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## Management Guide for Planning a Farm or Ranch Business


1994. Buford Ave - 232 ClaOff

St. Paul MN 55108-6040

# finpack 

 planning for tomorpoW... today COMPUTERIZED FARM FINANCIAL PLANNING AND ANALYSIS PACKAGECooperative Extension Service - South Dakota State University © U.S. Department of Agriculture

Revised 1989 by<br>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 Most of the data were provided through published and unpublished material by Experiment Station and Extension Service personnel at South Dakota State University.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

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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 <br> 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.

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 Budgetis 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 $\qquad$
Enterprise Added
I. Returns from enterprise added
$\qquad$
TOTAL RETURNS ADDED
II. Costs from enterprise dropped
$\qquad$
TOTAL COSTS DROPPED
III. Costs from enterprise added
$\qquad$
$\qquad$
TOTAL COSTS ADDED
IV. Returns from enterprise dropped
$\qquad$
$\qquad$
TOTAL RETURNS DROPPED
$\qquad$
$\qquad$
$\qquad$
$\qquad$
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. It 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:
Net Income minus
ROE $=\frac{\text { unpaid labor and management }}{\text { Net Worth }}$

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

```
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.

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 TomorrowToday program available through your local Extension office.

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

What is Your Debt Level

1. Debt-to-asset ratio Total Liabilities (B)/ Total Assets (B)

Can You Cover Current Obligations?

## RISK INDICATORS

| Superior | under $20 \%$ |
| :--- | :--- |
| Good | 20 to $40 \%$ |
| Close Watch | 40 to $55 \%$ |
| Weak | 55 to $70 \%$ |
| Inferior | over $70 \%$ |

Superior over 2.0
2. Current Ratio

Current Assets (B)/ Current Liabilities (B)

What is Your Interest Exposure?
3. Interest to Gross Income Interest Expense (I)/ Gross Income (I)

Whole Farm Profitability?
4. Return on Assets Net Income (I) + Interest Expense(I)/ Beginning Total Assets (B)

Profitability on Equity Investment?
5. Return on Equity Net Income (I)/ Beginning Net Worth (B)

Firm Growth or Decline Due to Earnings?
Good
Close Watch
Weak
Inferior

Superior under 10\%
Good 10 to 15\%
Close Watch 15 to $20 \%$
Weak
Inferior
Superior
Good
Close Watch
Weak
Inferior
1.4 to 2.0
1.0 to 1.4 0.7 to 1.0 under 0.7

20 to 25\% over $25 \%$
over $12 \%$
8 to $12 \%$
4 to 8\% 0 to $4 \%$
under $0 \%$
Superior over 10\%
Good 6 to 10\%
Close Watch 2 to $6 \%$
Weak
Inferior
-2 to $2 \%$
under - $2 \%$
6. Earned Net Worth Ratio Net Income (I) - Family Consumption (C)/ Beginning Net Worth (B)

Superior
Good
Close Watch Weak
Inferior
over $8 \%$
4 to $8 \%$
0 to $4 \%$
(-4) to $0 \%$ under -4\%
(B) from Balance Sheet
(I) from Income Statement
(C) from Cash Flow Statement

Prepared by Drs. Mark A. Edelman, Larry L. Janssen, Wallace Aanderud, Dept. of Economics, SDSU.

## 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
A. Cash available for new investment
B. Years to repay loan
C. Interest Rate
D. Annual Payment per $\$ 1,000$
(From Table below)
E. Loan Capacity
$\quad$ (A divided by D $\times 1,000$ )

| Example |
| ---: |
| $\$ 4,020$ |
| 30 |
| 13 |
| 134 |
| $\$ 30,000$ |

You
$\qquad$
$\qquad$
$\square$
$\square$
$\qquad$

Annual Payment per $\$ 1,000$ Borrowed table
No. of years
to repay loan

|  | $\frac{6 \%}{6 \%}$ |
| ---: | ---: |
| 1 | $\$ 1,060$ |
| 3 | 374 |
| 5 | 237 |
| 7 | 179 |
| 10 | 136 |
| 15 | 103 |
| 20 | 87 |
| 25 | 78 |
| 30 | 73 |
| 35 | 69 |
| 40 | 66 |


|  | $\frac{12 \%}{120}$ | $\$ 1, \frac{13 \%}{130}$ | $\$ 1,14 \%$ |  |  |  |
| ---: | ---: | ---: | ---: | ---: | ---: | ---: |
| 1 | 416 | 423 | 431 | $\$ 1,15 \%$ | 438 | $\$ 1,160$ |
| 3 | 277 | 284 | 291 | 298 | 342 | 402 |
| 5 | 220 | 226 | 234 | 241 | 249 | 313 |
| 7 | 177 | 184 | 192 | 199 | 203 | 215 |
| 10 | 147 | 155 | 163 | 171 | 175 | 188 |
| 15 | 134 | 142 | 151 | 160 | 164 | 178 |
| 20 | 128 | 136 | 146 | 155 | 159 | 173 |
| 25 | 124 | 134 | 143 | 152 | 157 | 172 |
| 30 | 122 | 132 | 142 | 151 | 156 | 171 |
| 35 | 121 | 131 | 141 | 150 | 155 | 170 |
| 40 |  |  |  |  |  |  |

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

| Family <br> Income | Number of Persons in the Household |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  | 2 |  | 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 <br> OR OPERATING AGREEMENT 

1. Set up farm account Each contribute share: Partner A $\qquad$ Partner B $\qquad$
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 $\qquad$ Partner B $\qquad$
5. All farm operating costs are paid from the farm account. Each partner pays their own real estate taxes and present loan 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).
*Parnter 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 notorized 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

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

Basic Marketing Facts and Tips

1. Holding longer $=$ more chance forlarge 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.

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.

CASH MARRET: 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 recieve, 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 <br> Metric Conversions

Commercial Weight
$2711 / 32$ 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)
```

