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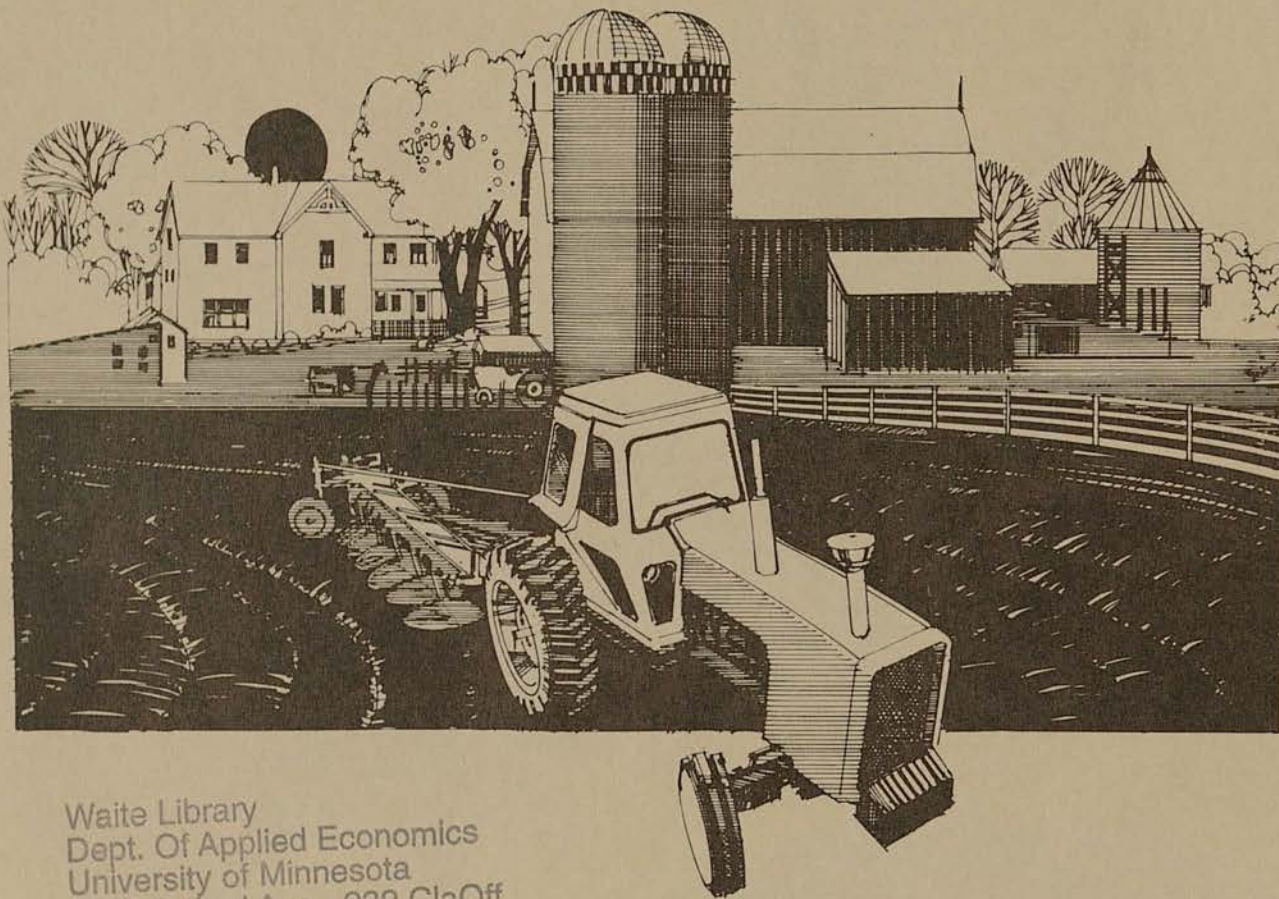
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# Management Guide for Planning a Farm or Ranch Business



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## ***finpack***

### ***planning for tomorrow... today***

COMPUTERIZED FARM FINANCIAL PLANNING AND ANALYSIS PACKAGE

Cooperative Extension Service • South Dakota State University • U.S. Department of Agriculture

Revised 1989 by  
LeRoy Lamp, Lawrence Madsen, Curtis Hoyt,  
Ralph Matz, and Burton Pflueger  
SDSU Extension Farm Management staff

## INTRODUCTION

This Management Guideline is designed to help you plan how to use your land, capital, labor and management skills more profitably. It is intended to serve as a handy reference to answer questions that come up during the daily activities of a farm or ranch business and to help plan changes in your current operation. You can also use the guide in Extension or vocational agriculture farm management or farm planning programs.

The estimates used in this guide are based on slightly above average management ability. Adjust them up or down to reflect your own management ability.

**Management Tips** are included throughout the publication. These are both reminders of timely production practices and stimulants to make production changes if needed.

The guide is divided into five sections color-coded for your convenience. Most of the data were provided through published and unpublished material by Experiment Station and Extension Service personnel at South Dakota State University. Information not available from these South Dakota sources was taken from the public and private sources listed below.

## CREDITS

Cooperative Extension Service, South Dakota State University,  
Brookings, S.D.

Agricultural Experiment Station, South Dakota State University,  
Brookings, S.D.

Cooperative Extension Service, University of Minnesota

Midwest Plan Service

USDA Crop and Livestock Reporting Service

Iowa State University research and Extension publications.

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## MANAGEMENT AIDS FOR YOUR FARM BUSINESS

### FINPACK

FINPACK is a computerized farm financial planning and analysis package available to producers. It provides long-range farm budgeting, one- to three-year cash flows, enterprise analysis and year-end farm business analysis.

FINPACK is available through the SDSU Cooperative Extension Service or other trained sources. The program costs \$50 per farm family through the Extension Service.

### DAKOTATXT

DAKOTATXT is an agricultural marketing and information service available on SDPTV channel via a de-coder. It primarily provides current market quotes from the major marketing exchanges. However, it also gives weather reports, crop and livestock emergency alerts and other relevant agricultural news.

**Overview of  
Management  
Guidelines  
for a Farm or Ranch  
Business Operation**



## FARM BUSINESS PLANNING FOR BETTER FAMILY LIVING

Farm business planning concerns use of resources. This means using your land, capital, labor and management to achieve the kind of living your family desires. In most cases, the family wants a higher income, but not necessarily the highest income possible. This is true because the desire for making money is closely tied to non-profit desires such as decreasing risk and the amount of time and effort needed earn money. Increasing individual family members' personal satisfaction is also important. Increasing the income level can meet these goals to a point. Eventually, however, some income must be forfeited to reach these non-profit goals.

A financially successful farm business pays for:

- 1) All cash operating expenses
- 2) Depreciation
- 3) Interest on investment
- 4) Operator and family labor (going wage rates)
- 5) Management

Family living expenses may or may not be generated by the farm business.

The budgeting procedures and data included in this guide are designed for farm business planning. Use them to compare different ways of organizing your farm business, not to calculate net income. Current prices, which are not provided in this guide, are needed to calculate net income.

These procedures show what may be the best long-term system of setting up the farm business. On the other hand, use an annual budget or operating plan for short-term planning and decision making. Keep and study farm records of your actual farm operation at all times. They will provide the information you need for both long- and short-term planning.

Budgeting procedures provide you with a planning method that allows you to quickly and easily compare different opportunities. You can use it to look at different ways to use your land, capital, labor and management. It also allows you to see how changes will affect your probable income.

Budgeting procedures can do five specific things for you:

1. Help you avoid costly organization mistakes which can happen unless you consider your whole farm business. Make your mistakes on paper rather than in practice.
2. Help you take a closer look at your whole farm operation. Remember each farm is different because each family has different resources and different needs.

3. Enable you to make plans that are adapted to your family and farm. It also also help you estimate your expected income.
4. Help you decide if, with your current resources, it is possible to reach your family's goals, wants and needs.
5. Help you decide what changes or adjustments in resources are needed and/or possible so as to be able to reach your family's goals, wants and needs.

### **HIGH PROFIT FARM PLANS**

Generally speaking, if you have good cropland, plan the land use and cropping programs for your farm first. However, most farms do not have enough cropland to earn the family's desired income from crops alone. Therefore, these farm business operations should include livestock enterprises.

If your farm or ranch has tillable land with relatively low crop productivity, plan the livestock program first and fit the cropping system to the livestock program.

#### **The Cropping System**

High profit cropping systems use crops and combinations of crops that will produce the most returns per acre in value, and corn or hay equivalent at the lowest possible cost. To achieve this you need to look for ways to cut the cost of production per bushel or ton of the crop produced.

Following recommended agronomic practices will lead to lower production costs per unit. Tillage methods, timeliness, choice of varieties, seeding rates, disease and pest control, soil testing and fertilizer use must be closely monitored.

Carefully consider machinery and equipment investment. In some cases, it may be more profitable to use custom operators or leasing plans. Using these alternatives may allow you to use your capital in a more productive part of the farm business. Use partial budgets to determine which alternatives may be the most profitable.

#### **Livestock System**

Development of the most profitable livestock program for your farm is an individual problem that involves many factors. These factors include available feed supplies, labor, managerial skill and personal preferences.

Keep in mind as you plan that profitable livestock programs are built around the feed supply produced by sound land use and



cropping systems. With the capital and labor available these livestock systems provide for:

1. Use of nonsalable pastures, crop aftermath and by-product feed.
2. Use of salable feeds.
3. Use of purchased feed.

Although higher returns from labor usually can be secured from crop production, livestock use labor that can not be used for growing crops. When more labor is allocated to the more profitable enterprises, a larger volume of business on a given acreage is possible.

Available markets, or the lack of them, will influence the amount and kind of livestock kept.

Livestock efficiency is one of the single most important factors influencing livestock net returns. Each livestock enterprise requires its own particular skills and practices. To be a good livestock producer, you must know and keep up with those skills that apply to your enterprise. Some bench marks for profitable livestock production:

1. Pigs marketed per litter -- 7.5 to 9.5
2. Pounds of milk per cow per ??? -- 140 to 180 cwt.
3. Percent beef calf crop weaned -- 90 to 95
4. Percent lamb crop raised -- 120 to 160
5. Daily Gains:
  - Fed Steer Calves -- 2.0 to 2.5
  - Fed Heifer Calves -- 1.8 to 2.2
  - Fed yearlings -- 2.3 to 3.0
  - Fed lambs -- 0.4 to 0.7
  - Pigs (birth to market) -- 1.4 to 1.6
6. Eggs per hen housed -- 210 to 250
7. Income per dollar's worth of feed fed
  - Average goal -- \$1.40 to \$1.90
  - Realistic goal -- \$1.60 to \$2.10

Invest in a costly automated system only if you can clearly see that it will pay for itself. New equipment should return from 22 to 28 percent of its purchase price each year to cover depreciation, interest, taxes, repairs and other costs of owning the equipment.

## BUDGET FOR MORE PROFIT

Budgeting is a planning method that you can use to compare different income opportunities on your farm or ranch. You need to consider three kinds of budgets: enterprise, total business, and partial.

An **Enterprise Budget** is developed for just one aspect of your operation. It lists the expenses from raising a specific crop or type of animal, and the income from selling that commodity. Develop separate budgets for each crop or type of livestock.

The **Total Business Budget** is a complete listing of the operation's income and expenses for the year. It is useful for determining the business's overall financial condition.

**Partial Budgets** usually are used to estimate how a planned change will affect net income. The costs and added returns of both the enterprise dropped and the enterprise added are compared to determine the expected change in net income.

Use the tables in EMC 864, or your own figures, to develop your crop and other land use enterprise budgets. Use example livestock enterprise budgets in EC 745 to estimate your own costs.

After you have decided which enterprise budgets apply to your operation, you are ready to analyze your total farm or ranch business. Complete the FINLRB portion of the FINPACK program available through your Extension office.

How does the profitability of your present plan compare with other plans for your farm or ranch business? Is there a more profitable plan that can be carried out? You can test alternative plans using a partial budget.

A plan sheet like the one following can be used to quickly estimate the potential effect of a planned change, before you include it in the plan for your whole farm or ranch business.

