

## WHAT'S THE VALUE OF HIGH-LYSINE CORN FOR SWINE?

by  
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Recent high price levels for protein supplements has led to renewed interest by farmers in raising potentially high-lysine corn varieties for swine. As its name suggests, high-lysine corn contains a higher percentage of lysine (and also the amino acid tryptophan) than normal corn. What are, however, the key factors that affect its value to swine producers and how profitable might this type of corn be for pork producers in the future?

The principle advantage of high-lysine corn is that its higher lysine content allows diets to be formulated with less supplemental protein, since some of this supplemental protein can be replaced by high-lysine corn. Lower cost diets are generally possible, depending on the price relationship between corn and supplemental protein sources.

A key disadvantage of high-lysine corn has, however, been that its yields are lower than those of normal hybrid corn.

These two aspects of high-lysine corn are illustrated in a summary of corn performance tests conducted at the Western Branch, OARDC, in 1973 (Table 1). High-lysine hybrids averaged 25.5 bushels less per acre or 17.3 percent below their normal hybrid counterparts. Individual high-lysine hybrid yields ranged from 30 percent lower to 2 percent higher as compared to the normal hybrids. In addition, the high-lysine hybrids showed more evidence of stalk lodging.

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Table 1. Performance of High-Lysine Hybrids Tested at Western Branch, OARDC, 1973<sup>1/</sup>

Brand	Hybrid No.	High-Lysine							Normal Counterpart							Type <sup>4/</sup> Cross	
		<sup>2/</sup> Desired plants per Acre	Final stand plants per acre	Yield Bu/A	Moisture at harvest %	Stalk lodging %	Emergence %	Lysine <sup>3/</sup> content %	Hybrid No.	Final stand plants per acre	Yield Bu/A	Moisture at harvest %	Stalk lodging %	Emergence %	Lysine <sup>3/</sup> content %		
DeKalb	XL22-02	24,000	22,400	121.0	14.6	20.2	84.5	.34	XL22	21,900	147.4	17.1	7.5	82.9	.29	SC	
Pfister	421	22,000	22,700	118.7	16.4	16.4	90.6	.36	19	23,600	145.2	16.6	3.7	94.1	.23	SC	
Cargill	HL1	22,000	21,600	125.8	18.3	9.7	88.6	.25	880	20,600	149.3	19.3	2.9	84.3	.19	SC	
Bq-Jac	HL345	20,000	19,500	111.0	18.7	23.9	87.5	.32	X22	21,000	143.2	20.0	12.5	94.1	.22	3WC	
P-A-G	50002	22,000	21,000	124.4	19.8	12.3	86.1	.23	SX53	21,800	149.8	18.2	0.0	89.3	.23	SC	
Ruff's	RX94A	23,000	18,700	121.4	20.1	15.4	74.6	.27	RX94A	20,800	142.4	21.3	10.0	83.0	.24	SC	
Pfister	466	20,000	20,600	116.1	20.5	3.4	89.4	.30	1032	21,200	145.6	19.6	3.3	92.0	.22	SC	
Funk's	24559	22,000	19,300	103.0	20.5	6.2	79.0	.31	G-4465	21,500	147.3	19.8	4.4	88.2	.21	DC	
Voris	V2563L	20,000	17,900	126.3	20.5	10.0	77.7	.31	V2563	19,300	146.2	19.5	7.8	84.1	.22	3WC	
Crow's	HL630	22,000	20,800	129.7	20.6	15.5	85.3	.26	No normal counterpart							SC	
Landmark	C722XHL	22,000	20,600	124.3	20.7	16.0	84.3	.27	C722X	20,300	138.2	18.2	9.1	83.2	.24	3WC	
Migro	M-HL653	22,000	21,000	120.9	21.1	15.2	86.1	.27	No normal counterpart							SC	
Pioneer	L3516	24,000	25,000	143.8	21.1	10.5	94.4	.33	3516	24,700	165.0	20.2	4.7	93.1	.22	SC	
Crow's	HL619	24,000	21,300	120.8	21.3	7.0	80.3	.28	618	23,700	159.3	21.9	12.3	89.5	.20	SC	
Ruff's	RX94	22,000	22,100	135.7	23.6	10.3	90.3	.35	RX94	19,900	133.1	19.6	14.0	81.4	.30	3WC	
Pioneer	L3369	22,000	22,000	138.7	23.8	12.7	90.0	.29	3369A	21,900	170.2	21.8	7.9	89.6	.21	SC	
Voris	V2642L	20,000	18,600	131.9	27.9	4.3	80.7	.29	V2642	20,700	165.0	24.6	1.7	90.2	.26	SC	
Average of all entries				124.3	20.6	12.3	85.3	.30					149.8	19.9	6.8	87.9	.23
LSD <sup>5/</sup> (.05)				15.6	1.3					15.0	.8						

