Crop Profile for Beans (Snap) in New York

Prepared: April, 1999

General Production Information

Snap beans are a vegetable crop of major importance in NY. Just under 30,000 acres are produced, primarily for processing into frozen and canned products. A small percentage of the crop moves through fresh market channels, both within and outside of the state.

Commodity Information:

- **State Rank:** 4th Processing; 5th Fresh Market
- **% U.S. Production:** 10
- **Acres Planted:** 28,600
- **Acres Harvested:** 27,700
- **Cash Value:** $28,132,000

Commodity Destination:

- **Fresh Market:** 16%
- **Processing:** 84%

Yearly Production Costs: $480 (estimated)

Production Regions

Processing snap beans are grown primarily in the Finger Lakes (Ontario, Wayne, Yates, Cayuga, Livingston, Oneida counties) and Lake Plains regions (Genesee, Orleans, Niagara, and Erie counties). Fresh market snap beans are grown in these regions, as well as in eastern NY and on Long Island.

Cultural Practices

Snap beans are not suited to heavy, poorly drained soils. Deep, fertile, light- to medium-textured soils are preferable. Uniform maturity for once-over harvest is important, especially for processing beans, and fields that vary in soil type or fertility level should be avoided. Planting dates for fresh market and processing snap beans are May 1 to July 25. The crop matures in fifty to sixty days, depending on the specific variety and desired pod size. Snap beans are usually planted in rows 30 to 36 inches apart, with seeds placed every two inches. Bean seed is sensitive to chilling injury when planted in cold soil. Beans are rarely irrigated in New York. Processing snap beans and most fresh market beans are machine harvested. Crops grown on a smaller scale, e.g. for direct-to-consumer sales, are often handpicked. Most of the snap beans produced in NY are green varieties, but approximately 5% are yellow or wax varieties.

Registration

Diseases (gray and white mold, root rot, and bacterial blights) and weeds are major pests requiring annual control. Insect damage is less frequent but still potentially severe. Without the registration of new, effective materials to replace them, the loss of vinclozolin, thiophanate-methyl, EPTC, trifluralin, metolachlor, or bentazon would have significant impacts on production and profitability. The availability of the herbicide fomesafen is a critical need for snap bean producers and processors in New York. In addition, producers must have an effective control for the seed maggot complex (chlorpyrifos or an effective alternative) and seed treatments for damping-off and root rot control. Most foliar insecticides labeled for snap beans are either organophosphates or carbamates; effective alternatives would need to be available if these were lost.

Registration of new materials by the EPA, even those designated as "low risk", does not guarantee that NY growers will have immediate access to them. The New York State Department of Environmental Conservation conducts its own in-depth reviews before registering new pesticides for use in NY, and may or may not register new materials for portions of or for the entire state.

Insect Pests

Mexican Bean Beetle (*Epilachna varivestis mulsant*)

Frequency of Occurrence:
Sporadic pest in snap beans. Often present at levels below economic significance.

Damage Caused:
Damage is confined to the leaves of the plants. Adult beetles and nymphs feed on leaf tissue between the veins, creating a skeletonized leaf.

% Acres Affected:
100% at risk; usually up to 10% affected per year.

Pest Life Cycles:
This member of the lady beetle family overwinters in New York as adults under trash and other ground cover along hedgerows and protected areas. Beetles return to bean fields in June to feed and lay eggs. There are two generations per year.

Timing of Control:
June through harvest.

Yield Losses:
Up to 20% in severely infested fields, but this is not common.

Regional Differences:
None.

Cultural Control Practices:
Early-planted trap crops to attract overwintering adults. Crop rotation can help suppress populations. Resistant varieties are not available.

Biological Control Practices:

Natural enemies help control Mexican bean beetles. An imported parasitoid, *Pebiobus foveolatus*, has successfully managed these beetles, but must be reared and released.

Post-Harvest Control Practices:
None.

Chemical Controls for MBB and Other Snap Bean Insects:

Pesticide	% Trt.	Type of Appl.	Typical Rates lbs ai/acre	Timing	# of Appl.	PHI[1] days	REI hours
acephate *(Orthene)*	20[2]	Ground, foliar. Sometimes by air.	0.75	Budding up to pin-pod stage. Sometimes earlier if high PLH infestations.	1[3]	14	24
carbaryl *(Sevin)*	15	Ground, foliar. Sometimes by air.	0.5-1.0	Budding up to pin pod stage	1[3]	2	12
dimethoate *(Dimethoate)*	6[2]	Ground, foliar. Sometimes by air.	0.25	Pre-bud to pin pod, occasionally earlier if PLH populations very high.	1[3]	2	48
methomyl *(Lannate)*	2	ground, foliar	0.45	Budding up to pin pod stage.	1	2	48
methyl parathion *(Penncap-M)*	1	ground, foliar	0.75	Budding up to pin pod stage	1	3	48
disulfoton *(Di-Syston)*	11	in-furrow application	1	At planting	1	60	48

esfenvalerate *(Asana)*	1[4]	foliar	0.015-0.03	Budding up to pin pod stage.	--	7	12
endosulfan *(Thiodan)*	1[4]	ground, foliar	0.5	Budding up to pin pod stage	1	7	24

1. PHI on this and all tables indicates the typical number of days between application and harvest, not label PHIs.
2. Acephate can be as high as 36%, and dimethoate as high as 21%, in years of exceptionally high insect pressure.
3. 10% of the acres that receive an application of acephate, carbaryl, or dimethoate receive a second application as well.
4. Approximately 30% of the fresh market snap bean acreage on Long Island is treated with endosulfan and esfenvalerate. This represents 6% of the fresh market snap bean acreage, and 1% of total snap bean acreage in NY.

