

# Crop Profile for Winter Wheat in Kentucky

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## General Production Information

**Production Facts:** Over the past ten years, Kentucky winter wheat production was relatively stable. On average the state is ranked about 19<sup>th</sup> and produces just under 1.5% of the U.S. production (See Table 1).

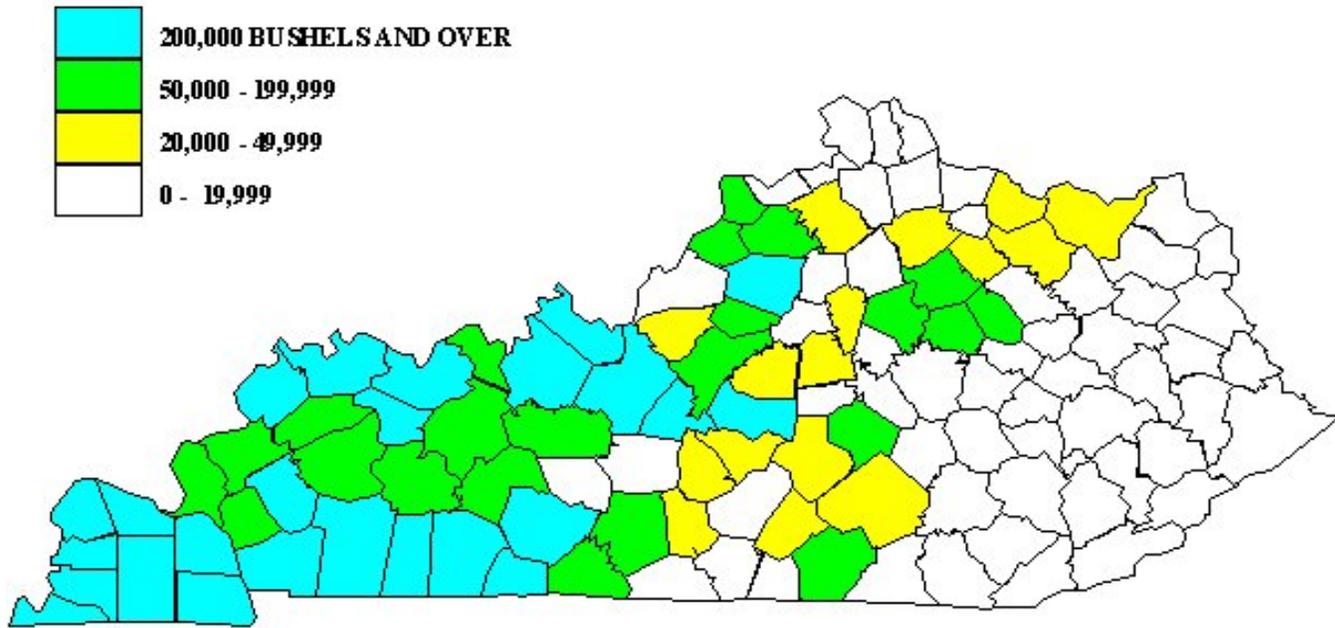
**Table 1.** Kentucky wheat production and marketing statistics (1990 - 2000).

Year	AC Planted (x1000)	AC Harvest (x1000)	Ave Yield (BU)	Production (x1000 BU)	Value (x1000 \$)	KY Rank in US	KY % US production	US Production (x1000 BU)
2000	670	420	57	23940	53865	19	1.53	1562733
1999	630	410	60	24600	52890	19	1.45	1699989
1998	750	550	45	24750	54450	18	1.32	1880605
1997	700	530	54	28620	94446	19	1.52	1882609
1996	700	530	53	28090	120787	16	1.9	1478048
1995	650	460	53	24380	93863	19	1.58	1547311
1994	590	420	60	25200	78120	19	1.52	1661043
1993	680	470	49	23030	65636	18	1.30	1769158
1992	620	420	55	23100	75075	18	1.44	1606534
1991	640	400	27	10800	28080	21	.79	1372182
1990	700	500	40	20000	55000	20	.98	2033299
AVERAGE	666.4	464.5	50.3	23319.1	70201.1	18.7	1.39	1861228.3

**Production Regions:** The winter wheat production area in Kentucky is relatively stable.

**Figure 1.** Illustrates the distribution of production for 2000. However, this is generally indicative of the past ten years.

# WINTER WHEAT PRODUCTION - 2000



## Cultural Practices

Winter wheat produced for grain is primarily grown in conjunction with two crop rotational sequences. The most common is a corn - wheat - double crop soybean system of three crops in two years. For example, corn planted in April-May is harvested in August and followed by wheat sown in October and harvested in June-July, followed by double-crop soybean sown in June-July and harvested in Sept-Nov. This is followed by a winter fallow. This sequence has the advantage of providing a true annual rotation for corn / soybean which reduces insect, weeds and disease pressure in both crops, but the disadvantage of having wheat follow corn (two grass crops).

Another system increasing in use is a four year sequence. Full season soybeans are planted in May, harvested in September, and followed by wheat sown in October and harvested in June-July. This is followed by double-crop soybean sown in June-July and harvested in Sept-Nov followed by a winter fallow, followed by corn planted in April-May. This sequence has the advantage of removing the wheat following corn sequence. However, it requires two sequential years of soybean in the summer interrupted by one season of corn every third year. This aids in insect, weed and disease control in the grass crops, but is problematic in the presence of soybean cyst nematode. Details of wheat production recommendations in Kentucky may be found in our comprehensive [wheat management manual ID-125](#)

Interest in no-till small grain production has increased among growers and is strongly supported by the Kentucky Small Grain Growers Association. Currently, more than 25 percent of the small grain acreage in Kentucky is seeded without tillage. Information specifically addressing all phases of no-till small grain crop management in Kentucky may be found in No-Till Small Grains Production in Kentucky, ID-136.

### Worker Activities:

Wheat production in Kentucky is a highly mechanized system. Little or no hand work is done to the crop. The exception would be scouting, which is usually done by consultants or the producer/farmer. Scouting intervals will vary with environmental conditions and with the commitment of the producer/farmer. Scouting of the crop for pest management needs may range from a weekly basis to once or twice per growing season. Applications of fungicides, herbicides and insecticides would be made as needed. Fertility is applied as a single or split application in late winter or spring.

**Planting:** Wheat is typically planted with a no-till drill. A drill commonly has 7.5 inch row spacings and is adjustable for planting depth.

**Pesticide & Fertilizer Application:** Most wheat producers apply pesticides with a boom sprayer and a closed cab tractor. It is also common for producers to hire a local cooperative or ag supply dealer to do pesticide and fertilizer applications with closed cab spraying equipment.

**Harvesting:** Wheat harvest is done with combines.

### Time Line of Mechanized Field Activities

**October:** Planting.

**November:** Fall pesticides - when (if) aphids appear. Insecticide and herbicide (if fall application is used) are often tank-mixed for a single application.

