Golden State Dairy Management Conference

Almond Hulls For Lactating Dairy Cows: Feeding Amounts & Composition

Ed DePeters

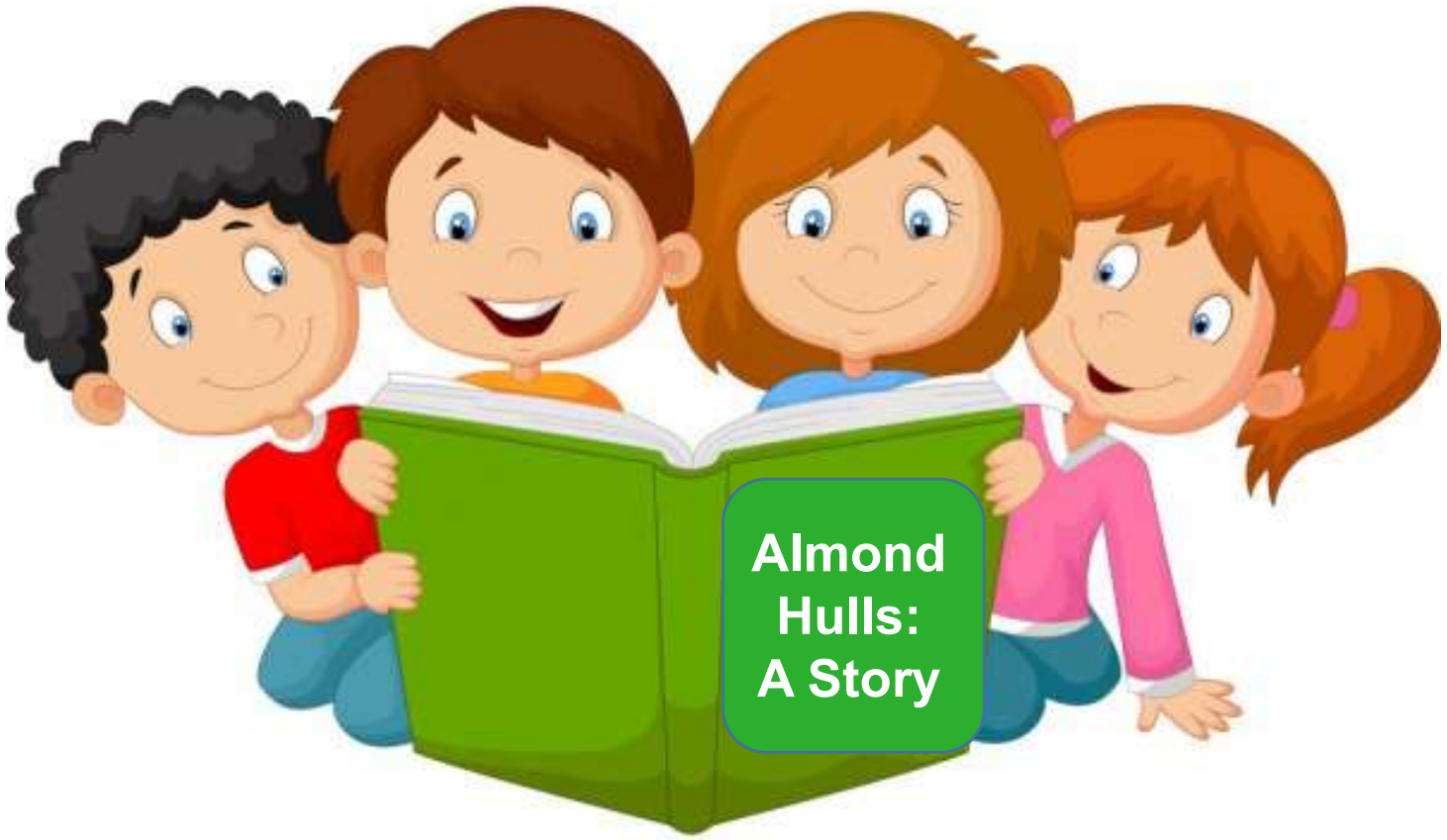
Animal Science Department

University of California at Davis

Team Effort

- Almond Board CA
  (Mr. Guangwei Huang & Dr. Karen Lapsley)
- Jed Asmus, January Innovations (ARPAS)
- **Jennifer Heguy**, UC Cooperative Extension (ARPAS)
- UC Davis
  - Hannah Bill (technician)
  - Katie Swanson (postdoctoral)
  - Staff at Dairy Facility & Feed Mill
  - Student Interns

