

Crop Profile for Beans (Lima) in Delaware

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Production Facts

- Annually, 40,000 acres of lima bean (*Phaseolus lunatus* L.) are planted in the United States with production concentrated in the mid-Atlantic, California, the Pacific Northwest, and certain areas in the Midwestern states of Wisconsin, Illinois, and Minnesota (1).
- In 2005 yields in Delaware averaged 1,140 pounds per acre generating a total production of 18,240 tons on the 16,000 planted and harvested acres (2).
- The value of production in 2005 was \$355/ton for a total value of \$6,475,000 (2).
- Delaware plants more acreage annually for process purposes than any other state (1).
- The total cost to produce an acre of lima bean is \$263.97 (1).

Production Regions (1)

Production in Delaware is concentrated in Sussex County.

Cultural Practices

In Delaware, lima beans are considered the cornerstone crop of the vegetable-processing industry. Lima beans are double-cropped on as much as three-fourths of the acreage, thus offering producers maximum utilization of the land. Limas are often planted in June or July after a pea or small grain crop. The same harvesting equipment is used for peas (*Pisum sativum* L.) and lima beans, so capitalization costs can be spread over two crop years.

Typically, the grower contracts with a processing company for a certain acreage. In most cases, the processing company performs the harvest and raw product delivery functions, although there are instances of growers owning their own harvest equipment. In the latter case, the processor pays a higher price for the lima beans.

Many factors influence lima bean yields, but weather conditions that affect flower bud development, pollination, and pod maturation have the most impact on yields in Delaware. Low lima bean yields are associated with profuse abscission of

flowers and developing pods. Research conducted at the University of Delaware in the 1970s revealed that high temperatures, low relative humidity, and low soil moisture lead to reduced pod set and retention. Temperatures of 90 degrees Fahrenheit or above reduce pollination and pod set. Prolonged drought (7 days or more with less than 1 inch of water) also negatively effects yield. High humidity favors pollination and pod set and is one reason lima beans have been grown successfully in Delaware. Fogs, heavy dews, and their moderating effects on temperature are helpful in pollination and pod set. High night temperatures also adversely affect yields, because energy is consumed through respiration, thereby limiting the plants physiological ability to set and retain pods. Interestingly, Delaware yields generally increase with later planting dates, which corresponds to both higher rainfall, cooler day temperatures, and cooler night temperatures in September and October, at a time when later plantings are flowering and setting pods.

The pH of the soil should be adjusted to 5.8 to 6.5. On most soil types in Delaware, pH in this range provides the optimum availability of plant nutrients. A pH of 6.5 to 7.0 will generally not be detrimental to lima bean yields, although manganese deficiencies could occur on sandy soils at a pH higher than 6.5. Liming to reach a pH of 6.5 or greater is unnecessary.

Baby lima beans may be planted as early as May 15 and as late as July 15. Fordhook lima beans cannot be planted after July 10, because their long maturity will not escape frost at the later dates. The earliest planting are subject to reduced stand due to cold soils. Minimum soil temperature for best germination is 65 degrees. The latest plantings must mature before frost, hence early-maturing varieties must be planted after July 10. The optimum range is May 30 to July 10. Early plantings that mature in August and early September are subject to reduced yields from heat and drought.

Research completed in the `50s, `60s, and early `70s in Delaware indicated a positive response from irrigation, especially on lighter, sandy soils. However, temperatures above 90 degrees can override the possible benefits of irrigation by causing blossoms to drop. There is a significant amount of lima bean acreage planted under dryland conditions in Delaware. Growers face the management decision of what crops offer the best potential return under irrigation. Although there is strong evidence of lima bean response to irrigation, other crops may offer better utilization of irrigation than late-season beans. However, there is little doubt than even in late-season conditions, irrigation reduces risks and offers better yield potential than non-irrigated conditions.

Worker Activities and Timing

Planting –

Lima beans are planted in scheduled plantings, coordinated by processors, to accommodate orderly flow of raw product into the processing plant. These

schedules are based on the amount of acreage that can be harvested per day by the harvesting operation of the processor. The growers with their own harvest equipment must coordinate their planting and harvest schedules with the processors. Baby lima beans may be planted as early as May 15 and as late as July 20. As discussed above, Fordhook lima beans cannot be planted after July 10.

