



# Planning Farm Storage Buildings

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A farm storage building is a good investment for many agricultural operations. The building can be used to store hay, machinery, or both. A good storage structure will protect hay and farm machinery from the weather thereby preventing the reduction in their value due to weather related damages. However, does the increased value of stored hay or machinery offset the cost of owning a building? The following discussion examines the costs and savings of owning a farm storage building.

**Example 1.** Calculate the estimated cost of an open-sided barn that is 100 feet long and 50 feet wide.

100 feet x 50 feet = 5,000 square feet

5,000 square feet x \$4.00/square feet = \$20,000

## Cost of Barn Storage

Barn storage is the best method for preserving hay and protecting machinery. However, a storage structure can be expensive to build. Initial building cost depends on several factors including building style, material costs, and labor costs. Initial cost of construction can range from \$4.00 per square foot for an open-sided barn to over \$6.00 per square foot for a fully enclosed barn.

To evaluate the feasibility of constructing a storage barn, the initial building cost must be converted into an annual cost. The annual cost of barn storage includes depreciation, interest on investment, repairs, taxes, and insurance. Table 1 shows how to calculate the annual cost of storage for the barn described in Example 1. You can enter your figures to estimate the cost of storage for your barn.

Depreciation is the cost associated with wear and tear on the building. Most farm buildings have a useful life

**Table 1.** Total annual cost of a 100-foot by 50-foot, open-sided farm storage building. If the initial cost of the building is \$20,000. Depreciation rate is over 20 years, interest rate is 9.0%, and repairs, taxes, and insurance total 2.0% of initial investment.

### Costs for Example Barn

Depreciation (20 years)	=	\$20,000 ÷ 20	=	\$1,000
Interest on investment	=	2/3 x 0.090 x \$20,000	=	\$1,200
Repairs, taxes, and insurance	=	0.020 x \$20,000	=	\$400
Total Annual Cost	=		=	\$2,600

### Costs for Your Barn

\$ _____ ÷ 20	=	\$ _____
2/3 x _____ x \$ _____	=	\$ _____
0.020 x \$ _____	=	\$ _____
	=	\$ _____

<sup>1</sup> This represents straight-line depreciation for managerial accounting purposes and should not be used for federal or state income tax preparation. Consult with your local Farm Business Management Extension Agent or a qualified accountant for more information on calculating depreciation for tax purposes.

of 20 years. The annual cost of depreciation<sup>1</sup> is found by dividing the initial building cost by the anticipated years of useful life of the building. Therefore, the annual cost of depreciation for the barn in Example 1 is \$1,000 ( $\$20,000 \div 20$  years).

Interest on investment is the cost of borrowing money or, if the money is not borrowed, the money that could have been earned in interest if invested. For convenience, assume the interest on investment is equal to 2/3 of the current annual interest rate. Interest on borrowed money ranges from about 8.0 to 10.0 percent. Therefore, interest on investment has a range of 5.3 to 6.7 percent. Assuming an interest rate of 9.0 percent for the example barn, the annual cost of interest on investment is \$1,200 ( $2/3 \times 0.09 \times \$20,000$ ).

Repairs, taxes, and insurance on the storage building are normally figured at 0.70 percent, 1 percent and 0.30 percent of initial cost, respectively, or a total of 2.0 percent. Therefore, the annual cost for these factors is \$400 ( $0.02 \times \$20,000$ ).

The total annual cost of a storage barn is the sum of the annual costs for depreciation, interest on investment, repairs, taxes, and insurance. For the barn in Example 1, the annual cost of barn storage is \$2,600. However, to determine if barn storage is economical, the annual

cost of storage needs to be compared to the benefit (income) of barn storage.

## Benefits of String Hay in a Barn

Dry matter losses occur even under the best storage conditions with any type of hay. However, losses are greatest in large round bales. Numerous studies have compared dry matter losses in these bales under various storage methods. Table 2 presents the results of three hay storage studies, which clearly indicate that dry matter losses were greatest in unprotected bales stored on the ground.

The reduction in dry matter losses caused by storing hay in a building often results in increased savings. To illustrate this, two examples are given that calculate the value of large round bales stored in a building and unprotected on the ground.

**Example 2.** Large round hay bales are stored in the barn described in Example 1. Barn vertical clearance is 14 feet. The 1,000 - lb bales are 5 feet in diameter and 4 feet wide. Bales are stacked vertically in a pyramid pattern (Figure 1). A total of 408 bales or 204 tons of hay (408 bales x 0.5 tons/lb) can be stored in the barn. Value of the hay is \$65 per ton of dry matter. Hay dry matter content is 85 percent. Determine the value of hay stored in the barn and the net annual savings for barn storage (Table 3).

**Table 2.** Dry matter and digestibility losses in large round hay bales during various storage methods over a seven-month period.