Almond Hulls as a Byproduct Feedstuff

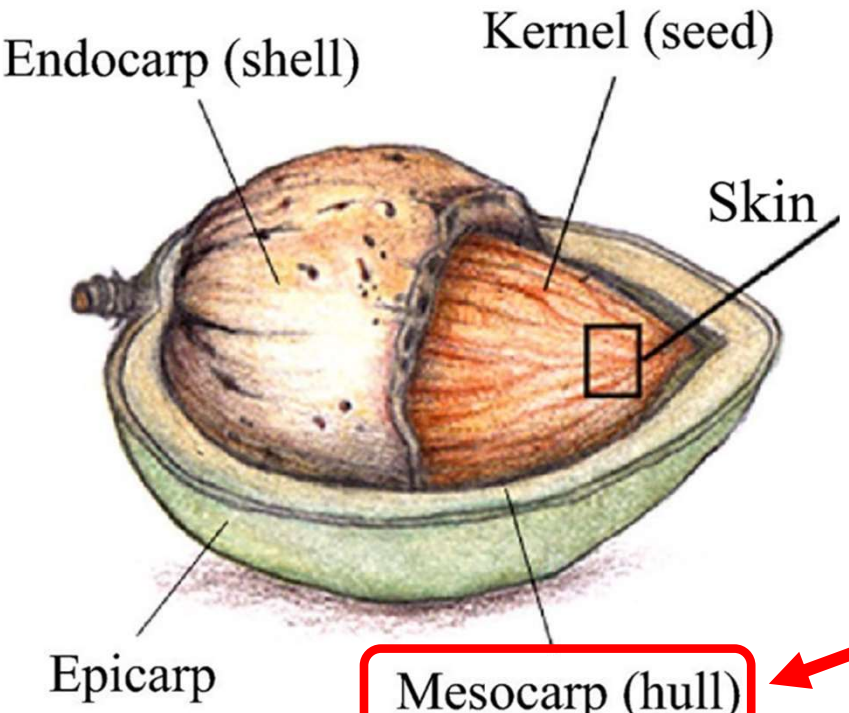


Almond hulls are <u>defined</u> in CA by commercial feed laws:
"They shall not contain more than 13.0 percent moisture, **nor more than 15.0 percent crude fiber**, and not more than 9.0 percent ash."

Almond Hulls (AH)

Almond Hulls are a byproduct feedstuff for ruminants that are created in the production of nuts for human consumption.

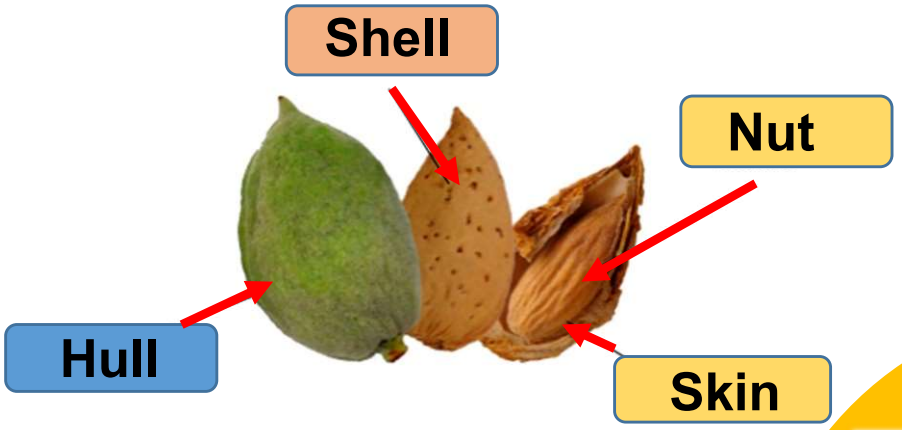
- Almonds belong to the family of stone fruits including peaches & cherries.
- Hull is **anatomically simila**r to the fleshy portion of the peach that we eat.

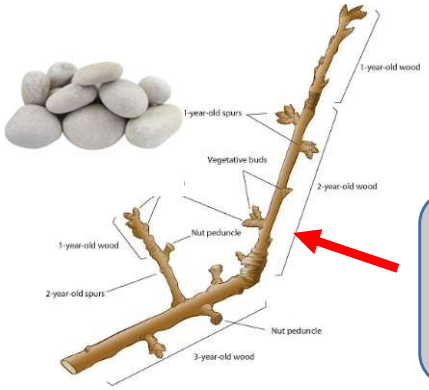


Almond Hulls are high in sugars

Field Weight Yields

In 2019/20, there were 2.2 billion pounds of nuts and **4.4 billion pounds of hulls** produced.





