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RP92-217 No. 19 Cost of Grain Storage

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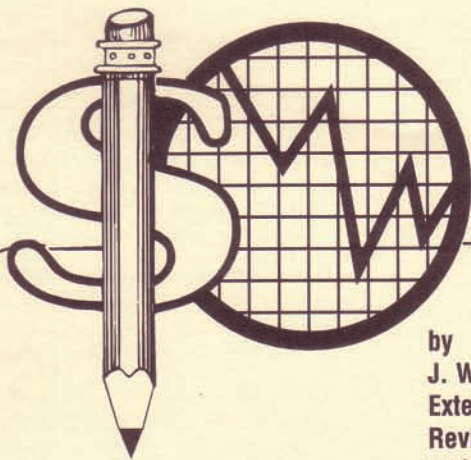


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Cost of Grain Storage

Producer Marketing Management
Fact Sheet #19

by
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Grain marketing decisions are among the toughest the farm owner/operator or manager must make. Grain producers store grain to speculate on receiving higher prices, earn a return above storage costs, or to take advantage of government programs. Prices must increase enough to cover the additional costs, or forward contract prices must exceed current prices by more than the cost of storage in order to justify forward pricing. The gain in prices received can come from both changes in price level and changes in basis.

Storage costs are greater than many farmers realize. This may result from not accounting for interest foregone on the stored grain (opportunity costs) and from the fact that grain shrinkage is not evident if grain is not weighed when stored.

In deciding when to market grain a producer has two basic choices:

- 1) sell for harvest delivery, or
- 2) store for later sale.

If he chooses to store, then he has a choice between:

- 1) on-the-farm storage, and
- 2) commercial storage.

The decision to store grain and/or to rent or build storage facilities touches off a whole series of related decisions. These include:

- 1) When to price the grain;
- 2) Whether to feed it to livestock;
- 3) Whether to take a government loan or participate in the Farmer Owned Reserve (if eligible);
- 4) What type of marketing alternative best fits the current market situation.

If the farmer chooses not to store grain, there are several marketing alternatives. These include the following:

- 1) (Cash) sale
- 2) Forward price for harvest delivery
- 3) Delayed payment
- 4) Deferred pricing (DP)
- 5) Basis contract
- 6) Hedged-to-arrive
- 7) Sell cash—buy futures
- 8) Hedge for harvest delivery
- 9) Use of the minimum price contract
- 10) Sell cash—buy call options
- 11) Forward contract—buy call options

Storage Bin Costs

The construction cost of storage space varies with the type and size of structure. In 1992, the investment in steel bins erected on a concrete foundation and floor ranged from 80 cents to over \$1 per bushel, depending upon the size of the bin. Small bins and flat storage are usually most expensive. There are economic advantages in having more than one bin—because this allows flexibility in storing more than one crop or type of grain. Conditioning and handling facilities can add an additional 20 to 40 cents per bushel to storage facility costs.

Cost of On-Farm Grain Storage

Storing and conditioning grain on the farm involves both fixed and variable costs. You can use the form, "Calculating Your Storage Costs," to help you calculate the cost of storing grain. For your convenience, this publication includes a partially filled-out version of the form (Form A, pp. 5-6) you can use as an example, as well as a blank version (Form B, pp. 7-8).

Annual fixed ownership costs include depreciation, taxes, insurance, and interest on the investment in facilities and equipment. Once you invest in a bin and the related equipment, the farm business incurs the fixed costs each year until all of the depreciation is recovered. You can use the first section of "Calculating Your Storage Costs" to calculate annual ownership costs.

Certain costs are incurred only when holding grain. These are known as "variable costs." The major variable costs are associated with the interest cost of holding grain and the cost of keeping the grain in good condition. These include the value of the moisture and dry matter shrinkage, insurance, and repairs. You can use the second section of "Calculating Your Storage Costs" to calculate variable costs.

NCR Extension Publication No. 217



Interest

The largest cost incurred in storing grain may be interest on the value of stored grain. This may be the cost of borrowing money or the alternative return that could be earned on another investment if the grain were sold. The cost varies with the length of time the grain is in storage and the value of the stored grain.

Interest cost depends upon the value of the grain and the length of time the grain is put in storage. The interest "cost" may be an actual cash cost, or it may represent an "opportunity cost" of not having the funds available from the sale of stored grain to invest elsewhere.

