



Cheat Control in Oklahoma Winter Wheat

Joe Armstrong
Extension Weed Specialist

Thomas F. Peeper
Professor Plant and Soil Sciences

Oklahoma Cooperative Extension Fact Sheets
are also available on our website at:
<http://osufacts.okstate.edu>

Cheat (*Bromus secalinus*) (Figure 1) is an annual brome-grass common to most Oklahoma winter wheat producers. This serious weed problem in winter wheat impacts the crop through competition and harvesting losses, and dockage losses, occur when cheat seed is marketed with grain. This weed is troublesome due to its similar growth cycle and response to typical wheat management practices. Cheat germinates in the fall, from late-August through mid-November, increases its reproductive tillers as it grows vegetatively through the fall and winter months, initiates its reproductive growth in mid-March, flowers and sets seed in May, and finally matures in early June. Cheat is the most common brome grass in Oklahoma, but there are genetically similar *Bromus* species in the state including downy brome (*Bromus tectorum*) (Figure 2), Japanese brome (*Bromus japonicus*), and rescuegrass (*Bromus catharticus*) (Figure 3).

Cultural and Mechanical Control Practices

Cultural practices that encourage vigorous winter wheat will help the crop gain a competitive advantage over cheat and other weeds. Cheat and wheat respond similarly to many management practices, but the following cultural and mechanical practices should be considered for minimizing the impact of cheat on the farm.

Prevention is the best recommendation for controlling any weed in any crop, but especially cheat in winter wheat. Although proper equipment cleanup and various other cultural control practices may take time and discipline to conduct, the alternatives for controlling cheat are costly and/or troublesome. Control cheat plants growing along borders, fence rows, and roadsides before they produce seed that spreads into the field. Prevent cheat from producing seed during the fallow season or after graze-out. Do not feed cheat-contaminated hay to cattle that are on or will soon move to wheat pasture, since cheat seed remain viable after passing through the digestive tracts of cattle. Clean all tillage, planting, fertilizer, and harvesting equipment prior to entering fields. Young seedling weeds can be transplanted into new fields on tillage equipment; cheat seeds are notorious for hiding in small crevices of harvesting equipment. Insist custom harvesters clean their combines before entering the field.



Figure 1. Cheat (*Bromus secalinus*) is a very common weed in Oklahoma wheat fields. At maturity, cheat has short awns that distinguish it from downy brome. (Photo by Dr. Don Murray, Regents Prof. of Weed Science, OSU).



Figure 2. Downy brome (*Bromus tectorum*) seed have long distinct awns.



Figure 3. Rescuegrass (*Bromus catharticus*) seed are larger than cheat or downy brome and lack awns. (Photo by Dr. Don Murray, Regents Prof. of Weed Science, OSU).



Proper land preparation is an important factor in the successful production of any crop. A moist, clod-free seedbed is critical for timely and uniform emergence of a competitive wheat stand. Control emerged weeds before seeding the crop. Control options before the wheat crop is established are usually cheaper than in-season control alternatives. These control options generally include tillage or the application of a broad-spectrum, postemergence herbicide such as glyphosate.

Good soil fertility management and optimum soil pH levels for wheat production increase the ability of wheat to compete with cheat. Proper seedbed preparation does not adequately control cheat in early planted wheat since cheat may germinate as late as December after the crop is drilled.

Plant cheat-free wheat seed to prevent the spread or reinfestation of cheat into fields. Buying certified seed or cleaning wheat seed prior to planting may slightly increase seed cost, but the long-term cost of in-season cheat control options is greater.

Increasing wheat seeding rate from 60 pounds up to 120 pounds per acre can increase the competitive ability of wheat and reduce the yield loss from cheat. Combining increased seedling rate with narrower row spacing improves wheat's competitiveness. These practices may increase the production cost of the crop, but should result in increased grain production as well as cheat suppression.

