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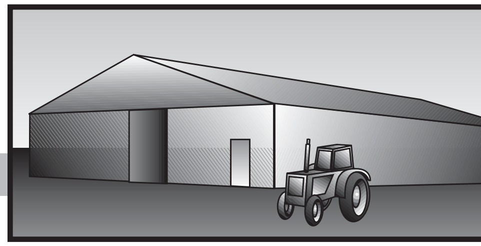

Biological Systems Engineering

PUBLICATION 442-760

Planning for a Farm Storage Building

*Susan Wood Gay and Robert "Bobby" Grisso**

A farm storage building is a good investment for many agricultural operations. The building can be used to store hay, machinery, or both. As a result, the value of these commodities will be worth more than if left in the field. 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.

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.

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

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 of 20 years. The annual cost of depreciation[1] is found by dividing the initial building cost by the anticipated

Table 1. Total annual cost of a 100-foot by 50-foot, open-sided farm storage building. 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 $______	=	$______
	=	$______

[1] 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.

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years of useful life of the building. Therefore, the annual cost of depreciation for the barn in Example 1 is $1,000 ($20,000 ÷ 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 x 0.09 x $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 x $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 Barn Storage of Hay

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.

	Dry Matter Loss (%)				
Study	**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	= $_______
	= ________
$______ - $______	= $_______

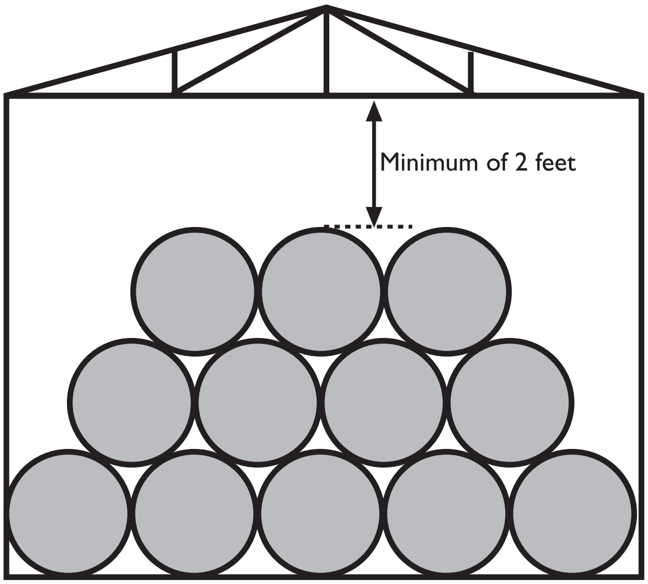

Figure 1. Under-roof storage with bales stacked in a pyramid pattern.

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). 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 Barn Storage 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.

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.

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

	Percent of Resale Price	
Item	**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

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
	$______ - $______	= $_______

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 that 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 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.

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	=	$_________
Net annual savings	**=**	**$5,700 - $2,600**	**=**	**$3,100**	**=**	**$_______ - $_______ = $_______**