2,240 pounds $=1$ long ton

Square Measure
144 sq. inches $=1 \mathrm{sq}$. foot
9 sq . feet $=1 \mathrm{sq}$. yard
$301 / 4 \mathrm{sq}$. yards $=1 \mathrm{sq} . \operatorname{rod}$
272 1/4 sq. feet $=1$ sq. rod 40 sq . rods $=1 \mathrm{sq}$. rood $4 \mathrm{sq} \cdot$ roods $=1$ acre $43,560 \mathrm{sq}$. 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 $=1 \mathrm{peck}$
$1,728 \mathrm{cu}$. inches $=1 \mathrm{cu}$. foot
2,150.4 cu. inches $=1$ bushel
$11 / 4 \mathrm{cu}$. feet $=1$ bushel
$243 / 4$ cu. feet $=1$ perch
27 cu . feet $=1 \mathrm{cu}$. yard
128 cu. feet $=1$ cord

## Liquid Measure

| 1 teaspoon $=1 / 6 \mathrm{oz}$. | 1 quart $=0.95$ liters (1.) |
| :---: | :---: |
| 3 teaspoons = 1 tablespoon | $1 \mathrm{l} .=1,000 \mathrm{ml}=1.06 \mathrm{qt}$. |
| 1 tablespoon $=1 / 2 \mathrm{oz}$. | 4 quarts $=1$ gallon |
| 1 pint $=16 \mathrm{oz}$. of water | 1 gallon $=8.3$ lbs. of water |
| 2 pints $=1$ quart <br> 1 acre foot of water | 7.5 gallons $=1$ cubic foot cubic feet of water |
|  | gallons |
|  | 144 lbs . of water |
| 1 acre inch of water | gallons |
|  | lbs. of water |

## Linear Measure



Perimeter (distance around)
RECTANGLE: $\mathrm{P}=2 \mathrm{x}$ length +2 x width
SQUARE: $\quad P=4 \mathrm{x}$ side
CIRCLE: $\quad$ Circumference $=* d$ $=2 * r$

$$
\begin{aligned}
& *=3.14 \\
& \mathrm{~d}=\text { diameter } \\
& \mathrm{r}=\text { radius }
\end{aligned}
$$

Area (A)
RECTANGLE: $\quad \mathrm{A}=$ length x width
SQUARE: $\quad A=$ length $x$ width (or the side squared)
PARALLELOGRAM: $A=$ base x height
TRIANGLE: $\quad A=1 / 2$ base $x$ height
CIRCLE:
$A=* r-s q u a r e d$
CUBE:

$$
\begin{aligned}
& \mathrm{A}=6 \mathrm{x} \text { edge-squared } \\
& *=3.14 \\
& \mathrm{r}=\text { radius }
\end{aligned}
$$

Volume (V)
CYLINDER: $\quad V=$ area of base $x$ height
$=* r-s q u a r e d \times h$
RECTANGULAR SOLID $\mathrm{V}=$ length x width x height
CUBE:
$\mathrm{V}=$ edge x edge x edge (edge-cubed)
CONE:

SPHERE: $V=4 / 3 * r$-cubed

* $=3.14$
$r=$ radius


## METRIC CONVERSION FACTORS

## Approximate Conversion from Metric Measures

| SYMBOL | WHEN YOU KNOW |  | MULTIPLY BY |  | TO FIND |  |
| :--- | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  | SYMBOL |  |  |  |
|  |  | LENGTH |  |  |  |  |
| $m m$ | 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 |  |


|  |  |  |  |  |
| :--- | :--- | :---: | :--- | :--- |
| $c m * *$ | square cm | AREA |  |  |
| $m * *$ | square m | 0.16 | square in | in** |
| km** | square km | 1.2 | square yd | $\mathrm{yd} * *$ |
| ha | hectare | 0.4 | square mi | $\mathrm{mi} * *$ |
|  | $=10,000 \mathrm{~m} * *$ | 2.5 | acres |  |
|  |  |  |  |  |
|  |  |  |  |  |

