Seed Selection:
Beyond Yield and Disease Resistance

Wheat Edition

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Selecting the right seed for your farm starts and stops with profitability. You want to select two or three varieties that are adaptable and will maximize yields on your farm. When selecting varieties, the top two criteria should be yield potential followed by disease resistance. Select high yielding varieties that are adapted to your soil type and production practices. Fusarium head blight (FHB) is the biggest disease problem facing the wheat industry. Varieties should be selected that have some resistance to FHB and other diseases.

Use data from the MSU Wheat Performance Trials, your local seed dealer, as well as your own experience with different varieties. Use data from multiple locations and multiple years. Varieties that perform consistently across locations are usually well adapted over a wide range of climates and conditions. Alternatively, evaluate data for testing locations nearest to you and your soil types. Make sure you consider at least three years of data for each variety. This will provide insight to how a variety performs over different weather scenarios. No two years are the same. Varieties that are consistently performing at the top indicate that they are well adapted to various climates.

Another key to profitability is also considering the economic returns related to seed and harvest costs. Those costs include seed purchases, test weight, falling number, moisture shrink loss, and drying charges.

Table of Contents

Cost Per Bag vs. Cost Per Acre

Identifying seed costs begins with knowing the price of an individual variety. Most types of seed are sold in fairly standardized units regardless of packaging (bag, tote or box). For wheat, seeds are sold in equivalents of 50 pounds per bag. However, there is an added variable of seed size, often described by how many seeds exist per pound. A 50-pound bag of wheat can vary from as much as 10,000 to 20,000 seeds per pound. The seed size (seeds per pound) is your first comparison point between variety options.

In the following example, local retailers are offering two varieties of wheat. Variety 1 is available in 50-pound bags with 15,000 seeds per pound. Variety 2 is also available in 50-pound bags but only has 10,000 seeds per pound. Variety 1 will cost $20 per bag, while variety 2 will cost $12.50 per bag.

Table 1. Example comparison of wheat varieties and prices.

Wheat Varieties	Seeds Per Pound	Price Per 50 lb. Bag
Variety 1	15,000	$20.00
Variety 2	10,000	$12.50

As Table 1 illustrates, variety 1 has a smaller seed size compared to variety 2 (5,000 more seeds per bag) but costs an additional $7.50. To fully understand the cost comparison, the desired planting population must also be considered.

Planting population, or planting rates of seeds per acre, do not often vary between wheat varieties. Instead, rates vary based on early planting months compared to late planting months. Early planting rates start at 1.2 million, while late planting rates can reach as high as 2.0 million seeds per acre. Therefore, if the two example varieties are planted in the same period, the planting rates would be identical. With identical planting rates, let's consider the cost differences between the wheat varieties in the previous example.

Table 2. Example comparison of planting rates on wheat variety costs.

Wheat Varieties	Price Per Bag	Seeds Per Pound	Planting Rate (Seeds Per Acre)	Bags Per Acre	Cost Per Acre
Variety 1	$20	15,000	1,400,000	(1,400,000 ÷ 15,000) = 1.87	($20 x 1.87) = $37.40
Variety 2	$12.50	10,000	1,400,000	(1,400,000 ÷ 10,000) = 2.80	($12.50 x 2.8) = $35.00

As Table 2 outlines, with a planting rate of 1,400,000 seeds per acre, 1.87 bags of variety 1 are needed to plant a single acre. At the same planting rate, 2.80 bags of variety 2 are needed to plant a single acre. At a cost of $20 per bag, the per acre cost of variety 1 is $37.40. In comparison, at $12.50 per bag, variety 2 has a cost per acre of $35.00.

With the addition of planting rates, only a marginal difference of $2.40 per acre exists between the two varieties. Which variety should you choose?

