Nutritional Analyses

- Dry bean and snap bean edible products are potential sources of several essential nutrients, energy, and a range of health-promoting components.
- Genetic diversity for many of these components is known to exist, but careful characterization of a range of cultivars for all traits is lacking.
- Eventual mapping of nutritional trait loci will enable breeders to develop more nutritious and health-beneficial cultivars in all market classes.

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Dry and Snap Bean Evaluations

- **Minerals: ICP-OES (Grusak, USDA-TX)**
- **Iron absorption promoters: Caco-2 *in vitro* assay (Grusak, USDA-TX)**
- **Phytate: Colorimetric method (Cichy, USDA-MI)**
- **Protein, Oil, Crude Fiber: Near-infrared Diode Array Analyzer (Tulmek, NDSU)**
- **Antioxidants and Sol/Insol Carbs: HPLC and colorimetric assays (Brick/Thompson, CSU)**
- **Carotenoids, Vitamin C, Fiber: HPLC (Myers, OSU)**

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Status of Summer 2010 dry bean samples

- 248 dry bean entries grown both in MI and WA in summer of 2010 were received in Houston in fall of 2010 (~150 grams each).
- All samples were ground (with stainless steel grinders), packaged, and sent to Tulbek (100 gm) and Cichy (15 gm) for their analyses.
- Grinding and packaging takes about 10 min per sample.
- In Houston, digestions and mineral analyses were completed on MI samples; **mineral analyses of WA samples are still in progress**.
- Iron bioavailability assays (Caco-2) were completed on WA samples (as planned).

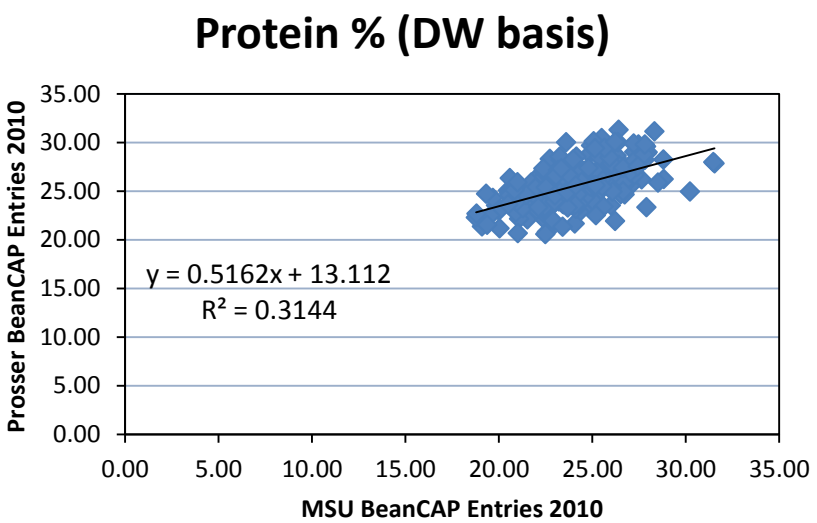
	Grinding Complete	Ship to Cooperators	Mineral Analyses	Caco-2 Iron Absorption	Protein, Fat, Crude Fiber	Phytate
MI (MSU)	X	X	X	----	X	X
WA (Prosser)	X	X	Feb 2012	X	X	X

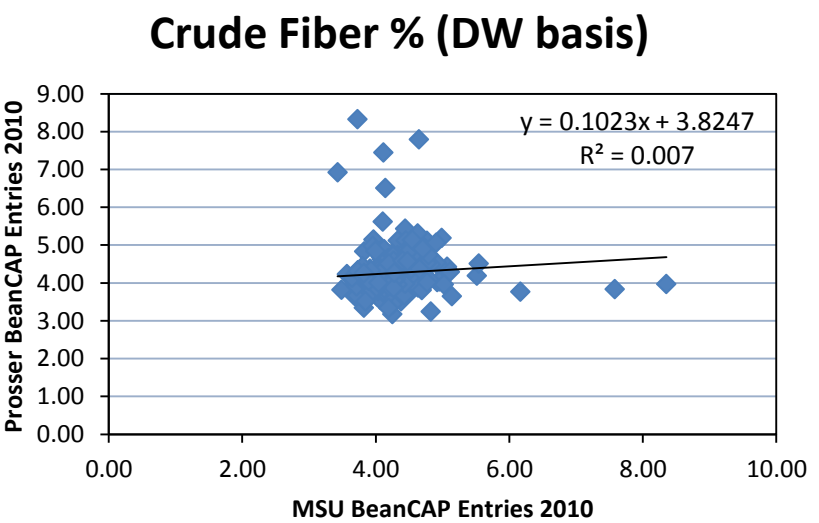
Elemental analysis of 248 Dry Bean Entries (MSU, 2010)