1. Separate plot comparisons.
2. As indicated by Producer
3. Percent lysine per unit weight of whole kernal corn
4. SC-Single Cross; 3WC-Threeway Cross; DC-Double Cross
5. When comparing 2 hybrids, a difference greater than the Least Significant Difference (LSD) indicates that the odds are 19 to 1 that this is a real difference between the hybrids and not due to chance variation (such as soil variation, etc.).

SOURCE: Jordan, D.M., Ohio Corn Performance Test, 1973, Agronomy Department, Series 215, OARDC, Ohio Cooperative Extension Service, Ohio State University, December, 1973.

The high-lysine corns averaged .07 percent more lysine than normal hybrids. Lysine content of the normal hybrids averaged .23 percent, with individual hybrids ranging from .19 to .30 percent. The high-lysine hybrids averaged .30 percent lysine, with individual hybrids ranging from .23 to .36 percent. There currently appears to be more variation in the lysine contents of samples of high-lysine corn, perhaps more so than is true of normal corn. It's more critical to know the lysine content when feeding high-lysine corn so that diet formulation can be more accurate. Furthermore, cross-fertilization with normal hybrid corn varieties may result in only normal levels of lysine in the high-lysine corn. The farmer should have a reputable laboratory analyze the corn for its lysine content to determine the feeding value of this corn.

Since no market exists for high-lysine corn, hog producers wanting to feed high-lysine corn would need to raise or contract their own corn source. This publication provides information which swine producers can use to evaluate the economics of raising high-lysine corn for hogs.

#### Ration and Feed Requirements

Feeding trials have not yet resolved all the questions concerning the problems of feeding hogs high-lysine rather than normal corn. However, most research results have indicated little or no difference in feed lot performance between the two types of corn, providing that the diets are balanced for amino acids.

To evaluate the economic value of feeding high-lysine corn, complete grower and finisher diets were formulated and compared (Tables 2 and 3). The

Table 2. Grower and Finisher Diets For Swine With Normal Corn and With High-Lysine Corn of Varying Lysine Content

Feed Ingredient	Grower Diets (% lysine of corn) <sup>a</sup>				Finisher Diets (% lysine of corn) <sup>b</sup>			
	Normal Corn	High-Lysine Corn			Normal Corn	High-Lysine Corn		
	.24	.30	.35	.40	.24	.30	.35	.40
	(pounds per ton mix)							
Corn	1,515	1,595	1,620	1,655	1,690	1,730	1,765	1,800
Soybean Meal, 44%	430	350	325	290	260	215	180	150
Vitamin-Mineral Additions (See Table 3)	57 <sup>c</sup>	57 <sup>c</sup>	57 <sup>c</sup>	57 <sup>c</sup>	54 <sup>d</sup>	54 <sup>d</sup>	54 <sup>d</sup>	54 <sup>d</sup>

a. To be fed from 40 - 120 pounds

b. To be fed from 120 - 200 pounds

c. Vitamin-Mineral No. 1 or No. 2 (Table 3)

d. Vitamin-Mineral No. 3 or No. 4 (Table 3)

