2004

Crop Watch No. 2004-17, July 30, 2004

Lisa Brown Jasa
University of Nebraska-Lincoln, ljasa@unlnotes.unl.edu

CROP WATCH

University of Nebraska Cooperative Extension
Institute of Agriculture and Natural Resources

University of Nebraska Lincoln

No. 2004-17, July 30, 2004

When comparing past 32 years

Soybean yield increase trend similar to corn

Are increases in corn yields outpacing increases in soybean yields? Midwest corn and soybean producers looking at yield trends over the last decade have been asking this question and researchers have been exploring the data.

"During the past 32 years, soybean yields have increased at an average rate of 0.41 bushels per acre, or about 2 bushels per acre every five years," said Jim Specht, UNL agronomy researcher and soybean breeder, speaking of the national yield trend. (*See Figure 1a*)

"Although long-term U.S. soybean yields have trended upward, there have been clusters of years in which the short-term yield trend was flat or down," Specht said. In Nebraska, the last 10 years may represent one of those clusters.

Many Midwestern soybean producers have watched soybean yields on their farms gradually fall

(Continued on page 157)

Inside

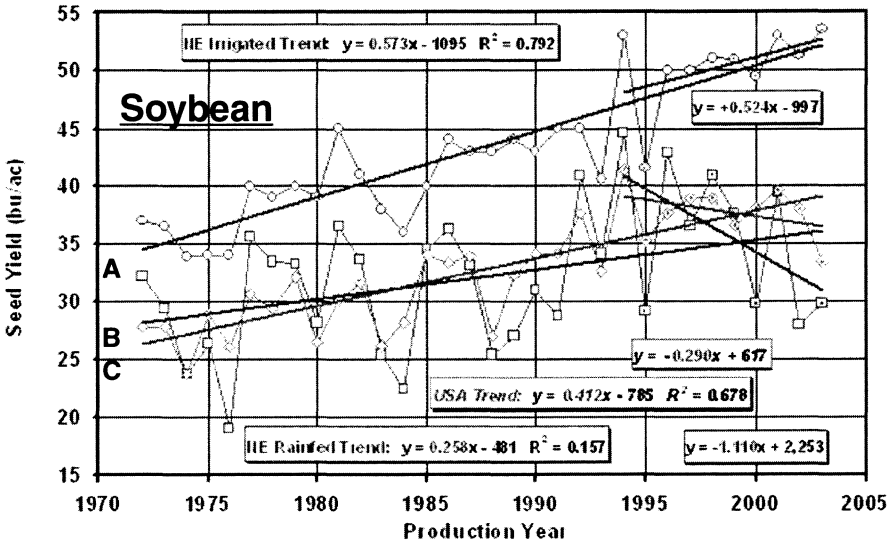

Figure 1A. U.S. and Nebraska soybean yield trends, 1972-2003. (Specht, 2004)
A = Nebraska irrigated soybean yield trend
B = Nebraska rainfed soybean yield trend C = U.S. soybean yield trend

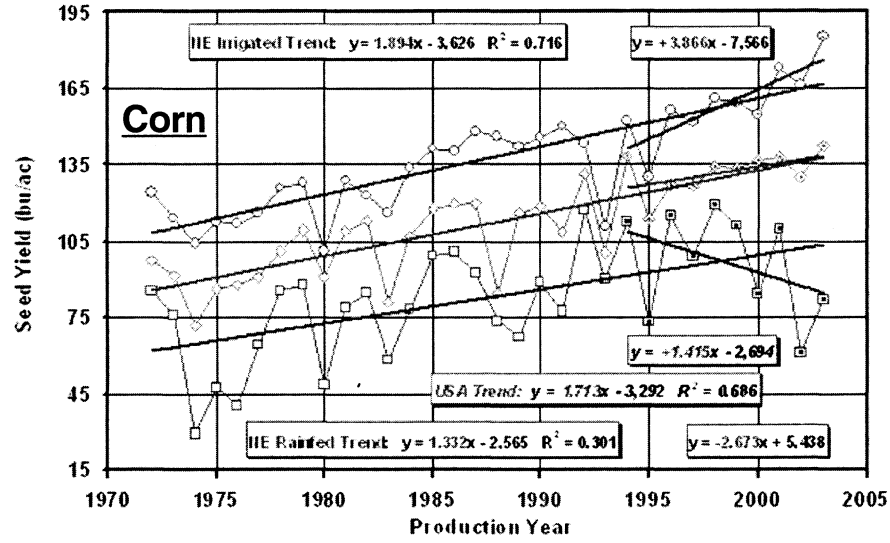

Figure 1B. U.S. and Nebraska corn yield trends, 1972-2003. (Specht, 2004)
A = Nebraska irrigated corn yield trend
B = U.S. corn yield trend C = Nebraska rainfed corn yield trend

Ag briefs

Andy Christiansen, Extension Eductor in Hamilton County: A few fields in the area have been treated for soybean aphid. European corn borer flight is building, but cool weather has kept light trap numbers low. Irrigation has begun.

