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WINNING WITH SUNFLOWERS

Volume 3 Annual 2019

Season-Long Checklist

Reach Your Yield and Profit Goals

PLUS

- Choosing Sunflower Hybrids
- Planter Pointers
- Overcoming Disease, Weed and Insect Challenges
- Successful Harvesting

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Nuseed's Fred Parnow has worked for more than 30 years in the sunflower business. During this time, he has accumulated a great deal of knowledge that he's happy to pass on for the benefit of growers.

One of Parnow's favorite sayings is: "Treat your sunflowers like they're the prize pig at the state fair." When farmers treat sunflowers like the runt of the litter, unfortunately their yields won't be very good. They'll have a disappointing experience, and they may never grow the crop again.

Parnow believes farmers who pick the best hybrids and treat their sunflowers right with a top-notch fertility program and proper disease and weed control practices should expect to yield 3,000 pounds per acre or more. "Give it the groceries, and you will be rewarded," he says.

Other tips from Parnow are to plant as early as possible and to always follow the right seeding practices to ensure a uniform plant stand. He also recommends farmers harvest their sunflowers as soon as they can and consider using desiccation to help speed things along. "The longer the crop stands in the field, the more bad things can happen," Parnow says.

Fred Parnow, Nuseed's Canada Business Manager, who started his sunflower career as a local seed dealer for Sigco Research, joined Seeds 2000 back in 2001 and became part of the Nuseed® team when they purchased the company in 2011. Parnow's sunflower expertise spans the Canada-U.S. border.

For in-season sunflower information follow Nuseed US and Canada on and

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2 Tracking Trends
The results are in for the latest National Sunflower Survey. Get the scoop on major U.S. sunflower production issues and trends.

6 Which Hybrid is Right for Your Farm?
Maturity is just one consideration for growers choosing sunflower hybrids.

10 Planter Pointers
Keep an open mind when fine-tuning planters for sunflowers.

12 Overcoming Weed Challenges
Weed-free fields are especially important when growing sunflowers.

15 Three Sunflower Diseases You Can Do Something About
Tackling sunflower rust, downy mildew and Phomopsis.

20 What's Bugging You?
Strategies for managing wireworms and red sunflower seed weevils.

23 Top Tips from Nuseed
Three experts share their best sunflower production advice.

24 Grower Spotlights
Four producers reveal their triumphs and challenges growing sunflowers.

28 Successful Harvesting
Get the goods on desiccation, combine settings, drying and storing your sunflower crop.

32 2019 Market Outlook
The hottest markets and trends this year and into the future.

34 Sunflower Season-Long Checklist
A tool for staying on task to reach yield and profit goals.

TRACKING TRENDS

The National Sunflower Survey is an important tool for identifying production issues for growers and areas where research dollars can be best spent.

For sunflower producers looking for better ways to manage their crops, the National Sunflower Survey can be an invaluable tool.

The survey is conducted by the National Sunflower Association (NSA), which every other year sends teams out to canvas producers' fields in the major sunflower growing regions of the United States, as well as the Canadian province of Manitoba.

"The purpose is to find out what the production issues and trends are in sunflowers," says Dr. Hans Kandel, an extension agronomist at North Dakota State University (NDSU) who has been helping oversee the NSA survey since 2007.

Kandel says each survey team has two to four members and is comprised of agronomists, entomologists, pathologists, crop consultants and producers who stop at random sunflower production fields during the fall.

During each survey, the teams visit about 200 fields, which represents approximately one field for every 10,000 to 15,000 acres in sunflower-producing counties in the United States, Kandel says. Areas that are assessed include plant stands, yield potential and agronomic practices as well as disease, insect and weed issues.

"We try to be very precise in the way the data is recorded," says Kandel. "It is very time consuming, with usually about an hour [spent] in each field."

According to Kandel, the survey enables researchers to aggregate data and see what trends in sunflower production develop over time. As an example, he points to Phomopsis, a newer sunflower disease that's been turning up with greater regularity in recent years.

"As you identify production issues, some of the research dollars are then allocated to those problem areas. So, there is a very strong utilization of the data to generate grants for specific sunflower research on those topics that are identified," says Kandel.

Kandel points out that one of the key aspects of the National Sunflower Survey is identifying major yield-limiting factors in sunflower production. He says in 2017, the top three factors (apart from drought) were:

1. Plant spacing
2. Diseases
3. Weeds

Kandel adds the NSA is currently making preparations for the next National Sunflower Survey slated to take place this fall.

Plant Spacing

Plant spacing was identified as a yield-limiting factor in 21 percent of the sunflower fields surveyed in 2017. In these fields, plants were unevenly distributed as a result of improper planting techniques, poor seed quality, insect damage or other factors.

"WE TRY TO BE VERY PRECISE IN THE WAY THE DATA IS RECORDED, WITH USUALLY ABOUT AN HOUR IN EACH FIELD."

"Gaps, skips and doubles or a combination can result in lower sunflower yield," Kandel says. "Once the plants are established, you can't change the number of plants per acre, so paying attention to where you put the seed at the beginning of the season is especially important."

In December 2018, the results of the 2017 National Sunflower Survey, were presented at Sunflower University in Bismarck, N.D. by Ryan Buetow, a cropping systems specialist with NDSU Extension who helps co-ordinate the survey.

During his presentation Buetow stressed the importance of even seed spacing within rows and proper seed depth to ensure good emergence.

Buetow reminded growers that sunflower fields with rows less than 30 inches apart typically have higher plant populations (and

better yields as a result) than those with 30-inch rows.

Kandel says it's likely a function of plants in wider rows being packed tighter together and not having adequate space to flourish and reach their optimal yield potential. "What we've found is that if the distance between the plants is more spaced out, you'll gain yield," he says.

Another survey finding pertained to row orientation. According to Kandel, sunflower crops planted in a north-south direction generally fared better than those planted in an east-west direction, because the sunflower heads rubbed against each other less.

Diseases

Disease was identified as the second-most prevalent limiting factor in the 2017 National Sunflower Survey, with 17 percent of the surveyed fields exhibiting some disease damage.

The survey identified Phomopsis, sclerotinia wilt and sclerotinia head rot as the three major diseases affecting sunflowers. Other diseases impacting sunflower production included sunflower rust and downy mildew.

The incidence of Phomopsis was actually down compared to other recent surveys, which Buetow attributed to dry conditions in 2017. Buetow also said researchers have identified a number of new Phomopsis species, and that's something the sunflower industry needs to be mindful of.

Kandel maintains a minimum rotation of four years between successive sunflower crops will help combat disease, in addition to selecting hybrids with tolerance and resistance to sunflower diseases.

Kandel says in areas where disease is a concern, growers can spray fungicides in-season to help manage certain diseases, like rust, and also use fungicide seed treatments as a management option against downy mildew.

Weeds

Weeds were the third-most prevalent limiting factor in the National Sunflower Survey.

"With weeds, we find that about eight percent of the fields showed higher weed pressure, which has probably resulted in yield reduction," Kandel says.

In North Dakota and Minnesota, kochia was the main broadleaf weed threat identified in the survey. The weed was found in more than 45 percent of the surveyed fields in 2017, substantially more than in 2015 when this number was less than 20 percent.

In the same region, Canada thistle was the second-most prevalent broadleaf weed, showing up in 15 percent of surveyed sunflower fields in 2017. Other broadleaf weeds that turned up in the region included red root pigweed, biennial wormwood, wild buckwheat and cocklebur.

Buetow indicated in his presentation that drought conditions in North Dakota and some other regions in 2017 may have hindered weed control efforts.

"[If] you go out there and spray [when] those plants aren't actually growing, the herbicide's not going to do a whole lot," he said. "Some weed species need to be actively growing to properly take up certain herbicides."

Kandel believes that effective weed control needs to start with clean fields. He recommends growers also consider applying preplant herbicides with residual action as well as in-season spraying if necessary.

Sunflower Reminders

A next-generation seed treatment is taking downy mildew protection to new heights.

It all starts with what you put in the ground. Plenaris® fungicide is the latest addition to CruiserMaxx® Sunflowers, the most comprehensive seed treatment in the market. CruiserMaxx Sunflowers with Plenaris, a combination of separately registered products, provides multiple modes of action, delivering the most sustainable and best-performing downy mildew management program in the industry, and provides the broadest disease and insect protection available to help maximize your genetic potential. Which is just what you need to end the season on a higher level. To learn more, visit **SyngentaUS.com/Plenaris**

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WHICH HYBRID IS RIGHT FOR YOUR FARM?

Maturity is just one consideration for growers choosing a hybrid.

Oil sunflowers will shine as far as performance and return on investment per acre, says Nuseed's Fred Parnow. "Sunflowers will pay the bills – there is no question," he says.

Over the past few years, high oleic acreage has been growing and is the largest segment of the total oil sunflower acres in the United States. Heart health benefits, stable shelf-life and neutral taste make high oleic sunflower oil a great fit for commercial cooking applications.

Demand from major buyers for sunflower oil, primarily high oleic and Nusun®, is fairly consistent throughout the year, says Parnow. In addition, oil crush buyers will pay a premium of two percent for any percentage above 40 percent oil content.

However, choosing which oil-type hybrids to grow is not like choosing corn or soybean varieties, says Alison Pokrzywinski, Nuseed's technical agronomist, as you can't narrow your hybrid choices by maturity only. Growers must assess a number of factors, including the individual needs of their farms, which will narrow their choices to a handful of hybrids, and then consider maturity.

Sunflower hybrid choice is directly related to the market a grower plans to enter and the specific region it will be planted. Oil sunflow-

ers can be produced under contract or for the open market. Local elevators also offer cash prices based on market demand.

When choosing oil sunflower hybrids, usually ROI is considered first. Sunflower growers will consider strong contracts, prices or market demand, ultimately choosing the most profitable opportunity for their operations, says Pokrzywinski.

Sunflower growers can sell to one market or several as there are many options open to them. Growers may also choose to plant multiple maturities or diversify hybrids to spread the risk on their farms. In addition, sunflower production contracts often include an "Act of God" clause further reducing growers' financial risk.

Next to price, on-farm storage capability is an important factor affecting choice. Growers with on-farm storage for sunflower are usually rewarded for storing their crops.

"Buyers often pay growers bonuses for storing the crop over an extended period of time. Whether it's oil for crush or dehull, sunflower buyers have customers who buy products 12 months of the year. Buyers are no longer adding storage onto their facilities, but they're rewarding farmers for having storage on their farms. It's the concept of the warehouse on wheels and on-time delivery. It pencils out for the farmer and works well for everybody," says Parnow.

Farmers without on-farm storage will want to consider contracts, and corresponding hybrid choices, that include hauling directly after harvest. With any contract a grower needs to confirm the contract requirements before purchasing seed.

Logistics is another important factor to consider when choosing markets and hybrids. For some farmers, proximity to receiving stations will limit their market and hybrid choices. Many farmers with large-scale operations have semitrucks for delivering their crops directly to processing plants. While some farmers will drive long distances for good contract prices, others may want on-farm pickup. "For some people that's worth a lot of money. It's all part of the contract," says Parnow.

Bird Food Market has Minimum Test Weight

Two of the most important characteristics of an oilseed sunflower are yield and oil content, that is, if the crop is destined for the crush market. However, for the bird food market, after yield, test weight is the most important factor. The bird food market requires a minimum 28-pounds per bushel test weight.

Bird food buyers specifically require pounds per bushel because the product is packed and must be transported. "It's a bulky product so if the test weight is below 28 pounds, it's like putting four pounds of peanuts in a two-pound sack – you can't get it in there," says Nuseed's Fred Parnow. A 28-pound per bushel test weight is easy to achieve, especially with good crop management, he adds.

The hybrids Nuseed brings forward have proven their ability to meet that test weight during multiple years in multiple locations, adds Alison Pokryzwinski, Nuseed's technical agronomist.