For a farmer who has an outstanding loan used to pay for fertilizer, fuel, and other operating supplies, interest on grain stored and not yet sold represents a cash cost. For an established farmer with high equity, grain storage offers a means of earning money on surplus capital. To maximize income, the producer must compare earnings for capital invested in stored grain with other alternatives both on and off the farm.

When grain is stored under Commodity Credit Corporation (CCC) loan, interest may not be a cost of holding the grain. The CCC loans are non-recourse loans. This means that, regardless of current market value of grain, the grains may be forfeited at maturity for the amount of the loan and with no interest charges. However, if the loan is redeemed prior to maturity, that is, the loan repaid and possession of grain regained, the amount of the loan plus all interest accrued to date must be paid. If a producer places grain under loan with the expectation of repaying the loan, the interest cost should be calculated beforehand so that a meaningful marketing strategy can be developed.

Extra Handling

The storage of grain on the farm involves an extra handling that is not incurred if the grain is sold at harvest. The extra labor and physical loss involved are typically estimated at 1 to 2 cents per bushel. (See Table 1.)

Additional Charges

There are additional costs arising due to storage of grain that may vary from farm to farm. For example, farmers have a choice of whether to insure grain in storage. If insurance is purchased, there may be a special policy covering wind, fire, and theft. The more likely situation is to cover the grain under a blanket multi-peril policy already on the farm business, and increase the coverage to include the value of the stored grain.

Some states have personal property taxes on stored grain. If grain is stored over the following summer, there may be extra conditioning costs.

Extra Shrink and Drying

Drying and/or aeration expenses for feed grains can be expensive due to high moisture content at harvest. These potential additional costs can have an impact on the marketing strategies chosen. The cost of bringing the grain into storable condition must be compared to the discount for selling higher moisture grain and the seasonal price increase expected.

Stored grain is a living organism. If the temperature and moisture conditions are right, the grain will heat (respire) and attempt to grow (spoil). Following good warehouse policies to maintain grain quality is critical. If the grain is allowed to "go out of condition," the discounts assessed for poor quality grain will likely be much larger than the price rise expected when the grain was placed in storage.

If corn is to be kept into the summer months, the moisture content must be reduced to 13 percent to increase the storability. The extra drying reduces the physical quantity available to be sold and adds to the drying cost. (See Table 2.) Typically, there are no premiums for corn with less than 15 percent moisture. This means an additional price level increase is needed to compensate for the smaller number of bushels sold.

Total On-Farm Storage Costs

Table 3 indicates that the total cost for storing corn on the farm at a \$2 per bushel harvest price for one month is 20 1/2 cents; for 9 months it could be 44 cents per bushel of dry corn sold. In the case of soybeans at \$6 per bushel (Table 4), the range is 20 cents for one month to 61 cents per bushel for 9 months. For wheat at \$2.50 per bushel (Table 5), the range is 16 cents for one month to 33 cents per bushel for 9

months. These are total costs. Most storage decisions are made on variable costs.

There is a difference between cash flow costs in a farm business and long-run costs. A twenty-year period is used for depreciation—yet the bin must be paid for in a much shorter time. Also, if properly maintained, a steel bin will last longer than 20 years.

Once the decision to erect a bin has been made, the farm business incurs the fixed cost of the bin each year until it is depreciated. This occurs whether the bin is used or stands empty. Once the bin is in place, the storage decision can be made by comparing only "variable costs" with the expected price rise in grain or the higher bid for later shipment.

Commercial Storage Costs

Charges for commercial storage typically consist of two parts: 1) a fixed fee that covers the period from harvest and the following 2-4 months and 2) a variable fee that begins after the time the fixed fee expires. For example, a typical storage charge for corn in some areas is a 15-cent minimum charge that covers the period from harvest until January 1 of the following year. Then the variable charge may be 1 1/2 to 2 cents per month for each additional month and part thereof. Some firms charge a daily fee for variable charges. Storage charges for soybeans and wheat are typically higher than for corn. Commercial storage charges tend to reflect the net income to an elevator that could be derived through other alternative uses of its storage space.