**February or March:** Fertility & Herbicide application.

**May:** Fungicide application.

**June or July:** Harvest.

### Integrated Pest Management

**IPM Programs:** In Kentucky, IPM programs for field crops have been in place since the late 1970's. Initially these were large scale demonstration programs. However, in recent years efforts have been directed toward education programs and demonstration/research. The core of our efforts in monitoring field crops are the proper use of scouting, identification, and economic thresholds to make chemical use decisions; and the use of critical cultural practices e.g. planting date, variety selection, tillage, etc. to avoid pest problems.

The KY-IPM program provides education through training sessions, publications, and video tapes of hands-on sessions. An annual "scout school" is held each March which teaches general techniques and procedures and concentrates on insect, weed, and disease identification of the main field crops. Additionally, individual working groups (e.g. Wheat Science Group) hold crop specific training and develop publications specific to the crop.

Those interested in wheat IPM can obtain a wheat scouting manual, will find training games, and early notice of important items on the IPM Web pages. Another source of important "early warning" is the Kentucky Pest News. This newsletter is delivered by mail, e-mail, and available on the web.

In general about 80% of Kentucky field crop producers are doing enough to be considered entry level IPM users and 20% are at a high level of use.

### Insect/Mite Control

**Table 2.** Total wheat insecticide sales reported by commercial chemical dealers to the Kentucky Department of Agriculture Division of Pesticides (lbs. active ingredient).<sup>1</sup>

Product	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	Chemical Family
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Azinphos-methyl			11										Organophosphate
Chlorpyrifos			275										
Diazinon			84						8				
Dimethoate	34												
Disulfoton	3043	3226	5526	10796	23678	53934	57296	34978	49206	25173	37917		
Methyl-parathion	1710		540				:						
Malathion	10695	2874	3290	1905	3045	1235	1422	905	1676	561	1205		
Methomyl	35	231	963	104	617	126	104	315			48.6	Carbamates	
Carbaryl	10		1290			45					28		
Carbofuran	1688	1011	2567	1824	3382	40	3580	201	464		80.2		
Permethrin	186		302				333					Synthetic Pyrethroids	
Lambda-cyhalothrin						240	2913	3632	2502	2690	2270		
Spinosyn											323		Biorationals
Stored Grain Insecticide Treatments													
Aluminum Phosphide							19		64	91	22	Inorganic Phosphide	
Pirimiphos-methyl						30				5		Organophosphate	
Chlorpyrifos-methyl				11					69	28			
Insecticide Seed Treatments													
Lindane			4	342								Organochlorides	
Diazinon			2.6	190								Organophosphate	

## Insect Pests

These pests are generally presented in the order in which they appear in the field. However, because winter wheat production is split into two growing seasons, several pest species will appear at two different seasons (e.g. Hessian Fly, aphids).

**Monitoring:** Scouting procedures for wheat insect pests can be found in Kentucky Integrated Crop Management Manual for Field Crops - Small Grains. IPM-4.

### Hessian Fly (*Maylota destructor*)

Hessian fly is a common but relatively minor pest. Although it is present in the state, and on rare occasion has caused

obvious losses, it is rarely seen in economic proportions. The common biotype is believed to be "H". This was determined some years ago by individuals at the USDA National Hessian Fly Program. The lack of importance of Hessian fly is most likely due to: use of the "fly free date" as a general planting target date, new high quality varieties, and need to control aphids in the fall.

**Chemical Controls:** Imidacloprid (Gaucho seed treatment). Small amount used for aphid control and probably provides some incidental control of Hessian fly. Disulfoton (Di-Syston 15%G and Di-Syston 8E): Registered but not recommended and not known to be used against this pest.

**Cultural Practices:** Delay planting until after the Hessian Fly Free Date. This is generally used by producers as the target date for their planting. With the increase in farm size and probability of poor weather late in the fall, this date can not be achieved by all producers.

## Cereal Aphids

**Bird Cherry-Oat aphid** (*Rhopalosiphum padi*)

**English grain aphid** (*Sitobion avenae*)

**Corn leaf aphid** (*Rhopalosiphum maidis*)

Cereal aphids are common pests of Kentucky wheat in both fall and spring, and are the reasons for the majority of insecticide treatments to the crop. Aphids alone are of little interest as pests. However, they are extremely important as vectors of Barley Yellow Dwarf Virus (BYDV), which results in the disease Barley Yellow Dwarf (BYD).

The Bird Cherry-Oat aphid is considered to be the most important vector of BYDV. However there are several species of aphids present in Kentucky that can vector the virus. Fall is the most important time for movement of the BYDV, but spring infections can be important in some years.

**Biology:** Observations indicate that populations of the English grain aphids and the Bird cherry-oat aphids may be controlled by the attacks of predatory syrphid flies, coccinellid beetles, and lacewings. However, little direct research on these controls has been conducted. Therefore, the impact of these natural enemies in Kentucky is unquantified.

**Chemical Controls:** Little or no insecticide is applied for aphid control in the fall. However, BYD prevention is more complicated. Control during fall is applied during the first 30 days if 3 aphids are found per row foot, for the next 60 days, if 6 aphids are found per row foot and after that, if 10 aphids are found per row foot. Occasionally, insecticides are also applied at "greenup" for BYD prevention. Rarely, spring aphid control is applied during the head filling stage if large numbers (50 or more aphids per head) are present and plants are exhibiting stress symptoms.

- **Disulfoton (Di-Syston 15%G and Di-Syston 8E):** 75 days PHI 72 hours REI (>25" annual rainfall). Most commonly applied in liquid nitrogen fertilizer. Applied 1.005 lb a.i./acre.
- **Lambda-Cyhalothrin(Warrior):** 30 days PHI and 24 hours REI. Application rate is 2.56 to 3.84 fl. oz./acre and no more than 0.06 lb a.i. per acre per growing season should be applied. This is the product of choice for most producers when making foliar applications.
- **Malathion (Malathion 57 EC):** 7 days PHI and 12 hours REI. Application rate is 1-1/2 pts/acre
- **Methomyl (Lannate 90WSP):** 7 days PHI and 48 hours REI, application rate is 1/4 to 1/2 lb/acre and no more than 1.8 lbs a.i. should be applied per acre per growing season.
- **Methyl parathion (PennCap-M):** labeled but not recommended, and not known to be used.

- **Phorate (Thimet 20%G):** labeled but not recommended, and not known to be used.

**Cultural Controls:** Planting at the proper time is the most important control tactic. Delayed planting to after the "Hessian Fly Free" date will reduce aphid populations. Use recommended seeding rates, as stands that are too thick provide good overwintering sites. Do not apply excess nitrogen, because luxuriant growth promotes aphid infestations. The latter two recommendations are especially important for reduction of aphids and BYD in warm Fall-winter-spring years.

**Cereal leaf beetle**  
(*Oulema melanopus*)

The Cereal leaf beetle was first observed as a pest of wheat in Kentucky in the mid 1980's. The first infestations were observed in south central Kentucky and since then the pest has moved steadily westward. Currently the distribution is considered to be statewide in the wheat growing region, but is still more pronounced in the south central and southern tier of Kentucky's western counties. Economically important cereal leaf beetle infestations are relatively rare. However, in a few places the pest does cause considerable loss. As a result, this pest is managed primarily by scouting.