Study	Dry Matter Loss (%)				
	Ground Stored	Elevated on Pallets	Elevated on Pallets and Covered with a Tarp	Covered with a Tarp Only	Barn Stored
Ely (1984)	65	38	14	—	4
Collins et al. (1987)	50	32	14	—	4
Hoveland et al. (1997)	30	—	—	10	0

**Table 3.** Calculation of the net annual value created by storing large round hay bales in a 100-foot by 50-foot, open-sided farm storage building.

### Value for Example Barn

Dry matter stored	=	0.85 x 204 tons	=	173 tons
Hay value	=	\$65/ton x 173 tons	=	\$11,245
Total annual cost of building	=		=	\$2,600
Net annual value	=	\$11,245 - \$2,600	=	\$8,645

### Value for Your Barn

0.85 x _____ tons	=	_____ tons
\$ _____ /ton x _____ tons	=	\$ _____
	=	_____
\$ _____ - \$ _____	=	\$ _____

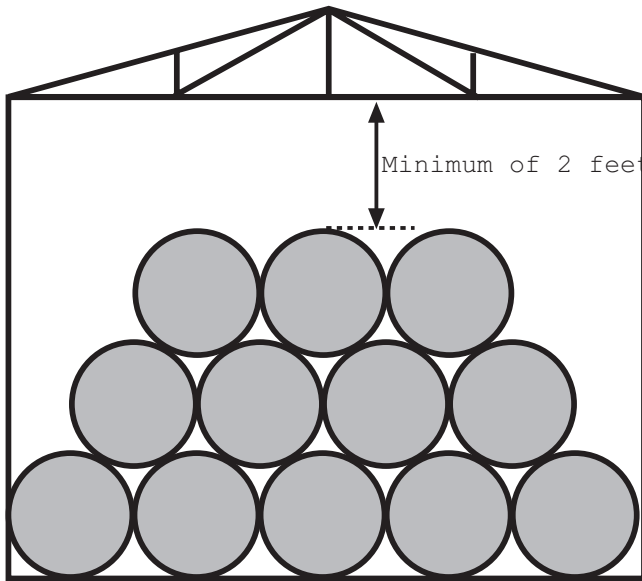


Figure 1. Under-roof storage with bales stacked in a pyramid pattern.

Hay value is based on dry matter content. A total of 173 tons (0.85 x 204 tons) of dry matter are stored in the barn in Example 2. Therefore, the value of hay stored in the barn is \$11,245 (\$65/ton x 173 tons). Net annual value is calculated by subtracting the annual cost of the building (\$2,600) from the benefit of barn storage (\$11,245). For Example 2, the net annual value is \$8,645.

**Example 3.** The same large round hay bales described in Example 2 are stored unprotected on the ground. The tonnage and value of the hay are the same. Hay dry matter content is 57 percent. Determine the value of hay stored unprotected on the ground (Table 4).

The amount of dry matter stored on the ground is 116 tons (0.57 x 204 tons). Therefore, the value of hay stored on the ground is \$7,540 (\$65/ton x 116 tons).

**Table 4.** Calculation of the net annual value created by storing large, round hay bales on the ground.

**Value for Example Barn**

Dry matter stored	= 0.57 x 204 tons	= 116 tons
Hay value	= \$65/ton x 116 tons	= \$7,540
Total annual cost of building		= \$0
Net annual value	= \$7,540 - \$0	= \$7,540

**Value for Your Barn**

0.57 x _____ tons	= _____ tons
\$ _____ /ton x _____ tons	= \$ _____
	= \$0
\$ _____ - \$ _____	= \$ _____

Since there is no annual cost of a storage barn, the net annual value for unprotected ground storage is \$7,540.

The net annual value of storing hay in a barn is \$8,645 as compared to the \$7,540 value resulting from storing hay on the ground. Therefore, a total \$1,105 is saved by barn storage. However, these savings are a conservative estimate that does not consider the added advantage of using the building for other purposes.

**Benefits of Machinery Storage Barn of Machinery**

The primary reason to store machinery in a building is to protect it from weather. Sunlight and moisture have adverse effects on belts, bearings, tires, paint, and many other components. As a result, machinery that has been stored in a barn usually has lower repair costs and less down time than machinery left in the field. Furthermore, a nationwide survey (Meador, 1981) indicated that farmers who traded in their machinery after five years of ownership received significantly more value for their equipment if it was stored in a building (Table 5). The average annual savings on barn storage of machinery is about 3.0 percent of the initial value of the machinery.

**Table 5.** Increased value of stored equipment at resale after five years of ownership (% of resale price).

Item	Percent of Resale Price	
	5 years	Per year
Tractor	16.5	3.3
Planters	22.0	4.4
Harvesting equipment	23.7	4.7
Tillage equipment	10.0	2.0

In most cases, the economic benefits from storing machinery and equipment are much greater than the cost of the storage. The following example shows the annual savings for storage of selected equipment.

**Example 4.** Two 100-horse power tractors, a combine, a cotton picker, and a hay baler (round) are stored in the barn described in Example 1. The initial cost of each piece of machinery is \$50,000 (per tractor), \$100,000, \$165,000, and \$15,000, respectively. After five years, the equipment is traded in at 50.0 percent of its original value. The annual savings on storing the equipment is 3.0 percent of its trade-in value. Determine the net annual savings of barn storage of the machinery (Table 6).

