



# Influence of Harvest Date on Pennycress Seed Yield and Quality

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## Introduction

**Opportunity:** Establish winter cover crops in Minnesota that maximize the short growing season and contribute to farm profitability.

- Temporal intensification can be used to integrate winter-hardy crops after summer annual crops have been harvested and utilize end-of-season growing degree units.<sup>5</sup>
- Winter annual crops are able to capture much of the growing season not utilized by a traditional corn (*Zea mays* L.) – soybean (*Glycine max* L.) rotation.<sup>6</sup>
- Early season pennycress (*Thlaspi arvense* L.) harvest allows a summer annual double crop to be planted, and increases the overall amount of seed harvested in a single growing season.<sup>7</sup>
- Pennycress oil can be used as a source of biodiesel. This can increase annual farm income due to overall greater seed production.<sup>8</sup>

**Challenge:** Pennycress is prone to seed shatter at or past physiological maturity. Harvest losses can exceed 60% if proper timing and practices are not established.<sup>9</sup>

## Objectives

1. Evaluate the effect of multiple June harvest dates on pennycress grain moisture and yield.
2. Determine oil content at each June harvest date.

## Materials and Methods

### Design:

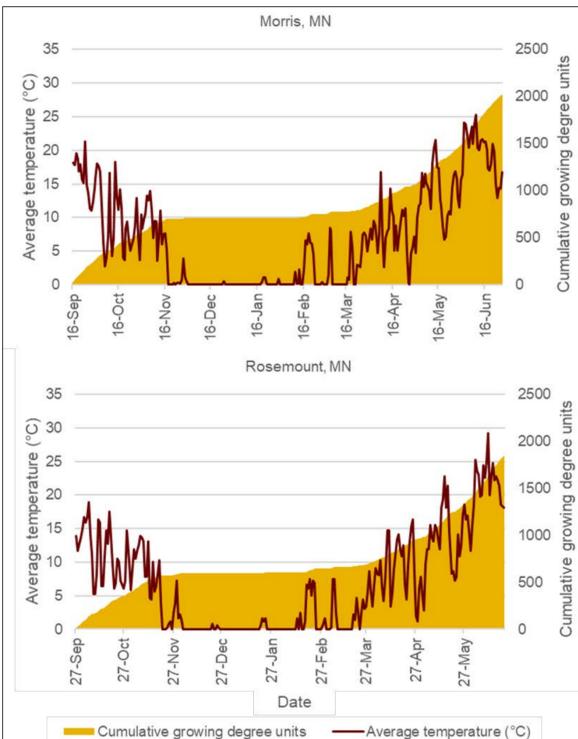
- Two locations: Morris and Rosemount, MN
- Randomized complete block design
- Four replications

### Management:

- Planted 16-Sep, 2016 (Morris, MN) and 27-Sep, 2016 (Rosemount, MN)
- 8 harvest dates in Jun 2017
- Treatments were hand harvested

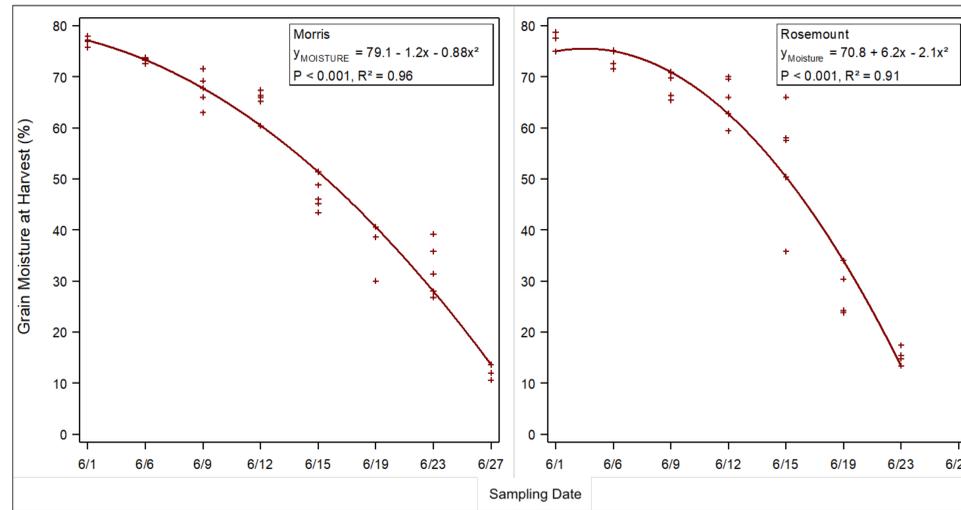
### Analysis:

- The REG procedure in SAS and the AIC were used to aid in model selection comparing linear, quadratic, and linear plateau models<sup>10, 11</sup>