**Chemical Controls:**

- **Methomyl (Lannate 90WSP):** 7 days PHI and 48 hours REI. Application rate is 1/4 to 1/2 lb./acre.
- **Lambda-Cyhalothrin(Warrior):** 30 days PHI and 24 hours REI. Application rate is 2.56 to 3.84 fl. oz./acre and no more than 0.06 lb a.i. per acre per growing season should be applied. This is the product of choice for most producers when making foliar applications.
- **(Sevin 80):** 21 days PHI and 12 hours REI. Application rate is 1-1/4 lb./acre.
- **Carbaryl (Sevin 80WSP):** 21 days PHI and 12 hours REI. Application rate is 1Qt./acre.
- Other formulations of Sevin may be used.

**Armyworm**  
(*Pseudaletia unipuncta*)

Armyworm or True Armyworm is a common insect in Kentucky wheat. Observation indicates that this pest can be found in any wheat field in any year. However, it is rarely an economic pest.

**Biology:** Observations indicate that armyworm is preyed upon by tachinid flies, a nuclear-polyhedrosis virus and various fungal pathogens. Little research specific to Kentucky has been done. However, empirical observation illustrates that the pest is most often kept below the economic threshold. Only twice in the past twenty years has there been a major outbreak.

**Chemical Controls:**

- **Bacillus thuringiensis (Dipel DF):** 0 days PHI and 0 hrs REI. Application rate is 2 lbs./ acre.
- **Bacillus thuringiensis (Javelin WG):** 0 days PHI and 0 hrs REI. Application rate is 1 to 1-1/2 lbs./ acre. Other B.t. products may be used.
- **Lambda-Cyhalothrin (Warrior):** 30 days PHI and 24 hours REI. Application rate is 2.56 to 3.84 fl. oz./acre and no

more than 0.06 lb a.i. per acre per growing season should be applied. This is the product of choice for most producers when making foliar applications.

- **Malathion (Malathion 57% E):** 7 days PHI and 12 hrs REI. Application Rate is 2 pts./ acre. Rarely used.
- **Methomyl (Lannate 90WSP):** 7 days PHI and 48 hours REI. Application rate is 1/4 to 1/2 lb./acre.
- **Methyl parathion (PennCap-M):** 15 day PHI and 5 days REI. Application rate is 1-3 pts./Acre. Rarely used and not recommended in Kentucky.
- **Carbaryl (Sevin 80WSP):** 21 days PHI and 12 hours REI. Application rate is 1Qt./acre.
- Other formulations of Sevin may be used.

### Post Harvest Control Practices

On farm storage of wheat is the most problematic of any grain crop grown in Kentucky. This is the result of harvesting in June and storage through the warm, moist summer months. Storage practices emphasize sanitation and the treatment of empty bins to prevent insect / mold problems. Currently the Universities of Kentucky and Tennessee are involved in a project funded by the Southern Region IPM program to study grain storage in the upper south. Reduction in insecticide use, especially insecticide applied directly to the grain is a goal.

**Cultural Controls:** Quality storage emphasizes the storage of clean dry wheat in clean dry bins, while controlling grain moisture and temperature.

### **Chemical Controls:**

- **Empty bins - Cyfluthrin (Tempo):** This product is applied to the walls, floor, and around the outside perimeter of empty bins. Application rate is 0.27 fl. oz. per 1000 sq ft.
- **Protectant - chlorpyrifos-methyl (Reldan):** Application rate is 11.5 fl. oz. per 1000 bu. This product is applied directly to the grain as it is being binned. Though it is used in Kentucky, it is a major expense in dollars and application time, so it does not see wide spread use.
- **"Cap out" (Application to the surface of grain in a bin):** - chlorpyrifos-methyl (Reldan) Application rate is 11.5 fl. oz. per 1000 bu.
- **Bacillus thuringiensis (Dipel, Javelin®, Sok-Bt. etc.):** Used only for moth pests. This treatment applied to the top 4" of grain and is not made if a protectant has been applied to the bulk grain.
- **Under Floor Fumigants:** (These are space fumigants and rates are dependent upon volume treated)
- chloropicrin (Chloro-pic): Application rate is ½ to 1 Qt. per bin.
- **Aluminum Phosphide (Phostoxin, Fumtoxin):** Application rate is 100 - 725 pellets, or 20 - 145 Tablets per 1000 cu. ft. Recommended but not often used. Products are dangerous and difficult to use properly. Specific and costly personal protective device are required, and specific personalized training is highly recommended.
- **Bulk Grain Fumigants (Aluminum Phosphide) Phostoxin /Fumtoxin:** Application rate is 120 - 900 Pellets or 25 -

180 Tablets per 1000 Bu. Used only as a last resort. Products are dangerous and difficult to use properly. Specific and costly personal protective devices are required, and specific personalized training is highly recommended.

## Diseases

**Table 3.** Pounds Fungicide Active Ingredient sold for Kentucky Wheat 1990 to 2000. (KY Dept of Ag. Division of Pesticides)

Active Ingredient	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Copper hydroxide	0	2046	0	0	0	0	0	135	0	0	0
Sodium bromide	0	124	0	0	0	0	0	0	0	0	0
Triforine	0	3	0	0	0	0	0	0	0	0	0
Metalaxyl	0	2	0	0	0	0	0	0	0	0	0
Iprodione	0	0	0	0	0	0	0	0	42	0	0
Thiophanate-methyl	0	0	0	0	0	0	0	0	61	123	0
Fosetyl-al	0	0	0	0	0	120	0	0	0	0	0
Mancozeb	4120	320	180	0	3346	800	3908	0	0	0	0
Azyoxystrobin	0	0	0	0	0	0	0	0	0	1136	0
Fludioxonil	0	0	0	0	0	0	0	0	0	0	1
Terrazole	0	0	0	0	0	0	0	0	0	74	0
Mefenoxam	0	0	0	0	0	0	46	236	186	338	88
Benomyl	30	0	19	0	116	26	0	18	29	89	0
Triadimefon	247	443	125	0	166	400	501	99	225	277	100
Carboxin	27	714	1063	0	0	959	101	136	368	614	5785
Captan	0	0	0	0	0	0	96	0	4	1	5
Thiram	27	714	1063	0	0	959	0	490	849	1638	6231
Difenoconazole	0	0	0	0	0	0	47	237	349	702	618
Propiconazole	15601	9772	12292	14946	12166	18978	24087	18732	20417	14986	14416
<b>TOTAL</b>	<b>20052</b>	<b>14137</b>	<b>14740</b>	<b>14946</b>	<b>15793</b>	<b>22241</b>	<b>28785</b>	<b>20082</b>	<b>22530</b>	<b>19977</b>	<b>27243</b>

### **Speckled Leaf Blotch** (*Septoria tritici*)

Speckled leaf blotch is an early-spring disease which usually is only a factor up to crop head emergence. However, later season development may occur during cool, wet springs. In any event, it is rare for speckled leaf blotch to cause significant yield losses in Kentucky. *Septoria tritici* is frequently associated with winter killed or frost injured wheat leaves.

