

# ARGOS®

## TECHNICAL MANUAL

VERSION EU.11/22.4





POTATO  
SPROUT  
SUPPRESSANT

# ARGOS®

TECHNICAL MANUAL

Active Ingredient: Orange Oil

## Introduction

This Technical Manual provides important information on **ARGOS®**, a new natural potato sprout suppressant in Europe to prevent and control sprouting on potato tubers in storage.

**ARGOS** is classified as a plant growth regulator and is based on orange essential oil. The oil is extracted from the entire orange fruit. Therefore, the active substance of the product has a natural origin. No chemical solvents or additives are used in the product.

**ARGOS** should be applied as a hot or cold fog. Equipment used must be temperature controlled to produce a hot fogging temperature 170–190°C. Considering the chemical and physical properties of **ARGOS**, the application of the product needs careful consideration, which is explained in this document.

This manual provides practical information to optimise the use and the efficacy of **ARGOS**. Refer to the product application instructions described in this Technical Manual whenever you feel it necessary and do not hesitate to contact us before initiating treatment if in doubt.



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# 1. GENERAL

In potatoes, dormancy is the physiological state of the tuber in which autonomous sprout growth will not occur within a few weeks, even when the tuber is kept in conditions ideal for sprout growth. During this period, post-harvest environmental conditions have only limited impact on the sprouting behavior.

The duration of the dormancy depends largely on the cultivar, stage of tuber development and on the conditions during tuber growth. Temperature, water supply and photoperiod and storage are important factors that regulate the sprouting behaviour. Potatoes start to sprout naturally a few weeks after harvest. Perfect control of storage conditions generally saves a few weeks. This is the case in professional storage buildings, with equipment that allows darkness, temperature and humidity to be controlled very precisely, to limit germination pressure as much as possible.

For longer storage periods, necessary for the availability of tubers between two potato harvests, **ARGOS** can further delay germination, while preserving the weight and quality of the tubers as much as possible.

**ARGOS** is an effective natural potato sprout suppressant used as a stand-alone product or as a perfect key element of a modern potato sprouting management program combining in-field use of **FAZOR / ROYAL MH** and in-store **ARGOS** treatments to ensure full season control.

**FAZOR / ROYAL MH** is a sprout suppressant applied to the growing crop. It should be used 3 to 5 weeks before desiccation. Read **FAZOR / ROYAL MH** label before use and follow all guidance to optimize efficacy.

**ARGOS** is applied by hot or cold fogging in store. For hot-fogging, machinery must be temperature controlled and able to regulate flow rate and air flow. White sprouts are burned off. Even small sprouts that cannot be seen with the naked eye are removed in this way. Due to the effective and powerful burning of early sprouts, development is prevented for several weeks. **ARGOS** does not taint the potato with odour or taste.

## 2. LABEL

The plant protection product is only authorised as a potato growth regulator for use by professional users in a storage facility.

### IMPORTANT INFORMATION

Active substance:	Orange Oil 843,2
Nature of the product:	HN/KN (hot and cold fogging concentrate)
Authorisation holder:	Arysta LifeScience Benelux Sprl, Rue De Renory 26/1, B-4102 OUGREE, Belgium



## INSTRUCTIONS FOR USE

**IMPORTANT:** This information is approved as part of the product label. All instructions in this section must be read carefully to achieve safe and effective use of the product.

### RESTRICTIONS OR WARNINGS

- **DO NOT USE on seed potatoes.**

### STORAGE DESIGN

Only potatoes stored in dedicated potato warehouses may be processed. The impact of **ARGOS** will be reduced in buildings without proper insulation, air circulation and temperature control.

Use in stores with forced air / ventilation ducts to ensure uniform airflow and to avoid blocking air gaps between the tubers, which may limit the effect of the product and lead to condensation.

The potatoes must be clean, dry and free from signs of disease. Make sure the peel is sufficiently skin proof before treatment. Daily inspection of the harvest is important to check skin firmness and incipient germination.

### APPLICATION TIMING

**ARGOS** should be used 1 month after harvest when the potatoes are dry and have proper skin firmness.

Up to 9 repeated treatments may be required and initial germination should be checked to ensure timely treatment.

### CIRCULATION AND VENTILATION

It is important to ensure slow recirculation of air throughout the harvest for even distribution and improved efficiency.

### WAREHOUSE

Slow recirculation of air should run uninterrupted during and after the fog treatment until the fog has disappeared.

