TKP3501
Farm Mechanization

Topic 9: Estimating Machinery Cost & Managing Machinery

Ahmad Suhaizi B. Mat Su
Email: asuhaizi@upm.edu.my / asuhaizi1@gmail.com
Learning Outcomes

- Be able to list the criteria for selecting tractors and machines
- Be able to understand ways to reduce the costs of owning and operating tractors and machinery
- Be able to comprehend the knowledge of the economic of the agricultural machinery and machinery management
- Be able to understand the importance of regular maintenance of agricultural machinery
Estimating Machinery Cost

Depression
Fix Cost, Estimating Fix Cost, How to reduce the fix cost?
Dealers Expect Another Year of Sluggish Sales

By Dave Kanicki

If there's an upside to how dealers view their business prospects for 2016, it's that more dealers expect revenue from new equipment sales to be at least as good or better in the year ahead than they were in 2015. Overall, 56.9% of dealers see revenues improving or flat for 2016.
Machinery Cost Items

- Fixed Cost: 34%
- Fuel & Lubrication: 10%
- Repair: 56%
Depreciation of Value

- Depreciation is the loss in value of a machine with the passage of time, whether or not in use.
- Regarded as amount of money should be saved every year, so that the salvage value (the money) will be used for the entire life of the machine.
- Simple equation as below:

  \[
  \frac{\$}{yr} = \text{annual depreciation}
  \]

  \[
  P = \text{purchase price}
  \]

  \[
  SV = \text{salvage value}
  \]

  \[
  \frac{\$}{yr} = \frac{P - SV}{yr}
  \]

  \[
  Yr = \text{year of service}
  \]
Determine the annual depreciation for a combine harvester with a purchase price of $15,400, a salvage value of $800 and an expected life of 8 years. *Answer: 1825.00 $/yr*
Interest on investment

- An interest cost should be used because the money tied up in purchasing a machine could be used for another purpose of invested.
- When money is owed on a machine the annual interest charges added to the depreciation, to estimate the yearly costs of ownership.
Taxes

- Any property and sales taxes paid on the equipment must be included as a fixed cost.
- An estimate of the annual taxes for agriculture machinery is 1% of remaining value.

**Problem:** what is the annual tax during the 2 yrs of ownership for a $55,000 machine when the expected life is 12 yrs.? The salvage value is $500.

**Answer:** $504.60/yr

**Tips:**
1) Calculate the $/yr (4540$/yr)
2) Cost of ownership – no 1
3) Annual tax $/yr = no 2 x 0.01/yr
Remaining Value (R.V)

- $R.V = \text{list price} \times 0.67 \times 0.94^y$ (for all combines, tractors, 4-wheel-drive tractor, crawlers,

- List
Table 1. Average annual fixed costs/ownership costs (as a percentage of new cost)

<table>
<thead>
<tr>
<th>Ownership period, years</th>
<th>Tractor (percentage)</th>
<th>All Machines Other Than Tractor</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>55.44</td>
<td>64.60</td>
</tr>
<tr>
<td>2</td>
<td>35.85</td>
<td>40.04</td>
</tr>
<tr>
<td>3</td>
<td>28.89</td>
<td>31.29</td>
</tr>
<tr>
<td>4</td>
<td>25.11</td>
<td>26.53</td>
</tr>
<tr>
<td>5</td>
<td>22.62</td>
<td>23.41</td>
</tr>
<tr>
<td>6</td>
<td>20.79</td>
<td>21.13</td>
</tr>
<tr>
<td>7</td>
<td>19.35</td>
<td>19.35</td>
</tr>
<tr>
<td>8</td>
<td>18.17</td>
<td>17.89</td>
</tr>
</tbody>
</table>
Table 2. Average Fixed and Repair Costs per Horse Power Hour

<table>
<thead>
<tr>
<th>New Cost per HP</th>
<th>Annual Tractor Use, Hours per Year</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>400</td>
</tr>
<tr>
<td>$300</td>
<td>$0.15</td>
</tr>
<tr>
<td>$350</td>
<td>$0.175</td>
</tr>
<tr>
<td>$400</td>
<td>$0.200</td>
</tr>
</tbody>
</table>

A basis for comparing leasing versus ownership cost, fixed cost plus repair cost can be combine for three levels of new tractor costs:

• $400 per horse power
• $350 per horse power
• $300 per horse power
### Sample hourly cost per horse power

