Crop Profile for Potatoes in Missouri

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General Production Information

- Missouri produces 0.38% (rank 21st) of the United States potato crop.
- In 2000, 1.83 million hundredweight of potatoes, valued at $9.8 million was produced on approximately 6,200 acres. The 5-year average production was1.72 million hundredweight valued at $9.2 million/year.
- Variable production costs are estimated at $1,013 per acre, and pest management costs exceed $170 per acre.
- Approximately 96% of the potatoes produced in Missouri are chippers. The remainder is marketed and sold locally.

Production Regions

Potato production in Missouri occurs primarily in two regions: southeast and northwest Missouri. The most concentrated acreage of potato production occurs in southeast Missouri in the "Bootheel" region. There are ten commercial potato growers in Missouri. Average production acreage is 609 acres. In 2000, the smallest grower produced 40 acres of fresh market potatoes which yielded 110 hundredweight per acre, whereas the largest grower produced 1,850 acres of chippers which yielded 260 hundredweight per acre. Maximum reported yields were 365 hundredweight per acre. Average statewide yields are 287 hundredweight per acre.

Cultural Practices

In Missouri, potatoes can be grown in a wide range of soil types, but the silt and sandy loam soils located in the Mississippi and Missouri river bottoms are preferred. Gumbo soils are avoided for potato production. Optimal production is achieved in soils that are deep (2 to 3 feet or more), light textured (sandy loams to silt loams), well-drained and at pHs between 6.0 to 6.5. Potatoes are planted on ridges

spaced 36 in.

Depending upon soil type, 75-150 lb/A of nitrogen is added each year with the amount of potassium and phosphorus added based on a Spring soil test. Seed potatoes are purchased from Wisconsin and are certified free of virus and bacterial diseases. Prior to planting, seed pieces are cut, cured, and then warmed several days before planting to aid rapid emergence of the sprout. Some growers do not use seed treatment fungicides and insecticides on seed pieces, but most apply Tops and Furbark. No biological seed treatments are used. Planting starts in March in Southeast Missouri and may be as late as May 1st in Northwestern Missouri.

Fields are cultivated and plants hilled as soon as the potato plants are established. Fields receive two cultivations (a.k.a. "drag off") within 28 days after planting in order to draw soil and fertilizer over the planted seed pieces. Weed control is a subsidiary benefit of these cultivations. Fields are scouted weekly throughout the season by the grower of a crop consultant. Most growers have not had problems with pest resistance in general, however the emergence of mating type A2 of the late blight pathogen has effectively eliminated the use of metalaxyl fungicide for late blight control. Now growers rotate mancozeb, chlorothalonil and azoxystrobin to combat fungicide resistance. Some growers also use pheromone traps and black light systems to detect early infestations of key insect pests. Use of such "low risk" pesticides such as azoxystrobin and imidacloprid is increasing among Missouri's potato growers. Growers, however, were near unanimous in their desire for a re-registration of the aldicarb label on potatoes in Missouri. Before harvest, potato vines are killed (usually chemically) to improve storage quality and prevent disease problems. Potatoes are harvested when the potatoes are mature and the vines dead.

The most limiting factors affecting potato production in Missouri are not pest-related but climate-related. Suitable soil types, access to markets, and processing facilities limit production capacity and acreage.

Pesticide Use in 2000

In 2000, Missouri's commercial potato growers representing 88% of the state's 6,200 acres reported that 100% of their acres were treated at least once with a fungicide, insecticide and herbicide, and 46% of the acres were treated with the nematicide Telone II. A total of 47,067 lbs a.i. of fungicides were applied an average 6.2 times per season for control of early and late blight. Mancozeb, chlorothalonil and azoxystrobin were applied to 56%, 32% and 11%, of the treated acres, respectively. A total of 32,461 lbs a.i. of mancozeb, 14,139 lbs a.i. of chlorothalonil, and 451 lbs a.i. of azoxystrobin were applied to the 6,200 acres. A total of 17,107 lbs a.i. of herbicides were applied an average 3.06 times per season for control of broadleaf and annual weeds. Metribuzin and metalochor were applied to 49% and 46% of treated acres, respectively. A total of 4,722 lbs a.i. insecticides were applied an average 3.22 times per season for control of potato leafhopper, Colorado potato beetle and aphids. Esfenvalerate, cyfluthrin and

oxamyl were applied to 34%, 32%, and 22% of the treated acres, respectively. A total of 271,558 lbs a.i. of dichloropropene was applied preplant to control root-knot nematode.

Insect Pests

Three key insect pest complexes cause economic losses in potato unless populations are kept below economic injury levels. Missouri growers apply an average 3.2 insecticide applications per season to control these key and secondary insect pests.

