Effects of supplementing carinata meal compared with cottonseed meal on performance, carcass characteristics, and sensory attributes in beef steers consuming a finishing diet

Schulmeister, T. M., F. Tarnonsky, F. Podversich, J. J. Vargas, I. Fernandez-Marenchino, A. Maderal, W. Cuervo, C. Gomez, A. Gonella-Diaza, J. C. B. Dubeux, and N. DiLorenzo

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Introduction

Brassica carinata

◗ **Ethiopia**

*Ethiopian mustard,
Carinata*

◗ **Selective breeding**

Erucic acid ⬆ > 40%

◗ **Favorable VLCFA profile**

Drop-in jet biofuel

T33 tailing the Falcon 20 in a test flight

◗ **Brassicaceae**

Mustard family

Marillia et al., 2013; AAFC, 2015; Seepaul et al., 2016
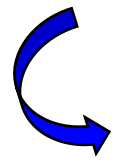
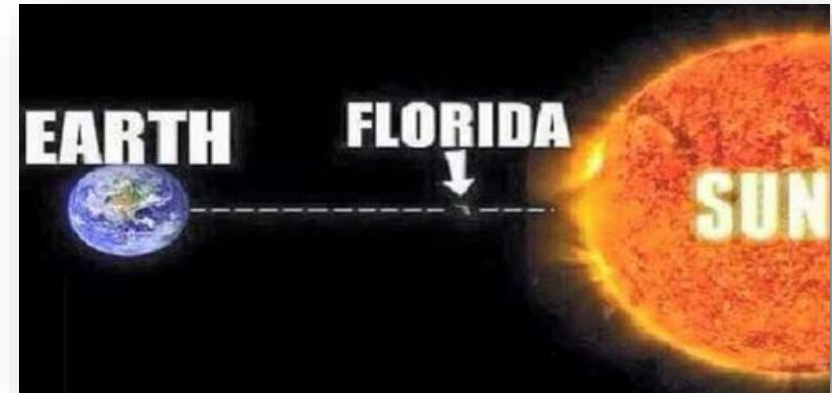# Introduction   Carinata

◗ **Specifically in SE U.S., benefits include:**

Cover crop

- **Cold/drought tolerant**

- **Heat/disease resistant**

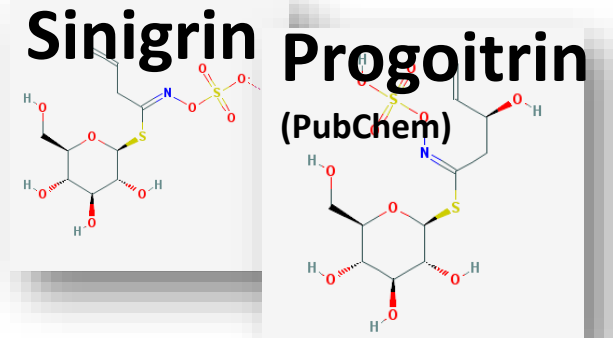- **Rotational crop**

- **Residual meal is ~ 40% CP**

Potential for local, high-quality protein supplement for beef cattle

AAFC, 2015; Seepaul et al., 2016

Introduction

Sinigrin **Progoitrin**
(PubChem)

◗ **Carinata: glucosinolates?**

Alteration of thyroid metabolism
Inhibition of Cu
Growth retardation
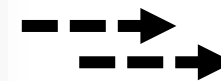Fertility Impairment
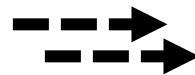Irritation & edema of GI mucosa

Glucosinolate content of 90 – 140 µmol/g is considered high in growing crossbred beef steers

(Lardy and Kerley, 1994)

Breeding

Processing

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New glucosinolate content: < 5.0 µmol/g

Spiegel et al., 1993; Schone et al., 1997; Taljaard, 1993; van Doorn et al., 1998; Zukalova and Vasak, 2002; EFSA, 2008

Background

◆ **Xin and Yu, 2014** ➡️ *In situ & Three-step*

　　➡️ **78:22 forage to concentrate TMR**

◆ **Schulmeister et al., 2019a** ➡️ *Heifer performance*

　　➡️ **Bermudagrass hay + carinata at 0.3% BW**

◆ **Schulmeister et al., 2019b** ➡️ *Ruminal metabolism*

　　➡️ **Bahiagrass hay + carinata at 0.3% BW**

◆ **Schulmeister et al., 2021** ➡️ *In situ & Three-step*

　　➡️ **Bahiagrass hay + carinata at 0.3% BW**

◆ **Tarnonsky et al., 2023** ➡️ *Heifer performance*
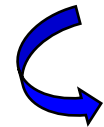
　　➡️ **Silage + 10% carinata inclusion**

Current

Why?