Use in IPM Programs: Use of each of these materials is consistent with Cornell IPM recommendations. Thresholds have been established for most insect pests of snap beans.

Use in Resistance Management: None reported for any of the insect pests of snap beans.

Efficacy Issues: Acephate is the preferred foliar insecticide because it provides the longest period of control, however the 14 day PHI limits its usefulness after pin-pod stage. Methyl parathion is used mostly for ECB control. Methomyl provides some ovicidal control of ECB.

Alternatives: IR-4 is scheduled to run residue trials on abamectin in 1999. It is expected that lambda-cyhalothrin (Warrior) will be registered by EPA on snap beans by 2001; and sometime thereafter in NY.

European Corn Borer (*Ostrinia nubilalis*)

Frequency of Occurrence:
Usually sporadic but can be significant in years of high European corn borer (ECB) pressure.

Damage Caused:

Snap beans are not the preferred host of ECB but they will reproduce on beans. ECB does not affect growth or yields measurably, but causes serious cosmetic injury. Processors have virtually a zero tolerance for ECB larvae in snap beans, and FDA regulations state that even slight levels of contamination render the crop unfit for human consumption. Since larvae are located inside the pod, it is very difficult to grade out larvae-containing pods. However, during processing, larvae can migrate out of the pods and float to the top of the package, providing a nasty surprise for the consumer. The most frequent damage occurs in beans harvested in September or later, but ECB contamination has been found earlier as well.

% Acres Affected:
100% at risk; up to 5% of acres affected each year.

Pest Life Cycles:
The ECB is a major pest of corn, and an occasional pest of snap beans, potatoes, and peppers. Corn borers overwinter as the last larval instar in the stalks and stems of corn. These pupate in late April and early May. Several strains exist in NY. Adults of the 2-generation strain first emerge in late May to early June and again in August. Adult emergence of the single generation strain peaks in July. Eggs are laid in masses primarily on the underside of leaves. Larvae hatch, feed for a short period on leaves, and then bore into stems or pods.

Timing of Control:
From early bud stage until seven days before harvest.

Yield Losses:
100%. If found in harvested product, loads can be rejected and entire fields bypassed.

Regional Differences:
Certain geographic locations seem to have consistently higher ECB pressure, and thus risk of infestation.

Cultural Control Practices:
None.

Biological Control Practices:
A variety of natural enemies help suppress ECB populations, but not always enough to meet the low tolerance in snap beans.

Post-Harvest Control Practices:
None.

Other Issues:
Producers do not have a reliable way of knowing which fields are at greatest risk of ECB infestation. Research is currently being conducted on methods (scouting, pheromone trapping, timing) that growers can use to determine when and if they should apply an insecticide for ECB control (Stivers). Growers in ECB "hot spots" typically apply an insecticide

once, usually at bloom. Occasionally a second spray will be applied. Most growers do not routinely treat for ECB.

Chemical Controls:
Acephate, carbaryl, methomyl, and methyl parathion are labeled for use against this pest. See "Mexican Bean Beetle" section for pesticide use information.

Alternatives:
The registration of lambda-cyhalothrin could provide a very useful tool in control of ECB and other insects in snap beans.

Potato Leafhopper(*Empoasca fabae*)

Frequency of Occurrence:
More common during hot dry growing seasons. Not always an economically important pest, but infestation and damage can be severe.

Damage Caused:
Potato leafhopper (PLH) is a sucking insect, and both nymphs and adults remove plant sap directly from the vascular system in the leaf. In the feeding process, PLH injects a salivary toxin that causes injury to the plant. The damage resulting from feeding and the toxin is called "hopperburn" and is characterized by whitening of leaf veins within two days after feeding. Subsequently the whitened area becomes yellow, then turns brown and dies. If infestations occur at an early enough stage of crop growth, they can cause stunting and decreased yields. Infestations occurring after bloom usually do not affect yields. During pre-bloom, treatment is recommended at 2 nymphs per trifoliate leaf; on newly emerged beans, much lower populations may be damaging.

% Acres Affected:
100% at risk; up to 50% affected per year.

Pest Life Cycles:
PLH is a migratory pest, coming from overwintering sites in the Gulf states and appearing first in NY in early June (sometimes as early as May). Adults are about 1/8 inch long, and nymphs are slightly smaller. The entire life cycle takes 28 days to complete.

