New Dry Bean Grower Survey Publication 1
Canola Flea Beetles Emerging .................. 2
Soybean Row Spacing and Seeding Rate ... 2
Spring Residue Management
Considerations .................................. 5
How Average Daily Soil Temperature
Impacts Sugarbeet Seed Emergence . 7
Response from an Early Season Fungicide
in Wheat .......................................... 7
Treacherous Field Conditions in some
Areas this Spring ............................. 9
Fertilizing Alfalfa .................................. 10
Nitrogen Calculator App for Corn, Spring
Wheat/Durum, Sunflower ................. 10
Updated Soybean Fertility
Recommendations ............................. 11
Nitrogen Enhancers and Additives ........ 11
Ruts and Soil Compaction after Harvest..12
Burndown of Horseweed (Marestail) in the
Spring .............................................. 13
Waterhemp Emergence Confirmed in at
Least Four Counties in North Dakota
and Minnesota ............................. 13
Controlling Emerged Waterhemp in
Sugarbeet ........................................ 14
Waterhemp Control in Sugarbeet Fields to
be Planted ................................. 15
Prevent Crabgrass this Spring .......... 16
Around the State ................................ 17
North Central ND .............................. 17
Northwest ND ................................. 17
Northeast ND ................................. 17
South-Central/Southeast ND ............. 18
Southwest ND ................................. 18
The Weather Summary and Outlook ...... 20

**NEW DRY BEAN GROWER SURVEY PUBLICATION**

If you’re planning on growing edible dry beans, please check out the new *2019 Dry Bean Grower Survey of Production, Pest Problems and Pesticide Use in Minnesota and North Dakota (E1952)*. The 2019 dry bean grower survey is the 30th annual survey of varieties grown, pest problems, pesticide use and grower practices. Research and Extension faculty at North Dakota State University and the directors of the Northarvest Bean Growers Association developed the survey. It is supported by the Northarvest Bean Growers Association, an association of dry edible bean growers in Minnesota and North Dakota.

CANOLA FLEA BEETLES EMERGING

Warmer, spring temperatures have caused flea beetles in canola to start emerging from overwintering sites. Flea beetles are being captured in pheromone traps by Lesley Lubenow at Langdon REC and T.J. Prochaska at NCREC in Minot. Overall, low population densities are present and the cooler weather forecast will slow the emergence.

The stripped flea beetle, *Phyllotreta striolata* (Fabricius), is small, $\frac{1}{32}$ to $\frac{1}{4}$ in. in length, with two yellow strips on their black wing covers (Figure 1). They emerge earlier than the more common crucifer flea beetle, *Phyllotreta cruciferae* Goeze. Crucifer flea beetles are a black beetle with an iridescent blue sheen on the wing covers. Flea beetles have enlarged hind femora (thighs) on their hind legs, which they use to jump quickly when disturbed. Their name, flea beetle, arose from this behavior.

*Phyllotreta* flea beetles have a single generation in the northern Great Plains. They overwinter as adults in the leaf litter of shelterbelts or grassy areas and rarely overwinter in canola stubble. Beetles emerge when temperatures warm up to 57 to 59 F in early spring. Flea beetles feed on volunteer canola and weeds, such as wild mustard before moving to spring planted canola fields. Depending on the temperature, it may take up to three weeks for adults to leave their overwintering sites.

Warm, dry, and calm weather promotes flea beetle flight and feeding activity throughout the field, while simultaneously slowing canola growth. When weather conditions are cool, wet, and windy, flea beetles may creep slowly into the field and concentrate feeding on the field edges.


Janet J. Knodel
Extension Entomologist

SOYBEAN ROW SPACING AND SEEDING RATE

North Dakota soybean seeding rate and row spacing varies across the state. In 2017 and 2018, eight soybean seeding rates (starting at 80,000 and increasing by 20,000 live seeds per acre increments) and row spacing (12 and 24 inch) were evaluated in 15 eastern North Dakota environments to quantify established plant densities, seed yield, and plant loss occurring during the season. Planting at 12 inch row spacing yielded 2.7 bushel per acre greater than 24 inch row spacing and provided $33 per acre greater net profit on average. Following plant establishment, 6.6% in season plant loss occurred on average (Table 1). Using 180,000 to 200,000 live seed per acre had higher yields compared to seeding rates of 120,000 or less (Table 2).
Table 1. Soybean established and harvest stand, stand loss, and yield for two row spacings averaged across seven seeding rates and 15 North Dakota environments.

<table>
<thead>
<tr>
<th>Row Spacing (Inch)</th>
<th>Established stand (ES) (plants per acre)</th>
<th>Harvest stand (HS) (plants per acre)</th>
<th>Loss from ES to HS (%)</th>
<th>Yield (bu/acre)</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
<td>134,000b</td>
<td>126,400a</td>
<td>5.6b</td>
<td>46.8a</td>
</tr>
<tr>
<td>24</td>
<td>138,000a</td>
<td>126,600a</td>
<td>7.6a</td>
<td>44.1b</td>
</tr>
</tbody>
</table>

Within columns, means followed by a different letter are significantly different at ($P \leq 0.05$).

Table 2. Soybean established and harvest stand, stand loss, and yield averaged across seeding rate and 15 North Dakota environments.

<table>
<thead>
<tr>
<th>Seeding Rate (live seeds acre)</th>
<th>Established Stand (ES) (plants per acre)</th>
<th>Harvest Stand (HS) (plants per acre)</th>
<th>Loss from ES to HS (%)</th>
<th>Yield (bu/acre)</th>
</tr>
</thead>
<tbody>
<tr>
<td>80,000</td>
<td>77,000e</td>
<td>72,000e</td>
<td>5.8</td>
<td>43.2c</td>
</tr>
<tr>
<td>100,000</td>
<td>94,000de</td>
<td>88,000de</td>
<td>5.5</td>
<td>44.1bc</td>
</tr>
<tr>
<td>120,000</td>
<td>114,000cd</td>
<td>108,000cd</td>
<td>5.5</td>
<td>44.9bc</td>
</tr>
<tr>
<td>140,000</td>
<td>133,000c</td>
<td>123,000c</td>
<td>7.3</td>
<td>45.8ab</td>
</tr>
<tr>
<td>160,000</td>
<td>162,000b</td>
<td>151,000b</td>
<td>6.8</td>
<td>45.9ab</td>
</tr>
<tr>
<td>180,000</td>
<td>178,000ab</td>
<td>165,000ab</td>
<td>7.3</td>
<td>47.0a</td>
</tr>
<tr>
<td>200,000</td>
<td>197,000a</td>
<td>181,000a</td>
<td>7.8</td>
<td>47.2a</td>
</tr>
<tr>
<td>LSD (0.05)</td>
<td>21,000</td>
<td>20,000</td>
<td>ns</td>
<td>2.1</td>
</tr>
</tbody>
</table>

