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GOLDEN OPPORTUNITIES

Volume 7 Annual 2023

Committed to Growth

Nuseed is focused on innovation and growth to help your farm succeed.

+ PLUS

- Oilseed Market Outlook
- Sunflower Pests to Watch For
- Omega-3 Opportunities
- Nuseed Carinata - Growing Acres and Demand

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FIELD NOTES

Over 10 years ago, Nuseed recognized the need for alternative sources of long-chain omega-3 fatty acids.

Wild, ocean-caught fish, the most common source of omega-3, are under increasing pressure to provide food and oil. Aquaculture provides a sustainable seafood option, but farmed fish are reliant on wild sources of omega-3 to support fish health. At Nuseed, we understood that both aquaculture and human nutrition markets needed a renewable source of scarce omega-3 oils. Nuseed Omega-3 Canola offers substantial benefits for animal and human nutrition.



In turn, we know this also has downstream benefits that can address supply chain issues with locally grown products as well as reducing pressure on our ocean resources.

Humans and animals need omega-3 fatty acids and the Nuseed Omega-3 Canola, branded as Aquaterra® for aquafeed and Nutriterra® for human nutrition markets, is helping fill this demand. The downstream benefits have massive potential to provide nutritious, sustainable oils to market while supporting growers of Nuseed Omega-3 Canola with a robust contract program.

The program — from seed to marketing — provides you, our growers, with everything you need to grow this crop profitably and sustainably. The oil produced from processed seeds has been approved for both human and animal supplementation in Canada and the United States. Nuseed Omega-3 Canola differs from its traditional counterparts by the addition of microalgae genes create a biosynthesis pathway where OA is converted to DHA.

According to the World Health Organization, over 80% of people worldwide are deficient in omega-3, and new research shows the value of consistent intake of omega-3 in maintaining overall health. Nuseed Omega-3 Canola, once processed, becomes a valuable source of omega-3 nutrition for both human and animal health.

We believe in a sustainable future, and it starts with developing new crops that deliver essential nutrition with fewer resources and give consumers new options for omega-3. From grower to consumer, Nuseed is invested in growing the value chain to help farmers succeed.

Katrina Benedicto
Marketing and Communication Director,
Nuseed Nutritional

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RESEARCH IS MAKING BIG THINGS HAPPEN IN SUNFLOWER AND CANOLA

Whether it's enhancing fish quality, boosting human nutrition or new hybrids of sunflower that push the boundaries of what's possible in terms of disease resistance, Nuseed researchers are bringing exciting new options to the field.

A New Option for Double Cropping and Short Seasons

Last year's spring was a wet one in northern North Dakota, and Jonathan Waibel was looking for a late-season option to make the most of what Mother Nature had thrown his way over the past few months.

So, he contacted Nuseed Field Sales Manager, Jed Wall, to find out what was possible.

"I asked him about possibly putting in some sunflowers late. He said, 'Let me see if I can get you some of these ones from Texas.' That's where they grow them in the short season," says Waibel, who farms near the Canadian border.

Hence his introduction to N4H161 CL, an ultra-early high oleic sunflower that shows what modern sunflower breeding can accomplish. It's the perfect hybrid for northern climates with short growing seasons or in the High Plains for a double crop option. With a shorter plant height, N4H161 CL has excellent root strength and late season plant health.

"I was pleasantly surprised with them, because we had some tough growing conditions, and it was not great planting. They were definitely two weeks — if not three weeks — earlier than my other sunflowers that I planted, probably a week or two earlier than those ones," Waibel says.

"They're short, and not as beautiful as other sunflowers look, but when we got out there to combine them, they exceeded our expectations."

N4H161 CL flowers several days earlier than anything else in the Nuseed lineup, giving a grower additional planting flexibility without sacrificing yield, Wall notes.

"2021 was our first really big launch of this hybrid. Our primary focus as we go forward is working with growers that want to double crop in the High Plains and other parts of the U.S.," Wall says.

"Not only is it a good-yielding hybrid, it's got good stalk and root strength and the oil content has been very good. It's been meeting

requirements with all the processors and it gives the growers a chance to make a second income off the same field.”

According to Wall, it’s an ideal crop to follow a wheat crop, to take advantage of the weed control applied to the previous crop. It can also benefit growers who have been discouraged from growing sunflower due to the blackbird problem — you have the option of planting very early, desiccating early and getting the crop harvested before the birds show up in the fall.

Waibel represents a contingent of “rescue growers” who benefit from using N4H161 CL in wet conditions where they have no choice but to plant late.

“It’s a solid hybrid — very good stalk and root strength, very good late-season plant health and excellent harvestability with great yield and oil. It offers a real one-two punch in that regard,” Wall adds.

How Canola is Enhancing the Quality of Fish and Setting Itself Apart for Human Health

Fish oil is rich in omega-3 fatty acids. Studies show they have an overall positive impact on brain, eye and heart health, as well as aiding in inflammation management.

These fatty acids are also essential as a feed additive to farmed salmon to support animal health and welfare, as well as conferring omega-3 nutrition in the filet.

But there’s been a problem in recent years. The fish oil supply is declining as wild populations are impacted by environmental pressures and overfishing. This means the aquaculture industry has replaced some fish oils with vegetable oils which lack these essential fatty acids. New omega-3 sources are needed to support fish health.

Nuseed Omega-3 Canola varieties are helping do this. Two new studies conducted by the Norwegian Institute of Food, Fisheries and Aquaculture Research (NOFIMA) found that salmon fed a diet that replaced standard canola oil with oil that includes Aquaterra — derived from Nuseed Omega-3 Canola for use in fish feed — produced better quality filets with more nutritional value.

“Our oils are still new to the market,” notes Katrina Benedicto, Director of Marketing and Communications for Nuseed’s nutritional division.



Katrina Benedicto is Director of Marketing and Communications for Nuseed’s nutritional division.

“Research with fish and human clinical trials continue to verify the safety and efficacy of Nuseed Omega-3 Canola. This research is showing that omega-3 canola oil is as effective as any other omega-3 oil source,” she says.

What’s more, a recent survey indicates that 64% of U.S. vitamin consumers prefer plant-based omega-3 supplements when offered an alternative to marine-based oil.

Not only that, but Benedicto notes that omega-3 canola oil has many things going for it that put it in a special category and set it apart from traditional fish oil.

Each year, the nutraceutical magazine *Nutra Ingredients* recognizes the most innovative ingredients, finished products and research in the nutrition and dietary supplements industry. They field hundreds of submissions from companies looking to bring attention to new products and projects. Finalists are selected within 17 categories.

New Express-Tolerant High Oleic to Build on Success of Previous Game-Changers

Nuseed is adding to its high oleic sunflower lineup, announcing the prelaunch of N4H490 E. The hybrid contains an advanced downy mildew gene that Nuseed Sunflower Breeder Jeremy Klumper says should bring some real robustness along with the chemistry that Nuseed is using to change the game in high oleic Express tolerant sunflower.

“We’ve brought together some really nice plant health traits, yield potential and upper end oil content on this product,” Klumper says. “N4H490 E will really add a robustness to our portfolio that will offer extra value to customers.”

Klumper says N4H490 E will be best suited from Texas all the way up to southern North Dakota but could have some use in central parts of the state if a grower is able to plant early enough.

What’s in a Salmon Filet? For Shoppers, a Lot

Quality is important for people who buy, and consumers select it with their eyes. Good color and a lack of dark spots are indicators of quality that consumers use to choose the salmon they buy.

A new study conducted by the Norwegian Institute of Food, Fisheries and Aquaculture Research (NOFIMA) found that salmon fed a diet of canola

oil made from Aquaterra’s omega-3 canola produced better quality filets with more nutritional value.

Fish fed omega-3 canola fish feed had muscle pigmentation that scored higher for appearance and nutritional value, showing higher levels of omega-3 fatty acids.

In 2022, Nuseed's Nutriterra Total Omega-3, an oil derived from Nuseed Omega-3 Canola for human consumption, was honored as a finalist for the specialty award Nutrition Research Project of the Year. Nutriterra was shown to work raising indices of omega-3 status in study participants. The recognition showed that Nuseed's innovation is essential to increasing access to high quality omega-3 nutrition.

"We set out to create a new source of omega-3 to close the gap between how much is needed to support aquaculture and human health and how little the ocean can provide. We ended up with a unique oil that provides benefits of marine-based and plant-based omega-3. It's always exciting when new research proves that our products offer more than a new source of omega-3, but an actual advancement in the category," Benedicto adds.

"People who don't consume fish due to allergies, dietary preference, or concern about ocean health, now have access to this alternative. To have a plant-based version of an omega-3 product that can supply the nutritional benefits of traditional fish oil is huge."

Triple-Stacked Sunflower Nearly a Reality

The Nuseed team is improving downy mildew and orobanche resistance in its sunflower hybrids, through the creation of triple-stacked hybrids to be launched in the near future.

Here's the basic concept: a Nuseed hybrid with a stack of downy mildew and orobanche resistance genes will help improve the durability of the resistance as opposed to using only one gene.

Currently, downy mildew affects growers throughout North America and Europe and is capable of killing or stunting plants, reducing stands and causing yield loss. Orobanche — also known as sunflower broomrape — is a parasitic plant and substantial threat to sunflower production in countries around the Black Sea and across Europe.

"The triple stacked hybrids are a product lineup that we're just on the threshold of bringing to market. It's something we've been working on for the past eight years, getting

the combination of herbicide, multiple downy mildew resistance genes and then orobanche resistance genes stacked into a single hybrid," says Jeremy Klumper, Sunflower Breeding Lead, NA and Europe for Nuseed.



Jeremy Klumper is a Sunflower Breeding Lead, NA and Europe for Nuseed.

"That allows us to continue to produce sunflower for a number of different uses. We won't have to worry about inbreds being susceptible to any of those pests. From a North American farmer standpoint, the benefit is stacking on multiple downy mildew genes and multiple origins, which just brings a robustness to the hybrids that will make

them unlikely to be overcome anytime soon by the mutations of those pests."

Traditionally, companies relied heavily on chemistry to battle downy mildew and orobanche, and while chemistry is still a very important part of it, as restrictions come into place country by country and products come and go, as a company, Nuseed wanted to develop a product that was reliable for growers across a wide global region that would last for the long term.

"We're using multiple advanced genes that up until today are not known to be overcome by any races of downy mildew or orobanche. We'll always be working on the next gene, the next great defense, so that we continue to be in a leading position in those categories," Klumper adds. 🌻



Salmon Fed Omega-3 Canola Produce More Nutritious Fillets

In a recent study, researchers at the Norwegian Institute of Food, Fisheries and Aquaculture Research (NOFIMA) found that fish consuming more Aquaterra Advanced Omega-3 canola oil had a higher ratio of omega-3 to omega-6 and contained more ALA, EPA, and DHA than fish fed the conventional diet. What do these compounds do for human health?

ALA: Alpha-lipoic acid is an antioxidant essential for aerobic metabolism in the human body, attacking "free radicals", waste products created when the body turns food into energy.

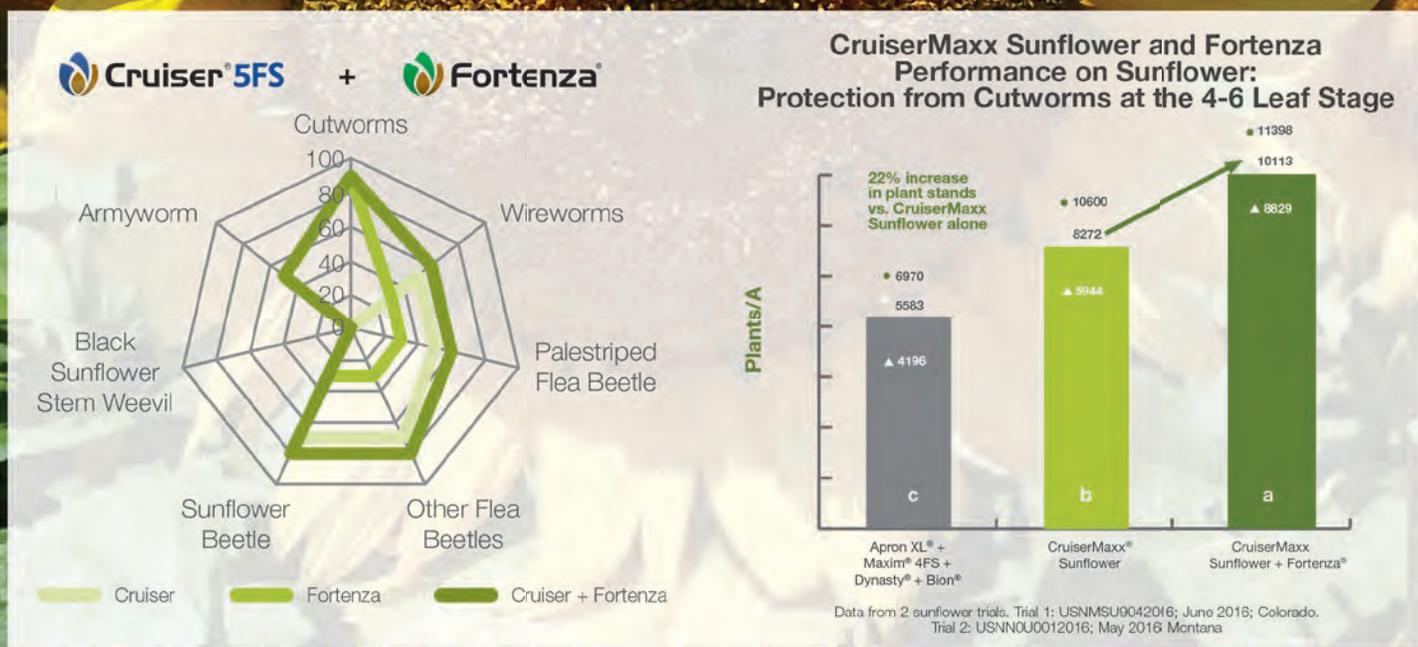
EPA: Getting more eicosapentaenoic acid in your diet has positive effects on coronary heart disease, cholesterol levels, high blood pressure and inflammation.

DHA: Docosahexaenoic acid is good for your heart, and you need DHA for a healthy brain. Babies need it so their nervous system can develop properly; DHA is in breast milk and is often added to formula.

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| Wireworm | 3 | 1 | 3 |
| Palestriped Flea Beetle | 3 | 2 | 3 |
| 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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NO WHERE TO GO BUT UP

Sunflowers and canola are all living up to their golden color as the market outlook for these crops remains strong.

Trends suggest that sunflower and canola markets will continue to grow in 2023.

This builds on a successful couple of years during the pandemic that saw a renewed interest in the crops, especially among bird-watching enthusiasts. If there's one common theme for 2023, it's continuing to build on that success.

Invasion Drives Sunflower Demand Here at Home



John Sandbakken
Executive Director of the
National Sunflower
Association

If there's one thing that continues to shape the North American sunflower market, it's the conflict in Ukraine.

Since it began, North America's sunflower market continued to see growth because of the increased demand

for sunflowers grown here, says John Sandbakken, Executive Director of the National Sunflower Association.

"Ukraine's sunflower crop in 2022 was considerably lower than it was for their long-term average. That's going to flow into 2023," he says.

Sandbakken said the invasion brought customers back to both the U.S. and Canada who were buying from overseas. "The benefits of securing sources close to home have really become apparent since those unfortunate events began."

Ukraine's sunflower crop was severely affected by the invasion, down over 40% in 2022 compared to the year prior, according to data from Ukraine's Ministry of Agrarian Policy and State Statistics.

According to Sandbakken, the stability offered by the North American sunflower industry is a boon to producers here.

"If you're going to be a player in the North American market, you have to have consistent supply and availability. The way we do that is by having acreage. And in order to get those, our prices have to be competitive with other crops," he says.

In the last five years, sunflower oil consumption in North America has increased by 67%, an upward trend that doesn't seem to be abating as far as the food market is concerned.

"When I look at where demand is for these products, whether it be oil or confections, we can easily add another 10% to 15% on top of those acres in 2023 just to keep the supply chain satisfied," he says.

And there are new uses for sunflower that are only serving to bolster demand even more.

"The global renewable diesel movement, especially here in North America, is going to be the biggest player in shaping the future of sunflower. If all these renewable diesel plants go online in the next few years like it is forecasted, the amount of feedstock that's going to be needed is incredible," he says.

"There's just not enough oil right now — be it canola or soybean oil — to fulfill that demand. Where sunflower oil fits in is not as a source of renewable diesel, but as a

replacement for the oils that are going to go toward biofuels.”

One acre of sunflowers can produce as much oil as two acres of soybean, he notes. That means sunflowers have a bright future as a go-to source for food grade oil when other oils are being diverted into the renewable diesel stream. Add to that the fact that high oleic sunflower is gaining steam, and the future is bright for this versatile crop.

Encouraging More Sunflower Growth



Darcelle Graham
Executive Director, National Sunflower Association of Canada

Despite enjoying a whopping 90% of Canada’s sunflower acres, Manitoba is actively trying to encourage more people to grow sunflower.

“With the wet spring season in 2022, we didn’t quite get in all the acres that we

were hoping for, so confection acres were pretty small this past year. We’re hoping to grow those back to the place where they were,” says Darcelle Graham, Chief Operating Officer at the Manitoba Crop Alliance.

Manitoba had 72,916 acres of sunflower in 2022, with 4,492 being confections and the rest being oilseed. Compare that to around 80,000 acres the year prior, with 15,000 acres being confection sunflower, a noted shift in between confections and oilseeds.

Still, she notes that overall yields are going up, and growers are able to grow more sunflower on the same amount of land. She’s confident growers will see positive pricing for both confections and oilseed sunflower in 2023.

“We’ve had some positive weather in recent years that has helped the crop. In our drier years, we haven’t seen the kinds of disease levels that contribute to losses. Plus, the growers have access to more crop protection products that they’re able to use to protect their crops.”

Renewable Fuel Mandates Transforming Canola



Clint Munro serves as Global Lead for Nuseed’s omega-3 supply chain.

The good times continue to roll for the canola market in 2023 and beyond.

Although the market is well below the highs of last year, it remains well above the 20-year average of approximately CDN\$500/mt on the ICE futures market, notes Clint Munro, Global Lead for Nuseed’s Omega-3 supply chain.

“As of this past January, the consumption of the 2022 Canadian crop is at a rate that would consume the total supply around 10 weeks before the 2023 harvest,” Munro says. “So, the function of the market is to ration the crop by either causing exports to be uncompetitive or reducing domestic crush margins so the crush rate slows.”

Domestic crush margins have been very high for the past two to three years and crushers will be doing everything to keep plants running close to their capacity, he says. As crushers continue to attract canola, basis levels should remain strong which is good news for growers still holding their 2022 crop.

“We would also expect the old crop/new crop spread to remain at an inverse and likely tighten further. This means the July 2023 futures is at a higher price than the November 2023 contract.”

The largest-ever canola crop in Australia of approximately 8 million metric tons will provide export competition during the first half of 2023, according to Munro.

Furthermore, the price of canola is becoming increasingly influenced by energy and renewable fuel mandates. This is supported by the recent decision from the United States Environmental Protection Agency (EPA) that canola oil-based renewable diesel will qualify as an advanced biofuel under the country’s renewable fuel standard.

Bird Seed Sales Stay Healthy



Jody Locke is Sunflower Group Product Manager for Scoular based in Winkler, Man.

During the pandemic, birdwatching rose in popularity as people stayed home and looked for hobbies that didn’t require them to venture out into public.

Bird food sales skyrocketed, but now that we’ve turned the corner on the pandemic, things are returning to the way they were prior to early 2020.

“We saw a very large increase in bird food sales for the first year-and-a-half of COVID. Those numbers have come down now — they’re normalizing to pre-pandemic levels for the most part,” says Jody Locke, sunflower group product manager for Scoular based in Winkler, Man.

She says bird food manufacturers learned a few things during the pandemic — a big one being that people are discovering birdwatching as a way of cultivating good mental health.

“Back in 2010, confection sunflowers were grown far more than black oil sunflowers were. That has done a complete turnaround where now we see black oil sunflowers dominating the acres in Manitoba, specifically. It’s definitely been a switch and it’s one that Scoular as a company is trying to reverse. We want more confection sunflowers in the ground, definitely,” Locke adds.

MARKET OUTLOOK

This is also increasing the volatility in the market. A recent example was when the EPA announced in November that total renewable fuel quotas for 2023 of 20.82 billion gallons versus 20.63 in 2022. Although a small increase, it was less than expected and soybean oil futures declined 15% over the next five trading days, Munro notes.

“The renewable fuel mandates are having a transformational impact on the canola industry with regards to capital investment in new crush plants,” he adds.

Crush capacity in Canada in 2023 is approximately 11.5 mmt, and this could increase to 16-18 mmt by the end of 2026.

“The first new builds will start processing in early 2024, and this is when growers can expect to see an increase in domestic demand for canola.”

Looking specifically at the harvest price for the 2023 crop, he says a useful reference point is that canola generally trades at a

premium to soybeans of around US\$50/mt. For the price relationship to increase it would usually require higher vegetable oil prices due to any combination of energy prices, lower palm oil production, increased canola and vegetable oil consumption by China — or lower crop yields in Canada.

Omega-3 Oils Demand to Double by 2050 - A Great Opportunity for Canola Farmers



Pablo Berner is Aquaculture Business Lead for Nuseed Nutritional.

More than a decade ago, Nuseed recognized the global omega-3 supply challenge and developed omega-3 canola with a unique profile that contains several omega-3 fatty acids. It's this canola that's used to create the

world's first non-marine source of long-chain omega-3 fatty acids and a proven partial replacement for fish oil in feed applications.

According to Pablo Berner, Aquaculture Business Lead for Nuseed Nutritional, salmon farming and shrimp farming is the most advanced aquaculture industry in the world. Only salmon farming can supply the approximately 3 million tonnes of the fish needed in different markets worldwide.

Almost 75% of global fish oil was used by the aquaculture market in 2021. Compare that to less than 16% used by the pharmaceutical industry and under 10% used for other sources like cooking oil and pet food.

“We expect the need for omega-3 oils to double by 2050. Knowing the world needs a new source of omega-3 fatty acid, we anticipate a bright future for the Nuseed Omega-3 Canola crop,” Berner says. ☀️

Two new studies bear out the potential omega-3 canola has to enhance fish quality. Read about these on page 3 & 4!



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ENSURING SEED AND GRAIN MOVEMENT IN UKRAINE

Nuseed employees in Ukraine are learning to live with a daily reality that's significantly different than what they knew prior to the Russian invasion that began early in 2022.

Although it's been difficult, Nuseed Europe General Manager Patrick Dieterich and his France-based team have been able to ensure the safety of Ukraine-based Nuseed team members and ensure the business of growing sunflowers is able to continue despite the instability caused by the invasion.

Prior to the Russian invasion, Nuseed had an office in Kyiv, and some remotely based salespeople throughout the country, Dieterich notes.

"In the lead-up to the initial start of the war, with everything that was in the news at that point, we did make some preparations with the team to make sure that they were safe and positioned to go if there was a need for an immediate evacuation within the country," he says.

"While everyone involved was hoping that the invasion wouldn't happen, certainly we had our eyes open prior to it actually beginning, so we were able to react quickly and facilitate the movement of team members. The focus for Nuseed and Nufarm is ensuring that everyone is safe. That's our number one goal, day in, day out," Dieterich says.

That includes a strategy focusing on personal safety, safety of family, friends and home property. More recently, that has expanded to ensure Ukraine team members have access to food, electricity and heat.

"Things have evolved from a 'how do we survive the war' mentality to living with it on a daily basis. It's a transition from an emergency event to 'this is how our life functions today,'" Dieterich says.

Historically, Russia has been the largest grower of sunflower in the world, with Ukraine being number two. Since the invasion began, Ukrainian sunflower acres have dropped by about 40%, while Russian sunflower acres are expected to increase.

"Certainly, as the main suppliers and growers of sunflower throughout the world, there's definitely been a change there for us. If we look at the ability initially to import seed into Ukraine, it was impacted. We did have seed already in the country by that point in the season when the war started, and we now have some carryover seed from last season, which is allowing our team to focus on getting that seed out to Ukrainian customers for this growing season," Dieterich says.

There's a lot involved in moving seed and getting it from the warehouse out to the distributor, then out to the farmer. With the deterioration of infrastructure and risk involved of driving on a daily basis, getting the seed into the fields is a challenge, he adds.

"There are unexploded ordinances, so that poses a risk to farmers. The next step is harvesting the crop and being able to store it in advance, then getting it out of the country. There's been a lot of destruction of grain storage facilities, of silos. Storing grain is challenging."

Then, of course, there's difficulties exporting grain via the Black Sea to be considered. Dieterich notes exporters are trying to work with companies exporting grain from Ukraine via truck or rail, but that can't replace the amount of tonnage that would have been exported via the Black Sea.

"The farmer is having to try and manage all that while continuing to ensure food availability for Ukraine, and then where possible to export any additional grain through the various routes that are open today," Dieterich says.

Despite the challenges, Dieterich says Nuseed and its partners have successfully managed to wade through many of the difficulties and ensure seed and grain gets to where it needs to go.

"We started off at the beginning of the war with twice-daily crisis meetings that involved our Ukrainian team members, Nuseed and Nufarm together making sure that we were reacting very quickly both in-country and within Europe, but also globally as well, to maintain the safety and security of the team," Dieterich says.

"We still have weekly calls and daily WhatsApp chats to make sure that everyone is checking in and still safe. We've been able to supply a number of emergency supplies of food, medicine, generators and sleeping bags to team members. So that's been really reassuring to the team and those of us at Nuseed. We're all in this together."

Nuseed has also worked with distributors in-country, allowing them to purchase and pick up smaller quantities of seeds at a time due to shortage of trucks and fuel.

"We've been more flexible in our commercial terms to ensure that we continue to operate the business to the best of our ability," Dieterich adds. ☀️



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OMEGA-3 CANOLA: BRIGHT PAST, GOLDEN FUTURE

Canola has, for many years, been an important and highly valuable crop for growers in the Northern Plains and Western Canada, but that bright past has a new, golden future ahead with a new canola type that has been years in development.

Nuseed Omega-3 Canola, with U.S. federal approval, is grown and processed into highly sought-after omega-3 oils and is the only land-based source of DHA essential nutrients.

Omega-3 canola is a sustainable plant-based solution that appeals to consumers and growers. One to two acres of omega-3 canola can produce as much DHA as 10,000 two pound fish. Nuseed Omega-3 oil is processed into two products using the proprietary oil ingredients, Aquaterra® for aquafeed and Nutriterra® for human nutrition support.

“Nuseed is committed to solving complex challenges through the power of plants. Our Omega-3 Canola is a true disrupter in the omega-3 space,” says Katrina Benedicto, Marketing and Communications Director, Nuseed Nutritional. “Before our crop-based innovation, marine sources (primarily fish important in the marine food chain) were the main option for long-chain omega-3s — specifically DHA and EPA.”

Benedicto also notes that omega-3 is an essential nutrient in short supply with many of the world’s fisheries, which are the current largest source of DHA and EPA, harvesting at capacity while demand for omega-3 keeps growing.

Aquaculture

For aquaculture, omega-3 canola is a significant change, providing a way for farmed fish to have much-needed omega-3 oils without putting additional pressure on ocean ecosystems. In 2020, Nuseed Omega-3 Canola was a finalist in the Global Seafood Alliance *Innovation of the Year* awards, in recognition of its potential to double the global supply of omega-3, an essential nutrient for fish and human health.

An Aquaterra white paper shows how the Nuseed Omega-3 Canola-based oil supports fish health as well as removes pressure on marine sources which have been steadily depleted and have become increasingly less sustainable than land-based sources. The white paper cited a number of conclusions from the trials evaluating the performance of Aquaterra Omega-3 under commercial-scale Chilean conditions.

They included:

- Excellent weight gains with consistently reduced mortality in all three trials with the DHA+EPA content as a major influencing factor.
- High content of DHA and ALA in filets.
- The product satisfies the nutritional requirements for commercially raised salmon while maintaining a consistent

fatty acid composition in the filets, which is valued by consumers as a sign of a healthy product.

The development of omega-3 canola increases the supply of fatty acids. As the first land-based source of long-chain omega-3 fatty acids, Aquaterra® provides the nutritional benefits of microalgae from a plant source.

“Nuseed is proud of the work we’ve done on this, but we didn’t accomplish this alone,” says Benita Boettner, Global General Manager of Nuseed Nutritional. “This was the result of many people in science and agriculture collaborating at all stages of development globally.”

The benefits for aquaculture are shown through feeding trials that it has improved both the health and welfare of farmed fish. All feed innovators involved in the testing were impressed with how it exceeded their expectations, including filet composition and the measurable levels of omega-3 fatty acids.

Human Nutritional Support

Nutriterra is a Friend of the Sea certified sustainable canola crop that supports soil and pollinator health. As an approved source of complete omega-3 fatty acids with a

fully traceable production chain, it ensures consumers can trust each step of the process and that it has high quality and proven purity. Previously omega-3 oils rich in DHA and EPA were exclusively marine sourced, but the continued pressure on oceans has increasingly become a concern, especially to consumers.

A study published in the *Frontiers of Nutrition* journal gives Nuseed Omega-3 Canola expert endorsement for product safety. The peer-reviewed study concluded that the Nuseed Omega-3 Canola oil is safe for human foods, nutraceuticals (supplements), and animal feeds.

Benefits to fish include enhanced sustainability, improved outcomes, and an increase in survivability in farmed fish. As a source of sustainable, plant-based omega-3, Aquaterra reduces pressure on marine sources of the essential fatty acid.

According to reports from the World Health Organization, many people lack omega-3 in their diet, which affects health and well-being globally. Higher omega-3 consumption supports human health in several ways and clinical trials have shown that Nutriterra is safe and effective as a source of these essential fatty acids.

Consumers have been looking for plant-based alternatives for many products, and now omega-3 supplements can be added to the list. This is a win for growers, processors, and consumers alike as it takes the pressure off traditional ocean-based sources, is sustainable, and there is room for growth within the sector.

A 2021 survey by Nuseed Nutritional U.S. Inc. showed that over 60% of consumers would choose a plant-based omega-3 supplement if it was an option, with the rising importance of essential fatty acids for human health in all areas from mental to physical health. A study done at King's College revealed that omega-3 fatty acids have anti-inflammatory properties that can help support cognitive health, add that to the known physical health benefits for the heart, eyes, and skin, and there are more reasons for using omega-3 nutraceuticals.

| ANALYTE | | STANDARD CANOLA | AQUATERRA® OMEGA-3 |
|-----------------------------------|-----------|-----------------|--------------------|
| Palmitic | C16:0 | 3.9 | 4.3 |
| Stearic | C18:0 | 1.6 | 2.7 |
| Oleic | C18:1n-9c | 63.6 | 42.3 |
| Linoleic | C18:2n-6c | 13.1 | 7.2 |
| α-linolenic acid (ALA) | C18:3n-3 | 10.3 | 20.2 |
| Stearidonic acid (SDA) | C18:4n-3 | 0.0 | 2.3 |
| eicosapentaenoic acid (EPA) | C20:5n-3 | 0.0 | 0.4 |
| Docosapentaenoic acid (DPA) | C22:5n-3 | 0.0 | 0.9 |
| docosahexaenoic acid (DHA) | C22:6n-3 | 0.0 | 9.2 |
| Sum: EPA+DPA+DHA | | 0.0 | 10.5 |
| Total Omega-3 | | 10.4 | 33.5 |
| Total Omega-6 | | 11.3 | 7.8 |
| Omega-6:Omega-3 | | 2:1 | 1:4 |
| Total Saturated Fatty Acids | | 6.7 | 8.3 |
| Total Monounsaturated Fatty Acids | | 68.9 | 46.9 |
| Total Polynsaturated Fatty Acids | | 23.5 | 41.3 |

Percentage of major fatty acids contained in conventional canola oil and Aquaterra® Omega-3 oil. Minor fatty acids omitted from the table.

Doctors and the FDA have recommended the consumption of omega-3-rich fish, like salmon, as well as supplements to boost omega-3 levels to support physical health. Consumers have indicated that there are barriers for some to using fish and fish-based oils to get EPA and DHA, including the fishy aftertaste of some supplements

and concerns over ocean health. Plant-based options provide the same benefits and give consumers comfort in the sustainability of their choices.

Heart, Eyes, and Skin

Heart – omega-3 ingredients DHA and EPA support heart health.

Accolades for Aquaterra

In 2020 the Global Seafood Alliance recognized Aquaterra from Nuseed as a finalist for their Innovation Award in recognition of its potential to double the world's supply of omega-3, a vital nutrient for animal and human health, with a particular focus on fish health.

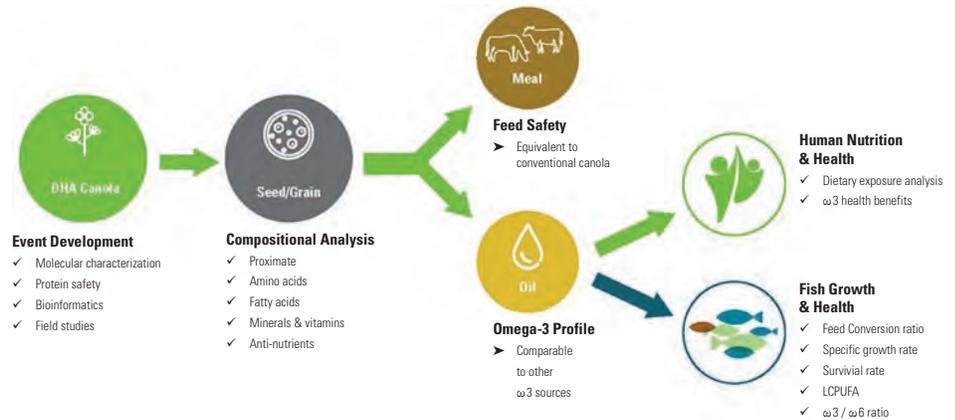
The GSA Innovation Award recognizes individuals and organizations who are finding new solutions to challenges facing the aquaculture industry. Established in 2012, the award has had applicants from around the world, and through three rounds of judging, winners are selected at the annual GOAL Conference.

Winners have come from India, Scotland, New Zealand, Norway, the United States, Brazil, Chile and Israel. Finalists are recognized for their achievements at the GOAL Conference as leaders in aquaculture innovation.

Additionally, Nutriterra was a finalist in the Nutra Ingredients Research Project of the year for 2022, listed as a game-changer in addressing the two major challenges in omega-3 nutrition: supply constraints and insufficient consumption.



Amplifying the power of plants with Nuseed Omega-3 Canola, benefiting human and animal health.



Katrina Benedicto, Nuseed’s Marketing and Communications Director for the product, there is a rapidly increasing customer demand and Nuseed is looking for more growers.

“The crop grows similarly to other canola varieties and the Nuseed program for growers gives them several key benefits, from access to seed, agronomy support, on-farm pick-up, and market access, plus other program benefits,” says Benedicto

Experienced canola growers will appreciate the herbicide tolerance to glufosinate and the overall emergence and plant structure of the varieties.

The golden future of omega-3 canola is bright indeed. As consumers become more aware

of the need to be sustainable, and health conscious and have trust in the sources of their food and supplements, they will be more invested in supporting the industry in both innovation and production.

“Not only does Nuseed Omega-3 Canola reduce pressure on the ocean to provide essential nutrition, it expands access to new consumers. Our research indicates that 64% of U.S. consumers prefer a plant-based omega-3 when provided an alternative to fish,” says Boettner. “People with plant-based diets, seafood allergies, concerns for ocean health, or a distaste for fish oil supplements now have an option that meets their nutritional needs without compromise.” 🌞

Eyes – DHA and EPA can help support eye health.

Skin – the care of skin for health and cosmetic reasons is a massive market with consumers looking for healthier looking and feeling skin. Omega-3 DHA and EPA help support the function of the skin barrier.

Omega-3 oils, like those found in fish oils and Nuseed Omega-3, have a long history of supporting physical health from cardiovascular, cognitive plus eyes, skin, and brain health.

In a recent article in *Food Engineering* magazine, it was noted that during the periods of COVID-19 isolation, it was not only people who were looking to improve their health, but they kept their pets’ health top-of-mind as well. Pets also enjoy benefits from consuming omega-3 supplements, and with many pandemic puppies now adult dogs, their health is a priority for their owners along with their own.

Growing Opportunities

Available since 2018, the majority of Nuseed Omega-3 Canola is currently grown in Montana and North Dakota, but according to

Increase Your Farm’s Profit Potential

Nuseed Omega-3 Canola has the potential to double the supply of DHA and EPA to the world, and we need capable partners to achieve this goal. With an attractive contract offering, here are some of the key contract points Nuseed offers Omega-3 Canola growers:

- Futures-based contracts with flexible pricing options
- Basis premiums to reward stewardship
- Local Nuseed agronomic and stewardship support
- Harvest flexibility for swathing or straight combining
- Incentives for on-farm storage if required

- On-farm pickup for grain
- Independent lab grading with samples taken during harvest, and at delivery
- Grower payment is within 30 days of pick up or delivery based on contract terms
- Local support for coordinating the delivery of planting seed, collecting samples and elevator delivery logistics
- Act of God contract clause (Force Majeure)

Canola growers interested in growing an ocean of nutrition can learn more here: Omega3Canola.com

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KNOWLEDGE TO SUCCEED

Nuseed's Sunflower University and Carinata University were hosted in February, delivering dealers and producers access to experts and agronomic insights.



After two years of virtual events due to COVID-19, it was clear that dealers and growers were happy to be back in the room at Nuseed's signature Sunflower University event. This year's hybrid event held February 8, 2023, in Pierre, South Dakota gave growers invaluable advice on everything from markets to pest threats to proper use of planting equipment.

Market Update

Opening the event was an update on the conflict in Ukraine given by Nuseed Europe Senior Director Damien Grundy and Konstantin Mishyn, country lead for Nuseed Ukraine. They noted that while the war has presented innumerable challenges for sunflower growers in the region, the world is responding by growing more sunflower to make up the four million-hectare shortfall in product that has resulted.

"There is a global shortage of sunflower seed and we expect high demand from many other countries for some of the leading hybrids on the market today," Grundy added.

According to numbers they presented, over a year since the war began, North America's sunflower market continues to see growth as a result of the increased demand for sunflower grown here.

Guy Christensen, Oilseed Marketing Representative at Archer Daniels Midland Company, said that in 2022 supply was the main concern, but total planted acres were above estimates. This year, price is on everyone's minds.