→ **New carinata meal studies**

- **As a protein supplement, <u>still</u> <u>novel</u>**
- **High-quality protein supplements are needed (economy!)**
- **<u>Reduced glucosinolate content</u>**
  - **Improved performance?**
  - **Carcass characteristics?**
  - **Meat sensory attributes?**

No previously published literature!

Objective

Evaluate the effects of supplementing carinata meal compared with cottonseed meal on performance, carcass characteristics, and sensory attributes in beef steers consuming a finishing diet

Hypothesis:

Carinata meal will perform similarly to cottonseed meal in performance, carcass characteristics, and sensory attributes

Materials & Methods

🐂 **Experimental design:**

- **Generalized randomized block design**
- **Performance conducted over 56 or 105 d**

🐂 **Animals and housing:**

Photo credited to F. Tarnonsky

- **32 Angus crossbred steers (533 ± 40 kg initial BW)**
- **Randomly assigned to treatment, within pen**
- **Penned in Feed Efficiency Facility, NFREC, Marianna, FL**

🐂 **Intake:**

- **Ad libitum access to feed and water**
- **Intake measured using the GrowSafe system**

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Materials & Methods

🐂 **Treatments:**

- BCM = 90% basal diet + 10% carinata meal
- CSM = 90% basal diet + 10% cottonseed meal

Photo credited to F. Tarnonsky

➢ Basal diet: 40% cracked corn

35% soyhull pellets

5% gin trash

5% bermudagrass hay

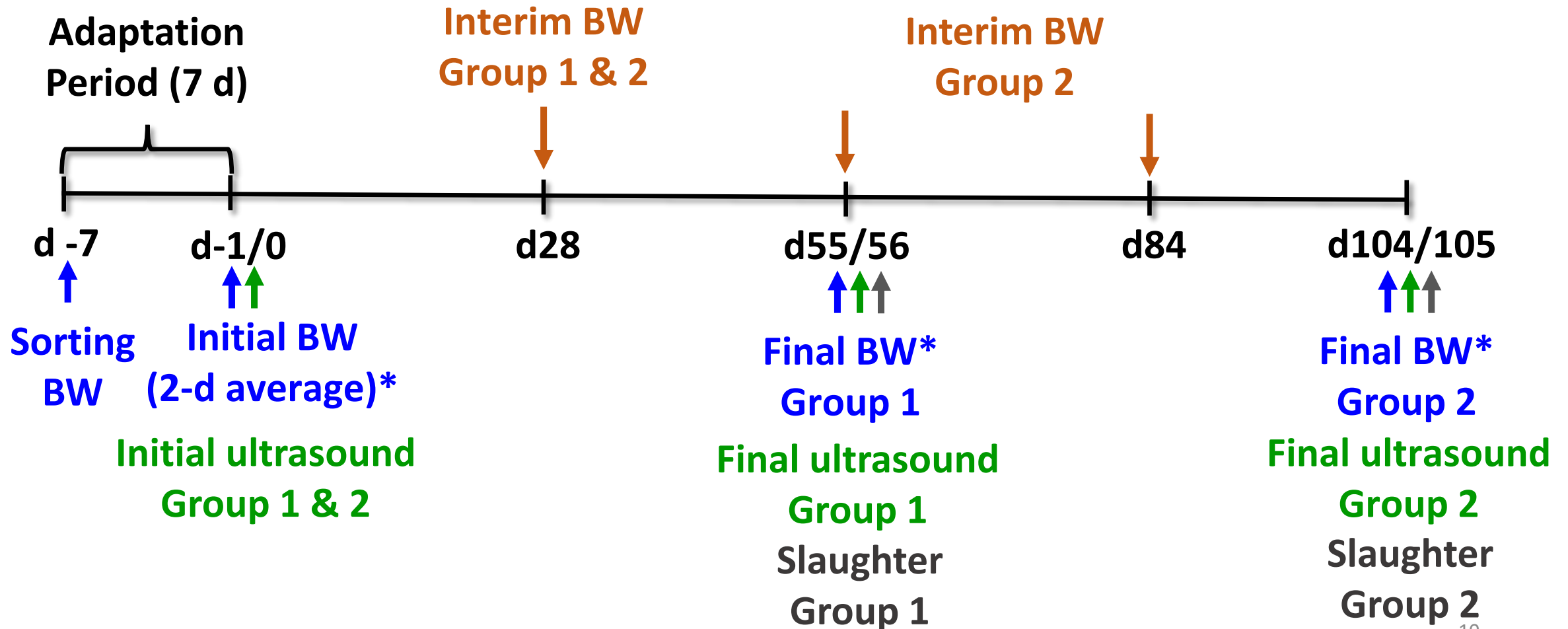5% vitamin-mineral supplement

*Weighed, mixed, and fed daily (DM basis)