$35,000, 100 HP (75 kW) Tractor

<table>
<thead>
<tr>
<th>Parameter/Hours per Year</th>
<th>400</th>
<th>600</th>
<th>800</th>
<th>1000</th>
<th>1200</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost to own</td>
<td>$0.150</td>
<td>$0.108</td>
<td>$0.089</td>
<td>$0.078</td>
<td>$0.073</td>
</tr>
<tr>
<td>3-year lease</td>
<td>$0.230</td>
<td>$0.166</td>
<td>$0.134</td>
<td>$0.115</td>
<td>$0.103</td>
</tr>
<tr>
<td>4-year lease</td>
<td>$0.215</td>
<td>$0.153</td>
<td>$0.124</td>
<td>$0.107</td>
<td>$0.096</td>
</tr>
<tr>
<td>5-year lease</td>
<td>$0.196</td>
<td>$0.141</td>
<td>$0.115</td>
<td>$0.101</td>
<td>$0.092</td>
</tr>
</tbody>
</table>

Leasing for longer annual use and years is less cost as compared to the short years
Example of average annual cost
$35,000, 100 HP (75 kW) tractor

<table>
<thead>
<tr>
<th>Parameter/Hours per Year</th>
<th>800</th>
<th>1000</th>
<th>1200</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost to own</td>
<td>$7,120</td>
<td>$7,800</td>
<td>$8,760</td>
</tr>
<tr>
<td>3-year lease</td>
<td>$10,720</td>
<td>$11,500</td>
<td>$12,360</td>
</tr>
<tr>
<td>4-year lease</td>
<td>$9,920</td>
<td>$10,700</td>
<td>$11,520</td>
</tr>
<tr>
<td>5-year lease</td>
<td>$9,200</td>
<td>$10,100</td>
<td>$11,040</td>
</tr>
</tbody>
</table>

Leasing for longer annual use and years is less cost as compared to the short years
Ways to reduce costs

The key is to reduce the production cost

1. Width utilization: effective width, avoid overlap
2. Time utilization: adjusting and lubricating when its not in used during “rest time” for the machine, avoid breakdown, reduce the time loss during turning, loading and unloading.
3. Matching tractors and machines: operates a the rated load. Small load, used wider machine.
4. Reducing original investment: Buy used equipment, build one
5. Increase annual use: to reduce the cost per unit, join ownership, increase size of enterprise, doing custom work or diversification.
Ways to reduce costs

The key is to reduce the production cost

1. Increase service life: proper maintenance, careful adjustment, avoid overload, skill operator

2. Break-even used: higher a contractor to do the work, owning machine = cost of hiring a custom operator.

3. Maintenance schedules/records

4. Buy used equipment's
Managing Machinery

Ownership, Leasing, Renting, Decision time-selecting the best alternative
OWNERSHIPS, LEASING AND RENTAL COSTS

- Good machinery management also involves the ability to evaluate the different alternatives to ownership.
- Leasing or renting equipment are two such alternatives.
- When a decision is to be made on leasing or renting a machine instead of buying one, using available and up-to-date information is important.
- This is an important point due to constantly changing interest rate, different leasing and rental arrangements, and internal revenue service regulation on deductions.
It is important to stay informed on market price to realize the greatest profit for a product.

Also important to stay informed on the different changes that affect the cost of renting, leasing or owning machinery.

Cost calculation for the ownership will be based on two factors: (1) fix cost and (2) variable cost.
Common definitions

- “Lease” is to apply to an arrangement lasting longer than one year (usually two or more years)
- “Rental” is refer to short-term arrangement usually lasting less than one year- (one day, one week, one month or several months.)
When renting is the best alternative

- There is a situation when renting is considered as the best alternative. Generally for short term solution.
- However renting machinery for short periods maybe beneficial for:
  1) Low annual use, specialized operations e.g. subsoiler, or area too small to justify the ownership (main factor)
  2) Deferring capital expenditure
  3) Timeliness. Use of period uncertainty
  4) Competitive cost opportunity. Local renting cost lower than ownership
  5) Helping complete important operations on time.
Drawback of renting

1) Rental rates cannot be guaranteed on long term basis, usually a year at a time

2) The rental machine need to be available when you need it
When Leasing is The Best Alternative

- Leasing is usually of greatest benefit to the high-annual use and limited-capital situation.
- Short on capital, such as in expanding the size of the business
- A short-time opportunity investment in the business occurs that will yield a greater return on capital than financing costs for purchasing equipment.
- The rate of return of business is considerably higher than interest on borrowed capital.
When Leasing is The Best Alternative