### STORAGE IN BOXES

Fog treatment should preferably only be carried out while positive pressure ventilation is used, which ensures active distribution of the fog between the tubers inside the boxes. Fans must run during and after the fog treatment until the fog has disappeared to achieve an even distribution of the product and improved effect.



## APPLICATION CONDITIONS

Field of use	Objective of growth regulation	Dose* of plant protection product per application	Maximum number of applications per storage cycle	Minimum interval between applications in days
Potatoes intended for consumption	Inhibition of sprouting	100ml/ton potatoes	9	21
Starch potatoes	Inhibition of sprouting	100ml/ton potatoes	9	21

\* Dose reduction is permitted, but the maximum number of applications and other conditions of use must be adhered to. Efficacy has been determined for the specified dose per application and not for reduced doses.

## OTHER CONDITIONS OF USE

Apply the plant protection product using cold or hot fogging equipment.

Hot fogging must only be used with temperature-controlled equipment. Hot fogging equipment with no temperature-control facility is not permitted. Temperature-controlled equipment must be set to ensure that the spray does not exceed 190°C. This is to prevent spontaneous combustion (spontaneous combustion point is 248°C).

Consult your distributor for the correct settings of the hot fogging equipment. Always read the application equipment manufacturer's instructions before application.

Start treatment on dry potatoes when the first signs of germination appear.

The doors and external vents of potato storage facilities must be well sealed during treatment, with internal ventilation only. Allow the internal ventilation to continue running after treatment, until the fog has settled. Then keep the storage facility sealed for roughly 24 hours, whereafter normal external ventilation may resume. Only enter the treated storage facility after brief ventilation with outside air (at least 30 minutes).

Wear suitable gloves when working with the treated crops.

To protect aquatic organisms, respect a period of 24 hours between the last application and the industrial rinsing of potatoes.

## SAFETY PRECAUTIONS

### OPERATOR PROTECTION:

- **WEAR SUITABLE PROTECTIVE CLOTHING (COVERALLS) AND SUITABLE PROTECTIVE GLOVES** when handling the concentrate or handling contaminated surfaces
- **WASH HANDS AND EXPOSED** skin before eating, drinking or smoking and after work
- **KEEP OUT OF STORE DURING TREATMENT**
- **DO NOT ENTER** treated areas for at least 24 hours after treatment
- **WEAR FULL-MASK AND FILTER A2P3** in case of entering in the storage area during the first 24 hours after treatment
- **WASH PRODUCT** from skin or eyes immediately
- **WHEN USING DO NOT EAT, DRINK OR SMOKE**

### WORKER PROTECTION:

- **WEAR SUITABLE PROTECTIVE GLOVES\*** when handling treated material.  
\* Meeting at least glove safety standard EN374-2:2019, Level 2 and CE category III. Such gloves can be identified by a CE Mark with four digits below, and the EN374 pictogram for micro-organisms.
- **WEAR FULL-MASK AND FILTER A2P3** in case of entering in the storage area during the first 24 hours after treatment.

## 3. MODE OF ACTION

The control of sprouting in potato tubers by orange oil is achieved by physically damaging the sprouts. Orange oil the active ingredient, produces a physical mode of action on contact. The treated sprout tissues rapidly undergo irreversible superficial drying that leads to a loss of cell fluid followed by rapid and complete necrosis.



Fig 1. Burned sprouts after ARGOS application

## 4. PHYSICAL AND CHEMICAL PROPERTIES

- **ARGOS** contains Orange Oil 843,2 HN/KN as the active ingredient
- Colour: colourless liquid
- Odour: orange
- Flash point: 51.5°C
- Auto-flammability of liquid: 248°C

## 5. EFFICACY MANAGEMENT

The timing and number of applications are dependent on many factors, such as:

- Tuber health, crop growing / harvesting conditions.
- Crop dormancy / quality at harvest.
- Variety stored.
- Store temperature.
- Ambient ventilation and/or refrigeration.
- Store construction.
- Store fill-level: stores should be filled to designed capacity to get the most effective use of applied **ARGOS**.
- If the storage area is not completely filled, it is advisable to take measures to ensure the correct dosage and efficient distribution of **ARGOS**.
- **ARGOS** can be used with or without a pre-harvest **FAZOR / ROYAL MH** application.