Planting a competitive wheat variety can reduce yield loss from cheat competition. The competitiveness of nine

Table 1. Wheat yield and percent yield loss from cheat competition of selected wheat varieties. The data are averaged over eight locations and three growing seasons. The average cheat population was 25 plants/ft².

Variety	wheat yield	wheat yield	yield loss
	without cheat	with cheat	from cheat
	bushels/acre	bushels/acre	—%—
Jagger	62.8	42.6	32
Agseco 7853	62.0	36.0	42
Triumph 64	47.6	33.9	29
Karl 92	45.5	32.9	28
Longhorn	50.9	32.3	37
2180	45.8	30.6	33
TAM 202	58.3	30.6	48
2163	52.3	29.6	43
TAM 107	44.4	25.5	43

wheat varieties commonly grown in Oklahoma was evaluated over a three-year period by the Oklahoma State University Small Grains Weed Control Program (Table 1). These varieties differ in their ability to compete with cheat. Adopting this important trait when selecting a wheat variety can improve the effectiveness of other control practices. Although wheat yield and yield loss from cheat fluctuate due to environmental conditions, the suppressive characteristics of competitive varieties toward cheat generally fluctuate in a similar manner. There are certain characteristics that increase the competitive ability of a variety such as, rapid emergence in the fall, early accumulation of biomass, and moderate height at maturity.

Delaying wheat planting until cheat germinates, then destroying it with tillage or a broad-spectrum herbicide can effectively control early cheat flushes. This works well in cool, wet falls which stimulate early cheat germination. This practice does not work in a dry fall or in a graze-out program. A delay in wheat planting will not completely control cheat, but it reduces infestation levels and cheat's competitiveness in the fall and winter months. Since the life cycles of cheat and wheat are similar, wheat's competitiveness can also be reduced during the fall and winter months. If forage production for winter wheat pasture is needed, a delayed wheat planting is not recommended.

Graze-out programs reduce cheat seed production, but only at the loss of the grain crop. In a typical graze-out program, wheat producers plant during the early fall to ensure maximum forage production and graze through the fall, winter, and spring months, well beyond the hollow stem stage of wheat and cheat. Once the cattle are removed, the wheat field should be sprayed with a broad-spectrum herbicide to ensure the remaining wheat and cheat do not reproduce and set seed for future infestations. Tillage alone often does not destroy cheat plants soon enough to prevent seed production. The OSU Small Grains Weed Science Program reported an 85 percent decline in cheat reproductive structures in conventionally tilled, continuous wheat, graze-out system (Table 2).

Burning stubble after wheat harvest can destroy viable cheat seed that adds to the soil seedbank the following year. Fire reduces or eliminates the standing stubble and sterilizes the viable weed seed; however, if the fire is not hot enough the seeds may not be sterilized and cheat stands the following

fall could go unchanged. The OSU Small Grains Weed Science Program conducted a survey of twenty wheat fields in Alfalfa, Garfield, and Kingfisher counties in 1998 and 1999 to determine the impact of stubble burning on cheat infestations the following year. Eight fields had lower cheat infestations the following year, six fields had higher infestations, and six fields showed no change. Therefore, burning does not provide a consistent method for reducing cheat and eliminates the ground cover and surface organic matter that is beneficial for reducing soil erosion, conserving soil moisture, and improving soil tilth.

Deep plowing can effectively bury cheat seed if the surface soil is completely inverted. Some of the newer plows only turn the furrow on edge, and secondary tillage scatters the seed throughout the top of the plow layer. For deep plowing to be effective, it must be the first tillage after harvest, and should be six to nine inches deep. It is important that the deep tillage buries the seed and is followed by shallow tillage so as not to work the seeds back to the surface. Cheat seeds that are buried six to nine inches deep will either decompose or germinate but not emerge. The OSU Small Grains Weed Science Program reduced cheat seed-head production by 44 percent the year following a deep plowing operation (Table 2). Although deep plowing reduces cheat infestations, soil conservation requirements and costs should be considered.

