

Fertilizer Management Research for Irrigated Crops



Irrigated Crop
Production Conference
Lethbridge, AB
Jan. 11, 2010

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Review results of two projects:

1. Irrigated Timothy project
2. Irrigated grain and oilseed project

Nitrogen Management with Timothy

❖ **Sites:** Lethbridge and Bow Island

❖ **Treatments:**

N Fertilizer Types =

Urea, ESN - coated urea, Ammonium nitrate

Rates =

0, 50, 100, 150, 200 kg/ha for 1st cut

0, 30, 60, 90, 120 kg/ha for 2nd cut



Lethbridge-Timothy
June 13, 2006
○ N. 200
Urea

0

N

200 kg/ha Urea
Spring Broadcast

Timothy – Lethbridge – June 13, 2006



100 Urea N 50 kg/ha Urea
Spring Broadcast
Timothy – Lethbridge – June 13, 2006



Lethbridge-Timothy
June 13, 2006
150 N 150
CU AN

150 ESN

N

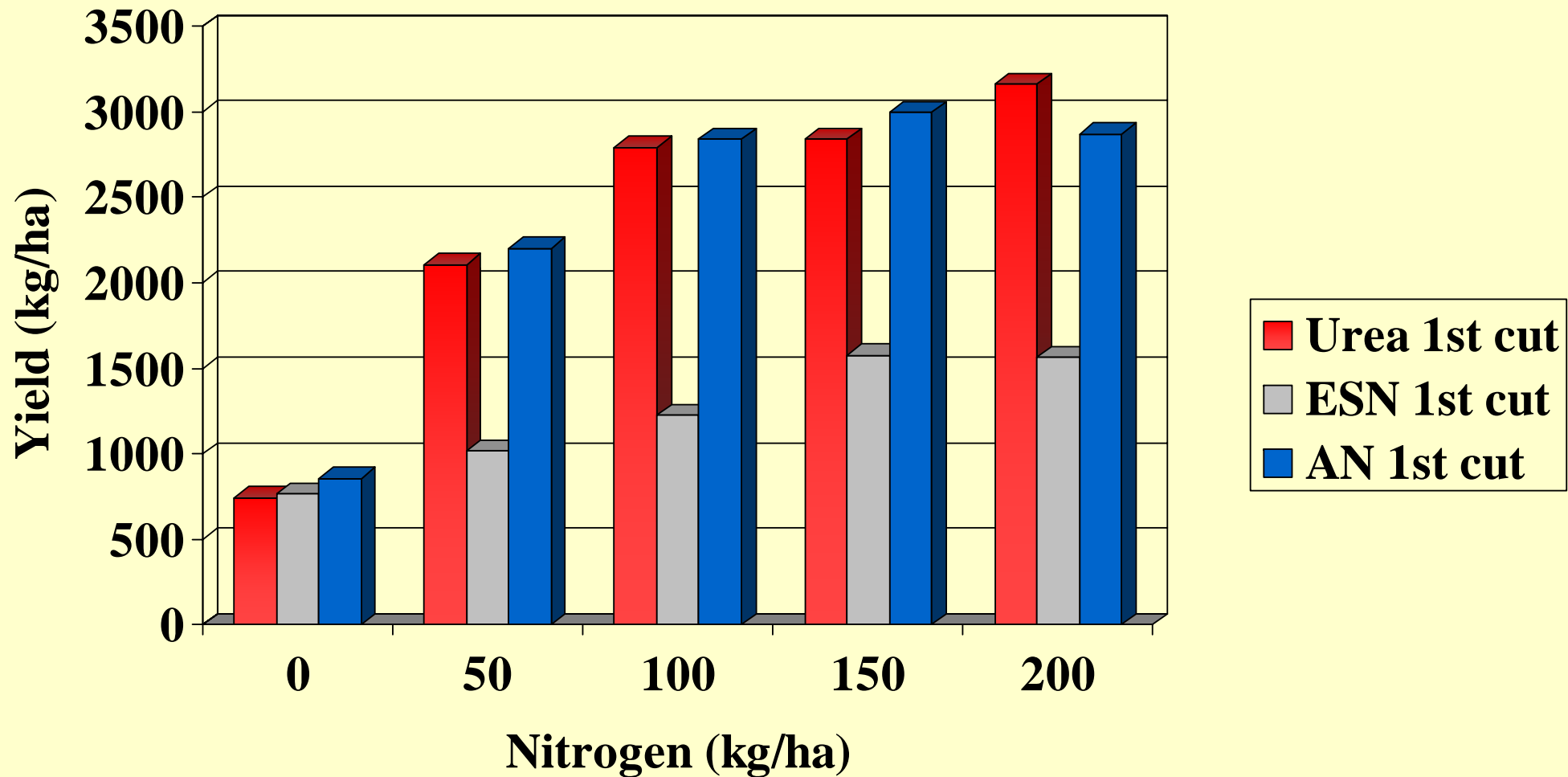
150 kg/ha AN

Spring Broadcast

Timothy – Lethbridge – June 13, 2006

Nitrogen Type and Rate

First Cut - Bow Island - 2005



Timothy Nitrogen Choices

- **Spring broadcast urea (46-0-0)**
 - Best option – if broadcast very early in spring (when very when soil is cool !)
 - Watch weather forecast and consider volatilization potential
- **Spring broadcast ESN**
 - NO – release rate is TOO SLOW!
- **Spring broadcast Agrotain coated urea (46-0-0)**
 - Higher fertilizer cost for only 10-12 days of protection – is it worth it ?!
 - Good option if weather conditions are warm and windy
- **Spring dribble banded UAN liquid (28-0-0)**
 - Good option – but consider volatilization potential – apply in early spring
 - Consider the higher cost of liquid N
 - Can add Agrotain to liquid for 10 to 12 days of protection from volatilization but the cost is even higher!
- **Ammonium nitrate (34-0-0)**
 - Best product – BUT must import from USA or Europe – Good Luck!!

