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Comparison of the NRC 2001 Model and DVE/OEB (Dutch) System in the prediction of protein supply to dairy cows from new co-products of bio-ethanol production

$RUP^{DEV} = 1.1 \times CP \times \%RUP$

$MP = ARUP^{NRC} + AMCP^{NRC} + AECP$

$0.75 \times MCP_{FOM}$

$AMCP^{NRC} = 0.80 \times$

$RUP^{NRC} = CP \times \%RUP$

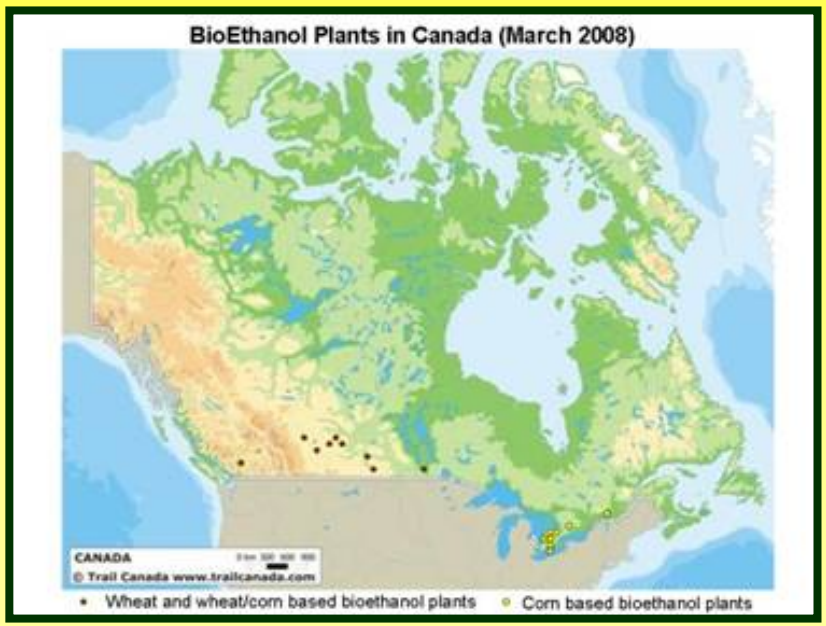
$DVE = ARUP^{DVE} + AMCP_{FOM} - ENDP$

Waldo Nuez Ortin

University of Saskatchewan

Research Justification

- **Increased ethanol production capacity in western Canada**



1.4 million mt of feedstock

↓

512 million liters of ethanol

↓

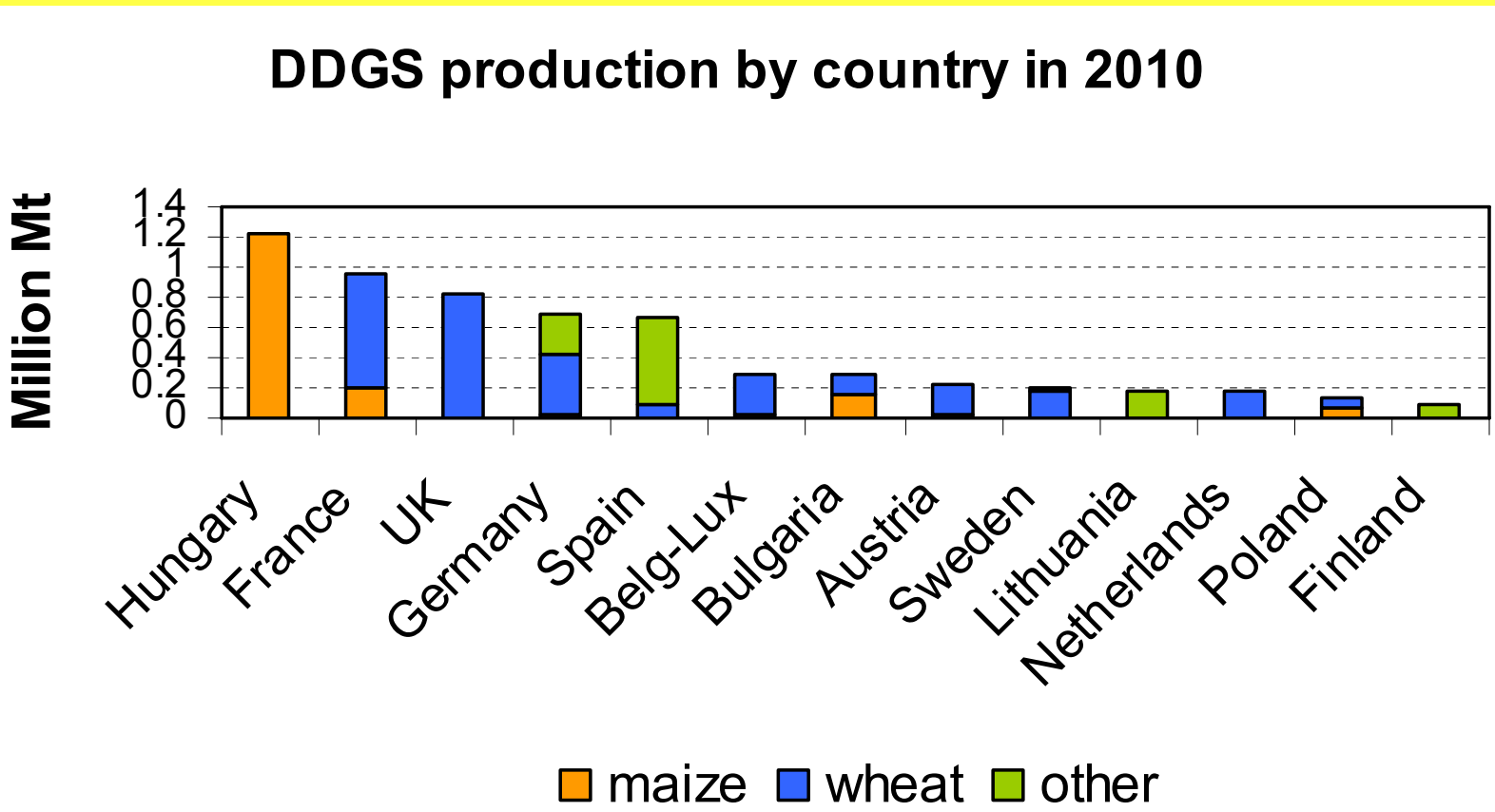
460,000 mt of DDGS

- **38% wheat**
- **62% wheat/corn**

www.ddgs.usask.ca

Research Justification

- **Europe** (2.8 billion liters of ethanol in 2008)



http://www.allaboutfeed.net

Research Justification

- **Dietary protein evaluation of DDGS for ruminants**
  - **Chemical profile, CNCPS** (*Nuez Ortin and Yu, 2009*)
    - **CP (%DM): 14% (wheat) vs. 39% (wheat DDGS) vs. 32% (corn DDGS)**
    - **PB2 (%CP): 62% vs. 28% vs. 54%**
    - **PB3 (%CP): 15% vs. 51% vs. 28%**
  - **In situ rumen procedure** (*Batajo and Shaver 1998, Grings et al. 1992*)
    - **RUP (%CP): 46% (corn) vs. 60% (corn DDGS)**
  - **Intestinal digestibility of RUP** (*NRC 2001*)
    - **dRUP: 90% (corn) vs. 75% (corn DDGS)**

Research Justification

- **Modern protein evaluation models**

  - Chemical profile
  - In situ rumen degradation characteristics
  - Intestinal digestibility of CP

  ↓

  - DVE/OEB (Dutch) System *(Tamminga et al. 1994)*
  - NRC 2001 Model *(NRC 2001)*

  ↓

  - Ruminal and postruminal availability of protein

Objective

Prediction of protein supply of DDGS to dairy cows using NRC 2001 and DVE/OEB System