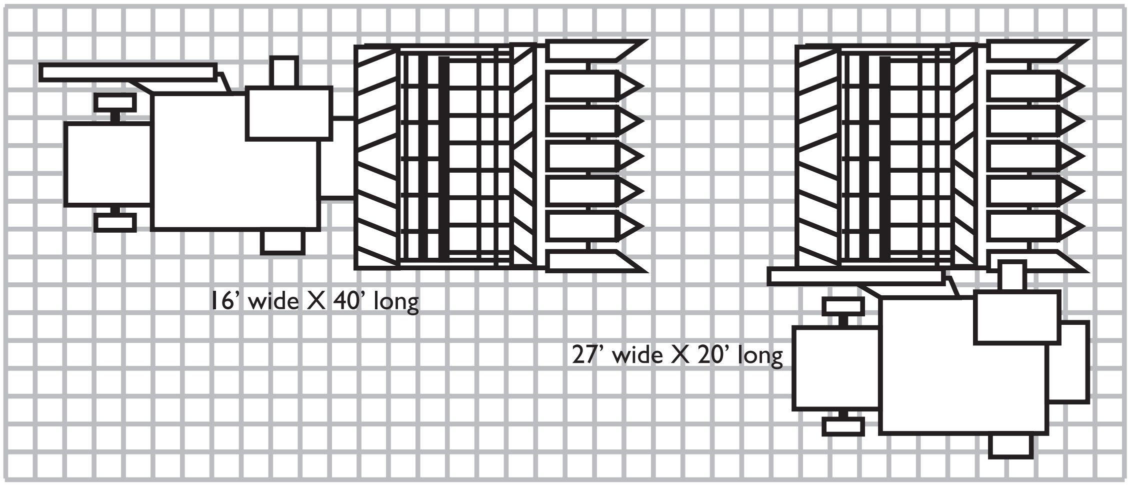

Figure 2. Storing self-propelled equipment (combines, pickers, forage harvesters) with or without headers attached will affect space requirements. For example, a 6-row combine requires about 20 percent more floor space when either the cornhead or platform header remains attached.

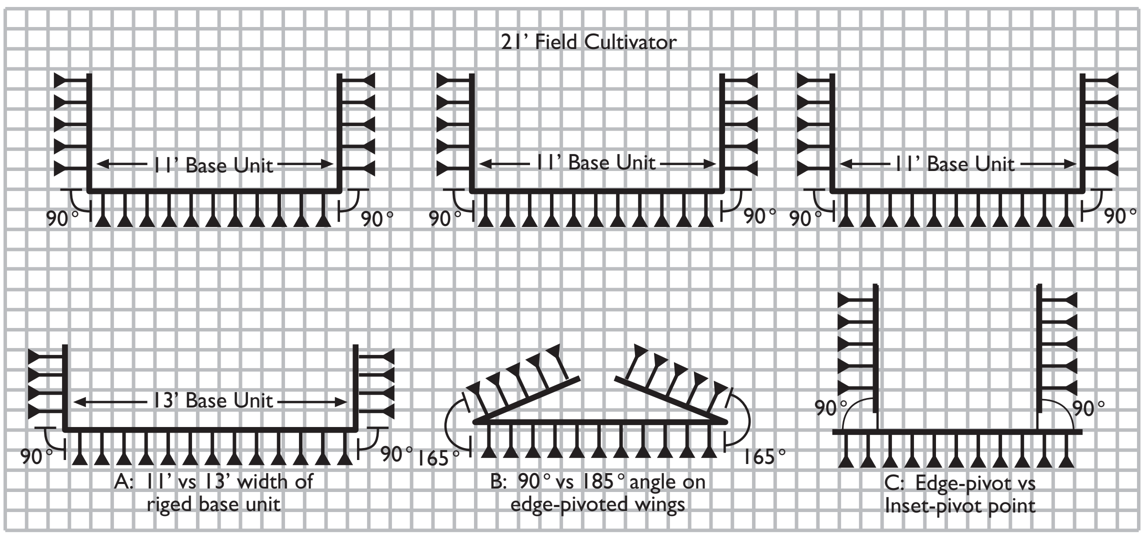

Figure 3. For fold-up implements, the base width and folding configuration affects transport width and door size and storage space requirements. The 21 feet field cultivator can have three configurations: (a) a narrower base width that reduces floor space but increases door height, (b) a greater wing-pivot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

