Quality Control Parameters: From the Feedmill to the Farm

SOY EXCELLENCE CENTER
A US SOY program

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Content

- Premise of Quality Assurance Program
- What to check in raw materials and feeds
- Quality parameters for soybean meal
- Recommendations

Quality Assurance (QA) vs Quality Control (QC)

QA - The process of verifying or determining whether the products or services meet or exceed customer satisfaction

QC - The operational techniques and activities for controlling, checking, or testing that specifications are met

- involves sampling, inspecting and testing of starting materials, in process, intermediate, bulk and finished products.
- includes where applicable, review of batch documentation, sample retention program, stability studies, product complaints, product recalls, and maintaining correct specifications of materials and products.

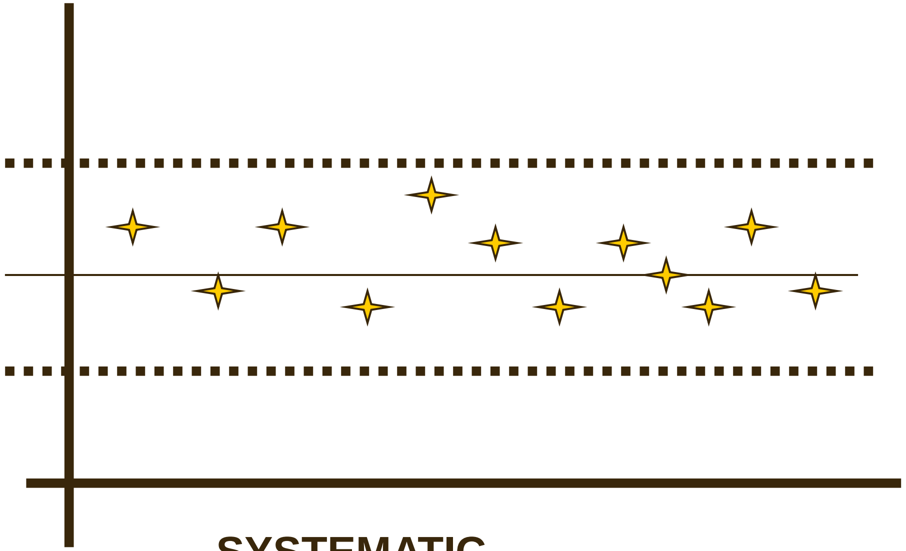
Practical Application 0f QA & QC

Premises of Quality Assurance Program

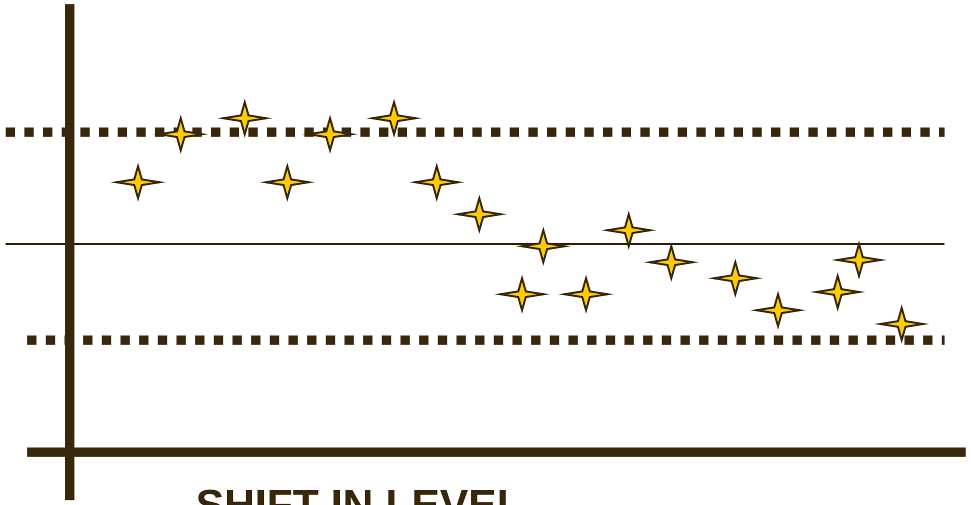
You can not improve what you do not control

You can not control what you do not measure

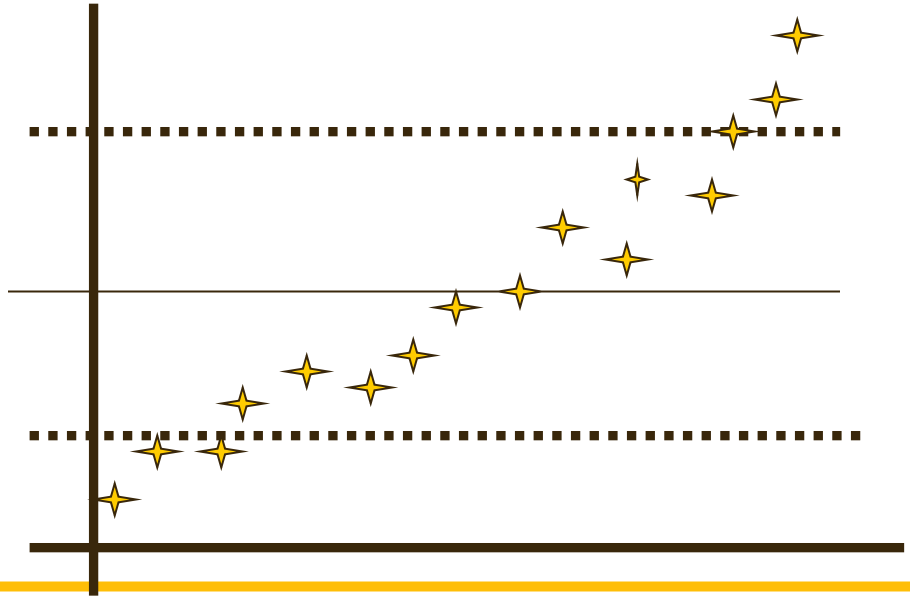
You can not measure what you do not define