Sunflowers vs. Corn or Soybeans

Sunflowers have the advantage over soybean and corn in regions with dry conditions like central and western North Dakota and South Dakota. "Under moisture stress corn and soybeans won't yield very high. Add in the high cost of production for those crops and sunflowers are going to look really good," says Nuseed's Fred Parnow.

"Farmers that treat sunflowers as their best cash crop will be rewarded greatly. You can make good money with sunflowers. It's a phenomenal crop," he says.

Adding sunflowers to the rotation also helps farmers 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 sunflower is its 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, and with respect to return on investment on your farm," says Pokrzywinski.

Harvest risk is also diminished because harvest timing of sunflower differs from many other crops, she adds.

HYBRID	MATURITY	DROUGHT TOL.	UNIFORM. AT FLOWER	TEST WEIGHT	DRY DOWN	OIL CONTENT	YIELD FOR MATURITY	PLANT HEIGHT	STALK RATING	ROOT RATING	LATE SEASON PLANT HEALTH	EMERGENCE
HIGH OLEIC												
COBALT II	EARLY	7	9	7	8	6	8	5	8	8	7	8
NEW N4H302 E	MED-EARLY	7	8	7	8	7	7	6	7	6	7	9
DAYTONA	MED-EARLY	8	6	8	7	6	7	5	8	6	7	8
NEW N4H470 CL Plus	MED	9	9	8	7	9	8	7	8	8	8	8
HORNET	MED	8	7	7	6	7	9	7	7	6	8	8
NEW N4H521 CL	MED-LATE	8	7	8	6	8	9	7	7	6	8	8
SIERRA	MED-LATE	8	8	7	6	6	9	8	7	7	7	7
NUSUN												
TALON	EARLY	6	8	6	7	5	7	5	7	8	6	7
N4HM354	MED-EARLY	7	8	7	8	8	9	6	8	8	7	8
FALCON	MED-EARLY	8	8	8	7	7	8	6	8	7	8	7
CAMARO II	MED	8	8	8	7	7	9	6	8	7	8	7
DEHULL												
N5LM307	MED-EARLY	7	7	7	8	N/A	8	6	7	7	8	8
BADGER DMR	MED	7	7	7	7	N/A	7	8	7	8	7	8
CONFECTION												
PANTHER DMR	EARLY	6	7	8	7	N/A	8	6	8	7	7	7
JAGUAR DMR	EARLY	6	8	7	8	N/A	7	6	7	8	6	7
LD5009	MED	6	8	7	7	N/A	7	7	7	8	6	8
4334	MED-LATE	7	6	7	6	N/A	8	7	7	7	8	7

Hybrid Rating Scale: 1=Poor, 9=Excellent (excluding Plant Height)
Plant Height Rating Scale: 1=Shortest, 9=Tallest

Learn more about each hybrid above at Nuseed.com. Visit Legendseed.net to access their hybrid selector tool and find a Legend Seeds retailer near you.

Herbicide Tolerant Trait Options

Another aspect in helping to determine sunflower hybrid options is a field's weed control needs. Farmers must know the weed spectrum and crop rotation in each field before choosing the herbicide tolerant trait options, such as BASF's Clearfield® Production System, the Clearfield Plus Production System or DuPont's ExpressSun®. Always follow registered label uses and product packaging instructions.

Through years of selective breeding, Nuseed has developed sunflower hybrids with herbicide tolerance to help growers manage weeds. ExpressSun sunflower hybrids are tolerant to Express® herbicide, which provides a range of broad-spectrum control or suppression of a range of broadleaf weeds. It's also the best option for Canada thistle, Russian thistle, prickly lettuce and marshelder control.

Although it doesn't control grasses, herbicides that do can be tank-mixed with Express. Herbicide application timing is at the V2 stage until just before pre-bud (R1). Additionally, this production system is cost-effective and there are very few rotational restrictions for the following crop year.

Sunflower hybrids with Clearfield or Clearfield Plus traits are tolerant to Beyond® herbicide for broad-spectrum residual grass

and broadleaf weed control, including ACCase-resistant weeds. This production system is the best option for eastern black nightshade, lanceleaf sage, redroot pigweed and cocklebur control. Herbicide application timing is from V2 to V8 stages, and there are more rotational restrictions with this production system.

N4H470 CL Plus is Nuseed's first Clearfield Plus hybrid and has excellent stalk and root strength as well as downy mildew resistance; N4H521 CL is a full-season Clearfield hybrid with top-yielding potential and downy mildew resistance.

"A KEY TO SUCCESSFUL SUNFLOWER PRODUCTION IS CLEAN, WEED-FREE FIELDS."

Tough weeds can be better managed with the Clearfield Plus system. Because Clearfield Plus hybrids can process Beyond herbicide better, the herbicide can be paired with methylated seed oil (mso) to make the tank mix hotter without any crop injury, says Pokrzywinski. "By adding that methylated seed oil you're able to get better penetration of the herbicide into the weeds for better control," she says.

Three new high oleic oil hybrids, each with a different herbicide tolerant trait, have been added to the market for 2019. Hybrid N4H302 E contains ExpressSun herbicide tolerance and is bred for earliness and adaptability;

The importance of weed control can't be emphasized enough, says Parnow, and is directly related to success with sunflowers and high yields. "A key to successful sunflower production is clean, weed-free fields. Nowadays, it's not acceptable to have weeds in your fields. We have the tools to take care of them," he says.

After a grower has assessed the farm's needs and capabilities, maturity is evaluated. Farmers living in South Dakota or southern North Dakota have more hybrid options than those located in more northern regions. Farmers can spread the risk on their farms by planting different maturities, which results in various planting dates and harvesting windows.

Ultimate Flexibility

Nuseed breeders have developed sunflower hybrids with multi-market flexibility. Nuseed's conoil seeds are either striped (Badger DMR) or black (N5LM307) and are primarily contracted for the dehull market. However, in addition to having a plump kernel required for the dehull market, they can also be sold to in-shell confection, oil or bird food markets depending on processor criteria and market demand.

A farmer can plant one hybrid which can be directed toward the bird food, crush or dehull markets, says Nuseed's Fred Parnow. "A farmer can sell that hybrid into any one of those markets any day of the week."

PLANTER POINTERS

An industry expert says growers should keep an open mind when fine-tuning planters for sunflowers.

What equipment you use for planting is important; however, how you use that equipment is even more crucial, says Jed Wall, sunflower business development manager for Legend Seeds in Wahpeton, N.D.

Furthermore, modern-day planters can plant just about any sunflower seed size, he says, if growers plan ahead and have their settings ready to go. However, there can be a lot of variability between brands, hybrids and seed sizes, yet only minor changes to the equipment may be needed to be up and running optimally.

To help sunflower growers determine the optimal settings for their planters, each spring Nuseed and Legend Seeds run more than 1,450 tests. Plantability tests are carried out on every hybrid of every lot number, and every seed size, to supply planter recommendations for the main planter manufacturers. Settings are fine-tuned until they reach 97 percent plantability for each hybrid.

"We use different plates, different vacuum settings, different seed lubricants, different speeds, et cetera. Sometimes a minor change in vacuum pressure and/or speed is all that is required. It all comes down to fine-tuning."

willing to switch plates, brushes, and baffle and eliminator settings for maximum potential," he says. Wall has even seen sorghum or small sweet corn plates give better results in the trials.

"BE WILLING TO SWITCH PLATES, BRUSHES, AND BAFFLE AND ELIMINATOR SETTINGS FOR MAXIMUM POTENTIAL."

The first of Wall's tuning tips for planters is to keep an open mind. "Try new things if what you're doing isn't working; change vacuums, change speeds. Don't just cross your fingers and hope it's working – get out of the tractor and dig seeds to check placement. Be

Wall also recommends trying to plant either diagonally or at a 90-degree angle against the way a field has been worked. "That bumping motion as you're moving across the field helps prevent seed bridging and keeps things moving along."

Using a seed lubricant is also important in most cases. All plantability tests were performed using eFlow 80/20, a blend of talc and graphite, which is also Wall's favorite.

Wall's other general planter tips include:

- Make sure the planter is level front to back and left to right, and that parallel bars are actually parallel
- Ensure uniform depth of each row unit
- Check plates, brushes and singulators for wear
- If experiencing lots of skips, increase vacuum setting and if experiencing lots of multiples, lower vacuum setting. A rule of thumb is multiples and skips should be close to equal, if the vacuum is set properly
- Be willing to adjust speed: if frustrated seeding at 3.5 to 4 miles per hour, increase speed to 5.5 to 6 mile per hour range. Some meters work considerably better at higher speeds
- With central-fill planters, keep planter box, or central seed unit, half-full of seed. This helps flowability if the box isn't full to the brim
- Make sure tires are properly inflated and sized
- Check closing wheel alignment
- Check disk openers for wear
- Ensure all drives are in good working order (chains, bearings and shafts)
- Check chains and sprockets are properly aligned to ensure there is no binding
- Make sure all seed tubes and sensors are clean and functional
- Check row cleaners. They should float freely with maintained pivot point and bearings. Residue left in furrow can change soil temperature and cause delayed emergence

For the recent Plantability Results email jed@legendseeds.net, visit nuseed.com for maintenance checklists by planter brand.

Seeding Savvy

While equipment modifications and maintenance are important, there are a few more factors when planting sunflowers that growers should be aware of, says Jed Wall, sunflower business development manager for Legend Seeds in Wahpeton, N.D.

Make sure you know your seeding depth, he says. The guideline for planting oilseeds is 1.5 to 2.5 inches. In addition, soil temperature should be above 50°F and excellent seed to soil contact is imperative as moisture needs to get through the woody hull to the seed to germinate.

Check that the planter is knifing into the soil intermittently. Planting into a field with wet residue can cause "hair pinning" where straw is pushed into the seed slot instead of slicing through it. This is usually more of a problem with air drills. The solution is to wait until the residue dries and slicing becomes easier, sharpen drill discs/blades, or adjust down pressure, says Wall.

Air Seeder Maintenance

Getting started in springtime with an air seeder also requires maintenance. Check opener discs for wear, says Jed Wall, sunflower business development manager for Legend Seeds. "If they're worn out, replace them," he says. Examine firming and closing wheel arms and bushings – these should be in good working condition.

Also inspect the condition of the air delivery system to ensure the air system fan is operating at the correct speed. Furthermore, examine all hoses and distributors for wear, air leakage, cracks or blockages.

Wall also recommends seed boots be within manufacturer's specifications. If more than 0.5 inches is burned off the boot's bottom, the boot should be replaced. If the boot is less than 11.3 inches, that boot is worn out, he says.

Check the right metering roll is in place for the proper application. Examine the metering roll for wear and that it's clean from foreign material. For example, it can get caked up with seed treatment.

Additionally, calibrate downforce to ensure the boot is running parallel with the ground. "If you have too much downforce, it'll cause the seed boot to run deeper in the trench, and the seed boot won't run parallel to the ground – and you'll have seed that's too deep," says Wall.

Check calibrations prior to entering the field to ensure they match up to seed use. To verify proper calibration, check your calibrations and seed usage after a few acres have been planted.

Finally, in general, make sure all bearings are in good condition.

OVERCOMING **WEED CHALLENGES**

Having and maintaining weed-free fields is crucial when growing sunflowers.

Whether it's kochia and wild buckwheat in western North Dakota, or marshelder, wild mustard or nightshade species in the eastern region of the state, there are many weeds that can challenge sunflower producers, says Dr. Brian Jenks, a weed scientist with North Dakota State University's North Central Research Extension Center.

Canada thistle and dandelion also give producers a run for their money. Producers should start trying to control those two perennial weeds in the fall with a glyphosate application in September or October – because that's when they'll get the best control, says Jenks.

"If growers can start targeting those weeds in the fall with herbicide applications, they should be able to reduce the populations by at least 50 to 80 percent. Sometimes, when all the stars line up, they might do even better than that," he says.