Phosphorus (P) Nutrition of Timothy



0

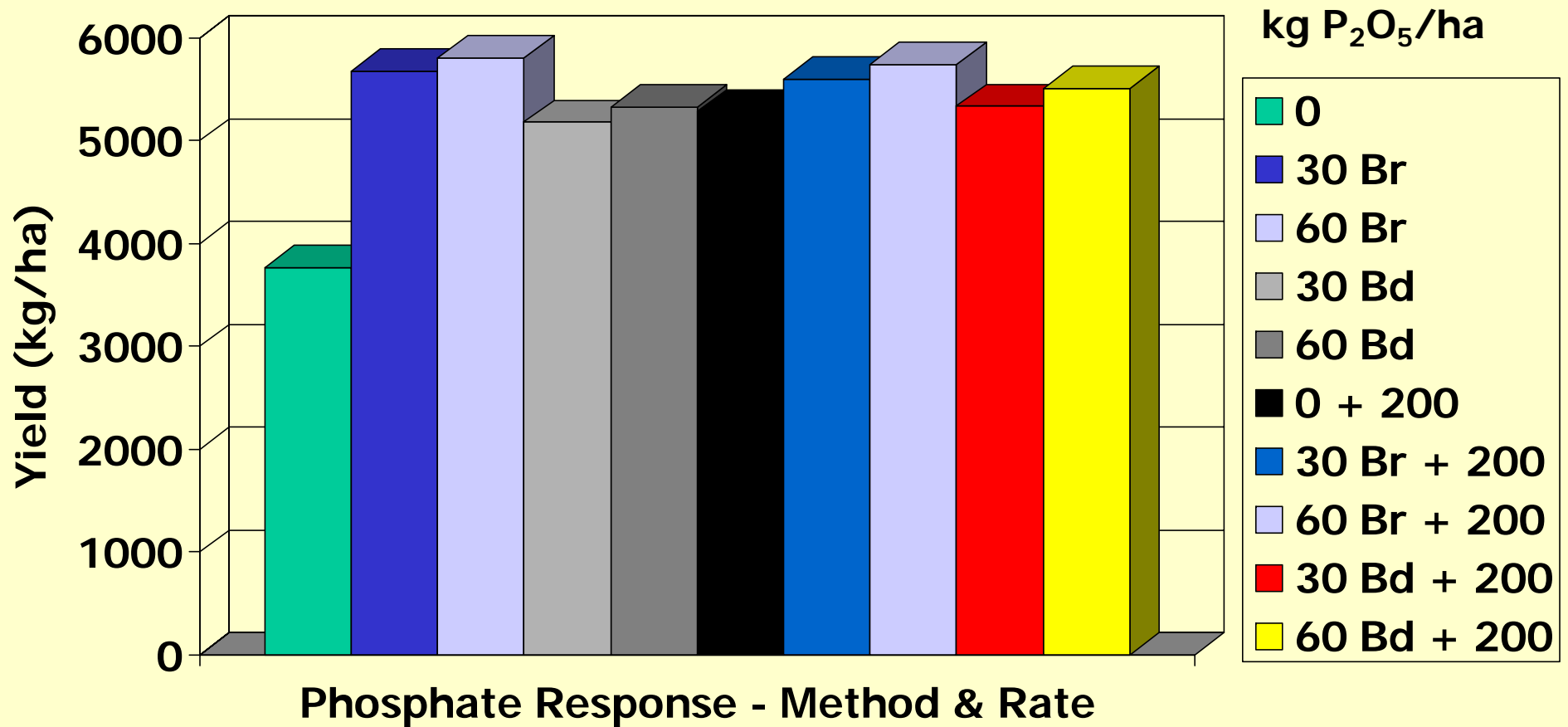
P_2O_5

60 kg/ha

Spring Broadcast

Timothy – Lethbridge – June 13, 2006

Phosphate Fertilizer – P₂O₅ 2006 Lethbridge – First Cut



Phosphorus Fertilizer – Established Timothy

- If soil P is low or P was not applied before establishment
 - apply 30 - 50 lb/ac of P_2O_5 in early spring.
 - **Under moist conditions, Timothy has feeder roots near the soil surface that can take up broadcast P with reasonable efficiency.**
 - **** Best option**** Broadcast P in early to mid April
 - can use fertigate with liquid P fertilizer (10-34-0) .
- P fertilizer is most effective when applied very early spring.
- Composted manure is an excellent source of both P and K.

Summary of Timothy Research:

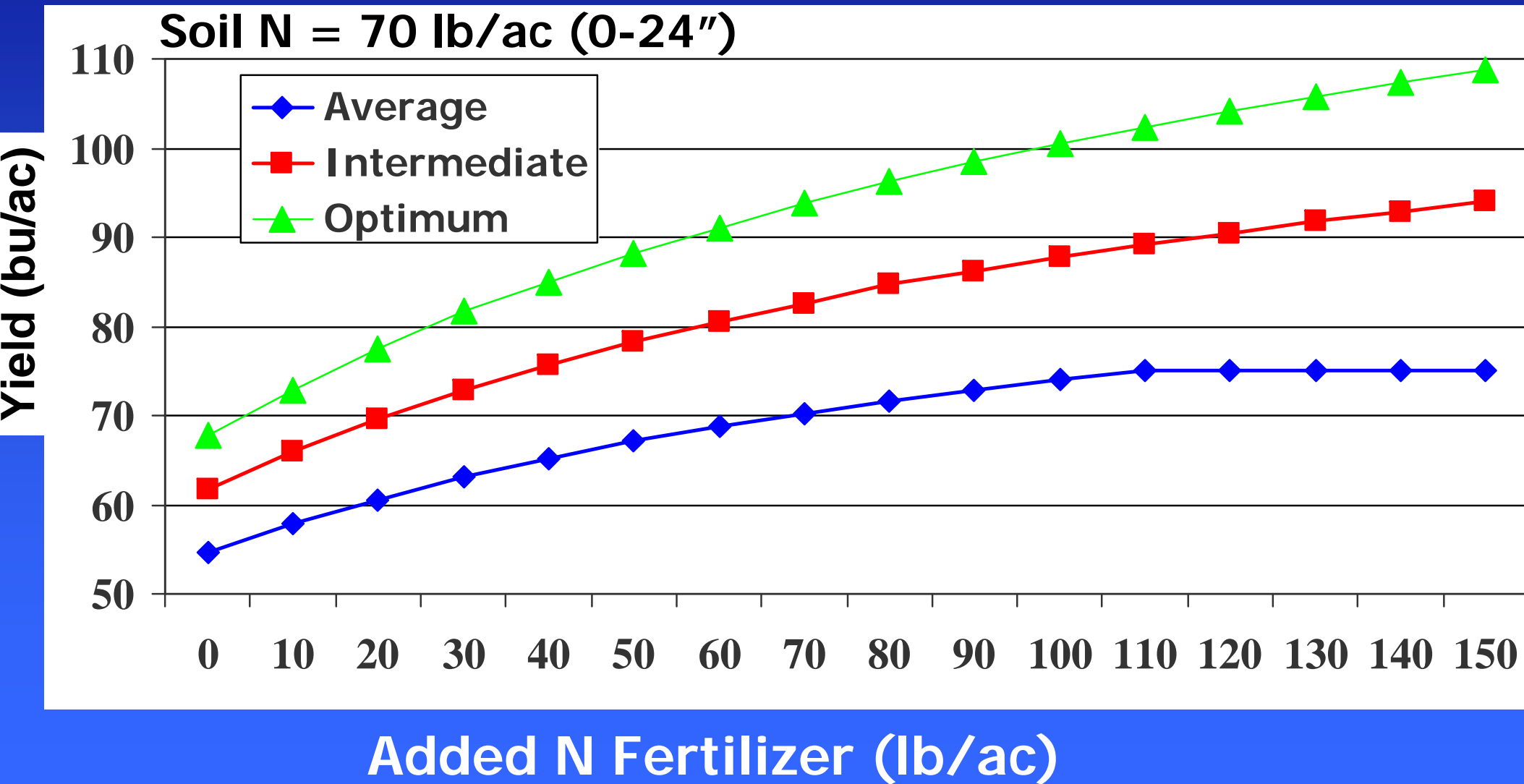
- Early spring broadcast urea is the cheapest and most cost effective way to apply N fertilizer - rate of 120 to 150 lb N/ac for 1st cut
- For second cut - apply urea N fertilizer and irrigate as soon as possible afterward - rate of 70 to 100 lb N/ac
- Phosphorus – if soil test P is < 70, then early spring broadcast 30 – 50 lb phosphate/ac
- Potassium - If soil test K < 250, then early spring broadcast 50 – 90 lb potash/ac
- Should not need any other nutrients – if you have recommendations for other nutrients call me and consult other agronomists for a second opinion!!

Irrigated Cereal and Oilseed Crop Response to Nitrogen

- Present N recommendations have **become dated** because:
 - Crop breeding has increased yield potential of most crops
 - Improved water use and management with pivot irrigation
 - Seeding earlier and at higher rates
 - Improved weed management options
 - Better disease control with seed treatments and foliar fungicide applications
 - More efficient management and fertilizers such as ESN
- The cumulative effects of improved agronomic management means Nitrogen fertilizer response by crops must be re-assessed