**Partial Budget for Planned Changes**

Enterprise Dropped \_\_\_\_\_

Enterprise Added \_\_\_\_\_

I. Returns from enterprise added \_\_\_\_\_ (dollars)

\_\_\_\_\_

TOTAL RETURNS ADDED \_\_\_\_\_

II. Costs from enterprise dropped

\_\_\_\_\_

TOTAL COSTS DROPPED \_\_\_\_\_

III. Costs from enterprise added

\_\_\_\_\_

TOTAL COSTS ADDED \_\_\_\_\_

IV. Returns from enterprise dropped

\_\_\_\_\_

TOTAL RETURNS DROPPED \_\_\_\_\_

V. Estimated Change in Net Income

A. Add returns added (I)  
to costs dropped (II) \_\_\_\_\_

B. Add costs added (III)  
to returns dropped (IV) \_\_\_\_\_

C. EXPECTED CHANGE IN NET INCOME  
(A minus B) \_\_\_\_\_

## QUICK TEST CHECKS FINANCIAL STRESS

Your financial condition is related to your ability to meet current expenses and obligations. If you are having trouble meeting these, you are suffering some degree of financial stress.

The debt-to-asset ratio has been used to measure financial stress in the past. The ratio tells you what percentage of your assets would be required to repay your debts. It is a good indicator of your financial risk at a specific time. However, it can not warn you if your risk level is changing.

Because of this shortcoming, the debt-to-asset ratio is being replaced by three other financial stress indicators. These ratios and how to calculate them are outlined below.

### Times Interest Earned Ratio

This ratio indicates the operation's ability to pay interest out of operating profit. The amount of financial risk decreases as the value of the ratio increases.

To calculate: Net Cash Income

$$\text{RATIO} = \frac{\text{before interest and taxes}}{\text{Total Interest Payments}}$$

Stress Score:

Healthy = Ratio of 2 or above.

Warning = Ratio of 1.2 to 2.

Trouble = Ratio under 1.2.

### Financial Leverage Ratio

This ratio measures whether the money you borrowed is making or losing money. There is a net benefit from borrowed capital when the ratio is greater than 1. Below a ratio of 1, every borrowed dollar is costing more than it earns.

Calculating this ratio is a three-step process. First, figure your return on equity (ROE), then your return on assets (ROA) and then the leverage ratio.

To calculate:

$$\text{ROE} = \frac{\text{Net Income minus}}{\text{unpaid labor and management}} \div \text{Net Worth}$$

$$\text{ROA} = \frac{\text{Net Income} + \text{interest paid} - \text{unpaid labor and management}}{\text{Total Assets}}$$

$$\text{RATIO} = \frac{\text{ROE}}{\text{ROA}}$$

Stress Score:

- Healthy = Ratio greater than 1.
- Trouble = Ratio less than 1.

### Debt Burden Ratio

This ratio assesses the ability of the operation to retire debt from working capital or earnings. As the ratio decreases, it is harder to retire farm debt from earnings.

$$\text{To Calculate: RATIO} = \frac{\text{Net Cash Income}}{\text{Total Farm Debt}}$$

Stress Score:

- Healthy = Ratio greater than 25.
- Warning = Ratio of 15 to 25.
- Trouble = Ratio under 15.

These ratios can not provide an absolute measure of financial health. But, having one or more of the ratios in the "trouble" area is a sign that additional analysis of your financial situation is needed.

**MANAGEMENT TIP** You can learn what your financial ratios are by using FINPACK of the Planning for Tomorrow-Today program available through your local Extension office.

## FINANCIAL ANALYSIS - RISK INDICATORS

The following ratios and indicators should be considered as **GUIDES ONLY** because circumstances vary widely between farm units and producers, as well as between producers and lenders.

### FINANCIAL RATIOS

### RISK INDICATORS

#### What is Your Debt Level

1. Debt-to-asset ratio	Superior	under 20%
Total Liabilities (B)/	Good	20 to 40%
Total Assets (B)	Close Watch	40 to 55%
	Weak	55 to 70%
	Inferior	over 70%

#### Can You Cover Current Obligations?

2. Current Ratio	Superior	over 2.0
Current Assets (B)/	Good	1.4 to 2.0
Current Liabilities (B)	Close Watch	1.0 to 1.4
	Weak	0.7 to 1.0
	Inferior	under 0.7

#### What is Your Interest Exposure?

3. Interest to Gross Income	Superior	under 10%
Interest Expense (I)/	Good	10 to 15%
Gross Income (I)	Close Watch	15 to 20%
	Weak	20 to 25%
	Inferior	over 25%

#### Whole Farm Profitability?

4. Return on Assets	Superior	over 12%
Net Income (I) +	Good	8 to 12%
Interest Expense (I)/	Close Watch	4 to 8%
Beginning Total Assets (B)	Weak	0 to 4%
	Inferior	under 0%

#### Profitability on Equity Investment?

5. Return on Equity	Superior	over 10%
Net Income (I)/	Good	6 to 10%
Beginning Net Worth (B)	Close Watch	2 to 6%
	Weak	-2 to 2%
	Inferior	under -2%

#### Firm Growth or Decline Due to Earnings?

6. Earned Net Worth Ratio	Superior	over 8%
Net Income (I) - Family	Good	4 to 8%
Consumption (C)/	Close Watch	0 to 4%
Beginning Net Worth (B)	Weak	(-4) to 0%
	Inferior	under -4%

(B) from Balance Sheet  
(I) from Income Statement  
(C) from Cash Flow Statement

Prepared by Drs. Mark A. Edelman,  
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**ANNUAL PAYMENT PER \$1,000 BORROWED  
By Years to Repay and Interest Rate**

The amount of capital that you can borrow without stressing your operation financially is commonly called loan capacity. The following example and table shows you one way of calculating loan capacity based on the amount of earnings available for capital investment.

**SAMPLE**

	<u>Example</u>	<u>You</u>
A. Cash available for new investment	\$4,020	_____
B. Years to repay loan	30	_____
C. Interest Rate	13	_____
D. Annual Payment per \$1,000 (From Table below)	134	_____
E. Loan Capacity (A divided by D x 1,000)	\$30,000	_____

**Annual Payment per \$1,000 Borrowed table**

No. of years  
to repay loan

	<u>Interest Rates</u>					
	<u>6%</u>	<u>7%</u>	<u>8%</u>	<u>9%</u>	<u>10%</u>	<u>11%</u>
1	\$1,060	\$1,070	\$1,080	\$1,090	\$1,100	\$1,130
3	374	381	388	395	402	409
5	237	244	250	257	264	271
7	179	186	193	199	206	213
10	136	142	149	156	163	170
15	103	110	117	124	131	139
20	87	95	102	109	117	126
25	78	86	94	102	110	119
30	73	81	89	97	106	115
35	69	77	86	95	104	113
40	66	75	84	93	102	112
<hr/>						
	<u>12%</u>	<u>13%</u>	<u>14%</u>	<u>15%</u>	<u>16%</u>	<u>17%</u>
1	\$1,120	\$1,130	\$1,140	\$1,150	\$1,160	\$1,170
3	416	423	431	438	442	453
5	277	284	291	298	302	313
7	220	226	234	241	249	257
10	177	184	192	199	203	215
15	147	155	163	171	175	188
20	134	142	151	160	164	178
25	128	136	146	155	159	173
30	124	134	143	152	157	172
35	122	132	142	151	156	171
40	121	131	141	150	155	170



**ESTIMATED TOTAL FAMILY LIVING COSTS  
Related to Number of Persons and Income**

Family Income	<u>Number of Persons in the Household</u>				
	2	3	4	5	6
\$11,000	\$8,500	\$9,415	\$9,915	\$10,375	\$10,785
13,000	9,735	10,455	11,100	11,725	12,285
15,000	10,665	11,380	12,020	12,640	13,195
17,000	11,605	12,330	12,980	13,600	14,155
19,000	12,645	13,360	14,000	14,640	15,190
21,000	13,865	14,600	15,255	15,875	16,430
23,000	14,395	15,140	15,805	16,460	17,045
25,000	14,930	15,685	16,360	17,040	17,650
27,000	15,400	16,215	16,940	17,680	18,280
29,000	15,910	16,740	17,480	18,220	18,885
31,000	16,410	17,305	18,100	18,835	19,490
33,000	17,050	17,910	18,680	19,430	21,100
35,000	17,550	18,385	19,130	19,965	20,710
37,000	17,960	18,900	19,740	20,570	21,310
39,000	18,450	19,400	20,250	21,090	21,940
41,000	18,960	19,940	20,810	21,720	22,535
43,000	19,470	20,480	21,380	22,305	23,130
Poverty Guidelines	4,850	6,020	7,190	8,360	9,530

**Note:** Total estimated expenditures above do NOT include taxes, savings, major remodeling, legal fees or funeral expenses.

Use this table to estimate your living expenses for lines 403, 404 and 405 in FINLRB Input Form if you do not have your own records.

**MANAGEMENT TIP:** Family living expenses should be paid from a personal account that is separate from the farm business account.

**CONSIDERATIONS FOR SETTING UP A FARM INCOME SHARING  
OR OPERATING AGREEMENT**

1. Set up farm account  
Each contribute share: Partner A \_\_\_\_\_ Partner B \_\_\_\_\_
2. Set up separate personal living accounts. Each is responsible for own personal living expenses.
3. All crop and livestock sales will be deposited in farm account.
4. Income from the farm account will be transferred to personal living accounts at a specified time using these percentages:  
Partner A \_\_\_\_\_ Partner B \_\_\_\_\_
5. All farm operating costs are paid from the farm account. Each partner pays their own real estate taxes and present loan principal and interest obligations from their own personal accounts.
6. Cull livestock sales will be deposited in the farm account.
7. Replacement livestock will be raised on the farm or purchased from the farm account.
8. Present owner of livestock will retain ownership of the same number of livestock as owned at the start of the operating agreement.
9. An inventory owned by each partner will be taken at the the start of the operating agreement on:
  - A. All livestock (Number, kind, weight and value).
  - B. Hay and Forage Feeds (Tons, kind and value).
  - C. Grain (Bushels, kind and value).
  - D. Other feeds and supplies on hand (Kind and value).\*Partner B may buy his share of grain and feed inventories on hand at the start of the operating agreement.
10. If the operating share agreement is dissolved, any increase above starting inventories will be shared at percentages listed above. Any decrease in inventories owned by Partner A that Partner B did not purchase as a share at the start of the operating agreement, will be paid back by Partner B at the percentage listed above.
11. A current inventory of livestock and machinery owned by each partner in the farm operation shall be maintained on file. The inventory list should be signed by both partners designating the legal owner with notarized signatures.
12. The share plan should be refigured any time there is a major change made in the resource contributions or capital investments in the farm operation.

# Marketing Guidelines

## TIPS FOR MARKETING GRAIN\*

### Commodity marketing is an emotional experience

1. Price changes create hope, greed, fear and panic.
2. Lack of understanding creates fear of marketing tools.
3. Lack of marketing goals and control creates despair.

### Objectives of a written marketing plan

1. Obtain above average NET PRICE - not highest price.
2. Generate CASH FLOW needs for business and family.
3. LIMIT LOSSES of investment because of declining prices.
4. REDUCE TIME that money is borrowed.
5. IMPROVE LENDER FAITH in your marketing management.
6. LIMIT EMOTION in the marketing decision.

### Net Price = prices received - marketing costs

1. Improving PRICES RECEIVED:
  - Know your transportation costs.
  - Check prices at available markets.
  - Keep records on dockage, grading and moisture.
  - Know the discount schedule of your market.
2. Subtract all costs of storage:
  - Interest Expense
  - Handling and moisture shrink
  - Spoilage and insect damage
  - Elevator storage charge (if stored in one)
  - Insurance

### Obtaining a higher NET PRICE?

1. Increase PRICES RECEIVED
  - Speculation on cash inventories is a risky strategy.
  - Other marketing alternatives can be less risky.
2. Decrease STORAGE COSTS
  - More predictable and sure way to reduce costs.
  - Greater control.

### Basic Marketing Facts and Tips

1. Holding longer = more chance for large monetary loss or gain.
2. Each commodity has distinct pattern of high and low prices.
3. Price declines or increases more likely in certain months.