Thomas Dorn, Extension Educator in Lancaster County: I am continuing to monitor several soybean fields in westesrn Lancaster County where I found soybean aphids earlier this month.. I have been scouting these fields weekly to monitor the change in aphid population. Last week, numbers seemed to be increasing with more plants with aphids and a few leaves with some small colonies as opposed to single aphids. This week, numbers seemed to have declined - I'm assuming we had mortality from the very hot weather the first half of the week. I broadened the scope of the soybean aphid survey this week by including fields northeast of Lincoln, near Waverly and east of Lincoln near the Cass county border. I found extremely low numbers of soybean aphids in every field I checked, but nothing to be concerned about at this time.

Other pests in this area include bean leaf beetles, which are developing now; and several species of subadult grasshoppers invading from field borders, road ditches and grassed waterways.

Corn pollinated well. Average ear size is 16 rows of kernels with potential for more than 50 kernels per row in most fields that did not have storm damage or standing water. I think ears will tip back to around forty kernels per row in most fields. Provided we continue to receive timely rains, dryland yield could be in the neighborhood of 140 bushels an acre (16 rows x 40 kernels x 20,000 ears per acre). As of Monday, most grain sorghum fields had not headed, although a few fields are heading or pollinating.

Thomas Hunt, Extension Entomologist at the Haskell Ag Lab, Northeast REC: We received a report of at least one soybean field where soybean aphid numbers definitely hit the economic threshold for treatment. More fields may reach the threshold with the more moderate, cooler weather expected this week. The aphids tend to multiply when temperatures are in the 70s and 80s and die when the temperatures reach the mid 90s.

Philip D. Steinkamp CCA and CNMP Coordinator, Northeast REC: I scouted six Antelope County corn fields July 24 and found most corn was 100% silked with pollen shed. Western bean cutworms infestations ranged from 4% in two fields to 7%, 8%, 9%, and 11% in the other fields. Almost all were hatched and some larvae were present. I also found a few rootworm beetles, mainly in the areas with heavier soils. Most of the corn looked pretty good with good potential. Very few disease problems were seen. All the fields were irrigated and soil moisture was good.

Del Hemsath, Extension Educator in Dakota, Dixon, and Thurston counties: Corn is in the pollination stage with ideal weather conditions for success. Soybean aphids are becoming more active, winged adults are being found with all stages of development on the infested leaves, so the stage is set for active development. Natural predators in the fields should help control aphid numbers. Soybeans are in the R4 stage in most areas. Since most of this area is in dryland production, we'll need August rains to get the crop through the reproduction stage. Pastures still look good and alfalfa regrowth is looking very good.

Roger Elmore, Extension Crops Specialist: I toured several fields in central Nebraska Tuesday and viewed damage from a July 12 storm with high winds and hail. Leaf stripping occurred on corn and leaf stripping, leaf loss, and stem breakoff occurred on soybean. Winds up to 100 mph resulted in greensnap on corn with some fields averaging 60% to 80% broken stalks. Breakage occurred at least from Elba to North Loup. Scott Brady, Extension educator in Greeley, Howard, Sherman and Valley counties, said the storms also caused damage near Boelus and Farwell.

(Continued on page 160)

CROP WATCH

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Crop Watch is published from March to November by Cooperative Extension and Communications and Information Technology in the University of Nebraska Institute of Agriculture and Natural Resources, PO Box 830918, 108 Agricultural Communications Bldg., UNL, Lincoln, NE 68583-0918. To order a print subcription or to change your address, write to *Crop Watch* at the above address or call (402) 472-7981. The newsletter also is available on the Web at **cropwatch.unl.edu**

Lisa Jasa, Editor; Email: ljasa1@unl.edu

Yield increases

(Contiued from page 155)

off or stagnate since 1994 when soybean yields hit an all-time high. In the past decade, soybean yields have trended downward with a 0.29 bushel per acre per year decrease in average yields. Nebraska rainfed soybean yields have declined even more, by 1.10 bushels per acre per year, while irrigated soybean yields have steadily advanced at the rate of 0.52 bushels per acre per year, said Specht, who will present his data on soybean yield trends at this year's Midwest Soybean Conference August 6-7 in Des Moines.