Cultivation –

Mechanical Cultivation is a major part of a weed control program in lima beans. Use of cultivating equipment like s-tine cultivators designed to maintain level fields is recommended.

Harvest –

All limas beans grown for processing in Delaware are harvested mechanically. Some trash particles are difficult to remove from the harvested product. Weeds like horsenettle and morningglory produce noxious seeds that are similar in size and/or color to lima beans. Noxious weed seeds as well as other foreign materials detected on a truck load can result in penalty or price deduction to the grower. Removal of these weed seeds with the cleaning systems on the combine with color sorters in the processing plant is difficult. Many times loads of lima beans must be re-sorted by hand when any noxious weed seeds are detected during a quality inspection. At present, the method to reduce weed seed content from the harvested product is a good weed-control program.

Insect Pests

Insect pests that attack lima beans include the seed corn maggot, lygus bug species, stinkbugs, spider mites, aphids, leafhoppers, Mexican bean beetles, and corn earworms. Because significant acreage of lima beans is planted in June and July, late-season corn earworms are a major economic pest. In recent years, lygus bugs and stinkbugs have become important pests of lima beans in the Mid-Atlantic region.

Seed Corn Maggot:

Biological: - None Available

Cultural: The use of cultural management practices before planting can help to reduce the potential for economic problems. A combination of the following cultural strategies can be used: (1) plow down cover crops at least 3-4 weeks before planting or transplanting, (2) completely bury cover crops or previous crop residue to reduce fly attraction to rotting organic matter on the soil surface, and (3) avoid the use of heavy manure applications close to planting

- **Chemical:** Currently, only commercially applied seed treatments are available for seed corn maggot control in lima beans. The use of a seed applied treatment containing thiamethoxam (Cruiser – 1.28 oz 5FS/100 lbs

of seed), or chlorpyrifos (Lorsban – 2oz 50SL/100 lb seed can help to reduce damage.

Spider Mites:

Biological: None

Cultural:None

Chemical:

- **Bifenthrin 2EC** (Capture – generics available) 3 day PHI; apply 5.12 – 6.4 fl oz/A; good control; one application; 10% acreage in outbreak year
- **dimethoate 4EC** – UAP formulation states 0 day PHI; Microflow label states 2 day PHI. 1 pt/A; fair control; one application; 5% acreage in outbreak year
- **Kelthane MF (dicofol)** – 21 day PHI; 1-3 pt EC/A; fair control; one application; applied to < 5% of the acreage in an outbreak year

Mexican Bean Beetle.

Biological: On farms with a succession of bean plantings, the release of the parasite, *Pediobius foveolatus*, may provide effective control. **However**, this system has only been demonstrated on soybeans and additional information will be needed to demonstrate its effectiveness on lima beans.

Cultural Controls: The use of an early planted trap crop for overwintered beetles may be effective for controlling MBB in later plantings of lima beans. A trap crop consisting of a mixture of snap beans and soybeans planted at least 3 weeks before the main crop will attract overwintering beetle. Beetles found in the trap crop could then be control by plowing under or spraying the trap crop with an insecticide. **However**, this system has only been demonstrated on soybeans and additional information will be needed to demonstrate its effectiveness on lima beans

Chemical:

- **Azadirachtin** (Azatin, Ecozin, Neemix 7-16 fl oz/A) – (Larvae only) — not used in DE
- **Mustang MAX** (zeta-cypermethrin) – 1 day PHI; 2.72 – 4 oz/A; good control; one application to < 5% acreage
- **Lannate LV – (methomyl)** 1 day PHI for up to 1 ½ pt/A; 3 day PHI > 1 ½ pt/A; 0.75 - 3 pt/A; good control; 1 application, to 5% of the acreage
- **Orthene 97S –(acephate)** 0 day PHI; 0.5 - 1.0 lb/A; not used
- **Sevin 80S – (carbaryl)** 3 day PHI; 0.625-1.25 lb/A; not used
- **Lambda-cyhalothrin** (Warrior; generics available) –7 day PHI; 1.92 – 3.20 fl oz/A; good control; one application to 5% of the acreage

- **Proaxis (gamma-cyhalothrin)** - 7 day PHI; 1.92 – 3.20 fl oz/A; good control; one application to < 2 % of the acreage

Potato Leafhopper:

Early migratory populations combined with dry weather conditions can result in an early increase in leafhopper populations. Plants appear yellow and stunted, with the typical "hopper burn" damage on the tips of the leaves. Both yields and plant maturity can be affected by leafhopper feeding from the seedling to pre-bud stage. Once pods are present, economic damage is less likely to occur.

