

# **EFFECT OF STORAGE METHOD AND DURATION ON GERMINATION OF PELLETTED FLUE-CURED TOBACCO SEED**

**G.A. Amankwa, S. Mishra, A.D. Shearer  
and D.L. Van Hooren**

**P.O. Box 322, Tillsonburg, Ontario N4G 4H5  
Canada**



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# Pelleted Seed

- Ontario producers grow pelleted seed in all greenhouse seedling production methods
- Leftover pelleted seed needs to be stored for use in following years
- Amount of pelleted seed remaining will vary from farm to farm
- Grower concerns regarding viability of stored pelleted seed the following season



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# Rationale

➤ Study was done in response to grower requests about best storage conditions for storing leftover pelleted seed



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# Factors affecting quality of tobacco seed after storage

- Initial quality of seed – field production environment, maturation and processing
- Conditions under which seed is stored
- Duration of storage period



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# Objectives

➤ To compare four common conditions under which crop seeds are stored, with the objective of identifying the best storage environments that would maintain the viability of pelleted tobacco seed when stored for a short term (1 to 2 years)



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# Materials and Methods

## Storage conditions

- Freezer: -18°C
- Refrigerator: 4°C
- Seed Room: 18°C
- Office: 21-23°C

Study conducted at CTRF, Tillsonburg, Ontario



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# Materials and Methods

## Seedlots

- Two pelleted seedlots of flue-cured tobacco were obtained from a commercial seed grower on April 14 2015
- 2011 grown cultivar CT157 pelleted in early 2015 to a size 9
- 2014 grown cultivar CT652 pelleted in early 2015 to a size 9
- Both samples were pelletized by Cross Creek Seed, North Carolina, USA



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# Materials and Methods

## Storage

- Equal amounts of seed were placed in small plastic containers
- Closed and sealed with paraffin wax to ensure airtight conditions
- Two sets of containers for each storage treatment
- Containers with seed were placed in the assigned storage location



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# Materials and Methods

## Storage

- Prior to the storage, seedlots were tested for germination
- One set of each treatment was taken out from storage on April 17, 2016 after one year and tested for germination
- Second set was taken out on April 18, 2017 and tested for germination



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# Materials and Methods



Plastic container for storing the pelleted seed



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# Materials and Methods

## Lab germination

- Pelleted seeds were placed on Whatman No.1 filter paper moistened with 4 mL deionized water in 9-cm Petri dishes
- 4 replicates of 50 seeds for each seedlot/storage location
- Petri dishes lids were secured with paraffin wax to prevent drying of the filter papers
- Germination was tested in an incubator (Sanyo Incubator MIR 153) at 24°C with light
- Experimental Design: CRD



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# Materials and Methods

## Data collected

- Germination counts were made 3 to 10 days after incubation
- Seeds germinated when cotyledons were visible
- Germination % = (Number of germinated seed/number of total seeds)\*100
- Germination Rate Index (%/day) =  $\sum [(G_i - G_{t-1})/i]$   
(Maguire, J.D. 1962): where i is the germination count day,  $G_i$  is the % germination through day i, and  $G_{t-1}$  is the % of seed germinated through the previous count day



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# Materials and Methods

## Statistical analysis

- Statistical analysis performed with SYSTAT version 13 according to a 2 x 4 factorial experiment in CRD
- Means compared using Tukey's test at  $P \leq 0.05$  significance level



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**Table 1. Seed germination for two pelleted seedlots of flue-cured tobacco before storage.**

Seedlot	Final Germination at 10 days (%)	Germination Rate Index
2011 grown CT157	92.0 a	14.8 a
2014 grown CT652	84.5 b	13.9 b
<i>p-value</i>	0.016	0.036

Note: Seeded on 14 April, 2015 and germination was monitored from 20<sup>th</sup> to 24<sup>th</sup> April, 2015. Means within a column followed by the same letters are not significantly different, based on Tukey's test at  $P \leq 0.05$ .



