

# Crop Profile for Peas (Green) in Delaware

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## Production Facts

- In 2005, 6,000 acres of green peas were planted and harvested for processing in Delaware (1).
- Production per acre was 1.5 tons/acre for a total production of 9,000 tons (1)
- The value of production was \$350/ton for a total value of \$3,150 (1).
- Nationally, 320,000 acres of green peas are harvested annually (2).

## Production Regions

Production is centered in southern Delaware.

## Cultural Practices

Peas are members of the legume family which produce their own nitrogen. They need soil that is only slightly acid (pH 6.0-6.5). Because peas are very susceptible to root rot, they should also be planted in well-drained soil. These crops require very little fertilizer. For a new planting, probably 1-1/2 pounds of 10-10-10 per 100 square feet is adequate. For a well-established planting, 1/2 pound of 10-10-10 is more than enough.

Peas are a cool-season vegetable that should be planted as soon as the soil can be tilled in the spring. One of the most consistent problems in producing peas is being forced to work the ground and plant when it is too wet, which results in soil compaction. Growers and processors must plant according to a schedule to ensure orderly flow of the peas to the factory. Therefore, they are often faced in the beginning of the planting season with less than desirable conditions (2). Peas can be planted in a single row, but grow best planted in double rows -- 6 inches apart with 30 inches between the double row.

The major problem in growing peas in Delaware is root rot. Root rot can be controlled by rotating the planting site and selecting a site with well-drained soil. Birds also love peas because the pea crop is one of the earliest available to feed their young. The best control against birds is netting.

### Worker Activities and Timing

Planting – between February 25 and April 30, when soil conditions are favorable (3).

Cultivation/ weed control – Weed control is accomplished primarily through use of herbicides (2).

Harvest – between May 20 and June 30 (3). Usually processors do the harvesting, although some growers have their own harvesting equipment. Pod-stripper combines have become the predominant method of harvesting green peas for processing in the Mid-Atlantic region (2).

## Diseases

The cool early growing season for peas does not favor the development of most potential diseases. Pea production requires relatively little fungicide use. Apart from seed protectants, which are widely used to reduce incidence of damping off due to *Pythium* root rot, few fungicides are used. Crop rotation, the use of resistant varieties, and preparation of fields to allow adequate soil drainage are key management strategies for diseases of peas

### Seed Treatment

Use seed already treated with an approved seed treatment, or treat seed with a slurry or dust that contains an approved commercial fungicide-insecticide mixture. For disease control, use seed treated with Maxim 4FS (0.08-0.16 fl oz/100 lb seed) for *Rhizoctonia* & *Fusarium* control and Apron XL LS (0.16-0.64 fl.oz/100 lb seed) for *Pythium* control.

### Downy mildew (*Peronospora viciae*)

Downy mildew is increasing in occurrence in the region. It is favored by cool, wet conditions.

#### Cultural Control:

Strategies include rotations of 3 years or more, avoiding planting next to last years pea fields where this disease has occurred, and planting resistant varieties. The disease can overwinter on old debris as well as being seed born.

#### Chemical Control:

Using seed treatments that are effective for downy mildew such as Allegiance FL or Apron XL can prevent primary systemic infections.

### White Mold

Damage and Life Cycle: White mold is the common name for *Sclerotinia* rot, a potentially destructive disease of peas caused by the fungal pathogen *Sclerotinia sclerotiorum*. The pathogen survives the winter within the soil in the form of sclerotia. Sclerotia germinate, form apothecia, and disseminate spores that infect plant tissue. The fungus grows rapidly under favorable field conditions. Mature peas develop watery lesions in infected tissue, especially where air circulation is poor and humidity is high. White mycelial growth develops into dense mats, and the surface tissue becomes slimy. Dark, irregular sclerotia develop in infected plant tissues. Leaves, stems and pods may

become infected. Stem rot is common in this disease, and is most problematic, destroying plants outright. The disease can be distributed with the seed, transmitted by farm equipment or animals, and spread by irrigation water. Also, spores can be blown on the wind from plant to plant and from field to field.