The initial cost of the equipment is \$380,000. At trade-in, the value of the equipment is \$190,000 (0.50 x \$380,000). Therefore, the total annual savings on barn storage of the equipment is \$5,700 (0.03 x \$190,000). The net annual savings is the total annual cost of the building (\$2,600) subtracted from the total annual savings on barn storage of the equipment (\$5,700) or \$3,100. However, this is a conservative estimate considering that additional savings can be expected from reduced machinery down time. For additional details on the savings of stored machinery, see VCE Publication 442-451, *Five Strategies for Extending Machinery Life*.

## Building Design for Hay Storage

The most desirable type of storage building for hay is one that has at least one end or side open. In Virginia, the opening should face south to prevent rain and snow from blowing into the building. The storage building should be clear span to eliminate working around interior poles.

Some building sizes work better than others for round bale storage. Building dimensions are usually exterior measurements. However, a 50-foot wide building will not provide adequate space for ten 5-foot diameter bales placed side by side. Building height is another important consideration for hay storage. Interior building height should be at least 2 feet higher than the height of stacked bales. Note that sidewalls must be built to withstand the horizontal pressures from each row of bales.

## Building Design for Machinery Storage

Building dimensions must account for adequate machinery clearance. For example, door width should provide at least 2 feet of clearance and door height should provide at least 1 foot of clearance for equipment brought into the shop. Building width should be at least twice the door width.

Planning for a machinery storage building also requires careful consideration of the estimated floor space requirements for the stored machinery. The floor space required for each particular item to be stored depends on a number of factors including fold-up configuration and whether or not implements remain hitched to machinery (Figures 2 - 4).

To determine minimum total storage area: 1) use actual area dimensions for current equipment and for machinery that may be purchased in the future (Table 8); 2) sum the areas of all items to be stored; and 3) multiply the total area by 1.15 to account for space between equipment.

The minimum requirement for floor space is merely a starting point for sizing the building. This floor space

**Table 6.** Calculation of the net annual savings created by storing several pieces of farm machinery.

	Example Equipment		Your Equipment	
Two 100-hp tractors	=	2 x \$50,000	=	\$100,000 = \$ _____
Combine	=		=	\$100,000 = \$ _____
Cotton picker	=		=	\$165,000 = \$ _____
Hay baler (round)	=		=	\$15,000 = \$ _____
Total initial cost of equipment	=		=	\$380,000 = \$ _____
Total equipment value at resale (after 5 years)	=	0.50 x \$380,000	=	\$190,000 = \$ _____
Total annual savings on stored equipment	=	0.03 x \$190,000	=	\$5,700 = \$ _____
Total annual cost of building	=		=	\$2,600 = \$ _____
<b>Net annual savings</b>	=	<b>\$5,700 - \$2,600</b>	=	<b>\$3,100</b> = \$ _____ - \$ _____ = \$ _____

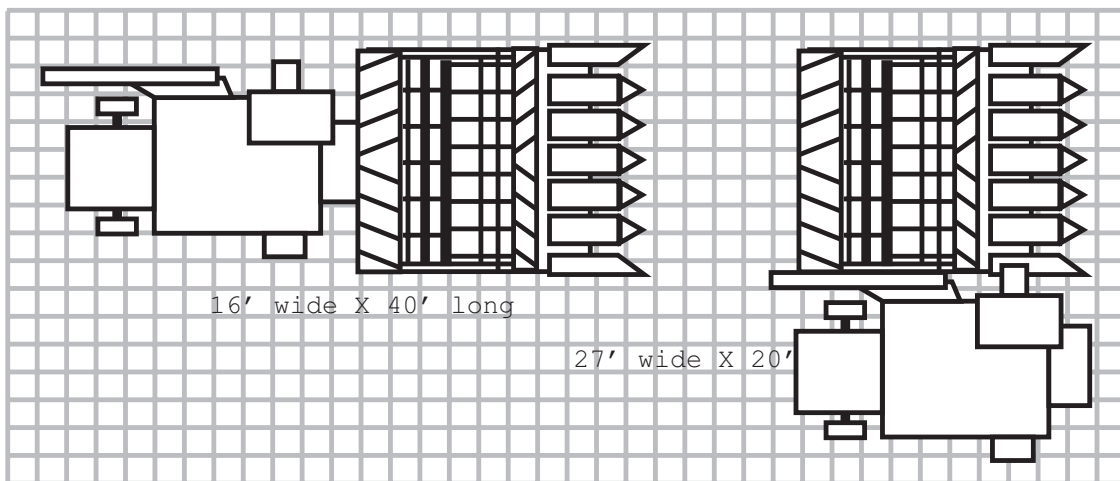


Figure 2. Storing self-propelled equipment (combines, pickers, forage harvesters) with or without headers attached will affect space requirements. For example, a 6-row combine requires about 20 percent more floor space when either the cornhead or platform header remains attached.