1) Magnitude of difference

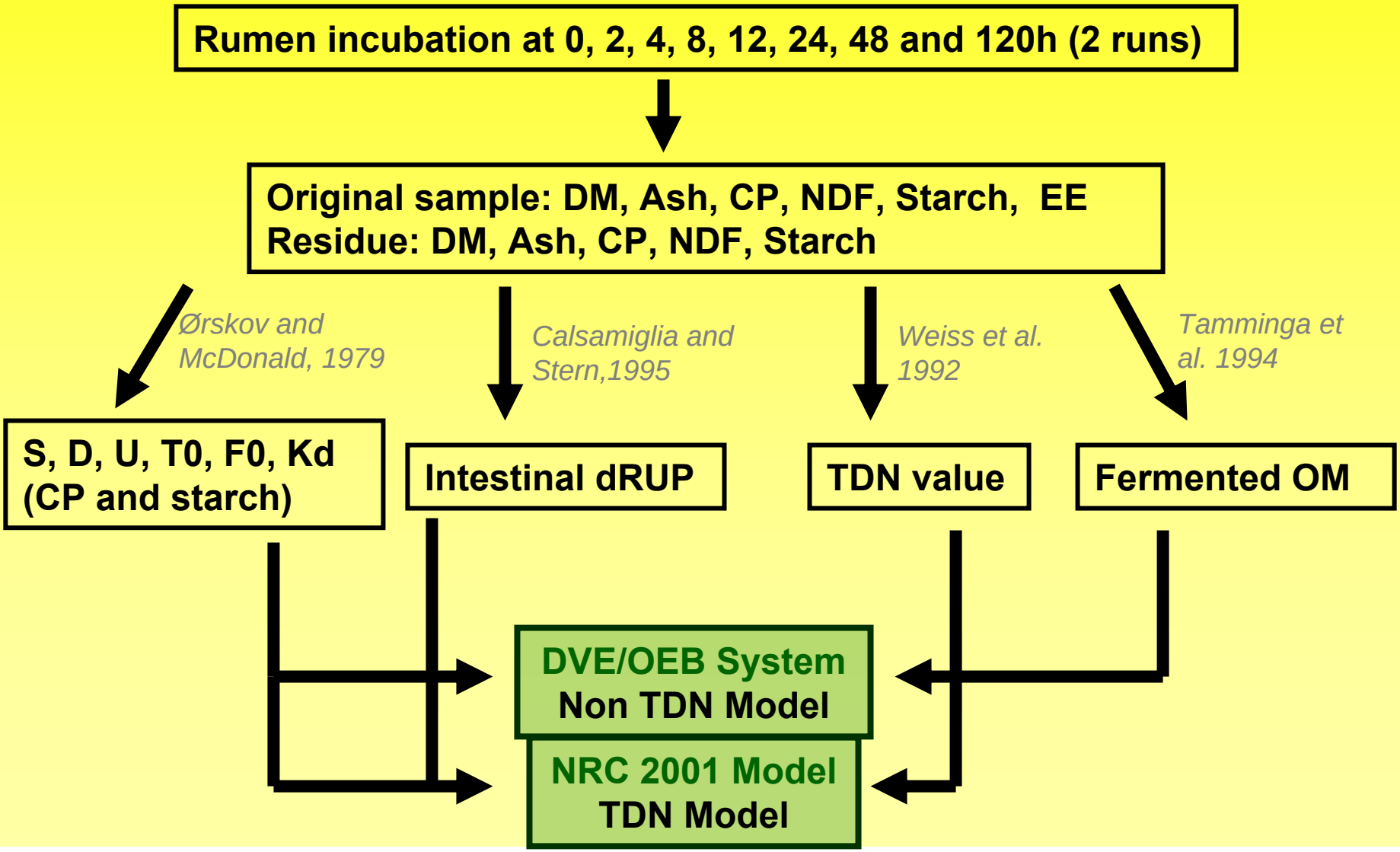
- **feedstock vs. wheat DDGS vs. corn DDGS vs. blend DDGS**

2) DVE/OEB System vs. NRC 2001 Model

Methodology

- **Samples**
  - Wheat (3)
  - Corn (3)
  - Wheat DDGS (5)
  - Blend DDGS (70% wheat:30% corn) (3)
  - Corn DDGS (3)
- **Animals**
  - 3 rumen fistulated Holstein cows (dry)

Methodology



Methodology

- **Availability of protein in SI**

DVE/OEB System	NRC 2001 Model
True absorbable protein in SI (DVE)	Metabolizable protein (MP)
Absorbable RUP + Absorbable microbial protein synthesized in rumen – Endogenous CP losses	Absorbable RUP + Absorbable microbial protein synthesized in rumen + Absorbable endogenous CP

