

Importance of Accuracy of NIRS in Plant Breeding

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Use of Near IR Spectroscopy in Variety/Hybrid Development Process

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Variety Development Process

- Drivers
 - Market Driven (Push or Pull)
 - Varieties/Hybrids have short life spans
 - Discovery Driven
 - New GM technologies
 - **YIELD!!!!**

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NIR technology is used in the development of all commercial crops

- Major compositional components in:
 - Alfalfa, Corn, Sorghum, Canola, Wheat, etc...
- Used to evaluate complex functionality traits
 - Fiber Digestion, Starch functional properties
 - ???

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Why a NIR solution?

- A solution which provides useful data in a useful timeframe.
- NIRS performance and acceptance has improved through advancements in instrumentation, chemometric theory and computer technology.
- Variety development process requires reliable identification of the “winners”

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Variety Development Process

- Multi-stage Process
 - Pre-Development
 - Development
 - Pre- and Post Commercialization
 - Experimental hybrid evaluation
 - Harvest performance plots

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Variety Development Process

- Analytical resources are required in each stage of advancement.
- It is important claims are realized in the marketplace – we have to align with others
- Time is of the essence
 - Thousands of samples to evaluate in a relatively short period of time
 - Driven by product advancement decisions
 - Nursery process is year-around, global effort
- Competition never rests

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Variety Development Process

- Recent North America Market line-up for Mycogen Seeds®
 - 114 Corn Hybrids
 - 85 Grain with a matrix of traits available
 - 29 Silage (BMR, Leafy, TMF, Dual Purpose) with GE traits as well
 - **Highly Competitive Industry**

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Example:

– To evaluate 10,000 silage yield trial samples requires

**Reference “wet”
Chemistry**

- Moisture, Protein, ADF, NDF, Starch, Lignin, NDFDig,
- ~\$65-\$100 / sample at commercial Laboratory
- ~\$45/ sample if done internally
- Estimated 9 months to complete**
- Est. Total Cost - up to \$1.0MM**

NIR

- Moisture, Protein, ADF, NDF, Starch, Lignin, NDFDig
- ~\$25-\$30 / sample at commercial Laboratory–(if qualified)
- ~\$5/ sample – labor and analysis
- ~\$5/sample-instrumentation, model dev. and maintenance
- Estimated 5 weeks to complete**
- Est. Total Cost ~ \$100,000**

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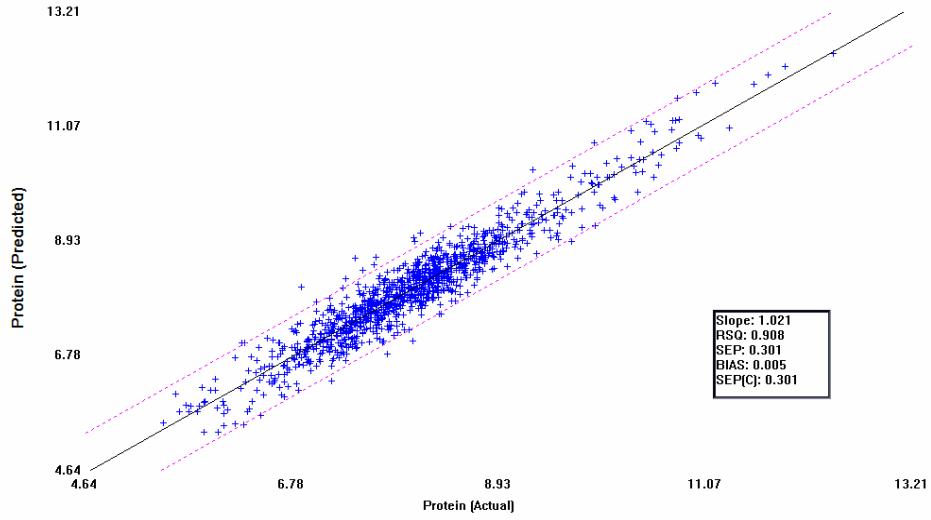
**DAS/Mycogen Seeds NIR Prediction Model Statistics for
Fermented Corn Silage
Scanned with FOSS 6500**