## PROGRAM FAZOR/ROYAL MH AND ARGOS

### 5.1 FAZOR/ROYAL MH (MALEIC HYDRAZIDE)

**ARGOS** is a flexible product that can be used alone, in a programme with other storage sprout suppressants or as part of a programme following a field applied maleic hydrazide such as **FAZOR/ROYAL MH**.

Where possible **FAZOR/ROYAL MH** should be applied to the growing crop to provide the best possible foundation to an in-store sprout control programme.

**FAZOR/ROYAL MH** is a plant growth regulator applied in the field before potato harvest. **FAZOR/ROYAL MH** is transported to the tubers and inhibits cell division but not enlargement of existing cells. Once tubers have reached 25mm in size, the cells are formed and there is no negative effect on the yield.

**FAZOR/ROYAL MH** extends dormancy by approximately 2 to 3 months.

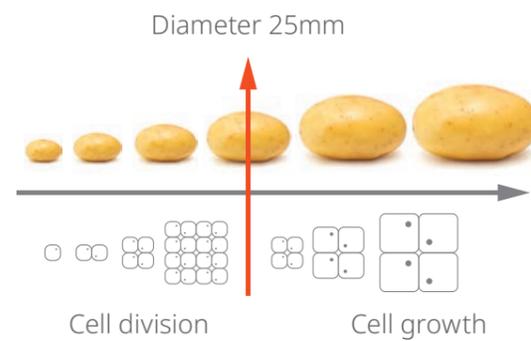
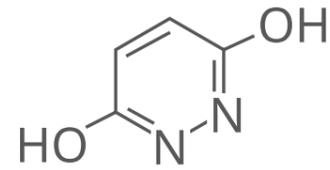
For efficient activity, it's important that **FAZOR/ROYAL MH** is properly absorbed and translocated to the growth points of the tubers. The right timing of application will be important to prevent potato sprouting in store.

- **FAZOR/ROYAL MH** is applied 3 to 5 weeks before haulm treatment and must be applied whilst the crop is still green and actively growing.
- At application time, check that 80% of the tubers are larger than 25mm.
- Temperature during application must not exceed 25°C (risk of foliage discoloration and/or poor uptake at higher temperatures).
- On warm days, it is recommended to apply **FAZOR/ROYAL MH** in the evening
- When the crop is irrigated a delay of one or two days is recommended before **FAZOR/ROYAL MH** application.
- A water volume of 150–300L/ha is recommended and can be increased to 500L/ha if the relative humidity is below 60%.
- Do not use wetting agents or other additives or tank-mix with blight fungicides.

### 5.2 IN-STORE TREATMENT WITH ARGOS

**ARGOS** is applied by hot and cold fogging on potatoes in storage. White sprouts are burned off. Even small sprouts that cannot be seen with the naked eye are removed. Effective application will prevent sprouting for several weeks.

- Maximum dose per treatment is 100ml per ton of potatoes.
- A maximum of nine treatments are possible in a storage cycle.
- The minimum interval between applications is 3 weeks.
- Potatoes can be delivered shortly after application.



### 5.3 VENTILATION REGIMES DURING ARGOS APPLICATION

#### 1. Bulk storage equipped with speed-controlled fans:

- Use all the fans at approximately 30% to 50% speed capacity during the treatment, depending on the size of the fans
- Maintain internal air recirculation for 30 to 60 minutes after treatment
- Keep the store closed for 24 hours.

#### 2. Bulk storage equipped without speed-controlled fans:

- If possible, disable one of every two fans
- Maintain internal air recirculation for 30 to 60 minutes and repeat 2 more times
- Keep the store closed for 24 hours.

#### 3. Storage in palox:

- If possible, reduce fans speed to 50-60%, depending on the size of the fans
- Maintain air recirculation for 30 to 60 minutes after treatment
- Set up ventilation of 30 minutes every 6 hours during the 24 hours storage closure to prevent condensation.

### 5.4 DOSE RATES

The recommended dosage of **ARGOS** is maximum 100ml per ton of potatoes.



## 6. POTATO VARIETIES SENSITIVITY

**ARGOS** can be applied on a wide range of varieties. Trials have been carried out on a range of widely grown commercial cultivars and under storage conditions that are representative of commercial practice in EU countries.

If a grower has any doubt on a potato variety, it is recommended to test **ARGOS** on a small sample or to contact your distributor or UPL team.