Crop rotation increases cheat control alternatives dramatically. Cheat control is excellent when conventional tillage in the spring is used to prepare the summer seedbed. If a no-till system is preferred, broad-spectrum burndown herbicides (eg. glyphosate, paraquat) are effective for killing the cheat prior to planting. Although crop rotations are effective for controlling one season of cheat, other control measures should be taken to protect against potential infestations that may arise from the abundant soil seed bank. Some of the more popular summer crops that are used for crop rotations are mungbean, soybean, cotton, sesame, corn, and grain sorghum. The OSU Small Grains Weed Science Program reported at least 92 percent fewer cheat reproductive structures using no-till summer crop rotations (Table 2). These crops can be profitable alternatives to producing winter wheat; however, due to the marginal summer precipitation patterns in western Oklahoma, careful planning should precede the planting of any summer crop. Winter canola is also an excellent option as a rotational crop to clean up cheat, because several herbicides labeled for use in winter canola, including glyphosate, Assure II, Poast, and Select, are highly effective against cheat.

Herbicide Options

As a result of recent advancements in herbicide chemistry, effective herbicides are available for cheat control in wheat (Table 3). Several herbicides selectively kill cheat when applied postemergence (after the cheat and/or wheat have emerged) with minimal if any injury to the wheat. In addition to these herbicides, Amber[®], Finesse[®], and Sencor[®] are labeled for cheat suppression in wheat, but are not recommended because of their variable efficacy and/or potential for crop injury. **Always read and follow the pesticide label to insure safety to the handler, applicator, and the crop.**

Beyond[®] herbicide is labeled for use only on Clearfield[®] wheat (imidazolinone tolerant) varieties. It will kill all other varieties. Beyond[®] can be applied to Clearfield[®] wheat that is

Table 2. Cheat seedheads per 10 ft² in the wheat crop after one crop rotation cycle. The crop rotations were continuous wheat, wheat followed by double-crop sorghum followed by soybean, or wheat followed by double-crop soybean followed by soybean, with the final crop being wheat for all crop rotations. Percent cheat seedhead reduction is based on the number of seedheads in the no-tillage, no-herbicide, continuous wheat treatment (i.e. 263 seedheads/10 ft²). Herbicides used in the continuous wheat rotation were only applied during the first year. Cheat seedhead reduction was evaluated prior to harvest for the application year and the following growing season. These data are averaged over three locations.

<i>Crop rotation Herbicide treatment or graze out program</i>	<i>Seedhead reduction due to</i>	
	<i>No tillage</i>	<i>Conventional tillage^a</i>
Continuous wheat	————— % Reduction —————	
Sencor 75 DF (fall application)	88 ^b (26) ^c	96 (7)
Maverick ^d	98 (33)	99 (84)
Graze out	64 (11)	84 (85)
No herbicide and no graze out	71 (0)	87 (44)
Wheat-sorghum-soybean rotation		
Average of rotational row-crop herbicides	94	75
No rotational row-crop herbicide applied	97	89
Wheat-soybean-soybean rotation		
Average of rotational row-crop herbicides	96	63
No rotational row-crop herbicide applied	93	47

^a Moldboard plowing and field cultivating were used to prepare the first year's seedbed. Chisel plowing and field cultivating were used between the first and second year's crops. Chisel plowing minimizes the amount of cheat seed returned to the soil surface after moldboard plowing.

^b Evaluated prior to harvest of first wheat crop.

^c Evaluated prior to harvest of second wheat crop, however, herbicides were only applied the first year.

^d Average of three Maverick treatments; fall applied, spring applied, and spring applied with 2,4-D. The range for the Maverick treatments in the no tillage systems was 95 to 99% prior to harvest of the first wheat crop and 31 to 36% prior to harvest of the second wheat crop. The range for the Maverick treatments in the conventional tillage systems was 98 to 100% prior to harvest of the first wheat crop and 73 to 91% prior to harvest of the second wheat crop.

