Harvesting for Seed & Straw
(a Work in Progress)

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The Opportunity: An Integrated Industry

Biomass Feedstocks

Trees
Grasses
Agricultural Crops
Agricultural Residues
Animal Wastes
Municipal Solid Waste

Bioconversion Biorefinings

Enzymatic Fermentation
Gas/liquid Fermentation
Acid Hydrolysis/Fermentation
Gasification
Combustion
Co-firing

USES

Fuels:
Ethanol
Renewable Diesel

Electricity

Heat

Chemicals
Plastics
Solvents
Pharmaceuticals
Chemical Intermediates
Phenolics
Adhesives
Furfural
Fatty acids
Acetic Acid
Carbon black
Paints
Dyes, Pigments, and Ink
Detergents

Food and Feed

The Challenge

1. **Change a harvest system optimized to harvest grain, and convert it to harvest three streams:**
   - **Grain**
   - **Straw**
   - **Chaff**

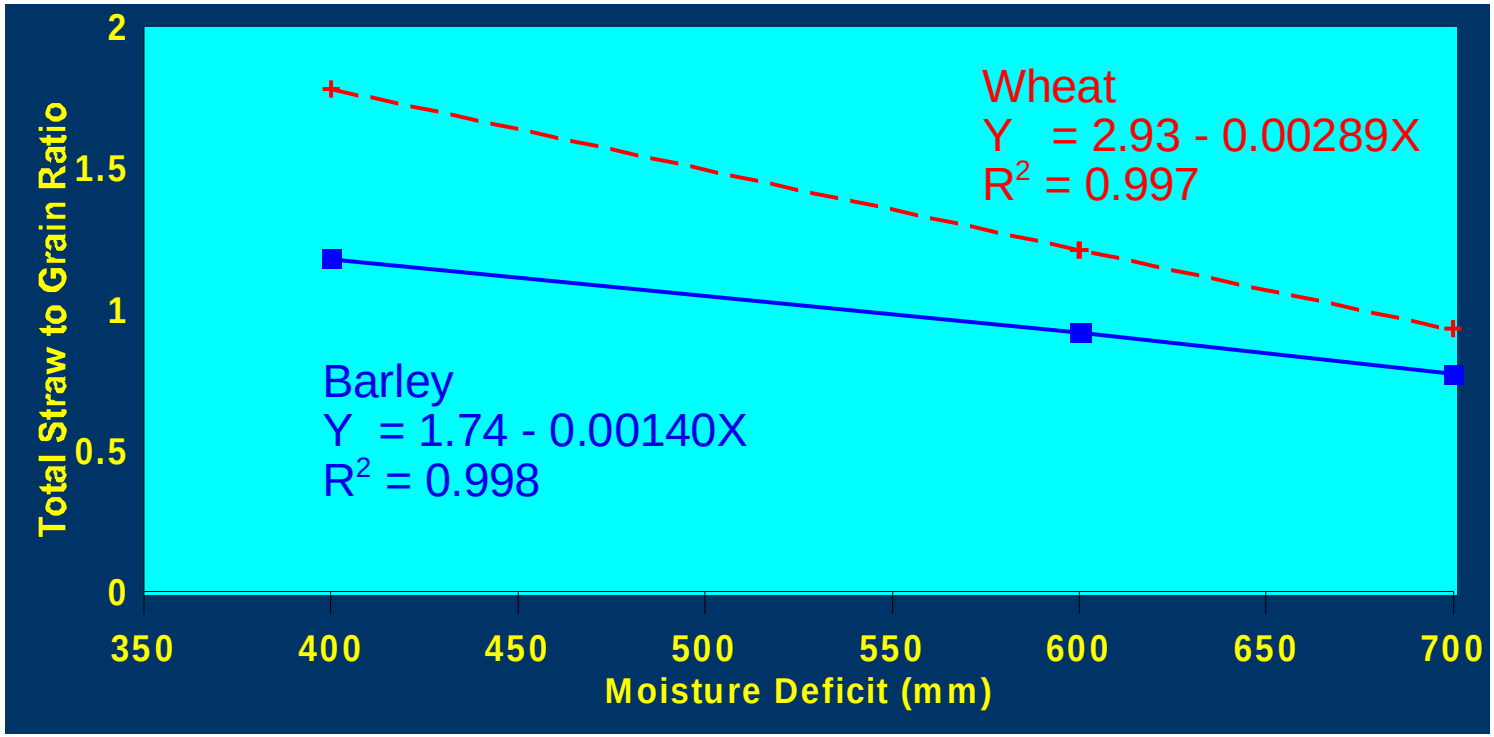
McLeod Harvest™ System

1. **Gathers grain and chaff together (Graff).**
2. **In-yard separation (central location).**
3. **Densification of material.**
4. **Suited for feed or bioconversion.**

Harvest System Challenges

