

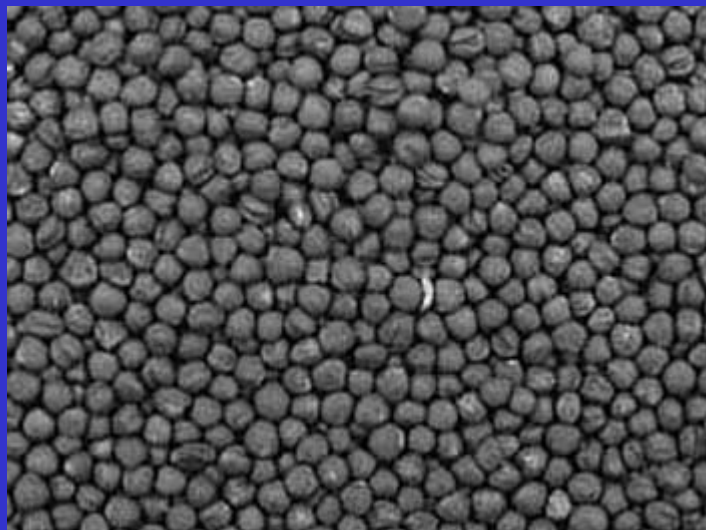
Feeding Oilseeds To Beef Cattle

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Why Feed Oil Seeds To Beef Cattle?



1. Energy & protein ingredients

- **Finishing diets formulated to provide maximum energy**
 - **Maximize gain / feed efficiency**
- **Grain content of diets can reach 85-95%**
- **Hard to maintain consistent intakes**



Potential Problems with Ad Libitum Feeding

- Sub-acute acidosis
- Liver abscesses
- Laminitis



Forages

- **Slower digestion**
- **Improves rumination**
- **Buffering ability**

BUT

- **Lower energy than are concentrates, therefore decreased gains**



Alternative Feed Sources

- **Feed alternatives with digestible fiber, low starch, and high energy**
 - Distiller's grains (wet and dry)

- **Fat Sources**
 - Tallow

- **Protein & Oil Sources**
 - Sunflower seed
 - Flax seed
 - Canola seed



Energy of Fat

- **Contain 2.25 times more energy than starch from grain**
- **More efficient (“cold” nutrients)**
- **Does not contribute to acid production**
- **May reduce potential for acidosis**

Drawbacks

- **Low inclusion rates (< 7%)**
- **Inhibit rumen fermentation either by coating feed particles or toxic effect on microbes**
 -
 - **Fibre digestibility reduced**
 - **Feed intake reduced**
- **Cost of oilseeds relative to traditional energy sources**

2. Fatty Acids and Consumers

- Saturated vs unsaturated fats
- Omega 3 vs omega 6 fatty acids
 - CLA
 - ALA
- Consumer interest in animal products that have altered fatty acid profiles:
 - Eggs
 - Milk
 - Beef
 - Pork

Fatty Acid Profile of Oil Sources

Comparison of Dietary Fats

DIETARY FAT	Fatty acid content normalized to 100 per cent			
Canola oil	7%	21%	11%	61%
Safflower oil	10%	76%	Trace	14%
Sunflower oil	12%	71%	1%	16%
Corn oil	13%	57%	1%	29%
Olive oil	15%	9%	1%	75%
Soybean oil	15%	54%	8%	23%
Peanut oil	19%	33%	Trace	48%
Cottonseed oil	27%	54%	Trace	19%
Lard*	43%	9%	1%	47%
Beef tallow*	48%	2%	1%	49%
Palm oil	51%	10%	Trace	39%
Butterfat*	68%	3%	1%	28%
Coconut oil	91%	2%	7%	

* Cholesterol Content (mg/Tbsp): Lard 12; Beef tallow 14; Butterfat 33. No cholesterol in any vegetable-based oil.


Source: POS Pilot Plant Corporation, Saskatoon, Saskatchewan, Canada June 1994

 SATURATED FAT

 MONOUNSATURATED FAT

 POLYUNSATURATED FAT

 Linoleic Acid

 Alpha-Linolenic Acid
(An Omega-3 Fatty Acid)



CANOLA COUNCIL OF CANADA 493-167 LOMBARD AVENUE WINNIPEG MANITOBA CANADA R3B 0T6

Why Feed Sunflower Seeds?

- **Sunflower high source of linoleic acid**
 - **Precursor of CLA**
- **Studies have shown a number of beneficial health effects**
 -
- **CLA increased 10-fold when cows supplemented with 6% roasted sunflower seeds (Kroeker 2005)**
- **Feeding sources of linoleic acid to cattle may result in higher CLA in meat (Mir et al. 2003)**

Why Flaxseed ?

- **Rich source of high quality oil (alpha-linolenic acid (ALA))**
- **Effect on immune system (omega 3 vs. omega 6 FA)**
- **Potential benefits to human health from lignan (phytoestrogens) content (meal vs oil)**
 - **Certain types of cancer prevention**
 - **Immune function**
- **Natural laxative from mucilage content**
- **Natural source of energy / protein**

Fatty Acid Composition of Linseed Oil, Compared to Other Oils

	Linseed Oil	Canola Oil	Soybean Oil	Tallow
Total Sat. %	9.0	7.4	15.1	52.1
Total unsat. %	91.0	92.6	84.9	47.9
Oleic (C18-1) %	6.0	56.1	22.8	36.0
Linoleic (C18-2) %	19.0	20.3	51.0	3.1
Alpha linolenic (C18-3) %	57.0	9.3	6.8	0.6

3. Potential ban on all animal byproducts in ruminant production systems

➤ Meal and bone meal

- Current ban on ruminant to ruminant feeding
- Extend to other species?
 - Maple leaf chicken?