Commercial storage rates must be published by the firm storing grain. While competition and tradition may

Table 1. Interest Costs Per Bushel for 6 Months Storage at Various Grain Prices and Interest Rates, Cents Per Bushel*

Cost per Bushel	Interest Rates			
	8%	10%	12%	14%
	Cents per Bushel			
\$2.00	8.0	10.0	12.0	14.0
2.50	10.0	12.5	15.0	17.5
3.00	12.0	15.0	18.0	21.0
3.50	14.0	17.5	21.0	24.5
4.00	16.0	20.0	24.0	28.0
5.00	20.0	25.0	30.0	35.0
6.00	24.0	30.0	36.0	42.0
7.00	28.0	35.0	42.0	49.0
8.00	32.0	40.0	48.0	56.0
9.00	36.0	45.0	54.0	63.0

*To calculate costs for other time periods, using the above data:
 For 2 months divide by 6
 For 3 months divide by 2
 For 9 months multiply by 1.5
 For 1 year multiply by 2

be major factors in establishing storage charges, they are typically higher than variable on-farm storage costs because they try to cover fixed costs. This is particularly true for long-term storage. Some private elevator firms do not offer commercial storage to farmers because they can obtain greater returns by using the storage to hedge grain and obtain a profit from the change in the basis. Government storage programs also offer greater returns to commercial facilities than farmers are willing to pay. Bargain rates for storage are sometimes used to attract additional volume. Grain stored at a particular elevator is likely to be sold at the elevator where it is stored—unless the producer is willing to pay an “out charge” in order to truck the grain to another elevator.

Grain stored at an elevator is subject to the rules established by that firm. This is likely to mean “pencil shrinking” corn to 14-percent moisture (using 1.3 to 1.4% shrink for each 1% moisture reduction) and incurring extra drying charges or discounts if the moisture content is higher than allowed, i.e., 14 percent.

The commercial storage charge covers the bin cost, insurance, extra handling, and any losses and/or damage incurred in storage. The interest on the investment in grain held in off-farm storage is the same as that for grain stored on the farm, and this cost is absorbed directly by the farmer.

An often overlooked factor is the long-term prospects for on-farm vs. off-farm storage charges. Over time, one can expect elevator charges to increase to reflect current costs and alternative uses. Most farm storage costs remain fixed. Thus the differences in storage costs between farm and commercial storage may widen over a period of years. You can use the last section of “Calculating Your Storage Costs” when considering on-farm vs. off-farm storage costs.

Summary

The decision of whether to utilize existing farm storage, build new farm storage, or use commercial storage is not a clear-cut decision where one solution fits all situations. Each producer must evaluate his own situation and alternatives. If farm storage is already available, it will most likely be used instead of commercial storage.

High interest rates (which affect carrying costs) and narrow (strong) harvest basis favor short-term storage. Costs incurred in storing grain cannot be avoided. Profits from storage hinge on making good price forecasts, choosing the appropriate marketing alternatives, and maintaining the quality of stored grains.

With storage the producer has expanded the time of marketing (pricing) to cover a two-year period. There are advantages and disadvantages to storage and the location of storage.

Table 2. Bushels of Grain Remaining When 1,000 Bushels of Corn Are Dried to Selected Moisture Levels with Invisible Shrink Computed at .5 Percent

Beginning Moisture (percent)	Ending 13.0	Moisture 14.0	Level 15.0
13.0	1,000		
13.5	989.3	1,000	
14.0	983.5	989.2	
14.5	977.8	989.2	
15.0	972.0	983.4	
15.5	966.3	977.6	1,000

When 1000 bushels of No. 2 corn at 15.5 percent moisture are dried to 13 percent, for long-term storage, there is a shrinkage loss of 33.7 bushels (1000 - 966.3). The value of the shrinkage depends upon the cash price level. With corn at \$2.00 per bushel the loss = \$67.40 (per 1000 bushels) or 6.74 cents per bushel. This has to be recovered by a rise in cash prices if the producer is to make money.

