Soybean Cyst Nematode (*Heterodera glycines* Ichinohe)
Risk Management Discussion Document – Stakeholder Consultation Questions and Answers Document

The soybean cyst nematode (SCN) Risk Management Discussion document (RMD), proposing de-regulation of the nematode pest, was circulated for stakeholder consultation in February 2011. The stakeholder feedback was received and summarized. The significant concerns raised by stakeholders, with a common theme, were identified. The Canadian Food Inspection Agency (CFIA) initiated further face to face consultation with stakeholders to achieve a mutual understanding of the respective position on de-regulation and thereby, address the stakeholder concerns.

This Questions and Answers document provides additional details that may not have been included in the RMD. It is intended that this document be reviewed in conjunction with the RMD.

Comment 1: No reported SCN detection in Quebec, Manitoba and Atlantic Canada

- *CFIA Survey Protocol*
  Soybean cyst nematode (SCN) surveys have been conducted by the CFIA according to the official "Soybean Cyst Nematode Survey Protocol."

  - SCN:
    This protocol requires composite samples be collected, by sub-sampling soil from each 10m X 10m grid on the field, with a composite sample of 2000 cc of soil collected per 4 acres.

    - This sampling protocol provides a probability of slightly less than 50% for detecting a single nematode focus in a field with a central population density (CPD) of 100 cysts/kg of soil.

  - Potato Cyst Nematode (PCN):
    For comparison, the current Canadian-US protocol for detection sampling for PCN, using a 4m X 6m grid, with one composite sample of 2000 cc of soil collected per acre.

    - This protocol provides a 95% probability of detecting a single focus with a CPD of 35 cysts/kg of soil.
    - The surveys have resulted in increased confidence that these pests are not present outside of the known regulated areas, as determined from these initial detections.

Soybean Cyst Nematode Surveys 1995 - 2009
 # Samples per Province

Year	ON	QC	MB
1995	-	351	-
1996	767	240	-
1997	193	200	-
1998	-	208	-
1999	-	198	-
2000	-	171	-
2001	1362	160	-
2002	-	170	-
2003	-	-	-
2004	-	-	-
2005	-	-	-
2006	372	-	18
2007	123	201	24
2008	217	-	-
2009	109	253	328

"-"Surveys not conducted

- *Surveys in Quebec and Manitoba:*
  Soil surveys for SCN have been conducted from time to time in Quebec and Manitoba, and have not been conducted in Atlantic Canada.

  - In those years, when the surveys have been conducted, the number of sites sampled and the sampling intensity may have been limited due to operational constraints. Hence, the survey may not have provided a thorough and fully representative reflection of the distribution of this pest, which may be present only in small foci, or in limited densities within a field, for several years following the initial infestation.
  - Also, the number of samples is not reflective of either the number of fields or the soybean production area surveyed.

- *Surveys in Ontario:*
  In Ontario, the survey has not been conducted annually either. In the years the survey was done, sampling has been done either by Ontario Ministry of Agriculture, Food and Rural Affairs, or by CFIA Inspectors using the CFIA SCN Survey Protocol.

  - In some cases in Ontario, samples were collected and submitted by a third party service provider, without confirmation of the sampling methodology used.

- In recent years, detections were confirmed in several new counties in Ontario.

- *SCN – No Impact on Market Access:*
  Unlike PCN, SCN is known to be present in much of the commercial soybean production areas of the United States and Ontario.

  - In those areas where it is present, several management practices have been put in place to control the pest.
  - Although SCN has a much wider host range than PCN, the market access is not restricted for commodities exported to the U.S., as the U.S. deregulated SCN in 1972.
  - Also, there are few trading partners, which identify SCN as a regulated pest for commodities exported from Canada.

- *PCN Surveys Facilitate Market Access:*
  By comparison, surveys for PCN, following recent detections of these pests in Idaho (2006), Quebec (2006) and Alberta (2007), have been extensive and intensive.

  - These intensive surveys have been required to maintain market access between Canada and the U.S. for a wide range of commodities considered pathways for spread, including potatoes, nursery stock, rootcrops, sod, etc.

- In a recent PCN survey in Manitoba (2010), which uses higher number of survey points and sampling intensity, approximately 19,000 lemon-shaped cysts were found.