Table 3. Vitamin - Mineral Additions to Swine Diets<sup>a</sup>

	<u>Grower Diets</u>		<u>Finisher Diets</u>	
	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>
	(pounds per ton mix)			
Dicalcium phosphate <sup>b</sup>	20.0	--	24.0	--
Monocalcium phosphate <sup>c</sup>	--	18.0	--	21.0
Limestone	20.0	23.0	16.0	20.0
Trace-mineral salt	10.0	10.0	10.0	10.0
Ohio Swine Vitamin premix 100 <sup>d</sup>	2.0	2.0	2.0	2.0
Antibiotic <sup>e</sup>	<u>5.0</u>	<u>5.0</u>	<u>2.0</u>	<u>2.0</u>
TOTAL	57.0	58.0	54.0	55.0

a These additons should not be premixed since the stability of the vitamins may be of short duration

b Dynafos:Calcium = 20-24%; Phosphorus = 18.5%

c Biofos:Calcium = 15-21%; Phosphorus = 21%

d The composition of this premix can be obtained from the Animal Science Department, O.S.U. or OARDC. Many commercial swine vitamin supplements may be substituted, but at the quantity indicated by the manufacturer.

e The quantity and type of antibiotic used will vary; The level indicated in this table is to promote growth and not for the control of disease.

grower diet is to be fed from 40 to 120 pounds. With both types of corn (normal and high-lysine), it is assumed that the pigs will gain 1.5 pounds per day and consume 2.75 pounds of feed per pound of gain during this growing period. The finisher diet is fed from 120 to 200 pounds, with 1.8 pounds of gain per day, and 3.8 pounds of feed per pound of gain. The average lysine content is .24% for normal corn. The high-lysine corn diets evaluated will contain varieties with a low (.30), medium (.35), and high (.40) analysis of lysine. Thus, each producer can use the diets in Tables 2 and 3 to evaluate his situation using the results of the analysis on his corn. The effect of feeding the high-lysine corn diets over the entire feeding period is that each pig will consume more corn and less soybean meal. Reductions in soybean meal consumption per pig are 15.6 pounds for low, 23.9 pounds for medium, and 32.2 pounds for the high high-lysine corn diets.

#### Feeding Value of High-Lysine Corn

The substitution of corn for soybean meal (or other protein feeds) in the diet means that overall feed costs may be reduced, since corn is lower priced than soybean meal. Alternatively we can determine the value of high-lysine corn compared to normal corn.

To illustrate this, changes in corn and soybean meal consumption per pig will be used to calculate a value for .35% high-lysine corn (Table 4). A pig, fed the normal corn diet from 40 to 200 pounds would consume a total of 7.55 bushels of corn and 86.8 pounds of soybean meal. With corn at \$3.00 per bushel, and soybean meal at \$200 per ton, the cost of the feed would be \$31.33. Using the medium (.35%) high-lysine corn diet only 62.9 pounds, or

Table 4. - Determining the Feeding Value of 0.35 Percent High-Lysine Corn      Example for a Reg Fed From 40 to 200 Pounds

1. 7.55 bushels of normal corn @ \$3.00	\$22.65
2. 86.8 pounds of soybean meal @ \$200 per ton	<u>8.68</u>
3. Feed Cost of normal corn diet (1+2)	\$31.33
4. Amount of soybean meal needed with 0.35% high-lysine corn 62.9 pounds of soybean meal @\$200 per ton	<u>6.29</u>
5. Value remaining for 7.97 bushels of high-lysine corn (3-4)	\$25.04
6. Value of high-lysine corn per bushel (5 ÷ 7.97 bushels)	\$ 3.14

\$6.29 worth, of soybean meal would be needed. Subtracting the \$6.29 cost of soybean meal from the total cost of \$31.33 for the normal corn diet leaves \$25.04 for the value of the 7.97 bushels of high-lysine corn. Thus high-lysine corn containing 0.35% lysine would have a feed value of \$3.14 per bushel.

It can be seen that the feeding value of high-lysine corn is dependent on both the price of corn and the price of soybean meal. Figure 1 illustrates the feeding value of .35% high-lysine corn for various prices of corn and soybean meal. Higher soybean meal prices for any price of normal corn increases the value of high-lysine corn. In the example above, .35% high-lysine corn had a value of \$3.14 per bushel. But with normal corn at \$3.00 per bushel and soybean meal at \$400 per ton, the value of high-lysine corn increases to \$3.44. However, as the price of normal corn increases, the values of high-lysine

