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EXTEND MACHINERY LIFE TO SAVE DOLLARS

Vernon L. Hofman
Extension Agricultural Engineer

Henry L. Kucera
Professor, Agricultural Engineering

Machinery ownership and operation is a major cost of crop and livestock production. Several cost cutting factors can be applied to machinery operation to save money. No single item will have a drastic impact on saving costs, but a combination of things can have a large effect on costs, improve machine reliability for many years to come and improve profit margins.

WAYS TO GET MAXIMUM LIFE FROM MACHINERY

Machinery Maintenance - A University of Illinois study shows that many farmers can reduce machinery repair costs 25 percent by improving routine maintenance procedures. With a yard full of machinery, that savings can be significant. As an example, a $50,000 tractor will typically require about $15,000 in repair costs during 5,000 hours of operation when receiving average maintenance. This cost can be decreased to about $11,000 with good service management.

Timely preventative maintenance and inspection not only will help reduce major problems, but will help identify developing problems while they can possibly be corrected with relatively minor repairs.

An effective machinery service program needs good record keeping rather than being based on the operator's feelings or memory as to when a machine needs attention. The program must be based on fact as determined by an accurate record of service for each piece of equipment as recommended in the operator's manual and adjusted to individual conditions.

To aid record keeping, mount a service record chart for each vehicle and implement in a prominent area of the farm shop or in a service "record book." Hour maintenance intervals such as 10, 50, 100, 250 and 500 should be indicated so they can be identified, performed regularly and marked down (Figure 1). Be sure to follow the "Preventative Maintenance Guide" in the operator's manual for each particular piece of equipment.

Also useful is a large planning calendar with machine operating manuals stuck in pockets or hung in a vertical row on the left and columns for each of the months of the year to the right (Figure 2). Use this calendar for noting major repair and service operations to be carried out on each piece of machinery in the months ahead. This system is more effective than depending on memory, especially where more than one operator uses the machines.

It may help to cover all charts and the calendar with plexiglass. Record data with a grease pencil, and at the end of the year, the plexiglass can be erased and the chart and calendar reused. Maintenance charts may not solve all maintenance problems and will require work to keep them up to date. But, economic machinery life must be extended, and proper maintenance as recommended by the manufacturer is the best way to do it.

Oil Analysis - A detailed look at a sample of engine or transmission oil is a valuable preventative maintenance tool. In many cases, it enables identification of a potential problem before a major repair is necessary. Oil analysis is a means of monitoring wear and contamination of oil, and when done on a regular basis establishes a baseline of normal wear and can indicate when abnormal wear or contamination occurs.

Oil analysis tests for the presence of a number of different materials to determine sources of wear and contamination. Early detection allows for corrective

action such as repairing an air intake, fuel or anti-freeze leak before major damage occurs. An example laboratory report form is shown in Figure 3. A major advantage of an oil analysis program is being able to anticipate problems and schedule repair work to avoid downtime during a critical time of machine use.

Another use of oil analysis is the evaluation of used equipment being considered for purchase. Without knowing the history or age of the oil being analyzed, this test should be considered conclusive only if it indicates a problem. A good report could result from either no problems or a short length of service time on the oil.

Oil or machinery dealers are able to recommend an oil analysis laboratory where this work can be done. The laboratory will provide a sample bottle, instructions and data sheet to be completed. This service will cost a small fee, but the cost will be returned many times over if a major breakdown is prevented, especially during planting or harvest.

Machinery Storage - Well Worth The Cost - Snow piling around and over machinery during the winter is doing more than covering it up - it is also eating away at the investment.

A survey of implement dealers in the north central states indicates that after five years, housed equipment has increased trade in values of:

Tractors	16%
Harvesting Equipment	20%
Planters and Drills	12%
Tillage Equipment	5%
Average Increase	13.5%

The farmer who keeps the most valuable machinery out of the weather can save a lot of money. For example, consider keeping $300,000 worth of tractors, combines and planters inside and

Figure 1. EXAMPLE

SERVICE SCHEDULE FOR _____

Hours of Operation	HOUR METER READINGS																			
10 Hour Service																				
10 Hour Service																				
10 Hour Service																				
10 Hour Service																				
10 Hour Service																				
50 Hour Service																				
100 Hour Service																				
250 Hour Service																				
500 Hour Service																				
1000 Hour or Yearly																				

Place chart in a prominent place in the shop. Perform the required service and write down the hour meter reading. Continue down the column to the 50 hour level and move to the top of the next column after the next 10 hour interval.

assume 50 percent trade-in value after five years: The equipment's value is approximately $22,500 greater due to inside storage, assuming the trade-in is increased by 15 percent.

The study also showed inside storage of a small tractor will increase the trade-in value by $400 to $500 per year. Proper storage of a 4-wheel-drive model should add $1,000 to $2,000 per year to the resale value.

Inside storage also saves money by reducing repairs and time in the shop. The survey revealed that housed machinery had only 7.6 percent downtime, while unhoused equipment was down 14.3 percent of the time it should have been working. