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WINNING WITH SUNFLOWERS

Volume 1 Planting 2018

Choosing Sunflower Hybrids

Think Return on Investment and Risk Management

PLUS

- Pre-Plant Planning
- Evaluating Seed Treatments
- 2018 Sunflower Market Outlook
- Seed Rates and Planter Adjustments

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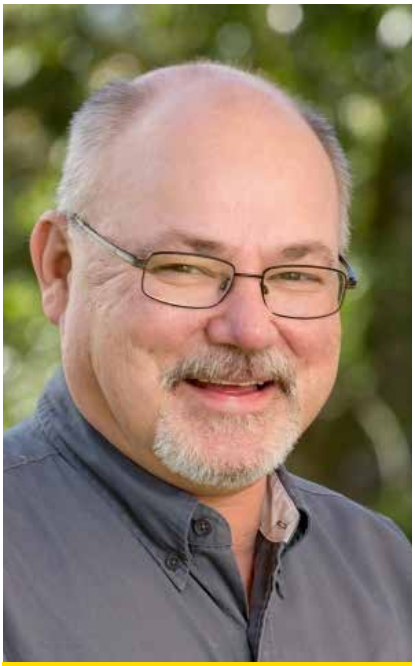
Is there still a home field advantage in this global economy? At Nuseed we have the best of both – a rich bank of global germplasm and the advantage of regional nursery and field testing to develop top performing hybrids with specific traits for local growers and processors.

Globally we are focused on three core crops with incredible potential to enhance food and feed: sunflower, canola and sorghum. Today in the United States we only sell sunflowers under the Nuseed® brand. That keeps me, as a plant breeder, very focused on bringing one or two high performing sunflower hybrids to market annually (after testing 1,500 in a single year).

Our U.S. based program definitely has benefits for local growers. We are testing our hybrids, as well as seed treatments in the same regions as our customers' fields. Disease pressure and insects are geographically dependent. Our ability to screen in these environments gives us an advantage as we select for the parent lines and hybrids that perform best in these conditions. We've also implemented a global quality assurance program so that only the very best goes in a Nuseed bag.



Editor's Note: Jim Gerdes, Nuseed R&D director of sunflower and trait development brings 27 years of experience developing top performing sunflower traits and hybrids in labs, greenhouses, nurseries and field trials in North Dakota, and around the world. His commitment and passion for sunflowers runs in the family, grown daughter Erin now works alongside Gerdes at the facilities in Breckenridge, Minnesota and Galchutt, North Dakota nursery.

Research technicians bag sunflower heads at the Nuseed nursery.

This planting issue of *Succeed* provides agronomic and marketing information to help local growers get their best results growing sunflowers.

Jim Gerdes
Nuseed R&D Director
Sunflower & Trait Development

Always follow product package and manufacturer instructions.

SUCCEED
Winning with Sunflowers

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CHOOSING SUNFLOWER HYBRIDS

Think return on investment and risk management.

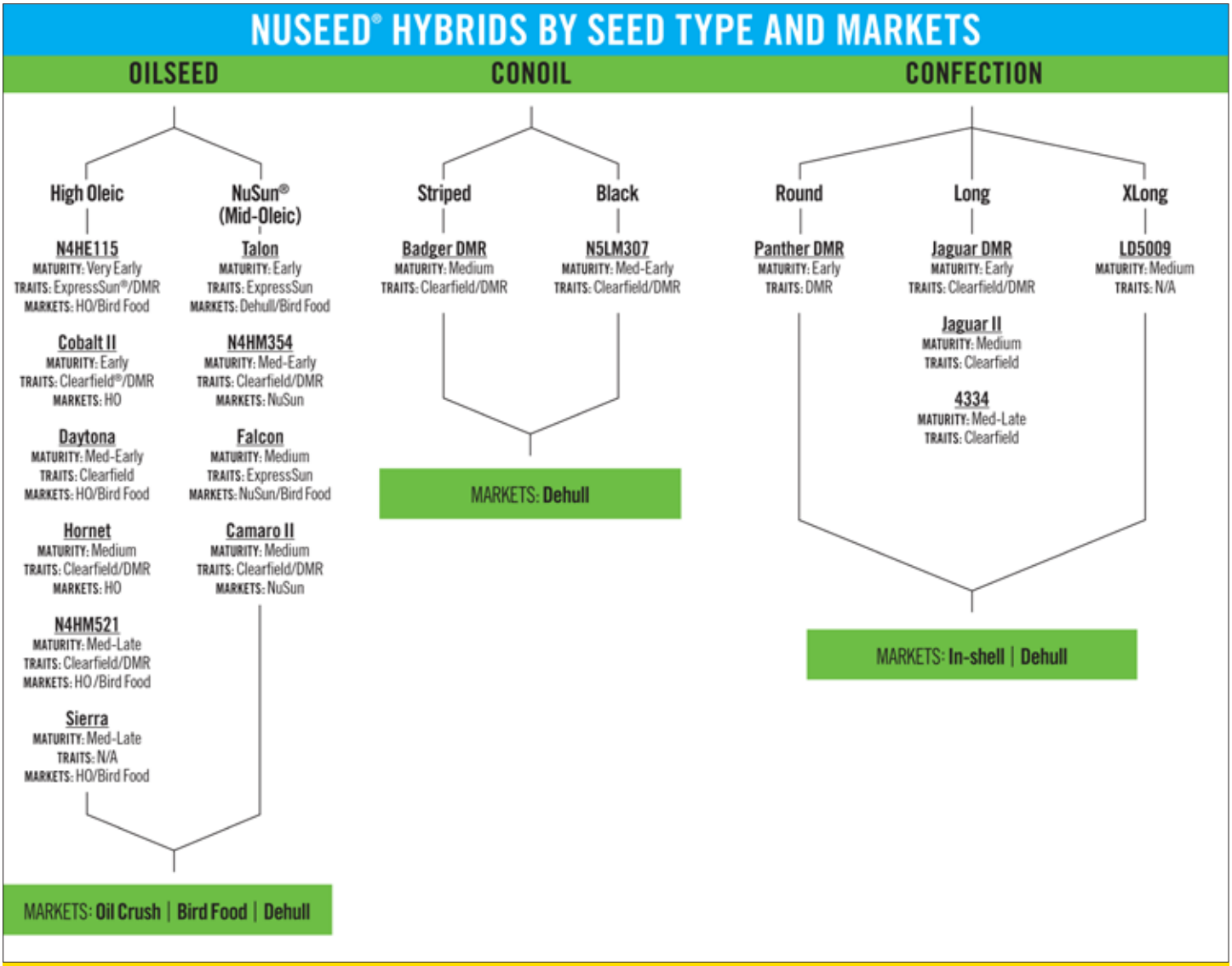
Alison Pokrzywinski
is Nuseed's sunflower technical agronomist.

Ask any producer why they grow sunflowers and nine times out of ten they'll say they make good money, says Fred Parnow, Nuseed's Canada business manager. As a crop, sunflowers offer a great return on investment, he says.

"If you put money into good management of sunflowers, they can be one of the best returns per investment cost you can grow," he says. "It's a pretty phenomenal crop."

Although financial gain may top the list of reasons producers choose to grow sunflowers, there are many others, says Parnow, including reduced risk. For example, sunflower production contracts usually include an "Act of God" clause, reducing a grower's financial risk when compared with producing other crops.

"Oil, confection, bird food, dehull – almost every market contract has an Act of God



Market Versatility: Most dehulls and confections are grown under contract. Conoils have the most market flexibility, sometimes being sold to in-shell confection, oil or bird food markets depending on processor criteria and market demand. Likewise, confection growers can sometimes sell into the bird food market.

clause. With a corn contract, you've got to deliver that corn," says Parnow.

Sunflowers also help reduce crop production risks, such as disease and insect pressure, environmental stress, and harvest timing, says Alison Pokrzywinski, Nuseed's technical agronomist. For instance, many sunflower pre-plant or pre-emergent herbicides employ different modes of action than those commonly used in other crops, reducing weed pressure and preventing herbicide resistance in fields. Furthermore, extending and diversifying crop rotation reduces disease and insect pressure in general, says Pokrzywinski.

Because they are a deep-rooted crop, sunflowers thrive under drier conditions and with fewer fertility inputs than other crops. Sunflowers can access moisture deep in the root zone as well as utilize nutrients that may be leached down in the soil profile. Not only are sunflowers beneficial for resource utilization, the crop helps producers manage environmental risks, such as inclement weather or drought.

