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Inoculating soybeans: When’s the best time?

Soybeans can obtain up to half of their nitrogen needs from the air when nitrogen-fixing rhizobia bacteria are in the soil.

Inoculation with rhizobia is crucial in those fields where soybeans have never been grown. Reinoculation is recommended if a well-nodulated soybean crop has not been grown on the field within the past three to five years. On sandy soils (more than 90% sand), rhizobia survival from one season to the next is low and the field should be inoculated annually. The cost for inoculating soybeans at planting, which ranges from $1 to $5 an acre, is less than applying nitrogen later as a rescue treatment.

Soybeans grown on soils without a rhizobia population will use available soil nitrogen. If sufficient nitrogen is not available, the plant is likely to exhibit deficiency symptoms and yield may be reduced.

To evaluate the efficiency of several inoculation products, trials were conducted at the South Central Research and Extension Center near Clay Center on silt loam soils with irrigated soybeans.

To improve the precision of the comparisons, eight to eleven replications were used in a randomized complete block design. In general, the controls were planted first in all

(Continued on page 41)

Moisture calls for increased weed control in wheat

Winter’s stormy but short-lived return last week may have altered the weed control plans of many Nebraska wheat producers. Before the storm, few weeds were present in Nebraska wheat fields due to the dry winter and spring. Moisture from last week’s snow storm will change that.

Wheat producers should check their fields for weed emergence and be prepared to spray if necessary. However, herbicide application should be delayed until producers are sure that their wheat was not injured by the cold temperatures experienced during the storm. Allow time for new wheat growth to appear before applying herbicides. This is particularly important if fertilizer is being used as the herbicide carrier.

Several years of research at the West Central Research Research and Extension Center at North Platte have documented wheat injury from herbicide-liquid fertilizer combinations, particularly when applications were made within a few days of freezing temperatures (see Managing Nitrogen in Winter Wheat in the March 14 Crop Watch). Plants under stress from the weather do not need to be stressed again by an immediate application of herbicide. Producers should avoid the use of residual herbicides such as Ally, Amber, or Finesse if they are unsure of how their wheat may have endured the storm. Use of these herbicides will greatly limit recrop options. Winter annual weeds, such as tansy mustard and shepherd’s-purse, should be treated as soon as possible to prevent seed production.

If possible, leave an untreated area in the field to measure weed control and potential crop injury. In case of crop injury or poor weed control, contact your local Extension Educator or one of us. We would like to follow up on the potential for variety-by-herbicide-by-fertilizer interactions. If wheat was injured by these factors before the storm, please notify us.

Drew Lyon, Extension Dryland Cropping Systems Specialist
Panhandle District

Gail Wicks, Extension Weeds Specialist, West Central District

Robert Klein, Extension Cropping Systems Specialist
West Central District
### Weather update

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*Dep.=departure from normal

### Use Herbicide Guide in planning weed control

The 1997 Guide for Herbicide Use in Nebraska contains a great deal of helpful information that many people miss. Tables included in this year's guide include performance of burndown for no-till, CRP/sod control with selected herbicides, additive tables for postemergence herbicides, grazing restrictions for pasture herbicides, pre-harvest intervals for postemergence herbicides, a herbicide rainfast table, as well as weed responses to selected herbicides in many cropping systems found within the state.

To get a copy of Extension publication EC130, contact your local Cooperative Extension Office, or write Publications, Box 830918, University of Nebraska, Lincoln, NE 68583-0918. Cost is $2 plus sales tax. (Postage and handling is $1.50.)

**John McNamara,**
Extension Assistant, Weed Science

**Alex Martin,**
Extension Weeds Specialist
Table 1. Effect of soybean inoculation products, 1994-1996

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Application methods: 1 = planter box treatment; 2 = in-furrow granular; 3 = in-furrow liquid

**Inoculation products** (Continued from page 39)

replicates followed by the various inoculant products. Procedures minimized contamination from one treatment to the next. Seed boxes and tubes were cleaned and sterilized after seed-applied treatments and the liquid delivery system was cleaned and sterilized between liquid treatments in 1994 and 1996. In 1995 long bulk strips of uninoculated soybean were used between the treatments at the Fillmore County location.

