

## Effects of Drying Corn on its Nutritive Value for Growing-Finishing Swine

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### Summary

No statistically significant differences in rate of gain were found when pigs were fed crib corn, high-moisture corn (24%), corn dried to 13% moisture at 190°F, 240°F or 290°F or corn dried to 10.6% moisture at 190°F as shelled corn and supplement free choice or in complete mixed rations (except the 24% moisture corn).

Pigs receiving corn dried to approximately 13% moisture made similar gains regardless of feeding method or air temperature used to dry the corn. Crib corn and corn dried to 10.6% moisture gave faster gains and better feed efficiency when fed in a complete mixed ration than when fed free choice with supplement.

The carotene level of corn decreased with increased drying time or increased drying temperature.

### Drying Corn

As crop acreages and yields per acre become increasingly larger, farmers in the Midwest often increase the temperatures of their present dryers instead of buying larger ones so they can dry more corn in a shorter

length of time. The milling industry has tended to avoid corn dried above 130°F. They found that corn dried at high temperatures (higher than 160°F) was difficult to mill and the starch proved to be inferior. Many farmers wonder how high temperatures affect the nutritional value of dried corn for hogs.

In a previous experiment (RPR 102) pigs fed a complete mixed ration using crib corn, corn dried at 140°F to 13 percent moisture or corn dried at 190°F to 13 percent or 9.5 percent moisture, gained slightly faster than pigs fed a ration using corn dried at 290°F to 13 percent moisture. Free choice feeding of supplement and shelled crib corn or corn dried to 9.5 percent moisture at 190°F resulted in slower gains than feeding the same corn in a complete mixed ration.

### Procedure

The corn used in this experiment was harvested from a one-hundred acre field which had been planted to a Funk G. Hybrid. A portion of the corn was dried with a continuous dryer and stored in steel bins, another portion was harvested as high moisture corn and stored in a glass-lined silo and the remainder was stored in a covered picket crib as ear corn.

Corn was handled and fed as follows:

Lot 1--Crib corn (19% moisture) - shell-corn with supplement free choice

Lot 2--Crib corn-complete mixed ration

Lot 3--Corn dried to 13% moisture at 190°F -shelled corn with supplement free choice

Lot 4--Corn dried to 13% moisture at 190°F -complete mixed ration

Lot 5--Corn dried to 10% moisture at 190°F -shelled corn with supplement free choice

Lot 6--Corn dried to 10% moisture at 190°F -complete mixed ration

Lot 7--Corn dried to 13% moisture at 240°F -shelled corn with supplement free choice

Lot 8--Corn dried to 13% moisture at 240°F -complete mixed ration

Lot 9--Corn dried to 13% moisture at 290°F -shelled corn with supplement free choice

Lot 10--Corn dried to 13% moisture at 290°F -complete mixed ration

Lot 11--High moisture corn (24%) -shelled corn with supplement free choice. Consumption of corn restricted to the dry matter intake of corn by pigs in Lot 3 (corn dried to 13% at 190°F.)

Lot 12--High moisture corn (24%) -shelled corn with supplement free choice-corn full fed

One-hundred and twenty crossbred pigs were allotted to the 12 lots on the basis of sex, weight and litter. They were fed on 30' x 40' concrete lots and had access to a Pur-Dual hog house, one waterer and four holes of a self feeder.

The protein supplement used is described in Table 2. This supplement was fed free choice in lots 1, 3, 5, 7, 9, 11, and 12. In lots 2, 4, 6, 8 and 10 the supplement was mixed with ground corn to give a calculated 16% protein ration which was fed to an average pig weight of 100 pounds and 13 percent

protein ration from 100 pounds to market weight.

### Results

Analysis of the corn fed in this experiment indicated that increased drying temperatures as well as increased drying time tend to decrease carotene levels in corn (Table 2). This decrease in carotene level is probably not an important effect as previous research (RPR 40 and RPR 74) has indicated that supplemental vitamin A needs to be added to a corn-soy ration, to meet the needs of the growing-finishing pig.

A summary of the pig performance in this experiment is presented in Table 3. No significant differences in pig growth rate due to drying temperature, moisture level or method of feeding the corn were found. Poorest growth rates were noted in pigs receiving the high moisture (19% or 24%) or the low moisture (10.6%) corn free choice with supplement.

The six lots of pigs receiving corn dried to approximately 13% moisture made similar gains regardless of method of feeding or air temperature used for drying the corn.

Corn dried to low moisture levels (10.6% -lots 5 and 6 or 9.5% RPR 102) has given faster and more efficient pig gains when ground and mixed in a complete ration than when fed free choice (shelled corn) with supplement.

Feeding equivalent dry matter levels of 24% and 13% moisture corn (lots 11 vs. lots 3, 7 and 9) resulted in similar levels of protein consumption (free choice). Pigs fed the high moisture corn (24%) utilized the corn dry matter as well as the pigs in lot 7 (12.1% moisture corn) but not as well as pigs in lots 3 and 9 which also received corn containing approximately 13% moisture.

These data indicate that air temperatures to 290°F may be used for drying corn without impairing its nutritive value and that drying corn to low moisture levels is costly and may decrease its value as a swine feed due to poorer utilization of the corn by the pig.

Table 1. Modified Supplement 2

Ingredient	Percent
Soybean Meal (44%)	62.5
Mean and Bone Scraps	20.0
Dehydrated alfalfa meal	10.0
Dicalcium phosphate	3.2
Calcium carbonate	0.3
Salt, iodized	2.5
Premix <u>a/</u>	1.5
	<u>100.00</u>

a/ The premix supplied the following ingredients per pound of supplement: 2,500 IU Vitamin A, 500 IU Vitamin D, 30 mcg B<sub>12</sub>, 5 mg riboflavin, 15 mg pantothenic acid, 25 mg niacin, 6.5 mg copper, 95 mg iron, 80 mg manganese, 114 mg zinc and 225 mg arsanilic acid.

