

POTATO IMPORTATIONS

1. SUMMARY

In international terms it has been recommended by Dr Roy Copeland, a renowned authority on potato disease control, that every effort should be made to exclude the following eight diseases (+/vector) from Northern Ireland and these should form the basis of any plant health on import control policy. Most other diseases are either already widespread in the Islands or prevalent worldwide. (see note at end.)

2. THE PATHOGENS

Fungi

- (i) Wart disease (*Synchytrium endobioticum*)

Bacteria

- (ii) Brown rot (*Ralstonia solanacearum*)
- (iii) Ring rot (*Clavibacter michiganensis ssp sepedonicus*)

Viruses and viroids

- (iv) Beet necrotic yellow vein virus (*rhizomania*)
- (v) Potato spindle tuber viroid

Nematodes

- (vi) Potato cyst nematodes (*Globodera rostochiensis* and *Globodera pallida*)
- (vii) Root knot nematode (*Meloidogyne chitwoodii* and *Meloidogyne jallax*)
- (vii) Potato nematode (*Ditylenchus destructor*)

Insects

- (ix) Colorado beetle (*Leptinotarsa decemlineata*)

3. NOTES ON THE SIGNIFICANCE OF THE ABOVE

(i) Wart Disease

At one time this was one of the most serious diseases of potatoes worldwide but since the discovery that some varieties of potatoes are immune from it and the application of strict regulations for its control, the losses from this disease have become negligible. It must still, however, be regarded as serious as where land is contaminated with the fungus, it remains so for many years and its presence can affect the ability to export potatoes from Ireland. Hence it is recognised that control should continue to be strictly observed.

A list of wart resistant varieties is available from DoA. Control is virtually impossible. The disease is recorded from North and South America.

(ii) Brown Rot (or bacterial Wilt)

One of the most destructive diseases of the potato and a severe limitation on production. It is a soil borne pathogen, infecting potato roots by plant to plant transfer in soil through wounds and lateral bud emergence sites.

The pathogen is commonly tuber-borne, hence the need to strictly control imports, especially from countries where it is prevalent. An additional problem is that where plants have been grown at higher altitude under cooler conditions, infected plants may not show symptoms but can produce infected seed, which can proliferate if grown at warmer temperatures. It is not normally a problem in areas where soil temperatures are below 15°C (in Northern Ireland mean soil temperatures are 2° (July) – 1° (Jan) but can be locally higher) but mutation and adaptation can occur. The disease is found in Northern Europe and South America.

(iii) Ring Rot

Ring rot is a tuber-borne bacterium spread mainly during seed cutting and planting out. It creates serious problems for the potato industry in North America and is one of the most important reasons for certified seed lot rejection. Infection spread is worst in wet, warmer soils where potato insect pests (see Colorado beetle) are implicated in its spread. None of the listed insects are found in Northern Ireland, but care needs to be exercised to prevent introduction. Crops can rot completely in the field or in storage. The spores can remain viable in buildings, equipment, storage boxes etc. Effective management is only by using certified, clean seed with a zero tolerance of this disease.

(iv) Beet necrotic yellow vein virus

Diseases spread by viruses usually reduce crop vigour but are rarely as devastating as the bacterial diseases described above. The yellow vein viruses have originated and are distributed in Northern South America.

(v) Potato spindle tuberoioid (PSTVd)

PSTVd has widespread world wide distribution and is reported from Argentina, North America, Australia and Poland in Europe. Symptom severity increases from year to year and may not be visible in the early years. Reduced growth and yield and deformed tubers are symptoms of the disease.

Environmental factors can effect virulence of the pathogen and lower levels of infection can persist as they tend not to be noticed in tested seed stocks. The disease is tuber borne and easily transmitted by contact. It persists from generation to generation in infected tubers. To quote Stevenson *et al* (2001):

PSTVd is easily transmitted by contact. Mechanical injury and even chewing insects have been implicated in field spread. More recently, experimental evidence has shown PSTVd transmission by aphids from plants co-infected with *Potato leafroll virus*. The viroid

persists from generation to generation in infected seed tubers. It is readily transmitted in true potato seed, which makes germ plasm collections and breeding programs likely disease reservoirs unless testing is conducted regularly.

Pepino (*Solanum muricatum*), tomato (*Lycopersicon esculentum*), and avocado (*Persea americana*) are natural hosts of PSTVd. Many plant species belonging to numerous families can be infected experimentally, including members of the families Amaranthaceae, Boraginaceae, Campanulaceae, Caryophyllaceae, Compositae, Convolvulaceae, Dipsacaceae, Sapindaceae, Scrophulariaceae, and Valerianaceae.

Exclusion and avoidance are best control strategies. Systematic testing of seed stocks can eliminate PSTVd from seed and commercial potato plantings and from germ plasm and breeding programs. The viroid is easily spread by contact and is often difficult to diagnose visually, so that elimination from infected stocks is often difficult, and success requires a long term commitment. In programs lacking suitable screening and testing procedures, more than 50% of stocks may be infected. Germ plasm shipped internationally should always be tested for PSTVd.

(vi) Potato cyst nematodes (PCN)

Potato cyst nematodes, *Globodera* spp., also known as golden nematodes or potato root eelworms, occur throughout the temperate regions of the world. Quarantine or regulatory actions are imposed against them in most countries. Actions taken range from banning of potato production to integrated management system that limit nematode spread.