  - These lemon-shaped cysts, unlike the globose-cysts belonging to the PCN species, are characteristic of the "schactii-group" of the genus *Heterodera*, which includes nematode species that are pests of corn (*H. zeae)*, soybean (*H. glycines*), sugarbeet and canola (*H. schactii*), and clover (*H. trifolii*).
  - Although the species of these cysts were not identified, it is possible some of these cysts could be *H. glycines*, the soybean cyst nematode.
  - A more extensive survey and higher sampling intensity, would increase the ability to detect of the presence of SCN at lower incidence if they were present in Manitoba (e.g. Red River Valley production areas) or Quebec (e.g. in the areas adjacent to the ON production areas).

Comment 2: De-regulation of SCN would lead to removal of restrictions on soil and introduction of the pest from SCN infested states of the USA.

- *Soil:*
  Soil is the most significant pathway for the introduction of SCN. All imports of seed and grain of field crop commodities, including soybeans, are required to

be free of soil.

- *Regulation of Soil:*
  Soil is regulated as a pathway of introduction for many soil pests, pathogens and weed seeds, both internationally and by CFIA.

  - In addition, imports of soybean seed have been regulated by the CFIA, under Policy Directive D-94-17, for the presence of soil peds, and restrictions are placed on the number of soil peds, with a tolerance of one ped per 68kg/150 lbs of seed.
  - However, unlike soybeans, other SCN host material, such as dry beans, peas, lentils, lupine, sugarbeet etc., have not been regulated for SCN or has any tolerance been set for the presence of soil.
  - All imports are subject to inspection upon arrival and detection of soil could lead to the rejection of the consignment.

- *Impact of SCN De-regulation on Soil:*
  If SCN is to be de-regulated, the major concern that has been raised is that the restriction on soil in soybean seed would be lifted and contaminated seed, originating from US States currently regulated for the presence of SCN, would have a free entry into areas of Canada, where SCN has not been detected.

  - The other concern raised is also that this could lead to introduction of the various races (HG types) of SCN.

- *Continued Regulation of Soil:*
  However, as mentioned earlier, the CFIA has restrictions on the import of soil, either alone, or when present with other commodities.

  - These restrictions are not in place to regulate SCN alone, but also many other pests, pathogens and weed seeds, which could be potentially introduced through soil.
  - The Grains and Oilseeds Section of the CFIA is currently developing a policy directive to regulate all commodities, including seed and grain of soybeans, corn and other beans, for the presence of weed species.

    - Weed species, including woolly-cup grass (WCG), jointed goat grass (JGG) and other species, are to be added to the "List of Pests Regulated by Canada" by fall 2011. Some of these weed species are known to occur in the USA.
      - Under the authority of *Plant Protection Act*, WCG and JGG are considered as regulated and under official control – WCG on-farm control programs; orders to destroy JGG in ON. These control programs have been carried out with grower's co-operation.

- The new regulations for these weed species would also enhance regulation of soil, which has been identified as a potential pathway for introduction.
- Hence, the import of soybean seeds from the USA would still be regulated for soil, which would in turn reduce the risk of introduction of new races (HG types) of SCN.

Comment 3: Prefer maintaining *"status quo"* (Option 1) or declaring Ontario as "infested" and regulated status in rest of Canada (Option 2)

- To maintain *"status quo"*, the counties of Ontario, where SCN is present, would have to be declared as "infested" and placed under strict regulations.
    - Canada can not continue to maintain inconsistent regulations on import versus domestic
        - Application of inconsistent import and domestic regulations is in contravention with the principles of the International Plant Protection Convention (IPPC). The contravention makes Canada vulnerable to World Trade Organization (WTO) challenges from trading partners.
    - Enhanced regulations would need to be enforced, which include domestic movement restrictions on soil, soybean seed, other potential host material, and farm machinery and equipment from the infested counties into non-infested counties of Ontario and other parts of Canada.

- To declare the whole province of Ontario as "infested" and maintain the regulated status in rest of Canada, strict regulations have to be enforced on material originating from Ontario and moving to rest of Canada.
    - The regulations would include domestic movement restrictions on soil, soybean seed, other potential host material (dry beans, peas, lentils, lupine, sugarbeet etc.,), and farm machinery and equipment from the entire Province of Ontario to the rest of Canada.