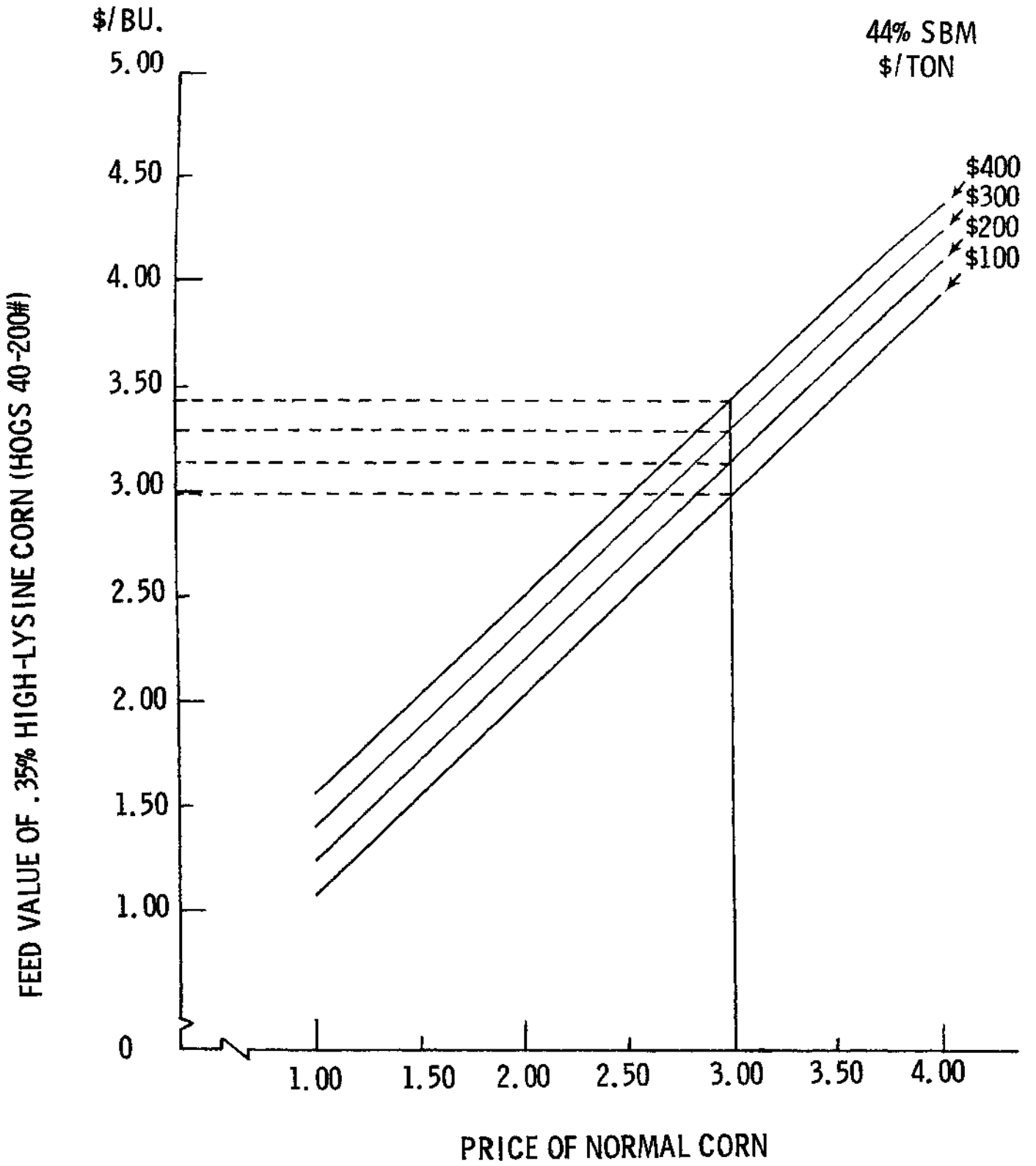


Figure 1. Feed Value of .35% High-Lysine Corn for Growing and Finishing Hogs Related to Market Prices of Normal Corn and 44% SBM



and normal corn become closer together. For example, with soybean meal at \$200 per ton and normal corn at \$2.00 per bushel .35% high-lysine corn is worth \$2.19 per bushel, 19 cents more per bushel. If normal corn is \$4.00, high-lysine is worth \$4.09, only 9 cents per bushel above normal.