Table 3. Application information and restrictions of cheat control herbicides for use in Oklahoma winter wheat.

<i>Herbicide</i>	<i>Appl. Time</i>	<i>Expected Result</i>	<i>Additive</i>	<i>Carrier</i>	<i>Grazing Restriction</i>
Beyond [®]	Post	excellent control	1/8 to 1/4% NIS	at least 50% water	none
Everest [®]	Post	excellent control	1/4 to 1/2% NIS	water or UAN	none
Maverick [®]	Post	excellent control	1/4 to 1/2% NIS	water or UAN	none
Maverick [®] Pro	Post	excellent control	1/4 to 1/2% NIS	water or UAN	none
Olympus [®] Flex	Post	excellent control	1/2% NIS	up to 50% UAN	30 days
Olympus [®]	Post	excellent control	1/4 to 1/2% NIS	up to 50% UAN	none
Power Flex [®]	Post	excellent control	1/4 to 1/2% NIS	up to 50% UAN	7 days
Finesse [®] Grass & Broadleaf	Post	excellent control	1/2% NIS	water or UAN	none
Amber [®]	Pre	some suppression	None	water or UAN	none
Finesse [®]	Pre	some suppression	None	water or UAN	none
Amber [®] + Sencor [®]	Post	fair to good control	1/4 to 1/2% NIS	water	14 days
Finesse [®] + Sencor [®]	Post	fair to good control	1/8 to 1/2% NIS	water	14 days

only beginning to tiller, but prior to jointing and to emerged, actively growing cheat with no more than five leaves. It is most effective on cheat if applied in the fall to small (two to five leaves), actively growing cheat plants; however, it is labeled for spring applications as well.

Applications of Beyond® must include a nonionic surfactant (0.25 percent v/v), and a nitrogen fertilizer solution (1 to 2.5 percent v/v) (5 to 15 pounds of spray grade ammonium sulfate per 100 gallons of spray solution may be substituted for the liquid nitrogen). Liquid nitrogen (UAN) cannot be used as the sole carrier when applying Beyond®; however, UAN can be used for up to 50 percent of the carrier with the addition of 0.125 to 0.25 percent v/v nonionic surfactant. Do not apply more than 8 fl oz/A of Beyond® during the growing season. Wheat cannot be harvested for grain within 60 days following a Beyond® application. Beyond® can be tank mixed with 2,4-D, Banvel®, Buctril®, Clarity®, or MCPA. See the label for specific tank-mix recommendations.

Everest® herbicide is labeled for postemergence applications after the wheat has a minimum of three leaves, but before jointing. Everest® is most effective on cheat if applied in the fall to small (two-leaf to five-leaf tiller), actively growing cheat plants; however, it is labeled for spring applications as well.

Water or liquid nitrogen (UAN) can be used as the carrier when applying Everest®. UAN can only be used as the carrier if the spray solution contains less than 50 percent liquid nitrogen and if the application will not exceed more than 30 pounds of actual nitrogen per acre, otherwise severe leaf burn may reduce forage production and cheat control. When using UAN

as the carrier, include 0.25 percent v/v non-ionic surfactant. When using water as the carrier, include 0.25 percent to 0.5 percent v/v nonionic surfactant. Everest® can only be applied once during a wheat crop (Table 3) and wheat can be grazed immediately after application. Everest® can be tank mixed with 2,4-D Ester, MCPA Ester, Buctril, or Finesse® or Amber® when water is the carrier. Observe the growth stage restrictions on using these herbicides.

Wheat may be replanted immediately after an application of Everest®. STS-soybean may be replanted after six months. Canola, soybean, and sunflower may be replanted after nine months, and corn may be replanted after 11 months. Everest® is degraded by soil microbes; therefore, environmental conditions that decrease microbial activity should be considered when making rotational cropping decisions. Drought and/or cold temperatures, as well as soils with less than 2 percent organic matter may reduce Everest® degradation. If these conditions exist, a soil bioassay may be necessary to ensure safety for rotational crops.