➤ Replacement of tallow ■

- ~3 billion lbs of feed fats purchased annually in US
- Most is inedible tallow & grease

➤ Others

- Blood meal
- Feather meal

4. Use of Edible Oils to Mitigate Greenhouse Gas Emissions from Cattle

- **Agriculture is Responsible for ~9% of Canada's Greenhouse Gas Emissions**
 - **Agricultural Soils = ~53% (mostly N₂O from fertilizer)**
 - **Enteric Fermentation = ~31% (mostly CH₄ from ruminants)**
 - **Manure Management = ~16% (CH₄ & N₂O from stored manure)**

Strategic Inclusion of Flaxseed and Other High Lipid Feeds on Performance and Carcass Characteristics of Cattle

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Objectives

➤ **To evaluate the effects of feeding high lipid feeds (flax and sunflower seed) on feedlot performance and carcass traits of feedlot cattle**



➤ **Strategic supplementation:**

- **during the first 60 days of the feeding period**
- **during the last 60 days of the feeding period**

Ingredient Composition of Backgrounding Diet

	<u>Control</u>	<u>1st 60 days</u>
➤ Barley silage	40%	40%
➤ Barley Grain	40%	26%
➤ Grass Hay	16%	23%
➤ Supplement	4%	4%
➤ Flax or Sunflower		7%

(As fed basis)

Ingredient Composition of Finishing Diet

	<u>Control</u>	<u>Last 60 days</u>
➤ Barley silage	15.5%	15.5%
➤ Barley Grain	80.0%	73.0%
➤ Supplement	4.5%	4.5%
➤ Flax or Sunflower		7.0%

(As fed basis)

Table 1. Effect of Dietary Treatments On Feedlot Performance And Carcass Characteristics

	Control	<u>Ground Flax</u>		<u>Whole Sunflower</u>		SE
		1 st 60 days	Last 60 days	1 st 60 days	Last 60 days	
<hr/>						
<i>Body weight, kg</i>						
Start of test	343.3	342.8	342.9	343.3	343.3	0.30
End of backgrounding	434.2a	429.2a	432.3a	419.9b	432.2a	2.40
Overall	619.9	625.4	623.8	623.9	621.6	3.10
<i>DMI kg/day</i>						
Backgrounding	9.36a	8.90b	9.51a	8.60b	9.16a	0.14
Finishing	10.60	10.92	10.59	10.81	10.72	0.15
Overall	10.22	10.28	10.25	10.12	10.24	0.12

Table 3. Effect of Dietary Treatments On Feedlot Performance And Carcass Characteristics

		<u>Ground Flax</u>		<u>Whole Sunflower</u>		
	Control	1 st 60 days	Last 60 days	1 st 60 days	Last 60 days	SE
<hr/>						
<i>Ultrasound Fat, mm</i>			■			
Backgrounding	4.77a	3.80b	3.99a	3.31b	4.74a	0.28
Finishing	9.14	8.29	8.20	7.92	9.24	0.37
<i>Ultrasound Ribeye</i>	<i>cm²</i>					
Backgrounding	72.8	75.3	76.0	73.9	75.7	1.25
Finishing	94.0b	98.1a	98.8a	97.2a	99.0a	0.99

Table 4. Effect of Dietary Treatments On Carcass Characteristics

	Control	<u>Ground Flax</u>		<u>Whole Sunflower</u>		SE
		1 st 60 days	Last 60 days	1 st 60 days	Last 60 days	
Carcass weight kg	355.5	354.6	356.3	356.9	355.1	1.60
Avg Back fat mm	9.3	8.0	8.1	8.0	9.0	0.40
Ribeye area cm²	91.1b	95.3a	95.8a	94.8a	93.1ab	0.99
Marbling Score	7.9	7.7	7.8	7.9	7.8	0.05
Lean Yield %	60.1b	61.5a	61.2ab	61.6a	60.2b	0.03

Table 5. Effect of Dietary Treatments On Fatty Acid Profile of Beef Ribeye Steaks

	Control	<u>Ground Flax</u>		<u>Whole Sunflower</u>		SEM
		1 st 60 days	Last 60 days	1 st 60 days	Last 60 days	
<i>Fatty Acid, mg/ 100 mg Fat</i>						
Palmitic (16:0)	22.28	22.12	22.30	23.01	22.87	0.78
Stearic (18:0)	10.99	11.23	10.59	11.50	10.84	0.60
Oleic (18:1)	36.2a	34.1ab	30.8b	33.3ab	32.0b	1.20
CLA	0.34	0.38	0.31	0.33	0.26	0.04
Linoleic (18:2)	1.80a	1.66a	1.90ab	2.54bc	3.02c	0.25
Linolenic (18:3)	0.26a	0.31a	0.77b	0.27a	0.23a	0.05



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Canadian Cattlemen's Association