While soybean yields appear to have stalled, corn has continued to see steady yield increases (*Figure 1b*) over the same period, suggesting the question: Are yield increases for corn outpacing those for soybeans?

In fact, in the last decade Nebraska irrigated corn yields have increased by 3.87 bushels per acre, twice the annual increase of 1.89 bushels per acre for the 32-year period being studied. In contrast, the 0.52 bushel per acre per year increase in Nebraska irrigated soybean yield during the last 10 years is not much different from the 0.57 bushel per acre increase calculated for the 32-year period.

Actual vs relative yield differences

While these numbers help address the differences in actual yields (*Figure 2a*), they still don't provide a basis for comparing the *relative* rate of yield increases for these two crops. To look at this further, Specht graphed soybean yields relative to corn yields (*Figure 2b*).

"This graph shows that the yield improvement trend lines for corn and soybean are nearly parallel, and indeed, nearly coincident. What does this mean? Well, setting aside the intrinsic 3:1 yield

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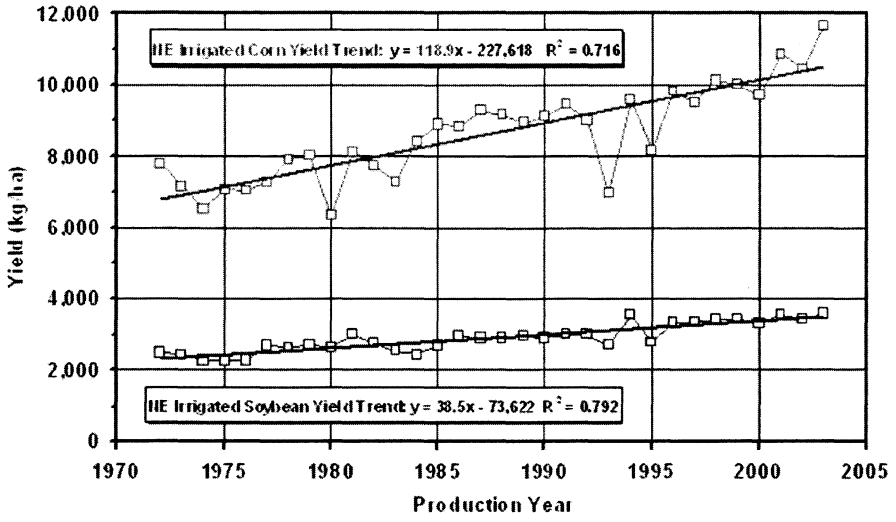


Figure 2a. Nebraska corn and soybean yields in absolute terms. (Specht, 2004)

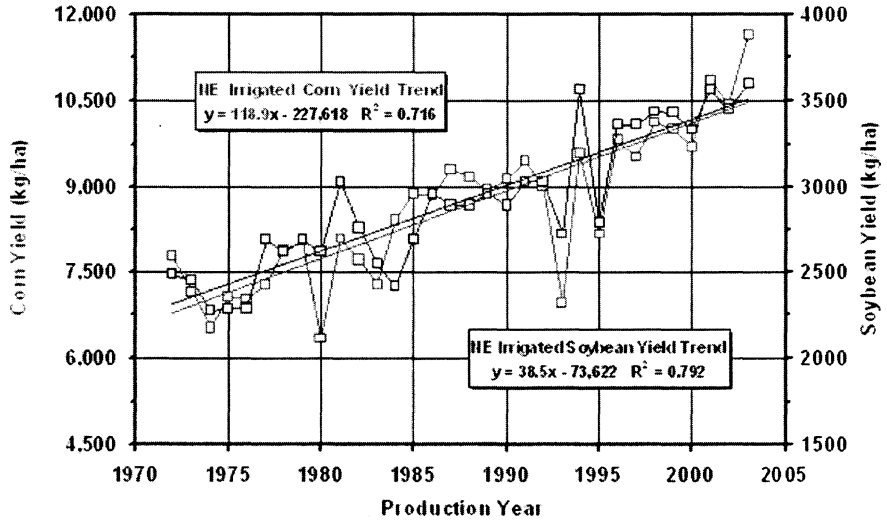


Figure 2b. Nebraska corn and soybean yields in relative terms. (Specht, 2004)