- The future is uncertain and it is preferred to defer long-run commitments. However, the to lease is the same as signing a sales contract as far as financial obligations are concerned.
- There is definite reliability and operational advantage in having new late-model equipment such as with leasing.
- There is uncertainty as to what size or model is needed in your farming situation.
- Owner is phasing out of business.
When **Owning** Is The Best Alternative

- Owning machinery will normally give a cost benefit:
  - If the capital is not a limiting factor
  - If the size of the business is fairly stable
  - If there is a little chance of it becoming obsolete by size or capability before it is worn out.
Comparing leasing costs to ownership costs

- The best starting point for any comparison of leasing and owning machinery is to establish accurate ownership costs.
- The eight year maximum ownership period is more realistic for the type of farming when leasing and renting may have practical application.
Comparing Leasing Costs to Ownerships Costs

- Review the costs in the comparisons.
- The costs include:
  1. Fixed costs
     - Depreciation of value, interest, tax, insurance, shelter
  2. Variable cost
     - Repair & maintenance, Fuel, oil & lubricant, consumables, and labor costs
Case Study

- Anas Agro Farm have been operating a 360 ha farm. He want to rent more land, including the eighty ha good farm land only 2 km down the road.

- The additional land also means additional equipment with most critical item being the need for a larger tractor. Anas recently purchased a 100-hp tractor and must make payments of $6250 year for more years.

- After carefully reviewing his cash flow, he rule out the trade for a large tractor. Their annual payments would go up to by $7500 a year and eliminate all of his remaining borrowing power. This leaves them with three alternatives;
Alternative:

Option 1: Buy a used tractor with 100 hp
  - Cost $25,000, payment $6,000 a year

Option 2: Rent a 150 hp tractor for 3 months for most critical work periods
  - Cost of $1250 per month, $3750 per yr

Option 3: Lease a new 100 hp tractor with option to buy
  - Cost of $7500 per year for five years

Why option do you think the best for the cash flow for Anas Agro Farm?
How to select..

1. Tractor size

2. Machine size
1. Selecting tractor size

- Two important considerations to keep in mind when deciding to buy a tractor are:
  - i. Provide for enough power to get all important field operations completed on time.
  - ii. Provide for sufficient annual use so costs will minimized.
i) **Provide for enough power to get all important field operations completed on time.**

List all field operation according to energy requirements and to estimate the total time available. 
Tractor must not be **overload** or else early failure component will occur.

**Power to considered in selecting of tractor size**

- **a. Power Take Off (PTO)**; is the power measured at the PTO shaft
- **b. Drawbar Horsepower**: is a measure of the pulling power of engine by way of tracks, wheel or tires.

- Soil conditions are also must be considered.
- On the farm with one principal field tractor the job is usually for primary tillage.
- On the corn planting, **moldboard plow** may be the highest draft implement. By sizing the principal tractor for primary tillage, it will be **overpowered** for some operations, but more importantly, all operations will get done on time.
ii) Provide for sufficient annual use so costs will minimize.

Calculating the relative cost is an important factor before making a decision to buy a tractor.

Parameters are as follows:

- Tractor costs
- Estimating cost (Fixed cost plus repairs)
- Fuel and lubricant Cost
Allowing for Expansion

- When buying tractor, there is another important factor that need to be considered;
- “Plan ahead and consider the possibility of the size of the operation”.
- It better to buy a larger tractor than needed when trading than to have a trade up to a larger a larger tractor in two or three years.
2. Selecting Machine Size

- Three important consideration to keep in mind when deciding to buy a machine for farming:

1. Selecting proper size for the power unit

2. Getting sufficient capacity to get needed work done within the prearranged time period.

3. Making a decision which results in maximum net profit.
Two others important considerations in selecting machine size are:

1- Timeliness

2- Alternative cost
Timeliness principle in accounting refers to the need for accounting information to be presented to the users in time to fulfill their decision making needs
1. Timeliness

- In sizing machines, always considered the importance of timeliness.
- Not easy to estimate timelines factor.
- One of the methods that can be used to estimate timeliness losses by using the timeliness factor as in Table 1.

<table>
<thead>
<tr>
<th>Timeliness Importance</th>
<th>Timeliness loss, percent lost per day of delay</th>
<th>Timeliness factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very high</td>
<td>1.0%</td>
<td>.010</td>
</tr>
<tr>
<td>High</td>
<td>0.8%</td>
<td>.008</td>
</tr>
<tr>
<td>Medium</td>
<td>0.6%</td>
<td>.006</td>
</tr>
<tr>
<td>Low</td>
<td>0.4%</td>
<td>.004</td>
</tr>
<tr>
<td>Very low</td>
<td>0.2%</td>
<td>.002</td>
</tr>
</tbody>
</table>
1. Timeliness

- Estimated Timeliness penalty = Area * timelines factor * the number of days delayed.

