DEPARTMENT OF AGRICULTURE

Status of Invasive Threats to Field Crops in Minnesota

Plant Protection Division

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Background

A number of emerging and invasive insects, plant pathogens, and weeds threaten commodities in Minnesota. These pests have the potential to cause problems for production and export if they were to become established here. The Minnesota Department of Agriculture (MDA), along with partners at the United States Department of Agriculture (USDA) and the University of Minnesota (U of M), conduct an annual review of invasive pests that pose the greatest threat to crops in Minnesota. Many of these pests have not been found in Minnesota and others are present but are not widely established. Survey efforts are designed to detect these organisms as early as possible by targeting high-risk areas. Many pests are likely to be unintentionally brought into Minnesota on items moved by people, so monitoring is conducted in or near urban areas. There are also many pests that could affect commodity crops because they can move great distances without assistance, so monitoring is also conducted in agricultural production areas away from potential urban pest introduction points.

Corn, Small Grains, and Soybeans

The MDA monitored corn, small grains, and soybean fields in 2019 for several invasive pests that are currently not known to occur in Minnesota or have limited distributions within the state. This survey was jointly funded by the USDA Animal and Plant Health Inspection Service (APHIS), Plant Protection Quarantine Program (PPQ), and the MDA.

Visual Survey

Plants were visually inspected for the presence of target pests. Fields were objectively selected for survey, but an effort was made to space out sampled fields within counties (Figure 1). Small grain fields were visually surveyed in May and June, and corn and soybean fields were visually surveyed July through August. Table 1 shows the number of counties and fields visually surveyed for each of the three agricultural commodities.

Table 1. Commodity Visual Survey

Crop	# Counties	# Fields Visually Surveyed
Corn	47	451
Small Grains	26	87
Soybeans	26	203