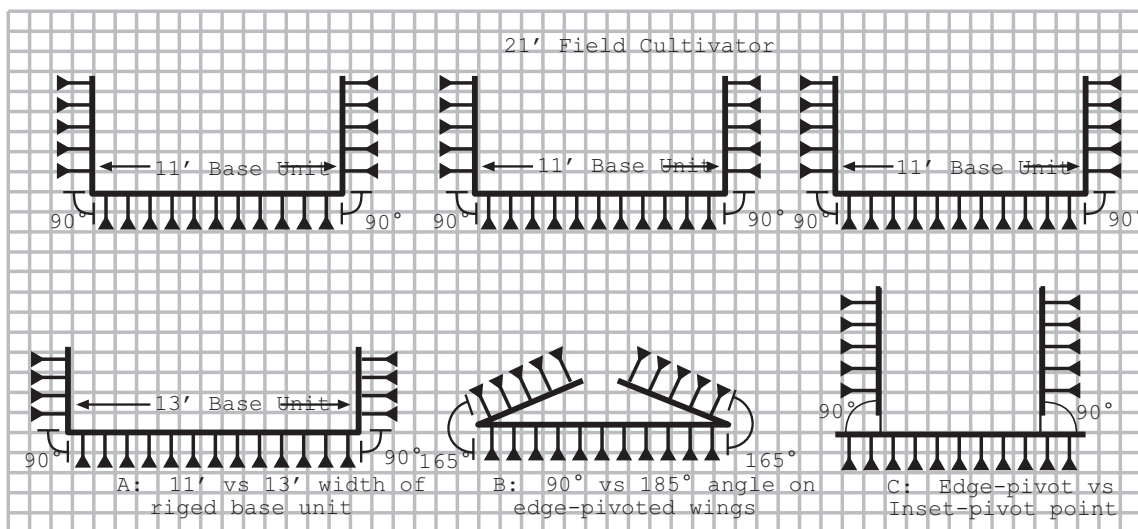


Figure 3. For fold-up implements, the base width and folding configuration affects transport width and door size and storage space requirements. The 21 feet field cultivator can have three configurations: (a) a narrower base width that reduces floor space but increases door height, (b) a greater wing-pivot angle with the same base unit that reduces both floor space and door height, (c) and an inset pivot with the same base unit width and 90 degree pivot angle that reduces floor space but increases door clearance.

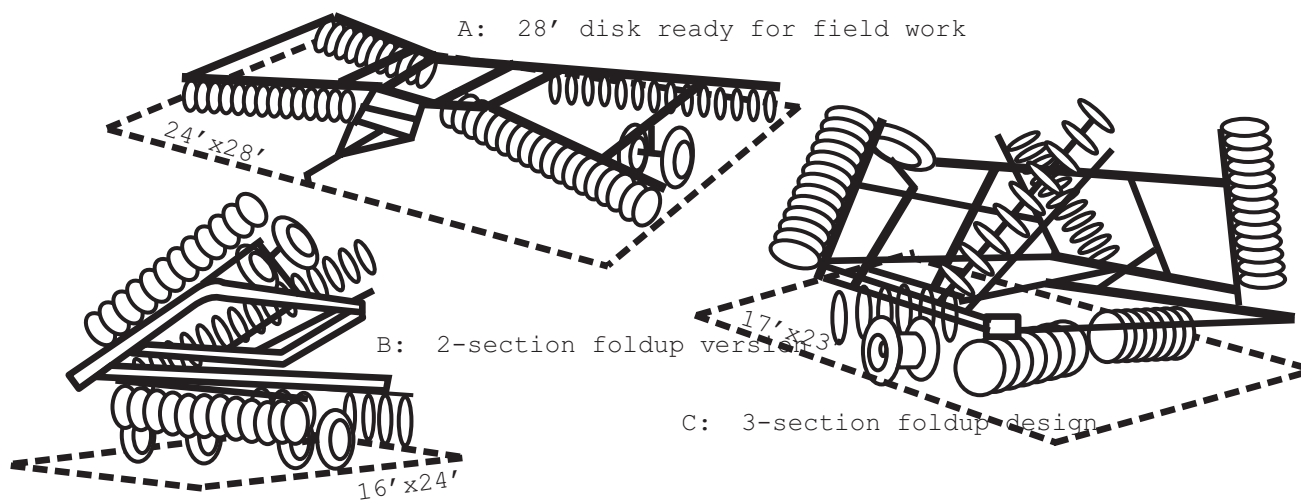


Figure 4. The same size machine from different manufacturers or earlier models may have different floor space requirements depending on the fold-up configuration. The 28-ft tandem disk may require: (a) 672 sq. ft. for field operation, (b) 384 sq. ft. for storage with a two-section fold up, or (c) 391 sq. ft. for storage with a three section configuration.

requirement may account for future storage needs, but does not consider overnight or short-term storage needs when it would be desirable to leave implements hitched to tractors. During such times, these units may have to be left outside or stored elsewhere – unless planned for in the original design.