Biological:None

Cultural:None

Chemical:

- **Admire Pro 4.6F (imidacloprid)** – 7.0 – 10.5 fl oz/A; not used due to cost
- **Imidacloprid 2F** (Admire; generics available) 16.24 fl oz/A – not used due to cost
- **Bifenthrin 2EC** (Capture – generics available) **3 day PHI**; apply 1.6-6.4 fl oz/A; good control; 1-2 applications ; 10 % acreage
- **dimethoate 4EC** – UAP formulation states 0 day PHI; Microflow label states 2 day PHI. 0.5 - 1 pt/A; good control; 1 application, to 20% of the acreage
- **Lannate LV** –(methomyl) ; 1 day PHI for up to 1 ½ pt/A; 3 day PHI > 1 ½ pt/A; rate: 0.75-3pt/A; good control; 1 application, to 10 % of the acreage
- **Mustang MAX** (zeta-cypermethrin) – 1 day PHI; 2.72 – 4 oz/A; good control; one application to 20% of the acreage
- **Orthene 97S** (acephate)- 0 day PHI; 0.5 - 1.0 lb/A; not used
- **Proaxis** – (gamma-cyhalothrin) 7 day PHI; 2.56 -3.84 fl oz/A; good control; one application to < 2% of the acreage
- **Imidacloprid 1.6F** (foliar- Provado; generics available)7 day PHI; 3.5 fl oz/A; not used due to cost
- **Sevin 80S** (carbaryl) - 3 day PHI; 1.25 lb/A; not used
- **Lambda-cyhalothrin** (Warrior; generics available) – 7 day PHI; 2.56-3.84 fl oz/A; good control; one application to 10% of the acreage

Bean Aphid:

Chemical:

- **Admire Pro 4.6F (imidacloprid)** – 7.0 – 10.5 fl oz/A – not used due to cost

- **Imidacloprid 2F** (Admire; generics available) 16.24 fl oz/A; not used due to cost
- **dimethoate 4EC** – UAP formulation states 0 day PHI; Microflow label states 2 day PHI. 0.5 - 1 pt/A; fair control; 1 application, to < 5% of the acreage
- **Lannate LV** (methomyl)- 1 day PHI for up to 1 ½ pt/A; 3 day PHI > 1 ½ pt/A;; 1.5-3pt/A; 1 good control; one application, to < 5% of the acreage
- **Orthene 97S** (acephate) - 0 day PHI; 0.5 - 1.0 lb/A; not used
- **Imidacloprid 1.6F** (foliar- Provado; generics available) 7 day PHI; 3.5 fl oz/A not used

Stink Bug and Lygus Bug Species:

In recent years, this complex of insects has caused significant losses in processing lima beans.

Biological:None

Cultural:None

Chemical:

- **Bifenthrin 2EC** (Capture – generics available) 3 day PHI; apply 2.1-6.4 fl oz/A; good control; one application; 20% acreage
- **Mustang MAX** (zeta-cypermethrin) – 1 day PHI; 3.2-4oz/A (stink bug only) 2.72 – 4 oz/A (TPB only); fair control; one application; < 5% acreage
- **Proaxis (gamma-cyhalothrin)** – 7 day PHI; 2.56 -3.84 fl oz/A; good control; one application; < 5% acreage
- **Lambda-cyhalothrin** (Warrior; generics available) – 7 day PHI; 2.56-3.84 fl oz/A; good control; one application ; 20 % acreage
- **dimethoate 4EC** - UAP formulation states 0 day PHI; Microflow label states 2 day PHI. 0.5 - 1 pt/A; 1 application, ; Only effective on lygus bugs species ; < 2% acreage
- **Lannate LV(methomyl)** -; 1 day PHI for up to 1 ½ pt/A; 3 day PHI > 1 ½ pt/A; 1.5-3 pt/A (plant bug only); one application, to 10 % of the acreage.