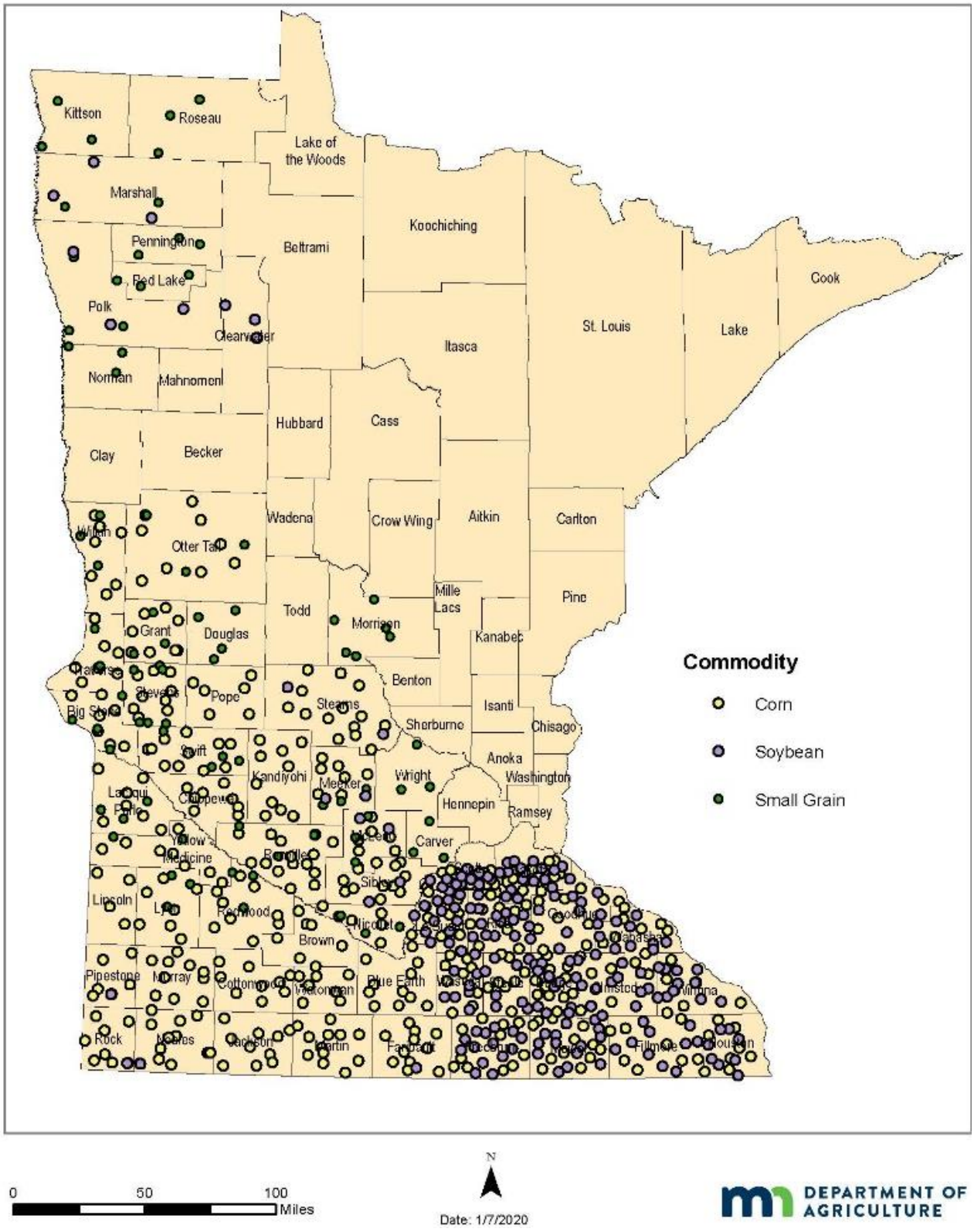

Figure 1. Locations of corn, small grains, and soybean fields visually surveyed in 2019.

Insect Visual Survey

In 2019, corn and soybean fields visually scouted for insects. Within each soybean field, a common protocol was followed for the target insect pests listed in Table 2. Four sets of 25 sweeps were made in separate areas of each field. Each set of 25 sweeps was separated from the other by at least 50 meters. Two sets of sweeps were made near the edge of the field (within 5-50 meters of field edge) and two sets of sweeps were made in the interior of the field (greater than 50 meters from the field edge). For corn, a random visual survey was conducted at four points in a field. Table 2 lists the counties the visual survey target pests were detected.

Figure 2. Adult brown marmorated stink bugs are approximately 1/2 inch long.

Figure 3. Soybean gall midge larvae.

Beginning in mid-July, survey in soybeans concentrated on the soybean gall midge which was found in southwestern Minnesota (Figure 3). Figure 4 shows where the survey was conducted. This emerging soybean pest has been found in 14 Minnesota counties (Bigstone, Chippewa, Cottonwood, Faribault, Jackson, Lac Qui Parle, Lincoln, Lyon, Murray, Nobles, Pipestone, Redwood, Rock, and Yellow Medicine) as of October 1, 2019. The University of Minnesota was the first to make a discovery of this insect pest. The MDA's survey found this midge in two counties (Table 2). The orange colored larvae can be found at the base of the plant causing the plant to look drought stressed and susceptible to wind break. Infestations of soybean gall midge generally begin at the edge of a soybean field.

Table 2. Corn and Soybean Visual Survey Insect Targets

Common Name	Scientific Name	Crop	County Detection
Cucurbit beetle	*Diabrotica speciosa*	Corn and Soybean	None
Brown marmorated stink bug	*Halyomorpha halys*	Corn and Soybean	None
Japanese beetle	*Popillia japonica*	Corn and Soybean	Dakota, Faribault, Fillmore, Freeborn, Mower, Olmsted, and Scott
Soybean gall midge	*Resseliella maxima*	Soybean	Murray and Rock