MASS (weight)

| $g$ | grams | 0.035 | ounces | oz |
| :--- | :--- | :--- | :--- | :--- |
| kg | kilograms | 2.2 | pounds | lb |
| t | tonnes | 1.1 | short tons |  |


|  |  | VOLUME |  |  |
| :--- | :--- | :---: | :--- | :--- |
| $m l$ | millimeters | 0.03 | fluid ounces | fl oz |
| $l$ | liters | 2.1 | pints | pt |
| 1 | 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 $* * *$ |

## TEMPERATURE (exact)

^C Celsius temp ${ }^{\wedge} \mathrm{C} \times 9 / 5+32$ Fahrenheit temp ${ }^{\wedge} \mathrm{F}$

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

| SYMBOL | WHEN YOU KNOW | MULTIPLY BY | TO FIND | SYMBOL |
| :---: | :---: | :---: | :---: | :---: |
|  |  | LENGTH |  |  |
| in | inches | 2.54 | centimeters | Cm |
| ft | feet | 30.0 | centimeters | cm |
| yd | yards | 0.9 | meters | m |
| mi | miles | 1.6 | kilometers | kn |


|  |  | AREA |  |  |
| :--- | :--- | :--- | :--- | :--- |
| in** | square inches | 6.5 | square cm | $\mathrm{cm} * *$ |
| ft** | square feet | 0.09 | square meters | $\mathrm{m} * *$ |
| yd** | square yards | 0.8 | square meters | $\mathrm{m} * *$ |
| mi** | square miles | 2.6 | square km | $\mathrm{km} * *$ |
|  | acres | 0.4 | hectares | ha |

## MASS (weight)

|  |  | MASs (weight) |  |  |
| :--- | :--- | :---: | :--- | :--- |
| oz | ounce | 28.0 | grams | g |
| lb | pounds | 0.45 | kilograms | kg |
|  | short tons | 0.9 | tonnes | t |
|  | $=2,000 \mathrm{lb}$ |  |  |  |

> 28.0
> 0.45
> 0.9
$=2,000 \mathrm{lb}$

AREA

| 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 | 1 |
| pt | pints | 0.47 | liters | 1 |
| qt | quarts | 0.95 | liters | 1 |
| gal | gallons | 3.8 | liters | 1 |
| ft*** | cubic feet | 0.03 | cubic meters | m*** |
| yd*** | cubic yards | 0.76 | cubic meters | m*** |
| TEMPERATURE (exact) |  |  |  |  |
| ${ }^{\wedge} \mathrm{F}$ | Fahrenheit temp | F-32 x 5/9 | Celsius temp | ${ }^{\wedge} \mathrm{C}$ |

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


# Crop Production Tables 

## Round Stacks

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

```
Volume = [(0.4 x 0) - (0.012 x C)] x c x c
```

In this formula, 0 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 $60 \mathrm{ft} .$, the volume in cu. ft. is figured this way:
$V=[(0.4 \times 40)-(0.012 \times 60)]$ x $60 \times 60$
$V=[1.6-.72] \times 60 \times 60$
$V=.88 \mathrm{x} 60 \mathrm{x} 60$
$V=3,168 \mathrm{cu} . \mathrm{ft}$.

## 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 fromula is need 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, 0 , 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:
$\mathrm{V}=[(.52 \mathrm{x} 0)-(.44 \mathrm{x} W)] \mathrm{x} W \mathrm{x} L$
For high, round-topped stacks:
$\mathrm{V}=[(.52 \mathrm{x} 0)-(.46 \mathrm{x}$ W) ] x W x L
For square, flat-topped stacks:
$\mathrm{V}=[(.56 \times 0)-.55 \times \mathrm{W})] \times \mathrm{X} \mathrm{x} \mathrm{L}$
EXAMPLE Determine cu. ft. in a square, flat-topped stack if L measures $50 \mathrm{ft} ., \mathrm{W}$ measures 35 ft . and 0 measures 70 ft .
$V=[(.56 \times 70)-(.55 \times 35)] \times 35 \times 50$
$V=[39.20-19.25] \times 35 \times 40$
$V=19.95 \times 35 \times 50$
$V=34,912 \mathrm{cu} . f t$.

## 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. |
| :--- | :---: | :--- | :---: |
|  | 470 |  |  |
| Alfalfa | 500 | Straw (baled) | 200 |
| Clover | 210 | Straw (loose) | 800 |
| Chopped Hay | 175 | Timothy | 625 |
| Baled Hay |  |  |  |
| (loosely stacked) |  |  | 450 |

## BEST TIME TO CUT HAY

| Cut |  |
| :--- | :--- |
| Alfalfa |  |
| Alsike and Red Clover | $1 / 10$ to $1 / 4$ of crop is blooming <br> or new shoots begin developing <br> from the crown |
| Annual Lepedeza | $1 / 2$ to full bloom |
| Crimson Clover | In full bloom to early seed stage <br> depending on height and leafiness |
| Ladino clover | Flower fading at base of most <br> advanced heads |
| Sericea | Heading out to bloom stage |
| Small grains | l2 to 15 inches high |
| Soybeans and cowpea | Grain is in milk stage |
| Sweet clover | Pods are from $1 / 2$ to fully |