## General Building Recommendations

- Open-sided buildings should be oriented from east to west to minimize sunlight exposure inside the building.
- Three-sided buildings should be oriented so that the open side faces away from the prevailing wind (generally from the south) to minimize the amount of rain blown into the building.
- All buildings should meet the Virginia Uniform State-wide Building Code (USB) requirements.
- Obtain bids on different types of buildings and analyze the economics based on the examples in this publication.
- Keep hay storage buildings as open as possible in the gable ends (peak of the roof) to allow moisture to escape during hay drying.
- Consider ridge vents for large storage buildings. Condensation and rusting will occur on the inside of the roof if ridge vents are not used.
- Consider stacking large round hay bales on their flat end rather than on their round side to increase the number of bales that can be stored. This can be done with a 4-foot front-end-loader fork.
- Eave height should be at least 14 feet, but make sure that your building is high enough for your needs.

## References

Collins, W.H., B.R. McKinnon, and J.P. Mason. 1987. Hay production and storage: economic comparison of selected management systems. ASAE Paper No. 87-4504. ASAE: St. Joseph, MI.

Ely, L.C. 1984. The quality of stored round hay bales or how much of your hay bale is left to feed. Georgia Dairyfax. January 1984. Animal and Dairy Science Department, University of Georgia, Athens, GA.

Hoveland, C.S., J.C. Garner, and M.A. McCann. 1997. Does it pay to cover hay bales? The Georgia Cattleman, July, 1997, pp. 9-10.

Meador, N. 1981. Spend 35% of equipment investment for storage. Farm Building News, Sept. 1981. p. 56.

## Publications

Farm Shop Plan Book, MWPS-26. 1985. The book illustrates floor plans, cross sections and construction details for four farm shops sizes: 24' x 32'; 32' x 40'; 40' x 48'; and 48' x 56' (32 Pages).

Machine Shed: 40' x 104', MWPS-74143 - 13 ft height clearance with 40' x 40' shop

Machine Shed: 48' x 96', MWPS-74146 - 14 ft height clearance with 48' x 40' shop

Machine Shed: 60' x 96', MWPS-74147 - 14 ft height clearance with 60' x 40' shop

Machine Shed: 30' x 72', MWPS-74148 - 12 ft height clearance with 30' x 40' shop

Machine Shed: 56' x 88', MWPS-74149 - 13 ft height clearance, no shop included, 40' clear span with a 16' shed attached for addition space.

To order MWPS publications, contact MidWest Plan Service, 122 Division Hall, Iowa State University, Ames, IA 50011 – 3080, 1-800-562-3618, [www.mwps-hq.org](http://www.mwps-hq.org)

## Acknowledgments

Drs. Susan Gay and Robert Grisso are acknowledged for their contribution to the first version of this publication. The author would also like to would like to express their appreciation for the review and comments made by Lori S. Marsh, Associate Professor and Extension Engineer, Biological Systems Engineering; Keith Dickinson, Extension Agent, Crops and Soil Science, Fauquier County; and Robert M. Pitman, Superintendent, Eastern Virginia Agricultural Research and Extension Center.

## Modified from:

Parson, S.D., R.M. Strickland, D.D. Jones and W.H. Friday. Planning guide to farm machinery storage. AE-115, Purdue University, Cooperative Extension Service, West Lafayette, IN

Hofman, V. and K. Hellevang. 1994. Planning Farm Shops. AE-1066, North Dakota State University Extension Service, Fargo, ND.

Worley, J. and W.D. Givan. 1999. Economics of Farm Storage Buildings. Bulletin 1173, University of Georgia Cooperative Extension, Athens, GA.

