the world, but that's what Nuseed is doing with its Omega-3 Canola Production System.

Omega-3 fatty acids are essential nutrients that have many benefits for human and animal health. They are important for brain, eye and heart development, as well as inflammation management and immune function. However, most of the omega-3s consumed by humans come from marine sources, such as fish and algae, which poses environmental and sustainability challenges.

Nuseed, a global leader in canola breeding and processing, has developed a novel technology that enables the production of omega-3 canola oil from canola grown by its contracted growers. This is the first time that a plant has been genetically modified to produce long-chain omega-3s (DHA and EPA), which are the most important types for human health.

It's something that's been born out of necessity. As the world's marine resources experience a decline, the need for land-based sources of omega-3 is intensifying, and Nuseed is answering the call.

Debbie Stiles, Nuseed's North American Strategic Marketing Manager for its Omega-3 Canola Production System, says the system is having a transformative effect on growers, aquaculture and consumers alike.

"I spend 90% of my time communicating with growers the significance of this and why it's important for them. It's like a full circle where we can see right from the production side all the way through to how it's impacting the consumer," she says.

One of the unique aspects of the Nuseed Omega-3 Canola Production System is its direct link to consumer demand, providing growers with a clear view of market opportunities.

"We have a direct line of sight on consumer demand because we feed that canola into our nutritional side of the business, working to bring the resulting oil products directly to the aquaculture industry and consumers. It's a closed-loop system, and we know what aquaculture and consumers want and where the market is going."

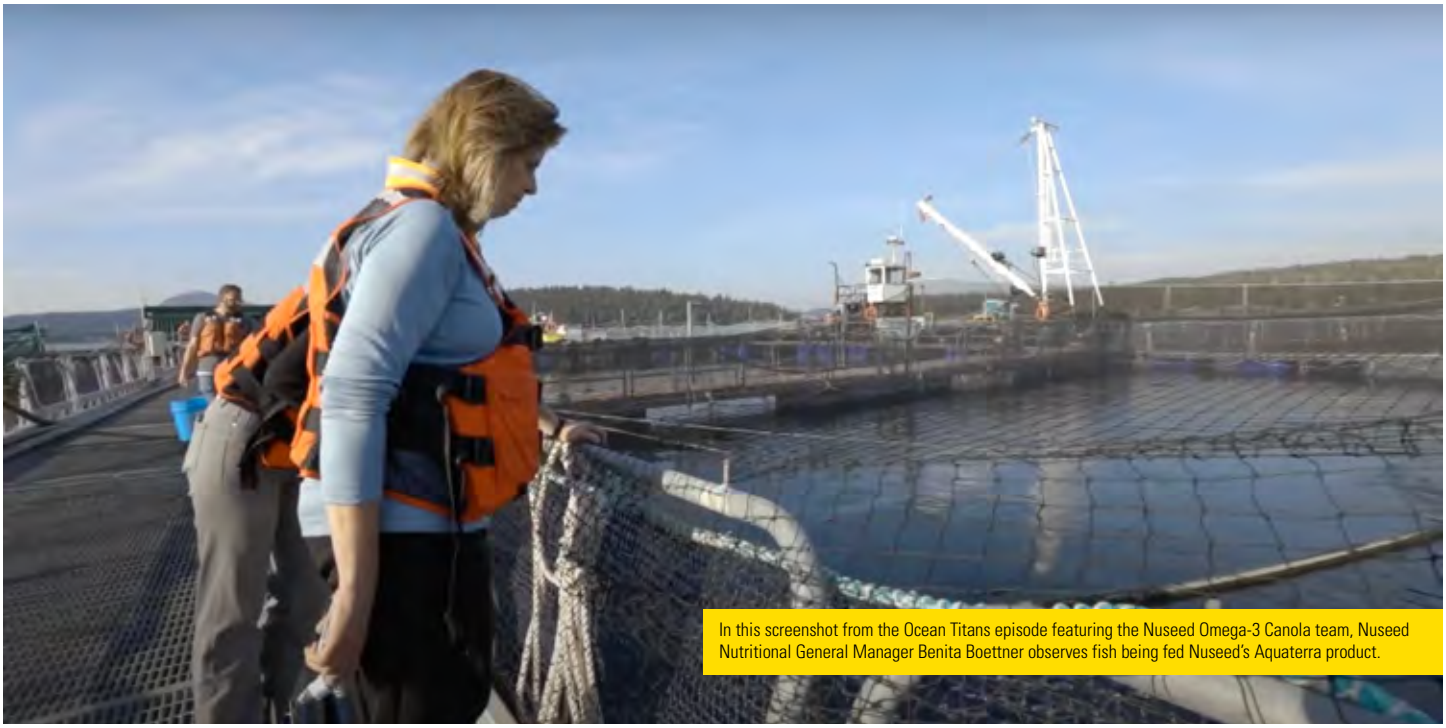
Furthermore, Stiles notes that because Nuseed knows exactly what the canola is ultimately being used for, there's little risk for the grower.

"This is entirely different from other crops where the grower might grow something thinking there's going to be a lot of demand, but then they find out the bottom has fallen out of the market and they have nowhere to send their crop. With the Nuseed Omega-3 Canola Production System, they don't have to worry about that, we're with the grower through to delivery of the product." she says.

And growers are responding in kind.

"Approximately 100 growers from across Montana and North Dakota seeded Nuseed Omega-3 Canola in spring 2023. In 2024, approximately 400 growers will be participating in the Nuseed Omega-3 Canola Production System."

She attributes this impressive growth to increased visibility, branding efforts, and enhanced communication with growers and



In this screenshot from the Ocean Titans episode featuring the Nuseed Omega-3 Canola team, Nuseed Nutritional General Manager Benita Boettner observes fish being fed Nuseed's Aquaterra product.

more media attention about declining ocean resources in light of climate change.

Writing on the Wall

Back in July, anyone visiting Lima, Peru, would see the ships dedicated to anchovy fishing were docked. Normally at that time of year, thousands of fishermen are typically at sea, engaging in the semi-annual anchovy catch.

As of May 2023, the Peruvian government began signalling concerns about the jeopardy of the first anchovy season of the year. This has been closely monitored by the industry, given that Peru's waters contribute 20% of the global omega-3 oil supply. Any disruptions in the supply chain could lead to increased prices for omega-3 oil, affecting both the aquaculture and human nutrition industries.

Global supply chain disruptions have become a sensitive issue for the omega-3 industry, driven by rising demand, climate change, and the more frequent and intense El Niño conditions. These factors pose a threat to the stability of the industry's supply chain, especially with the growing interest in marine-derived products from both consumers and the rapidly expanding aquaculture sector.

The first significant setback occurred on June 2, when the Peruvian government approved a 1.09 million metric ton anchovy quota for the initial season — a 60% reduction from the 2.792 million metric tons allocated in 2022. Scientific survey fishing conducted in May revealed that the condition of the anchovy population was even worse than anticipated.

The Power of Omega-3 Canola

Omega-3 Canola currently represents a niche market, but its significance is growing, particularly in the face of climate change, says Mark Jackson, General Manager for Nuseed Americas.

"The recent cancellation of the anchovy season in Peru is just one example underscoring the urgency for alternatives, as traditional sources from the ocean are dwindling. This is an area where we've identified a sustained growth trajectory," he says.

"That's one of the reasons why the product was brought to the marketplace. We are now helping to sustain that industry, allowing it to grow beyond previous limitations. This trait Nuseed has developed for its Omega-3 Canola brings long-chain fatty acids, including the crucial omega-3 DHA for brain function and health, into a land-based plant for the first time. It's a real achievement."

Jackson further emphasizes the positive impact on Nuseed's contracted growers, noting that Nuseed's Omega-3 Canola Production System enables the farmer to use their land to bolster sustainability.

"We've got great genetics, yields are improving, and the plant is fantastic. In regions like Montana, where canola isn't traditionally grown, we integrate it into the rotation, improving the overall rotation health," he says.

"It's a unique approach that leverages traditional assets in a market that, while looking like a commodity market, is anything but. It not only benefits fish health but also human health."

Boats in a traditional fishing harbour in Lima, Peru, where the anchovy season was cancelled in 2023.

In response, authorities decided to cancel the entire first anchovy season.

"A critical issue for the ministry is the preservation of fishing resources. If we left at this time and allowed the anchovy fishing activity to develop, what we would do is deplete the resource," said Peru's Minister of Production Raul Perez Reyes.

The cancellation emphasizes the need for diversified and reliable sources of omega-3 oil.

With the public increasingly focused on essential nutrition, innovative solutions are crucial to navigating supply chain challenges. Pioneering products such as Aquaterra and Nutriterra, derived from Nuseed Omega-3 Canola, provide a plant-based source of DHA and EPA omega-3 oil. These rapidly scalable canola-based oils play a key role in stabilizing the omega-3 supply chain for use in aquaculture feeds and human nutrition supplements.

Feeding Farmed Fish — and Humans

With the global population on the rise, the demand for farmed fish has surged. Aquaculture has heavily depended on fish oil to supply farmed fish with the essential long-chain polyunsaturated fatty acids necessary for optimal growth and nutrition.

However, current populations of ocean fish cannot replenish quickly enough to satisfy the rapidly escalating requirements for omega-3 oil. Nuseed's Aquaterra emerges as a crucial solution to averting supply shortages and fostering the expansion of aquaculture.

Nuseed's Aquaterra is a product that provides omega-3 fatty acids to aquaculture feed. It is made from Nuseed Omega-3 Canola and is the world's first land-based source of long-chain omega-3 fatty acids, which are essential for fish health and growth. Aquaterra has been tested and proven in commercial-scale trials and has received certification for its environmental and social benefits.

Nutriterra from Nuseed is a product that provides omega-3 fatty acids for human health. It is made from Nuseed's Omega-3 Canola and contains DHA+EPA and ALA, which are the most important omega-3 fatty acids for human nutrition.

It has a milder flavor and smell than fish oil, and is easily digestible, suitable for vegetarian diets and does not contain high levels of saturated fats. It also reduces the pressure on wild fish stocks by providing a more abundant and accessible source of omega-3s for human consumption.

Nuseed recently chose Connoils as its exclusive partner for the production and distribution of Nutriterra DHA Canola oil in powder formats. This innovative format broadens the potential applications for the world's inaugural plant-based source of total omega-3 oil, encompassing beverages and functional foods. Nutriterra has received FDA approval as a New Dietary Ingredient for its utilization in dietary supplements.

"Connoils technology is producing powder with unmatched stability and quality," says Mark Smith, Nuseed Nutritional Nutraceutical Lead. Connoils employs a low-temperature electrostatic dehydration method, ensuring excellent encapsulation and the preservation of nutritional integrity, he adds.

Documentary Highlights the Power of Nuseed Omega-3 Canola

The World Ocean Council (WOC) has teamed up with Special Interest Films to create a film series shining a spotlight on trailblazers in ocean sciences and industries. The Ocean Titans series endeavors to showcase organizations dedicated to preserving and nurturing healthy ocean environments for future generations, all the while promoting the growth of responsible and environmentally conscious businesses.

Nuseed was chosen in 2023 for inclusion in this series due to the Aquaterra Advanced Omega-3 technology, an exclusive omega-3 oil derived from Nuseed Omega-3 Canola. This agricultural innovation utilizes biotechnology to generate the nutritional benefits of microalgae within sustainable canola crops.

The eight-minute film is now accessible on YouTube as part of an Ocean Titans episode titled "Producing Sustainable Plant-Based Omega-3". The film sheds light on Nufarm's dedication to innovation and delves into the narrative behind Nuseed's creation of Aquaterra, the world's first land-based provider of long-chain omega-3 fatty acids.

To watch the video visit youtu.be/U4-ZSBDoX6g

"Our proprietary research indicates that 64% of consumers prefer a plant-based omega-3 when presented with an alternative to marine oils."

Together, Aquaterra and Nutriterra form a powerful solution to the issue of declining wild fish stocks.