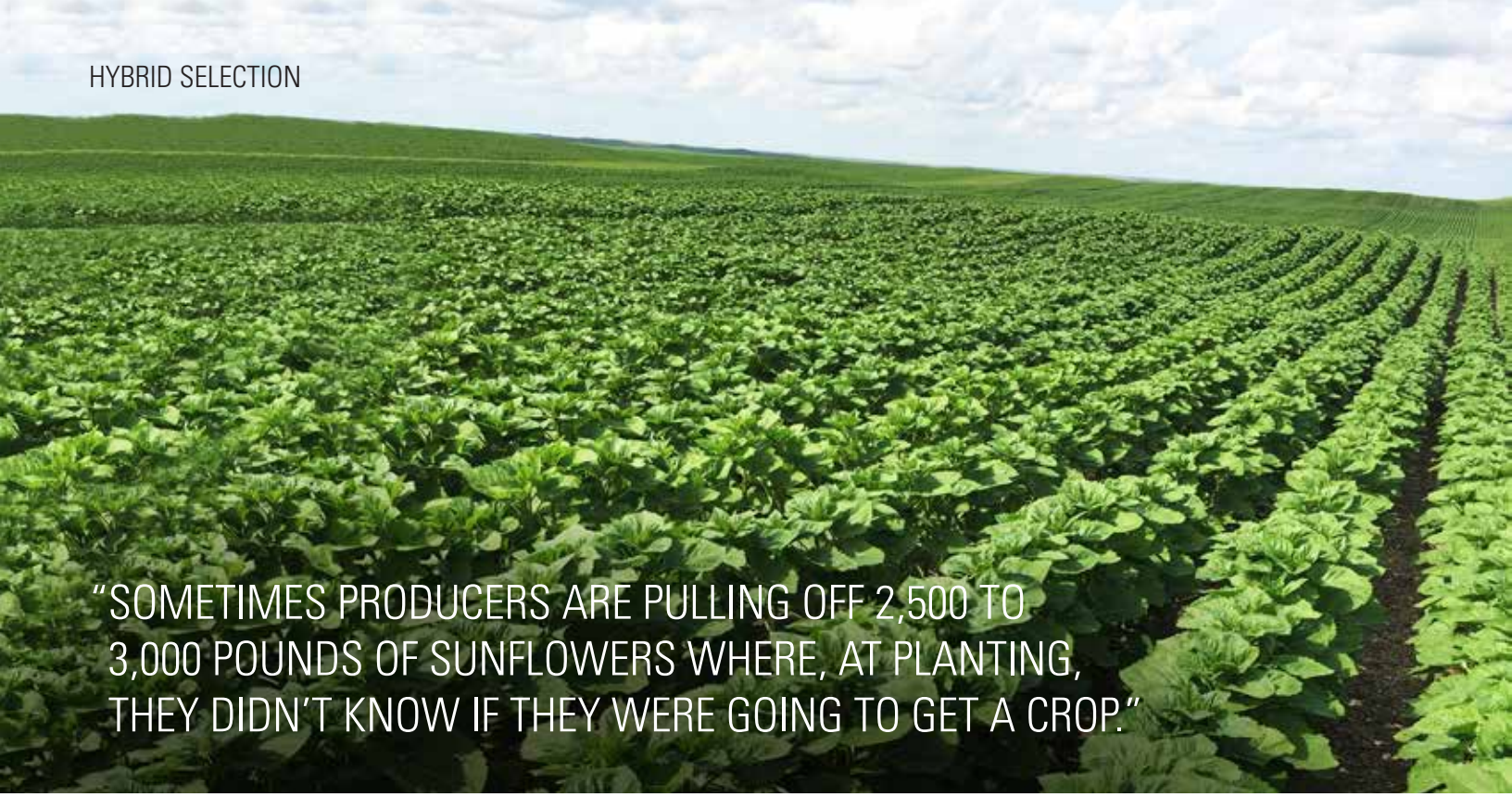
"One of the benefits of growing sunflowers is the use of subsoil moisture and nutrients. Sometimes producers are pulling off 2,500 to 3,000 pounds of sunflowers where, at planting, they didn't know if they were going to get a crop. That's spreading out your risk, as far as the weather goes, with respect to return on investment on your farm," says Pokrzywinski. Harvest risk is also diminished because harvest timing of sunflowers differs from other crops, she adds.

Marketing Versatility

Before choosing a hybrid an understanding of the different sunflower markets, and the risks and rewards of each, is important.

The three sunflower seed types – confection, oil and conoil – can be further divided by oil or visual traits and then again by buyer or end-use market.

1. Oilseeds are either high oleic or NuSun® and sold to oil crush, bird food or dehull buyers.
2. Conoil seeds are either striped or black and primarily contracted for kernel (dehull). Producers have the most potential versatility with conoils which sometimes sell to in-shell confection, oil or bird food markets depending on specific processor criteria and market demand.



3. Confection seed types include round, long or extra-long with in-shell or dehull as the primary markets. Sometimes confection growers have the opportunity to sell into the bird food market, again depending on processor or buyer criteria and markets.

"There are multiple market options, and sunflowers are a specialty crop. Many specialty crops are going to be positioned very attractively to producers. There's a lot of global supply right now of the big crops – corn, beans and wheat – giving good pricing opportunities for sunflowers," says Pokrzywinski.

The region the hybrid will be grown must also be a key consideration. The Nuseed portfolio has a top performing hybrid for every market segment and every region. Legend Seeds Dealers, the exclusive distributor of Nuseed sunflowers in the U.S., are an excellent information source on which hybrids are appropriate for their regions as well as what markets fit the producers' operations. Legend Seeds Dealers are also familiar with the production practices required for the hybrids they sell, such as machinery adjustments and planting deadlines.

Agronomic Traits

Hybrid decisions should also be based on the herbicides producers use on their farms. Sunflower producers only have two options for in-season weed control— BASF's Clearfield® or DuPont's ExpressSun® production systems. Nuseed's portfolio includes both herbicide tolerant traits. "It's important for producers to know which weeds are the primary issues on their farms or what weeds will be the issue in-season—and to choose their sunflower hybrid accordingly," says Pokrzywinski.

It's also important to consider disease pressure and when at risk, choose a hybrid with resistance to that disease, says Pokrzywinski. Different disease pressures occur at different times. Growing sunflower hybrids with different maturities can also help manage disease risk.

Seed treatments are a valuable risk management tool for the early stages of plant growth. Plenaris® seed treatment is available on several Nuseed hybrids. It provides excellent protection against all downy mildew races, and in combination with Dynasty® seed treatment, brings resistance management as additional control.

Risk vs Reward

"Often it's not just about the yield. There are so many other important aspects to what makes a sunflower hybrid the right fit on a farm," says Pokrzywinski.

When choosing a hybrid, producers may also want to consider the following:

- what processing facilities are within close proximity, such as oilseed crushing plants
- what grain types do the local elevators take
- the contract's delivery period
- storage requirements

"If you're a grower who doesn't have on-farm storage, you need to work with somebody that can haul right away. If you can store, you're usually rewarded financially," says Pokrzywinski.

Typically, conoils and confections offer higher contract prices than other markets. However, higher contract prices usually means higher stakes, says Pokrzywinski. For example, meeting contract quality standards for the confection market, such as seed size and insect and disease damage, is often challenging. Thus, management of confection or conoil crops is different from oilseed sunflower crops.

"THERE'S A LOT OF GLOBAL SUPPLY RIGHT NOW OF THE BIG CROPS – CORN, BEANS AND WHEAT – GIVING GOOD PRICING OPPORTUNITIES FOR SUNFLOWERS."

Legend Seeds representatives participate in a Nuseed training day for the latest information on the sunflower hybrids for their region.

The risk may be higher, says Parnow, but the reward is also higher. "The financial reward can be phenomenal. If you want to grow confection, you've got to have a few things going for you," he says. For example, before committing to a higher risk crop, producers should consider their cash flow requirements and storage capabilities.

"People want that grand slam price with confections. That's what they should shoot for. You may have to hold on to that crop for a while – it could be a year and a half. You've got to have good storage to hold a crop that long. Not everyone can do that."

In fact, producers should match their contracts with the needs of their farming operations, taking cash flow requirements into consideration, says Parnow. And when it's time to sign, read contracts thoroughly, he says. Always confirm your sunflower hybrid choice with your contract buyer or processor prior to seed purchase.

In terms of risk and reward, oilseeds are typically the easiest to grow and are the lowest risk, says Parnow; however, they also offer producers the lowest financial rewards of the three markets.

The bird food segment is also low risk but can provide excellent rewards, he says. This market segment can be aggressive in late summer, and the price can go up fast within a short timeframe, says Parnow.

"A couple of years ago, [the market] started at 18 or 19 cents and then went up to 24 cents really fast. It's usually a short window of time. For people in the bird feed business there's opportunity late summer and the peak is a short window – maybe about a month or two," he says.

Both the dehull and conoil markets offer excellent rewards at moderate risk to producers. However, no matter what market segment producers choose to enter, or what hybrids they choose to grow, quality is what matters most, says Parnow.

To achieve top quality, manage the crop properly, he says. "Sunflowers can be one of the most rewarding crops on the farm. Don't be afraid to give it the groceries – fertilize properly, spotless weed control and insect and disease management," says Parnow. "Treat the crop like it should be treated and you'll be rewarded very well for it," he says.

PRE-PLANT PLANNING: GET THE FIRST STEPS RIGHT

Achieving success with sunflowers requires getting the crop off to a good start. Two growers share the lessons they've learned when it comes to planting.

A very adaptable crop, sunflowers will grow in a wide range of soil types.

Travis Iglehart knows a thing or two about planting sunflowers for commercial production. His family has been growing the crop for the oil, confection and conoil markets for three generations at Iglehart farms, near Garrison, North Dakota. According to Iglehart, sunflowers are a versatile and profitable crop, not to mention good for the soil and for extracting water or nutrients deep in the soil profile.

"In wet years, sunflowers will get your soil back in shape. If there are nutrients left over, the roots will go down and get those, too," says Iglehart. "Sunflowers will excel in dry years, as well. They do what they can to survive with what they've got to work with."

Of the steps involved with sunflower production, planting is important to get right, and is central to a crop's success. However,

before planters are adjusted and seed is put in the ground, best results begin with pre-plant planning.

Crop Rotation

The biggest factor influencing Iglehart's sunflower crop success is crop rotation, he says. The benefits of his durum, canola, wheat, soybean, corn and sunflower rotation, are many, he says, noting reduced disease and weed pressure. He feels that planting sunflowers after corn further reduces his weed competition and fertilizer inputs.

