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CROP WATCH

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Adjusting crops for limited water supplies

Different crops respond differently to water and to the timing of water delivery. For corn (*Figure 1*) it takes about 10 inches of soil water to get the first bushel of grain. After the first bushel of corn, each additional inch of water available to the corn plant will increase yield by 12-16 bushels per acre. For soybean it takes about seven inches of soil water to get the first bushel, with yield increasing by three to four bushels per acre for every additional inch of crop water use.

In severely dry summers every additional inch of water could make the difference between loss and profit. See *Table 1 (page 13)* for the amount of irrigation needed for maximum crop yield in three areas of Nebraska with average precipitation and temperatures.

A center pivot must be capable of delivering the amount of water needed by the crop during the peak crop water use period. *Table 2* illustrates the amount of water that can be applied with different system capacities and with one crop or with multiple crops whose critical water needs

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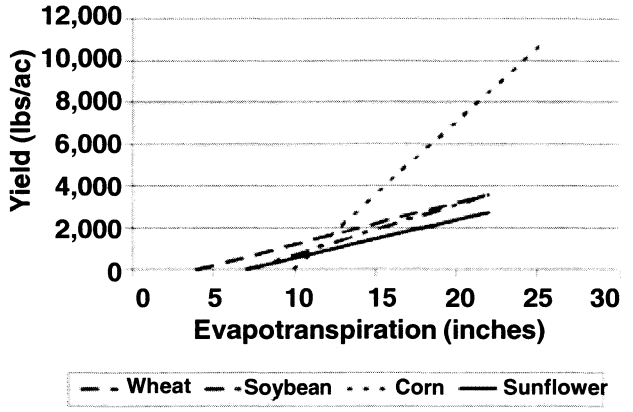

Figure 1. Evapotranspiration (in inches) at various yields. *(From "Crop rotations with full and limited irrigation and dryland management", J.P. Schneekloth; N.L. Klocke; G.W. Hergert; D.L. Martin; and R.T. Clark, Transactions of the ASAE. Nov/Dec 1991.)*

Double Focus:
Wheat & Reduced water cropping strategies

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Assessing potential damage & estimating winter wheat yields

With the lack of precipitation in late summer and fall in many areas of the state, winter wheat stands in some fields are questionable. This may be especially evident in continuous cropping situations.

Winter wheat seasonal water use varies widely due to weather conditions, but generally it needs 16 to 24 inches. Using a midpoint of 20 inches, water use would be 4 inches from emergence to start of spring growth, 4 inches from start of spring growth to jointing, 2 inches from jointing to boot, 2.4 inches from boot to flower, 3 inches from flower to milk, 1.6 inches from milk to dough, and 3 inches from dough to maturity. Normally it takes about 4-7 inches of water to get yield. For each inch of water above that, yield increases an average of 4-6.5 bushels per acre.

The fall and winter dry conditions may contribute to crown and root disease since dry soil warms up and cools down six times faster than moist soil. This alternating freezing and thawing will diminish the health of the wheat plant, damaging stands and decreasing yields.

Estimating wheat yields early

Wheat growers frequently need to estimate wheat yields in the spring to decide whether recropping is necessary. Determining a reasonable

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Ag briefs

Klein recognized

Bob Klein, a professor and Extension cropping systems specialist, earlier this month was presented a Holling Family Award for Teaching Excellence in Agriculture and Natural Resources. Klein, who is officed at the University of Nebraska West Central Research and Extension Center at North Platte, is a regular contributor to *CropWatch* on issues of crop production and system management.

Klein was recognized for a new method for teaching about variety selection as part of Nebraska Cooperative Extension programming. Producers working with Klein and in small-group, interactive settings used variety test data to select varieties best suited to reduce risk on their farm.

The awards were given to six faculty members and two teaching assistants who demonstrated innovation, impact and program quality. The awards are made possible by a $3 million gift from the Holling family to the University of Nebraska Foundation to honor their pioneer parents.

Scout wheat for weeds

Scout winter wheat fields for winter annual weeds such as the various mustards, shepherdspurse, field pennycress, and downy brome. If these weeds are present, the best control is achieved by spraying before mid April (mid March for blue mustard).

For more information see the March 7, 2003 issue of *CropWatch*, available online at *http://cropwatch.unl.edu/archives/2003/crop03-2.htm#wheat_weeds*

Early spring weed control best in dormant alfalfa

Pennycress, tansy mustard, downy brome and other winter annuals are common problems in established alfalfa, but often can be controlled with herbicide applications in early spring before alfalfa "green-up." Weeds are small in spring and several herbicides will work well; however, once alfalfa breaks dormancy, herbicide options become more limited. Some herbicides require that alfalfa be established at least one year before treatment. Several of these herbicides restrict planting another crop for two years following application so planning is important. Check product labels for planting restrictions.