Timing of Control:
Emergence through bloom.

Yield Losses:

Usually small, but in extreme infestations, can be up to 50%.

Regional Differences:
Western counties tend to have higher PLH pressure than Central NY counties.

Cultural Control Practices:
None.

Biological Control Practices:
Although a variety of natural enemies of PLH have been reported, their impact on infestations is not well understood.

Post-Harvest Control Practices:
None.

Chemical Controls:
Acephate, carbaryl, dimethoate, methomyl, methyl parathion, and disulfoton are labeled for use in snap beans for PLH control. See "Mexican Bean Beetle" section for pesticide use patterns. In addition, phorate (Thimet) is labeled for use. Only about 1% of the acreage is treated with phorate (none in Long Island), at 0.45-0.9 lbs ai/acre. This is an at-planting application.

Alternatives:
The registration of lambda-cyhalothrin could provide a very useful tool in control of PLH and other insects in snap beans.

Seedcorn Maggot (*Delia platura and D. florilega*)

Frequency of Occurrence:
Sporadic but potentially devastating when infestations occur.

Damage Caused:
Larvae attack seeds and newly emerging seedlings. Infested seeds and other plant parts are hollowed out. Damaged plants are weak and may not develop. As a result, stands can be thinned, sometimes as high as 80%. In these cases, fields must be replanted or abandoned. Snap beans are the most susceptible of all vegetables attacked by SCM complex.

% Acres Affected:
100% at risk; up to 20% affected per year

Pest Life Cycles:
The seed maggot complex, composed of *Delia florilega* and *D. platura*, can damage beans and other large seeded vegetables. *D. platura* overwinters as a puparium from which a fly emerges in early spring. After mating, females lay eggs on newly planted seeds. After hatching, the small larvae bore into the seed or seedling and begin feeding. Damage is most likely in early plantings. The most destructive populations of seed maggots occur in May, and a second generation causes damage in late June and July.

Timing of Control:
Seed treatment before planting.

Yield Losses:
Up to 75% due to reduced stand.

Regional Differences:
None.

Cultural Control Practices:
Several cultural practices reduce the risk of seed maggot damage to beans, including avoiding planting into cool wet soils; avoiding planting in soils containing fresh organic matter (manure, crop or weed residues); and planting later in the season. Heavy rain and cool soil temperatures subsequent to planting aggravate the problem. Resistance can be found in one older variety (Spartan Arrow) but has not been transferred to commercial varieties.

Biological Control Practices:
None.

Post-Harvest Control Practices:
None.

Chemical Controls:

Pesticide	% Trt.	Type of Appl.	Typical Rates	Timing	# of Appl.	PHI days	REI hours
chlorpyrifos *(Lorsban)*	100	commercial seed treatment	1 oz ai/100 lbs seed; 1 oz ai/acre	before planting	1	50	--

phorate *(Thimet)*	1	in furrow, at planting	0.45-0.9 lb ai/acre	at planting	1	50	48
lindane *(Isotox)*	1[1]	planter box treatment	2 oz product/100 lbs seed	at planting	1	50	24

1. Approximately 25% of Long Island acreage is treated with this material.

Use in IPM Programs:
Cornell IPM recommendations call for the use of commercially treated or grower-treated seed.

Use in Resistance Management:
None reported.

Efficacy Issues:
The very low rates of chlorpyrifos used on bean seed in NY results in low risk of crop loss for producers and processors due to seedcorn maggot. Relying strictly on non-chemical control measures (timing of planting, site selection) would significantly limit the snap bean acreage in the state. Cultural practices that are extremely beneficial for maintaining soil quality (e.g. cover cropping, crop rotation with high residue crops, manure applications, and spring plowing vs. fall plowing) would also be greatly limited on snap bean acreage. Phorate is only partially effective against seedcorn maggot. As a systemic insecticide, it provides early season control against other insects (MBB, ECB, and PLH), but not later season control, when these pests can become economic problems.

Alternatives:
If seed treated with chlorpyrifos was not available, producers could use a planter-box treatment of either diazinon (0.25 oz ai/bushel of seed) or chlorpyrifos (1.0 oz ai/bushes of seed). These are effective treatments but more difficult to handle safely than commercially treated seed. Thiamethoxam (trade name Adage), a new insecticide by Novartis, may be an effective alternative, but efficacy trials would need to be conducted.

Tarnished Plant Bug (*Lygus lineolaris*)

Frequency of Occurrence:
Sporadic but can cause significant damage.

Damage Caused:
The sucking injury from the nymphs, and sometimes adults, causes buds to drop, and pods to be spotted, stunted, and misshapen. Pods with tarnished plant bug (TPB) injury may be more prone to fungal pathogens that increase the cosmetic damage to the surface.