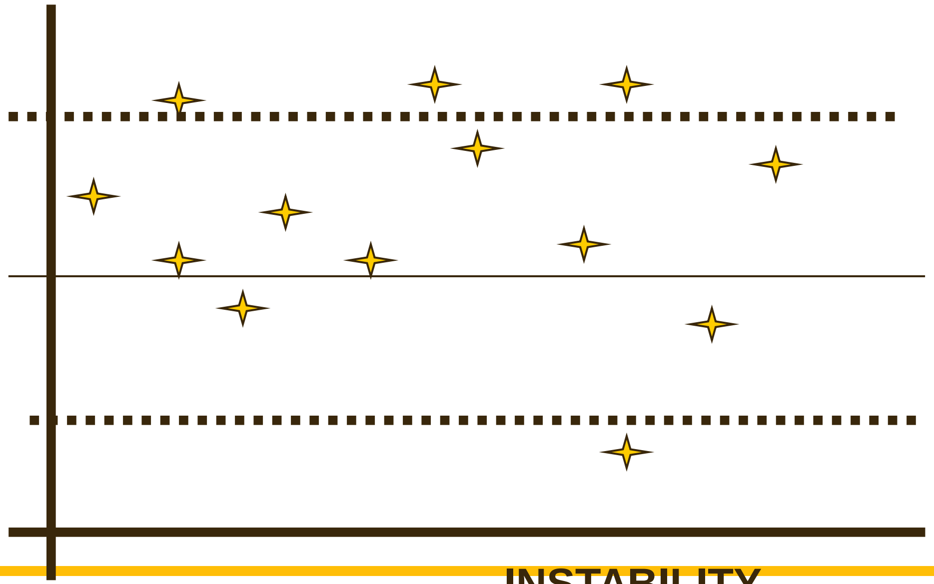
SYSTEMATIC



SHIFT IN LEVEL



TRENDS



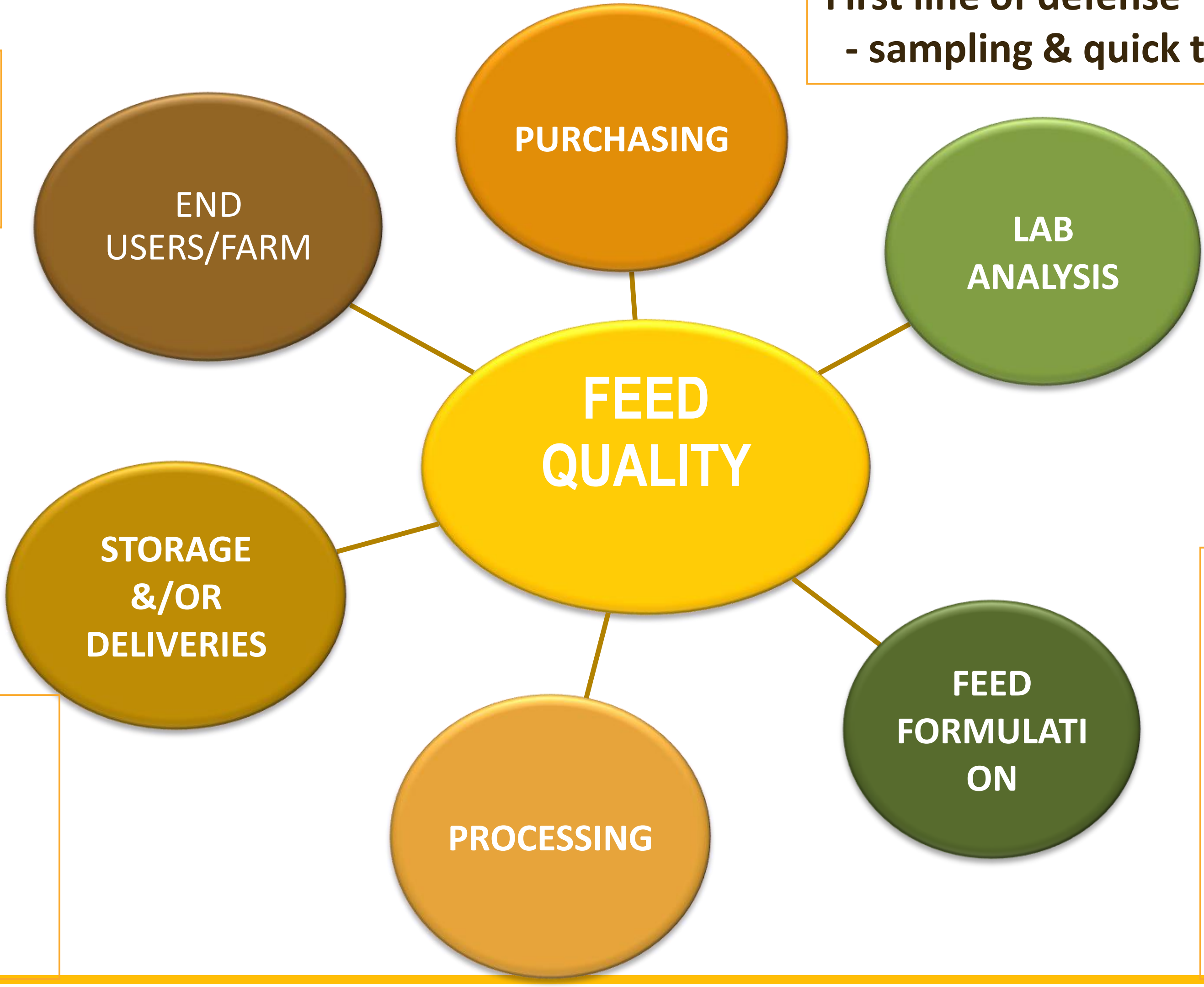
INSTABILITY

FEED QUALITY PARAMETERS; *WHAT & WHERE TO CHECK?*

Target Performance
Cost of production
Quality of produce

Warehouse mgt
Hygiene
Labeling

Feedmill set-up & equipment