"We did get a 32% increase in planted acres for 2022. That was parlayed into a 40% increase in actual production. On top of that, we had even higher oil content than we average in a normal year, which meant a lot of extra oil for the market," Christensen said.

"Some years, we have demand and no supply, which would have been the case with the 2021 crop. Other years, we have more supply than we have demand. In 2023, we're going to deal with some excess supplies, which will have some impact on future planting.

That said, the overall vegetable market should be well supported by what's happening around it," he added.

Pests and Agronomics

This year's Sunflower University had a host of expert presenters from industry, extension and the Nuseed team. This year's topics included red sunflower seed weevil, planter parts and settings to optimize your seeding and the effects of soil pH on sunflowers.

Area agronomist Kyle Okke of Agile Agronomy spoke about a trend he's noticed around pH levels in soil in the Dakotas. He has noted that an increasing number of soil tests are coming in with low pH levels, and growers are curious as to what is going on and how it could affect them.

"Low pH thing isn't something that's just happened over the last few years. We're simply becoming more aware of it. With the increase over time of farmers choosing to variably apply site-specific nutrients, we're now site-specifically soil sampling nutrients

to know how to make the correct recommendations. That is starting to uncover the masked variability that we wouldn't have seen in traditional soil samples," he said.

"We're uncovering these things now, and it's starting to explain some of the phenomenon that we've seen where we have poor stands, potentially some poor weed control, and not seeing the yields we once saw."

So how did this happen? Okke explains for the past 30 years or so, crop rotations have become very nitrogen dependent. Because of zero tillage practices that have become dominant over the past three decades, growers have increased their nitrogen use in pursuit of high yields.

"What's happening as a result, is the nitrogen fertilizer itself is actually displacing calcium and other compounds that increase soil pH in the top levels of soil. Those compounds that keep pH high are being pushed deeper into the soil profile by the nitrogen. So, the top six inches of soil is becoming acidic. We're basically pushing all this calcium and magnesium deeper into the ground, and what's replacing it is hydrogen and aluminum, leading to low pH."

The solution? There are many, some short term but others longer term, Okke says. Ultimately growers will need to weigh the costs and find what works best for their farm.

Carinata University Launched

With its first growing season midway through, Nuseed was proud to host its first round of Carinata University, February 14 and 16, 2023. With events hosted in El Campo, Texas and Quitman, Georgia, Nuseed brought together Nuseed Carinata growers and local extension experts to talk about the progress of the crop and see where Nuseed could add potential benefits to help continue to push for growers' and the contract crops' success.

"This isn't about Nuseed," says Justin Ingalls, Nuseed NA Commercial Lead based out of Sioux Falls, South Dakota, at Carinata University in Quitman, Georgia. "This is an opportunity for you, to bring a crop to an area — to replace some cover crops with a new crop that provides value and benefits to you. They have some sustainability, some



Sunflower University attendees in Pierre, South Dakota.

soil health and give you an opportunity during those winter months to have some revenue off those acres."

Nuseed's Carinata University focused on updating producers on the growth in the program, future Nuseed Carinata R&D and also helping producers prepare for harvest. Attendees participated in a carinata combine clinic with experts from Bushel Plus. See page 34 for more information from this workshop.

Resiliency and Surviving the Cold Snap

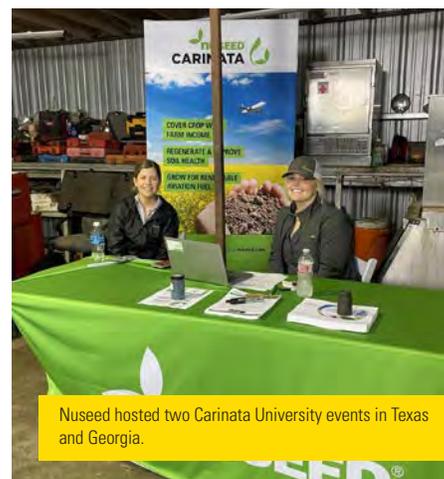
After a late planting, there was one major challenge growers in Florida and Georgia growing carinata experienced: a freak cold snap, where temperatures dropped below 20°F for close to 72 hours.

Fortunately, one major benefit of Nuseed Carinata hybrids is resilience — though no one wanted the cold, the freezing temperatures allowed the crop to really show off its capabilities.

In the coming days after the cold snap, it didn't seem like the Carinata crop was going to bounce back, says De Broughton, an Agronomist with 6 Gen Ag Services and Nuseed Carinata Field Agent based in Florida. In fact, Broughton was estimating about a 30% loss in the field.

"When you skip forward to February — it's even more lush," Broughton says. "It's amazing how much resilience it had, and it wasn't expected."

"Stand loss is going to happen with or without frost," says Logan Dyer, southeastern



Nuseed hosted two Carinata University events in Texas and Georgia.

R&D Agronomist for Nuseed. "We're not going to see as many plants at harvest as at emergence."

When it comes to the future of Nuseed Carinata, Dyer sees a bright outlook ahead for the crop. Our first hybrid Nujet 400 brought excellent agronomic advantages, and there are more hybrids coming soon in our R&D pipeline. ☀️

Sunflower University on Demand

The recording of the 2023 Nuseed Sunflower University is now available for viewing on our YouTube channel!

You can view it here:
https://youtu.be/_fYGNdaSRo

JETTING INTO THE FUTURE

Nuseed sees a high-flying market for Nuseed Carinata in North America.



As a member of the brassica family, carinata has some familiar relatives including canola, turnips, radishes, and mustards. This not-so-humble non-food crop is something of a new golden child for a world looking to sequester carbon and invest sustainable fuel sources.

In the U.S., Nuseed Carinata is grown between main crop rotations for lower carbon feedstock to replace fossil fuels and reduce emissions. The program's carbon savings will also be an advantage to local governments

and companies working towards carbon reduction targets and policies.

As the aviation industry increases its sustainability targets, and therefore its dependence on renewable jet fuels, market demand for advanced fuels is expected to grow.

Listed by the International Civil Aviation Organization (ICAO) as having similar greenhouse gas savings as top performing feedstocks, primarily waste and used cooking oil, Nuseed Carinata is recognized as a com-

parable carbon reduction sustainable aviation fuel (SAF) feedstock with the advantage of scalable, certified sustainable production. This has unlocked new market channels for the crop and new contract production opportunities for growers.

Market Development

Nuseed Carinata was first commercially introduced to Argentinian growers in 2019. Today's commercial production is exported to France and crushed by Europe's largest bio-diesel processor, Saipol, for certified, lower carbon oil feedstock and the meal co-product, a traceable source of non-GMO plant protein.

In February 2022, a 10 year Nuseed Carinata strategic offtake and market development agreement with bp was announced. One year from the signing of this agreement, the first shipment of Nuseed Carinata left the port of San Pedro, Argentina for crushing by Saipol in France. The resulting certified Nuseed Carinata Oil will be delivered to bp.

But that's not where the program stops. Nuseed Carinata is being scaled globally with commercial production already expanding in South America and the Southern United States, and development programs underway in Australia and Europe.

"The Nuseed Carinata teams in Argentina and globally have done a tremendous job of working with contract growers to increase certified sustainable production and collect the data for accountability from field to oil," said Brent Zacharias, Nuseed Global Group Executive. "We've connected local contract growers and global industry partners to add value through traceable independently certified sustainable production and greenhouse gas savings."

This past year marked the launch of contract production of Nuseed Carinata in the United States. Grown as a cover crop, its oilseed harvested then crushed for lower carbon oil feedstock and a high protein meal co-product for feed, gives flexibility for use as a cover and cash crop with the contract offered by Nuseed.

6 Gen Ag Services Owner, Independent Agronomist and Nuseed Carinata Agent, De Broughton explains, "In Florida, carinata fits



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CARINATA MARKET DEVELOPMENT

great with our system as it is hard to get good nutrients and water retention in our sandy soil, it breaks up the monotony of the same crop year after year, and, adds back biodiversity to the soil.”

From field to oil, Nuseed Carinata is delivering added value to growers, processors, and end-users.

New Carinata Research for the Future

While Nujet 400 is currently the flagship hybrid for contract production, Nuseed is hard at work developing new hybrids. Logan Dyer, a R&D Agronomist for Nuseed, says the major focus now is targeting increased frost tolerance and yields.

“We want to look at our hybrids having stable yields on low input fields,” he says. “With that, we were able to put out the world’s first carinata hybrid, Nujet 400, and we have a few more in the pipeline that continues to focus on that high yield and frost tolerance.”

In addition, Dyer says they’re looking at focusing on lodging resistance. Further down the pipeline, herbicide tolerance is also becoming a high-priority item.

“We’re looking at herbicide tolerance primarily for carryover from peanut and cotton being grown before — we want it to fit into that rotation really well,” he adds.

In addition to herbicide tolerance, early maturity is another trait that’s becoming more important, as Dyer notes that early maturity allows the crop to get in and out of the field at a faster rate. The goal is to have the Carinata mature earlier so growers can continue to get their cotton or peanut crop planted in time.

“Right now, we have about 50 trials going on through the southeast and Texas,” Dyer says. “Some of our main trials are going to be

“WE WANT TO LOOK AT OUR HYBRIDS HAVING STABLE YIELDS ON LOW INPUT FIELDS.”

planting date trials, where we have different varieties being planted earlier than what we recommend and later than recommended to see how we can handle frost, how we can make a comeback and what our yields are going to be.”

Dyer says if you had to rank the current focuses of Nuseed Carinata research, it would be:

- Frost tolerance
- Shorter maturity
- Herbicide tolerance

In 2023 and beyond, Nuseed Carinata will continue to expand contract grower support for rapidly growing commercial programs in the Southern U.S. and in South America. This in combination with Nuseed R&D teams in Australia and Europe working locally to advance development programs. ☀️

NUJET 400



Nuseed currently offers Nujet 400, the first hybrid grown under contract production. A tall, high branching, high biomass hybrid with large lower leaves it has strong agronomic performance with high disease and pod shatter resilience.

Nuseed Carinata Market Milestones

It’s been an eventful year in the growth of the Nuseed Carinata business and the program shows no signs of slowing down.





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ON THE DEFENSE

Whether it's red sunflower seed weevil, rhizopus head rot, blackbirds or weeds, researchers are finding new ways to ensure sunflower can thrive in the field.

Blackbirds on sunflower at a farm in Manitoba.

Defeating the Red Sunflower Seed

Weevil (RSSW) There are numerous insect pests that affect sunflower, but the big kid on the block remains the RSSW, especially in central South Dakota.

But the good news is that growers can fight back if they employ some integrated pest management (IPM) strategies.

"We've learned a couple of things over the past year. The first is that RSSW damage has been consistently high and consistently worse in South Dakota than in North Dakota, and we continue to have reports of insecticide failures in managing RSSW in South Dakota," says Jarrad Prasifka, Research Entomologist at the USDA-ARS in Fargo, ND.

"The other big thing we've learned is the value in relying on more than just insecticides. There are other techniques that can be used along with insecticides to battle this pest."

Seed weevil damage has indeed been worse in South Dakota, but Prasifka says North Dakota growers affected by the insect have felt the pain quite keenly; the weevil can

decimate a crop and leave growers fearful that the problem may return the next year. It's even found further north on the Canadian Prairies.

USDA insect surveys used to be done annually but are now done every other year. The next one is scheduled to be conducted in the fall of 2023, but until then, growers in the Dakotas are advised to be on the lookout.

"EARLY PLANTING IS STILL ONE OF THE MOST POWERFUL TOOLS GROWERS HAVE IN THE FIGHT AGAINST RSSW."

Adults are as long as 3 millimeters and are covered with reddish-orange, oval scales. The larvae occur in the upper third portion of developing sunflower seeds. They appear during late June on sunflowers and feed on the bracts where they form tiny holes. As the bud develops, adults feed on pollen produced by the flowers. Females lay their eggs inside the seeds. The larvae are small, legless and C-shaped in appearance.

In September, the mature larva chews its way out of the seed, drops to the ground and overwinters in the soil, coming back the following year.

"We've been continuing to advocate for using something else other than insecticides; insecticides will always be important, but what other tools can we bring to bear?" Prasifka says.

Integrated pest management (IPM) can be a powerful tool, making for an integrated approach that involves planting earlier and planting earlier-maturing hybrids.

"This is something that goes back 40 years. In the 1980s, there was really good research on that. People can be skeptical when you tell them that research done four decades ago can help solve a problem we have today, but that is indeed the case," Prasifka says.

That research, conducted from 1981-1984 by North Dakota State University researchers, shows that damage caused by red sunflower seed weevil was lowest (6.59%) on early-planted sunflowers and highest (84.9%) on late-planted sunflowers.

The researchers concluded that planting sunflowers early would significantly reduce damage caused by RSSW and would not appreciably reduce oil content and seed weight. Similar results were found in trials conducted by South Dakota State University in 1982.

“People will say, ‘Well, we have different hybrids today, and the weather is different now than it was then.’ But that research is as relevant today as it was in 1984,” Prasifka says.

To back this up, Prasifka took part in pilot studies in both North and South Dakota last summer and saw positive results with early planting similar to what was found back in 1984.