## 7. THE STORE

Before using **ARGOS** make sure only dedicated storage areas and storage boxes have been carefully cleaned in order to prevent residues of previous anti-sprout products which could cause phytotoxicity. Only stores equipped with ventilation systems where the air is blown or sucked through the potatoes are suitable for the use of **ARGOS**.

The mode of action of **ARGOS** is based on the contact action followed by necrosis of the sprouts and the prevention of sprout growth. The effect takes place shortly after application. As soon as **ARGOS** has been distributed evenly on the potatoes by the forced air, the product does its work.

Following several years practical experience, positive results have been obtained in all types of storage. Thanks to its short-term effect, **ARGOS** can be used efficiently in older storage sheds and non-optimally filled bulk and box storage. It is most important to ensure that **ARGOS** will go through the bulk of potatoes or boxes containing potatoes. Ensure that **ARGOS** is not diluted by taking proper measures.

If the equipment is outside the storage area, the building will have to be equipped with a minimum port of 15cm across to introduce the **ARGOS** nebulization pipe. This should be introduced in the potato storage area through a non-flammable (e.g. rock wool) panel (min 1m<sup>2</sup>) in the case of hot fogging application.



## 8. STORE APPLICATION

### ARGOS APPLICATION IN COLD STORES

1. Ensure excessive soil is removed from the potatoes.
2. Dry potatoes with adequate ventilation.
3. 24 hours before **ARGOS** application, disable relative humidity control (if present) to ensure all materials in the store are dry.
4. Switch off cooling system at least 24 hours before application and maintain the ventilation in "manual" mode to homogenize the temperature of all units in the building (structure, potatoes, ...) and avoid condensation.
5. Ensure there is no ice or moisture on the cooling system.
6. For the fresh market with a mechanical cooling systems, progressively cool down the potatoes from the harvest. Before the first application, reach a plateau between 8 and 12°C (according to the harvest temperature). Be aware that store temperature below 5°C will increase the risk of condensation on tubers.
7. Check the building for leaks and close all openings (eg: CO<sub>2</sub> extractors, etc, ...).
8. In boxes and bulk, provide enough internal ventilation before treatment to remove all traces of condensation and ensure a uniform temperature.
9. Before the start of application, it is important to get internal slow speed air re-circulation through the crop for evenness of distribution and improved efficacy.
10. Carefully choose the fog introduction point in the store. The fog should be introduced and allowed to mix with air, to aid dispersal, before being drawn into the ventilation for distribution around the store. Ensure the fog is distributed evenly across the bulk potatoes and it isn't directed at just one part of the pile.
11. A distance of at least 5m is recommended between the outlet pipe of the equipment and the potatoes to ensure good fog distribution.
12. Apply the dose appropriate for the stored tonnage with the internal recirculation running at a reduced speed and maintain a consistent fog temperature of 170–190°C to ensure product is applied as a dry fog and does not drip from the end of the application nozzle.
13. Continued moderate internal recirculation of **ARGOS** fog, during and for a period of at least 30 minutes after application will help the distribution through the store and subsequent distribution on the potatoes
14. Every 6 hours, it is advised to establish an additional internal ventilation for a period of 30 minutes to re-homogenize **ARGOS** in the store area.
15. Keep the storage area closed for approximately 24 hours to optimize the efficacy. After 24 hours, it is advised to establish an additional internal ventilation for a period of 15 minutes before switching on the cooling system.
16. It is advised to wait 24 hours before entering the storage area.



## ARGOS APPLICATION IN PROCESSING STORES (AMBIENT ± FRIDGE)

1. Remove excessive soil from the potatoes.
2. Dry potatoes with adequate ventilation.
3. 24 hours before **ARGOS** application, disable relative humidity control (if present) to ensure screen and store fabrics are dry.
4. Switch off the cold air at least 24 hours before application and maintain the ventilation in “manual” mode to homogenize the temperature of all units in the building (structure, potatoes, cooling equipment, ...) and avoid condensation
5. Ensure there is no ice or moisture on the cooling system.
6. Before the start of application, it is important to get internal slow speed air re-circulation through the crop for evenness of distribution and improved efficacy.
7. A distance of at least 5m is recommended between the outlet pipe of the equipment and the potatoes to ensure good fog distribution.
8. Apply the dose appropriate for the stored tonnage, with the internal recirculation running at a reduced speed and maintain a consistent fog temperature 170–190°C to ensure product is applied as a dry fog and does not drip from the end of the application nozzle.
9. Continued moderate internal recirculation of **ARGOS** fog, during and for a period of at least 30 minutes after application will help the distribution through the store and subsequent distribution on the potatoes.
10. It is recommended to maintain the storage area closed for approximately 24 hours to optimise efficacy. After 24 hours, external ventilation is possible under normal regime.
11. It is advised to wait 24 hours before entering the storage area.