Production efficiency
Recovery
Labeling



First line of defense
- sampling & quick tests

Chemical tests
Proximate analysis
Mycotoxin

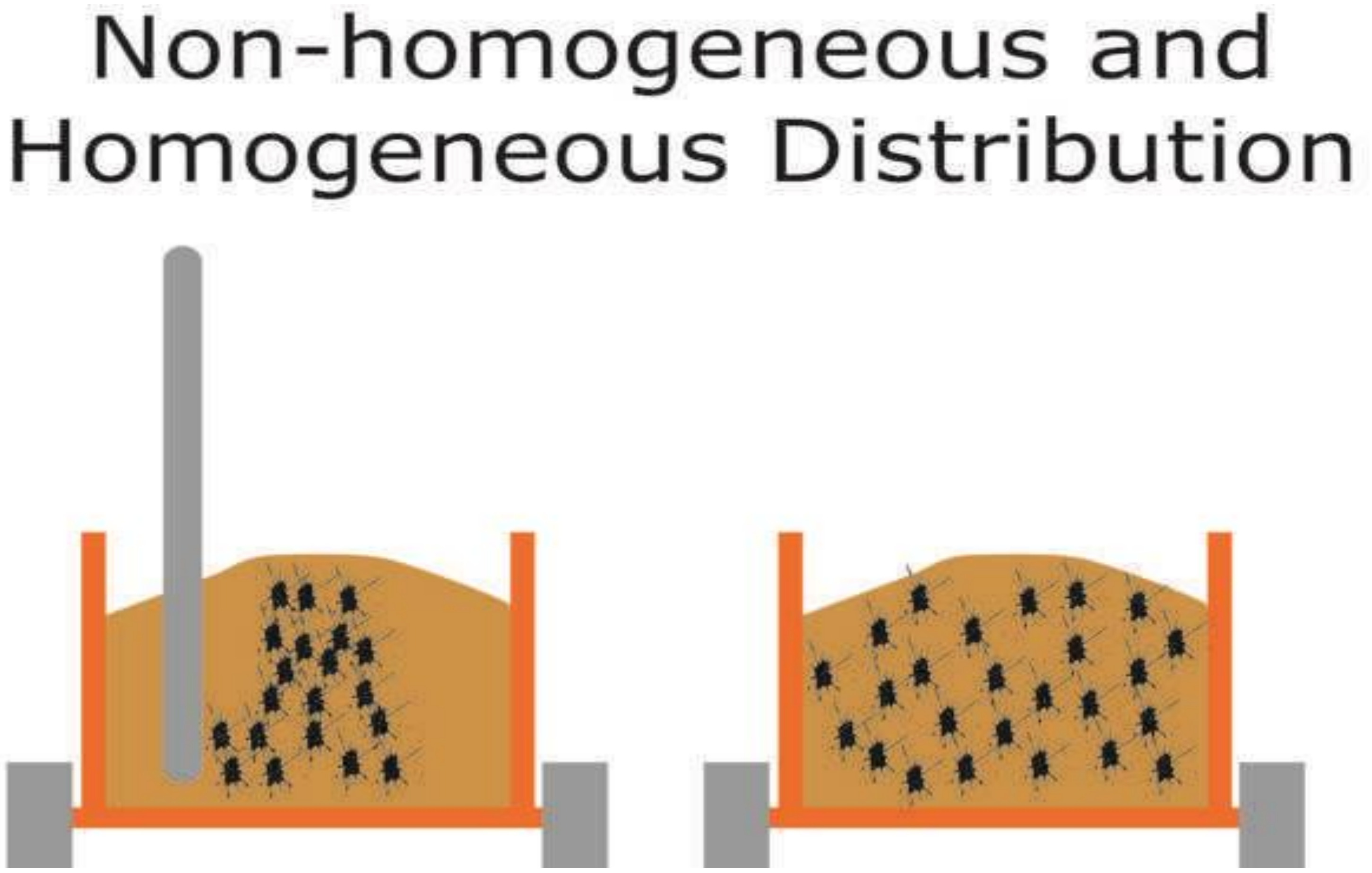
Nutrient content of indv'l ingredient.
Nutrient requirement
Consistency
Supply
Target performance
Market situation