The 1994 trial was conducted on a field with no prior history of soybean production. However, in July nodules were present on plants in all treatments. Two of the three inoculant products improved soybean yields over the uninoculated control (Table 1).

The 1995 and 1996 trials were planted on fields with a previous history of inoculated soybean production (corn-soybean rotation). The corn-soybean rotation with two to five years between soybean crops represents the majority of irrigated soybean production systems in south central Nebraska. Since the seed bed was quite dry at planting in 1996, we included a control treatment with water applied in the seed furrow. This was done to determine if the small amount of water applied with the liquid treatments in a dry seed bed affected germination, emergence, vigor or yield. It did not.

No differences were found between the treatments and the uninoculated controls in either 1995 or 1996 (Table 1).

The rhizobia bacteria do not function in soils below pH 5.0 and molybdenum deficiencies can occur in soils with a pH below 6.0. (Molybdenum is necessary for nitrogen fixation.) With soils in this range, inoculate with a product which contains supplemental molybdenum or add lime if continuous soybeans are expected to be grown in the field.

Soybeans on non-sandy soils, with pH greater than 6.0, and that have had a well-nodulated crop within the past five years do not usually respond to inoculation. Inoculation with a low cost material can be used as insurance.

Soybean leaves and canopies that appear particularly green may not be indicative of whether soybeans are “well nodulated”. High levels of residual nitrogen fertilizer may mask an inoculation failure. In addition, nodules will not fix nitrogen if soil nitrogen level is high.

The degree of nodulation can be determined by carefully digging.(Continued on page 46)
Research: 20-inch rows provide top yields

A 20-inch row spacing provided maximum soybean yields for four seeding rates compared with 10- and 30-inch row spacings, according to University research in south central Nebraska.

Research trials were conducted to determine if optimum row spacing and seeding rate were the same for different cultivars in irrigated and rainfed water regimes.

A three-year study was conducted near Clay Center and a two-year study was conducted near Oxford. All combinations of three row spacings and four seeding rates (45,000-330,000 seeds/acre) were used with five cultivars. The treatments were planted in adjoining irrigated and rainfed fields at each site.

Yield of determinate cultivars averaged over water regimes increased as seeding rate increased from 45,000 to 140,000 seeds per acre and did not change with the higher seeding rates. Yields of indeterminate cultivars normally were not affected by changes in seeding rate. The time of canopy closure did not change at seeding rates over 140,000.

Soybean yield responses to row spacing depended on the site, water regime, and cultivar used. The 20-inch row spacing consistently had the highest yields (31 and 48 bushels/acre, rainfed and irrigated, respectively) at all five sites when averaged over the other factors. The ranking of the other two row spacings varied with water regime: 10-inch row spacing (47 bu/acre) was more productive than 30-inch row spacing (46 bu/acre) with irrigation, but the opposite was true in rainfed (29 and 30 bushels per acre for 10- and 30-inch row spacings).

The University recommends producers plant 150,000 live seed per acre regardless of water regime. This provides a measure of insurance against poor emergence from crusting and early season hail damage. If seed-to-soil contact is poor, consider increasing planting rates to achieve a emergence rate of about 120,000 seedlings per acre. In contrast to previous recommendations, this work indicates that using greater seeding rates with determinate varieties is not necessary. Canopy closure dates were similar for all varieties and was similar at seeding rates at and above 140,000 seeds per acre. Seeding rates at or above 140,000 seeds per acre should provide similar competition for weeds.

In low-yielding environments, narrow rows (10 in.) may reduce yields compared to wider rows. On the other hand, in high yielding environments narrow rows will probably yield better than wide rows (30 in.). A 20-inch row spacing may be the best choice in any environment.

Twenty-inch rows obviously are not practical with gravity irrigation. However, other work at the South Central Research and Extension Center suggests that twin rows on top of ridges spaced 30 inches apart yield more than 30 inch rows in years with good yield potential.

Roger Elmore
Extension Crops Specialist

How to launder pesticide contaminated clothing

Clothing worn while using pesticides needs special handling to avoid contaminating the launderer and other family members. Proper laundry practices can help keep a family safe from serious health problems. If you are the launderer of such clothing, here is a checklist to determine if you are doing the right thing.