The answer lies in reviewing your farm's criteria for what it needs out of a wheat variety. Growth expectations, or factors, of how well a plant will produce harvestable grain are key components of seed selection. Growth factors become more important once you begin to look at the final cost per acre between varieties. In the above example, it can be assumed that growth factors are similar between the two varieties. If that were not the case, the choice could easily rest on which variety's attributes best meet your intended use or needs on the farm. Learn more about growth factors in Bulletin E-3505: How to Read a Seed Guide (Wheat Edition) (https://www.canr.msu.edu/resources/bulletin-e-3505-how-to-read-a-seed-guide-wheat-edition).

Harvest Cost Considerations

Harvest time costs can also be helpful when comparing wheat varieties. Commercial grain buyers will grade wheat bushels based on a number of factors. Factors can include test weight, moisture content, kernel damage, heat damage from drying, non-grain or foreign material, and falling numbers. Grain that is sold without meeting these standards is discounted by fee or reduced bushels. The most common and impactful with regard to seed selection are standard test weight, ideal storage moisture, and falling numbers.

Trial results will list testing results for these factors in each variety. When comparing varieties, it can be helpful to convert test weight, moisture levels, and falling numbers to potential discounts to give you an indication of harvest time costs across varieties. By combining seed costs with potential revenues, you can then identify varieties that will perform and be profitable for your farm. For more information on variety test trial data, review the Michigan State Wheat Performance Trials website: https://www.canr.msu.edu/varietytrials/wheat/.

Test Weight

Test weight is used to determine the standard volume of harvested grain. In the case of wheat, 60-pounds is used to determine the standard weight for each bushel. If test weight is below 60-pounds, less produced bushels exist compared to the standard. Conversely, if test weight is higher than 60-pounds, then more bushels exist.

Bushel adjustments can be made at grain elevators when delivering bushels for sale. However, shrink factors are often used as a replacement for adjusting delivered bushels on test weight. Test weight and moisture content are inversely related. Research indicates that the higher the grain moisture, the lower the test weight. Therefore, a shrink factor that adjusts wet bushels to dry bushels is considered a suitable adjustment for lower test weight. However, even if a test weight bushel adjustment is not made, a price discount for low test weight is still charged.

In most cases, most grain buyers don't begin to charge a fee until the test weight falls below 58 pounds. The discounts are typically based on a range between each pound of test weight (Table 3).

Table 3. Example Test Weight Discount Chart

	Range	Range	Range	Range	Range	Range
Test Weight	57.9-57.5	57.4-57.0	56.9-56.5	56.4-56.0	55.9-55.5	55.4-55.0
Discount Fee	$0.02	$0.04	$0.06	$0.08	$0.14	$0.14+

Once a discount fee is identified, it is subtracted from the initial sale price. The adjusted price calculation is illustrated as:

Initial Sale Price – Discount Fee = Adjusted Sales Price

Table 4. Example of a discount fee on wheat bushels with low test weight.

Wheat Varieties	Initial Sales Price	Test Weight	Discount Fee	Adjusted Sale Price
Variety 1	$4.80	57 lbs.	$0.04 per bushel	$4.80 - $0.04 = $4.76
Variety 2	$4.80	56 lbs.	$0.06 per bushel	$4.80 - $0.06 = $4.74

Table 4 illustrates where grain buyers would assess a discount fee on delivered bushels. Using an initial sale price of $4.80 per bushel, the final sale price on variety 1 is discounted by $0.04 per bushel to equal $4.76. Variety 2 has a discount of $0.06 per bushel for the lower test weight and a net price of $4.74 per bushel.

In some cases, premiums may be paid for bushels with a test weight higher than the standard 60-pounds.

Table 5. Example of a premium paid on wheat bushels with high test weight.

Wheat Varieties	Initial Sales Price	Test Weight	Premium	Adjusted Sale Price
Variety 1	$4.80	61 lbs.	$0.01 per bushel	$4.80 + $0.04 = $4.81
Variety 2	$4.80	62 lbs.	$0.02 per bushel	$4.80 + $0.06 = $4.82

As Table 5 illustrates, the value per bushel increases based on higher test weight. Both varieties have test weight values above the standard 60-pounds, which the example grain elevator pays additional premiums. The price adjustments result in variety 1's bushels valued at $4,329 (900 x $4.81) and variety 2's bushels valued at $4,338 (900 x $4.82).