VALUE BEYOND YIELD®

- INCREASED PROFITABILITY
- FLEXIBLE CONTRACTS
- GROWING CONSUMER DEMAND
- POWERFUL GENETICS

nuSEED®

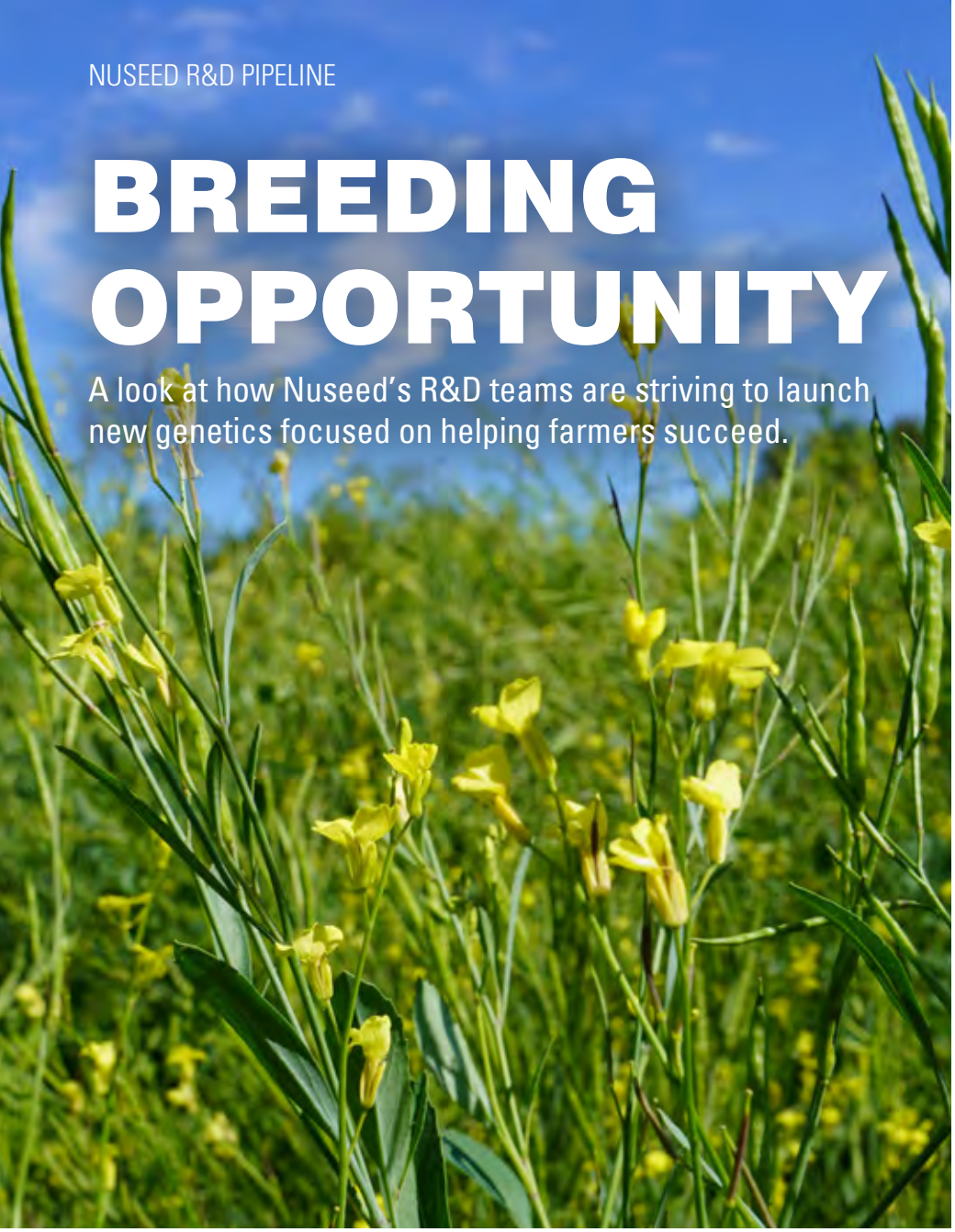
Nuseed is the seed technologies platform of Nufarm Limited (ASX:NUF).

PROFIT AND PERFORMANCE FOR FARMERS DRIVEN BY GROWING MARKET DEMAND.

Grow with us at: **Omega3Canola.com**

BREEDING OPPORTUNITY

A look at how Nuseed's R&D teams are striving to launch new genetics focused on helping farmers succeed.



Nuseed's research and development teams are constantly striving to meet the changing needs of growers, processors, and end-use customers. The breeding programs for Nuseed's Omega-3 Canola, Carinata and sunflowers aim to improve farm profitability, disease resistance and yields. Each crop also has specific innovations including increasing omega-3 levels and shatter resistance in Nuseed Omega-3 Canola, offering high oleic conoil sunflower hybrids for enhanced shelf stability, and shortening the maturity cycle and improving frost tolerance in Nuseed Carinata. Top-notch experts combined with state-of-the-art facilities are resulting in progress in each of these areas and more.

Nuseed Fortifies Sunflowers with Shelf-Stable Conoil and Disease-Resistant Hybrids

Disease resistance is a dominant focus for Nuseed's sunflower breeding program. Developments in hybrids offering resistance against downy mildew, black sunflower rust or verticillium wilt will offer growers the options they need against these threats. In addition, a high oleic conoil hybrid brings shelf stability to sunflower seed end products.

Downy Mildew Resistance

Downy mildew is a significant threat to sunflower growers in the Great Plains states.

"We're heavily testing and starting to launch a hybrid with multiple genes of resistance for downy mildew," says Jeremy Klumper, Nuseed's Sunflower Breeding Lead for U.S. and Europe. "Having multiple genes of resistance makes our hybrids more robust and durable."

Utilizing more than one gene ensures there are multiple modes of action against this disease, which extends its effective time period, even if the disease mutates or adapts.

Hybrid N4H490 E, was soft launched in 2023 and will be available for broader sales in 2024. Growers who have been affected with virulent races of downy mildew should consider this hybrid.

"Having this level of protection makes it a product growers are going be interested in," Klumper shares. "They're going to know they're not just relying on a seed treatment or inferior downy mildew genes. They're going to have a robust set to work with."

This trait is added on top of yield, oil content and other valuable seed characteristics.

"Behind that we have multiple other hybrids with an additional gene of tolerance that we hope will enter the advancement process and be coming up in future years for commercialization," says Klumper. "One of these is N4H205 E, which underwent testing in 2023."

Black Sunflower Rust

A black sunflower rust resistant gene has been publicly identified, and Nuseed has genetic markers for it.

"We're starting to use that in an integration process to bring black rust resistance primarily into confection inbred lines," shares Klumper.

Confection sunflowers produce larger kernels that are lower in oil content. These are sold as a snack food, like the Spitz® brand sunflower seeds we see in stores.

Rust affects the foliar surface, stopping photosynthesis and removing the plant's ability to finish its lifecycle.

"Having that resistance gene allows that plant to be healthy all the way through matu-

rity, making sure seed quality is high, and top yield can be realized," explains Klumper.

Verticillium Wilt
Verticillium wilt resistance is on a similar path to black sunflower rust. Researchers have identified resistance and completed the lab marker work around that resistance. Now Nuseed will work to integrate that trait into a commercial line.

Both black sunflower rust and verticillium wilt-resistant hybrids are in the early stages of development. The markers are identified, and researchers will now backcross the traits into a commercial inbred that is already proven and successful with farmers and processors.

High Oleic Conoil Sunflowers
Conoil sunflowers are a cross between confectionary and oilseed sunflowers. They provide a product that processors dehull and then the kernel is used in end products like baked goods, salad bars, and granola bars.

Nuseed has released a hybrid, N5H493 CL, that is now commercially available. This hybrid has a high oleic oil profile, which means it is lower in saturated fats. Saturated fats will go rancid if left on the shelf too long. Nuseed's high oleic level hybrid provides a longer shelf life to end products made with its kernels. This product will be soft launched in 2024.

Nuseed Takes a Five-Fold Approach to Improving Carinata, Enhancing its Appeal to Growers

Nuseed Carinata is grown in winter and must be harvested before the summer food crop goes in. Because of this, Nuseed is focused on shortening the maturity cycle, and increasing frost tolerance while working on herbicide-tolerant hybrids, and improving harvestability and yield grown under limited nutrients.

"There are five goals that as breeders, we're looking to improve that will increase both adoption and productivity of the acres we're currently on," said Logan Dyer, Research and Development Agronomist with Nuseed.

Jeremy Klumper Nuseed Sunflower Breeding Lead for U.S. and Europe

Shortening the Maturity Cycle
The main objective of our Nuseed Carinata hybrid breeding program is to shorten maturity cycles. Planting to harvest is currently about 170 days, and the goal is to shorten it by about 10-14 days.

"The quicker we can get in and out of their field, the more receptive growers will be to trying Nuseed Carinata and see the benefits of it on their farms," says Dyer.

This needs to happen without yield loss, so the focus is on developing shorter season hybrids with the same or better yields than are currently available in Nuseed's commercial lineup.

Herbicide Tolerance
The current Nuseed Carinata lineup has no herbicide tolerance, and this means sometimes fields are unsuitable. Researchers at the Nuseed Innovation Center in West Sacramento have successfully expressed genes and traits that enable herbicide tolerance using traditional plant breeding innovations.

Accelerated Hybrid Development

Hybrids used to take 8 to 10 years to develop. The in-house molecular lab and growth chambers at the Nuseed Innovation Center in West Sacramento, California allow researchers to accelerate this process of developing a hybrid.

"We can turn three generations in one calendar year," says Klumper. "We can alter the amount of light and we can alter the heat cycling and the amount of nutrients that those plants are getting. Typically, you need about four generations of backcrossing to say that you've moved the gene into this new line and it's fixed. Now you can start making hybrid crosses with it."

This means there's about a year and a half in growth chambers, and then it goes to field testing to see how the hybrid performs across multiple environments, adding at least another two years. "We're always looking for ways to speed it up," says Klumper. "Different techniques - whatever we can do to improve that process, we're doing."

"In the southeast and Texas, Nuseed Carinata growing regions, producers use residual herbicides to keep the field clean during their summer crop season without having to spray multiple times during the season," Dyer shares. "These residuals can last up to three years in the soil."

The plan is to introduce herbicide tolerant genetics which will broaden the potential acres.

Frost Tolerance
Carinata originates from Eastern Africa as a spring-type brassica, but the southeastern states and Texas have mild enough winters to grow it. However, there remains the risk of below-freezing temperatures.

"Our growing region is still susceptible to the occasional hard freeze and periods of time that could potentially damage carinata late in the growing season," explains Dyer. "Our goal is to test all our hybrids in regions north of where we are at a commercial level. Each one of our hybrids has to withstand colder temperatures and harder freezes than we expect in any of our commercial fields." This improves the tolerance of any extreme cold weather events and increases the geographical range where Nuseed Carinata can grow.

"Last year, the entire southeast experienced a hard freeze right before Christmas," says Dyer. "These extreme weather events are increasing."

Increased Yield on Limited Nutrients
Nuseed Carinata grain is certified by the Roundtable on Sustainable Biomaterials. This certification is contingent on how grain is grown and handled, including limitations on synthetic nitrogen.

"With that limited fertility, we have to still achieve yields that are going to be economically viable for growers to put Nuseed Carinata on their farm and obtain that added revenue stream," states Dyer.

Researchers are working to increase Nuseed Carinata's yield under low fertility conditions that improve greenhouse gas savings.

Harvestability
Historically, carinata's height is a direct correlation to yield. This is beneficial to the breeding process because it is easy to identify high yielding cultivars by plant height. This also means at the end of the season, fields with high yield have a lot of unnecessary biomass and more material to go through the combine.

The aim is to create a smaller plant that doesn't sacrifice yield. "Having plants that are architecturally smaller can actually increase the efficiency of a combine," says Dyer.

