ASAE EP475.3 JAN2018
Design and Management of Storages for Bulk, Fall-Crop, Irish Potatoes

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Developed by the ASAE Environment of Stored Products Committee; approved by the Structures and Environment Division Standards Committee; adopted by ASAE August 1990; reaffirmed December 1995; revised June 1996; reaffirmed January 2001, February 2006; revised editorially February 2006, reaffirmed January 2011, December 2015; revised May 2017, January 2018.

Keywords: Management, Potatoes, Storages

1 Purpose and Scope

1.1 This Engineering Practice provides a guide for the functional design and management of permanent, bulk storages for Irish potatoes.

1.2 This Engineering Practice applies specifically to the late-crop (fall-crop) area of the United States and Canada. This area is north of latitude 40°. It may be applicable in other geographic areas with similar climatic conditions and potato varieties. For more precise guidelines contact individuals that are knowledgeable about unique local weather conditions and potato varieties.

1.3 This Engineering Practice applies to storages that are designed to hold the product for more than two or three months.

2 Normative References

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ANSI/ASAE EP446, Loads Exerted by Irish Potatoes in Shallow Bulk Storage Structures

ANSI/NFPA 70 National Electrical Code

ASCE 7, Minimum Design Loads and Associated Criteria for Buildings and Other Structures

ANSI/ASAE EP378, Floor and Suspended Loads on Agricultural Structures Due To Use

ASAE D271, Psychometric Data

ASAE S701 Guidelines for the use of Thermal Insulation in Agricultural Buildings

ASTM E96 Standard Test Methods for Water Vapor Transmission of Materials

3 Definitions

3.1 cool-down period: The period following pre-conditioning or suberization when potato temperatures are reduced to desired holding temperatures

3.2 guarded slot: Air discharge opening from a duct designed such that potatoes do not block the opening or restrict the open area

3.3 holding period: The period that follows cool-down. Potatoes are held at a constant temperature that is consistent with end-use criteria and minimizes respiration rates. This period may be 2 to 9 months.

3.4 initial conditioning: The initial conditioning of the potatoes associated with cooling or warming and drying to conditions appropriate for suberization

3.5 pre-conditioning period: The period following the suberization period and before the cool-down period where potatoes are held at 12°C or higher to reduce excess sugar to improve process quality prior to cool-down period.

3.6 recirculation: Recycling of air that is contained within the building

3.7 reconditioning period: The period following the holding period when potatoes are warmed up to improve processing quality or reduce risk of subsequent bruise damage due to handling

3.8 senescence: The point in the stored potato's life characterized by the dominance of degradative changes; often considered as the start of tuber sprouting

3.9 suberization/wound healing period: The storage period when suberin is deposited at the wall surface of exposed cells and when new cells are formed under wound surfaces (wound healing)

3.10 sugar accumulation: Starch cells in the potatoes are converted to sugars that are accumulated. This results in a dark color in French fries and chips and causes a sweet flavor in fresh potatoes.

3.11 ventilation: The process of moving air through the potatoes. It may include recirculation of air within the storage or exchanging inside air with outside air to control temperature, humidity, oxygen level, carbon dioxide level, and condensation.

4 General Considerations

4.1 The main purpose of the storage is to provide conditions that will maintain high tuber quality, control diseases, and provide a marketable raw product with minimal weight loss.

4.2 The layout of the storage should be amenable to mechanized, high- volume loading and unloading systems while minimizing the handling impact on the potato.

4.3 Potatoes for different end uses are stored at different temperature conditions. (See clause 5.1.3.)

4.4 There may be up to six phases of a storage season. Their sequential order is:

(1) temperature equalization and surface drying

(2) suberization and wound healing

(3) pre-conditioning

(4) cool-down

(5) holding

(6) reconditioning