Within columns, means followed by the same letter are not significantly different at ($P \leq 0.05$), ns = not significant.
Seed cost affects the seeding rate at which the maximum net profit is observed. Quadratic regression between live seeding rate and net profit was performed to identify maximum partial net profit. Seed costs were obtained from Sebesta (2020), Plastina (2019), and Haugen and Swenson (2020) who estimated herbicide tolerant seed prices to be $33 (NDSU GT soybean Foundation Seed), $50.80, and $57.80 per soybean unit (140,000 seeds per acre), respectively. Price per individual seed was calculated and multiplied by live seeding rate. Partial net profit was computed by subtracting live seed cost from gross revenue (yield multiplied by estimated market price of $9 per bushel) and only takes seed cost into consideration. The quadratic regression analysis show there is a specific maximum net profit for each of the three seed costs. Based on the quadratic regression equation, net profit maximizes at higher seeding rates as the seed cost is lower (green line in Figure 1). Economic returns based on seed cost suggest opportunities to increase producer profit with slightly lowering seeding rates when using seed with higher unit costs (red and blue lines in Figure 1). As market prices increase, the benefit of lower seeding rates will diminish. North Dakota’s current recommendation of 150,000 established plants per acre is in the range to optimize yield but will likely not optimize profit based on high seed costs and current market values.

Fortunately for North Dakotans, there are possibilities to obtain less expensive (than used in Figure 1) certified soybean seed of NDSU’s conventional or glyphosate tolerant varieties, which would also change the calculated partial profit. Although slightly lower seeding rates can optimize net profit for more expensive seed sources, research on North Dakota’s iron deficiency chlorosis (IDC) prone soils has shown that reducing seeding rate will increase IDC expression and lower yields when IDC is present.

On a farm scale, higher production with higher seeding rates will likely reduce the harvest cost per bushel. The lower harvest costs per bushel may offset additional seed costs when higher seeding rates are used. In this article, we analyzed the yield based on live seeding rate. Not all live seed planted will develop into an established plant. If
producers can increase their planting accuracy and have a better establishment rate, the amount of live seed needed for an optimal stand could be reduced.

For more information, see Schmitz PK, Stanley JD, Kandel, H. Row spacing and seeding rate effect on soybean seed yield in North Dakota. Crop, Forage and Turfgrass Management. 2020;6:e20010.
https://doi.org/10.1002/cft2.20010

Hans Kandel
Extension Agronomist Broadleaf Crops

Peder Schmitz
NDSU Research Assistant

SPRING RESIDUE MANAGEMENT CONSIDERATIONS

Unharvested crops from last year, high amounts of crop residues covering the soil’s surface due to a wet fall that precluded tillage in areas where it is normally done, an abnormally cold April and this week’s rain and cold weather has seriously impeded normal planting progress (if not a perfect storm, I don’t want to experience one!). In the aforementioned list of challenges, the management of crop residues is basically the only factor you have some control over this spring as you try to get your crops planted in a timely manner. The following are some principles to consider as you decide how to most effectively manage excessive crop residues.

Crop Residues Impact Soil Drying – Crop residues slow soil drying. This is an obvious point and the reason that most farmers in the wetter regions of the state do some sort of fall tillage. Without fall tillage these soils may take too long to dry in the spring, frequently causing delays to spring field work. Dr. Aaron Daigh, soil physicist at NDSU, in one of his winter talks presented data that showed that 1 inch of residue reduces the relative evaporation rate from the soil to only 30% of that of a bare soil. Thicker residues reduce evaporation even further (this presentation can be reviewed at https://mnwheat.org/wp-content/uploads/2020/02/2020BestDaigh.pdf). This means that if a bare soil takes 3 days to dry after a rain to the point it can be worked, a soil with an inch of residue will likely take 9 days to get to the same condition. Furthermore, he reported that it is not residue type or weight, but depth of the residue on the soil that determined the rate of evaporation from the soil. Accordingly, erect residues will permit greater drying than those that has been chopped and spread.

Options for management excessive residues in the spring – Normally, crop residues are best managed in the fall through removal (baling), grazing or tillage. Managing residues in the spring are more challenging. Spring residue management options include doing nothing (planting directly into them), performing some type of tillage to cut and bury them or burning them. For no-tillers in western ND that have unharvested small grain crops, planting directly into last year’s crop may be the best option. Research elsewhere has shown there is limited yield drag when planting into standing wheat residues compared to more traditionally harvested fields. Obviously, planting wheat after unharvested wheat can be problematic due to the potential for massive amounts of volunteer wheat arising from the unharvested crop. In this scenario, I would recommend planting something other than a small grain so that you have some way to control the volunteers. When no-till planting corn or other warm season crops, use residue managers that are properly adjusted. Moving residues from directly above the seed row can improve emergence uniformity and may allow the soil to warm up faster directly over the seed.