Debris: Sticks & Dirt

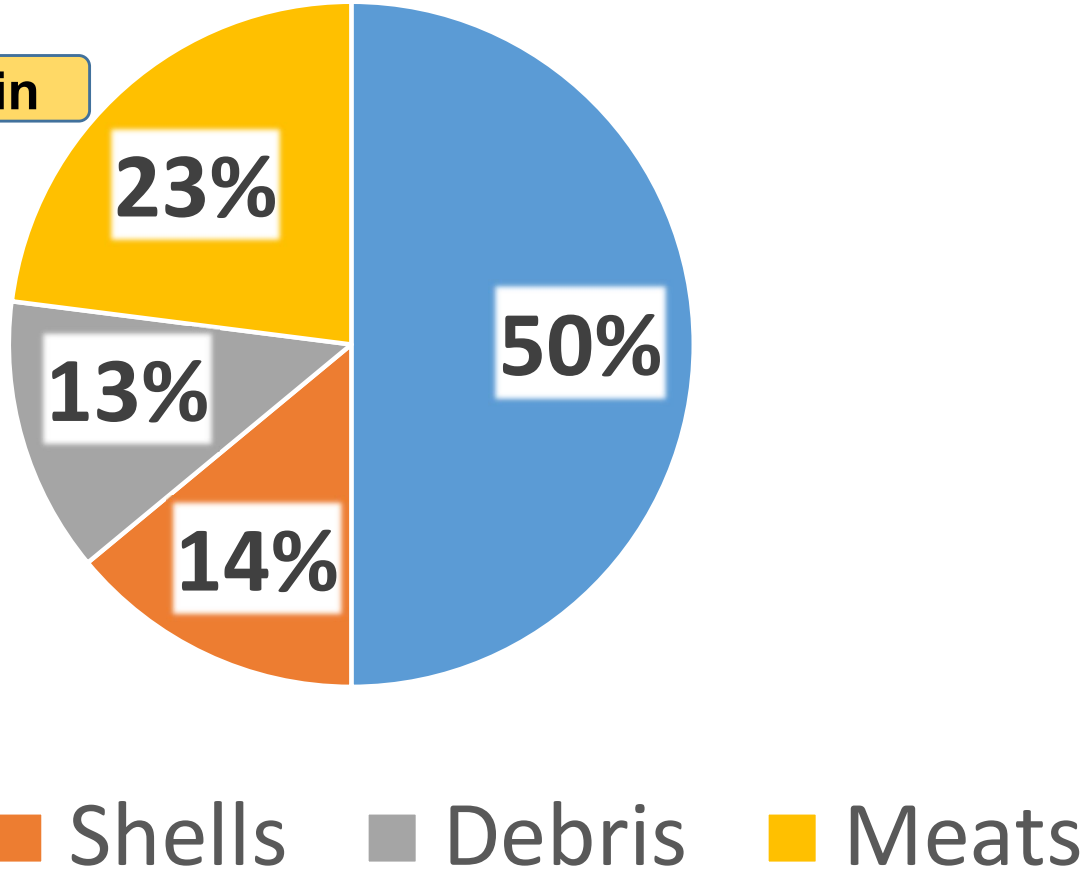
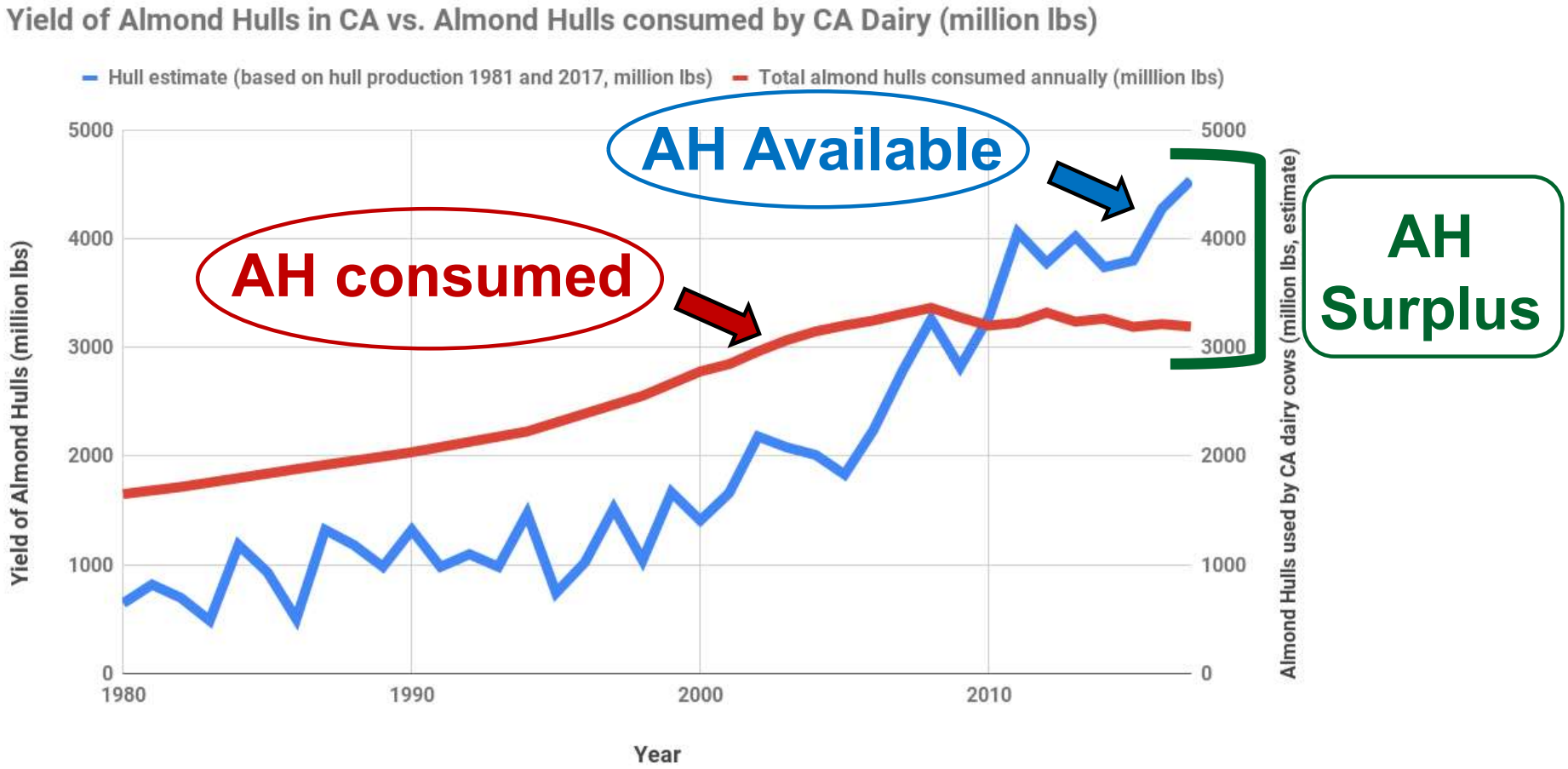


Figure is from Environmental Protection Agency. Food & Agricultural Industry 2017

Projected AH Quantity & Dairy Cow Consumption

At 5 lb AH/cow daily there will be a surplus of AH.