Methodology

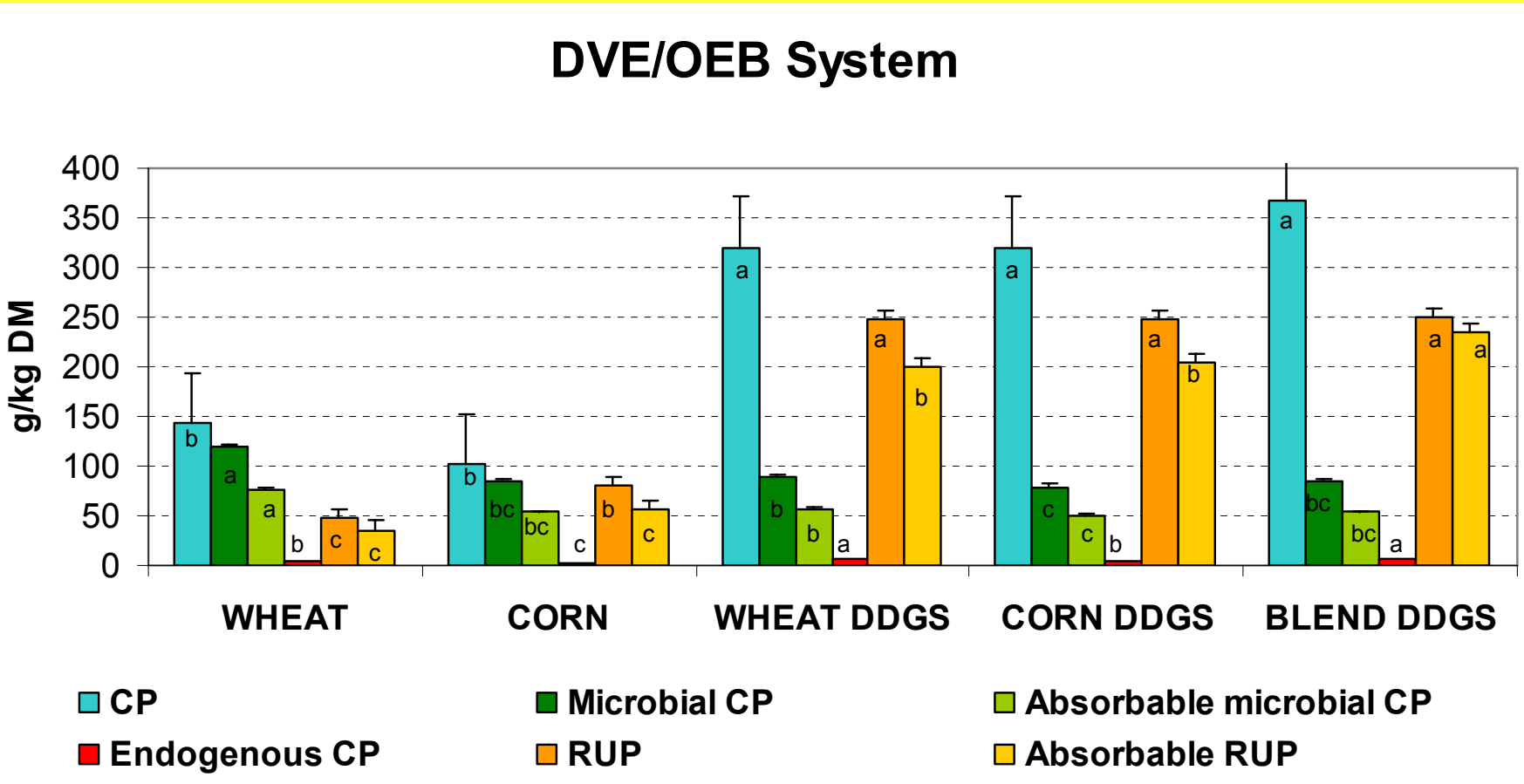
- **Degraded protein balance**

DVE/OEB System (Non-TDN Model)	NRC 2001 Model (TDN Model)
Degraded protein balance (OEB)	**Degraded protein balance (DPB)**
Microbial protein synthesis$_{RDP}$	Microbial protein synthesis$_{RDP}$
–	–
Microbial protein synthesis$_{FOM}$	1.18 x Microbial protein synthesis$_{TDN}$