- The enforcement of these domestic regulations would be mandatory to keep up Canada's international obligations, relating to IPPC, of maintaining equivalent import and domestic regulations on potentially pest infested material.

- Enforcement of domestic movement restrictions would need to consider:
    - The wide geographic area of the infested counties in Ontario or Ontario in its entirety;
    - The need to build a system to gather information on movement activities, with regards to infested soil and host material (including seeds of many crop kinds), and farm machinery and equipment;

- The time needed to communicate and educate growers regarding domestic compliance to the movement of regulated articles, which includes equipment and agricultural commodities associated with infested soil (e.g. root crops, nursery stock, etc.);
- The expanding range of *H. glycines* in Ontario attests to the continuous spread from infested counties to other areas by other means, including natural means such as wind and birds;
- Enhanced obligation by CFIA to conduct statistically based surveys in non regulated areas to determine presence or absence of SCN.

- <u>If SCN were to be detected in other "non-infested" parts of the country:</u> In order to qualify SCN as a quarantine pest under IPPC, containment measures would have to be implemented by the CFIA that would parallel the current measures in place to contain the two species of potato cyst nematode (PCN) present in Canada, *Globodera pallida* and *G. rostochiensis*, as per the Golden Nematode Order, SOR/80-260 (Saanich, British Columbia) and Golden Nematode Infested Places Order (Quebec).

- The stricter enforcement of quarantine measures, as opposed to earlier lack of enforcement on Ontario detections, would be a result of the review of the CFIA's domestic regulation policy. This would allow us to maintain our WTO obligations of harmonized enforcement of regulations on both the domestic and import fronts, and be least trade restrictive.

- <u>Using PCN as an example</u>, quarantine measures would include:

    - Immediate issuance of notice of quarantine or equivalent regulatory order;
    - Categorization of lands in the infested zone, as infested, exposed and adjacent. All these categorized lands will be placed under quarantine;
    - Restriction on the production of all host and minor hosts of *H. glycines*;
    - Prohibition on movement of soil and equipment associated with infested soil;
    - Prohibition on movement of plant and plant parts with infested soil;
    - Restriction on the movement of equipment and plant material from other category fields in the quarantine area;
    - Restriction on movement of grains intended for other end uses; and
    - Establishment of various compliance agreements for facilities handling regulated plant and plant parts originating from regulated areas.

- Maintaining regulatory control of PCN, even in the relatively small regulated areas, where it is currently present in Canada, creates a significant resource burden on CFIA and the regulated parties.

    - It would be very costly to implement a similarly rigorous regulatory program for SCN.

- It would severely impact most soybean seed growers and those agricultural sectors, such as equipment operators, who carry out business in and between Ontario or Quebec that move soil, either intentionally or unintentionally.

Comment 4: Why have the regulations not been enforced stringently for SCN like it is being done for PCN?

- Canada has been regulating SCN since 1973. The USA had de-regulated this nematode pest the previous year. The intention was to prevent the introduction of this pest through the various potential pathways. After the first detection in Ontario in 1987, SCN was added to the Schedule II of the *Plant Protection Regulations*, which required that Movement Certificates be requested by any individual who wishes to move plant material, equipment and farm machinery from SCN infested areas. The CFIA has rarely received a request to issue Movement Certificates.

- There are few market access issues for SCN, as the pest has been reported in most soybean producing countries of the world. The USA, Canada's major trading partner deregulated SCN in 1972.

    - SCN more susceptible to environmental conditions and management practices.
        - The pest, since its reported first detection in Ontario in 1987, has been controlled through effective Best Management Practices, which have been developed through industry/government partnerships and are being employed throughout the soybean growing areas of Canada. They include:
            - The use of SCN-resistant varieties in good rotations with non-host crops
            - Resistant varieties: a major management tool. Early 1990's, yields went down from 50-60bu/ac to 20-25 bu/ac. Through the introduction of resistant varieties, yields have gone up to higher levels (average 40 bu/ac).
            - Planting clean seed that is free of soil peds.
            - Thorough cleaning of agricultural and earth moving equipment between fields
            - Good soil conservation practices to reduce soil movement from field to field
            - Regular soil samples to monitor for SCN.

    - Domestic surveys although limited in scope, have continued to show an expansion of the counties in Ontario where SCN has been identified.

