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Irrigating soybeans

How timing, climate affect efficiency

Irrigating when soybeans can best use the water can help ensure yields while limiting energy costs. But is the right time to irrigate the same in western and eastern Nebraska where soils and climate differ significantly? Irrigation research sheds light on the effect of irrigation timing and other factors in improving irrigation efficiency.

Research summarized by Dr. Jim Specht, NU professor of agronomy, indicates that soybean yields are increasing for both dryland and irrigated conditions in Nebraska.

Data from the Nebraska Agricultural Statistics Service for average dryland and irrigated soybean yields were regressed for the period between 1972 and 1997. Specht, an NU soybean breeder, reported that soybean yields increased at a rate of 0.52 bu/ac/yr for irrigated soybeans and 0.37 bu/ac/yr for dryland conditions. He attributes this trend to three factors:

1) improved producer knowledge of soybean production systems;
2) improved soybean genetics; and
3) an increase in CO₂ content of the atmosphere.

Crop water use

Total water use of a fully irrigated soybean crop (evaporation plus transpiration) ranges from 21 to 24 inches per year. About 65% of this water is used during the reproductive stages. The average peak crop water use rate, about 0.3 inches per day, begins near the full flowering stage and continues through pod development. The most important times for soybean plants to have adequate available water are during pod development (R3-R4) and seed fill (R5-R6). Irrigation also may be required during the flowering stage on sandy soils or, during very dry years, on medium and fine-textured soils; however, if water is applied during flowering, it is important to follow with adequate water during seed fill. Otherwise, more but smaller seeds will develop, reducing yields.

Although soybean roots can reach depths of 5 to 6 feet, the largest concen-
Paul C Hay, Extension Educator in Gage County: The wheat crop looks like it will be 45+ bushels per acre plus 20 bushels of corn. This is in spite of the thin wheat stands from winter kill and a healthy dose of striped rust. Does the 20 bushels of corn from a wheat field confuse you? Farmers who will keep the wheat stubble clean this fall and plant no-till corn in 2002 will have yields 20 bushels per acre above other rotation and tillage choices. Dryland farmers need to look for opportunities to increase yields and lessen risks and this is an excellent opportunity to do just that.

Terry Gompert, Extension Educator in Knox County: In the last 30 days we have had only 0.3 inches of rain. In the next hay crop, both alfalfa and prairie will be very short (maybe 1/4 of normal). Grazing management needs to move into drought methods: consider depopulations, strip grazing, slowing down rotation, and the potential for grazing crops. Little grasshoppers are showing up in some locations. Corn looks okay, but soybean stands are poor.

Gary Hall, Extension Educator in Phelps and Gosper counties: We are pumping water to corn as quickly as possible since we seem to be in the dry area of Nebraska this year. Wheat harvest will start in the next 7-10 days.

Nebraska Agricultural Statistics Service: Hot, dry weather conditions late last week pushed wheat maturity and prompted producers to pump water to spring planted crops. The following crop condition report was filed by the USDA Agricultural Statistics Service in Nebraska on crop conditions through Sunday, June 24.

Winter wheat crop rated 5% very poor, 16% poor, 40% fair, 35% good, and 4% excellent. Virtually all of the acreage had headed with 51% turned color by week’s end, behind last year at 95% and average at 66%. The crop was ripe on 1% of the state’s acreage as of Sunday. This compares with 54% ripe last year and 15% for the five-year average. Western fields were beginning to show signs of stress from the hot, dry conditions.

Corn condition rated 4% poor, 22% fair, 60% good, and 14% excellent. Producers continued with weed control and irrigation where needed.

Sorghum was virtually all planted with 95% emerged. This compared with 97% last year and 95% average. Condition rated 1% very poor, 3% poor, 35% fair, 56% good, and 5% excellent.

Oat condition rated 1% very poor, 5% poor, 28% fair, 57% good, and 9% excellent. Heading progressed last week to 73%. This compared with 87% last year and 77% average.

Dry bean planting was virtually complete with 86% emerged by week’s end. Condition rated 4% poor, 29% fair, 63% good, and 4% excellent. First cutting alfalfa harvest progressed to 96% complete. Second cutting activities were 6% harvested and compared to 17% last year and 4% average. Condition rated 2% very poor, 6% poor, 25% fair, 58% good and 9% excellent. Cutworm damage has been limiting regrowth in some fields.

Soybean condition rated 4% poor, 22% fair, 60% good, and 14% excellent. Producers continued with weed control and irrigation where needed.

Soybean fields were emerged with condition rated 5% poor, 25% fair, 60% good, and 10% excellent.
Irrigating soybeans  (Continued from page 135)

Irrigation research indicates that in eastern Nebraska, delaying irrigation until the pod-development stage will result in top yields most years. In west and west central Nebraska or on sandy soils, full season irrigation scheduling is best.