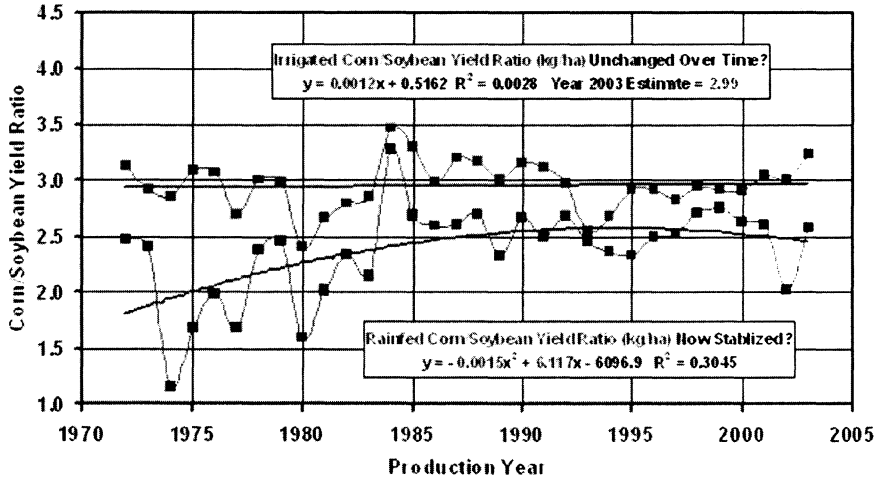


Figure 3. Nebraska irrigated and rainfed corn/soybean yield ratios. (Specht, 2004)

Yield increases (Contiued from page 157)

advantage of corn over soybean, if corn breeders are improving corn yield each year by 1.5 bushels per acre, then soybean breeders had better be improving soybean yield each year by at least 0.5 bushels per acre, or else the 3:1 corn/soybean yield ratio would increase. Have soybean breeders maintained this 3:1 parity? *Figure 2b* would indicate that they have (in metric yield). Thus, the yield potential of the new soybean varieties is, in relative terms, keeping pace with the rise in the yield potential of the new corn hybrids," Specht said.

The impact of inherent differences

When examining these yield differences, it's helpful to remember the agronomic differences between these two crops as well as the impact of drought and the lack of rains timely for soybean production in four of the last 10 years (1995, 2000, 2002 and 2003). It's also helpful to look at the longer-term trend in yield increases for each crop relative to that crop's yield, rather than comparing the bushel per acre increase in corn directly with the bushel per acre increase in soybean.

Corn is intrinsically more productive than soybean because of two physiological attributes, Specht said.

"One is that the photosynthetic system in corn is much more efficient, and that system operates more effectively at high temperatures. The second is that corn seed is mostly carbohydrate, which is energetically the least expensive of the three constituents a plant can put into its seed.

"Protein and oil are energetically far more expensive for a plant to create, and putting substantial amounts of these two constituents into seed greatly reduces the amount of dry matter a (soybean) plant can accumulate for seed yield purposes. As a result, corn yields are three times greater than soybean," Specht said.

As climate trends shift so will soybean yields

While increasing the rate of soybean yield improvement offers some challenges, researchers see potential for continued progress.

Breeders operate on the theory that soybean yield is a dependent function of three entities: genotype, environment, and the interaction of these two factors, such as when genotypes have yield responses that are not consistent across environments, Specht said.

"Nebraska irrigated and rainfed soybean yield trends show that the varieties that breeders developed during the past decade did have high yield potential, but unfortunately rainfed producers growing those varieties encountered some unfavorable growing seasons," he said.. Below normal rainfall during the critical seed-fill period in four of the last 10 years contributed to a seeming downward trend. Rainfed yields during the other six years were, in fact, greater than the yields predicted for those years by the 32-year trend line.

"It is clear from my analysis that soybean breeders are steadily increasing soybean yield potential and doing so at a rate that is relatively comparable to what corn breeders are achieving. If lower August rainfall is becoming a more frequent occurrence in the Midwest (as a result of global warming), soybean breeders will need to aim more of their breeding effort at enhancing the drought tolerance of modern varieties," he said.

Once the climate trend returns to its previous pattern, soybean yields would be expected to return to levels predicted by the historical long-term trend line, Specht said, as long as producers continue to input the latest genetic and agronomic technologies into their systems.

Lisa Jasa
CropWatch Editor

Purdue researchers offer another perspective

Two agronomists at Purdue University also addressed the question of whether corn yield increases were outpacing soybean increases. They compared bushel-per-acre-per-year yield increases from a longer period, 1930 to 2003. In a July 15 news release, they noted that average corn yields jumped nearly sevenfold, from 20.5 bushels per acre to 142.2 bushels per acre while soybean yields increasedfrom 13 bushels per acre to 33.4 bushels per acre. National soyban yields have hovered around 40 bushels per acre for about a decade.