Soft Wheat N Fertilizer Response

1982/90 AAFRD Research

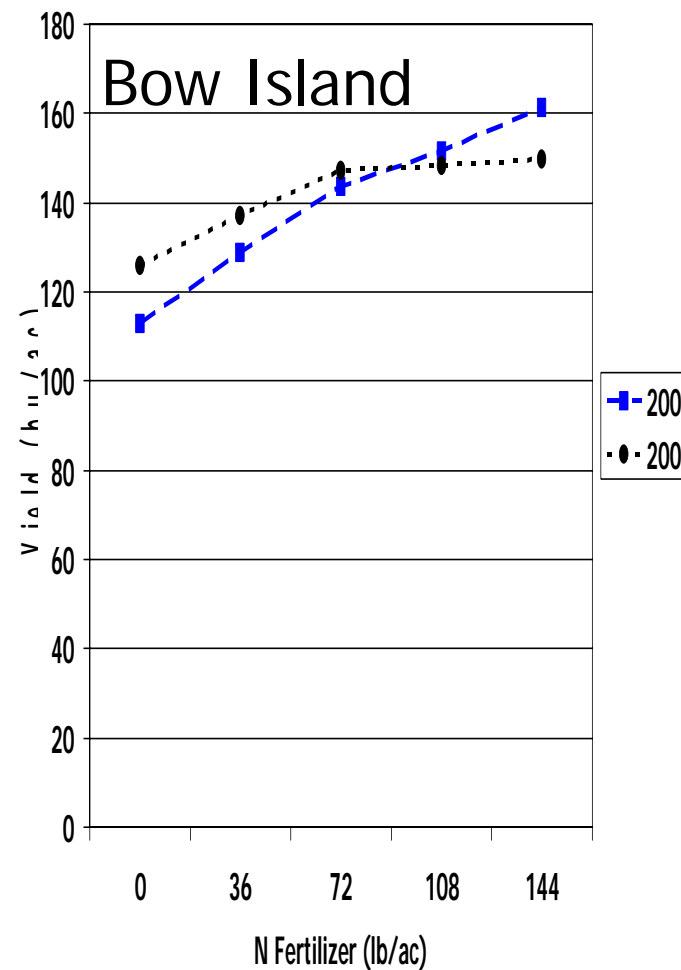
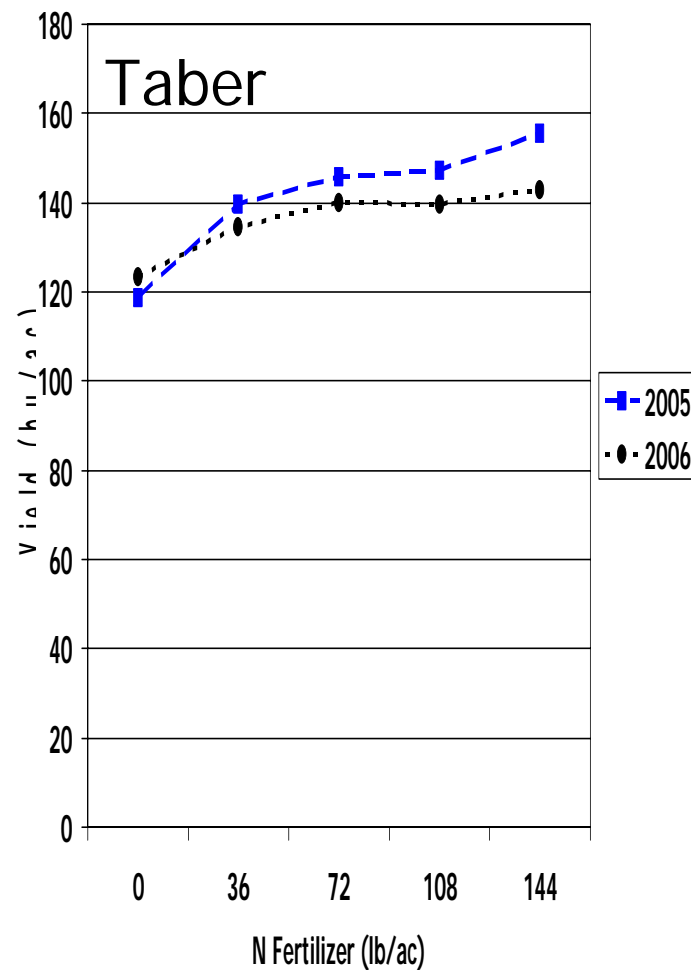
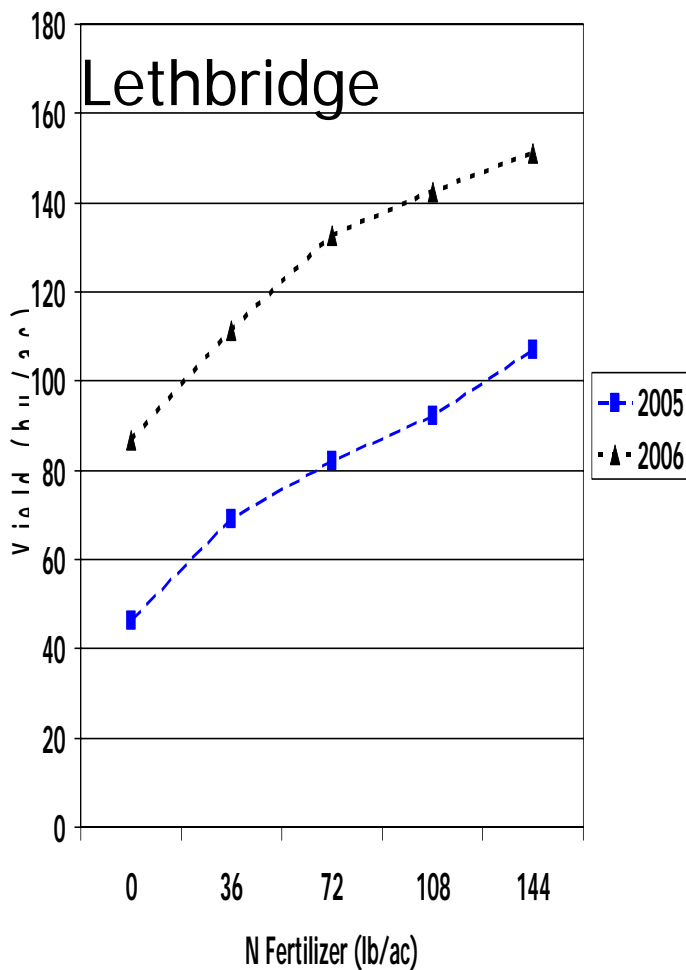


Irrigated Crops Research Project

- Project title:
 - “Optimizing water use, nitrogen use and agronomic management of irrigated grain and oilseed crops”
- The project was for 4 years, starting in 2006, and in 2009 the field trips were completed.

Experiments 1 and 2:

- **Exp. 1 - Nitrogen fertilizer response:**
 - N rates 0, 40, 80, 120, 160 kg/ha
 - All 11 crops at four locations each year
 - Lethbridge, Readymade/Chin, Taber and Bow Island
- **Exp. 2 - Nitrogen use efficiency:**
 - 82-0-0, 46-0-0, Coated ESN 45-0-0, 34-0-0
 - Applied in early fall, late fall and early spring
 - All banded and broadcast/incorporated except AA
 - Located at Bow Island and Lethbridge each year