Irrigation of roots occur in the top 3 feet of the soil profile, where irrigation water management efforts should be concentrated. Soybean produce highest yields on soils with good internal and surface drainage - soybeans do not like wet feet.

Research results
1980s Nebraska research
Research has shown that indeterminate soybean respond well to delayed irrigation; however, as rainfall and stored soil water decrease from east to west across the region, delayed irrigation can reduce yields when compared to full-season irrigation. To develop soybean irrigation best management practices (BMPs), research has focused on comparing full-season irrigation to stage-of-growth irrigation. In the early 1980s four irrigation treatments were tested at Tryon, North Platte, Clay Center, and Mead:

1. Full-season (Full). Irrigations were scheduled to maintain the available soil water above the 50% depletion level.
2. Full Flower (Flower). Irrigation began at the R2 Stage.
3. Pod Elongation (Pod). Irrigation began at the R4 Stage.
4. Dryland. Water was applied only if needed for stand establishment.

The average relative yields were determined by comparing Treatments 2, 3, and 4 to the full-season irrigation treatment for each of the sites. Dryland yields were greater at Mead and Clay Center than at the two west-central locations, due to increased precipitation before and during the growing season in eastern Nebraska. Relative yields from the pod elongation treatments decreased from the eastern to the west-central locations.

Soil water storage and rainfall were not enough to produce maximum yields from the pod-elongation treatment at the North Platte and Tryon locations; the pod-elongation treatment produced yields equal to the full-season treatment. These data suggest that, for eastern Nebraska, a strategy of delaying

<table>
<thead>
<tr>
<th>Treatment 1. Full-season, 100% of ET</th>
<th>Treatment 2. 75% of ET</th>
<th>Treatment 3. 50% of ET</th>
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<tr>
<td>Treatment 4. Dryland</td>
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<tr>
<td>Treatment 5. 75% of ET in vegetative stages and 100% of ET in reproductive stages</td>
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<tr>
<td>Treatment 6. 50% of ET in vegetative stages and 100% of ET in reproductive stages</td>
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Yields for treatments receiving minor stress during the vegetative stages were equal or better than the 100% ET replacement treatment in 1986 and 1987. Significant water savings results from implementing Treatment 6 (50%/100%); however, in 1988 yields were depressed for full season stress (Treatment 2 = 54 bu/ac, Treatment 3 = 32 bu/ac) and vegetative stage stress treatments (Treatment 5 = 56 bu/ac, Treatment 6 = 42 bu/ac) due to severe stress in June. The highest

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Nutrient deficiencies suspected

From McCook to Reynolds and Red Cloud to Broken Bow, many corn fields have large areas of chlorotic (i.e., yellow) plants spread across the field. The pattern of chlorosis within the field is quite variable. Within an affected area of the field, most if not all of the plants are yellow, vary in height and display a variety of coloration suggestive of nutrient deficiencies—iron, sulfur, zinc, or another nutrient. The leaf stripe symptoms may appear on several adjacent plants within a row and occur on old and new growth.

The best diagnosis at present is that these symptoms are minor element (e.g., Zn, Mg, Fe, S) deficiencies resulting from the fluctuating weather conditions (i.e., temperature and rainfall) of late May and early June. Low soil temperature and high soil moisture can reduce the microbial activity necessary for the mineralization of these micro-nutrients. With consistent warm temperatures over the next few weeks, most fields should recover.

I have consulted soil fertility specialists and will post additional information and analysis when available. For photos of injured plants and updates on this topic check the “Hot Topics” section of the Plant Disease Central website at http://pdc.unl.edu or check future issues of Crop Watch.

Jim Stack
Extension Plant Pathologist

Irrigating soybeans (Continued from page 137)

calculated June ET in 17 years coupled with less than 1.0 inch of rainfall resulted in severe water stress. Full ET yields were 64 bu/ac.

This research shows that soybeans can sustain moderate stress during the vegetative stages without a corresponding yield reduction; however, managers must closely watch soil water content during the vegetative stages to alleviate severe stress.

2000 Concord results

In 2000, soybean irrigation tests were conducted at the Haskell Agricultural Laboratory near Concord. The soybean variety was a mid-class II maturity planted into a silt loam soil. Using a solid-set system, irrigation was initiated at R3 to keep the soil water content in plots nearest the sprinkler line above the 50% available soil water content. Irrigation water application decreased with distance from the sprinkler line. Irrigation application ranged from fully irrigated (near the sprinkler line) to dryland.

Yields ranged from 40 bu/ac for the dryland treatment to 47 bu/ac in plots receiving an average gross application of 8.7 inches of water. The slope of the yield vs. water applied line was 0.95 bushels per acre-inch of water applied.