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

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)

| Shed Width | Baled | Chopped | Loose |
| :---: | :---: | :---: | :---: |
| $24^{\prime \prime}$ | 2.0 |  |  |
| $30^{\prime}$ | 2.6 | 1.9 | 0.8 |
| $36^{\prime}$ | 3.1 | 2.3 | 1.0 |
| $40^{\prime}$ | 3.4 | 2.8 | 1.2 |
|  |  | 3.1 | 1.4 |

(Table courtesy of Midwest Plan Service)
APPROXIMATE DRY MATTER CAPACITY OF SILOS

| Depth of Settled Silage |  | Silo Diameter, ft. |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  | 16' | 18' |  |  |  | 26 | $28^{\prime}$ | $30^{\prime}$ |
| 20' | 8 | 12 | 16 | 21 | 27 | 33 | 40 | 47 | 56 | 65 | 74 |
| $24^{\prime \prime}$ | 11 | 15 | 21 | 27 | 34 | 43 | 52 | 61 | 72 | 83 | 96 |
| $28^{\prime}$ | 13 | 19 | 26 | 35 | 44 | 53 | 64 | 76 | 90 | 104 | 119 |
| 32' | 16 | 23 | 32 | 41 | 52 | 65 | 78 | 93 | 109 | 127 | 145 |
| $36^{\prime}$ | 19 | 28 | 37 | 48 | 62 | 76 | 92 | 109 | 129 | 150 | 172 |
| $40^{\prime}$ | 22 | 32 | 44 | 57 | 72 | 89 | 107 | 127 | 150 | 173 | 199 |
| $44^{\prime}$ |  | 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 |
| $68^{\prime}$ |  |  |  |  | 155 | 190 | 228 | 271 | 328 | 369 | 424 |
| 72' |  |  |  |  |  |  |  | 293 | 356 | 400 | 458 |
| $76^{\prime}$ |  |  |  |  |  |  |  | 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 $50 \mathrm{cu} . \mathrm{ft} .=1$ ton)

| Depth ft. |  | $20^{\prime}$ | $30^{\prime}$ | $\begin{aligned} & \text { Silo } \\ & 40^{\prime} \\ & \hline \end{aligned}$ | $\begin{aligned} & \text { floor } \\ & \text { 50, } \end{aligned}$ | width $60^{\prime}$ | $\begin{aligned} & \mathrm{ft} . \\ & 70^{\prime} \end{aligned}$ | $80^{\prime}$ | 90' | $100^{\prime}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 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' |  | 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:
$10^{\prime}$ depth $=1 / 8 \quad 16^{\prime}$ depth $=1 / 5$
12' depth $=1 / 7 \quad 18^{\prime}$ depth $=1 / 5$
$14^{\prime}$ depth $=1 / 6 \quad 20^{\prime}$ 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
$1 / 4$
$1 / 2$
$0 \times$ closed end capacity
1/2
$2 \times$ closed end capacity
1/1
$4 \times$ closed end capacity

EXAMPLE: Bin is $50^{\prime}$ wide and $12^{\prime}$ deep with one closed end.
Capacity per $10^{\prime}$ (from table) $=127$ tons
Capacity per $120^{\prime}=12 \times 127=1,524$ tons
Closed end $=1 / 7 \times 127=18$
Open end deduction $=2 \times 18=36$ tons Total Capacity $=1,544+18-36=1,526$ tons

# APPROXIMATE STORAGE SPACE REQUIREMENTS FOR SILAGE AND HIGH MOISTURE CORN 

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

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

STORAGE CAPACITY FOR COMMON ROUND BINS

| $\begin{gathered} \text { Diameter } \\ \text { (ft.) } \end{gathered}$ | bu. per ft. of height | Capacities for Selected Depths |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | 11' | 13' | 16' | 19' |
| 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 <br> (ft.) | RECTANGULAR |  | ROUND |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  | $\begin{gathered} \text { height } \\ \text { (ft.) } \end{gathered}$ | bu. per 10 ft . <br> (length) | $\begin{aligned} & \text { diameter } \\ & \text { (ft.) } \end{aligned}$ | height (ft.) | $\begin{gathered} \text { capacity } \\ \text { (bu.) } \end{gathered}$ |
| 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 $21 / 2$ cubic feet per bushel. |  |  |  |  |
|  | $\begin{aligned} & \text { Include } \\ & \text { tunne } \\ & \text { Roof sl } \end{aligned}$ | $1 / 2$ cone spac e 1:1 | th no ded | ction | center |


| Average Annual | Native Range or Pasture Condition |  |  |  |
| :---: | :---: | :---: | :---: | :---: |
| Precipitation | Excellent | Good | Fair | Poor |
|  | -Anim | Unit Mon | 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 $21 / 2$ 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 $21 / 2$ 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 | Alfalfa Hay <br> Equivalent Factor |
| :--- | :---: |
| 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 $=1 \mathrm{AUM}$
$1 / 3 \mathrm{~T}$. 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 $=3 \mathrm{~T}$. oat silage +2 bu. corn
1 T. alfalfa hay $=3 \mathrm{~T}$. oat silage +300 lbs. supp.
1 T. alfalfa grass silage $=1 \mathrm{~T} . \operatorname{corn}$ silage $+100 \mathrm{~T} . \operatorname{supp}$.
1 T. corn silage $=4$ bu. corn +.15 T . grass hay
1 bu. corn $=1.1$ bu. sorghum

$$
\begin{aligned}
& =1.25 \text { bu. barley } \\
& =2 \text { bu. oats } \\
& =0.9 \text { bu. wheat }
\end{aligned}
$$