#### What About Potential Yield Loss?

Estimates of the feeding value of high-lysine corn would be useful if it could be purchased in the market. But, there is no separate market for high-lysine corn. So interested farmers must raise or contract to have their own high-lysine corn. The higher feeding value of these diets (through reductions in high-protein feeds such as soybean meal) allow profit to be maintained even at lower yields for some price levels of corn and soybean meal. Thus, the question becomes: How much lower yield can I accept from high-lysine corn?

Relating the feeding value of high-lysine corn to the market value of normal corn determines the percentage yield necessary for high-lysine corn to be as profitable as raising normal corn (Figure 2). In other words, what percent lower yield is acceptable from raising high-lysine corn and still be as profitable as raising normal corn on that same acreage and feeding the corn to hogs? The breakeven yields are dependent on the lysine content of the corn, the price of normal corn, and the price of soybean meal. With corn at \$3.00 per bushel and soybean meal at \$100 per ton, .35% high-lysine corn must yield 100 percent of normal corn for profits to be equal. But with soybean meal at \$200 per ton, the breakeven yield drops to 95 percent. This means that if soybean meal costs \$200 per ton and corn at \$3.00 per bushel, raising and feeding .35% high-lysine corn to hogs will increase profit if

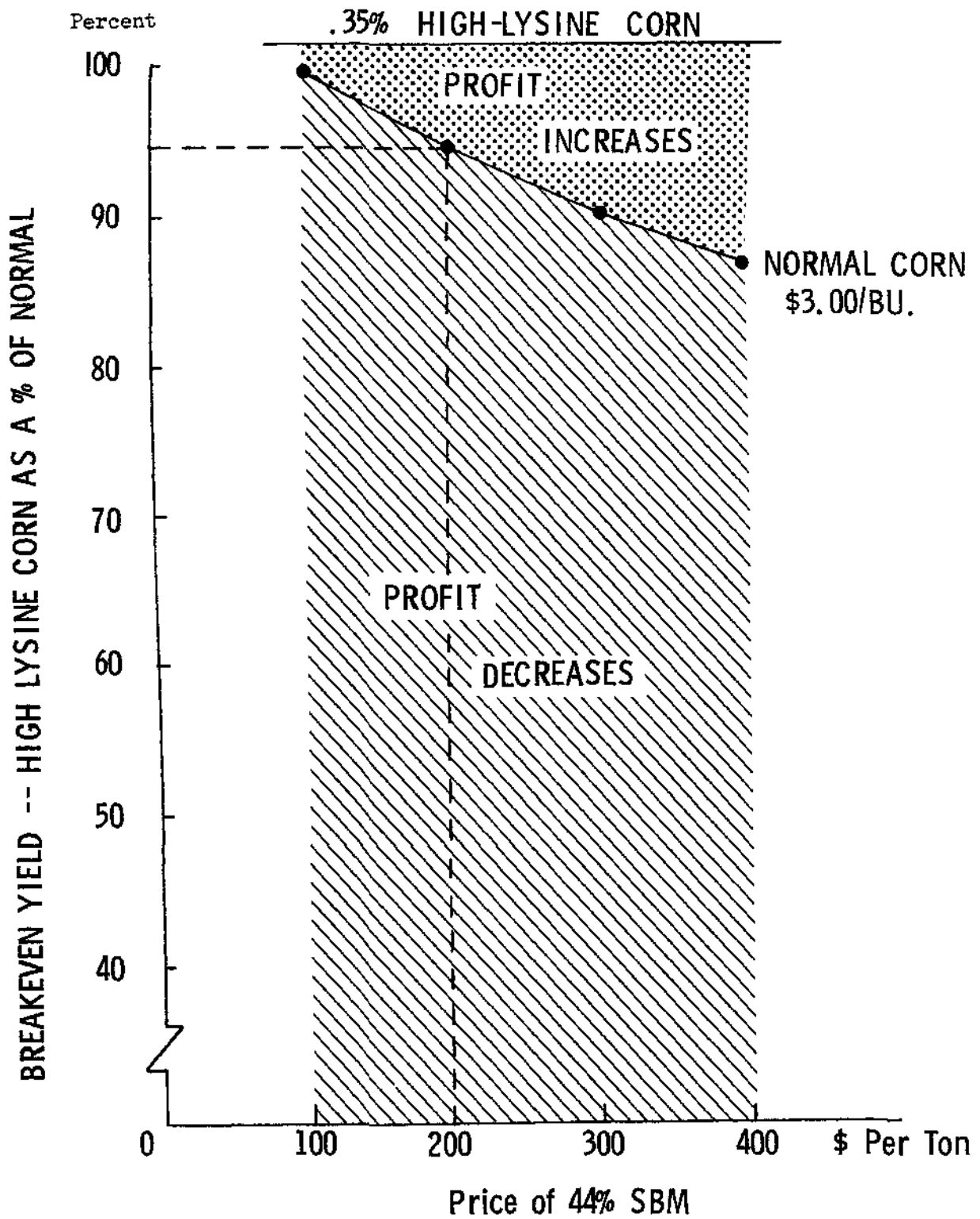


Figure 2. Percent Yield Needed With .35% High-Lysine Corn To Equal \$3.00 Per Bushel Normal Corn For Growing and Finishing Swine