"It's a big advantage to plant sunflowers after corn. Because you heavily fertilize corn, the sunflowers seem to take less fertilizer, according to soil tests," says Iglehart.

"SUNFLOWERS WILL EXCEL IN DRY YEARS, AS WELL. THEY DO WHAT THEY CAN TO SURVIVE WITH WHAT THEY'VE GOT TO WORK WITH."

"After corn, the field is pretty clean. With no weeds in the sunflower field, you get a better stand and no weed competition for the crop."

A minimum three-year rotation to reduce disease risk and weed pressure is necessary, says Alison Pokrzywinski, Nuseed sunflower technical agronomist. Rotate out of crops, such as canola, rapeseed, dry edible beans, and soybeans, that are susceptible to the same diseases as sunflowers, such as Sclerotinia, she says.

"Make sure you have some sort of grain, whether it be wheat or corn, in the rotation, so you can help keep your susceptibility down," says Pokrzywinski.

A broad rotation also allows the use of herbicides with different modes of action, decreasing the risk of herbicide-resistant weeds in the field.

Open vs Contract Markets

After planning sunflowers into the rotation, and before purchasing seed, an understanding of the different sunflower markets is important. Whether it's oil, confection or conoil, markets play a central role in a producer's hybrid choices.

Producers must choose the sunflower hybrid for the market they plan to enter and for the specific region where it will be planted. For Iglehart, who grows around 3,000 sunflower acres for all markets, hybrid choice depends on demand. Strong contracts or prices determine the hybrids he plants.

"I try to sell to the markets that have the higher demand, whether it's bird food, dehull or high oleics – whatever markets have the better bids," he says.

While planting most sunflower acres under contract, Iglehart will also sell on the open market. The crop's versatility allows him to sell to several different markets. "Most of the time the contracts are attractive, so you take advantage of them, and you can lock in a profit. I'll also roll the dice and hopefully get lucky on the open market."

Iglehart plants Nuseed's Hornet, Jaguar DMR, and N5LM307 hybrids. Hornet is a high oleic hybrid while Jaguar DMR is a confection hybrid. Introduced for the 2017 growing season, the N5LM307 hybrid is the first black conoil designed for the dehull market. All three hybrids carry the Clearfield trait and are resistant to multiple races of downy mildew.

Iglehart likes to diversify the hybrids he plants in one season. "If I grew all Hornets and the market is low on high oleic, then I'm out. If I diversify my sunflower acres, I can hit all the markets," he says.

Legend Seeds Dealers, the official Nuseed sunflower distributors in the United States, and the authorized retailers in Canada, know the sunflower hybrids best suited for their regions and the markets they can be used for, and will aid producers with their hybrid choices, says Pokrzywinski. However, before purchasing seed, growers must confirm with buyers or processors that their hybrid choices are appropriate.

"The first step is to talk to your seed dealer and decide what market you want to go into, and what market is a good fit," she says. "They know the right Nuseed hybrids and their planting deadlines."

Travis Iglehart is a third generation sunflower producer from Garrison, N.D.

Fertilizer Rates

After rotation, meeting the crop's specific nutrition and fertilizer requirements are important to attain best results, says Iglehart. Each year, he has his soil analyzed by a company offering soil testing, precision agriculture and crop planning. He follows the recommendations made for his fertility management plan to the letter. In the past, Iglehart admits he was putting too much fertilizer down, not knowing what the soil needed.

"My fertilizer rates are cut way back after using my agronomist's recommendation. They give me my best yield goals for the ground I have, with minimal inputs," he says. "Every field I'm putting on different amounts of fertilizer, not only nitrogen, but micros, like zinc – and some fields are calling for potash. I'm getting better results, better yields, and healthier plants."

Sunflowers may not require as much nitrogen as other crops, says Pokrzywinski, and over-fertilization may do more harm than good. It's also important to remember fertilizer can't be placed in-furrow, but there are still options to place it in the soil, she says.

"After planting wheat or corn, producers may think sunflowers need a lot of nitrogen. They don't, necessarily. In fact, you can have a negative response by applying too much nitrogen – your yield can decrease and your plants get very tall and lanky, and can lodge more. Assess what your soil has available against what your crop needs and apply accordingly."

Gord Graham, who grows around 5,300 sunflower acres near Rainer, Alberta, also pays close attention to nutrient and fertilizer levels in his fields. In addition to his cropping acres,

TRUE VERTICAL TILLAGE FRACTURES THE SOIL STRAIGHT UP AND DOWN, AND DOESN'T CREATE A HARD PAN, SAYS IGLEHART. "IT CAN GO FROM POOR YIELD TO A BUMPER CROP, JUST WITH SOMETHING SO SIMPLE."

Graham's operation includes a feedlot. He says access to manure has proved beneficial to his sunflower crop as it is an excellent source of fertilizer and good for his soil.

"It's a great resource for us. We don't put any commercial fertilizer on. It helps with the organic matter in the soil, which is much higher than the area average, and it's directly related to the manure we apply," he says.

Seedbed Prep

Proper seedbed preparation is required prior to seeding sunflowers. Whether it's conventional-till or no-till, an even seedbed promotes uniform germination and emergence, and good plant stand establishment.

Iglehart uses a true vertical tillage unit with fluted blades to get his seedbeds in shape, rather than a tillage unit with concave blades – a lesson he learned the hard way.

The concave blades created a hard pan in the soil, says Iglehart, and the planter had trouble seeding at a consistent depth. In addition, some plant roots didn't tap through the hard pan, and when storms passed through the area, the wind knocked some of the sunflowers over, he says. Meanwhile, the true vertical tillage unit he used on his other fields produced a different outcome.

"The difference was night and day," says Iglehart. "You could see the line in the field where the sunflowers did not blow over. It was an excellent stand; the seed depth was consistent, and it was a lot easier to plant into."

True vertical tillage fractures the soil straight up and down, and doesn't create a hard pan, says Iglehart. "It can go from a poor yield to a bumper crop just with something so simple."

In a no-till situation, Pokrzywinski recommends maintaining clean fields with good chemical control to get plants off to a strong start. She suggests applying a pre-plant or pre-emergence herbicide in addition to DuPont's ExpressSun® or BASF's Clearfield® production systems.

"The majority of growers are putting some sort of 'pre-' down, most of them being Spartan®, or something from the Spartan family," she says. Spartan, available in the United States, is a Group 14 pre-plant or pre-emergence herbicide with sulfentrazone as the active ingredient.

A Group 15 herbicide with the active ingredient pyroxasulfone, recently received a supplemental sunflower label in the United States. "It's another tool in the toolbox," says Pokrzywinski. "Having options helps break up glyphosate use." Always follow registered product labels carefully.

Taking care not to burn the seed by spreading the manure on his sunflower fields as evenly as possible, Graham says he must do more tillage than the average grower. "If we have a rough seedbed or too much trash, it's hard to maintain the proper seed depth," he says.

He also uses Yetter® wheels to clean debris away from the seed rows. "When you do tillage work, even if it's no-till, they're going to clear that trash, even small rocks or dirt lumps. It's just like seeding into a table-top-type environment, rather than into debris that will stop emergence," says Graham.

The planning and preparation growers do before pulling into the field is every bit as important as when they start putting the seed into the ground.

Darcelle Graham, National Sunflower Association of Canada executive director

STELLAR SUNFLOWER **MARKETS IN 2018**

Industry experts predict North American sunflower acres will increase in 2018 due to lucrative pricing, strong markets and 2017's yields.

John Sandbakken, National Sunflower Association's executive director

Expect U.S. sunflower acres to increase in 2018. Competitive prices, strong markets, tight stocks and the crop's performance under drought conditions last year are a few reasons producers will add sunflower acres into their rotations, say industry experts.

"I think we are going to see an increase in acreage. When you look at where new crop prices are at for 2018, sunflower is one of the crops that pencil out well, and can show a profit for most producers," says John Sandbakken, the National Sunflower Association's executive director.

A shrinking stock supply should keep sunflower prices in a strong position, says Sandbakken. "We did have pretty good beginning stocks, but by the end of the marketing year, I think we'll be in a very tight situation for stocks — which is good for 2018 crop prices," he says.

Although diminished stocks for both oil and non-oil sunflower types are predicted, confection growers may be particularly well placed in 2018.

"A bigger surprise for the market was the USDA lowered beginning stocks by 20,000 metric tons, which is huge," says Sandbakken. "It's making the scenario even better for confection growers."

U.S. sunflower yields were the third highest on record in 2017, despite severe drought conditions in the Dakotas and parts of Minnesota. Non-oil sunflower yields were the second highest on record. These high yields will also be a draw for producers, says Sandbakken.

"Everybody's very surprised at how well the crop turned out," he says. "In North Dakota, for example, the average yield only went down 80 pounds per acre. That's a very insignificant drop in yield given the growing climate last year. It really showcases the drought tolerance sunflowers have and how well they do in years when you have minimal amounts of moisture to work with," he says.

Another positive development, particularly for the confection market, is a weakening U.S. dollar. The United States exports about 50 percent of what it produces when it comes to confection varieties, says Sandbakken.

"Something that has held us back for the past couple of years is a strong dollar. The recent trend is the dollar is moving lower, especially in the European Union, which is one of our key markets for high-quality confection products. That's a real positive as far as exports moving forward for the rest of this marketing year."

In addition, the Mexican peso has gained strength against the U.S. dollar. Mexico is the second largest market for U.S. confection exports. A strengthened Mexican peso opens excellent opportunities for confection exports, says Sandbakken.