Spring tillage for managing residues is a poor choice when soils are wet, even though burying the residues will help dry the soil. Tilling wet soils results in compaction, damages structure and creates poor seed beds. A good rule of thumb is, if it is too wet to plant it is too wet to till. One exception might be the use of vertical tillage to help blacken the soil if the residue cover is only 1 to 2 inches deep. Even though vertical tillage does not invert the soil and cover residues, it exposes enough soil (if residues are not too deep) to allow it to warm and dry more quickly than untilled soil. Tillage (disks and cultivators) can effectively manage residues once the soil has dried sufficiently. Unfortunately, this may be after the optimum period for planting the crop of interest, especially when the weather is cool and wet like this year for parts of the state. Use the near-term weather forecast to determine if “waiting and tilling” might be a viable option. In some situations, burning may be the best option for managing residues this spring. This practice is not generally recommended as it results in nutrient losses, reduces the amount of carbon that is returned to the soil that is critical to
biological processes and soil health, exposes the soil surface to erosion, impacts soil microbes and fauna near the soil surface and reduces soil structure. The long-term negative impacts of burning residues, however, may not be too significant if done only occasionally. The obvious short-term benefits are that much of the residue is immediately removed and the surface of the soil is blackened and dries more quickly. In some cases, it might be possible to plant these fields without prior tillage. Burning residues may also reduce some diseases and kill some weed seeds. Though a slow burn has the potential to kill some of the volunteer wheat seeds in fields that were not previously harvested, many seeds will survive and a fast burn will leave many viable seeds. Therefore, a strategy for dealing with volunteers during the season in these situations is needed. If you decide to burn, follow local regulations, and use best practices and care so that the fire doesn’t move beyond your own field.

**Prevented Planting as an Option** – If the crop is insured, another option for dealing with fields that are too wet to plant before the final planting date, is to take the prevented planting option. There may situations (i.e. a newly rented tract of land) where an unharvested field may not qualify for Prevent Plant so discuss this with your insurance agent well in advance of any decision. If taking Prevent Plant, consider management practices that will reduce the likelihood of Prevent Plant the following year, encourage soil health and control the buildup of weeds. More specifics on these topics in future articles.

![Figure 1. Burning this corn field effectively removed surface residues and blackened the soil while leaving some erect stalks.](image)

Joel Ransom
Extension Agronomist, Cereal Crops
HOW AVERAGE DAILY SOIL TEMPERATURE IMPACTS SUGARBEET SEED EMERGENCE

Sugarbeet seeds germinate and emerge over a wide temperature range in the presence of adequate moisture and oxygen.

In Minnesota and North Dakota, growers are busy planting sugarbeet where field conditions are favorable. Areas with higher than average precipitation last fall which includes Hillsboro through East Grand Forks are taking a long time to dry which has delayed planting. Average daily soil temperature at the 4” soil depth has been slowly increasing and currently ranges from 46 to 54° F with cooler soils in the northern Red River Valley. Hopefully planting can continue soon when the soil temperature is increasing. With adequate soil moisture and higher average daily soil temperature, germination and emergence will be faster and more uniform. For example, seeds planted when the average daily soil temperature is 45° F will take up to three weeks to emerge whereas planting done at a soil temperature of 60° F will result in emergence after one week.

The following table gives approximate days to emergence of sugarbeet seeds planted at different soil temperature ranges with adequate moisture.

<table>
<thead>
<tr>
<th>Soil Temperature (°F)</th>
<th>Days to Emergence</th>
</tr>
</thead>
<tbody>
<tr>
<td>38-45</td>
<td>21 days or more</td>
</tr>
<tr>
<td>45-52</td>
<td>10-21 days</td>
</tr>
<tr>
<td>52-60</td>
<td>7-12 days</td>
</tr>
<tr>
<td>60-70</td>
<td>5-7 days</td>
</tr>
</tbody>
</table>


Best wishes for a safe planting season.

Mohamed Khan
Extension Sugarbeet Specialist
NDSU & U of MN
701-231-8596

RESPONSE FROM AN EARLY SEASON FUNGICIDE IN WHEAT

A common practice that will occur in the coming weeks is tank mixing a fungicide with the first herbicide pass in wheat (Figure 1). The application of a fungicide at this wheat growth stage is primarily targeting early-season residue borne diseases such as tan spot. However, one common question that arises during this time of year is what to expect (yield) from this fungicide? I have provided a few data sets that highlight the yield response of an early-fungicide in wheat.
2015 Fungicide by Variety Trial
The yield response of a fungicide can vary depending on disease risk and variety used. A good example of this was a fungicide by variety trial conducted in 2015 at Carrington (Blaine Schatz) and Fargo. Five HRSW varieties were used to compare the impact of a fungicide application at tillering (Table 1). The Carrington location had a much higher disease risk as it was seeded onto minimally tilled wheat ground, whereas the Fargo location was seeded into cultivated soybean ground. Although this is only one year of data from two locations, these data sets demonstrate that a greater yield response occurs when there is a higher level of disease risk.

Table 1. Yield response of an early-fungicide application on five hard red spring wheat varieties conducted at the Carrington REC (high disease risk) and Fargo (low disease risk).

<table>
<thead>
<tr>
<th>HRSW Variety</th>
<th>Carrington – High FLS Risk</th>
<th>Fargo – Low FLS Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Non-Treated Control (bushels/acre)</td>
<td>Priaxor @ 2 oz Tillering (bushels/acre)</td>
</tr>
<tr>
<td>Barlow</td>
<td>46.9</td>
<td>51.3</td>
</tr>
<tr>
<td>Elgin</td>
<td>47.3</td>
<td>50.8</td>
</tr>
<tr>
<td>Prosper</td>
<td>50.7</td>
<td>51.3</td>
</tr>
<tr>
<td>SY-Soren</td>
<td>42.8</td>
<td>43.4</td>
</tr>
<tr>
<td>WB-Mayville</td>
<td>32.4</td>
<td>38.3</td>
</tr>
<tr>
<td>Mean Across All Varieties</td>
<td>44.0</td>
<td>47.0</td>
</tr>
</tbody>
</table>
Larger Data Set
A total of 59 replicated fungicide trials that included a tillering fungicide application were conducted in Fargo from 2008-2015. Disease levels varied in the trials and were categorized into three disease risks (low, moderate and high) based on environmental conditions and production practices. Based on this data set (when compared to a non-treated control), the mean positive yield response for an early-season fungicide was 0.1% for low disease risk, 3% for moderate disease risk, and 4% for high disease risk. Another way to interpret this data is if a 65 bu/A wheat crop is expected, the potential yield response from a fungicide at tillering in moderate to high disease risk environment is approximately 2-3 bushels. This data set also supports that a greater yield response from a fungicide will occur in higher disease risk environments.