Horseweed is another one to hit in the fall with glyphosate plus a tank-mix partner such as 2,4-D, Sharpen®, or dicamba depending on crop rotation; in fact, any winter annual species, such as prickly lettuce, or other fall-emerging weed species, should receive a herbicide application at that time.

However, sometimes those weeds haven't emerged yet, or there may be weeds that emerge after the fall glyphosate application. That's the time producers may want to consider a broad-spectrum herbicide with residual control, like Valor® (flumioxazin).

"Whereas glyphosate will only control what has emerged, Valor will provide residual control of weeds that emerge later. That's where this herbicide has a niche – it has shown to be quite good on fall-emerging weeds or winter annuals," says Jenks.

When it comes to controlling kochia and wild buckwheat, Jenks recommends using a soil-applied herbicide. Spartan® (sulfentrazone) in the spring or Sonalan® (ethalfluralin) in the fall works well. "Spartan generally gives us the best kochia control and at least some suppression of wild buckwheat," says Jenks.

Although herbicide-tolerant production systems, such as, Clearfield, Clearfield Plus or ExpressSun, are excellent tools for controlling weeds post-emergence, Jenks advises producers combine them with soil-applied herbicides to control spring annuals. Furthermore, he maintains producers should not count on post-emergence herbicides to control all weeds in-season.

"We need to get away from relying solely on post-emergence herbicides. If we don't put a soil-applied herbicide down, and we just rely on Express or Beyond, I'm certain we'll be losing yield if we don't control weeds early in the season. It's very critical to keep the field as clean as possible for those first four to six weeks or more," he says.

"By using soil-applied and post-applied herbicides, we're going to control the weeds earlier, we'll have better overall control, and we're also going to manage or prevent resistant weed development by having multiple modes of action," says Jenks.

Nuseed's technical agronomist, Alison Pokrzywinski, agrees. She says yields will be better without competition from spring annuals controlled by a soil-applied, pre-emergent herbicide.

"By planting a hybrid with a herbicide-tolerant trait you have more options. If the fall application or pre-emergent did the job, great. If you still have a weed problem in-season, you can manage it," says Pokrzywinski.

Scouting after herbicide spraying is also important to determine if the target weeds were controlled, as herbicide-resistant weed populations continue to rise.

Producers must make herbicide decisions based on the specific weeds in their fields. Thus, keeping an eye on weed populations and being aware of the weed types present in their fields is crucial. "Growers need to know what weeds are out there – all of their decisions must be based on their specific weeds," says Jenks.

"Good weed control is very important in sunflowers because, generally, they're planted in 30-inch rows and it takes a long time for the crop to shade the weeds. We never really get full canopy cover, so it's important to control those weeds early, and keep them down for as long as possible through the growing season," says Jenks.

Canada thistle seedling
Photo courtesy of the Canola Council of Canada

Young kochia plants
Photo courtesy of University of Nebraska – Lincoln

Mature marshelder weed
Photo courtesy of the University of Kentucky

Wild buckwheat seedling
Photo courtesy of the Canola Council of Canada

HERBICIDE RATINGS FOR COMMON WEEDS IN SUNFLOWERS

WEED SPECIES	ZIDUA®	SPARTAN CHARGE®**	SPARTAN ELITE®	AIM®	BEYOND®	EXPRESS®
BARNYARDGRASS	E	N	P-E	N	E	N
DOWNY BROME	F-G	F-G	P-F	N	G-E	N
GREEN FOXTAIL	G-E	P	F-E	N	E	N
QUACKGRASS	N	N	N	N	F	N
VOLUNTEER CEREALS	N	N	P-F	N	G-E	N
WILD OAT	F-E	N	P-F	N	E*	N
YELLOW FOXTAIL	G-E	P	F-E	N	G-E	N
BIENNIAL WORMWOOD	F	G	F-G	-	P	P-F
CANADA THISTLE	N	N	N	N	N-P	G
COCKLEBUR	P	P	P	P	G-E	N-F
COMMON MALLOW	-	-	-	-	P	P-F
COMMON RAGWEED	P-F	N	N	N	N	N
EASTERN BLACK NIGHTSHADE	F-G	E	G-E	G	E	P-F
HAIRY NIGHTSHADE	F-G	F-G	F-G	G	E	-
KOCHIA	F	F-E	E	F-E	E*	E*
LAMBSQUARTER	P	G-E	E	F-G	F	P-F
LANCELEAF SAGE	-	N	N	N	E	N
MARESTAIL (HORSEWEED)	N-P	F	F-G	N	P*	N
MARSHELDER	P	P-G	P-G	P	G-E	E
PRICKLY LETTUCE	-	P	P	P	E*	G*
REDROOT PIGWEED	G	F-E	G-E	G	E	F-E
RUSSIAN THISTLE	F	G-E	G-E	F	G-E*	E*
SMARTWEED	F	G-E	G-E	N	G-E	F-G
WATERHEMP (ALS-RES)	G	F-E	G-E	F-G	N	N
WILD BUCKWHEAT	P	P-F	P-G	P	P	P
WILD MUSTARD	P	P	P	P	E	E
WILD SUNFLOWER	N	N	N	P	E	F

*** Will not control resistant biotypes. ** Spartan Charge and Spartan have the same weed control ratings, the difference is that Spartan alone will not control anything already emerged.**

E = Excellent = 90 - 99% control
G = Good = 80 - 90% control
F = Fair = 65 - 80% control
P = Poor = 40 - 65% control
N = None = no control
"-" = insufficient information

Reference: 2019 North Dakota Weed Control Guide

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THREE SUNFLOWER DISEASES YOU CAN DO SOMETHING ABOUT

Take action against sunflower rust, downy mildew and Phomopsis.

Sunflowers are native to North America, as are the pathogens that infect them, which is the reason producers generally see more diseases on sunflowers than crops that didn't originate from here, says Dr. Samuel Markell, professor and extension plant pathologist at North Dakota State University.

However, there's good news for sunflower growers dealing with sunflower rust, downy mildew and Phomopsis: a number of tools are available to help growers manage these diseases in their fields.

Downy Mildew

Before setting foot in the field, growers should be thinking about downy mildew, which is caused by the soil-borne fungal pathogen *Plasmopara halstedii*. It hits sunflowers early, says Markell, and kills or severely stunts plants. The pathogen can survive more than 10 years in the soil.

However, a fungicide seed treatment with a novel active ingredient and mode of action can transform downy mildew management.

"This is probably the thing I'm most excited about," says Markell. "In 2011, we got our hands on something that was really novel."

The active ingredient, oxathiapiprolin, has undergone extensive testing by NDSU since 2011, and is highly effective, says Markell. "It's a game changer. It's a fantastic product," he says.

The new fungicide, which is marketed as Plenaris® by Syngenta® and Lumisena® by Corteva Agriscience®, provides almost complete control of all known downy mildew races. Plenaris will be added as a seed treatment to all Nuseed hybrids going forward, says Alison Pokryzwinski, Nuseed's technical agronomist.

The only time the fungicide failed, says Markell, occurred during a trial when it rained for about 30 days in a row after planting. "And that's just because it was a seed treatment – they don't last forever."

Downy mildew can also be managed with downy mildew-resistant hybrids. However, the pathogen can overcome these hybrids occasionally, so fungicide seed treatments are also recommended for use with resistant hybrids.

"IF YOU GET BEHIND RUST, YOU CAN'T MANAGE IT. IF YOU GET A FUNGICIDE ON ABOUT R5, YOU'RE GOING TO PROTECT YOUR YIELD. IT'S ALL ABOUT THE TIMING."

Sunflower Rust

Before seed goes in the ground, producers should also think about sunflower rust, a disease caused by the fungal pathogen *Puccinia helianthi*.

When sunflower rust shows up at the bloom stage (R-5) or earlier, especially on confection hybrids, and there is more than one or two percent covering the upper leaves, yield loss will occur unless the disease is managed, says Markell.

"Rust can really knock your yield if it starts early and you have lots of days with wet leaves, but it's also one of the easiest diseases to manage," he says.

Some sunflower hybrids are resistant to rust, and fungicides also work well on the disease. Usually, rust is carried by wind into a field from other fields or residue. Growers often start to see infection symptoms during the late vegetative stages. "Rust, in general, is a dusty cinnamon brown pustule, and if you rub it off you tend to have a little white clearing underneath," says Markell.

Scouting for rust is essential as the crop approaches the bloom stage. One percent severity on the upper four leaves at or before bloom is the action threshold for fungicide application.

"That's about the time a grower might put an insecticide application down for protection from some of the head insects. Right before that point, I would encourage growers to scout. And if they see rust on the upper leaves – anything more than a trace amount, because one percent isn't a lot – they might want to think about putting a fungicide on as well," he says.

"If you get behind rust, you can't manage it. If you get a fungicide on about R5, you're going to protect your yield. It's all about the timing." After the bloom stage is over, at R-6 or R-7, rust won't affect yield. "All it does is help dry down the crop," says Markell.

Both the strobilurin (Headline®) and triazole (Folicur®) fungicide classes work well on rust, he adds.

The sunflower rust pathogen can withstand winters in the United States and Canada. Wild sunflower populations as well as volunteers can harbor the rust pathogen. Markell recommends producers get rid of these plants if they are adjacent to their fields.

Phomopsis Stem Canker

Phomopsis stem canker, which is caused by the fungus *Phomopsis helianthi*, is a sunflower disease Markell is concerned about. "This one has really blown up on us in the last five or six years. Mid-season, you'll see brown lesions on the stems, and they hollow out the plant. Usually, you get pretty horrific lodging if you have some wind," he says.

Disease incidence has dramatically increased in North Dakota and Minnesota, especially under wet conditions.

Often symptoms begin with lesions at the leaf edges where Phomopsis spores have infected the plant. The dark brown lesions spread into the stem, eventually hollowing it out.

Managing Phomopsis stem canker is crucial. Choosing hybrids with resistance or tolerance to the disease is important, but not a perfect solution. Some hybrids manage the disease better than others, says Markell. If producers have had Phomopsis stem canker in the recent past, he recommends they plant hybrids with some level of resistance or tolerance to the pathogen.

Presently, Markell is working on managing this disease better with fungicides. "Fungicides are not a perfect solution, but we've been doing a lot of research on this for some time and in some environments, fungicides may be helpful," he says. "We're looking at the combination of growth stage and chemicals."

Studies included the strobilurin (Headline), triazole (Folicur) and succinate dehydrogenase inhibitor (Endura®) fungicide classes. In each of the trials, better yields, lower numbers of wilted plants and a higher percentage of robust heads were associated with strobilurin application at R1, says Markell.

However, he's not recommending this strategy to producers just yet because study results have been variable and somewhat inconsistent, he says. "We couldn't hit the timing right. We think it's because that infection window is so wide. But if it's wet right before R1, and the conditions are favorable for Phomopsis, this is something growers might want to consider."

In the future, a forecasting model will be available to help growers with fungicide application decisions for Phomopsis stem canker management. "We're developing a forecasting model right now that's being led at South Dakota State University. Hopefully in a couple of years we'll have that available," says Markell.

New Diagnostic Tool

Currently, another new tool is available to sunflower growers to make identifying diseases in the field easier. *The Sunflower Disease Diagnostic Series* is a set of diagnostic cards developed by five pathologists

across the north central region. Growers can email nuseed.marketing@nuseed.com to request a complimentary printed set.

"It's a handy tool to have in the glovebox," says Pokryzwinski. "It's easy to find the information you need to make the right choice for disease management."

And when it comes to protecting your crop from disease, the more information you have about what's in your field, the better off you are, says Markell.

Whether through diagnostic cards, images or a crop consultant, accurate disease identification is important, says Markell, as is scouting.