Maverick® is labeled for preemergence and postemergence applications in wheat to selectively control several winter annual grasses including cheat. Maverick® is most effective for controlling cheat and maximizing wheat yield if applied in the fall to small, (two- leaf to five-leaf tiller) actively growing cheat plants (Figures 4 & 5); however, the products are labeled for spring applications as well.

Water or liquid nitrogen (UAN) can be used as the carrier when applying Maverick®. Only use UAN solutions that contain less than 50 percent liquid nitrogen as carriers and do not exceed more than 30 pounds of actual nitrogen per

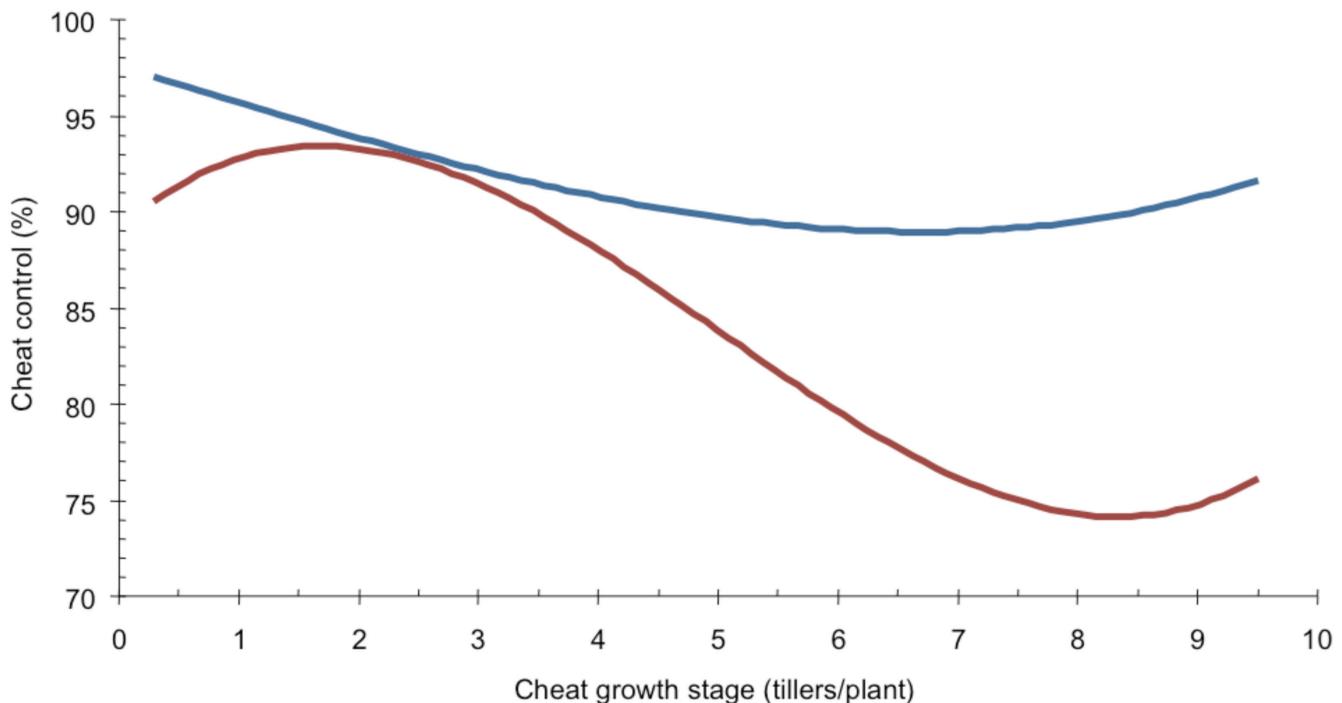


Figure 4. Effect of cheat growth stage (tillers/plant) on cheat control with Maverick® (red line) and Olympus® (blue line). Maverick® and Olympus® are most effective when applied in the fall to small cheat plants. This trend should also be expected with other postemergence herbicides including Beyond®, Olympus® Flex, and PowerFlex®.