Apply before alfalfa green up

Glyphosate and Gramoxone Max will control emerged winter annual broadleaf and grass weeds but will have no effect on weeds germinating after application. There are no use restrictions regarding age of the alfalfa stand.

Karmex can be used in alfalfa established one year or longer to control winter annual broadleaf weeds and suppress summer annual broadleaves. There is a 24-month restriction on planting crops following a Karmex application.

Sencor, Sinbar, and Velpar can be used on alfalfa established one year or longer to control winter annual broadleaf weeds and downy brome. Sinbar also will suppress dandelion. Sinbar and Velpar have a 24-month planting restriction for several crops.

Apply before or after green up

Pursuit, Raptor, and Select can be used on both dormant and actively growing alfalfa. These three herbicides can be used on new alfalfa seedlings or established stands; however, Pursuit and Raptor have planting restrictions of one year or longer for certain crops. Pursuit and Raptor will both control winter annual broadleaf weeds, with Pursuit providing control of many later germinating summer annual broadleaf weeds. Raptor will also control downy brome. Select will control downy brome but will not affect broadleaf species.

Alex Martin
Extension Weeds Specialist

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Adjusting *(Continued from page 11)*

are at different times. For example, if a 130-acre field was planted half to wheat and half to corn, an 800-gpm system would be able to apply 0.64 inches a day to the half of the field requiring water most at that time.

To operate efficiently many irrigation districts plan to deliver a minimum of one inch of water per week. For example, if 6 inches of irrigation water is available for the summer, the maximum length of the irrigation season would be six weeks – less if water demands are greater than one inch per week. The Bureau of Reclamation has estimated that the amounts of water listed in *Table 3* will be available for 2004. The district uses these estimates to determine how much to supply to water users. In districts where water is expected to be restricted, reduce the estimates if the district does not plan to deliver one inch of water every six to seven days.

In the North Platte Valley, the water availability for this year appears to be very similar to last year – less water than normal and irrigation water supplies that will likely run out early. To show what we might expect, ownership of water for the North Platte project as of February 1, was at 217,000 acre feet. This compares to 133,000 acre feet in 2003 and 315,000 acre feet in 2002. By February 1 of the past three years, water in ownership to the North Platte project water users have all been well below the average of 615,000 acre feet.

Based on current forecasts from the Bureau of Reclamation, it is estimated that only about 78% of the average irrigation demand will be met. The most critical months are still ahead and normal precipitation will be needed not only in the mountains but also in the form of spring rains to avoid yet another water short year.

Irrigators with low capacity groundwater wells also will need to prepare for dry soil conditions by maintaining and preparing their systems for a potential early start. If the soil moisture is not near field capacity at planting, regardless of the crop, irrigation will need to begin earlier than usual to keep from getting too far behind. As soon as weather permits, system maintenance and repair should be initiated to avoid any unnecessary delays.

Bob Klein, Extension Cropping Systems Specialist West Central REC
Dean Yonts Extension Irrigation Specialist Panhandle REC
Bill Kranz, Extension Irrigation Specialist, Northeast REC

Table 1. Irrigation needed for maximum crop yields with average precipitation and temperatures in three areas of Nebraska.

Management level	Panhandle Avg.	Panhandle Best	Southwest Avg.	Southwest Best	Central Avg.	Central Best
	inches					
Furrow irrigation, water used	25.0	22.0	22.0	20.0	20.0	18.0
Center pivot & conventional till., water used	18.0	15.5	16.0	14.0	15.0	13.0
Center pivot & no-till, water used	15.0	12.0	13.0	10.0	12.0	9.0
Water conserved from center pivot & no-till vs. conventional till.	3.0	3.5	3.0	4.0	3.0	4.0

Table 2. The amount of water that can be applied to a single crop or multiple crops requiring water at different times on a 130-acre system.

System capacity	Number of crops: One	Two	Three
	inches per day		
200 gpm	0.08	0.10	0.24
400 gpm	0.16	0.32	0.48
600 gpm	0.24	0.48	0.73
800 gpm	0.32	0.64	0.96
1000 gpm	0.40	0.80	1.21

Table 3. Estimated water availability for 2004, from a March 2004 Bureau of Reclamation report. If conditions don't improve, some districts may not deliver water in 2004.