A steady increase in sunflower oil consumption, especially in the United States, over the past four years means strong demand and good growth in both domestic and export markets.

Most sunflower oil production is used in the United States, and about 75 percent of the remainder is used in Canada — the largest export market for oils, says Sandbakken.

"Both markets have seen very good growth and I think that trend will continue," he says.

Increasing oilseed acres in Canada are partly due to a robust bird food market.

"A BIGGER SURPRISE FOR THE MARKET WAS THE USDA LOWERED BEGINNING STOCKS BY 20,000 METRIC TONS, WHICH IS HUGE. IT'S MAKING THE SCENARIO EVEN BETTER FOR CONFECTION GROWERS"

"Farmers who like growing sunflowers have recognized new markets in Manitoba, and in other provinces, for bird food," says Fred Parnow, Nuseed's Canada business manager. "The price of bird food at the farm gate in Manitoba is lower than confections, but farmers recognize that oilseeds for bird food are lower risk than confections — but have excellent profit potential," he says.

Throughout the season, there are short-term, high demand spikes for bird food on either side of the border, says Parnow.

Also, with the gap narrowing between confection and oilseed prices, Canadian producers are opting to plant more oilseed sunflower varieties, says Darcelle Graham, the National Sunflower Association of Canada's executive director.

"Oilseed acres are starting to creep up. We're seeing more growers plant oilseeds just with the reduction in price between a confection and an oilseed," she says.

"We've had an additional market come up with dehull, and that may drive growers to it a bit more. It's also a little less challenging to grow an oilseed, and meet the quality specifications, than confectionary," says Graham.

Parnow also notes the demand for dehull-type sunflowers continues to be strong and consistent on both sides of the border, with many buyers in Canada and the United States.

Like their neighbors to the south, Canadian producers are taking notice of the sunflower plant's ability to perform well in times of moisture stress.

"It's a crop that can manage through drought, as well as mine down for nutrients that other crop types aren't reaching. It's a diverse crop that can fit into growers' rotations and provide them an alternative crop, which can potentially subsidize some of their other rotational crops in the off years," she says.

Understanding sunflower markets is particularly important for both U.S. and Canadian producers, as hybrid choice is based on market needs, or the needs of buyers, says Parnow. Furthermore, producers should match their contracts with the needs of their farming operations, he says.

Whatever market is sought after, 2018 should deliver profits, says Sandbakken.

"Sunflower looks very good. It's going to make some money. Overall, people are going to be more interested to put acres back into their rotations based on that," he says.

"Look at sunflowers to diversify your risk. Most of the major crops in 2018 have depressed pricing. You need to grow crops that are going to make you money, and sunflowers are a good option to do that, especially in key growing areas."

GROWERS RETHINK CORN AND SOYBEAN ACRES

When you do the math, sunflowers might surprise you.

Many growers with full bins, watching the corn and soybean prices are rethinking their 2018 planting strategy. Sunflowers with their profitability, rotation, seed treatment and agronomic benefits are penciling out to have very real advantages. "Sunflowers performed really well in dry conditions in 2017. They use nutrients and moisture further down in the soil. And when growers compare yield, income, and input costs, sunflowers can really improve their bottom line," says Nuseed field sales leader, Trygg Olson. "The marketing flexibility of sunflowers is also really attractive to a lot of growers. With the price of corn and soybeans, it's worthwhile for a grower to talk sunflower contracts with processors and secure their hybrids early."

Based on regional averages, the table at the right provides example comparison by crop of the cash price and yield needed for equivalent net returns.

"It only takes 1,480-lb sunflowers to give an equivalent return to 100-bu corn at $3.57/bu," explains Olson.

These numbers are approximate and are very dependent on weather and other influences.

Growers are encouraged to visit ag.ndsu.edu/farmmanagement/tools and click on the Crop Compare spreadsheet to make an assessment for their farming operation.

Prices which provide the same return over variable costs between oil sunflower, corn and soybean - *South Central ND*

Select Reference Crop	**Oil Sunflower**	
Enter Oil Sunfower futures price	**$0.180**	<= enter cash price if no futures market
Enter expected local basis (cash futures)	**$0.013**	basis is usually negative
Expected Oil Sunflower local cash price	**$0.193**	

The base price on sunflowers was $18.00 and a 2:1 premium on 43.5% oil.

Crop	Oil Sunflower	Corn	Soybeans	S. Wheat	Barley
Yield	1480	100	29	44	67
Relative Price	$0.193	$3.57	$9.23	$6.09	$3.93
Income	$286.00	$357.00	$268.00	$268.00	$263.00
Variable Costs:					
Seed	$33.00	$76.85	$65.75	$14.88	$12.40
Herbicide	$33.20	$20.00	$20.00	$25.20	$23.70
Fungicide	$0.00	$0.00	$0.00	$9.00	$9.00
Insecticide	$6.00	$0.00	$4.00	$0.00	$0.00
Fertilizer	$28.47	$56.97	$4.05	$47.70	$44.27
Crop Insurance	$13.40	$17.00	$19.60	$12.80	$14.30
Fuel & Lube	$10.06	$13.80	$8.76	$9.41	$10.41
Repairs	$17.60	$21.39	$17.16	$17.72	$18.36
Drying	$4.44	$18.00	$0.00	$0.00	$0.00
Miscellaneous	$15.50	$7.50	$4.75	$7.50	$7.50
Operating Int.	$3.84	$5.50	$3.42	$3.42	$3.32
Total Variable Costs	$166.00	$237.00	$147.00	$148.00	$143.00
Return Over Variable Costs	$120.00	$120.00	$120.00	$120.00	$120.00

Note: Only variable costs are considered in this comparison. You can include an amount under "Miscellaneous" to account for any differences between crops in fixed costs, labor, management and risk.

*Example only, using the NDSU 2017 Crop Compare Farm Management Tool. Numbers are approximate.

"IT ONLY TAKES 1,480-LB SUNFLOWERS TO GIVE AN EQUIVALENT RETURN TO 100-BU CORN AT $3.57/BU."

EVALUATING SEED TREATMENTS

Nuseed's Seed Treatment Technology Initiative assesses production tools on its sunflower hybrids, including Plenaris®, a fungicide to manage downy mildew.

Providing the latest research and information on crop production to sunflower growers, such as new products and practices, is vital says Jeff Coultas, a consulting agronomist overseeing the Nuseed® Seed Treatment Technology Initiative.

Seed treatment technologies assessed in the Nuseed initiative are evaluated for many criteria, including growth enhancement and protection from pests or disease, depending on the technology's purpose, as well as sunflower yield, oil content, seed size, and hybrid performance.

However, the project's primary objective is to evaluate the response of Nuseed hybrids to seed treatment technologies, says Coultas.

"Nuseed has initiated this type of project to evaluate how these seed treatments work, but more importantly, to determine if they have any effect on their product, which is the seed," says Coultas. "As a seed provider, you want to be sure there aren't any unforeseen interactions that could influence the genetics."

Jeff Coultas, consulting agronomist to Nuseed's Seed Treatment Technology Initiative explains downy mildew is an adaptive organism that requires effective management of new strains with new resistance genes as well as novel fungicides.

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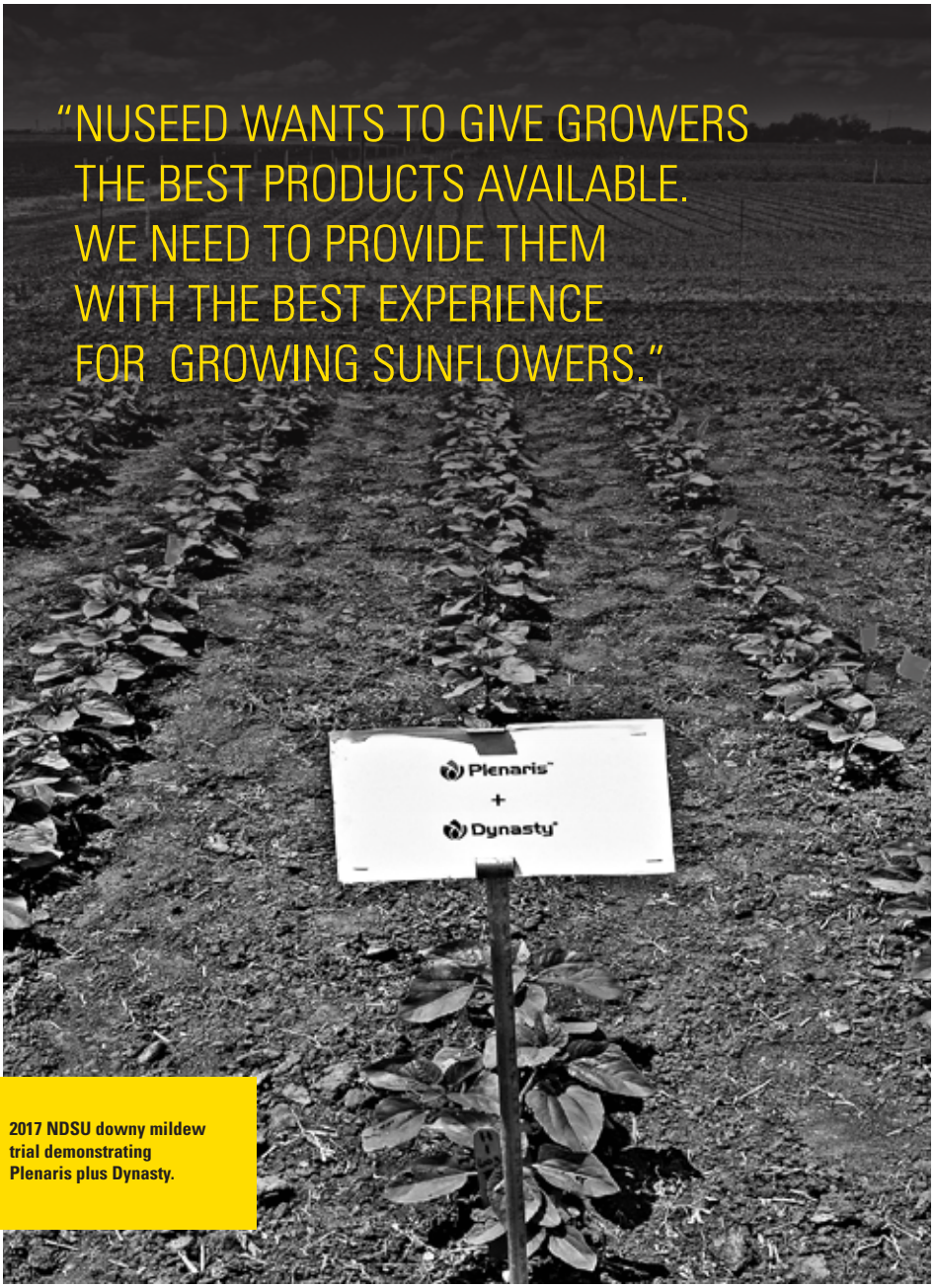