Methodology

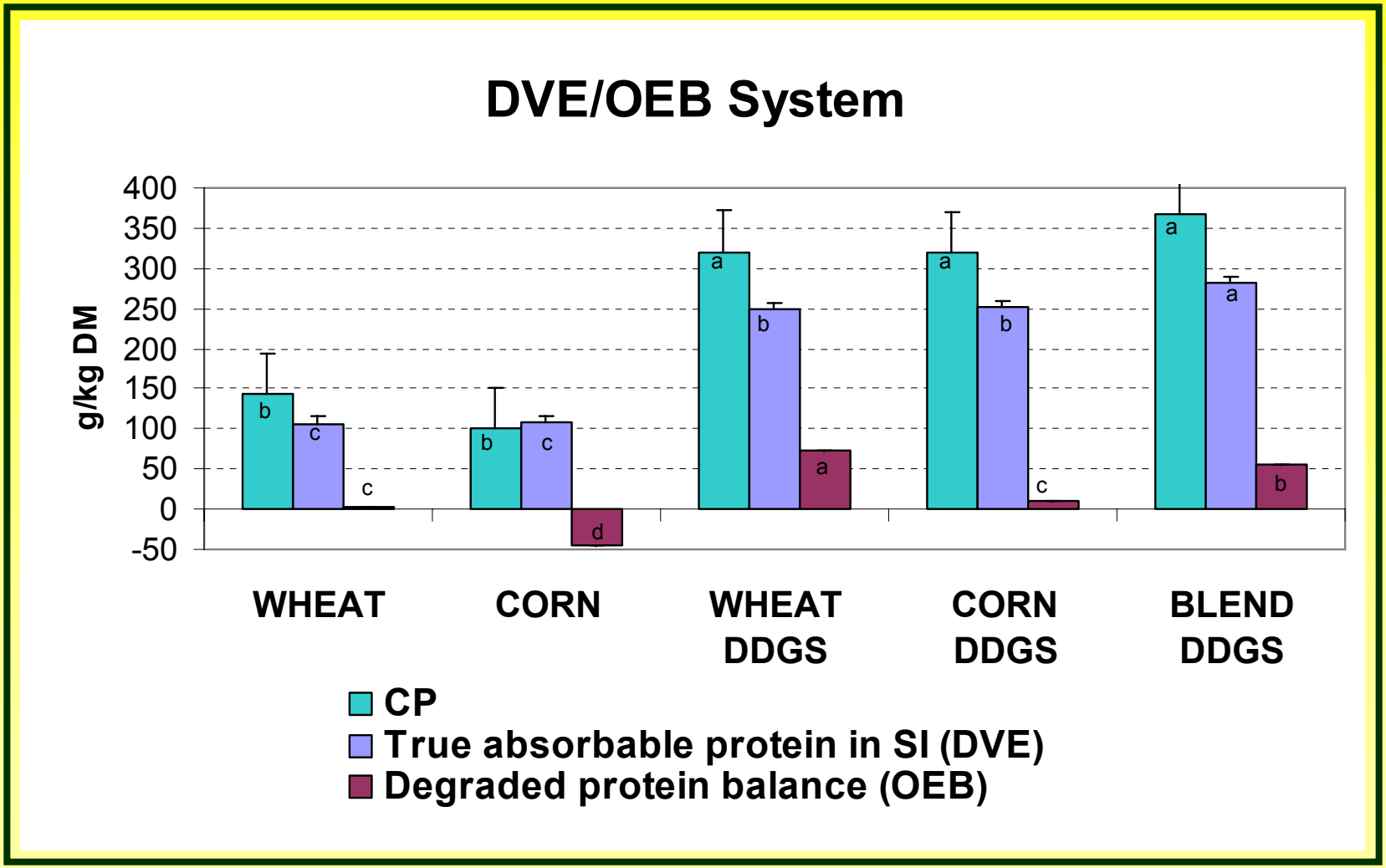
- **Statistical analysis**
  - **DDGS type effect on protein availability (Objective 1)**
    - **CRD**
      - Batches and runs as replicates
      - SAS Mixed procedure
      - Means separation using Fisher Protected LSD method ($P<0.05$)
  - **DVE/OEB System vs. NRC 2001 Model (Objective 2)**
      - Paired t test
      - Correlation

