

Wheat Storage and Impact on Quality

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Effect of wheat storage conditions on quality

- Effect of wheat storage – Study around freshly harvested wheat under controlled conditions
- Effect of wheat storage – Study around long term storage under commercial conditions

Effect of wheat storage conditions on quality

Effect of wheat storage – Study around freshly harvested wheat under controlled conditions

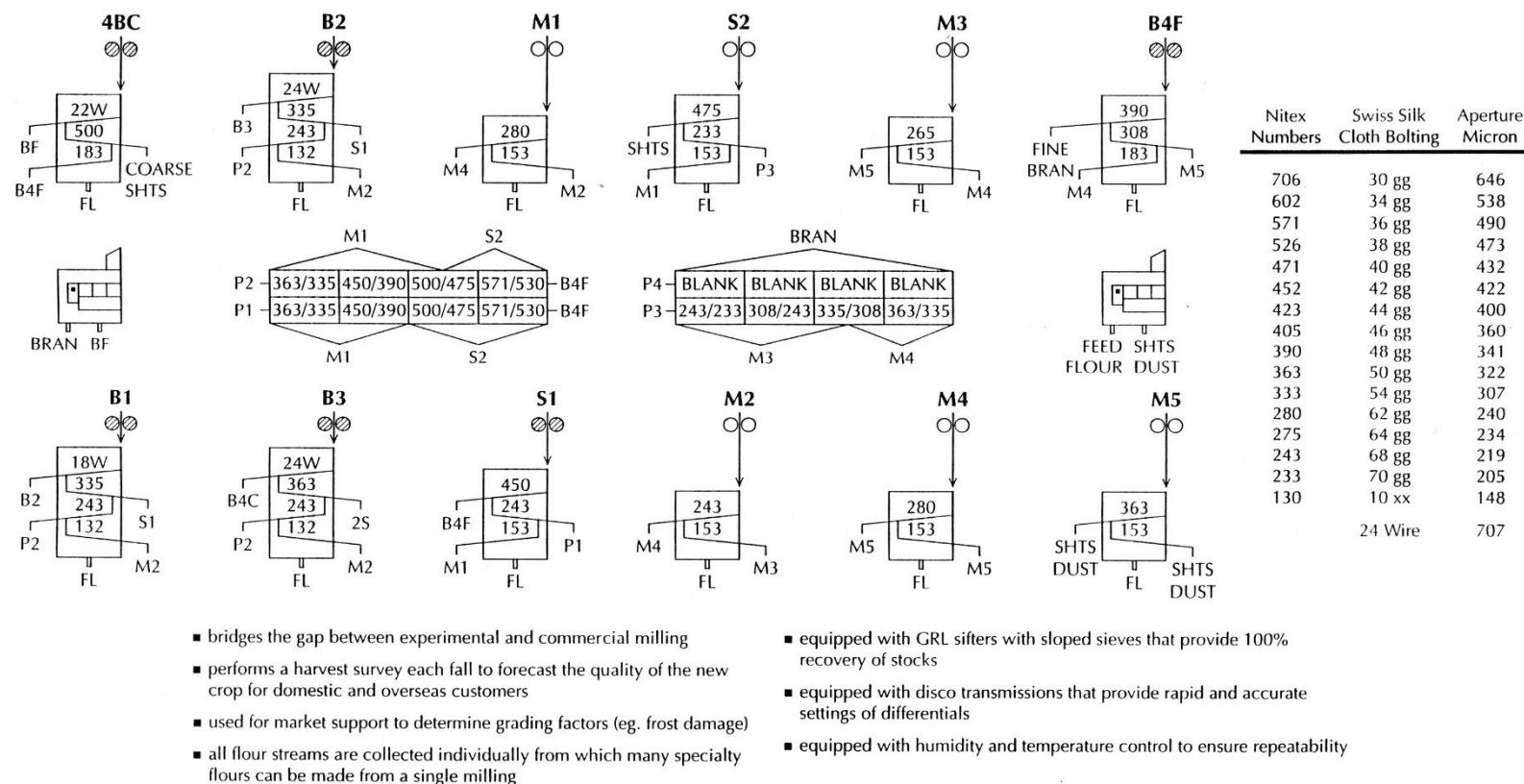
Pilot milling properties of two commercially grown CWRS varieties obtained immediately following harvest, and at storage intervals of up to 30 months at 21°C and minus 15°C following harvest, were evaluated.