the yields of high-lysine corn are 96 percent or more of the yield of normal corn. Likewise, profits will be lowered if yields are 94 percent or less of those from normal corn. Alternatively, .35% high-lysine corn will reduce profits of pork producers unless it yields within 5% of the yields of normal corn. If 100 bushels per acre is your average, you could accept 95 bushels per acre; if your average is 150 bushels, you could accept 142.5 bushels per acre. This, of course, is dependent on feeding all the high-lysine corn to hogs.

Breakeven yields are presented for 4 price levels of corn, 4 price levels of soybean meal and three lysine contents of high-lysine corn so that each individual farmer can evaluate (Figure 3) his own situation. (The high-lysine corn planted one spring will be largely fed during the following year). Thus, to use this information, hog producers need to estimate what corn and soybean meal prices will be in the next feeding year. Estimates are that corn will be about \$3.00 per bushel and \$200 per ton for soybean meal (44%) for 1976. Such price levels would mean high-lysine corn must yield within 4 to 6 percent of normal corn to be an acceptable substitute.

#### Do Lower Yields Mean Less Total Profits?

High-lysine corn generally results in lower yields per acre. At the same time consumption of corn per pig is greater than for normal corn. Thus fewer pigs can be produced from one acre of corn. Does this mean that total farm profit will be lower? No, the breakeven points shown in Figures 2 and 3 also hold for total farm profit. The reduction in feed costs per pig offsets the cost of additional corn that must be raised or purchased to allow the same