1. Weather:

- **Poor stands: straw recovered can be near zero.**
- **Poor harvest weather.**
- **Risk factor for biomass businesses.**



Harvest System Challenges

2. Producer Choices:

a. Cutting height

- Decreasing from 20 to 10 cm could increase straw harvest by ~50% with a negative impact on fuel, time, & cost.
- Stubble height choice can be positive or negative for snow trapping.

b. Semi-dwarf cereals may reduce biomass availability.

Harvest System Challenges

c. Rotary vs. Conventional Combines:

- **Rotary combine: grinding action leaves less baleable straw.**
- **Rotary combine: grinding action may either enhance or worsen further processing.**

30’ Header - Rotary

20’ Header - Conventional

Harvest Systems R&D

1. Use of Stripper Technology Within Existing Agronomic Systems

- Cereal Systems
- Flax Systems
- Pulse Crops
- Oilseeds

2. Information Collected:

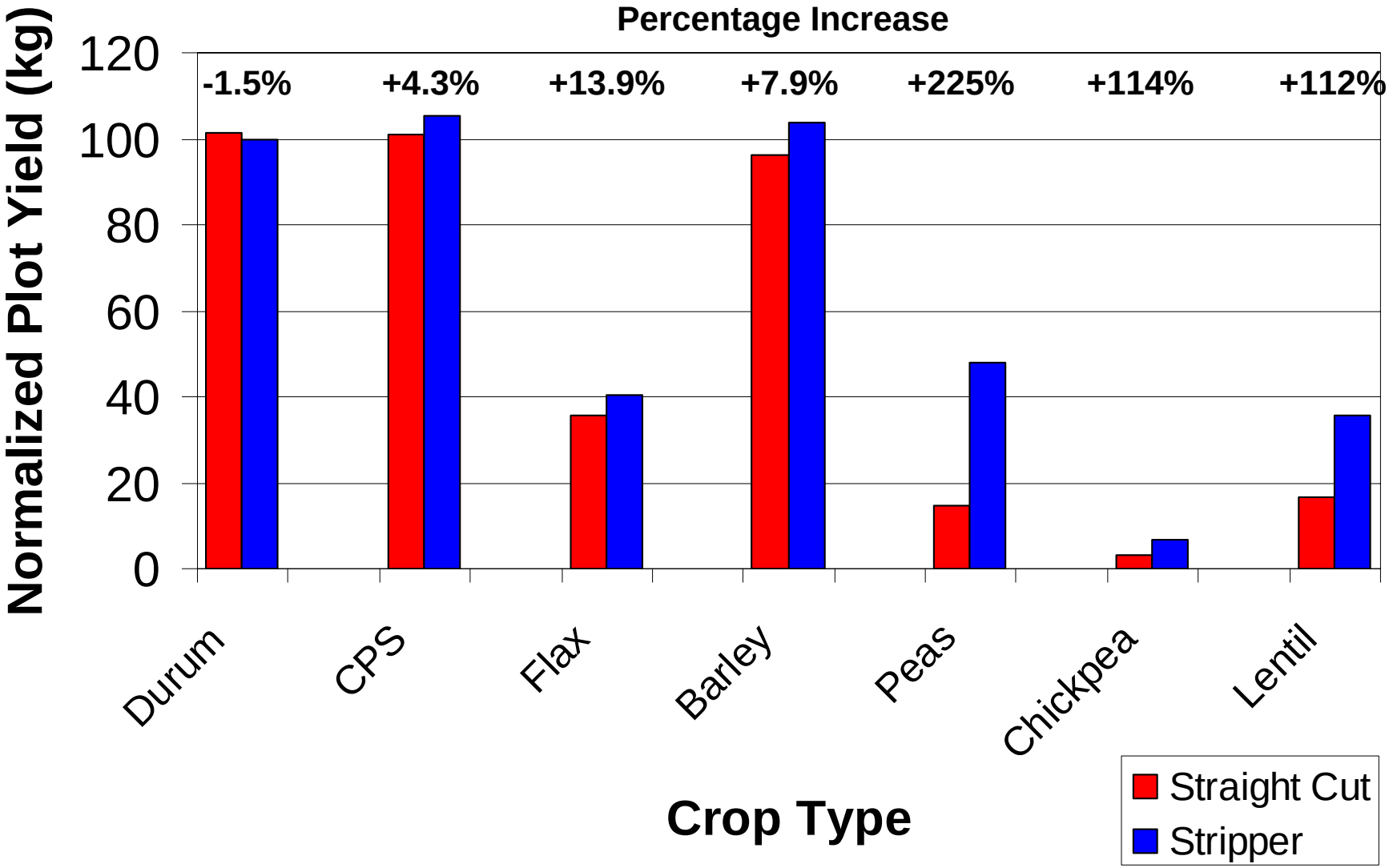
- Biomass Quantity and Quality;
- Fuel Savings;
- Opportunity Cost / Benefit;
- GHG Savings;
- Capital Cost Reductions;