Effect of wheat storage conditions on quality

Effect of wheat storage – Study around freshly harvested wheat under controlled conditions

Physical dough properties and baking properties of flour produced at each storage time were also tested. Flour from wheat stored for various times was also tested after storage for one month at 21°C to determine if short-term flour storage reduced processing differences associated with wheat storage time.

Grain Research Laboratory Pilot Mill • CWRs Mill Flow



Canadian Grain
Commission

Commission canadienne
des grains



Canada

Figure 1: Grain Research Pilot Mill Flow Diagram

Source: Canadian Grain Commission

Effect of wheat storage conditions on milling properties



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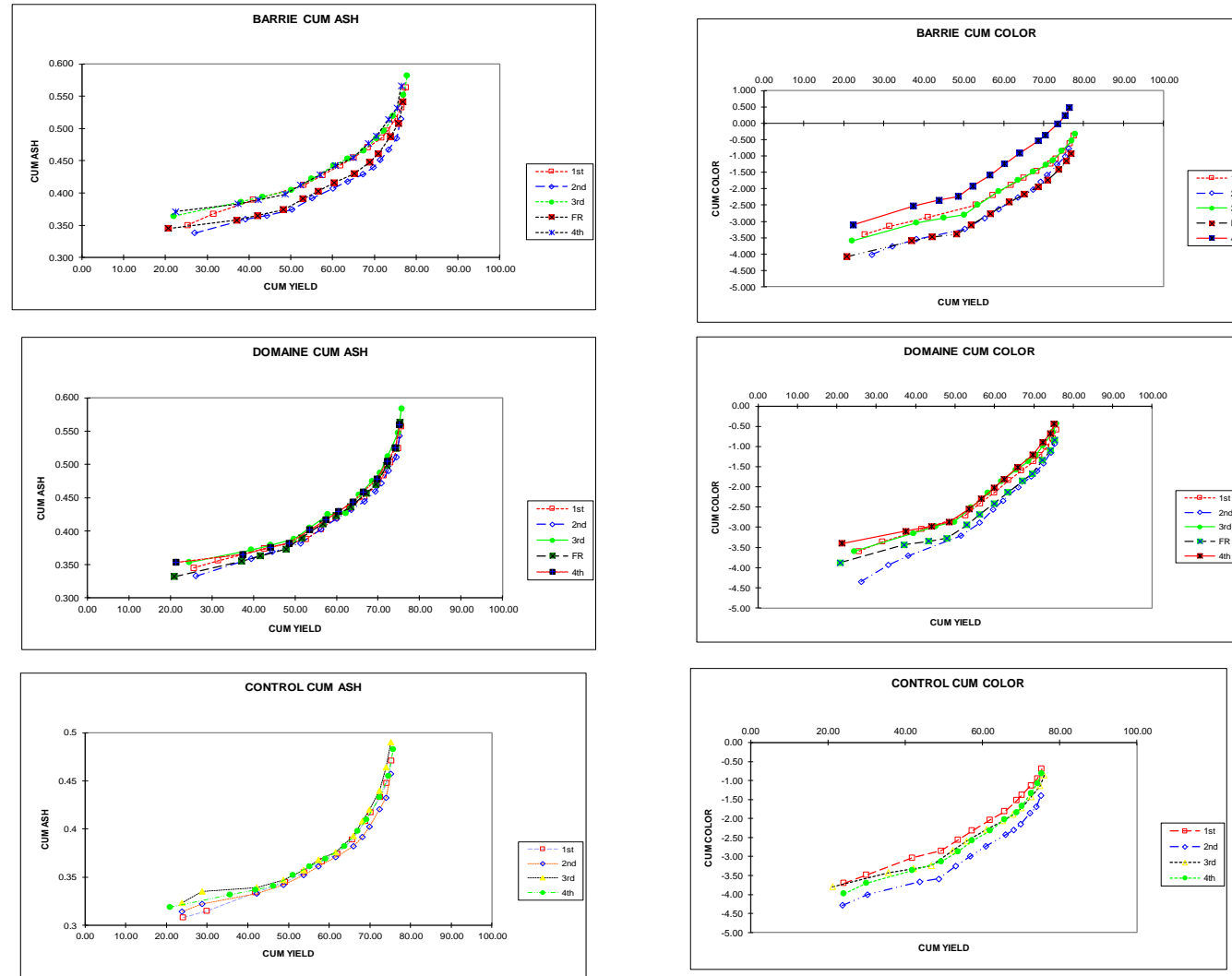