1. Do you wear rubber or latex gloves when handling pesticide contaminated clothing to avoid getting pesticide residue on your skin?
2. Do you pre-rinse contaminated clothing to help remove some of the chemical residue?
3. Do you store the contaminated clothing in a well-marked bag away from the rest of the family wash?
4. Do you wash together only those clothes containing the same pesticide?
5. Do you use hot water (140 degrees or higher) to better remove the pesticide?
6. Do you use a heavy duty liquid detergent for effective removal of oil-based emulsifiable concentrate formulations?
7. Do you use a powdered phosphate detergent for effective removal of wettable powder formulations?
8. Do you use a normal 12-minute washing cycle?
9. Do you line-dry the clothes in sunlight to help break down pesticides?
10. Do you wash the contaminated clothing more than once?
11. Do you launder the contaminated clothing daily when pesticides are applied daily?
12. Do you thoroughly wash the machine with hot water and detergent after washing the contaminated clothing?

If you have answered yes to the above questions, you are helping reduce the dangers that these chemicals can cause.

Rose Marie Tondl
Extension Clothing Specialist
Use planting date to avoid bean leaf beetles

The bean leaf beetle is a sporadic pest of soybean in Nebraska that can be easily avoided by using an appropriate planting date.

Adults vary in color, but are usually reddish to yellowish-tan. They are about 1/4 inch long and commonly have two to four black spots and a black border on each wing cover. These spots and the black border may be missing or less pronounced. However, in all cases there is a small black triangular-shaped coloration at the base of the wing covers near the thorax. Bean leaf beetle adults have chewing type mouthparts and feed on soybean leaves, causing defoliation, and on soybean pods causing scarring.

Studies in Nebraska in the early 90s compared beetle populations in early May soybean plantings and those in early June plantings. Significantly higher beetle populations and leaf feeding damage were observed in the early plantings. Although leaf feeding in these early plantings rarely contributes to a

![Bean leaf beetle](image)
yield loss, there have been a few instances when damage was so severe that a re-planting or the use of an insecticide was necessary to insure an adequate plant stand. In addition, when beetle colonization occurs in early emerging soybean fields, beetle populations generally remain high throughout the season.

The best management practice to reduce bean leaf beetle feeding damage is to plant late within the recommended planting period of May 5-20 for central Nebraska and not planting before May 5. Planting at the appropriate time (May 15-20) can almost guarantee escape from the pest. Plantings extending into June can result in lower yields.

If time and labor constraints force early plantings, begin routine scouting of those fields at first signs of soybean emergence by observing the average numbers of beetles/soybean seedling. It's best to sample at mid-morning or in the afternoon and avoid sampling during temperature extremes.

Economic thresholds at the V1 stage, (when the unifoliate and first trifoliate leaves are unrolled) change according to the value of the crop and the cost of control. However, considering the current price of soybeans, an average of about three to five beetles/soybean seedling might cause enough damage to justify using an insecticide. See NebGuide G90-974, The Bean Leaf Beetle in Soybeans, for more information.

John Witkowski
Extension Entomologist
Northeast District

Chemicals can help combat algae in turfgrass

In wet years algae can develop into a persistent and sometimes difficult problem to control on bentgrass greens and other turfs. A few of the products registered for algae control on turfgrasses are:

- Algamec Turf Algaeicide (Gordon's)
- QuikStop Plant Fungicide and Algaeicide (Gordon's)
- Formec 80 (Gordon's)
- Daconil Ultrex, Daconil 2787
- Flowable Fungicide, Daconil
- Weather Stik (ISK Biosciences)
- Fore (Rohm and Haas)
- DeMoss (Mycogen)
- Algaen-X (Scotts)
- Physan 20 (Maril)

Products that contain mancozeb such as Formec 80 and Fore may inhibit germination of bentgrass seed used in overseeding. Many algaecides carry the Danger label, and can cause phytotoxicity to the turf. Exercise care in their use. Fore, Formec 80 and the Daconil products only carry the Caution label.