Receiving

- Entrance control - sampling, sensory, quick tests
- Laboratory checks and tests – sampling prep, proximate analyses,etc
- Storage & warehouse

First line of defense

Sampling – the distribution Pproblem



Adapted from; E Yeow, 2013.

What to check in raw materials and feeds?

Physical:

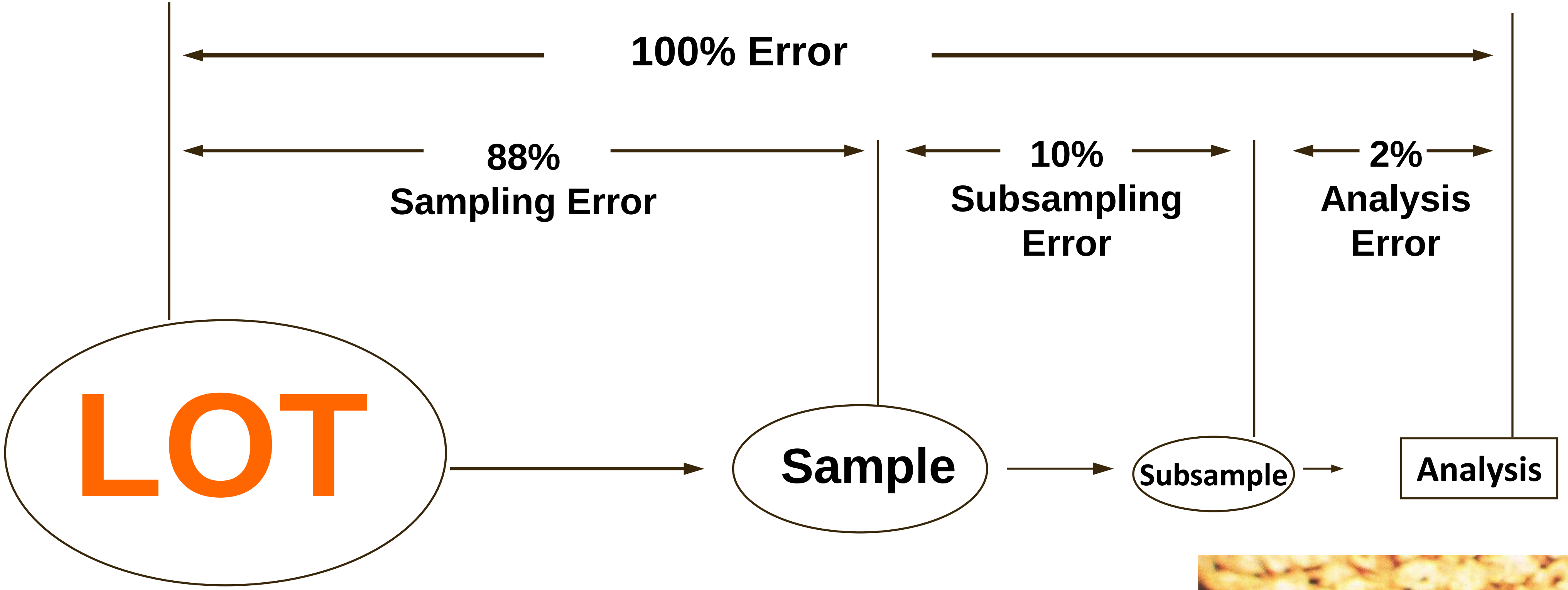
Damaged, contaminated or infected raw materials from harvests; immature seeds, insect damaged, molds & lumps.

Nutritional/Chemical:

At the lab

- Proximate analysis
- Nutrient variability
- Anti nutritional factors (ANFs)
- Chemical (dioxin)
- Contamination and residues,
- Presence of bacteria
- Molds/mycotoxins.

Errors in Analysis



(Whitaker & Dicken,1974)

We need amino acids!

