FINAL PROJECT REPORT
Canola Agronomic Research Program (CARP)

The Annual Final Report should fully describe the work completed for the year and note the personnel involved. It should also note any deviations from the original plan and next and/or corrective steps as may be required if deviations are noted. The report should also provide an update on the status of the Project including forecasted date of completion. A complete statement of expenses should be included. In the event major changes are anticipated within the budget supporting notes along with a proposed budget should also be included. The report should also capture a complete summary of activity for the year.

Project Title: Determining Best Practices for Summer Storage of Canola in Western Canada

Research Team Information

Lead Researchers:		
Name	***Institution***	***Expertise Added***
Joy Agnew	PAMI	Ph.D., P.Eng., 13 years of research experience, 5 years of grain storage research experience
Research Team Members		
Name	***Institution***	
Les Hill	PAMI	
Bryan Lung	PAMI	

Project Start Date: May 20, 2014 **Project Completion Date:** December 31, 2014

Reporting Period: May 20, 2014, to December 31, 2014

CARP Project Number: 2014.25

Instructions: This Final Project Report shall be completed and submitted on or about March 31st of the fiscal year that the agreement is in effect (upon completion of the project). The Lead Researcher of the project in question shall complete and submit the report on behalf of his/her complete research team.

This Report is a means by which to provide a detailed account upon completion of the project. Final project financial reporting should be provided at this time.

The following template is provided to assist you in completing this task. Please forward the completed document electronically to your appropriate CCC contact.

1. Date of Completion: December 1, 2014

Data collection concluded on November 20, 2014, and analysis finished on December 1, 2014.

2. Status of Activity: (please check one)

_____ **Ahead of Schedule** _____ **On Schedule** _____ **Behind Schedule** **X Completed**

Comment:

In the original proposal and project plan, PAMI agreed to collect data from the bin-scale testing for a minimum of six weeks or until the grain was removed from the bin(s). Two of the three bins were monitored until the end of July, and the third was monitored until the end of November.

3. Completed actions, deliverables and results; any major issues or variance between planned and actual activities.

The project successfully gathered in-bin data on the effect of bin management (aeration, turning, leaving it alone) on the temperature and relative humidity profile in-bin throughout the summer months (June and July). In addition, the bench-scale trials provided data on the warming rate of canola with different airflow rates. The original plan involved two bench-scale trials (one to assess the effect of airflow rate and one to assess the effect of starting temperature); however, the second bench-scale trial was removed from the workplan due to budget issues and the low probability of generating new/useful information. This change in workplan was communicated to the Canola Council via email in July 2014.

The project results generated information on:

- Temperature profile in a bin of cooled canola throughout the summer months
- Effect of turning and aeration on temperature profile
- Warming rate of canola due to aeration
- Effect of airflow rate on the warming rate of canola

The key results from the project are:

- There was very little moisture migration in all three bins throughout June and July, therefore, no spoilage or condensation was observed for any treatment. However, lack of moisture migration may have been partially due to the lack of moisture in the canola (the canola moisture content was 6%).
- There were large temperature differences in each bin throughout the summer. The baseline bin temperature was 25°C at the edge and -3°C in the core for most of July.
- There was no noticeable difference in the grain temperature on the sunny side of the bin versus the shady side of the bin.
- The temperature in the bin headspace fluctuated widely from day to night (reaching as high as 55°C), but the relative humidity of the air in the headspace was very low (<40%). The temperature of the grain at the top of the bin (within 2 ft of headspace) did not fluctuate during the day.
- Turning the seed (700 bushels in a 4,000 bushel bin) initially resulted in a relatively warm core and warm edges but cool seed between the core and edges. This temperature differential eventually evened out (the core actually cooled throughout June).
- Aerating the seed resulted in a uniform temperature distribution (approximately 20°C), but the transition between the warming front and the cool seed resulted in some unstable conditions (potential for condensation).
- Aerating the seed (using warm, summer air) added a large quantity of water to the air voids in the bin (as measured by absolute humidity). However, this moisture was not transferred to the seed since the moisture content of the canola did not change (6.6% at the start of monitoring and 6.5% three weeks after aeration was completed).

- The turned bin and aerated bin had some unstable conditions in July that could possibly have resulted in spoilage. Unstable conditions resulted in warm seed being directly adjacent to cool seed. In the aerated bin, these conditions occurred as the warming front moved through the cool seed. In the turned bin, these conditions occurred because the warm seed at the top funneled down into the center of the bin during turning, leaving a warm core adjacent to cool seed. However, these unstable conditions did not result in noticeable condensation or spoilage.
- The baseline bin had a large temperature differential (28°C), but the temperature difference was gradual, resulting in generally stable conditions
- The warming rate of canola is approximately equal to the cooling rate when using aeration flowrates (0.1 to 0.5 cfm/bu). In the 4,000 bu bin, it took approximately 48 hours to uniformly warm the seed using 0.75 cfm/bu (the lowest flowrate possible with the fan on the bin). In the small test bins, it took 90 hours to uniformly warm canola from -10°C to 20°C using 0.25 cfm/bu and 75 hours to uniformly warm canola from -10°C to 20°C using 0.5 cfm/bu.
- Based on the results from this study, “leaving it alone” seems to be the best practice to minimize storage risk throughout the summer. However, these results were limited to overdry canola that had been frozen over the winter and stored in an 18 ft diameter bin. Canola starting at a higher moisture content or a higher temperature or stored in a different sized bin might behave differently during the summer. Therefore, the key recommendation from this project is to leave it alone but monitor the temperature profile and have a plan in place to move it if problems arise.

4. Significant Accomplishments

The significant accomplishments of this project are:

- The efficient collection and dissemination of time-sensitive information. The project was approved in mid-May and data collection began in early June. The data was provided to producers and agronomists in real-time via a live feed display of the temperature and relative humidity data and blog updates were provided discussing the implications of the data.
- The collection of bin-scale data provided “real” data that can be directly applied while the bench-scale results provided more scientifically valid, replicated results.
- The project provided clear results for the conditions tested. If the canola is overdry and frozen over the winter, leaving it alone results in the best conditions for storage over summer.
- The results were effectively disseminated to a wide audience via the Canola Council’s blog, PAMI’s website, and numerous workshops and seminars where the lead researcher provided a project summary and update. To date, the presentation was given at or is planned for four AgriTrend workshops in Alberta, the Canola Discovery Forum in Saskatoon, the Farm Forum Event in Saskatoon, the Saskatchewan Agronomy Update in Saskatoon, and CanoLAB in Brandon.

5. Research and Action Plans

The results from this project were useful and interesting, but the resulting recommendation is limited to overdry canola that was frozen over the winter. If the stored canola has a higher moisture content or different starting temperature, the degree of moisture migration may be different over the summer months, which could raise the risk of spoilage or heating. In addition, the temperature profile and potential for moisture migration may be different in bins with a larger diameter. Therefore, PAMI is proposing to continue this research project and monitor bins of larger diameter with different starting conditions. The challenge will be finding partner producers with stored canola at a specific moisture content. PAMI has proven capable of collaborating with producers and gathering timely and useful information to help producers make better storage management decisions.

PAMI will continue to disseminate the results of this project at various events and will prepare a factsheet related to summer storage of grain and efficient and safe “freezing” of grain in the winter to improve storage conditions in the summer.