% Acres Affected:
50%

Pest Life Cycles:
TPB has a fairly wide host range. The adult bug and possibly some immature forms (nymphs) overwinter in protected areas within and around fields. Nymphs go through several stages. The life cycle is completed in 3-4 weeks, and there are usually four generations per year in NY. Nymphs feed more constantly than the adults and thus are more destructive.

Timing of Control:
Bloom to harvest.

Yield Losses:
If damage is significant (over 5%), whole loads can be rejected at the processing plant, and entire fields by-passed. Growers are docked for TPB damage that can be graded out at the plant.

Regional Differences:
None.

Cultural Control Practices:
Avoidance of the most susceptible varieties.

Biological Control Practices:
Natural enemies can help control TPB populations.

Post-Harvest Control Practices:
None.

Other Issues:
None.

Chemical Controls:
Acephate, carbaryl, dimethoate, methomyl, and methyl parathion are labeled for use for TPB control. See "Mexican Bean Beetle" section for pesticide use information.

Two-spotted Spider Mite (*Tetranychus urticae*)

Frequency of Occurrence:
Infrequent.

Damage Caused:
Heavy infestations may cause leaves to drop. Damage is usually only seen in very hot, dry weather.

% Acres Affected:
100% at risk; usually <5% affected per year.

Pest Life Cycles:
This mite has a wide host range. The adult mite is yellow to dark green with two to four black dorsal spots.

Timing of Control:
From seedling emergence through pod set.

Yield Losses:
Usually low; <10%

Regional Differences:
None.

Cultural Control Practices:
None.

Chemical Controls:

Pesticide	% Trt.	Type of Appl.	Typical Rates	Timing	# of Appl.	PHI days	REI hours

dicofol *(Kelthane)*	<1	ground, foliar	0.38-0.5 lb ai/acre	as needed	1	5	12
dimethoate *(Dimethoate)*	See "Mexican Bean Beetle" section for dimethoate use patterns. Spider mites are the target pest for very few dimethoate applications.						

Diseases

Botrytis Gray Mold (*Botrytis cinerea*)

Frequency of Occurrence:
Annually.

Damage Caused:
Gray mold develops in dense plant canopies when the weather is warm and moist. Infected pods become covered with fungal growth and decay.

% Acres Affected:
100%

Pest Life Cycles:
Gray mold infections are caused by spores of the fungus *Botrytis cinerea* infecting blossoms and subsequently infecting pods that are in contact with the blossoms. Disease development is most rapid when temperatures are between 65-74º F and moisture is present during bloom. The disease tends to be worse in fields where leaves have mechanical damage or pesticide injury, and where dead leaves are on the ground. The fungus grows and produces spores on dead and living material. The fungus can infect many species of plants and is known to develop resistance to fungicides.

Timing of Control:
Scouting should begin at early bud stage. If needed, fungicides should be applied when 30 to 70% of plants are flowering.

Yield Losses:
Can be up to 100%. Loads of harvested beans can be rejected at the plant if pod mold levels are above 5%, and entire fields

can be bypassed. Growers are docked for damaged pods that can be graded out at the plant.

Regional Differences:
Disease pressures tend to be higher in far western counties than in central NY counties.

Cultural Control Practices:
A number of cultural practices can help control the disease, including: crop rotation with non-hosts, avoiding planting in shaded areas or poorly drained fields; planting rows along the direction of the prevailing winds to speed drying; and avoiding overfertilizing. No resistant varieties are available.

Biological Control Practices:
None.

Post-Harvest Control Practices:
Incorporate infested debris immediately after harvest to hasten decomposition of the material.

Other Issues:
Research on gray mold management is ongoing in NY because of the serious magnitude of the disease (Dillard). Many NY isolates are resistant to benomyl and thiophanate-methyl. New fungicides are being tested (see "Alternatives" section below). There are no effective methods for forecasting or scouting for this disease and using thresholds to make treatment decisions. The best IPM recommendations call for using cultural practices to minimize the disease, and to apply fungicides during bloom, except when fields have been quite dry.

Chemical Controls:

Pesticide	% Trt.	Type of Appl.	Typical Rates	Timing	# of Appl.	PHI days	REI hours
benomyl *(Benlate)*	2	ground, foliar	1 lb ai/acre	30-70% bloom	1	14	24
chlorothalonil *(Bravo)*	1[1]	ground, foliar	1 lb ai/acre	30-70% bloom	1	7	48

iprodione *(Rovral)*	1	ground, foliar	0.75 lb ai/acre	30-70% bloom	1	14	12
thiophanate-methyl *(Topsin-M)*	6	Ground, foliar. Sometimes by air.	1.05 lb ai/acre	30-70% bloom	1	14	12
vinclozolin *(Ronilan)*	45	Ground, foliar. Sometimes by air.	0.5 lb ai/acre	30-70% bloom.	1[2]	10	12

1.Used mostly on Long Island.

2.1-3% of fields that receive an application of vinclozolin also receive a second application.

Use in IPM Programs:
Vinclozolin is useful in areas where Botrytis is not resistant to benzamidazoles.