What to Use?
There are several fungicides labeled that are effective on fungal leaf spot diseases of wheat. For more information, please consult the 2020 North Dakota Field Crop Plant Disease Management Guide or use the NCERA-184 fungicide efficacy table. As a reminder, fungicides are best used in a preventative manner and will only protect available leaf tissue at time of application. Also, it is important to remember how a fungicide moves in leaf tissue. Most systemic fungicides are locally systemic (moves short distance from droplet), translaminar (moves from top side of leaf to the underside), or moves upward with xylem to a leaf tip. As the wheat crop progresses, new unprotected leaves will emerge, so scouting is one of our best tools to stay on top of disease progression.

Andrew Friskop
Extension Plant Pathology, Cereal Crops

TREACHEROUS FIELD CONDITIONS IN SOME AREAS THIS SPRING
I have had numerous reports from central to eastern North Dakota of tractors/seeders/applicators becoming stuck in fields where the soil surface is dry and where the field it can easily be driven over by a pickup truck or an ATV. Some of these conditions arise most springs because of ‘frost boils’. Frost boils are caused by pockets of soil ice not-yet thawed, which because there is little free water compared to the surrounding thawed soil attracts water and becomes a little like quicksand. This spring, there was hardly any deep ice in the soil, certainly not now, and these ‘soft spots’ are more numerous than normal and are appearing in places that are totally unexpected.

I believe that these spots are the result of high precipitation after September 1, 2019 to present (over 10 inches to present), so unless there was a cover crop on these acres (which was not common due to the wet conditions that made planting impossible) there has been nothing to use the water. The water is relatively near the surface at perhaps 2-3 feet, and because our soil is intermingled with veins of different textures due to their glacial drift nature, the water has moved sideways; in the central/west of the state it emerges as seeps in sidehills; in the east it ‘boils’ below the surface, making a positive pressure towards the surface, but not reaching it, making soils weak for trafficability in spots.

I wish there was some way to tell from looking where these areas are, but there is no way to know. Most farmers already know to keep another tractor handy with suitable safety tow ropes. But another tip is that once the field has been driven over, don’t drive over it in a different direction soon afterwards if possible. There was one report of an applicator finishing a quarter and then driving diagonally across the finished field to reach the next field, and then it got stuck. It may have found a spot that was missed when applying fertilizer initially, but it might also be a result of the disturbance of the soil ‘gel’. Geologists mention gel sometimes in papers on clays, and small particles. When these contain sufficient water, they act like a gel (think Jell-O - not an endorsement). But when these gels are disturbed by vibration, they liquify, losing their integrity and building structures can be compromised (Thank goodness there are no earthquakes in the RRV).

If going to the field for the first time, just be prepared and take whatever comfort there is in the knowledge that there will be many neighbors in the same unhappy state of getting stuck by the time fieldwork is complete.
FERTILIZING ALFALFA

The updated Alfalfa Soil Fertility Requirements circular has been published on-line for about a year. You can find it at: https://www.ag.ndsu.edu/publications/crops/alfalfa-soil-fertility-requirements-in-north-dakota-soils/sf1863.pdf or on my webpages under ‘Extension Publications’. The highlights are as follows:

Nitrogen is not necessary for alfalfa for establishment nor annually. Nitrogen application might result in nitrate accumulation in the forage, so even manure or compost should be applied moderately, with a forage nitrate test performed if areas of the field were over-applied. At establishment, the seed should be inoculated with *Rhizobium meliloti*. The inoculant bacteria will persist over the life of the stand.

Phosphorus and Potassium- North Dakota P rates are based on the Olson soil test. Establishment broadcast rates of P are critical, since removal rates of P per ton of hay can add up over years. Potassium recommendations for establishment are based on soil test and clay chemistry, which is estimated with the map available in the circular. A high smectite-illite clay ratio soil will require a greater K soil test than a lower ratio soil. For both P and K, fertilization in years after establishment should be applied after 1st cutting. The availability of P and K are higher early in the season, reducing the chance of a P and/or K response, and in some years frost heaving will expose alfalfa crowns above the soil surface, and a fertilizer application may damage stand when applied in early spring. After 1st cutting, crowns are protected and the alfalfa response to P and K is greater.

Sulfur and micronutrients- The sulfur (S) soil test is not diagnostic for sufficiency or deficiency in the region, so a S fertilization decision based on soil test will not be helpful. In years with high fall rainfall, normal to above average snowmelt and/or significant spring rains (like this year), S may be deficient. The problem would be greater in establishment years, because alfalfa roots very deep, and established stands have roots in soil layers that might contain gypsum or other S-containing minerals and overcome any early-season top-yellowing, whereas year-of-establishment alfalfa in sandier soil will not have that advantage. Other micronutrients, including zinc (Zn) and boron (B) have not been a problem in North Dakota, even in soils testing very low. Alfalfa can evidently extract what it requires from our soil regardless of what the soil test shows. There have been B responses in Minnesota on deep sandy, irrigated soils, but not in ND.

Soil pH- Alfalfa, more than any other major ND crop is sensitive to acid pH. The pH for maximum alfalfa production is 6.7, and a greater pH does not reduce production. Estimates for reduction with acid pH are about 7% reduction at pH 6, 28% reduction at pH 5.5, and 42% reduction at pH 5. It would be wise to zone-sample alfalfa fields for pH, and in long-term no-till fields, sample the 0-2 inch depth and the 2-6 inch depth separately. The amendment for increasing pH is some form of liming material, such as mined limestone/dolomite (there are no native sources in ND), municipal waste water lime, and sugar beet waste lime. The field should be limed, if necessary, before establishment. If the acid pH is at the 0-2 inch depth, surface application would be effective based on research to date and ongoing in North Dakota.