For more information on test weight discount, review test weight in small grains from Michigan State University (https://www.canr.msu.edu/news/test_weight_in_small_grains).

Moisture Content Discount

A moisture content discount is based on delivery of wheat that has a moisture content greater than 13.5%. Wheat is able to be efficiently and safely stored when its moisture content is 13.5% or lower. The process of drying wheat to an ideal storage moisture of 13.5% is passed from the grain buyer on to the producer.

Two distinct methods are used to assess a moisture discount. The first method is a price discount based on the percentage points of moisture above 13.5%. The second method is a discount fee based on drying cost and a shrink factor to adjust wet bushels to dry bushels. Let's explore both methods of moisture discounts briefly.

Method #1: Price Discount

The price discount method can be calculated using the following equation:

[(Actual Percentage Points of Moisture – Ideal Percentage Points of Moisture) x Percentage Discount Factor] x Anticipated Sales Price = Price Discount

The price discount can then be subtracted from the anticipated sales price. Multiply the final price after a moisture discount by your delivered bushels to determine a net sale value. It is often easier to use this method by breaking down each part of the equation into different steps (Table 6).

Table 6. Example of discounting wheat price per bushel based on moisture content.

Wheat Varieties	Variety 1	Variety 2
Delivered bushels	900 bushels	900 bushels
Moisture of delivered bushels	18.5%	20.5%
Point of moisture difference between delivered moisture and 13.5% for ideal storage	18.5 – 13.5 = 5.0 percentage points	20.5 – 13.5 = 7.0 percentage points
Percentage discount	2%	2%
Total moisture discount percentage	5.0% x 2.0% = 10%	7.0% x 2.0% = 14%
Anticipated price	$4.80	$4.80
Cost of total moisture discount	$4.80 x 10% = $0.48	$4.80 x 14% = $0.67
Final price after moisture discount	$4.80 – $0.48 = $4.32	$4.80 – $0.67 = $4.13
Net Sale Value	900 x $4.32 = $3,888.00	900 x $4.13 = $3,717.00

Table 6 outlines the method of a price discount based on moisture content. Using the same 900 bushels from previous examples, the bushels are delivered with a moisture content of 18.5% for variety 1 and 20.5% for variety 2. The moisture reading for variety 1 is 5 percentage points higher than the ideal storage moisture of 13.5%. Variety 2 has 7 percentage points higher than ideal storage. The grain buyer assesses a percentage discount of 2% for every point above 13.5%. The total moisture discount for variety 1 is 10% (5% x 2%) and multiplied against the anticipated price per bushel of $4.80. The result is a reduction in price of $0.48 ($4.80 x 10%) for a net price of $4.32 per bushel. Variety 2 has a total moisture discount of 14% (7% x 2%), a reduced price of $0.67 ($4.80 x 14%) for a net of $4.13 per bushel.

Method #2: Discount Fee Based on Drying Costs and Shrink Factor

To outline the method of using a discount fee for drying cost and shrink factors, we'll use a three-step equation. The first step is to calculate the drying costs using the following formula:

[(Actual Percentage Points of Moisture – Ideal Percentage Points of Moisture) x Drying Cost Per Bushels] x Delivered Bushels = Total Drying Costs

Table 7. Example of drying costs on wheat bushels based on moisture content.