"We're looking at about a 0.4 bushel per acre per year average increase for soybeans. For corn, it's 1.5 bushels per acre per year," said Jeff Volenec, a Purdue agronomist. "Will soybeans equal the annual increase in corn yields in the near future? No. Can we improve on the 0.4 bushel per acre per year? Yes."

The Purdue researchers suggest that the difference in yield increases lies in two factors: basic genetic differences between the two crops and more funding for corn research, leading to hybrid improvements.

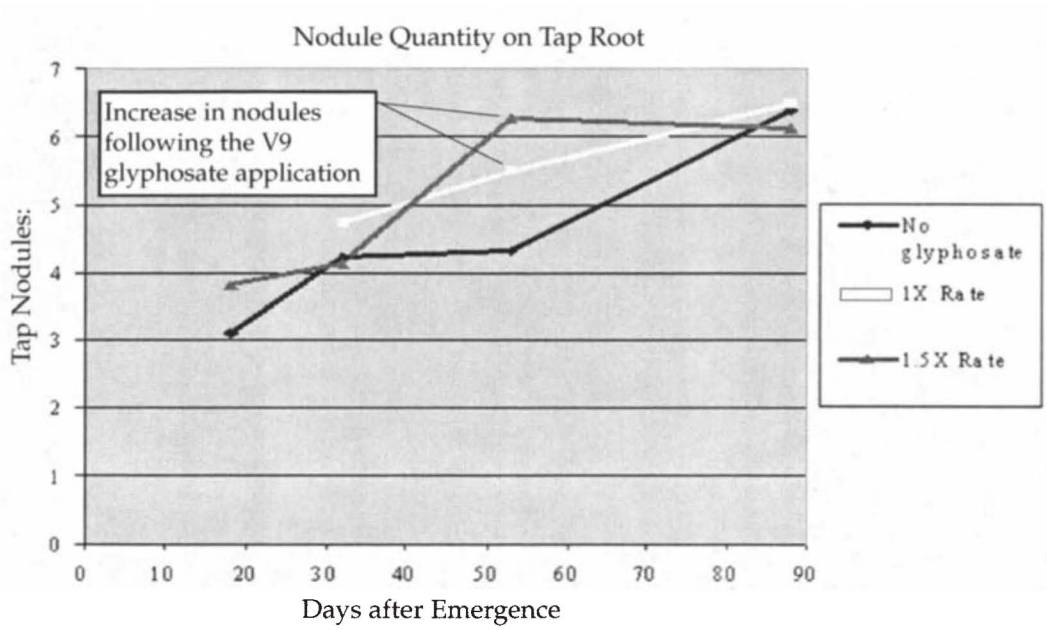
In the story, he suggests that increased research on soybean plant physiology could pay yield rewards. For example, if researchers could manipulate the soybean canopy to increase light availability to the plant, much as they did with corn 40 years ago, higher yields might result. For the whole story, see *http://news.uns.purdue.edu/UNS/html4ever/20004/040715.Volenec.yields.html*

Research explores whether glyphosate use affects soybean nodulation, growth and yield

Ninety-two percent of Nebraska soybean acres were planted to glyphosate resistant varieties this year. With producers selecting these varieties almost exclusively, it is important to understand how they perform and respond to glyphosate.

Glyphosate resistant varieties are those in which a resistant EPSPS gene has been inserted in the plant to make it tolerant to glyphosate herbicides. When glyphosate is applied over-the-top, it translocates downward through the plant with most of the herbicide remaining in root tissue. Although these plants are resistant to glyphosate, the bacteria which live on the roots in structures called nodules are not resistant. The bacteria, *Bradyrhizobia japonicum,* are extremely valuable to the soybean plant because they fix atmospheric nitrogen (N_2) into a form (NH_3) useable by the plant. If these bacteria are hindered by the presence of glyphosate in the soybean roots, it's important to determine if soybean growth and yield are affected.

Previous research has been conducted on this topic, primarily in laboratories, growth chambers, and greenhouses. In that research, sometimes glyphosate reduced the bacteria's ability to grow and fix nitrogen. Field research has been fairly limited in scope and has provided inconsistent results. In some instances, researchers found fewer nodules per plant following high rates of glyphosate (1.5 and 3 times the normal rate) applied one to four weeks after planting; yet other times, nodule counts were unaffected or actually increased.