Table 3. Farmer Costs of Storing and Holding Shelled Corn from Harvest to Varying Delivery Times¹

Cost Item	Months Grain Stored			
	1	3	6	9
On-Farm Storage - - - - cents per bushel stored - - - -				
Storing				
Annual bin costs	17.5	17.5	17.5	17.5 ³
Extra handling labor and shrink	2.0	2.0	2.0	2.0
Total storing	19.5	19.5	19.5	19.5
Holding				
Insurance and conditioning	0.2	0.4	0.5	0.6
Interest @ 10% (\$2.00/bu)	1.7	5.0	10.0	15.0 ⁴
Extra shrink ² (15.5%)			4.5	6.7
Extra Drying			1.2	2.0
Total holding	1.9	5.4	15.7	24.3
Total storing and holding	21.4	24.9	35.2	43.8
Rented Elevator Storage				
Storage services (\$.15 min + \$.02)	15.0	15.0	21.0	27.0
Shrink (15.5% to 14%)	4.5	4.5	4.5	4.5
Interest @ 10%	1.7	5.0	10.0	15.0
Total storing and holding	21.2	24.5	35.5	46.5

¹Harvest price of No. 2 corn is \$2.00 per bushel.

²Value of shrinkage incurred in drying corn below 15.5 percent moisture.

³Actual cost will vary depending upon cost of bin, length of depreciation and interest rate used.

⁴Actual cost will vary depending upon value of grain, interest rate used and length of storage.

Advantages of Farm Storage

- 1) Avoids selling grain at a depressed harvest basis;
- 2) Avoids the harvest bottleneck of waiting to unload at the elevator;
- 3) Allows matching handling (conditioning) capacity

with harvest capacity to maintain control of the harvesting operation;

- 4) Allows capturing profits from conditioning—or avoiding excessive discounts for grain with excessive moisture;
- 5) Allows speculation on the price level—typically holding for seasonal price rise;

Table 4. Farmer Costs of Storing Soybeans from Harvest to Varying Delivery Times¹

Cost Item	Months Grain Stored			
	1	3	6	9
On-Farm Storage	--- cents per bushel stored ---			
Storing				
Annual bin costs	11.7	11.7	11.7	11.7 ²
Extra handling labor and shrink	<u>3.5</u>	<u>3.5</u>	<u>3.5</u>	<u>3.5</u>
Total storing	15.2	15.2	15.2	15.2
Holding				
Insurance and conditioning	0.2	0.4	0.5	0.6
Interest @ 10% (\$6.00/bu)	5.0	15.0	30.0	45.0 ³
Total holding	<u>5.2</u>	<u>15.4</u>	<u>30.5</u>	<u>45.6</u>
Total storing and holding	20.4	30.6	45.7	60.8
Rented Elevator Storage				
Storage services (\$.20 min + \$.03)	20.0	20.0	29.0	38.0
Interest @ 10%	<u>5.0</u>	<u>15.0</u>	<u>30.0</u>	<u>45.0</u>
Total storage costs	25.0	35.0	59.0	83.0

¹Harvest price is \$6.00 per bushel

²Actual cost will vary depending upon cost of bin, length of depreciation and interest rate used.

³Actual cost will vary depending upon value of grain, interest rate used and length of storage.

- 6) Increases the marketing alternatives and increases length of time available for marketing;
- 7) Allows participation in government storage (loan & FOR) programs;
- 8) Provides economic incentives in the form of fast depreciation and low interest loans for storage facilities.

Disadvantages of Farm Storage

- 1) Cost of purchasing and/or maintaining storage facilities;
- 2) Extra handling costs in moving grain, loss of grain, and conditioning;
- 3) Personal property tax liability on the storage facilities and possibly on the grain;
- 4) Extra cost associated with over-drying grain, which is necessary for long-term storage;
- 5) Responsibility for maintaining the quality of the grain;
- 6) Risk of pilferage—due to theft or insects and rodents;
- 7) Storage investment may limit alternative investments;
- 8) Need for additional skill in marketing to assure storage profits;
- 9) Fixed cost, which is incurred by the farm business whether bins are used or left empty;
- 10) Cost incurred by landlord on storage used by tenant without compensation. (Tenants may be reluctant to build a bin on the landlord's farm).

Advantages of Commercial Storage

- 1) Flexibility;
- 2) Investment the producer would have in storage bins which can be directed to other enterprises;
- 3) Shifting of responsibility for the condition (quality) of the grain from producer to elevator firm;
- 4) Opportunity to have a service at a busy time of the year;
- 5) Ability to sell grain at any time of the year—with just a phone call.