Example:
- If using a medium timeliness penalty for each day that 100 ha of cotton go unplanted?

  Estimated timeliness penalty = 100*0.006*1
  = 0.6 ha lost
The amount of penalty in crop loss can also be estimated by using NOMOGRAPH.

In NOMOGRAPH, Two straight-line are drawn and then it intersects the turning line to find the penalty.

Remember!! NOMOGRAPH is only a rough guide to determine a timeliness penalty.
2. Alternative cost

- Calculating alternative cost is one of the techniques to decide on what size of equipment to buy.
- In this calculation, we make an accurate cost estimate for each alternative cost.
- As a shortcut of estimating cost, use fixed costs and labor costs only.
- The costs for repairs, fuel and lubrications will be fairly constants on a per-acre basis.
Case Study I: Alternative cost

- Two combines ( $64,000 and $50,000). Need to harvest a paddy of 500 acres

- Field capacity :
  
  Price
  - Combine 1 ($64,000) is 8 acres/hr.
  - Combine 2 ($50,000) is 5 acres/hr.

  Age
  - Combine 1 (10 years old)
  - Combine 2 (8 years old)

  Labor
  - Labor cost are the same: $6/hr
Refer the table for ANNUAL FIXED COST

- **Average Annual Fixed Cost:**
  - **Combine 1:**
    - $64,000 \times 15.61\% = $9,990
  - **Combine 2:**
    - $50,000 \times 17.89 = $8,945

<table>
<thead>
<tr>
<th>Age, years</th>
<th>All tractors</th>
<th>All other Farm Machines</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>55.44%</td>
<td>64.60%</td>
</tr>
<tr>
<td>2</td>
<td>35.85%</td>
<td>40.04%</td>
</tr>
<tr>
<td>3</td>
<td>28.89%</td>
<td>31.29%</td>
</tr>
<tr>
<td>4</td>
<td>25.11%</td>
<td>26.53%</td>
</tr>
<tr>
<td>5</td>
<td>22.62%</td>
<td>23.41%</td>
</tr>
<tr>
<td>6</td>
<td>20.79%</td>
<td>21.13%</td>
</tr>
<tr>
<td>7</td>
<td>19.35%</td>
<td>19.35%</td>
</tr>
<tr>
<td>8</td>
<td>18.17%</td>
<td>17.89%</td>
</tr>
<tr>
<td>9</td>
<td>17.16%</td>
<td>16.66%</td>
</tr>
<tr>
<td>10</td>
<td>16.28%</td>
<td>15.61%</td>
</tr>
<tr>
<td>11</td>
<td>15.49%</td>
<td>14.68%</td>
</tr>
<tr>
<td>12</td>
<td>14.79%</td>
<td>13.86%</td>
</tr>
</tbody>
</table>
ANNUAL LABOR COST:

= Area /capacity X labor cost per hour

Combine 1 needs 62.5 hours to complete the job
(500 acres : 8 acres/hr = 62.5 hr)
Combine 2 needs 100 hours to complete the job
(500 acres : 5 acres/hr = 100 hr).

Labor cost is $6/hr

Thus, ANNUAL COST OF LABOR for Combine 1 is $375
(62.5 hr X $6.00/hr = $375)

ANNUAL COST OF LABOR for Combine 2 is RM600
(100 hr X $6.00/hr = $600)
Total Crop Value

- Total crop value can be calculated based on bushel harvested X price per bushel

- 14,730 bushels X $4.00 = $58,920 (Combine 1)
- 14,550 bushels X $4.00 = $58,200 (Combine 2)
Comparison combines alternatives costs

<table>
<thead>
<tr>
<th>COMBINE COSTS</th>
<th>Initial Cost</th>
<th>Average Annual Fixed Cost</th>
<th>Annual Labor Cost</th>
<th>Total Crop Value</th>
<th>Net Crop Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$64,000</td>
<td>$9,990</td>
<td>$375</td>
<td>$58,920</td>
<td>$48,555</td>
<td></td>
</tr>
<tr>
<td>(Combine 1)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$50,000</td>
<td>$8,945</td>
<td>$600</td>
<td>$58,200</td>
<td>$48,655</td>
<td></td>
</tr>
<tr>
<td>(Combine 2)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The combine I gave a reduction cost of $100 difference in net crop values ----- ($48,655-48,555= $100)

The final decision would depend on manager. However, in many cases, the reduced risk resulting from a faster harvest would make the larger combine more attractive to buy.
Type of machinery records

1. Field records

Field records indicate the true machine capacity for your farm, providing ideal information for labor, and machinery planning.