**Table 8.** Typical floor area requirements of various items of farm equipment.<sup>a</sup>

Equipment Item and Size	Length (ft.)	Width (ft.)	Area (sq. ft.)	Height (ft.)	Equipment Item and Size	Length (ft.)	Width (ft.)	Area (sq. ft.)	Height (ft.)
<b>TRACTORS</b>					<b>FIELD APPLICATION EQUIPMENT</b>				
2-wheel-drive 2 - 3 plow	11.5	8	92		Field Sprayer (rear mtd.)				
2-wheel-drive 4 - 5 plow	14	9.5 <sup>b</sup>	133	9.5	21 - 42 ft. (fold-up boom)	6 - 8	8 - 9	48 - 72	
2-wheel drive 6 - 8 plow	15.5	10.5 <sup>b</sup>	163	9.5	Field Sprayer (drawn)				
4-wheel drive <300 HP	20	12 <sup>b</sup>	240	11.5	21 - 42 ft. (front-fold boom)	11 - 15	8	88 - 120	8 - 13
4-wheel drive >300 HP	22.5	12 <sup>b</sup>	270	12.5	42 - 47 ft. (fold-up boom)	15 - 22	10 - 13	150 - 286	
<b>TILLAGE MACHINERY</b>					30 - 40 ft. (rear-fold boom)	25 - 30	9.5	238 - 285	
<b>Subsoiler (V-frame)</b>					60 - 80 ft. (rear-fold boom)	48 - 58	8 - 9	384 - 522	
3 - 13 shank (rear mtd.)	4.5 - 10.5	8.5 - 20.5	38 - 215		Knife-Down Applicator				
7 - 13 shank (drawn)	14.5 - 18.5	13 - 20.5	188 - 379		13 ft. (rear mtd., rigid)	6	13.5	81	
5 - 13 shank (drawn, wings)	15.5	15	233	9.5	15 ft. (rear mtd., rigid)	6	15.5	93	
<b>Moldboard Plow<sup>c</sup></b>					20 ft. (rear mtd., folding)	7	11	77	
3-bottom	9	5	45		24 ft. (rear mtd., folding)	8	11	88	10
4-bottom	12	6.5	78		27 - 30 ft. (rear mtd., folding)	8	11	88	12
5-bottom	15	8	120		Fertilizer Spreader				
6-bottom	22	9.5	209		1 - 2 ton (spinner-type)	8	5.5	44	
7-bottom	28	12.5	350		4 ton (spinner-type)	10	6	60	
8-bottom	31	14	434		5 ton (spinner-type)	15	7	105	
<b>Chisel Plow (drawn)</b>					6 - 8 ton (spinner-type)	18	8	144	
7 - 10 ft. (rigid frame)	13.5	10	135		Manure Spreader				
11 - 20 ft. (rigid frame)	16.5	11 - 20	180 - 330		125 bu. (rear discharge)	15.5	6.5	101	
17 - 27 ft. (hinged frame)	16.5	13.5	223	9	200 - 300 bu. (rear discharge)	17 - 23	8	136 - 184	
21 - 31 ft. (dual fold wings)	19.5	16	312	9	350 - 500 bu. (rear discharge)	21 - 24	8.5	179 - 204	
23 - 35 ft. (dual fold wings)	20	20.5	410	14.5	700 bu. (rear discharge)	30	8.5	255	8
35 - 41 ft. (dual fold wings)	22.5	21	473	17.5	200 bu. (side discharge)	20	7.5	150	
37 - 59 ft. (dual fold wings)	25	14 - 20.5	350 - 513	15.5 - 19.5	300 - 400 bu. (side discharge)	20	8.5	170	8
<b>Offset Disk Harrow (drawn)</b>					1500 gal. (liquid)	15	8	120	
11 - 20 ft.	15.5-19.5	11-20	170-390		2500 gal. (liquid)	17	8	136	
<b>Tandem Disk Harrow (drawn)</b>					3000 gal. (liquid)	20	8.5	170	8
6.5 - 15.5 ft. (rigid frame)	10 - 14	6.5 - 15.5	65 - 220		5000 gal. (liquid)	24	11.5	276	9.5
16 - 24 ft. (single fold wing)	18.5	12.5	231	10.5	<b>PLANTING AND SEEDING MACHINERY</b>				
13.5 - 18 ft. (dual fold wings)	16	12	192	9	<b>Grain drill</b>				
18 - 27 ft. (dual fold wings)	19.5	13.5	263	10.5	7 - 9 ft. (rear mtd.)	6	7 - 9	42 - 54	10 - 12 <sup>c</sup>
27 - 33 ft. (dual fold wings)	24	16	384	12	11 - 20 ft. (rear mtd.)	8	11 - 20	88 - 160	10 - 12 <sup>c</sup>
32 - 38 ft. (dual fold wings)	25	19	475	13.5	7 - 9 ft. (drawn)	9	8.5 - 10.5	77 - 95	10 - 12 <sup>c</sup>
27.5 - 40 ft. (section swing around)	55 - 54	15 - 20	825 - 1300		11 - 14 ft. (drawn)	10.5	12 - 15	126 - 158	10 - 12 <sup>c</sup>
<b>Field Cultivator</b>					20 ft. (drawn)	13.5	21	284	10 - 12 <sup>c</sup>
7.5 - 20.5 ft. (rear mtd., rigid)	8	7.5 - 20.5	60 - 164		20 - 24 ft. (drawn, sectional)	21	13.5 - 17.5	284 - 368	10 - 12 <sup>c</sup>
10 - 20.5 ft. (drawn, rigid)	15.5	10 - 20.5	155 - 318		26 - 32 ft. (drawn, sectional)	25	13.5 - 17.5	338 - 438	10 - 12 <sup>c</sup>
15.5 - 24.5 ft. (rear mtd., wings)	16	8	13.5	108 9	40 ft. (drawn, sectional)	29.5	17.5	516	10 - 12 <sup>c</sup>
20.5 - 26.5 ft. (drawn wings)	15.5	13.5	210	15.5	54 ft. (drawn, sectional)	36	17.5	630	10 - 12 <sup>c</sup>
27.5 - 42.5 ft. (drawn, rearfold)	19	21.5	19	408 9.5	<b>Row Crop Planter (corn, bean)</b>				
42.5 - 50 ft. (drawn, rearfold)	21.5	19	408	20	4 - 40/6-30 in. (drawn)	14.5	13 - 15.5	189 - 225	9
48.5 - 60.5 ft. (drawn, rearfold)	25	25	20	500 16.5	6 - 40/8-30 in. (drawn, end trans.)	23.5	9	212	10
<b>Spring-Tooth Harrow</b>					8 - 40 in. (drawn, end trans.)	29	12	348	11
15 - 27 ft. (drawn, folding)	15	13	195	8 <sup>d</sup>	12 - 30 in. (drawn, end trans.)	33	13	429	12
30 - 39 ft. (drawn, folding)	28	12	336	8 <sup>d</sup>	4 - 40/6 - 30 in. (rear mtd., toolbar)	8	13 - 15.5	104 - 124	9
48 - 60 ft. (drawn, folding)	40	15	600	8 <sup>d</sup>	6 - 40/8 - 30 in. (rear mtd., toolbar)	8	19.5	156	11
<b>Roller Harrow (drawn)</b>					8 - 40/12 - 30 in. (rear mtd., folding)	8	18.5	148	12.5
7.5 - 15.5 ft. (rigid frame)	15	8 - 16	120 - 240		8 - 40/12 - 30 in. (drawn, folding)	23 - 28	13.5 - 15	311 - 420	11 - 12
21 - 25 ft. (wings)	19.5	14	273	10	12 - 40/16 - 30 in. (drawn, folding)	25 - 33.5	13.5 - 15	338 - 503	11 - 12
32 ft. (wings)	19.5	17.5	341	11	18 - 30 in. (drawn, folding)	36.5	15	548	12
<b>Rotary Hoe (rear mounted)</b>					24 - 30 in. (drawn, folding)	36	13.5	486	13
12 - 15 ft. (rigid frame)	4	12 - 15	48 - 60						
21 - 34 ft. (rigid, end transport)	23 - 36	5	115 - 180						
21 - 34 ft. (wings)	5	11 - 17.5	55 - 88	8					
<b>Row-Crop Cultivator</b>									
4 - 40/6 - 30 in. (front/rear mtd.)	8	16	128						
6 - 40/12 - 30 in. (front mtd.)	13 - 20	23	260 - 640						
6 - 40/12 - 30 in. (rear mtd., end transport)	23 - 32.5	8	184 - 260						
6 - 40/8 - 30 in. (rear mtd., folding)	8	11.5	92	10					
6 - 40/12 - 30 in. (rear mtd., folding)	8	16	128	10					
16 or 18 - 30 in. (rear mtd., folding)	8	21	168	17.5					