Figure 2: Influence of Storage on Cumulative Ash and Color

Effect of wheat storage conditions on milling properties



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Table 1. Evaluation of Milling Performance with respect to Cumulative Ash Values

| Wheat Samples | Barrie | Domaine | Control |
|---------------------|-------------------------|-------------------------|-------------------------|
| Milling Performance | | | |
| Good | 2 nd Milling | 2 nd Milling | 2 nd Milling |
| | 5 th Milling | 5 th Milling | 1 st Milling |
| | 1 st Milling | 1 st Milling | 4 th Milling |
| | 3 rd Milling | 4 th Milling | 3 rd Milling |
| Fair | 4 th Milling | 3 rd Milling | |

Evaluation of Milling Performance with respect to Cumulative Color Values

| Wheat Samples | Barrie | Domaine | Control |
|---------------------|-------------------------|-------------------------|-------------------------|
| Milling Performance | | | |
| Good | 5 th Milling | 2 nd Milling | 2 nd Milling |
| | 2 nd Milling | 5 th Milling | 3 rd Milling |
| | 3 rd Milling | 1 st Milling | 4 th Milling |
| | 1 st Milling | 3 rd Milling | 1 st Milling |
| Fair | 4 th Milling | 4 th Milling | |

Table 2. Effect of Wheat Storage Conditions on Farinograph Properties

| Wheat Storage | AC Barrie | AC Domaine |
|---------------------------|-----------|------------|
| Freshly harvested | | |
| Water absorption, % | 61.1±0.3 | 61.8±0.1 |
| Dough development time, % | 5.1±0.1 | 4.1±0.1 |
| Stability, min | 7.8±0.3 | 6.3±0.3 |
| Stored 6 weeks at 21°C | | |
| Water absorption, % | 60.5±0.0 | 61.7±0.2 |
| Dough development time, % | 5.6±0.4 | 4.4±0.3 |
| Stability, min | 9.0±0.0 | 7.3±0.3 |
| Stored 9 months at 21°C | | |
| Water absorption, % | 61.4±0.3 | 62.1±0.2 |
| Dough development time, % | 5.7±0.7 | 4.7±0.2 |
| Stability, min | 9.5±0.5 | 6.8±0.3 |

Table 3. Effect of Wheat Storage Conditions on Farinograph Properties

| Stored 30 months at 21°C ² | | |
|--|----------|----------|
| Water absorption, % | 60.7 | 61.3 |
| Dough development time, % | 6.8 | 5.5 |
| Stability, min | 11.3 | 9.3 |
| Stored 30 months at –15°C ² | | |
| Water absorption, % | 61.7±0.1 | 62.2±0.5 |
| Dough development time, % | 5.0±0.0 | 4.3±0.3 |
| Stability, min | 7.0±0.0 | 5.8±0.3 |

Table 4. Effect of Wheat Storage Conditions on Alveograph Properties

| Wheat Storage | AC Barrie | AC Domaine |
|--------------------------------------|-----------|------------|
| Freshly harvested ¹ | | |
| Length, mm | 157±3 | 159±5 |
| P, height X 1.1, mm | 63±3 | 59±3 |
| W, X 10 ⁻⁴ J | 299±5 | 219±11 |
| Stored 6 weeks at 21°C ¹ | | |
| Length, mm | 138±22 | 154±2 |
| P, height X 1.1, mm | 71±1 | 63±2 |
| W, X 10 ⁻⁴ J | 317±32 | 251±10 |
| Stored 9 months at 21°C ¹ | | |
| Length, mm | 142±9 | 147±1 |
| Height, mm, % | 79±2 | 79±3 |
| W, X 10 ⁻⁴ J | 370±37 | 299±9 |

Table 5. Effect of Wheat Storage Conditions on Alveograph Properties

| Stored 30 months at 21°C ² | | |
|---------------------------------------|-------|--------|
| Length, mm | 109 | 134 |
| Height, mm, % | 93 | 82 |
| W, X 10 ⁻⁴ J | 383 | 337 |
| Stored 30 months at –15°C | | |
| Length, mm | 143±5 | 164±7 |
| Height, mm, % | 71±3 | 64±1 |
| W, X 10 ⁻⁴ J | 323±4 | 274±16 |