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**Table 2. Effect of storage method on germination percentage and germination rate after one year of storage.**

<b>Storage Method</b>	<b>Final Germination at 10 days (%)</b>	<b>Germination Rate Index</b>
<b>Freezer</b>	<b>86.5 a</b>	<b>12.3 a</b>
<b>Refrigerator</b>	<b>87.3 a</b>	<b>12.4 a</b>
<b>Seed Room</b>	<b>85.0 a</b>	<b>12.0 a</b>
<b>Office</b>	<b>84.3 a</b>	<b>11.9 a</b>
<i><b>p-value Storage Method (SM)</b></i>	<b>0.694</b>	<b>0.604</b>
<i><b>p-value Seedlot x SM</b></i>	<b>0.624</b>	<b>0.616</b>

Note: Seeded on 18 April, 2016 and germination was monitored from 25<sup>th</sup> to 28<sup>th</sup> April, 2016. Means within a column followed by the same letter are not significantly different from each other, based on Tukey's test at  $P \leq 0.05$ .



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**Table 3. Seed germination for two pelleted seedlots after one year of storage under different conditions.**

Seedlot	Final Germination at 10 days (%)	Germination Rate Index
2011 grown CT157	90.8 a	12.9 a
2014 grown CT652	80.8 b	11.4 b
<i>p-value</i>	0.000	0.000

Note: Seeded on 18 April, 2016 and germination was monitored from 25<sup>th</sup> to 28<sup>th</sup> April, 2016. Means within a column followed by the same letter are not significantly different from each other, based on Tukey's test at  $P \leq 0.05$ .



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**Table 4. Germination percentages and germination rate indices after two years of storage.**

<b>Storage Method</b>	<b>Final Germination at 10 days (%)</b>	<b>Germination Rate Index</b>
<b>Freezer</b>	<b>88.5 a</b>	<b>12.5 a</b>
<b>Refrigerator</b>	<b>86.5 a</b>	<b>12.2 a</b>
<b>Seed Room</b>	<b>84.0 ab</b>	<b>11.2 b</b>
<b>Office</b>	<b>80.2 b</b>	<b>10.7 b</b>
<i>p-value Storage Method (SM)</i>	<b>0.004</b>	<b>0.000</b>
<i>p-value Seedlot x SM</i>	<b>0.164</b>	<b>0.001</b>

Note: Seeded on 24 April and germination was monitored from 1<sup>st</sup> to 4<sup>th</sup> May, 2017. Means within a column followed by the same letter are not significantly different from each other, based on Tukey's test at  $P \leq 0.05$ .



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**Table 5. Seed germination for two pelleted seedlots after two years of storage under different conditions.**

Seedlot	Final Germination at 10 days (%)	Germination Rate Index
<b>2011 grown CT157</b>	<b>89.8 a</b>	<b>10.9 a</b>
<b>2014 grown CT652</b>	<b>80.0 b</b>	<b>9.9 b</b>
<b><i>p-value</i></b>	<b>0.000</b>	<b>0.000</b>

Note: Seeded on 24 April and germination was monitored from 1<sup>st</sup> to 4<sup>th</sup> May, 2017. Means within a column followed by the same letter are not significantly different from each other, based on Tukey's test at  $P \leq 0.05$ .



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# Summary

- **After one year storage, no significant differences were found among storage methods**
- **After two years storage, statistical differences were found among storage methods on all germination counting dates. The germination rate indices were higher (rapid germination rate) for the freezer and refrigerator storages and considerably lower for seed room and office storages**
- **Seed stored in the freezer and refrigerator for two years had 88.5% and 86.5% germination, respectively, the same germination % (88.3%) as the initial germination of the seed. Storage at the seed room and office provided 84.4% and 80.2% germination, respectively**

# Summary

- **Storing pelletized seed in a freezer or refrigerator appears to be the best options to maintain as much seed germination and seed vigour as possible**
- **The seed must be stored in sealed waterproof containers to keep out moisture, a major cause of rapid deterioration in seed viability and vigour**
- **Ordinary room temperature storage may be associated with slower and poorer germination, and this can result in non-uniform plants and adversely impact the amount of usable transplants.**

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