District	Estimated farm delivery
	inches
Mirage Flats	3.5
Ainsworth	Full supply
Sargent	15.0
Farwell	12.0
Twin Loops	Full supply
H&RW	1.0
Frenchman Valley	0.5
Frenchman-Cambridge, Meeker, Red Willow and Bartley	3.0
Cambridge Canal	8.0
Almena	3.0
Bostwick in Nebraska	1.5
Bostwick in Kansas, Upper Courtland	2.0
Bostwick in Kansas, Lower Courtland	6.0
Kirwin	4.0
Webster	4.0
Glen Elder	Full supply
Central Nebraska Public Power and Irrigation District	Full supply

When a dry season is expected

Select crops suited to available water

Crop producers in many areas of Nebraska will have limited water for irrigation in 2004. Many reservoirs are at low capacity and planning to limit or not make water deliveries. In addition, problems are expected to intensify related to irrigation wells with limited capacity or reduced output The subsoil moisture is below normal (see the *March 5 CropWatch*), the winter precipitation has been sparse in many areas, and the long range forecasts do not indicate enough excess moisture to help many areas catch up to average levels. This is due to both drought and overdevelopment of ground water resources in some areas.

In those areas where water is likely to be restricted, the timing of water deliveries may not correlate with crop water needs, making it important to select a crop whose water needs match when water is likely to be available (*Figure 1*). Soybean, for example, uses most of its water during pod fill. If water is not available then, yields will be greatly affected.

What crops are a producer's best options, given the prospects for limited water supplies?

1. Before making any cropping decisions, check with the appropriate Farm Service Agency, CRC coverage, Revenue Assurance, etc. regarding any restrictions.

2. When selecting crops, look at when the crop most needs water as well as how much water will be needed. Compare when the crop needs the water with when it will be available from the irrigation district. If water is not expected to be available during a critical growth period, consider another crop. Try to make adjustments that will work in a dry year, but will not limit potential yields if the drought ends.

3. Make sure there is an economic use for the crop being considered as well as the technical expertise and equipment necessary for growing a different crop.

Seed companies continue to improve the yield under both dry and wet conditions and some rate the drought tolerance of the seed they market. Changes in maturity and time of critical events can influence how a variety responds to drought. Drought hardy varieties that mature early make sense as long as you don't give up much yield potential. You probably will not be able to make direct comparisons of drought ratings among companies since they use different scales and criteria.

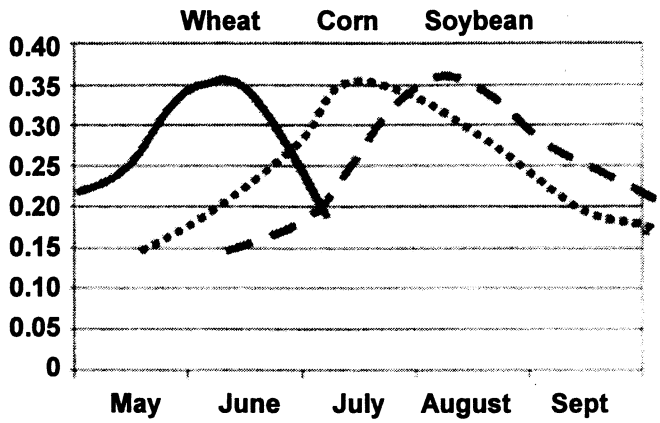

Figure 1. Daily plant water use throughout the season for wheat, corn and soybean. Critical periods of high water use differ among the crops, allowing for targeted irrigation when each crop needs it most. (*From "Management Strategies to Stretch Limited Water Supplies"; J.P. Schneekloth and N.L. Klocke. Proceedings of the 2002 Central Plains Irrigation Shortcourse, 2002.*)

When we look across the state of Nebraska, varieties and hybrids have rather limited areas of adaptation. Both corn and soybean need to stay fairly close to their adapted areas. When comparing yields of potential varieties and hybrids, look within your geographic area and consider the experiences you've had on your farm. Don't throw out all your current varieties and replace them with ones you've never tried. It is safest to replace 25% or less of your acres with a new, untried variety or hybrid.

Crop traits

Corn. When water is limited, avoid full season corn hybrids and adjust fertility rates for a lower yield goal. A corn hybrid with a four- to five-day shorter maturity will reduce crop water use by one inch. Reducing plant population for corn can reduce water use, but populations must be planted below approximately 16,000 plants per acre before substantial water savings can be expected. With lower plant populations, weed control becomes even more important later into the season. Also, studies have shown that early water stress in corn has much less of an impact on yield than water stress during tasseling. If water supplies are limited, concentrate irrigation at tassel time (*see Figure 2*).

Soybean. For soybean if the soil profile is near field capacity at planting, the late flower through pod elongation periods are critical

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Select crops

(Continued from page 14)

water use periods. If there is a chance water may not be available at pod fill, consider planting the soybean earlier (although frost and some insects may increase risks). Planting early may not gain you a lot of maturity, but it can help. Planting earlier may allow the plant to benefit from more rainfall events than if the crop were planted later (see *Figure 3*).