These nematodes were long classified as a single species, *Heterodera rostochiensis*. In 1973, they were divided into two species: *H. rostochiensis*, with golden females, and *H. pallida* with white or cream coloured females. Because the females become round cysts, these species were later assigned to the genus *Globodera* and assumed their current designations, *G. rostochiensis* and *G. pallida*.

Potato cyst nematodes originated in the Andes, where they co-evolved with their preferred host, the potato (*solanum* spp.) One or both species are known to occur in at least 58 countries in Europe, Asia, Africa, North America, Central America, South America and Oceania. Only *G. rostochiensis* has been found in the United States (Stevenson, 2001).

Potato cyst nematodes are best spread by moving infested soil such as that adhering to equipment, seed tubers or storage containers. Soil contaminated tubers is the most common way these pathogens are spread worldwide. PCN is prevalent in cool climates and is virtually impossible to eradicate.

Most countries employ statutory controls backed by soil surveys and strict regulatory activities that prevent the spread of cyst nematodes within their borders and prevent their introduction from outside their borders. The primary components of such controls in the United States are the restriction of seed production on infested land and legislation requiring the growing of resistant cultivars.

Because of the limited host range of potato cyst nematodes, crop rotation is a practical means of controlling them in most countries where they occur. The length of the interval between potato crops depends on the initial nematode population density. At low

population densities, a 2 to 4 year gap between potato crops is sufficient, but at higher densities, a gap of up to 7 years is necessary. A wide choice of nonhost crops is available, because tomato and eggplant are the only other commercial host crops and they are not usually grown in the same areas as potatoes. Nematode populations decrease by up to 40% per year when nonhosts are grown. However, even when nonhosts are grown, infestations can persist for 20 years or more.

Both fumigant and nonfumigant nematicides are used in potato cyst nematode management schemes. Soil fumigants have been used where a drastic and rapid reduction in the nematode population density is required, such as in quarantine or in regulatory settings. Nonfumigant nematicides are used to protect crops from the damage and to produce a profitable yield in the presence of the nematode. Because of concern over potential contamination of ground water and other environmental and health problems, none of these nematicides are currently used in the United States to control cyst nematodes.

A number of fungi have been isolated from *Globodera* spp., but biological control of potato cyst nematodes with natural enemies has realised only limited success.

Because of inherent weaknesses or limitations in most nematode control practices, integrated control strategies involving two or more control practices are necessary to achieve satisfactory control.

PCN is common and widespread in Northern Ireland, but its damaging effects can be restricted by:

- (a) Rotating areas where potato crops are grown and taking care to avoid soil transfer and contamination.
- (b) Using nematode resistant varieties.
- (c) Preventing import of fresh, more resistant strains of PCN by ensuring that imported seed and ware potatoes are soil free.

A combination of all, or at least 2 of the above measures can help control PCN. Lists of “susceptible,” “resistant” and “partial resistant” cultivars to PCN can be obtained from DoA. (Sourced from the Department of Agriculture and Rural Development for Northern Ireland, and the Agri-Food and Biosciences Institute).

This grading has been replaced by a 1 - 9 scale of resistance.

(vii) Rootknot nematodes

Although of worldwide importance, potato pathogens are more prevalent and damaging in tropical and sub-tropical areas, there are temperate species such as *M. chitwoodii*. This species is recorded from Argentina and as potatoes are generally grown in the cooler climates, *M.chitwoodii* may eventually become the most important species attacking potatoes worldwide. Management strategies include exclusion, prevention of spread, crop rotation, early harvest, planting green manure, cover crops and treatment with nematicides. As with most diseases like this, a combination of management practices is best to control the disease, but prevention of entry and sound phyto sanitary practices can ensure it does not enter the country.

(viii) Potato rot nematode

Potato rot nematode is an important potato pathogen with worldwide distribution. It has been recorded from Europe and South America. Spread is primarily by infected seed potatoes and there are no resistant varieties.

(ix) Colorado beetle

This beetle should be controlled as it is a vector of potato disease (e.g. Ring rot). It also causes defoliation of crops by the feeding of adults and larvae on the foliage. It is a notifiable insect in the UK, but is not likely to survive in the cooler climate of the islands.

Silver scurf (*Helminthosporium solani*) and Black scurf (*Rhizoctonia solani*) are ubiquitous across the world and already present in most of Ireland's potato crop. It would still be wise to exclude imports of seed potatoes heavily infested by the diseases.

(4) GUIDELINES FOR WARE POTATO CONTROL

Ware potatoes should be free from *Synchytrium endobioticum* (wart), *Globodera* (eelworm) species, *Meloidogyne* species (root knot nematodes) and *Ditylenches destructo* (potato nematode) and they should have been produced in land known to be free of the organisms as well as Beet Necrotic yellow vein virus. They should also be free from the 2 bacteria species (Brown rot and Ring rot) and Potato spindle tuber viroid.

Colorado beetle control. This could either be by ensuring that the consignment is free of Colorado beetle (CB) or that potatoes were grown in an area free from CB. It is likely the Ireland is too cold for CB to survive so there may be no need to specify any restriction on CB.

Usually no restriction is placed on levels of other viruses or fungal diseases on ware potatoes.

The position is different for seed potatoes, which have to be free from all the above pests and pathogens and must also be within specific tolerances for other viruses and fungal diseases. Ireland should be applying a minimum tolerance equivalent to that specified by UN/ECE for Basic Grade seed potatoes.

We will prepare some colour symptom and identification charts for the diseases listed above.

If you have further queries re a plant health control strategy please do not hesitate to contact us (through Jim McAdam).

Professor Jim McAdam

Dr. Roy Copeland