## 9. APPLICATION EQUIPMENT

The treatment of potatoes in storage with **ARGOS** is done by cold or hot fogging. **ARGOS** is converted into a fog by the equipment and distributed by the air flow from the ventilation. Due to its low viscosity, **ARGOS** is volatile and penetrates well and easily into the potato heap or boxes.

### HOT FOGGING

With hot fogging application, it's imperative to avoid a risk of fire. Consequently, only temperature-controlled equipment can be used.

The recommended constant temperature of hot fogging of **ARGOS** is 170–190°C.

**✗ ARGOS cannot be used with any thermal fog generators which are not temperature controlled.**  
**Check with the manufacturer of the equipment that it is suitable for use with ARGOS.**

### CAUTION HOT FOGGING EQUIPMENT:

**ARGOS** has a self-ignition temperature of 248°C. **ARGOS** is introduced into a fogging chamber, where it is heated and vaporized for application. It is important to avoid contact of undiluted **ARGOS** with hot working parts inside machinery. This does NOT occur under normal operation.

In the case of machinery failure, application should be stopped and where delivery pipes are used, these should immediately be removed from the store wall. In the event of failure in a machine approved for use inside the store, the machine should be removed from the building.

It is important that application machinery must be attended by the operator during application.

### EQUIPMENT CLEANING PROCEDURES:

For all temperature-controlled equipment there is a risk when using flammable liquid, it is mandatory to carefully clean the equipment after each use. For this purpose, please refer to the technical manual of the machine manufacturer.

## 10. NOZZLE AND FLOW RATE

- Ensure the most appropriate nozzle is used to produce a “dry fog” (no drip from the end of applicator). It may depend on the flow rates and temperature settings of the machine, external conditions and internal crop/air temperatures.
- A distance of at least 5m is recommended between the outlet pipe of the equipment and the potatoes to ensure good fog distribution.
- There should not be any wet spots on the floor.

## 11. OTHER CROPS – CROSS CONTAMINATION

We cannot guarantee there will be no cross contamination to subsequent crops in **ARGOS** treated stores or boxes.

Due to the volatile nature of **ARGOS**, crops in adjoining stores may also be at risk of contamination. Increased ventilation during summer when stores are empty will help remove residues. **ARGOS** does not have approval for other crops. The risk of having contamination in subsequent storage is greatly decreased compared to CIPC.

## 12. WAITING PERIOD

**DO NOT ENTER treated areas for at least 24 hours after treatment.**

Latest time of application: 48 hours before removal from store for sale or processing.

## 13. STORE MATERIAL PRECAUTION AND WARNING

**ARGOS** may damage certain building and insulating materials and electrical components. If any doubt, samples of such material should be tested prior to the application of **ARGOS** or advice sought from the supplier. These effects can be avoided or reduced if the methods of application of **ARGOS** are carefully respected. If in any doubt, contact your local appointed UPL representative or appointed UPL distributor.

## 14. PHYTOTOXICITY

Condensation or dripping of **ARGOS** on the potato tubers should be avoided, as scorch could occur. This damage can be avoided by using the proper application techniques described in this manual. It is critical to have the right ventilation regime adapted to the application of **ARGOS** to ensure efficacy and avoid condensation and related phytotoxicity (skinburn).

## 15. LEGAL NOTICE

### RESPONSIBILITY

It is mandatory to refer to the product application guideline as per the label instructions, and within this technical manual before each use. In case of doubt, do not hesitate to contact UPL before proceeding with the application.

UPL declines all responsibility in the event of non-compliance with these instructions.

The equipment chosen for the **ARGOS** application is the sole responsibility of the user.

The purpose of this technical manual is to present the conditions of use of the potato sprout-suppressant **ARGOS**.

By using the product **ARGOS** you acknowledge that you have read and understood the label and technical manual.



**This manual is intended as an extension of the label instructions. In all cases the label instructions apply as the primary instructions.**





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Protection by UPL

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