Corn Earworm:

Biological: Naturally occurring parasites, predators and disease can play a role in controlling the corn earworm populations. Therefore, the use of an economic threshold becomes critical. A fungal disease present during cool, moist periods in September can help to reduce corn earworm populations. **However**, these natural controls often do not work quick enough to prevent losses in lima bean yield and quality during years of heavy population pressure.

Cultural:None

- **Bifenthrin 2EC** (Capture – generics available) 3 day PHI; apply 2.1-6.4 fl oz/A; good control; 1-2 applications; 20% acreage
- **Lannate LV – (methomyl)** 1 day PHI for up to 1 ½ pt/A; 3 day PHI > 1 ½ pt/A; 1.5- 3 pt/A; good control although control is rate dependent; one application; 5% of the acreage
- **Mustang MAX** (zeta-cypermethrin) – 1 day PHI; 2.72- 4 oz/A; good control; one application; 20% acreage
- **Proaxis (gamma- cyhalothrin)** – 7 day PHI; 2.56 -3.84 fl oz/A; good control; 1 application to < 5% acreage
- **Lambda-cyhalothrin** (Warrior; generics available) 7 day PHI; 2.56-3.84 fl oz/A; good control; one application; 20% acreage

Beet Armyworm:

A Migratory pest that can cause problems late in the season.

Biological Control: None

Cultural Control: None

Chemical Control:

- Entrust (spinosad) – 3 day PHI; 1.25-2.0 80W/A; not used due to cost; an organic product
- Intrepid (methoxyfenozide) – 7 day PHI; 4-8 oz 2F/A early; 8-16 oz/A late; good control; one application; 10% acreage
- Lannate LV(**methomyl**) 1 day PHI for up to 1 ½ pt/A; 3 day PHI > 1 ½ pt/A; 1.5-3 pts/A; poor control due to resistance; not recommended
- Spintor (spinosad) – 3 day PHI; 4-6 oz 2SC/A; good control; one application; 10% acreage.
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Diseases

Anthracnose and Web Blight (*Rhizoctonia*)

Cultural Control:

Use western-grown seed and rotate to allow 2 years between bean plantings.

Chemical Control:

When disease appears and environment favors development, use the following:

- azoxystrobin (Quadris--6.2–15.4 oz 2.08F/A; PHI 15 days; no more than 2 applications/season; REI 4 hrs or Amistar--2-5 oz 80WDG/A; may be applied day of harvest; no more than 4 foliar applications/year), (rhizocotonia only). Not used in DE

Bacterial Brown Spot

This seed-borne disease occurs primarily on lima beans and is more troublesome in irrigated fields.

Chemical Control:

- Fixed copper (Cuprofix Ultra 40 Disperss 1 lb ai/A; Repeat on a 7-14 da schedule; REI 12 hrs.). Not used in DE.

Soybean Rust (*Phakopsora pachyrhizi*)

It has not been determined yet if soybean rust is going to be a production problem in the Mid-Atlantic area on lima bean. If soybean rust should threaten this crop, experience on soybean indicates that preventative applications are best.

Chemical Control:

- azoxystrobin (Quadris--6.2 oz 2.08F/A; PHI 15 days; no more than 2 applications/season; REI 4 hrs or Amistar--2 oz 80WDG/A; may be applied day of harvest; no more than 4 foliar applications/year), (rhizoctonia only)
- Headline (pyraclostrobin – 9 oz/A; 2 applications per season; 12 hr REI; 21 da PHI)
- Nova (myclobutanil) 24c for soybean rust on limas.

Root Rots

Root rot is caused by a complex of soilborne fungi including Rhizoctonia, Pythium and Fusarium. The primary fungus causing root rot in the mid-Atlantic region is Pythium. Pythium causes extensive damage in July and August during periods of warm, humid weather.