Field records also indicate over/under utilization of equipment and pinpoint investment in too large or too small a machine.
An example of field record

Field Days Worksheet Example—600 acres of corn, 600 acres of soybeans.

<table>
<thead>
<tr>
<th>Type of Operation</th>
<th>(2) Total Acres to be covered by Implement</th>
<th>(3) Your Implement Size</th>
<th>(4) Field Capacity Acres Per Hour</th>
<th>(5) Labor Available for Fieldwork Hours/Day (Col. 4 x Col. 5)</th>
<th>(6) Acres Covered Per Day (Col. 2/COL. 6)</th>
<th>(7) Field Days Needed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Field cultivate</td>
<td>1,200</td>
<td>27 ft.</td>
<td>19</td>
<td>16</td>
<td>304</td>
<td>3.9</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plant corn</td>
<td>600</td>
<td>12-30</td>
<td>13</td>
<td>16</td>
<td>208</td>
<td>2.9</td>
</tr>
<tr>
<td>Plant soybeans</td>
<td>600</td>
<td>12-30</td>
<td>13</td>
<td>16</td>
<td>208</td>
<td>2.9</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>28.2</strong></td>
</tr>
<tr>
<td>Harvest soybeans</td>
<td>600</td>
<td>18 ft.</td>
<td>4.6</td>
<td>10</td>
<td>46</td>
<td>13.0</td>
</tr>
<tr>
<td>Harvest corn</td>
<td>600</td>
<td>6.30</td>
<td>3.8</td>
<td>12</td>
<td>46</td>
<td>13.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>26.0</strong></td>
</tr>
<tr>
<td>Item</td>
<td>Total or per acre value</td>
<td>Rate or life</td>
<td>Annual Charge</td>
<td>Landlord</td>
<td>Tenant</td>
<td></td>
</tr>
<tr>
<td>-------------------------------</td>
<td>-------------------------</td>
<td>-------------</td>
<td>---------------</td>
<td>----------</td>
<td>--------</td>
<td></td>
</tr>
<tr>
<td>1. Land</td>
<td>$400,000</td>
<td>.04</td>
<td>$24,000</td>
<td>$24,000</td>
<td>$</td>
<td></td>
</tr>
<tr>
<td>2. Real estate tax</td>
<td>$4,000</td>
<td>.01</td>
<td>$4,000</td>
<td>$4,000</td>
<td>$</td>
<td></td>
</tr>
<tr>
<td>3. Land maintenance</td>
<td>$4,000</td>
<td>.01</td>
<td>$4,000</td>
<td>$4,000</td>
<td>$</td>
<td></td>
</tr>
<tr>
<td>4. Crop machinery</td>
<td>$83,200</td>
<td>.06</td>
<td>$5,012</td>
<td>$</td>
<td>$5,012</td>
<td></td>
</tr>
<tr>
<td>5. Depreciation</td>
<td>$11,885</td>
<td></td>
<td>$11,885</td>
<td>$</td>
<td>$11,885</td>
<td></td>
</tr>
<tr>
<td>6. Repairs</td>
<td>$2,320</td>
<td>.10</td>
<td>$208</td>
<td>$</td>
<td>$208</td>
<td></td>
</tr>
<tr>
<td>7. Insurance</td>
<td>$208</td>
<td>.0025</td>
<td>$208</td>
<td>$</td>
<td>$208</td>
<td></td>
</tr>
<tr>
<td>8. Taxes</td>
<td>$208</td>
<td>.0025</td>
<td>$208</td>
<td>$</td>
<td>$208</td>
<td></td>
</tr>
<tr>
<td>9. Labor</td>