1 T. ear corn $=28 \mathrm{bu}$. 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 or oat yield.

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

| Seeds | Inches between each Kernel | Final |
| :--- | :---: | :---: |
| Per ac. | (based on row width) | Population* |


|  | 20" | $24 "$ | 28" | 301 | 32" | $36^{\prime \prime}$ | 38" | $40^{\prime \prime}$ |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 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 |
| 32,000 | 9.8 | 8.1 | 7.0 | 6.6 | 6.1 | 5.4 | 5.2 | 4.9 | 28,800 |

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: |  |  |  |  |  | 401 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | 20" | $24 "$ | $30^{\prime \prime}$ | 32" | 361 | 38" |  |
| 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 |
| 160 | 9.8 | 8.2 | 6.6 | 6.2 | 5.5 | $\underline{5.2}$ | 4.9 |
| *One rod equals | 5 ft | 40 r | equa | 660 | .; 0 | acre | uals |
| 160 sq. rods or | 560 | $f t$. |  |  |  |  |  |


| KERNEL | ACRES planted at different plant populations |  |  |  |
| :--- | :--- | :---: | :---: | :---: |
| Count/bag | $\frac{16,000}{3.8}$ | $\frac{18,000}{3.3}$ | $\underline{20,000}$ | $\frac{22,000}{2.0}$ |
| 60,000 | 4.4 | 3.9 | 3.5 | 3.2 |
| 70,000 | 5.0 | 4.4 | 4.0 | 3.6 |
| 80,000 | 5.6 | 5.0 | 4.5 | 4.1 |
| 90,000 | $\underline{4.9}$ | $\underline{5.3}$ | $\underline{4.8}$ | $\underline{4.3}$ |
| 95,000 |  |  |  |  |

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 <br> for $1 / 1000$ Acre |
| :--- | :---: |
| $20^{\prime \prime}$ | $26^{\prime} 2^{\prime \prime}$ |
| $30^{\prime \prime}$ | $1^{\prime \prime} 5^{\prime \prime}$ |
| $36^{\prime \prime}$ | $14^{\prime} 6^{\prime \prime}$ |
| $38^{\prime \prime}$ | $13^{\prime \prime} 9^{\prime \prime}$ |
| $40^{\prime \prime}$ | $13^{\prime} 1^{\prime \prime}$ |

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.
tep 2: Weigh grain. Multiply by 1000 for "pounds per acre"
tep 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 $19 \%$.
$7,250 \mathrm{lbs} . / 58.42 \mathrm{lbs}$. per bu. $=124 \mathrm{bu}$. 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.

| \% Moisture | Shelled | Ear | \% Moisture | Shelled | Ear |
| :---: | :---: | :---: | :---: | :---: | :---: |
| in corn | corn* | corn* | in corn | corn* | corn* |
| 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 | Machine Ownership Costs |
| :--- | :---: | :--- |
| Area \& Tillable Ac. | New Average | Depreciation Interest |
|  | dollars per acre- |  |


| North East - Area 1 |  |  |  |
| :---: | :---: | :---: | :---: |
| 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 |
| East North Central - Area 2 |  |  |  |
| 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 |
| Central North Central - Area 3 |  |  |  |
| 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 |
| South Central - Area 7 |  |  |  |
| 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 |
| Southwest Central - Area 6 |  |  |  |
| 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 |
| East South East - Areas 8 \& 9 |  |  |  |
| 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 |
| Western Range - Areas 4 \& 5 |  |  |  |
| Average for area 150 | 90 | 13.50 | 10.80 |
| *Depreciation based on 10 is equal to $9 \%$ of new investmen <br> *Interest charge was calcul | ar | 10\% sa | alue |

## 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.
$\qquad$ tillable ac. $x$ \$_ per ac. $=\$$ $\qquad$ est. machinery inventory
Machine investment and ownership costs may vary from table due to:
*No. of crop acres per farm
*Average field size
*Diversity of crops grown
*Percentage of cropland in fallow
*Age of equipment
*Equipment size
*Amount of custom hire