Frequency of occurrence: The fungus can tolerate a broad range of temperatures, but fungal growth is most rapid at temperatures between 20 and 25°C. This disease can be a recurring problem in specific fields, where it can result in a yield loss of 5 to 10%.  
Cultural Control : Resistant varieties are not used. Growers plant disease-free seed into well drained fields. A 5- year rotation into non-leguminous crops is recommended, but a minimum 3 year rotation is observed by most growers of processing peas. Plant debris is plowed deeply under the soil surface following harvest. Growers avoid dense stands in order to promote good air circulation among the plants. Also, careful and restricted use of irrigation helps to reduce disease incidence.

Chemical Control:

*Preplant.* 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 inoculum levels of sclerotia 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.

Contains--2-4 lb 5.3WG/A

Percent of crop treated: none at this time

### **Fusarium Wilt**

Damage and Life Cycle: Fusarium wilt of peas is caused by the soil-inhabiting fungal pathogen *Fusarium oxysporum f. sp. pisi*. Near-wilt, a related disease, is caused by a different race of the same pathogen. Both diseases can be introduced from soil borne pathogens, but the symptoms and control strategies for the diseases differ somewhat. The fungus can survive in the soil as long as 10 years as chlamydospores and by association with the roots of non-host crops. The fungus penetrates the roots of peas and may colonize the vascular system of non-resistant varieties. The pathogen spreads in contaminated soil, seed, and plant debris, and can be transported from field to field by wind and water. Soil temperature, pea cultivar, and soil type can affect the rate of disease spread.

Fusarium wilt is characterized by yellowing of the lower leaves and a general stunting of the plants. Leaf margins curl downward and, in some cases, the stem becomes swollen and brittle at the soil line. A discoloration of internal root tissue also occurs. At soil temperatures above 20°C, the disease progresses rapidly, plants may be killed, often in small patches (depending upon the race of the fungal pathogen). These dead plants serve as a reservoir of inoculum for spread of the disease. One of the outcomes of Fusarium wilt infection is uneven maturity among plants in the field, which leads to yield loss and reduced quality of produce. The symptoms of near wilt are similar, but the disease's progress and plant death generally occurs more slowly than in Fusarium wilt.

Frequency of Occurrence: Some races of the fungus are widely distributed and can kill 1-3% of plants in infected fields. Because warm soil temperatures are conducive to the spread of inoculum, damage can vary significantly from year to year and the most severe losses occur in late peas.

#### Cultural Control:

Use resistant varieties and crop rotation. However, when disease potential is very high, some of these resistant varieties do not offer sufficient control and there can still be a reduction in yield and quality. Good rotational practices are important. Most processors contract with growers with enough irrigated land to rotate into corn and grains for 3 years between plantings of peas or other leguminous crops. This rotation interval is not as effective for *fusarium* as it is for *Aphanomyces* and *Ascochyta*.

#### Chemical Controls:

Fungicides are not available for the control of Fusarium wilt.

### **Damping-Off**

Damage and Life Cycle: Damping-off refers to symptoms caused by several species of Pythium: seeds rot before they germinate, shoots decay before they emerge, and seedlings collapse. This fungus causes a soft, watery rot which can affect seeds or roots.

Pythium species are common in the soil and persist as spores in plant debris left in the field. They have a broad host range that includes many other crop plants and weeds. The fungus attacks peas during or immediately after germination. In established plants, immature secondary root tissue is attacked and destroyed, a condition known as "root pruning." If a plant survives, seedlings are weak and stunted and yield is reduced.

Frequency of occurrence: In most seasons, damping off is not of great economic importance. It is seen to some degree in every field each year, but generally has little effect on yield. Severity of infection is dependent upon the weather. Damage is most severe when soil moisture is high. The Pythium species that cause damping off in peas differ in the temperature that is optimal for their growth, but the best range for most species is from 18-24°C. Fortunately, pea germination occurs at lower temperatures, giving peas the chance to outgrow Pythium, especially early season plantings. Cultivars with wrinkled seeds are most susceptible to Pythium attack. Pythium often occurs as a part of a complex of other diseases, significantly, Fusarium species. Damping off affects up to 20% of pea acreage annually. Fortunately, damage occurs at an early stage when healthy pea plants can compensate for losses most effectively. For this reason, damping off generally has little impact on pea yield.