Equipment: Based on Massey 550

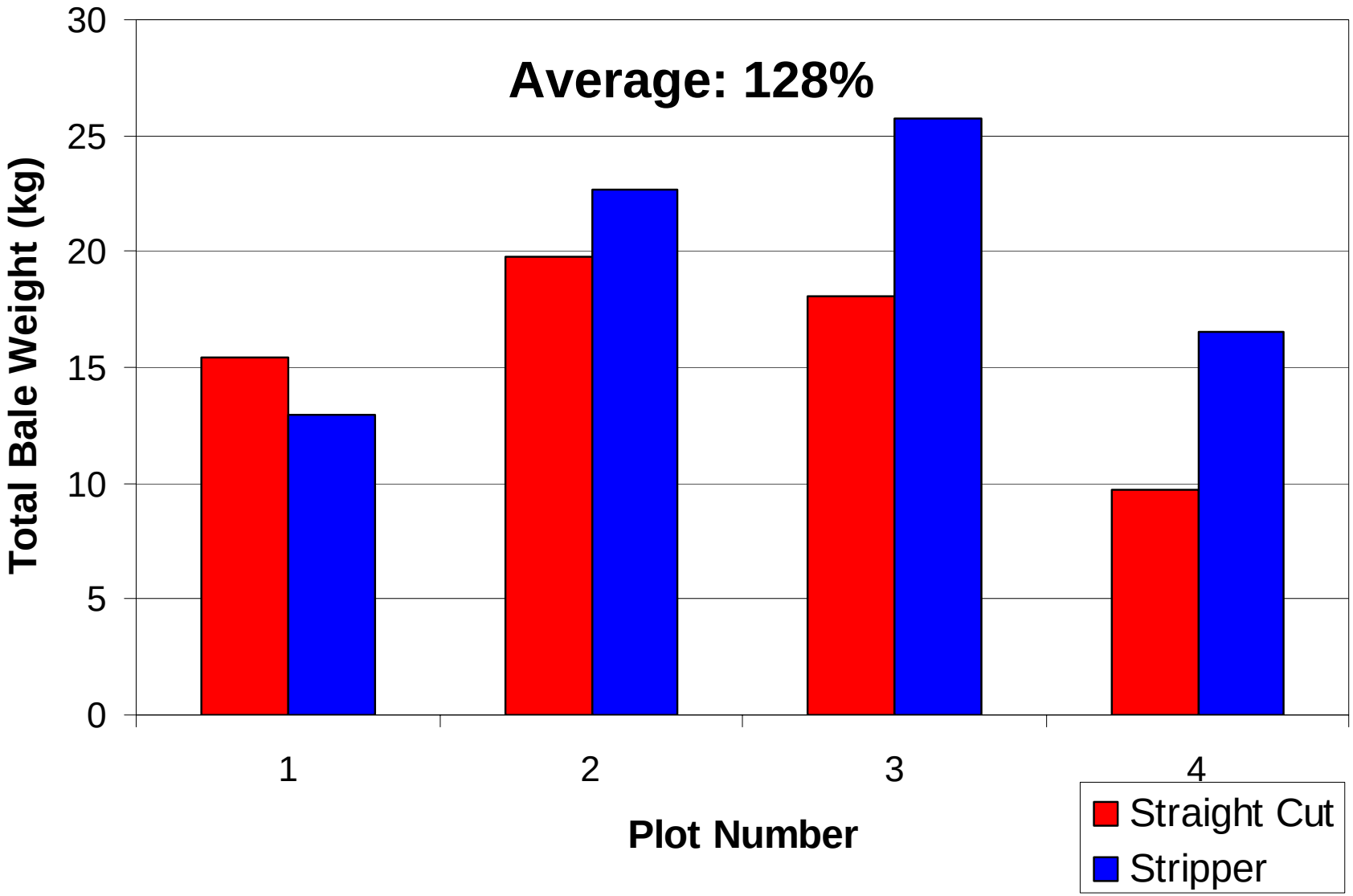
Harvest