Effect of wheat storage – Study around freshly harvested wheat under controlled conditions

- Minor fluctuations with respect to B₁ release, flour stream distribution, flour yield, flour ash and flour grade color were observed during storage at 21°C following harvest for two CWRS cultivars. They did not show simple relationship to duration of storage. AC Barrie showed greater fluctuations than AC Domaine during storage.
- Flour physical dough properties strengthened during storage at 21°C for up to 30 months with evidence of some moderate increase in strength observed only after six weeks of storage. No changes were observed during long term storage at minus 15°C.
- Storing flour for one month after milling at 21°C showed increase in dough strength but the dough strength still ranked according to storage time.
- Volume of CSP bread produced under lab conditions did not show much differences for wheat storage time nor for flour storage time. However increase in dough strength properties impart greater processing tolerances.

Effect of wheat storage conditions on quality

Effect of wheat storage – Study around long term storage under commercial conditions

Two old wheat samples stored in bins from two separate areas were brought for milling, analytical, rheological and baking quality evaluation. Lab milling of two commercially stored CWRS wheat lots representing two different regions were brought to CIGI.

Background information

- Long term stored wheat samples were tested in the past showing the following trend:
 1. High falling number and high amylograph peak viscosity
 2. Very strong dough properties
 - long development time
 - Long stability and
 - Low MTI.
- Normal baking process produced poor loaf quality with lower loaf volumes, inferior internal and external characteristics

Background information

- The storage study described earlier involved milder storage conditions in terms of temperature and humidity and storage space.
- A more comprehensive study was required to measure the quality changes and to evaluate overall impact on functionality.

Materials & Method

Two samples of wheat stored in commercial storage bins under two different ambient conditions were brought and tested along with a control sample for comparative quality evaluation.

Buhler lab milling, analytical and rheological tests were conducted using standard testing methods used at CIGI.

Table 6. Effect of Wheat Storage Conditions on Wheat Quality

| Parameters | CWRS sample stored under higher temperature | CWRS sample stored under moderate temperature | CWRS Control Sample |
|---------------------|---|---|---------------------|
| Test Weight, kg/hL | 83.6 | 82.2 | 80.3 |
| Protein content , % | 14.0 | 14.2 | 13.9 |
| Falling Number, sec | 2250 | 553 | 386 |
| | | | |

Table 7. Effect of Wheat Storage Conditions on Wheat and Milling Properties

| Parameters | CWRS sample stored under higher temperature | CWRS sample stored under moderate temperature | CWRS Control Sample |
|-----------------------|---|---|---------------------|
| Flour Yield, % | 73.9 | 73.4 | 73.5 |
| Ash Content, % | 1.55 | 1.54 | 1.6 |
| Particle Size Index,% | 51 | 53 | 50 |



