Feeding value of lactating cow diets popularly used by Vietnamese household dairy farms

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Vietnamese dairy production

- Tropical climate -> Too hot for dairy cows

- Majority of farms are small, "household dairy farms" (HDF) and produce > 80% of Vietnam's fresh milk

- Limited land for roughage, cows are always kept indoors, mainly Holstein Friesian genetics

- <20 cows per farm and low yield, 16 L/cow/day

Opportunity for improvement of nutrition?

Diets of HDF cows

- Most diets are thought to be based on king grass (low protein, high fiber), natural grass, commercial concentrate pellets

- Farmers feed cows based on experience and simple rules

  North: kg of concentrate fed per cow per day = (milk yield – 5)/2

  South: kg of concentrate fed per cow per day = 4-6 kg

  Unbalanced diets ?

Aims and hypothesis

- **Aims**

    - Characterising typical lactating cow diets in four contrasting dairying regions

    Establish a local feed nutrient library

    - Use PCDAIRY diet formulation model, recently translated into Vietnamese (thank to USDA and UC Davis)

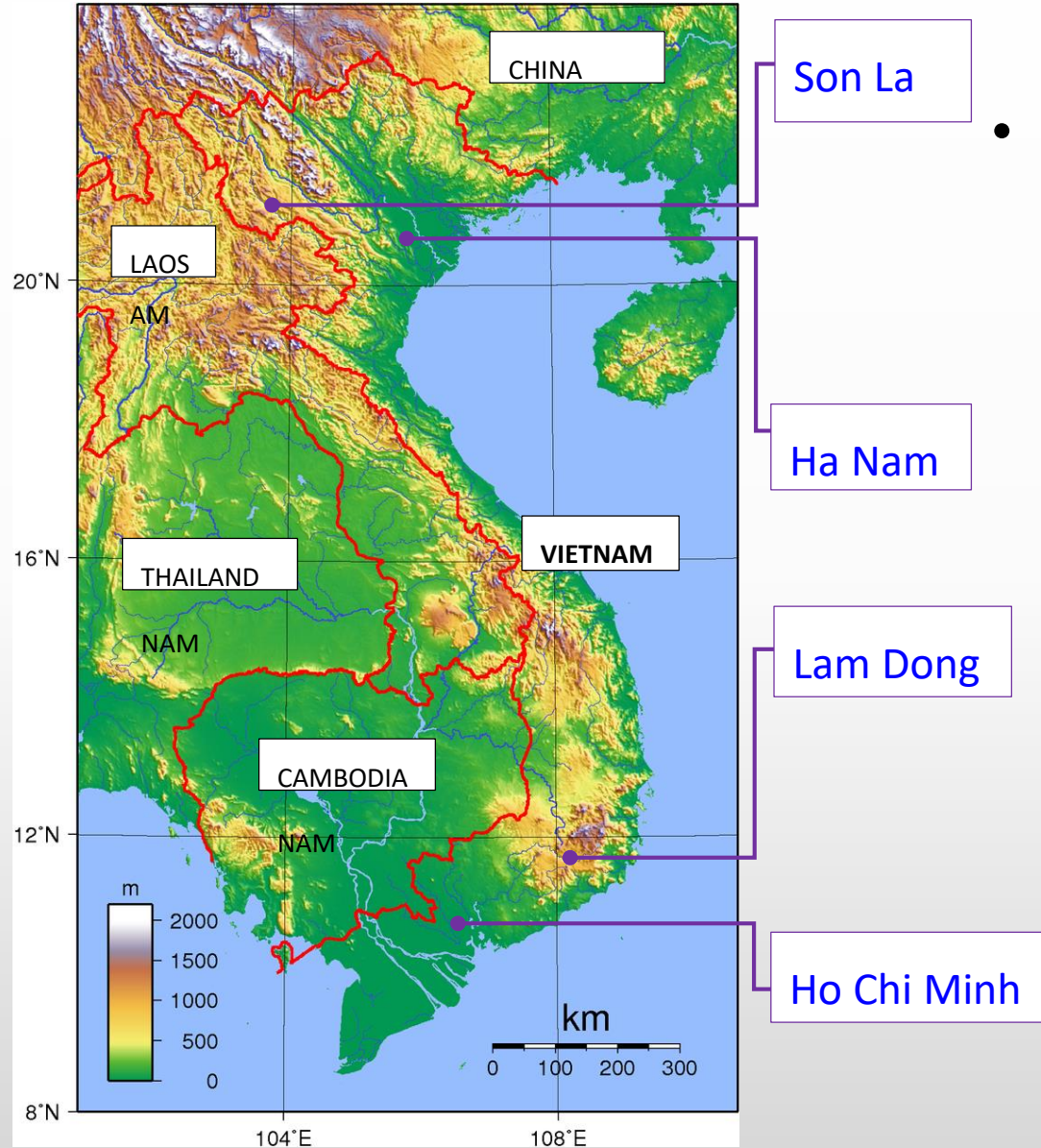   - Evaluate the potential to improve milk yield by dietary interventions

- **Hypothesis**

    Lack of dietary protein and excess king grass were the main reasons for low milk yield in Vietnam.