“It doesn’t seem to have changed much — early planting is still one of the most powerful tools growers have in the fight against RSSW.”

When it comes to the Dakotas, he advises that if you’re planting in the first half of May, you’re going to notice a benefit relative to planting in June.

“Even if you still see a lot of weevils, we found that if you plant early, you’re not going to see nearly as much damage. What we think happens is the weevils have to find the plant and then mate, and the females have to eat pollen for six or seven days before they develop eggs,” Prasifka says.

“So, even if there’s weevils all over your plants, if that’s the first sunflower plant they’ve been on, they’re not ready to go as soon as bloom starts. That’s my best explanation for why even when you have

quite a few weevils. If you’ve planted early, you can evade some of the damage.”

Of course, the battle against RSSW is not as simple as telling growers to just plant early.

“Telling somebody to plant in early May is not a good broad statement, because it depends on weather and it depends on where you are. In North Dakota, planting in early May might not always be reasonable. The window for crop insurance doesn’t start until around May 11 in many areas. But, if you’re in central South Dakota, your window starts as early as the end of April,” he says.

“In that case, the first half of May is not all that early. What I’m suggesting is don’t completely change everything about how you’re farming. Plant a single field early or plant a strip early and see how it works for you.”

He says he’s often surprised how few growers take advantage of early planting.

“Only about 5% of growers are planting in that first five weeks of the crop insurance window. Even though there’s a whole five weeks there, only one in 20 growers is getting their crop in that early. That tells us that the strategy is not being used much at all,” he adds.

He adds that insecticides remain a useful tool in the fight against the RSSW, but he recommends tweaking the way they’re applied.

“If you’re contracting with an applicator, it’s worth talking to them about having more gallons of water per acre applied to basically make sure you get better coverage.

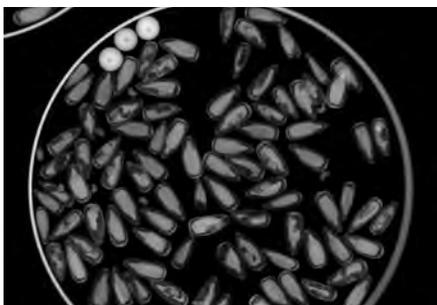


Examples of RSSW on sunflower.

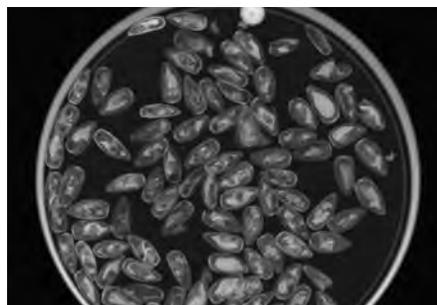
Or, are there any synergists that are aiding in increased efficacy? There is some data showing there’s chemistry that helps some of the pyrethroids perform better,” he adds. “It’s worth investigating.”

Battling Rhizopus Head Rot

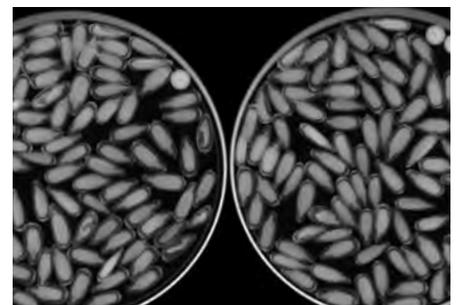
For the first time, researchers have been able to consistently create Rhizopus head rot disease symptoms in sunflower. This will help them further investigate the disease, how it works and how it might affect sunflower growers in the future.



A sample showing 51% weevil damage, planted on June 3. Photos courtesy Jarrad Prasifka



A sample with 96% weevil damage, planted on June 17.



A sample from sunflowers planted on May 16 showing 7-10% weevil damage.

SUNFLOWER THREATS

“It can be very difficult to consistently create infections with this disease, so we consider this quite an accomplishment,” says Bob Harveson, Extension Pathology Specialist at the University of Nebraska.

Researchers purposely wounded sunflower heads out in the field and applied the fungus that causes the disease. The result was a consistent occurrence of symptoms that gave them more insights into the disease that can often be little-known but cause significant damage to a field when present. In their research, up to a 60% reduction in sunflower seed yield was seen in previous studies.

“Now that we’re able to consistently produce symptoms, we can evaluate chemical products better that might be used to combat the disease.”

For Harveson, there still remains a lot of questions about when the best time is to apply products to combat the disease.

“This is a late-season disease that happens during the process of flowering. You don’t see it until the very end. We’re not totally sure why; it may come down to the genetics of the plant.”

Rhizopus head rot is a sporadic disease, seemingly to occur every few years. When it does pop up, it can be very destructive. According to the National Sunflower Association (NSA), the disease has been reported from all sunflower-producing countries around the world.

Although it has historically been considered to be of minor importance in the United States and Canada, it has also been documented as causing severe damage annually to sunflowers grown in Israel, the NSA notes.

It commonly poses a serious threat to production in the High Plains of the United States. Under the right environmental conditions, entire fields can be wiped out by it, Harveson notes.

It’s a disease that is caused by a fungus that is pretty much everywhere — soil, in the air, you name it. It can even show up on old bread, he notes.

“In sunflower, it’s not a problem unless the plant heads are wounded in some manner, because it needs help to get in there and grow. But once that does happen, it can be really problematic with sunflowers.”

It’s oftentimes considered a postharvest disease in vegetables, but it’s one of the few diseases Harveson can think of that hits a production crop in the field.

“Wind and hailstorms in summer will really stimulate this disease to take off, because it blows things around that cause wounds on the heads, and that gives the fungi an opening. Then, if you get hot weather, you’ve opened up the door for it to progress.”

Can Sunflowers Ignore Weeds?

Imagine sunflower hybrids that could thrive in a field full of weeds or other crop plants. Sunflowers that would literally “ignore” the weeds and other crops that surround them and grow to their full potential, without the need for herbicides.

Thanks to research being conducted by David Horvath at USDA-ARS in Fargo, ND, the above scenario might one day be possible.

Horvath is examining genetic data from Nuseed sunflower hybrids to see how they respond to weeds and high-density planting situations. He says by the beginning of 2024, a comprehensive paper will be published on which genes affect how sunflowers respond to competition in the field.

Theoretically, breeders can then create new varieties where these genes are turned on or off so the plants can better thrive among weeds or in double cropping situations.

Even though the research isn’t quite ready to be revealed yet, Horvath and his team have gleaned some key insights into how sunflower responds to weeds and competition from other crops — namely, that weeds do not reduce crop yield in the way we have traditionally thought they do.

“Everyone’s always thought the reason why you get reduced yields is because the weeds — and in some cases other sunflowers — are sucking up all the nutrients out of the ground and depriving the sunflower of

resources. But that isn’t why weeds are reducing yield,” Horvath says.

“Many growers are familiar with the critical period for weed control which takes place very early in the season, when the plants are tiny. If weeds aren’t controlled during that time period, you lose yield, even if you remove the weeds afterwards.”

The thing is, this critical period for weed control is early in the growing season. The weeds are smaller than the sunflower, for the most part, he notes.

“The plants are far apart, there’s usually plenty of moisture and nutrients still in the ground, right? But that’s the time period when the weeds are causing the sunflowers to reduce their yield.”



Thanks to research being conducted by David Horvath at USDA-ARS in Fargo, ND, sunflowers might one day be able to “ignore” weeds.



Severely infected head showing grayish fungus growing up through the head.



Severe Rhizopus head rot infection after a rainstorm.

Photos by Bob Harveson.

What Horvath and his team think is happening is that the sunflower, at that early stage in the season, detects the weeds, then changes its physiology from a high growth to a defense response, where it conserves resources and makes sure it expends just enough energy to grow enough seeds to ensure the next generation is planted.

“If we can figure out how that sunflower detects those weeds and responds to them at a genetic level, then we can block that response. The result is the sunflower can pretty much ignore the weeds, at least in most well-managed fields where growers have done a good job of fertilizing.”

He goes on to say that if the sunflowers are not panicking because they detect weeds, they will simply continue to grow to use the available nutrients to create as many seeds as possible.

“There are plenty of nutrients by the end of the season for them to get a pretty decent yield out of, even with weeds present or in high-density plant situations.”

He adds that the findings of the research may be able to help with double cropping and cover cropping as well.

“If you could create plants that essentially ignore other crops around them, you can throw in some camelina or another early-season crop that you can grow right along with the sunflower. As long as there’s enough nutrients in the soil for the sunflower to get good yield at the end, you can do that and get two crops off the same field. Who doesn’t like that idea?” Horvath adds. 🌻

Buzz Off Blackbirds

Can drones be used to keep blackbirds away from sunflower fields? Yes. But research done in 2022 shows the technology has a way to go before it can become cost-effective.

Page Klug, Researcher at the USDA-APHIS Wildlife Services, National Wildlife Research Center in North Dakota, is continuing her research and hoping to shed more light on the concept of using drones to drive birds away.

As reported in the 2022 edition of *Succeed*, during peak blackbird damage time in 2019 and 2020, Klug and fellow Researcher Mallory Gyovai White at North Dakota State University (NDSU) evaluated the behavioral responses of free-ranging blackbird flocks to 10 minutes of hazing (swooping and circling) with a large spraying drone. In collaboration with NDSU master’s student Jessica Duttonhefner, Klug had just wrapped up a study evaluating the efficacy of integrating an avian repellent (active ingredient methyl anthranilate) applied with the spraying drone.

In these studies, researchers found that the probability of a blackbird flock abandoning a sunflower field is greater later in the day, with smaller flocks, smaller fields, or when flocks are close to a field edge. Although they did not find an increase in flock abandonment with the addition of a repellent, they did find that flock size declined by 56% when the drone applied the repellent compared to 38% when the drone applied water.

Overall, drone use efficacy may be boosted by extending hazing time, increasing negative stimulus (adding repellents, other frightening devices or multiple drones), beginning hazing earlier in the season on small flocks to avoid establishment of foraging areas and by hazing in the morning (before the birds are satiated).

But there’s a snag. Using a drone to keep blackbirds away requires a manual drone operator, not to mention regular battery charging, and it’s currently unknown how much hazing is needed in terms of duration to

provide maximum effect. Klug says research planned for 2023 hopes to shed some light on this.

“There are producers who currently use drones, and we have found if you go earlier in the season when the flocks are smaller, you could potentially encourage them to move on from your field,” Klug adds.

“You’re probably not likely going to be able to encourage them to migrate, but they’ll probably end up going somewhere else and eating alternative forage. That’s part of it; protecting the field early so that they don’t establish that feeding area.”

While some growers are already using drones to keep blackbirds away, doing so is challenging and those growers don’t yet have all the data needed to know exactly how much time should be devoted to hazing for maximum effect.

“Right now, the question I mostly get is whether this is cost effective, because you have to have a manual operator out there operating the drone. My answer is no, it’s probably not cost-effective at this point. But we’re doing this research so that when we get to the point where the technology is there, where you can have a docking station to charge a battery and use artificial intelligence to pilot the drone, it can be a viable option for growers,” she says.

This type of research is important as well because the data generated can be given to engineers who might be working to design new drone systems built for this purpose, to make these drones more autonomous and cost effective.

“Using any frightening devices should be part of an integrated management strategy, and one sure way to avoid bird damage is to plant early, plant early-maturing varieties, and desiccate to enable harvest before peak blackbird numbers in October,” Klug adds.

CYCLE BREAKERS AND SOIL BUILDERS

Whether grown as a cover crop or cash crop, adding Brassicas like canola and Nuseed Carinata to your crop rotation has many benefits for your farm and bottom line.

Research and the numbers don't lie. A strong crop rotation has agronomic and economic benefits for your farm operation. Rotational crops improve the diversity, sustainability, and resilience of cropping systems by breaking disease cycles, improving soil structure and fertility, and providing more weed management options.

While canola/rapeseed and mustard are commonly grown in Canada and European countries Brassica crops — including canola, carinata, camelina and mustard — are still gaining ground in the United States. Seen as a very promising rotational crop, canola can be grown as both a winter and spring crop in several areas across the U.S.

The Pacific Northwest (PNW) Canola Association has been encouraging growers to include canola in their rotations for several years. The PNW Canola Association is working with growers to actively highlight the benefits of adding canola to traditional

“CARINATA IS A CROP WITH A HIGH LEVEL OF BIOMASS.”

winter wheat-fallow and winter wheat-spring legume rotations. The introduction of Brassicas to crop rotations has shown positive improvements in soil health, weed control, decreased input use, and yield bumps in the crops that follow canola in the rotation.

Soil Health and Structure

Nuseed Carinata is contract grown as a harvested cover crop between main crop rotations to regenerate soil and generate additional farm income. Growers cannot influence Mother Nature, but they can make strategic crop choices that can improve their soil health. Brassica crops, like canola and carinata both have large taproots that can help break up compacted soil and increase infiltration. The increased infiltration of water into the soil can improve the soil's ability to absorb and retain water.