Figure 3: Buhler lab mill

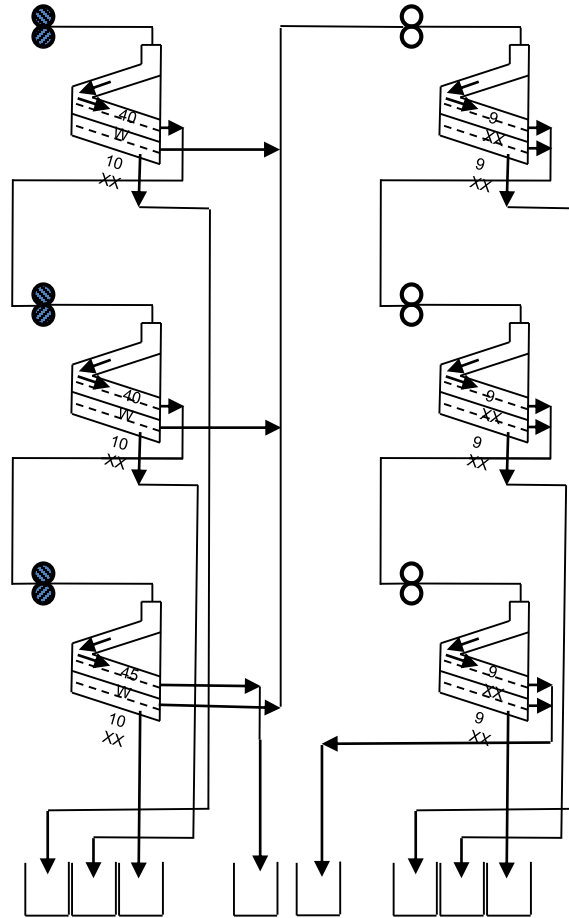


Figure 4: Buhler lab mill flow diagram

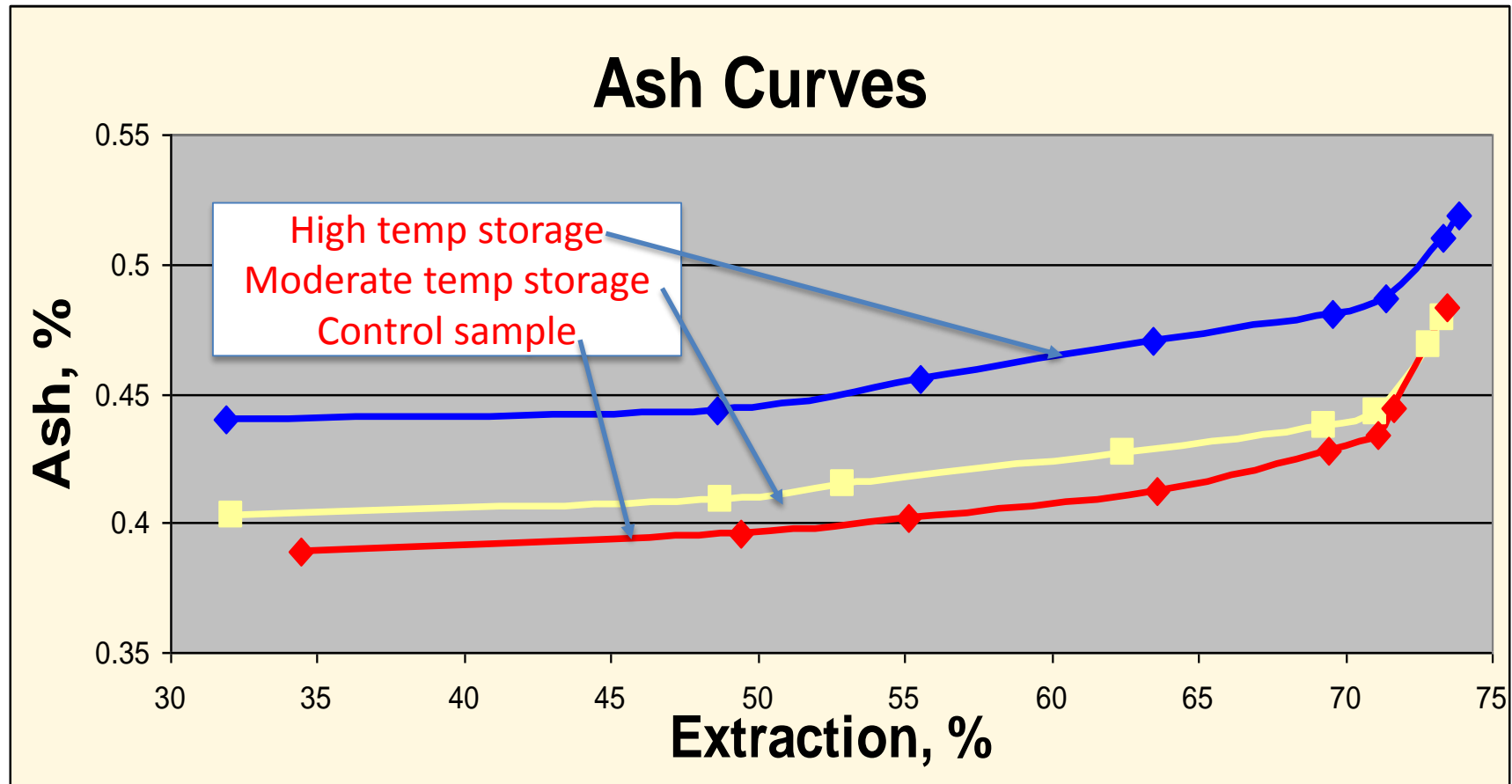


Figure 5: Influence of Storage on Cumulative Ash

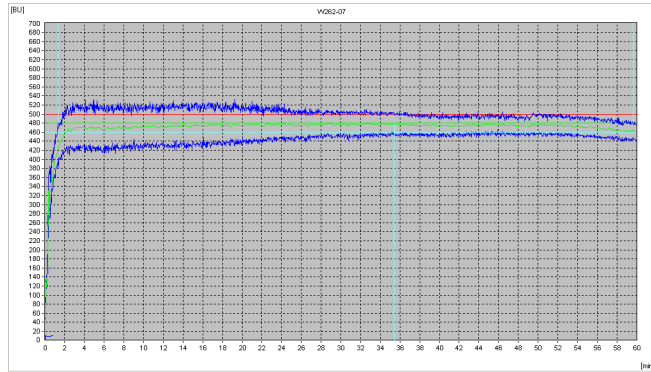
Table 8. Effect of Wheat Storage Conditions on Flour Quality