Sorghum. Grain sorghum irrigation is particularly applicable when limited irrigation is a management objective. Grain sorghum usually outyields corn up to the 120-140 bushel yield level where adapted. The biggest advantage with grain sorghum is seen in *Figure 4* in the drought sensitivity for sorghum. While not having a critical need for water during any growth stage, if water is limited or not available, grain sorghum will go dormant and resume growth when water is available.

Dry bean. In western Nebraska dry bean is a good choice where water supplies are limited. Because dry bean is not a program crop and is considered a fruit or vegetable crop, be sure an acreage increase does not jeopardize your other bases. Early or late water stress on dry bean has been shown to depress yields somewhat; however, maintaining soil water during flowering can still produce respectable yields. Although dry bean only uses about 16 inches of water, most of it is used during July and early August. If water availability is limited to early spring, production can be reduced.

Small grains and forages. Most of Nebraska has the greatest potential for precipitation in early spring. Even though conditions are dry, excess rain during the spring can result in water loss to deep percolation or runoff. Planting small grains and forages or having winter wheat planted may allow irrigators to take

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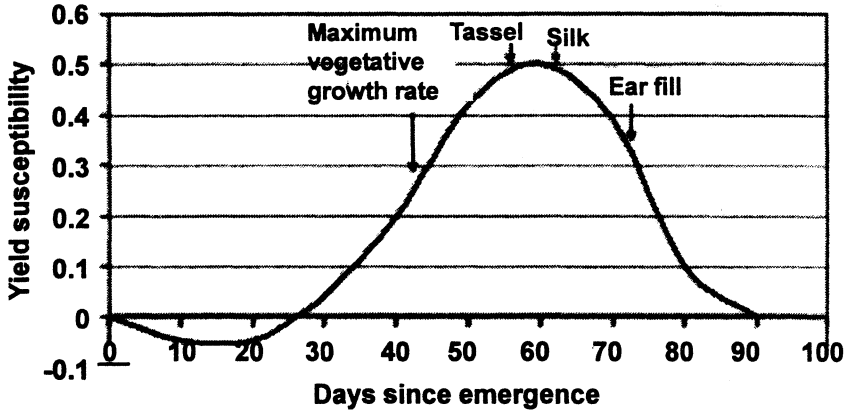

Figure 2. Range of yield susceptibility in corn. (From Sudar et al., 1981)

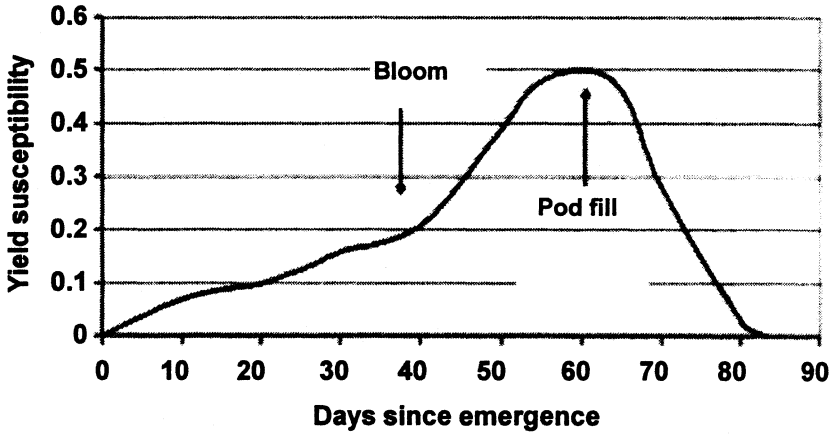

Figure 3. Range of yield susceptibility in soybean. (From Sudar et al., 1981)

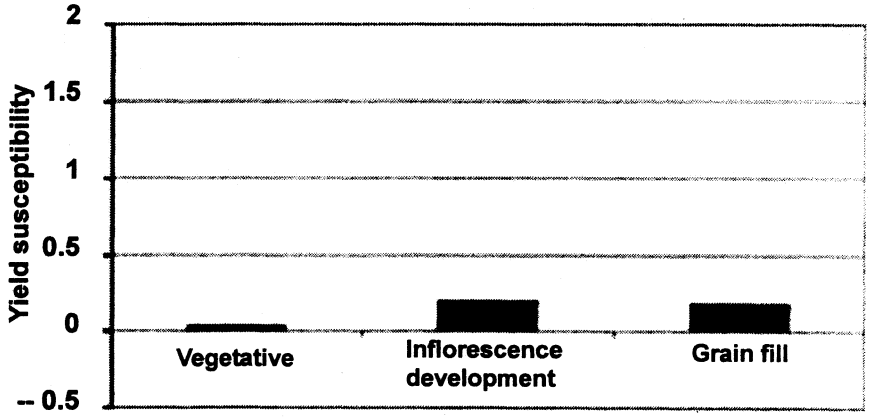

Figure 4. Drought sensitivity for sorghum (Meyer et al., 1999)