<td>$13,380</td>
<td>Hrs. 22.30</td>
<td>$13,380</td>
<td>$</td>
<td>$13,380</td>
<td></td>
</tr>
<tr>
<td>10. Management</td>
<td>$9,664</td>
<td>.02</td>
<td>$9,664</td>
<td>$</td>
<td>$9,664</td>
<td></td>
</tr>
<tr>
<td>11. Fertilizer</td>
<td>$</td>
<td></td>
<td>$</td>
<td>$</td>
<td>$</td>
<td></td>
</tr>
<tr>
<td>12. Seed</td>
<td>$</td>
<td></td>
<td>$</td>
<td>$</td>
<td>$</td>
<td></td>
</tr>
<tr>
<td>13. Fuel-Oil</td>
<td>$</td>
<td></td>
<td>$</td>
<td>$</td>
<td>$</td>
<td></td>
</tr>
<tr>
<td>14. Herbicides</td>
<td>$</td>
<td></td>
<td>$</td>
<td>$</td>
<td>$</td>
<td></td>
</tr>
<tr>
<td>15. Insecticides</td>
<td>$</td>
<td></td>
<td>$</td>
<td>$</td>
<td>$</td>
<td></td>
</tr>
<tr>
<td>16. Harvesting</td>
<td>$</td>
<td></td>
<td>$</td>
<td>$</td>
<td>$</td>
<td></td>
</tr>
<tr>
<td>17. Drying</td>
<td>$</td>
<td></td>
<td>$</td>
<td>$</td>
<td>$</td>
<td></td>
</tr>
<tr>
<td>18. Hauling</td>
<td>$</td>
<td></td>
<td>$</td>
<td>$</td>
<td>$</td>
<td></td>
</tr>
<tr>
<td>19. Crop insurance</td>
<td>$3,950</td>
<td>$5,065</td>
<td>$5,065</td>
<td>$</td>
<td>$</td>
<td></td>
</tr>
<tr>
<td>20. Other</td>
<td>$</td>
<td></td>
<td>$</td>
<td>$</td>
<td>$</td>
<td></td>
</tr>
<tr>
<td>21.</td>
<td>$</td>
<td></td>
<td>$</td>
<td>$</td>
<td>$</td>
<td></td>
</tr>
<tr>
<td>22.</td>
<td>$</td>
<td></td>
<td>$</td>
<td>$</td>
<td>$</td>
<td></td>
</tr>
<tr>
<td>23. TOTAL COSTS (Lines 1-22)</td>
<td>$89,672</td>
<td>$35,950</td>
<td>$53,722</td>
<td>$</td>
<td>$</td>
<td></td>
</tr>
<tr>
<td>24. Percent crop share = Line 23 Landlord (Tenant)</td>
<td></td>
<td></td>
<td>$</td>
<td>$</td>
<td>$</td>
<td></td>
</tr>
<tr>
<td>25. Fertilizer</td>
<td>$0</td>
<td>$-6,360</td>
<td>$6,360</td>
<td>$</td>
<td>$</td>
<td></td>
</tr>
<tr>
<td>26.</td>
<td>$</td>
<td>$</td>
<td>$</td>
<td>$</td>
<td>$</td>
<td></td>
</tr>
<tr>
<td>27.</td>
<td>$</td>
<td>$</td>
<td>$</td>
<td>$</td>
<td>$</td>
<td></td>
</tr>
<tr>
<td>28.</td>
<td>$</td>
<td>$</td>
<td>$</td>
<td>$</td>
<td>$</td>
<td></td>
</tr>
<tr>
<td>29.</td>
<td>$</td>
<td>$</td>
<td>$</td>
<td>$</td>
<td>$</td>
<td></td>
</tr>
<tr>
<td>30. ADJUSTED TOTAL (Line 23 + 25-29)</td>
<td>$89,672</td>
<td>$29,590</td>
<td>$60,082</td>
<td>$</td>
<td>$</td>
<td></td>
</tr>
<tr>
<td>31. Percent crop share = Line 30 Landlord (Tenant)</td>
<td></td>
<td></td>
<td>$</td>
<td>$</td>
<td>$</td>
<td></td>
</tr>
<tr>
<td>32.</td>
<td>$</td>
<td>$</td>
<td>$</td>
<td>$</td>
<td>$</td>
<td></td>
</tr>
<tr>
<td>33.</td>
<td>$</td>
<td>$</td>
<td>$</td>
<td>$</td>
<td>$</td>
<td></td>
</tr>
</tbody>
</table>