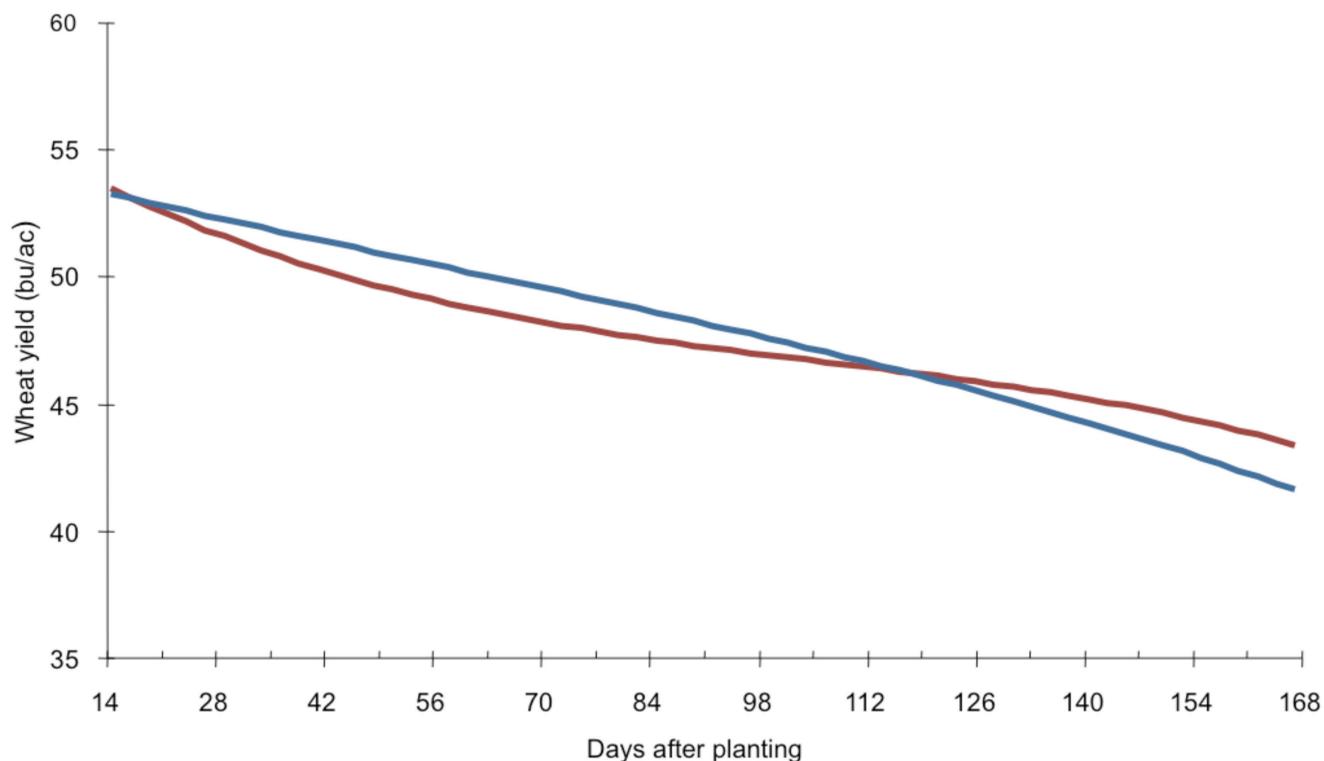


Figure 5. Effect of Maverick® (red line) and Olympus® (blue line) application timing on wheat yield. Wheat yields and cheat control (Figure 4) are usually highest when Maverick® and Olympus® are applied in the fall to small cheat plants. This trend should also be expected with other postemergence herbicides including Beyond®, Olympus® Flex, and PowerFlex®.