**Biology:** None available.

**Cultural Controls:** No wheat varieties are highly resistant to speckled leaf blotch, but moderately resistant varieties are available for planting. Avoid continuous wheat production in a field. Avoid any practices which might encourage spring

freeze damage.

**Chemical Controls:** Monitoring- Check fields weekly beginning just before flag leaf emergence. Randomly select 40 stems and observe the leaves for developing lesions caused by *S. tritici*. Base spray decisions on published thresholds on specific indicator leaves, depending on the stage of crop development.

**Application:**

- **Propiconazole (Tilt 4E; PropiMax EC):** Section 3 label restricts applications no later than Feeke's growth stage 8. Treatments made at or prior to Feeke's will be of marginal effectiveness in limiting fungal disease epidemics due to the early, required time of application. Application rate is 4.0 fl.oz. product/acre in 15 gal/acre by ground or 5 gal/acre aerially. Tilt provides excellent control of *S. tritici* when applied at the appropriate time in the disease epidemic; the existing label does not allow for application of the fungicide when it is typically most needed for fungal disease control in Kentucky.
- **Propiconazole + Trifloxystrobin (Stratego 250EC):** Section 3 label restricts applications no later than Feeke's growth stage 8. Treatments made at or prior to Feeke's will be of marginal effectiveness in limiting fungal disease epidemics due to the early, required time of application. Application rate is 10.0 fl.oz. product/acre in 15 gal/acre by ground or 5 gal/acre aerially. Stratego provides very good control of *S. tritici* when applied at the appropriate time in the disease epidemic; the existing label does not allow for application of the fungicide when it is typically most needed for fungal disease control in Kentucky.
- **Azoxystrobin (Quadris F):** Apply 6.2 - 10.8 fl oz/A. Lower use rates may not perform acceptably in moderate to severe disease situations. Application can be made up to the start of crop flowering (Feeke's stage 10.5). The most effective applications are usually made in the early to late head emergence stages, depending on the year. Azoxystrobin will provide excellent control of *S. tritici* when properly applied and at higher use rates.
- **Mancozeb (Dithane DF):** Dithane DF has a 24 hour REI and a 26 day PHI. Applied using ground or aerial spray or chemigation from onset or tillering to joint. Application rate is 2.1 lbs. per acre at 7-14 day intervals. Apply pesticide with an appropriate surfactant since this is a protective treatment that remains on the foliage only. Mancozeb will provide seven to 10 days of acceptable protection against *S. tritici*.

**Stagonospora Leaf and Glume Blotch**

*(Stagonospora nodorum)*

The leaf blotch phase is a mid- to late-season disease which is most severe under warm, wet conditions. Glume blotch develops in a crop starting during early grain development and continues through physiological maturity. Like leaf blotch, glume blotch is most severe during warm, wet conditions in late spring. Stagonospora leaf and glume blotch is the most consistent yield limiter in wheat in Kentucky.

**Biology:** None available.

**Cultural Controls:** Moderately resistant varieties are available and can be planted to moderate disease severity. Avoid planting continuous wheat fields in fields. Optimize nitrogen fertility.

**Chemical Controls:** Monitoring- Check fields weekly beginning just before flag leaf emergence. Randomly select 40 stems and observe the leaves for developing lesions caused by *S. nodorum*. Base spray decisions on published thresholds on specific indicator leaves, depending on the stage of crop development.

**Application:**

- **Propiconazole (Tilt 4E; PropiMax EC):** Section 3 label restricts applications no later than Feeke's growth stage 8. Treatments made at or prior to Feeke's will be of marginal effectiveness in limiting fungal disease epidemics due to the early, required time of application. Application rate is 4.0 fl.oz. product/acre in 15 gal/acre by ground or 5 gal/acre aerially. Tilt provides excellent control of *S. nodorum* when applied at the appropriate time in the disease epidemic; the existing label does not allow for application of the fungicide when it is typically most needed for fungal disease control in Kentucky.
- **Propiconazole + Trifloxystrobin (Stratego 250EC):** Section 3 label restricts applications no later than Feeke's growth stage 8. Treatments made at or prior to Feeke's will be of marginal effectiveness in limiting fungal disease epidemics due to the early, required time of application. Application rate is 10.0 fl.oz. product/acre in 15 gal/acre by ground or 5 gal/acre aerially. Stratego provides excellent control of *S. tritici* when applied at the appropriate time in the disease epidemic; the existing label does not allow for application of the fungicide when it is typically most needed for fungal disease control in Kentucky.
- **Azoxystrobin (Quadris F):** Apply 6.2 - 10.8 fl oz/A. Lower use rates will not perform acceptably in moderate to severe disease situations. Application can be made up into the start of crop flowering (Feeke's stage 10.5). The most effective applications are usually made in the early to late head emergence stages, depending on the year. Azoxystrobin will provide excellent control of *S. nodorum* when properly applied and at higher use rates.
- **Mancozeb (Dithane DF):** Dithane DF has a 24 hour REI and a 26 day PHI. Applied using ground or aerial spray or chemigation from onset or tillering to joint. Application rate is 2.1 lbs. per acre at 7-14 day intervals. Apply pesticide with an appropriate surfactant since this is a protective treatment that remains on the foliage only. Mancozeb will provide seven to 10 days of moderate protection against *S. nodorum*.

**Powdery Mildew**  
(*Erysiphe graminis*)

Powdery mildew is an early-to mid-season disease in Kentucky. Disease often develops during late stem erection and may continue throughout the season if it is cool and wet. Normally, the disease goes dormant as temperatures climb in May. However, extremely early development may result in significant crop yield losses even if the disease shuts down after crop head emergence. Powdery mildew is most common in high yield potential crops. These crops characteristically have thick stands and, often, excessive nitrogen. Progress of powdery mildew is frequently halted by late spring freezes and by hard rain which tends to wash inoculum off of plant surfaces.

**Biology:** None available.

**Cultural Controls:** Highly resistant varieties are available and should be planted in areas with a history of powdery mildew. Powdery mildew resistance is not known for being very durable in some varieties; thus, efforts should be made to plant varieties which are not showing evidence of impending resistance failure. Do not use excessive seeding rates and optimize nitrogen fertility. Treat seed of highly susceptible varieties only if your farm has a history of powdery mildew on wheat. Triadimenol will provide control of powdery mildew through the early head emergence stages.

**Chemical Controls:**

- **Seed Treatment:** Triadimenol (Baytan 30)
- **Monitoring:** Check fields weekly beginning just before flag leaf emergence. Randomly select 40 stems and observe the leaves for developing lesions caused by *E. graminis*. Base spray decisions on published thresholds on specific indicator leaves, depending on the stage of crop development.