Soft wheat response to N fertilizer at 6 irrigated locations over three years



Bow Island-S.S. June 18, 09

Irrigated Cop Study

Exp #1 - N Rates

Barby

40 N-160

Malt Barley
160 N 40

160 kg N/ha

Lethbridge - July 10, 2008
Irrigation - Exp 1
Barley - Exp 1
160 N 40

40 kg N/ha

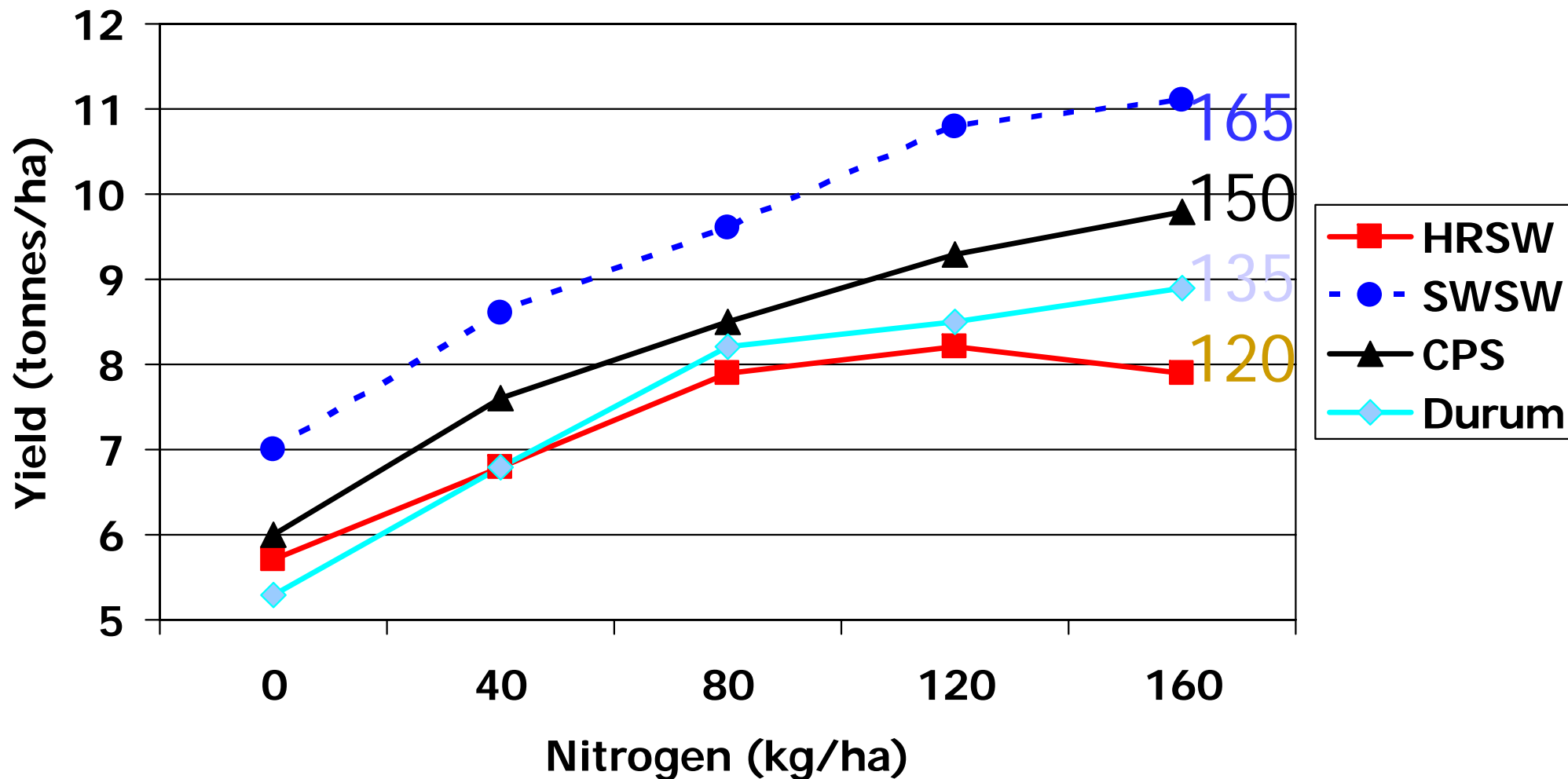
Triticale
160 N 0

160 kg N/ha

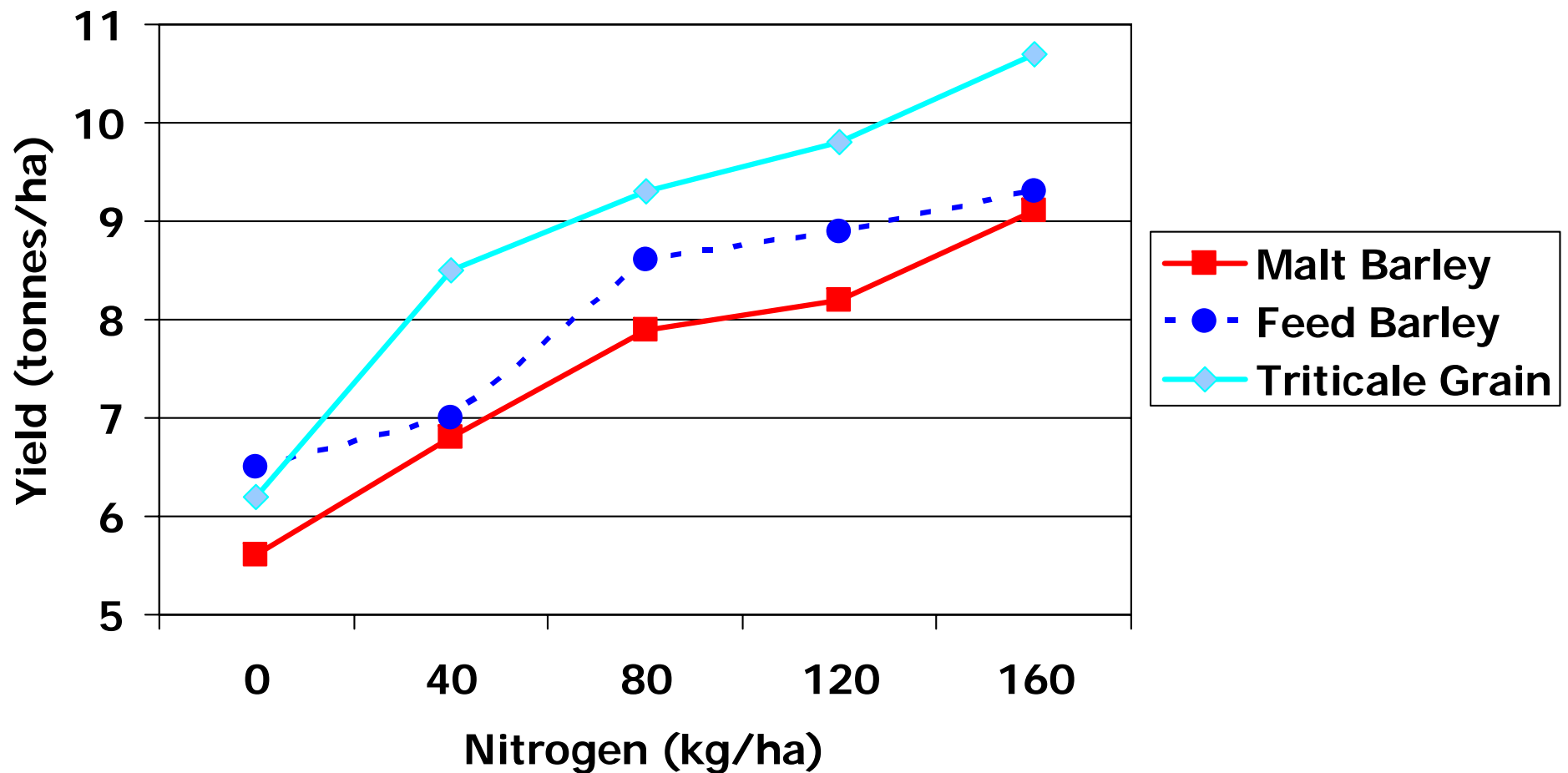
Lethbridge - July 10, 2008
Irrigation - Exp 1
Triticale - Exp 1
N
160 0