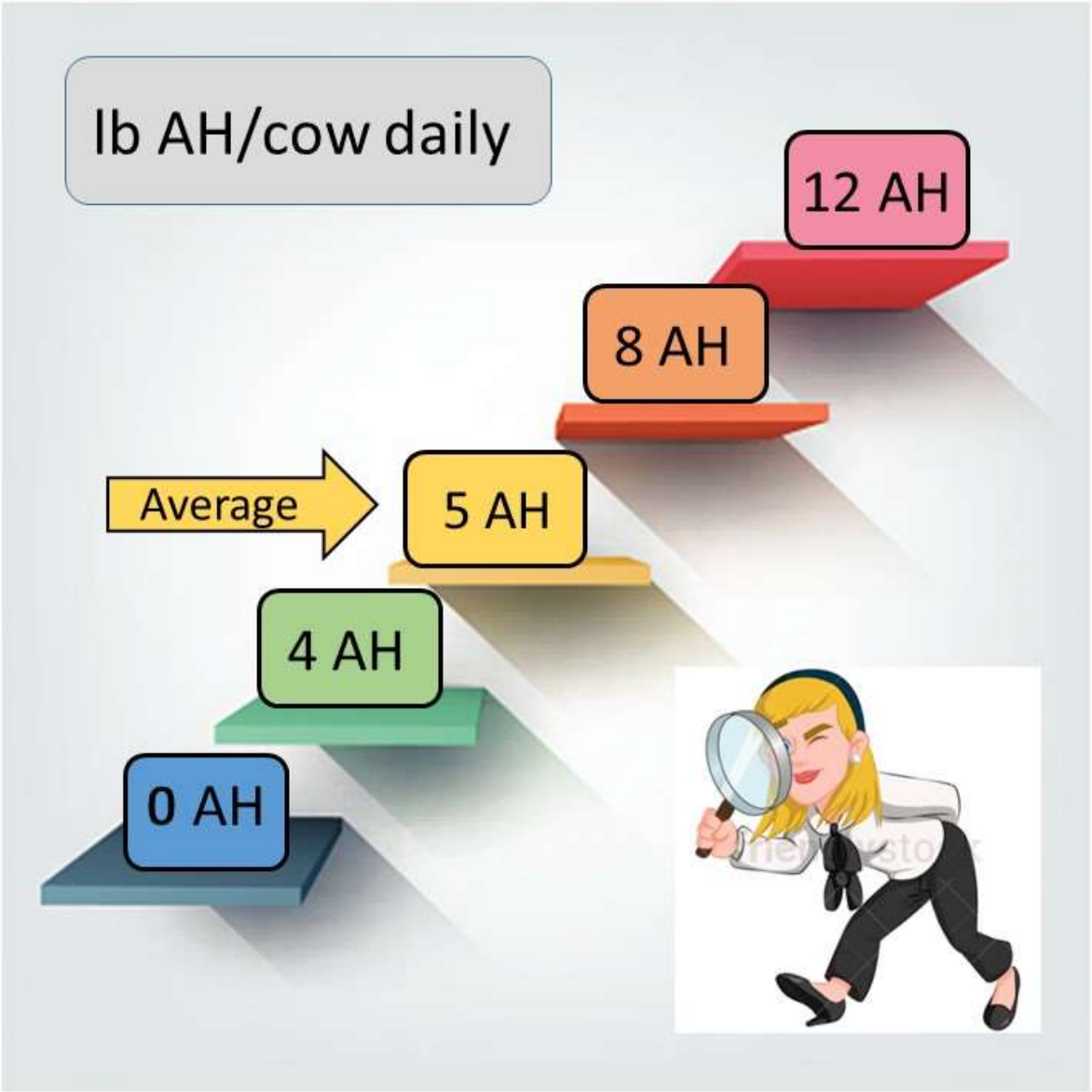
Milk cows in CA are fed ~5 lb As Fed almond hulls (Heguy 2020)

Question our research addressed: Can high amounts of almond hulls be fed to high producing dairy cows?