Wheat Varieties	Variety 1	Variety 2
Delivered bushels	900 bushels	900 bushels
Moisture of delivered bushels	18.5%	20.5%
Point of moisture difference between delivered moisture and 13.5% for ideal storage	18.5 – 13.5 = 5.0 percentage points	18.5 – 13.5 = 7.0 percentage points
Drying cost	$0.08 per point	$0.08 per point
Drying charge	5.0 x $0.08 = $0.40 per bushel	7.0 x $0.08 = $0.56 per bushel
Total drying charge on delivered bushels	$0.40 x 900 = $360.00	$0.56 x 900 = $504.00

In Table 7, our example grain buyer places a drying cost of $0.08 per point moisture content above 13.5%. With a difference of 5 percentage points from variety 1 at 18.5%, the drying charge per bushel is $0.40. Multiplied by the original amount of 900 bushels, the total drying charge is $340.00. For variety 2, a moisture content of 20.5% equals a drying charge of $0.56. Multiplied by 900 bushels, the total drying charge for variety 2 is $504.00.

The second step is to calculate the bushel reduction from shrink factors using the following formula:

[(Actual Percentage Points of Moisture – Ideal Percentage Points of Moisture) x Shrink Factor] x Delivered Bushels = Shrink Adjustment Bushels

The shrink adjustment is then subtracted from the delivered bushels for an adjusted total. Table 8 outlines how wheat bushels would be adjusted using a shrink factor.

Table 8. Example of shrink factor adjustment of wheat bushels based on moisture content.

Wheat Varieties	Variety 1	Variety 2
Delivered bushels	900 bushels	900 bushels
Moisture of delivered bushels	18.5%	20.5%
Point of moisture difference between delivered moisture and 13.5% for ideal storage	18.5 – 13.5 = 5.0 percentage points	20.5 – 13.5 = 7.0 percentage points
Shrink factor	1.4% per point	2.1% per point
Shrink adjustment on bushels	5.0 x 1.4% x 900 = 63 bushels	7.0 x 1.4% x 900 = 132.30 bushels
Total bushels after shrink adjustment	900 – 63 = 837 bushels	900 – 132.20 = 767.70 bushels

With a shrink factor of 1.4% per point, the 5.0 difference in moisture for variety 1 leads to a 63 bushels reduction (5.0 x 1.4% x 900). The result is that 900 bushels delivered turns into 837 bushels. For variety 2, the 7.0 difference in moisture is assessed at a higher shrink factor of 2.1%. The higher shrink factor is used to account for the expected lower test weight after excess moisture is removed. The shrink factor results in a reduction of 132.20 bushels for variety 1 or 767.70 delivered bushels. *Note: Shrink factors are normally provided by grain buyers as part of a discount schedule based on the actual percentage points of moisture on delivered grain.*

The final step is to combine both the drying cost charge and the bushel reduction into a net sale value. The combination of steps is illustrated in the following equation:

(Shrink Adjusted Bushels x Anticipated Sale Price) – Drying Costs = Net Sale Value

Table 9. Example of net sale value of wheat bushels for variety 1 after drying cost and shrink factor adjustments.

Shrink Adjusted Bushels	Price Received (per bushel)	Gross Sale Value	Drying Costs	Net Sale Value
837	$4.80	837 x $4.80 = $4,017.60	$360.00 ($0.40 on 900 delivered bushels)	$4,017.60 – $360.00 = $3,657.60

Table 9 shows the previous step examples to illustrate calculating the net sale value. As the table outlines, adjusted bushels of 837 are priced at $4.80 per bushel. The gross sale value is $4,017.60. Subtract the drying costs of $360.00 from Table 8 for a net sale value of $3,657.60.

Table 10. Example of net sale value of corn bushels for variety 2 after drying cost and shrink factor adjustments.

Shrink Adjusted Bushels	Price Received (per bushel)	Gross Sale Value	Drying Costs	Net Sale Value
767.70	$4.80	767.70 x $4.80 = $3,684.96	$504.00 ($0.56 on 900 delivered bushels)	$3,684.96 - $504.00 = $3,180.96

Table 10 shows the previous step examples to illustrate calculating the net sale value. As the table outlines, adjusted bushels of 767.70 are priced at $4.80 per bushel. The gross sale value is $3,684.96. Subtract the drying costs of $504.00 from Table 8 for a net sale value of $3,180.96.