Pulling it Together
A new hybrid, Nujet 350, is commercially available now in Argentina. It is shorter and has uniform, or 'tabletop' growth, was harvested 5-7 days earlier, and is more frost tolerant.

This will be tested on U.S. fields this coming year to ensure it brings those added traits without sacrificing yield. "It has to outdo what we currently have available," Dyer explains.

There is also progress on herbicide tolerance.

"We have an extensive line of herbicide-tolerant parental lines that went to make our first big group of herbicide-resistant hybrids," says Dyer. "We are screening these hybrids this year to see where the herbicide tolerant lines are in comparison with our commercial hybrids. That will tell us how quickly we can get those traits in our commercial hybrid."

Nuseed Omega-3 Breeders Adding Value and Resilience for North American Canola Farmers

Nuseed's canola development is currently focused on its Omega-3 hybrids. Aiming to surpass non-omega-3 commercial canola varieties' performance, the breeding program addresses challenges like disease resistance, shatter tolerance and the threats of both clubroot and verticillium wilt.

Two new hybrids are coming on the market next year. Both are higher-yielding than the original varieties and have higher levels of omega-3. These are best suited to northern U.S. growers.

Going forward, the goals of the breeding program are aimed at strengthening the hybrids to increase growers' interest in putting Nuseed Omega-3 Canola in their rotation, and to protect the plants in the field from biotic and abiotic stresses.

"We still need to improve our yield performance to compete best with the non-omega-3 commercial varieties of canola that

are in the market," says Katy Navabi, North America Canola R&D Lead at Nuseed.

Increasing both yield and the levels of omega-3 means the crop is worth more at harvest time. As the omega-3 level increases, so does the value of the seed.

These two traits are a large focus of the breeding program, but there are other improvements in the works, such as oil content and disease resistance.

"THE GOAL OF THE NORTH AMERICAN BREEDING PROGRAM IS TO GET AS MUCH GENETIC DIVERSITY ADAPTABLE TO THE NORTH AMERICAN ENVIRONMENT AS POSSIBLE."

Shatter resistance is also a focus and another way to increase the value of the crop. "Our varieties have some level of shatter tolerance to give farmers options for harvest, but not to the point that they are considered shatter resistant," shares Navabi.

Clubroot, which is a dominant fungal disease on the Canadian Prairies, is spreading toward Montana and North Dakota. It is critical that Nuseed Omega-3 Canola hybrids carry genetic resistance to this as it spreads.

Breeding Program

"A newly emerged fungal disease is verticillium wilt," says Navabi. "This past year in Manitoba and North Dakota, some of our trials were infected. We need to stay on top of it, starting by investigating the genetic resources that carry resistance to this disease, and introducing those genetic resources into the breeding populations."

Navabi is most excited that Nuseed has established and grown a breeding program

based in Saskatoon, the heart of canola growing in North America. Nuseed Omega-3 Canola and Nuseed Carinata researchers share a facility, and the cohesive team supports each other through challenges.

The breeding efforts of this program will feed into the trials in North America, including Montana, North Dakota, Manitoba, Alberta and Saskatchewan.

"The goal of the North American breeding program is to get as much genetic diversity adaptable to the North American environment as possible," shares Navabi. "In the past, Nuseed's North American breeding program relied on Australian germplasm. Now we have established a program to evaluate and create the germplasm for the North American environment. The three pillars of the program are create, evaluate and improve."

In addition to the internal partnerships with the Australian team and the Carinata team, the expansion of the West Sacramento Innovation Center created another collaboration opportunity for the North American canola/omega-3 program.

"Now we can utilize the molecular breeding technologies to the fullest," explains Navabi. Important to the omega-3 trait introgression program is the ability to use whole genome markers to accelerate the process.

"With whole genome marker technologies, we can identify and characterize our breeding material at a sequence level and have a better understanding of how to improve them," Navabi shares. "This helps improve crosses and population development."

Traits like omega-3 expression, clubroot disease resistance and shatter tolerance are all very complicated, and having molecular markers available for them makes it easier for breeders to track the genes or make predictions of the genetic values. The discovery work at the Innovation Center in collaboration with breeders will provide technologies to speed up the breeding process and add efficiency.

"We can define projects and breeding strategies that can help us breed for these complex traits more efficiently, making sure that we have markers for the genes that express these traits so that we can breed more efficiently, faster and explore larger populations," says Navabi.

DRONES BRING PRECISE SOLUTION TO TRICKY SUNFLOWER DESICCATION

How drone technology continues to deliver unique opportunities for agriculture.

Drones are increasingly taking to the air over agricultural lands, applying products and seeds to the land. Last summer, their precision and efficiency proved invaluable when a Nuseed sunflower trial plot situated within a farmer's field required desiccant application. The positive results have inspired the farmer to consider the use of drones in the future.

Jeremy Herr, Co-owner of Herr Farms, grows wheat, corn, soybeans and sunflowers in South-Central North Dakota with his brother. This past summer, Herr brought in a drone applicator company to apply desiccant to a 10-acre Nuseed sunflower trial plot.

While Herr hasn't historically needed to desiccate sunflowers in the fall, it's becoming more common due to blackbird pressure and disease risk from moisture. Herr would usually turn to an airplane for aerial application, but this plot required precision that couldn't be achieved that way.

"There was a Nuseed trial plot in the middle of some longer season sunflowers, so we couldn't spray the entire field," Herr explains. "They wanted to get the plot off sooner than later because of blackbird pressure."

Having many different varieties in the plot meant that some were past ready for harvest, and others nowhere near, so desiccating ensured they could all be harvested at the same time.

"With land based rigs there would probably be compaction in the field, and you'd lose some stands from hitting sunflowers and knocking them over," explains Herr. "With an airplane you could hit all of the crop, but there are overhead powerlines on this field and you wouldn't be able to get around those like you can with a drone."

By utilizing a drone, they were able to stay away from all the other sunflowers in the quarter-section field, and the plot was harvested 38 days before the rest of the field came off.

"I wasn't able to get into the rest of the field because moisture came 5-10 days after we desiccated that," says Herr. "Desiccating with a drone in this case was perfect, and we'll probably do more of it in the future."

The application in this case took about an hour for the 10-acre plot.

Aerial Advantage

Ethan Schutter, Owner of Midwest Drone Applicators, started his business about a year ago in Indiana. So far, his business has been focused primarily on fungicide and insecticide application.

"Not very many people know the advantages of drones yet," says Schutter. "But as I talk to them, it becomes apparent very quickly that there's a benefit to using them. It's essentially taking the place of airplanes and helicopters, and whenever it's wet, a ground sprayer."

He explains a key advantage of a drone over an airplane or helicopter is its precision. The drone pushes the product down into the canopy. It can also get closer to the field ends without spraying the ditches or getting product on another person's field.

"You're saving product and you get better application, which in turn increases crop yields," Schutter adds.

Another application for drones with row crops is to plant cover crops before fall harvest. This is advantageous because there is no damage to the current crop.

"It allows the seed to get growing faster to hold the soil better, preventing soil erosion," says Schutter.

He notes that this works best with taller crops to avoid the cover crop getting cut as well when the fall crop is harvested.

Finding Their Fit

This was the first time Herr used a drone applicator, but it won't be his last. He anticipates looking to drones for fungicide applications in areas where they can't use a land-based sprayer. He appreciates the targeted spraying drones offer for spot spraying that can't be achieved with land-based or plane spraying.

While it worked well, there could be limitations.

"There could be capacity issues both in terms of battery and in terms of coverage," says Herr. "To cover the number of acres that we would need to cover in a day, we would need multiple drones with multiple refill stations."

Battery life is a consideration, as is capacity for product. In Herr's case, they applied the product at the aerial rate of three gallons per acre, which is significantly lower than the typical 12-15 gallons that a ground-rig would apply for desiccation. It worked well, but in some cases, they need to get up to the higher rates, and the drones might need to refill frequently.

Schutter uses a DJI T40 drone, which can cover up to 45 acres per hour. He has four batteries per drone, allowing for charge and cool down time. The turn around time when it lands for refilling is less than a minute.

"It lands, you change the battery, fill it up, and by the time you are done filling it up, it's reconnected with the GPS and it can go again," Schutter explains.

Cost needs to be factored in, of course. This past year, Schutter estimated that for operation only in his region, a ground sprayer would cost about $8-10 per acre, and airplane $12-13 and a helicopter $30-40. Drones came in around $15-18. However, considering the maneuverability and the level of application precision drones offer, they likely provide good return on investment in the right conditions.

Farmers are witnessing the tangible benefits of incorporating drones into their agricultural practices and are increasingly willing to call upon them to provide solutions for more effective and efficient farming.

THREE CHEERS — AND YEARS — FOR NUSEED CARINATA U.S. CONTRACT PRODUCTION

New hybrids provide soil regeneration between crop rotations plus a new drop-in solution ready to help replace fossil oils and reduce carbon.

Graham Collier is Nuseed Carinata's Global Lead of Product Success.

As the third season of Nuseed Carinata contract production begins in 2024, the non-food, certified sustainable *Brassica carinata*, is proving itself following over a decade of research showcasing its soil benefits as a cover crop in the southeast United States.

In that time, global interest in its harvested oilseed has surged as a promising low-carbon oil feedstock to replace petroleum fuels now for immediate emissions reduction for hard-to-decarbonize sectors, like aviation. Being drop in ready, it provides a clear carbon reduction advantage by not requiring the replacement or retrofitting of current fleets.

Graham Collier, Ph.D., Nuseed Carinata's Global Lead of Product Success, underscores the opportunity for growers presented by the contract production of this low carbon bioenergy feedstock.

"It's a practical opportunity for growers to be rewarded for regenerating soil, protecting nature, adopting sustainable practices and helping reduce, remove and restore carbon to mitigate climate change," Collier says.

This resilient crop is poised to revolutionize the bioenergy landscape, offering a dedicated non-food industrial feedstock for biofuel production, grown between main crop rotations to avoid displacing food crop production, while also yielding a valuable co-product in the form of a high protein meal for livestock feed. When crushed to extract its oil, the remaining Nuseed Carinata meal provides a new source of high protein for animal feed. Its non-GMO status opens doors to European markets.

Breeding Revolution

Despite there currently being no commercial carinata grown north of the American border, it's being bred by a global collaborative research team based out of Nuseed breeding research facilities in the Canadian province of Saskatchewan. They're working in partnership with crop development experts in Nuseed Innovation Centers located in Argentina, Australia and the United States headed up by Global Nuseed Carinata Breeding Lead, Rick Bennett, Ph.D.

"The familiarity I had with canola made the transition to working with Nuseed Carinata an enticing prospect," Bennett says. Both crops are brassicas and Nuseed's R&D expertise worldwide is focused on unlocking the full potential of oilseeds.

"Looking back, it's gratifying to witness the evolution of carinata from its grassroots beginnings as a proof of concept to the current status of having a viable commercial program thriving in South America."

That expansion continues with the recent initiation of commercial programs in the southern United States, as well as commercial development programs underway in Europe and Australia.

The ambitious yet achievable goal is to boost the utilization of harvested cover crops on currently exposed and erosion-prone hectares between main crops in Europe and the Americas. This initiative aims to establish a domestic, low-carbon oil feedstock supply grown through certified sustainable practices. Rabobank approximates that around 170 million hectares in these regions could experience positive impacts from implementing cover cropping.

This remarkable crop is being scaled globally to make a sizable contribution to renewable fuel feedstock markets. It's particularly suited for sustainable aviation fuel (SAF), and has already been co-processed at bp's refinery in Lingen, Germany.

Non-food, verified to not increase indirect land use change, and backed by field data demonstrating sustainable practices plus

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carbon reduction, Nuseed Carinata is a feedstock well suited to supply the rapidly increasing global demand for SAF as U.S. and European policies work towards carbon reduction and accountability.

The Nuseed and bp 10-year agreement announced in early 2022 has enabled Nuseed to accelerate the expansion of its Nuseed Carinata sustainable production program, through bp purchasing oil derived from Nuseed Carinata and processing or selling it into growing markets.