## Application:

- **Propiconazole (Tilt 4E; PropiMax EC):** Section 3 label restricts applications no later than Feeke's growth stage 8. Application rate is 4.0 fl.oz. product/acre in 15 gal/acre by ground or 5 gal/acre aerially. Tilt provides very good control of powdery mildew when applied at the appropriate time in the disease epidemic. Note: early applications which may be needed to manage powdery mildew effectively may provide insufficient mid- to late-season control of other fungal diseases.
- **Propiconazole + Trifloxystrobin (Stratego 250EC):** Section 3 label restricts applications no later than Feeke's growth stage 8. Application rate is 10.0 fl.oz. product/acre in 15 gal/acre by ground or 5 gal/acre aerially. Stratego provides very good control of *S. tritici* when applied at the appropriate time in the disease epidemic; the existing label does not allow for application of the fungicide when it is typically most needed for fungal disease control in Kentucky.
- **Azoxystrobin (Quadris F):** Apply 6.2 - 10.8 fl oz/A. Lower use rates will not perform acceptably in moderate to severe disease situations. Application can be made up into the start of crop flowering (Feeke's stage 10.5). Azoxystrobin will provide good control of powdery mildew when properly applied and at higher use rates.

### Leaf Rust

(*Puccinia graminis* f.sp. *tritici*)

Leaf rust is typically a late-season disease because the causal fungus has difficulty overwintering in Kentucky and spores, thus, must be brought into Kentucky in air currents from more southern states. In years when leaf rust successfully overwinters in Kentucky, early-season leaf rust epidemics may develop and cause extensive crop losses in susceptible varieties over a wide area. Leaf rust epidemics are frequently slowed or stopped when freezing temperatures develop post stem erection.

**Biology:** None available.

**Cultural Controls:** Avoid planting varieties which are highly susceptible to leaf rust. Good leaf rust resistance is generally available in varieties well adapted to Kentucky. Leaf rust resistance is not known for being very durable because of the great reproductive potential and genetic diversity of *P. graminis* f. sp. *tritici*; thus, efforts should be made to plant varieties which are not showing evidence of impending resistance failure. Avoid early autumn plantings since the rust fungus can become established in the fall and increase the likelihood that it will successfully overwinter in the crop.

**Chemical Controls:**Monitoring- Check fields weekly beginning just before flag leaf emergence. Randomly select 40 stems and observe the leaves for developing lesions caused by *P. graminis* s. sp. *tritici*. Base spray decisions on published thresholds on specific indicator leaves, depending on the stage of crop development.

## Application:

- **Propiconazole (Tilt 4E; PropiMax EC):** Section 3 label restricts applications no later than Feeke's growth stage 8. Treatments made at or prior to Feeke's will be of limited effectiveness in managing leaf rust epidemics due to the early, required time of application. Application rate is 4.0 fl.oz. product/acre in 15 gal/acre by ground or 5 gal/acre aerially. Tilt provides excellent control of leaf rust when applied at the appropriate time in the disease epidemic; the existing label does not allow for application of the fungicide when it is typically most needed for fungal disease control in Kentucky.
- **Propiconazole + Trifloxystrobin (Stratego 250EC):** Section 3 label restricts applications no later than Feeke's growth stage 8. Treatments made at or prior to Feeke's will be of limited effectiveness in managing fungal disease

epidemics due to the early, required time of application. Application rate is 10.0 fl.oz. product/acre in 15 gal/acre by ground or 5 gal/acre aerially. Stratego provides excellent control of leaf rust when applied at the appropriate time in the disease epidemic; the existing label does not allow for application of the fungicide when it is typically most needed for fungal disease control in Kentucky.

- **Azoxystrobin (Quadris F):** Apply 6.2 - 10.8 fl oz/A. Lower use rates may not perform acceptably in moderate to severe disease situations. Application can be made up into the start of crop flowering (Feeke's stage 10.5). The most effective applications are usually made in the early to late head emergence stages, depending on the year. Azoxystrobin will provide superior control of *S. nodorum* when properly applied and at higher use rates.
- **Mancozeb (Dithane DF):** Dithane DF has a 24 hour REI and a 26 day PHI. Applied using ground or aerial spray or chemigation from onset or tillering to joint. Application rate is 2.1 lbs. per acre at 7-14 day intervals. Apply pesticide with an appropriate surfactant since this is a protective treatment that remains on the foliage only. Mancozeb will provide seven to 10 days of very good protection against leaf rust. This assumes excellent coverage during fungicide application.

### **Loose Smut** (*Ustilago tritici*)

Loose smut is rarely a problem when certified seed is planted. In contrast, the disease can be quite severe when bin-run or otherwise poor quality seed is planted.

**Biology:** None available.

**Cultural Controls:** None available.

**Chemical Controls:** Seed Treatment-

- **Difenoconazole (Dividend XL):** This is a wheat seed treatment which can only be applied to wheat by trained seed dealers and conditioners. Dividend XL contains 16.5% difenoconazole and 1.38% matalaxyl. It provides excellent control of loose smut and general soil pathogens, including *Pythium* spp.
- **Tebuconazole (Raxil-Thiram):** This is a wheat seed treatment which can only be applied to wheat by trained seed dealers and conditioners. Raxil-Thiram provides excellent control of loose smut and general soil pathogens.
- **Carboxin (Vitavax 200):** This is a wheat seed treatment which can be applied on the farm or by seed dealers/conditioners. Vitavax contains It provides excellent loose smut control if applied properly. Poor coverage of seed can compromise loose smut control.

### **Barley Yellow Dwarf (Barley Yellow Dwarf Virus)**

Barley yellow dwarf (BYD) causes significant yield losses in some fields, but is only a significant factor statewide in one out of five -10 years. BYD is transmitted to wheat by aphid vectors. Consequently, many disease management efforts are actually aimed at the vectors (see insect pests section). The occurrence of BYD in a plant also encourages the proliferation of secondary bacterial pathogens on leaves which can result in rapid plant deterioration. BYD can appear in wheat in the fall, but it is much more common for symptoms to be expressed between flag leaf emergence and head emergence in late-spring.

**Biology:** None available.

**Cultural Controls:** BYD resistance is poorly developed and identified in most adapted wheat varieties. Nonetheless, some information is available which can be used to identify wheat varieties which either tolerate BYD or resist symptom expression to one degree or another. Plant wheat after the Hessian fly-free date to reduce seedling exposure to migrating aphids in the fall.

**Chemical Controls:** See "aphids" under the Insect Pests section.

### **Soil-borne Wheat Mosaic (Soil-borne Wheat Mosaic Virus)**

Soil-borne wheat Mosaic (SBWM) is periodically a problem in some fields, but it is not generally widespread in most years. SBWM virus is transmitted by the soil fungus, *Polymyxa graminis*. Cool, wet soil conditions favor infection in the fall. Symptom expression in the spring occurs any time after stem erection and may continue throughout the season. SBWM can cause extensive yield losses in heavily infected crops, but more often the disease is confined to low, wet areas in fields. Accurate identification of SBWM requires laboratory tests since symptom expression is highly variable.

**Biology:** None available.

**Cultural Controls:** Delay planting in the fall as long as practical and plant resistant varieties, which are generally available. Improve surface and/or internal drainage in fields.