I. Potato leafhopper (*Empoasca fabae*)

The adult leafhopper is vivid lime green to yellow green, somewhat wedge-shaped, and about 3 mm long with tiny white spots on its head and pronotum. They are very mobile and readily fly. The potato leafhopper does not overwinter in the Midwest, but is blown up on winds from the Gulf States in the spring. Eggs are laid by singly insertion into stems or large leaf veins and hatch in 7-10 days. Development to the adult stage takes 2-3 weeks. Injury to the potato plant occurs when the adults and more importantly the nymphs feed and damage the conductive tissues. Margins of the leaf beyond the point of feeding turn yellow and roll. Eventually the entire leaf will turn brown and die, causing the characteristic damage known as hopperburn.

2. Colorado potato beetle (*Leptinotarsa decimlineata*)

The adult beetle has a thick oval body with black and yellow stripes running lengthwise along the wing covers. The beetle overwinters in the soil usually in field borders or woody areas. They emerge in May, about the time that newly planted potatoes come through the ground. After mating the females lay their orange-yellow eggs in clusters on the underside of the potato leaf. The eggs hatch in a few days and the dark red larvae emerge. The larvae feed on the potato leaves and turn more orange colored as they develop. There are two rows of large black dots on both sides of larvae. When mature they leave the plant, enter the soil, pupate and emerge as adults several days later. These adults feed much more than the overwintered adults and can do extensive foliar damage. There are usually 1-2 generations of Colorado potato beetles each year.

Secondary Insect Pests

Aphids (*Myzus persicae* and *Macrosiphum euphoreiae*)

Two types of aphids can cause problems on potatoes, the green peach aphid and the potato aphid. Aphids can injure potato plants by sap feeding, however population density must be high to affect yield. Aphids can also transmit viruses while they feed. The virus will not affect yields the season it is transmitted but can severely limit production in subsequent crops. The green peach aphid has an egg-shaped creamy white to light peach body. They have very short generation times and reproduce quickly so many overlapping generations occur each year. The potato aphid has a longer body and range from green to pink in color. They are much bigger than the green peach aphid and very mobile when disturbed. The potato aphid has a short generation time and gives rise to many offspring, so large populations can develop quickly.

Potato Flea Beetle (*Epitrix cucumeris*)

The potato flea beetles overwinter as adults in the soil where they matured. They emerge in the spring and begin feeding on the new growth of the young potato plants. The adults are small, black to dark brown beetles with hind legs designed for jumping. The females lay their tiny white eggs in the soil near the base of the plant. The eggs hatch in 7-14 days and the slender white larvae then feed on root hairs, seed pieces and developing tubers for 2-3 weeks. Pupation occurs in 11-13 days followed by the emergence of the new adults usually in July. If the population is large the second generation of flea beetles can cause economic damage to potato tubers. The potato flea beetles feeding injury gives a plant a shotgun blast appearance. Severely damaged leaves may not recover. Feeding damage to tubers by larvae can reduce their quality.

Integrated Pest Management Strategies

Insect Pest Management

Insect pests in potatoes are managed primarily through suppression strategies. Crop rotations, tillage, pheromones and scouting are additional integral insect management strategies used to manage insect pests.

Prevention Strategy

The planting of insect-free transplants and field sanitation practices that remove alternate hosts and reduce overwintering sites are practiced on 100% of the acres.

Avoidance Strategy

No avoidance tactics are used to control insect pests in Missouri potatoes.

Monitoring Strategy

Pheromone traps and black light monitoring are used by some Missouri growers.

Mating disruption: No insect pests are managed through mating disruption in Missouri potato fields.

Suppression Strategy

One hundred percent of the potato acreage is treated an average 3.22 times to control key insect pests on potatoes. The pyrethroid insecticides are the primary insecticides used to control potato leafhopper, Colorado potato beetle, and aphids on about 70% of treated acres. Oxamyl and phorate are the two organophosphate insecticides used on about 25% of treated acres. Dimethoate and imidacloprid are used on less than 5% of acreage. Missouri potato growers are not experiencing any insect resistance problems at this time. Most growers have found insect pest management more costly and management intensive since the registration for aldicarb was withdrawn in the early 1990s. They have expressed a desire to have the aldicarb label re-instated in Missouri.

Chemical Controls:

Esfenvalerate (Asana XL 0.66EC) is applied on approximately 34% of the acres for control of potato leafhopper, aphids. It is applied at the average rate of 0.03 lbs a.i. per acre with a typical PHI of 7 days.

Cyfluthrin (Baythroid 2EC) is applied on approximately 32% of the acreage for control of potato leafhopper, Colorado potato beetle and aphids. It is applied at an average rate of 0.03 lbs a.i. per acre.

Oxamyl (Vydate C-LV3.77 lbs) is applied on approximately 22% of the acres for control of Colorado potato beetle. It is applied at the rate of 0.62 lb a.i. per acre with the labeled PHI of 7 days observed.

Imidacloprid (Provado 1.6F, Admire 2F) is applied on approximately 2.5% of treated acres for control of Colorado potato beetle. It is applied at the rate of 0.05 lb a.i. per acre with the labeled PHI of 7 days observed.