Length Equipment Item and Size	Width (ft.)	Area (sq. ft.)	Height (sq. ft.)	(ft.)
<b>GRAIN HARVEST MACHINERY (continued)</b>				
Combine (self-propelled, without header)				
4-row	20	10	200	11.5 <sup>f</sup>
4-row/6-row	23	12	276	12.5 <sup>f</sup>
6-row/8-row	26	13	338	12.5 <sup>f</sup>
8-row/12-row	26	14.5	377	13 <sup>f</sup>
Direct-Cut Header for Combine (platform header)				
10, 13, 15, 16, and 18 ft.	8	11 - 19	88 - 152	
20, 22, 24, and 30 ft.	9	21 - 31.5	189 - 284	
Row Crop Header for Combine (corn, bean, grain, sorghum)				
2 - 40/3 - 30 in.	9	8	72	
3 - 40/4 - 30 in.	10	9.5 - 10	95 - 100	
4 - 40/6 - 30 in.	10	13 - 14.5	130 - 145	
5 - 40 in.	10	16	160	
6 - 40/8 - 30 in.	10	19.5 - 20.5	195 - 226	
8 - 40 in.	11	26	286	
12 - 30 in.	12	30.5	366	
Pick-Up Header				
10 and 13 ft.	15	10 - 13	150 - 195	
Combine (pull-type with header)				
13 ft. Direct-cut or pick-up	33	14	462	10 <sup>f</sup>
4 - 40 in. Row-crop or 11 ft. 43 pick-up	43	14.3	615	12.1 <sup>f</sup>
<b>HAY-FORAGE HARVEST MACHINERY</b>				
Mowers (rear mounted)				
6 ft. (cutterbar)	7.5	6.5	49	
7 ft. (cutterbar)	7.5	7.5	56	
9 ft. (cutterbar)	7.5	8.5	64	9.5
Mower-Conditioner (drawn)				
7 ft. (cutterbar)	13	9.5	124	
9 ft. (cutterbar)	15.5	11.5	178	
12 ft. (cutterbar)	21.5	13	280	
14 ft. (cutterbar)	21.5	15	323	
Windrower (self-propelled without header)				
70 HP	13.3	10.6	141	10 w/cab
75 HP	13.7	12.3	169	10 w/cab
94 HP	14.8	12.9	191	10 w/cab
Auger Header				
10, 12, 14, and 16 ft.	8	11 - 17	88 - 136	
Draper Header				
12, 15, 18, 21, and 25 ft.	9	14 - 26	126 - 234	
Rake, Side Delivery				
7.5 ft. (rear mounted)	7.5	4	30	
9 ft. (rear mounted)	7.5	10	75	
8.5 - 10 ft. (semi-mounted)	10.5	10 - 11	105 - 116	
7.5 ft. (drawn)	16.5	7	116	
9 ft. (drawn)	17.5	7	123	
11 ft. (drawn)	20	7	140	
18 ft. (drawn, sectional)	10	12	120	
21 ft. (drawn, sectional)	10	16	160	
Pick-Up Baler (conventional)				
18.5	18.5	13.5	250	
Round Baler				
650-lb. bales	10	6.5	65	
800-lb. bales	11.5	6.5	75	
850/900-lb. bales	12.5 - 14	7 - 8	88 - 112	
1500/1800-lb. bales	13.5 - 15.5	8	108 - 124	8 - 9
Stack Wagon				
1.5 ton	18.5	10.5	194	13
3 ton	23	12	276	15
Forage Harvesters (self-propelled without header) <sup>§</sup>				
175 - 200 HP	14	8	112	10.5
250+ HP	15.5	8.5	132	10.5
250+ HP (with hopper)	18	9	162	14
Forage Harvester (drawn)				
16	16	9.5	152	10
Forage Harvester (mounted)				
12	12	8.5	102	10
Forage Chopper/Blower				
10 - 13	10 - 13	6 - 7.5	60 - 98	