2017 NDSU downy mildew trial demonstrating Plenaris plus Dynasty.

For example, seed treatment fungicides Plenaris and Intego®, and the microbial seed inoculant QuickRoots®, among others, were tested on three sunflower hybrids and across multiple locations in 2017. Preliminary data indicates no negative crop response to these products across all hybrids and locations.

Nuseed's seed treatment initiative also includes studies on flowability, plantability and seed storage, as any substance added to the seed could potentially affect an aspect of crop production, such as seed singulation and spacing.

This information is valuable to growers, says Ross Hakes, Nuseed's sales and strategic marketing manager. "Nuseed wants to give growers the best products available. We need to provide them with the best experience for growing sunflowers."

Downy Mildew Field Trials

All downy mildew field trials included three sunflower hybrids, two oil and one confection, and were carried out on replicated plots at several locations in North Dakota, Minnesota and South Dakota, representing a broad base of genetic backgrounds and sunflower production areas.

Nuseed contracted field trials to assess CruiserMaxx® Sunflower with Plenaris on downy mildew control and crop response at three North Dakota State University (NDSU) sites – the efficacy field trials were carried out at Carrington, N.D., while traditional yield trials were conducted at Langdon and Minot, N.D. The field at the Carrington site was previously inoculated with spores causing downy mildew (Plasmopara halsedii) and irrigated at planting to heighten disease pressure.

Nuseed also carried out field trials to evaluate CruiserMaxx Sunflower with Plenaris on crop stand and vigor at test plot sites in Galchutt and Garrison, N.D.; Red Lake Falls, Minn.; and Hoven, S.D.

Field trial results indicated no negative crop responses to Plenaris across all hybrids and locations. Also, crop stand and vigor were not adversely affected by the seed treatment fungicide.

NDSU has evaluated Plenaris efficacy on downy mildew since 2011 under intense downy mildew pressure. Their results confirmed its superior efficacy.

Downy Mildew

Adding new seed treatment technologies to the seed, such as Plenaris, helps stay one step ahead of diseases, like downy mildew, that have many races and can adapt to overcome protection practices.

For example, since 1980, downy mildew races have overcome some downy mildew resistance traits in sunflower hybrids and have become insensitive to chemistries used to control the disease. Although crop rotation is effective for other sunflower diseases such as sclerotinia, rust and phomopsis, rotation has minimal effect on downy mildew management because overwintering spores will survive in the soil up to 10 years.

"Downy mildew is a primary example of a disease that can overcome all the control

mechanisms, whether it's crop rotation, genetic resistance or seed treatments. It's important to keep presenting new control tactics to keep it in check. It has the propensity to come forward with new races," says Coultas. "Because this is an adaptive organism, we need lots of tools. To manage it effectively, we continually need new resistance genes as well as novel fungicides."

Novel Active Ingredient and Multiple Modes of Action

In 2018, Nuseed sunflower producers will have another tool to manage downy mildew. Syngenta's seed treatment fungicide Plenaris will be available on select Nuseed sunflower hybrids.

Plenaris is currently registered for use in the United States in key sunflower states, and features a new active ingredient, oxathiapiprolin, and mode of action, FRAC Group F9, for downy mildew control. Registration is pending in Canada. Field trial results indicate Plenaris is highly effective on downy mildew. Essentially, we're looking at almost complete control across all of the most prevalent downy mildew races in sunflowers, states Coultas. The fungicide's efficacy has been evaluated in numerous independent field trials, including the Nuseed Seed Treatment Technology Initiative's assessment for crop safety, yield and efficacy.

Plenaris is combined with Dynasty® fungicide, providing multiple modes of action for resistance management and enhanced downy mildew control.

Cooperation is Key

Building and maintaining academic partnerships, like the one between Nuseed and the NDSU Extension Service, is an important element to developing, testing and implementing new tools for sunflower production, says Coultas.

"It's integral to the whole product development process to be able to work with interested, competent, academic personnel for credible third-party data for industry and growers to rely on. NDSU runs a top-notch academic program and is very effective across the board, but particularly with sunflowers – where there aren't many people doing work."

Academic partners, such as NDSU, are involved in many aspects of sunflower production research, and have been particularly helpful generating field trial data, says Coultas. Data that helps provide tools, like Plenaris, to growers.

As the exclusive Nuseed Distributor in the United States, Legend Seeds dealers will have current information on hybrids and availability, says Hakes, adding all Nuseed sunflower hybrids will eventually include Plenaris.

Hakes says the Nuseed Seed Treatment Technology Initiative will continue to test new technologies, helping to put new tools in growers' hands to meet their sunflower production goals.

"We want to continue to identify new technologies coming to market, and make them available to our customers. We need to do that as a company. Just as we would bring new hybrids to market, we need to bring the best seed treatments and technologies to market as well," says Hakes.

CHECK YOUR PLANTER

Pre-season maintenance will have you field ready and pay long-term dividends.

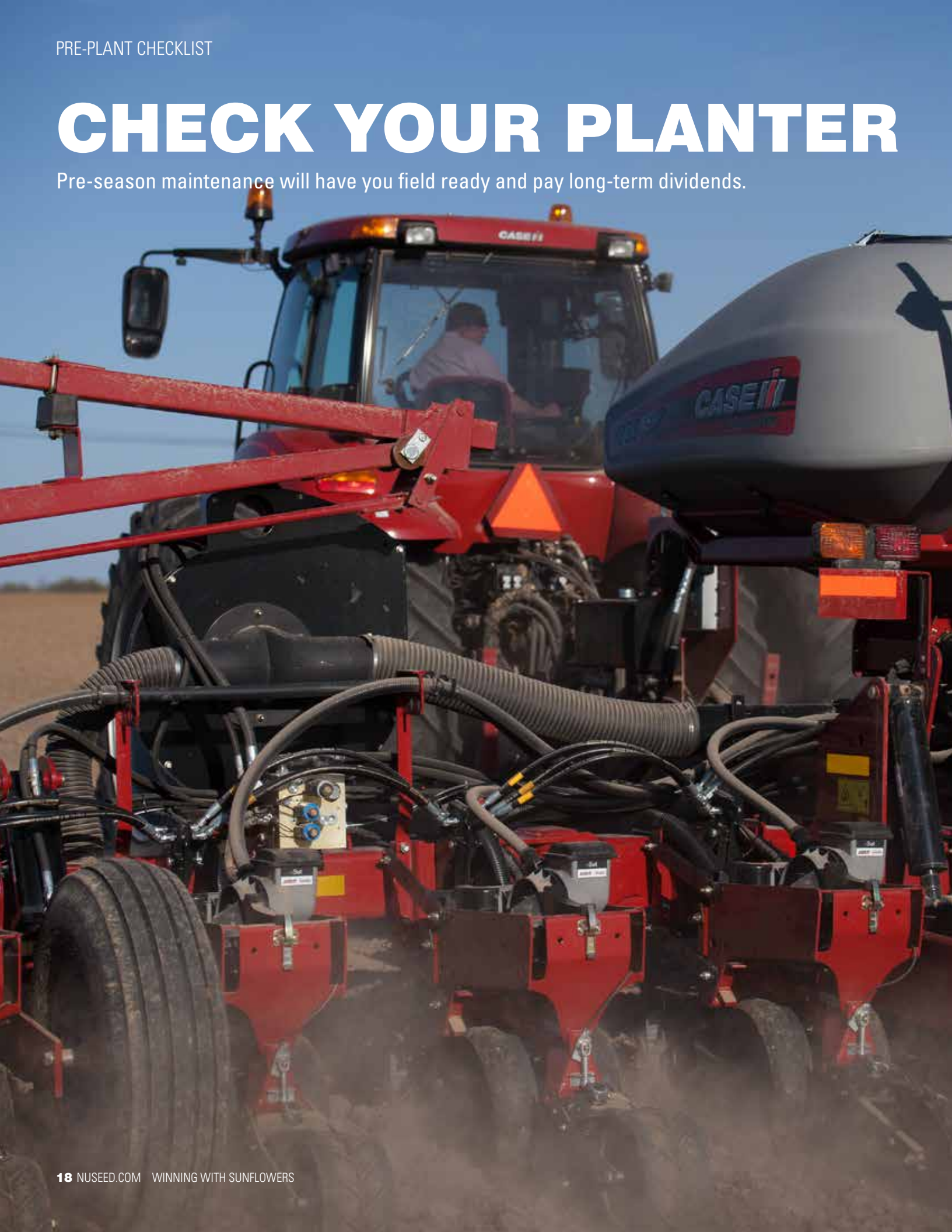

Photo courtesy of Precision Planting®.