- Effectively enforcing domestic restrictions for a pest with numerous pathways is extremely difficult.
- The disadvantage we face is that SCN can survive up to 7 to 9 years, and more variation in races (HG types) can be observed.
    - Constant breeding for new resistance and search for resistance sources is needed.
    - Rotation of resistant varieties for nematode race management.

- Huge impact of PCN on exports and market access.

    - Important quarantine pest of most countries, including important trading partners, such as the US.
    - Major concern PCN could spread with soil associated with a wide range of commodities.
    - PCN can last in the soil as cysts for extended periods (e.g. minimum of 12 years to over 25 years).

Comment 5: Given the absence of symptoms in the soybean fields in Quebec or Manitoba, how could it be said that SCN is potentially present?

- SCN does not necessarily cause symptoms that can be detected visually.

    - According to Niblack (2005), the SCN specialist at the Crop Sciences Department of the University of Illinois at Urbana- Champaign, soybean fields should not be scouted for the "typical" symptoms of stunting and chlorosis, or given a clean bill of health because symptoms are absent.
    - The nematode's ability to reduce soybean yields up to 30% without causing any visually detectable symptoms has been reported several times in literature.

- Niblack observed that scores of asymptomatic and symptomatic fields in Illinois were infested with SCN.

    - The percentage of fields infested with SCN far exceeds the percentage of fields in which symptoms of SCN infection can be detected.

- Significant populations of SCN need to build up in a field, through successive host crop plantings before populations develop which can cause significant symptom development and yield loss in a crop.

    - Generally populations begin in foci, or "hot spots" within a field.
    - These initial foci are difficult to detect without extensive surveys, and symptoms when first seen, may not initially be recognized by the producer as due to the presence of SCN.

Comment 6: Mode of Spread of SCN in the USA

- Human mediated or natural movement of cyst-bearing soil can rapidly spread the pest within fields in the direction of cultivation and within and between areas.

- Examples:
  - SCN was first detected in the USA in a bulb growing area in North Carolina in 1954 and by 2000 it had spread to 28 US states and Southern Ontario.
  - SCN was first detected in Faribault County, Minnesota in 1978 and by 2000 it had been detected in 52 counties in the southern half of the state.
  - In Illinois, the pest was first found in one county in 1959 but by the 1986 growing season it had spread to 81 of 102 counties in Illinois.
  - By 2000 SCN had infested every soybean-producing state in the U.S.
  - The rapid spread of SCN within the USA is graphically demonstrated in Figures 1, 2 (Niblack 2005, Pl. Disease, 89: 1020 – 1026), 3 and 4. The correlation between the increase in soybean production and the spread of SCN can be clearly seen from figures 4 and 5.

Fig. 1. Distribution of the soybean cyst nematode, *Heterodera glycines*, in the United States, 1962. Gray areas indicate counties in which the nematode was found in at least one field. (Image courtesy R. D. Riggs)

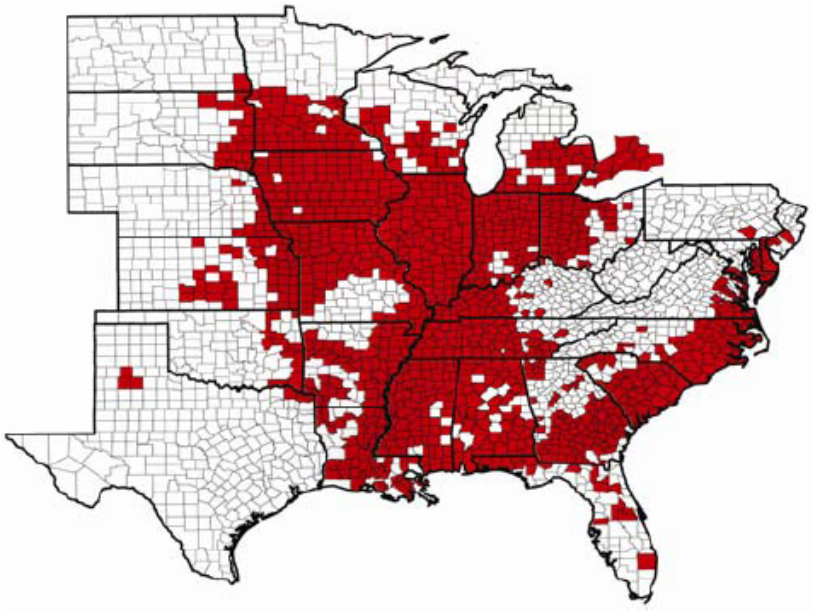

Fig. 2. Distribution of the soybean cyst nematode, *Heterodera glycines*, in the United States, 2005. Red indicates counties in which the nematode was found in at least one field. (Image courtesy R. D. Riggs)