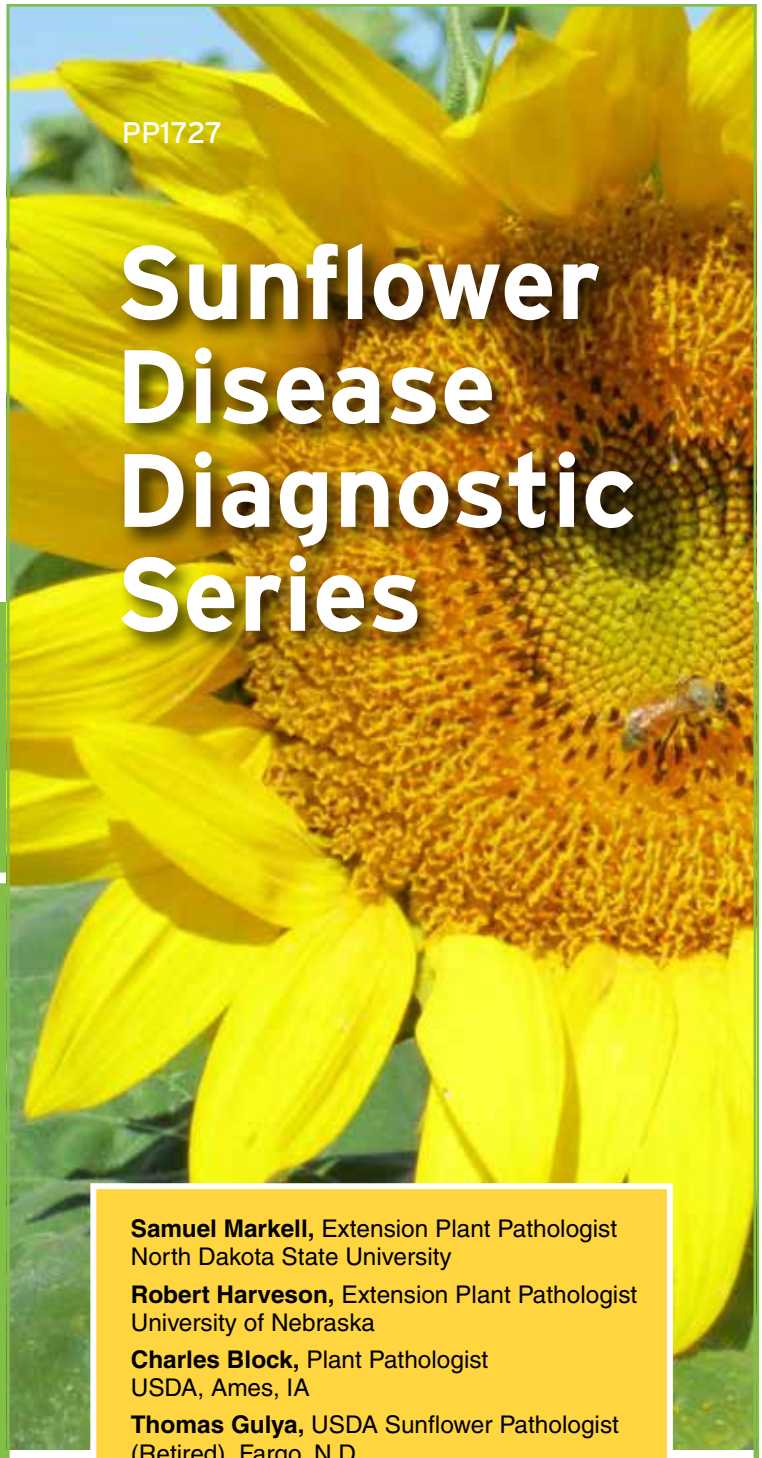
"Ideally, get in and scout at least three times in the season. Scout early when downy mildew is active, once right before bloom for rust and Phomopsis stem canker, and once toward the end of the season to see what else showed up," he says.

Disease ID
First Step in Disease Management

The Sunflower Disease Diagnostic Series is a set of diagnostic cards developed by five pathologists across the north central region to help growers identify these sunflower diseases:

- Bacterial head rot
- Rhizopus head rot
- Sclerotina head rot
- Bacterial stalk rot
- Charcoal rot
- Downy mildew
- Fusarium root and stem rots
- Phoma black stem
- Phomopsis stem canker
- Sclerotina mid-stem rot
- Sclerotina wilt/basal stalk rot
- Verticillium wilt
- Albugo/white rust
- Alternaria leaf blight
- Apical chlorosis
- Bacterial leaf spot
- Powdery mildew
- Rust
- Septoria leaf blight
- Virus diseases

Diseases are organized by plant part (e.g. leaf, stem or head) and symptom occurrence timelines. The diagnostic cards are available online at www.ag.ndsu.edu/publications/crops/sunflower-disease-diagnostic-series/pp1727.pdf and, for a limited time, by emailing nuseed.marketing@nuseed.com to request a printed set be mailed to you.



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WHAT'S BUGGING YOU

Entomologist Dr. Janet Knodel discusses two major pests bugging sunflower producers and what can be done about them.

Currently, an infestation level of one to two red sunflower seed weevils per head in confection and four to six per head in oil sunflowers are the average economic thresholds.

Insects can take a bite out of producers' yields. And there are two insects that top Dr. Janet Knodel's list of pests sunflower producers should pay attention to. The extension entomologist and professor at North Dakota State University says red sunflower seed weevils and wireworms can cause a lot of headaches for producers.

Before taking action against pests with insecticides, Knodel recommends producers use integrated pest management strategies (IPM).

"That means getting out and scouting fields weekly throughout the season," she says. "As key pests come into critical windows, when they're increasing in population, we recommend checking the fields more often – twice per week."

IPM Know-How

Knodel urges producers to follow correct scouting protocols and to use economic thresholds to make spraying decisions. "Since sunflower is a favored crop used for pollinators, we try to mitigate insecticide spraying and encourage farmers to spray only when it's necessary by using these thresholds."

Economic thresholds take many factors into account, such as the crop's market value, plant stand, pest density and cost of insecticides. In addition, although many insects can be found in sunflower crops, most of them are beneficials and not pests, says Knodel.

Furthermore, populations cycle, she says, so they're not always high for all insects. Weather conditions also determine if an environment is favorable for a particular pest. Another factor that affects population size is how successfully an insect has overwintered.

"It's really important to scout because we can't forecast whether or not a certain insect is going to be a big problem that year," says Knodel.

IPM employs biological, cultural, physical and chemical tools to manage pests. Using IPM strategies are not only beneficial for the environment and the organisms living within

it, but are also advantageous for producers in terms of costs savings and resistance management.

"The IPM grower may never have to spray because insects may not reach threshold levels. We only want to use our tools in our IPM box when we need to, so we don't overuse them and potentially develop insecticide resistance. Plus, if you're spraying, and you don't have to, there are a lot of beneficials out there that feed on the eggs and immature stages of insects," says Knodel.

"If that farmer didn't have to spray because the populations are naturally low, he's allowing the natural enemies, who are always out there in the field, to do their part in reducing the overall populations for next year," she says.

Wireworm Wary

There are more than 9,000 wireworm species in the world, with 885 of those in North America. Around 20 wireworm species are considered pests in field crops and often more than one species is present in a field.

These insects have a long life cycle, from three to five years, making them pests in the same field year after year. When wireworms are in the larval stage, they cause the most damage to sunflower plants by feeding on the roots and stems. They also tunnel up the stems and feed on secondary roots, and the holes they create allow diseases to enter the plants. Wireworm feeding damage causes poor plant stands and stand loss due to blank spots in fields or skips in rows.

Wireworm field sampling and surveying populations to determine if the insects will be a problem is difficult, says Knodel. Although intensive and time-consuming, bait bags and solar bait traps can be used for field sampling. If there is more than one wireworm per trap, soil insecticides or insecticide seed treatments are required, she adds. However, it's likely too late to do anything about the wireworms that season.

"The main control method is preventative. There are no rescue treatment options. If you have a lot of wireworms and you're losing stand, there's nothing you can do that season. You must make the decision to use a seed treatment or in-furrow insecticide before you plant," says Knodel.

Wireworm

Current registered pest control products for wireworm include the pyrethroid zeta-cypermethrin (Mustang® Maxx) applied in-furrow at planting and neonicotinoid seed treatments including imidacloprid (Dyna-Shield®, Gaucho® 600 and Senator® 600SF) and thiamethoxam (Cruiser® 5FS).

One of the problems with current wireworm control strategies is neonicotinoid seed treatments do not kill all of the wireworms, says Knodel. Some of the wireworms experience only temporary morbidity. Additionally, pyrethroids are repellents and generally non-lethal to wireworms.

"The wireworms can be sick for more than 150 days and they do not feed on the plants, then they recover and continue on with their life cycles. They'll be there again next year when you plant. That's one of the major reasons we're seeing an increase in wireworm populations," she says.

Insecticide seed treatments and in-furrow pyrethroid applications provide seedling protection.

"They protect the plant during that critical stage when it's a seedling, but, unfortunately, it's not like some of the old chemistries that caused wireworm mortality. All insecticides we've trialed worked well providing adequate protection early on. There's an acceptable level of protection with the tools we have now," says Knodel.

Weevil Photo courtesy of Kansas State University

She also maintains producers need to know the histories of their fields. "If you have a history of wireworms, you're likely to continue to have it. Wireworms follow the moisture in the soil, so when it's really dry they move deeper into the soil profile and may quit feeding."

Those producers with severe wireworm pressure should look at their crop rotations. Wireworms prefer wheat and other grass crops, and they also feed on weeds. Producers should control grassy weeds as those weeds will maintain wireworm populations in fields, says Knodel.

Seed Weevil Woes

Feeding damage caused by red sunflower seed weevil larvae can cause big problems for producers. Throughout July and August, adult seed weevils emerge from the soil and feed on sunflower foliage and buds, they then move to the heads to feed on pollen and flowers.

Female seed weevils deposit eggs right in the seeds. Larvae feed on the kernels in August and September, and in the fall they chew a hole in the side of the kernel and drop down to the ground to overwinter in the soil.

"The red sunflower seed weevils feed on seeds and reduce the size of seeds. Some-

Pesticide Resistance

More than 500 different insects have developed resistance to insecticides worldwide, says Dr. Janet Knodel, an extension entomologist and professor at North Dakota State University. Pyrethroid resistance is on the rise partly due to repeated use of the same insecticide year after year and not using economic thresholds to make insecticide application decisions.

There are a number of pyrethroids used to control insects in sunflower crops; however, resistance to one pyrethroid is resistance to all pyrethroids because they're all the same mode of action, says Knodel.

"We call this cross resistance. There is hope though; we can control resistance in insects. We've done it before, we can do it again. Just rotate your insecticide modes of action and use a higher rate so that we don't develop resistance."

Knodel says other tips to lower the risk of insecticide resistance include:

- Avoid using the same mode of action (or insecticide class) year after year
- Avoid using the lowest labeled insecticide rate
- Do not use premix insecticides containing two insecticides of the same or two different modes of action because premixes have lower amounts of active ingredient per insecticide
- Optimize insecticide application by spraying during low winds and avoiding inversions
- Use alternative IPM strategies

It's important to report suspect cases of insecticide resistance. In North Dakota report suspect cases to a NDSU extension entomologist (Janet Knodel or Patrick Beauzay) or local county extension agent or crop specialist at Research and Extension Centers. In South Dakota report suspect cases to South Dakota State University extension field crop entomologist Adam Varenhorst.

Dr. Janet Knodel is an extension entomologist and professor at North Dakota State University.

times when you combine, the seeds will get blown out the back. They also reduce sunflower yield and oil quality," says Knodel.

To manage the seed weevils they must be prevented from laying eggs. "Once they're in the seed, that larva is protected, and it will feed on the kernel," says Knodel.

Scouting is essential for seed weevil management. Knodel recommends scouting early because weevils are attracted to the earliest blooming fields where they will start to congregate.

Crop protection products should only be applied when economic thresholds are reached. Farmers must calculate accurate economic thresholds for their fields using correct sampling methods before applying insecticide for seed weevil control.