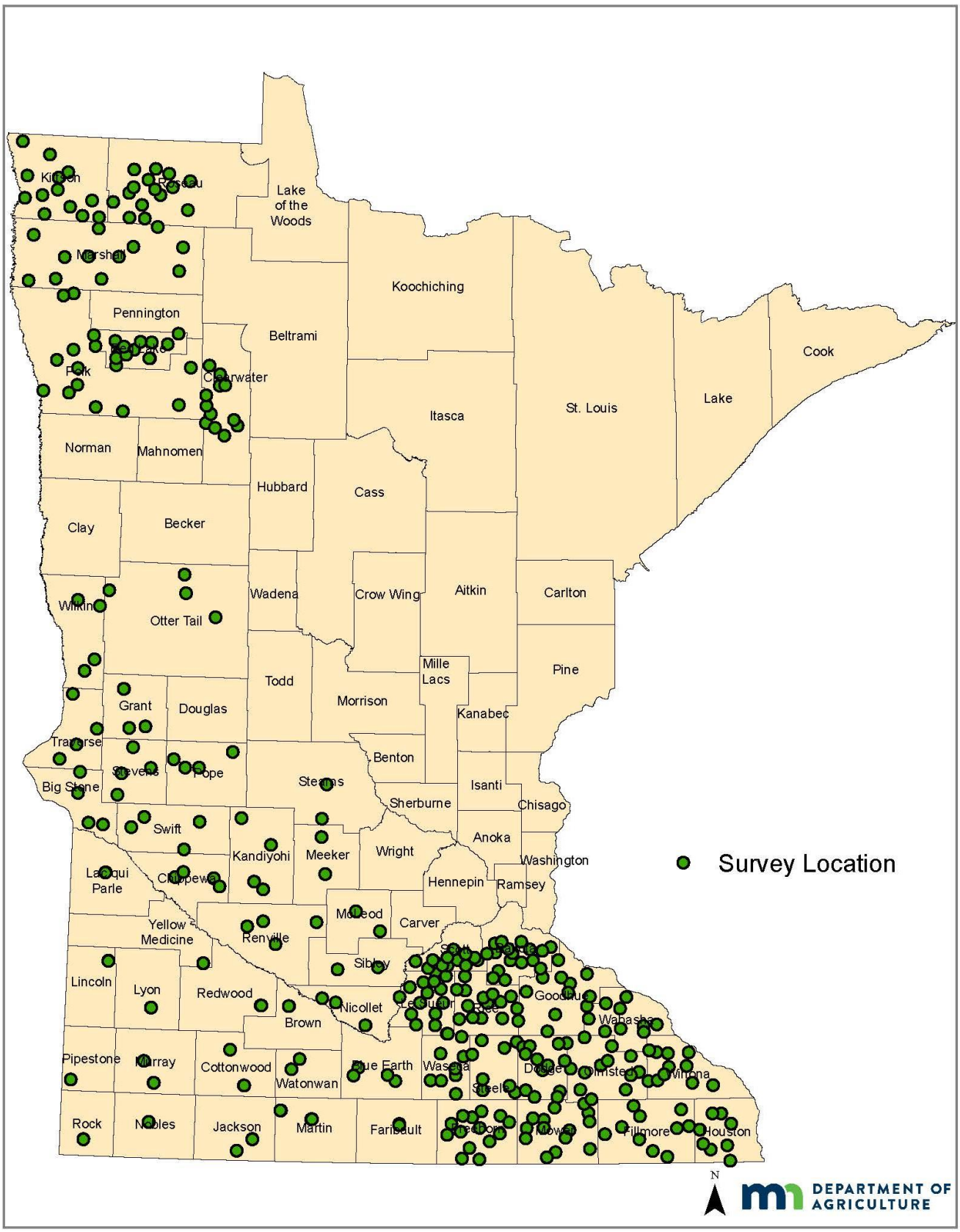

Figure 4. Soybean gall midge survey locations.

Disease Visual Survey

Soybean and corn plants were also visually examined for disease symptoms. Samples were collected from plants displaying symptoms consistent with any of the target pathogens listed in Tables 3, 4, and 5. Disease analysis was performed by the MDA Lab. No target plant pathogens were found in 2019.

Table 3. Corn Visual Survey Disease Targets

Common Name	Scientific Name
Late wilt of corn	*Harpophora maydis*
Java downy mildew	*Peronosclerospora maydis*
Brown stripe downy mildew	*Sclerophthora rayssiae var. zeae*
Tar Spot	*Phyllachora maydis*
Southern corn rust	*Puccincia polysora*
Bacterial leaf streak	*Xanthomonas vasicola*

Figure 5. Bacterial leaf streak in corn. Tamra Jackson-Ziems, University of Nebraska-Lincoln.

Table 4. Soybean Visual Survey Disease Targets

Common Name	Scientific Name
Tan spot, bacterial wilt	*Curtobacterium flaccumfaciens*
Soybean rust	*Phakopsora pachyrhizi*

Table 5. Small Grains Visual Survey Disease Targets

Common Name	Scientific Name
Wheat blast	*Magnaporthe oryzae* (wheat strain)
Dwarf bunt	*Tilletia controversa* (cereal strain)
Wheat Flag Smut	*Urocystis agropyri* (wheat strain)

Figure 6. Soybean rust. Dean Malvick, University of Minnesota Extension.