Weighing

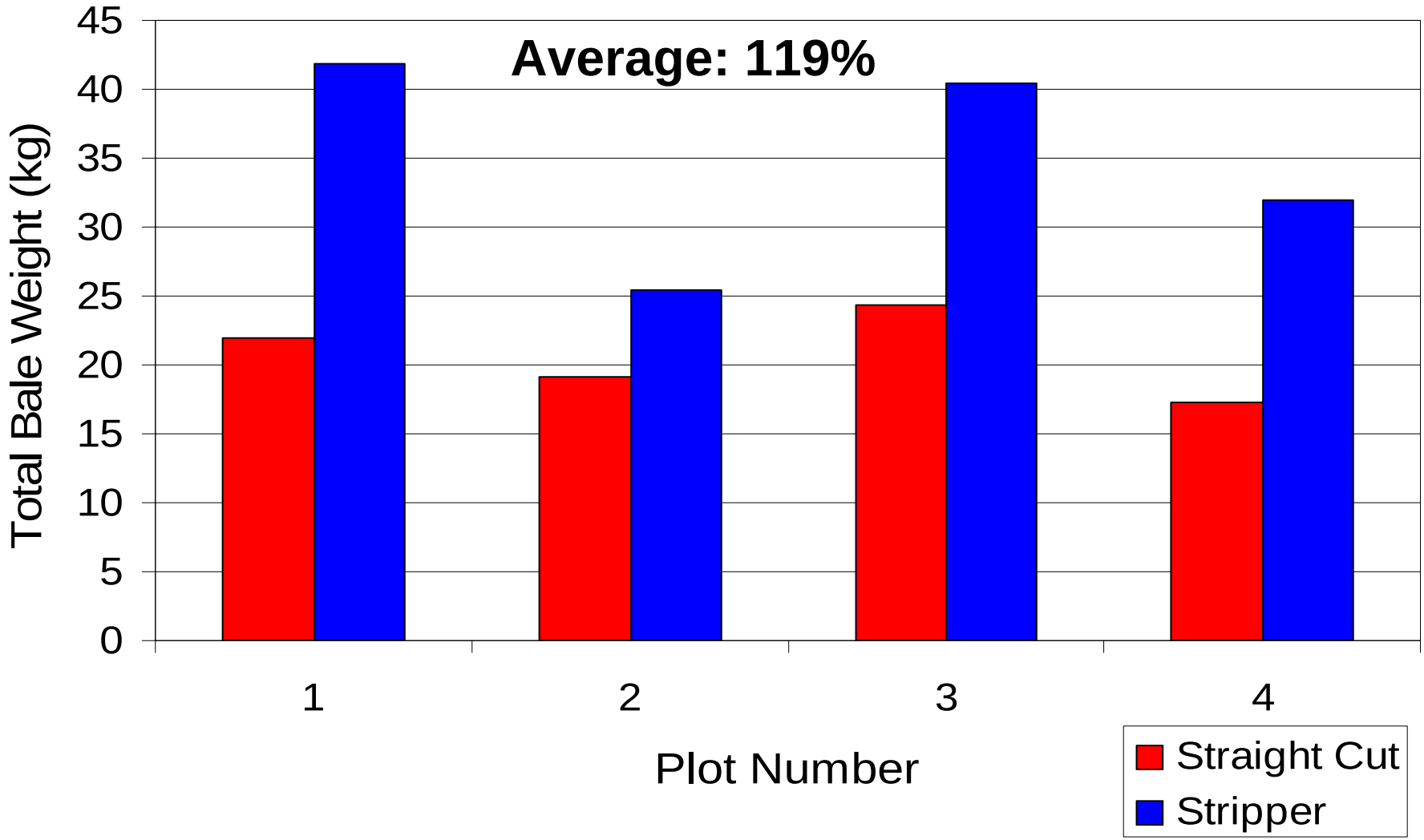
Small Plot Grain Yields (2005)