Assessing wheat *(Continued from page 11)*

estimate of wheat yield allows growers to predict if it is in their best interest to destroy the wheat and plant a summer crop or leave the wheat for harvest. With little soil moisture in many areas of the state, the chance of a spring crop being successful is limited. Before making such a decision, growers should be aware of any restrictions imposed by government programs, crop insurance, or previous herbicide use.

Several methods can be used to estimate winter wheat yield potential. I will discuss two, both of which rely on several assumptions that may not be accurate for every season or situation. These assumptions presume that plants are healthy, soil moisture and nutrients are adequate, and that weeds, insects and disease are not affecting yield. Added to the uncertainty of yield estimates is wheat's ability to compensate for changes in the environment.

Method 1

Table 1 is easy to use; however, it relies on several assumptions required to make a yield estimate in the fall or early spring prior to extensive tillering or stem elongation. These assumptions include:

1. that the wheat plants, on average, develop about five heads;
2. that each head, on average, develops about 22 kernels; and
3. that there is an average of 16,000 kernels per pound.

Late-planted wheat and wheat seeds that do not germinate until later because of dry conditions will tiller less and have fewer heads.

To use *Table 1*, count the number of plants per foot of row. It is best to use at least five feet of row in at least five sites within the field and calculate the average number of plants per foot of row. If the stands are uneven, for example the stand is better or worse in the wheel tracks, make sure your percentage of samples is these areas accurately represents the proportion of these areas in the whole field. Locate the column in the table that corresponds to your average number of plants per foot of row and then move down that column until it intersects with the row corresponding to your row spacing. This is your estimated yield.

Method 2

Table 2 was developed using data collected from 1994 to 1998 with the Nebraska Wheat Quality Tour. These tours were conducted near May 1, prior to head emergence in most of the state. Factors such as heavy weed, disease, or insect infestations or inadequate soil moisture at the time of the tour may suggest fewer final heads and a lower yield potential than indicated in the table. In addition, the table becomes unreliable in situations of extremely low or

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Table 1. Estimated wheat yield potential.

	Number of plants/foot row											
Row spacing	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*
----- inches -----	*---------- bushels/acre ----------*											
6.0	10	20	30	40	50	60	–	–	–	–	–	–
7.5	8	16	24	32	40	48	56	64	–	–	–	–
9.0	7	13	20	27	33	40	47	54	60	–	–	–
10.0	6	12	18	24	30	36	42	48	54	60	–	–
12.0	5	10	15	20	25	30	35	40	45	50	55	60
14.0	4	9	13	17	21	26	30	34	39	43	47	52

Table 2. Estimating winter wheat yield after stem elongation for the Nebraska Panhandle.*

	Number of tillers/foot of row											
Row spacing	*10*	*15*	*20*	*25*	*30*	*35*	*40*	*45*	*50*	*55*	*60*	*65*
-------- inches -------	*---------- bushels/acre ----------*											
6.0	22	34	49	56	67	79	90	101	112	–	–	–
7.5	18	27	36	45	54	63	72	81	90	99	118	–
9.0	15	22	30	37	45	52	60	67	75	82	90	97
10.0	13	20	27	34	40	47	54	61	67	74	81	88
12.0	11	17	22	28	34	39	45	51	56	62	67	73
14.0	10	14	19	24	29	34	38	43	48	53	58	63

*This table was developed using data collected in the Nebraska Panhandle. For other Nebraska locations, multiply the yield in the table by the following factor: southwest Nebraska - 0.9; central and south central Nebraska - 0.85; southeast Nebraska - 0.75.

In wheat and alfalfa

Army cutworm potential high in western Nebraska

Alfalfa and wheat fields should be scouted immediately, before cutworms delay spring regrowth.

Last fall, army cutworm moth activity was extremely high in parts of the Nebraska Panhandle, indicating a greater potential for problems than we've seen for several years. Indeed, recent reports indicate that some fields just breaking dormancy near Scottsbluff already have heavy cutworm populations. (Army cutworms also were reported this week in fields near Kearney and Arapahoe.)

Army cutworm moths are active in September and October when they lay their eggs in the soil. Shortly after being laid, the eggs will hatch. As fall and winter conditions permit, these partially grown cutworms will feed on surrounding vegetation. Due to their need for winter vegetation, these cutworms are only likely to overwinter where winter wheat, alfalfa, grasses or weeds are present.