Use of Edible Oils to Mitigate Greenhouse Gas Emissions from Beef Cattle

Dairy Farmers
of Canada



Les Producteurs laitiers
du Canada

Canadian
Pork
Council



Conseil
canadien
du porc

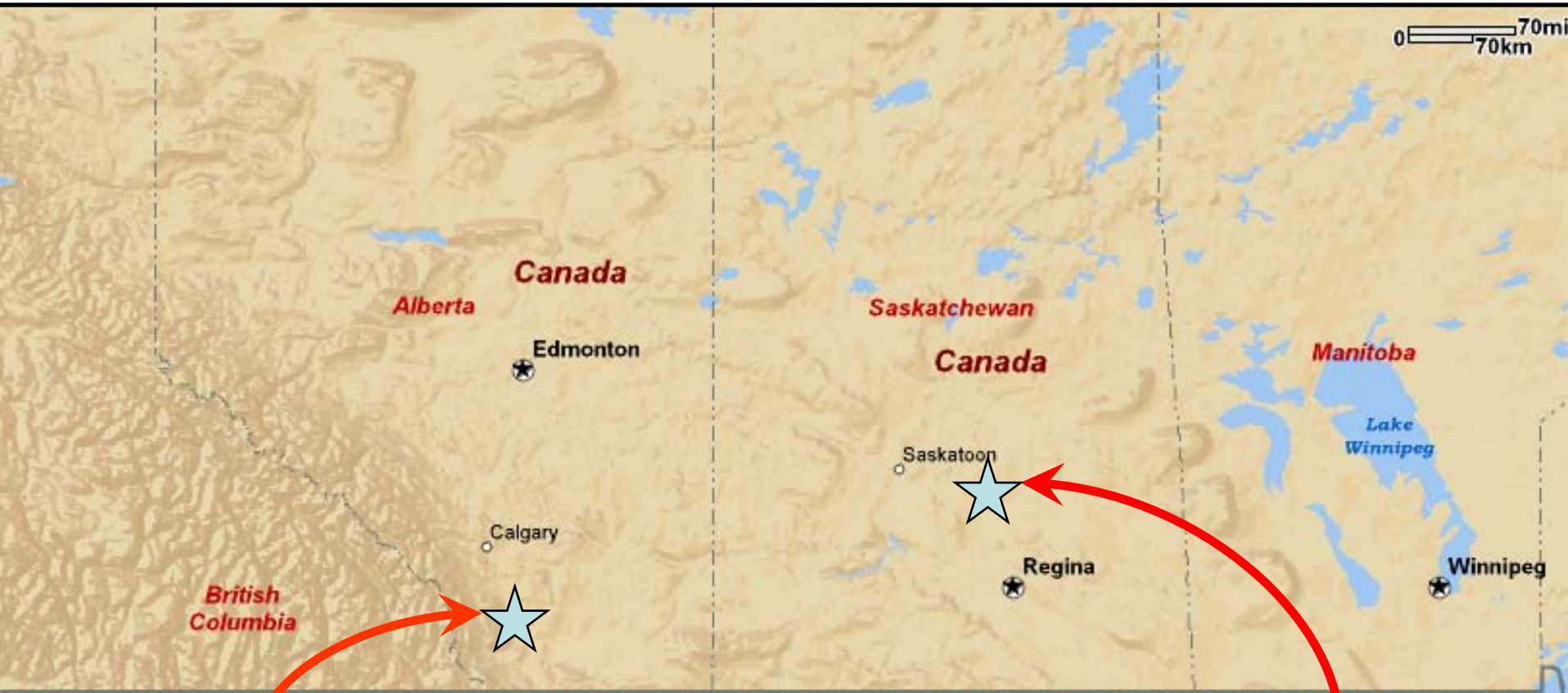
Agriculture & GHGMP

- Agriculture is Responsible for ~9% of Canada's Greenhouse Gas Emissions
 - Agricultural Soils = ~53% (mostly N_2O from fertilizer)
 - Enteric Fermentation = ~31% (mostly CH_4 from ruminants)
 - Manure Management = ~16% (CH_4 & N_2O from stored manure)

Use of Edible Oils to Mitigate Greenhouse Gas Emissions from Beef Cattle

- Substitution of non-fermentable energy (oil) source for fermentable (starch) carbohydrates
- Free fatty acids have toxic effects on rumen microbes including methanogens
 - Stronger for Polyunsaturated fats
 - pH sensitive

Feedlot Demonstration Trials



0 70mi
70km

Canada
Alberta

Edmonton

Calgary

**British
Columbia**

Canada
Saskatchewan

Saskatoon

Regina

Manitoba

Lake
Winnipeg

Winnipeg

Claresholm Beef Producers Ltd.
(Claresholm, Alberta)

Pound-Maker Agventures
(Lanigan, Saskatchewan)

Pound-Maker Agventures

- 4 Treatments
 - Control: Conventional Diet
 - Canola: Control with Ground Canola Seed Replacing Barley Grain at 8% of Diet DM
 - Flax: Control with Ground Flaxseed Replacing Barley Grain at 8% of Diet DM
 - Sunflower: Control with Whole Sunflower Replacing Barley Grain at 8% of Diet DM
- 3 Replicates (3 Pens of 20 Animals)
 - Total of 12 Pens and 240 Animals

Data Collection

- Methane Measurements
 - SF₆ Permeation Tube and PVC Yoke System
- Standard Feedlot Performance Data
 - Weights, Intakes, and Animal Health
- Standard Carcass Characteristic Data
 - Carcass Weights, Quality and Yield Grades
- Fatty Acid Profiles
 - Subcutaneous Fatty Acid Analysis