#### Cultural Controls:

Some newer cultivars show some resistance to Pythium. Cultural practices that aid in disease management include use of seed that has high vigor, seeding at the proper depth, and preparation of fields to allow for adequate drainage.

#### Chemical Control:

For damping-off caused by *Pythium*, apply the following as a broadcast treatment at seeding.

Ridomil Gold (mefenoxam; REI – 48 hr.) --0.5-1 pt 4E/A (*Pythium* only)

% crop treated: Occasional > 1%

Azoxystrobin (Amistar--0.125-0.25 fl oz/ 80WDG/1000 ft row or

Quadris--0.40-0.80 fl oz 2.08F/1000 ft row). REI - 4 hr.

% crop treated: Occasional > 1%. For both, seed treatments are used mostly

#### Root Rot

**Damage and Life Cycle:** *Aphanomyces* root rot is caused by the fungal pathogen *Aphanomyces euteiches* f. sp. *pisi*, although other soil-borne organisms contribute to the disease complex. Oospores can remain dormant in the soil for years. When conditions are favorable, the spores germinate and pass through several life stages before developing into hyphae that can grow through host plant tissue. Infection can occur at all temperatures favorable for pea development. Once pea roots are infected, the mycelium of the fungus begins to decay the root tissue. As roots decay, the oospores return the soil to serve as inoculum in years to come. Characteristic symptoms include water-soaking, softening, and slight discoloration of the taproot and lower stems of infected plants. The outer root tissue of infected plants can be easily sloughed off. Symptoms develop faster at warmer temperatures.

**Frequency of Occurrence:** *Aphanomyces* root rot, or common root rot, is one of the most destructive diseases of peas. It occurs in most pea producing regions of the U.S., including the Mid-Atlantic. In the Northeast, average annual yield loss to this disease is about 10%, though losses in individual fields may be up to 100%. Wet soil conditions and poor drainage are associated with higher rates of infection. The disease is most damaging in years when a cool, wet spring is followed by an early, warm summer with low rainfall.

#### Cultural Control:

Rotate to allow 4 to 5 years between pea plantings. Do not double crop with any type of bean. Attempts to control root rot through the development of resistant host plant strains have not been successful. Crop rotation is an extremely important practice, but because oospores can survive in the soil for years, even the recommended rotations of 4 to 5 years may not be sufficient in all cases. Other host plants such as beans, alfalfa, and spinach must be avoided in the rotation. Many leguminous weeds can also serve as host plants and should be controlled. The best management strategy includes using long rotations, planting in fields with well-drained soils, avoiding soil compaction with heavy farm machinery, and avoiding planting in moderately to highly infested fields.

#### Chemical Control:

There are currently no registered fungicides that can consistently control moderate to high infestations of *Aphanomyces*. Soil fumigants are not used to control this disease.

## Viruses

Pea viruses can be of economic importance. The worst of these is enation mosaic virus.

**Life Cycle:** A number of viruses are known to infect peas worldwide. Four of these are of potential economic importance to pea production in the Mid-Atlantic. Each of these viruses is responsible for a unique disease characterized by distinct symptoms as described below. All of them overwinter in clover, alfalfa, and other plants in the legume family, and are transmitted by aphids. For this reason, viruses sometimes occur in peas as complexes. These are very minor problems in Delaware.

**Damage and Frequency of Occurrence:**

*Pea Enation Mosaic* - This disease is caused by the pea enation mosaic virus (PEMV). Periodic serious losses to this disease among susceptible cultivars are seen in the Northeast. If contracted early, it can cause distortion of leaves and pods or plant death prior to bloom. Typical symptoms include areas of yellow discoloration on foliage, blister-like ridges (enations) on pods and on the underside of leaves, pod distortion and suture splitting. Conditions that increase aphid populations can increase the occurrence of this virus. Tolerant cultivars are available, but are not used by processors because economic impact of the disease is very low and because varieties are selected based on qualities related to ease harvesting and processing.