## ESTIMATED MAN HOURS PER ACRE

AND ALLOCATED VARIABLE POWER AND IMPLEMENT COST PER ACRE Pre-harvest Operation
Table 7

|  | Machine | Man | Repairs \& | Fuel, Oil |
| :---: | :---: | :---: | :---: | :---: |
| Operation | Size | Hours | Service | Grease |
| Plow | 4-16's | . 52 | \$5.08 | \$1.54 |
| Plow | $5-16^{\prime} \mathrm{s}$ | . 41 | 4.71 | 1.90 |
| Plow | $6-16^{\prime} \mathrm{s}$ | . 35 | 4.67 | 2.29 |
| plow | $8-16^{\prime} \mathrm{s}$ | . 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 |
| Surflex | 2-16 feet | . 11 | . 58 | . 54 |

(G) = Gasoline
(D) = Diesel

Fuel cost conversion $\quad(G-D)=0.83$

$$
\begin{aligned}
& (\mathrm{D}-\mathrm{G})=1.20 \\
& (\mathrm{D}-\mathrm{G})=0.89
\end{aligned}
$$



## ESTIMATED MAN HOURS PER ACRE <br> AND ALLOCATED VARIABLE POWER AND IMPLEMENT COSTS PER ACRE Harvest Operations

Table 8

|  | Machine | Man | Repair \& | Fuel, Oil |
| :---: | :---: | :---: | :---: | :---: |
| Operation | Size | Hours | Service | Grease |
| Swath Small Grain | $14^{\prime \prime}$ (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 | $16^{\prime \prime} \mathrm{PTO}$ \& M | . 31 | 2.80 | 1.41 |
| Combine Grain \& Beans | $20^{\prime}$ PTO | . 26 | 2.34 | 1.44 |
| Combine Grain \& Beans | 20' SP | . 25 | 2.92 | . 92 |
| Combine Grain \& Beans | $24^{\prime \prime} \mathrm{SP}$ | . 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 | $16^{\prime} \mathrm{SP}$ | . 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) | $6.0 \mathrm{~T} / \mathrm{hr}$. | . 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 |
| Corn Combine | 8 row (SP) | .20 | 2.81 | . 95 |

*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* <br> Including Overhead and Maintenance 

Table 9 $\qquad$

| Enterprise | Low | Average | High | Typical | Yours |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | -hours | per a |  |  |
| 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 cut
2 cuttings
1.1
0.8
1.0

3 cuttings
2.21 .7
1.5
1.8
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 | - |

[^0]
## Livestock

## Production Tables

## LIVESTOCK BREEDING AND SELECTION Mating Capacity of Sires

|  | Number of Females to Mate in a Breeding Season |  |
| :---: | :---: | :---: |
| Animal | Hand mating | Pasture mating |
| 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 |

## BREEDING TABLES

Puberty Periods

|  | Ave. Age <br> (mo.) | Best Age to <br> 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 | 9 th day | 340 |
| Cow | 28 days | 6 to 8 weeks | 283 |
| Sow* | 3 to 9 days | $81 / 2$ weeks | 114 |
| Ewe | 6 to 7 months | summer \& fall | 150 |
| *Conce | te and litter | size can usua | increase |

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. 6 th, or 340 days from Jan. 1st; for cows, Oct. 10 or 283 days from Jan. 1st; etc.

| Time of Service | Mares | Cows | Ewes | Sows |
| :---: | :---: | :---: | :---: | :---: |
|  | 340 days | 283 days | 150 days | 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 |


| Time of | Mares | Cows | Ewes | Sows |
| :---: | :---: | :---: | :---: | :---: |
| Service | 340 days | 283 days | 150 days | 114 days |
| July 5 | June 9 | Apr. 13 | Dec. 1 | Oct. 27 |
| July 10 | June 14 | Apr. 18 | Dec. | 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. ${ }^{\text {a }}$ | 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 |


| Gestation |  | Incubation |  |
| :--- | :--- | :--- | :--- |
| 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 | 41 days |
| Goat | 5 months | Swan | 28 days |
| Guinea Pig | 21 days | Turkeys |  |
| Mare | 11 months |  |  |
| Mule | 12 months |  |  |
| Opossum | 26 days |  |  |
| Rabbit | 30 days |  |  |
| Sheep | 5 months |  |  |
| Sow |  |  |  |
| Squirrels \& Rats | 28 weeks |  |  |
| Wolf\& Fox | 62 days |  |  |

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

| Calf |  | Averag | Weaning | Weight | (lbs) |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Crop | 500 | $\underline{474}$ | 450 | 425 | 400 | 375 | 350 |
| 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 $21 / 2$ |
| Sows plus Litter | $1 / 2$ to 6 |
| Ewes or Lambs | 1 to 2 |
| 100 Laying Hens | 8 to 10 |
| 100 Turkeys 10 weeks |  |
| 100 Turkeys 25 weeks |  |


| Kind of Animal | Number per <br> Animal Unit | Conversion <br> Factor* |
| :--- | :---: | :---: |
| Beef cow and calf |  |  |
| Dairy cow | 1.0 | 1.00 |
| Weaned calves (400-600) | 1.0 | 1.00 |
| Heifers (550-700) | 2.0 | .50 |
| Deferred steers (600-750) | 1.7 | .65 |
| Bulls | 1.5 | .70 |
| Horses | .8 | 1.25 |
| Colts |  |  |
| Ewes and lambs | 2.8 | 1.25 |
| Ewes |  | .50 |
| Lambs raised | 7.0 | .20 |
| Feeder lambs | 15.0 | .14 |
| Goats | 20.0 | .07 |
| Brood sows | 7.0 | .05 |
| Hogs raised to 200 lbs. | 2.5 | .14 |
| Feeder pigs | 5.0 | .40 |
| Hens or ducks | 7.0 | .20 |
| Pullets raised | 100.0 | .15 |