Outstanding Performance

Ramdeo Seepaul is a Research Assistant Scientist at the University of Florida.

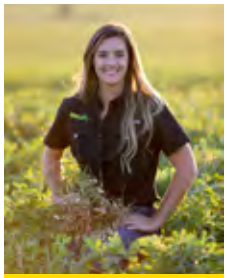
In Florida field studies, carinata outperformed canola, achieving a higher seed yield of 2,500 pounds per acre. Ramdeo Seepaul, a Research Assistant Scientist at the University of Florida, highlights carinata's outstanding performance in replicated yield trials.

Carinata's attributes, including a high oil content ranging from 40-46% and a significant erucic acid content of 40-44%, make it well-suited for various biofuel conversion technologies.

Erucic acid is a long-chain mono-unsaturated fatty acid with 22 carbon atoms, giving carinata its distinctive composition, Seepaul notes.

Collier clarifies that Nuseed Carinata hybrids, the world's first, grown as a cover crop, also have advanced agronomic performance over initial open-pollinated varieties used in initial research and are not in direct competition with other crops in the region.

De Broughton, a crop consultant with 6 Gen Ag Services and a field agent for Nuseed, notes the historical challenge of low financial returns for traditional cover crops in Florida, emphasizes Nuseed Carinata's additional farm income potential and soil benefits for coastal plain farms to also improve organic matter.



De Broughton is a Florida crop consultant with 6 Gen Ag Services and a field agent for Nuseed.

Seepaul recognizes carinata varieties in general as a high-residue biomass crop, producing up to 9,000 pounds of biomass per acre. Challenges in growing it include its small seed size. Broughton advises management falls between a low-maintenance cover crop and a traditional cash crop.

Acknowledging the requirement of fitting Nuseed Carinata between existing crop rotations, and to expand growing regions, Nuseed R&D efforts are helping develop shorter-growing season varieties.

"More cultivars give us more flexibility," Broughton says. Currently, Nuseed Carinata hybrids fit well with cotton and soybean rotations.

As 2024 marks three years of Nuseed Carinata contract production in the U.S., the company stands as the pioneer in commercializing and hybridizing the crop.

Collier emphasizes, "Currently, we have the first and only commercial carinata program in the market." Despite being in its fifth year of global commercial production, primarily in Argentina, Nuseed Carinata in the United States is in the initial phases of awareness, scalability, and widespread adoption.

Bridging the gap between the present state and the realization of this carbon-saving potential requires a holistic commitment to innovation and sustainability in both sectors, including adequate policy and incentives, Seepaul adds.

The bp Connection

Just a year after announcing the Nuseed Carinata offtake and market development agreement with bp, the inaugural shipment of Nuseed Carinata embarked on its journey from the Port of San Pedro, Argentina, in 2023. The shipment went to France for processing by Saipol, with the resulting certified Nuseed Carinata Oil delivered to bp.

Brent Zacharias, Nuseed Group Executive, highlights the collaborative efforts with contract growers, including the significant role played in enhancing certified sustainable production.

"It's crucial to establish connections between local growers and global industry partners — this adds value through traceable, independently certified sustainable practices and substantial greenhouse gas savings," he says.

Saipol, with its pivotal role in providing proprietary processing for the non-food oilseed, processes Nuseed Carinata grain into certified sustainable lower carbon oil for the European market. Christophe Beaunoir, CEO of Saipol, notes that the production of a co-product also takes place — non-GMO meal, offering a new traceable plant-based protein source.

The global scale-up of Nuseed Carinata is evident, with commercial contract production already making significant strides in South America and the southern United States. Further development programs are underway in Australia and Europe, marking a promising trajectory for sustainable agriculture, Zacharias adds.

We look forward to how our strategic agreement with bp will help introduce Nuseed Carinata Oil into burgeoning markets.

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nuSEED® CARINATA

NEW CROP PROVING A HARDY COVER CROP OPTION FOR PRODUCERS

Nuseed Carinata stands up in cold temperatures with proven hybrid vigor and advanced genetics.

Cover crops are ideal for improving soil, sequestering carbon as they grow over winter and reducing erosion and carbon loss. What's not ideal? The weather between main crop rotations when cover crops are grown. Because of adverse conditions typically the cover crop return-on-investment expectation is solely the soil health benefits for the following main crop.

However, Nuseed Carinata is a new contract cover crop that is produced using certified sustainable farming practices and grows well when weather is too harsh for main crop production. Nuseed Carinata is harvested for its oilseed and additional farm income, and the remaining biomass is returned to the soil surface. Carinata grain is crushed to extract lower carbon oil and supply a meal co-product for animal feed.

Frost resilience is critical to expanding Nuseed Carinata hectares to more regions in both hemispheres to help meet the rapidly growing feedstock demand for sustainable aviation fuels (SAF) and other sectors working to de-carbonize by replacing fossil fuels to reduce emissions.

Rebounding After a Once in a 40-year Freeze

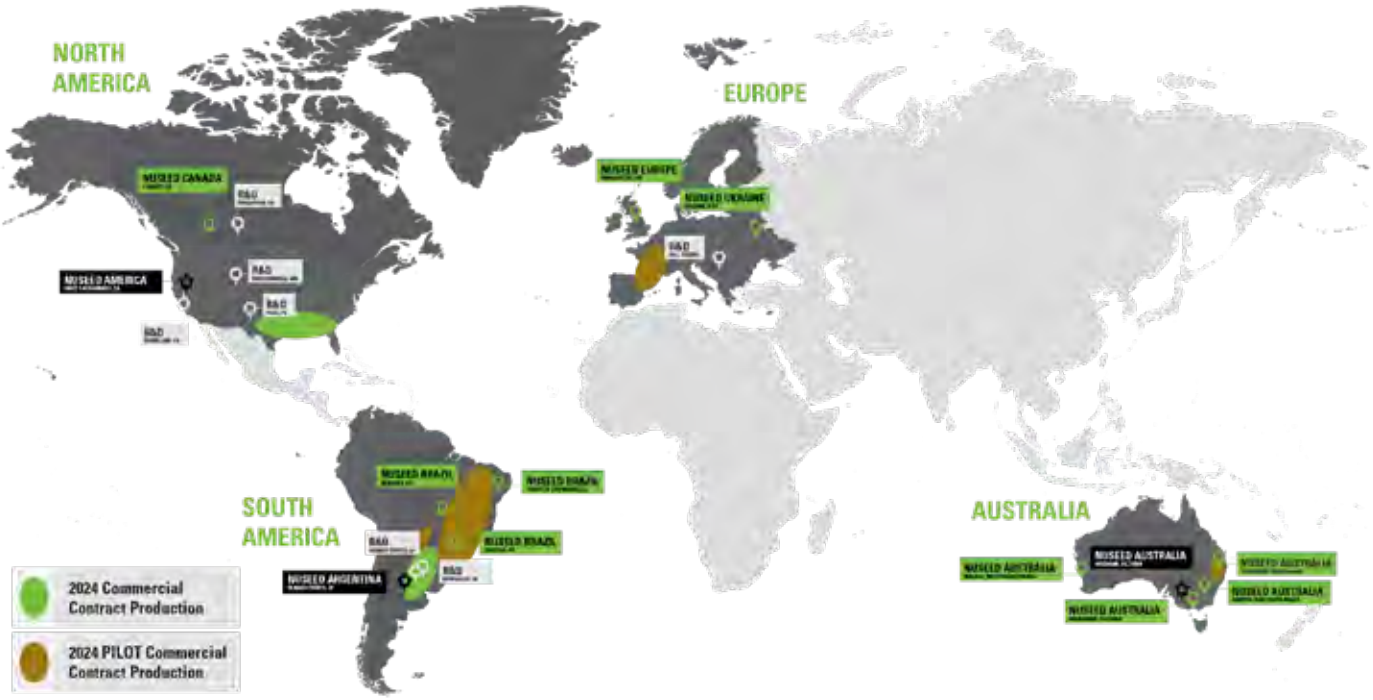
"In Florida and Georgia, the resilience of Nuseed Carinata was so dramatic, some in our R&D circles started describing it as the 'Lazarus effect'. Many fields we thought were dead, came back to life and resulted in a successful harvest," says Logan Dyer, Nuseed Carinata Research Agronomist based in Florida.

Nuseed Carinata hybrid frost recovery near Quitman, Georgia.

"THE RESILIENCE OF NUSEED CARINATA WAS SO DRAMATIC, SOME IN OUR R&D CIRCLES STARTED DESCRIBING IT AS THE 'LAZARUS EFFECT'. MANY FIELDS WE THOUGHT WERE DEAD, CAME BACK TO LIFE AND RESULTED IN A SUCCESSFUL HARVEST."

After three days of below 32°F, said to be a once-in-40-year freeze event, the average harvested cover crop yield was approximately 25 bushels per acre. Initially seen as an unwelcome challenge in the first year of commercial introduction in the southern United States, the freeze turned into an opportunity to prove the frost resilience of the world's first carinata hybrid.

"Nuseed Carinata's potential as a cover crop in the window between main crop rotations in currently planned production regions was demonstrated," confirms Dyer. "The results were encouraging for future R&D into potential production expansion north to gain more cover crop acres in the southern United States."



Nuseed Carinata hybrid resilience after frost in Entre Rios Province, Argentina.

Argentina Freeze Helps Fill Breeding Pipeline

You might think a freeze event at the Nuseed Carinata research trials near the Nuseed Innovation Center in Venado Tuerto, Argentina would be a disappointing setback. However, the saying 'adversity makes for opportunity' stands true.

"Our R&D team in Argentina identified and characterized unique lines within our breeding program that survived and rapidly recovered from the freeze event and are now able to introduce them into our hybrid pipeline globally," explains Dr. Rick Bennett, Nuseed Carinata Global Plant Breeding Leader.

Breeding lines that bounced back from at least seven hours at -7°C /19°F at the Innovation Center are now being utilized in a crossing program to develop superior frost-tolerant parental line materials, coupled simultaneously with molecular marker identification for this trait. The very best new hybrid combinations resulting from this effort will advance within the Nuseed Carinata breeding program.

Field Ready

The harvested cover crop's ability to rebound after freeze events in both the southern U.S. and Argentina demonstrates the agronomic advancement the Nuseed Carinata R&D experts have been able to achieve. "We're excited to see the performance of our new commercial hybrids," shares Dyer.

The cold weather events are providing the Nuseed Carinata R&D team in Argentina a chance to evaluate new carinata lines for cold hardiness in real-life conditions. The selections made within one of the key growing regions and under realistic conditions will help to further understand and advance frost tolerance and other important agronomic traits that will be introduced over the coming years.

CULTIVATING PARTNERSHIPS

Nuseed Omega-3 Canola Production System and Nuseed Carinata contracts offer support and opportunity.

In its simplest terms, entering a contract to grow Nuseed Omega-3 Canola or Nuseed Carinata means agreeing to plant a specific number of acres of that crop and then sell the harvest back to Nuseed. In practice, growers are entering a partnership with Nuseed that offers both financial benefits and agronomic support.

"One of the benefits is there is a premium offered for each of these contracts which provides the opportunity of increased returns per acre for the grower," says Clint Munro, North America and Australia Lead, Value Chain and Trade.

A Nuseed contract consist of two pricing components, the premium, and the underlying commodity futures reference. The premium is secured at the time of signing the contract, however, there is flexibility on pricing the futures market. The standard reference market for the Nuseed Omega-3 Canola Production System is canola futures and soybean futures for Nuseed Carinata, this provides flexibility to the grower in terms of when they lock in the final component of their flat price. The total or flat price the grower will receive per bushel is the premium plus the futures price.

Start to Finish Support

Regardless of the level of experience growers have with these crops, Nuseed offers support to ensure success.

"There is support year-round offered by Nuseed – especially agronomy support," shares Munro. "Everything from planting the crop to harvest management and then coordination of delivering the crop. For Omega-3 Canola Production System crops, Nuseed is not only providing the end market, but also picking crop up off farm, so that means the grower doesn't have the cost of trucking to get it to a grain elevator or a crush plant."