Disadvantages of Commercial Storage

- 1) Loss of depreciation and tax deductions for interest for income tax purposes.
- 2) Availability and quality of feed for livestock may be a problem;
- 3) Typically higher cost than farm storage;
- 4) Loss of flexibility of where to market—without paying "out" charges;
- 5) Potential cash flow problems if the elevator storing your grain goes bankrupt. (A farmer is usually an unsecured creditor. In case of a bankruptcy, a farmer may lose a crop or receive only a small fraction of its value. The case may be several years old before any settlement is made).

Table 5. Farmer Costs of Storing and Holding Wheat from Harvest to Various Delivery times¹

Cost Item	Months Grain Stored			
	1	3	6	9
On-Farm Storage	--- cents per bushel stored ---			
Storing				
Annual bin costs	11.7	11.7	11.7	11.7 ²
Extra handling labor and shrinkage	2.0	2.0	2.0	2.0
Total storing	<u>13.7</u>	<u>13.7</u>	<u>13.7</u>	<u>13.7</u>
Holding				
Insurance and conditioning	0.2	0.4	0.5	0.6
Interest @ 10% (\$2.50/bu)	2.1	6.3	12.5	18.7 ³
Total holding	2.3	6.7	13.0	19.3
Total storing and holding	<u>16.0</u>	<u>20.4</u>	<u>26.7</u>	<u>33.0</u>
Rented Elevator Storage				
Storage services (\$.15 + \$.02.5)	15.0	15.0	22.5	30.0
Interest @ 10%	2.1	6.3	12.5	18.7
Total storage costs	<u>17.1</u>	<u>21.3</u>	<u>35.0</u>	<u>48.7</u>

¹Harvest price is \$2.50 per bushel.

²Actual cost will vary depending upon cost of bin, length of depreciation and interest rate used.

³Actual cost will vary depending upon value of grain, interest rate used and length of storage.

Form A Calculating Your Storage Costs

Type of Grain _____ Year 19____ Number of Bushels _____

Annual Fixed (Ownership) Costs¹:

Item	Cost					
<u>Bu</u>	<u>\$ 10,000</u>	X	<u>12</u>	% fixed costs	=	<u>\$ 1,200</u> annual fixed costs
	<u>\$ 1,000</u>	X	<u>12</u>	% fixed costs	=	<u>\$ 120</u> annual fixed costs
	<u>\$ _____</u>	X		% fixed costs	=	<u>\$ _____</u> annual fixed costs
	<u>\$ _____</u>	X		% fixed costs	=	<u>\$ _____</u> annual fixed costs
	<u>\$ _____</u>	X		% fixed costs	=	<u>\$ _____</u> annual fixed costs

1. **Total Annual Fixed Costs** \$ 1,320
 2. **Annual Fixed Costs Per Bushel** (Line 1 ÷ no. of bu.) 13.2 ¢/bu

Annual Variable Cost: 6 Months for 10,000 Bushels

Utilities: (electricity, propane, etc.)	
Unloading Equipment	<u>\$ 50</u>
Drying and Aeration	<u>\$ 50</u>
Insecticide	<u>\$ 25</u>
Repairs @ 1.5% of original cost	<u>\$ 150</u>
Insurance on Grain	<u>\$ 50</u>
Shrinkage @ <u>1</u> %	<u>\$ 250</u>
Interest on Grain @ <u>6</u> % for <u>6</u> mos.	<u>\$ 750</u>
Taxes (on grain)	<u>\$ _____</u> (may not apply)
Other variable costs	<u>\$ 100</u>

3. **Total Annual Variable Costs** \$ 1,400

¹ Use formula:

D = depreciation	% of new cost
I = interest	5 = 20 year depreciation
R = Repair	6 = 12% annual interest rate
T = Taxes	<u>3</u>
I = Insurance	<u>14%</u>