This number agrees well with the Full-Season Treatment in the 1980s Nebraska research. Longer season varieties in Group III or IV will have larger yield increases per inch of water applied than Group II or Group I. Consequently, yield boost expectations should be based on the relative maturity of the variety and how irrigation is managed during the growing season.

Research summary

Results of these and other research efforts indicate that adequate water during the pod development and seed fill stages is critical to boosting irrigated soybean yields. Yield responses to irrigation water are lower for soybeans than for corn and can be less than 1.0 bushels per acre-inch for shorter season varieties. Growing seasons that do not produce moderate to severe dryland plant stress may not see much of a yield boost from irrigation; however, significant yield increases are possible if irrigation is used to alleviate severe plant stress during the reproductive stages.

Bill Kranz, Irrigation Specialist, Northeast REC
Brian Benham
Water Resources Specialist
South Central REC

Forages may be next best replant option after storms

After hail or storm disaster strikes your fields, replanting a grain crop may be nearly impossible due to herbicide carryover or the late planting date. As a result, annual emergency forage crops might a good choice.

Unfortunately, previous herbicide use also can cause problems with forages. Many herbicides for corn and milo will injure pearl millet and foxtail millet, but sudangrass, forage sorghum, and sorghum-sudan hybrids will tolerate moderate levels of atrazine; and safened seed can be used if Dual or Bicep have been applied. These sorghums also tolerate most herbicides labeled for use with grain sorghum. Another possible emergency forage crop is short-season corn as silage or as late season pasture, especially if corn herbicides eliminate other possibilities.

Soybean herbicides cause even bigger problems for replanting to forages. All summer grasses are sensitive to most soybean herbicides. Sunflower silage and soybeans for hay or silage are among the few alternatives compatible with soybean herbicide carryover.

Drill late maturing soybeans thick for forage, about two bushels an acre. Cut and crimp as bottom leaves begin to yellow, and don’t turn windrows before harvest. Silage is easier to harvest than hay. Protein and energy will be similar to alfalfa, but a little less palatable.

Seed sunflowers at about 20,000 seeds per acre. Harvest as silage when 50% to 65% of plants are blooming. Feeding value will be slightly less than sorghum silage.

Bruce Anderson
Extension Forage Specialist
Various caterpillars, pests reported in field crops

Thistle and red admiral caterpillars

Thistle caterpillars, the larval stage of the painted lady butterfly, have been reported damaging soybean fields from Marquette to Bertrand. Some of these caterpillars are actually larvae of the red admiral butterfly (see photo). Both caterpillars are members of the genus Vanessa. Larvae appear very similar and have similar biologies and damage potential.

Thistle caterpillars are the larvae of painted lady butterflies. Painted lady and red admiral butterflies have been very abundant in Nebraska this spring. These butterflies fly up from southern overwintering sites each spring. Red admiral caterpillars normally feed on nettles. As the name indicates, thistle caterpillars normally feed on thistles. After defoliating thistles they move in search of food and may damage soybeans and sunflowers.

Both caterpillars damage plants by webbing leaves together and then feeding on the leaves. These caterpillars reach 1.5 inches in length at maturity. Thistle caterpillars are brown to black with a yellow stripe along each side of the body. A key characteristic is their well-defined spiny hairs, which cover their body and give them a prickly appearance. Thistle caterpillars usually have dark, black spines, while red admiral larvae have lighter colored spines.

According to the Handbook of Soybean Insects, published by the Entomological Society of America, an economic injury level for V3-V4 soybeans would be three thistle caterpillars per row-foot. The same threshold would apply to the red admiral caterpillar. A variety of insecticides may be used for control, including the pyrethroid insecticides (e.g., Pounce, Asana, Warrior), Sevin or Lorsban. A complete list of insecticides labeled for use on soybeans is available on the NU Department of Entomology web site at http://entomology.unl.edu/instable/soydefol.htm.

Field reports indicate that caterpillars are being found throughout fields. In some cases these caterpillars will feed on soybeans, which is an important indicator of damage. It is recommended that a field be monitored for a few days to ensure that the caterpillars have moved on or can be controlled.

Thistle and red admiral caterpillars are susceptible to certain soil fungi. If the weather turns cool and wet, the caterpillars may be killed by these fungi.

There are two generations of wooly bear caterpillars in Nebraska each year; the second generation is what was so common late last summer.

Alfalfa butterflies

High numbers of alfalfa butterflies are being reported in the Clay Center area and other parts of south central Nebraska.

Alfalfa butterflies have yellow to orange wings, with a black margin. Females may be white. The immature alfalfa caterpillar is green, with a pink and white stripe running down the side of the body. It is 1.5 inches long at maturity. Alfalfa usually harbors a high number of natural enemies, including spiders, predatory bugs, and parasitic wasps which help keep alfalfa caterpillars under control. Alfalfa butterflies go through two generations a year.