For a detailed description on calculating economic thresholds and proper field sampling techniques visit https://www.ag.ndsu.edu/publications/crops/integrated-pest-management-of-sunflower-insect-pests-in-the-northern-great-plains#section-26. Videos on red sunflower seed weevil scouting techniques are also available at https://www.ag.ndsu.edu/extensionentomology/field-crops-insect-pests/sunflower.

Currently, an infestation level of one to two red sunflower seed weevils per head in confection and four to six per head in oil sunflowers are the average economic thresholds.

The best window for insecticide spray timing is when 50 percent of the plants in a field have developed yellow ray petals (R5.0), 30 percent of the plants are shedding pollen (R5.3) and 20 percent of the plants are at the bud stage (R2 to R3).

There are a number of foliar insecticides registered to control red sunflower seed weevil, including organophosphates and pyrethroids. However, some of those insecticides are currently under regulatory review.

"We could lose Lorsban®, it'll be a big loss for sunflowers. It'll be either restricted or revoked. The same thing goes for our neonicotinoid seed treatments and our foliars – there will be a decision on neonicotinoids this spring," says Knodel.

Cultural management strategies include planting early, which will help reduce the number of seeds infested in the field. However, producers must be mindful of other pests in their fields. For example, planting early may help reduce seed weevil infestation, but producers may run into banded sunflower moth issues.

"You have to know your pests out there before you decide to plant early," she says.

Trap cropping can also be effective; however, producers must plant twice – sunflowers are planted early (seven to 10 days) around the field's perimeter before seeding the main field.

"Research shows trap cropping can concentrate insects into the field's edges because the seed weevils are highly attracted to those early-blooming flowers – and you have less area to spray. It costs you less, but trap cropping wasn't adopted well by farmers because they usually don't have time to go into the field to plant twice, but it is available," says Knodel.

TOP TIPS FROM NUSEED

Nuseed's experts share their top advice on growing and harvesting sunflowers.

INDUSTRY EXPERT	TIP NO. 1	TIP NO. 2	TIP NO. 3
 **Alison Pokrzywinski** is Nuseed's technical agronomist. Alison shares her experience with early-season sunflower management.	**"Start clean and stay clean** with respect to your sunflower fields and weeds. One of the best ways to do that is with a good herbicide program that includes pre-plant or pre-emergence herbicides in addition to Clearfield, Clearfield Plus or ExpressSun production systems, depending on the hybrid's herbicide tolerance trait."	"Growers should **calibrate planting equipment** to get good singulation at planting. That comes from knowing the seed size, knowing how to adjust your planter and making sure you're using the right plate."	"Know what early-season issues might arise and stay ahead of those problems. For example, if you know downy mildew is an issue in your field, **have the genetics or seed treatment, or both, in place.** If you have had problems with cutworms in the past, be on top of scouting rather than resorting to a rescue option."
 **Fred Parnow** is Nuseed's Canada business manager. Fred shares his best overall sunflower tips after 30 years in the industry.	"The number one point of success for sunflowers is early planting. People with top yields **plant early**."	"With respect to planting equipment, **strive for uniformity** when planting – uniform seed depth and uniform seed distribution."	"Aim high, strive for 3,000-pound yields. Choosing the **right hybrid, proper fertility** and both early- and mid-season weed control are all imperative."
 **Trygg Olson** is a field sales leader for Nuseed. Trygg offers up his top advice for harvesting sunflowers.	"If you plan on **desiccating**, make sure the plants are physiologically mature at 35 percent moisture. If you desiccate too soon, you can actually lose oil content percentages."	"Proper **combine set-up is key** – have the right header, the right ground speed and the right rotor speeds."	"When it comes to grain handling and putting your crop in the bin, if you're at risk for seed cracking **use a conveyor instead of an auger.** Put your grain into storage with as little damage as possible."

HOMING IN ON HIGH OLEICS

Focusing on high oleic hybrids has been advantageous for this North Dakota grower.

For North Dakota farmer Adam Bettenhausen, growing sunflowers is second nature.

"My grandfather and my dad started growing sunflowers pretty early on when they started to become a real cash crop. We've stuck with them ever since," says Bettenhausen.

The slate of sunflowers at Bettenhausen Farms has varied over the years, but recently the focus has shifted to high oleic oil hybrids.

"We wanted to focus with just one type of sunflower. At the time high oleics were our best moneymaker. So, we've moved the whole farm in that direction," says Bettenhausen, who makes a practice of field-testing a number of new high oleic hybrids every year.

In 2018, Bettenhausen's trials included N4H302 E, a new high oleic hybrid from Nuseed with the Dupont™ ExpressSun trait providing tolerance to Express herbicide.

Bettenhausen says he chose the hybrid because of stubborn weed issues on his farm.

"We're constantly looking for something else to add to the arsenal, and this new Nuseed hybrid fit that bill, so we thought we'd try it out," Bettenhausen says.

"In this area, we struggle with kochia and a couple other broadleaf weeds. We really couldn't seem to do a good job with Beyond, and if you compare the systems as a whole, the Express versus the Clearfield package, Express is a lot cheaper to use. So, we were interested in moving in that direction."

For the N4H302 E trial, Bettenhausen utilized variable rate seeding and planted between 19,500 and 24,000 seeds per acre.

"Everything was timely and went pretty well as far as planting. The sunflowers handled disease well," says Bettenhausen. "The stand was good [and] there were no lodging problems or any kind of issues getting them harvested."

Production Tips

Bettenhausen says it pays to give sunflowers the same care and attention as other crops.

"Nowadays, everybody is putting every little thing into a corn crop or a soybean crop. They're putting multiple applications of fertilizers, splitting up applications, using biologicals, et cetera," says Bettenhausen.

"If even half of this management effort is put into a sunflower crop, you can definitely make your money back."

Bettenhausen says cutworms can be a problem in his area, so he typically applies an insecticide at planting to help control the pest. He adds weevils can also be an issue at the sunflowers' head-fill stage.

"We've struggled with them for the past couple of years and that requires being really diligent," says Bettenhausen, who scouts his sunflower fields for emerging weevils and will order aerial spray applications once an appropriate threshold is reached.

Bettenhausen notes that large flocks of migrating blackbirds will often nestle into his sunflower fields to feed in the fall. "They can take out a lot of the yield," he says.

SNAPSHOT
Grower: Adam Bettenhausen
Farm: Bettenhausen Farms, Wishek, North Dakota
Crops: Sunflowers, soybeans, corn, canola, spring wheat
Sunflower Acres: 1,200 to 1,800

Bettenhausen will utilize wildlife cannons and pyrotechnics to try to keep the birds away but acknowledges that can be labor intensive. For this reason, he prefers to desiccate and harvest his sunflowers before the blackbirds show up.

"If you can get them off before the birds move in, that can be pretty advantageous," he says.

For Bettenhausen, it's also beneficial to bring his product directly to sunflower processors, which is why Bettenhausen Farms has a large amount of on-farm storage and also its own trucks for hauling the crop to crushing facilities.

Bettenhausen says about a third of his sunflower crop was forward-contracted to processors last year and he'll likely do the same this year.

"The rest is held on to in storage and we try to hit seasonality in the market in the June-July timeframe. We usually find that sunflower prices generally are the best at that time of year," he says.

SUNFLOWERS HIT THE SWEET SPOT

Sunflowers are good for the soil and for this South Dakota grower's bottom line.

South Dakota farmer Colby Brink has been growing sunflowers for more than 30 years. He plans to keep growing them for the foreseeable future because they're good for his farm's bottom line.

"The No. 1 reason we plant sunflowers is profitability," says Brink. "Sunflowers have consistently been a crop that pencils out, some years better than others, but it always pencils in the positive."

Brink notes that because sunflowers have deep penetrating taproots that can access hard-to-reach nutrients and are also drought tolerant, they're an excellent match for the soils and dryer climate of central South Dakota.

"Because of that, it's hard not to plant them, and so sometimes we have to remind ourselves to follow our rotations and not get greedy," he says.

Until recently, the bulk of Brink's crop has gone to the NuSun® oil or bird food markets. In the past few years, he's also started growing sunflowers for the high oleic oil and dehull markets.

Last year, Brink had an opportunity to field-test a new high oleic hybrid from Nuseed called N4H470 CL Plus, with the Clearfield Plus production system for sunflowers. He was very pleased with how his trial of the new hybrid turned out.

"The plantability was fantastic – good singulation and good spacing. They looked good coming up and everything was phenomenal with them," Brink says.

He adds that aside from some Folicur fungicide he mixed with his insecticide spray at flower, the Nuseed hybrid he trialed didn't require any disease treatments, largely due to South Dakota's hot, dry summer in 2018.

Production Tips

Brink maintains the key to a successful sunflower crop is to ensure your fields are clean at planting.

> "THE NO. 1 REASON WE PLANT SUNFLOWERS IS PROFITABILITY."

"Kochia and pigweed have become huge problems in sunflower fields, especially those that did not have a good pre-emerge and burndown program," he says. "If you don't manage those tough-to-control weeds before planting, you will have very little chance of doing that once the crop has emerged.

Brink says another important step in attaining higher sunflower yields is ensuring proper seed treatment and placement.

Last year, we treated everything with Cruiser and Plenaris. This gave us hands down better control of early season downy mildew, and by far better flowability and singulation."

Brink advises sunflower growers to scout their fields weekly to stay ahead of in-season weed, insect and disease problems, and to also always maintain proper settings on their combines when harvesting the crop.

SNAPSHOT
Grower: Colby Brink
Farm: KCM Partnership in Pierre, South Dakota
Crops: Sunflowers, wheat, corn, soybeans, milo
Sunflower Acres: 1,000

Brink believes diversification is important when it comes to marketing sunflowers. It's why he'll usually grow a number of different market types at his farm, marketing a percentage of his crop prior to planting and then the rest during the growing season as the crop develops.

Brink says he's a fan of Nuseed's sunflower portfolio because they are developed in the United States and are tailored to fit farmer and processor needs.

"I am very confident in the hybrids that Nuseed brings to market as they're the ones processors are specifically asking for," he says.

REAPING THE REWARDS OF **GOOD CROP MANAGEMENT**

A Red River Valley grower treats his sunflowers like a high-value crop and is handsomely rewarded.

Glenn Heuchert is a long-time sugar beet grower in North Dakota's Red River Valley who didn't think much of sunflowers before growing the crop about 20 years ago.

"I used to classify them as a weed, but then I started growing sunflowers and making money on them. I've said as long as they're working, I want to keep growing them," Heuchert says.

"I treat my sunflowers just like I do my sugar beet and edible bean crops. If you want to make money on them, you need to treat them like a high-value crop," he adds. "I've made good money in sugar beets but there's been some years I've made even more on sunflowers."

In recent years, Heuchert has been growing both high oleic oil and NuSun sunflower hybrids on his farm. In 2018, he field-tested N4H302 E, a new high oleic hybrid from Nuseed with the DuPont ExpressSun trait providing tolerance to Express herbicide.

The new N4H302 E yielded 2,700 pounds per acre for Heuchert. "Anything that's over 2,000 pounds is a good crop as far as I'm concerned," he says.

"It came out really consistent – it seemed like everything I planted came up," Heuchert adds. "The plants all stood well and had even height. The spacing was perfect so they all had a uniform head size."

Heuchert says due to minimal weed pressure he didn't need to apply Express or any post-planting herbicide. North Dakota's hot, dry summer in 2018 meant there wasn't much in the way of disease either.

Production Tips

Heuchert says he usually trials three different hybrids on his farm every year. He says he looks for high test weight and oil content and, of course, a good yield – but what he values most is consistent results.

"I like a hybrid that is consistent for two, three, or four years, so I can adapt it to varying weather conditions. I've had some hybrids that one year yielded 3,200 pounds per acre, and the next year it was a complete dud."