In comparing the two types of discount methods, the price discount (method #1) appears to offer a more favorable net sale value. However, which method is more favorable depends on individual grain buyer discount rates, drying costs, and shrink factors at any given time. Additionally, a discount fee based on drying costs and a shrink factor (method #2) is

common among Michigan grain elevators. Always visit with prospective grain buyers to identify their discount schedules each season, especially if these methods are used to aid in your seed selection decisions.

Note: Due to concerns with low falling numbers and pre-harvest sprouting, some elevators may not charge for drying up to a determined threshold. The reduced cost for drying incentivizes producers to harvest earlier to maintain wheat quality. The bushels would still be charged for a shrink factor. For example, wheat harvested up to 18% moisture would not be charged for drying to 13.5% moisture. However, a $0.09 discount per bushel for shrink would still be applied.

For more information on calculating moisture discount costs for your farm, visit Understanding Grain Shrinkage and Expansion, a document from University of Wisconsin-Madison (https://fyi.extension.wisc.edu/energy/grain-drying-and-storage/determining-grain-shrinkage-rates/).

Falling Numbers

Another harvest time cost can be how quickly quality decreases with preharvest sprouting and low falling numbers. Poor quality seed that sprouts or has low falling numbers can lead to additional discounts. In good quality wheat we expect a 300-400 falling number, and the point at which a discount occurs varies by elevator (Table 12).

Table 11. Example Falling Number Discount Chart

	Range	Range	Range	Range	Range
Falling Number	>300	300-250	250-200	199-180	Below 180
Discount Fee	$0.00	$0.05	$0.15	$0.25	Subject to reject

Similar to Table 3, once a discount fee is identified, it is subtracted from the initial sale price (Table 12). The adjusted price calculation is illustrated as:

Initial Sale Price – Discount Fee = Adjusted Sales Price

Table 12. Example of a discount fee on adjusted wheat bushels with a low falling number.

Wheat Varieties	Initial Sales Price	Falling Number	Discount Fee (falling number 250-200)	Adjusted Sale Price
Variety 1	$4.80	240	$0.15 per bushel	$4.80 - $0.15 = $4.65
Variety 2	$4.80	280	$0.05 per bushel	$4.80 - $0.05 = $4.75

Table 12 illustrates where grain buyers would assess a discount fee for falling numbers. Using an initial sale price of $4.80 per bushel, the final sale price on variety 1 is discounted by $0.15 per bushel to equal $4.65. Variety 2 has a discount of $0.05 per bushel for the higher falling number and a net price of $4.75 per bushel.

Although not routinely shown in a seed guide, quality concerns are true for all wheat varieties, but especially white wheat. For more information on falling numbers, visit: www.canr.msu.edu/news/falling-numbers-in-wheat-what-causes-it-why-am-i-getting-docked.

Summarizing Harvest Costs

To illustrate the impact of quality grades on seed varieties, below is a summary of the total discounts from the previous examples. The summary includes shrink factor adjustments, so an adjustment to bushels on test weight is not included.

Table 13. Summary of revenue impacts from quality discounts on wheat

	Step #1: Price Discounts	**Step #1: Price Discounts**
Wheat Varieties	Variety 1	Variety 2
Initial sales price	$4.80	$4.80
Test weight discount	-$0.04	-$0.06
Moisture content – drying cost (method #2)	-$0.40	-$0.56
Falling number discount	-$0.15	-$0.05
Total discounts	-$0.40 – $0.04 – $0.15 = $0.59	-$0.56 – $0.06 – $0.05 = $0.67
Net sales price after discounts	$4.80 - $0.59 = $4.21	$4.80 - $0.67 = $4.13
	Step #2: Bushel Discounts	**Step #2: Bushel Discounts**
Delivered bushels	900 bushels	900 bushels
Moisture content – shrink factor (method #2)	-63 bushels	-132.30 bushels
Net bushels	900 – 63 = 837 bushels	900 – 132.30 = 767.70 bushels
	Net Sales	**Net Sales**
Net sales (pre-discounts and bushel adjustments)	900 bushels x $4.80 = $4,320.00	900 bushels x $4.80 = $4,320.00
Net sales (after discounts and bushel adjustments)	837 bushels x $4.21 = $3,523.77	767.70 bushels x $4.13 = $3,170.60
Revenue loss from quality discounts	$4,320 – $3,523.77 = $821.34	$4,320 – $3,170.60 = $1,149.40