*Pea Stunt* - Pea stunt is caused by the red clover vein mosaic virus (RCVMV). The virus is endemic to all major areas of pea production in the U.S. This disease occurs to some extent every year. It can be seen on occasional plants in the field but does not spread easily and so is of little economic importance. Symptoms are characteristic chlorosis or necrosis of the veins, stunting, terminal rosetting, and poor pod set. Early infection can lead to plant death prior to bloom. Stunt-tolerant cultivars are available and are the primary means of control.

*Bean Yellow Mosaic* - Bean yellow mosaic virus (BYMV) causes this disease, also called pea mosaic. Symptoms include green and yellow mottling or mosaic patterns and characteristic growth from axillary buds. This disease is of no economic importance, due the availability of good resistant varieties.

*Pea streak* - The condition known as pea streak is actually caused by multiple viruses or a complex of viruses. The primary causal agents in the U.S. are pea streak virus (PSV), red clover vein mosaic virus (RCVMV), and necrosis-inducing strains of the alfalfa mosaic virus (AMV). The most severe form of the disease is caused by PSV. Early infection with PSV kills most pea cultivars. Later infections are characterized by brown and purple leaf spots that follow the vascular system. Necrosis follows quickly after transmission of PSV by aphids, which typically carry the disease from nearby alfalfa fields. Entire fields can be devastated in a very short time. Infection by PSV at early bloom stage results in dark or sunken spots on pods. Other forms of pea streak are characterized by purplish brown streaks on stems, flattened purplish brown pods, death of veins, and wilting and death of terminal growth. Occurrence of the most severe forms

of pea streak are associated with proximity of alfalfa fields, where PSV persists. Disease occurrence is somewhat cyclic, with peak occurrence every 5 to 7 years.

**Cultural Control:**

Use resistant varieties when possible and control aphids.

**Chemical Controls:**

Although aphids are important vectors for all of these viruses, insecticide applications to control aphids are only used in cases where aphid populations are large and feeding injuries are occurring. Since one or a very few aphids may spread viral diseases quickly, the level of aphid control required to prevent any viral transmission is not economically or biologically feasible. Because viral diseases in peas are of little economic importance, no specific management strategies are used.

**Bacterial Blight**

**Damage and Life Cycle:** Bacterial blight of peas is caused by the bacterium *Pseudomonas syringae* pv. *pisi*. Bacterial blight affects all above ground portions of the plant. The pathogen overwinters in seed. Infection can also result from soybean residue. Symptoms are first seen in seedlings grown from infected seed. The disease can spread to other plants in the same field. Secondary infections often occur when hard rain or sand drainage result in wounds where new infections can start. Water-soaked spots develop on the pods, stems, and leaves of infected plants. In wet weather, spots enlarge and a white to cream-colored slimy ooze may collect on the surface of the spots. In dry weather, spots dry up, becoming brown and papery. Blowing rain facilitates the spread of the pathogen from one plant to another in the field.

**Frequency of Occurrence:** Bacterial blight is of minor economic importance. Its occurrence is linked to contaminated seed and wet weather. Use of certified seed produced by reliable companies is essential, but doesn't completely eliminate the potential for the disease. Even rigorous seed testing cannot detect every infected seed. Bacterial blight can cause significant losses, but its occurrence is relatively rare. When it occurs, it is due to the combination of a low level of contamination in the seed and weather conditions that are favorable for infection.

**Cultural Control:**

Plant clean seed and use resistant varieties. Avoid walking through fields when vines are wet.

**Chemical Controls:**

There are no chemical controls that work directly on bacterial diseases.

