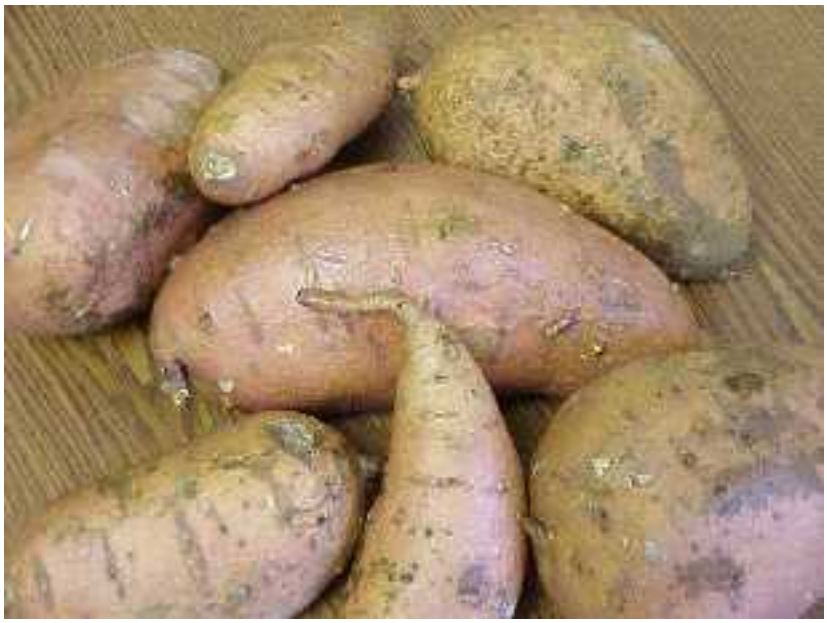
Crop Profile for Sweetpotatoes in Virginia

Prepared June, 2001



General Production Information

- sweetpotato production in Virginia averaged 190 cwt./acre in 1999.
- A total of 9.5 million pounds of sweetpotatoes were produced in Virginia either for the processing or fresh market in 1999.
- The 1999 crop was valued at $1,207,000 or roughly $0.13/lb.
- Sweetpotatoes ranked 8th, accounting for 0.78% of the national sweetpotato production in 1999.

Production Regions:
The majority of the sweetpotato acreage is located on the Eastern Shore of Virginia. However, sweetpotatoes are also produced to a smaller extent in south-central and southeastern Virginia.

Cultural Practices

Sandy loam soils such as *Bojack* and *Munden* are best suited for sweetpotato production in the eastern portions of Virginia. These types of soils allow for more shapely sweetpotatoes and also improve the

ease with which they are harvested. Potatoes grown on clayey soils typically yield higher, but are misshapen and difficult to remove from the ground at harvest. Soil pH should range from 5.6-6.0 with the optimum at 5.8. Fertilizers are generally needed and can be either band applied or broadcast. Nitrogen is recommended at a rate of 40-60 lb./acre at planting and then again at a rate of 10-15 lb./acre as the vines start to run. In addition, phosphorus and potassium are recommended at planting at a rate of 50-200 and 100-300 lb./acre, respectively, depending on soil test results. The amount of potassium required may be split between the planting and layby application although more is typically applied at layby as vines are beginning to increase growth. Other micronutrients such as boron may also be needed depending on soil test results. These are usually applied as needed by the plant (i.e. boron is applied at a rate of 1.0 lb./acre at layby). Land is conventionally tilled to incorporate these fertilizers.

Just prior to sprouting, seed roots are stored at 85° F and 90% relative humidity until the sprouts are 1.0-1.5 inches long. Presprouted sweetpotatoes are then placed in clean soil beds beginning in early April or as weather permits to allow for the growth of transplants. Beds may be covered with floating row covers or clear plastic to prevent frost damage. Once the transplants are approximately 6-8 inches tall, they are cut from the beds by snipping at the soil line, to minimize the transfer of diseased tissue, and planted in 30-36 inch rows. In Virginia this typically occurs mid-May to mid-June, although it may be earlier in the more southern areas of the state. In rows, transplants are cultivated to loosen the soil and for weed control up until layby or when the vines start to spread. The roots are machine dug and hand harvested four to five months after planting. After the roots are dug, they should be cured in the storage house at 80-85°F and 90% relative humidity for six to eight days. Following this period, temperature is lowered to 55°F, with relative humidity at 85%.

sweetpotatoes recommended for production in Virginia include *Beauregard**, *Goldmar*, *Hayman*, *Hernandez*, *Jewel*, and *Yellow* and *Red Jersey* strains. *Beauregard*, *Goldmar*, and *Jewel* are resistant to *Fusarium* wilt and *Goldmar* and *Jewel* are resistant to root knot nematode damage. Additional varieties may be planted in Virginia depending on grower preference and market demand.