Constituent	Type	N	Mean	SD	Est.Min	Est.Max	SEC	RSQ	SECV	1-VR	#	Seq
Protein	1	1117	8.02	0.97	5.11	10.94	0.28	0.919	0.29	0.911	173	0
ADF	1	1109	26.50	3.39	16.33	36.66	1.00	0.913	1.03	0.907	173	0
NDF	1	1057	43.27	4.64	29.35	57.20	1.17	0.936	1.22	0.931	173	0
STARCH	1	1100	26.93	6.66	6.97	46.90	1.50	0.949	1.59	0.943	173	0
ASH	1	1098	4.58	1.09	1.32	7.84	0.38	0.880	0.40	0.867	173	0
NDFD30	1	1097	58.23	5.84	40.70	75.76	1.94	0.889	2.03	0.879	173	0

Estimated cost of model development – over \$250,000 to date

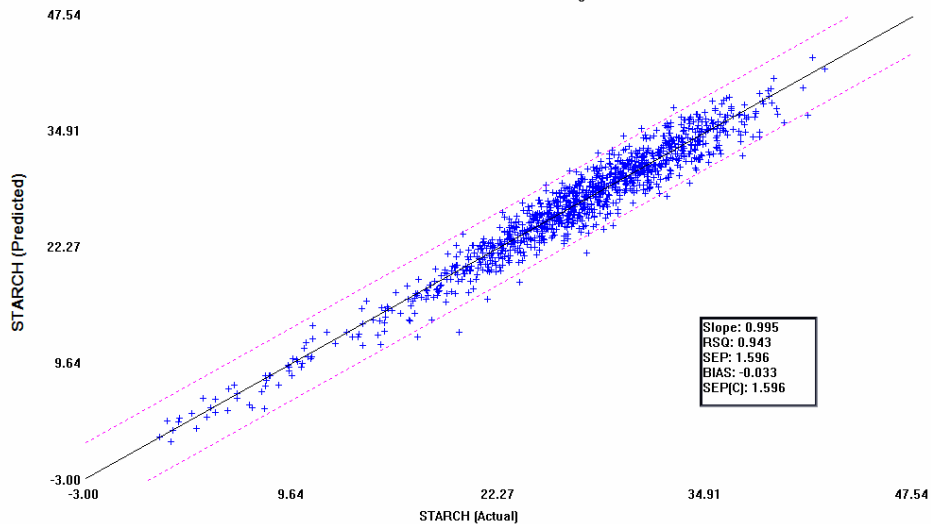
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NIR Prediction of Fermented Corn Silage