Mushrooms and fairy rings also can be troublesome problems in turf. Products registered for temporary suppression of mushrooms and fairy rings in turf include ProStar (AgrEvo), QuikStop Plant Fungicide and Algaeicide (Gordon's) and Consan 20 (Hi-Yield). Consan 20 is carried by some garden centers and would be available to homeowners.

Systemic turfgrass fungicides are becoming more available at garden centers. Banner is now available as Spectracide Immunex Fungicide Concentrate. Bayleton has been repackaged by several companies into homeowner products - Fung-Away (Green Light), Bonide Lawn Fungicide, Greenview Turf Fungicide (Lebanon), Lebanon Turf Fungicide and Lawn Fungicide (Howard Johnsons). Several products contain Cleary's 3336 or thiophanage methyl - Bonide Turf and Ornamental Bonomyl Systemic Fungicide, Dragon Systemic Fungicide 3336 WP, Scotts Lawn Fungus Control and Halt Systemic (Fertilome). Since many of these products are a granular formulation, they may need to be applied more frequently than a wettable powder or an emulsifiable concentrate applied as a spray.

John E. Watkins
Extension Plant Pathologist
Soybean fertility plan begins with a soil test

The major fertility needs for Nebraska soybean production are lime, phosphorus (P) and possibly nitrogen (N). The best way to determine the fertility status of the soil for soybean production is to have had a soil test within the last one to three years.

Lime

Soils in eastern Nebraska are likely to be acid unless they have been limed. Lime should be profitable if the soil pH is 5.8 or below. A buffer pH is used to determine the lime requirement. Remember, aglime is at least an eight-year investment. The best time to apply lime for legumes would be to the crop in the preceding year. It at all possible the lime should be mixed with the top 6 inches of soil.

Liming acid soils increases availability of nitrogen and phosphorus by enhancing microbial activity which increases mineralization of organic matter. The symbiotic bacteria that fix nitrogen in soybean nodules also function better at pH values between 6 and 7.

Phosphorus

If the Bray and Kurtz 1 P soil test value is above 10 ppm, the probability of a phosphorus response is very low. Where soybeans are grown in rotation with corn, the beans will usually obtain sufficient phosphorus as long as the phosphorus soil test is around 15 ppm, a goal for optimum corn production.

What if phosphorus is needed? If phosphorus is needed for soybeans, it can be applied broadcast and incorporated, in bands 4 to 6 inches deep and not more than 15 inches apart, or as a starter. Starter fertilizers should not be placed with the seed. However, the phosphorus should be banded about 1 inch to the side and at or slightly below seed depth.

Nitrogen

Soybeans obtain nitrogen from three sources. As a legume, the major nitrogen source is the rhizobium bacteria that fix atmospheric nitrogen in the nodules (provided the bacteria is present and the pH is in the proper range). Soybeans will also use nitrogen mineralized during the growing season as well as carry over NO₃-N in the soil profile from previous crops. Under some soil conditions such as low pH, low organic matter and low residual NO₃-N, soybean yields may be increased by supplemental nitrogen. The need for supplemental nitrogen cannot be accurately predicted by soil tests. If producers have light colored soils, low in organic matter and acid, they may want to apply about 100 pounds of nitrogen in a strip diagonally across the field prior to planting beans. Then, if prior to flowering, the beans in the strip that received nitrogen are darker green than the rest of the field, applying 80 to 120 pounds of nitrogen (preferably as anhydrous or injected liquid) will probably be profitable.

Iron

Soybeans grown in calcareous soils may be chlorotic because they cannot properly utilize iron in the soil. Under these conditions, use a tolerant variety, plant at least 12 seeds per foot of row and consider placing an iron chelate with the seed at planting.

More detailed information on fertilizing soybeans can be found in the following NebGuides: Fertilizer Suggestions for Soybeans, G87-859, Using Starter Fertilizers for Corn, Grain Sorghum and Soybeans, G77-361, and Soybean Chlorosis Management, G89-953.

