FATS AND PROTEINS RESEARCH FOUNDATION, INC.

Director's Digest

FRED D. BISPLINGHOFF, D.V.M.
Director Technical Services

7150 ESTERO BLVD. • APT. 906
FT. MYERS BEACH, FL 33931
AREA CODE 813 — 463-4744

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HIGH OIL CORN AND THE RENDERING INDUSTRY

A member of our industry received information from a reliable source that high oil corn may become a reality in the next few years. We were requested to discuss this genetically improved corn hybrid with scientists who are working with the product and evaluate it's impact on the U.S. rendering industry. Below is a summary of our investigation and attached is a more lengthy economic analysis of it's potential negative effects on animal fat utilization in various species' rations.

Rumors of high oil corn being more than a fantasy have been circulating in agri-business for many years. The University of Illinois has been working on the project for 27 years but only recently have major breakthroughs come forth. One factor that contributed to this improvement is the development of an unique germ plasma by Pfister Seed Corn Co. that yields higher oil levels while maintaining standard acreage yields. Pfister recently won a lawsuit against Pioneer Seed Corn Co. in which they claimed Pioneer stole their germ plasma. The second factor is the emergence of DuPont, with its

strong financial position, into the picture which has enabled Pfister and University of Illinois scientists to accelerate their work.

It seems that Pfister has successfully produced 6% oil corn and have had some success with levels as high as 9 and 10%. Most scientists think an 8% high oil seed corn will be available for sale in 1993 or 1994. Below are some major points of the new hybrid.

1. Will contain at least same protein content of regular corn with excellent chance of slightly higher levels.
2. All evidence to date points to a higher lysine content.
3. Dairy nutritionists report the additional oil is primarily oleic acid which poses less of a problem in the rumen than linoleic acid. This "new" corn oil will have many excellent human food applications with its high level of a monosaturated fatty acid.
4. Some evidence that part of the oil escapes the rumen microorganisms by being encapsulated in corn fragments.
5. Research experiments and field trials have demonstrated no apparent problems with dairy cattle or swine, but more work needs to be done.
6. It is rumored that the seed corn will be priced so the extra oil (2-4%) will cost the livestock producer 6 - 8 cents per pound.
7. The extra oil replaces starch in the kernel on a one for one basis.
8. Papers have been submitted for publication in scientific journals.

It is our opinion that 6% oil corn would have a reasonable impact on usage but a significant influence on price. 8% oil corn would replace a significant amount of animal fat in the feeding fat market. The major negative would be the reduction in growth and the placing of a price barrier on our feeding fat products. With a higher oleic acid content it will challenge our markets in several fatty acid applications.

More industrial/edible corn oil means increasing the world fats and oil anticipated surplus of 1993-1995. DuPont will see that it is available in all corn producing nations and if they stay with the project will fund research to adapt this hybrid to short growing season regions. We will monitor this

competitive challenge but need more details before we can accurately predict its full impact on our industry. We have outlined some thoughts on its potential replacement of animal feeding fats.

ECONOMIC STUDY

These examples are only generalizations and conditions and costs will vary from area to area. There are many nutritional factors that must be considered and I did not run (except poultry) the diets through a least-cost computer software program. The below data are estimates and will be reviewed in the future so please pass on any information you receive on this product.

SWINE DIETS

$2.66 Bu. Corn = .0475 cents per pound or $4.75 cwt. High oil corn (8%) at 7 cents per lb. for extra 4 lbs. = 4 x 7 cents = .28 cents or $5.03 cwt. Assuming high oil corn has same protein level and oil replaces starch on a one for one basis, 1250 lbs. of high oil corn would supply the same starch as 1200 lbs. of regular corn and contribute 50 lbs. of extra oil.

GROWING RATIONS

(5% added fat)

COST ANALYSIS FOR 19 CENT FAT

Regular Corn Formula - 1200 lbs. Corn x $4.75 = $57.00
100 lbs. Fat x $19.00 = $19.00
Cost of starch and fat energy = $76.00

High Oil Corn Formula - 1250 lbs. Corn x $5.03 = $62.88
50 lbs. Fat x $19.00 = $ 9.50
Cost of starch and fat energy = $72.38

COST DIFFERENCE FOR 12 CENT FAT

Regular Corn Formula = $69.00
H.O. Corn Formula = $68.88

COST DIFFERENCE FOR 10 CENT FAT

Regular Corn Formula = $67.00
H.O. Corn Formula = $67.88
(H.O. Corn will have protein value for extra 50 lbs.)