Cultural control:

Rotate beans with nonlegume crops. Avoid poorly drained soils. Plow under previous crop residue rather than disking it. Select varieties that set high in the plant and use a close row spacing to avoid pod contact with the soil to reduce disease incidence.

Chemical control:

Apply one of the following at planting:

- Ridomil Gold--0.5-1 pt 4E/A. Apply in a 7-inch band over the row at seeding. (for Pythium only). REI 48 hrs.
- To provide control of root rot caused by Pythium and Rhizoctonia, apply the following:
Ridomil Gold PC--12 oz 11G/1,000 foot of row; REI 48 hrs. Adjust application equipment so that granules are uniformly applied in the furrow at planting.

- To provide control of root rot caused by *Rhizoctonia*, apply the following in a band up to 7 inches wide:
- azoxystrobin (Quadris at 0.4–0.8 fl oz 2.08F/1000 ft of row; PHI 15 days; no more than 2 applications/season; REI 4 hrs or Amistar at 0.125-0.25 oz 80WDG/1000 ft of row; may be applied day of harvest; no more than 4 foliar applications/year), (*rhizocotonia* only)

% of acreage treated: 2%

Lima Bean Downy Mildew

Cultural Control:

Races B, D, E, and F have been found in the mid-Atlantic area during the past 10 years. Race F was the predominant race detected on susceptible varieties in 2003 and 2004 and the only race detected in 2006. Use resistant varieties where possible. Conditions for disease are favorable when fields receive 1.2 inches or more of rain within 7 days and when the average daily temperature during this period is 78oF (25.6oC) or less. If a period of 90oF (32.2oC) occurs during this period, the cycle is broken, and an additional 7-day period with the above weather conditions is necessary to start infection. Periods of fog or heavy dew can lower the amount of rain necessary for infection to occur. Since environmental conditions vary from field to field and in different locations within a field, use the above information as a guideline. Fields that are not rotated and planted to susceptible varieties should be scouted regularly for disease occurrence.

Chemical Control:

When weather conditions are favorable for disease or when disease is observed in the field, use the following:

- copper, fixed (Champ DP; REI 24 hr; apply on a 7-14 da schedule, Kocide DF)--2 lb 58DE/A
- Section 24 (c) registration in DE is in effect for the use of Ridomil Gold/Copper (2lb/A; up to 4 applications may be made on a 7-10 da schedule; 48 hr REI; PHI 3 da).
- Phostrol also has a 24 (c) registration in DE; REI 4 hr.

50% of fall harvested acreage treated. More in other years when disease conditions are very favorable

Lima Bean Pod Blight (*Phytophthora capsici*)

Cultural Control:

Rotate away from other susceptible crops such as peppers, cucurbits, and tomatoes. Avoid heavy irrigations and irrigations at night.

Chemical Control:

In fields with a history of Phytophthora blight on peppers and cucurbits, applications of a fixed copper fungicide every 7-10 days may be beneficial for control.

- copper, fixed (Champ DP; REI 24 hr; apply on a 7-14 da schedule, Kocide DF)--2 lb 58DE/A. Not used in DE.

White Mold (*Sclerotinia*) and Gray Mold (*Botrytis*)

Chemical Control:

Preplant: For white mold only, the following biological fungicide has been tested in some states; however, limited information is available on effectiveness in the Mid-Atlantic region. Apply 3 to 4 months prior to the onset of disease to allow the active agent to reduce levels of sclerotia inoculum in the soil. Following application, incorporate to a depth of 1 to 2 inches but do not plow before seeding beans to avoid untreated sclerotia in lower soil layers from infesting the upper soil layer.

- Contans--2-4 lb 5.3WG/A; REI 4 hrs. Not used in DE.

Post seeding: Fungicide sprays are needed *only* when the soil has been wet for 6 to 10

days before bloom. For lima beans, later fungicide applications have been beneficial if favorable environmental conditions persist. Use one of the following:

- Endura--8-11 oz 70W/A; REI 12 hr; PHI (succulent) 7 da; PHI (dry) 21 da; maximum # of applications - 2/season.
- Rovral--1.5-2 pts 4F/A; REI 24 hr; Maximum # of applications - 2/season; last application no later than peak bloom.
- thiophanate-methyl (Topsin M--1.5-2 lb 70WP/A; no more than 4 lb/A/season; REI 12 hr; PHI 14 da (succulent) 28 da (dry))
- Switch--11-14 oz/A 62.5WG; REI 12 hr; PHI 7 da; apply 7-10 da intervals; max rate 56 oz/A/crop.