| Parameters | CWRS sample stored under higher temperature | CWRS sample stored under moderate temperature | CWRS Control Sample |
|--------------------------|---|---|---------------------|
| Protein Content (CNA), % | 13.2 | 13.5 | 13.3 |
| Wet Gluten, % | 33.6 | 35.9 | 33.2 |
| Ash Content, % | 0.50 | 0.46 | 0.48 |
| | | | |

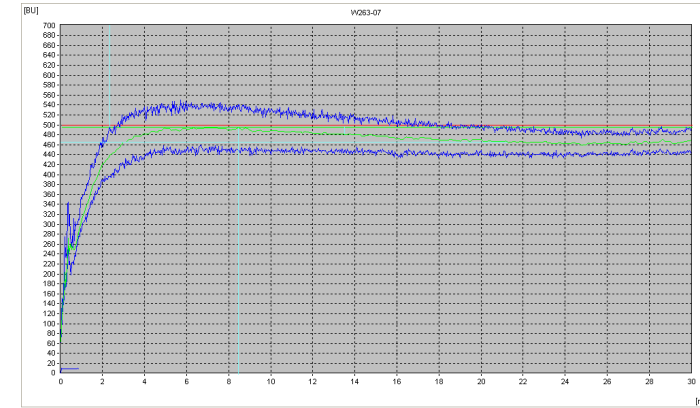
Table 9. Effect of Wheat Storage Conditions on Flour quality

| Parameters | CWRS sample stored under higher temperature | CWRS sample stored under moderate temperature | CWRS Control Sample |
|-------------------------------|---|---|---------------------|
| Minolta L* | 84.7 | 85.9 | 86.6 |
| Colour a* | 0.39 | -0.16 | -0.44 |
| b* | 12.9 | 12.6 | 14.4 |
| Starch Damage (SDmatic), UCD | 17.2 | 18.3 | 15.8 |
| Amylograph Peak Viscosity, BU | 1260 | 880 | 760 |

CWRS High Temp.



CWRS Moderate Temp.



CWRS Control

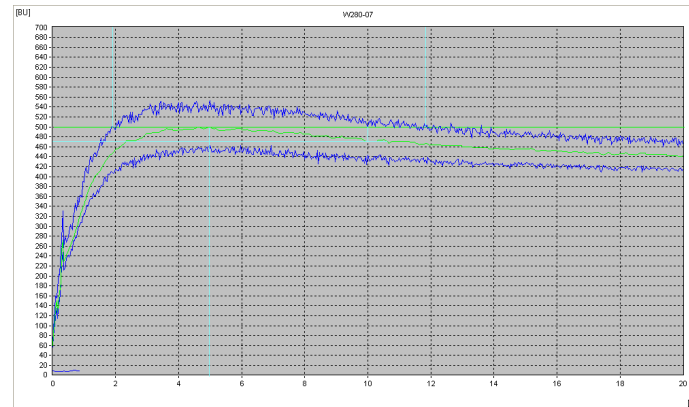
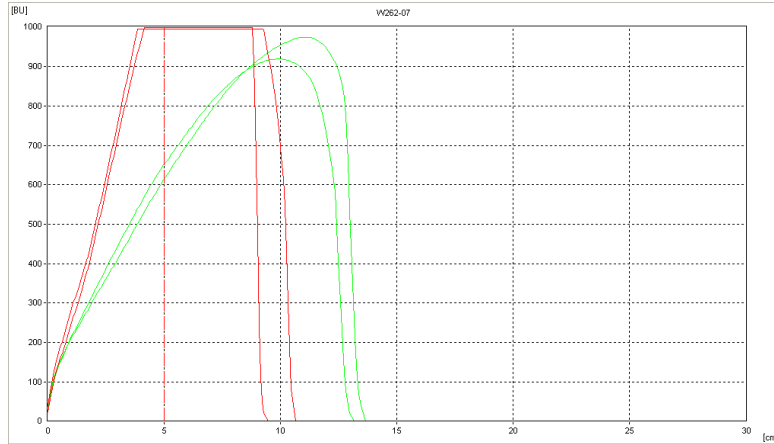