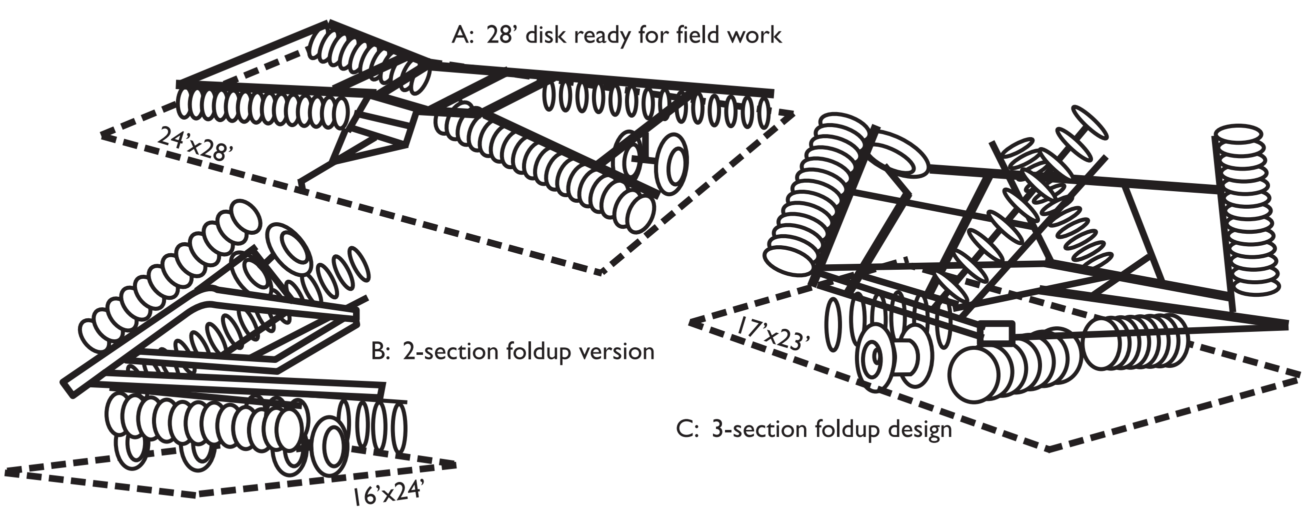

Figure 4. The same size machine from different manufacturers or earlier models may have different floor space requirements depending on the fold-up configuration. The 28-ft tandem disk may require: (a) 672 sq. ft. for field operation, (b) 384 sq. ft. for storage with a two-section fold up, or (c) 391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

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 Statewide 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.mwpshq.org

Acknowledgments

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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.[a]