Breakeven Yield Percent For --

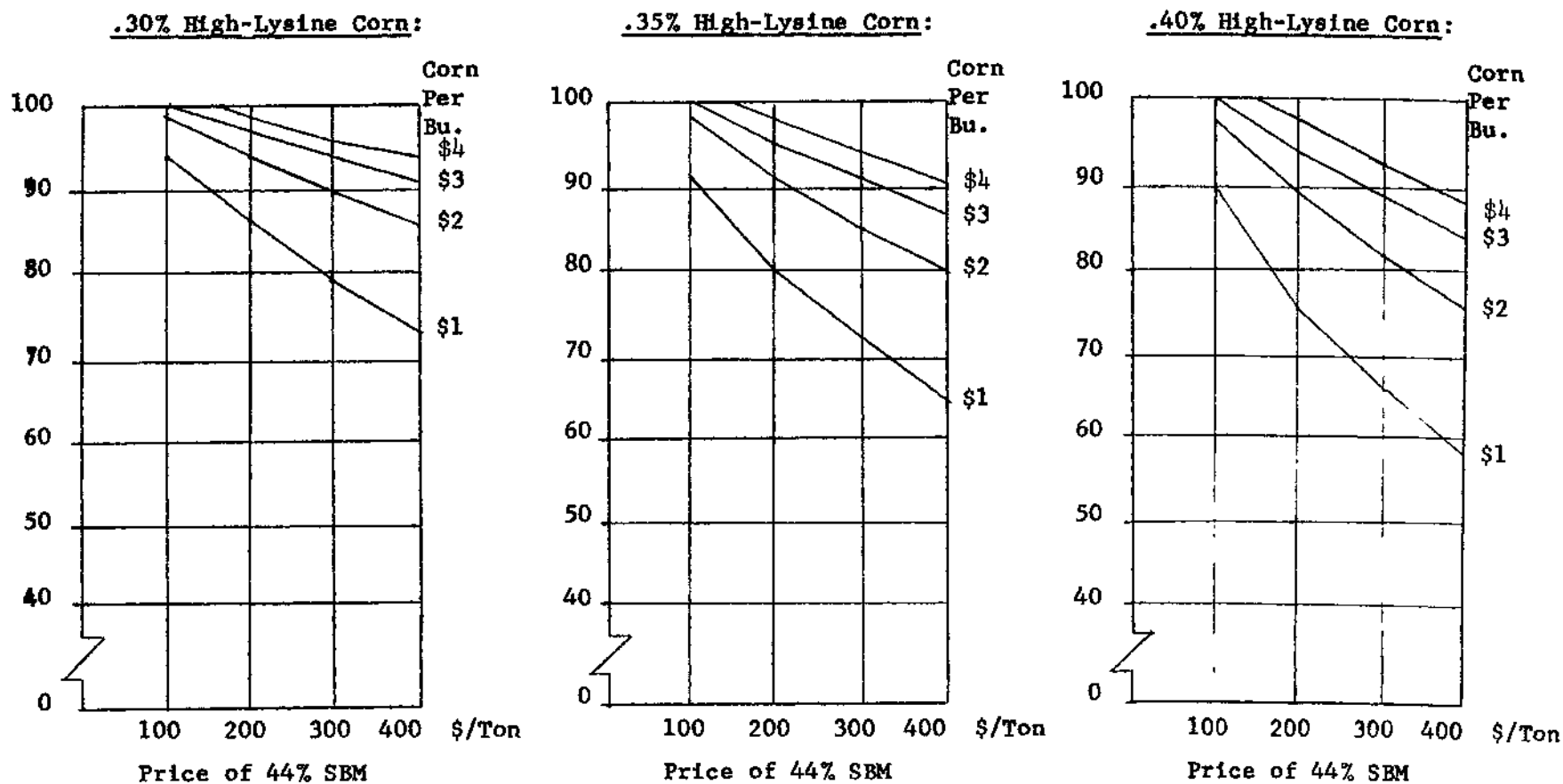


Figure 3. Percent Yield Needed With High-Lysine Corn To Be As Profitable As Normal Corn For Growing and Finishing Swine, For Varying Levels of Lysine Content, Prices of Corn, and Prices of 44 Percent Soybean Meal.

number of pigs to be marketed. If you expect to purchase additional corn, the corn prices refer to the purchase price of corn. If you will need additional acreage to provide the additional corn, the price of corn to consider is the net price you receive for corn sold.

The following example illustrates this for a single acre of corn, yielding 125 bushels per acre of normal corn (Table 5). Additional corn must be purchased. Table 3 indicates that if prices are expected to be \$3.00 per bushel for corn and \$200 per ton for 44% soybean meal, 95 percent or 119 bushels of .35% high-lysine corn is just as profitable as a 100 percent yield or 125 bushels of normal corn.

One hundred twenty-five bushels of normal corn provides feed for 16.55 pigs. The 119 bushels of .35% high-lysine corn is only enough to feed out 14.97 hogs. Additional corn must be purchased to feed out another 1.58 head. In both cases, appropriate quantities of soybean meal, minerals, and other feed ingredients must be purchased.

There appears to be little difference in the agronomic cost of raising high-lysine or normal corn, so these costs are reported as equal. Likewise, if the same number of hogs are sold, total income is the same regardless of the price of the hogs. Thus, what it comes down to is a comparison of the cost of soybean meal needed to feed out 16.55 hogs on 125 bushels of normal corn with the cost of soybean meal and additional corn needed to feed out 16.55 hogs on 119 bushels of .35% high-lysine corn. These costs are essentially identical.