Due to the need for extensive field research we conducted a three-year (2001-2003) study on this topic. Soybean fields in south central Nebraska were treated:

1) with multiple rates of glyphosate (1 and 1.5 times the normal rate);

2) at various application timings (at soybean growth stages of V1, V4, & V9);

3) with two irrigation levels (dryland and irrigated), and

4) with four soybean varieties.

Our research results differed from that of others in that no effect on nodulation occurred after glyphosate was applied to either V1 or V4 soybeans. We also found no effect on nodule counts later in the season following the V9 glyphosate application, except in some cases where nodule counts increased following the V9 application (see Figure 1). Previous to our findings, Arkansas researchers did observe an instance where nodule counts increased late in the season but nodule size decreased. Therefore, although the nodules were not reduced due to the glyphosate, their size was limited. Although we did not collect nodule mass, this is a possible explanation for the increase we observed.

The hypothesis that glyphosate reduces nodule quantity at typical field rates (normal and 1.5 times the normal rate) is not supported by our research. Nodule counts only varied in response to the time glyphosate was applied (early versus late season). Soybean varieties showed occasional differences yet the overall nodulation response to glyphosate was similar across all varieties. As always, when investigating nodulation in fields, it is extremely important to remember the high variability that occurs across years, water levels, and soil types. Numerous factors work together in a soybean field to provide a good environment for the bacteria and poor nodulation is rarely due to one factor. Glyphosate does not appear to be one of the

(Continued on page 160)

Grass and forage production

How intensive is "intensive grazing"?

What do you think of when you hear the phrase "intensive grazing"? Many small pastures with lots of fencing? Moving animals to new pastures almost daily? Lots of animals completely grazing small areas before moving to fresh pasture?

Most folks don't fully understand what the word "intensive" refers to. It's not intensive fencing. It's not intensive labor or animal movement. And it's especially not intensive defoliation. Intensive is all about management.

First, before you need to determine your goals and what you want to accomplish with your grazing. If you want maximum production and are willing to make the needed investment in labor and materials, then dividing your grazing land into many smaller pieces is a likely option. Most important is how you manage the grazing of each individual small pasture as well as how all the small pastures are combined into one management unit.

Often when producers adopt an intensive grazing strategy, there is a relatively common misunderstanding about implementing the strategy. Many times producers may think that intensive grazing means you should graze each small pasture short before moving to the next pasture. Nothing could be further from the truth. Sometimes severe or short grazing may be appropriate, but more often than not we want to leave more grass behind after a move so it will regrow faster and be ready for another grazing sooner. Thus, it's the intensity of your management that enables you to meet your grazing goals.

When used correctly, intensive grazing can be a great tool. Remember, however, that it's the management, not the defoliation, that is intensive.

Bruce Anderson
Extension Forage Specialist

Glyphosate

(Continued from page 159)

factors which cause a reduction in nodule quantity. Finally, yield was not reduced due to any of the different glyphosate rates or application timings.

Measurements of soybean leaf chlorophyll content -- often thought of as the "greenness" of the leaf -- also were collected during the three-year study. These findings will be included in the next edition of *Crop Watch*. A summary of this research will also be included in an upcoming NebGuide publication.

References: Reddy et al., 2000; King et al., 2001; Reddy and Zablotowicz, 2003.

Lori Abendroth
Research and Extension Associate
Department of Agronomy and Horticulture
Roger Elmore
Extension Crop Specialist
Fred Roeth
Extension Weed Specialist

Field updates

(Continued from page 156)

Jack Campbell, Extension Entomologist at the West Central REC, North Platte: The grasshopper spray program seemed to go very well this year with posttreatment grasshopper counts indicating a good kill. Four blocks totalling 108,000 acres were sprayed at a cost to the ranchers of about $1 per acre.

The new APHIS nymphal survey indicates numbers of 15 and above in Logan, McPherson, Thomas, Blaine, Loup, Rock, Brown, Sioux, Dawes and Boyd counties. A Wednesaday report from Dundee County indicated high grasshopper numbers may be developing there as well. If the fall adult count is similar to the nymphal count, we may have problems in those counties next year. This yer timely rain provided for regrowth of grasses, offsetting much of the damage that could have occurred under severe drought conditions.

Nebraska Agricultural Statistics Service: Based on July 1 conditions, Nebraska's 2004 winter wheat crop is forecast at 57.6 million bushels, down 11% from last month's forecast and 31% below last year's crop. Average yield is forecast at 32 bushels per acre, 3 bushels below last month and 14 bushels below last year's near record yield. This is the lowest yield since 1992 when the average was 30 bushels per acre.