*Research has shown that the variety *Beauregard* yields a more uniform crop if no nitrogen is applied before or at transplanting. For maximum production, apply the recommended nitrogen as a sidedressing 3 to 4 weeks after transplanting.

Special Use Labels:
Section 18 Emergency Use Exemptions and Special Local-Need 24(c) labels are used to supplement the chemical tools available to producers for pest control. Once the problem or gap in pest control has been identified specialists submit the proper documentation for the emergency/special label. Thus far, Extension Specialists have been successful in obtaining these labels, which must be applied for annually and are usually only valid for limited time intervals. Given the temporary nature of the emergency/ special labels, compounds labeled in this manner were not included in chemical pest sections found below. Local extension offices will usually have the most current emergency/special label information. Without these, pest control in sweetpotatoes as well as other vegetable crops would be extremely difficult for producers.

Insect Pests

Insect descriptions found below were modified from information presented on the Virginia Tech Insect ID website. Control recommendations found below were modified from information presented in the 2000 Commercial Vegetable Production Recommendations--Virginia.

Both foliage-feeding and soil-dwelling insects damage sweetpotatoes in Virginia. Foliage-feeding pests can reduce plant yield indirectly, but densities are typically not high enough to cause problems. In contrast, soil-dwelling pests, which feed directly on the developing roots cause greater losses than from weeds and diseases combined. Generally this is due to the difficulty involved in controlling soil-dwelling insects for the entire season. At present, the insecticides listed below provide the only practical and economical tactic for controlling soil insects.

Cucumber Beetles

Spotted Cucumber Beetle, ***Diabrotica undecimpunctata howardi***
Striped Cucumber Beetle, ***Acalymma vittata***

Both the spotted and striped cucumber beetles cause damage to sweetpotato in Virginia. The adults feed primarily on the foliage causing irregularly shaped holes, but this feeding rarely results in economic loss. However, the larval stage, otherwise known as the rootworm, feeds directly on the roots rendering them commercially unmarketable.

Monitoring: Currently no thresholds are available for cucumber beetles in Virginia.

Chemical Control: See *Chemical Insect Control* section.

Biological Control: No current recommendations for commercial production.

Cultural Control: Spring cultivation of fields will help expose larvae to predation and may remove alternate food sources that will discourage their presence and hence egg-laying.

Cutworms

Black cutworm, ***Agrotis ipsilon***
Variegated cutworm, ***Peridroma saucia***
Granulate cutworm, ***Feltia subterranea***

Cutworm larvae are dull gray, brown, or black, and may be striped or spotted. Another distinguishing quality is their act of rolling into a tight C-shape if disturbed. Most cutworms are night feeders that hide under plant and soil debris common in weedy or minimum-tillage fields. Newly hatched larvae feed on young plants at the soil line; possibly severing the stems. Later generations of cutworms feed on developing roots and in severe cases may tunnel completely through the roots, greatly diminishing the plants' productivity. Direct feeding on tubers which are hallow rooted or which push above the soil line will result in reduced marketability.

Monitoring: Cutworms are not typically seen in the open during the day, however, digging the soil around injured plants may reveal their presence. If cutworms are actively cutting plants, a postplanting contact treatment may be used.

Chemical Control: See *Chemical Insect Control*.

Biological Control: No current recommendations for commercial production.

Cultural Control: No current recommendations for commercial production.

Flea Beetles
Chaetocnema confinus, Systena spp., and *Phyllotreta* spp.

Several species of flea beetle attack sweetpotato plants in Virginia and can greatly damage young transplants and directly injure roots. Adults typically feed on foliage, whereas larvae feed directly on the fibrous roots generating many narrow tunnels and reducing marketable yield. Flea beetles are typically black, brown, or striped in appearance, active on the plants and will quickly hop away when disturbed. Flea beetles over-winter as adults in protected areas and emerge in the spring to lay eggs in the soil at the base of the sweetpotato plant. Several generations occur each year in Virginia.