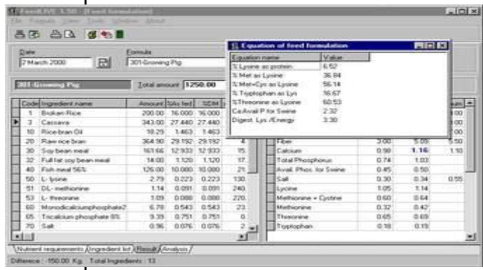
By the Nutritionist & Feed Formulator

- Availability & supply of raw materials
- Chemical analysis assays/ profile
- Nutrient specifications
- (Updated) Database of all ingredients
- Target production performance
- Prices

.. Feed Formulation

- Carbohydrates (Energy)
- Protein (essential AA)
- Fats/lipids
- Vitamins
- Minerals
- Water

- Nutrient requirement of the animal
- Raw material nutrient content
- Availability
- Safety
- Cost



Possible Feed production errors

- ✓ Failure of process to achieve target weights
- ✓ FIFO management of ingredients & complete feed
- ✓ Uncontrolled hand add ingredients
- ✓ Cross contamination & mill hygiene
- ✓ Physical quality
- ✓ Medication selection

;.. At the Feedmill.

What to check at the farm

At the Farm

- ✓ failure of the diet to meet nutrient specifications
- ✓ inconsistent quality of raw materials
- ✓ sudden changes in ingredients use
- ✓ inappropriate particle size
- ✓ inadequate/inconsistent feed mixing
- ✓ deterioration of feed and ingredients in storage

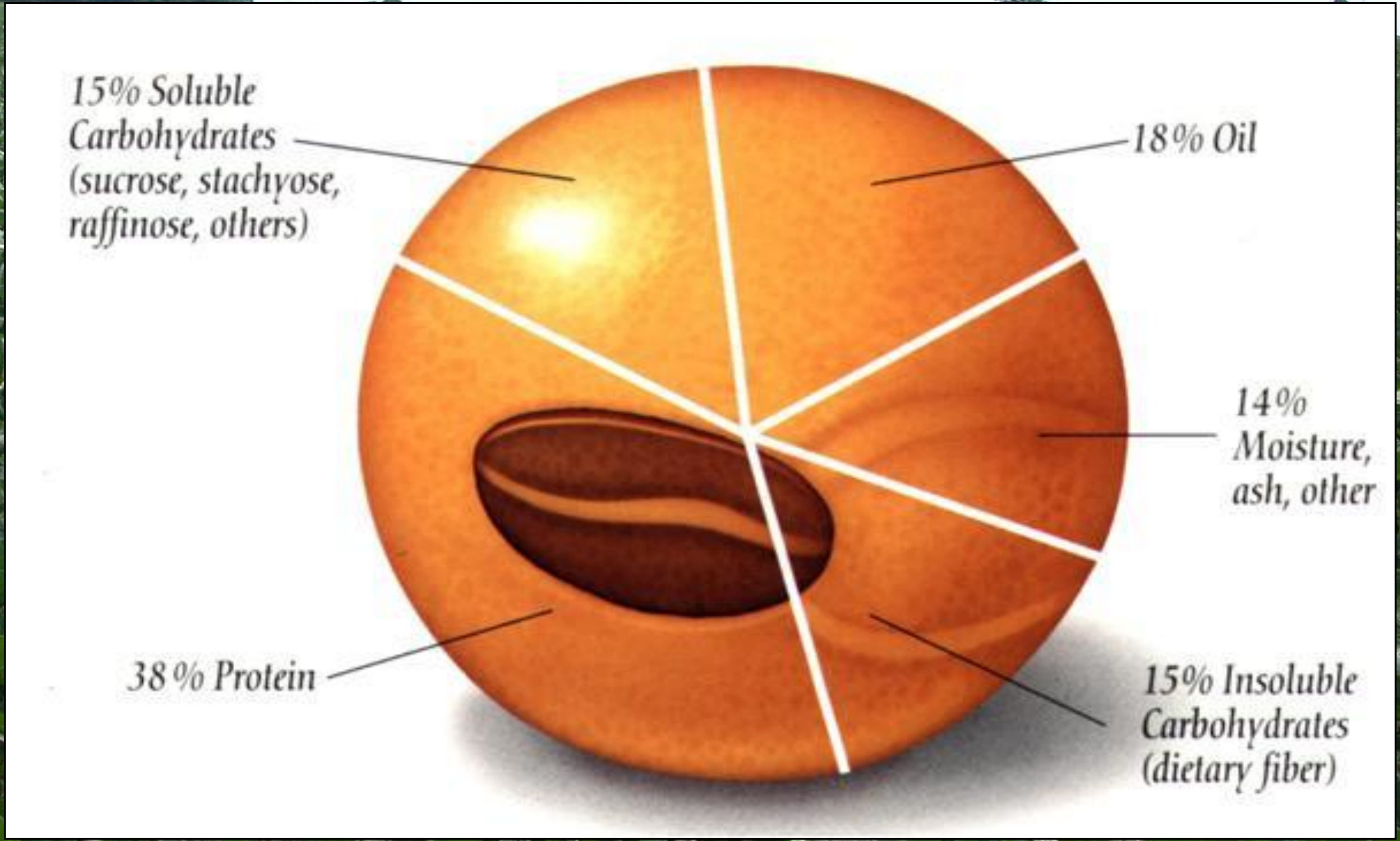
Application of Quality Control in SBM

Average nutrient components of raw soybeans

Average inclusion rate of SBM:
20 to 25%

Contributes:

- Morethan 50% protein & EAA
- About 25% of Energy



All Soybean Meals are NOT created Equally!!