Results (Objective 1)



a, b, c, d Means with same letter in the same block are not significantly different (P>0.05) LSD method

Results (Objective 1)



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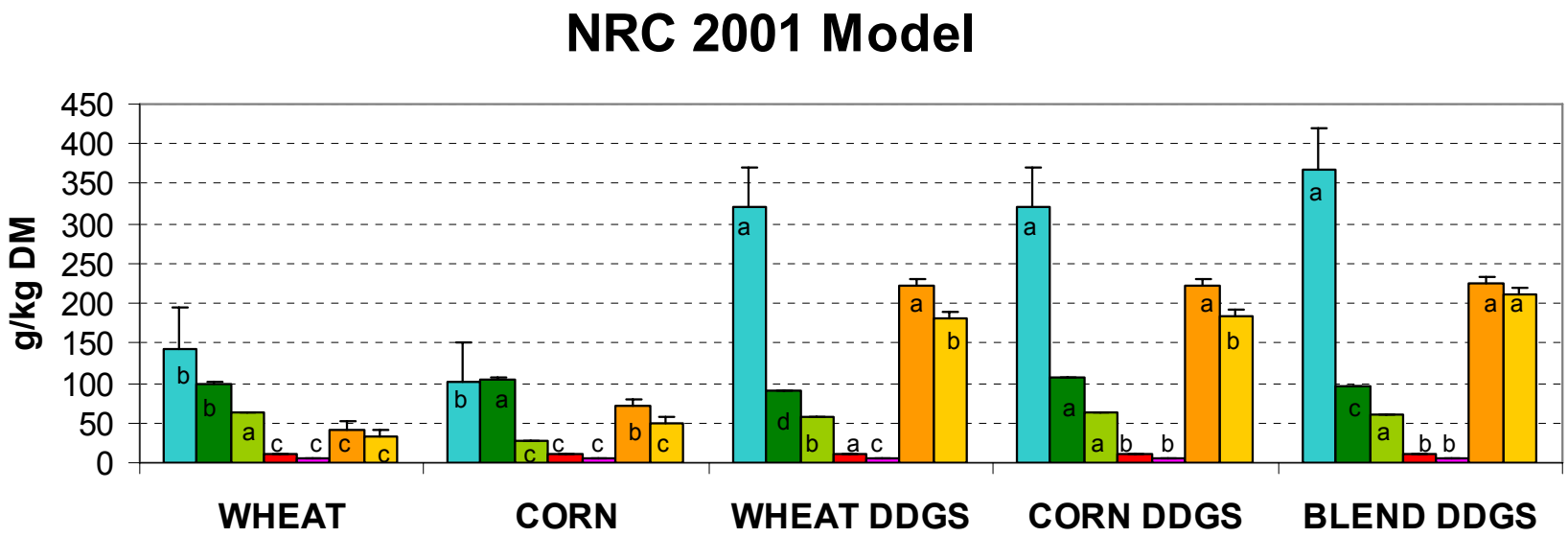