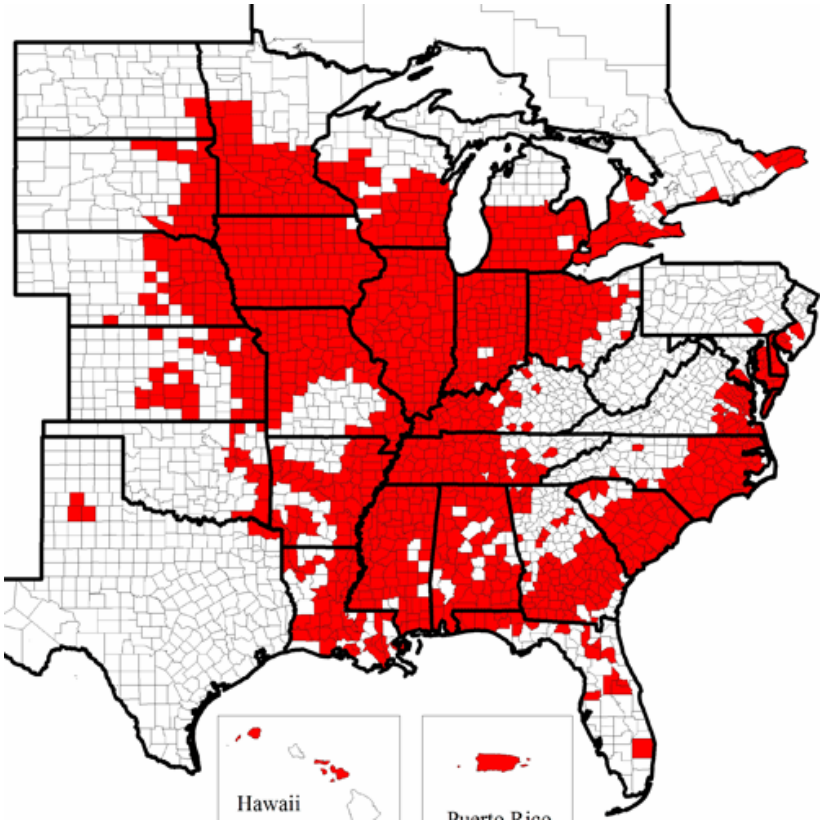

Fig. 3. Distribution of SCN in the United States as of November 2008 (http://www.planthealth.info/images/scn_distrib_1108_lg.gif)