Figure 6: Influence of Storage on Farinograph curve

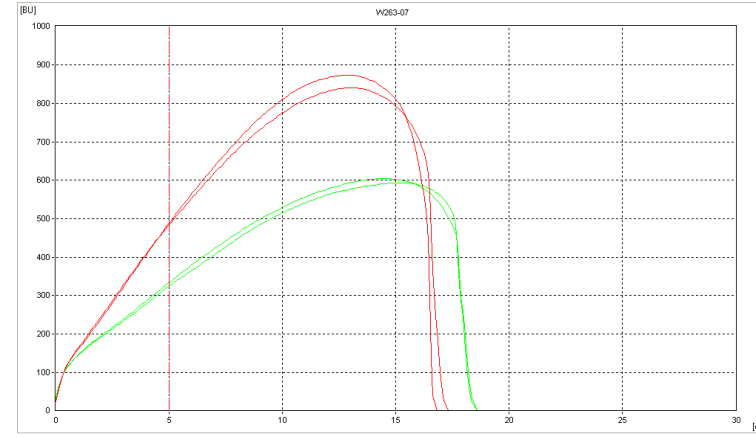
Table 10. Effect of Wheat Storage Conditions on Farinograph

| Parameters | CWRS sample stored under higher temperature | CWRS sample stored under moderate temperature | CWRS Control Sample |
|--|---|---|---------------------|
| Absorption, % | 61.4 | 60.3 | 60.6 |
| Dough Development Time (DDT), min | 35.5 | 8.5 | 5.0 |
| Stability, min | 58.4 | 20.0 | 9.9 |
| Mixing Tolerance Index (MTI), BU | 6 | 15 | 30 |

CWRS High Temp.



CWRS Moderate Temp.



CWRS Control

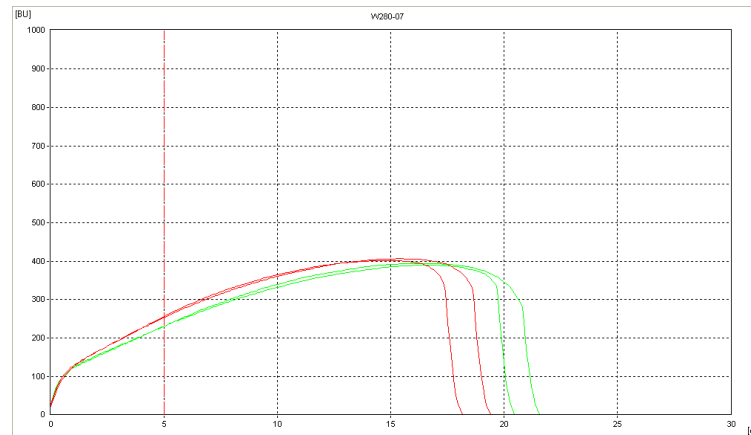


Figure 7: Influence of Storage on Extensograph curve

Table 11. Effect of Wheat Storage Conditions on Extensograph

| Parameters | CWRS sample stored under higher temperature | CWRS sample stored under moderate temperature | CWRS Control Sample |
|--------------------|---|---|---------------------|
| Rmax, BU | 1000+ | 857 | 404 |
| E, mm | 101 | 171 | 188 |
| A, cm ² | 134 | 178 | 100 |
| Rmax/E | 9.9 | 5.0 | 2.2 |

Table 12. Effect of Wheat Storage Conditions on Alveograph Properties

| Parameters | CWRS sample stored under higher temperature | CWRS sample stored under moderate temperature | CWRS Control Sample |
|----------------|---|---|---------------------|
| P, mm | 159 | 105 | 90 |
| L, mm | 40 | 63 | 55 |
| P/L | 3.97 | 1.66 | 1.65 |
| W (x 10E-4), J | 286 | 274 | 217 |

Acknowledgement

Assistance provided by the following departments at CIGI is much appreciated:

- Milling technology
- Analytical services

Assistance provided by the GRL of CGC is much appreciated in testing of various samples and milling of the samples using the pilot mill.