0 kg N/ha

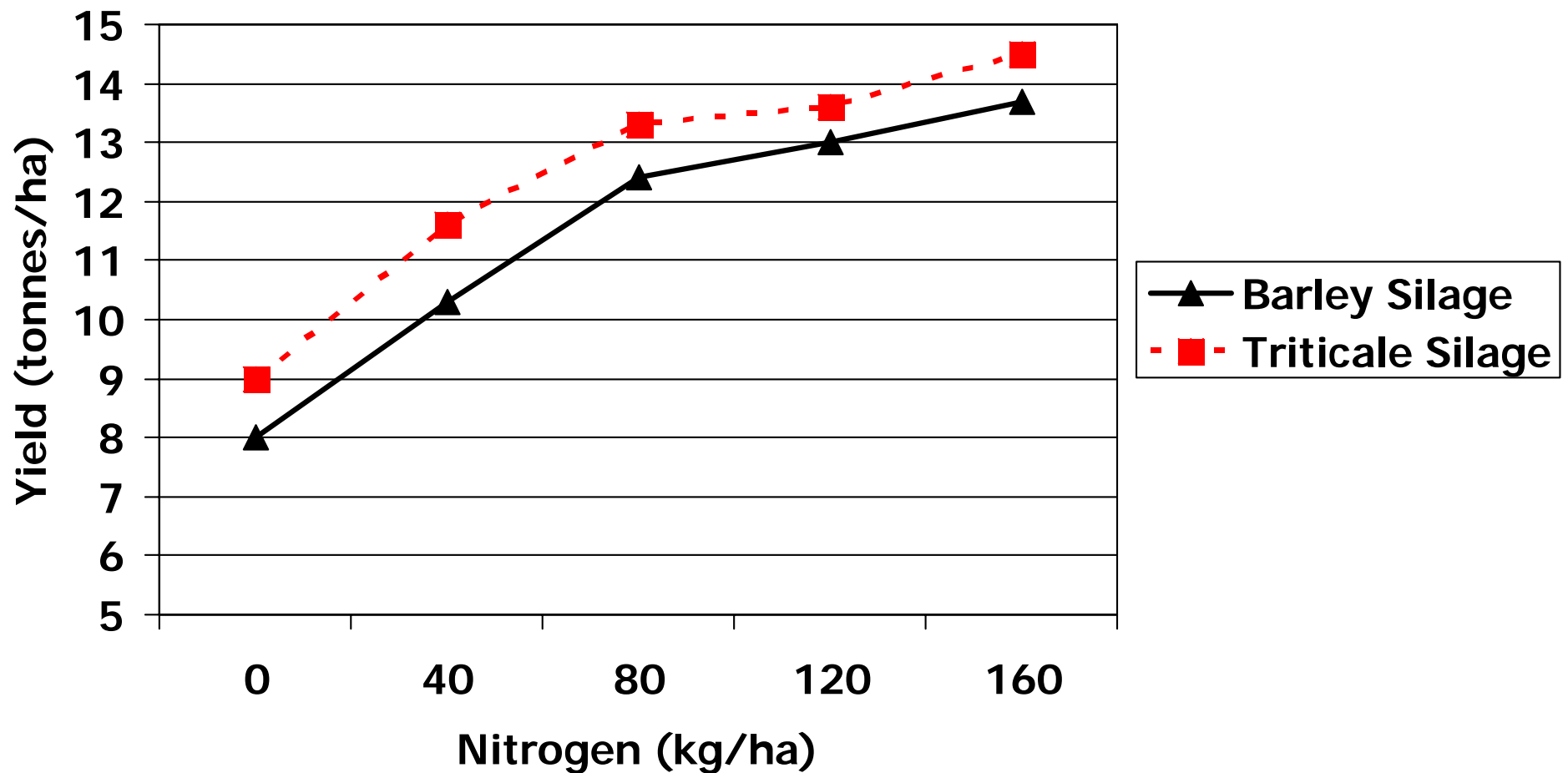
Wheat response to Nitrogen at Lethbridge - 2006