4. By knowing marketing alternatives, you can control price risk and increase net price.

#### **Specific Marketing Tips**

1. Maintain up-to-date market information.
2. Consider forward pricing part of your crop by using
  - Forward Contracts
  - Buying a Put Option
  - Hedge on Futures Market
3. If selling at harvest, sell at earliest possible moment.
4. Market to take advantage of favorable historical odds.
5. Use commodity loans as cheap capital and a price floor.
6. Attempt to achieve marketing goal early in the year.
7. Periodically evaluate ALL marketing alternatives.
8. Talk to other producers, lenders and county agents about organizing marketing management meetings.

#### **Linking the marketing plan to cash flow and equity position**

1. Segment business and family cash flow.
2. Speed cash inflows, if possible and economical.
3. Slow cash outflows, if credit rating is maintained.

\*Dick Shane, SDSU Extension grain marketing specialist.

## **LIVESTOCK MARKETING TIPS\***

**Marketing plans must be made in conjunction with production plan.**

1. The plan should be written down.
2. Develop farm and family goals.
3. Develop price objectives.
4. Revise, review and monitor - be FLEXIBLE.

**Seasonal price patterns do exist; however, they are:**

1. Not always consistent
  - CATTLE prices usually lowest in fall and highest in spring
  - HOG prices have lows in both the fall and spring.
2. Noticeable in basis patterns on futures market.
3. Not good price predictors.

**Include forward pricing in your alternatives**

1. Forward contracting
  - Prices based on futures market (lower).
  - Expect to make delivery or pay penalty.
  - There are no margin calls or commission fees.
  - Contract specifications are not set.
2. Hedging
  - Expect to pay broker commissions and make margin calls.
  - Contract specifications are set.
  - The basis is critical (see sources below).
  - Opposite transactions are required to hedge.
3. Options
  - The futures market is the underlying commodity.
  - Costs are known to the buyer (premium).
  - Able to take advantage of higher prices.

**Sources of bias in marketing decisions**

1. Delivery point and futures market.
2. Between markets - your local and delivery point.
3. Quality of product - grade, weight, sex.
4. Time.
5. Market psychology.

**Must work with broker, banker and spouse.**

1. Broker
  - Knowledgeable about your product.
  - Follows your direction.
2. Banker
  - Understands your total requirements.
  - Unlimited margin money.
3. Spouse
  - Keep informed and help make decisions.

\*Gene Murra, SDSU Extension livestock marketing specialist.

## GLOSSARY OF MARKETING TERMS

**CASH MARKET:** Selling livestock or crop commodities at auctions and terminals for that day's market price for that commodity.

**FORWARD CONTRACTING:** Using a method of marketing that sells a commodity for a specified price on a specific date in the future. Commodity must be delivered at an agreed upon location and date, and be of contract quality or specifications.

**FUTURES CONTRACT:** The agreement to buy and receive, or to sell and deliver, a commodity at a future date for a specified price.

**HEDGING** The sale (or purchase) of futures against the physical commodity or its equivalent as protection against a price decrease (or increase).

**LONG:** One who has bought a futures contract.

**SHORT:** One who has sold a futures contract.

**BASIS:** Historical differences between local cash price of a commodity and its near future contract's price.

**MARGIN:** The amount deposited by buyers and sellers to insure performance on futures contracts. If a futures position is losing money, the broker requests additional money to maintain the margin deposit level. These requests are referred to as **MARGIN CALLS**.

**OFFSET:** The liquidation of a long or short futures (or option) position by an equal and opposite futures (or option) transaction.

**CALL OPTION:** The right, but not the obligation, to sell a futures contract at a specified price during a specified time period.

**PUT OPTION:** The right to sell a futures contract at a specified price during a specified time period.

**PREMIUM:** The cost an option buyer pays the option seller for an option.

**STRIKE PRICE:** The price at which the option can be exercised. It is also called the **EXERCISE PRICE** because it is the price that the futures position is set at in case the option is exercised.

**EXERCISE:** The process by which the option buyer converts the option into a futures position.



**EXPIRATION DATE:** The day when the owner of the option loses the right to exercise the option.

**IN-THE-MONEY:** The current market price exceeds the strike price of a call or is below the strike price of a put.

**INTRINSIC VALUE:** The amount of difference between the current market price of a call or put, and the option's strike price.

**OUT-OF-THE-MONEY:** The current market price is less than the strike price of a put. Out-of-the-money options have time value. They have no intrinsic value.

**Guide to  
Weights and Measures  
including  
Metric Conversions**

## WEIGHTS AND MEASURES

### Commercial Weight

27 11/32 grains (gr.) = 1 dram (dr.)  
16 drams = 1 ounce (oz.)  
2,000 pounds = 1 ton (T.)  
2,240 pounds = 1 long ton

### Dry Measure

2 pints (pt.) = 1 quart (qt)  
8 quarts = 1 peck (pk)  
4 pecks = 1 bushel (bu)

### Square Measure

144 sq. inches = 1 sq. foot  
9 sq. feet = 1 sq. yard  
30 1/4 sq. yards = 1 sq. rod  
272 1/4 sq. feet = 1 sq. rod  
40 sq. rods = 1 sq. rood  
4 sq. roods = 1 acre  
43,560 sq. feet = 1 acre  
640 acres = 1 sq. mile

### Cubic Measure

67.2 cu. inches = 1 dry qt.  
231 cu. inches = 1 gallon  
537.6 cu. inches = 1 peck  
1,728 cu. inches = 1 cu. foot  
2,150.4 cu. inches = 1 bushel  
1 1/4 cu. feet = 1 bushel  
24 3/4 cu. feet = 1 perch  
27 cu. feet = 1 cu. yard  
128 cu. feet = 1 cord

### Liquid Measure

1 teaspoon = 1/6 oz.  
3 teaspoons = 1 tablespoon  
1 tablespoon = 1/2 oz.  
1 pint = 16 oz. of water  
2 pints = 1 quart  
1 acre foot of water = 43,560 cubic feet of water  
= 326,700 gallons  
= 2,718,144 lbs. of water  
1 acre inch of water = 27,225 gallons  
= 226,512 lbs. of water

1 quart = 0.95 liters (l.)  
1 l. = 1,000 ml = 1.06 qt.  
4 quarts = 1 gallon  
1 gallon = 8.3 lbs. of water  
7.5 gallons = 1 cubic foot

### Linear Measure

1 centimeter (cm) = 10 millimeters (mm)  
1 inch = 2.54 cm = 25.4 mm  
1 foot = 12 inches = 30 cm  
1 yard = 36 inches = 3 feet = 0.91 meter  
1 meter = 100 cm = 39.4 inches = 1.1 yards  
1 rod = 16.5 feet = 5.5 yards  
1 chain = 4 rods = 66 feet  
1 furlong = 40 rods  
1 kilometer (km) = 1,000 meters = .62 miles  
1 mile = 5,280 feet = 1,760 yards = 320 rods  
= 80 chains = 1.61 km = 8 furlongs

## READY REFERENCE FORMULAS

### Perimeter (distance around)

RECTANGLE:  $P = 2 \times \text{length} + 2 \times \text{width}$

SQUARE:  $P = 4 \times \text{side}$

CIRCLE:  $\text{Circumference} = \pi d$   
 $= 2\pi r$

$\pi = 3.14$

$d = \text{diameter}$

$r = \text{radius}$

### Area (A)

RECTANGLE:  $A = \text{length} \times \text{width}$

SQUARE:  $A = \text{length} \times \text{width}$  (or the side squared)

PARALLELOGRAM:  $A = \text{base} \times \text{height}$

TRIANGLE:  $A = \frac{1}{2} \text{base} \times \text{height}$

CIRCLE:  $A = \pi r^2$

CUBE:  $A = 6 \times \text{edge}^2$

$\pi = 3.14$

$r = \text{radius}$

### Volume (V)

CYLINDER:  $V = \text{area of base} \times \text{height}$   
 $= \pi r^2 \times h$

RECTANGULAR SOLID  $V = \text{length} \times \text{width} \times \text{height}$

CUBE:  $V = \text{edge} \times \text{edge} \times \text{edge}$  (edge-cubed)

CONE:  $V = \frac{1}{3} \text{area of base} \times \text{height}$   
 $= \frac{1}{3}\pi r^2 \times \text{height}$

SPHERE:  $V = \frac{4}{3}\pi r^3$

$\pi = 3.14$

$r = \text{radius}$

## METRIC CONVERSION FACTORS

### Approximate Conversion from Metric Measures

<u>SYMBOL</u>	<u>WHEN YOU KNOW</u>	<u>MULTIPLY BY</u>	<u>TO FIND</u>	<u>SYMBOL</u>
<b>LENGTH</b>				
mm	millimeters	0.04	inches	in
cm	centimeters	0.4	inches	in
m	meters	3.3	feet	ft
m	meters	1.1	yards	yd
km	kilometers	0.6	miles	mi
<b>AREA</b>				
cm**	square cm	0.16	square in	in**
m**	square m	1.2	square yd	yd**
km**	square km	0.4	square mi	mi**
ha	hectare = 10,000 m**	2.5	acres	
<b>MASS (weight)</b>				
g	grams	0.035	ounces	oz
kg	kilograms	2.2	pounds	lb
t	tonnes = 1,000 kg	1.1	short tons	
<b>VOLUME</b>				
ml	milliliters	0.03	fluid ounces	fl oz
l	liters	2.1	pints	pt
l	liters	1.06	quarts	qt
l	liters	0.26	gallons	gal
m***	cubic meters	35.0	cubic feet	ft***
m***	cubic meters	1.3	cubic yards	yd***
<b>TEMPERATURE (exact)</b>				
^C	Celsius temp	$^{\circ}\text{C} \times \frac{9}{5} + 32$	Fahrenheit temp	^F

NOTE: \*\* = squared  
 \*\*\* = cubed  
 ^ = degrees

## Approximate Conversions to Metric Measures

<u>SYMBOL</u>	<u>WHEN YOU KNOW</u>	<u>MULTIPLY BY</u>	<u>TO FIND</u>	<u>SYMBOL</u>
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### LENGTH

in	inches	2.54	centimeters	cm
ft	feet	30.0	centimeters	cm
yd	yards	0.9	meters	m
mi	miles	1.6	kilometers	km

---

### AREA

in**	square inches	6.5	square cm	cm**
ft**	square feet	0.09	square meters	m**
yd**	square yards	0.8	square meters	m**
mi**	square miles	2.6	square km	km**
	acres	0.4	hectares	ha

---

### MASS (weight)

oz	ounce	28.0	grams	g
lb	pounds	0.45	kilograms	kg
	short tons = 2,000 lb	0.9	tonnes	t

---

### VOLUME

tsp	teaspoon	5.0	milliliters	ml
Tbsp	tablespoon	15.0	milliliters	ml
fl oz	fluid ounces	30.0	milliliters	ml
c	cups	0.24	liters	l
pt	pints	0.47	liters	l
qt	quarts	0.95	liters	l
gal	gallons	3.8	liters	l
ft***	cubic feet	0.03	cubic meters	m***
yd***	cubic yards	0.76	cubic meters	m***

---

### TEMPERATURE (exact)

^F	Fahrenheit temp	$^{\circ}\text{F} - 32 \times \frac{5}{9}$	Celsius temp	^C
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NOTE:   \*\* = squared  
          \*\*\* = cubed  
          ^ = degrees

# Crop Production Tables



## Measuring Hay in Stacks

### Round Stacks

The volume in cubic feet of round stacks is best figured by using this formula:

$$\text{Volume} = [(0.4 \times O) - (0.012 \times C)] \times C \times C$$

In this formula, O equals the OVER, or the distance in feet from the ground on one side up and over the peak down to the ground on the other side. You should take two measurements of O from different spots and then average them.

C equals the CIRCUMFERENCE or the distance in feet around the stack at the ground.

**EXAMPLE** If O measures 40 ft and C measures 60 ft., the volume in cu. ft. is figured this way:

$$V = [(0.4 \times 40) - (0.012 \times 60)] \times 60 \times 60$$

$$V = [1.6 - .72] \times 60 \times 60$$

$$V = .88 \times 60 \times 60$$

$$V = 3,168 \text{ cu. ft.}$$

### Oblong or Rectangular Stacks

The volume of an oblong or rectangular stack equals its length times the area of its cross section. The LENGTH can be easily measured, but an accurate formula is needed to figure the area of the cross section. Two other measurements, the OVER and the WIDTH, are used in this formula.