Variability cost you $

- **Degree of cooking;** over cooked or under cooked SBM reduced nutrient availability

- **Level of fiber** affects energy in SBM

- **Particle size affects digestibility**

 - re grinding adds to the cost

Sources of variability of nutrient values of SBM

- Soybean quality at harvest (% damaged beans, FM)

  US soy are graded according to pre-determined quality parameters

- Post-harvest handling, storage and transport

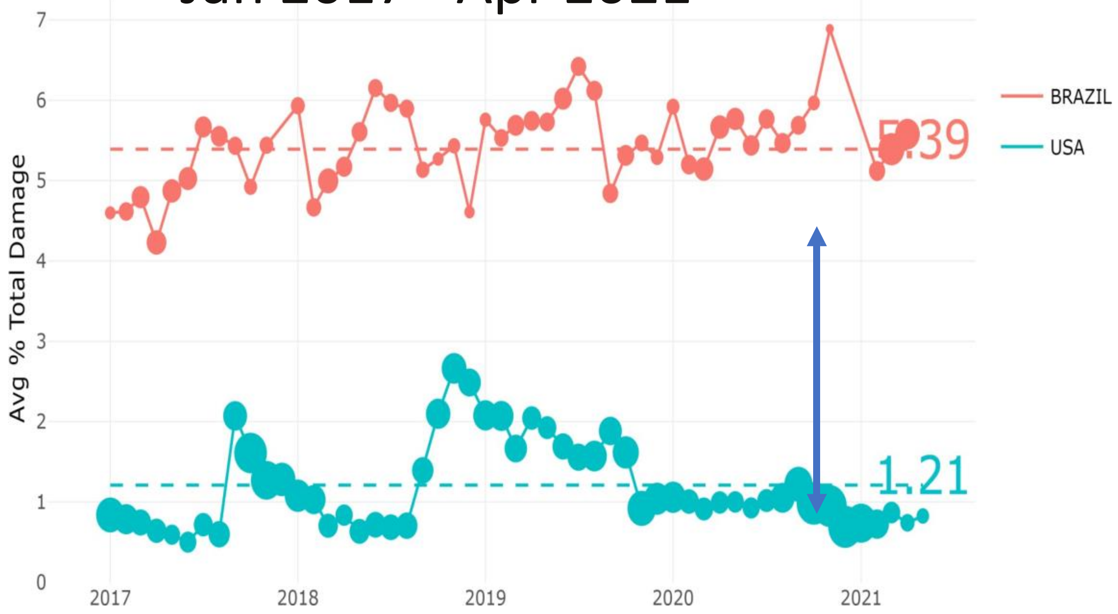
- Processing involved

  - Degree of heat treatment – overcooked/undercooked SBM reduced AA dig
  - Level of fiber & ash – dilutes nutrient and energy in SBM
  - Particle size – reduced digestibility in young animals, re-grinding adds to the cost

US vs Brazilian Soybean Damage at Harvest. Uranga et al, 2021

US & BR Total Damage Content

Jan 2017 - Apr 2021



- US has 4.18% lower average total damage (5.39% vs 1.21%)
- Brazil allows a max of 8% of total damage while US allows a max of 3% for Grade 2.

Quality of Soybeans collected in the different ports in Spain, 2022. G Mateos, 2023

	Brazil	USA
Farm gate[b]	> 4.5	≤ 1.0
Port of origin[c]	> 6.2	1.1
Port of destinations[d]	9.4	3.6

[b] Samples collected at Mato Grosso and Iowa
[c] Average 2022 (FGIS and Ag Commodities)
[d] Europe, Spain ports