Elements	BeanCAP Range	Fold Range
Ca (mg/g DW)	0.40 – 3.75	**9.5 x**
K (mg/g DW)	10.50 – 15.78	**1.5 x**
Mg (mg/g DW)	1.21 – 2.40	**2.0 x**
P (mg/g DW)	3.25 – 6.52	**2.0 x**
S (mg/g DW)	1.50 – 2.60	**1.7 x**
Cu (µg/g DW)	6.59 – 13.86	**2.1 x**
Fe (µg/g DW)	47.16 – 101.39	**2.1 x**
Mn (µg/g DW)	10.05 – 19.98	**2.0 x**
Na (µg/g DW)	not detected	
Ni (µg/g DW)	0.62 – 6.28	**10.2 x**
Se (µg/g DW)	0.28 – 1.01	**3.6 x**
Zn (µg/g DW)	31.03 – 68.54	**2.2 x**

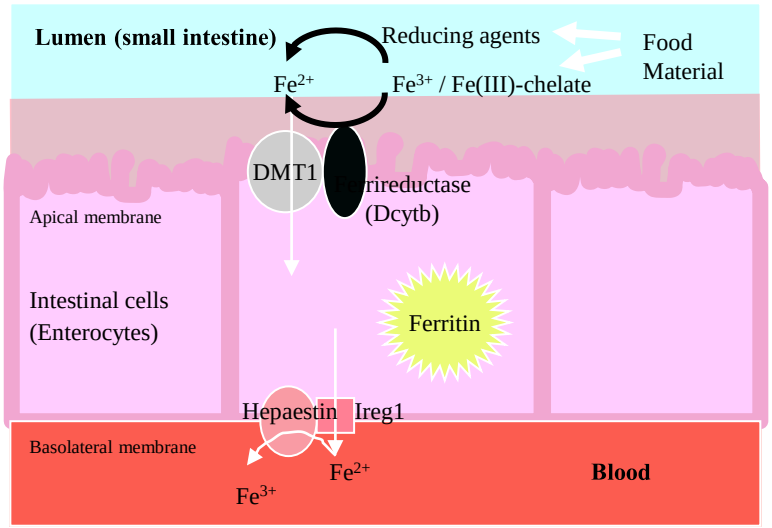
Protein/Fiber/Fat Analyses (2010 samples)

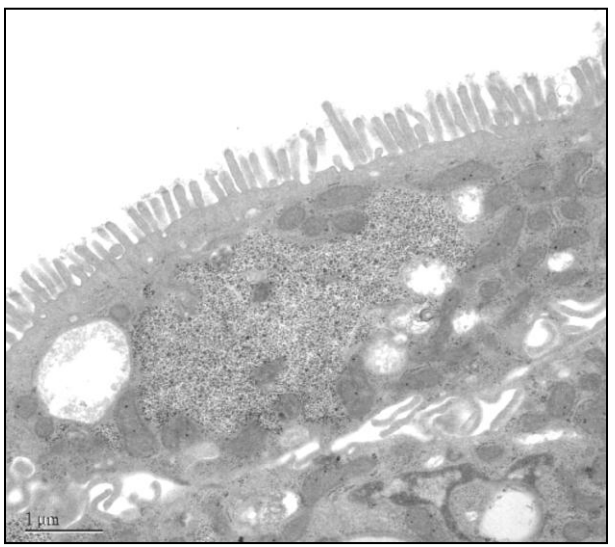
	MI (MSU 2010)	WA (Prosser 2010)
% Protein (DW basis)	18.77 – 31.54	20.57 – 31.29
% Crude Fiber (DW basis)	3.43 – 2.28	3.18 – 8.33
% Fat (DW basis)	0.97 – 2.28	0.98 – 2.11