Objectives

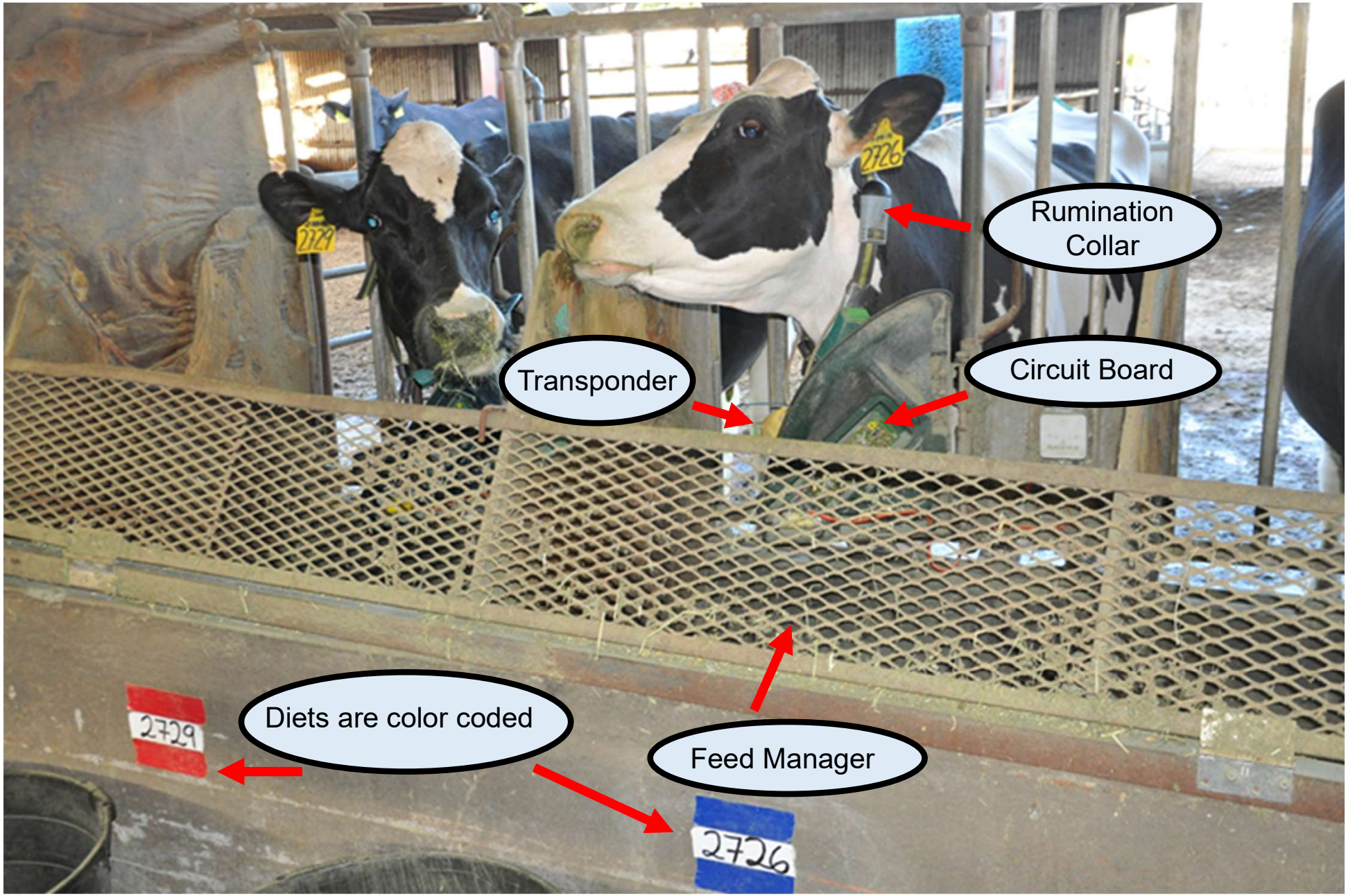
- (1) Evaluate feeding **high amounts** of almond hulls (AH) as a concentrate ingredient to lactating cows.
- (2) Determine the impact of foreign debris material, shells and sticks, on the quality (chemical composition & digestibility) of almond hulls. ***"Variability in Composition"***

Objective



Lactation Study

- 12 lactating Holstein cows (96 DIM)
  - 4 1st , 4 2nd, 4 3rd lactation cows
- Treatments: 0, 4, 8, or 12 lb AH/cow daily
- Production performance: milk yield, milk composition & component yield, feed intake, rumination activity, and diet digestibility.



Each cow was trained to eat from 1 assigned manger. Transponder allows her into her manager. Rumination collar measures rumination (cud chewing).

Ingredient Composition of TMR (lb/cow)

Ingredient	0 lb AH	4 lb AH	8 lb AH	12 lb AH
Almond hulls	0	4	8	12
Alfalfa hay	23.3	23.3	23.3	23.3
Corn, flaked	20.9	19.3	18.2	15.0
Soy hulls	6.9	4.7	1.2	0
Wheat hay	2.0	1.5	1.5	1.5
Soybean meal	0.9	1.1	1.7	2.3
DDG	3.8	3.8	3.8	3.8
Cottonseed	2.3	2.3	2.3	2.3
Minerals	1.4	1.4	1.4	1.4

Based on average intake of 61.5 lb. AH used as a concentrate ingredient.