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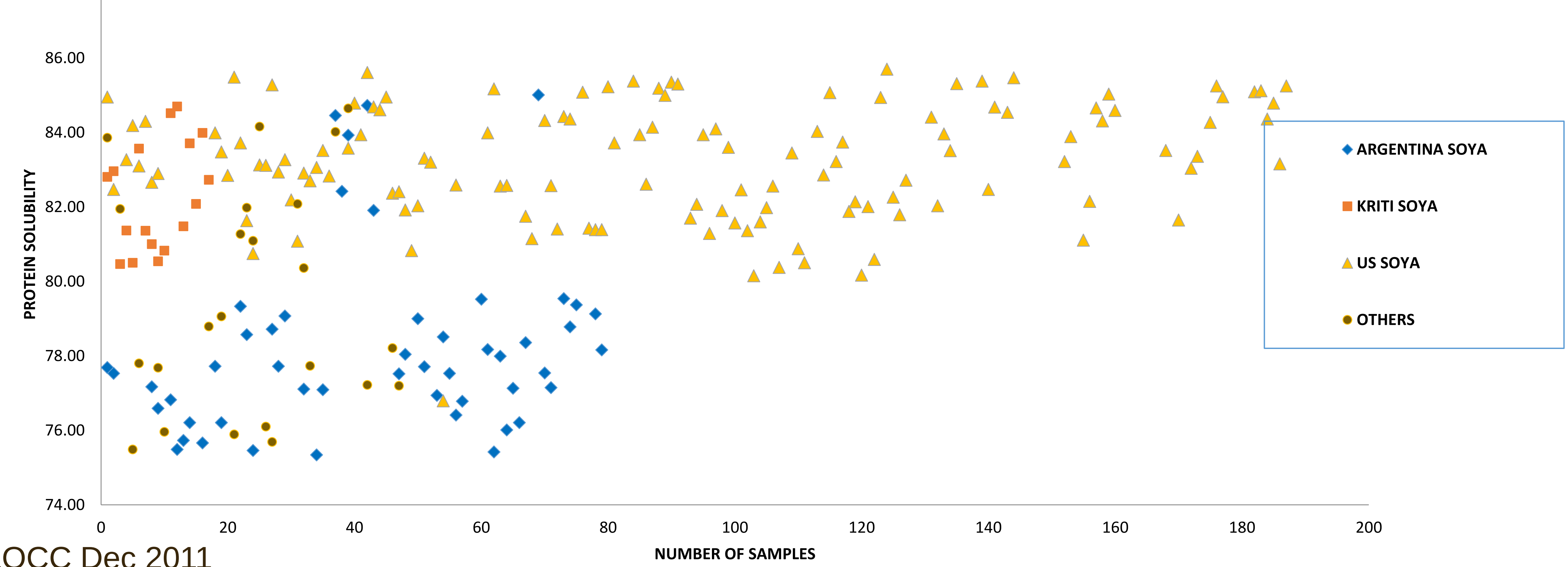
What do we want from Soybean meal?
Precision Animal Nutrition

- **Soybean meal value should be based on:**
  - Digestible amino acids (Crude Protein is reported based on Nitrogen, and not all N are true protein and therefore are not digestible)
  - Energy (comes from digestible protein, fats/oil, starch and sucrose)
  - Consistency – each point of SD adds to the cost in formulating diets. The higher the SD, the higher the effects on safety margin during feed formulation.
  - Moisture content – every 1% of moisture in SBM is equivalent to US5.00/MT (at US$500.00/MT price)

Quality variability



Analysis of SBMs from Different Origins

Origin	No	C.P. (%)	Dig coef C.P,%	Dig CP (%)	Tot Lys (%)	Tot Met (%)	Dig coef Lys (%)	Dig coef Met(%)	Dig Lys (%)	Dig Met (%)
Arg	16	46.9^{bc} (1.08)	82^{a} (4.1)†	38.6^{b} (1.96)†	2.84 (0.19)	0.68^{bc} (0.04)	86^{a} (4.5)	86^{a} (3.4)	2.44^{a} (0.23)	0.59^{b} (0.04)
Brazil	10	48.2^{a} (1.65)	83^{a} (3.6)	39.8^{a} (1.99)	2.79 (0.25)	0.69^{ab} (0.07)	85^{a} (5.3)	87^{a} (3.7)	2.39^{ab} (0.33)	0.60^{ab} (0.06)
USA	16	47.3^{b} (0.50)	85^{a} (1.8)	40.0^{a} (0.82)	2.88 (0.20)	0.72^{a} (0.02)	88^{a} (2.4)	88^{a} (1.7)	2.52^{a} (0.22)	0.63^{a} (0.02)
Probability		**	**	***	NS	**	*	**	*	***

Ravindran 2014. Internal Poultry Journal

† Values within parenthesis represents standard deviation

Apparent Metabolizable Energy (AME), kcal/kg

Origin	No	AME (Range, kcal/kg)	AME (Mean, kcal/kg)	US vs Other Origin, kcal/kg
Argentina	16	1796 – 2417	2227[b] (148)†	148
Brazil	10	2003 – 2531	2317[ab] (165)	58
India	13	1567 – 2299	2000[b] (191)	237
USA	16	2120 – 2541	2375[a] (114)	
Probability		***	***	

Every 150 kcal of extra energy is equivalent to about US$2.00/MT (based on corn priced at US$400.00/MT)

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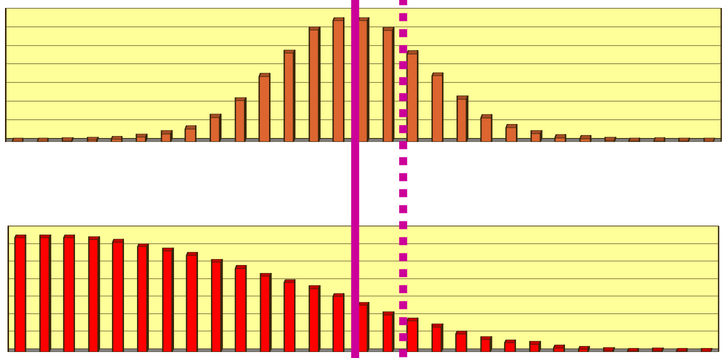
NOTE: Individual values ranged between 1570 and 2540 kcal/kg

† Values within parenthesis represent standard deviation

Effect of heat treatment on ANFs and protein or amino acid digestibility.