**Ascochyta Blight**

**Damage and Life Cycle:** Three species of related fungal pathogens cause important diseases of peas. *Ascochyta pisi* causes leaf and pod spot; *Mycosphaerella pinodes*, the perfect stage of *A. pinodes*, causes blight; and *Phoma medicaginis* var. *pinodella*, causes foot rot. All of these diseases are characterized by lesions on leaves, stems,

blossoms and pods, and by discoloration of the hypocotyl, cotyledons, and roots. All of these pathogens are soil-borne and persist to a greater or lesser degree in or on soil and plant debris; *A. pisi*, however, is primarily carried on or in the seeds. Infested seeds may be infected and develop into weak, stunted plants that are unproductive or die. Leaf lesions vary in appearance, depending on the fungal species involved and on the geographic region. Stem lesions of *Mycosphaerella pinodes* can cause girdling. When flowers are infected by one of these species, sepals may become girdled, killing the developing pod or resulting in distorted pods. Leaves of infected plants become desiccated on all but the highest nodes. Root infection is often limited to the primary roots, but in some cases lateral roots are also destroyed. *A. pisi* is the most common in Delaware

Frequency of occurrence: These diseases are common in pea production areas worldwide. It is difficult to estimate yield loss attributed directly to Ascochyta diseases. *Phoma medicaginis* var. *pinodella*, which causes foot rot, is the most serious of these pathogens.

#### Cultural Control:

Use fungicide treated seed. Follow a crop rotation scheme that provides at least 2 years without peas. Deeply incorporate crop debris immediately after harvest before the fungus can be dispersed by wind or rain.

#### Chemical Control:

In fields with a history of blight apply preventatively:

Azoxystrobin (Quadris--6.2-15.4 fl oz 2.08F/A or Amistar at 2-5 oz 80WDG/A), REI – 4 hr.

% crop treated: Labeled, but rarely used.

Headline--6-9 fl oz 2.1EC/A. REI – 12 hr.

% crop treated: Labeled but rarely if ever used. The disease is too hard to predict and by the time you see it, it is too late to spray and get control.

### **Nematodes**

Nematodes are very seldom an important pest control issue in peas. Fields with moderate to heavy infestations of nematodes generally have no significant effects on yield in peas. Peas are a good host for nematodes, but because they are planted early and grow during cool weather, they are harvested before damage from nematodes becomes evident. Fumigants are not used prior to planting peas, but may be used following pea harvest before planting of certain rotational crops in double cropping situations.

## Insect Pests

In Delaware, there are two main insect pests of peas: seed corn maggot and pea aphid.

### **Seed Corn Maggot** (*Delia platura*)

This insect is a problem in spring planted peas. It is primarily a problem during cool, wet growing seasons. Only a few maggots per seed or plant can significantly reduce stands. It overwinters primarily as a puparium in the soil. Eggs are laid just below the surface of recently plowed ground. High crop residue and fresh manure also attract flies which feed on the organic matter. The maggots hatch in four to seven days and feed primarily on decaying organic matter. After feeding for seven to 21 days, the larvae pupate in the soil, usually near the place of larval feeding. The entire life cycle is completed in three to four weeks. There may be three to five generations of seedcorn maggots per season, however the first is usually the only generation to cause any damage to peas.

**Monitoring:** Scouting and applying rescue treatments after the damage is observed are ineffective. Management options must be applied to high-risk fields prior to planting.

**Frequency of Occurrence:** most seasons

**% Acres Affected:** Up to 80% of the acreage with economic levels each year.

**Timing of Control:** At planting.

**Yield Losses:** In severely affected fields, yields may be decreased by as much as 50% due to stand loss. Losses typically are 10-15%.

### **Controls:**

**Biological** - Although predators, parasitoids, and pathogens are known to slightly reduce infestations, they do not provide economic levels of control.

**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. No resistant varieties are available.

**Chemical:** In the past, seed treatments and soil insecticides provided fair to good control, especially under heavy seed corn maggot pressure. However, with the cancellation of diazinon, soil insecticides are not an option. The use of chlorpyrifos seed treatment alone can help to reduce damage.

**Seed treatment:**

Chlorpyrifos: Lorsban 50 SL--2 fl oz per 100 pounds of seed by applying as a slurry treatment prior to planting, *plus* Apron XL LS (0.32 to 0.64 fluid ounce) per 100 pounds of seed. Used on 30 % of the acreage; providing 70-80% control.

Thiamethoxam: Cruiser 5FS - 1.28 fl oz/100 lbs of seed. Used on <1 % of the acreage – relatively new label and expensive to use.