Equipment Item and Size	Length (ft.)	Width (ft.)	Area (sq. ft.)	Height (ft.)
TRACTORS				
2-wheel-drive 2 - 3 plow	11.5	8	92	
2-wheel-drive 4 - 5 plow	14	9.5[b]	133	9.5
2-wheel drive 6 - 8 plow	15.5	10.5[b]	163	9.5
4-wheel drive <300 HP	20	12[b]	240	11.5
4-wheel drive >300 HP	22.5	12[b]	270	12.5
TILLAGE MACHINERY				
Subsoiler (V-frame)				
3 - 13 shank (rear mtd.)	4.5 - 10.5	8.5 - 20.5	38 - 215	
7 - 13 shank (drawn)	14.5 - 18.5	13 - 20.5	188 - 379	
5 - 13 shank (drawn, wings)	15.5	15	233	9.5
Moldboard Plow[c]				
3-bottom	9	5	45	
4-bottom	12	6.5	78	
5-bottom	15	8	120	
6-bottom	22	9.5	209	
7-bottom	28	12.5	350	
8-bottom	31	14	434	
Chisel Plow (drawn)				
7 - 10 ft. (rigid frame)	13.5	10	135	
11 - 20 ft. (rigid frame)	16.5	11 - 20	180 - 330	
17 - 27 ft. (hinged frame)	16.5	13.5	223	9
21 - 31 ft. (dual fold wings)	19.5	16	312	9
23 - 35 ft. (dual fold wings)	20	20.5	410	14.5
35 - 41 ft. (dual fold wings)	22.5	21	473	17.5
37 - 59 ft. (dual fold wings)	25	14 - 20.5	350 - 513	15.5 - 19.5
Offset Disk Harrow (drawn)				
11 - 20 ft.	15.5-19.5	11-20	170-390	
Tandem Disk Harrow (drawn)				
6.5 - 15.5 ft. (rigid frame)	10 - 14	6.5 - 15.5	65 - 220	
16 - 24 ft. (single fold wing)	18.5	12.5	231	10.5
13.5 - 18 ft. (dual fold wings)	16	12	192	9
18 - 27 ft. (dual fold wings)	19.5	13.5	263	10.5
27 - 33 ft. (dual fold wings)	24	16	384	12
32 - 38 ft. (dual fold wings)	25	19	475	13.5
27.5 - 40 ft. (section swing around)	55 - 54	15 - 20	825 - 1300	
Field Cultivator				
7.5 - 20.5 ft. (rear mtd., rigid)	8	7.5 - 20.5	60 - 164	
10 - 20.5 ft. (drawn, rigid)	15.5	10 - 20.5	155 - 318	
15.5 - 24.5 ft. (rear mtd., wings)	8	13.5	108	9
20.5 - 26.5 ft. (drawn wings)	15.5	13.5	210	15.5
27.5 - 42.5 ft. (drawn, rearfold)	21.5	19	408	8 - 19.5
42.5 - 50 ft. (drawn, rearfold)	21.5	19	408	20
48.5 - 60.5 ft. (drawn, rearfold)	25	20	500	16.5
Spring-Tooth Harrow				
15 - 27 ft. (drawn, folding)	15	13	195	8[d]
30 - 39 ft. (drawn, folding)	28	12	336	8[d]
48 - 60 ft. (drawn, folding)	40	15	600	8[d]
Roller Harrow (drawn)				
7.5 - 15.5 ft. (rigid frame)	15	8 - 16	120 - 240	
21 - 25 ft. (wings)	19.5	14	273	10
32 ft. (wings)	19.5	17.5	341	11
Rotary Hoe (rear mounted)				
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
Row-Crop Cultivator				
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
FIELD APPLICATION EQUIPMENT				
Field Sprayer (rear mtd.)				
21 - 42 ft. (fold-up boom)	6 - 8	8 - 9	48 - 72	
Field Sprayer (drawn)				
21 - 42 ft. (front-fold boom)	11 - 15	8	88 - 120	8 - 13
FIELD APPLICATION EQUIPMENT *(continued)*				
42 - 47 ft. (fold-up boom)	15 - 22	10 - 13	150 - 286	
30 - 40 ft. (rear-fold boom)	25 - 30	9.5	238 - 285	
60 - 80 ft. (rear-fold boom)	48 - 58	8 - 9	384 - 522	
Knife-Down Applicator				
13 ft. (rear mtd., rigid)	6	13.5	81	
15 ft. (rear mtd., rigid)	6	15.5	93	
20 ft. (rear mtd., folding)	7	11	77	
24 ft. (rear mtd., folding)	8	11	88	10
27 - 30 ft. (rear mtd., folding)	8	11	88	12
Fertilizer Spreader				
1 – 2 ton (spinner-type)	8	5.5	44	
4 ton (spinner-type)	10	6	60	
5 ton (spinner-type)	15	7	105	
6 - 8 ton (spinner-type)	18	8	144	
Manure Spreader				
125 bu. (rear discharge)	15.5	6.5	101	
200 - 300 bu. (rear discharge)	17 - 23	8	136 - 184	
350 - 500 bu. (rear discharge)	21 - 24	8.5	179 - 204	
700 bu. (rear discharge)	30	8.5	255	8
200 bu. (side discharge)	20	7.5	150	
300 - 400 bu. (side discharge)	20	8.5	170	8
1500 gal. (liquid)	15	8	120	
2500 gal. (liquid)	17	8	136	
3000 gal. (liquid)	20	8.5	170	8
5000 gal. (liquid)	24	11.5	276	9.5
PLANTING AND SEEDING MACHINERY				
Grain drill				
7 - 9 ft. (rear mtd.)	6	7 - 9	42 - 54	10 - 12[e]
11 - 20 ft. (rear mtd.)	8	11 - 20	88 - 160	10 - 12[e]
7 - 9 ft. (drawn)	9	8.5 - 10.5	77 - 95	10 - 12[e]
11 - 14 ft. (drawn)	10.5	12 - 15	126 - 158	10 - 12[e]
20 ft. (drawn)	13.5	21	284	10 - 12[e]
20 - 24 ft. (drawn, sectional)	21	13.5 - 17.5	284 - 368	10 - 12[e]
26 - 32 ft. (drawn, sectional)	25	13.5 - 17.5	338 - 438	10 - 12[e]
40 ft. (drawn, sectional)	29.5	17.5	516	10 - 12[e]
54 ft. (drawn, sectional)	36	17.5	630	10 - 12[e]
Row Crop Planter (corn, bean)				
4 - 40/6-30 in. (drawn)	14.5	13 - 15.5	189 - 225	9
6 - 40/8-30 in. (drawn, end trans.)	23.5	9	212	10
8 - 40 in. (drawn, end trans.)	29	12	348	11
12 - 30 in. (drawn, end trans.)	33	13	429	12
4 - 40/6 - 30 in. (rear mtd., toolbar)	8	13 - 15.5	104 - 124	9
6 - 40/8 - 30 in. (rear mtd., toolbar)	8	19.5	156	11
8 - 40/12 - 30 in. (rear mtd., folding)	8	18.5	148	12.5
8 - 40/12 - 30 in. (drawn, folding)	23 - 28	13.5 - 15	311 - 420	11 - 12
12 - 40/16 - 30 in. (drawn, folding)	25 - 33.5	13.5 - 15	338 - 503	11 - 12
18 - 30 in. (drawn, folding)	36.5	15	548	12
24 - 30 in. (drawn, folding)	36	13.5	486	13
GRAIN HARVEST MACHINERY				
Combine (self-propelled, without header)				
4-row	20	10	200	11.5[f]
4-row/6-row	23	12	276	12.5[f]
6-row/8-row	26	13	338	12.5[f]
8-row/12-row	26	14.5	377	13[f]
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	