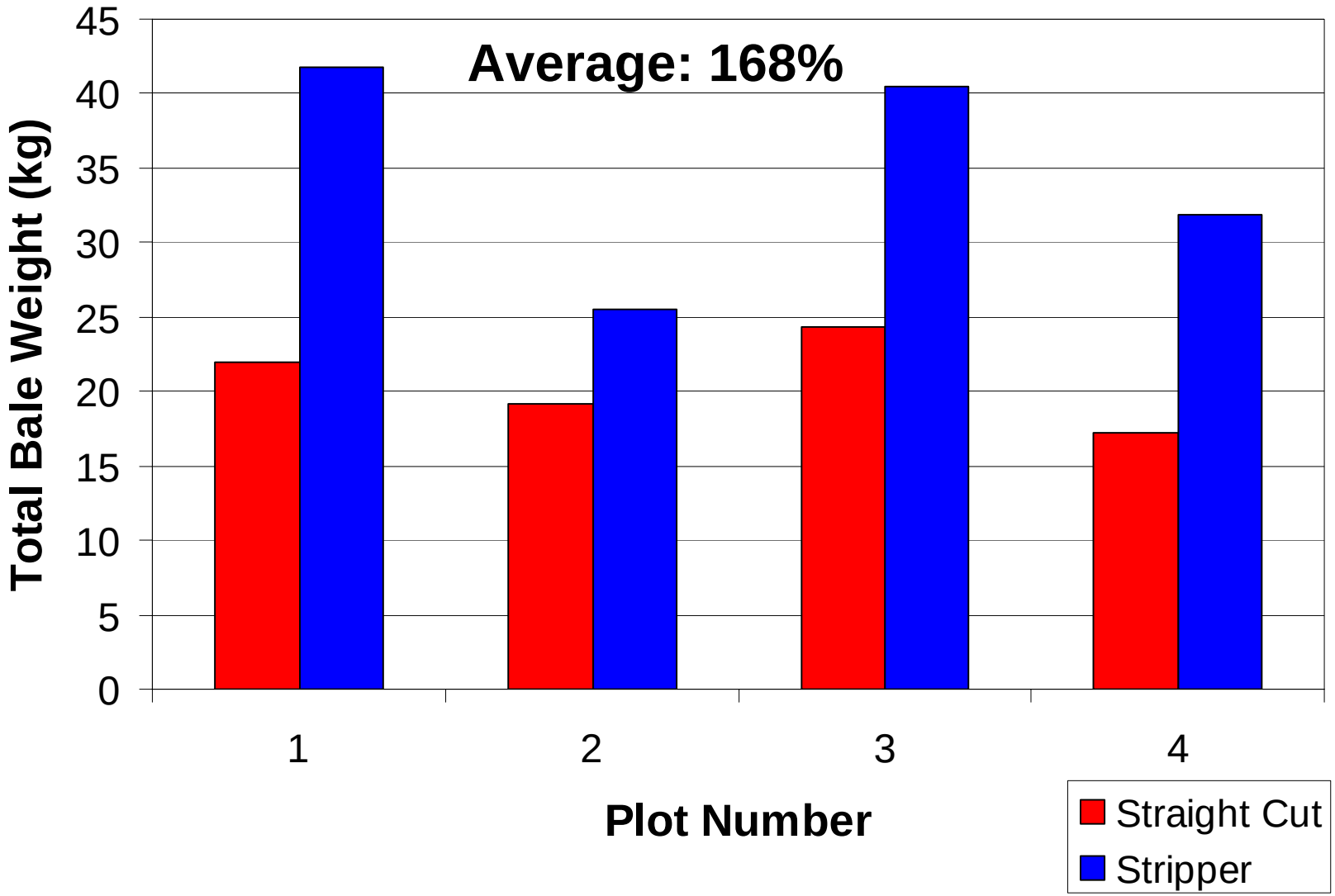
Comparison of Flax Bale Yield



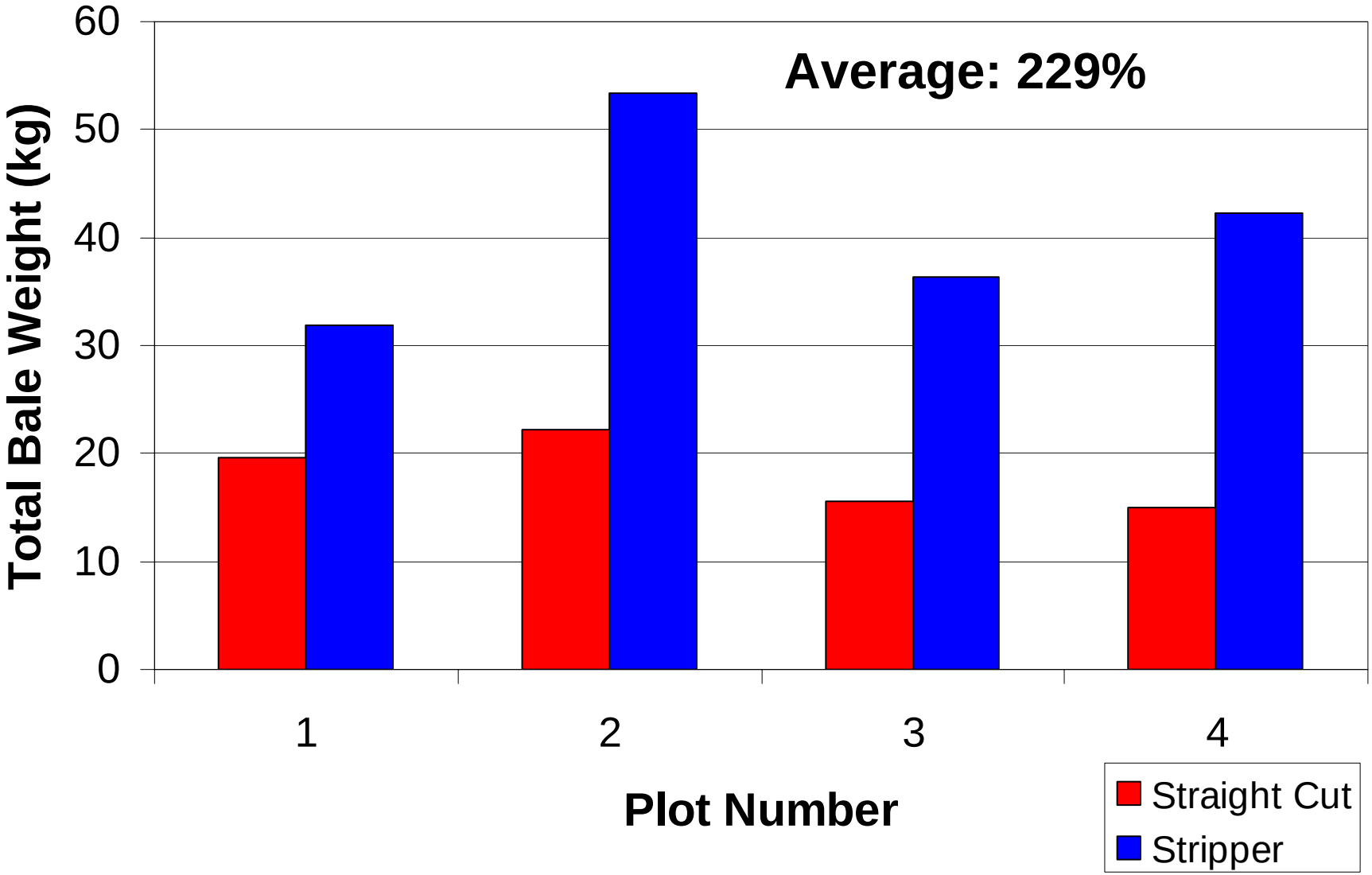
Comparison of Durum Bale Yield



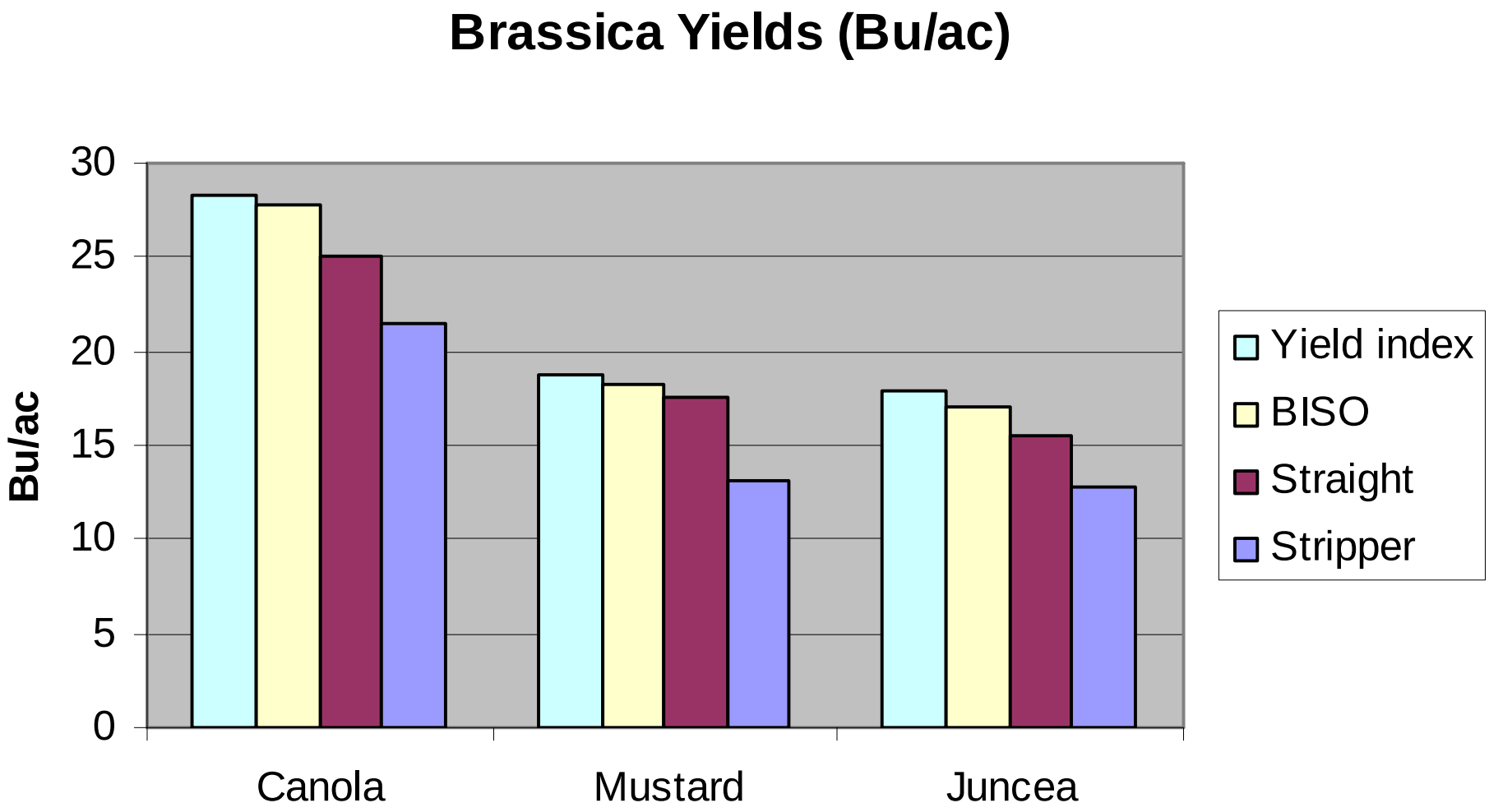
Comparison of CPS Bale Yield



Comparison of Barley Bale Yield



Canola Losses



Flax Harvest @ Lyle Simonson Farm

80 Acres Split into 3 Large Plots

- Case IH = 25.7 bu ac^{-1}
- Massey 550 & 20’ header = 24.6 bu ac^{-1}
- Massey 550 & Stripper header = 25.7 bu ac^{-1}

Industry Involvement

Schweitzer-Mauduit & Simonson Farms

- Pulp fibre for fine paper.
- Harvest impact on final fibre yield.

Stripper Header in Flax: Wright Farm

Final Straw Height:

24 – 26”

Gleaner - Hired Operator

Stripper

Performance in Sawfly Wheat & Lentils