Fig 1. Initial Trial Weights

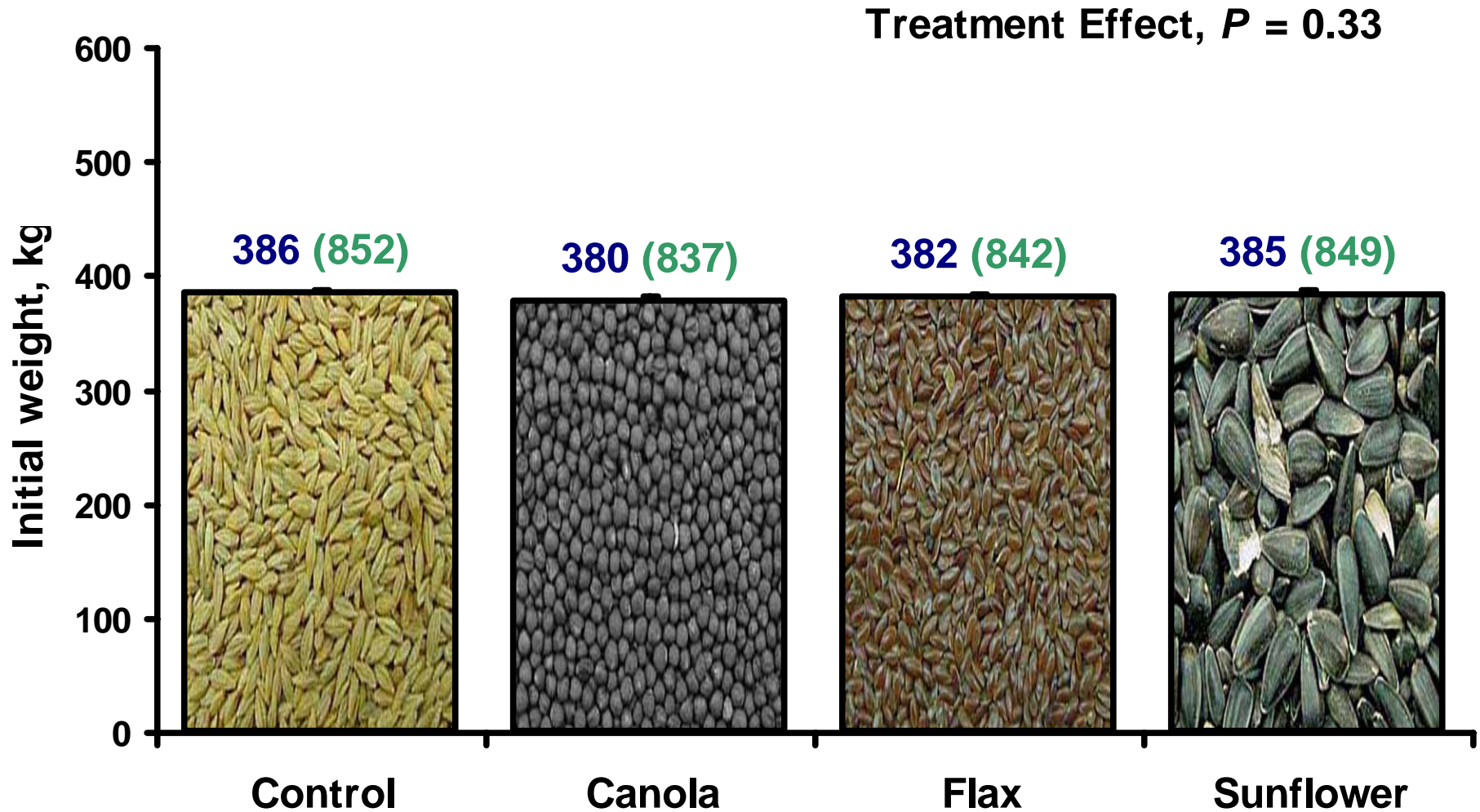


Fig. 2. Effect of Oilseed Inclusion on Final Shrunken Weight

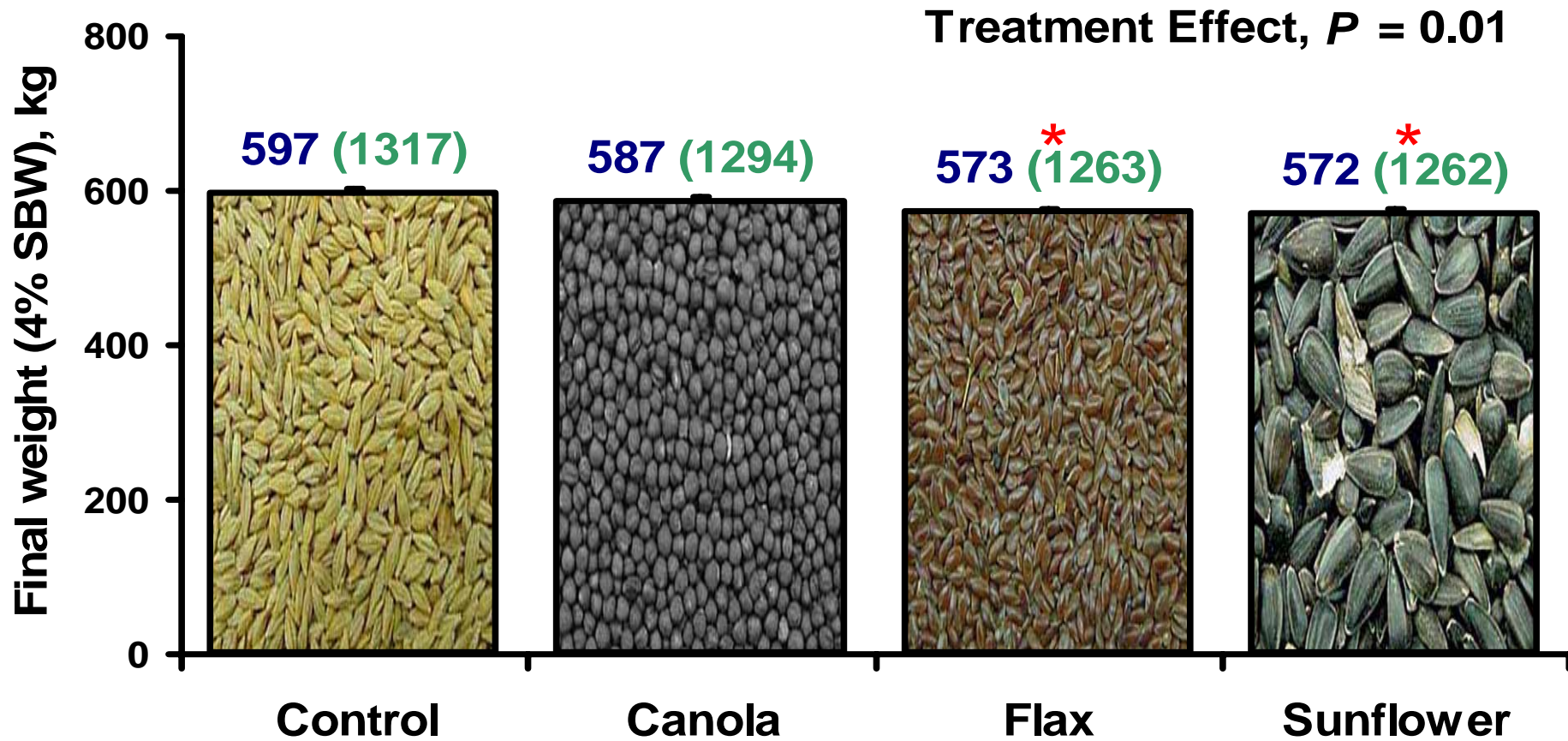


Fig. 4 Effect of Oilseed Inclusion on Average Daily Gain

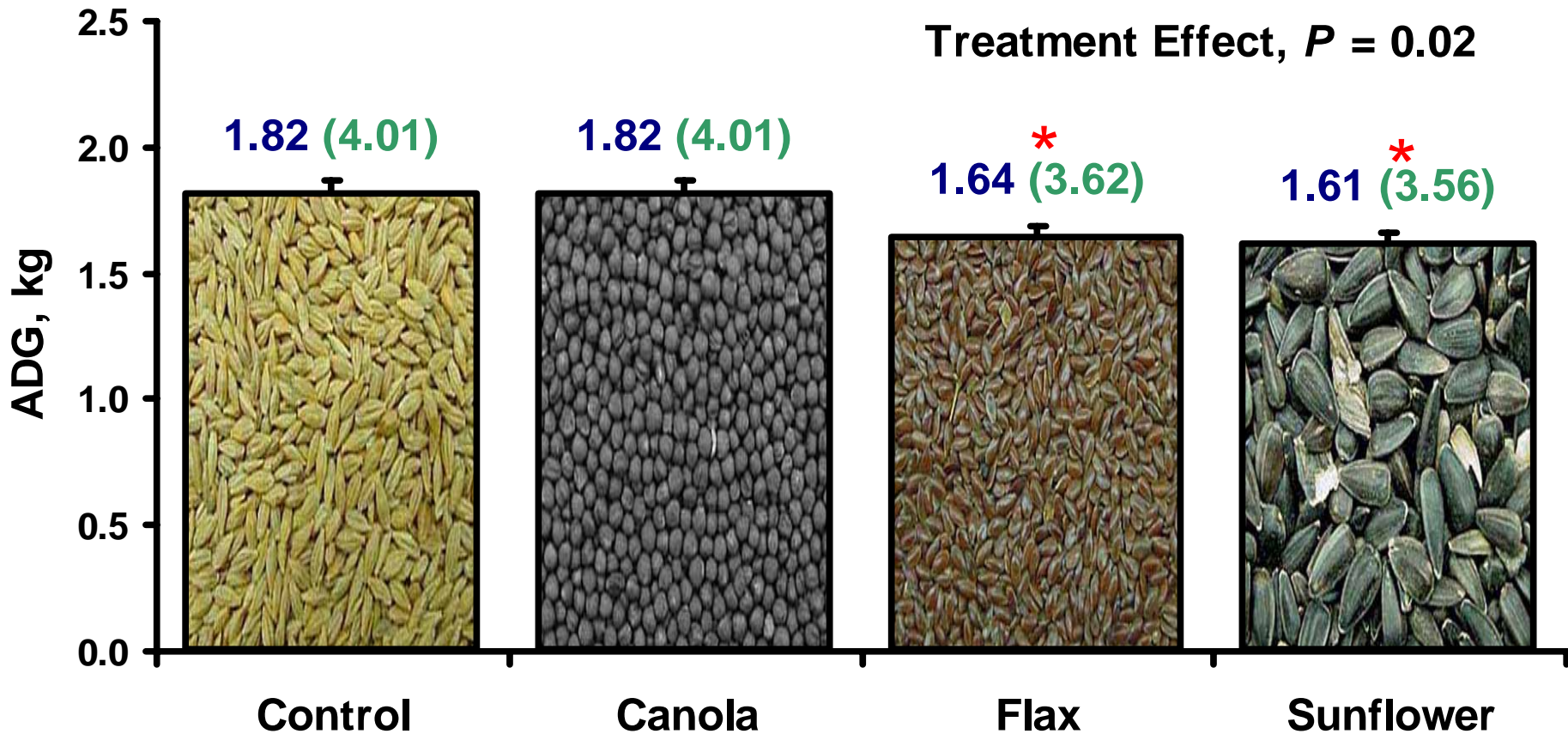


Fig. 5 Effect of Oilseed Inclusion on DMI

Treatment Effect, $P = 0.79$

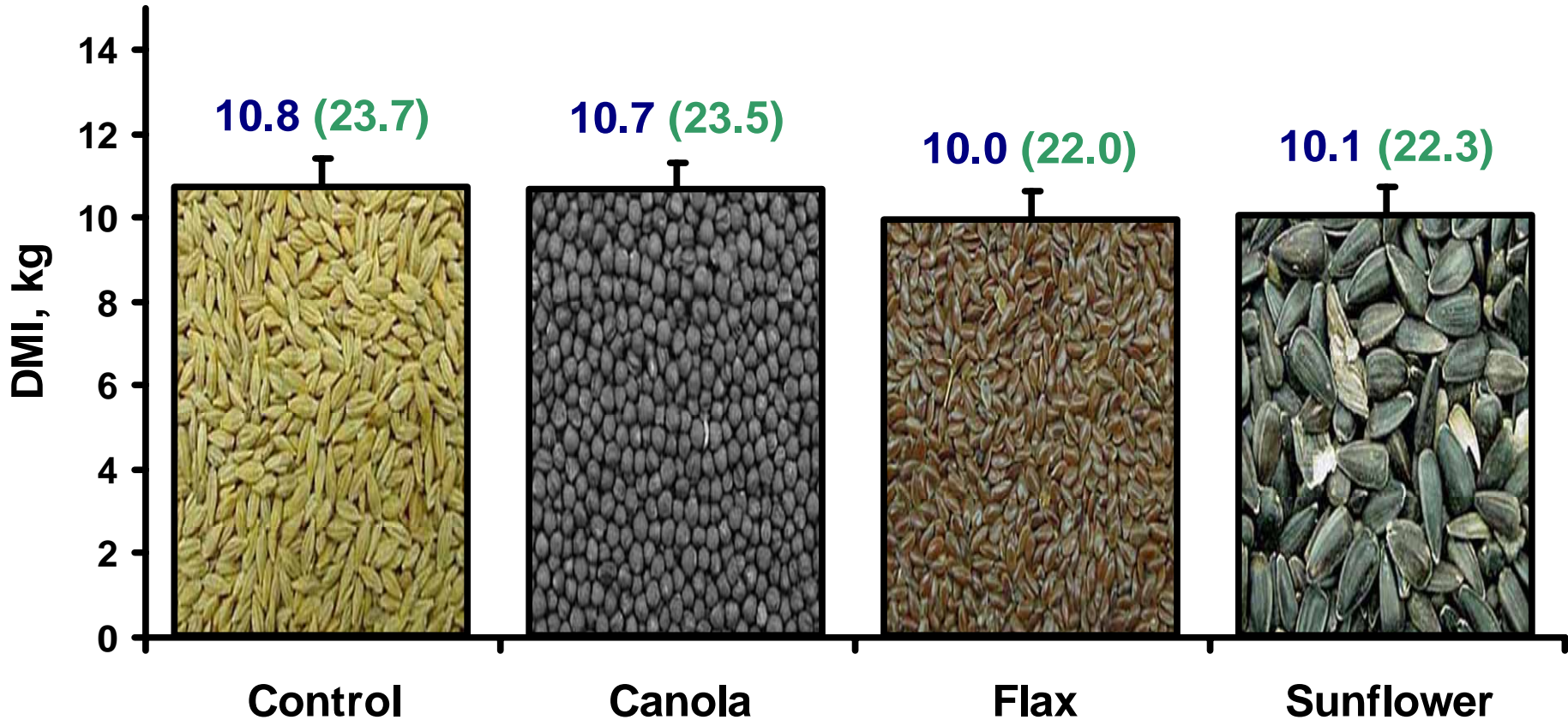