The right planter maintenance and settings are vital to seeding all types of sunflowers, and becomes even more important the larger the seed size.

Planter mechanical issues can lead to undesirable large variances in head size, moisture, kernel size and quality. Poor planting passes can also lead to lodging and make harvesting difficult.

TWO IMPORTANT STEPS

Photo courtesy of Precision Planting®.

1. Parallel arms should be parallel to the ground and are corrected by adjusting the bar height.

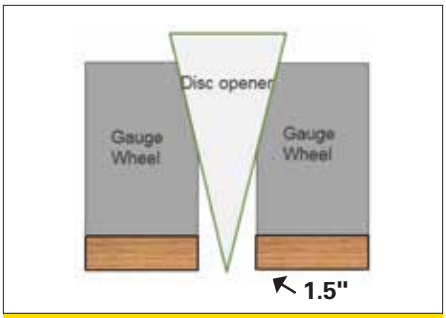

Image courtesy of Precision Planting®.

2. Use wood blocks of the same thickness to ensure each row's mechanical depth setting is identical to the rest of the planter.

PLANTER BASICS

- ☐ Consult your planter manual for proper inflation and tire size. Unwanted population variation occurs with over or under inflation of the meter drive system tires
- ☐ Check closing wheel alignment
- ☐ Check disk openers for wear. For John Deere®, Kinze® and White 8000 and older planters the diameter of a new disk is 15". A disk worn smaller than 14.5" may create a W in the trench and cause a difference of up to ¾" in seed depth. White 9000 planters are 16" openers and Case IH planters are 14" openers when new
- ☐ Make sure drives are all in good working order (chains, bearings and shafts)
- ☐ Make sure all chains and sprockets are properly aligned to ensure there is no 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

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 proper speed
- ☐ Check all hoses and distributors for wear, air leakage, cracks or blockage
- ☐ Make sure seed boots are within spec (if more than ½" 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, causing it to not run parallel to the ground)
- ☐ Make sure all bearings are in good condition
- ☐ Check to ensure 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

ALWAYS WHEN PLANTING SUNFLOWERS

- ☐ Be willing to dig seeds to check placement
- ☐ 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 your planter's meters operate at best for each lot of seed. Some lots may require faster or slower speeds than normal
- ☐ Consider filling your planter hoppers half full to reduce bridging potential

TIPS BEYOND THE PLANTER

Soil Temperature

- Soil temperature needs to be at 50°F or more for your chosen soil depth (1.5 to 2.5 inches). Planting sunflower seed into cold soils may cause seed to go into dormancy causing delayed germination.

- If planting deeper than two inches, consider increasing planting population. Percent emergence will decrease as planting depth is increased. **Confection sunflowers should never be planted deeper than two inches.**

Seed to Soil Contact

- Make sure soil is pressed firmly against the seed at planting and the furrow is closed following seed placement. This is important in all crops, but particularly for sunflower. Moisture first needs to get through the woody hull and then to the seed. Poor seed to soil contact will result in uneven emergence.

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 for the furrow to prevent hair pinning. With air drills very little can be done, wait for better conditions.

PRE-SEASON SET UP AND MAINTENANCE SPECIFIC TO BRAND AND TYPE OF PLANTER

Annually test your meter on a plant meter stand to learn what speed, air or vacuum pressure, plate size, finger type, and eliminator setting should be used for each seed lot. It's an inexpensive way to make sure your planter can place costly inputs at the proper population and spacing for optimal sunflower development.

John Deere® Finger Planter

- Visually inspect meter for worn, damaged or missing parts
- Disassemble meter and check bearing
- Check finger assembly for rust, wear or broken parts
- Bead blast housing and straighten if needed. Replace backing plates if bent or excessively worn
- Coat inside belt housing with graphite
- Re-install and/or replace belt, idler, bushing and drive sprocket
- Align belt
- Replace brush
- Install finger assembly and torque nut for proper operation
- Re-install and/or replace housing cover
- Lubricate and install lock
- Make sure you have proper fingers in your planter
- Sunflower fingers for 3's and 4's
- Corn fingers for 2's and sometimes 3's

John Deere Pro Max 40

- Check plates for wear and warpage
- Plates should be stored vertically when not in use
- Make sure double eliminator is not worn out
- Make sure knock out wheel turns freely and is not worn out and is aligned properly with plate
- Door gaskets are subject to wear and can cause spacing and singulation issues if cracks, holes, or chips are present. Remove from the lid and inspect carefully, replace if damaged
- Check all brushes for wear
- Check bearings in each unit to make sure unit doesn't wobble during operation and turns freely

Case 1200 Early Riser®

- Check wear on plates: if the groove on the face of the plate is no longer visible the plate is worn out (if you replace a plate you also will have to replace the cover as they are mated parts)
- Check to make sure plates are not warped
- Store plates vertically when not in use
- Check all brushes for wear
- Check singulator for wear
- Check that all bearings spin freely and the unit doesn't wobble

Precision Planting eSet® / vSet® / mSet®

- Make sure plates are in good working order and also check wear strips
- Make sure bearings turn freely and do not wobble
- Check quality and position of all brushes. Lower brush should be in the angled position
- Make sure singulator is in specification for wear, undamaged and in the floating unlocked position
- Make sure paper clip is intact and if you are running size 4 seed that you put the rubber hose on
- Make sure paper clip is in up position
- Use the specialty extractor and inspect wear line indicator. Replace when close to the wear lines
- Check butterfly drive for spring tension
- Inspect lid and hub seals for cracks, holes or tears
- Use the specified plate and extractor combination for specific seed size
- Check agitation assembly is present and in good condition

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THINKING BIG

Get set for big heads with big seeds and big yields. Fine tuning seeding rates and planter adjustments for success.

It can be challenging getting planter settings right for sunflowers, especially confection hybrids. Alison Pokrzywinski, Nuseed sunflower technical agronomist, recommends checking all planter components and replacing any broken or worn out parts. To improve seed flow, she says, use graphite or talcum powder as recommended in the planter operator's manual.

Specific suggestions for planter maintenance and settings based on planter brand and model are available in Nuseed's *Sunflower Field Guide* and *Confection Sunflower Planting Guide* both downloadable at nuseed.com in the resources section. Planter settings, maintenance recommendations and seed meter set-up information are also available on both the Canadian and American National Sunflower Association websites.

Seed placement is an important aspect to achieving the desired results. Singulation, or placing one seed per space, is essential, says Pokrzywinski. Multiple seeds in one location creates competition between the plants, which results in smaller grain.

"When a sunflower plant has more room, it will get bigger, put on a bigger head, and produce bigger seed. When you have doubles in the field, the plants will put on smaller heads and produce smaller seeds – that's not what you want when you're going into, say, the dehull or confection market," she says.

How close the sunflower plants are seeded depends upon the hybrid. Recommended seeding rates are based on the grain characteristics desired by the end-use markets. For example, confection hybrids, such as Nuseed's Panther DMR, are often seeded at a rate of 16,000-17,000 seeds per acre for the in-shell market, whereas, conoil hybrids, such as Badger DMR, are seeded at 18,000-20,000 seeds per acre for the dehull or bird food markets.

"Confection, conoils and oilseeds all have different requirements for planting population. It depends on what you want for your target seed size. The lower the population, the bigger and plumper your seeds are going to get. The higher the population the smaller the seeds. You want to make sure you have the right plant population for your area," she says.

For sunflower grower Gord Graham, who grows 5,300 acres of confection hybrids near Rainier, Alberta, seed sizing has been his biggest challenge. He says during that first year he learned about doubles eliminators at the school of hard knocks.

"Our seeding rate was way too high because we didn't have the doubles eliminators in. Our splits [percentage of large seed] were brutal, at around 50 percent," he said.

In addition to the doubles eliminators, to bring the seeding rate down, Graham tried different sprocket sizes and changed his planting plates to John Deere's ProMAX 40 flat seed disks. However, the seeding rate was still too high. After changing sprockets once again, the seeding rate was better, but still not low enough.

"This year, we got a variable-rate drive planter," he said. "Basically, we punch a number into the computer and away we go. We should've done it years ago."

Now Graham's seeding rate is at 16,800 seeds per acre and he's hopeful his

Optimizing your plant spacing will help maximize your yields.

splits will be 80 percent or more. "We've got our seeding rate down to where I believe it should make a difference," he says.

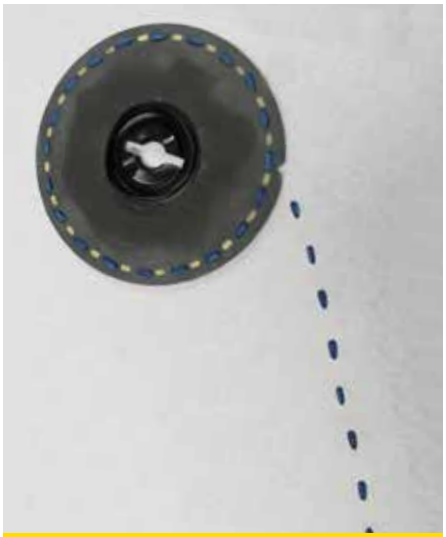
"SINGULATION, OR PLACING ONE SEED PER SPACE, IS ESSENTIAL."