**Chemical Controls:** None available.

### **Wheat Spindle Streak Mosaic (Wheat spindle streak mosaic virus)**

Wheat spindle streak mosaic (WSSM) is a very common virus disease which only rarely causes significant yield losses. The virus is transmitted by the soil fungus, *Polymyxa graminis*. Infection occurs in the fall under cool, wet soil conditions. Symptom expression begins in late-winter/early-spring and is encouraged by cool soil conditions. Symptom remission is common as soil and air temperatures increase after flag leaf emergence. Occasionally, symptoms will persist season-long during cool seasons, and this is when the most serious yield losses can occur.

**Biology:** None available.

**Cultural Controls:** See soil-borne wheat mosaic.

**Chemical Controls:** None available.

### **Wheat Streak Mosaic (Wheat Streak Mosaic Virus)**

Wheat spindle streak mosaic (WSSM) rarely occurs in Kentucky, although periodic episodes of the disease devastated some fields in 2000. The virus is transmitted by wheat curl mite. Infection occurs in the fall when virus-carrying mites move into wheat following emergence of seedlings. Symptom expression begins in late-winter/early-spring and is encouraged by cool soil conditions. Symptoms continue to get worse as the season progresses, and severe infections will all but eliminate yield prospects in individual fields.

**Biology:** None available.

**Cultural Controls:** This recommendation rarely applies in Kentucky, but do not plant wheat in a field that has had green corn in it for two or three weeks prior to planting wheat. Disease incidences appear to occur on a regional basis as high level wind currents move wheat curl mites from the Plains states into Kentucky. The occurrence of the disease may be random

from one field to the next. This is thought to be the result of virus-carrying mites being washed into some fields by early fall thunderstorms.

**Chemical Controls:** None available.

### **Bacterial Streak/Black Chaff**

(*Xanthomonas ampestris* pv *translucens*)

Bacterial streak is only a problem when leaves are damaged by insects or freezing. Black chaff is present in most fields, each year, but does not damage yields. Black chaff is frequently confused with glume blotch.

**Biology:** None available.

**Cultural Controls:** Avoid any practices which might predispose crops to freeze damage in early spring.

**Chemical Controls:** None available.

### **Take-all Disease**

(*Gaeumannomyces graminis* var. *tritici*)

Take-all is very common statewide, but low populations of the pathogen in well-rotated fields usually restrict the disease to random, small groups of plants. In contrast, poorly rotated fields frequently develop high populations of the take-all fungus and the result can be almost complete crop loss. Disease may become evident as early as stem erection, or the disease may not be noticed until void heads emerge in late spring.

**Biology:** Take-all decline is a naturally occurring, as yet unidentified, biological phenomenon in which populations of the take-all fungus decline precipitously. Unfortunately there is little practical use for this phenomenon since serious crop losses would precede the initiation of take-all decline.

**Cultural Controls:** Do not plant wheat in back-to-back years and control volunteer wheat and grassy weed hosts which can support high levels of *G. graminis* var. *tritici* in fields. Allow one or more years between wheat crops when take-all levels are high in a field. Take-all is favored by neutral to alkaline soil, so altering the pH through soil fertility and tillage programs may help reduce the severity of take-all in some fields. Improve surface and internal drainage of field where practical.

**Chemical Controls:** None available.

### **Fusarium Head Blight [Head Scab]**

(*Fusarium* spp, especially *F. graminearum*)

Fusarium head blight (FHB) is a serious disease in some fields every year, but only occasionally does it cause extensive losses statewide. Heavily infected crops will have low yields and test weights and the harvested grain may be contaminated with a human/livestock toxin, vomitoxin, among others. Seed quality for crops harvested for seed may be low even if yields are not greatly reduced. Fusarium head blight is favored by warm, wet weather during crop flowering. Crops not showing extensive FHB symptom expression may still have unacceptably high vomitoxin levels.

**Biology:** None available.

**Cultural Controls:** Plant multiple varieties with different maturities; practices which might stagger the flowering period of wheat on the farm increases the probability of escape. Planting wheat after soybeans or tilling stubble prior to planting

wheat following corn may provide minor relief. However, neither tillage nor previous crop will have much impact on disease development if conditions favor FHB when a crop is flowering. No wheat varieties are highly resistant to FHB, but newer wheat varieties may have "type II" resistance which will provide some relief from FHB in situations where disease pressure is light to moderate. Varieties with Type II FHB resistance will fail under heavy disease pressure.

**Chemical Controls:** None available for use in Kentucky.

#### **Additional Note:**

Fungicides are being evaluated extensively for Fusarium Head Blight control as part of the National Fusarium Head Blight Initiative. Kentucky is involved in these efforts. Certain fungicides applied during early crop flowering often suppress infection by the head blight fungi, but severity and vomitoxin are rarely impacted.

Herbicides listed under the chemical controls section for each weed species were rated as providing good control in the Weed Control Recommendations for Kentucky Farm Crops 2002. It should be noted that product names and formulations are current as of 2002, however names and formulations may change in the future. It should also be noted that the species listed in this document are not an exhaustive list of weeds encountered in Kentucky wheat fields. These species are some of the more commonly encountered.

## **Weeds**

Kentucky wheat producers have made a concerted effort over the past decade to maximize yields. Unlike other bulk commodities, weeds are typically not the most significant pests hindering wheat production. Most of the wheat grown in Kentucky is winter wheat, which means that its life cycle does not overlap with the more common summer annual weeds that are typically thought of as problem weed species in summer annual crops. Wheat is also planted on narrow row spacings and will create ground cover relatively quickly, often effectively smothering a significant number of weeds.

Weeds are present in all agricultural production fields. Rarely are weeds controlled on an individual basis. Unlike the control of most insects and plant pathogens, where there is typically a target species, management strategies for weed control are typically aimed at a broad spectrum of species. In a given year, there will commonly be predominant weed species present in any given field, with numerous other species present at levels that do not have a significant impact on production and yield. However, weeds are dynamic and opportunistic. Weed species composition can change rapidly in response to changes in production and management practices. As a result, there will always be weed species present that will be competitive to crop yield in most wheat fields.

Compounding these dynamics, a weed species complex may also consist of plant species with differing life cycles. Winter annuals are species that germinate in the fall or early spring and complete their life cycle within the growing season. Perennial species are plants that survive for three or more years. Species with biennial life cycles are not numerous, yet can be found in many fields. Early emerging summer annuals, such as giant ragweed and Pennsylvania smartweed, may also be present in wheat production fields.

**Chemical controls:** This is the most common tool used for weed management in wheat. Herbicides give producers the ability to efficiently control a broad spectrum of species. They have also lowered risks associated with crop loss due to uncontrolled weeds, and have given producers the ability to consistently produce higher yields. Yet there are environmental issues associated with heavy reliance on chemical weed control such as the potential movement of chemicals into ground and surface water supplies. Off-site movement, via particle drift or volatilization, can result in conflict between rural and urban interests.

Because weed management is seldomly focused around the control of a single species, this section of the crop profile will be structured differently than the insect and disease sections. Herbicide options for individual species will be listed after the weed description. The other control practices will be discussed once because they will be similar for most common species. As stated before, weeds are not managed on an individual basis in wheat production and listing specific control measures for specific species is not representative of actual production practices.