Fig. 6 Effect of Oilseed Inclusion on Feed Efficiency

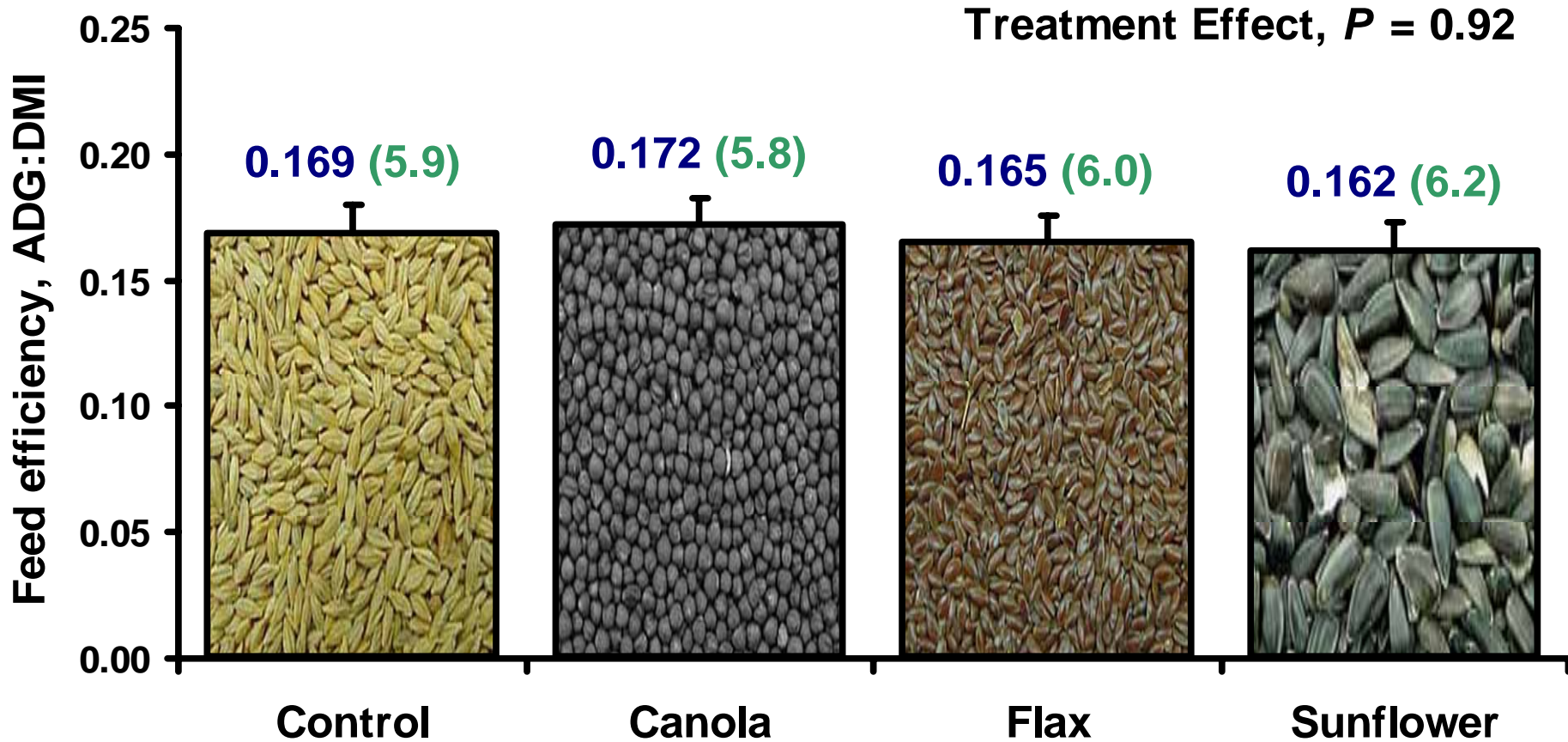


Fig 7. Effect of Oilseed Inclusion on Carcass Yield Grades

Treatment Effect, $P = 0.13$

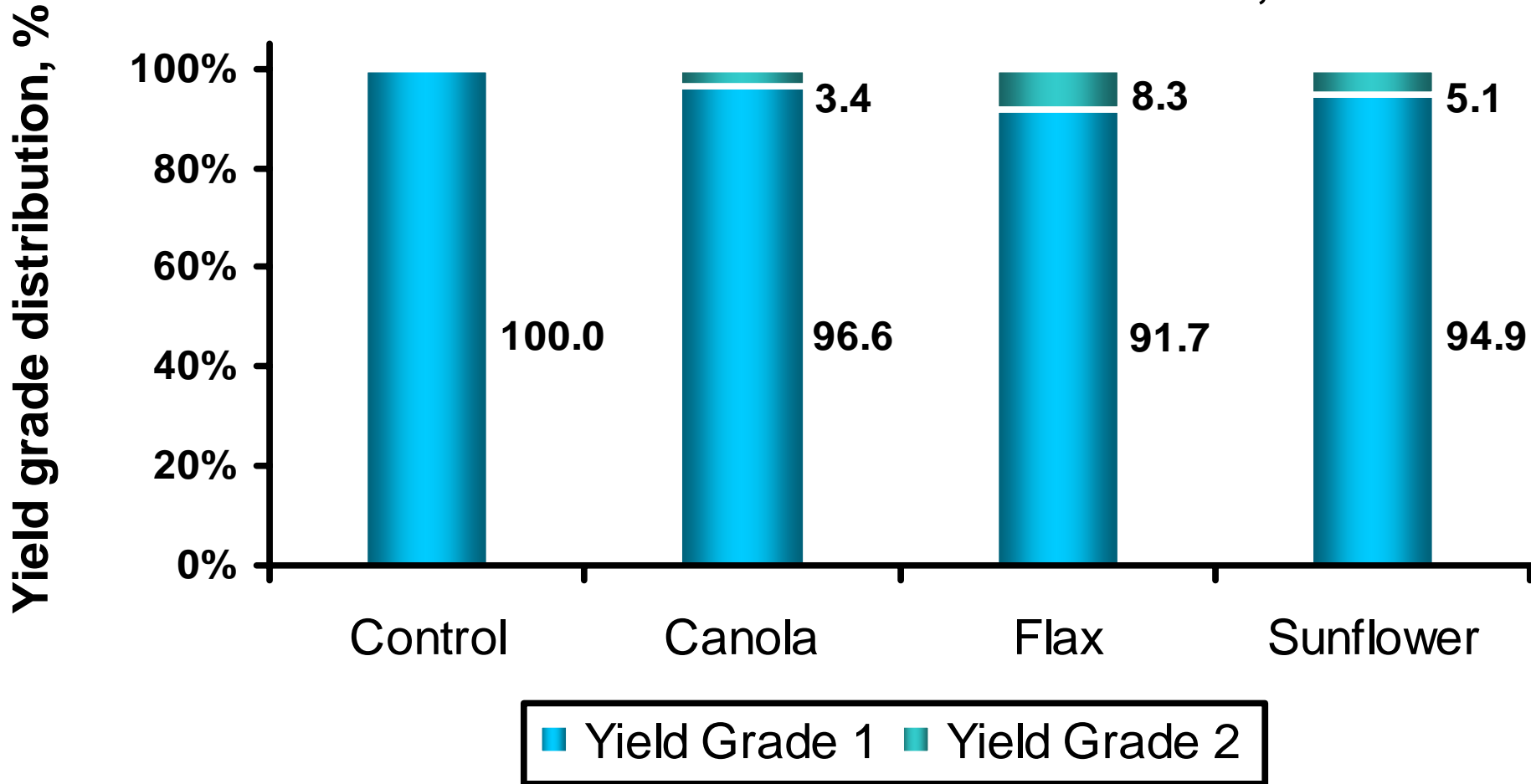
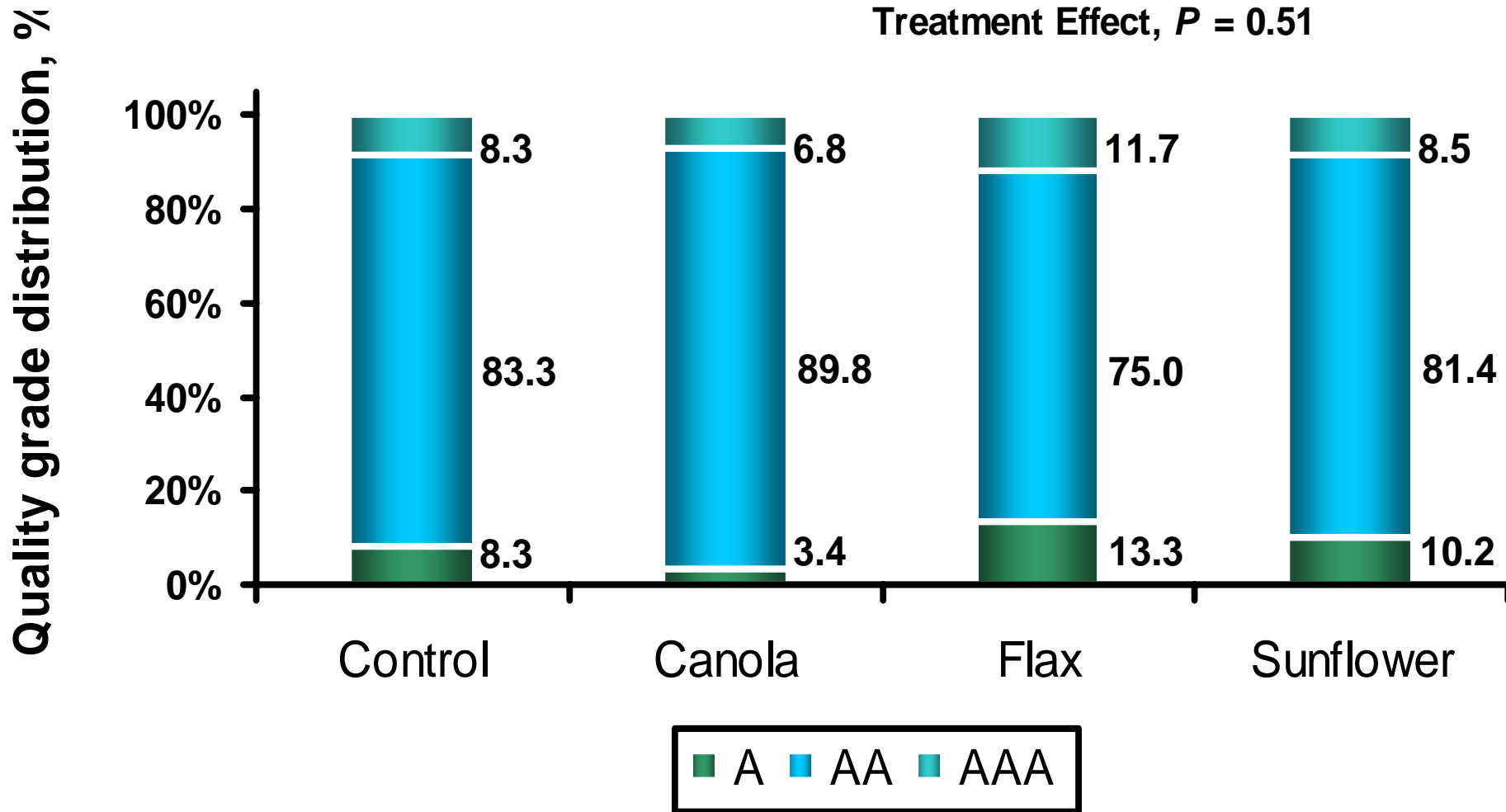


Fig 8. Effect of Oilseed Inclusion on Carcass Marbling Scores



Summary & Conclusions

- **Results show minimal beneficial effects of high lipid feeds on performance:**
 - Decreased feed intake during backgrounding
 - Decreased gain during backgrounding with sunflower seeds
 - Improved feed efficiency with up to 10% sunflower seeds in finishing diets – have not been able to repeat!
- **Some evidence of a re-partitioning effect on carcass composition:**
 - Decreased backfat deposition during backgrounding
 - Increased ribeye & lean yield (Flax seed)
- **No effect on marbling score from oil seed feeding**

Summary & Conclusions

- **Can change fatty acid composition of the beef carcass:**
 - **Sunflower – increase linoleic acid content (18:2) but little change in CLA content**
 - **Flax – increase linolenic acid content (18:3) no effect on EPA or DHA**
- **Commercial application → ??**

Summary & Conclusions

- **What Role will Feeds such as Flax and Sunflower Seeds Play in Future Beef Production?**
 - **Elimination of animal byproducts?**
 - **Elimination of growth implants?**
 - **Reduction or elimination of use of antibiotics?**
 - **Green house gas concerns?**
 - **Consideration of economics?**