Jamie Birch, co-owner of Montana Ag, an agronomy center in Conrad, Montana, acts as an agent for Nuseed. She helps growers determine if contract growing is a good fit for them, as well as providing agronomic support once they enter a contract. While she deals solely with the Nuseed Omega-3 Canola Production System, agronomists in the south provide the same services to potential and existing Nuseed Carinata growers.

This level of service is integral to Nuseed's contracts.

"Nuseed and Montana Ag are here to support growers and make sure that they have a positive experience," says Birch.

Carinata provides a unique opportunity as it is a cover crop grown over winter and harvested before seeding the next year's crops. This removes competition with food crops and enables farmers to gain additional income while protecting and enhancing their fields for the next year's crops.

With Nuseed being the seed technologies platform of Nufarm, Nuseed Carinata and Omega-3 Canola Production System growers benefit from access to both seed technologies and crop protection solutions. Together, they offer a crop protection incentive plan. Growers who purchase qualifying Nufarm crop protection products, including herbicides and fungicides, may be eligible for rebate payments with proof of purchase and after meeting a purchase threshold.

Nuseed Omega-3 Canola Production System contract growers gain bonuses for early commitment, and contracting 1,000 plus acres. There are also input cost reductions, bonuses for returning growers, and referral rewards.

Jamie Birch of Montana Ag, an agent for Nuseed, provides advice and agronomic support to Nuseed Omega-3 Canola Production System growers from first consideration of the contract right through harvest.

The harvest payment helps ensure producers have some of the funds in December, even if their crop hasn't been delivered yet.

"Nuseed understands that there's a lot of money going out at that time of year, so they want to make sure that they give growers 25% of their payments by December 15," says Birch.

Growers can be confident that there is a stable end market for these crops. Nuseed Omega-3 Canola is processed for aquaculture feed and human nutritional supplements. Nuseed Carinata is used for renewable fuel, particularly sustainable aviation fuel.

"Nuseed is both developing end market relationships with the customers and building the end market and the opportunity for the growers," Munro explains.

Managing Risk

Birch points out that an advantage of a contract with Nuseed is they're going to purchase everything you grow. Some contracts only take a certain number of bushels and then the grower must go to market with the rest.

"Growers know that they have a home for the crop, and honestly, I think lending officers appreciate that too," says Birch.

To protect against the risk of poor crop outcomes due to circumstances beyond anyone's control, Nuseed also provides Act of God protection.

Opportunities for the Nuseed Omega-3 Canola Production System contracts lie predominantly in Montana and North Dakota. Nuseed Carinata is grown in the south, from Texas through Georgia to northern Florida.

Once a producer decides to pursue a growing contract with Nuseed, there is a stewardship qualification form to review and sign, and then a final production contract. Factors like what the crop and spray history is for the land and what is grown nearby are taken into consideration when determining if land is suited for the contract crop. Nuseed's agents and employees help growers understand the pricing and terms of the contract.

If conditions aren't right for the coming season, this can be revisited the following year.

It is important that the product's identity is preserved, and part of that is ensuring certain stewardship requirements are met. These include following good growing practices, ensuring volunteers are controlled, and for Nuseed Carinata, recording crop input data.

Nuseed Omega-3 Canola Production System producers need to have aerated storage on farm. Growers then store the Omega-3 Canola until Nuseed calls for delivery. Nuseed needs a continuous supply of oil for their end customers, so they do crush runs periodically over the 12 months following harvest.

In the south, farmers typically have less on-farm storage, and Nuseed takes the Carinata directly after harvest.

Nuseed Carinata is certified under the Roundtable on Sustainable Biomaterials. This voluntary program is a requirement for some global customers to meet carbon reduction or corporate sustainability reporting needs. Growers are informed of the steps needed before signing their contract, and Nuseed and its agents guide growers through meeting these standards and providing records to satisfy certification requirements.

"Working with the growers year-round, we get to exchange feedback," says Munro. "We have people who are visiting the farm and seeing firsthand what's working well. There's a connection in the supply chain that Nuseed has by being the developer and breeder of a new variety, connecting with the end market customers and including the grower in that chain."

Growing Success

Brooks Garland, a peanut grower in North Florida, entered a contract with Nuseed in 2022 to grow Nuseed Carinata over winter. "I learned that Carinata could actually provide a financial benefit by offsetting the cost for my primary crop and could also suppress weeds, reducing the need for herbicides."

He was supported by Nuseed and its agents through the process - evaluating whether it was the right fit, working through the contract and supporting him through the growing season. Garland's farm began cover crop harvest mid-May of 2023. The team and Garland were pleased with the yield outcome and claim results were "better than expected".

"The support and guidance provided by Nuseed and their partners were instrumental in the success of this crop," says Garland.

MANAGEMENT MATTERS

Protect your stored oilseeds.

You work hard throughout the growing season to produce a fantastic oilseed crop. Once your sunflower or canola hits the storage bin at harvest, you would be justified in looking forward to a well-earned break. However, carefully managing your stored crop through its months in the bin is a critical component of optimizing returns.

As every grower knows, the two concerns in oilseed storage are spoilage and insect infestation. Both can be controlled by managing the delicate balance between a stored crop's temperature and moisture.

The Temperature + Moisture Equation

To manage insects, colder is better: most storage insects go dormant around 50°F and are killed outright if grain can be held below freezing for a period of time. To manage spoilage in either oilseed sunflowers or canola, the industry's typical recommendation is 8% moisture and a maximum temperature of 60°F.

Just how much does temperature matter to safe storage length? A whole lot.

"Stored canola at 12% moisture and 60°F, all you've got is 18 days before there's enough spoilage occurring that canola starts clumping together. Farmers might call it sweating, but it's spoilage," says Ken Hellevang, North Dakota State University Ag Engineer and a grain drying specialist. "If you can cool that same 12% moisture canola to 40°F, now you've got about 110 days. It all hinges on temperature."

Moisture matters too. At 10.6% moisture, Hellevang says stored canola should be safe for 40 days at 60°F and 238 days at 40°F. Add just 1.4% more moisture and the safe storage length drops by more than half.

As plant breeders continue to improve oil content in oilseeds, producers may need to take a hard look at whether the 8% moisture level traditionally accepted as 'safe' for long-term oilseed storage is, in fact, still safe.

"Historically for canola and sunflower, we could probably get by with 8% as the recommended moisture content," says Hellevang. "As oil contents of both commodities increase – we're seeing oil contents for sunflowers increasing up to about 45% — the moisture content that's safe for storage is reduced. Typically, today we're talking about 7% moisture being safe for summer storage, where it just didn't have to be that dry when guys were storing it 30-40 years ago."

Managing the Core

Oilseeds are at highest risk of spoilage in the central core of a grain bin. Two key factors typically contribute. The first, in any crop but particularly in the case of sunflowers, relates

to dockage. When relatively large sunflower seeds flow into a bin, particles segregate depending on size and density, explains Hellevang.

"We end up with a spout line or an accumulation right under the center of the fill hole that is typically much smaller particles, whether that's weed seeds or broken kernels. Because it's more difficult to get air flow through that finer material and it tends to be higher in moisture content, that tends to become an area where we have more storage problems."

The second factor relates to temperature differentials. The riskiest period for oilseed spoilage tends to be the two- to four-week window after harvesting if a grower doesn't run air right away, and again post-winter when the difference between the temperature inside the bin and the warming temperatures outside the bin create convection currents through the grain.

"Especially in spring if you get warm air going up the sides of the bin, going over the top and coming down through the center, that will increase the grain temperature and moisture, which can spoil the grain in the top center of the grain," says Barry Coleman, Executive Director of the Northern Canola Growers Association.

While that kind of convection current can be problematic in any storage bin, canola is particularly at risk, he adds.

"The small seeds and high oil content means it's very tough to move air through canola, so getting the temperature down is the main thing and cooling is more of a priority than drying."

Most producers' go-to solution for managing convection current induced heating in the center of the storage is known as 'coring the bin' (unloading grain, which will 'take the top off the bin'). Coleman says pulling canola from the crown of the storage down through the middle of the bin, and then either shipping it or moving it to a secondary storage, is a very effective way of managing heating in the middle of the bin. Successful storage managers use coring the bin as just one option in a whole suite of proactive management tools, all underpinned by careful, consistent, on-going monitoring.

"I've got a slide in the storage presentation I do for producers that says: 'Management means making decisions based on understanding the science of grain storage.' If we're going to manage the storage, we need to make sure that we're monitoring all its different aspects. Having cables in place does not eliminate the need for people still looking and smelling and using some of those old technologies like putting samples into a moisture meter," Hellevang says.

Bin Monitoring Technology Options

Today's bin monitoring technology puts your stored crop's status right in the palm of your hand, with real-time updates easily viewable on any smart device. That said, producers need to understand both the value and the limitations of bin monitoring technologies.

Temperature Cables

Temperature cables are a smart management strategy that should be installed in every bin, says Ken Hellevang, North Dakota State University Ag Engineer and a grain drying specialist. However, producers need to recognize that they provide temperature spot checks, not a comprehensive picture.

"If you look at most grains, they have an R [insulation] value of about 1/inch. So, if heating is happening two feet away from that temperature sensor, that's an R24 insulation barrier between whatever's happening and the cable. That's more insulation than you've probably got in your house."

In fact, he points out, researchers at Purdue University put full gunnysacks of wet grain into bins about three feet from temperature cables to test the cables' sensitivity in an extreme heating situation. Despite the grain in the sacks intensively rotting, the temperature cables were unable to pick up on the heating.

"A temperature cable tells an important part of the story, but it's just part of the story," says Hellevang. "Guys tend to rely on them too much."

Moisture Sensors

A more recent addition to the grain monitoring world is moisture sensors. Moisture sensors measure air temperature and the air's relative humidity which, when combined in a formula, should produce a reasonably correct moisture content reading. That's not quite the case, however.

"The unfortunate thing is the relative humidity measurement is not really accurate. If you look at the literature, it'll usually say that it's measuring the moisture content to within plus or minus one percentage point."

Sunflower measuring 10% moisture could actually be 9% or 11%: a variation that could drastically impact the stored crop's safety.

CO2 Sensors

The newest monitoring technology measures carbon dioxide levels — a by-product of both insect activity and spoilage — in storage. According to research from Purdue, it is possible to detect spoilage more quickly using CO2 measurements than any of the other methods. That said, more work is still required before the technology can meaningfully contribute to storage safety, says Hellevang.

"It's so new that I'm not sure that we totally understand its practical application. Where do you put your sensors? How important is making sure that the fan is off? How important is having a seal versus letting the wind blow through?"

LIVING WITH RESISTANCE

Best approaches to handling sunflower pest and weed pressures in 2024.

As the sunflower crop emerges from the soil each year, so do new developments related to resistance with crop protection products and their regulation in the U.S. and Canada. Last year was no exception, so it's important to consider what approaches are best in 2024 in terms of pest and weed control.

In pests, the red sunflower seed weevil (RSSW) remains widespread in the U.S. east of the Rocky Mountains and into Canada. Because these weevils only reproduce on wild and cultivated sunflowers, U.S. populations are highest, explains Dr. Jarrad Prasifka, Research Entomologist with the USDA-Agriculture Research Service in Fargo, North Dakota, where you find the most sunflower acreage: North Dakota and South Dakota.

However, one is worse than the other. Prasifka points to recent surveys conducted by the National Sunflower Association, which conducts counts in the fall of odd years, that showed damage in South Dakota fields was found to be two to three times worse on average than in North Dakota. "A single weevil inside a sunflower achene only eats about one-third of the seed, but samples from the most recent surveys (2019 and 2021) show some fields with no damage and others with more than 50% of seeds damaged," he says.