**Alternative Controls:** There are no viable alternative control measures for weed control in Kentucky wheat.

**Cultural Controls:** Wheat production cultural practices can have an impact on weed control. Crop competition can reduce weed pressure by smothering weed species. Quick, even crop emergence and establishment is important to gain a competitive advantage.

Crop rotation can be useful in controlling weeds. In Kentucky, wheat is commonly planted in a corn/wheat/soybean rotation. By rotating crops, producers can use herbicides with different modes of action and keep weed populations at a manageable levels that may otherwise build up under monoculture systems.

**Biological Controls:** There are no biological control agents for weed control in Kentucky wheat fields.

**Post Harvest Control Practices:** There are no post harvest weed control practices. Soybeans are often double cropped soon after wheat harvest. Subsequent weed control will occur in the soybean crop if planted after wheat harvest.

**NOTE:** Herbicides listed under the chemical controls section for each weed species were rated as providing good control in the [Weed Control Recommendations for Kentucky Farm Crops 2002](#). It should be noted that product names and formulations are current as of 2002, however names and formulations may change in the future. It should also be noted that the species listed in this document are not an exhaustive list of weeds encountered in Kentucky wheat fields. These species are some of the more commonly encountered.

**Italian ryegrass**  
(*Lolium multiflorum*)

**Origin:** Europe

This species is also referred to as annual ryegrass. It will range in height 0.3 to 1.0 m in height. The leaf blades are typically shiny and deep green in color. The blades are also flat and have prominent veins. It has a truncated, membranous ligule and small clasping auricles. It is often used as a temporary turf or pasture species since it grows quickly and thrives in cool conditions.

**Chemical Controls:** Hoelon (diclofop-methyl)

**Downy brome**  
(*Bromus tectorum*)

**Origin:** Europe

Downy brome is one of the more common brome grass species encountered in Kentucky wheat fields. It is an annual or winter annual species that will range in height from 0.1 to 1.0 m. The sheath and leaf blade is covered with dense pubescence and the ligule is short, membranous, and has a jagged margin.

**Chemical Controls:** Hoelon (diclofop-methyl) and Sencor (metribuzin) provide fair control of brome species but no herbicide provided good control.

**Cheat**  
(*Bromus secalinus*)

**Origin:** Europe

This species can grow as an annual or winter annual. The leaf blade is generally smooth, but may have sparse hairs on the blade and sheath. The leaves are flat, dark green, and have prominent veins. The awns of cheat seed are shorter, relative to downy brome seed. Cheat has a membranous ligule with a jagged top and may have small auricles. It will typically reach heights of 0.1 to 0.6 m.

**Chemical Controls:** Hoelon (diclofop-methyl) and Sencor (metribuzin) provide fair control of brome species but no herbicide provided good control.

**Common chickweed**  
(*Stellaria media*)

**Origin:** Europe

This species has the ability to grow as an annual or winter annual. Common chickweed has a prostrate growth habit and branches can be 5 to 50 cm in length. The leaves are opposite, and ovate to elliptic in shape. Each leaf will also have a sharply pointed tip. The upper stem and leaves will often be covered in short hairs. It has a shallow, fibrous roots system. Similar species include field chickweed and mouseear chickweed (perennials).

**Chemical Controls:** Harmony Extra (thifensulfuron-methyl & tribenuron-methyl) and Sencor (metribuzin)

**Henbit**  
(*Lamium amplexicaule*)

**Origin:** Europe

The cotyledons are rounded with a notch where it attaches to the petiole. The leaves are opposite, orbicular in shape, deeply lobed, and often appear to be wrapping around the stem. The stem is square and has short hairs pointing towards the base of the plant. The plant typically grows low to the ground and only achieves heights of 0.1 to 0.4 m. Purple deadnettle (*Lamium purpureum*) is a similar species that is often confuse with henbit.

**Chemical Controls:** Harmony Extra (thifensulfuron-methyl & tribenuron-methyl) and Sencor (metribuzin)

**Shepherdspurse**  
(*Capsella bursa-pastoris*)

**Origin:** Europe

This plant will grow as either an annual or a winter annual. Shepherdspurse initially has a rosette growth habit and the deeply lobed leaves are alternate. The stem is erect, ranging in height from 0.1 to 0.6 m, and sparsely branched. The seed structure is triangular in shape with a notch at the tip. It will have a thin taproot. The flowers are small, white, and arranged in clusters.

**Chemical Controls:**

- Clarity (dicamba - diglycolamine salt)
- Banvel (dicamba - dimethylamine salt)
- Harmony Extra (thifensulfuron-methyl & tribenuron-methyl)
- Harmony GT (thifensulfuron-methyl)
- MCPA (amine formulation)
- Sencor (metribuzin)

**Cornflower**  
(*Centaurea cyanus*)

**Origin:** Eurasia

This plant will grow as either an annual or winter annual. As a young plant, it will typically be grayish in color and hairy. Lower leaves can be toothed, but in general the leaf margins are entire. Cornflower will grow up to 1.0 m in height. Flower color will vary from white to red to blue to purple. It may also be referred to as bachelor's button.

**Chemical Controls:** Buctril (bromoxynil)

**Field pennycress**  
(*Thalspi arvense*)

**Origin:** Europe

*This plant will grow as either an annual or winter annual. The cotyledons are oval to elliptic-oblong. The young plant has an basal rosette growth habit with alternating leaves. Older plants will vary in height from 0.3 to 0.8 m. Leaves are spatulate to oblanceolate with toothed margins and they will typically clasp the stem. The flowers are white, while the fruits are distinctively rounded, flattend, and winged with a notch at the tip.*

**Chemical Controls:**

- 2,4-D
- Buctril (bromoxynil)
- Harmony Extra (thifensulfuron-methyl & tribenuron-methyl)
- Harmony GT (thifensulfuron-methyl)
- MCPA (amine formulation)
- Sencor (metribuzin)

**Mustard**  
(*Brassica spp.*)

**Origin:** Eurasia

*This plant will grow as either an annual or winter annual. The cotyledons are kidney shaped with a distinct indentation at the tip. The leaves are alternate and broadly egg shaped with stiff hairs. Lower leaves are often deeply lobed. The plant has an erect growth habit and will vary in height from 0.2 to 1.0 m. The clustered flowers are yellow and the seedpods are tubular with small round seeds. It has a shallow taproot. There are numerous mustard species found in Kentucky wheat fields. Some of the more common species are Brassica kaber, Brassica nigra, Brassica juncea, and Brassica rapa.*

**Chemical Controls:**

- 2,4-D
- Buctril (bromoxynil)
- Harmony Extra (thifensulfuron-methyl & tribenuron-methyl)
- Harmony GT (thifensulfuron-methyl)
- MCPA (amine formulation)
- Sencor (metribuzin)

**Marestail**  
(*Conyza canadensis*)

**Origin:** Native

The young plant has oval cotyledons, has rosette growth, and egg-shaped leaves with toothed margins. This species is typically covered with short hairs. As the plant matures it develops an erect stem ranging from 0.3 to 2.0 m in height. The leaves are alternate, linear to elliptic in shape, and dense, typically with toothed margins. This species is common throughout Kentucky and all of North America.