Monitoring: Currently no thresholds are available for flea beetles in Virginia.

Chemical Control: See *Chemical Insect Control*.

Biological Control: No current recommendations for commercial production.

Cultural Control: Plowing under weed and crop debris following harvest may help to disturb the flea beetle life cycle.

Tortoise Beetles, Various Species

Tortoise beetles feed on the foliage of sweetpotato and in severe cases can greatly reduce plant

productivity. A distinguishing feature of this beetle is its turtle-shaped body, which is somewhat shell-like in appearance. Adults become active in the spring, moving from drying weeds onto growing sweetpotato plants. There are several different species and several generations per year in Virginia.

Monitoring: Currently no thresholds are available for tortoise beetles in Virginia.

Chemical Control: See *Chemical Insect Control*.

Biological Control: No current recommendations for commercial production.

Cultural Control: No current recommendations for commercial production.

White Grubs, *Phyllophaga* spp.

White grub damage is similar to that caused by cutworms, although not usually as deep. Often large, broad, shallow feeding trails result from grub feeding, greatly reducing crop value and marketability. Larval presence is typically most severe in fields planted into reclaimed pasture or other grassy areas. Adult white grubs (Japanese beetles or June Bugs) are generally active in the spring and early summer. Female beetles lay their eggs on bare ground; larvae hatch in the fall and over-winter in the soil. Depending on the species present, a generation may take from one to three years to complete.

Monitoring: Currently no thresholds are available for white grubs in Virginia.

Chemical Control: Soil insecticides that are applied for wireworm control may also be effective in reducing grub populations. See *Chemical Insect Control*.

Biological Control: No current recommendations for commercial production.

Cultural Control: Spring cultivation will help disturb grub feeding and may also expose them to predation. Areas that were recently in sod or that were previously infested with these insects should be avoided.

Wireworms, *Conoderus vespertinus* and *Melanotus communis*

Two species of wireworm infest sweetpotatoes in Virginia. These pests reduce the economic value of the sweetpotatoes by tunneling into the roots. Wireworm adults, otherwise known as click beetles, lay their eggs in the soil during late-July and early-August. In Virginia, there are multiple generations of some wireworm species making the timing of controls even more difficult.

Monitoring: There are two methods for monitoring wireworm populations prior to planting. The first involves randomly placing 1 bait station per acre throughout the field 2-3 weeks before planting. In this

case, bait consisting of 1 cup of untreated wheat and 1 cup of untreated, shelled corn should be buried 4 inches deep and covered with ground. An additional 18-inch square piece of black plastic should be placed over the ground covering the station to warm the soil and speed germination, which entices the wireworms. At the end of 10-14 days, the stations should be dug up and the number of wireworms counted. The second method can be employed if the soil temperature at the 6-inch depth ranges between 45° and 85°F and the soil moisture is equivalent to that desired for planting. If these conditions are present, soil samples from 20 scattered sites per acre can be collected representing a profile 12 inches deep and 6 inches in diameter. These samples should be sifted to determine the number of wireworms. If an average of one wireworm per bait station (method 1) or 5 or more wireworms in 20 soil samples (method 2) are found, a labeled soil insecticide should be applied. If areas of high activity are found within the field, these might be spot treated.

Another type of monitoring involving blacklight traps is also used to help properly time foliar insecticide applications. When flight activity of the click beetle, *Conoderus vespertinus*, increases in the blacklight trap (July and August), a weekly insecticide treatment regimen should be followed until activity ceases.

Chemical Control: A preplant soil insecticide will provide control of wireworm larvae, but additional foliar treatments during July and August will be necessary for adult (click beetle) control. See *Chemical Insect Control*.

Biological Control: No current recommendations for commercial production.

Cultural Control: Spring cultivation will help disturb the wireworm lifecycle. Areas that were recently in sod or that were previously infested with wireworms should be avoided.

Chemical Insect Control

The list below contains all of the products available to producers for insect control in sweetpotatoes. Use estimates are also included based on anecdotal data.