NITROGEN CALCULATOR APP FOR CORN, SPRING WHEAT/DURUM, SUNFLOWER

Many growers and their consultants have already downloaded and are using the nitrogen calculator app for corn, spring wheat/durum and sunflower, but it is available free for all to use. Go to the Android or Iphone app store and search for North Dakota Crop Nitrogen Calculator and follow the instructions. The calculator was developed as what the Ag Economists call an ‘Economic Production Function’, which means that there is a decreasing rate of yield improvement as N rate increases, and the maximum economic rate of N is based on the N cost, and yield and quality return from using the N rate. In corn, there is no quality consideration. In sunflower, higher N decreases oil, thus net return. In what, higher N increases protein, but in a different manner than the relationship between N and yield. Also, with any of NDSU fertilizer recommendations, the grower/consultant is free to wiggle the final recommendation based on things they know that the recommendation number doesn’t know. These might include protein characteristic of the wheat variety or past performance of the field. The use of the calculator has been validated in field experiments since publication that support the use of the long-term no-till N credit, the soybean N credit, and the general recommendation values on yield results.
UPDATED SOYBEAN FERTILITY RECOMMENDATIONS

The NDSU soybean fertility recommendations were updated this winter based on research conducted by NDSU researchers at Minot, Dickinson, Carrington and Fargo during the past decade. These recommendations can be accessed at [https://www.ag.ndsu.edu/publications/crops/soybean-soil-fertility](https://www.ag.ndsu.edu/publications/crops/soybean-soil-fertility). The major changes are:

**Inoculation** - Inoculation any time does not hurt soybean agronomically; however, given the economic conditions it would rarely provide a positive return to a grower who has planted soybean in the same field within the past 4 years. If a field is in soybean for the first time, double inoculation is key to success (peat or liquid combined with a granular inoculant application).

**N** - There is no need for any N with soybean at any time.

**P** - The critical value for the Olson soil test has been reduced to 8 ppm. At 8 ppm or higher, no P would be needed. P fertilizer can be applied, but do not expect an economic return. No fertilizer (other than an appropriate iron (Fe) fertilizer with water) should be applied to the seed, or stand reduction and yield reduction would be the probable result. Mid-row banding of P is not effective. Side-bandng or broadcast P is the method for applying P to soybean.

**K** - The rate depends on the smectite/illite ratio of the soil (see map in circular) and the K soil test. Cation balance is not a factor.

**Soil pH** - No lime is necessary if the surface pH is 5.7 or greater. In long-term no-till fields, sampling by zone and with a 0-2 inch and 2-6 inch depth will better define areas where liming might be needed. In western no-till areas, more soils with pH less than 5 are being found and these should be surface limed.

**Iron (Fe)** - There are several new formulations of Fe fertilizers being tested, but for now, Fe ortho-ortho-EDDHA is by far the best Fe fertilizer. Its use should be in-furrow at seeding, using rates recommended on the label. Iron deficiency chlorosis in eastern ND can be minimized by:

1. Selecting a field without excessive carbonates/salts.
2. Selecting a very tolerant variety based on NDSU test results.
3. Increase plant population.
4. Use a companion cover crop (barley or oats) at seeding.
5. Fe-o-o-EDDHA in furrow.

**Sulfur** - Soybean is not as susceptible to S deficiency compared with corn or small grains or canola. It is possible to have S deficiency on upland field positions in deep sandy soils in years with excessive fall/winter/spring precipitation (this year?). The soil test is not diagnostic for S sufficiency or deficiency.

**Foliar fertilizer** - Use of foliar fertilizer to increase soybean yield in ND has not been effective.

**NITROGEN ENHANCERS AND ADDITIVES**

Some farmers, dealers and crop consultants are still somewhat confused as to what nitrogen (N) additive does what. The short answer is to read the Nitrogen Extenders and Additives circular from the North Central Regional NCERA-103 committee found at [https://www.ag.ndsu.edu/publications/crops/nitrogen-extenders-and-additives-for-field-crops](https://www.ag.ndsu.edu/publications/crops/nitrogen-extenders-and-additives-for-field-crops).

There are two basic types of N additives- urease inhibitors and nitrification inhibitors. Urease inhibitors are products that delay the conversion of urea to free ammonia and carbon dioxide (the components of urea) through the activity of soil urease enzyme (that originally came from plants and bacteria) for about 10 days. Once the urea is split, the free ammonia can be lost into the air if the urea was placed within 2 inches of the soil surface, with greatest loss potential if the urea is surface applied. This process also happens deeper in the soil when urea is placed there, but the
loss of ammonia through volatility is nearly zero at depths greater than 2 inches. At the surface or near-surface, the ammonia loss is greatest when residues are present and/or soil pH is greater than 7. The urease chemistry proven to be effective as an inhibitor is NBPT (or in Limus (BASF) NPPT is also effective). This is the chemistry found in Agrotain™ (not an endorsement), but any product that contains NBPT and the active-ingredient per ton urea is similar to that on the Agrotain Ultra™ (not an endorsement) label should be effective. I studied tech grade NBPT for 4 years on multiple sites and any NBPT at similar rate is effective at nearly eliminating urease activity for about 10 days.

For example, Agrotain Ultra contains 26.7% NBPT by weight, and the product weighs 8.9 pounds per gallon. The label rate per ton is 3 qts/acre, so there is about 1.8 lb NBPT per ton of urea. Any other chemistry that claims urease inhibition has not been found to be effective or has not been tested adequately. The farmer should never be the risk-taker in new products. The burden of proof should be on the company, not the end-user.

The other type of N additive is a nitrification inhibitor. These are products that inhibit the bacterial transformation of ammonium-N to nitrate-N and make the N susceptible to leaching loss in sandier soils (loams and coarser) and denitrification (usually in eastern ND particularly in soils with clay content > 30% roughly). The two chemistries with some activity as a nitrification inhibitor are DCD, and nitrapyrin. A nitrification inhibitor has shown its greatest usefulness as a fall ammonium-N additive, with less success in the spring due to a shorter activity of the chemistry due to the warmer spring conditions generally than in the fall. A nitrification inhibitor would not act as a urease inhibitor, and a urease inhibitor has no activity against nitrification.