**Chemical Controls:**

- 2,4-D
- Dicamba
- Buctril (bromoxynil)

**Giant ragweed**  
(*Ambrosia trifida*)

**Origin:** Native

Giant ragweed is found throughout Kentucky and is abundant in the Ohio and Mississippi river valley regions. The cotyledons of this species are round to oblong and thick, similar to common ragweed only larger. The leaves are opposite and distinctly 3-lobed (palmately lobed). The leaf margins are toothed and the entire leaf is coarsely hairy. Giant ragweed has an erect, branching, coarse stem, and can vary in height from 1 to 4 m. This species is one of the first summer annuals to emerge in the spring and its pollen can cause hay fever.

**Chemical Controls:**

- 2,4-D
- Dicamba
- Buctril (bromoxynil)

**Pennsylvania smartweed**  
(*Polygonum pennsylvanicum*)

**Origin:** Native

The cotyledons are oblong, smooth, and can be green to red in color. Leaves are alternate and lanceolate in shape on a stem that is green to reddish in color, with swollen nodes. There is an ocrea (thin papery sheath) at the base of each petiole at each node. Mature plants will vary in height from 0.3 to 1.2 m.

- 2,4-D
- Dicamba
- Buctril (bromoxynil)

**Curly dock**  
(*Rumex crispus*)

**Origin:** Eurasia

*This perennial species has alternate leaves radiating mainly from the base of the plant. The leaves are linear-lanceolate in shape and leaf margins are wavy to curled. They are typically smooth and have a prominent midrib. This plant has an erect growth habit and will vary in height from 0.2 to 1.2 m. Curly dock reproduces by seed and from large taproots. When the seed head is mature it will be dark reddish-brown in color.*

**Chemical Controls:**

- Harmony Extra (thifensulfuron-methyl & tribenuron-methyl)
- Harmony GT (thifensulfuron-methyl)

**Wild garlic**  
(*Allium vineale*)  
**Wild onion**  
(*Allium canadense*)

**Origin:** Native

*Wild garlic and wild onion are similar in appearance and appear at similar times of the year. Wild garlic has linear leaves that are smooth, round, and hollow. The stems are smooth, erect, and leafless. The bulbs are covered by a papery outer coating. They reproduce by aerial and underground bulbs, rarely by seed. Wild onion leaves are smooth and flat. The bulb has a fibrous, net-veined covering.*

**Chemical Controls:**

- Harmony Extra (thifensulfuron-methyl & tribenuron-methyl)
- Harmony GT (thifensulfuron-methyl)

**Table 4. Information for herbicides commonly applied to wheat.**

Product	Active Ingredient(s)	Formulation	Rate	Timing	REI
Acquire	Glyphosate	4 lb ai/gal	1.5 to 2 pt/ac	PRE	4 hrs
Glyfos X-tra					
Glyfomax					
Glyphomax Plus					
GlyStar Original					
GlyStar Plus					
Mirage					

Roundup Original					
Roundup Ultra					
Touchdown					
Roundup UltraMAX	Glyphosate	5 lb ai/gal	1.25 to 1.6 pt/ac	PRE	4 hrs
Roundup UltraDRY	Glyphosate	71%/lb product	14 to 19 oz/ac	PRE	4 hrs
Gramoxone MAX 3S	Paraquat	3 lb ai/gal	0.75 to 1.33 pt/ac	PRE	12 hrs
Achieve 40DG	Tralkoxydim	0.4 lb ai/lb product	7 to 9.6 oz/ac	POST	12 hrs
2,4-D	Ester	4 lb ai/gal (others available)	0.5 to 0.75 pt/ac	POST	48 hrs
2,4-D	Amine	4 lb ai/gal (others available)	0.5 to 1 pt/ac	POST	48 hrs
Buctril	Bromoxynil	4 lb ai/gal	0.5 to 1 pt/ac		12 hrs
Banvel	Dicamba	4 lb ae/gal	8 to 16 oz/ac	POST	24 hrs
	dimethylamine salt				
Clarity 4S	Dicamba	4 lb ae/gal	8 to 16 oz/ac	POST	24 hrs
	diglycolamine salt				
Everest 70WDG	Flucarbazone-sodium	0.7 lb ai/lb product	0.61 oz/ac	POST	12 hrs
Harmony Extra 75DF	Thifensulfuron-methyl	0.5 lb ai/lb product	0.3 to 0.6 oz/ac	POST	12 hrs
	Tribenuron-methyl	0.25 lb ai/lb product		POST	
Harmony GT 75DF	Thifensulfuron-methyl	0.75 lb ai/lb product	0.3 to 0.6 oz/ac	POST	4 hrs
Hoelon	Diclofop-methyl	3.0 lb ai/gal	1.33 to 2.66 oz/ac	POST	24 hrs
MCPA	Amine	2 lb ai/gal	1 pt/ac	POST	48 hrs
Sencor	Metribuzin	0.75 lb ai/lb product	2 to 8 oz/ac	POST	12 hrs

**Table 5.** Herbicide active ingredient sold for wheat in Kentucky (1991-2000).

	1991	1992	1993	1994*	1995	1996	1997	1998	1999	2000
2-4,D	15813.7	13472.9	8008.5	53039.8	20618.4	16690.9	11153.62	13763.29	10399.04	18432.18
Bromoxynil	110	400	443	140	0	116	196	54	0	93.76
Dicamba	527	112	0	104	0	0	0	0	0	0
Diclofop-methyl	0	292.5	787.5	1909.5	2932.5	4447.5	15258	16590	11835.45	13945.5
Diuron	0	0	0	0	0	0	0	38.4	24	0
Glyphosate	3774	1757.52	0	192	0	0	0	0	0	0
Metribuzin	0	0	60.75	23.25	147.75	357.75	901.5	1077.75	797.43	435.75
Metsulfuron-methyl	0	0	3.01	7.18	0.38	0	6	5.86	6	0.6
Paraquat	343.5	467	0	527.5	770	377.5	0	0	0	0
Thifensulfuron	4177.24	9797.14	7194.51	15145.18	9641.6	8194.29	5891.45	9114.86	5017.53	5424.63
Triadimefon	0	8.5	0	0	0	0	0	0	0	0
Tribenuron	2088.62	4898.56	3597.27	7572.58	4820.81	4097.12	2945.7	4557.45	2508.77	2715.56

<b>Total</b>	<b>26834.06</b>	<b>31206.12</b>	<b>20094.54</b>	<b>78660.99</b>	<b>38931.44</b>	<b>34281.06</b>	<b>36352.27</b>	<b>45201.61</b>	<b>30588.22</b>	<b>41047.98</b>
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*\* We feel that the total amount of pesticide use in 1994 is inaccurate. There was likely an error in data processing and/or collection to result in a total this large.*

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