Equipment Item and Size	Length (ft.)	Width (ft.)	Area (sq. ft.)	Height (ft.)
<b>HAULING EQUIPMENT</b>				
Multi-Bale Mover (round)				
3, 1500-lb. bales	25.2	6.5	166	
6, 1500-lb. bales	26	8	208	
8, 850-lb. bales	30.5	8	244	
Stack Mower				
1.5 ton	18.5	10.5	194	13
3 ton	23	12	276	15
Forage Wagon				
14 ft. box	17	8	136	11.5
16 ft. box	19.5	8	156	11.5
High Dump Wagon				
300 bu.	13	8.5	111	13
360 bu.	15	10	150	13
Gravity Flow Wagon				
165 - 220 bu.	10.5	6.5	68	8
225 - 380 bu.	11 - 12.5	7 - 8	77 - 100	8 - 9
450 - 550 bu.	12 - 17	8	96 - 136	9 - 10
650 bu.	16	8.5	136	9.5
1000 bu.	24	8.5	204	9.5
Grain Auger Cart				
400 bu.	15.5	8	124	10
575 bu.	18	8	144	10
650 bu.	20.5	8.5	174	10
700 bu.	23	10	230	9
820 bu.	25	8.5	213	10.5
Trailer (cargo/implement)				
20 - 26 ft.	25 - 31	8	200 - 248	
Gooseneck Trailer				
20 - 32 ft.	28 - 40	8	224 - 320	
Laydown Implement Trailer				
18 ft.	30	8 - 12	240	
Truck				
1.5 ton	21	8	168	
<b>MISCELLANEOUS MACHINERY</b>				
Rotary Mower/Disk Mower				
5 ft. (rear mounted)	7.5	5.5	41	
6 ft. (rear mtd., rigid)	8.5 - 11	6.5	55 - 72	
7 ft. (rear mtd., rigid)	9.5 - 11.5	7.5	71 - 86	
9 ft. (rear mtd., rigid)	7 - 11.5	9.5	67 - 110	
13.5 ft. (rear mtd., rigid)	7 - 12	14	98 - 168	
15 ft. (drawn, folding)	12	8.5	102	
Stalk Shredder				
6.5 - 20 ft. (flat-type)	10	7.5 - 21.5	72 - 215	
Skid-Steer Loader				
18 HP	7.5	3.5	26	
25 HP	8.5	4	34	
30 - 35 HP	9.5	4.5	43	
40 - 45 HP	9.5 - 10	4.5 - 5.5	4 - 55	
Front-End Tractor Loader				
14 - 15.5	14 - 15.5	5 - 6	70 - 93	
Mixer-Feeder Wagon				
150 bu.	16.5	7.5	124	
235 bu.	18.5	8	148	8
312 bu.	20	9	180	8
Grinder-Mixer				
12	12	8	96	8.5
Tub-Grinder				
24	24	9.5	228	12 - 13

<sup>a</sup> The hitching terms "drawn" and "pull-type" are used synonymously. Also, equipment height

(far right column) is shown only if height exceeds 8 feet.

<sup>b</sup> Add 5 feet (and recalculate area) for tractors with duals, 2.5 feet one side only.

<sup>c</sup> Sizes given are general requirements for mounted, semi-mounted, or pull-type, including 14, 16, 18, 20, and 22-inch bottoms.

<sup>d</sup> Add 3 to 4 feet of height if equipped with tine-toothed finishing attachment.

<sup>e</sup> Grain drills with markers are 10 to 12 feet high.

<sup>f</sup> Extension on grain bin may exceed height shown.

<sup>§</sup> See self-propelled combine for approximated dimensions of direct-cut, row-crop, and pick-up headers.