Noxious Weed Visual Survey

Soybean fields were also scouted for Palmer amaranth (*Amaranthus palmeri*), a noxious weed which has caused extensive corn and soybean crop losses in impacted areas of other states (Figure 7). Palmer amaranth has been found in many states including neighboring South Dakota, North Dakota, Iowa, and Wisconsin. In September 2016, Palmer amaranth was found in Minnesota for the first time. Since then, infestations have been found in multiple counties through a variety of pathways. In 2019, the MDA inspected 203 soybean fields in 26 counties for Palmer amaranth. No suspect plants were found.

For more information about Palmer amaranth see the MDA website: www.mda.state.mn.us/plants-insects/palmer-amaranth-minnesota.

Figure 7. Palmer amaranth plants in a Minnesota field.

Insect Trapping Survey

In addition to visual inspections of fields, 147 insect traps for the Old World Bollworm (*Helicoverpa armigera*) and 100 for the Cotton Cutworm (*Spodoptera litura*) were placed in 32 counties (Figure 8). Traps were baited with a species-specific pheromone lure and set in ditches bordering corn fields and suspended above the vegetation. Trap set was in late June. Traps were checked at least once and removed in late August. Trap samples were screened and specimens that could not be eliminated as target species were submitted to the MDA Lab. Specimens that could not be eliminated as suspects by the MDA Lab were submitted to the USDA for final identification. No target pests were found in 2019.