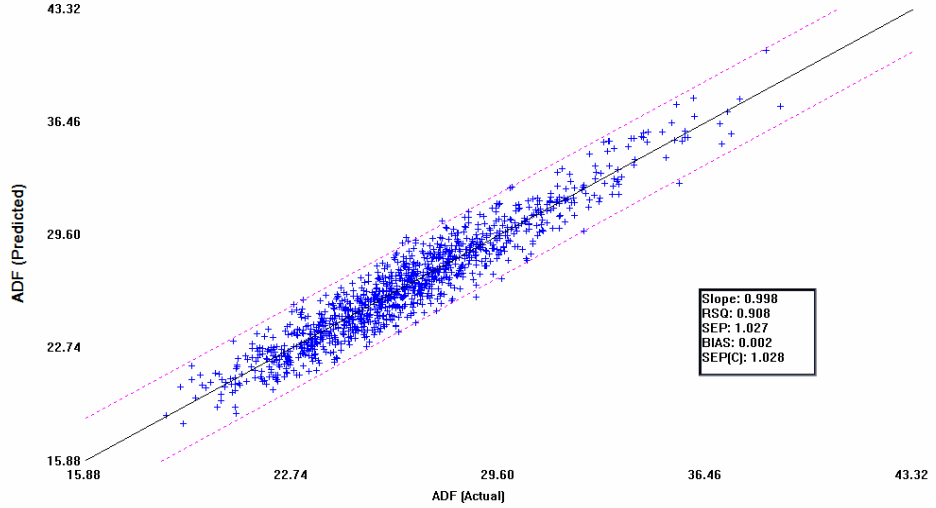
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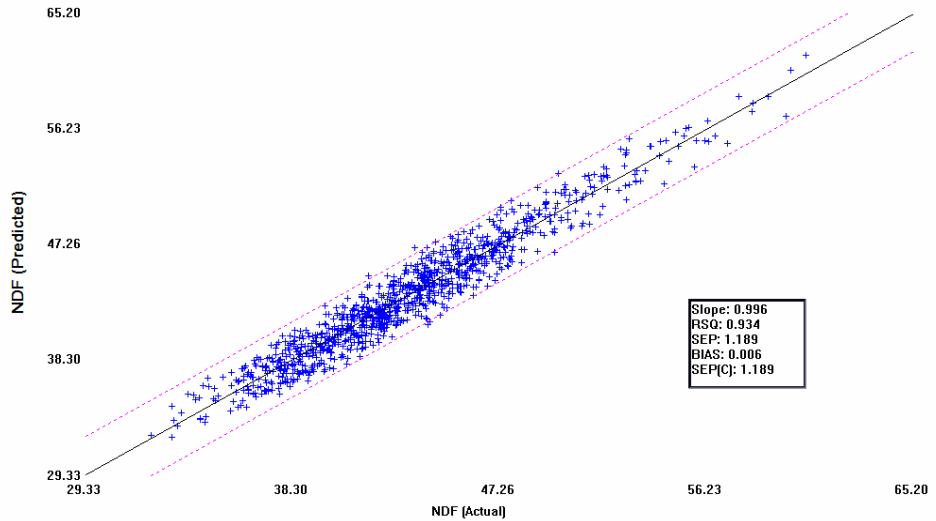
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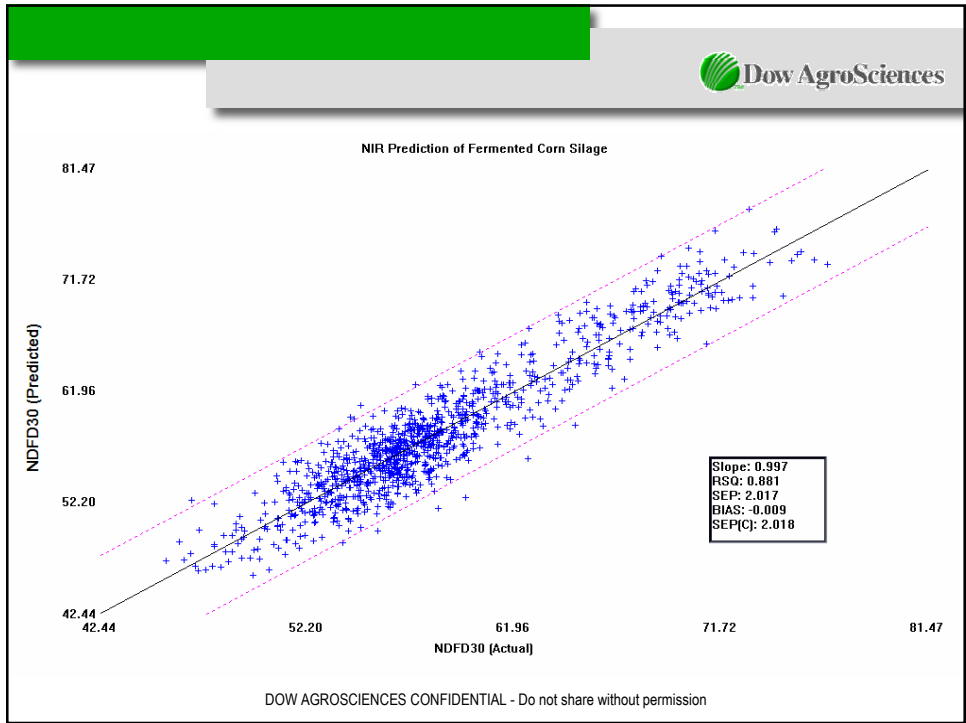


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NIR Prediction of Fermented Corn Silage



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Why is DAS/Mycogen Seeds involved in the NIRS Feed and Forage Testing Consortium?

- Alignment of results in marketplace
- Assist in advancement of NIR technology for the benefit of our customers
- Lower the cost of development of NIR prediction models
- Increase product awareness

Conclusions

- The pace of industry requires fast, reliable, accurate analytical results.
- The reliability of NIR models is dependent on the materials it represents
- NIR models can be made for most feed components
- The NIRS Feed and Forage Testing Consortium is working diligently to defend the reputation of NIR technology

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