*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 | $\begin{gathered} \text { Dairy } \\ \text { Cow } \end{gathered}$ |  | Feeding Beef Cattle |  | Feeding Hogs |  | Feeding Lambs |  | Average Values bu. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | bu. | 1 b . | bu. | 1 l . | bu. | 1 b . | 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 Gutter Cleaner Free Stall* Free Stall* (No.) Stanchioned and pipeline walk thru Herringbone -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 Ranch Conditions Calf Sold Calf Sold

| (No.) | (hours/head) | (No.) | (hours/head) |
| :---: | :---: | :---: | :---: |
| $0-25$ | 12 | $0-100$ | $8 *$ |

25-50 11
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 <br> (hours/head) | Summer Pasture |  |
| :---: | :---: | :---: | :---: |
| (No.) | 4 | (No.) | (hours/head) |
| $0-75$ | 3 | $0-75$ | 1.0 |
| $75-150$ | 2 | $75-150$ | 0.8 |
| $150+$ |  | $150+$ | 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


EWES AND LAMBS

> Sell Mixed Market and Feeder Lambs

| (No.) | (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.

Table 1 Planning Data

| Feeder Cattle |  | Bred |  |  | Bulls |
| :---: | :---: | :---: | :---: | :---: | :---: |
| Calves | Finishing | Heifers | Cows | Cows |  |
| 400-800\# | 800-1200\# | 800\# | 1000\# | 1300\# | 1500\# |
|  | -C | fee | a |  |  |

Lot Space
Unpaved lot w/ mound
Mound space Unpaved lot w/o mound
Paved lot

| $150-300$ | $250-500$ | $250-500$ | $300-500$ | $300-500$ | 1200 |
| ---: | :---: | :---: | :---: | :---: | :---: |
| $20-25$ | $30-35$ | $30-35$ | $40-45$ | $40-45$ | $50-60$ |
| $300-600$ | $400-800$ | $500-800$ | $500-800$ | $500-800$ | 1500 |
| $40-50$ | $50-60$ | $50-60$ | $60-75$ | $60-75$ | $-\cdots$ |

Barn Space

| 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 17-20 cu. ft.
w/slotted floor
-not recommended -

## Feeder Space

Once/day feeding 18-22
Once/day feeding 18-22
Twice/day fdg. 9-11

| $22-26$ | $22-26$ | $24-30$ | $26-30$ | $30-36$ |
| :---: | :---: | :---: | :---: | :---: |
| $11-13$ | $11-13$ | $12-15$ | $12-15$ | -- |
| $4-6$ | $4-6$ | $5-6$ | $5-6$ | -- |
| $10-11$ | $11-12$ | $12-13$ | $13-14$ | - |

## Approximate Feed Requirements



| Ventilation | -cubic feet per minute per head- |  |  |  |  |  |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| Cold Barns** | Clarm Barns | $15-100$ | $20-130$ | $30-180$ | $50-470$ | $50-470$ |

Manure Production***

| 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 |

[^1]Table 2 Bunk Design

| Throat Height (maximum) |  |
| :--- | :--- | :--- |
| Calves (400-800 lb) | $18^{\prime \prime}$ |
| Heifers/finishing ( $800-1,200 \mathrm{lb})$ | $20^{\prime \prime}$ |
| Mature cows/bulls | $24^{\prime \prime}$ |

Bunk Depth (maximum)
Calves 8"
Heifers/finishing 12"
Mature cows 18"
Bunk Width
Eat from both sides
Calves 36"
Heifers/finishing 48-60"
Mature Cows
Eat from one side
48-60"
Mechanical feeder
18" bottom width
Add 6-12" to 60" width
Step Along Bunk
Height
6-8"
Width
12-16"
Bunk Apron

| Slope | $3 / 4-1 "$ per foot |
| :--- | :--- |
| Width | $10-12^{\prime}$ (minimum) |

Neck rails
3/8" tightly woven cable
2" pipe
2x6 plank 16-24" opening

Table 3 Floor and Lot slopes
Handling Facilities
1/8 to 1/4" per foot
Lots
Paved
1/8"/foot (minimum)
Earth
Mound sideslope
Bunk Apron

1/2-3/4" per foot
$1^{\prime}$ per $5^{\prime \prime}$
3/4-1" per foot nearly self-cleaning