Slow and Steady

Seeding depth is another important factor to consider for getting the crop off to a good start. When seeding, the soil temperature should reach 50 degrees Fahrenheit. Generally, seeding depth is from 1.5 inches to 2.5 inches; however, confection hybrids should never be seeded deeper than two inches. Furthermore, due to its larger, thicker shell, confection sunflower seed requires more moisture to germinate and emerge than oilseed hybrids.

"It's a fine line knowing where your moisture line is and making sure you're not planting too deep," says Pokrzywinski.

When it comes to planter speed, slow and steady should be the pace. Although planters differ, a general starting speed of five miles per hour will ensure best results. Slowing the planter down is even more important when planting confection hybrids. The large size and light test weight make these hybrids more challenging to plant correctly. Slowing down provides more accurate performance of the seed metering device.



Follow recommended seeding rates. Setting up for seed singulation is a priority.

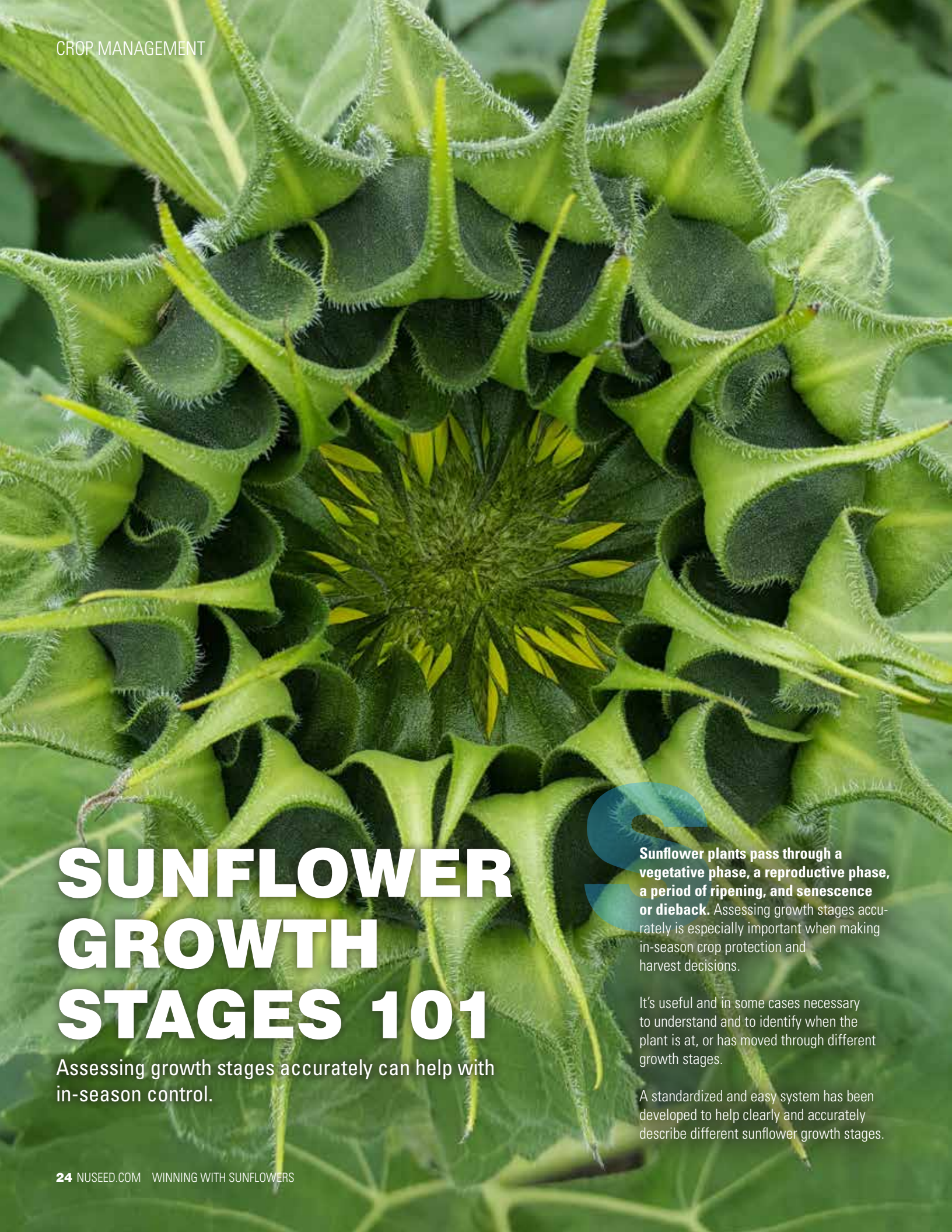
Nuseed Confection, Conoil and Dehull Oilseed
Example Seeding Rates for North and South Dakota in Typical Conditions*

Product	Market	Recommended Seeding Rate** Seeds/Acre	Target Final Plant Population Plants/Acre
6946DMR	In-shell	16,000-17,000	14,400-15,300
Panther DMR	In-shell	16,000-17,000	14,400-15,300
Jaguar DMR	In-shell	16,000-17,000	14,400-15,300
Jaguar II	In-shell	16,000-17,000	14,400-15,300
LD5009	In-shell	15,000-16,000	13,500-14,400
4334	In-shell	16,000-17,000	14,400-15,300
N5LM307	Black In-shell, Dehull, Bird Food	18,000-20,000	16,200-18,000
Badger DMR	Dehull	18,000-20,000	16,200-18,000
Talon	Dehull, Bird Food	19,000-20,000	17,100-18,000

*assumes germination rate of 90%

*assumes seeded in areas with adequate moisture. In dry climates the seeding rate should be reduced by 10-20%

**recommended seeding rates are for example purposes only, consult with your local retailer or dealer for seeding rates for specific regions and conditions



SUNFLOWER GROWTH STAGES 101

Assessing growth stages accurately can help with in-season control.

Sunflower plants pass through a vegetative phase, a reproductive phase, a period of ripening, and senescence or dieback. Assessing growth stages accurately is especially important when making in-season crop protection and harvest decisions.

It's useful and in some cases necessary to understand and to identify when the plant is at, or has moved through different growth stages.

A standardized and easy system has been developed to help clearly and accurately describe different sunflower growth stages.

When assessing the growth stage of sunflowers in the field, take representative samples to reach an average reading. Avoid headlands where compaction often distorts plant development and avoid obvious patches of uneven growth caused by diseases or changes in the soil type. Sunflowers, particularly hybrids, tend to grow uniformly across the field, so you should be able to determine the growth stage reasonably quick in most situations.

The growth stage key is divided into either vegetative (V) or reproductive (R) stages of plant development.

Vegetative development is further divided into two phases, vegetative emergence (VE) and true leaf development.

Vegetative emergence (VE) covers the period from seedling emergence to when the first true leaf is less than 4 cm (~1.5") long. As a general principle, this is when pesticides are best avoided because plants at this stage are more susceptible to the phytotoxic effects of agrochemicals.

The next stage is the vegetative (V) period with the growth stage given as "V" plus the number of true leaves over 4 cm in length. For example, if there are two leaves over 4 cm the growth stage would be V2, if there are four leaves it would be V4 and so on. If lower leaves have died and fallen off, count the leaf scar and include it in the assessment. Growth stage V2 to V8 are particularly significant as this is when many post emergence herbicides are applied.

The next stage is reproductive (R) and is separated into nine stages based on flower development.

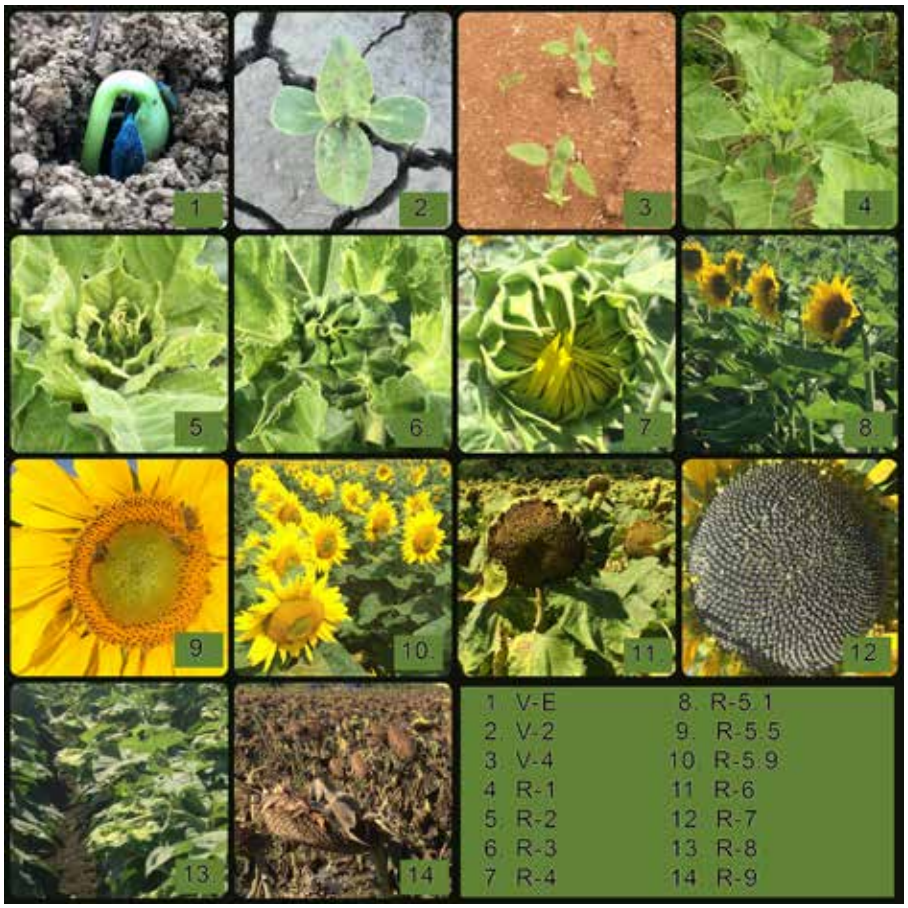
R1 to R4 describe the stages from when the flower bud first emerges through to just before the start of flowering.