The following definitions are used in the formulas below. The OVER, O, is the distance from the ground on one side, up and over the peak and down to the ground on the other side. The WIDTH, W, is the width of the stack at the ground. The LENGTH, L, is the average length of the stack at the ground.

For low, round-topped stacks:

$$V = [(.52 \times O) - (.44 \times W)] \times W \times L$$

For high, round-topped stacks:

$$V = [(.52 \times O) - (.46 \times W)] \times W \times L$$

For square, flat-topped stacks:

$$V = [(.56 \times O) - .55 \times W] \times W \times L$$

**EXAMPLE** Determine cu. ft. in a square, flat-topped stack if L measures 50 ft., W measures 35 ft. and O measures 70 ft.

$$V = [(.56 \times 70) - (.55 \times 35)] \times 35 \times 50$$

$$V = [39.20 - 19.25] \times 35 \times 50$$

$$V = 19.95 \times 35 \times 50$$

$$V = 34,912 \text{ cu. ft.}$$

## DETERMINING HAY TONNAGE

To find the approximate number of tons in a given stack, simply divide the number of cubic feet in the stack (formulas given on the previous page) by the cubic feet per ton as shown in the table below.

### Cubic Feet per Ton of Settled Hay

Type of Hay	cu. ft.	Type of Hay	cu. ft.
Alfalfa	470	Straw (baled)	200
Clover	500	Straw (loose)	800
Chopped Hay	210	Timothy	625
Baled Hay (loosely stacked)	175	Wild Hay	450

### BEST TIME TO CUT HAY

Cut	When
Alfalfa	1/10 to 1/4 of crop is blooming or new shoots begin developing from the crown
Alsike and Red Clover	1/2 to full bloom
Annual Lepedeza	In full bloom to early seed stage depending on height and leafiness
Crimson Clover	Flower fading at base of most advanced heads
Ladino Clover	Heading out to bloom stage
Sericea	12 to 15 inches high
Small grains	Grain is in milk stage
Soybeans and Cowpea	Pods are from 1/2 to fully matured
Sweet Clover	Blooming begins

**MANAGEMENT TIP:** It is better to harvest hay early than late.

**CALCULATING STORAGE CAPACITIES**

**Shelled corn bushels in round bin**

Capacity = bin diameter ft. x depth ft. x .630

**Bushels in rectangular storage**

Capacity = width ft. x depth ft. x length ft. x .8

**Hay Sheds with 20 ft. sidewalls**

Capacity per foot of Length  
(tons)

<u>Shed Width</u>	<u>Baled</u>	<u>Chopped</u>	<u>Loose</u>
24'	2.0	1.9	0.8
30'	2.6	2.3	1.0
36'	3.1	2.8	1.2
40'	3.4	3.1	1.4

(Table courtesy of Midwest Plan Service)

**APPROXIMATE DRY MATTER CAPACITY OF SILOS**

Depth of Settled Silage (ft.)	Silo Diameter, ft.										
	10'	12'	14'	16'	18'	20'	22'	24'	26'	28'	30'
20'	8	12	16	21	27	33	40	47	56	65	74
24'	11	15	21	27	34	43	52	61	72	83	96
28'	13	19	26	35	44	53	64	76	90	104	119
32'	16	23	32	41	52	65	78	93	109	127	145
36'	19	28	37	48	62	76	92	109	129	150	172
40'	22	32	44	57	72	89	107	127	150	173	199
44'		37	50	65	82	102	123	146	172	200	229
48'		42	56	74	93	115	140	166	195	226	260
52'			64	83	105	129	157	186	219	254	291
56'			71	93	117	144	174	207	243	282	324
60'			78	102	129	159	192	228	273	309	357
64'					142	174	210	250	301	339	391
68'					155	190	228	271	328	369	424
72'								293	356	400	458
76'								316	385	431	493
80'								339	414	462	528

**MANAGEMENT TIP:** Use this formula to estimate tons of silage at various moisture contents:  
 actual tons of silage =  
 (tons of dry matter) x (100/est. dry matter in silage)

**CAPACITIES OF HORIZONTAL SILOS PER 10 FT. OF LENGTH**  
**(Level Fill at 50 cu. ft. = 1 ton)**

Depth ft.	Silo floor width, ft.								
	20'	30'	40'	50'	60'	70'	80'	90'	100'
10' bu.	1800	2600	3400	4200	5000	5800	6600	7400	8200
tons	45	65	85	105	125	145	165	185	205
12' bu.	2206	3168	4128	5088	6048	7008	7968	8928	9888
tons	55	79	103	127	151	175	199	223	247
14' bu.	2632	3752	4872	5992	7112	8232	9352	10472	11592
tons	66	94	122	150	178	206	234	262	290
16' bu.	3064	4344	5624	6904	8184	9464	10744	12024	13304
tons	77	109	141	173	205	237	269	301	333
18' bu.	3528	4968	6408	7848	9288	10728	12168	13608	14048
tons	88	124	160	196	232	268	304	340	376
20' bu.	4000	5600	7200	8800	10400	12000	13600	15200	16800
tons	100	140	180	220	260	300	340	380	420

NOTE: Closed end bins hold additional storage. To compensate for this, multiply the capacity listed by the following ratios:

10' depth = 1/8	16' depth = 1/5
12' depth = 1/7	18' depth = 1/5
14' depth = 1/6	20' depth = 1/4

Open end of bin is less than full. Use the following ratios to determine what factor to deduct:

Slope of silage	Deduction
1/4	0 x closed end capacity
1/2	2 x closed end capacity
1/1	4 x closed end capacity

**EXAMPLE:** Bin is 50' wide and 12' deep with one closed end.

Capacity per 10' (from table) = 127 tons

Capacity per 120' = 12 x 127 = 1,524 tons

Closed end = 1/7 x 127 = 18

Open end deduction = 2 x 18 = 36 tons

Total Capacity = 1,544 + 18 - 36 = 1,526 tons

**APPROXIMATE STORAGE SPACE REQUIREMENTS  
FOR SILAGE AND HIGH MOISTURE CORN**

<u>Material Description</u>	<u>lb./cu. ft.</u>	<u>cu. ft./ton</u>
Corn Shelled:		
25% moisture	43.1	46
30% moisture	39.7	51
Corn and cob meal:		
30% moisture	38.5	52
Silage:		
upright silo	40*	50
horizontal silo	35*	60
spread in bunk	25*	80

\*Silage densities and weights are highly variable, depending on material, cut, moisture content and depth in silo.

**STORAGE CAPACITY FOR COMMON ROUND BINS**

<u>Diameter</u> <u>(ft.)</u>	<u>bu. per ft.</u> <u>of height</u>	<u>Capacities for Selected Depths</u>			
		<u>11'</u>	<u>13'</u>	<u>16'</u>	<u>19'</u>
14	125	1375	1625	2000	2375
18	203	2200	2635	3250	3850
21	277	3050	3600	4400	5300
24	362	4000	4700	5800	6900
27	458	5050	5950	7300	8700
30	565	6215	7345	9040	10735
36	814	8950	10600	13000	15450
40	1005	11050	13050	16100	19100

NOTE: Does not include space above eave. Based on 15.5 MC corn and 1.25 cu. ft. per bushel.

**APPROXIMATE CAPACITY OF EAR CORN CRIBS**

width (ft.)	RECTANGULAR		diameter (ft.)	ROUND	
	height (ft.)	bu. per 10 ft. (length)		height (ft.)	capacity (bu.)
4	12	188	12	12	540
	16	256		16	720
	20	320		20	900
6	12	288	14	12	740
	16	384		16	980
	20	480		20	1230
8	12	284	16	12	960
	16	512		16	1280
	20	638		20	1610
10	12	480	18	12	1220
	16	640		16	1620
	20	800		20	2030

NOTE: Based on 2 1/2 cubic feet per bushel.  
 Includes 1/2 cone space with no deduction for center tunnel.  
 Roof slope 1:1

**PASTURE PRODUCTION RATES FOR NORMAL SOIL GROUPS**

<u>Average Annual Precipitation</u>	<u>Native Range or Pasture Condition</u>			
	<u>Excellent</u>	<u>Good</u>	<u>Fair</u>	<u>Poor</u>
	-Animal Unit Months per Acre*-			
30-34"	1.2-2.0	0.9 -1.6	0.6-1.2	0.3- 0.6
25-29"	1.0-1.8	0.75-1.4	0.5-1.1	0.25-0.5
20-24"	0.8-1.5	0.6 -1.2	0.4-0.9	0.2-0.4
15-19"	0.6-1.2	0.45-0.9	0.3-0.7	0.15-0.3
10-14"	0.4-0.9	0.3 -0.6	0.2-0.5	0.1 -0.2
5- 9"	0.2-0.6	0.15-0.4	0.1-0.3	0.05-0.1

\*An AUM is the grazing needed for a 1,000 pound cow for 1 month.

**USE THESE NOTES TO DETERMINE YOUR GRAZING RATE**

The figures to the right in each column under each range or pasture condition are rates that many pastures are being used at. South Dakota's range and pasture condition decreases when these lands are grazed at these rates. Also, livestock production will be LOWER than assumed in the budget tables.

The figures to the left in each column under each range or pasture condition are recommended agronomic rates of use. Pasture condition should improve when these rates are used.

Soil condition and group are important factors when estimating grazing rate:

\*SAND, SANDY, SILTY and CLAYEY soils use the values given for the annual precipitation level.

\*WETLANDS triple the value given.

\*SUBIRRIGATED double the values.

\*OVERFLOW and SALINE LOWLANDS use values for the next highest precipitation level.

\*CHOPPY SANDS use values one-half level lower.

\*FOR VERY SHALLOW SOIL, SHALE and BADLANDS use values at least two levels lower.

\*DENSE CLAY, SHALLOW SOIL and PANSPOT use values one-half to one level lower.

**TAME PASTURE:**

Animal unit months of grazing from land planted to grass or grass legume mixtures can be estimated if you can estimate the hay yield that you would expect from these acres. AUM's of grazing per acre equal approximately 2 times the tons of hay that could be harvested.

Grazing capacity can also be estimated based on native pasture productivity. Use a factor of 2 1/2 times the expected productivity of good to excellent native pasture for the area. For example, if native pasture is expected to produce one AUM per acre, tame pasture should product 2 1/2 AUM's of grazing.

**MANAGEMENT TIP:** Grazing capacity can be increased by rotational grazing (Savory System) and selective weed control and pasture renovation practices.

## FORAGE CONVERSION RATES FOR HAY EQUIVALENT

<u>Forage</u>	<u>Alfalfa Hay Equivalent Factor</u>
Alfalfa Hay	1.00
Grass Hay	.90
Oat Hay	.90
Corn Silage (30% DM)	.30
Sorghum Silage (30% DM)	.27
Oat Silage (30% DM)	.29
Alfalfa Haylage (65% DM)	.63
Alfalfa Silage (55% DM)	.54
Alfalfa Silage (25% DM)	.28
Alfalfa Grass Silage (40% DM)	.30
Mixed Grass Silage (30% DM)	.27

### OTHER FEED VALUE RELATIONSHIPS

\*44% soybean oilmeal was assumed where supplement is indicated.

- 1 T. corn silage = 1 AUM
- 1/3 T. grass hay = 1 AUM
- 1 T. alfalfa equivalent = 3.5 AUM's
- 3 T. corn silage = 1 T. grass hay + 4.5 bu. corn
- 3 T. corn silage + 200 lbs. supp. = 1 T. alf. hay + 8 bu. corn
- 1 T. grass hay = 3 T. oat silage + 2 bu. corn
- 1 T. alfalfa hay = 3 T. oat silage + 300 lbs. supp.
- 1 T. alfalfa grass silage = 1 T. corn silage + 100 T. supp.
- 1 T. corn silage = 4 bu. corn + .15 T. grass hay
- 1 bu. corn = 1.1 bu. sorghum
- = 1.25 bu. barley
- = 2 bu. oats
- = 0.9 bu. wheat
- 1 T. ear corn = 28 bu. shelled corn

\*Depending upon the farm situation and the fall season, small grain stubble and corn stalks may provide up to 1 AUM of grazing. The most usual rate of use is less than 0.5 AUM per acre.