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UNL Soil and Plant Analytical Laboratory
(402) 472-1571

Controlling waterhemp

Mix herbicide families to avoid resistance

Poor control of common waterhemp with Pursuit and other ALS-inhibiting herbicides is a common occurrence in eastern Nebraska. Herbicide resistance spread rapidly in part because ALS resistance is pollen mobile and common waterhemp is a cross pollinated plant. The heavy reliance on Pursuit in soybeans probably played a major role in resistance development. Cross resistance to other ALS-inhibiting herbicides — both imidazolinones and sulfonylureas — render both classes of herbicides ineffective against common waterhemp.

Several waterhemp management strategies are available in soybeans. Cobra, Blazer or Reflex can be included in postemergence treatments. Soil applied treatments that help control ALS resistant waterhemp include chloroacetamide and dinitroaniline herbicides and the recently registered Authority Broadleaf, Canopy XL and Cover.

Waterhemp control in corn has not been as difficult as in soybeans; however there have been some problems with Extrazine. Extrazine is a 3:1 mixture of Bladex and Atrazine. Bladex is not effective

(Continued on page 45)
With ridge-till

Not too much off the top this spring

Ridge planters use row cleaning devices to push residue and weed seed to the row middles where a crop cultivator can provide weed control. Removing the residue enhances soil warming, which can be important when planting early in the spring on heavier or poorly drained soils. Ridge planting is an excellent match for furrow irrigated fields since the ridges are already in place from last year's irrigation ditching. This fact is why Nebraska is the leader in ridge plant with more than 1.6 million of the nation's 3.4 million acres.

While producers have practiced ridge tillage for many years, this year they may need to reset their planters in response to the delayed spring. When the soil temperatures were about 45 F in early April, many producers were ready to start planting because the air temperatures were over 70 F and it felt like spring. The recent snow and cold weather has delayed planting and now producers are getting nervous because the typical start planting date of April 15 has passed.

The established ridges will warm up and dry out in the coming days quicker than residue-covered, no-till fields or flat, tilled fields. To take advantage of this warmer environment, producers should reset their planters to remove less of the ridge top. Removing too much places the crop seed in a cooler, wetter environment, which can slow germination and emergence. Leaving the warm, dry soil on top of the ridge makes closing the seed-vee easier. Keeping some residue on top of the ridge will also help keep the depth gauge wheels cleaner.

When removing weed seeds from the ridge, very little soil needs to be moved and there is no reason to remove the previous crop's root masses. The row cleaning devices should be operated at a very shallow depth, removing less than 1/2 inch of the ridge top to keep the row at least 3 to 5 inches higher than the residue-covered row middles. With the ridges shaped to shed water to the furrow, the erosion potential will be reduced in the cleanly tilled rows. Even if the field is relatively flat and has little erosion potential, creating furrows by operating the row cleaning device too deep can cause sediment to be deposited in the row, forming a crust.

No-till on top of the ridge or cleaning the ridges in a separate operation are other options for poorly drained soils and wet springs. No-till leaves all the dry soil and residue on the ridge and often can be performed when it is too wet to ridge plant. Even though it is an extra trip through the field, cleaning the ridges preplant allows "extra" warming and drying time of the seed zone. In addition, this may permit the use of conventional planting equipment on previously cleaned ridges.

Producers should not try to move more soil to remove weeds in the row or cover weeds between the rows because they will lose the benefits of the ridge. The ridge plant system and the planting equipment were never designed for emerged weed control at planting time. Depending on the weeds and the planting date, a properly timed herbicide application may be needed, either early preplant, burndown, or early postemerge.

Paul Jasa
Extension Engineer

Herbicide-resistant waterhemp (Continued from page 44)
against waterhemp and the reduced amount of atrazine in Extrazine does not always provide complete control. ALS resistant waterhemp would not be controlled with Accent, Beacon, Exceed, Peak, or Permit. Triazine-resistant waterhemp was reported in Fillmore County in 1990, and has since been confirmed in several other locations. It has not spread as fast as ALS-resistance. In part, this may be because triazine resistance is transmitted by seed, not pollen.

Diversification in cropping systems and herbicide programs is a viable approach to combating resistance. It is important to rotate herbicides with different modes of action to keep resistant weeds from becoming a problem.