FINISHING RATIONS

(4% added fat)

19 cents Fat

1520 lbs. Regular Corn =	$72.20	1583 lbs. H. O. Corn =	$79.62
80 lbs. Added Fat	$15.20	17 lbs. Added Fat	$ 3.23
Cost of Energy	$87.40		$82.85

12 cents Fat

Regular Corn Formula - $81.80
H.O. Corn Formula - $81.66

10 cents Fat

Regular Corn Formula - $80.20
H.O. Corn Formula - $81.32

Factors programmed in computer least-cost formulations that may influence inclusion levels and ingredient values are:

1. If protein content of H.O. corn is same as regular, than less soybean meal would have to be added when less corn is replaced by fat. If it has a higher protein level it will be an extra benefit.
2. If lysine content is slightly higher in H.O. corn, there will be be a lysine credit as most swine producers add lysine to rations and it makes the corn protein more valuable.
3. If H.O. corn gives reasonable dust control we would lose this winter months added fat market.

Positive Outlook - The extra oil in H.O. corn may not elicit the same response as added animal fat (similar to S.B. oil). Some of the early fat in swine diets was conducted with corn oil with inconclusive results. H.O. corn may allow feeding higher fat levels to swine but the animal fat would have to be on saturated (hard) side.

POULTRY DIETS

Dr. Fuller worked with poultry nutritionists at the University of Georgia and included high oil corn in a typical Georgia broiler ration. Broiler

feed must contain a certain M.E. level and to obtain the desired energy it is necessary to add fat. Regardless of the price of H.O. corn, there is insufficient space in ration to add more corn due to the inclusion of other ingredients. We calculated regular corn (NRC) at 3450 M.E. kg. and 8% H.O. corn at 3465 M.E. kg. The computer brought H.O. corn in even at a high price of .1201 cents per kg. when regular corn price was .1122 cents kg. 8% H.O. corn price was .11836 cents kg.

8% H.O. corn replaced 32% of added fat in broiler finisher and 23% in broiler starter. These diets had high levels of added fat (9.18% starter; 7.9% finisher). This is twice the levels formulated in some areas of U.S. The lower the added fat inclusion level the higher the replacement percentage. I believe a renderer could expect the same percentage reduction in turkey finisher diets.

In another computer least-cost study Drs. Fuller and Dale reviewed the effect of H.O. Corn in a broiler grower ration that was supplemented with a more normal amount (3.759%) of fat. Hundred weight prices were $6.25, $6.65 and $7.09 for regular, 6% oil and 8% oil corn respectively. The animal-vegetable fat blend was included at a cost of $13.50 cwt. The 6% H.O. corn replaced 78% of added fat and the 8% H.O. corn replaced all of the supplemental fat as well as bringing in 21% of regular corn. The three rations had the same M.E. Kcal/Kg. level (3179) and per cwt. cost ($8.32). Please note Dr. Dale's abstract on back page of Digest.

Positive Outlook - Please understand that we are working solely on rumors and estimates. As mentioned in the introduction, the greatest impact will be in the loss of future growth which will create more surplus and more competitive prices. If geneticists can only go to 6% than the negative aspects would be reduced dramatically.

DAIRY CATTLE RATIONS

Many nutritionists, in an effort to avoid excess starch in rumen, restrict intake of corn to 20-22 pounds per day. If the starch content of corn is

reduced in same proportion of increase in oil than we could expect a small increase in corn intake due to lower starch levels.

Based on No. 2 Corn

21 lbs. of H. O. Corn would yield - .84 lb. of additional fat

25 lbs. of H. O. Corn would yield - 1.0 lb. of additional fat

Since the H.O. corn would contain unsaturated oils the addition of soybeans or cottonseeds may be eliminated as the combination of additional corn oil plus unsaturated fatty acids from oilseeds may prove to be too toxic to rumen microorganisms even if the oil is released very slowly. Some scientists state that part of the oil will stay tied-up in corn and will by-pass rumen. If H.O. corn eliminates oilseeds inclusion it will have little impact on animal fat usage except in 12-14,000 lbs. year herds where producers are adding approximately 1/4 to 1/2 pound of fat per head per day (no oilseeds) to bring animals into a positive energy balance in early lactation. If it does not replace all of oilseeds than we lost a substantial portion of our dairy cattle fat market. If oilseeds can be utilized with high oil corn more nutritionists may recommend all additional fat be by-pass fat.