🐂 **Sampling & Analysis:**

- Performance
- Carcass characteristics
- Sensory attributes

Materials & Methods

🐄 **Schedule:**

Ad libitum access to treatments and water

Adaptation Period (7 d)

Interim BW Group 1 & 2

Interim BW Group 2

d -7   d-1/0   d28   d55/56   d84   d104/105

Sorting BW

Initial BW (2-d average)*

Initial ultrasound Group 1 & 2

Final BW*
Group 1

Final ultrasound Group 1

Slaughter Group 1

Final BW*
Group 2

Final ultrasound Group 2

Slaughter Group 2

Nutrient profile

Item, % DM	Treatment	
	BCM	CSM
DM	90.6	91.6
CP	13.8	14.8
EE	2.4	3.1
aNDF	38.3	39.8
ADF	27.4	29.4
TDN	66.5	67.0

- ➢ DM = dry matter
- ➢ CP = crude protein
- ➢ EE = ether extract
- ➢ aNDF = neutral detergent fiber*
- ➢ ADF = acid detergent fiber
- ➢ TDN = total digestible nutrients

Analyzed by Dairy One Forage Testing Laboratory, Ithaca, NY

*aNDF measured using α-amylase and sodium sulfite

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Statistical analysis

Performance

Sensory attributes

Quality grade

- Data were analyzed as a generalized randomized block design
  - Proc glimmix of SAS
    - binomial proportion
    - ILINK option to calculate treatment proportions
  - Fixed effects: treatment, pen(treatment)
  - Fixed effects: treatment
  - Covariate: initial BW and day of age
  - Random effect: slaughter group
  - Experimental unit: steer (n = 32 steers)
- Differences between treatment means identified by Tukey's least squares means comparison
- Significance declared when $P \leq 0.05$

Results

Effects of protein inclusion on performance parameters

Item	Treatment		SEM	*P*-value
	BCM	**CSM**		
Initial BW, kg	527	539	7.5	0.11
Final BW, kg	647	661	6.7	0.08
ADG, kg	1.49	1.62	0.073	0.24
DMI, kg/d	11.99	12.21	0.435	0.24
DMI, % BW	1.85	1.85	0.062	0.99
G:F, kg/kg	0.12	0.14	0.006	0.15
RFI, kg DM	0.13	-0.13	0.755	0.82

➢ ADG = average daily gain   ➢ G:F = gain to feed ratio

➢ DMI = dry matter intake   ➢ RFI = residual feed intake

Results

Effects of protein inclusion on carcass characteristics

Item	Treatment		SEM	*P*-value
	BCM	CSM		
Hot carcass weight, kg	383	391	5.4	0.10
Dressing percentage, %	62.64	62.34	0.428	0.61
LM area, cm^2	93.81	91.59	1.66	0.33
Rib-fat thickness, cm	1.62	1.73	0.092	0.42
Yield grade	3.58	3.67	0.087	0.47
Marbling score	430	436	28.0	0.89

➢ LM = longissimus muscle

➢ Marbling score scale: small^{00} = 400, modest^{00} = 500

Results

Effects of protein inclusion on sensory attributes

Item	Treatment		SEM	*P*-value
	BCM	CSM		
Slice shear force, kg	19.17	20.56	1.574	0.55
Crude fat, %	6.80	6.50	0.610	0.76
Thaw loss, %	20.20	22.09	0.923	0.17
Cook loss, %	16.60	16.23	0.814	0.76
Lightness	42.64	43.30	0.621	0.48
Redness	32.21	32.09	0.520	0.87
Yellowness	26.27	26.56	0.659	0.76