\*Approximately 1 ton of silage is produced for each 5 bushels of corn yield or for each 7 bushels of oat yield.

**MANAGEMENT TIP:** Try to harvest hay at its optimum. Remember that it is better to harvest hay early than late.



## KERNEL SPACINGS TO ACHIEVE VARIOUS PLANT POPULATIONS

Seeds Per ac.	Inches between each Kernel (based on row width)								Final Population*
	20"	24"	28"	30"	32"	36"	38"	40"	
14,000	22.4	18.6	16.0	15.0	13.9	12.4	11.8	11.2	12,600
15,000	20.9	17.4	14.9	14.0	13.0	11.6	11.0	10.4	13,500
16,000	19.6	16.4	14.0	13.2	12.2	10.9	10.4	9.8	14,400
17,000	18.4	15.3	13.2	12.4	11.5	10.2	9.8	9.2	15,300
18,000	17.4	14.6	12.4	11.7	10.9	9.7	9.2	8.7	16,200
19,000	16.5	13.8	11.8	11.1	10.3	9.2	8.7	8.2	17,100
20,000	15.7	13.1	11.2	10.5	9.8	8.7	8.3	7.8	18,000
22,000	14.3	11.9	10.2	9.5	8.9	7.9	7.5	7.1	19,800
24,000	13.1	10.8	9.3	8.7	8.1	7.2	6.9	6.5	21,600
26,000	12.1	10.1	8.6	8.1	7.5	6.7	6.4	6.0	23,500
28,000	11.2	9.3	8.0	7.5	7.0	6.2	5.9	5.6	25,200
30,000	10.4	8.7	7.5	7.0	6.5	5.8	5.5	5.2	27,000
<u>32,000</u>	<u>9.8</u>	<u>8.1</u>	<u>7.0</u>	<u>6.6</u>	<u>6.1</u>	<u>5.4</u>	<u>5.2</u>	<u>4.9</u>	<u>28,800</u>

\*Final population allows for a 10% stand loss.

NOTE: Where hill dropping is used, double or triple the single kernel spacing, depending number of kernels dropped per hill.

### NUMBER AND LENGTH OF ROWS IN AN ACRE

Length of rows in rods*	If distance between rows is:						
	20"	24"	30"	32"	36"	38"	40"
40	39.6	33.0	26.4	24.7	22.0	20.8	19.8
60	26.4	22.0	17.6	16.5	14.7	13.9	13.2
80	19.5	16.5	13.2	12.7	11.0	10.4	9.9
100	15.8	13.2	10.5	9.9	8.8	8.3	7.9
120	13.2	11.0	8.7	8.2	7.3	6.9	6.5
140	11.3	9.4	7.5	7.0	6.3	5.9	5.6
<u>160</u>	<u>9.8</u>	<u>8.2</u>	<u>6.6</u>	<u>6.2</u>	<u>5.5</u>	<u>5.2</u>	<u>4.9</u>

\*One rod equals 16.5 ft.; 40 rods equals 660 ft.; one acre equals 160 sq. rods or 43,560 sq. ft.

## ESTIMATING ACRES PER BAG OF SEED CORN

KERNEL count/bag	ACRES planted at different plant populations			
	<u>16,000</u>	<u>18,000</u>	<u>20,000</u>	<u>22,000</u>
60,000	3.8	3.3	3.0	2.7
70,000	4.4	3.9	3.5	3.2
80,000	5.0	4.4	4.0	3.6
90,000	5.6	5.0	4.5	4.1
<u>95,000</u>	<u>5.9</u>	<u>5.3</u>	<u>4.8</u>	<u>4.3</u>

**MANAGEMENT TIP:** From a genetic standpoint, kernels of the hybrid lot are the same regardless of kernel size. University research has not shown a significant yield advantage for any one kernel size. Kernel size relates more to planting convenience which is becoming less important.

### ESTIMATED POPULATION AND YIELDS

Row Width	Length of Row for 1/1000 Acre
20"	26'2"
30"	17'5"
36"	14'6"
38"	13'9"
40"	13'1"

#### How many plants per acre?

**Step 1:** Measure 1/1000 of acre (see above).  
Count plants.

**Step 2:** Multiply by 1000.

**Example:** 40 inch rows - measure 13'1".  
Counted 18 plants. Multiply by 1000.  
18,000 plants per acre.

#### How many bushels per acre?

**Step 1:** Measure 1/1000 of acre (see above).  
Harvest corn.

**Step 2:** Weigh grain. Multiply by 1000 for "pounds per acre"

**Step 3:** Check moisture. Use the Moisture Content Table on the next page to divide "pounds per acre" by pounds per bushel adjusted for moisture.

**Example:** 36-inch rows. Measure 14'6". Harvest 7.25 lbs of shelled corn x 1000 = 7,250 lbs. per acre.  
Moisture is 19%.  
7,250 lbs./58.42 lbs. per bu. = 124 bu. per acre.

#### How to correct yields for moisture content.

**Step 1:** Shell a two-pound sample and test IMMEDIATELY.

**Step 2:** Use the table on the next page to determine how many pounds of that corn are required to equal a bushel (56 lbs.) of No. 2 shelled corn at 15.5% moisture.

**CORRECTING YIELDS FOR MOISTURE CONTENT**

<u>% Moisture in corn</u>	<u>Shelled corn*</u>	<u>Ear corn*</u>	<u>% Moisture in corn</u>	<u>Shelled corn*</u>	<u>Ear corn*</u>
10.0	52.48	63.49	23.5	61.86	79.01
11.0	53.17	64.25	24.0	62.26	79.76
12.0	53.17	65.06	24.5	62.68	80.50
12.5	54.08	65.50	25.0	63.09	81.25
13.0	54.39	65.95	25.5	63.52	82.03
13.5	54.71	66.42	26.0	63.95	82.82
14.0	55.02	66.89	26.5	64.38	83.50
14.5	55.35	67.39	27.0	64.82	84.19
15.0	55.67	67.89	27.5	65.27	84.90
15.5	56.00	68.40	28.0	65.72	85.62
16.0	56.33	68.94	28.5	66.18	86.32
16.5	56.67	69.51	29.0	66.65	87.04
17.0	57.01	70.09	29.5	67.12	87.76
17.5	57.36	70.69	30.0	67.60	88.50
18.0	57.71	71.31	31.0	68.58	89.94
18.5	58.06	71.95	32.0	69.59	91.43
19.0	58.42	72.60	33.0	70.63	92.85
19.5	58.78	73.27	34.0	71.70	94.28
20.0	59.15	73.96	35.0	72.80	95.71
20.5	59.52	74.60	36.0	73.94	97.17
21.0	59.90	75.36	37.0	75.11	98.64
21.5	60.28	76.07	38.0	76.32	100.13
22.0	60.67	76.79	39.0	77.57	101.63
22.5	61.06	77.53	40.0	78.87	103.16
23.0	61.45	78.25			

(Iowa State Publication, Agronomy 205)

\*Equals the number of bushels required to equal a bushel (56 lbs.) of No. 2 shelled corn at 15.5% moisture. The figures for ear corn are applicable only during the harvest season.

## INVESTMENT AND MACHINE OWNERSHIP COSTS PER TILLABLE CROP ACRE

Area & Tillable Ac.	Investment		Machine Ownership Costs	
	New	Average	Depreciation	Interest
			-dollars per acre-	
<b>North East - Area 1</b>				
Small (under 300)	270	150	24.30	15.00
Medium (300-700)	250	140	22.50	14.00
Large (over 700)	220	120	19.80	12.00
<b>East North Central - Area 2</b>				
Small (under 600)	200	110	18.00	11.00
Medium (600-1,000)	180	100	16.20	10.00
Large (over 1,000)	155	85	13.95	8.50
<b>Central North Central - Area 3</b>				
Small (under 700)	170	95	15.30	9.50
Medium (700-1,200)	155	85	13.95	8.50
Large (over 1,200)	130	70	11.70	7.00
<b>South Central - Area 7</b>				
Small (under 500)	225	125	20.25	12.00
Medium (500-900)	210	115	18.90	11.50
Large (over 900)	170	95	15.30	9.50
<b>Southwest Central - Area 6</b>				
Small (under 400)	290	160	26.10	16.00
Medium (400-700)	270	150	24.30	15.00
Large (over 700)	225	125	20.25	12.50
<b>East South East - Areas 8 &amp; 9</b>				
Small (under 300)	280	155	25.20	15.50
Medium (300-600)	260	145	23.40	14.50
Large (over 600)	220	120	19.80	12.00
<b>Western Range - Areas 4 &amp; 5</b>				
<u>Average for area</u>	<u>150</u>	<u>90</u>	<u>13.50</u>	<u>10.80</u>

\*Depreciation based on 10-year life with 10% salvage value is equal to 9% of new investment.

\*Interest charge was calculated at 10% of average investment.

### YOUR FARM ESTIMATE:

If you do not have your own inventory value for crop machinery, use the average per acre investment that you feel is closest to your situation.

\_\_\_\_\_ tillable ac. x \$ \_\_\_\_\_ per ac. = \$ \_\_\_\_\_ est. machinery  
inventory

Machine investment and ownership costs may vary from table due to:

\*No. of crop acres per farm

\*Age of equipment

\*Average field size

\*Equipment size

\*Diversity of crops grown

\*Amount of custom hire

\*Percentage of cropland in fallow

**ESTIMATED MAN HOURS PER ACRE  
AND ALLOCATED VARIABLE POWER AND IMPLEMENT COST PER ACRE  
Pre-harvest Operation**

Table 7

<u>Operation</u>	<u>Machine Size</u>	<u>Man Hours</u>	<u>Repairs &amp; Service</u>	<u>Fuel, Oil Grease</u>
Plow	4-16's	.52	\$5.08	\$1.54
Plow	5-16's	.41	4.71	1.90
Plow	6-16's	.35	4.67	2.29
Plow	8-16's	.25	4.32	2.00
Plow	10-16's	.18	4.30	1.50
Plow	16-18's	.11	4.35	1.40
Disk (Tandem)	17 feet	.15	.48	.43
Disk (Tandem)	19 feet	.14	.56	.49
Disk (Tandem)	22 feet	.12	.56	.52
Disk (Tandem)	25 feet	.10	.54	.52
Disk (Tandem)	30 feet	.09	.53	.51
Chisel Plow	15 feet	.20	.68	.93
Chisel Plow	17 feet	.17	.66	.92
Chisel Plow	25 feet	.13	.79	.99
Chisel Plow	29 feet	.11	.75	1.08
Chisel Plow	31 feet	.10	.78	1.12
Field Cultivator	12 feet	.27	.53	.61
Field Cultivator	17 feet	.20	.51	.60
Field Cultivator	27 feet	.13	.57	.59
Field Cultivator	33 feet	.10	.59	.64
Field Cultivator	49 feet	.07	.63	.73
Springtooth	24 feet	.12	.23	.33
Springtooth	36 feet	.08	.23	.28
Spiketooth Harrow	30 feet	.10	.29	.41
Spiketooth Harrow	48 feet	.07	.25	.37
Spiketooth Harrow	66 feet	.04	.24	.38
Plow/pony press	4-16's	.60	6.25	2.75
Plow/pony press	6-16's	.40	5.95	2.60
Plow/pony press	8-16's	.30	5.65	2.55
Rotary Hoe	25 feet	.12	.26	.23
Rotary Hoe	40 feet	.08	.27	.19
Chop stalks	4 row	.20	.49 (G)	.52
Chop stalks	8 row	.12	.54	.43
Surflex	16 feet	.20	.63	.58
<u>Surflex</u>	<u>2-16 feet</u>	<u>.11</u>	<u>.58</u>	<u>.54</u>

(G) = Gasoline                      (D) = Diesel  
 Fuel cost conversion    (G-D) = 0.83                      (D-G) = 1.20  
 Repair cost conversion (G-D) = 1.12                      (D-G) = 0.89

Table 7 (con't)