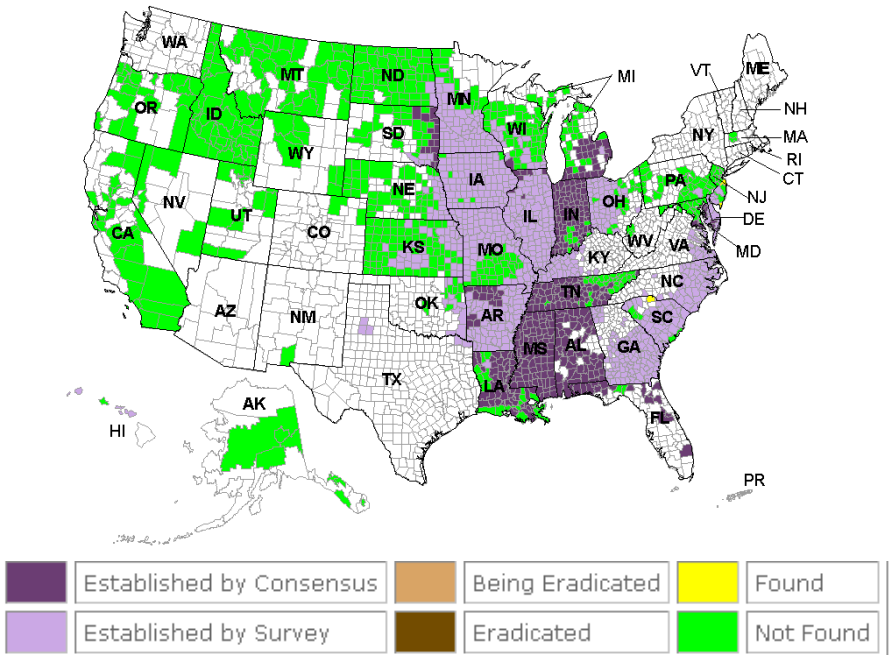

Fig. 4. This map represents all pest survey data submitted to the NAPIS database by participating states in the Cooperative Agricultural Pest Survey program with <USDA,APHIS,PPQ>. Data is based on all survey observations with the most recent recorded survey on 11/02/2010. CERIS does not certify the accuracy or completeness of this map.

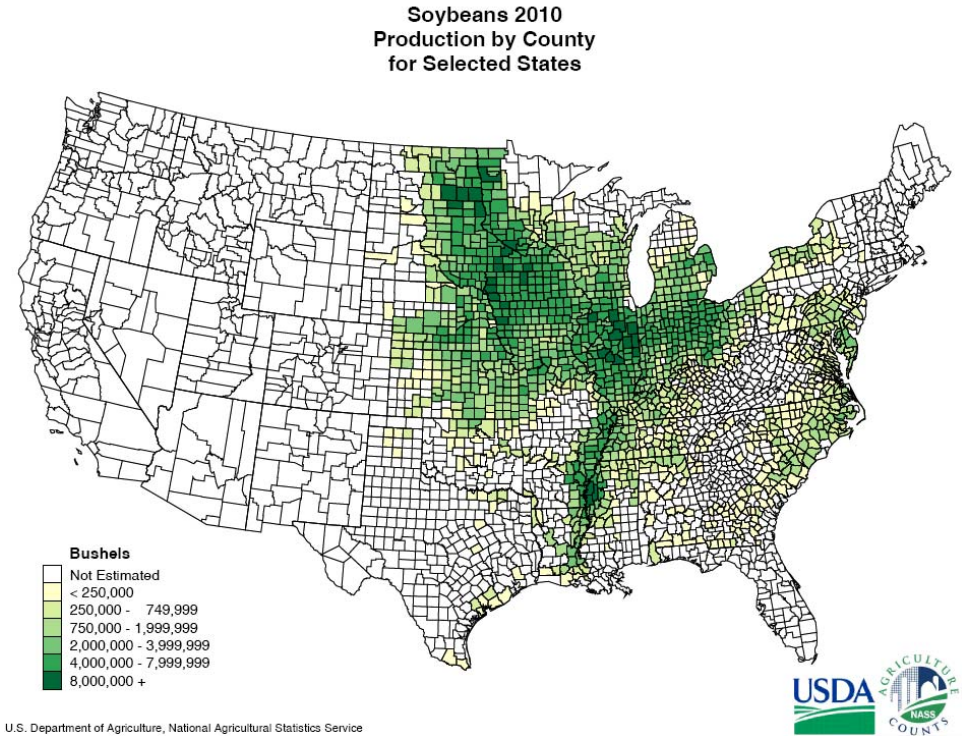

Fig. 5. Soybean production in the United States for the year 2010. (Source: US Department of Agriculture, National Agricultural Statistics Service)

Comment 7: Natural sources are not a factor of spread, as indicated by the negative results of the survey from the fields regularly flooded by the Red River water from the USA.

- *Natural Means – Established Mode of Spread:*
  Natural means of spread, such as flood water, wind and birds, have been identified as established modes of spread of SCN into new areas.

    - Several bulletins released by Agriculture Extension Services of Agriculture Departments of states in the US, where SCN is present, identify these natural means as modes of spread of SCN.
    - For example, a 1987 and 1988 survey of fields, located in the Missouri flood plains of Nebraska, indicated that many of the SCN positive fields were located within 1.6 km of the Missouri river. The role of flooding and water fowl movement was attributed to the spread of the nematode.

- *Surveys in Manitoba and Quebec:*
  Detection of SCN has not been found in the production areas of the regularly flooded Red River Valley in Manitoba or the soybean production areas of Quebec.