Use in Resistance Management:
Since *Botrytis cinerea* is known to develop resistance to fungicides, it is critical to have a number of fungicides available for resistance management. Resistance to vinclozolin, benomyl, and thiophanate-methyl have been documented.

Efficacy Issues:
Vinclozolin is the most effective fungicide available for control of both gray and white molds, which very often appear together. Where Botrytis has developed resistance to benzamidazoles, benomyl and thiophanate-methyl are not effective.

Alternatives:
Under research conditions, azoxystrobin (Quadris), propiconazole, and trifloxystrobin (Flint), provided good to excellent control of gray mold. A 1% solution of calcium nitrate also shows promise in aiding control of the disease. Myclobutanil (Nova) may be effective on gray and white molds; IR-4 is scheduled to conduct residue trials in 1999. Cyprodinil (Vanguard; Novartis) is another potential alternative, but research has yet to be conducted.

Sclerotinia White Mold (*Sclerotinia sclerotiorum*)

Frequency of Occurrence:
Annually.

Damage Caused:
Infected pods become covered with white fungal growth and decay. As the fungus grows, hard, dark structures form among the fungal strands.

% Acres Affected:
100%

Pest Life Cycles:
Sclerotia are produced among the white, cottony fungal strands on diseased plants. Sclerotia overwinter on or in the soil. Apothecia develop from sclerotia when the soil is wet for about ten days. Ascospores are released from apothecia and infect wet blossoms. The disease is spread to other parts of the plant from infected blossoms. White mold tends to develop in dense plant canopies. The disease tends to be worse in fields where leaves have mechanical damage or pesticide injury, and where dead leaves are on the ground. White mold tends to develop when the weather is warm and hot.

Timing of Control:
30-70% bloom

Yield Losses:
Can be up to 100%. Loads of harvested beans can be rejected at the processing plant if pod mold levels are above 5%, and entire fields can be bypassed. Growers are docked for damaged pods that can be graded out at the plant.

Regional Differences:
None.

Cultural Control Practices:
If there is a field history of white mold, beans should not be preceded by a bean, tomato, potato, lettuce or crucifer crop. Grains and corn are good rotational crops, however rotation may not be completely effective because the fungus has a very wide host range. Avoid planting in shaded areas and in small fields surrounded by trees; do not plant in fields that drain poorly or have a history of severe white mold. Plant fields in the direction of prevailing winds and use a wide row spacing to promote drying of the soil and reduce moisture in the plant canopy. Avoid overfertilization.

Biological Control Practices:
None commercially available. However, research has shown a number of antagonistic bacteria, yeasts and fungi to have some efficacy.

Post-Harvest Control Practices:
None.

Other Issues:
Research on white mold is ongoing in NY (Dillard).

Chemical Controls:
Benomyl, iprodione, thiophanate-methyl, and vinclozolin are labeled for control of white mold in snap beans. See "Botrytis Gray Mold" section for pesticide use patterns. Vinclozolin and benomyl are the most effective against white mold.

Alternatives:
Under research conditions, propiconazole and an experimental material, CGA173506, provided good to excellent control of white mold. Myclobutanil (Nova) may be effective on gray and white molds; IR-4 is scheduled to conduct residue trials in 1999. Development of biological controls is focusing on bacteria in the genera *Bacillus* and *Pseudomonas*. Additional research is being conducted with antagonistic years and parasitic fungi in the genus *Coniothyrium*.

Root Rot and Damping Off (various species)

Frequency of Occurrence:
Annually.

Damage Caused:
Symptoms of this disease complex include poor seedling establishment, seedling death, uneven growth, yellowing of leaves and premature defoliation. Roots of infected plants are reduced in size, discolored, and exhibit different degrees of decay. There is great variation in symptoms due to the different organisms involved, and weather and soil conditions.

% Acres Affected:
100%

Pest Life Cycles:
Bean root rot in NY can be caused by *Fusarium*, *Rhizoctonia*, *Thielaviopsis*, *Pythium* (all fungi) and the lesion nematode *Pratylenchus* spp. These pathogens may infect beans singly or in combination. *Pythium ultimum* has a wide host range and can survive in soil for many years as oospores. It is most damaging to beans during cool wet weather. *Rhizoctonia solani* also has a wide host range, and survives in soil as hyphae, usually in association with host residues. The fungus also produces sclerotia. *Thielaviopsis basicola* and *Fusarium solani f. sp. phaseoli* both survive in soil for many years in the form of chlamydospores. *Thielaviopsis* has a very wide host range, and causes the most damage

under warm, wet conditions. The host range of *Fusarium* is much narrower, and this disease seems to do the most damage to plants already stressed by other factors. *Pratylenchus penetrans* survives as eggs or larvae and adult stages either in host plant roots or in soil, and has a wide host range. Like *Fusarium*, the lesion nematode probably causes the greatest amount of damage to plants under stress.

Timing of Control:
Pre-plant.

Yield Losses:
Up to 100% in severely affected fields. Usually the disease strikes certain areas of the field, such as headlands or low spots.