Composition of Almond Hulls

Variation

Item	Mean	SD	Minimum	Maximum
CF, %	14.9	1.77	13.8	17.5
Lignin, %	7.2	0.78	6.3	8.1
CP, %	4.5	0.24	4.2	4.7
EtOH CHO, %	32.0	2.16	29.7	34.1
H_2O CHO, %	34.7	2.24	31.8	37.2
aNDFom, %	23.5	2.08	21.9	26.4

CF As Is basis = 12.8%

≤15% definition

N = 4 samples

Variation

Summary Production

No Difference in Feed Intake and Milk Yield

Item (lb/d)	0 lb AH	4 lb AH	8 lb AH	12 lb AH
DM Intake, lb/d	58.7	60.1	58.1	58.6
Milk, lb/d	85.4	86.5	81.2	82.9
ECM, lb/d	92.0	92.8	88.2	90.2

AH = Almond hulls

Energy-Corrected Milk (**ECM**) accounts for volume and energy content of each milk component. Puts everything on an equal basis.

Summary Production

Milk Composition Differed

Item (lb/d)	0 lb AH	4 lb AH	8 lb AH	12 lb AH
EC Milk, lb/d	92.0	92.8	88.2	90.2
Fat, %	3.81[a]	3.78[a]	3.95[b]	3.97[b]
Protein, %	3.46[a]	3.43[a]	3.35[b]	3.33[b]
Solids, %	12.58	12.58	12.65	12.64

As the amount of almond hulls consumed increased from 0 to 12 pounds/cow daily:

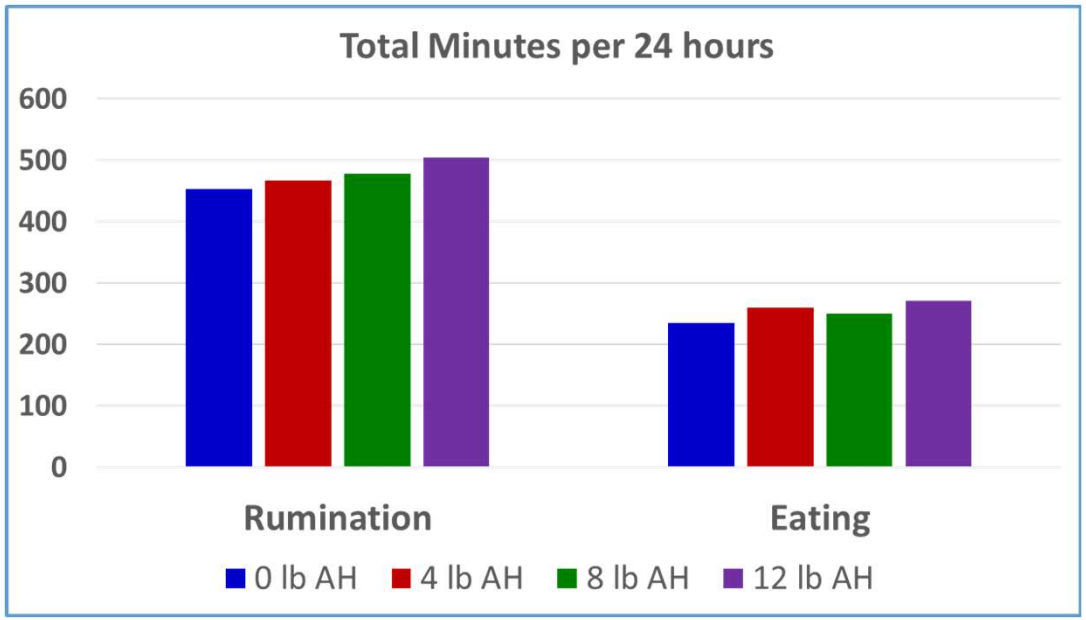
- Milk fat % increased
- Milk protein % decreased

Summary Production

Milk Composition Differed

Item (lb/d)	0 lb AH	4 lb AH	8 lb AH	12 lb AH
EC Milk, lb/d	92.0	92.8	88.2	90.2
Fat, %	3.81[a]	3.78[a]	3.95[b]	3.97[b]
Protein, %	3.46[a]	3.43[a]	3.35[b]	3.33[b]
Solids, %	12.58	12.58	12.65	12.64

60 minutes more chewing so more stable rumen environment.