R5 describes the beginning of flowering and is subdivided to describe the percent of the flower that has completed or is in flower such as R5.1 (10%), R5.5 (50%), R5.9 (90%).

R6 to R9 cover the period from when flowering is complete (R6) through to physiological maturity (R9) and harvest.

Stage	Description
VE Vegetative Emergence	Seedling has emerged and the first leaf beyond the cotyledons is less than 4cm long.
V (number) Vegetative Stages (e.g. V-1, V-2, V-3 etc.)	Determined by counting the number of true leaves at least 4cm in length beginning as V-1, V-2, V-3 etc. If senescence of the lower leaves has occurred, count leaf scars (excluding cotyledons).
R1 Reproductive Stages	The terminal bud forms a miniature floral head rather than a cluster of leaves. When viewed from directly above, the immature bracts have a many-pointed star-like appearance.
R2	The immature bud elongates 0.5 to 2.0cm above the nearest leaf attached to the stem. Disregard leaves attached directly to the back of the bud.
R3	The immature bud elongates more than 2cm above the nearest leaf.
R4	The inflorescence begins to open. When viewed from directly above, immature ray flowers are visible.
R5 (number) e.g., R-5.1, R-5.5, R-5.9, etc.	The beginning of flowering, divided into substages depending on the percent of the flower that has completed or is in flower, eg. R-5.1 (10%), R-5.5 (50%), R5.9 (90%).
R6	Flowering complete, ray flowers wilting.
R7	Back of the head started to turn a pale yellow.
R8	Back of the head yellow, bracts remain green.
R9	Bracts yellow and brown, plant at physiological maturity.

(A. Schneiter and J. F. Miller. 1981. Description of Sunflower Growth Stages. Crop Sci.11: 635-638.)



THE HOME FIELD ADVANTAGE

What the location of Nuseed's main breeding nursery in Galchutt, North Dakota, means to developing superior sunflower hybrids.

Jeremy Klumper, Nuseed sunflower breeder, updates agronomists and dealers during a tour at Nuseed's breeding nursery in Galchutt, N.D.

Nuseed's world-class sunflower nurseries are located right here in North America, which is a distinct advantage for local producers, says Jim Gerdes, the company's R&D director of sunflower and trait development.

"Our hybrids are born and bred in the USA," says Gerdes. "We plant our nurseries in sunflower growing areas so that we have natural disease pressure from economically important diseases as well as other factors that affect the crop."

Situated in the Red River Valley at Galchutt, N.D. – about 12 miles northwest of Wahpeton, N.D. – Nuseed's main breeding nursery provides the ideal environment to test the agronomic performance of the company's sunflower hybrids.

"A lot of disease pressure and insects are geographically dependent. Our ability to screen in these environments gives us an advantage, in that, it's just part of our normal process to select for the parent lines and hybrids that perform best in these environments," says Gerdes.

"WHILE OTHER SEED COMPANIES ARE PULLING BACK FROM INVESTMENT IN THE U.S. BREEDING ACTIVITY, NUSEED CONTINUES TO INVEST HEAVILY IN U.S.-BASED SUNFLOWER RESEARCH AND BREEDING EFFORTS."

Focused on the End Use

Half of the 50-acre nursery is dedicated to inbred line development while the other half supports yield trials. Breeding efforts are also split down the middle with confection and oil hybrids receiving equal attention, says Jeremy Klumper, Nuseed's North American oilseed sunflower breeder.

The program's diversity and the variety of products the company is ready to move forward is unparalleled, he says. "We are a large enough program that we can diversify across multiple seed types. We're working toward marketing many different seed types, seed shapes, and seed colors, and that makes us very unique," he says.

Furthermore, this diversity provides options for both producers and processors. "We're taking what the customer is looking for seriously. In confection crops, it's really driven by what the processor wants to package," says Klumper.

Developing new hybrids with different characteristics that perform and yield better than current options requires testing a huge number of hybrids.

"It's a numbers game," says Klumper. Each year around 1,500 hybrids are tested at the nursery. Klumper says he shoots for about 900 new hybrids to evaluate, roughly 250 hybrids are in the second year of testing, about 100 are in their third year and another 50 in the fourth. When they make it to year five, there may only be 12 to 20 hybrids left, he says.

Eventually, through the selection process, one or two new hybrids per year may make it to market – one confection and one oil hybrid.

"We only pick hybrids that have all the characteristics we're looking for. They must perform well, they must have the seed type we're looking for and they must have the oil profile. We can't keep material in the program that's mediocre. It forces us to choose only the best. At the end of the day, we advance one or two new commercial products each year."

Selecting for Success

Located close to Nuseed's sunflower headquarters in Breckenridge, Minn., the Galchutt nursery is picturesque in the summer, however, fall is an exciting time for breeders because it's when they assess whether their labors have borne fruit.

"Sunflowers look very nice in their vegetative states, and they're very pretty in bloom. Fall is the time some of the warts, or problems, start showing up. It's when all the selection happens," says Klumper.

"The plants are drying down and you have a chance to see what they're truly going to be like as a finished product – as a hybrid and as an inbred. You see what all the work you did all summer turns into."

One of the breeder's primary purposes is to develop hybrids with strong base genetics, says Gerdes, which perform well in terms of agronomics, disease resistance, yield and oil content.

"Once we identify those high-performing combinations, we'll use molecular markers and trait introgression to move in other traits that may be lacking," says Gerdes.

Thinking Global, Investing Local

"We're the only company that is actively breeding for oilseeds, confectionaries and conoils, and we're working on those

SUPERIOR HYBRIDS

Nuseed's U.S.-based nurseries are the breeding ground for superior sunflower hybrids. Here's why:

- Nurseries are strategically planted in sunflower-growing areas in the United States
- Nuseed is the only multinational company working with all hybrid types and herbicide traits
- First-rate molecular lab and breeding nursery located in Woodland, Calif.
- Largest confection hybrid breeding program in North America
- Hybrids are developed in U.S.-based nurseries to take advantage of disease and insect pressures for trait selection
- Nuseed's 50-acre, primary sunflower nursery is located at Galchutt, N.D.
    - Breeding program focuses on both confection and oil hybrids, equally
    - Half of the nursery's acres are dedicated to inbred line development and the other half to yield trials
    - Every year, around 1,500 hybrids are tested at the Galchutt nursery from which one or two new commercial hybrids may be released each year

different types with all the different herbicide traits: Clearfield®, Clearfield® Plus and ExpressSun®. The majority of that work is being done at the Galchutt nursery," says Gerdes.

While other seed companies are pulling back from investment in U.S. breeding activity, Nuseed continues to invest heavily in U.S.-based sunflower research and breeding efforts.

Since 2012, the size, scale and scope of the company's U.S. sunflower program has increased dramatically, says Gerdes. "We have more than tripled the size and efforts we're putting into sunflowers. We are also using cutting-edge molecular tools to assist us in identifying new traits and moving traits around. That contributes to improving the performance of our hybrids both domestically and internationally as well," he says.

In addition to the Galchutt nursery, other resources within North America include a state-of-the-art molecular lab and breeding nursery in Woodland, Calif., where seed production and increase of inbred lines is carried out as well as developing experimental hybrid seed. The combined expertise of agronomists, breeders and molecular scientists is also a vital asset.

"We have a good system and network within the company and outside the company to ensure the products we're developing are suited for the major growing areas we're targeting," says Gerdes.

Nuseed can also draw upon resources and talent from its overseas facilities, including three international breeding programs located in Argentina, Serbia and Australia.

Nuseed's commitment to local breeding activities and the development of high-performance sunflower hybrids sets the nursery and the company apart, says Klumper.

"We put the hybrids through as many scenarios as we can to ensure the product is not going to be a flash in the pan. We want hybrids that are going to stand the test of time."

Gerdes also believes Nuseed's North American commitment to research and hybrid development in U.S.-based facilities, like the Galchutt nursery, is important for success, but he's equally proud of sharing this versatile crop with the world.

"Sunflowers are one of the few crops native to North America, and so it's nice for me to see a local crop being grown globally," says Gerdes.

EXCELLENT CHOICES FOR THE NUSUN® MARKET

N4HM354 – a top NEW hybrid in high demand

- Beyond® herbicide tolerant
- Increased oil content
- Resistant to multiple races of downy mildew
- Wide adaptation with medium-early maturity

FALCON – easy to grow, easy to market

- DuPont™ Express® herbicide tolerant
- Nusun® oil and bird food markets
- Excellent stalk strength
- Medium maturity, single-cross hybrid

CAMARO II – high performance with excellent late season plant health

- High yielding
- Excellent oil content
- Beyond herbicide tolerant
- Resistant to multiple races of downy mildew
- Improved Sclerotinia head rot resistance

Oil, conoil or confection – there's an excellent Nuseed® sunflower hybrid for every market and every farm.

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