Methodology

Topographic map of Vietnam mainland and study sites.

- August to October 2017 (Autumn)

| Characteristics	Region			
	Son La (SL)	Ha Nam (HN)	Lam Dong (LD)	Ho Chi Minh City (HCM)
Farms selected	8	8	8	8
Location	North	North	South	South
Altitude (m)	600-700	2-70	800-1000	0.5-25
THI	70.0	73.5	65.6	78.3
Experience (years)	14	11	11	4

Data collection

- Visited each farm: an afternoon + next morning

  - Ask farmers: lactating cows, days in milk, lactation number

  - Weigh morning and afternoon milk yield per cow: 346 lactating cows

  - Sample from each milk collection for composition analysis at VNUA: 690 samples

  - Weigh all feed types and subsample, bulked across farms within region, send to DairyOne Lab (USA) for analysis: 29 samples

  - Cow body weight estimated using a girth tape

Methodology

- PCDairy Modeling

    - Inputs: Lactating herd data, diets, feed nutrient values

    - Outputs: diet nutrient compositions, potential milk yield from protein compared to energy

- Comparisons: ANOVA and Kruskal Wallis tests for comparisons between four regions
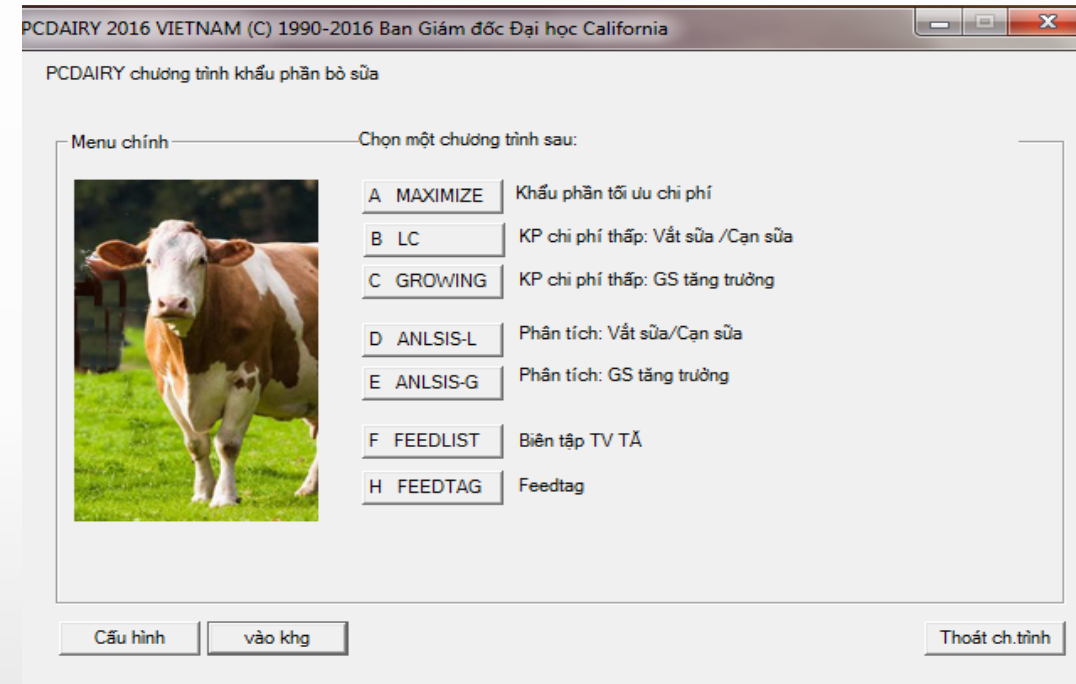
PCDairy - Diet formulation software by University of California Davis translated into Vietnamese