Table 5 also indicates that if the yield loss for raising high-lysine corn equals that shown in Figure 3 for given prices of corn and soybean meal,

Table 5. Calculations Showing Equal Returns Above Feed Costs

Item	Type of Corn Produced	
	Normal	High-Lysine
Normal Corn @ \$3.00/Bu. 44% Soybean Meal @ \$200/Ton	Normal Corn @ 125 Bu./A. .35% High-Lysine Corn @ 119 Bu./A.	
Yield Per Acre	125 Bu.	119.3 Bu.
Corn Per 200 lb. Hog	7.55 Bu.	7.97 Bu.
Hogs Per Acre	16.55	14.97
<u>Income</u>		
If producing normal corn		
16.55 hogs fed normal corn @ \$70	\$1,158.50	
If producing high-lysine corn		
14.97 hogs fed high-lysine corn @ \$70	}	\$1,158.50
1.58 hogs fed normal corn @ \$70		
<u>Feed Expense</u>		
Variable cost per acre of corn	145.00	145.00
Cost of soybean meal, minerals and vitamins:		
If producing normal corn		
16.55 hogs fed normal corn @ \$9.73	161.03	
If producing high-lysine corn		
14.97 hogs fed high-lysine corn @ \$7.34		109.88
1.58 hogs fed normal corn @ \$9.73		15.37
Additional corn purchased:		
If producing high-lysine corn		
1.58 hogs @ 7.55 bu./hog @ \$3.00/bu.		<u>35.79</u>
TOTAL FEED EXPENSE	\$306.03	\$306.04
<u>Return Above Feed Cost</u>	\$852.47	\$852.46

profit per acre will be the same for either normal or high-lysine corn. If yield loss is less, high-lysine corn will lead to increased profit; if yield loss is greater, raising high-lysine corn will result in lower profits. The unknowns are still potential differences in yield and future prices of corn and soybean meal.

#### Other Considerations

Available evidence led this comparison to be based on equal feed lot performance for both normal and high-lysine corn. However, some experiments have shown slightly greater feed efficiency for high-lysine rations. If further research shows consistent increase in feed efficiency for high-lysine rations, somewhat greater yield losses would then become acceptable.

Many hog producers have different levels of feed efficiency than the ones used in this study. Would increased or decreased feed efficiency alter these comparisons? No, the relative feed values of normal and high-lysine corn would still be the same. But, use of more or less feed per pound of gain will affect profits on an individual farm.

Other problems with high-lysine corn must be kept in mind. It is a fine textured corn that results in a powdery meal when ground. This can create problems of bridging in self-feeders, but this can be overcome by grinding the corn more coarsely and by careful management.

Another problem is possible contamination of this corn with normal corn varieties at the time of pollination. If the high-lysine corn is not grown in isolation, the lysine content and feedlot performance may actually be similar to that of normal corn. It should again be emphasized that lysine analyses should be conducted on each field of high-lysine corn.

Soybean meal (44%) was used as the major protein source in this comparison, but other protein sources could also be evaluated.

Many swine producers do not mix their own rations and purchase a commercial supplement. Since less protein supplement will be needed per ton of feed, it should be emphasized that the vitamin and mineral levels in these commercial supplements need to be elevated in order to balance the diet. Recent swine feeding research at the Western Branch, OARDC demonstrates that the supplemental mineral levels should be increased by 50% or to a calcium level of 4.0% and phosphorus of 2.7%. Trace minerals and vitamin fortification should also be increased by the same percentage.

#### Summary

The price of corn, price of soybean meal (or other protein source), lysine content, and loss in yield for high-lysine corn are the key variables affecting the feeding value of high-lysine corn for swine. Farmers can use the information presented in this publication to decide if they should consider raising high-lysine corn in future years. Current outlook estimates indicate greater upward pressure on corn and feed grain prices, than on prices of protein supplements. Thus farmers should probably anticipate only small (4-10 percent) reductions in yield from high-lysine corn compared to their normal counterpart if they expect to achieve equal profits from their hog enterprise.

When the price of protein is high relative to corn, larger yield reductions can be taken and profits still be increased. However, farmers need to remain alert to future developments in raising and feeding high-lysine



corn, as well as price expectations, so as to take advantage of opportunities that may arise to profitably use high-lysine corn.