Ammonium thiosulfate was studied by Dr. Goos in the NDSU soils department about 30 years ago, and found that it had some small activity as a urease inhibitor and a nitrification inhibitor; however, its activity was far less than the inhibitors previously mentioned, and should probably not be considered as a primary inhibitor product. Another fertilizer formulation that is neither a urease inhibitor or a nitrification inhibitor is ESN™ (not an endorsement). This is a polymer-coated urea that separates the urea from the soil through its coating. Because of the separation, until the urea is released through its coat, the urea within is not subject to urease activity, and the ammonia generated by any urease activity is not subject to nitrification until after the urea release and ammonia generation. The N released by the ESN therefore has a longer life through the season compared with urea alone. Its drawback is that the timing of release is dependent on the temperature and precipitation through the growing season, and the use of all ESN risks low release in seasons of drier and/or cooler soil temperatures. This product is also described in the N additives circular.

Dave Franzen
Extension Soil Specialist
701-799-2565

RUTS AND SOIL COMPACTION AFTER HARVEST

Wet field conditions during harvest left many fields with ruts. The cold and wet weather means that many of those areas have yet to be filled and leveled with tillage. These areas will have deep soil compaction below the typical depth of most primary tillage implements. The winter freeze only helps alleviate compaction in the top several inches and is inefficient at breaking up compaction at deeper depths. Producers can expect an average yield loss of 15% or slightly more for over the next two or three years. Once soils have had time to dry this spring, ruts should be filled and leveled with tillage only as deep as or shallower than the rut. Tilling below the rut in wet conditions will not improve yields, but will result in smeared soils, additional deep compaction, breakdown of soil aggregates, and a poor seedbed to plant into. Prioritize filling and leveling ruts with a couple tillage passes to get a flat seedbed for uniform seed placement. Natural cracking of soils during the dry summer months and, to some extent, the crops root system will start alleviating the deeper soil compaction before next fall’s field operations.

Aaron Daigh
NDSU Assistant Professor of Soil Physics
**BURNDOWN OF HORSEWEE (MARESTAIL) IN THE SPRING**

One of the many results of abundant rainfall last fall is the increased presence of horseweed in many no-till fields across the state. The best time to control horseweed is in the fall when plants are small and more susceptible to herbicides. As we progress farther into May, horseweed will begin/continue to bolt and become more challenging to control the longer we wait. It is safe to assume that most of our horseweed is glyphosate-resistant, and we also have several populations that are resistant to ALS-inhibiting (Group 2) herbicides. Here are some of our best options for controlling horseweed prior to planting crops in the spring:

**Dicamba** – The largest issue with applying dicamba in the spring is that it limits the number of crops we can still plant in a timely fashion. Most dicamba labels allow immediate planting of corn. Small grains require at least 22 day plantback when applying 0.25 pounds of dicamba, regardless of formulation. We can use Engenia, Fexapan, Tavium, or Xtendimax ahead of Xtend soybean with no plantback restrictions. All other crops have at least a 4 month plantback restriction which means dicamba is not a practical choice.

**Elevore** – Elevore has been on the market for a few years now. It can be applied 14 days prior to planting canola, corn, soybean, small grains, or sunflowers. All other crops require at least a 9-month plantback restriction. Elevore will provide similar control of horseweed to higher rates of dicamba, but it also has a more limited weed control spectrum. Due to the limited spectrum, it is generally recommended to also include glyphosate and/or 2,4-D with Elevore. The inclusion of 2,4-D will increase the plantback restriction to some crops.

**Paraquat** – Paraquat (Gramoxone, others) can be applied prior to planting most of our crops. It is currently not registered for use in canola, chickpea, lentils, flax, or oats. New in 2020, applicators must have completed an online certification to use paraquat. Keep in mind that paraquat works best with higher carrier volumes. Paraquat also benefits from being tank-mixed with atrazine or metribuzin, but this will further limit the crops we can immediately plant.

**Sharpen** – Sharpen can be applied at 1 ounce per acre with no plantback restriction for chickpea, lentils, corn, peas, small grains, and soybeans. If soils are coarse with less than 2% OM, then a 30-day waiting period must be observed for soybeans. Higher rates of Sharpen can be used, but will increase the plantback restrictions for some crops. See page 6 in the 2020 ND Weed Control guide for more detail on rates.

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**WATERHEMP EMERGENCE CONFIRMED IN AT LEAST FOUR COUNTIES IN NORTH DAKOTA AND MINNESOTA**

Waterhem emergence was confirmed in Cass county North Dakota and in Kandiyohi, Renville, and Yellow Medicine counties in Minnesota between May 1 and 4, 2020. Approximately 100 growing degree days (GDDs) (base 45F) accumulated between January 1 and May 5 according to the North Dakota Agricultural Weather Network (NDAWN) station near Sabin, MN. Iowa State University research and research conducted at NDSU in 2016 and 2017 reported waterhem emerges at approximately 300 to 350 GDDs or approximately May 20 in Fargo. Waterhem emergence was corroborated by Dr. Joe Ikley, NDSU Extension Weed Specialist, reporting emergence on May 1 at an additional location. Our observations in Minnesota and North Dakota are in alignment with observations in nearby states. Dr. Rodrigo Werle, Extension Cropping Systems Specialists at the University of Wisconsin reported waterhem emergence earlier in 2020 than emergence in previous years.

Why is waterhem emerging in early May in 2020 as compared to mid-May in previous years? Several ideas might explain our observations. First, early heavy snow might have insulated the soil, reducing the depth of frost and contributed to winter’s frost rapidly coming out of the ground compared to other years when frost moved deeper into the soil and persisted further into spring. Second, Extension has created tremendous waterhem awareness during
winter programing. Our stakeholders are very capable of identifying waterhemp and may have found and reported it earlier than other years. Finally, it is possible agriculturalists using various weed management practices are selecting for earlier germinating biotypes.

CONTROLLING EMERGED WATERHEMP IN SUGARBEET

Thursday’s weather is much improved, and you elect to observe emergence patterns in sugarbeet fields. Unfortunately, along with sugarbeet you observe short and wide cotyledons (I call them row boats) that can only be waterhemp. What are your waterhemp control options in sugarbeet?