acre, as severe leaf burn may reduce forage production and cheat control. Regardless of carrier, always include a nonionic surfactant in the spray solution (0.25 percent v/v with a UAN carrier, or 0.5 percent v/v with a water carrier). Never use a UAN solution or a nonionic surfactant that lowers the spray pH below 5. Maverick® can only be applied once during a wheat crop (Table 3). These products can be tank mixed with formulated amines, such as 2,4-D amine herbicides; however, there may be a decrease in cheat control if a tank mix is used.

Maverick® does not have grazing restrictions; however, wheat can not be harvested for hay within 30 days after application or for grain within 55 days after application. Following an application of Maverick®, there is a rotation restriction of three months with 18 inches of cumulative precipitation before planting STS-soybean. For cotton, there is a rotation restriction of 12 months and 30 inches of precipitation. The plant back restriction for corn grain sorghum, and sunflower is 22 months with 30 inches of cumulative precipitation. For fields with a soil pH greater than 6.0, a field bioassay must be conducted before planting sunflower to ensure crop safety. Wheat may be replanted at any time after an application of Maverick®.

Olympus® is labeled for postemergence applications for control of several broadleaf and grass weeds, including cheat. Olympus® can be applied anytime from one-leaf wheat up to jointing and is most effective on cheat when applied in the fall. Applications must include a non-ionic surfactant at 0.25 to 0.5 percent v/v. Olympus® can be applied with up to

50 percent liquid nitrogen (UAN) as the carrier, but the application should not include more than 30 pounds of actual nitrogen per acre. Olympus® can be tank mixed with several products for postemergence weed control in wheat. Check individual product labels to determine the appropriate rates, adjuvants, and application timings.

There is a restriction of 12 months and 24 inches of precipitation between application and planting of non-STs soybean, sorghum, and sunflower. STS-soybean may be planted after 4 months and 10 inches of precipitation. Corn requires an 18 month wait and 30 inches of cumulative precipitation. Wheat can be replanted immediately in case of crop failure.

Olympus® Flex is labeled for postemergence control of cheat and other grass and broadleaf weeds and can be applied from wheat emergence up to jointing. Applications may be made in water or solutions of up to 50 percent liquid nitrogen. A non-ionic surfactant should also be included at 0.5 percent v/v. A spray grade liquid nitrogen fertilizer at 1 to 2 quarts/A or ammonium sulfate fertilizer at 1.5 to 3 pounds/A should be included if liquid nitrogen is not used as part of the spray solution. Olympus® Flex can be tank mixed with several products for postemergence weed control in wheat. Check individual product labels to determine the appropriate rates, adjuvants, and application timings.

After application of Olympus® Flex, there is a five-month plant back restriction for soybean, nine-month restriction for grain sorghum, 10-month restriction for cotton, and 12-month restriction for sunflower. In addition to the rotation interval,

18 inches of cumulative precipitation are also required before planting these crops. Canola and corn have a 12-month rotation restriction with 24 inches of precipitation required before planting. Wheat may be replanted at anytime.

PowerFlex® is another option for postemergence cheat control in wheat and may be applied from the three-leaf wheat growth stage up to jointing. The best results are obtained when grass weeds are treated at the two-leaf to two-tiller growth stage and are actively growing. When PowerFlex® is applied alone, spray solutions should include a non-ionic surfactant at 0.25 to 0.5 percent v/v and spray grade liquid nitrogen fertilizer at 1 to 2 quarts/A or ammonium sulfate fertilizer at 1.5 to 3 pounds/A. Applications can be made with up to 50 percent liquid nitrogen (UAN) as the carrier, but the application should not include more than 30 pounds of actual nitrogen per acre. PowerFlex® can be tank mixed with other products labeled for postemergence application in winter wheat; however, PowerFlex® should not be mixed with products containing dicamba or amine formulations of 2,4-D or MCPA, as these combinations may result in reduced grass control.