Heuchert says one of the things he's learned during his years of growing sunflowers is the importance of proper seeding.

"Every grower needs to find out what is the optimum spacing that works for him, how many seeds he needs to drop, what are the survival rates, and everything else you need to know to get an even, consistent stand," he says.

"I used to try dropping 23,000 seeds per acre in 22-inch rows, because I felt I'd have better emergence," Heuchert adds. "I felt that my stalk strength may have been suffering because the population was too high, so this year I dropped the seeding rate down to 21,000 seeds per acre and I still had a good stand."

Heuchert says he typically desiccates his sunflowers to avoid crop losses prior to harvesting. "It's more consistent than leaving it up to Mother Nature, plus you don't have to deal with damage caused by birds and wildlife in your fields."

SNAPSHOT
Grower: Glenn Heuchert
Farm: G & C Heuchert Farms, Grafton, North Dakota
Crops: Sunflowers, sugar beets, edible beans
Sunflower Acres: 300 to 700

"I LIKE A HYBRID THAT IS CONSISTENT FOR TWO, THREE, OR FOUR YEARS, SO I CAN ADAPT IT TO VARYING WEATHER CONDITIONS. I'VE HAD SOME HYBRIDS THAT ONE YEAR YIELDED 3,200 POUNDS PER ACRE, AND THE NEXT YEAR IT WAS A COMPLETE DUD."

TAPPING INTO WATER EFFICIENCY

With water a large consideration, this Colorado grower focuses on sunflowers.

Patrick Hume is one of many farmers in Colorado's eastern plains region adversely affected by declining groundwater levels. Hume and his dad, Charles, co-owners of Big Flat Farms, used to be primarily irrigated corn producers but they've switched their focus to a crop that needs much less water.

"We have water issues, and sunflowers just work for us. You can get about as much gross profit with them as you can with corn, using about a third of the water," says Hume, noting that half of his sunflower crop is farmed under dryland conditions and the rest receive minimal irrigation.

Hume says because sunflowers are a broadleaf crop, it allows his farm to diversify its rotation and also leverage different chemistries, "so we can directly combat resistant weeds."

"Sunflowers also seem to really scavenge nutrients left in a field after a corn or milo crop that other plants don't," he adds.

"Sunflowers do an excellent job of eliminating any stubble that you might have left from a previous crop, which in my mind is great because that usually gets turned into soil organic matter that holds water – and water is our number one limiting resource here. So, for us, it's a pretty good fit."

Hume says his father started growing sunflowers more than 30 years ago. During that time, the farm has produced sunflowers mostly for the high oleic oil market.

Last year, Hume's farm trialed N4H521 CL, a new high oleic hybrid from Nuseed, with the Clearfield production sysytem for sunflower with tolerance to Beyond herbicide. N4H521 CL also has resistance to downy mildew.

Hume says he was impressed with N4H521 CL's emergence and standability. Hume notes there were some lodging issues due to high winds at one point in the season, but he says the new hybrid seemed to fare better than test plots of other hybrids he grew.

Hume was also pleased with how well the N4H521 CL hybrid held up at harvest. "It harvested fine and they didn't break open before I could get them in the header," he says.

Production Tips

Hume says it's crucial to ensure your fields are protected from wind erosion in drier regions like his. To keep the soil from blowing away, Hume will plant his dryland sunflowers into corn, wheat and milo stubble.

"You need to make sure that your ground's covered before you even attempt sunflowers in dryland conditions," he says. "I learned that lesson the hard way by trying to plant them in a year that had quite a bit of drought."

Hume says it's also important when growing dryland sunflowers to ensure that pre-emergence herbicides are put down early and are adequately incorporated into the soil – which often means keeping a close eye on the weather for timely rainfall events.

Without a proper pre-emergence program, Hume adds, "you're just going to be fighting weeds the entire season and you're probably not going to have a very good experience."

Hume recommends that growers follow at least a one-in-three-year rotation for their sunflowers to avoid disease issues, and cautions growers to always keep track of their chemical applications.

"I know there are quite a few corn herbicides and plenty of milo herbicides that will mess up sunflowers," he says. "If you have accurate records and can go back and see everything you've put on a certain field for at least two years, if not further back, this will help you have some success."

SNAPSHOT
Grower: Patrick Hume
Farm: Big Flat Farms, Springfield, Colorado
Crops: Sunflowers, corn, milo, winter wheat
Sunflower Acres: 2,000

SUCCESSFUL HARVESTING

Desiccation, combine settings, drying and storage all play an important role.

Maturity and dry down sometimes go hand in hand and sometimes not, says Nuseed's sunflower technical agronomist, Alison Pokrzywinski. An early-season hybrid with good late-season plant health or stay green trait is not necessarily going to have good dry down. And a fuller-season hybrid that doesn't necessarily have good late-season plant health could dry down really well.

This is where desiccation can be important, says Pokrzywinski. "An earlier hybrid with good late-season plant health may not look like it's ready, but all the indicators are there [for maturity], and you can go in and desiccate. However, if you wait for Mother Nature, it could take a while."

Natural sunflower dry down can be slow and uneven. Desiccants decrease losses due to inclement weather, lodging and bird depredation by speeding up the dry-down process.

However, desiccation is not for everybody and it's not for every farm, adds Pokrzywinski. For example, growers in central or South Dakota, who plant around June 20, likely aren't going to desiccate—by the time the crop is mature enough for desiccation, fall has set in and the temperatures are much cooler, or it's close to a killing frost.

Nevertheless, Pokrzywinski says she believes desiccation is underutilized by growers.

"Sunflowers can get hit by a lot of issues in the fall, whether it's disease, blackbirds, wind or rain. Growers need to consider the maturity of their crops and how far from harvest they would be if they don't desiccate."

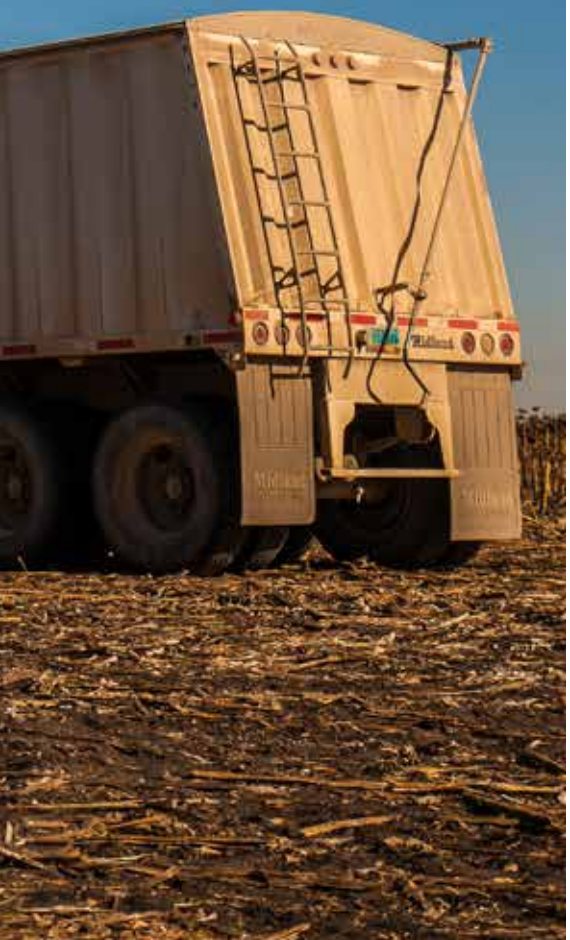
For sunflower crops planted early in the growing season, that crop may be mature by the end of August. In this case, desiccation is advantageous for growers because the crop can be harvested early and put in the bin before the elements or blackbirds decrease yield.

Waiting for a crop like this to dry down naturally, or for a killing frost, may take a long time, during which the sunflowers are

vulnerable. "Sometimes growers are waiting until October or November for a hard frost to kill off the plants," says Pokrzywinski.

Additionally, desiccation would be advantageous for those growers experiencing late-season stalk disease in their crop. Getting the crop off as soon as possible prevents further stalk damage.

Growers who desiccate also have more control over harvest timing, and desiccation also helps even out moisture levels before harvesting. "If you plant on the earlier side, you should automatically put desiccation into your budget," she says.



"WE GET PAID ON HOW MANY POUNDS WE DELIVER, WHETHER IT'S OIL OR CONFECTION SEEDS. THE GOAL IS TO HAVE IT DRY ENOUGH TO STORE, BUT NOT TOO DRY SO THAT WE START LOSING VALUE IN WHAT WE'RE DELIVERING TO MARKET."

Harvester Set-Up

Proper equipment set-up is important when it's time to harvest, says Trygg Olson, a field sales leader for Nuseed.

"Make sure the fan is set at the right speed. If it's too high, you're blowing too much out the back. If the fan speed is too low, you're going to have empties, which will affect the test weight," he says. "If you're too fast on the rotor, or if the concaves are set too tight or too loose, you're going to have trash in there and you'll start grinding the seed up and shelling seeds out."

The target for seeds thrown behind the combine is less than 10 seeds per square foot, which is 100 pounds of actual yield, says Jed Wall, sunflower business development manager for Legend Seeds in Wahpeton, N.D.

Wall also emphasizes the importance of test weight and encourages growers to check they're getting their desired test weight when harvesting.

"When you're combining, always play with your air and don't be afraid to blow your empties out of the back. With sunflowers we're always going to have some blanks. Blank seeds sometimes get mistaken for actual pounds—the more blanks, the lower the test weight is. If the test weight is too low, you're going to have a hard time selling product," he says.

"Growers are sometimes afraid to turn up the air and they don't check their test weights as they go. At the point of selling, those sunflowers weigh 26 pounds per bushel. If you break the sample down, some seeds didn't fill because they were deformed, or there's empty hulls," says Wall.

Ground speed is also important. Olson recommends a ground speed that keeps the combine full so that it'll do a good job of threshing: this may be somewhere between three and five miles per hour. However, today's large combines often need to travel more than five miles per hour to keep full.

