Appendix 1

GUIDELINES FOR CLEANING AND DISINFECTION

Guidelines for Cleaning and Disinfection of Tools, Planting, Harvesting, Grading and Packing Equipment, Containers, Crates, Boxes, Trailers, Transport Vehicles and Stores

These guidelines for cleaning and disinfection of tools, planting, harvesting, grading and packing equipment, containers, crates, boxes, trailers, transport vehicles and stores are designed to help members develop their own cleaning and disinfection schedules, which detail how and when to clean, required under Standard 10.

Introduction to Cleaning and Disinfection

Before starting to clean tools, planting, harvesting, grading and packing equipment, containers, crates, boxes, trailers, transport vehicles and stores members must ensure they have met their Statutory requirements including that

- A COSHH risk assessment has been completed.
- Cleaning chemicals are only used in accordance with the manufacturers' directions.
- All staff have appropriate personal protective equipment.

Cleaning of tools, planting, harvesting, grading and packing equipment, containers, crates, boxes, trailers, transport vehicles and stores

Systematic cleaning must allow sufficient time to remove plant residues and soil, which can harbour infections. The efficacy of many disinfectants, especially those acting through oxidative reactions, is reduced or eliminated by the presence of organic material. It is therefore important that surfaces are thoroughly cleaned prior to application of disinfectants.

- Start at the top of the equipment and work downwards.
- Start at the top of the trailer and clean from the inside to the edges.
- First remove obvious dust, soil, potato debris and potatoes using a broom.
- Remove adhered dust, soil and potato debris from the surfaces of the machinery/equipment/ trailer, using a detergent.
- Wash down surfaces, preferably with heated water (steam is particularly effective) where possible.
- Members must demonstrate that discharge from the cleaning and disinfection process is not returned to agricultural land or water sources.

Disinfection of tools, planting, harvesting, grading and packing equipment, containers, crates, boxes, trailers, transport vehicles and stores

Disinfection must take place following the cleaning of tools, planting, harvesting, grading and packing equipment, containers, crates, boxes, trailers, transport vehicles and stores and after obvious dust, soil and potato debris has been removed. The efficacy of many disinfectants, especially those acting through oxidative reactions, is reduced or eliminated by the presence of organic material.

The removal of obvious soil and debris prior to disinfection is the **most important** phase of the cleaning process.

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The efficacy of different disinfectants varies according to the type of bacterial pathogen and the surface material treated. For more information see the section on Background Information on Experimental Validation of Disinfectants below.

- Surfaces must be thoroughly cleaned prior to application of disinfectants.
- Efficacy of some disinfectants is pH dependent (see product labels for optimum pH). Detergents used in pre-cleaning can affect the pH and surfaces should therefore be rinsed with water and allowed to dry prior to application of disinfectant. This includes any water pools on the tools, planting, harvesting, grading and packing equipment, containers, crates, boxes, trailers, transport vehicles and stores.
- Use one of the types of disinfectants in the list of currently approved disinfectants below that is appropriate or the surface material to be treated.
- Use disinfectants in accordance with the manufacturers' directions.
- If directions require rinsing, wait at least 10-15 minutes after application in order to kill target bacteria. However, if bacteria are in biofilms or dried vegetable matter, they may remain protected from chemical activity.
- Members must demonstrate that discharge from the cleaning and disinfection process is not returned to agricultural land or water sources.

Approved Disinfectants

This updated list of recommended choices of disinfectants for use in seed potato production, is based on EPPO recommendations, recent research findings and current approvals on the use of biocides. Particularly relevant is phytosanitary standard PM 10/1 (1), published by the European and Mediterranean Plant Protection Organisation (EPPO, 2006), describing cleaning and disinfection measures in potato production against the quarantine pests *Clavibacter sepedonicus* (ring rot bacterium) and *Ralstonia solanacearum* (brown rot bacterium).

Although every effort has been made to ensure accuracy, Assured Food Standards does not accept any responsibility for errors or omissions. Trade names are only used where use of that specific product is essential. All such products are annotated® and all trademark rights are acknowledged.

The following list of approved disinfectants is correct as at June 2019. Members must check the approval status of disinfectants prior to use as new approvals can be granted or existing approvals revoked at any time.