Diseases

Early and late blight are the primary economically limiting diseases of potatoes for Missouri growers.

Missouri growers apply an average 6.2 fungicide applications per season to control these two foliar diseases. Approximately one-half of the potato acreage in Missouri is treated with a nematicide to control root-knot nematode.

Early Blight (*Alternaria solani*) The fungus overwinters in dead vines and leaves where it can persist for at least one year. Infection on leaves first appears as dark brown spots with dark concentric rings. Stem infections first appear as small brown spots. The spots increase in size and can cause the leaf to die prematurely resulting in substantial defoliation. Early blight occurs under a wide variety of weather conditions. It is promoted by heavy dews and rainfall and is severe on unhealthy plants, particularly those with insufficient nitrogen.

Late Blight (*Phytophthora infestans*) The fungus will over-winter in infected tubers, in cull piles and can be introduced in infected seed tubers. Under cool, damp conditions the fungus first infects leaves and stems. If moist conditions persist, the fungus forms a whitish mold on the underside of leaves and on infected stems. Late blight will spread rapidly if left unchecked, killing plants within a week or so. Fungal spores can be washed into the soil and infect tubers, causing them to rot in the field or in storage.

Root-knot nematode (*Meloidogyne incognita*) While there are several different genera of plant parasitic nematodes found in the major potato production areas of the state, the most notable of these nematodes, root knot nematode affects potato growers in Southeast Missouri. Potatoes in Northwest Missouri are unaffected by this nematode pest because it cannot survive frozen winter soil conditions.

Disease Management

Although it may appear that Missouri potato growers rely almost exclusively on suppression strategies (e.g. fungicides) for disease management, prevention and avoidance strategies are essential to insure fungicide efficacy and minimize the number of applications.

Prevention Strategy

Missouri growers recognize that field sanitation plays a role in the management of late blight. Growers practice deep tillage, vine dessication, and cull pile burial and crop rotation for late blight management.

Avoidance Strategy

Disease resistant varieties to late blight and scab are used where practicable.

Monitoring Strategy

The use of disease forecasting systems is not practiced in Missouri.

Suppression Strategy

One hundred percent of the potato acreage is treated an average 6.2 times to control key diseases on potatoes. The EBDC fungicide mancozeb is the primary fungicide used to control potato leafhopper, Colorado potato beetle, and aphids on about 56% of treated acres. Chlorothalonil is used on about 25% of treated acres. Missouri potato growers are not experiencing any disease resistance problems at this time.

Chemical controls:

Mancozeb (Dithane, Manzate, Penncozeb DF, and Manzate 200 and Dithane M-45 80WP) is applied to 56% of treated acres at an average rate of 1.52 lbs a.i. per acre. Mancozeb has a 24 hr REI and a 14 day PHI.

Chlorothalonil (Bravo and Echo 720F, Terranil 90DF, Bravo ZN) is applied to 32% of treated acres at the average rate of 1.17 lbs. a.i. per acre. Chlorothalonil has a 48 hr REI and a 7 day PHI.

Azoxystrobin (Quadris SC2.08) is applied to 11% of treated acres at an average rate of 0.11 lbs a.i. per acre. Azoxystrobin has a 14 day PHI.

Weeds

Several key weed pests cause economic losses in potato unless populations are kept below economic injury levels. Missouri growers apply an average 3.06 herbicide applications per season to suppress weeds. Because potatoes primarily are grown in rotation with soybean, corn and cotton, the key weeds in these production systems are the same weeds found in potato. Johnsongrass and yellow nutsedge present additional management concerns in potato in addition to the broadleaf (cocklebur, waterhemp, pigweed, etc.) and grass (foxtails, panicum, crabgrass, baryardgrass, etc.) commonly found in other annual cropping systems.

Weed Management Strategies

Crop rotation, cultivation and herbicides are the three main strategies growers use to control weeds in potatoes.

Prevention Strategy

Pre-plant tillage provides control of winter annual and other emerged weeds. Most weed germination occurs during the first four weeks after potato planting.

Avoidance Strategy

Crop rotation is the important avoidance tactic used in weed management.

Monitoring Strategy

Less than 3% of the potato acreage is treated with post-emergence herbicides. Growers rely primarily on prophylactic soil-applied applications based on historical weed infestations rather than in-season weed monitoring.

Suppression Strategy

In Missouri, 100% of potato fields are treated with herbicides to suppress weed competition. Each acre receives an average 3.06 herbicide applications. Growers rely almost exclusively on two herbicides for season-long suppression of annual grasses and broadleaf weeds.

Chemical controls:

Metribuzin (Turbo 8EC, Lexone DF) is applied to 49% of acres by ground at rates of 0.31-0.36 lbs a.i. per acre.

Metolachlor (Dual II, Turbo 8EC) is applied to 46% acres by ground at rates of 1.46 - 1.61 lb. a.i. per acre.

Pendimethalin, glyphosate, sethoxydim and **paraquat** are applied to less than 3% of the treated acres.

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