**Garlic Growers Association Launch New Clean Seed Program**

The Garlic Growers Association of Ontario has just announced that it is taking orders from members for clean planting material from the SPUD unit at the New Liskeard Agricultural Research Station, University of Guelph. This is a big milestone that will allow growers to order clean material for fall 2020.

Garlic is a vegetatively grown crop, just like potatoes or strawberries, that is amplified not by seed, but asexually by clones, daughter tubers or cuttings. Unlike true seed production, the offspring of clones accumulate viruses and other pathogens in each progressive generation which results in a yield drag. In garlic, that yield drag has been estimated to be anywhere from 25–50%. By propagating material that has been ‘freed’ of viruses through tissue culture, growers are able to take advantage of that yield boost until viruses and other pathogens build up in the crop over time (**Fig. 1**).

Virus infection is generally transmitted by sap-sucking insects like aphids, thrips or leafhoppers. These insects have a stylet that pierces the plant’s cells and if a virus is present, the virus can enter the insect’s foregut and salivary glands. As the insect moves to a new plant and pierces it, some virus-infected saliva may be left behind from the previously visited plant. Viruses can accumulate in clones after years of production while not causing any visible symptoms. They can slow the plant down by causing a yield drag or making the plant more susceptible to other stressors. Since the cause is viral, it cannot be ‘cured’ with a pesticide application. Some crops, like potatoes, have a certified seed program which is federally regulated and has set limits on how much disease and virus can be tolerated. There are also seed classes based on age and disease/virus levels. Other smaller crops, such as garlic, do not have the same regulations; so seed is often reused indefinitely. In garlic, there is the option of growing out bulbils, the seed-like structure that is found in the scape in hardneck varieties. Growing the bulbils can clean the seed of nematodes, bulb mites, fungi and bacteria, but viruses are still found in this part of the plant.

In the early 2000s, a project to develop clean seed was undertaken by the New Liskeard Agricultural Research Station (NLARS) SPUD Unit, University of Guelph, CORD, FedNor as well as the Garlic Growers Association of Ontario (GGAO). The project goals were to develop an efficient/economical system to micropropagate a cultivar of garlic called ‘Music’ to be free of viruses. The project produced virus-freed planting stock, developed a greenhouse production system as well as developed guidelines for clean seed production. The NLARS SPUD unit determined the best type of plant tissue to use, the best media to promote plant development as well as established methods to detect bacterial and fungal contamination (**Fig. 2**).

In garlic, the cells of the meristem/shoot tip of a scape can grow faster than the virus can infect the cells. Meristem tips are cut and placed on a media, and under lights and ideal conditions they grow without the rest of the plant present. A mass of cells, known as a differentiated callus, develops and root and shoot hormones are used to produce, you guessed it, roots and shoots. This plant tissue is then tested for viruses multiple times and if clean, these plants are then multiplied (**Fig. 3**) and used to create bulbs, called roundels, for field production (**Fig. 4**).

Over the next few years, growers will see new garlic cultivars added to the public germplasm besides ‘Music’ and work will be conducted to increase the multiplication rate of the micropropagation process for all cultivars. This is a huge step forward for the garlic industry. Implementation of this clean seed will see increases in bulb size, yields, storage life as well as reduce the presence of storage rots, bulb and stem nematode, bacteria, fungi and viruses. Even just the ability to store and sell the crop into January will allow growers to fetch a premium.

France and other countries have had a clean seed systems in place for a while. The vigour and size of the bulbs is impressive; however, these cultivars do not always perform well in Canadian conditions, may take a couple years to acclimatize and the material is often difficult to import in time for planting. The SPUD unit offers a more local source of planting material that does well in our climate and has cultivars that already perform well in our growing conditions.

The hardest part of implementing clean seed into a current program will be growing out the roundels into marketable bulbs quickly while keeping them relatively separate from the existing field. Propagating roundels can be done many ways and it is still uncertain as to what is the most efficient method of propagation would be. The roundels could be started the same way that you would start onion transplants and then planted in a secluded field or grown in a greenhouse with insect screens.

The roundels leave the SPUD unit about the size of a dime. After a few months of growth, a round (single clove bulb) the size of a toonie, or a small, double clove bulb is harvested. Planting this material yields a small to medium size bulb and then the following year is when a large increase in size and yield is typically seen (**Fig. 5**). During this process scapes could be harvested and those bulbils could be planted as virus-freed planting stock as well.

This process of growing out clean planting stock will not be for everyone, and similar to potatoes, there may be growers that focus on seed or multiplication of seed during the forth and fifth generation. If growers continually choose to use virus-freed planting stock, over time the amount of disease will be pushed out of the production system. While clean planting stock may have a greater upfront cost, the benefits and yield bumps in the future greatly outweigh the initial costs.

Membership is open to growers in Ontario and there is still time to become a member and order roundels for this fall. Visit www.garlicgrowersofontario.com for more information.

**Figure 1** – Hypothetical yield improvement curve from clean planting stock. The initial increased yield difference is thought to be between 25-50%. How quickly insects spread viruses and decrease the potential yield over time will vary from field to field.Fig 2 – Virus-freed microplant being divided into multiple plants.

**Figure 2** – Garlic shoot tips being tested for pathogens in tissue culture.

**Figure 3** – Virus-freed microplant being divided into multiple plants.

**Figure 4** – Roundels, small, single-cloved bulbs, ready to be shipped from the SPUD unit.

**Figure 5** – A comparison in bulb size between existing and clean plant material (Photo B. Hughes, 2008)