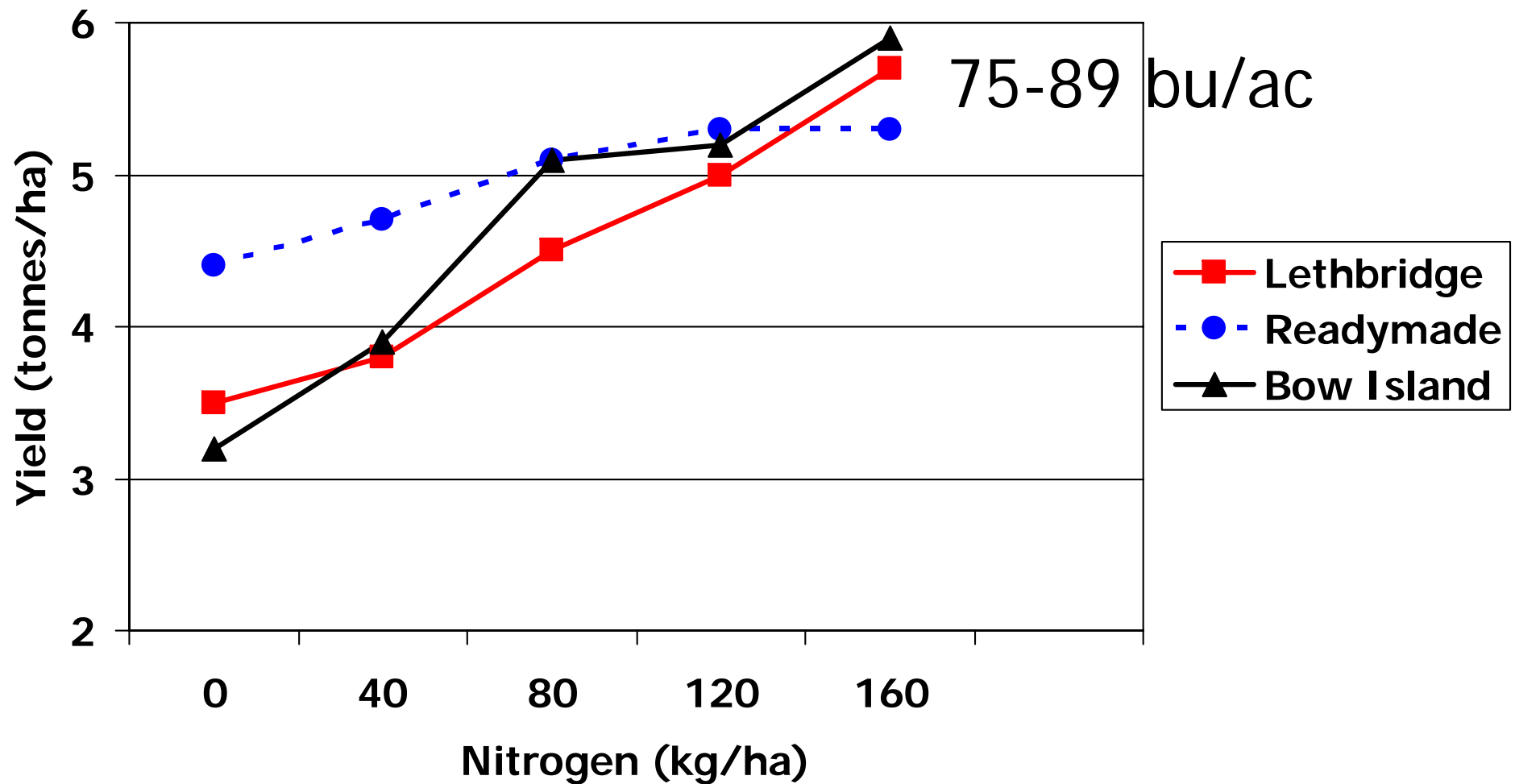
Barley and Triticale Grain response to Nitrogen at Lethbridge - 2006