- **carbaryl (**Sevin 80S**)*-**PHI-14 days. Carbamate. Applied at a rate of 1.0-1.2 lbs. a.i./acre for control of adult flea beetles; up to 2.0 lbs. a.i./acre can be used for tortoise and cucumber beetles. Sevin Bait (5%) applied at a rate of 20-40 lbs./acre may help control cutworms. An average of 3 applications of carbaryl are used to treat sweetpotatoes for insect control per growing season in Virginia. It is estimated that this practice is carried out on 90% of the acreage. REI-12 hours.
- **chlorpyrifos (**Lorsban 4E**)-**Organophosphate. Apply just before transplanting at a rate of 2.0 lbs. a.i./acre and incorporate into the top 4 to 6 inches of soil for control of wireworms, flea beetle larvae and grubs. Almost all of the land for sweetpotato production is treated for wireworms prior to planting. Chlorpyrifos usage generally accounts for 80% of this treatment while ethoprop is used on the other 20%. REI-24 hours.
- **diazinon (**Diazinon**)-**PHI-14 days. Apply at a rate of 3.0-4.0 lbs. a.i./acre for control of wireworms. Not generally used by producers, in light of other more efficacious alternatives. REI-

24 hours.

- **endosulfan (**Thiodan 3EC**)***-PHI-0 days. Pyrethroid. Apply at a rate of 0.50 lbs. a.i./acre for control of adult flea beetles. Do not feed *Thiodan*-treated potatoes to livestock and do not exceed a maximum of 3.0 lbs./a.i. per acre per year. Not generally used by producers, in light of other more efficacious alternatives. REI-48 hours.
- **ethoprop (**Mocap 6EC**)**-Organophosphate insecticide. Apply as a preplant treatment in a 12- to 15-inch band or broadcast at a rate of 3.0-4.0 lbs. a.i./acre. Following application, incorporate into the top 4 inches of soil for control of wireworms, flea beetle larvae, and grubs. As reported above, ethoprop accounts for approximately 20% of the insecticide usage for wireworm control. Given that this chemical also has nematicidal activity, it is often used in fields where nematodes are also a problem. REI-24, 48 hours.

*Mid-summer foliar sprays may aid in wireworm control by killing the egg-laying adults or click beetles.

Diseases

Control recommendations were taken from the 2000 Commercial Vegetable Production Recommendations--Virginia.

Diseases affect sweetpotatoes within the field but are also a problem during storage and handling of the harvested crop. Each of the diseases listed below occur within Virginia depending primarily on weather conditions but also on a number of other factors such as field location, history of incidence, soil pH, etc. Good sanitation and management practices are key to a successful disease control program.

Black Rot, *Certocystis fimbriata*

Black rot, as the name suggests, appears as black, circular spots that are sunken and often cover more than half of the sweetpotato surface. Black rot can cause severe yield losses in the seedbed, the field and in storage. Once in storage, black rot can spread very quickly from infected to healthy potatoes. Affected potatoes have a bitter taste when cooked. Drainage water, machinery, and diseased roots that are discarded in the field can cause disease spread.

Monitoring: No thresholds have been established for black rot in sweetpotatoes.

Chemical Control: Just prior to bedding, seed roots can be dipped in *Mertect 340F* and planted immediately.

Biological Control: No commercially effective controls are available.

Cultural Control: Good sanitation and management practices are critical in the control of black rot. Whenever possible, use sprouts that have been cut off above the soil line for transplanting. This practice will stop the spread of black rot from infected roots. Avoid applying fertilizer after July 1, bruising the roots during harvest, and also low temperatures and relative humidity during curing. Crop rotations of at least two years may provide additional control of all field diseases.

Fusarium Wilt, *Fusarium* spp.

Field infestations by *Fusarium* spp. will cause sweetpotato vines to wilt and die. First appearing as discoloration on young leaves, *Fusarium* growth will result in darkening of the interior of the stems and ultimately in death. This disease may be spread by runoff, machinery, and/or diseased roots, which have been discarded in the field.

Monitoring: No thresholds have been established for *Fusarium* wilt in sweetpotatoes.

Chemical Control: No adequate chemical controls are labeled for use on sweetpotatoes.

Biological Control: No commercially effective controls are available.

Cultural Control: *Fusarium* wilt resistant varieties are available and should be used in areas with high occurrences of this disease.