PowerFlex® has a three-month rotation restriction to soybean and nine-month rotation restriction to canola, corn, grain sorghum, and sunflower.

Finesse® Grass & Broadleaf can provide postemergence control of cheat and many other weeds in winter wheat. Ap-

plications should be made after the wheat has two leaves but before jointing begins. The best control will be achieved when applications are made when cheat is in the one-leaf to two-tiller growth stages. Finesse® Grass & Broadleaf may be applied in either water or liquid nitrogen carrier solutions. If the rate of liquid nitrogen in the spray solution is less than 50 percent of the total spray solution volume, a non-ionic surfactant should be included at 0.063 to 0.25 percent v/v of spray solution. If water alone is used as the carrier, a non-ionic surfactant should be included at 0.5 percent v/v with either 2 quarts/A of spray quality liquid fertilizer or 2 pounds/A of spray-grade ammonium sulfate. Finesse® Grass & Broadleaf may be tank mixed with other products for weed control in wheat. Read and follow the label for all products. If Finesse® Grass & Broadleaf is applied in a tank mix with a dicamba-containing product, grass control may be reduced. As well, if tank-mixing Finesse® Grass & Broadleaf with 2,4-D ester, do not add a surfactant to the spray solution.

Wheat may be replanted four months after an application of Finesse® Grass & Broadleaf. STS-soybean may be replanted after nine months. Non-STS soybean can be replanted after 14 months and 25 inches of cumulative precipitation. Check the label for details for rotation restrictions for other crops.

The Oklahoma Cooperative Extension Service

Bringing the University to You!

The Cooperative Extension Service is the largest, most successful informal educational organization in the world. It is a nationwide system funded and guided by a partnership of federal, state, and local governments that delivers information to help people help themselves through the land-grant university system.

Extension carries out programs in the broad categories of agriculture, natural resources and environment; family and consumer sciences; 4-H and other youth; and community resource development. Extension staff members live and work among the people they serve to help stimulate and educate Americans to plan ahead and cope with their problems.

Some characteristics of the Cooperative Extension system are:

- The federal, state, and local governments cooperatively share in its financial support and program direction.
- It is administered by the land-grant university as designated by the state legislature through an Extension director.
- Extension programs are nonpolitical, objective, and research-based information.

- It provides practical, problem-oriented education for people of all ages. It is designated to take the knowledge of the university to those persons who do not or cannot participate in the formal classroom instruction of the university.
- It utilizes research from university, government, and other sources to help people make their own decisions.
- More than a million volunteers help multiply the impact of the Extension professional staff.
- It dispenses no funds to the public.
- It is not a regulatory agency, but it does inform people of regulations and of their options in meeting them.
- Local programs are developed and carried out in full recognition of national problems and goals.
- The Extension staff educates people through personal contacts, meetings, demonstrations, and the mass media.
- Extension has the built-in flexibility to adjust its programs and subject matter to meet new needs. Activities shift from year to year as citizen groups and Extension workers close to the problems advise changes.

Oklahoma State University, in compliance with Title VI and VII of the Civil Rights Act of 1964, Executive Order 11246 as amended, Title IX of the Education Amendments of 1972, Americans with Disabilities Act of 1990, and other federal laws and regulations, does not discriminate on the basis of race, color, national origin, gender, age, religion, disability, or status as a veteran in any of its policies, practices, or procedures. This includes but is not limited to admissions, employment, financial aid, and educational services.

Issued in furtherance of Cooperative Extension work, acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture, Robert E. Whitson, Director of Cooperative Extension Service, Oklahoma State University, Stillwater, Oklahoma. This publication is printed and issued by Oklahoma State University as authorized by the Vice President, Dean, and Director of the Division of Agricultural Sciences and Natural Resources and has been prepared and distributed at a cost of \$2.69 per copy. 1109 Revised GH.