Regional Differences:
None.

Cultural Control Practices:
Because chemical controls are not usually cost effective (except for seed treatments), this disease is managed almost entirely through cultural practices. Growers are recommended to: rotate away from vegetables for at least two years; plant only into soils with good soil structure and free from compaction; avoid poorly drained fields; cover crop with small grains or grasses. Heavily infested fields should be planted shallow and late. Infected fields may benefit from a shallow cultivation not too close to the stems. Covering the lower stems with soil will promote further root formation and reduce root rot damage, but this can lead to foliar infections with *Rhizoctonia*. Some commercial varieties exhibit better tolerance than others.

Biological Control Practices:
Trichoderma (Rootshield) has been tested but does not perform well on beans.

Post-Harvest Control Practices:
Crop debris should be plowed down to initiate decomposition.

Other Issues:
Research on methods to control root rot and damping-off in snap beans is ongoing because the problem is so widespread. Effective seed treatments are absolutely essential for producing snap beans in NY on a commercial scale. The recent registrations of Maxim (fludioxonil) and Apron XL (mefenoxam) as seed treatments provide very useful tools for control of damping-off. Current research seeks to identify effective materials against *Thielaviopsis*, evaluate varietes for resistance to root rots, and to quantify the effects of cover crops, composts, rotation, and other cultural practices on root rot control (Abawi).

Chemical Controls:

Pesticide	% Trt.	Type of Appl.	Typical Rates	Timing	# of Appl.	PHI days	REI hours
metalaxyl[1] *(Apron)*	85	seed treatment	0.5 lbs ai/100 lbs seed; =0.4 lbs ai/ acre	before plantings	1	50	NA
mefenoxam *(Ridomil Gold)*	<1	soil treatment; broadcast or in-furrow band incorporated	2-4 pts product/ banded acre	pre-plant or at planting	1	50	48
PCNB *(Terrachlor)*	<1	Soil treatment	1-1.5 lb ai/ acre	pre-plant	1	50	12
captan *(Captan)*	100	commercial seed treatment	label rates	pre-plant	1	50	NA
chloroneb *(Demosan)*	100	commercial seed treatment	label rates	pre-plant	1	50	NA

1. The use of metalaxyl as a seed treatment is being phased out, to be replaced by mefenoxam seed treatment at 0.75 lbs ai/acre. This is used primarily by processing growers, not fresh market growers.

Use in IPM Programs:
Use is consistent with Cornell IPM recommendations.

Use in Resistance Management:
None reported.

Efficacy Issues:
Mefenoxam is effective against *Pythium* and *Phytophthora*. It can be used in combination with PCNB for *Rhizoctonia* control as well. Soil-applied fungicides are relatively expensive and so are infrequently used on snap beans.

Bacterial Blights (*Xanthomonas campestris* and *Pseudomonas* spp.)

Frequency of Occurrence:
Sporadic, but are usually found at some level in all but the driest seasons. Bacterial brown spot (BBS) is the most common.

Damage Caused:
All three bacterial diseases cause lesions on leaves and pods of infected plants. Pod lesions can be sunken and brown (BBS), or reddish brown (common blight and halo blight), and render the crop unfit for consumption. Lesions can also cause pods to become misshapen. If infection occurs early, plant damage will also cause a decrease in pod set and size.

% Acres Affected:
100% at risk; up to 5% affected per year.

Pest Life Cycles:
Three bacterial diseases affect snap beans in NY: Bacterial brown spot (BBS; *Pseudomonas syringae* pv. *syringae*), common blight (*Xanthomonas campestris*), and halo blight (*Pseudomonas syringae*). The primary source of inoculum of BBS seems to be infected crop debris, transferred mechanically or through irrigation to new fields. It can also be seedborne, but certified western-grown seed has usually tested clean. Recent research in other states indicates that BBS inoculum is endemic on bean leaf surfaces and in oak trees. Common blight can be spread from infected seed, crop residues, and possibly weeds. Infected seed is the most important source for halo blight. All three diseases are worse under wet conditions, and are easily spread by wind-driven rain, movement through wet fields, and through irrigation.

Timing of Control:
Pre-plant (selection of seed source); and from bloom through harvest.

Yield Losses:
Up to 100% in severely affected fields. Harvested loads of snap beans with greater than 5% damage to pods can be rejected, and entire fields bypassed. Growers are docked for infected beans that can be graded out at the plant.

Regional Differences:
None.

Cultural Control Practices:
Use of western-grown, certified seed is one of the best control practices available. Also useful are destroying crop residues on the surface of the soil, limiting movement of people and machinery when fields are wet, crop rotation, and the selection of commercially available varieties with good tolerance to the diseases.

Biological Control Practices:
None.

Post-Harvest Control Practices:
None.