The recorded head count from Nebraska's objective yield survey, at 43.0 heads per square foot, is the lowest since 1996.

Crop condition

Corn condition rated 1% very poor, 2% poor, 13% fair, 50% good, and 34% excellent, above last year and average, according to this week's report from the Nebraska Agricultural Statistics Service. Irrigated fields rated 89% good and excellent while dryland fields rated 79%. This compares to 77% and 40%, respectively, a year ago. Silking was 81% complete. Five percent of the acreage had reached the dough stage.

Soybean condition rated 1% very poor, 3% poor, 19% fair, 53% good, and 24% excellent, above last year and average. Seventy-four percent of

Control volunteer wheat now to reduce disease potential in 2005

With this year's wheat crop in the bin, it's time to take some steps to ensure a successful crop in 2005. One of the first steps is controlling volunteer wheat in the field this year. Besides depleting soil water, volunteer wheat serves as a "green bridge" or source for the transmission of several wheat diseases and insects from one wheat crop to the next. From year to year wheat streak mosaic, transmitted by the wheat curl mite, is perhaps the greatest disease concern in Nebraska.

The wheat curl mite survives on volunteer wheat and other grass hosts during the fallow period and is blown onto emerging winter wheat plants in the fall. The wheat curl mite then transmits wheat streak mosaic virus to wheat plants, sometimes resulting in devastating yield losses. It is recommended that volunteer wheat plants be dead at least two weeks before emergence of fall- seeded wheat to reduce the incidence of this disease.

The wheat curl mite also has been identified as the vector for high plains virus, a new and potentially destructive disease of corn and wheat. Additionally, management of the "green bridge" is critical for the control of Rhizoctonia root rot, take-all, Pythium root rot, barley yellow dwarf, Russian wheat aphid, other cereal aphids, and Hessian fly. The regional incidence of the Russian wheat aphid the last two years has increased the risk from this insect in western Nebraska.

Volunteer wheat that emerged within the wheat crop in June or early July, before wheat harvest, is the most likely to be infested with mites and serve as a "green bridge" for wheat streak mosaic. This pre-harvest volunteer wheat often gets its start as the result of hail, strong wind, or rain that shatter grain out of the maturing wheat head. By mapping the location of June and early July hail storms, you can get a good idea of areas at the greatest risk from wheat streak mosaic the following spring. It is critical that pre-harvest volunteer wheat be destroyed as soon as possible.

Control options

If conditions following harvest are warm and dry, shallow tillage can provide rapid and highly successful control of volunteer wheat. Usually, if you do not blade immediately after harvest, it is impossible to get the blade into the ground later unless there is moisture. Tillage is less effective when soils are wet or cool conditions exist. Tillage also destroys crop residue, which may be in short supply in many western Nebraska wheat fields as a result of the persistent drought.

Another option, and one that conserves crop residue, is to use herbicides to control volunteer. If the volunteer wheat is growing well and not showing signs of drought stress, glyphosate can provide excellent volunteer control. As plant stress increases, glyphosate rates will need to be increased to maintain satisfactory control. Be sure to add ammonium sulfate to the spray mixture. Plants must be totally dead to break the "green bridge". Curl mites have been found to survive in high numbers on plants that appear dead, but still had green growth at the base of the plant.

If wheat plants are showing strong signs of drought stress, glyphosate will not provide satisfactory control. Under these conditions, growers should consider applying Gramoxone Max, with or without atrazine. Plant coverage is important for good control with Gramoxone Max so it should be applied in at least 10 gallons per acre of spray solution. See the label for more details. With moisture, atrazine will provide some control of emerged plants and residual control of later emerging plants. Atrazine does persist in soil, so growers should be aware of the crop rotation restrictions for their soils and location.

Drew Lyom, Extension Dryland Crops Specialist
Gary Hein Extension Entomologist
Both at the Panhandle REC
Robert Klein Extension Crops Specialist

Ensure you plant treated wheat seed

Wheat seed treatments pay off in yield advantages, seemingly even in areas where disease hasn't been a major factor, reports Bob Klein, Extension crops specialist at the West Central REC in North Platte.

For a number of years researchers there have used wheat seed treatments on their wheat variety plots, even though there were no major diseases.

"They always pay for themselves in increased yields [on those plots]," he said. With the disease risk possibly increasing next year, growers should be sure to buy certified, treated seed, he said. And, be sure to get quality, uniform coverage of the seed. Generally, seed box treatments just don't provide the consistent coverage that's needed, he said.