Typical diet ingredients per region

Feed intakes (kg DM/cow/day)	HCM		LD		HN		SL	
	n	Mean (Sd)	n	Mean (Sd)	n	Mean (Sd)	n	Mean (Sd)
King grass	6	2.55[ab] (1.97)	8	5.04[a] (1.56)	7	3.23[ab] (2.38)	5	1.24[b] (1.5)
Fresh tropical grass	2	0.67 (1.42)	0		1	0.5 (1.42)	2	0.51 (0.97)
Fresh corn with cob	0		2	1.1 (2.26)	2	0.68 (1.29)	1	0.23 (0.64)
Corn silage	0		4	1.38[bc] (1.69)	7	3.24[ab] (2.72)	8	4.99[a] (0.97)
Rice straw	1	0.64 (1.8)	0		0		0	
Rice straw	5	1.02 (0.91)	0		0		0	
Partial mixed ration	0		0		0		8	1.98 (0.76)
Lactating pellets	8	6.09 (0.85)	8	6.37 (0.92)	8	6.61 (1.66)	8	7.25 (1.09)
Brewer grain	6	1.87[a] (1.49)	3	0.59[b] (0.81)	0		5	0.66[ab] (0.77)
Wet cassava residue	7	1.3 (0.78)	0		0		0	
Corn powder	0		5	0.78[b] (0.86)	8	1.61[a] (0.48)	0	
Roasted soybeans	0		1	0.09 (0.26)	2	0.12 (0.28)	0	

Typical dietary nutritive value per region

Nutrient content (%DM)	HCM mean (SD)	LD mean (SD)	HN mean (SD)	SL mean (SD)	Target
Dry matter intake (%BW)	3.2 (0.38)	3.3 (0.27)	3.2 (0.16)	3.3 (0.21)	>3
Dry matter (DM, % as fed)	36[ab] (2.3)	32[b] (2.8)	37[ab] (3.9)	39[a] (3.7)	
Net energy for lactation (NEL, Mcal/kg DM)	1.40 (0.04)	1.44 (0.05)	1.36 (0.11)	1.38 (0.07)	1.69
Crude protein (CP)	17.1[a] (2.24)	16.4[ab] (0.91)	14.8[b] (1.12)	17.5[a] (0.75)	14 - 18
Acid detergent fibre (ADF)	27.4 (1.26)	26.2 (2.57)	27.5 (4.05)	28.2 (2.12)	19 - 21
Neutral detergent fibre (NDF)	47.4 (2.65)	43.9 (3.77)	46.9 (4.96)	44.9 (2.47)	27 - 40
Fat	3.6[ab] (0.66)	3.9[ab] (0.35)	4.1[a] (0.53)	3.4[b] (0.29)	3 - 6
Starch	16.7[b] (3.61)	22.6[a] (4.12)	20.3[ab] (3.47)	16.8[b] (2.19)	22 - 26
Nonfibre carbohydrate (NFC)	24.9 (4.59)	29.3 (4.12)	27.9 (3.40)	27.4 (2.90)	30 - 40
Lignin	5.8[ab] (0.70)	5.5[b] (0.54)	5.9[ab] (0.75)	6.8[a] (0.95)	
Ca	0.7[b] (0.07)	0.6[c] (0.05)	0.8[b] (0.12)	1.0[a] (0.08)	0.50 - 0.56
Na	0.3 (0.03)	0.3 (0.09)	0.3 (0.06)	0.3 (0.10)	0.18 - 0.21
P	0.44[b] (0.04)	0.41[bc] (0.03)	0.40[c] (0.04)	0.49[a] (0.02)	0.27 - 0.35
S	0.26[a] (0.04)	0.20[b] (0.01)	0.23[ab] (0.02)	0.26[a] (0.01)	0.20

Dietary balance according to PCDairy

PCDairy outputs (Milk yield, energy corrected, kg/cow/day)	HCM mean (SD)	LD mean (SD)	HN mean (SD)	SL mean (SD)
Potential milk yield from net energy	16.5 (2.9)	20.6 (3.1)	17.6 (4.1)	19.8 (2)
Potential milk yield from crude protein	25[b] (3.8)	27.6[ab] (2.3)	23.9[b] (4.1)	30.9[a] (1.6)
Balance of predicted milk yield from protein relative to energy	1.54[a] (0.24)	1.35[b] (0.11)	1.38[ab] (0.16)	1.57[a] (0.15)
Actual milk yield	13.1[b] (1.9)	15.1[b] (1.6)	15.6[b] (3.1)	19.2[a] (1.4)

Factors other than diet to consider

Conclusions

- Diets varied dramatically between regions

  - Maize silage common in the north

  - Brewers grain, cassava pulp, rice straw common in the low altitude south

- All diets lacked energy relative to protein

  - Lack of starch, excessive fiber (NDF)

  - Opportunity to replace king grass?

- Husbandry factors other than diet could be more important contributors to low milk yield

  - Actual milk yield was less than the modelled potential.