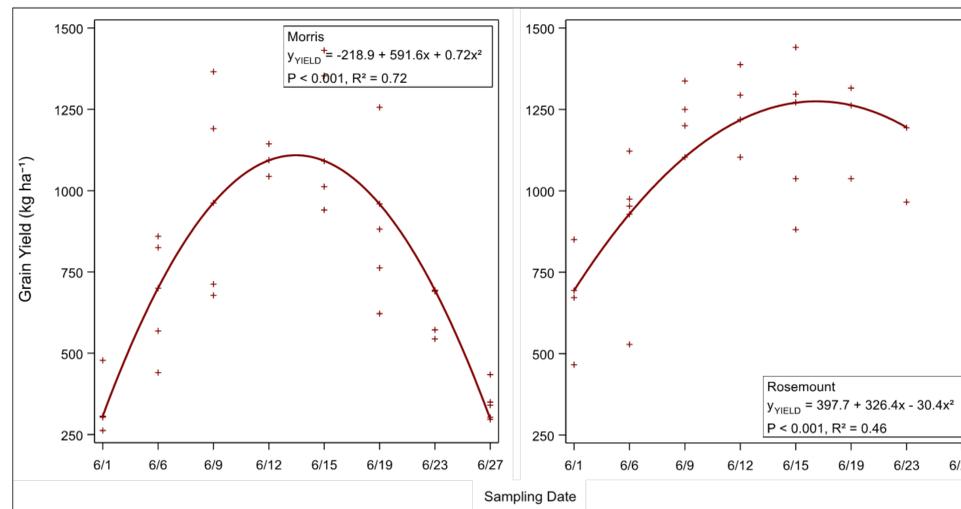


**Figure 1.** Temperature and cumulative growing degree units at two research locations, (2016-2017).<sup>12,13</sup>

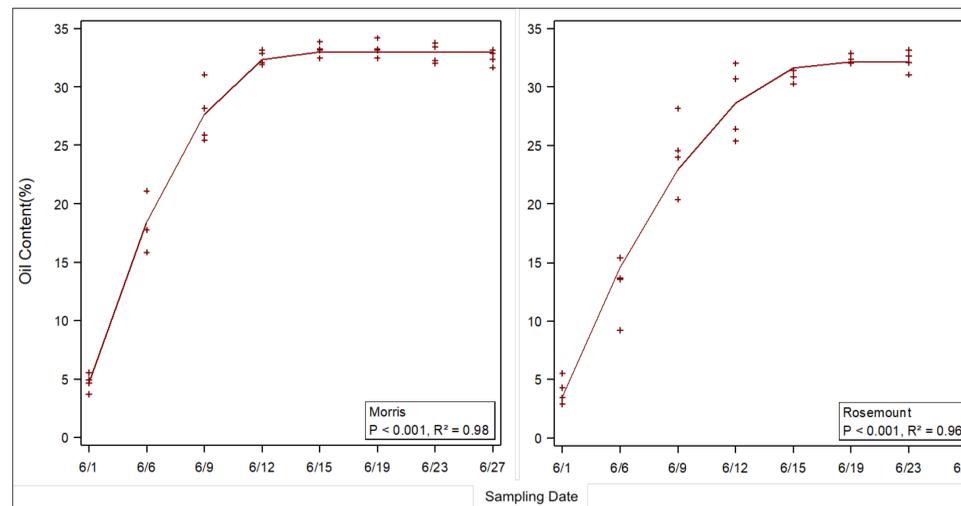
## Results



**Figure 2.** Predicted pennycress grain moisture at harvest in response to sampling date in Morris and Rosemount, MN (2017).



**Figure 3.** Predicted pennycress grain yield at harvest in response to sampling date in Morris and Rosemount, MN (2017).



**Figure 4.** Predicted pennycress oil content at harvest in response to sampling date in Morris and Rosemount, MN (2017).

## Discussion

### Pennycress Harvest Parameters:

- Pennycress grain yield and oil content is optimized between 50-60% moisture.
- Harvest dates driven by timing of physiological maturity may lead to an increase in post-harvest costs.
- To ensure maximum grain yield and oil content, genetic improvements or harvest aids will be necessary in the future.
- Environmental conditions and equipment can impact grain loss at low grain moisture.
- Moisture content low enough to facilitate harvest without having to dry seed post-harvest is associated with seed loss.



**Figure 5.** Mature pennycress, Rosemount, MN (2017).

- As silicles mature, fragility increases.

### Pennycress Oil Production:

- Oil content plateaued as grain yield reached maximum value.
- Later harvest dates did not result in changes to oil content.



**Figure 6.** Mature pennycress field, Rosemount, MN (2017).

## Conclusions

Pennycress harvest date should be chosen carefully based on silicle maturity in order to minimize grain loss.

Mid-June harvest dates are the most productive in terms of grain yield and oil content.

- Grain yield was maximized between 12-Jun and 15-Jun at both locations.
- Oil content plateaus at the same time that harvest losses increase.

Given that oil content remains consistent, maximizing grain harvest is the most important factor in choosing pennycress harvest date.

## References

- <sup>5</sup>Heaton et al., 2013, Biofuels, Bioprod. and Bioref., 7:702-714.  
<sup>6</sup>Burnham et al., 2002, J. Prod. Agric. 2(1):32-36.  
<sup>7</sup>Version 9.4; SAS Institute Inc., Cary, NC  
<sup>8</sup>Phippen and Phippen, 2012, Crop Sci. 52:2767-2773.  
<sup>9</sup>Johnson et al., 2015, Agron. J. 107:532-540.  
<sup>10</sup>Moser et al., 2009, Energy and Fuels, 23:4149-4155.  
<sup>11</sup>Carlson et al., 2018 (Unpublished).  
<sup>12</sup>USDA-ARS Swan Lake Research Center Weather Station  
<sup>13</sup>Rosemount Research and Outreach Center Weather Station

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