<u>Operation</u>	<u>Machine Size</u>	<u>Man Hours</u>	<u>Repair &amp; Service</u>	<u>Fuel, Oil Grease</u>
Noble Blade	5 feet	.55	4.52	1.92
Noble Blade	10 feet	.32	4.43	1.88
Rod Weeder	12 feet	.22	.28	.43
Rod Weeder	24 feet	.10	.20	.31
Plant Row Crops, W/O	4 row, 40"	.16	.70 (G)	.40
Plant Row Crops, W/FC	4 row, 40"	.22	.89 (G)	.37
Plant Row Crops, " "	6 row, 36"	.15	.98	.34
Plant Row Crops, " "	8 row, 36"	.12	.85	.34
Plant Row Crops, " "	12 row, 30"	.08	1.42	.29
Cycloplanter, W/FC	4 row, 36"	.16	.58	.27
Cycloplanter, W/FC	6 row, 30"	.13	.80	.28
Cycloplanter, W/FC	8 row, 30"	.10	.77	.25
Cycloplanter, W/FC	12 row, 30"	.06	.69	.24
No Till Planter	4 row, 30"	.29	1.13	.65
No Till Planter	8 row, 30"	.15	1.13	.54
No Till Planter	12 row, 30"	.10	1.06	.51
Cultivate	4 row	.26	.75 (G)	.46
Cultivate	6 row	.17	.56	.29
Cultivate	8 row	.13	.46	.21
Lister Planter	4 row	.26	.80	.68
Lister Cultivator	4 row	.24	.55	.50
Drill Small Grain	10 feet	.35	2.37	.81
Drill Small Grain	14 feet	.23	2.20	.61
Drill Small Grain	20 feet	.18	2.05	.41
Drill Small Grain	28 feet	.15	1.96	.40
No Till Drill	10 feet	.39	2.39	.86
No Till Drill	20 feet	.20	2.23	.41
Small Grain: Cultivate, drill & harrow	14 feet	.24	4.28	1.51
Small Grain: Cultivate, drill & harrow	20 feet	.19	4.26	1.18
Endgate Seeder	- - -	.09	.15	.26
Roto Tiller	16 feet	.20	1.11	1.58
Anhydrous Applicator	24 feet	.16	.71	.97
Dry Fert. Spreading	45 feet	.06	.19	.16
<u>Spray, Corn or S.G.</u>	<u>26 feet</u>	<u>.16</u>	<u>.25 (G)</u>	<u>.26</u>
(G) Gasoline				

**ESTIMATED MAN HOURS PER ACRE  
AND ALLOCATED VARIABLE POWER AND IMPLEMENT COSTS PER ACRE  
Harvest Operations**

Table 8

<u>Operation</u>	<u>Machine Size</u>	<u>Man Hours</u>	<u>Repair &amp; Service</u>	<u>Fuel, Oil Grease</u>
Swath Small Grain	14' (PTO)	.18	\$1.19	\$0.42
Swath Small Grain	18' (PTO)	.14	1.17	.30
Swath Small Grain	21' (PTO)	.12	1.08	.26
Swath Small Grain	16' (SP)	.14	1.72 (G)	.21
Swath Small Grain	18' (SP)	.13	1.91	.28
Combine Grain & Beans	16' PTO & M	.31	2.80	1.41
Combine Grain & Beans	20' PTO	.26	2.34	1.44
Combine Grain & Beans	20' SP	.25	2.92	.92
Combine Grain & Beans	24' SP	.20	2.78	.76
Haul/Store SG.&Beans	Tractor/Wagon	.39	.40	1.28
" " " " " " "	Tractor	.32	.25	1.48
Corn picker-sheller	2 row	.79	3.08	1.75
Haul & Store Corn	Tractor/Wagon	.60	.42	1.96
Haul & Store Corn	Truck	.50	.45	2.20
Chop Silage (8T)	2 row	.63	8.09	2.86
Chop Silage (8T)	4 row	.40	6.90	2.57
Haul & Store Silage	3 tractors	1.70	1.90	3.88
" " " " " "	Dump Wag/truck	.55	3.55	2.32
Mow Hay	7 feet	.35	.87 (G)	.48
Mow Hay	9 feet	.27	.76	.36
Rake Hay	24' (dump)	.10	.20	.18
Rake Hay	7 feet	.30	.70	.37
Rake Hay	9 feet	.25	.70	.34
Windrow Hay	16' SP	.17	1.72	.21
Windrow Hay	18' SP	.16	1.91	.28
Windrow Hay	21' SP	.14	1.94	.24
Mow, Condition	Windrow, 12'	.20	1.50	.27
Mow, Condition	Sickle, 9'	.33	1.70	.50
Bale Hay (1.5 T/A)	4.5 T/hr.	.40	5.00*	.93
Lg. Round Bale (same)	6.0 T/hr.	.30	2.08**	1.00
Stack Hay (same)	Front Loader	.35	1.15	.70
Stack Mover (same)	10 Ton	.10	1.00	.36
Stack Wagon (same)	3 Ton	.28	4.75	1.04
Stack Wagon (Same)	6 Ton	.24	5.95	.76
Haul-Store-Bale/T.	Bale wagon(SP)	.25	2.20	.52
Haul-Store-Bale/T.	2 men	1.40	.45 (G)	.92
Chop Haylage	12' windrow	.45	4.10	1.76
Chop Haylage	14' windrow	.40	3.60	1.80
Haul & Store Haylage	Dump wag/truck	.45	2.90	1.88
Haul & Store Haylage	3 tractors	1.40	1.55	3.16
Corn Combine	4 row (PTO)	.39	4.58	1.37
Corn Combine	4 row (SP)	.37	3.67	1.37
Corn Combine	6 row (SP)	.25	3.14	1.10
<u>Corn Combine</u>	<u>8 row (SP)</u>	<u>.20</u>	<u>2.81</u>	<u>.95</u>

\*Includes cost of twine (\$2.40) per ton of hay at 1.5 ton

\*\*Includes cost of twine (\$0.55) per ton of hay at 1.5 ton

**ESTIMATED ANNUAL LABOR REQUIREMENTS IN HOURS PER ACRE  
GRAIN AND FORAGE CROPS\***  
Including Overhead and Maintenance

Table 9

<u>Enterprise</u>	<u>Mechanization and Efficiency Level</u>				<u>Yours</u>
	<u>Low</u>	<u>Average</u>	<u>High</u>	<u>Typical</u>	
	-hours per acre-				
Corn	4.5	3.6	3.0	3.3	_____
Grain Sorghum	3.3	2.8	1.8	2.3	_____
Wheat					
After small grain	2.9	2.5	2.0	2.2	_____
After row crops	3.4	2.9	2.4	2.6	_____
On fallow	2.6	2.2	1.6	1.8	_____
Barley	2.9	2.5	2.0	2.2	_____
Rye	3.0	2.6	2.1	2.3	_____
Oats	3.0	2.6	2.1	2.3	_____
Flax	2.8	2.4	1.9	2.1	_____
Soybeans	4.0	3.0	2.0	2.7	_____
Sunflowers	3.5	2.9	1.9	2.4	_____
Alfalfa or grass*	0.9	0.8	0.6	0.7	_____
Annual Hay (Pre-harvest)	1.7	1.4	1.2	1.3	_____
Summer Fallow	1.5	1.3	1.1	1.2	_____
Baled Hay+					
1 cutting	3.9	3.2	2.6	3.0	_____
2 cuttings	6.3	5.0	4.3	4.9	_____
3 cuttings	8.4	6.8	6.2	6.5	_____
Stacked Hay					
1 cutting	1.8	1.6	1.0	1.3	_____
2 cuttings	3.2	2.4	1.9	2.2	_____
3 cuttings	4.2	3.6	2.6	3.0	_____
Stack wagon, swath, move					
1 cutting	1.3	1.1	0.8	1.0	_____
2 cuttings	2.2	1.7	1.5	1.8	_____
3 cuttings	3.0	2.2	2.0	2.4	_____
Silage					
Alfalfa**	4.1	2.9	2.2	2.5	_____
Corn	6.0	4.6	3.8	4.4	_____
Oats	5.1	3.8	3.1	3.6	_____

\*Labor requirements for planting only. Labor for making hay or silage is estimated in forage harvest system.

\*\*One cutting assumed. For two cutting multiply hours by 1.8.

+For big bale, windrow, haul and store use 50% of hours above.

**MANAGEMENT TIP:** A good maintenance program can reduce downtime and costly repair and labor expenses, and extend equipment life.



# Livestock Production Tables

**LIVESTOCK BREEDING AND SELECTION**  
**Mating Capacity of Sires**

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<u>Animal</u>	<u>Number of Females to Mate</u> <u>in a Breeding Season</u>	
	<u>Hand mating</u>	<u>Pasture mating</u>
Cattle	20	10-12
2-year-old or over	30-50	25-30
Hogs		
Boar pig	5-20	5-8
Yearling boar	20-30	10-15
Mature boar	35-40	15-20
Sheep		
Ram lamb	10-20	10-12
Ram 18 months or over	30-50	20-25
Horses		
2-year-old stallion	10	5
3-year-old stallion	30	15
4-year-old stallion	35-40	20
6-year-old stallion	40-75	20-25

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## BREEDING TABLES

### Puberty Periods

	Ave. Age (mo.)	Best Age to breed (mo.)	Duration	Repeats
Jennet	12	24 to 36	3 to 7 days	3 weeks
Mare	10	24 to 36	3 to 7 days	3 weeks
Cow	10	18 to 24	10 to 30 hrs.	3 weeks
Sow*	6	9 to 10	1 to 4 days	3 weeks
Ewe	6	18 to 20	1 to 2 days	13-19 days

\*Gilts should be bred early the second day of heat and sows sometime during the second day.

### Estrus (Heat)

	Occurs After Parturition	Time to Breed After Delivery	Ave. Gestation per. days
Jennet	3 to 17 days	9th day	365
Mare	3 to 17 days	9th day	340
Cow	28 days	6 to 8 weeks	283
Sow*	3 to 9 days	8 1/2 weeks	114
Ewe	6 to 7 months	summer & fall	150

\*Conception rate and litter size can usually be increased by mating females two or more times during Estrus period (heat).

### GESTATION TABLE

Read across to expiration of period from date in first column. THE gestation periods are averages.

EXAMPLE: From Jan. 1st expiration date for mares is Dec. 6th, or 340 days from Jan. 1st; for cows, Oct. 10 or 283 days from Jan. 1st; etc.

#### Jan. 1 - June 30

Time of Service	Mares 340 days	Cows 283 days	Ewes 150 days	Sows 114 days
Jan. 1	Dec. 6	Oct. 10	May 30	Apr. 25
Jan. 6	Dec. 11	Oct. 15	June 4	Apr. 30
Jan. 11	Dec. 16	Oct. 20	June 9	May 5
Jan. 16	Dec. 21	Oct. 25	June 14	May 10
Jan. 21	Dec. 26	Oct. 30	June 19	May 15
Jan. 26	Dec. 31	Nov. 4	June 24	May 20
Jan. 31	Jan. 5	Nov. 9	June 29	May 25
Feb. 5	Jan. 10	Nov. 14	July 4	May 30
Feb. 10	Jan. 15	Nov. 19	July 9	June 4
Feb. 15	Jan. 20	Nov. 24	July 14	June 9
Feb. 20	Jan. 25	Nov. 29	July 19	June 14
Feb. 25	Jan. 30	Dec. 4	July 24	June 19
Mar. 2	Feb. 4	Dec. 9	July 29	June 24
Mar. 7	Feb. 9	Dec. 14	Aug. 3	June 29
Mar. 12	Feb. 14	Dec. 19	Aug. 8	July 4
Mar. 17	Feb. 19	Dec. 24	Aug. 13	July 9
Mar. 22	Feb. 24	Dec. 29	Aug. 18	July 14
Mar. 27	Mar. 1	Jan. 3	Aug. 23	July 19
Apr. 1	Mar. 6	Jan. 8	Aug. 28	July 24
Apr. 6	Mar. 11	Jan. 13	Sept. 2	July 29
Apr. 11	Mar. 16	Jan. 18	Sept. 7	Aug. 3
Apr. 16	Mar. 21	Jan. 23	Sept. 12	Aug. 8
Apr. 21	Mar. 26	Jan. 28	Sept. 17	Aug. 13
Apr. 26	Mar. 31	Feb. 2	Sept. 22	Aug. 18
May 1	Apr. 5	Feb. 7	Sept. 27	Aug. 23
May 6	Apr. 10	Feb. 12	Oct. 2	Aug. 28
May 11	Apr. 15	Feb. 17	Oct. 7	Sept. 2
May 16	Apr. 20	Feb. 22	Oct. 12	Sept. 7
May 21	Apr. 25	Feb. 27	Oct. 17	Sept. 12
May 26	Apr. 30	Mar. 4	Oct. 22	Sept. 17
May 31	May 5	Mar. 9	Oct. 27	Sept. 22
June 5	May 10	Mar. 14	Nov. 1	Sept. 27
June 10	May 15	Mar. 19	Nov. 6	Oct. 2
June 15	May 20	Mar. 24	Nov. 11	Oct. 7
June 20	May 25	Mar. 29	Nov. 16	Oct. 12
June 25	May 30	Apr. 3	Nov. 21	Oct. 17
June 30	June 4	Apr. 8	Nov. 26	Oct. 22