“Because canola has this large taproot, compared with other crops, the taproot creates large pores in the soil, which is beneficial for

water infiltration. Therefore, you get more water storage and less erosion of soils,” says Haiying Tao, Assistant Professor of Soil Nutrient Management and Soil Health, University of Connecticut. “Canola is also capable of bringing the nutrients deep in the soil, that are left behind by wheat, up to the surface soils.”

She also notes that in addition to helping mine nutrients in the soils, the canola crop’s residue adds additional nutrients to the soil when it breaks down — a benefit for following crops.

Carinata brings all the same soil benefits as canola and well-known cover crops to contract growers in Georgia, Florida and Texas growing it primarily between peanut, cotton and soybean rotations during the winter months.

Disease and Pest Benefits

Crop diversification also helps to break disease and pest cycles and provide additional weed control options. Continuous cropping, or a very short rotation, allows the build-up of soil borne pathogens and insect pests specific to that crop. Over time these populations can become so large that it impacts that host crop, causing yield losses. By rotating to a different crop family, which is not a host crop for that pathogen, you can reduce the concentration of the pests in soil. Rotating crops also means that you will be using different herbicides and different active ingredients, reducing the build-up of herbicide-resistant weeds in your fields.

Cover Crop Benefits

As a harvested non-food cover crop, Nuseed Carinata has the same soil benefits as well known cover crops, but it also provides a contract opportunity for growers. Uniquely positioned, Nuseed Carinata is an independently certified sustainable, non-food contracted cover crop grown between your main crop rotations. It offers the traditional cover crop soil health benefits as well as a harvested product that is a certified sustainable lower carbon oil feedstock to help replace fossil fuels and reduce emissions.

“Carinata is a crop with a high level of biomass,” says De Broughton a Florida Agronomist, owner of 6 Gen Ag Services, and

Field Agent for Nuseed Carinata. “Which, after harvest, not only returns nutrients to the soil even in a low or no-till system, but it also leaves an improved residue layer to help the next crop in the rotation with better moisture and more access to nutrients.”

She adds that Nuseed Carinata gives growers a cash cover crop option that can improve even sandy, compacted soil. With rising input costs, especially fertilizer, accessing this higher nutrient soil can have a big economic benefit, over time.

“Carinata is low input, hardy in tough conditions like heat or drought and it has so many soil benefits,” she explains.

The benefits of cover crops increase over time. Some key benefits include:

- Improving soil organic matter and tilth
- Root structures can open soil to improve moisture and nutrient movement
- Supports low to no-tillage practices

- Sequestering carbon in the soil
- Dense foliage helps control weeds, erosion, carbon and moisture loss

A proper crop rotation and utilizing cover crops are an investment in the winter or next crop and in the ongoing efforts to your farm’s improved soil health and sustainability. ☀

State Stats



In 2022, North Dakota led U.S. canola production as usual with nearly 3.42 billion pounds, followed by Washington (231.4 million), Montana (159.6 million), Minnesota (127.84 million), Oklahoma (5.6 million) and Kansas (3.78 million).

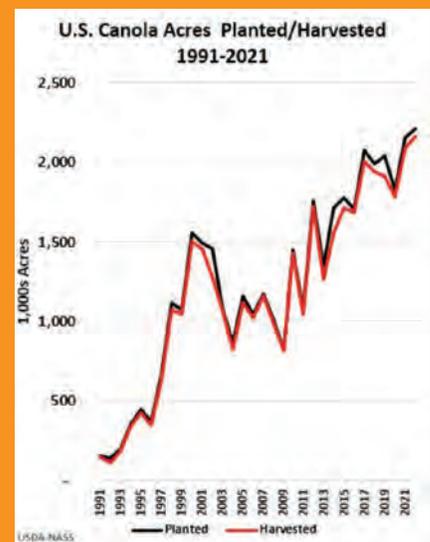
Source: U.S. Canola Association

U.S. Canola Production on the Rise

In the U.S., canola had record production in 2022, up a whopping 45% from 2021, according to the Oct. 12, 2022 crop report from the U.S. Department of Agriculture’s National Agricultural Statistics Service (NASS). Nearly 2.2 million acres were harvested with an average yield of 1,826 pounds per acre, resulting in 3.95 billion pounds of canola.

Looking back 30 years at NASS records, U.S. canola production has grown in spite of ebbs and flows, increasing more than 95% from 191 million pounds to nearly 4 billion. Yield has been erratic with several big dips (2002, 2007, 2012, 2017 and 2021) influenced by Mother Nature, however, production well outpaced yields during those years. More importantly, canola genetic traits have continued to improve, largely driving the 500-pound/acre increase since 1991, when yield was only 1,300 pounds per acre.

Planted and harvested U.S. canola acres have grown dramatically from around



150,000 in 1991 to well over 2 million in recent years. Planted and harvested acres were generally well aligned until the past eight years. With rapid and unforeseen climate changes, harvests decreased more than usual. It is likely that noticeable gaps between planted and harvested acres will continue. Source: U.S. Canola Association

FIELD READY CHECKLIST

From planting through harvest, this checklist will keep you on track to reach your sunflower, canola and carinata yield goals and maximize your profits. While each of these oilseed crops have some management practices that are unique to them, they all benefit from the best practices outlined below.



1. HYBRID SELECTION

- Choose hybrids based on market, herbicide tolerance, maturity and disease tolerance needed on an individual farm. Nuseed has a sunflower and canola hybrid right for every field and every market.

2. PLANTER BASICS

- Consult your planter manual for proper inflation and tire size. Unwanted population variation occurs with overinflation or underinflation of the meter drive system tires.
- Make sure planter is level front to back and left to right parallel bars are actually parallel.
- Check closing wheel alignment.
- Check disk openers for wear, the diameter of a new disk is 15". A disk worn smaller than 14.5" may create a W in the trench and cause difference up to 3/4" in seed depth.

- Make sure drives are all in good working order (chains, bearings and shafts).
- Make sure all chains and sprockets are properly aligned to prevent binding.
- Make sure all seed tubes and sensors are clean and functional.
- Row cleaners are vital. They should float freely with maintained pivot point and bearings. Residue left in-furrow can change soil temperature and cause delayed emergence.

3. AIR SEEDER BASICS

- Check opener disks for wear — most manufacturers' disks are 18"; if they are 17" or less, replace them.
- Examine firming and closing wheel arms; check bushings.
- Check the condition of the air delivery system, making sure the air system fan is operating at the proper speed.
- Check all hoses and distributors for wear, air leakage, cracks or blockage.

- Make sure seed boots are within spec (if more than 1/2" is burned off the bottom of the boot, it should be replaced. To check, use your tape measure and if the boot is less than 11.3", look into replacing the boot).
- Calibrate downforce to ensure the boot is running parallel with the ground (too much downforce will cause the seed boot to run deeper in the trench, and it will not run parallel to the ground).
- Make sure all bearings are in good condition.
- Check that you have the proper metering roll for the proper application. Also, check the metering roll for wear, and clean from any foreign material.
- Check meter calibrations prior to entering the field, and check your calibrations and seed usage after planting a few acres.

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4. BEFORE YOU PLANT

- Early-season weed control is crucial. Control early-season weeds with soil-applied herbicides or a pre-seed burn-off to keep fields as free from weeds as possible for the first four to six weeks.
- Utilize seed treatments for below-ground protection of insects and diseases.
- When appropriate, plan for and use a registered in-furrow insecticide at planting to control chewing insects.
- Proper seedbed preparation is required prior to seeding sunflowers and small seeded crops like canola and carinata.
- Whether using conventional-till or no-till, an even seedbed promotes uniform germination and emergence and good plant stand establishment.
- Consider crop rotation. A minimum three-year rotation to reduce disease and weed pressure is also recommended.
 - Sunflowers: Avoid back-to-back rotation with canola, rapeseed, dry edible beans and soybeans, or other crops susceptible to the same diseases as sunflowers.
 - Carefully plan your rotation to control problem weeds and also manage herbicide resistance. Always follow registered uses and label instructions.

- Meet the crop's specific nutrition requirements and fertilizer for realistic targets according to geography, soil type and annual precipitation. Remember, overfertilization can do more harm than good, and fertilizer should never be placed in the seed furrow.

5. PLANTING CONSIDERATIONS

- Soil temperature
 - Sunflowers: Temperature needs to be at 50 degrees Fahrenheit or more for your chosen soil depth (1.5" to 2.5"). Planting sunflower seed into cold soils may cause seed to go into dormancy, resulting in delayed germination.
 - Canola: A good starting point for seeding canola is when the three-day average soil temperature in the seed zone is 40 degrees Fahrenheit. This is the temperature where biological activity typically begins. Canola germinating and growing in cool soil conditions will have prolonged exposure to diseases as well as insects.
- Planting depth
 - Sunflowers: If planting deeper than 2", consider increasing planting population. Percent emergence will decrease as planting depth is increased. Confection sunflowers should never be planted deeper than 2".
 - Canola: Canola must be planted into moisture! Recommended seeding depth for winter and spring canola is 0.5"-1.5". If moisture is deeper than 1.5" and the drill is capable of placing seed deeper, it is preferable the seed is not covered with more than one inch of soil.
- For good seed-to-soil contact, make sure soil is pressed firmly against the seed at planting and the furrow is closed following seed placement. Poor seed-to-soil contact will result in uneven emergence. This is important in all crops, but particularly for sunflower. Moisture first needs to get through the woody hull and then to the seed.
- When planting into no-till, stop and check incrementally that the planter is knifing into the soil. Planting into a field with wet residue can cause "hair pinning" — pushing straw into the seed slot instead of slicing through it. Row cleaners should be able to move residue away from the furrow to prevent hair pinning. With air drills, very little can be done; wait for better conditions and consider residue management options.
- Be willing to dig seeds to check placement.



Sunflower Considerations:

- Be prepared to switch plates, baffle settings, singulator or double eliminator settings and vacuum or air pressure for desired singulation. Revisit settings between seed lots.
- Use a lubricant, such as eFlow 80/20 Seed Lubricant.
- Ensure your vacuum is set properly as your skips and multiples should be close to equal (if more multiples, lower your vacuum; if more skips, increase your vacuum).
- Know the speed at which your planter's meters operate best for each seed lot. Some lots may require faster or slower speeds than normal.
- Consider filling your planter hoppers half full to reduce bridging potential.
- Because seeding rates are based on commercial grain characteristics desired by specific end-use markets, review Nuseed seeding rate recommendations for the chosen hybrid.

Canola Considerations:

- Winter canola – the seeding window varies from July-September. Row spacing is commonly set at 12-28".
- Spring canola – typically seeded in April or as soon as field conditions permit and soil temperatures are suitable. Row spacing is normally set at 7-12".

- Hybrid seed size varies. Be sure to use the Thousand Seed Weight when calculating your seeding rate.

6. IN-SEASON

- Base herbicide decisions on the specific weeds present in fields at time of spraying.
- Use of herbicide-tolerant sunflower and canola hybrids in addition to soil-applied and preseason herbicides will result in optimal weed control and help reduce resistant-weed development risk.
- Scout after herbicide spraying to confirm control of target weeds.
- Use integrated pest management strategies for optimal insect control. Correct pest identification is key. Scout fields weekly for pests in-season. Scout fields more often (twice per week) as key pests come into critical windows based on an insect scouting calendar.
- Follow correct scouting protocols and base insecticide application decisions on economic thresholds.
- Sunflower Considerations:
 - Scout before bloom for rust to manage it in-season.
 - Apply fungicide at the R-5 stage on crops infected with one percent or more sunflower rust on upper four leaves.

- In all regions, seed-boring insects can be controlled with insecticides during the bloom stage.

Canola Considerations:

- Scout early to monitor for flea beetle damage to seedlings.
- Canola is impacted by above and below ground insects so be sure to check the roots for damage.
- Scout at the early bloom stage to monitor for sclerotinia and consider fungicide application if needed.

7. PRE-HARVEST PREP

Sunflower Considerations:

- Get the crop off early by applying a desiccant. Natural sunflower dry down can be slow and uneven. By speeding up the dry-down process, chemical desiccants decrease crop losses due to inclement weather, lodging, disease and bird depredation.
- Desiccants can be applied to the crop once plants have reached physiological maturity. At this point, seed moisture is about 35%, the backs of the heads turn yellow, and bracts turn brown in color (R-9 stage). Applying desiccant before this stage may reduce test weight and seed quality. Remember to check local regulations for approved desiccants.



8. HARVEST

- Check test weight when harvesting.
- Keep a clean combine to reduce fire risk. Blow the combine down at least twice daily and have fire extinguishers on hand.
- Sunflower Considerations:
 - Sunflowers are ready for harvest when the backs of the heads turn from yellow to brown. Prepare harvest equipment — minor adjustments to combines can make a big difference at harvest.
 - Cylinder speeds should range from 300 to 500 revolutions per minute.
 - Concave settings should be open.
 - Use the slowest cylinder speed with the largest concave opening to reduce seed damage.
 - Adjust the fan to accommodate sunflower seeds, which are lighter than other grains, so that air flow keeps only trash floating across the sieve. If fan speed is too high, seeds will be blown out the back of the combine. If fan speed is too low, empties will end up in the grain, which will affect test weight.
 - Combine when seed moisture reaches 20% or less — experts recommend 12 to 15%. Seed moisture can be brought under 10% by drying for storage.
 - Combine speed should average between five to six miles per hour. However, today's large combines often need to travel more than five miles per hour to keep full — ground speed should keep the combine full for optimal threshing.

