Physical Corn Kernel Attributes Influence on Beef Cattle Performance

Syngenta is committed to sharing agronomic knowledge with our customers to help them grow more corn. The Corn Hybrid Beef Feed to Gain Ratings are provided to help our customers produce the best corn for livestock rations.

Kernel characteristics such as test weight, density and hardness can vary significantly between corn hybrids. Test weight, expressed as pounds per bushel, can often become part of seed selection discussions even though grain market prices are typically not discounted until test weight falls below No. 2 yellow corn standards of 54 lbs/bu. There is a belief by many that high test weight grain is associated with high grain yields and feeding performance, however there is little evidence in research literature to support this. Syngenta, in collaboration with the University of Nebraska-Lincoln (UNL), designed trials to evaluate the role that physical corn kernel characteristics have on influencing beef cattle feed performance.[1] Trials were designed in a way to address two main objectives:

1. Is cattle feed performance affected by physical attributes of corn hybrid grain utilized in feed rations?
2. What kernel characteristics of the hybrid most influence feed performance?

Feedlot Study Results

Of all animal performance variables measured, "feed-to-gain ratio" was the only feed performance characteristic influenced by hybrid grain characteristics (Chart 1). Feed-to-gain is the average pounds of feed needed for each pound of animal gain. Low feed-to-gain values indicate that less feed is needed to produce similar weight gain. Other animal performance variables such as dry matter intake, average daily gain, hot carcass weight, marble score and 12th rib fat were not influenced by hybrid differences. In a dry-rolled, corn-based diet, cattle fed corn hybrids with a higher proportion of soft endosperm tended to gain more efficiently than cattle fed corn hybrids with a harder endosperm.

Kernel Test	Hybrid Used in Feedlot Trials							SEM	P
	1	2	3	4	5	6	7		
1,000 K wt.	318^c	317^c	315^{cd}	311^d	326^b	344^a	341^a	1.74	0.01
Stenvert Hardness									
% Soft	72^a	67^b	64^c	68^b	63^c	73^a	71^a	0.01	0.01
Time to grind (seconds)	7.6d^e	7.8^{cd}	9.7^a	8.1^c	8.7^b	7.3^e	7.9^{cd}	0.12	0.01

Table 1. Hybrid 1,000 kernel weight and Stenvert Hardness test results

Grain Characteristics Related to Low Feed-to-Gain Ratio

Of the 8 kernel characteristics measured across hybrids, 1,000 kernel weight, kernel hardness and in-situ rate of disappearance were strongly correlated with lower feed-to-gain ratios. More commonly recognized attributes such as high test weight were not as correlated to feed efficiency gains. Due to the high correlations and relative ease of being able to characterize hybrids for 1,000 kernel weight and hardness characteristics, Syngenta utilizes these findings to characterize commercial hybrid physical grain characteristics for determining which are more likely to have better feed performance.

1) 1,000 kernel weight
   - Closely related to kernel size
   - Different measurement than test weight
   - Higher values correlated to better (lower) feed-to-gain ratios (r^2 = -0.8135; P = 0.026).
2) Kernel hardness
   - The "Stenvert Hardness Test" provided the best predictors of feed-to-gain response.
   - Softer kernels have better feed-to-gain ratios.
   - Hybrids that required less time to grind in a micro-hammer mill (r^2 = 0.8275; P = 0.022) and produced a larger percentage of soft particles (r^2 = -0.83202; P = 0.021) resulted in improved feed performance (lower feed-to-gain ratio).
3) In-situ rate of disappearance
   - Percent of grain digested within live animal rumen over designated time.

References:

[1] Jaeger, S.L. M.K. Luebbe, C.N. Macken, G.E. Erickson, T.J. Klopfenstein, W.A. Fithian, and D.S. Jackson. 2006. Influence of corn hybrid traits on digestibility and the efficiency of gain in feedlot cattle. Journal of Animal Science. 84(7): 1790-1800.

NK® Corn Beef Feed-to-Gain Ratings
(Based on UNL study correlating 1000 kernel weight and hardness to feed)*

NK Hybrid Series	Relative Maturity (RM)	Beef Feed-to-Gain Rating*	NK Hybrid Series	Relative Maturity (RM)	Beef Feed-to-Gain Rating*
NK7837	78	Good	NK0760	107	Best
NK8005	80	Poor	NK0821	108	Good
NK8204	82	Good	NK0877	108	Good
NK8519	85	Best	NK0886	108	Best
NK8618	86	Good	NK0962	109	Fair
NK8760	87	Fair	NK1026	110	Good
NK8881	88	Good	NK1082	110	Good
NK8920	89	Best	NK1188	111	Good
NK9023	90	Best	NK1205	112	Good
NK9175	91	Good	NK1239	112	Good
NK9227	92	Good	NK1321	113	Fair
NK9347	93	Good	NK1354	113	Best
NK9468	94	Good	NK1364	113	Best
NK9535	95	Good	NK1452	114	Best
NK9653	96	Fair	NK1460	114	Best
NK9738	97	Best	NK1523	115	Fair
NK9922	99	Good	NK1573	115	Best
NK9930	99	Poor	NK1661	116	Fair
NK9991	99	Fair	NK1677	116	Fair
NK0007	100	Fair	NK1694	116	Good
NK0243	102	Best	NK1701	117	Fair
NK0314	103	Poor	NK1748	117	Fair
NK0440	104	Best	NK1755	117	Good
NK0472	104	Fair	NK1808	118	Fair
NK0624	106	Good	NK1822	118	Fair
NK0696	106	Fair	NK1860	118	Fair
NK0748	107	Good			

Beef Feed-to-Gain Ratings Key: Best Good Fair Poor

* Ratings based on Jaeger, Stephanie L.; Macken, Casey N.; Erickson, Galen E.; Klopfenstein, Terry J.; Fithian, Wayne A.; and Jackson, David S., "The Influence of Corn Kernel Traits on Feedlot Cattle Performance" (2004). Nebraska Beef Cattle Reports. Paper 197.

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