4. Annual Variable Cost per bu. (Line 3 ÷ no. of bu.)	<u>14</u> ¢/b
5. Total Annual Farm Storage Costs per bu (Line 2 + Line 4)	<u>27.2</u> ¢/bu
6. Expected Price Increase During Storage	<u>30</u> ¢/bu
7. Added Income Above Farm Storage Costs (Line 6 less Line 5) (+ or -)	<u>3</u> ¢/bu
8. Commercial Storage Costs:	
a. Fixed charge for 3 month storage plus a variable charge	<u>15</u> ¢/bu
b. <u>2</u> ¢/mo. X <u>3</u> Months	<u>6</u> ¢/bu
c. Interest on Grain in Storage Price/bu. \$ <u>2.50</u> X <u>6</u> % int. X <u>3</u> mos.	<u>7.5</u> ¢/bu
9. Total Annual Commercial Storage Costs (Line 8a + Line 8b + Line 8c)	<u>28.5</u> ¢/bu
10. Added Income Above Commercial Storage Cost (Line 6 less Line 9)	<u>1.5</u> ¢/bu
11. Farm vs Commercial Storage (Line 7 less Line 10)	<u>1.5</u> ¢/bu

D. Leo Figurski, Kenneth L. McReynolds, and Don D. Pretzer, "On-Farm Grain Storage. Does It Pay?" Kansas State Cooperative Extension Service, C-610, September 1979

Form B
Calculating Your Storage Costs

Type of Grain _____ Year 19____ Number of Bushels _____

Annual Fixed (Ownership) Costs¹:

Item	Cost				
_____	\$ _____	X	_____ % fixed costs	= \$ _____	annual fixed costs
_____	\$ _____	X	_____ % fixed costs	= \$ _____	annual fixed costs
_____	\$ _____	X	_____ % fixed costs	= \$ _____	annual fixed costs
_____	\$ _____	X	_____ % fixed costs	= \$ _____	annual fixed costs
_____	\$ _____	X	_____ % fixed costs	= \$ _____	annual fixed costs

1. **Total Annual Fixed Costs** \$ _____
2. **Annual Fixed Costs Per Bushel** (Line 1 ÷ no. of bu.) _____ ¢/bu

Annual Variable Cost: _____ Months for _____ Bushels

Utilities: (electricity, propane, etc.)

Unloading Equipment	\$ _____	
Drying and Aeration	\$ _____	
Insecticide	\$ _____	
Repairs @ 1.5% of original cost	\$ _____	
Insurance on Grain	\$ _____	
Shrinkage @ _____ %	\$ _____	
Interest on Grain @ _____ % for _____ mos.	\$ _____	
Taxes (on grain)	\$ _____	(may not apply)
Other variable costs	\$ _____	

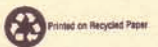
3. **Total Annual Variable Costs** \$ _____

¹ Use formula:

D = depreciation	% of new cost
I = interest	5 = 20 year depreciation
R = Repair	6 = 12% annual interest rate
T = Taxes	<u>3</u>
I = Insurance	14%

4. **Annual Variable Cost per bu.** (Line 3 ÷ no. of bu.) _____ ¢/bu
5. **Total Annual Farm Storage Costs per bu** (Line 2 + Line 4) _____ ¢/bu
6. **Expected Price Increase During Storage** _____ ¢/bu
7. **Added Income Above Farm Storage Costs** _____ ¢/bu
(Line 6 less Line 5) (+ or -)
8. **Commercial Storage Costs:**
- a. Fixed charge for 3 month storage _____ ¢/bu
plus a variable charge
- b. _____ ¢/mo. X _____ Months _____ ¢/bu
- c. Interest on Grain in Storage
Price/bu. \$ _____ X _____ % int. X _____ mos. _____ ¢/bu
9. **Total Annual Commercial Storage Costs** _____ ¢/bu
(Line 8a + Line 8b + Line 8c)
10. **Added Income Above Commercial Storage Cost** _____ ¢/bu
(Line 6 less Line 9)
11. **Farm vs Commercial Storage** _____ ¢/bu
(Line 7 less Line 10)

D. Leo Figurski, Kenneth L. McReynolds, and Don D. Pretzer, "On-Farm Grain Storage. Does It Pay?" Kansas State Cooperative Extension Service, C-610, September 1979



Issued in furtherance of Cooperative Extension work, Acts of Congress of May 8 and June 30, 1914, in cooperation with the USDA and Cooperative Extension Services of Minnesota, Missouri, Nebraska, North Dakota, Ohio, and South Dakota. H.A. Wadsworth, Director, Purdue University Cooperative Extension Service, West Lafayette, Indiana 47907.