The Weed Response Tables in the 1997 Nebraska Herbicide Use Guide indicate the expected performance of corn, sorghum, and soybean herbicides against ALS-resistant, triazine-resistant, and susceptible common waterhemp. This information can be useful in designing effective programs for the control of herbicide resistant weeds.

John McNamara, Extension Assistant, Weed Science
Alex Martin
Extension Weeds Specialist

Free soybean guide
The Nebraska Soybean Board and Cooperative Extension joined this year to publish the Nebraska Soybean Field Guide, a pocket manual packed with production and pest information, tables and illustrations. Contact your local Cooperative Extension Office for your free copy.
Army cutworms feeding in west central Nebraska

Army cutworms are now feeding in wheat and alfalfa fields in west central Nebraska. Some areas have seen economic damage in alfalfa where green-up has been delayed. These cutworms are showing a considerable range in larval size from ½ inch to over an inch in length. The most severe situation has been seen in Keith, Perkins, Chase, Dundy, Lincoln, Hays, Hitchcock, Frontier, Red Willow, Dawson and Furnas counties. Growers in these areas should be watching for army cutworm damage.

In alfalfa army cutworms will feed on the newly emerging leaves near the crown. They can be found in the loose soil surrounding the crown of the plant. This feeding will delay alfalfa green-up. Any delay in green-up is a sign of problems and the cause should be determined right away. If enough cutworms are present and feeding is allowed to continue long enough, the plants may die. If alfalfa is able to green up normally the likelihood of significant cutworm damage is minimal. Scouting should be done to determine the larval density in the field by counting the number of larvae per square foot in several areas of the field. For established stands of alfalfa, four or more army cutworms per square foot are required to cause significant losses. In newly-seeded stands the threshold drops to only two larvae per square foot.

In wheat the army cutworms graze on the leaves, causing reduced foliage. Significant damage is more likely in fields with minimum foliage (i.e., stressed areas). During the day the cutworms bury themselves in the loose soil at the base of the plants and between the rows. At night they climb up on the plants to feed. As with alfalfa, scouting should be done to determine the larval density in larvae per square foot. If the wheat is vigorously growing, four or more cutworms per square foot are needed to cause significant damage. If the wheat is stressed and not growing well, the wheat will not be able to outgrow the cutworm damage. In this case only two cutworms per square foot may cause significant damage.

Larval feeding will continue until the larvae are fully grown. They will then burrow into the soil, create an earthen chamber and pupate. Adults will emerge from the soil in May and early June. Emerging moths often are a nuisance in urban areas as they migrate to the Rocky Mountains for the summer. As they migrate, they often seek shelter around store fronts, garages, bushes and shrubs, feeding on available nectar-bearing, flowering plants. In the fall these moths migrate back to the plains where they deposit their eggs in wheat and alfalfa fields.

Several insecticides are registered for army cutworm control in wheat and alfalfa. As with other cutworms the most effective insecticides are the synthetic pyrethroids. These include Ambush, Pounce and Baythroid for alfalfa and Warrior for wheat. Also, Lorsban provides good control of cutworms in both alfalfa and wheat.


Jack Campbell, Extension Entomologist, Panhandle District
Gary Hein, Extension Entomologist
West Central District

Inoculating soybeans (Continued from page 41)

random plants throughout the field two weeks after emergence and examining the root systems. A well-nodulated plant should have five to seven nodules on the primary root. If plants have fewer nodules, monitor the field carefully to determine if numbers of nodules increase. If they do not, and nitrogen deficiency symptoms develop, apply 50-60 lbs of nitrogen to supplement soil nitrogen reserves. Apply this nitrogen at or soon after flowering.

Fields with no history of inoculated soybean production should be inoculated. Materials that provide greater numbers of bacteria to the root zone are best. These trials did not test inoculant on sandy soils or on high pH soils, however other research indicates that these fields should be inoculated every year.

New strains of nitrogen-fixing bacteria and carriers are constantly sought and are included in inoculation products.

For more information see Soybean Inoculation — When is it Necessary?, UNL NebGuide G84-737. A report on this research is available on the web at http://www.ianr.unl.edu/ianr/screc/Hotline/inoculate/inoculate.htm.

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