1. Obtain "Annual Charge" by multiplying, or dividing, the total or per acre value by rate or life.
2. Interest charge should be computed on "average" investment in crop machinery.
3. Management charge based on investment in land and crop machinery.
Considering Future Capacity Needs

- Prior to buying a new machine or tractor, we have to make a decision what size of a machine is needed with regards to any future increases in the size of an agricultural operation.
- The purchase of a tractor is one of the most important decisions to be made by any farmers.
- There is a vast array of makes, model an sizes of tractor available in the market for the farmer.
- So, a correct decisions will benefit the farm business very much, but the wrong decision will be an expensive mistake to be regretted for many years.
- Making decision before purchasing a tractor and machines is the second step in developing machinery management skills (first step is deciding when to trade.. ).
What is the basis of making decisions?

- The amount of money available is not a really good basis for a decision.
- If decision based on ready money, the largest tractor manufactured could end up being used only 100 hours per year.. or an undersized tractor may require too much time to complete a job.
- It is better to buy the tractor or machine with adequate power or capacity even if the financing purchase is necessary.
- Another potential basis for machine selection might be to get equipment large enough to allow one person to do all the work.
QUESTIONS / review

- What factors need to be considered for renting?
- Is it possible to terminate the lease early, if you are not satisfied?

Often there are penalties for doing so. There may also be extra charges for high usage rates.

- Who is responsible for maintenance and repairs?

Generally, you are, although leased machines often carry the same warranty as purchased equipment. Clarify who is responsible for insuring the leased equipment, as well.

- Read this article:
  
  http://www.agmanager.info/farmmgmt/machinery/MF2953.pdf
  
  https://www.extension.iastate.edu/agdm/crops/html/a3-35.html
Custom Work
Calculating Custom Work Costs

Farm managers who does not have capital, time or desire to operate the machinery by them self, so they can hire custom operator.

Hiring custom operator is one important alternative to owning machinery.

For some cases in may be better to use a custom operator.

Why?

1. Provides faster completion of work
2. Provides the least-cost method.
3. Does not require the capital needed for owning a machine.
4. Doing additional custom work can help a
Calculating Custom Work Costs

- When hiring a custom operator, do not forget *timeliness* considerations.
- Waiting on a custom operator to arrive is expensive in terms of timeliness. *If it means not getting crop planted or harvested at the optimum time*
- *Always consider timeliness in making a decision to use either a custom operator or alternative method.*
Determining and Comparing Costs

- Determining *when* to use a custom operator is one of the most important decisions made in machinery management.
- A simple formula for calculating the break-even point for owning machinery versus custom work;
  - \( \text{BEP} = \text{the point where the total revenue is just sufficient to cover the total cost (means no profit or loss has been made at this point)} \)
  - \( \text{B.E.P} = \frac{\text{Average annual fixed cost}}{\text{Custom charge/area} - \text{operating cost/area}} \)
BREAK EVEN POINT

345 ACRES (155 HECTARES) NEEDED TO JUSTIFY OWNERSHIP

Fig. 4—Increasing Annual Use Helps Reduce Fixed Costs So You Can Justify Ownership
From B.E.P formula:

$$\text{B.E.P} = \frac{\text{Average annual fixed cost}}{\text{Custom charge/area} - \text{operating cost/area}}$$

In determining break even point, average annual fixed cost, operating cost/area and custom charge per area need to be known.

1. Determining Average Annual Fixed Cost

The annual fixed costs can be determined by knowing the cost of the machine and length of ownerships. If a chisel plow is to be owned for 10 years, the average annual fixed costs is 11.98 percent of the new cost as shown in Table 3, Chapter 6 (Average Annual Depreciation and Fixed Costs As A Percentage of Original List Price).
2. Determining average operating costs

Operating costs include:

- Fuel
- Lubricants
- Labor
- Repairs

3. Determine a custom charge/area
Example 1

Suppose average annual fixed cost are $2,500 per year to own a windrower, and total operating cost are $3.50/ha for labor, fuel, lubricant and repairs. Assume custom charge per ha is $12. Economic wise, should he owns the machine or hire custom operator?

Step 1: Average Annual Fixed cost: $2,500
Step 2: Determine operating cost/ha : $3.50/ha
Step 3: Find B.E.P

B.E.P = Average annual fixed cost
      Custom charge/area – operating cost/area

= 2500

12/ha – 3.50/ha

= 294 hectares

In this case, 294 or more are needed for ownership to be less costly than hiring a custom operator.
As depicted in a graph

294 ha/yr or more are needed for ownership to be less costly than hiring a custom operator. If he has less than 294 ha/year to work he should rather choose to hire custom operator as you can see from the graph; the line of hiring a custom operator (green) is lower (means least-cost) than red line which is the total cost that he should bear from owning the machine.
Suppose he has only 200 hectares per year to bale, but he is willing to accept the higher cost of ownership. What is the additional cost to own the machine instead of using custom operator?

For 200 ha,

Average annual fixed cost = $2500
Operating cost = $3.50 * 200 = $700
Total fixed cost + operating cost annually from owning the machine = $2500 + $700 = $3200
Custom charge = $12 * 200 = $2400
The extra cost to own the machine in this case = $3200 - $2400 = $1200
Doing custom work (provide a service) to justify ownership

In slide No.10, the difference between the break-even point of 294ha and 200ha is 94 ha. Therefore, 94 ha of custom work is needed to justify ownership.