South Dakota bears the brunt of damage due to the very high weevil populations especially in the area around the community of Pierre. Those huge numbers have benefited from historically warm winters, says Prasifka, but also very little tillage, a limited range of effective insecticide options, and a tendency to plant sunflowers later in the spring.

Pyrethroid Resistance

There's also bad news in that South Dakota weevil populations appear to have resistance to the pyrethroid insecticides growers commonly employ.

Adult red sunflower seed weevil infestation

"That means there is no pesticide available right now that provides the kill level that growers expect to see," says Prasifka. "Yes, during the 2023 season, growers and aerial applicators both reported that mixing malathion with pyrethroids labelled for use in sunflowers was effective for control, but this was only possible because of an exemption by the Environmental Protection Agency allowing malathion to be used during August 2023."

Prasifka considers the resistance of RSSW to pyrethroids the main insecticide resistance challenge facing sunflower farmers. Many growers have completely depended on chlorpyrifos and pyrethroids, he says. With chlorpyrifos no longer allowed and pyrethroids – at least in South Dakota – now not as effective as they were years ago, the situation is quite serious.

"Though there may be new insecticides approved for use in sunflowers in the coming years," he says, "or more emergency exemptions like that which occurred in August 2023, the best thing we can do is start using other tools to make sure we don't rely so much on repeated insecticide applications. That's what causes resistance in the first place."

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Other Flea Beetles	3	2	3
Sunflower Beetle	3	0	3
Armyworm	0	3	3
Black Sunflower Stem Weevil	0	0	0

Performance: 3 Very good | 2 Good | 1 Weak | 0 None
Based on Syngenta internal studies.

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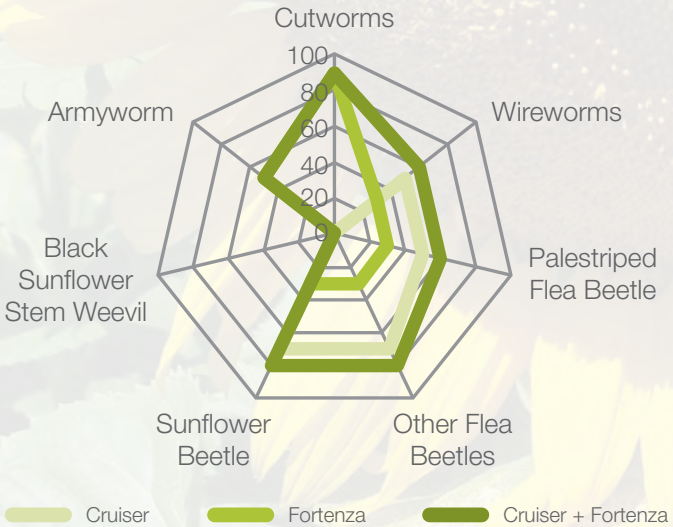
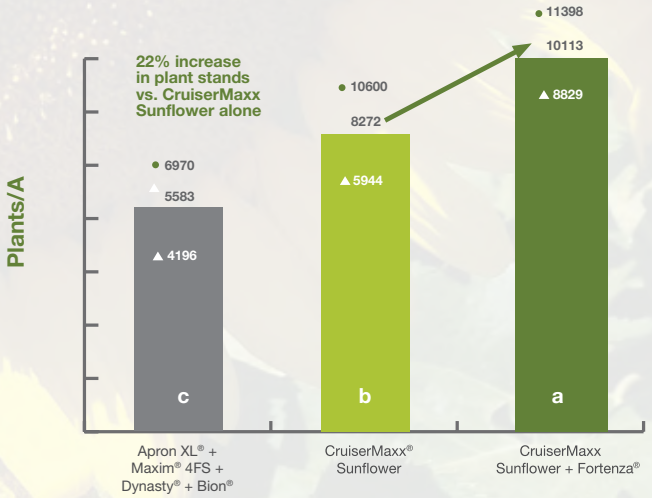


CruiserMaxx Sunflower and Fortenza Performance on Sunflower: Protection from Cutworms at the 4-6 Leaf Stage



Data from 2 sunflower trials. Trial 1: USNMSU9042016; June 2016; Colorado. Trial 2: USNN0U0012016; May 2016; Montana

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Seed damage from red sunflower seed weevil

Adult weevils on sunflower head

Sunflower seed weevil larvae

And although he notes that 'other tools' like weevil-resistant hybrids or natural microbial controls that may provide control in the future, they aren't here yet so growers need to take action of their own.

Consider Early Planting and Tillage

Prasifka reports that the results of both published and current ongoing studies suggest planting as early as possible – during the first half of May in central South Dakota – makes it more likely that a sunflower crop could bloom before the total weevil population in a given area has emerged. Prasifka saw this strategy play out successfully firsthand in 2022.

"We had trials at South Dakota State University's Dakota Lakes Research Farm where without insecticides, damage to sunflowers planted mid-May was about 90% less than sunflowers planted in mid-to-late June."

He cautions, however, that planting early won't likely totally negate the need for insecticides in South Dakota in the region around Pierre. The numbers of RSSW are just too high – anywhere from 10 to 100 times as high around Pierre as they are in North Dakota.

"Limited tillage would also probably help, only following sunflowers and once every four to five years for a field," Prasifka adds, "but that's hard to recommend for farmers in an area where agriculture is mostly no-till."

Overall, he says early May planting throughout that entire area along with as much tillage as possible, and of course, the best insecticide options, may be the only effective way to reduce populations around Pierre to levels that are easier to manage.

Monitoring Moths and Borers

Other sunflower pests of concern include banded moth and sunflower moth. Trapping data is available every year for both moths by North Dakota State University (NDSU) for locations across that state.

While banded moths are present each and every year in sunflower fields, Prasifka says this species has not been causing high levels of damage on average. "They are also likely to be kept low by insecticides applied for other insects like seed weevils present during bloom," he notes.

Sunflower moth is mostly a concern in southern states, mainly Texas, Kansas and Nebraska, because the larvae can't survive the colder winters of the Dakotas. Prasifka reports that sometimes enough adults fly north and put some sunflower fields at risk, but insecticides with the active ingredient Rynaxypyr are successful against this pest.

Dectes stem borer is also generally present and while it doesn't generally cause lowered seed yields, it can cause losses through weakening the base of the stem and subsequent lodging.

Prasifka therefore recommends keeping plant populations on the low end of normal, so that stems are thicker and won't be as prone to breaking due to borer attack. He also puts in another plug for early planting in relation to the Dectes stem borer.

"If you plant early you have a chance to harvest before fall winds pick up and create those conditions that lead to lodging," he shares. "We had one grower near Pierre who planted early and was able to harvest sunflowers in late August. He reported plenty of Dectes in his plants, but little lodging at harvest time."

Lygus Bug Resistance

Lygus bug is a concern in confection sunflower hybrids. Carbine, a relatively new insecticide mainly used to target aphids in pulse crops, offers some protection against lygus bugs but no killing effect on chewing insect pests of sunflower seeds, such as banded sunflower moths or larvae of seed weevils.

Carbine was given emergency use registration for lygus bug in Manitoba from July 21, 2023 until July 20, 2024. Up until 2022, growers in Canada were able to use products with lambda-cyhalothrin, but in 2023, a ban announced in 2021 on using these products in sunflowers and certain other crops came into effect, leaving no options for lygus bug control in confection sunflowers.

Carbine is the only product on the U.S. market with a label that specifies lygus bug

Early-planted sunflowers in bloom

control, but in general, most U.S. sunflower growers reach for their go-to pyrethroid insecticide instead.

Dr. Janet Knodel, Professor and Extension Entomologist at North Dakota State University, explains that most broad-spectrum insecticides like pyrethroids will kill most insects. However, the pyrethroids are not labeled for lygus bug.

Knodel explains that sometimes crop protection product companies haven't always completed the necessary testing to add a particular insect to a label, but the product may very well control that insect. "It is legal to use that insecticide if it is registered in that crop and state," she says. "However, because the insect is not listed on the label, the chemical company does not infer any control of it and the grower could not ask for reimbursement of crop losses due to failure of insecticide control for any insect not listed on the label."

It's important to consider this in insecticide choice.

Battling Resistant Weeds

Going into 2024, sunflower growers in the U.S. are already well aware that Group 4 herbicide-resistant kochia will be a common challenge, notes Alison Pokrzywinski, Nuseed Product Development Manager based in Devils Lake, North Dakota.

"We continue to preach about using a good pre-plant routine and not relying on the in-season herbicide pass where there is some ALS-resistant kochia (Group 2)," she says. "It may mean that there might be a few more kochia plants out there for a sunflower grower that are surviving in other crop rotations."

Pokrzywinski usually recommends a Group 14 product with sulfentrazone as a base to control kochia in the spring. "From there, there is a variety of mixes that include sulfentrazone, including with pyroxasulfone (Zidua), which is a Group 15," she says.

She adds that together, these two products can also help combat some other weed issues that are starting to emerge in some of the sunflower regions, such as waterhemp and Palmer amaranth.

"IF YOU PLANT EARLY YOU HAVE A CHANCE TO HARVEST BEFORE FALL WINDS PICK UP AND CREATE THOSE CONDITIONS THAT LEAD TO LODGING."

"A Group 14 fall application of flumioxazin (Valor) followed by another pre-application in the spring is also a good option. A good pre-emergent along with a good burndown."

Roundup hasn't been working as well on kochia, which is really tiny in the spring (commonly known as 'button kochia'). Pokrzywinski says, "We tank-mix a product called Aim (carfentrazone) to aid in the burndown of button kochia, but now resistance was found to that in 2022 by North Dakota State University (NDSU)."

She adds that there are strong concerns for effective future control with other Group 14 products (sulfentrazone and flumioxazin) that are important to sunflower growers. Spraying when the kochia is small (less than 3 inches) helps, she says, and adding another 'burner aid' such as Paraquat could also be used.

The moral of the story – whether it's weeds or insects — it's important to remain observant. Successful pest management requires an integrated approach that combines cultural practices and crop protection products.

Kochia Resistance Testing

In a NDSU report from May 2023, a team of extension researchers reported that in 2022, there were reports of kochia populations surviving field use rates of carfentrazone (Aim) and saflufenacil (Sharpen). Testing confirmed that there are several populations from across North Dakota that are resistant to saflufenacil and likely also carfentrazone. However, these populations are controlled with diphenyl-ether herbicides (acifluorfen, fomesafen, lactofen), but it is important to remember that kochia must be less than 3 inches tall to expect control with these diphenyl-ether products in the field.

The team tested additional herbicides on several of these populations and preliminary data from May 2023 showed bromoxynil (Buctril; Group 6), bentazon (Basagran; Group 6), atrazine (Group 5), metribuzin (Group 5), topramezone (Armezon; Group 27) and paraquat (Group 22) provided control. The team added that combinations of herbicides from Group 5/6 plus either Group 22 or Group 27 will result in synergistic control on kochia.

"The Group 14 resistance is the latest case of kochia defeating another herbicide site of action," states the NDSU team. "We encourage anyone applying those products to scout within seven days after application to determine the success of that application. Our resistance screening has served as confirmation that this resistance is in several parts of the state, but we are still not sure exactly how widespread this resistance is across the state."

During winter 2023/2024, this team is testing additional populations, and growers with populations of kochia that survived Group 14 herbicides in 2023 are urged to contact Joe Ikley, Brian Jenks, or Kirk Howatt at NDSU.

BROADENING CROP KNOWLEDGE WITH NUSEED UNIVERSITIES

Educational events for Nuseed's Omega-3 Canola Production System, Nuseed Carinata and sunflower growers help them network and grow a better crop.

Want to grow a better crop?

With its Sunflower University, Carinata University and Omega-3 Canola Production System University events, Nuseed staff place a lot of value on educating growers.

"With the Omega-3 Canola Production System University events, we're reaching out to numerous growers who may not have had experience cultivating canola, particularly in Montana," says Debbie Stiles, Nuseed North American Strategic Marketing Manager, Omega-3.