First, you must be proactive. Waterhemp populations are mixture of susceptible and resistant biotypes in agricultural fields. It is much easier to control waterhemp populations with resistant alleles when waterhemp is small. I recommend glyphosate at 32 fl oz/A plus ethofumesate at 6 fl oz/A applied through flat fan nozzles using a small droplet spectrum to ensure contact with small weeds. Second option is for producers with access to Betamix. Betamix rate is commensurate with sugarbeet size and likely will range from 12 to 16 fl oz/A. The third option is inter-row cultivation to remove waterhemp as early as possible without damaging sugarbeet stand.
Continue to follow the sugarbeet weed management plan including use of soil residual herbicides postemergence to sugarbeet and preemergence to waterhemp once sugarbeet research the 2-leaf stage.

**WATERHEMP CONTROL IN SUGARBEET FIELDS TO BE PLANTED**

Slightly more than half of the 2020 sugarbeet crop has been planted in Minnesota and North Dakota as of Tuesday, May 5, 2020. We highly recommend a preplant or preemergence herbicide if you are a sugarbeet grower, have not completed sugarbeet planting, and identify waterhemp as your most important weed control challenge. We previously recommended a preemergence herbicide to provide a short-term layer of control for early germination pigweed including waterhemp until the layby program can be implemented. However, preemergence herbicides require rainfall for activation. A query of Fargo climate data from 1881 to 2014 by Daryl Ritchison, Director of the North Dakota Agricultural Weather Network (NDAWN) concludes only three days during the month of May with precipitation at 0.25 inch or greater. Those odds are not good enough especially since waterhemp emergence has been reported in four counties in Minnesota and North Dakota in 2020. We need immediate activation.

We recommend the use of Ro-Neet, Eptam, ethofumesate, or Dual Magnum using the 24c local needs label preplant and activated with tillage. Follow label directions for application of Ro-Neet and Eptam including incorporation immediately following application due to volatility. We recommend ethofumesate at 1 to 3 pint/A alone or ethofumesate at 2 pt/A in combination with Dual Magnum at 0.5 to 0.75 pt/A preplant. Dual Magnum can be applied alone at 0.5 to 1 pt/A. We recommend Dual Magnum at 1 pt/A on soils with greater than 3.5% organic matter.

*Waterhemp emergence in a sugarbeet field in Kandiyohi county Minnesota (photo credit Darrol Ike).*

Tom Peters
Extension Sugarbeet Agronomist
NDSU & U of MN
PREVENT CRABGRASS THIS SPRING

Mother Nature can be extraordinarily fickle in the northern Great Plains. One day you are admiring spring tulips in your short sleeves; the next day, sleet pellets will coat the ground. This extreme weather variability dampens our hopes and makes timing the application of crabgrass pre-emergent herbicide difficult to do.

Crabgrass is an annual weed with a wide leaf that can look unattractive to homeowners wanting a uniform-textured lawn. While crabgrass plants do not overwinter, new seeds germinate each spring from an abundant soil seedbank when the average soil temperature, at a depth of 2 inches, reaches 55°F for three to five days. Seeds will continue to germinate throughout summer, but the majority will germinate at soil temperatures between 60 and 70°F.

With our late spring, turf soil temperatures have been slow to rise. However, the soil will warm very quickly with warmer air temperatures. Apply a crabgrass pre-emergent herbicide before we reach an average soil temperature of 55°F. To check on the average turf soil temperature in your area, please consult the North Dakota Agricultural Weather Network (NDAWN) website at https://ndawn.ndsu.nodak.edu/soil-temps.html. Of the two numbers that appear on the NDAWN soil map, the second number represents turf soil temperature, while the first number is the temperature of bare soil.

Crabgrass preventers are a class of pre-emergent herbicides that are applied before the crabgrass seeds germinate. Most pre-emergent herbicides will not provide effective control after germination. Commonly available crabgrass preventers for established lawns include active ingredients such as pendimethalin, prodiamine and dithiopyr. Of these three herbicides, dithiopyr is the only one that has early postemergent activity. Dithiopyr can control crabgrass seedlings that are in the one- to three-leaf stage if you missed the window for pre-emergent applications. When applying a crabgrass preventer, follow all label instructions. To be effective, you need to apply 1/2 inch of water to dissolve the granules and move the herbicide into the top layer of soil. Once dissolved, the crabgrass preventer will form a barrier in the soil.

A word of caution: Do not apply a standard crabgrass preventer to newly seeded or overseeded lawns. The pre-emergent herbicide cannot differentiate between pesky crabgrass seeds and desirable lawn seeds. Instead, lawn products that contain the active ingredient siduron (Tuperan) can be used in that situation. Alternatively, a starter fertilizer that contains the active ingredient mesotrione (Scotts Turf Builder Starter Food for New Grass Plus Weed Preventer) also is available.
AROUND THE STATE

NORTH CENTRAL ND

Spring operations continued to ramp up over the north central region of North Dakota last week. Growers have been eager to begin planting. Planting of peas, lentils, faba bean, and small grains have taken place at the NCREC over the last seven days. A small storm system moved across the northern plains early Monday Morning. Here are some quick precipitation reports from the last week (starting April 26th): Minot: 0.26”; Bottineau: 0.02”; Garrison: 0.00”; Karlsruhe: 0.03”; Mohall: 0.21”; Plaza: 0.00”; and Rugby: 0.19”. Bare soil temperatures at the NCREC was observed at 57°F.

Two weeks ago, some canola flea beetle traps were placed at the NCREC. Populations have been observed in grassy areas and numbers have remain low at this time.

TJ Prochaska
Extension Crop Protection Specialist
NDSU North Central Research Extension Center

NORTHWEST ND

Planting continues in Northwest ND in fields that are dry enough to allow it. In Williams County, the top 2” are dry but moisture is present below that. A few scattered showers moved through the area over the weekend with many areas receiving no or just a trace amount of rain. At NDAWN stations that received enough to record, 0.1”-0.25” was seen in most places. Temperatures have been cooler than normal and crops have been slow to emerge. This week’s forecast has highs in the 60’s and down into the 50’s over the weekend with overnight lows in the 30’s and chances of frost over the weekend. Hopefully next week warmer temperatures will come and stay.

Weeds are starting to germinate, so burndown spraying needs to get done if it hasn’t already. I’ve see tiny kochia and tansy mustard (aka flxweed) coming up. Overwintering rosettes of horseweed are green and a few of the early mustards like shepherd’s purse and pennycress are bolting and even starting to flower.