Table 13 illustrates the total discounts from quality adjustments. In step #1, price discounts total $0.59 per bushel for variety 1 and $0.67 per bushel for variety 2. Discounts were based on low test weight, falling numbers, and drying cost for high moisture. Subtracted from the initial sales price of $4.80, the net result is a lower sales price of $4.21 for variety 1 and $4.13 for variety 2. High moisture also led to a shrink factor that lowered the total bushels from 900 to 837 bushels delivered for variety 1 and 767.70 bushels for variety 2. If the delivered corn had met all of the quality standards, the net revenue would have been $4,320.00 for both varieties. Instead, the net sales after discounts for variety 1 are $3,523.77 or a loss of $821.34. For variety 2, the net sales after discounts are $3,170.60 or a loss of $1,149.40.

Grain quality is an important aspect of selecting the right seed for your farm. Wheat varieties that don't meet established standards for test weight, moisture content, and falling numbers can see significant discounts. Economic returns related to harvest costs are why the key to profitability when selecting seed is to consider more than just yields.

Seed Selection Resources

In addition to the content found in this factsheet, MSU Extension also offers a decision tool to help calculate many of these values. The *Seed Selection Cost Comparison Decision Tool* helps to identify which options maximize production and profitability. Tool comparisons provide a ranking for each seed variety based on yield and economic returns. These rankings illustrate top production and profitability options to consider in making seed purchases. To download the Seed Selection Cost Comparison Decision Tool, visit: https://www.canr.msu.edu/resources/seed-selection-cost-comparison-decision-tool.

Seed Selection Cost Comparison Decision Tool

	Enter Below	Enter Below	Enter Below	Enter Below	Enter Below	Enter Below	Enter Below	Enter Below	Enter Below	Enter Below
Variety	Variety 1	Variety 2	Variety 3	Variety 4	Variety 5	Variety 6	Variety 7	Variety 8	Variety 9	Variety 10
Moisture (%)	14.00%	15.00%	14.50%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Test Weight (lbs.)	57.5	56	58	0	0	0	0	0	0	0
Yield (bu/acre)	60	63	62	0	0	0	0	0	0	0
Revenue/Acre	$ 816.60	$ 857.43	$ 843.82	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	Enter Below	Enter Below	Enter Below	Enter Below	Enter Below	Enter Below	Enter Below	Enter Below	Enter Below	Enter Below
Seed Cost/Acre	$ 32.00	$ 64.00	$ 55.71	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Test Weight Dockage	$ 1.26	$ 5.04	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Moisture Dockage/ Drying Costs	$ 11.25	$ 22.51	$ 8.84	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cost/Acre	$ 44.51	$ 91.55	$ 64.55	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Return Over Costs	$ 772.09	$ 765.88	$ 779.27	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Yield Rank	3	1	2	4	4	4	4	4	4	4
Economic Rank	2	3	1	4	4	4	4	4	4	4

Producer/Farm Name

Plot Identifier/Name

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Figure 1. Screenshot of the MSU Seed Selection Cost Comparison Decision Tool.

For the latest variety trial data to use with the decision tool, visit the MSU Wheat Performance Trials website at: https://www.canr.msu.edu/varietytrials/wheat/.

Often, much of the information needed to select wheat varieties can be found in the seed guide. For information on how to read a seed guide, review MSU Extension's bulletin E-3505: How to Read a Seed Guide (Wheat Edition) (https://www.canr.msu.edu/resources/bulletin-e-3505-how-to-read-a-seed-guide-wheat-edition).

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