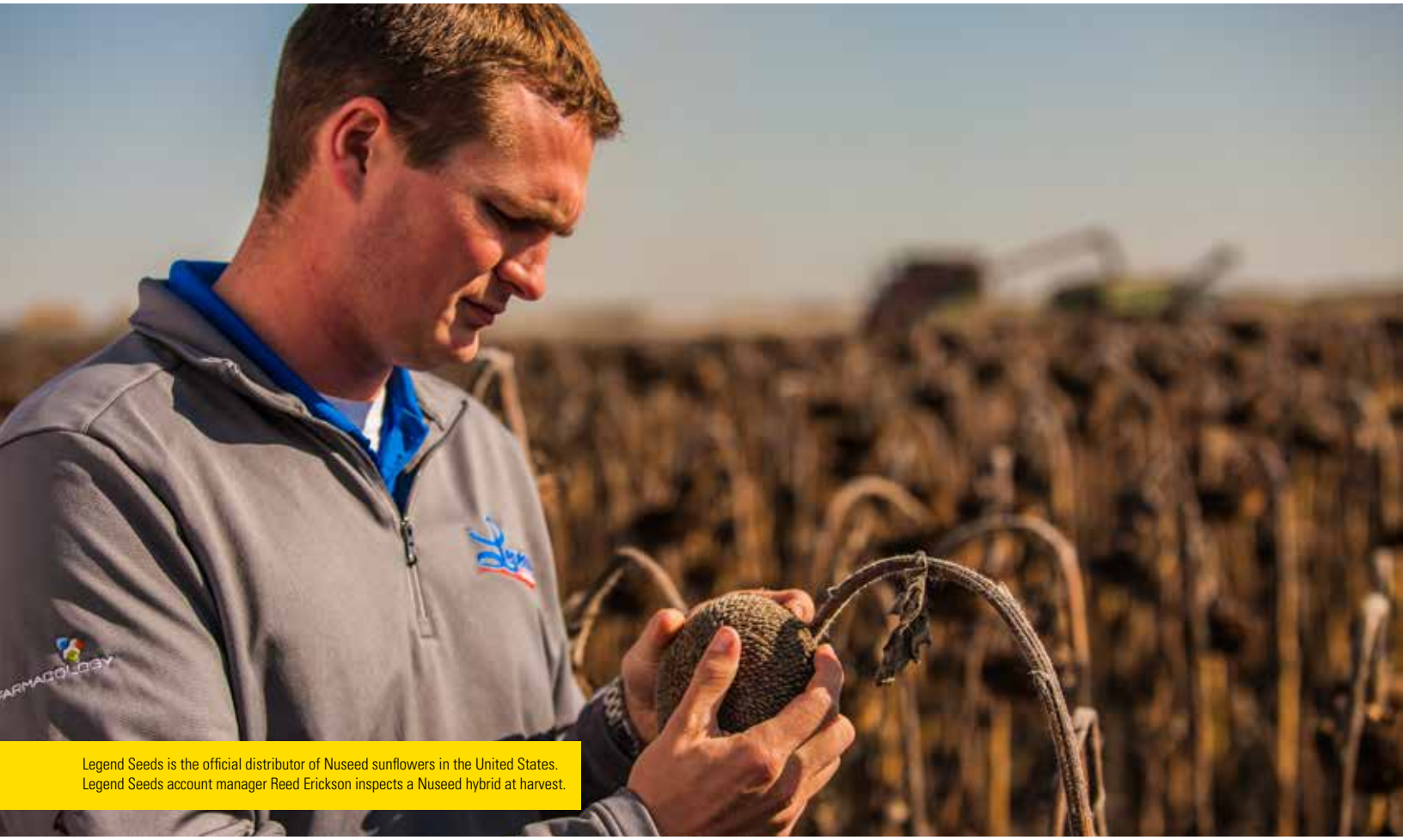
Combines used for threshing small grains can be adapted to harvest sunflowers. Platform and corn headers can be used with some modifications, such as catch pans, a deflector bar and a small reel. A rotating drum can be used to replace the deflector bar and reel. A row-crop header can be used without modifications.

However, a header designed for sunflowers is worth the investment, says Olson. "A sunflower designed head is going to pay for itself because it will greatly reduce shatter loss and do a better job of harvesting."

Keeping a clean combine at harvest is essential as it decreases fire risk. Growers should blow the combine down at least twice per day and have extinguishers on hand, says Wall. A snorkel system, which is an extension for the air intake on a combine, is also available for fire risk mitigation.

One last qualification for harvesting success is a good attitude, not a "good enough" attitude. "Some growers run into trouble with a good enough attitude. They'll tell themselves things look good enough and they're either blowing too much out of the machine or they're not blowing enough. They end up with a big expensive recleaning or going to a less desirable market," says Wall.

"Make sure the product you're putting in the bin is a good quality product and makes the specs for what you're going to sell it for," he says.



Legend Seeds is the official distributor of Nuseed sunflowers in the United States. Legend Seeds account manager Reed Erickson inspects a Nuseed hybrid at harvest.

Drying and Storage

Drying sunflowers isn't that much different from drying other grain types, says Dr. Kenneth Hellevang, extension engineer and professor at North Dakota State University's Department of Agriculture and Biosystems Engineering.

What's important to remember is all grain drying fundamentals apply, no matter what method is being used to dry the grain, he says these fundamentals are found in the NDSU Extension Service Publications written by Hellevang, Natural Air and Low Temperature Crop Drying (EB-35) and Grain Drying (AE-701).

However, there are several important differences between drying sunflowers and other grains growers should understand, he says. The biggest being the grain's weight.

"Sunflowers weigh less per bushel, so if we're accustomed to drying corn or wheat, or something that is much heavier, you'll find sunflowers dry quicker because there are less pounds of water that need to be removed."

When it comes to natural-air or low-temperature in-bin drying, Hellevang says he gets many phone calls from sunflower growers in the fall who have left harvest too late, and they have run into trouble trying to dry their crops in cooler temperatures.

"The moisture holding capacity of air is related to the air temperature. If we look at drying sunflowers in late October or November, it's going to dry much slower, and differently, than drying wheat in September," he says. "Farmers need to make sure if they're doing it with a natural-air drying system that they start early enough."

Although it may be tempting for growers to delay harvest and leave a sunflower crop in the field to dry, as temperatures fall in October and November, there is less drying ability in the air. Temperatures near freezing have no drying ability left.

"Frequently I recommend people harvest [the crop] at a little higher moisture content than they might be inclined to, and then utilize the warmer air in October to dry, rather than try to dry in November," says Hellevang.

"With temperatures down near freezing, we can't just add a little supplemental heat and fix it. It's very inefficient drying, and frequently the farmer needs to hold [the crop] over winter and actually do the drying in the spring and early summer, if they harvest too late in the fall."

Storage Moisture Versus Market Moisture

Another aspect to consider is storage moisture content doesn't necessarily correspond to the market moisture content. "The sunflower trade has been marketed based on a 10 percent moisture content as being the standard," Hellevang says.

Confection and non-oil seeds can be stored short term at 10 percent moisture content, but going into warmer-season, or long-term, storage Hellevang encourages growers to dry grain just below that value, to somewhere between nine and 10 percent moisture content.

Oilseeds must be at eight percent moisture or a little lower, he says. However, in some cases, the moisture content needs to be even lower.

"The eight percent is associated with a 40 percent oil content of the seed. Now, we're seeing oil contents closer to 45 percent, which is good from a marketing and oil production standpoint, but it also means the storage moisture content needs to be lower—somewhere between seven and eight percent," says Hellevang.

Another, often overlooked, aspect of storage management is for growers to cover the fan or air duct when not in use. If the fan or air duct is left uncovered, when wind blows and hits that opening, the grain will be ventilated and warmed, much like running the aeration system.

Also, if either fan or air duct is left uncovered, a natural chimney effect is produced. "Both the blowing wind and this natural chimney effect will warm the grain in storage, which makes the grain more susceptible to insect infestations. Or if we're marginal on moisture content, and a little on the damp side, it increases the potential for mold growth as well," says Hellevang.

Managing grain in storage, especially as bins keep getting larger, can be challenging. Grain monitoring systems can help growers stay on top of moisture management, storage temperatures and grain conditioning.

Grain monitoring systems also offer growers many conveniences. From the combine or pickup cab, growers can monitor bin status on smart phones or computers, remotely shut fans on and off, change storage parameters, and a host of other storage functions.

Hellevang says grain monitoring systems are wonderful tools for growers; however, bins still need to be physically checked, he says. "It doesn't eliminate the need for storage managers to be observing the bin: to use their sense of smell to try to determine if there's off odors, or look for indications of condensation and other problems that might be showing up."

In general, Hellevang recommends growers conduct a thorough evaluation of stored grain conditions every couple of weeks when outside temperatures are warm. In the winter months, stored grain should be checked every two to four weeks, he says.

Ultimately, drying and storing sunflowers is a balancing act.

"We get paid on how many pounds we deliver, whether it's oil or confection seeds. The goal is to have it dry enough to store, but not too dry so that we start losing value in what we're delivering to market," says Hellevang.

Raise a Grand Champion Crop

After choosing the right hybrid for your farm, planting early will set you on the road to a great harvest.

In fact, Nuseed's Fred Parnow says the number one reason for sunflower success is planting early. Those producers who plant early have larger yields—and profits.

"Change the way you've done things and plant early," he says. "People with top yields plant early."

During Parnow's 30-plus years in the industry, in almost all cases environmental conditions did not harm sunflower seedlings planted early in the season. He has witnessed canola seedlings die after a 29°F frost hits a farm, yet the sunflower seedlings come through unaffected.

"Sunflowers are very tough in the spring. I've only seen 10 fields in my entire career where there was frost damage on sunflower seedlings and the grower had to replant," says Parnow.

"Sunflowers rarely rot or freeze in the field. The quicker you can get that crop off the field, the less bad things can happen, like weather, birds, and snow," he says.

Parnow has seen both oil and confection sunflowers push 3,500 pounds in 2018. "Too often sunflower is treated like the runt of the litter. These yields tell me growers are rewarded by treating sunflower like the prettiest hog at the state fair. These producers are not afraid to give 'em the groceries. The goal is 3,000 pounds per acre—we need to set the bar higher."

Parnow says growers will be rewarded handsomely for good crop management by treating sunflowers as their best cash crop.

Good crop management includes:
- Early planting
- Appropriate fertility program
- Correct weed and insect control
- Desiccation
- Early harvest

"These are not your grandfather's sunflowers. We do things differently today than your father or grandfather did years ago. For anyone in the business, 2,000 pounds per acre should be an absolute minimum expectation," says Parnow.

"Top management leads to top yields and top ROI."

2019 MARKET OUTLOOK

It's a high oleic heyday, and one factor contributing to the market boost is the FDA's recent ruling on consumption of edible oils containing oleic acid and heart health.

John Sandbakken, National Sunflower Association's executive director.

The hottest market in sunflowers these days is high oleics, and it's a trend the National Sunflower Association doesn't see ending anytime soon.

"The trend is up very sharply. Overall, in the coming year, we see even more growth in high oleic usage," said John Sandbakken, the NSA's executive director, during his December 2018 presentation at Sunflower University in Bismarck, N.D.

Mark Jackson, Nuseed's general manager for North America, says high oleic oils are becoming a staple in the food industry. "They are critical to slowing down the oxidation process and helping food companies deliver great tasting foods."

One important factor behind the positive outlook for high oleic sunflower oil was a recent move by the U.S. Food and Drug Administration (FDA), said Sandbakken. In November, the FDA ruled there is credible evidence to support a qualified health claim that consuming oleic acid in edible oils may reduce the risk of coronary heart disease.

"Sunflower is one of those oils that is included in the mix," said Sandbakken, adding companies that sell high oleic sunflower oil will now be able to promote the heart health claim in their advertising.

"It will be huge. I mean it is really a demand builder [and] a market influencer. It's a heck of a thing to get," he said. "There's a trend overall to move to high oleic oils … and also lower fat oils. Americans want to eat as much food as they currently do [but] they just want it to be healthier. And so that's why they're switching to these types of oils."

Sandbakken added there are export opportunities for high oleic sunflower oil "but domestic markets are really where the business is. That's why this FDA health claim was so important to get because that just really helps us continue to build the value here."

The qualified heart health claim will help the sunflower industry talk directly to consumers about the nutritional benefits of sunflower oil, says Jackson. "And it should help drive more consumers to add sunflower oil into their diets."

"Nuseed has a broad profile of high oleic sunflowers that deliver on high yields and oil content across maturity zones," says Jackson.

While high oleics continue to gain popularity, Sandbakken said the prospects don't appear to be as bright for NuSun or mid-oleic sunflower oil.

"The industry is moving more to the high oleic oils right now and use [of NuSun] is dropping," he said. "There is still demand for NuSun [and] there are companies that want to use it, so this market will not go away, at least not in the near term, but long term it will continue to decline."

Sandbakken pointed out more than 80 percent of the sunflower oil produced in the United States is for domestic use, compared to 30 years ago when around 80 percent of the crop was exported. He said a positive aspect of this trend is more market stability.

"In the old days when we were exporting most of the oil, it was a very volatile market, meaning we were competing against the Argentines and the Algerians in these really low-cost markets," he said. "We are in a more stable market situation [now]."

Sandbakken also talked about current trends in confection sunflowers, including how a high U.S. dollar has caused the industry to shift its focus to the domestic market in recent years.

"It's going to be a slow grind for confections as long as we have that strong dollar," he said. "We're becoming more domestically focused on the use of our seed for confections, and as long as the dollar stays strong, I think that's going to probably be the trend here for the long term."

Sandbakken said the trend was particularly strong in the kernel market, where the most recent figures show only 19 percent of this crop is exported (Canada and Mexico are the two largest U.S. customers). He said strong competition from Eastern European nations with cheap currencies like Bulgaria and Romania is one reason why.