Continued on page 8

Table 8. (continued)

Equipment Item and Size	Length (ft.)	Width (ft.)	Area (sq. ft.)	Height (ft.)
GRAIN HARVEST MACHINERY *(continued)*				
Combine (pull-type with header)				
13 ft. Direct-cut or pick-up	33	14	462	10[f]
4 - 40 in. Row-crop or 11 ft. pick-up	43	14.3	615	12.1[f]
HAY-FORAGE HARVEST MACHINERY				
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	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)[g]				
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	9.5	152	10
Forage Harvester (mounted)	12	8.5	102	10
Forage Chopper/Blower	10 - 13	6 - 7.5	60 - 98	
HAULING EQUIPMENT				
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	

Equipment Item and Size	Length (ft.)	Width (ft.)	Area (sq. ft.)	Height (ft.)
HAULING EQUIPMENT *(continued)*				
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	
MISCELLANEOUS MACHINERY				
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	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	8	96	8.5
Tub-Grinder	24	9.5	228	12 - 13

[a] The hitching terms "drawn" and "pull-type" are used synonymously. Also, equipment height (far right column) is shown only if height exceeds 8 feet.
[b] Add 5 feet (and recalculate area) for tractors with duals, 2.5 feet one side only.
[c] Sizes given are general requirements for mounted, semi-mounted, or pull-type, including 14, 16, 18, 20, and 22-inch bottoms.
[d] Add 3 to 4 feet of height if equipped with tine-toothed finishing attachment.
[e] Grain drills with markers are 10 to 12 feet high.
[f] Extension on grain bin may exceed height shown.
[g] See self-propelled combine for approximate dimensions of direct-cut, row-crop, and pick-up headers.