Chemical Controls:

Pesticide	% Trt.	Type of Appl.	Typical Rates	Timing	# of Appl.	PHI days	REI hours
fixed copper compounds *(Kocide and others)*	3	ground, foliar	varies with formulation	as needed.	1-2	7	48
streptomycin *(Agri-Strep)*	100	seed treatment, slurry	1-5%	before planting	1	50	NA

Use in IPM Programs:
Use of both materials is consistent with Cornell IPM recommendations.

Use in Resistance Management:
None reported.

Efficacy Issues:
Use of fixed copper compounds can be helpful in slowing the infection and spread of bacterials diseases in beans, but will not act as a curative. Agricultural streptomycin is labeled as a seed treatment for control of halo blight, but only by commercial seed dealers.

Bean Rust (*Uromyces appendiculatus*)

Frequency of Occurrence:

Sporadic.

Damage Caused:
The disease causes reddish brown circular pustules on leaves and pods, rendering the pods unfit for sale or consumption.

% Acres Affected:
25% at risk; up to 5% affected per year.

Pest Life Cycles:
This fungal pathogen overwinters on infected crop debris. Regular occurrence of dew favors infection and development of severe epidemics.

Timing of Control:
Early in the growing season.

Yield Losses:
Can be up to 100% in severely affected fields.

Regional Differences:
Rarely seen in upstate NY, but is more typical in Long Island (Suffolk County).

Cultural Control Practices:
Useful cultural practices include: crop rotation, planting in areas of good air and water drainage, and selecting varieties with some tolerance to the disease.

Biological Control Practices:
None.

Post-Harvest Control Practices:
Incorporating infested debris immediately after harvest helps decrease inoculum for nearby or subsequent crops.

Chemical Controls:

Pesticide	% Trt.	Type of Appl.	Typical Rates	Timing	# of Appl.	PHI days	REI hours

chlorothalonil *(Bravo)*	<1	ground, foliar	1.67 lb ai/acre	Early in season.	1	7	48
maneb *(Maneb, Manex)*	<1	ground, foliar	1.5 lb ai/acre	Early in season.	1	30	24

Bean Viruses (several)

Frequency of Occurrence:
Sporadic.

Damage Caused:
Symptoms range from stunted plants, mottled and malformed leaves and pods, to mosaic patterns on leaves.

% Acres Affected:
100% at risk; up to 5% affected per year.

Pest Life Cycles:
Beans are subject to damage from bean common mosaic virus (BCMV), bean yellow mosaic virus (BYMV), clover yellow vein virus (CYVV) and cucumber mosaic virus. All are spread by a variety of common aphid species, and CMV and BCMV can be seedborne.

Timing of Control:
Before planting.

Yield Losses:
Usually minimal.

Regional Differences:
None.

Cultural Control Practices:

Some resistant varieties are available for BCMV. Use of certified, disease-free seed is critical. Elimination of weed hosts, especially in a zone surrounding bean fields, can lessen the risk of infection.

Biological Control Practices:
Natural enemies can keep aphid populations low, thus minimizing spread of these viruses.

Post-Harvest Control Practices:
None.

Chemical Controls:
None available. Controlling virus infections by controlling aphid vectors is not effective.

Weeds

Broadleaf and Grass Weeds (many species)

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) during harvesting.

% Acres Affected:
100%

Pest Life Cycles:
A wide range of annual and perennial weed species is present in snap bean fields in NY. Some of the more common ones include redroot pigweed, common lambsquarters, common ragweed, velvetleaf, several nightshade species, yellow nutsedge, hairy galinsoga, and various annual and perennial grasses.

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

Yield Losses:
Can be as high as 100% in severely affected fields.

Regional Differences:
While weed species spectra can vary regionally, weeds are an important pest in all snap bean growing areas.

Cultural Control Practices:
Rotation may be helpful in controlling problem weeds. Cultivation can be useful in bean weed control. Banding of herbicides at planting is useful in bean production where cultivation is possible.

Biological Control Practices:
None.

Post-Harvest Control Practices:
Application of herbicides and/or tillage after harvest can be useful in controlling perennial weeds.

Other Issues:
Considerable research is being conducted in several areas of snap bean weed control, including the use of cultivation; screening new herbicides for crop tolerance and efficacy; determining efficacy of lower-than-labeled rates of herbicides; efficacy of surfactants; and the effects of crop rotation on weed populations (Bellinder). The NY snap and dry bean industries recently communicated their great need for approval of a Section 18 request for the use of Reflex (fomesafen) as a post-emergence herbicide. This material is extremely effective on most problem weeds, even when used at lower than labeled rates. It plays a critical role in an IPM program. Postemergence as-needed applications can be based on field scouting; application rates are adjustable for weed species and weed growth stage; and fomesafen can be used in combination with bentazon for improved weed control at reduced rates for both materials. Fomesafen was available under Section 18 labels for five years prior to 1998, when the request was not granted. As a result, producers used a significantly greater amount of herbicides in 1998, but had less effective weed control. The 1999 Section 18 request was recently granted.