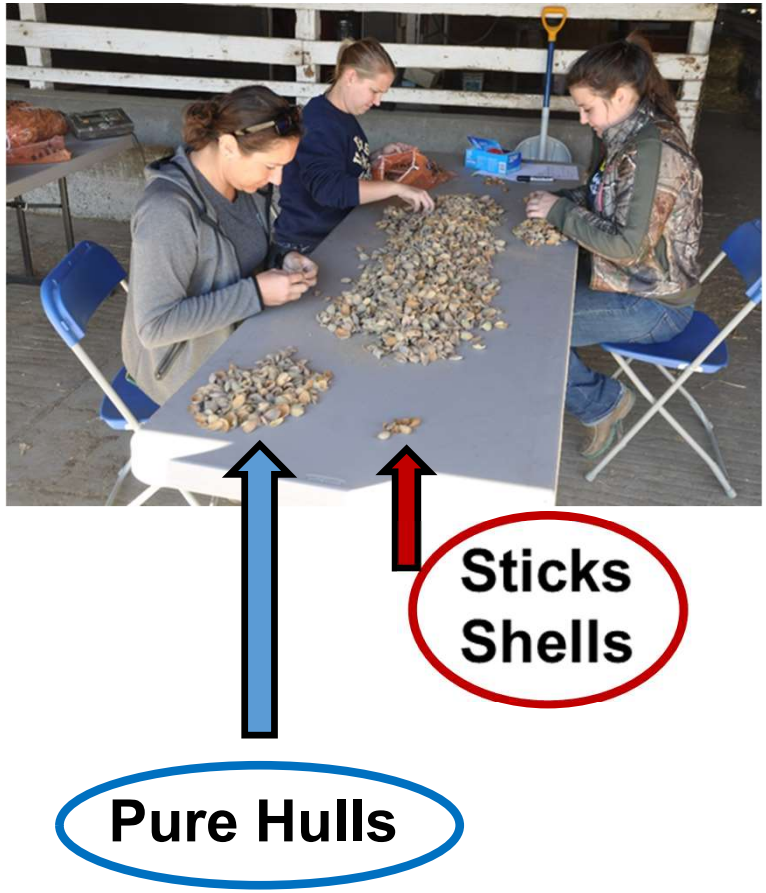


Composition Study

To determine the impact of Debris (sticks & shells) on chemical composition of almond hulls:

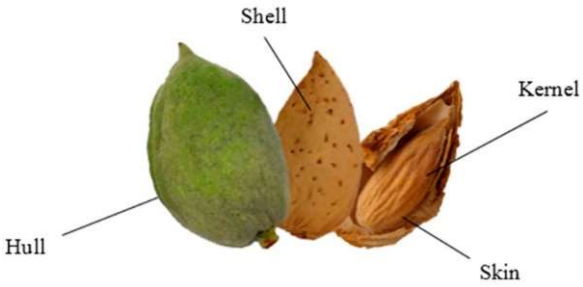
- 12 samples of commercial AH (**"Total" Hulls**) were obtained from hullers.
- 5 Nonpareil AH & 7 Other Variety (Pollinators).
- Hand sorted each sample to separate into **"Pure" Hulls** and **Debris** (sticks & shells).

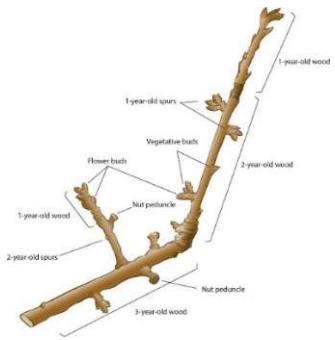
- **Total Hulls, Pure Hulls, and Debris** were analyzed for chemical composition.



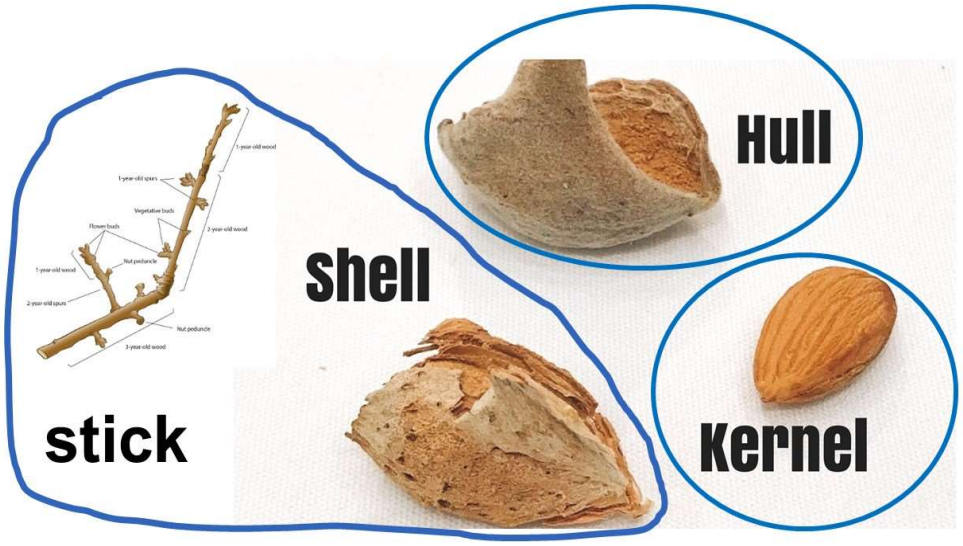
Proportion of Debris in Commercial AH (wt/wt)

5 Nonpareil: **4.7% Debris**
7 Other Variety : **6.8% Debris**





Almond Huller



Orchard Floor

Composition of Almond Hulls: Nonpareil

Item	Total AH	Pure AH (No stick & shell)	Debris (stick & shell)
CF, %	14.6	13.0	44.4
CP, %	5.1	5.1	6.9
EtOH CHO, %	32.6	33.6	7.9
aNDF, %	21.4	19.3	62.3
NSC, %	32.9	34.0	8.3
NEL, Mcal/lb	0.71	0.74	0.47

Sticks & Shells decreased the sugar and energy content.
Sticks & Shells increased the fiber content.

Composition of Total Almond Hulls (Variety)

Item	Nonpareil AVG	Other AVG
CF, %	14.6	18.1
CF, % As Is	12.7	15.9*
Lignin, %	8.6	9.7
CP, %	5.1	5.0
EtOH CHO, %	32.6	28.0
aNDF, %	21.4	25.5

Other = Pollinators

Nonpareil > Other

Ca law: Almond hulls ≤ 15% crude fiber on an As Is basis.