COST ANALYSIS

19 cents Fat

Regular Corn = 20 lbs. corn plus 1 lb. of tallow = $1.14

H.O. Corn = 20 lbs. corn plus .2 lb. of tallow= $1.04

12 cents Fat

Regular Corn = 20 lbs. corn plus 1 lb. tallow = $1.07

H.O. Corn = 20 lbs. corn plus .2 lb. tallow= $1.03

10 cents Fat

Regular Corn = 20 lbs. corn plus 1 lb. tallow = $1.05

H.O. Corn = 20 lbs. corn plus .2 lb. tallow = $1.08

Positive Outlook - H.O. Corn may allow us to go to higher levels of fat in high producing herds wihout negative effects.

BEEF CATTLE RATIONS

Steers and heifers in feedlots consume close to 6-7 lbs. per day of corn and their diets include 2-4% added fat. Six and one-half pounds of 8% H.O. corn would yield a little over one-quarter pound per day of extra oil. A steer consuming 6 kg. of feed per day containing 3% added fat would be receiving .4 lb. a day of added fat.

If the nutritionist could increase the corn in ration due to lower starch content than each additional 1/2 lb. of corn would yield .02 lb. of fat. When replacing 40 pounds of the 60 lbs. of fat in a 3% added fat diet with 40 pounds of 8% H.O. corn, the ration would have the same fat content as one with 60 lbs. of added fat with regular corn. A two-third reduction in usage and the diet would have same starch level.

Positive Outlook - Recent F.P.R.F. studies have demonstrated that saturated fats have a higher Net Energy Value than unsaturated fats. Beef cattle may not respond to high corn oil levels and we may be able to raise the total added fat content of feedlot rations to 6-8% on a routine basis.

EFFECT OF OIL CONTENT ON TRUE METABOLIZABLE ENERGY OF YELLOW CORN. N. M. Dale* and E. Whittle, Extension Poultry Science Department, University of Georgia, Athens, Georgia 30602.

Twenty samples of yellow corn varying markedly in oil content were obtained from plant breeding companies. Each was evaluated for proximate composition and nitrogen corrected true metabolizable energy (TME_n). Assayed samples were free of broken kernels and foreign material. All values are expressed on an 86% dry matter basis.

Oil ranged from 3.4% to 17.1%. Fourteen samples contained more than 5% oil. TME_n content ranged from 3.310 kcal/g, for the sample with 3.4% oil, to 3.977 kcal/g, for the sample with 17.1% oil.

The TME_n of corn samples varying in oil content can be estimated from the following equations:

$$TME_n \text{ (kcal/kg)} = 3234 + 37 \text{ (\% fat)}$$
$$TME_n \text{ (kcal/lb)} = 1470 + 16.8 \text{ (\% fat)}$$

KEY WORDS: corn, oil, energy

RESULTS OF LINEAR REGRESSION

	X	Y	PREDICTED Y
Observation # 1	2.9	3310	3371.304
Observation # 2	3.1	3385	3379.473
Observation # 3	3.5	3325	3395.811
Observation # 4	3.6	3376	3399.896
Observation # 5	4.2	3511	3424.402
Observation # 6	4.2	3405	3424.402
Observation # 7	4.4	3424	3432.572
Observation # 8	4.5	3521	3436.656
Observation # 9	4.6	3492	3440.741
Observation # 10	4.7	3375	3444.825
Observation # 11	5.1	3392	3461.163
Observation # 12	5.1	3502	3461.163
Observation # 13	5.3	3436	3469.332
Observation # 14	5.4	3426	3473.416
Observation # 15	5.6	3591	3481.585
Observation # 16	6.0	3585	3497.923
Observation # 17	7.0	3573	3538.768
Observation # 18	8.4	3566	3595.951
Observation # 19	11.2	3619	3710.317
Observation # 20	17.1	3977	3951.301

Variance of X is	10.72471
Variance of Y is	21701.89
Standard Error is	4021.481
Intercept A is	3252.854
Slope B is	40.84487
Corr. Coeff. is	0.90799
The t-value is	9.19420 with 18 deg. of freedom
Significance level	< 0.0001