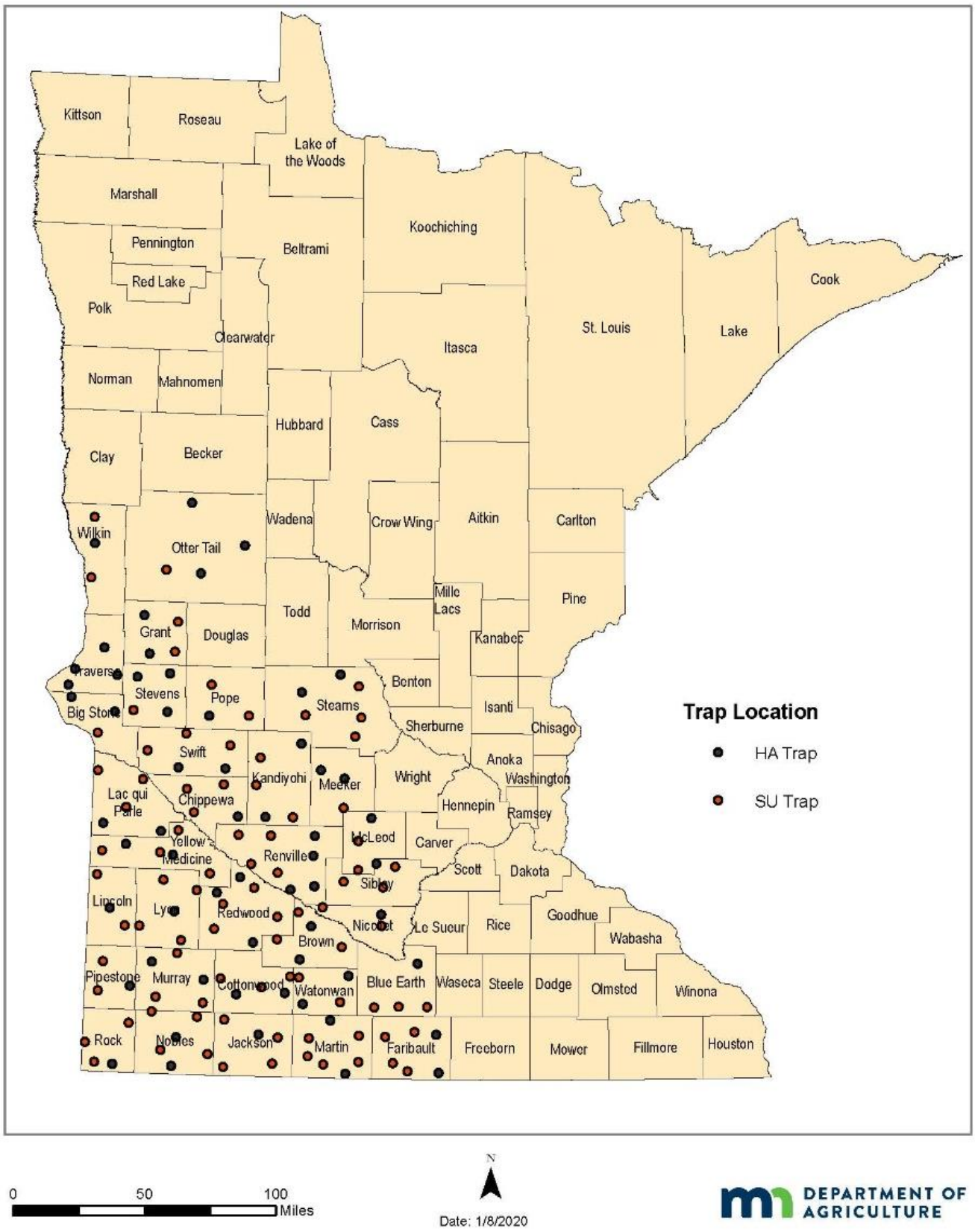

Figure 8. Location of Old World Bollworm (HA) and Cotton Cutworm (SU) traps.

Canola

Swede midge (*Contarinia nasturtii*) is a small fly that infests cruciferous crops such as broccoli, cabbage, canola, etc. This insect has been found infesting canola in Canada, so there is concern for Minnesota's northern canola producing counties. This year, four Jackson traps were set in each of nine canola fields in Kittson, Marshall, and Roseau counties. The 36 traps were placed in late June and removed in mid-August. No Swede midge was found in any of the traps.

The MDA and U of M created a pest profile and guidance document for managing Swede midge. These are available on the U of M's VegEdge website: www.vegedge.umn.edu/swedemidge.

Potatoes

Potatoes grown for seed are at high risk for moving certain soil-borne pathogens. Unlike potatoes grown for other uses, seed potatoes are not washed at any time and they are planted back into the soil. Some of the most important soil-borne pathogens that could affect seed potatoes are nematodes that produce cysts. Nematodes are microscopic worms that feed on the roots of plants, causing reductions in growth and yield. Cysts, produced by the females of some species, are pinhead-sized egg sacs containing 200 – 400 eggs. They are protected by a hardened cuticle which allows them to survive for many years in a field, even in the absence of a host crop. Most kinds of cyst nematodes feed and reproduce on one or two kinds of plants, though some will feed on more. Several cyst nematodes are considered quarantine pests, such that severe long-term restrictions would be placed on movement of plant material and equipment from an area found to contain one of them.

In order to export seed potatoes to Canada, a grower must have documentation to confirm that the field from which the seed potato was harvested was found free from potato cyst nematodes (PCN) based on a specifically designed survey from a geographically identifiable field. Until 2014, the MDA survey, the "PCN Survey," targeted two species of PCN, pale cyst nematode (*Globodera pallida*) and golden nematode (*Globodera rostochiensis*). Both are quarantine pests in potato growing areas around the world, including the United States. Due to increasing concerns about the possible introduction into Minnesota of other cyst nematodes that can cause reduced yield in crops commonly rotated with seed potatoes, four species were added in 2014. Renamed the Cyst Nematode Survey, the six species listed in Table 6 have been targeted each year through 2019. No targets have been found as of completion date of the 2019 survey.

Table 6. Cyst Nematode Survey Targets

Common Name	Scientific Name
Pale cyst nematode	*Globodera pallida*
Golden nematode	*Globodera rostochiensis*
Chickpea cyst nematode	*Heterodera ciceri*
Cereal cyst nematode	*Heterodera filipjevi*
Mediterranean cereal cyst nematode	*Heterodera latipons*
Mexican corn cyst nematode	*Punctodera chalcoensis*

In 2019, the MDA was able to certify the first seed potato field (230 acres) as exempt from sampling for potato cyst nematode. Exemption was based on negative finds in two previously sampled seed potato crops as described in the USA Canadian Guidelines for cyst nematode regulation.

Soil samples were collected from 69 acres as requested by seed potato growers (Figure 9). Additional soil sampling will be conducted in the spring of 2020 on fields that were too wet or frozen to sample in fall. All fall soil samples were seived and examined for the presence of nematode cysts. A representative number of cysts found were sent to a USDA APHIS nematologist for identification.

Figure 9. Nematode cysts (circled in red) found in soil samples from seed potato fields.

Final Results of 2018 and 2019 Cyst Nematode Survey

No cysts of the target species were identified in the 295 cysts submitted in 2019 and the 211 cysts submitted in 2018. The submitted cysts were identified as either *Heterodera glycines*, the soybean cyst nematode and a widely established pathogen of soybean, or as *Cactodera milleri*, which is not known to be a pathogen of agronomic crops.

More information on potato cyst nematodes can be found at www.mda.state.mn.us/potato-cyst-nematode.

For More Information

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