Chemical Controls (without fomesafen[1]):

Pesticide	% Trt.[1]	Type of Appl.	Typical Rates	Timing	# of Appl.	PHI days	REI hours
EPTC *(Eptam)*	75	broadcast incorporated	3.5 lbs ai/acre	pre-plant	1	50	12

trifluralin *(Treflan)*	82	broadcast incorporated	0.5 lbs ai/acre	pre-plant	1	50	12
metolachlor[2] *(Dual)*	48	preplant incorporated or preemergence	1.5 lb ai/acre	preplant or preemergence	1	50	12
glyphosate *(Round Up)*	<1	ground	l lb ai/acre	Late spring, several weeks before planting snap beans.	1	65	4
sethoxydim *(Poast)*	1	ground	0.28 lbs ai/acre	Postemergence. Applied when grasses are actively growing and not under stress.	1	15	12
quizalofop p-ethyl *(Assure II)*	2	ground, postemerge	0.07 lb ai/acre	Postemerge. Applied when grasses are actively growing and not under stress.	1	15	12
bentazon *(Basagran)*	30	ground	0.5-1 lb ai/acre	postemergence, after beans have one fully expanded trifoliate	1	30	12
pendimethalin *(Prowl)*	14	ground, preplant incorporated	0.825 lb ai/acre	preplant	1	14	12
paraquat *(Gramoxone)*	1	ground	0.625 lbs ai/acre	used in late spring, before crop is planted	1	65	12

1. % acreage treated and typical rates shown here reflect herbicide use when fomesafen is NOT available. Based on herbicide use during years when Reflex WAS labeled under a Section 18 request, the availability of fomesafen would decrease the use of EPTC to 67%, trifluralin to 79%, metolachlor to 39%, bentazon to 20%, and pendimethalin to 8% of crop treated. Fomesafen was used on 40% of the snap bean acreage in 1997.

2. Most acreage in Long Island is treated with metolachlor, but very little with trifluralin or EPTC. Some bentazon and gramoxone

are used, especially when fomesagen is not available.

Use in IPM Programs:
Use of each of these materials is consistent with Cornell IPM recommendations. Post-emergence materials (sethoxydim, quizalofop p-ethyl, and bentazon) 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. EPTC and trifluralin are generally effective on grasses and broadleaves except for nightshades, velvetleaf, galinsoga, ragweed and mustards. EPTC is less effective in cold, wet soils or when heavy rains occur 1-2 days after spraying. The performance of trifluralin is adversely affected under dry soil conditions. Metolachlor controls many grasses, but is weak on some broadleaves such as lambsquarters.
Surface applications work well, provided that rainfall occurs within a few days. Shallow incorporation is necessary under dry conditions, and also reduces risk of crop injury. Sethoxydim and quizalofop p-ethyl are generally effective on annual and perennial grasses. Pendimethalin is effective on velvetleaf, but is best when used in combination with EPTC. It must be incorporated shallowly.

Alternatives:
The availability of fomesafen is a critical need for snap bean producers and processors in New York. Several alternative herbicides, including halosulfuron, chloransulam, flumetsulam, and sulfentrazone, are currently being tested. However, preliminary results indicate problems with crop tolerance, and none of these materials provides adequate control of the most problematic weeds in snap beans.

Contacts

Dr. Robin Bellinder
Weed Scientist
Dept. Fruit and Vegetable Sciences
Cornell University
Ithaca, NY 14853
607-255-7890
rrb3@cornell.edu

Dr. George Abawi

Plant Pathologist
Dept. Plant Pathology
NYSAES
Geneva, NY 14456
315-787-2374
gsa1@cornell.edu

Dr. Helene Dillard
Plant Pathologist
Dept. Plant Pathology
NYSAES
Geneva, NY 14456
315-787-2469
hrd1@cornell.edu

Dr. Steve Reiners
Horticulturist
Dept. Horticulture
NYSAES
Geneva, NY 14456
315-787-2311
sr43@cornell.edu

Dr. Chuck Eckenrode
Entomologist
Dept. Entomology
NYSAES
Geneva, NY 14456
315-787-2345
cje1@cornell.edu

Curt Petzoldt
Vegetable IPM Coordinator
NYS IPM
NYSAES
Geneva, NY 14456
315-787-2206
cp13@cornell.edu

Lee Stivers
Area Extension Specialist

Cornell Cooperative Extension
249 Highland Ave.
Rochester, NY 14620
716-461-1000
ljs14@cornell.edu

Dale Moyer
Cornell Cooperative Extension, Suffolk Co.
246 Griffing Ave
Riverhead, NY 11901
516-727-7850
ddm4@cornell.edu

Profile Prepared By:

Lee Stivers
Cornell Cooperative Extension
249 Highland Ave
Rochester, NY 14620
716-461-1000
email) ljs14@cornell.edu

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7. Members of the New York State Snap Bean Advisory Committee, comprised of producers, processors, consultants, researchers and Extension Educators, provided detailed information on pesticide use and usage patterns in NY snap beans. In addition, they provided perspective on industry needs, and reviewed drafts of this Crop Profile.

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