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Is feed moisture variable or controlled nutrient?

If moisture is precisely controlled and properly selected for the feed being pelleted, production rates will increase, power consumption will decrease and a better-quality pellet will be produced.

By **DAVID GREER***

COMMERCIAL livestock diets are carefully formulated for various nutrients such as energy, amino acids, minerals and vitamins, but not for moisture.

By weight, moisture is approximately 10% of the "air-dry" diet but can vary significantly, which affects feed quality, processing cost and animal performance.

Figure 1 graphically presents data generated at Kansas State University (KSU) in a series of studies on the effect moisture has on pellet quality, as measured by the KSU pellet durability index (PDI). Table 1 is a composite of data generated from these studies in the research pellet mill at KSU. The feed pelleted was a non-medicated hog finisher.

These data indicated that a cold mash moisture content near 15% in the mixer produced the best combination of pellet quality, production rates and energy use in the pellet mill used for these studies.

As a result, 15% was chosen as the treated cold mash moisture content for a broiler feeding study.

Figure 2 summarizes data from Tables 2 and 3 showing the correlation between performance of birds fed a pelleted grower feed and pellet quality.

Two diets were studied: a control mash containing 6.5% moisture and a treated mash where the control mash moisture content was adjusted in the mixer to 15%. Both were fed as a mash and as a pellet produced using the same production rates, temperatures, etc. The mash was drier than usual because the corn purchased was 10% moisture at harvest.

In this study, the effect of treating moisture as a precisely controlled nutrient significantly increased the pellet quality and feed conversion. PDI and modified PDI were increased 41.5% and 88.9%, respectively. (Modified PDI is determined by adding five hexagonal bolts to the tumbling chamber with the pellet sample.)

Further evidence of improved pellet quality was the difference between PDI and modified PDI of the two pelleted feeds: 19.1% for the control pellets compared to 6.5% for the moisture-treated pellets.

Calculating feed conversions on the conventional "as-fed" basis, the higher-moisture pellets did not perform as well, but on a 100% dry matter basis, feed conversion was improved 2.9%.

When moisture was added in the mixer, it, in effect, reduced nutrient density 7% in the treated pellets compared to the control pellets, yet the performance of the treated pellets was superior to that of the control.

The pelleted feed was all produced within a two-day period, placed in woven plastic feed bags and stored in a warehouse adjacent to the poultry barn where the test was conducted. It was summer in Kansas, so the grower feed was stored for three to six weeks in significantly hot conditions before it was fed. There was no evidence of mold in either the control feed or the higher-moisture treated feed.

The additional moisture did not cause any mold problems because it was bound to the starch in gelatinization and was not free to migrate to the surface of the pellet. The increase in starch gelatinization was essentially correlated one-to-one to the increase in moisture content. Raising the moisture content 7.3% increased gelatinization 6.3%.

The next logical question is, "Can mash moisture content be precisely controlled in the mixer?" The answer is, "definitely."

Table 4 contains composite data from three pelleting studies replicated in time and separated from each other by several months. Obviously, moisture control this good requires very accurate moisture data in real time. It was accomplished with a capacitive moisture sensor flush-mounted in the mixer (pictured).

The second question is, "What effect does the added moisture in the cold mash have on feed production?" If moisture is precisely controlled and properly selected for the feed being pelleted, production rates will increase, power consumption will decrease and a better-quality pellet will be produced. ■

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1. The effect of precise moisture control on the feed pelleting process

----------Mash moisture content, %----------				----Production data----		----------Temperatures----------			---Pellet quality---	
Incoming	Target	Treated	Cond.	Lb./min.	kWh/ton	Cond.	Hot pellet	Delta T	PDI, %	% moist
11.4	12.0	12.2[a]	15.1	87.6	5.21	180	190	10[f]	77.6[a]	12.9
11.0	13.0	13.1[b]	15.9	87.2	5.25	180	188	8[g]	80.0[b]	13.3
10.9	14.0	14.0[c]	16.8	88.6	5.19	180	188	8[g]	83.9[c]	14.3
10.7	14.5	14.7[d]	17.0	84.9	5.14	180	186	6[h]	87.6[d]	14.2
11.1	15.0	15.1[e]	18.5	82.9	5.09	180	186	—	88.6[e]	15.6

[a,b,c,d,e]Means within a column with different superscripts differ (P < 0.05).
[f,g,h]Means with different superscripts differ (P < 0.1).

2. Broiler performance data on a grower diet (3-6 weeks)

Feed	Liveweight gain, g	-------Feed efficiency------- As fed	100% dry matter	Mortality, %
Control	1,559[a]	1.84[a]	1.70[b]	5.99[a]
Treated	1,542[a]	1.94[b]	1.65[a]	4.89[a]

[a,b,c,d] Means within a column with no common superscript differ significantly (P < 0.05).

3. Pellet durability data

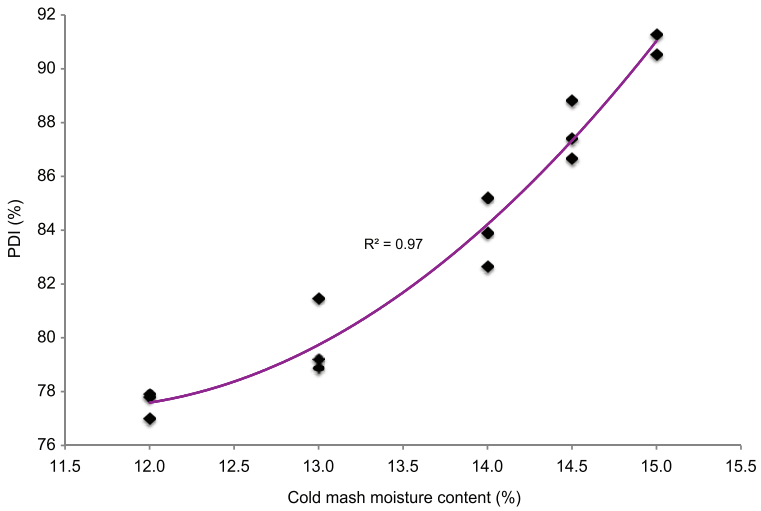
Feed form	Moisture (%)	KSU PDI (%)	PDI modified (%)
Control mash	6.5	—	—
Treated mash	14.9	—	—
Control pellet	7.6	61.7	42.6
Treated pellet	15.0	87.3	80.8

4. Cold mash moisture control in the mixer

Target moisture, %	12.0	13.0	14.0	15.0	16.0
Laboratory assay, %	12.1[a]	13.0[b]	14.0[c]	15.1[d]	16.2[e]
Standard deviation	0.1	0.1	0.2	0.2	0.1
Number of batches	3	6	8	10	3

[a,b,c,d,e] Means with different superscripts differ (P < 0.0001).

1. Correlation between cold mash moisture content and KSU PDI



2. Correlation among PDI, modified PDI and broiler feed efficiency