**Pea Aphids** (*Acyrtosiphon pisum*)

This aphid pest of peas overwinters as eggs in alfalfa and clover. In spring, eggs hatch into wingless parthenogenetic females which, after reaching the adult stage, give birth to young nymphs, often ten to fourteen per day. Winged aphids appear at the second or third generation and fly to pea fields, often producing, under favorable conditions, 12 or more wingless generations in rapid succession throughout the summer. As peas become mature and less favorable for feeding, winged adults again appear, and many of these fly back to clover and alfalfa where males and egg-laying females are produced. Pea aphids are sucking insects that feed directly on plant sap

**Monitoring:** Fields should be sampling from the bud stage until harvest using a 15-inch diameter sweep net or by examining individual plants. Take 5 sweeps in 10 locations or examine 5 plants in 10 locations throughout a field for the presence of pea aphids. A treatment is recommended if you find 50 or more aphids per sweep or 5 to 10 aphids per plant.

**Frequency of Occurrence:** Economic levels occur most seasons.

**% Acres Affected:** approximately 70% typically affected in any given year.

**Timing of Control:** Pre-bloom until harvest.

**Yield Losses:** 20-25% yield loss; additional loss has occurred from virus vectored by pea aphids

**Cultural Control Practices:** No resistant varieties available.

**Biological Control Practices:** Naturally occurring predators, parasitoids, and pathogens help suppress aphid populations.

**Chemical Controls:** There are several foliar insecticides labeled for pea aphid control in peas:

- dimethoate 2.67EC 0.5 pt/acre, 0 day PHI; 1 application, 35% of the acreage
- malathion 57EC 1.5 pt/acre, 3 day PHI; not used on peas in Delaware
- methomyl (Lannate) LV 1.5-3 pt/acre, 1 day PHI; 1 application; used on 30 % of the acreage

- imidacloprid (deleted a spelling error – had a l in front (foliar-Provado; generics available)--3.5 fl oz 1.6F/A; 7 day PHI; 12 hr REI. Used on < 1 % of the acreage due to cost and need to use multiple applications under heavy pressure.
- Thionex--0.67-1.33 qt 3EC/A. 5 day PHI; 24 hr REI. Used on < 5% of the acreage

## Weed Control

### Annual and Perennial Broadleaves and Grasses

**Frequency of Occurrence:** Annually.

**Damage Caused:** Reduced yields from weed competition, and loss due to interference with harvesting equipment. Crops can become contaminated with weed plant parts (e.g. nightshade berries, Canada thistle buds or daisy buds) during harvesting which can result in reduced selling price or in severe cases, rejection of the crop.

**% Acres Affected:** 100%

**Pest Life Cycles:** A wide range of summer and winter annual and perennial weed species is present in pea fields in DE. Some of the more common ones include smooth pigweed, common lambsquarters, common ragweed, eastern black nightshade, yellow nutsedge, Canada thistle, mustards, and various annual and perennial grasses.

**Timing of Control:** Preplant, at planting, and postemergence.

**Yield Losses:** Can be as high as 100% in severely infested fields. Fields with infestations of weeds posing contaminant problems (Canada thistles, daisies) can be passed over for harvesting.

**Regional Differences:** While weed species spectra can vary regionally, weeds are a serious pest of peas throughout the state.

**Cultural Control Practices:** Cultivation is generally not useful in pea weed control because of the narrow row spacing.

**Biological Control Practices:** None.

**Post-Harvest Control Practices:** Application of herbicides and/or tillage after harvest can control perennial weeds.

**Other Issues:** Research on pea weed control is ongoing.

**Chemical Control:**

## **Preplant Incorporated or Preemergence**

Imazethapyr--0.024-0.032 lb/A. Apply 1.5 to 2.0 fluid ounces per acre Pursuit 2SC. Shallow, thorough incorporation improves consistency of performance when dry weather follows application. Primarily controls broadleaf weeds. Use in combination with another herbicide to control annual grasses. Pursuit residues persist in the soil after harvest and may affect following crops. Incorporation may increase the persistence of soil residues. Do not make more than one application of Pursuit per acre per year. REI = 4 hours. 50% of crop is treated.