    - However, to date operational constraints have limited surveys from being conducted regularly and continuously in these areas.
    - In those years, when the surveys have been conducted, the number of sites sampled and the sampling intensity may not have provided a thorough and fully representative reflection of the distribution of this pest, which may be present only in small foci, or in limited densities within a field, for several years following the initial infestation.

Comment 8: Very limited distribution of SCN in North Dakota and Minnesota

- *SCN Detections in North Dakota ad Minnesota:*
  Soybean cyst nematode has been steadily spreading in both Minnesota and North Dakota, along the Red River and towards the Canadian border (figures 6 and 7).

- *Bulletin on Potential SCN Spread by Natural and Human Means:*
  In 2007 the University of Minnesota (U of M) issued the following warning about the spread of SCN in the Red River Valley (Tonneson, 2007):

    - "SCN will likely spread quickly through the Red River Valley, says James Kurle, U of M plant pathologist.
        - One reason is spring flooding. The infested fields in Clay and Wilkin counties are located near tributaries of the Red River.
        - Flood waters will carry SCN over a wide area.

- Potato and sugarbeet production in the Red River Valley will likely spread SCN, too, with the movement of residual soil on tillage and harvest equipment.
- Continuous planting of susceptible soybean varieties or other susceptible crops, such as dry beans, which are common in the Red River Valley, will also accelerate the SCN build-up.
- There are a very limited number of resistant soybean varieties available in early maturity groups.
- SCN populations can increase as rapidly on some kidney bean varieties as they can on susceptible soybeans. Other classes of dry beans support significant SCN populations, too.
- It therefore seems inevitable that SCN will spread throughout soybean production in the floodplain of the Red River if it is not already there at undetectable levels."