"In North Dakota, where there are already established canola growers on the northeast side, the transition is more familiar. However, as we venture further west into Montana, we encounter a significant number of individuals attempting canola cultivation for the first time. That requires some education to help them learn more about getting the best results."

And that's the crux of the Nuseed education events, be they in the carinata, canola or sunflower arenas — ensuring growers produce the best product for the market. That's especially important for contracted Nuseed Omega-3 Canola Production System and Nuseed Carinata growers, who are producing non-commodity crops for specific contract markets.

For the Omega-3 Canola Production System University events, the focus is on trials, variety pipeline and the Omega-3 Canola Production System, and how to optimize combines and maximize bushels.

"Looking ahead, especially in 2024, our focus is on providing valuable insights into optimizing field yields. We aim to address key questions such as when to swath, whether to straight cut, and how to determine the right moment for these actions," Stiles says.

"Additionally, we delve into topics like assessing maturity, configuring combines to minimize losses, and other practical considerations to ensure a successful harvest."

Lessons in Sunflower

When it comes to sunflower, Alison Pokrzywinski, Sunflower Product Development Manager for Nuseed, has found it extremely useful to educate growers and agents not just about combine configurations and practical harvest strategies, but about the agronomic benefits of the crop; it's something she's tried to stress when planning the annual Sunflower University events usually held in North or South Dakota. This year's event was held in Bismarck, ND. It focused on in-season production, presenting an array of in-season sunflower production topics.

"Planning Sunflower University is on my mind all year long. There are other events that I attend throughout the year, like the National Sunflower Association research forums. That's something that I use to help generate ideas, along with just chatting with people at grower events about what's on their mind," she says.

"I get excited when I think of a new idea or concept that I haven't really thought about before, or when a grower is leaving one of

our sunflower events and makes a comment that they really liked the meeting and found the topics covered to be useful and relevant. Our main goal is to educate growers and our retailers to help people grow better sunflowers. At the end of the day, if they're happy and successful, then they're going to want to keep growing sunflowers."

Maria Harvey, Sunflower Lead for Legend Seeds in Bismarck, says the annual event is an invaluable learning opportunity for herself and her customers.

"Becoming highly knowledgeable in your domain, whether you're on the sales side or you're a grower — can transform you into a reliable and trustworthy person in the agricultural community," she says.

Building trust is a gradual process, and as people begin to rely on your expertise, they are more inclined to share their insights and experiences, she says. This reciprocal relationship fosters mutual learning, creating a network of people who trust and support each other.

"Anyone claiming to work in agriculture but neglecting those educational experiences may raise eyebrows, because going into the classroom — whether it's in the field or an event like Sunflower University — is where you truly grasp the practical aspects of the job, experiencing firsthand the adaptations and solutions required to overcome the ever-present changes we face in agriculture."

Learning About Carinata

De Broughton, a Florida agronomist, owner of 6 Gen Ag Services, and Field Agent for Nuseed, has been taking part in the Nuseed Carinata University events for a while now along with her husband Ben, who also works in the carinata realm.

"He took the stage for a comprehensive presentation on planting, and last year I shared

an update on the season's progress, covering aspects like crop status and desiccation. This involvement in Nuseed Carinata University has been quite enriching for both of us, as we transitioned from being participants to becoming speakers at these gatherings," she says.

Broughton's connection to Nuseed came about through her role as an agronomic crop consultant with her company 6 Gen Ag Services, which has a contract with Nuseed.

"My responsibilities involve assisting growers throughout the entire crop cycle, focusing on aspects like land preparation, planter setup, milestone monitoring, fertilization, and decision-making on desiccation and harvest timing," she says.

While her primary territory is northern Florida and southern Georgia, the scope of her involvement has expanded as she connects with more growers interested in Nuseed Carinata, a crop many are new to planting on their own farms.

"Speaking at Nuseed events has been a valuable experience. It allows us to share our knowledge directly with growers and connect with them on a personal level. Preparing for these presentations forces us to organize our thoughts and communicate effectively, and the questions raised by growers provide insights into various approaches to crop cultivation," she adds.

"While research is essential, the growers' experiences teach us more about the practical application of that research in different scenarios."

Engaging with growers in this way has proven to be a two-way learning process. The interactive nature of smaller group settings at Nuseed events fosters meaningful communication, Broughton says.

"Standing next to a planter in a more relaxed, outdoor setting encourages hands-on interaction and facilitates open discussions. It's not just about sharing information; it's about creating a platform where growers can learn from each other's experiences and adapt best practices to their unique farming systems."

Marcel Kringe agrees. He's spoken at Carinata University and Omega-3 Canola Production System University events, representing the Manitoba-based company Bushel Plus, which

helps growers optimize their combines and overall harvest.

The collaboration with Nuseed began when Kringe caught the attention of Alison Pokrzywinski, who attended one of his combine clinics. Recognizing the wealth of experience present in the room, Pokrzywinski proposed the idea of hosting the combine clinics as part of Nuseed's events, bringing together both seasoned canola growers and those venturing into the world of carinata, a crop closely resembling canola.

"It's incredible to see the commitment of growers who have been harvesting canola for over 30 years and are still eager to learn. The idea of combining the expertise of long-time canola farmers with the fresh perspectives of new carinata growers is truly innovative," Kringe says.

"Bushel Plus is dedicated to helping people optimize their harvest, and this aligns perfectly with the goals of Nuseed. We want to ensure that every bit of grain is harvested efficiently to contribute to the food supply chain," Kringe adds.

He acknowledges the close-knit nature of the agricultural industry and the importance of networking and relationships.

"It's a fairly small industry and working with Nuseed allows us to collaborate with people who have strong relationships with growers. The Nuseed events provide a platform to educate growers about canola and carinata and how harvest optimization can benefit them."

Last year, Florida grower Ryan Lawson became interested in contract production of Nuseed Carinata for the additional farm revenue and to regenerate soil between main crops. He attended the Nuseed Carinata University in Quitman, GA, to immerse himself in learning about this new crop.

"GOING INTO THE CLASSROOM IS WHERE YOU TRULY GRASP THE PRACTICAL ASPECTS OF THE JOB, EXPERIENCING FIRSTHAND THE ADAPTATIONS AND SOLUTIONS REQUIRED TO OVERCOME THE EVER-PRESENT CHANGES WE FACE IN AGRICULTURE."

"It was an opportunity to gather knowledge, understand the intricacies of the crop, and connect with fellow growers. Attending it proved to be a valuable experience. As one of the few growers in northern Florida experimenting with this crop, the event served as a crucial platform for me to expand my understanding," he says.

At the event, he engaged in discussions, sought advice, and learned from the experiences of others. Discussing the impact of attending Nuseed's event, he says the gathering is not just for learning opportunities but also a channel for providing feedback.

"Being one of the limited number of Nuseed Carinata growers in my region, it was essential to share insights and experiences with Nuseed, to help shape the future of carinata cultivation," Lawson adds.

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HIGHLIGHTS:
Name: Jon Holte
Title: Sunflower Breeder
Crop: Sunflower
Location: North America and Europe
Motto: Whenever there is a challenge I say, 'it is all part of the fun!'

CHALLENGES IN AG: "IT'S ALL PART OF THE FUN!"

Growing up surrounded by agriculture kickstarted Jon Holte's interest in the industry.

Jon Holte, sunflower breeder with Nuseed, started his journey in agriculture when he was a child working on his grandfather's farm. Once he realized this was the field he wanted to pursue a career in, Holte earned his bachelor's degree in biology from Concordia College in 1994.

"My adviser from college had a friend who was a plant breeder," shares Holte. "When I was getting ready to graduate, he put me in contact with the plant breeder. That's how I started my career in plant breeding, research and agriculture."

Holte's career included a number of years with a plant breeding program outside of Nuseed. There he worked on several different crops at one time. Now, with Nuseed, Holte enjoys his work on sunflower breeding.

"When I noticed there was a position open in sunflower breeding at Nuseed, that really sparked my interest," says Holte. "It's challenging day in and day out to really improve the genetics of the sunflower, but getting to help growers across the northern hemisphere is really rewarding."

Before he started his role with Nuseed, he was excited for this opportunity.

"It seemed like a great opportunity to be one of the few sunflower breeders in North America. I'm working on developing new sunflower hybrids for the growers. I look forward to really being able to make an impact on the growers," comments Holte.

Holte's research with sunflowers is based in the U.S. but is used across North America and Europe.

"Globally, you get to help improve the genetics and products that are for farmers across the world," says Holte.

While the job is not easy, it is very rewarding, and that makes it all worth it for Holte. "The biggest struggle is Mother Nature. Every year it is a new challenge to overcome. You have to try to develop products that are stable over multiple years, different environments, different climates, different weather patterns and seasonal effects. How do you take that all into account and overcome that?" shares Holte.

Mother Nature certainly impacts everyone in agriculture. Holte plans to use his career to not only mitigate those impacts, but also improve sunflower crops overall.

HIGHLIGHTS:
Name: Shane Naslund
Title: Commercial Agronomist
Crop: Omega-3 Canola
Location: North Dakota and Montana

BUILDING A STRONG FUTURE FOR NUSEED OMEGA-3 CANOLA PRODUCTION SYSTEM

Shane Naslund is working to meet Nuseed's goals and continue to broaden their market share.

Nuseed Commercial Agronomist Shane Naslund, based in North Dakota, focuses on Nuseed's Omega-3 Canola Production System. He says a love for agriculture started for him right from childhood.

"I ended up working on the family farm through college and that's what got me interested in being in agriculture," says Naslund. He went on to get a degree in Agricultural Business Management and Sales, and took several courses in agronomy.

Naslund joined Nuseed after working in a similar role with BASF. With Nuseed, his territory includes locations across North Dakota and Montana.

"There are 10 trial locations across North Dakota and 10 across Montana, which provides us at Nuseed with a really good footprint for increased data to use for the hybrids moving forward," says Naslund.

Across all the locations in his territory, Naslund has been able to meet and help many farmers with their Omega-3 Canola growing needs.

"A career highlight that I've had with Nuseed is getting to know and meet the farmers. They call on me to identify weeds, fertilizer, inputs and seeding rates. It's really fun for me to help them and know that I'm making a positive impact on their farm," he adds.

Not only is he able to be a source of knowledge to farmers growing Omega-3 Canola, Naslund has also been able to face

growing challenges head-on with Nuseed and target high-level goals.

"I look forward to the challenge of working with new seeds and the new hybrids that are coming forward and helping the farmers that currently work with us. Nuseed has really ambitious goals of getting more contracts and more market share. We are also working to identify those fringe areas of the canola regions where we can potentially grow."

During his career, Naslund has also been able to meet some personal goals. He was able to get a full-time role with Nuseed, which was a personal goal of his. There was a time when Naslund was mainly working in contract positions. While the contract positions allowed him to learn and have additional flexibility, Naslund was ecstatic to be hired for a full-time position with Nuseed.

He adds, "I want to stay doing what I'm doing through retirement. I am at a really good company, and I want to stay working with a really good company. I feel like Nuseed is it and I'm ready to stay at what I'm doing."

HIGHLIGHTS:
Name: James Johnson
Title: Field Sales Manager
Crop: Omega-3 Canola
Location: North Dakota and Montana

PUTTING IN HARD WORK PAYS OFF IN CANOLA CAREER

Having grown up on a small ranch while also working at family members' farms, James Johnson was hooked on agriculture.

Nuseed Field Sales Manager, James Johnson, focuses his time now on the Nuseed Omega-3 Canola Production System in North Dakota and Montana. Having grown up working on his family's small ranch and at extended family members' farms as well, Johnson has always been passionate about agriculture.

"I attended North Dakota State University in Fargo, North Dakota," shares Johnson. "I obtained my bachelor's degree in Agricultural Systems Management with minors in Ag Business and Agronomy."

During his time in school, he also continued to work on farms as time allowed. While his family's ranch was no longer operational, Johnson knew he wanted to stay involved in some part of the agriculture industry.