Army cutworms are most often a threat to wheat and alfalfa in early spring, just as these crops break dormancy. Alfalfa and wheat fields should be monitored immediately, before cutworms are able to delay spring regrowth. The cutworms feed at night but may be found on plants on some cloudy days. During the day, they will be found buried in the loose soil and debris or under soil clods.

Treatment decisions should be based on the number of cutworms present, the amount of damage, and the plant's ability to outgrow this damage. In poorly growing wheat or alfalfa two or more army cutworms per square foot may warrant treatment; however, in healthy wheat or alfalfa the threshold is four or more per square foot. When determining whether treatment is necessary, it's important to consider the plant's ability to outgrow the defoliation damage as well as the number of cutworms present.

Various pyrethroid insecticides will provide emergency control of cutworms.

Further information on the army cutworm is available in the NebGuide "Management of the Army Cutworm and Pale Western Cutworm" (G1145) available from Extension offices and on the Web at *http://ianrpubs.unl.edu/insects/g1145.htm.* The University of Nebraska Department of Entomology Web site also has information at *http://entomology.unl.edu/fldcrops/index.htm.*

Gary Hein, Extension Entomology Specialist, Panhandle REC

Assessing wheat *(Continued from page 16)*

extremely high tiller counts, or in years when crop development as of May 1 is well ahead of or behind normal. For later season yield estimates, yield predictions can be made by substituting the actual number of heads per foot for tillers per foot.

To use *Table 2*, count the number of tillers per foot of row. Again, it is best to use at least five feet of row in at least five sites within the field and calculate the average number of plants per foot of row. Be sure sample sites are representative of the field. Locate the column in the table that corresponds to your average number of tillers per foot of row and then move down that column until it intersects with the row corresponding to your row spacing. This is the estimated yield. Although these multipliers may appear to be in error --- everyone knows that wheat fields in the semi-arid Panhandle usually yield less than fields to the east -- on a per head basis the multiplier is correct. Wheat fields in the sub-humid portions of the state produce more heads per acre, but typically fewer kernels per head than in the Panhandle.

For example, if your winter wheat field is in southwest Nebraska and you have an average of 30 tillers per foot of row, and your row spacing is 10 inches, multiply the table results of 40 bushels per acre by 0.9 to get a yield estimate of 36 bushels per acre.

For more information, see *Estimating Winter Wheat Grain Yields* (NebGuide 1429), available online at *http://ianrpubs.unl.edu/fieldcrops/g1429.htm.*

Bob Klein, Extension Cropping Systems Specialist West Central REC

Select crops

(Continued from page 15)

better advantage of the spring rains. These crops are actively growing in the early spring and can use water that may not be useable by more traditional row crops. In some parts of the state, animal forages may be a good option for producers who also raise cattle since the cost of forage will likely increase if dry conditions persist.

Summary

Soil water conditions may change, but it appears likely that areas in Nebraska will face shortages of irrigation water. Always check with the appropriate agency before selecting crop, planting dates, and other production practices which may affect eligibility for programs.

Bob Klein, Extension Cropping Systems Specialist

In winter wheat

Assess soil nitrogen before determining rate

Most winter wheat grown in Nebraska requires some additional nitrogen fertilizer for profitable production. This is true for virtually all soils in Nebraska where wheat is commonly grown unless there is a large carry-over of fertilizer nitrogen. Residual fertilizer nitrogen can be measured effectively with a residual soil nitrate test of the root zone. While the depth of the root zone is often six feet or more for wheat, most available nitrogen affecting yield is in the top two to three feet of soil.

Samples should be taken to a depth of three feet to determine residual nitrate levels. Samples may be taken less than three feet deep, but they will be slightly less accurate. (See *Guidelines for Soil Sampling*, G91-1000 for comprehensive overview of soil sampling guidelines; it's available from Extension offices or online at *http://ianrpubs.unl.edu/soil/g1000.htm*). If a soil analysis is not available, use 9 ppm of nitrate-N per acre, which represents an average or medium soil nitrate level.

Topdressing nitrogen on wheat in spring can help avoid the potential yield depression associated with fall nitrogen applications. It also allows for the evaluation of yield potential based on stands and soil moisture. Topdressing in the spring provides a significant advantage to wheat producers because it can help them avoid investing in a crop with a low yield potential. **Topdressing should be completed before April 15 or prior to jointing.** Generally, wheat grain yields decrease and grain protein increases with later applications.

The optimum nitrogen rate (lbs N/acre) for winter wheat (with a maximum rate of 100 lbs N/acre for dryland, and 150 lbs N/acre for irrigated) is calculated using equation 1 (*above*).