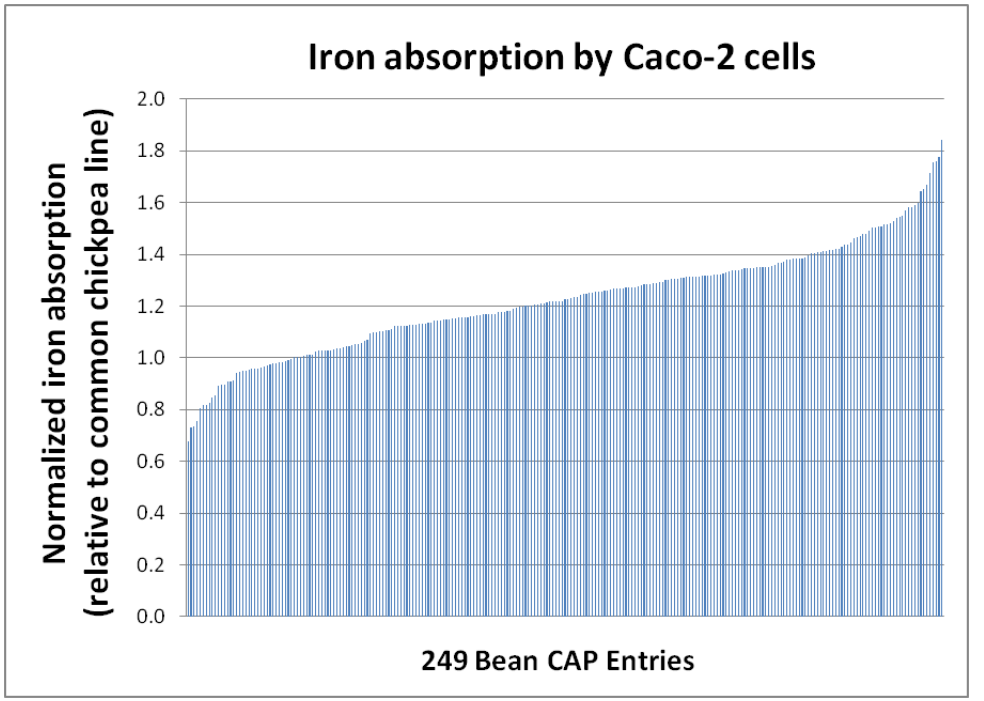




In vitro iron absorption using Caco-2 Cells







- Cooked bean samples were mixed with a standard amount of iron and fed to Caco-2 cells after *in vitro* digestion.
- Assay measured the potential of food components (in bean) to promote iron absorption.
- Normalized values demonstrated a 2.7-fold range.

Status of Summer 2011 dry bean samples

	Shipment Received	Grinding Completed	Ship to Cooperators	Mineral Analyses	Protein, Fat, Crude Fiber	Phytate
300 Entries (2 reps)						
CO (~600 samples)						
MI (~600 samples)						
ND (~600 samples)						
NE (714 samples)	**X**	**Feb 2012**	**Feb 2012**			
Drought/Irrigated (96 Entries x 2)						
ID (~384 samples)	**X**	**Mar 2012**	**Mar 2012**			
MI (~192 samples)						
ND (0)	---					
NE (~192 samples)	**X**	**X**	**Feb 2012**	**Mar 2012**		
PR (~384 samples)						
WA (~384 samples)	**X**	**X**	**Jan 2012**	**Feb 2012**		

Note that ~4050 samples will require 675 man-hrs for grinding (~17 wks). We're looking for other quicker, yet "clean", grinding options.

Work Plans for 2012

- Receive all dry bean samples from field cooperators and complete grinding; distribute subsamples to analytical cooperators.
- Complete mineral analyses on all samples.
- Work with Phil McClean's group on data analyses and Association Mapping.
- Perform Caco-2 iron absorption with subset of entries from multiple environments; this would be first look at G x E for iron bioavailability with any crop.
- Plan and write manuscript(s), especially a characterization of 2010 field samples.