- The target for seeds thrown behind the combine is less than 10 seeds per square foot, which is 100 pounds of actual yield.
- Canola Considerations:
 - Canola is most commonly swathed or direct cut. The choice of method is often driven by field uniformity, pod integrity, time and weather.
 - The optimum stage to swath for both yield and quality is 60% seed color change.
 - Canola's harvest speed is slower than most small grains, particularly in dense stands or when stalks are thick. Adjustments will likely be needed depending on moisture, slope, and even variety.

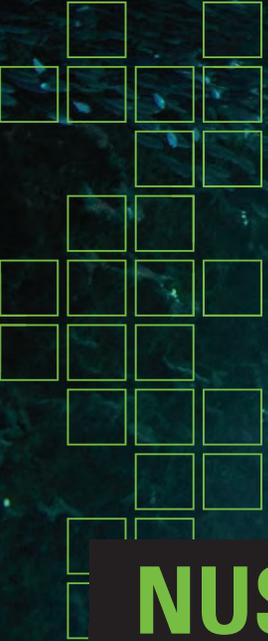
9. DRYING AND STORAGE

- All grain drying fundamentals apply, no matter what method is being used to dry the grain.
- When drying in a high-temperature dryer, constant monitoring is needed as the chaff, lint and other debris associated with sunflowers are highly combustible.
- In storage, monitor grain every couple of weeks when outside temperatures are warm and every two to four weeks in the winter months.
- Sunflower Considerations:
 - Check drying rates as sunflowers dry quicker than other grains because there are fewer pounds of water to be removed.

- Oilseeds (at 40% oil content) should be stored at eight percent moisture, however that value is determined by the oil content. Oilseeds with higher oil contents (closer to 45%) should be stored between seven and eight percent. Typically, confection and non-oil seeds can be stored short term at 10% moisture content, but for long-term storage growers must dry grain to 9%.
- Canola Considerations:
 - Condition canola to 8% moisture content and less than 60 degrees Fahrenheit as soon as possible after harvest, for safe long-term storage.
 - Monitor storage facilities closely within the first six weeks after harvest when respiration can be high. Regular monitoring should occur throughout the winter.

Sources:

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- Pacific Northwest Canola Association Production Strategies (<https://pnwcanola.org/for-growers/production-strategies/>)
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For a successful canola or carinata harvest, make sure your combine is functioning properly.

When it comes to harvesting, whether you're in the mindset of corn, soybeans, canola, sunflower or carinata, one of the most important factors — if not the most important factor — for a successful harvest is your combine.

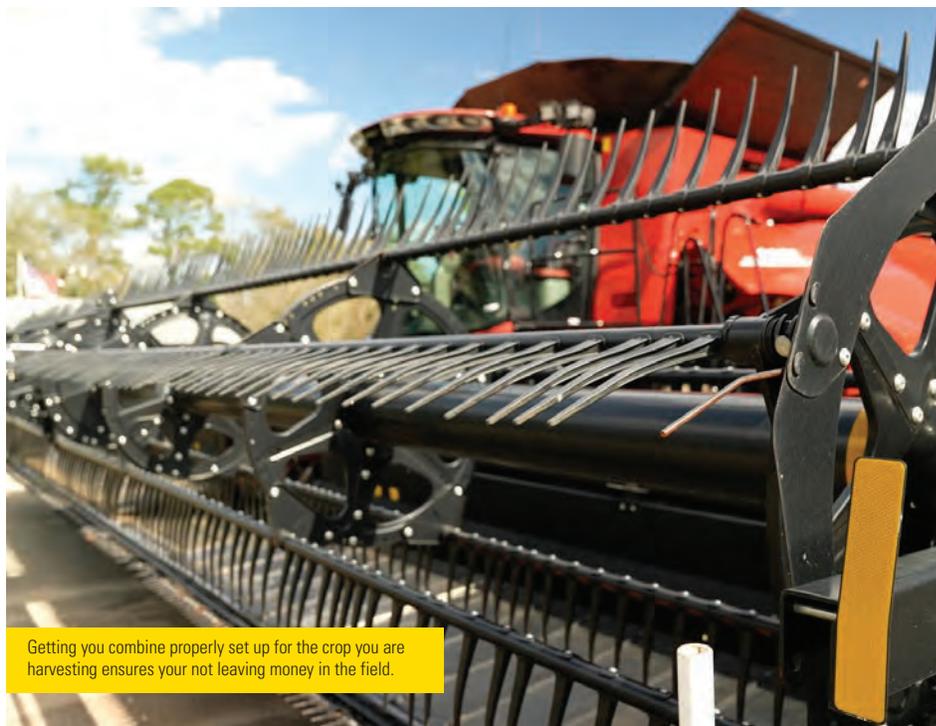
When gearing up for harvest, Marcel Krings, CEO and Founder of Bushel Plus Ltd., says there's one major takeaway from their combine workshop: ensure you're doing your preventative maintenance before you start harvesting.

"There are a lot of important, little things that people aren't often aware of in their combine," Krings, who presented at the Nuseed Carinata University in Quitman, Georgia, says. "We operate in 33 different countries, and the questions seem to be the same everywhere when it comes to combines — we realized there are experts like us that can help answer these questions, dial in the combine better and ensure the farmers can run their equipment more efficiently. The more crop you can save at harvest, the less harvest loss you'll experience."

Comb Through Your Combine

When it comes to preventing loss throughout harvest, one of the first pieces to start with is a thorough check through your combine. While it might be a tedious practice, double checking all the maintenance work of your combine helps minimize any issues during the short window of harvest you have.

That means ensuring that everything is working correctly, from the front of your combine to the back of your combine. Double checking points like knife speed and knife sharpness, as well as your overall header condition, kicks you off for a positive start to the season.



Getting your combine properly set up for the crop you are harvesting ensures you're not leaving money in the field.

For Murray Skayman, Product Development Specialist at Bushel Plus, one of the most important things to keep an eye on in terms of the header is your knife sharpness and knife speed.

"One thing that gets often neglected is your knife speed," Skayman says. "Speed is important — if you don't have the right speed, you won't cut clean, and if you're not clean, you're dragging stuff over."

Keeping that knife speed and knife sharpness in mind helps ensure that you're not clogging up your combine or suffering grain loss from uneven feedings.

"The main thing around the header is you want to feed the combine as evenly as possible," Krings says. "If you keep feeding piles and piles or uneven lumps, that's very tricky

for a combine to process. This is really where your success starts."

In addition, Krings notes that the wear of your guards and your knife speed is also important for reducing your fuel consumption.

"If you have bad guards or bad knives on your header, that takes a lot more horsepower to drive," he says. "You might not think of it right away when you look at it, but it's super important to keep this maintenance up to date preharvest."

Moving past the header of the combine, you come across the threshing department. According to Skayman, you want your threshing done in the concaves as soon as possible, as you don't want unthreshed material getting too far back into the combine.

In addition, ensuring you've done all your machine calibrations is important.

"It's one of those things again we can do prior to harvest," Kringe says, adding that performing calibrations beforehand really ensures you're performing well in the field during harvest.

After ensuring your combine is completely calibrated and maintained, from there, it's all about ensuring you're minimizing grain loss.

Ways to Minimize Loss in the Field

While pre-maintenance on your combine can do a world of good to help minimize your losses during harvest, we all know there's always a chance that when you start harvesting, there might still be some combine issues that pop up.

"Although that might seem like something to wash under the bridge," Kris Kristjanson, Technical Sales Manager at Bushel Plus, says, "that could have the potential to be a lot of lost money."

Checking the actual grain loss of your combine has always been a dusty and dirty job to get down on your hands and knees and look for kernels. It's also proven that looking on the ground is not an accurate enough method to find all the kernels which represent your lost grain on the ground. Even worse, running beside the combine with a shovel or throwing a pan to catch a loss sample is proven to be unsafe. At the end of the day we all want to come home safe to our families in the busy harvest season. The possibility of getting run over by large combine tires is not worth it.

"When you start the crop season, you have spent money to purchase the best seed and fertilizer," says Kristjansen. "Every step is well thought out to grow the best crop possible. You're spending money to have an agronomist come out to the field. You're going so far as to have fertilizer sample testing in the field, so you have the right amount of fertilizer. You're spending all this money to grow the best crop possible, so when harvest comes around, you want to make sure to get all the grain in the bin and have the least amount of harvest loss. In reality, harvest loss out of the back of a combine has been seen anywhere from 2 to well over 8 bushels

"IN FARMING YOU CAN REPEAT A LOT OF THINGS, WE CAN RE-SEED OR RE-SPRAY A FIELD, BUT WE CAN ONLY HARVEST ONCE. WE HAVE ONE SHOT AT IT SO WE WANT TO DO IT RIGHT,"

per acre (bu/ac). These are scary numbers but those are real life scenarios that we want to help you prevent."

He also adds, "In farming you can repeat a lot of things, we can re-seed or re-spray a field, but we can only harvest once. We have one shot at it so we want to do it right, because we reap all the benefits from our hard work earlier that year. We can't manage what we don't measure, so we need to check and dial in our harvest losses the best we can at harvest."

To help minimize losses during harvest and to make this process more efficient and safe, Bushel Plus created the Smartpan System — a remote-controlled drop pan system that attaches with magnets to the back axle or feederhouse of the combine and allows a pan to be dropped in the field with the use of an app or remote control to measure how much grain loss is happening from the combine in the field.

After the pan catches the sample, the sample can be cleaned within seconds through the use of the handheld air separator included in the Smartpan system. This allows you to separate the chaff and straw from the grain kernels in the sample without the use of sieves or your lung power.

The next step is to weigh your sample with the included field scale and input your findings into their SmartDrop app. From there, the app will automatically calculate how much grain loss you're experiencing in bushels and dollars per acre.

"To put it in perspective, the app will also show you the dollar amount lost per hour, which is a big eye opener," says Kristjanson.

"If you're losing a few bu/ac it can easily add up to a lot. For example, if you are losing 4bu/ac of canola, at a crop price of \$13/bu, and are harvesting about 20 acres per hour, that means you're losing over one thousand dollars per hour in grain! This is a number we have seen out in the fields. If you're good to jump in the cab that morning with a stack of \$1,000 bills and start throwing one out of the window every hour, then it's a conversation that we don't need to have. But if that's something you do care about, let's find out what's going on with your machine."

By calculating your estimated grain loss in the field, it might cause some time lost to harvest. But, when doing it right with a proper system, it will be safe and time efficient. Therefore in the long run, Kristjanson says it'll save you heartache and cash when you go to sell your grain."

If you aren't currently checking properly and think there might be a possibility you're losing \$800 to \$1000/hour in grain, you will benefit from taking 5 minutes to do a loss check with the Bushel Plus Smartpan System.

"It's a big eye-opener for growers in the field," Kringe says. "It allows them to pause and say: 'You know what? I do have 10-15 minutes to dial in the combine.'"

When looking for success in the field with your canola and carinata harvest, make sure you're starting with the easiest step: ensuring your combine is running up to snuff. 🌻

If you want to learn more about Bushel Plus Ltd's combine clinics and products, please visit [BushelPlus.com](https://www.bushelplus.com) or follow along on social media @BushelPlus.



Paul Knudsen has been a staple in the sunflower industry and helped develop the market.

KNUDSEN LEAVES BIG SHOES TO FILL FOR THE INDUSTRY

After 14 years of hard work and dedication in his position at Global Harvest Foods, Grain Manager Paul Knudsen will be exiting his role into retirement.

When reflecting on his time in the agriculture industry, Global Harvest Foods' Paul Knudsen's story begins all the way back when he was a child. Knudsen grew up on a farm in Northeast South Dakota where he was involved in the operation throughout the 1980s and early 1990s. He then embarked on his educational journey at the University of Minnesota and received a degree in Applied Economics.

Before his time at Global Harvest, Knudsen was employed by ConAgra Grain — now known as Gaviion — for 14 years, working out of Minneapolis, Minn. and Tulsa, Okla. At Gaviion, he was responsible for grain origination, merchandising, barge and rail freight trading and facility management.

Knudsen joined the Global Harvest team in 2009 at the Akron, Colo. facility where he spent his first year with the company learning about the various bird food ingredients and market.

"Global Harvest Foods was attractive to me as an employment opportunity because it was a family-owned, smaller business that had a very open and dynamic culture. It has always been a progressive company with motivated individuals driven to grow the company with innovative approaches to opportunities and problems alike," explains Knudsen.

Throughout his 14 years with Global Harvest, Knudsen has moved throughout the country, calling Tulsa, Okla., Nashville, Tenn., Marco Island, Fla. and now Lake Oconee, Ga. home. His current role with the

company encompasses the responsibility for the origination of sunflowers, milo, millet, corn and wheat, staging those grains to fit Global Harvest's logistical needs at its seven facilities across the United States.