Table 1 shows the nitrogen recommendations (lbs N/acre) for wheat for various nitrogen and wheat prices at several soil nitrate concentrations.

All fertilizer nitrogen sources (ammonium nitrate (33-0-0); urea (45-0-0); urea-ammonium-nitrate UAN (28-0-0); and anhydrous ammonia (82-0-0)) are generally effective for spring nitrogen fertilization. Ammonium nitrate is preferred for topdressing when incorporation is impossible because it is the least susceptible to loss from volatilization. If the nitrogen fertilizer is incorporated soon after application, all nitrogen sources should be equally effective. Base your fertilizer selection on the most economical source of nitrogen that fits the restrictions of the particular wheat production system you use.

For more information on fertilization of winter wheat and other crops visit the UNL Soil Fertility and Nutrient Management Web site at *http://soilfertility.unl.edu.*

David Tarkalson
Soil Fertility and Nutrient Management Specialist
West Central REC

Table 1. Recommended nitrogen rate (lbs N/acre) for wheat, determined by nitrogen and wheat prices at several soil nitrate concentrations.

Residual Nitrate-N	Wheat price per bushel					
	$3.00			$3.50		
	Fertilizer price per pound of nitrogen					
Average ppm in 3 ft.	0.30	0.35	0.40	0.30	0.35	0.40
	----- Nitrogen rate (lbs N/acre) -----					
1	87	75	63	98	87	77
2	77	65	53	87	77	66
3	66	54	42	77	66	56
4	56	44	32	66	56	45
5	45	33	21	55	45	35
6	35	23	10	45	35	24
7	24	12	0	34	24	14
8	13	1	0	24	13	3
9	3	0	0	13	3	0
10	0	0	0	3	0	0
11	0	0	0	0	0	0
12	0	0	0	0	0	0

Equation 1.

$((N\ PRICE / WHEAT\ PRICE) + 0.014558 \times NO_3\text{-}N - 0.235) / -0.00138$

Where,

-- N PRICE is the price of nitrogen fertilizer in dollars per pound;
-- WHEAT PRICE is the price of wheat in dollars per bushel; and
-- NO_3-N is the average ppm nitrate-N in the top three feet of soil.

Visit the University of Nebraska ***Wheat Production Systems 2004*** Web site -- a multi-disciplinary, comprehensive resource at: ***http://www.panhandle.unl.edu/personnel/lyon/heathbk.htm***

Reducing tillage during fallow weed control

The pre-wheat fallow period, commonly referred to as summer fallow, has traditionally been managed with tillage. Depending on rainfall amount and distribution, this has required four to eight tillage operations in most years. Each of these tillage operations can result in a soil water loss of 1/3 to 1/2 inch or more and the destruction of crop residue. *Table 1* shows the benefits of surface straw residue on the amount of water stored and the surface soil temperatures attained during a summer fallow period with limited precipitation.

We classify stored soil water as being 100% effective as a source of water for plants. In the spring when the soil is moist and air temperatures are low to moderate, it is impossible to kill weeds with tillage unless the weeds are buried, which also destroys the crop residue. About 89% of the water in snow that is captured is stored in the soil. A Colorado study even found that 70% of their snow came when the ground was not frozen and could be better captured.

Most herbicide applications during fallow will eliminate two tillage operations. The most economical herbicide treatment is to use glyphosate with or without 2,4-D,

The corn crop was cut for silage, leaving little residue to protect the soil from erosion and moisture loss.

depending on the weed species present. Always put spray grade ammonium sulfate at 17 lbs per 100 gallons of spray solution in the tank before adding glyphosate. Surfactant may need to be added if the glyphosate does not contain a surfactant or enough surfactant. The

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Early application key to controlling winter annuals

Many producers in southeast Nebraska and other areas of the state are starting to notice scattered blankets of purple flowers in their no-till fields each spring. By the time they realize the extent of this henbit invasion, often it is too late to do anything. Other winter annual weeds such as marestail (horseweed), pennycress, shepherdspurse, and tansy mustard also are showing up more regularly in no-till corn fields.

So why have these weeds become a problem and what can be done about them?

First, it helps to know about their biology. Since these weeds are annuals they have one year to germinate, grow, and finally set seed. Basically, it is the annual's job to produce seed so that the species will survive to the next year -- everything else is secondary. The life cycle of winter annuals is a little different than summer annuals like foxtail and velvet leaf which typically germinate and produce seed within the growing season for corn and soybeans. These weeds actually germinate in the fall and begin growth before winter. After winter they usually bolt and produce seed before corn or beans are planted.