Commercial Almond Hull Feed Inspections

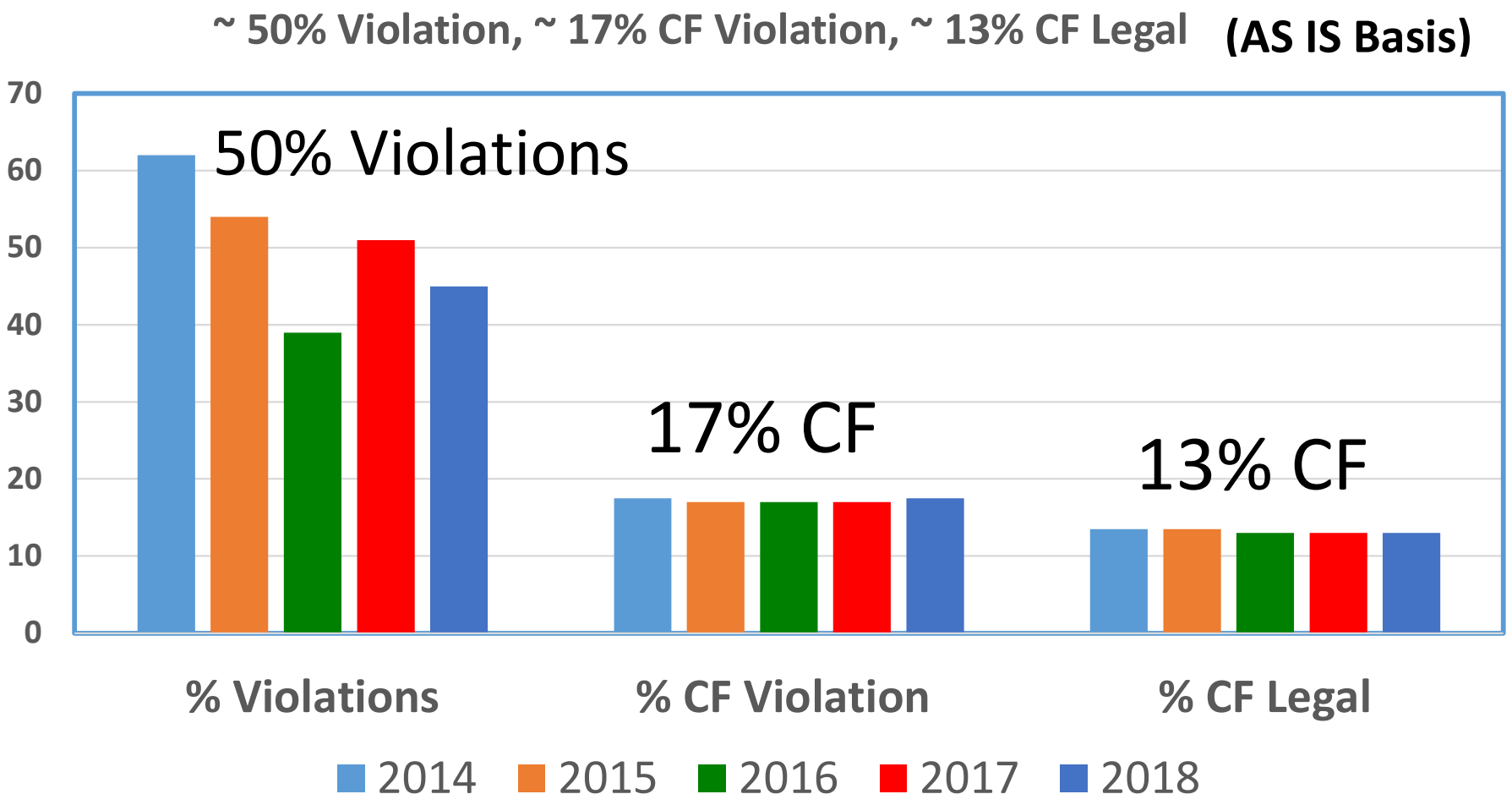
- Evaluated the **data for a 5-year period** from the CA Department of Food & Agriculture for samples of commercial almonds collected by Field Inspectors.
- These samples of commercial almonds were analyzed for crude fiber and moisture.
- **<u>Aim</u> was to determine what proportion of samples collected were found to be in violation of commercial feed laws/regulations.**

Almond hulls are defined in CA by commercial feed laws: "They shall not contain more than 13.0 percent moisture, **nor more than 15.0 percent crude fiber**, and not more than 9.0 percent ash."

cdfa
CALIFORNIA DEPARTMENT OF FOOD & AGRICULTURE

Violation for Almond Hulls

Findings: On average **50%** of the almond hulls sampled were in violation. Hulls in violation average 17% crude fiber.



Almond Hulls must be ≤ 15% Crude Fiber As Is basis

Don’t Guess - Test

Take Home Messages

1. AH (high quality) **can be fed at high levels** to lactating dairy cows.
2. Composition – **Varies Greatly!!**
3. Test the composition of your AH

   "Don't Guess - Test"
4. AH are an excellent source of **readily available carbohydrates (sugar)** and digestible fiber.

"Thank You"

*** Golden State Dairy Management**
*** Almond Board of CA**
- Biomass Workgroup
(almond handlers & growers)

QUESTIONS ??

Ed DePeters : ejdepeters@ucdavis.edu