GESTATION TABLE con't

July 5 - Dec. 31

Time of Service	Mares 340 days	Cows 283 days	Ewes 150 days	Sows 114 days
July 5	June 9	Apr. 13	Dec. 1	Oct. 27
July 10	June 14	Apr. 18	Dec. 6	Nov. 1
July 15	June 19	Apr. 23	Dec. 11	Nov. 6
July 20	June 24	Apr. 28	Dec. 16	Nov. 11
July 25	June 29	May 3	Dec. 21	Nov. 16
July 30	July 4	May 8	Dec. 26	Nov. 21
Aug. 4	July 9	May 13	Dec. 31	Nov. 26
Aug. 9	July 14	May 18	Jan. 5	Dec. 1
Aug. 14	July 19	May 23	Jan. 10	Dec. 6
Aug. 19	July 24	May 28	Jan. 15	Dec. 11
Aug. 24	July 29	June 2	Jan. 20	Dec. 16
Aug. 29	Aug. 3	June 7	Jan. 25	Dec. 21
Sept. 3	Aug. 8	June 12	Jan. 30	Dec. 26
Sept. 8	Aug. 13	June 17	Feb. 4	Dec. 31
Sept. 13	Aug. 18	June 22	Feb. 9	Jan. 5
Sept. 18	Aug. 23	June 27	Feb. 14	Jan. 10
Sept. 23	Aug. 28	July 2	Feb. 19	Jan. 15
Sept. 28	Sept. 2	July 7	Feb. 24	Jan. 20
Oct. 3	Sept. 7	July 12	Mar. 1	Jan. 25
Oct. 8	Sept. 12	July 17	Mar. 6	Jan. 30
Oct. 13	Sept. 17	July 22	Mar. 11	Feb. 4
Oct. 18	Sept. 22	July 27	Mar. 16	Feb. 9
Oct. 23	Sept. 27	Aug. 1	Mar. 21	Feb. 14
Oct. 28	Oct. 2	Aug. 6	Mar. 26	Feb. 19
Nov. 2	Oct. 7	Aug. 11	Mar. 31	Feb. 24
Nov. 7	Oct. 12	Aug. 16	Apr. 5	Mar. 1
Nov. 12	Oct. 17	Aug. 21	Apr. 10	Mar. 6
Nov. 17	Oct. 22	Aug. 26	Apr. 15	Mar. 11
Nov. 22	Oct. 27	Aug. 31	Apr. 20	Mar. 16
Nov. 27	Nov. 1	Sept. 5	Apr. 25	Mar. 21
Dec. 2	Nov. 6	Sept. 10	Apr. 30	Mar. 26
Dec. 7	Nov. 11	Sept. 15	May 5	Mar. 31
Dec. 12	Nov. 16	Sept. 20	May 10	Apr. 5
Dec. 17	Nov. 21	Sept. 25	May 15	Apr. 10
Dec. 22	Nov. 26	Sept. 30	May 20	Apr. 15
Dec. 27	Dec. 1	Oct. 5	May 25	Apr. 20
Dec. 31	Dec. 5	Oct. 9	May 29	Apr. 24

## INCUBATION AND GESTATION PERIODS

<u>Gestation</u>		<u>Incubation</u>	
Bear	6 months	Chickens	21 days
Bitch	9 weeks	Ducks	30 days
Cow	9 months	Guineas	28 days
Cat	8 weeks	Geese	30 days
Deer	8 months	Pheasants	25 days
Dormouse	31 days	Pigeons	21 days
Goat	5 months	Swan	42 days
Guinea Pig	21 days	Turkeys	28 days
Mare	11 months		
Mule	12 months		
Opossum	26 days		
Rabbit	30 days		
Sheep	5 months		
Sow	16 weeks		
Squirrels & Rats	28 days		
Wolf & Fox	62 days		

### Pounds Production per cow at Different Weaning Weights And Calf Crop Percentages

Calf	Average Weaning Weight (lbs)						
<u>Crop</u>	<u>500</u>	<u>474</u>	<u>450</u>	<u>425</u>	<u>400</u>	<u>375</u>	<u>350</u>
95%	475	452	425	404	380	366	333
90%	450	428	405	383	360	338	315
85%	425	404	383	361	340	319	298
80%	400	380	360	340	320	300	280
75%	375	356	338	319	300	282	263
70%	350	333	315	298	180	263	245

### AVERAGE WATER REQUIREMENTS

	Gal./Day/Head
Dairy Cows	15 to 25
Beef Cattle	7 to 12
Swine (Market Hogs)	1 to 2 1/2
Sows plus Litter	4 1/2 to 6
Ewes or Lambs	1 to 2
100 Laying Hens	8 to 10
100 Turkeys 10 weeks	10
100 Turkeys 25 weeks	15

### COMPUTING ANIMAL UNITS

Kind of Animal	Number per Animal Unit	Conversion Factor*
Beef cow and calf	1.0	1.00
Dairy cow	1.0	1.00
Weaned calves (400-600)	2.0	.50
Heifers (550-700)	1.7	.65
Deferred steers (600-750)	1.5	.70
Bulls	.8	1.25
Horses	.8	1.25
Colts	2.0	.50
Ewes and lambs	5.0	.20
Ewes	7.0	.14
Lambs raised	15.0	.07
Feeder lambs	20.0	.05
Goats	7.0	.14
Brood sows	2.5	.40
Hogs raised to 200 lbs.	5.0	.20
Feeder pigs	7.0	.15
Hens or ducks	100.0	.01
Pullets raised	250.0	.004

\*1,000 pounds of body weight is commonly considered as an animal unit. If you prefer to estimate your own animal units; add beginning and ending weights, and divide this total by (2 times 1,000).

### CORN EQUIVALENT FEED VALUE OF GRAINS\*

Grain	Dairy		Feeding		Feeding		Feeding		Average Values bu.
	bu.	lb.	bu.	lb.	bu.	lb.	bu.	lb.	
Corn	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Sorghum	1.00	1.00	.87	.87	.92	.92	.95	.95	.95
Barley	.86	1.00	.77	.90	.82	.95	.75	.87	.80
Wheat	1.07	1.00	1.12	1.05	1.10	1.03	.91	.85	1.10
Oats	.51	.90	.49	.85	.49	.85	.46	.80	.50

\*The figures shown in this table are approximate rates that may be expected when the various feeds are used in appropriate amounts and in well balanced rations. Consult literature on livestock feeding for more complete information.

## LIVESTOCK LABOR REQUIREMENTS

NOTE: All labor hours include an addition for total general farm overhead labor.

### DAIRY COWS

Cows (No.)	<u>Stanchioned</u>	<u>Gutter Cleaner and pipeline</u>	<u>Free Stall* walk thru</u>	<u>Free Stall* Herringbone</u>
			-hours per cow-	
0-25	90	85	75	70
25-49	75	70	60	55
50-74	65	60	50	45
75-100	55	50	40	35
100+	50	45	35	30

\*For loose housing systems add 5 hours to free stall system.

### BEEF COWS (to weaning)

Farm Conditions Calf Sold		Ranch Conditions Calf Sold	
(No.)	(hours/head)	(No.)	(hours/head)
0-25	12	0-100	8*
25-50	11	100-200	7
50-75	10	200-300	6
75+	8	300+	5

\*Add one hour per cow for A.I.

### OTHER CATTLE

Wintering		Summer Pasture	
(No.)	(hours/head)	(No.)	(hours/head)
0-75	4	0-75	1.0
75-150	3	75-150	0.8
150+	2	150+	0.6



**RAISING DAIRY CALVES**

Springing Heifers		Yearling Feeders	
(No.)	(hours/head)	(No.)	(hours/head)
0-15	28	0-15	12
15-30	23	15-30	10
30+	20	30+	8

**LIVESTOCK FEEDING ENTERPRISES**

BEEF (1)		LAMBS (100)		PIGS (10)	
(No.)	(hrs./mo.)	(No.)	(hrs./mo.)	(No.)	(hrs./mo.)
40-80	.90	0-100	30	0-150	2.1
80-120	.70	100-300	20	150-300	1.8
120-200	.45	300-500	10	300-450	1.5
200-300	.35	500-800	6	450-600	1.2
300+	.25	800+	5	600+	0.9

**BROOD SOWS**

Litters per year per sow (No.)	Sell Market Hogs		Sell Feeder Pigs	
	<u>1</u>	<u>2</u>	<u>1</u>	<u>2</u>
	-hours per sow-			
0-10	26	42	23	35
10-20	22	38	19	32
20-30	20	33	18	28
30-40	18	28	16	24
40-60	16	25	14	22
60+	14	21	12	18

**EWES AND LAMBS**

(No.)	Sell Mixed Market and Feeder Lambs (hours/ewe)
0-50	4.5
50-100	4.0
100-300	3.5
300-500	3.0
500-750	2.5
750+	2.0

LAYING HENS

Farm Flock *		Commercial Flock	
(No.)	(hrs./100)	(No.)	(hrs./1,000)
0-100	240	0-2,500	800
100-200	210	2,500-5,000	550
200-300	180	5,000-7,500	400
300+	150	7,500+ **	300

\*Includes labor to raise 120 sexed chicks per 100 hens.  
 \*\*Labor required for 10,000 bird flock may be less than 200 hours per 1,000 hens when fully mechanized.

**BEEF HOUSING DESIGN DATA**

**Table 1 Planning Data**

	Feeder Cattle		Bred			Bulls 1500#
	Calves 400-800#	Finishing 800-1200#	Heifers 800#	Cows 1000#	Cows 1300#	
	<u>-cubic feet per animal-</u>					
<b>Lot Space</b>						
Unpaved lot w/ mound	150-300	250-500	250-500	300-500	300-500	1200
Mound space	20-25	30-35	30-35	40-45	40-45	50-60
Unpaved lot w/o mound	300-600	400-800	500-800	500-800	500-800	1500
Paved lot	40-50	50-60	50-60	60-75	60-75	- -
<b>Barn Space</b>						
Barn w/lot	15-20	20-25	20-25	20-25	25-30	40
Barn w/o/lot	20-25	30-35	30-35	35-40	40-50	45-50
Enclosed barn w/slotted floor	17-20 cu. ft. per 1,000#		-not recommended -			
<b>Feeder Space</b>						
	<u>-inches per animal-</u>					
Once/day feeding	18-22	22-26	22-26	24-30	26-30	30-36
Twice/day fdg.	9-11	11-13	11-13	12-15	12-15	- -
Self fed grain	3-4	4-6	4-6	5-6	5-6	- -
Self fed roughage	9-10	10-11	11-12	12-13	13-14	- -
<b>Approximate Feed Requirements</b>						
(To estimate storage)	<u>-pound/animal per day-</u>					
Hay	4.8	3.5	3.5	25-30	25-30	- -
Haylage	9.6	7.0	7.0			
Corn Silage	19.2	13.7	13.7			
Grain	6.5-9.5	5.5-7.5	5.5-7.5			
40% supp.	1.3	0.9	0.9			
<b>Water*</b>						
	<u>-animals per cup or bowl-</u>					
Lot	25	20	20	20	18	16
Pasture	18	--	15	15	14	10
	<u>-animals/ft of accessible tank perimeter-</u>					
Lot	16	16	16	16	16	9
Pasture	10	10	10	10	10	7
	<u>-Gal. per head per day-</u>					
Hot weather	8-15	15-22	15	18	25	27
Cold weather	4-7	8-11	7	9	13	14
<b>Ventilation</b>						
	<u>-cubic feet per minute per head-</u>					
Cold Barns**						
Warm Barns	15-100	20-130	30-180	50-470	50-470	- -
<b>Manure Production***</b>						
lb/head/day	24-48	48-72	48	60	78	90
cu.ft./hd/day	0.4-0.8	0.8-1.2	0.8	1.0	1.3	1.5

\*Size system to provide full day consumption in a 4-hr period in hot weather.