Table 2. Corn drying results (dried November 1963)

Lot no.	Corn sample	Drying temp	Drying time hours	Moist. before drying percent	Drying cost <u>a/</u> per bu	Moist. after drying percent	Cu. ft. /min. /bu <u>b/</u>	Grain temp at hot discharge <u>c/</u>	Carotene mg/lb
1,2	Crib	-----	-----	-----	-----	19.0	-----	-----	1.30
3,4	LS-1	190°F	2	21.8	2.6¢	13.3	75	154°F	1.07
5,6	LS-2	190°F	4	21.6	5.0¢	10.6	75	169°F	0.85
7,8	LS-3	240°F	1 1/2	21.5	2.7¢	12.1	75	178°F	0.97
9,10	LS-4	290°F	1 +	21.2	2.0¢	12.3	75	188°F	0.82
11,12	High moist.	-----	-----	-----	-----	24.0	-----	-----	1.59

a/ Drying costs includes fuel and power.

b/ Cubic feet of heated air supplied per minute per bushel of corn.

c/ This was a position between the heating and cooling portion of the continuous flow dryer.

Table 3. Effect of drying corn on pig performance (Nov. 27, 1963 to March 5, 1964)

Item	Unit	Crib corn				190° F - 13% H <sub>2</sub> O		190° F - 10% H <sub>2</sub> O	
		Lot 1	Lot 2	Lot 3	Lot 4	Lot 5	Lot 6	FC	CMR
		FC a/ 10	CMR b/ 10	FC	CMR	FC	CMR	FC	CMR
Number of pigs	1b	55.7	50.0	54.8	50.3	54.5	50.3	50.3	50.3
Average initial weight	1b	199.8	203.1	201.0	200.5	199.4	203.8	203.8	203.8
Average final weight	1b	1.50	1.59	1.68	1.62	1.50	1.63	1.63	1.63
Average daily gain	1b	4.77	5.63	4.74	5.68	4.72	5.53	5.53	5.53
Average daily feed	1b	(4.45)	(4.53)	(4.72)	(4.88)	(4.85)	(4.91)	(4.91)	(4.91)
Corn or mix as fed	1b	0.84	(.77)	0.82	(.78)	0.83	(.76)	(.76)	(.76)
Corn 13% H <sub>2</sub> O equiv	1b	(5.29)	(5.30)	(5.54)	(5.66)	(5.68)	(5.67)	(5.67)	(5.67)
Supplement	1b								
Total feed 13% H <sub>2</sub> O equivalent	1b	318	353	282	351	313	339	339	339
Feed/cwt. gain	1b	318	305	282	303	313	292	292	292
Corn or mix as fed	1b	(296)	(284)	(281)	(302)	(322)	(301)	(301)	(301)
Corn	1b	56	48	49	48	55	47	47	47
Corn 13% H <sub>2</sub> O equiv c/	1b	(352)	(332)	(330)	(350)	(387)	(348)	(348)	(348)
Supplement	1b	\$8.73	\$8.58	\$8.23	\$9.11	\$9.52	\$9.17	\$9.17	\$9.17
Total feed	1b								
13% H <sub>2</sub> O equiv	1b								
Cost/cwt. gain d/	1b								

a/ Shelled corn and supplement fed free choice

b/ Ground corn blended with the supplement and fed as complete mixed ration

c/ Corn in lots 1 & 2, 19%; corn in lots 3 & 4, 13.3%; corn in lots 5 & 6, 10.6% moisture

d/ Prices used: supplement \$89.66 per ton; shelled corn \$ 2.10 per cwt. (13% moisture basis) grinding \$ .10 and mixing \$ .05 cwt. Cost of drying the corn is included (Table 1).

Table 3 (continued)

Item	Unit	240°F -13%		290°F -13%		High Moisture Corn	
		F.C.		F.C.		Limited e/	
		Lot 7	Lot 8	Lot 9	Lot 10	Lot 11	Lot 12
Number of pigs		10	10	10	10	10	10
Average Initial weight	lb	53.3	49.1	55.4	49.1	53.8	55.3
Average Final weight	lb	200.5	205.8	202.7	202.2	204.4	200.2
Average Daily gain	lb	1.54	1.63	1.61	1.58	1.56	1.49
Average Daily feed							
Corn or mix as fed	lb	4.82	5.47	4.75	5.20	5.54	5.40
Corn 13% H <sub>2</sub> O equiv	lb	(4.87)	(4.77)	(4.79)	(4.52)	(4.84)	(4.74)
Supplement	lb	0.75	(0.75)	0.78	(0.71)	0.80	0.63
Total Feed 13% H <sub>2</sub> O equiv	lb	(5.62)	(5.52)	(5.57)	(5.23)	(5.64)	(5.37)
Feed/cwt. gain							
Corn or mix as fed	lb	312	335	294	327	353	363
Corn	lb	312	289	294	282	353	363
Corn 13% H <sub>2</sub> O equiv f/	lb	(315)	(292)	(296)	(284)	(308)	(317)
Supplement	lb	49	46	48	45	51	43
Total Feed 13% H <sub>2</sub> O equiv	lb	(364)	(338)	(344)	(329)	(360)	(360)
Cost/cwt. gain		\$8.96	\$8.77	\$8.48	\$8.68	\$8.75	\$8.59

e/ Fed corn dry matter equivalent to the consumption of Lot 3.

f/ Corn in lots 7 &amp; 8, 12.1%; corn in lots 9 &amp; 10, 12.3%; and corn in lots 11 &amp; 12, 24% moisture.