In Nebraska many producers have found that no-till fields are an excellent means of conserving moisture in dryland situations; however, if winter annuals are present, they will use valuable moisture that could be available to the crop.

Many people wonder why these winter annual weeds seem to have become more of a problem in recent years. One theory is that as more growers plant Roundup Ready soybeans, there is less herbicide residual to control these weeds. When conventional soybeans were planted, the herbicide program provided residual to keep many winter annuals from germinating or growing in the fall.

How can spring applications be made most effective? Timing of the herbicide application is the biggest issue. Most herbicides work best before weeds have bolted. This is why fall control is generally preferred when possible – it's fairly simple and typically very successful.

If spring control measures are necessary, the first step is to monitor fields early and begin spraying as soon as temperatures warm up enough for plant growth. The next step is to use the right product. Several products will control henbit and provide similar or better control of marestail, pennycress, and other winter annuals (*see table*).

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Products to control winter annuals in no-till fields.

Treatment	*% Control*
2,4-D (4L) ester 1 pt	65
2,4-D (4L) ester + Dicamba* -- 1 pt + ½ pt	84
Atrazine* + COC 2 qt	100
Gramoxone 1.5 pt	92
Glyphosate 24 oz	84
Glyphosate 32 oz	88
Glyphosate + 2,4-D -- 24 oz + 1 pt	95

*Don't use atrazine or dicamba before planting soybeans.

Be alert to early season wheat disease problems

Although it is too early to assess any potential disease problems in this year's wheat crop, a discussion of some of the symptoms to watch for as the wheat starts growing is in order. In general wheat in southeast and south central Nebraska was in good condition going into winter. This was not the case for parts of west central Nebraska and the Panhandle where poor fall moisture limited stand emergence.

Dry conditions in fall often predispose winter wheat plants to crown and root rot. This disease complex weakens plants during winter which leads to a stand decline in spring as the wheat emerges from dormancy. Infected plants may die during winter or they may initiate growth in March and then decline and die two or three weeks later. Early symptoms of crown and root rot appear as a dark brown discoloration of roots and the sub coronal internodes between the seed and the crown. Infected crowns rot to a greater or lesser degree, depending on the stage and severity of disease development. Plants will not recover from severe crown damage even with optimal growing conditions in April. Those with moderate crown and root infection tiller sparsely and yield less than healthy plants.

Infected wheat crowns, subcoronal internodes and roots are darkened and rotted.

Individual fields affected by crown and root rot contain scattered pockets of yellow dying and dead plants. Terrace ridges and exposed slopes often show the greatest degree of loss. To diagnose crown and root rot, dig suspected plants, wash the roots and look for any dark discoloration on the roots and subcoronal internodes. Split the crown with a sharp knife and examine for discoloration. Infected crowns appear tan or brown where healthy ones are white. Often the extent of rot in the crown determines the overall health of the plant.

Other than assessing the stand to determine if it should be left or destroyed, nothing can be done to cure the problem. When assessing the stand don't be too hasty to write it off. Give the wheat a chance to recover from winter before making that decision. (See *Assessing Potential Damage*, page 11, for more information.)

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surfactant is the last item added to the tank.

Spring is the most effective time to use herbicides instead of tillage to control weeds. When spring tillage buries the weeds, it also buries any crop residue. Some research has found that as rainfall events become less frequent in mid to late summer, soil water storage during summer fallow may be improved with a single shallow tillage operation compared to using no till exclusively.

The cost for the spray grade ammonium sulfate, glyphosate and surfactant may be as low as $3.50 an acre. This does not include the application cost. The reduced glyphosate costs this year make herbicides an even more likely choice for weed control throughout the fallow period. Use a drill capable of seeding into the crop residue. If the summer is dry and hot, the seeder may not be able to penetrate the soil deep enough to place the wheat seed in firm moist soil. This can be resolved by using one tillage operation which maintains the crop residue in late June to early July, depending on the weather and area in the state, to help eliminate the potential soil penetration problem. Using no-till from year to year will help build organic matter and soil structure, making this less of a problem.

If there is little or no crop residue, such as when the previous crop was removed for hay or silage, it won't work well to use herbicide for weed control for the entire fallow period. The photo *(page 19)* shows the damage that can result from removing all residue. If you need to remove a crop for hay or silage, leave 6-8 rows of residue 12-20 rows apart, depending on the height of the crop, to protect the soil and crop residue from wind erosion and to trap snow.

Table 1. Benefit of surface straw residue during summer fallow.

Straw position	*Water stored (inches)*	*Soil temp (°F)*
Bare soil	0.58	118
Straw flat	2.89	107
1/4 Standing, 3/4 Flat	2.35	108
3/4 Standing, 1/4 Flat	3.02	90

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