\*\*Provide ridge openings, eave inlets and adjustable wall openings located low on sidewalls in the animal zone.

\*\*\*Total storage volume can be 25-50% higher because of wasted or spilled feed and water.

**Table 2 Bunk Design**

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<b>Throat Height (maximum)</b>	
Calves (400-800 lb)	18"
Heifers/finishing (800-1,200 lb)	20"
Mature cows/bulls	24"
<b>Bunk Depth (maximum)</b>	
Calves	8"
Heifers/finishing	12"
Mature cows	18"
<b>Bunk Width</b>	
Eat from both sides	
Calves	36"
Heifers/finishing	48-60"
Mature Cows	48-60"
Eat from one side	18" bottom width
Mechanical feeder	Add 6-12" to 60" width
<b>Step Along Bunk</b>	
Height	6-8"
Width	12-16"
<b>Bunk Apron</b>	
Slope	3/4-1" per foot
Width	10-12' (minimum)
<b>Neck rails</b>	
3/8" tightly woven cable	
2" pipe	
2x6 plank	16-24" opening

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**Table 3 Floor and Lot Slopes**

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Handling Facilities	1/8 to 1/4" per foot
Lots	
Paved	1/8"/foot (minimum)
Earth	1/2-3/4" per foot
Mound sideslope	1' per 5'
Bunk Apron	3/4-1" per foot nearly self-cleaning

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**MANAGEMENT TIP:** The only accurate way to know the nutrient content of a feed is to have it chemically analyzed or tested.

**DAIRY HOUSING DESIGN DATA**

**Table 1 Cow Stall Platform Sizes**

<u>Cow Weight</u>	<u>Stanchion Stalls</u>		<u>Tie Stalls</u>	
	<u>Width</u>	<u>Length</u>	<u>Width</u>	<u>Length</u>
Under 1,200 lb	4'0"	5'6"	4'0"	5'9"
1,200-1,600 lb	4'6"	5'9"	4'6"	6'0"
Over 1,600 lb	Not recommended		5'0"	6'6"

\*Use electric cow trainers. Dimensions from curb edge to gutter edge.

**Table 2 Recommended Stall Barns Dimensions**

**Alley Width**

Flat manger-feed alley	5'8" to 6'6"
Step manger-feed alley	6'0" to 6'6"
Step manger (24")	
Feed alley (4'0" to 4'6")	
Service alley with farn cleaner	6'0"
Cross alley*	4'6"

**Manger Width**

Cows under 1,200 lb	20"
Cows 1,200 lb or more	24-27"

**Gutters**

Width**	16" or 18"
Depth, stall side	11-16"
Depth, alley side	11-14"

\*Taper the end stalls toward 6" at the front for added turning room for the feed cart.

\*\*Or as required for barn cleaner.

**Table 3 Free Stall Dimensions**

Heifers	Width	Length
5-8 mo.	2'6"	5'0"
9-12 mo.	3'0"	5'6"
13-15 mo.	3'6"	6'6"
16-24 mo.	3'6"	7'0"
<b>Cows (ave. herd weight)</b>		
1,000 lb	3'6"	6'10"
1,200 lb	3'9"	7'0"
1,400 lb	4'0"	7'0"
1,600 lb	4'0"	7'6"

Stall width measured center-to-center of 2" pipe dividers. For wider divider dimensions, increase stall width accordingly. Stall lengths are measured from front of stall to alley side of curb.

**Table 4 Typical Free Stall Alley Width**

Feeding and stall access alley	10-12'
Access alley between 2 stall rows	
Solid floor	8-10'
Slotted floor	6-9'
Feeding alley	9-10'

**Table 5 Replacement Animal Space Requirements****CALF HOUSING**

Housing Type	Pen Size
0-2 mo (individual pens)	
Calf Hutch (plus 4x6' outdoor run)	4x8'
Bedded Pen	4x7'
Tie Stall	2x4'
3-5 mo (groups up to 6 head)	
Super Calf Hutch	25-30 cu.ft./hd
Bedded Pen	25-30 cu.ft./hd

**HEIFER HOUSING**

Housing Type	Age, months			
	5-8	9-12	13-15	16-24
	-cu.ft. per animal-			
Resting area & paved outside lot	25	28	32	40
	35	40	45	50
Total Confinement				
Bedded resting area*	25	28	32	40
Slotted floor	12	13	17	25

\*Assume access to 10' wide scraped feed alley.

**Table 6 Feeding Space Requirements**

	Age, months					Mature Cow
	3-4	5-8	9-12	13-15	16-24	
	-inches per animal-					
<b>Self Feeder</b>						
Hay of silage	4	4	5	6	6	6
Mixed ration or grain	12	12	15	18	18	18
<b>Once-a-day feeding</b>						
hay, silage or ration	12	18	22	26	26	26-30

**Table 7 Bunk Design**

<b>Throat Height (max)</b>	
Calves	18"
Heifers	20"
Mature Cows	24"
<b>Bunk Width (max 60")</b>	
Both sides feeding	
Calves	36"
Heifers	48-60"
Mature Cows	48-60"
One side feeding	18" bottom width
Mechanical feeder	Add 6-12" up to max width
<b>Step along bunk</b>	
Height	4-6"
Width	12-16"
<b>Bunk Apron</b>	
Slope	3/4 -1" per foot
Width	10-12'
<b>Neck Rails</b>	
3/8" cable	
2" pipe	
2x6 plank	16-24" opening

**SHEEP HOUSING DESIGN DATA**

	Rams <u>180-300#</u>	Dry Ewes <u>150-200#</u>	Ewes w/lambs <u>5-30#</u>	Feeder lambs <u>30-110#</u>
<b>Building floor space (sq.ft./hd)</b>				
Solid	20-30	12-16	15-20*	1.5-2 sq.ft. 8-10
Slotted	14-20	8-10	10-12	of creep 4-5 fdg/space per lamb
<b>Lot Space (sq.ft./hd)</b>				
Dirt	25-40	25-40	30-50	20-30
Paved	16	16	20	10
<b>Feeder Space** (in/hd)</b>				
Limit-fed	12"	16-20"	16-20"	2"/lamb 9-12"
Self-fed	6"	4-6"	6-8"	creep 1-2"
<b>Water</b>				
Head/bowl*** or nipple	10	40-50	40-50	av'ble 50-75
Tank (hd/ft)	2	15-25	15-25	25-40
gal/hd/day+	2-3	2	3	0.1-0.3 1.5
<b>Manure/day (plus bedding and spilled water)</b>				
pounds	10	6	7	4
cubic feet	0.15	0.1	0.12	0.065
<b>Supplemental Heat</b>	- -	- -	100-200 Btu/100lb	- -
			+ 50-250 watt heat lamp	
<b>Ventilation</b>				
Cold Barns	provide ridge openings & adjustable wall openings			
Warm Barns	provide adjustable ceiling fresh air intakes and exhaust fans for 25 to 200 cfm/1,000 lb			
<b>Wool Produced</b>				
lb/yr	6-18	5-14	- -	4-7
<b>Approximate Feed Needed++ (lb/day per animal)</b>				
Hay	4-7	2.5-4	4-7 + grain	1-2 + grain
Haylage	8-10	5-7	8-10 + grain	2-4 + grain
Corn Silage + supp.	12-20	7-9	12-18	4-6
Grain	0.5-2.5	0.0-0.75	0.75-2.5	1.0-3.0
<u>Supplement</u>	<u>0.0-0.25</u>	<u>0.12-0.25</u>	<u>0.25-0.5</u>	<u>0.25-0.5</u>

\*For lambing rates above 170%, increase floor space 5 sq.ft./hd.  
 \*\*Feeder space/animal depends on: animal size, shorn v. unshorn, breed, pregnancy stage, number of times fed/day and feed quality.

\*\*\*Use heated or circulating type in cold buildings.  
 +Water requirements vary considerably with time of year and ration. Maintain water at 35°F in winter and below 75°F in summer.

++Approximate rations for 3 optional forages. Data for computing feed storage and handling needs only.



**SWINE HOUSING DESIGN DATA**

	<b>Ventilation Rates</b>			<b>Temperature</b>	
	<u>Winter</u>		<u>Summer</u>	<u>Winter</u>	<u>Room</u>
	Min	Nor			
Sow and litter	20	80	210	-degrees F-	
				60	80
Pigs					
20-40 lb	2	15	36	70	
40-100	5	20	48	60 +/-	15
100-150	7	25	72	60 +/-	15
150-210	10	35	100	60 +/-	15
Sow or Boar (limit-fed)					
200-250 lb	10	35	120	60 +/-	15
250-300	12	40	180	60 +/-	15
300-500	15	45	250	60 +/-	15

	<b>Supplemental Heat (Btu/hr)</b>				<b>Waste Production</b>		
	<u>Slotted Floors</u>		<u>Bedded or Scraped Floors</u>		<u>Liquids + Solids</u>		
	Cold	Mild	Cold	Mild	cu.ft.	gal	
Sow & Litter	1500	1000	2000*	1400*	0.54	4	
Pigs							
20-40 lb	275*	125*	300*	150*	0.04	0.3	
40-100	250	100	500	200	0.11	0.75	
100-150	250	100	500	200	0.17	1.13	
150-210	250	100	500	200	0.23	1.6	
Sow or Boar (limit-fed)							
200-250 lb	250	100	500	200	0.14	0.94	
250-300	250	100	500	200	0.17	1.13	
300-500	250	100	500	200	0.28	1.88	

\*Provide brooder heat for pigs.

Swine considerations con't.

**FEEDER and WATERER SPACE**

Self feeder: 1 space/4 pigs  
Supp. feeder: 1 space/15 pigs  
Sow feeders: 1'/sow self feed  
2'/sows all feed at once  
Waterers: 1 space/20-25 pigs

**BUILDING FLOOR SPACE**

Sows and boars: 15-20 sq.ft.  
Pigs to 40 lbs: 3 sq.ft./pig  
40-100 lbs.: 4 sq. ft./pig  
100-150 lbs: 4 sq.ft./pig  
150-market: 8 sq.ft./pig  
100-market: 6 sq.ft. under roof  
+ 6 sq.ft. outside paved lot

**FLOOR AND LOT SLOPES**

Slotted floors; usually flat  
Farrowing, solid floors:  
1/2 - 3/4"/ft w/o bedding  
1/4 - 1/2"/ft w/bedding  
Finishing: 1/2 - 1"/ft  
Paved lots: 1/4 -1"/ft  
Paved feeding lots:  
indoors: 1.4"/ft. min  
outdoors: 1"/ft.  
Building alleys:  
1/2"/ft cross slope for crown  
1/10 - 1.4"/ft to drain  
Gutters and pits:  
1"/25'to 1"/100'to drains.

**SPRAY COOLING**

Water = 0.09 gal/hr/pig.  
Nozzle size = 0.045 gal/min/pig

\*Cover slots during farrowing; wide slots behind sows, 3/8" elsewhere.

\*\*3" width preferred over wider slats.

**PASTURE SPACE**

10 gestating sows/acre  
7 sows w/litters per acre  
50-100 growing-finishing pigs  
per acre; depending on  
fertility

**SHADE SPACE**

15-20 sq.ft./sow  
20-30 sq.ft./sow & litter  
  
4 sq.ft./pig to 100 lbs.  
6 sq.ft./pig over 100 lbs.

**FLOOR THICKNESS**

4": Feed aprons and floors with  
minimum vehicle traffic,  
building floors.  
5": Paved feedlots; building  
drives.  
6": Heavy traffic drives.

**SLOT WIDTHS in slotted floors**

Newborn pigs\*: 3/8" and 3/4 -1"  
25-40 lb. \*\*: 1/2 to 1"  
40 to market: 3/4 to 1"  
Sows & Boars: 1" to 1 1/4"

**AIR INTAKE (Ventilation)**

Size in sq.in. = 1/4(cfm fan  
capacity)