"It's just been really difficult to try to stay competitive with them, and so the industry is focusing more and more on the domestic market, finding more ways to use the product domestically," said Sandbakken.

For in-shell confection sunflowers, he noted, exports have also been trending down but the domestic and export markets are more evenly split. Recent figures showed 52 percent of the U.S. in-shell crop went to domestic use while the remainder was exported.

"In-shell [is] the main product that's being exported right now and where the focus of the industry is [but] the export markets have been tough the last couple of years especially. A strong U.S. dollar has just been really difficult to deal with," Sandbakken said.

"We're competing against foreign competitors like the Chinese who are selling in U.S. dollars but have a lower value of currency," he added. "That's one of the reasons why you've seen some of the roll back on confection in-shell."

Sandbakken said Spain and Mexico are the two biggest buyers for U.S. in-shell sunflower seeds. He added Turkey used to be a very large customer as well, "but there again, the Chinese have moved in and it's been just difficult to try to compete with them on price."

Domestic and export are distinctly different markets for confection sunflowers, requiring different products, added Sandbakken. For example, the preference in Europe is for longer seed types because customers there tend to eat one at a time, and hybrids are changing to meet this demand.

Jackson has also noticed shifts. "The U.S. confection market has changed tremendously over the last few years, with exports declining due to the strong dollar and a change in consumer preference to longer and broader confection grain," he says.

Mark Jackson, Nuseed's general manager for North America.

Nuseed has two new in-shell confection hybrids specifically designed to enable U.S. processors to regain lost ground in the export market, says Jackson. The new confection hybrids can reach 0.98 to 1.18 inches (25 mm to 30 mm) in length.

Within the confection sector, Sandbakken said he expects demand will grow at about the same rate for the in-shell and kernel markets. In terms of overall sales volume, he believes the in-shell market will continue to exceed the kernel market "at least for the next seven years."

Sandbakken also touched on the declining bird food market during his presentation.

"It is trending down. There are [fewer] people feeding birds and I'm not sure how that will change," he said.

"Bird food used to be a really strong demand sector for the U.S. [sunflower industry]," he said, but as a result of an aging population that has changed.

Sunflower Research

The sunflower industry has benefited from a broad range of research projects over the years, many of them funded by the North Dakota-based National Sunflower Association (NSA). The NSA executive director, John Sandbakken, spoke about the association's research priorities during his December 2018 presentation at Sunflower University in Bismarck, N.D.

According to Sandbakken, the NSA's four key research priorities are:

- Diseases
- Insects
- Weeds
- Production issues

"The four main diseases that we're really focusing on are Phomopsis, sclerotinia, rust and downy mildew," Sandbakken said, noting that progress has been made in developing new genetics and fungicides to help combat these diseases.

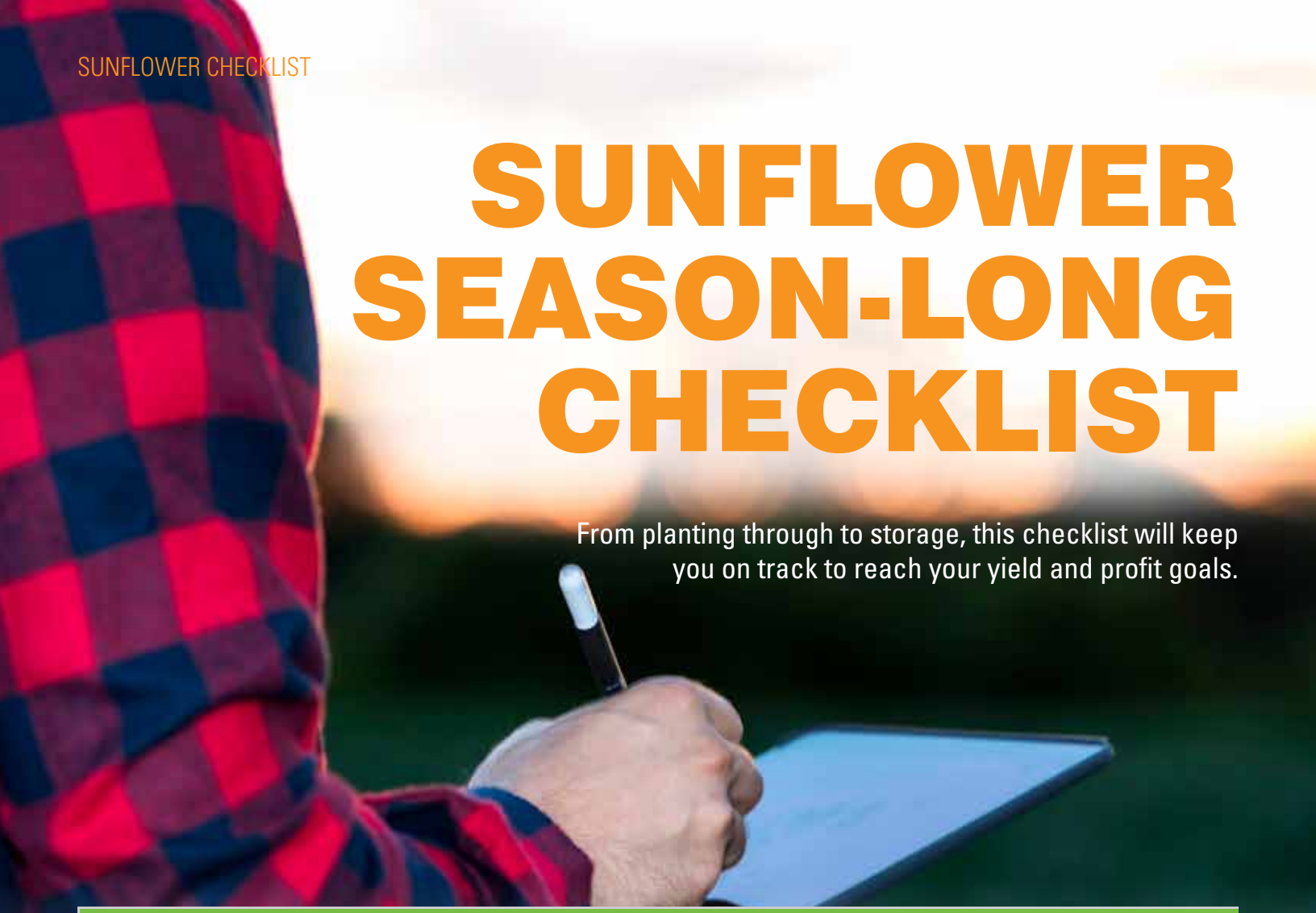
"On the insect side, we're evaluating various IPM (Integrated Pest Management) strategies for control of pests that affect sunflower," said Sandbakken. He added NSA-funded projects also include screening for insecticide resistance as well as developing new traits to fight pests such as sunflower seed weevil and banded sunflower moth.

Regarding weeds, Sandbakken said, the NSA continues to look for innovative ways to utilize both older and newer chemistries for weed control, including adding sunflower to labels for products coming out for other broadleaf crops.

Among the production issues being studied are damage caused by blackbirds and possible control measures such as repellents, drones and even lasers, Sandbakken said. In addition to investing heavily in hybrid seed development, he added, the NSA also funds projects looking into factors that contribute to healthy, high-yielding plant stands.

SUNFLOWER SEASON-LONG CHECKLIST

From planting through to storage, this checklist will keep you on track to reach your yield and profit goals.



Nuseed Confection, Conoil and Dehull Oilseed Recommended Seeding Rates

Product	Market	Recommended Seeding Rate** Seeds/Acre
6946DMR	In-shell	16,000-17,000
Panther DMR	In-shell	16,000-17,000
Jaguar DMR	In-shell	16,000-17,000
Jaguar II	In-shell	16,000-17,000
LD5009	In-shell	15,000-16,000
4334	In-shell	16,000-17,000
N5LM307	Black In-shell, Dehull, Bird Food	18,000-20,000
Badger DMR	Dehull	18,000-20,000
Talon	Dehull, Bird Food	19,000-20,000
Nuseed's oilseed hybrid seeding rate recommendation is 18,000-24,000 seeds per acre.		

* assumes germination rate of 90%
** assumes seeded in areas with adequate moisture
In dry climates the seeding rate should be reduced by 5-10%
Planting is the most critical step in producing a successful crop of confection sunflower. It is critical to produce a uniform stand that emerges all at the same time. Remember you only get one chance to get it right.

1. HYBRID SELECTION

☐ Choose hybrids with higher levels of tolerance or genetic resistance based on market, maturity, herbicide tolerance and genetic disease resistance. Nuseed has a sunflower 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 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 3/4" 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 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 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

4. BEFORE YOU PLANT

☐ Early-season weed control is crucial. Control early-season weeds with soil-applied herbicides to keep fields as free from weeds as possible for the first four to six weeks

☐ Use fungicide and disease seed treatments for disease control to reduce damage from below-ground insects

☐ 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. Whether using conventional-till or no-till, an even seedbed promotes uniform germination and emergence and good plant stand establishment

☐ In no-till situations, maintain clean fields with good pre-emergence control to get plants off to a strong start

☐ A minimum three-year rotation to reduce disease and weed pressure is also recommended. Rotate sunflowers with corn or cereals and out of canola, rapeseed, dry edible beans and soybeans, or other crops susceptible to the same diseases as sunflowers

☐ A minimum three-year rotation to reduced disease and weed pressure is also recommended. 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 fertilize for realistic targets according to geography, soil type and annual precipitation. Remember, over-fertilization can do more harm than good and fertilizer should never be placed in the seed furrow

5. PLANTING CONSIDERATIONS

☐ Soil temperature needs to be at 50°F 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

☐ 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"

☐ 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. 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

☐ 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

☐ 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 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

6. IN-SEASON

- ☐ Base herbicide decisions on the specific weeds present in fields at time of spraying
- ☐ Use of herbicide-tolerant sunflower hybrids in addition to soil-applied herbicides, will result in optimal weed control and help reduce resistant weed development risk
- ☐ Scout after herbicide spraying to confirm control of target weeds
- ☐ Scout before bloom for rust to manage it in-season
- ☐ Apply fungicide at R-5 stage on crops infected with one percent or more sunflower rust on upper four leaves
- ☐ 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
- ☐ In all regions, seed-boring insects can be controlled with insecticides during the bloom stage

7. PRE-HARVEST PREP

- ☐ 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 percent, 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

- ☐ 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 percent or less – experts recommend 12 to 15 percent. Seed moisture can be brought under 10 percent 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 5 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
- ☐ 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

9. DRYING AND STORAGE

- ☐ All grain drying fundamentals apply, no matter what method is being used to dry the grain
- ☐ Check drying rates as sunflowers dry quicker than other grains because there are fewer pounds of water to be removed
- ☐ When drying in a high-temperature dryer, constant monitoring is needed as the chaff, lint and other debris associated with sunflowers are highly combustible
- ☐ Oilseeds (at 40 percent 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 percent) should be stored between seven and eight percent. Typically, confection and non-oil seeds can be stored short term at 10 percent moisture content, but for long-term storage growers must dry grain to nine percent
- ☐ In storage, monitor grain every couple of weeks when outside temperatures are warm and every two to four weeks in the winter months

Sources:
- *Nuseed and Industry Experts*
- *Nuseed Sunflower Field Guide (www.nuseed.com/wp-content/uploads/2017/05/2015-Sunflower-Field-Guide-LoRes-for-Website.pdf)*
- *Nuseed Confection Sunflower: Best Practices Guide (www.nuseed.com/wp-content/uploads/2017/05/5-1-17-NuseedBestPracticesGuide_US_online_version.pdf)*
- *North Dakota State University Sunflower Production Guide (www.ag.ndsu.edu/publications/landing-pages/crops/sunflowerproduction-a-1331)*

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