## **Preemergence**

Clomazone--0.188-0.38 lb/A. Apply 8 to 16 fluid ounces Command 3ME preemergence to control annual grasses and many annual broadleaf weeds, except pigweed sp. Use the lower rate on coarse-textured soils low in organic matter and higher rates on fine-textured soils and on soils with high organic matter. Some temporary injury, seen as a partial whitening of leaf and/or stem of the crop, may be observed after seedling emergence. Complete recovery from early injury will occur without affecting yield or delaying maturity. Command spray or vapor drift may injure sensitive crops and other vegetation up to several hundred yards from the point of application. DO NOT apply when wind or weather conditions favor spray drift. Avoid preemergence applications when fields are adjacent to horticultural, fruit, vegetable, or other sensitive crops. Drift injury from off-site Command movement is extremely apparent; therefore, do not use Command on fields near sensitive locations. Herbicide residues may limit subsequent cropping options when Command is used for weed control in peas. REI = 12 hours. <5% of crop is treated.

S-metolachlor—0.48-96 lb/A. Apply 0.5 to 1.0 pints per acre Dual Magnum 7.64E (or OLF). Primarily controls annual grasses, suppresses yellow nutsedge, and suppresses or controls certain annual broadleaf weeds including pigweed species and nightshade species. Common lambsquarter and common ragweed will NOT be controlled. Recommended rates may be lower than the labeled rate to reduce the risk of crop injury. The use of less than 1 pint of Dual Magnum may reduce the duration or level of control of some weeds. Cold wet weather after application increases the risk of crop injury, which may delay maturity. Use the minimum recommended rate, or choose another herbicide when cold wet weather is anticipated after planting. REI = 24 hours. 60% of crop is treated.

## **Postemergence**

Bentazon--0.75-1 lb/A. Apply 1.5 to 2 pints per acre Basagran 4SC after peas have more than three pairs of leaves. Do not add oil concentrate. Ground application in a minimum of 20 gallons per acre is preferred. For broadleaf weed control only. REI = 12 hrs. PHI = 30 days. >10% of crop is treated.

Quizalofop-P-ethyl--0.04-0.08 lb/A. Apply 6 to 12 fluid ounces Assure II/ Targa 0.88EC per acre postemergence to control most annual and perennial grasses. Add with oil concentrate to be 1 percent of the spray solution (1 gallon per 100 gallons of spray solution) or nonionic surfactant to be 0.25 percent of the spray solution (1 quart per 100 gallons of spray solution). 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, and broadleaf weeds will not be controlled. Do not tank-mix with other pesticides unless labeled, as 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 14 fluid ounces per acre in one season. REI = 12 hours. <1% of crop is treated.

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 = 2 hours. 5% of crop is treated.

### **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 hours. <5% crop treated.

**Use in IPM Programs:** Use of these herbicides is consistent with IPM recommendations. Post-emergence herbicides (bentazon, sethoxydim, quizalofop P-ethyl) support the use of scouting and as-needed applications.

**Use in Resistance Management:** None reported.

**Efficacy Issues:** The listed herbicides have different but overlapping spectra of species control. Bentazon is typically used together for control of broadleaf weeds including Canada thistle. Grasses are controlled either with sethoxydim or quizalofop P-ethyl. Producers have a great need for new herbicide registrations, especially for herbicides,

which will help, control problem perennial weeds such as Canada thistle or yellow nutsedge.

**Alternatives:** Other new herbicides under research include sulfentrazone, imazamox, cloransulam, carfentrazone, flufenacet, and pendimethalin.

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## References

1. Scuse, Michael T. and Chris Cadwallader. Delaware Agricultural Statistics Summary for 2005-2006. Delaware Department of Agriculture.

2. E. Kee, K. Everts, J. Glancey, T. Wooten. 2004. Pea Production for Processing on Delmarva. <http://ag.udel.edu/extension/vegprogram/pdf/vf-04.pdf>

3. Commercial Vegetable Production Recommendations. 2007. University of Delaware Cooperative Extension.