Events calendar

Information about these University of Nebraska Cooperative Extension events is available in this and previous issues of *CropWatch* or on the Web at *http://cropwatch.unl.edu*

August

- **Panhandle Research and Extension Center Field Day,** August 5
- **Harvest Field Day,** vineyard production, August 7, near Nemaha
- **High Plains Ag Lab Summer Crops Field Day,** August 10, near Sidney
- **Soybean Management Field Days,** August 10-13, four locations: Fairmont, Stella, Hooper and Lindsay
- **Nebraska Grazing Conference,** August 10-11, Kearney
- **Soybean Cyst Nematode, Soybean Aphid, and Soybean Rust Field Day,** August 17, rural Nemaha
- **Crop Diagnostic Late Summer Clinic,** August 18, ARDC, near Mead
- **Soybean Cyst Nematode, Soybean Aphid, and Soybean Rust Field Day,** August 19, rural Ashland
- **Soybean Cyst Nematode, Soybean Aphid, and Soybean Rust Field Day,** August 20, rural Wayne
- **Precision Farming Clinic,** entry level, August 26, ARDC, near Mead

Panhandle Field Day Aug. 5

Institute of Ag and Natural Resources Vice Chancellor John Owens and Extension State Climatologist Al Dutcher will be among the featured speakers at the Panhandle Research and Extension Center annual Field Day August 5. The event will begin at 9:45. The Scottsbluff-Gering Chamber of Commerce Agribusiness Committee will serve a barbeque at noon.

A list of presentation topics and feature speakers follows:

- Performance of Roundup Ready alfalfa, *Bob Wilson, extension weeds specialist*
- Update on Roundup Ready sugarbeets and demonstration of wick applicator, *Wilson*
- Transgenic corn for managing western bean cutworm, *Gary Hein, extension entomologist*
- Reduced population and skip row to reduce water requirements in corn, *David Baltensperger, extension crop breeding specialist*
- Bird seed crops with potential for irrigation and limited irrigation, *Baltensperger*
- Winter wheat in irrigated rotations to manage limited water, *Drew Lyon, extension dryland crops specialist*
- Building family strengths in times of drought. *Kathy Bosch, extension family life specialist*
- New techniques to control white mold in dry beans, and other plant disease topics, *Bob Harveson, extension plant pathologist*
- Twin row sugarbeets, can we plant and harvest?, *John Smith, extension machinery systems engineer*
- What happens to corn yield with in-canopy sprinklers, *Dean Yonts, extension irrigation specialist*
- Weather forecast, Fall 2004 -- Spring 2005, *Al Dutcher, extension state climatologist*

High Plains Field Day Aug. 10

Production issues and recommendations for western Nebraska crops will be the focus of the High Plains Ag Lab Summer Crops Field Day Aug. 10. The ag lab, located six miles northwest of Sidney, consists of 2,400 acres of crop production research and livestock trials. A satellite unit of the Panhandle Research and Extension Center in Scottsbluff, it is in the center of one of Nebraska's major dryland crop production areas.

The field day begins with registration at 11 a.m. and continues with a free lunch at 11:50 p.m.

Following is a schedule of field day speakers.

11:30 a.m. Welcome, *Dr. Charles Hibberd, director of the Panhandle REC in Scottsbluff.*

12:30 p.m. Skip row corn and sorghum, *Drew Lyon, Panhandle REC dryland cropping systems specialist.*

12:50 p.m. Weed control in proso and chickpea, *Lyon*

1:10 p.m. Pea Feeding, *Erin Fendrick, graduate student at the University of Nebraska-Lincoln.*

1:30 p.m. Controlling volunteer wheat, *Karen Deboer, extension educator, Cheyenne County.*

1:50 p.m. Crop rotations, *Tom Nightingale, farm manager at the High Plains Ag Lab,* and *Lyon*

2:30 p.m. Crop rotation economics, *Paul Burgener, extension agricultural economist,* Panhandle REC, and *Cheryl Halstead, UNL graduate student*

2:50 p.m. Alternative Crop Update on New Proso and Foxtail Varieties, *David Baltensperger, extension alternative crops specialist,* Panhandle REC

3:10 p.m. Fall forages, *Aaron Berger, extension educator in Kimball and Banner counties.*

More then 50 crop and livestock research trials are conducted each year at the ag lab and used by producers in western Nebraska, eastern Wyoming, northeastern Colorado, and western Kansas.