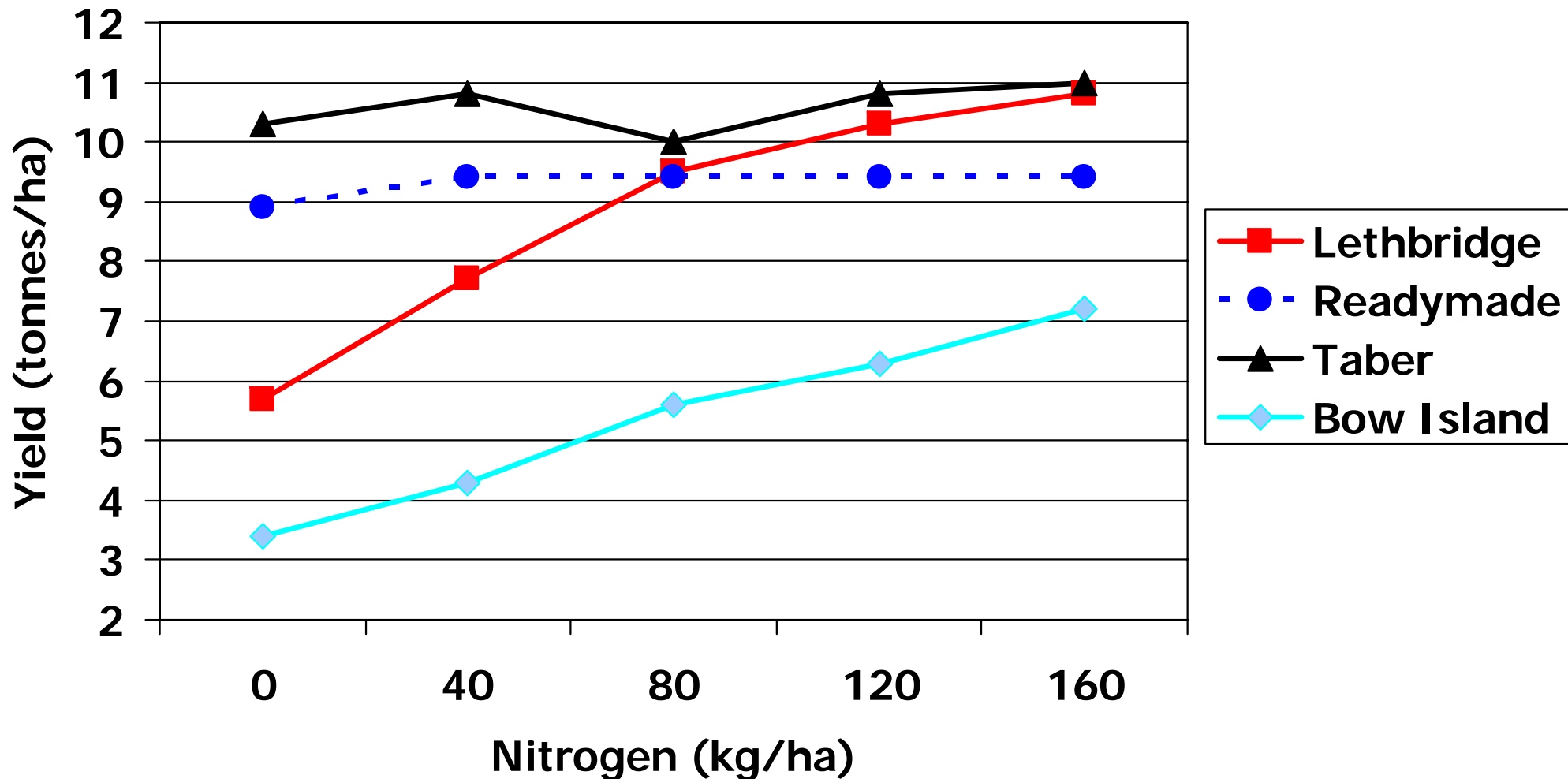
Barley and Triticale Silage response to Nitrogen at Lethbridge - 2006



Canola response to N - 2008



Soft Wheat – N Response - 2008



Irrigated Research

- An examination of a irrigated research sites shows that the amount of **Soil nitrate-N** is much less than the Total N taken up by crops in the control treatments.
- The difference
Crop-N Uptake - Soil nitrate-N = Amount of mineralized organic N taken up by crops.
- The average Soil nitrate-N level in the 30 fields was 46 lb/ac and the average Crop-N taken up by plants was 138 lb/ac.
- On average the amount of **mineralized N** taken up by crops was 92 lb/ac but ranged from 40 to 164 lb/ac.
- **This is a substantial amount of N provided by the soil versus the amount of N that comes from fertilizer to contribute to increased crop yield – BUT very difficult to predict the amount!**

What are:

1. Best fertilizer types to use

2. Best times to apply N

3. Best placement

➔ To achieve optimum yield!

**30 kg N/ha ESN
Sidebanded-Seeding**

Lethbridge Site - July 10, 2008
ESN - Canola: Irrigated
30 ESN 120 ESN
Side- Seed-
Band Place

**120 N/ha ESN
Seed-placed**

2007 Nitrogen Use Efficiency - BI

Method	Early fall	Late fall	Spring
Banded urea	7.3	7.9	7.5
Banded CRU	7.2	7.6	8.2
Banded urea+CRU	7.2	7.7	7.7
Banded ammonia	8.0	8.4	8.1
Broadcast urea	6.9	7.9	7.4
Broadcast CRU	7.5	7.8	7.5
Broadcast urea+CRU	7.3	7.5	7.7
Broadcast ammonium nitrate	7.5	7.6	7.2
Average	7.4	7.8	7.6

Nitrogen Timing and Placement Recommendations

- **Best Placement:**
 - Banded N is more effective than broadcast incorporated N
 - Side band at seeding
- **Best Time:** Late fall or spring N application
 - Spring may be slightly better for N efficiency
 - But fall N application allows for earlier seeding in spring
 - Banded N in spring results in soil moisture loss
 - Fall banding conserves spring moisture
 - Spring side-banding at seeding would be best option
- **Nitrogen Forms:**
 - No apparent differences for cereal and oilseed crops among banded Urea, NH_3 or ESN

A photograph of a vast, healthy green field of wheat or barley crops. The plants are tall and dense, with some showing developing grain heads. The field extends to the horizon under a bright, clear sky. The text is overlaid in white, bold font.

Optimum Crop Production

is the result of

**Optimum Nutrient, Agronomy and Water
Management**

Summary of N Management for Cereal and Oilseed Crops

- Most irrigated cereal and oilseed crops need 180 to 200 lb N/ac (soil N + fertilizer N)
- Soil test to determine nutrient levels and use AFFIRM – to determine economic rates of N fertilizer
- Band N in late fall using 82-0-0 or 46-0-0
OR
- Side-band N fertilizer at the time of seeding
- Broadcast N in spring is less efficient and many delay optimum seed for seeding irrigated crops

How will this project impact on-farm irrigated crop management?

- **Irrigation water management:**
 - Improved understanding of crop water use and recommendations to producers
 - Managing water in the top 40 to 50 cm maintaining soil moisture at 60-90% may be optimum
- **Nitrogen management:**
 - New information on optimum Nitrogen response for 11 crops
 - Band fertilizer in late fall for improved efficiency
 - For best efficiency - direct seed irrigated grains and side-band N fertilizer

How will this project impact on-farm irrigated crop management?

- **Agronomic management:**
 - Optimum seeding time - mid to late April for most crops for optimum yield and water use efficiency
 - Use optimum seeding rates – which is somewhat higher than most farmers are presently using
- **Cropping system management for optimum yields:**
 - Utilize ALL Best Management Practices for optimum crop production, water use and water use efficiency
 - Shifting to more direct seeding of crops in spring

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