Protein & A.A. Diges- tibility:



Concentration anti-nutritional factors

Temp. →

T.I.:	25 - - - 20 --------------- 5 2 -------- 1
U.I.:	.3 .02 - - - - - 0
0.2 % KOH:	90 - - 85 70
PDI:	- - 40 - 30 15

Recommendations: Quality Control Points

1. Creation of standards
2. Stipulation of quality standards at purchasing
3. Quality assurance on raw material deliveries
4. Quality assurance in raw material storage
5. Quality assurance in feed production
6. Quality assurance in finished feeds storage

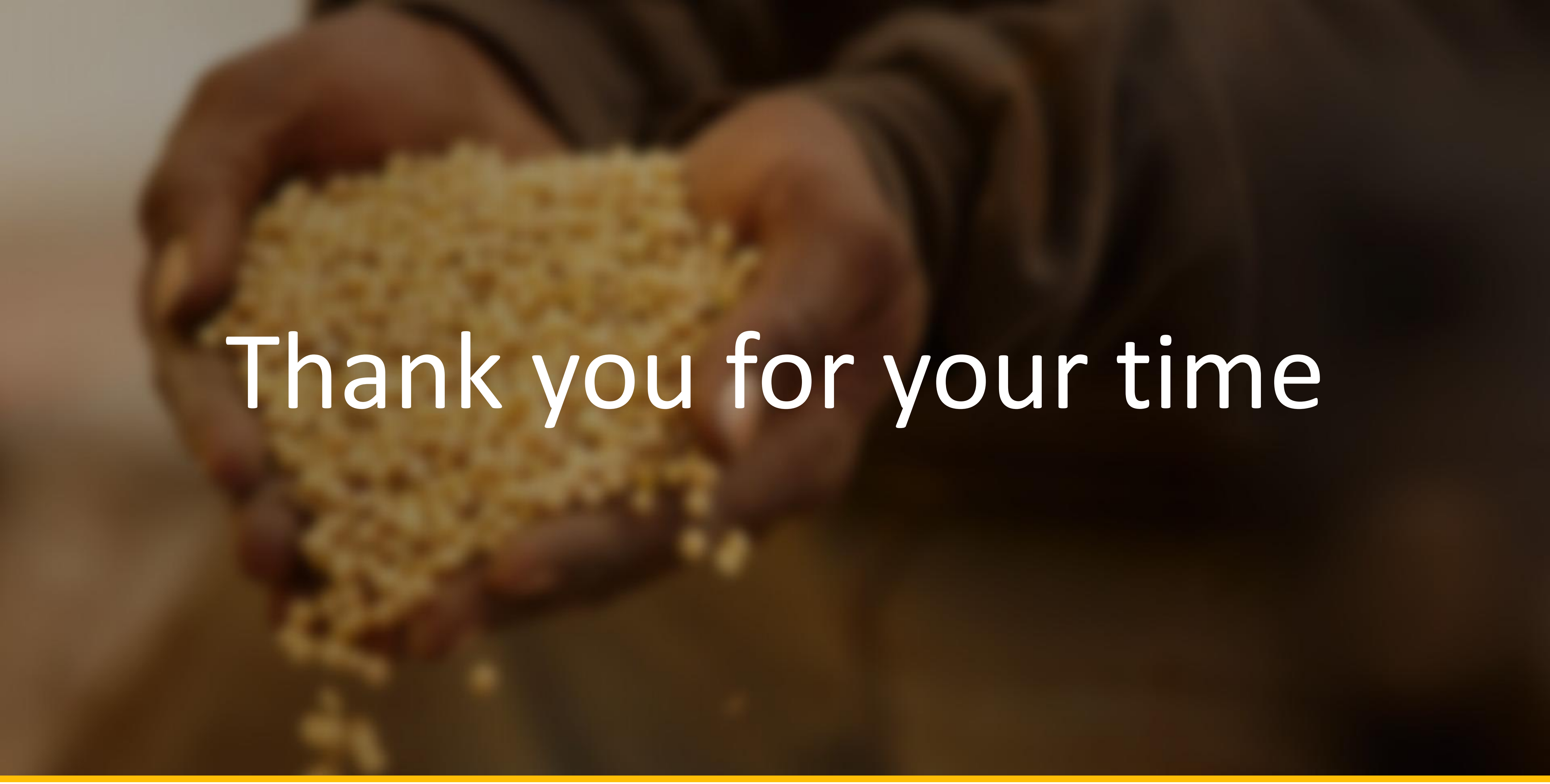
Recommendations: *Quality management..;*

Ingredient Purchase/receiving	Sampling & testing; quick tests; MC
Storage	Hygiene & Proper handling/FIFO
Feed Formulation	Least cost vs Best cost based on nutrient content. Updated database
Processing/ Manufacturing	Maintenance, Equipment set-up
Delivery/ Storage	Facilities, testing, Recording/labeling
Farm/ End users	**Target performance**

Summary & Conclusions

- Feed Quality is equal to animal performance
- Controlling feed quality should start from the point of raw material entry, storage, formulation, processing and finally to the farm;
- Quality Control application should be a responsibility of whole production chain

Animal Performance is the Ultimate test!



Thank you for your time