Fields with high numbers of alfalfa butterflies should be monitored for caterpillars in the next few weeks. If there are 10 or more alfalfa caterpillars per sweep, an insecticide may be needed. An insecticide containing Bacillus thuringiensis (Dipel, Thuricide, etc.) would be effective and would not kill beneficial insects. Cutting alfalfa also greatly reduces alfalfa caterpillar survival.

Bob Wright, Extension Entomologist, South Central REC
Elmore researches seed selection, cultural practices, crop production efficiencies

Roger Elmore is an Extension crops specialist and NU professor of agronomy and horticulture at the South Central Research and Extension Center near Clay Center. He has a 50% Extension and a 50% research appointment.

Elmore came to Nebraska in 1981 following graduate school at the University of Illinois. He grew up on a grain and livestock farm near Princeton, Illinois and served as a Peace Corps volunteer in Malaysia following his undergraduate degree in agriculture/biology from Illinois State University. In Malaysia he was assigned to a state’s Department of Agriculture where he worked on diversified cropping systems for lowland rice growers. The Elmore family still enjoys a good curry with rice! In 1990-1991 Roger and his family spent nearly a year on faculty development leave in the humid pampas of Argentina studying grain production, the seed industry, and extension systems. He’ll tell you he learned a lot about beef cattle, and grazing systems (and beekeeping too). ‘Asados,’ (a barbeque over wood coals) are still popular at the Elmore home near Clay Center.

Elmore’s extension program revolves around the crop variety testing program. He is responsible for the corn, soybean, grain sorghum, and winter wheat variety trials in south central Nebraska, working with Len Nelson, Extension crop variety specialist in Lincoln, who coordinates the project statewide. Elmore also helps lead a semimonthly conference call on current crop/pest conditions with other extension specialists and educators and is a regular contributor to Crop Watch. His area of interest and responsibility is in irrigated and dryland cultural practices, variety and hybrid selection, and crop production efficiency.

Roger’s research program involves cultural practices and hybrid-environment interaction with soybeans and corn. Some of his recent and current projects (and cooperators) are:

- Mid-season corn stalk breakage, a.k.a. greensnap
- Variable corn hybrid planting system on high pH soils (with Extension specialists Richard Ferguson and Gary Hergert)
- Roundup Ready corn hybrid trials: effects of Roundup application and effects of Roundup Ready gene on corn performance (isoline comparisons) (with extension specialist from across the Corn Belt including Bob Klein and Len Nelson in Nebraska)
- Narrow row corn production for irrigated environments (with Brian Benham, NU Extension specialist)
- Effect of corn plant spatial arrangement on plant disease development (with Jim Stack and Brian Benham, NU extension specialists)
- Corn pollination and ear fill
- Roundup Ready soybean trials: effects of Roundup application and effects of Roundup Ready gene insertion process (sister-line comparison) (with Nebraska Extension specialists: Klein, Roeth, Nelson, Martin, Shapiro, and Knezevic) These articles were published recently in Agronomy Journal. See them at: http://screc.unl.edu/Research/research.htm
- Corn spacing and developmental uniformity (with Ken Russell and Fred Roeth) and a sister study on planter speeds (with Extension educators Chuck Burr, Andy Christiansen, Terry Hajny, Steve Melvin, and Gary Zoubek).
- Glyphosate effects on soybean nodulation with and without irrigation (with Fred Roeth).
- George Hoffmeister and Ralph Klein of the South Central REC provide full time technical help on all these projects.

After wheat, try silage or hay

After wheat harvest, several crops can be planted for silage. For example, an early maturing corn is one possibility if you plant it thick, although yield still might not be very high. A better choice for late planting might be forage sorghum if chinch bugs and other insects are not a problem. Use high grain producing hybrids when available. The best choice of all for short-season silage might be sunflowers. They survive light frost and yield well under many conditions.

If you want hay instead of silage, plant sorghum-sudan hybrids, pearl millet, or foxtail millet when chinch bugs aren’t a problem. A hay crop exceeding 1.5 ton per acre still can be grown if planted soon and rain is timely. Another hay or silage alternative is solid-seeded soybeans. Silage is easier to harvest than hay for good quality. A couple tons of good forage can be grown from taller, full season varieties planted after wheat. A final hay option could be oats planted about the first of August. Yields over two tons are possible if moisture is good, fertility high, and our hard freeze comes a little late.

Also consider oats, as well as turnips, for fall pasture when planted in late July or early August. Oats and turnips are cheap to plant and with a few timely rains in August and September, both will produce much high quality feed in a short time.

Bruce Anderson
Extension Forage Specialist