Scurf, *Monilochaetes infuscans*

Scurf is mainly a storage disease. Infected roots appear dry and shriveled, particularly under storage conditions. Scurf is spread when infected potatoes come in contact with healthy ones. The disease is particularly damaging in years with higher than average rainfall.

Monitoring: No thresholds have been established for scurf in sweetpotatoes.

Chemical Control: Just prior to bedding, seed roots can be dipped in *Mertect 340F* and planted immediately.

Biological Control: No commercially effective controls are available.

Cultural Control: Good sanitation and management practices are critical in the control of scurf. Whenever possible, use sprouts that have been cut off above the soil line for transplanting. This practice will stop the spread of scurf from infected roots. To reduce the likelihood of this disease, avoid applying fertilizer after July 1, bruising the roots during harvest and also low temperatures and relative humidity during curing. Crop rotations of at least two years may provide additional control of ALL field diseases.

Soft Rot, *Rhizopus stolonifer*

Soft rot caused by the fungi, *Rhizopus stolonifer*, is a destructive storage disease. Infection begins in wounds and progresses rapidly resulting in soft, watery, and sunken portions of the potato. Spread may occur rapidly between infected and healthy roots and is often facilitated by insects, rodents or air currents in the storage house. Additional handling of the roots may also bring about the formation of soft rot.

Monitoring: No thresholds have been established for soft rot in sweetpotatoes.

Chemical Control: *Botran 75WP* can be used at harvest and also during bedding (see Chemical Disease Control section below).

Biological Control: No commercially effective controls are available.

Cultural Control: Good sanitation practices and limited handling are necessary to properly manage soft rot in stored sweetpotatoes.

Soil Rot, *Streptomyces ipomoea*

Soil rot caused by *Streptomyces ipomoea* is also referred to as pox resulting from the black spots, which occur on the feeder roots and underground portions of the stem. Lowered yield and root quality are more severe during dry weather and on poor soils. Like black rot, this disease can be spread by drainage water, machinery, and diseased roots that have been discarded in the field.

Monitoring: No thresholds have been established for soil rot in sweetpotatoes.

Chemical Control: No adequate chemical controls are labeled for use on sweetpotatoes.

Biological Control: No commercially effective controls are available.

Cultural Control: Crop rotation, clean seed roots and clean beds will help control soil rot. Also, maintaining a low pH of 4.8-5.2 will deter fungal growth.

Chemical Disease Control

Few fungicides are labeled for use on sweetpotatoes and these are used mainly as pre-plant/post-harvest dips rather than in-field foliar applications. Disease control is best handled from a preventative standpoint and most often involves good sanitation and management practices.

- **dicloran (**Botran 75WP**)**-Dicloran can be used during bedding at a rate of 0.75 lb. a.i./acre in 100

gallons of treating solution. Roots should be dipped for 10-15 seconds prior to planting. Dicloran can also be used at harvest at the same rate to prevent soft rot. Spray seed-stock potatoes and tables after cleaning and before packaging. REI-12 hours.

- **thiobendazole (**Mertect 340F**)**-During bedding, dip seed roots in a suspension containing thiobendazole and water (see label for amounts) and plant immediately for control of black rot and scurf. Do not treat potatoes after cutting. REI-12 hours.

Nematodes

Control recommendations were taken from 2000 Commercial Vegetable Production Recommendations--Virginia.

Root knot (*Meloidogyne hapla*) and lesion (*Pratylenchus penetrans*) are the two most common species of nematodes affecting sweetpotatoes within Virginia.

Monitoring: Both diagnostic and predictive nematode assay programs in Virginia provide data to producers on the numbers and kinds of nematodes in soil along with recommendations for control. Soil samples for diagnostic assays are processed without charge to determine the cause of production problems during the growing season. Predictive nematode assays are done on samples collected after harvest. These samples are processed at a cost of $11 per sample, and must be collected in the fall no later than November 20.

Chemical Control: See *Chemical Nematode Control* section below.

Biological Control: No commercially effective controls are available.

Cultural Control: Sanitation and good cultural practices are the best preventative measures against nematodes. Examples include obtaining nematode-free roots and washing soil from machinery and tools before using them at different locations. Crop rotation with non-host crops to lower their population size is highly recommended in the event of nematode activity.