Explanation: You know that BEP is 294ha/yr. Let say from the example you only have 200ha/yr to work by using the machine. Instead of paying high from owning the machine, what you can do is

i) hire custom operator (as been explain in slide No 9 for least-cost)

ii) Or if you insist to buy the machine, you have to do a custom work to justify ownership. So in this case, you need to do another 94 ha to justify ownership. As you can see from the graph, after BEP (294ha/yr) the red line is lower than green means if you work on the break even point and more, the lower the cost of ownership thus it will justify your ownership.
Example 2
Let say you buy a windrower as in Example 1 and do the custom work at rate of $12/ha at the same time. How much profit will you get if you work 300ha/yr.

As in Example 1;
Annual fixed cost = $2500/yr
Annual Operating cost = $0.35/ha* 300ha = $1050/yr
Income for custom work= $12/ha*300 = $3600/yr
Profit = Income from custom work – Total annual cost from owning the machine.

= $3600 – ($2500+$1050) = $50/yr

Explanation: from Example 1 we know that the BEP is 294ha/yr. By owning and doing a custom work at the same time at 300ha/yr the profit is $50/yr. To increase profit, more custom work would be needed. The effect of increasing the numbers of ha/yr on cost and profit is shown in Fig 3. page 12-3
Establishing a rate for custom work (\$/ha)

- Establishing a rate for custom-work charges depends on several variables, including:
  - Size of the field
  - Travel distance from home base or last job
  - Difficulties due to crop or field conditions
  - Labor costs
  - Profit-and-risk margins
Procedure to establish a rate for custom work consists of three steps:

1. Estimating annual use
2. Determining the basic cost
3. Adding on the margin
Determining the profit-and-risk margin is a tricky procedure.

This margin may range from 20 to 60 percent. In establishing a rate for custom work depending on the complexity of a machine.

A complex machine like a combine has a much greater chance for a breakdown than a simpler tool like a disk harrow.
Mark up for the risk and profit depends on the individual situations.

If there is a lot of competition, the margin may be quite small.

If there is a little competition and the operation is a fairly new method, the custom price may be quite high.
KADAR UPAH PERKHIDMATAN
PPNS BAHAGIAN JENTERA

MENUAI
RM 40.00/TAN

POTONG JERAMI
RM 80.00/LOT

ROTOR 1
RM 120.00/LOT

ROTOR 2
RM 110.00/LOT

ROTOR 3
RM 100.00/LOT

SISIR/RATA TANAH
RM 80.00/JAM

BUAT BATAS
RM 80.00/EKAR

PLOUGH
RM 120.00/EKAR

TABUR KAPUR
RM 40.00/TAN

NOTA: Kadar upah tertakluk kepada pindaan
<table>
<thead>
<tr>
<th>Typical Operation</th>
<th>Average Custom Charges</th>
</tr>
</thead>
<tbody>
<tr>
<td>Light Tillage (Very little risk, favorable field conditions)</td>
<td>Cost plus 20 to 30 percent</td>
</tr>
<tr>
<td>Plowing or Chiseling (Average field conditions)</td>
<td>Cost plus 30 to 40 percent</td>
</tr>
<tr>
<td>Medium to Heavy Disking (Average risk)</td>
<td></td>
</tr>
<tr>
<td>Hay and Silage Operation (Heavy risks)</td>
<td></td>
</tr>
<tr>
<td>Combining (severe field conditions)</td>
<td>Cost plus 40 to 50 percent</td>
</tr>
</tbody>
</table>
Example 3 (from page 12-6)

- Suppose you want to run a custom wheat-combining operation, and plan to buy a $220,000 combine that can harvest 3.24ha/hr. Total annual use is 200hrs/yr and total fixed and operating cost is $45.29/ha.

- Step 1: Determine Annual Use = 200hrs/yr

- Step 2: Determine basic cost (total fixed and operating cost per ha) = $45.29/ha

- Step 3: Add profit-risk margin (refer percentage for combine in table slaid 18) – a profit-risk margin of 40% might be appropriate for combine.

- Thus the custom rate charge would be calculated as follow:
  
  $45.29 + (40\% \times \$45.29) = \$63.41/ha
Summary

- A custom cost may be the least-cost choice compared to owning a machine in some cases.
- One advantage of hiring a custom operator is that less money is tied up ownership of machinery.
- One of disadvantage may be the lack of timeliness.
Thank you.