Sawfly Damaged Wheat

Flax

Lentils

Wheat

Snow Trapping

Seed Quality

1. **Malting Barley:**
   - **Stripper leaves many awns & cleaner sample.**
2. **Lentils:**
   - **Leaves 10 – 12” stubble.**
   - **No dirt & few cracks or peels.**
3. **Flax:**
   - **Works with tough straw.**
   - **Less overall loss**
4. **All crops: picks up down material (lodged, tracks, sawfly, etc.)**

Prairie Harvest Systems R&D

1. **Cooperation with the Climate Change, Biomass Energy, and other agencies.**

   - **NSERC**
   - **Producers**
   - **APF Flax Initiative**
   - **Saskatchewan ADF**
   - **USDA & USDOE**

2. **Cooperation with Industrial Partners**

   - **Dow**
   - **Schweitzer-Mauduit**
   - **logen**
   - **Case New Holland**

Biolin Research & Thompson Farms

- **Fibre for composites, textiles & other material uses.**
- **Harvest impact on fibre quality.**

Cutting Treatments

Improving Retting

Packing Treatments

Future Plans

1. **Large scale demonstrations: Straight cut vs. Stripper technology**
   - **Straw yield;**
   - **Straw quality;**
   - **Energy, time, and machine depreciation impacts.**
   - **Impact on following crop if not harvested.**

2. **Continued evaluation of biomass for thermal, physical, and biological processes.**
   - **Industrial cooperators;**
   - **NGO's**
   - **Federal partners.**

Future Plans

3. Development of optimized harvester.

Takes advantage of:

- **Energy savings of the stripper header;**
- **Existing equipment (forage tractor);**

Producer benefits;

- **Lower harvest cost**
- **Reduced time**
- **Improved seed quality**
- **Biomass options**

Harvest System Challenges

Changes to the Harvest System must improve producer economic potential:

- **Maintain or Improve grain quality;**
- **Work in a multitude of crop types;**
- **Improve the quantity and quality of MOG.**
- **Reduce time of harvest;**
- **Reduce the fuel requirement for harvest;**
- **Reduce header inventory (existing combine system);**
- **Reduce the cost of the combine;**

Acknowledgements

1. Natural Resources Canada
2. Wheatland Conservation
3. Farm Cooperators
4. PAMI
5. Above Board
6. Schweitzer-Mauduit
7. Biolin Research
8. Iogen Corp.

Thank You for Your Attention !

Questions ?