Chemical Nematode Control

Several chemicals are currently available for nematode control, although this may change in the next few years. Currently the soil fumigants chloropicrin, dichloropropene (Telone C-17), metam sodium (Busan), (Nemasol), (Vapam HL), and methyl bromide (Terr-O-Gas 67) (MC-33) are recommended for use in Virginia. In addition, the nematicides aldicarb (Temik 15G), ethoprop (Mocap 10G or 6EC) and oxamyl (Vydate L) are also recommended. Of the possible chemical controls, producers in Virginia chose *Mocap* most often when dealing with problem areas. Typically, chemical controls are used only

when cultural practices are unable to provide adequate control. However, these chemicals are still important tools when other methods of control have failed.

Weeds

Control recommendations were taken from 2000 Commercial Vegetable Production Recommendations--Virginia.

The few herbicides currently labeled for weed control in sweetpotatoes work on annual grasses and certain broadleaf weeds. However, producers in Virginia are faced with a multitude of additional broadleaf weed problems including cocklebur, common lambsquarters, morningglory, smooth pigweed, and yellow nutsedge. Special Use Labels, such as those discussed in an earlier section have been extremely important tools for producers in Virginia. During the past several seasons, for example, a Special Local Needs Label 24(c) was approved for the herbicide commonly known as *Command 4EC*. *Command 4EC* (clomazone) was used on 90% of the sweetpotato acreage for preemergence control of annual grasses and many annual broadleaf weeds. Without these special labels, adequate weed control would be difficult. Other control options include hand pulling or cultivation early in the season. If not controlled, weeds greatly reduce root quality and may interfere with the harvest.

Monitoring: Proper weed identification is an important part of effective weed control. Weeds observed in previous crops within a given field should be noted to aid in future herbicide decisions.

Chemical Control: See *Chemical Weed Control* section below.

Biological Control: No commercially effective controls are available.

Cultural Control: Cultivation may be used to control weeds during early stages of growth. Also, avoiding fields with a history of severe weed infestations may be an appropriate action.

Chemical Weed Control*

The list below contains all of the fully labeled products available to producers for weed control in sweetpotatoes. Use estimates are also included based on anecdotal data.

- **fluazifop (**Fusilade DX 2E**)**-PHI-55 days. Apply at a rate of 0.125-0.188 lb. a.i./acre for postemergence control of annual grasses and certain perennial grasses (repeated applications). Do not apply more than 1.50 lb. a.i./acre per season. Do not plant corn, sorghum, cereals, or any other grass crop within 60 days of the last application. Fluazifop does not usually an adequate level of control and was therefore only used on less than 5% of the sweetpotato acreage during

the 2000 growing season in Virginia. REI-12 hours.

- **napropamide (**Devrinol 50 DF**)**-Apply at a rate of 1.00-2.00 lb. a.i./acre after transplanting, but before weed emergence to control annual grasses and certain annual broadleaf weeds. Application must be irrigated or cultivated within 24 hours. Use may reduce the stand and yield of fall planted small grains. Moldboard plowing will reduce the injury to small grain cover crops. Napropamide was used on an estimated 90-95% of the sweetpotato acreage during the 2000 growing season. Clomazone is often applied in conjunction with this product to provide improved weed control. REI-12 hours.
- **sethoxydim (**Poast**)**-PHI-30 days. Postemergence herbicide used at a rate of 0.20-0.50 lbs. a.i./ acre for control of annual grasses and certain perennial grasses. Repeat applications may be necessary for additional control of tough perennial grasses. Do not apply more than 0.94 lb. a.i./ acre in one season. Most growers receive adequate weed control with the products applied at planting (napropamide and clomazone) and typically use this product in problem areas. An estimated 15-20% of the sweetpotato acres were treated with sethoxydim during the 2000 season. REI-12 hours.

*Section 18 Emergency Use Exemptions and 24(c) Special Local-Need label requests may be submitted to supplement the list above.

On-line Resources

C&P Press Online Crop Protection Reference
http://www.greenbook.net/free.asp

Crop-Net Crop Protection Website
http://www.crop-net.com/index.html

Insects and Related Pests of Vegetables
http://ipmwww.ncsu.edu/AG295/html

Pests of Vegetables and Fruit Trees
http://everest.ento.vt.edu/~idlab/vegpests/vegfact.html

Virginia Tech Pesticide Programs
http://www.vtpp.ext.vt.edu

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Virginia Potato & Vegetable Growers Association
Numerous members - circulated to association for review.