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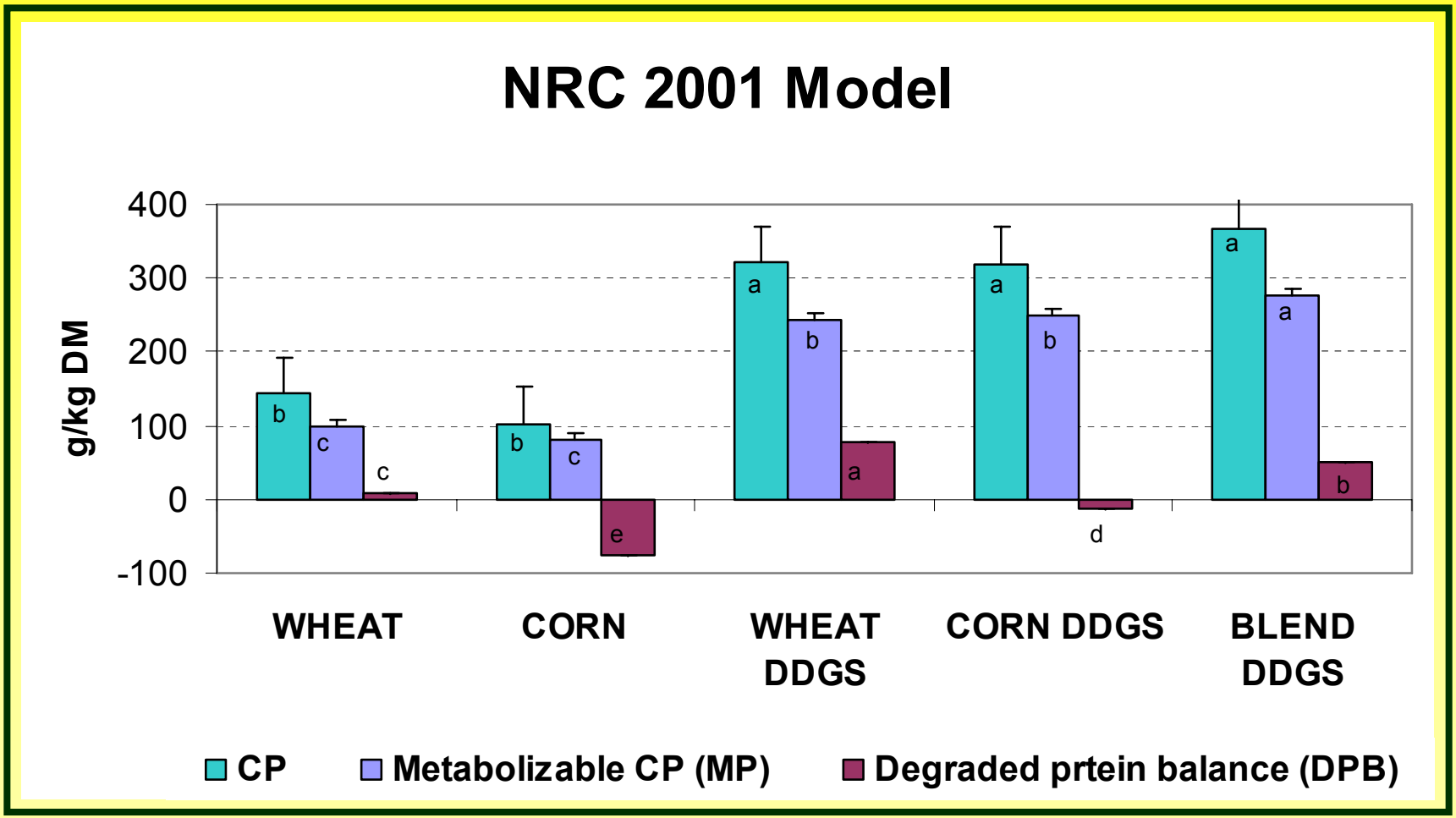
Results (Objective 1)



[a, b, c, d] Means with same letter in the same block are not significantly different (P>0.05) LSD method

Results (Objective 2)

DVE/OEB System vs. NRC 2001 Model

Items g/kg DM	Mean DVE/OEB	Mean NRC 2001	Difference	SED	P value	R	P value
Absorbable microbial CP	53.98	60.10	**-6.11**	1.267	<0.0001	**-0.44**	0.0405
Absorbable endogenous CP	6.32	4.39	**1.92**	0.394	<0.0001	**0.45**	0.0371
Absorbable RUP	210.35	189.50	**20.85**	0.664	<0.0001	**1.00**	<0.0001
Metabolizable CP/DVE	258.01	253.99	**4.01**	0.793	<0.0001	**0.99**	<0.0001
Degraded protein balance	50.70	45.94	**4.76**	2.728	0.0957	**0.97**	<0.0001

Paired t test.
Pearson correlation.

Conclusion

- **DVE/OEB System vs. NRC 2001 Model for DDGS evaluation:**

  - **True absorbable protein in SI (DVE/MP):**
    - **DDGS > feedstock grain**
    - **Blend DDGS (70:30) > wheat DDGS = corn DDGS**

  - **Balance between microbial protein synthesis from available RDP and available energy (DPB):**
    - **Corn DDGS showed the closest to zero value**

  - **Absorbable RUP**
    - **MP/DVE was higher for the DVE/OEB System**

Thank you!!

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UNIVERSITY OF SASKATCHEWAN

CAJA MADRID FUNDACION

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