- Lists of disinfectants approved by Defra for general use in England Scotland and Wales can be checked at: **http://disinfectants.defra.gov.uk**
- Biocides that are authorised for sale and use in the UK under the Biocidal Products Regulation (BPR, Regulation (EU) 528/2012) can be checked at: **https://echa.europa.eu/documents/10162/27434452/art_95_list_en.pdf**

In addition

- Recommended application rates and/or contact times may vary according to the surfaces to be treated (see product labels). Minimum contacts times of 10-15 minutes are usually required to kill target bacteria, although bacteria in biofilms or dried vegetable matter may remain protected from chemical activity.
- Some disinfectants can be applied as dips, fogs or foams for which application rates usually differ from spray treatments.
- Some disinfectants are potentially corrosive to certain surface materials (see product labels).

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Currently Approved Disinfectants

Disinfectants currently approved for sale in the UK, as at June 2019, with expected activity against *Clavibacter sepedonicus*, *Ralstonia solanacearum*, *Dickeya* spp. and *Pectobacterium* spp. include:

- Chlorine-based products with at least 1% active chlorine (e.g. hypochlorite bleaches)
- Stabilised chlorine dioxide (e.g. Purogene®, Clorious2®)
- Chloramides (e.g. Halamid®)
- Iodine-based products (e.g. Fam-30®, Virophor®, Iodo-pharm®, Virudine®, Deosan Iodel FD®)
- Peroxide/peracetic acid/peroxyacetic acid/peroxygen -based products (e.g. Virex®, HPPA®, Jet-5®, Sanprox-P®, Vanodox®, Virkon S®)
- Organic acids (e.g. Menno-Florades®; Menno-Clean®)
- Gluteraldehyde-based products (e.g. Unifect-G®, Korsolin®, Virakil®)
- Quaternary ammonium- based products (e.g. Ambicide®, Bardac 22®, Hortisept Pro®, Vitafect®)

Background Information on Experimental Validation of Disinfectants

Kaponen et al. (1992) demonstrated that effective control of different bacterial pathogens varied according to the disinfectant used and the surface material treated. Good control of the ring rot bacterium (*Clavibacter sepedonicus*) was achieved after 20 minutes contact at room temperature with peroxygen-, iodine- or glutaraldehyde-based disinfectants, applied on plastic, wood or metal surfaces. Quaternary ammonium disinfectants were less effective, especially in the presence of organic peat. Iodine-based disinfection was also the most effective against the blackleg bacterium (*Pectobacterium atrosepticum*) on all surfaces and in the presence of organic peat. In this case, quaternary ammonium disinfectants were only effective at high doses on clean plastic surfaces, whereas peroxygen and glutaraldehyde disinfection was least effective.

Czajkowski et al. (2013) showed good levels of control of *Dickeya solani* with various disinfectants, including 1 % sodium hypochlorite, 5 % peracetic acid, 10 % hydrogen peroxide and 1 % benzoic acid (MennoClean®), when applied in axenic cultures for at least 5 mins. All except the hydrogen peroxide treatment effectively killed *D. solani* when mixed with homogenised potato tuber tissue.

More recently, Howard *et al*. (2015) compared efficacy of three disinfectants on biofilms of *C. sepedonicus* on surface materials typically found in commercial potato storage facilities. Sodium hypochlorite was the most effective disinfectant on wood and hydrogen peroxide was best on mild steel whereas efficacies of hypochlorite, hydrogen peroxide or quaternary ammonium disinfectants were not significantly different on concrete, rubber or polycarbonate surfaces. Only hydrogen peroxide was able to achieve effective disinfection (3 log reduction in bacterial viable count) on all five surfaces when applied at 0.27% hydrogen peroxide. Their results clearly showed that plant pathogenic bacteria in the biofilm state, particularly when spread and dried onto surfaces of agricultural machines and other equipment, are very resistant to a range of commonly applied disinfectants.

Disinfectant efficacy was also recently tested against *Clavibacter sepedonicus* on wooden potato storage crates smeared with infected potato tuber pulp containing a high inoculum (Stevens et al., 2017). Effective control was achieved by dipping for 1-2 min in the hypochlorite-releasing chloramide (1% Halamid®), for 2-5 min in pentapotassium bis(peroxymonosulphate) bis(sulphate) (1% Virkon S®) or for 5-10 min in either the quaternary ammonium disinfectant didecyldimethylammoniumchloride (0.3% Bardac 22®) or in benzoic acid-based disinfectant (2% MennoClean®). It was also possible to achieve disinfection of contaminated wooden crates in a commercial crate washer that combined the disinfection process with biofilm disruption by power jet cleaning.

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References

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