Results

Effects of protein inclusion on sensory panel scores
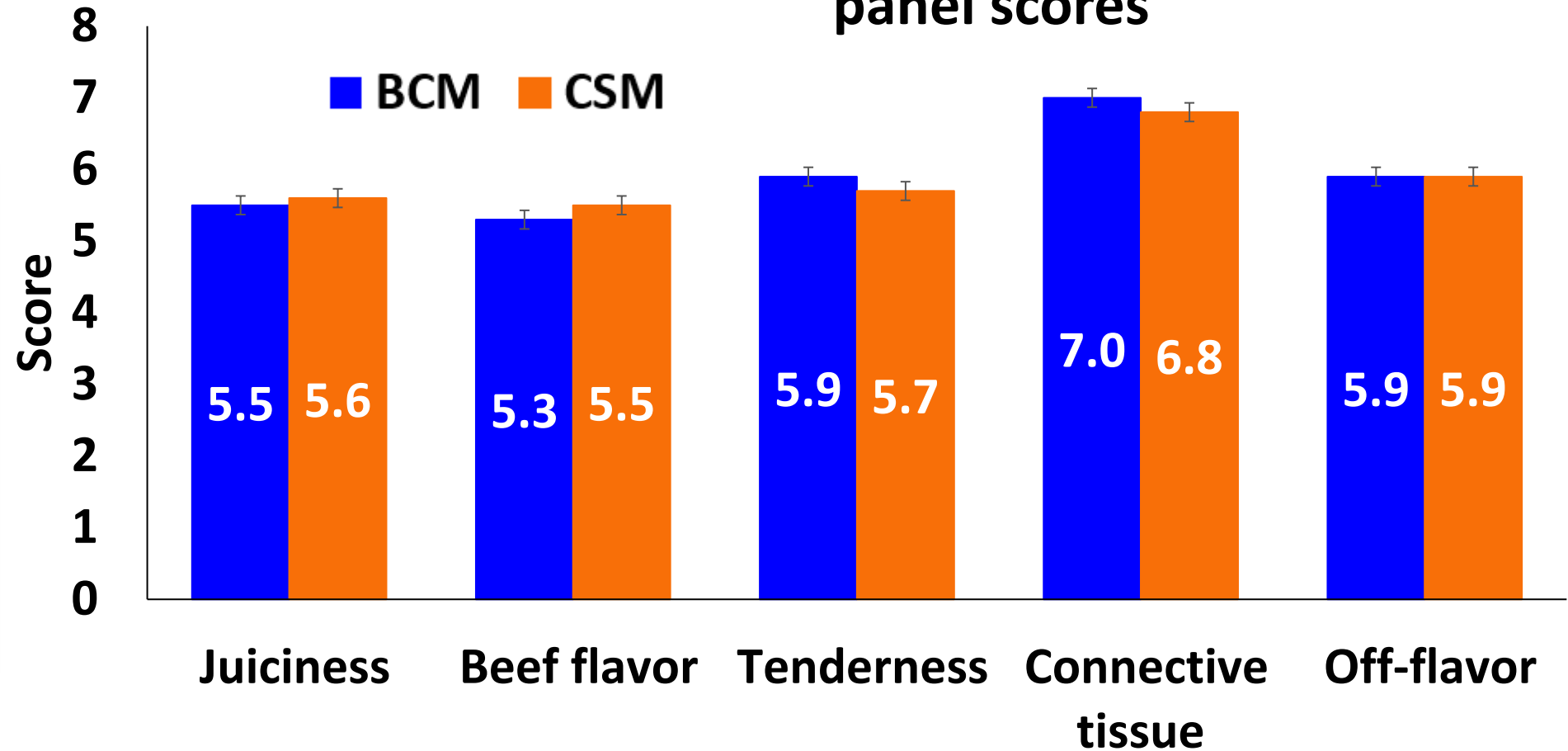
Treatment:

| | P = 0.43; SEM = 0.13 | P = 0.07; SEM = 0.05 | P = 0.48; SEM = 0.19 | P = 0.54; SEM = 0.16 | P = 0.54; SEM = 0.03 |

➤ **Evaluated on 8-point number scale: 8 = most desirable ... 1 = least desirable**

Results

Effects of protein inclusion on the frequency distribution of USDA quality grade scores

Item, %	Treatment		SEM	*P*-value
	BCM	CSM		
Prime	11	8	7.93	0.76
Upper 2/3 Choice	46	54	13.44	0.71
Low Choice	41	28	12.94	0.46
Select	2	10	6.06	0.34

Prime – high quality, abundant marbling
Choice – high quality, less marbling than Prime
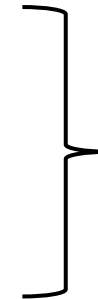Select – uniform in quality, less marbling than Choice

Summary & Conclusion

🐄 Summary

- **32 finishing Angus crossbred steers**
- **Basal diet + 10% carinata meal or cottonseed meal**

Performance
Carcass characteristics
Sensory attributes / panel scores
USDA quality grade distribution

No statistical differences!

🐄 Conclusion

Carinata meal, a novel high-quality protein source, is comparable to cottonseed meal in delivery of expected beef cattle performance and meat sensory attributes

Acknowledgements

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SPARC | Southeast Partnership for Advanced Renewables from Carinata
https://sparc-cap.org/

facebook.com/NFRECnutrition

www.dilorenzonutritionlab.com

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Thank you!