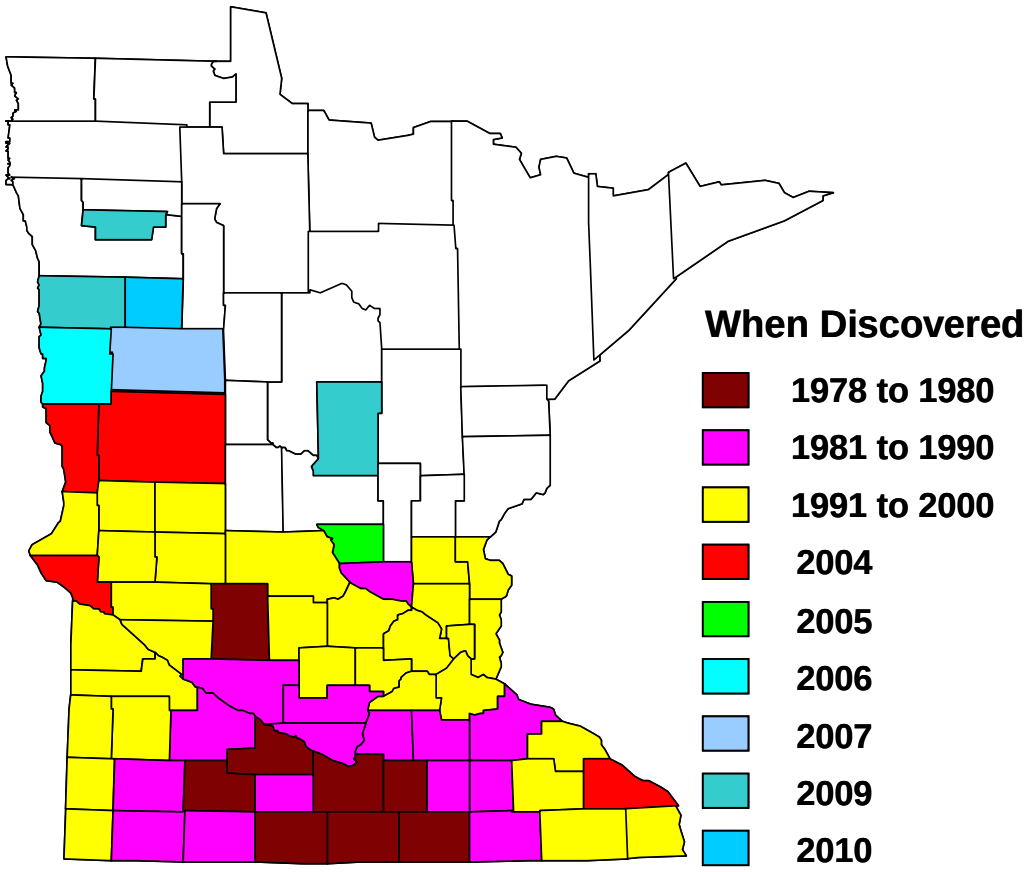

Fig. 6: Counties of Minnesota infested with soybean cyst nematode. (Courtesy: Dr. Senyu Chen, Professor, Plant Pathology and Nematology, Southern Research and Outreach Center, University of Minnesota)

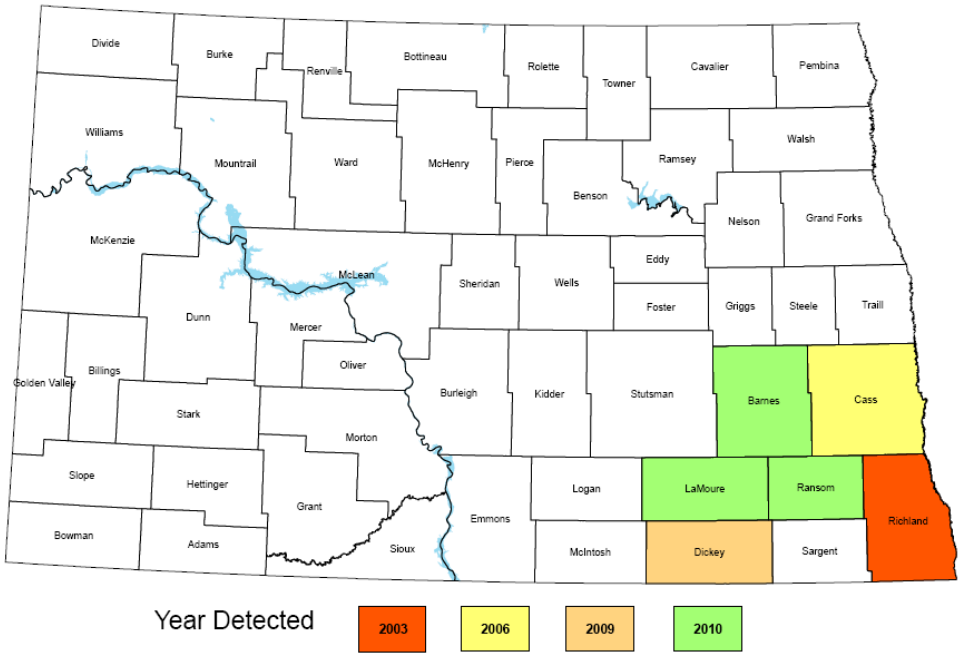

Fig. 7. Counties of North Dakota infested with soybean cyst nematode. (Courtesy: North Dakota Department of Agriculture)

Comment 9: The role of CFIA is to continue regulation until SCN HG-types (races) are understood and SCN-resistant soybean varieties suitable for MB and QC are developed.

The mandate of the CFIA is to prevent the introduction and spread of pests/pathogens and protect the agricultural resource base of Canada. In fulfilling its mandate, the CFIA performs surveillance activities, which confirm the presence or absence of regulated quarantine pest. If a regulated pest is detected, quarantine measures are enforced to contain, prevent the spread and eradicate the pest/pathogen. When quarantine measures have not been effective in containing and eradicating the pest/pathogen, due to several contributing factors, the focus shifts from eradication to management of the pest/pathogen.

Management measures include surveys to understand the variability in the pest/pathogen with regards to races or pathovars, and development of cultivars specifically resistant to the race of the pest/pathogen prevalent in a given geographical area. It is not the mandate of the CFIA to undertake pest/pathogen management responsibilities. Federal and provincial agricultural departments, along with the scientific research support from universities and industry, carry out pest/pathogen management measures.

In the case of SCN, the CFIA will support sharing information on subject matter experts with the provincial agricultural departments and grower associations. It will be up to these departments and associations to develop and implement a plan on understanding the HG-types of SCN and developing SCN-resistant soybean cultivars suitable for production in MB and QC.