When weather is favorable 80% of crop is treated. In contrast, almost none was treated last year.

Weed Control

Conventional Tillage Preplant Incorporated

Imazethapyr --0.024-0.047 lb/A. Apply 1.5 to 3 fluid ounces per acre Pursuit 2SC. Shallow, thorough incorporation improves consistency of performance when dry weather follows application. Primarily controls broadleaf weeds. Combine with another herbicide to control annual grasses. Pursuit residues persist in the soil after harvest and may affect following crops. DO NOT exceed 3 fluid ounces per

acre of Pursuit 2SC at planting or make more than one application per acre per year. REI - 4 hr. 90% of acreage

S-metolachlor--0.63-1.91 lb/A. Apply 0.66 to 2 pints per acre Dual Magnum 7.62E. Incorporate 2 to 3 inches deep by disking twice with blades set 4 to 6 inches deep. Primarily controls annual grasses and nutsedge. REI - 24 hr. 90 - 100% of acreage

Pendimethalin (lima beans)—0.41 lb/A. Apply 1 pint of Prowl 3.3EC or OLF per acre and incorporate to mix thoroughly with the top 2 to 3 inches of soil. Primarily controls annual grasses and certain broadleaf weeds. Do not use when soils are cold and/or wet soil conditions are anticipated during emergence, or crop injury may result. REI - 24 hr. 25 - 40% of acreage

Trifluralin--0.5-0.75 lb/A. Apply 1 to 1.5 pints per acre of Treflan 4E or 10 to 15 pounds per acre of Treflan 5G. Incorporate it into 2 to 3 inches of soil within 8 hours after application. Primarily controls annual grasses and a few broadleaf weeds. Treflan may be applied up to 4 weeks prior to planting. Do not use or reduce the rate used when cold, wet soil conditions are expected, or crop injury may result. REI - 12 hr. 60 - 75% of acreage

Conventional Tillage Preemergence

Halosulfuron 0.024-0.047 lb/A--Apply 0.5 to 1.0 dry ounces of Sandea 75 DF preemergence to control or suppress yellow nutsedge and many annual broadleaf weeds Results have been most consistent when the application was followed by rainfall or irrigation. Use the lower rate on coarse-textured (sandy) soils low in organic matter, and the higher rate on fine-textured (silt and clay) soils. Observe a thirty (30) day preharvest interval (PHI). Do NOT apply Sandea to crops treated with a soil applied organophosphate insecticide, or use a foliar applied organophosphate insecticide within 21 days before or 7 days after a Sandea application. REI - 12 hr.

Imazethapyr --0.024-0.047 lb/A. Apply 1.5 to 3 fluid ounces per acre Pursuit 2SC. Weed control may be inconsistent when dry weather follows application. Primarily controls broadleaf weeds. Combine with another herbicide to control annual grasses. Pursuit residues persist in the soil after harvest and may affect following crops. DO NOT apply more than 3 fluid ounces of Pursuit 2SC per acre per year. REI - 4 hr. 90% of acreage

S-metolachlor--0.63-1.91 lb/A. Apply 0.66 to 2 pints per acre Dual Magnum 7.62E. Primarily controls annual grasses and a few broadleaf weeds. REI - 24 hr. 90 - 100% of acreage

Conventional Tillage

Postemergence

Bentazon--0.5-1 lb/A. Apply 1 to 2 pints per acre Basagran 4SC when beans have fully expanded first trifoliolate leaves. Use lower rate to control common cocklebur, mustards, and jimsonweed and the higher rate to control yellow nutsedge, common lambsquarter, common ragweed, and Canada thistle. Temporary, pronounced crop injury may be observed that can result in delayed maturity. The use of oil concentrate may increase the risk and severity of crop injury. To reduce the risk of crop injury, omit additives or switch to a nonionic surfactant when weeds are small and soil moisture is adequate. Do not spray when temperatures are over 90oF (32.2oC). REI - 48 hr. PHI – 30 da. 20 - 25% of acreage