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

Table 1 Cow Stall platform sizes

| Cow Weight | Stanchion StallsWidth $\quad$ Length |  | Tie Stalls |  |
| :---: | :---: | :---: | :---: | :---: |
|  |  |  | Width | Length |
| Under 1,200 1b | 4'0" | 5'6" | $4^{\prime} 0 \prime$ | 5'9" |
| 1,200-1,600 1b | 4'6" | 5'9" | 4'6" | 6'0" |
| Over 1,600 1b | Not | mended | 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
Step manger-feed alley
Step manger (24")
Feed alley (4'0' to $4^{\prime} 6^{\prime \prime}$ )
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"

[^2]Table 3 Free stall Dimensions

| Heifers | Width | Length |
| :---: | :---: | :---: |
| $5-8 \mathrm{mo}$. | $2^{\prime} 6^{\prime \prime}$ | $5^{\prime} 0^{\prime \prime}$ |
| 9-12 mo. | $3^{\prime} 0^{\prime \prime}$ | $5^{\prime} 6^{\prime \prime}$ |
| 13-15 mo. | $3^{\prime} 6^{\prime \prime}$ | $6^{\prime} 6^{\prime \prime}$ |
| 16-24 mo. | $3^{\prime} 6^{\prime \prime}$ | $7^{\prime} 0^{\prime \prime}$ |
| Cows (ave. herd weight) |  |  |
| 1,000 1b | $3^{\prime \prime} 6^{\prime \prime}$ | $6^{\prime 1} 10^{\prime \prime}$ |
| 1,200 1b | $3^{\prime \prime} 9^{\prime \prime}$ | $7^{\prime} 0^{\prime \prime}$ |
| 1,400 1b | $4^{\prime} 0^{\prime \prime}$ | $7^{\prime \prime \prime}$ |
| 1.6001 b | $4^{\prime} 0^{\prime \prime}$ | $7^{\prime} 6^{\prime \prime}$ |

Stall width measured center-to-center of $2^{\prime \prime}$ 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
    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
0-2 mo (individual pens)
Calf Hutch (plus 4x6' outdoor run) 4x8'
Bedded Pen $4 \times 7^{\prime}$
Tie Stall 2×4'
3-5 mo (groups up to 6 head)
Super Calf Hutch $25-30 \mathrm{cu} . \mathrm{ft}$./hd
Bedded Pen
Pen Size
25-30 cu.ft./hd
HEIFER HOUSING

| Housing Type | Age, months |  |  |  |
| :---: | :---: | :---: | :---: | :---: |
|  |  | -cu.ft |  |  |
| Resting area \& | 25 | 28 | 32 | 40 |
| paved outside lot | 35 | 40 | 45 | 50 |
| Total Confinement |  |  |  |  |
| Bedded resting area* | 25 | 28 | 32 | 40 |
| Slotted floor | 12 | 13 | 17 | 25 |

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

Table 7 Bunk Design
Throat Height (max)
Calves
18"

Heifers 20"
Mature Cows 24"
Bunk Width (max 60')
Both sides feeding
Calves 36"
Heifers
Mature Cows
One side feeding
Mechanical feeder
48-60"

Mechanical feeder
48-60"
18" bottom width
Add 6-12" up to max width
step along bunk
Height
4-6"
width
12-16"
Bunk Apron
slope
3/4-1" per foot
Width
10-12'
Neck Rails
3/8" cable
2" pipe
$2 \times 6$ plank 16-24" opening


Wool Produced

| lb/yr | $6-18$ | $5-14$ | - | $4-7$ |
| :--- | :--- | :--- | :--- | :--- |

Approximate Feed Needed++ (lb/day per animal)

| 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 |
| Supplement | 0.0-0.25 | 0.12-0.25 | 0.25-0.5 | 0.25-0.5 |
| *For lambing rates above 170\%, increase floor space 5 sq.ft/h |  |  |  |  | **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. Maintian water at $35+\mathrm{F}$ in winter and below 75 F in summer.
++Approximate rations for 3 optional forages. Data for computing feed storage and handling needs only.

*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

## BUIDLING 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 $=0.09 \mathrm{gal} / \mathrm{hr} / \mathrm{pig}$.
Nozzle size $=0.045 \mathrm{gal} / \mathrm{min} / \mathrm{pig}$

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 $1^{\prime \prime}$ Sows \& Boars: 1" to 1 1/4"

AIR INTARE (Ventilation)
Size in sq.in. $=1 / 4(\mathrm{cfm}$ fan capacity)
*Cover slots during farrowing; wide slots behind sows, 3/8" elsewhere.
**3" width preferred over wider slats.
 $\qquad$
$\qquad$



$$
\begin{aligned}
& \text { Q } \\
& \text { Q }
\end{aligned}
$$


When




$\square$
$+{ }_{4}^{2}$







4 1 +4
4)

What




[^0]:    *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.

[^1]:    *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.

[^2]:    *Taper the end stalls toward 6" at the front for added turning room for the feed cart.
    **Or as required for barn cleaner.

[^3]:    *Assume access to $10^{\prime}$ wide scraped feed alley.