The Perfect Partnership

Knudsen's partnership with Nuseed began not long after he jumped into his role at Global Harvest. He received the opportunity to appear at local grower seed meetings in S.D. and N.D. where he would discuss the markets, present contracting programs and create awareness of Global Harvest as a marketing option within the sunflower marketplace.

"I have gained a volume of knowledge about management practices, seed varieties, weed and insect control, fertility and so much more through my interactions with Nuseed representatives. They are always available to share their knowledge and opinions on every aspect of sunflower production and the associated challenges," he says.

Knudsen had the honor of being featured at the 2021 Nuseed Sunflower University where he presented on the bird food demand and market outlook.

"I very much appreciated the opportunity that Nuseed provided me to be involved in the 2021 Sunflower University forum. I enjoyed the questions that were asked and tried to promote not only Global Harvest Foods, but the sunflower industry as a whole," he shares.



Knudsen Welcomes Replacement TJ Collins

As Knudsen prepares to transition out of his role at Global Harvest and into retirement, he will be missed by many — especially his friend and fellow industry member Jed Wall, Field Sales Manager for Nuseed. Knudsen and Wall worked together closely on a variety of projects during Wall’s nearly eight years as a Sunflower Business Development Lead at Legend Seeds.

“Paul’s been a great voice for sunflower over the years — promoting sunflower, helping growers get lined up with contracts and providing growers with a reliable place to market their grain,” says Wall.

Luckily, the two still had the opportunity to collaborate once Wall began working with Nuseed.

“Paul is a man of his word,” continues Wall. “He will leave a legacy of honest and true business tactics. At Global Harvest, he was really in tune with the growers. He’s leaving behind not only a good book of business with

Based in Sioux Falls, S.D., TJ Collins looks forward to continuing Knudsen’s legacy as he transitions into the role of Grain Manager at Global Harvest. Collins has a vast experience, ranging from logistics, purchasing and finance from his nine years spent with the Navy to knowledge in the ethanol industry, grain trading and grain origination.

After working closely with Knudsen for several months, Knudsen personally approached him, encouraging him to apply for the open position. Due to his respect for Knudsen, he felt as though the role was a perfect fit.

“He’s an honest guy. He follows through with what he’s going to do. He’s very

good at communicating what’s out there for the next year and does a nice job of communicating with not only us, but the growers as well,” says Wall on Collins.

When asked about his greatest goals for this new position as Knudsen prepares to exit, Collins shares, “Paul will be sorely missed when he retires. But I do know that everything that I’ve been able to learn from him and take from his demeanor is going to be incredibly helpful as I go into the role. Working with Paul and trying to fill his shoes is probably going to be the biggest goal that I have and to continue to develop the business as best I can.”

the growers, but he’s also helped the industry continue to get acres in while ushering in the next generation.”

While Knudsen has achieved massive success, the love he has for the industry, solving problems and forging towards a successful future has made it difficult to

leave this world behind. He might be retiring, yet his mark will not soon be forgotten.

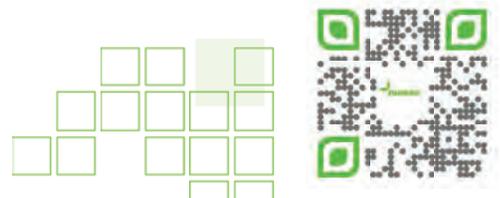
“I am grateful for the opportunities I have experienced and know that I will keep in contact with many of the individuals that have truly become friends,” concludes Knudsen. ☀️

FIND THE RIGHT HYBRID FOR YOUR FARM

Learn more about the latest cutting edge canola and sunflower hybrids from Nuseed and increase your farm's profit potential.



To download the 2023 Sunflower & Canola Hybrid & Market Guide follow the QR code or visit nuseed.com.



NEW AT NUSEED

Our staff is the backbone of the work we do at Nuseed. With growing markets, we're welcoming new team members as well as recognizing the hard work of our team.

WALL ELECTED TO NATIONAL SUNFLOWER ASSOCIATION BOARD

Nuseed's Field Sales Manager brings field and board experience to the table.

Nuseed's Jed Wall was elected to represent the hybrid seed industry on the National Sunflower Association (NSA) Board of Directors in December 2022. A Field Sales Manager with Nuseed in Wahpeton, N.D., Wall brings over 26 years

of experience in the sunflower industry with significant knowledge of the North American sunflower business to the NSA board.

In addition to being on the NSA board, Wall serves as a volunteer for a number of local



organizations giving back to agricultural education. He currently serves as treasurer for Farm Rescue, which is dedicated to supporting farm families in need and a cause near and dear to the Nuseed team.

OMEGA-3 CANOLA CONTRACTS PROVIDE GROWERS SOLUTIONS

Fort Benton's Ben Brimlow advises growers to keep up strategies that work and incorporate strategies that work better.

As a Field Sales Manager, North Central Montana-based Ben Brimlow supports growers by providing solutions through Nuseed Omega-3 canola contracts.

"Nuseed's Omega-3 canola contracts provide value to the farm in many ways including improved soil health from crop rotation diversification, and excellent weed management with the glufosinate tolerant trait," says Brimlow. "Producers will also benefit from basis contracts with flexible pricing options, local agronomic and stewardship support, on-farm crop pick up, a force majeure contract and a long history of delivering on commitments."

Farmers – specifically in Brimlow's focus area of Montana – have faced significant environmental and economic challenges this past year, including record drought, heavy grasshopper pressure and high input costs. In the midst of these challenges, Brimlow

has worked through Nuseed to provide drought-resilient canola varieties for dryland producers, competitive contract premiums, timely payments and force majeure contract clause to offer additional protection for producers.

"FARMING ISN'T SIMPLY 'A JOB' — IT'S A WAY OF LIFE THAT REQUIRES PASSION AND A CAN-DO MENTALITY."

When working with growers, Brimlow stresses the importance of keeping in mind that every farm is a unique operation with its own objectives, strategies and resources.

"Solutions should only be offered after needs are clearly identified; that comes with asking questions and understanding the operation," he explains.



SNAPSHOT
Field Sales Manager: Ben Brimlow
Location: Fort Benton, North Central Montana
Crop: Nuseed Omega-3 Canola
Motto: Improve every day. Be continually grateful for the sun, and the rain.

Brimlow's passion for canola and success in the field stems from his respect and love of working with growers. He understands the difficulties associated with farming and works to make the lives of growers easier in the process.

"There are many reasons I enjoy working with growers. Farming isn't simply 'a job' — it's a way of life that requires passion and a can-do mentality," he adds. "Many Montana producers are fourth generation, working the same ground their ancestors settled, respecting those that came before while adopting new technologies and strategies to steward the land for the next generation.

"Customers can look forward to a tried-and-true partnership with strong on-ground support." 🌻

NUSEED CARINATA HAS A BRIGHT FUTURE

Field Sales Manager Derek Barber looks forward to a successful new year with Nuseed Carinata.

Florida-based Derek Barber highlights the importance of working relationships with growers to help farms achieve production goals through Nuseed Carinata in 2023.

Nuseed operates the world's largest and most advanced carinata breeding program for top performing hybrid Carinata, according to Barber. Nuseed entered a 10-year strategic agreement with bp to accelerate market adoption for Nuseed Carinata.

"The benefits for growers are two-fold in increasing revenue as a contract grown oilseed harvested cover crop and ecosystem improvement," explains Barber. "Nuseed Carinata allows a grower the unique opportunity to receive all the benefits of a cover-crop (attract pollinators, ground cover, soil health, putting carbon back into the soil, living roots, etc.). In addition to the soil health benefits, growers can see nematode suppression and nutrients returned back to the soil through plant matter."

With the first commercial U.S. acres planted in November 2022, Nuseed Carinata is a newer, unfamiliar crop for growers. When growers come to Barber with questions, he prioritizes listening to their concerns.

"NUSEED CONTINUES TO LISTEN TO OUR GROWERS WHILE WE WORK WITH THEM THROUGHOUT THE GROWING SEASON TO HARVEST."

"Carinata is a new crop for growers, which will bring many questions. A big one is to just listen to customers and be honest with answers. Also, know that every farm has a slightly different situation regarding production management," he says.

The fall of 2023 will be the first year of the full launch, following the soft launch from



2022. Barber is excited for the benefits this will bring growers in the future.

"Nuseed is continuing to research and develop new hybrids with frost tolerance and earlier maturity. I'm looking forward to working with growers on rewarding sustainability and long-term contract commitments," he adds.

Nuseed is committed to increasing contract acres in 2023. Customers can expect training events, field days and a growing Nuseed Carinata team, says Barber.

"Nuseed continues to listen to our growers while we work with them throughout the growing season to harvest. We want growers to have a positive experience growing Carinata and working with Nuseed," he concludes. ☀️

THERE IS A PERFECT FIT FOR EVERY NUSEED CARINATA GROWER

Field Sales Manager Parker Bontrager finds new solutions alongside growers.

Based out of China Spring, Texas, Parker Bontrager is excited by the energy, soil and farm benefits from Nuseed Carinata as he shares how contracts are invaluable for customers that are new to the crop.

"Nuseed Carinata is grown for cover crop soil benefits and harvested for revenue. This is a great benefit to farmers, allowing them to

earn additional income between main crops, while protecting their soil throughout the winter from erosion, sequestering carbon, improving soil health and improving yield on following crops," he explains.

While many farmers in Texas are unfamiliar with Nuseed Carinata, that shouldn't stop them from growing the crop, according to Bontrager. With the help of Nuseed, growers



will have access to the knowledge and resources needed to be successful in the field.

"This is the first year for most farmers to plant Nuseed Carinata in Texas," says Bontrager. "Many have had to learn how to

set planters, seeding rates, herbicide use, etc. I have been there to ensure growers have the knowledge they need and have the best experience possible.”

During that transition time when getting familiar with the crop, the worst thing a grower can do is not ask for help, says Bontrager. He is always available to provide the best solution for each grower’s situation, no matter how unique it may be.

“Don’t be afraid to ask us for help! We know the harvested non-food cover crop is new and can bring new challenges and are here to help in any way we can,” Bontrager adds.

One thing growers must keep in mind is that one solution doesn’t fit all.

“Every farm is different. Each grower has a different set of issues they are dealing with. Be personal. Carinata has a fit, but it may be different for each grower,” he advises.

When looking towards the new year ahead, Bontrager believes that 2023 will be bright for himself, the company and customers.

“2023 will be the best year yet for Nuseed! Growers can look forward to getting Nuseed Carinata Contracts early and a great customer support base,” he says. ☀️

HOME GROWN SEEDS AND EARLY PLANNING EQUAL SUCCESS FOR SUNFLOWER AND CANOLA

South Dakota native Ryon Berry supports growers as they manage their own unique challenges on farm.

Field Sales Manager Ryon Berry is an expert on sunflower and canola and enjoys sharing his knowledge with growers to find the best solution alongside his colleagues at Nuseed.

“Nuseed has a knowledgeable and experienced staff, which is a resource to help plan where to best place the right genetics for the most likely challenges the farmer may face,” says Berry.

One aspect in particular that makes Nuseed’s sunflower breeding program so unique is that it is based within the U.S., which many programs can no longer say, according to Berry.

“Nuseed’s sunflower seed is developed in the U.S., selecting for genetics that perform best in our environment,” he explains. “Many other programs have moved overseas but those programs are less able to select for what performs here at home.”

While Nuseed’s sunflower seed is bred for success, the grower must also have a strong plan in place – preferably one that is

developed and implemented earlier in the season, shares Berry.

“A lot of the most successful growers I have worked with plan their crop rotation and input needs before spring. Early planning helps reduce supply challenges and often results in less stress on the farm,” he says.

“A LOT OF THE MOST SUCCESSFUL GROWERS I HAVE WORKED WITH PLAN THEIR CROP ROTATION AND INPUT NEEDS BEFORE SPRING. EARLY PLANNING HELPS REDUCE SUPPLY CHALLENGES AND OFTEN RESULTS IN LESS STRESS ON THE FARM,”

After a successful year in 2022, Nuseed has various projects in the works to further benefit its customers.



“There are a multitude of exciting things that customers can look forward to from Nuseed in the upcoming months. We have a new high oleic Express tolerant sunflower hybrid that will be going into on-farm field trials in 2023. We are also offering opportunity to capture a market premium raising our Omega-3 Canola. And as always, customers can look forward to Nuseed working every day to service their needs,” he adds.

While this industry is far from an easy one, Berry believes that the reward outweighs those difficulties, particularly when growers have a strong plan and the support of Nuseed.

“We face a lot of challenges in agriculture, but overcoming those challenges is what makes it so rewarding to be in this industry,” he says. ☀️

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- **PRODUCTION CONTRACTS** to grow **NUSEED OMEGA-3 CANOLA** for aquafeed and human nutrition markets
- **PRODUCTION CONTRACTS** to grow **NUSEED CARINATA** for cover crop soil benefits and harvested for revenue