Halosulfuron--0.024-0.031 lb/A. Apply 0.5 to 0.66 dry ounces of Sandea 75 DF plus nonionic surfactant to be 0.25 percent of the spray solution (1 quart per 100 gallons of spray solution) postemergence to control yellow nutsedge and certain annual broadleaf weeds. Applications should be sprayed when the crop has 2 to 3 trifoliolate leaves and annual weeds are less than 2 inches tall. Treatments applied when beans are younger increases the risk of temporary stunting, and applications after the 3 trifoliolate leaf stage increases the risk of a split set. Susceptible broadleaf weeds usually exhibit injury symptoms within 1 to 2 weeks of treatment. Typical symptoms begin as yellowing in the growing point that spreads to the entire plant and is followed by death of the weed. Injury symptoms are similar when yellow nutsedge is treated but may require 2 to 3 weeks to become evident and up to a month for the weed to die. Occasionally, slight yellowing of the crop may be observed within a week of Sandea application. When observed, recovery is rapid with no effect on yield or maturity. Sandea is an ALS inhibitor. Herbicides with this mode of action have a single site of activity in susceptible weeds. The risk of the development of resistant weed populations is high when herbicides with this mode of action are used continuously and exclusively to control a weed species for several years or in consecutive crops in a rotation. Integrate mechanical methods of control and use herbicides with a different mode of action to control the target broadleaf weeds when growing other crops in the rotation. Observe a thirty (30) day preharvest interval (PHI). Do NOT apply Sandea to crops treated with a soil applied organophosphate insecticide, or use a foliar applied organophosphate insecticide within 21 days before or 7 days after a Sandea application. REI - 12 hr.

Imazamox –0.031 lb/A. Apply 4 fluid ounces of Raptor 1SC per acre to control annual broadleaf weeds when the crop has one to two fully expanded trifoliolate leaves. Add nonionic surfactant to be 0.25% of the spray solution (1 quart per 100 gallons of spray). Add one half to 1 pint of bentazon (Basagran) to reduce the expression of injury symptoms. Strictly observe all plantback restrictions. Raptor is an ALS inhibitor. Herbicides with this mode of action have a single site of activity in susceptible weeds. The risk of the development of resistant weed populations is high when herbicides with this mode of action are used

continuously and exclusively to control a weed species for several years or in consecutive crops in a rotation. Integrate mechanical methods of control and use herbicides with a different mode of action to control the target broadleaf weeds when growing other crops in the rotation. ALS resistant weeds are present in the mid-Atlantic region and will not be controlled. REI - 24 hr. PHI – applications must be made before bloom.

Sethoxydim--0.2-0.3 lb/A. Apply 1 to 1.5 pints per acre Poast 1.5EC with oil concentrate to be 1 percent of the spray solution (1 gallon per 100 gallons of spray solution) postemergence to control annual grasses and certain perennial grasses. The use of oil concentrate may increase the risk of crop injury when hot or humid conditions prevail. To reduce the risk of crop injury, omit additives or switch to nonionic surfactant when grasses are small and soil moisture is adequate. Control may be reduced if grasses are large or if hot, dry weather or drought conditions occur. For best results, treat annual grasses when they are actively growing and before tillers are present. Repeated applications may be needed to control certain perennial grasses. Yellow nutsedge, wild onion, or broadleaf weeds will not be controlled. Do not tank-mix with or apply within one week before or after Basagran or any other pesticide unless labeled. The risk of crop injury may be increased, or reduced control of grasses may result. Observe a minimum preharvest interval of 15 days and apply no more than 4 pints per acre in one season. REI - 12 hr. 5 - 10% of acreage

Postharvest

Paraquat--0.6 lb/A. A Special Local-Needs 24(c) label has been approved for the use of Gramoxone Inteon 2SC for postharvest desiccation of the crop in Delaware. Apply 2.4 pints per acre Gramoxone Inteon 2SC as a broadcast spray after the last harvest. Add nonionic surfactant according to the labeled instructions. REI - 24 hr.

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