Clair Keene
Extension Cropping Systems Specialist
NDSU Williston Research Extension Center

NORTHEAST ND

We are in a cool weather pattern. In the northeast, counties received between 0.5” and 1” of rainfall except Pembina and eastern Walsh county. Fertilizer spreading is occurring. Small grain fields were seeded but progress is slow. Very little spring work has started in Rolette, Towner and Cavalier counties. I have started to catch striped flea beetles in traps over the last weekend. They will have the emerging volunteer canola and wild mustard species to feed upon.

In Cavalier County and surrounding areas, wild oat management is a big issue. This winter, I heard Brian Jenks, North Central REC weed scientist, speak on wild oat control. Here are few things I learned. Barley is more competitive than wheat on wild oat populations. In wheat, consider a later planting date to kill the first flushes of wild oat prior to seeding. A drawback of this strategy is potential wheat yield loss. Other wheat production strategies are to use a higher population, use a tall variety, and spray glyphosate as late as possible PRE. Axial XL and Raptor may work for some farmers. Wild oat populations submitted for NCREC testing in 2018 showed resistance to Axial at 48% and Raptor at 45%.

Lesley Lubenow
Extension Cropping Systems Specialist
NDSU Langdon Research Extension Center
SOUTH-CENTRAL/SOUTHEAST ND

According to NDAWN, the region’s average bare soil temperature at 4-inch depth on May 4 ranged from 43 to 52 °F. Given the week’s forecast, this temperature range will likely remain similar for the week resulting in minimal small grain and corn seed germination and plant development. At Carrington on May 5, deep soil temperature down to nearly 6 feet was >35 degrees. April 1 through May 4 rainfall ranged from 0.3 inches (Robinson) to 2.7 inches (Oakes), with the Carrington REC receiving 1.0 inch. This region has at least adequate and generally excessive soil moisture.

Alfalfa regrowth is at ≤6-inch height. Winter rye and winter wheat are in the tillering to early jointing stages. Based on growing degree day units and limited field inspection, the region’s barley and spring wheat seeded the last weekend of April is emerging. However, corn planted April 24-26 is only about half-way to plant emergence.

SOUTHWEST ND

Wheat, canola, and pulses continue to be planted across the region. Some producers have started on corn and soybeans. There is a lot of fieldwork going on throughout the countryside, if it isn’t planting equipment going down the road, it’s a fertilizer spreader or sprayer. Moisture as always has been variable, some fields and portions of fields are still too wet to get into but a majority of the acres I’ve seen could use some moisture in the topsoil. Scattered showers and in some cases hail, fell across the region over the past week. According to NDAWN from April 27th to May 5th Dickinson received 0.16 inch of rain but some in the surrounding area received more. While much of the state is facing the issue of too much moisture there are many in this region that wouldn’t mind a bit more moisture, to a point. With cold weather in the forecast over the next week we’ll need to keep a close eye on early planted corn and particularly soybean stands.

As a reminder be sure to consider plants per acre when seeding, not just bushels/acre. When things get busy some decisions can be rushed, but be sure to think for the long term. When facing potential issues in a field be sure to follow the steps of integrated pest management: identify your issue, monitor and assess damage, follow guidelines for when management action is needed, do your best to prevent the issue in the first place, and finally use a combination of biological, cultural, mechanical, and chemical management tools. Along with potential issues like disease, or insects such as wireworm be sure to consider issues stemming from acidic soils. If you haven’t soil sampled in a while and you’ve noticed areas with poor stand be sure to take a soil sample at a 0-2” and 2-6” depth and get it tested for pH in those zones. If the pH is below 5.5, application of lime is recommended. While the amount of lime needed will vary, you’ll likely need at least 1 ton of lime per acre in acidic zones. I know many are considering putting a few hundred pounds of
lime in furrow, but the research I’ve read does not show that to be an ideal solution when you are dealing with acidic soil. We’ll be taking a look at in-furrow lime on a few trials this season. We have also expanded the acidic soil wheat variety trial this year. Changing the soil pH is not going to be a quick fix, there are tradeoffs involved with each management option. Be sure to stay aware and share the roads.

Ryan Buetow
Extension Cropping Systems Specialist
NDSU Dickinson Research Extension Center
THE WEATHER SUMMARY AND OUTLOOK

A very slow moving rain system moved across North Dakota from Sunday night into Tuesday. It was the speed rather than the strength of that storm that dropped some 1 inch plus totals to parts of eastern North Dakota. The Red River served as the boundary line as most of northwestern Minnesota recorded little if any precipitation outside of locations right near the North Dakota border. Total Rain from those three days are presented in Figure 1 and Figure 2.

Figure 1. Rain from May 3 to May 4, 2020 at selected NDAWN stations

Figure 2. Rain totals from May 5, 2020 at selected NDAWN stations
The next 7 days will continue with the cooler temperatures that arrived earlier this week. Temperatures do not appear to get back to seasonal averages or warmer than average until the end of next week. As I mentioned last week, I would expect this month to finish below average, but not as much as April. In turn, the second half of May looks much better, but the cool air that is in place, looks entrenched for another week. With the cooler air in place, soil temperatures will remain on the cool side (Figure 3). On sunny afternoons you will always see a rise in soil temperatures, but overall temperatures are in the 40s and like our air temperature, will not improve much until the middle or end of next week.

Precipitation chances in the next week looks mostly confined to this weekend and then toward the middle of next week when that expected warmer weather returns to the northern plains. If you are reading this from far southwestern North Dakota, there will probably be some rain today (Thursday), but that looks to be missing the rest of North Dakota into northwestern Minnesota. The system this weekend, may contain some snow and like you, I hope that doesn’t materialize. Certainly, it has happened this time of year before, in fact western North Dakota recorded measurable snow in early June, 2009, but if some flakes materialize or not even mentioning it is a testament to how chilly the air mass will be this weekend.

Because of the cold weather in the next seven days, growing degree days (GDDs) will be so low as to not warrant mapping the totals. Hopefully, next week the warmer air will move in and I will include estimated GDDs for the region in this weather segment.

Daryl Ritchison
Meteorologist
Director of the North Dakota Agricultural Weather Network
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