"My focus shifted towards the agronomy side, specifically sugar beets initially after being exposed to beet harvest every fall during college," recounts Johnson. "That led me to my first job, which was an agriculturist with Sidney Sugars Inc."

Johnson stayed at Sidney Sugars Inc. for six years until the company closed. This chapter ending lead him to his current role with Nuseed as a Field Sales Manager.

"The role with Nuseed sounded very interesting because it was very similar to what I was previously doing – meeting with growers, contracting, agronomy and harvest support, and just helping with any other questions they might have," says Johnson.

Johnson hoped when he began the role, canola would be a profitable alternative crop for farmers in the area since sugar beets were no longer an option. The career change wasn't easy for Johnson at first.

"Switching my focus from sugar beets to canola took a little time to get more familiar with agronomy practices. Canola is also a fairly new and unknown crop in some of the areas I cover so it's a lot of teaching and advising for new growers."

All of Johnson's hard work and learning about Omega-3 Canola paid off in the long term. He was able to achieve additional licensing due to his high level of canola knowledge.

"My biggest career highlight has to be when I obtained my Certified Crop Advisor license. I spent numerous hours studying and preparing for those tests and the hard work paid off," adds Johnson.

HIGHLIGHTS:
Name: Danny Crane
Title: Field Sales Manager
Crop: Carinata
Location: Texas

SUCCESS IN THE AGRICULTURE INDUSTRY

Growing up around agriculture, there was no question whether Danny Crane was going to stay in the industry.

Danny Crane, a Field Sales Manager based in East Bernard, Texas, is focused on Carinata with Nuseed. He grew up surrounded by the agricultural industry and then stayed in it by continuing his education and later getting a job in the agriculture sector.

"I grew up following my dad around in rice fields. He was a rice farm manager and then independent rice consultant for the past 40 years," shares Crane. "After I graduated from Texas A&M University, I was employed in the ag retail business for 16 plus years. Agriculture runs in my blood."

While attending Texas A&M University, Crane earned his Bachelor of Science degree in Agricultural Development. He has always been interested in seed and plants, and his interest has only grown since learning about Nuseed Carinata.

"I have been very intrigued with carinata ever since I first researched this crop that we contract with growers," says Crane. "I plan on making every effort to ensure Nuseed Carinata is successful! It's new to the market and there are skeptics, but I have always loved a challenge!"

Crane is glad that he can work with growers and help them be successful.

"Carinata provides benefits to the soil as a cover crop plant. Carinata also can be used as a fuel source and help reduce other fuel source needs," he adds.

The crop is versatile, and Crane emphasizes the importance of this crop's success to him personally.

"My goal is to make Nuseed Carinata successful in all facets, not only now, but long term for many years to come! Until I retire, I want to make this crop successful," says Crane.

HIGHLIGHTS:
Name: John Walker
Title: Field Sales Manager
Crop: Omega-3 Canola
Location: Montana
Motto: Grow through positivity, thrive through development – cultivating a brighter future one seed at a time!

SUCCESS WITH NUSEED

FFA sparked John Walker's interest in agriculture and Nuseed has him excited to stay.

John Walker, a Field Sales Manager in Montana for Nuseed, has always been involved in the agricultural sector. From a young age, Walker was working on farms and ranches, which paved the way for him to be actively involved in the National FFA Organization.

"When I was in high school, I was really involved with FFA," shares Walker. "I was a state officer with FFA here in Montana. I knew I was going to get into agriculture, I just didn't know which way exactly."

Following his active FFA career, Walker went on to Montana State University, where he studied economics. After his undergraduate studies, he joined Farmers Business Network.

"When I was at Farmers Business Network, I was involved in everything from sales, development, cold calling, to getting to know growers across the nation and more," says Walker. "From there, I quickly transitioned into being the pulse buyer for Montana, North and South Dakotas and the Pacific Northwest."

Seeking a change, Nuseed caught Walker's attention by offering a position that was closer to home.

"What I really enjoy with Nuseed is that this type of marketing allows growers to be more profitable," comments Walker.

Walker describes this region, which faces challenges in product logistics, as a "black hole". One aspect of his role at Nuseed that he values is the ability to reduce the black hole effect for growers in his territory.

"I really enjoy helping producers grow their operations and being able to bring a new seed product to a lot of these places. I want to see them succeed. At Nuseed, we are always looking for upward mobility and I do think that is a positive attribute with Nuseed," says Walker.

Nuseed has allowed Walker to help growers be successful and make some friendships along the way. The positive culture at Nuseed is a big aspect of that. Offering growers the help they need when contracting and growing Nuseed's Omega-3 Canola Production System is a highlight for Walker.

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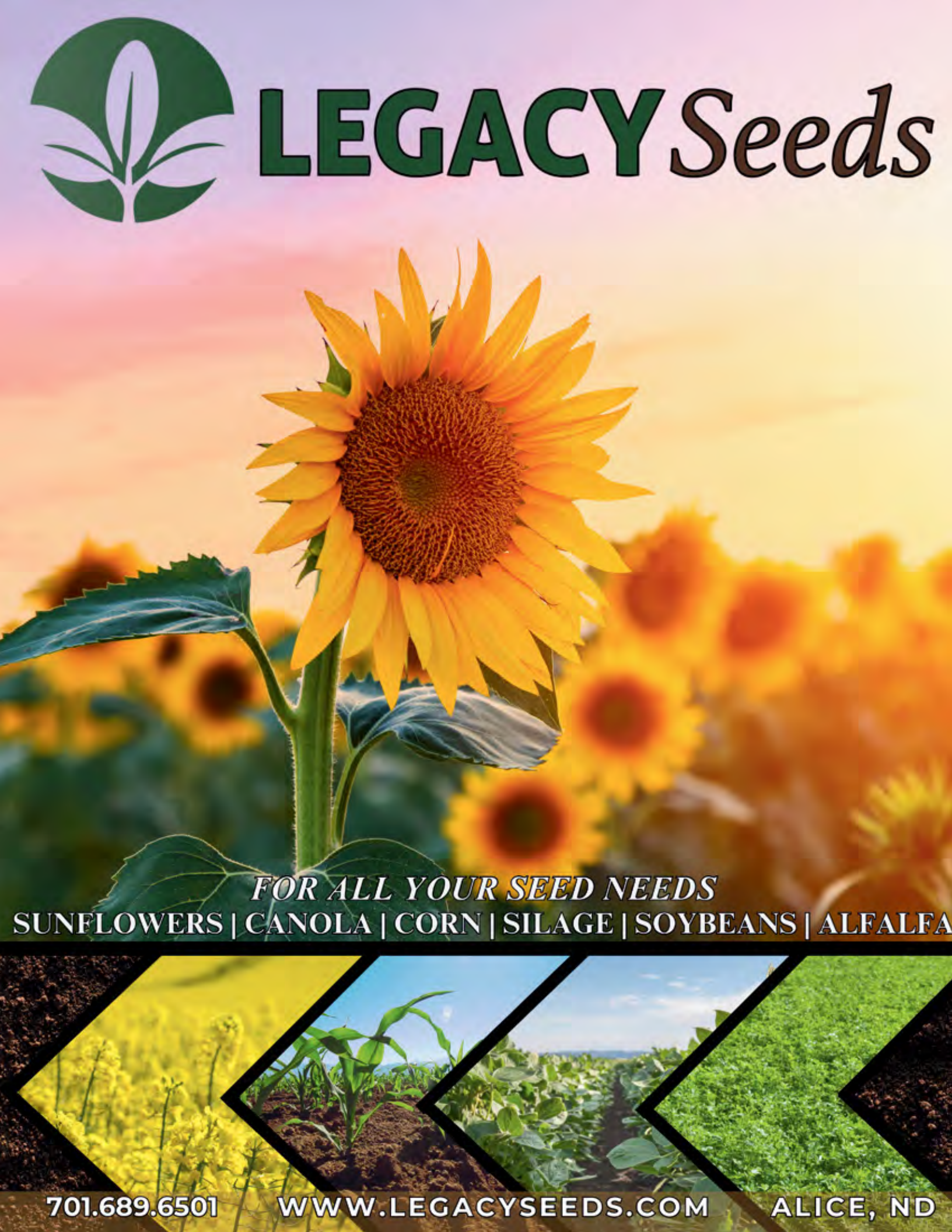

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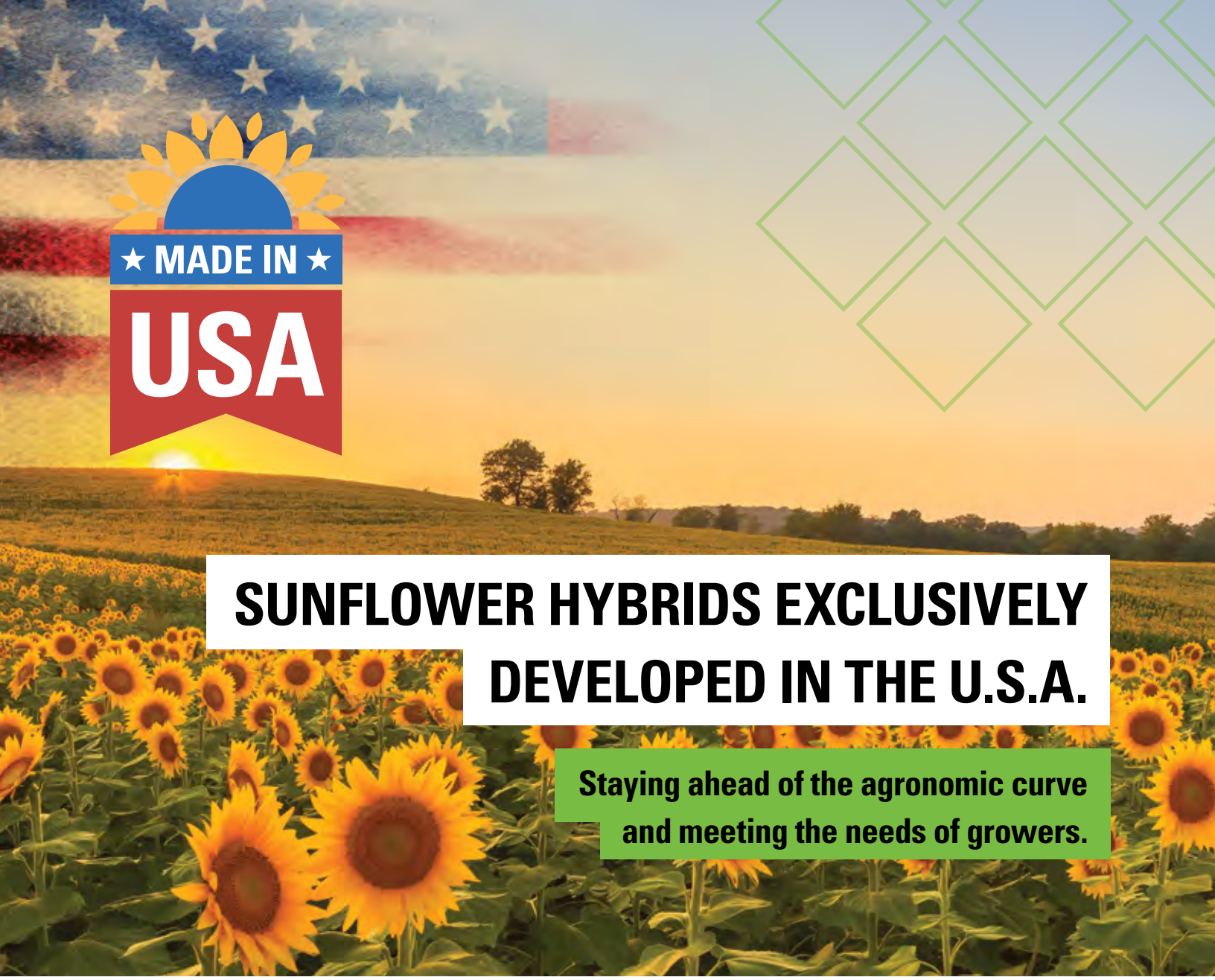

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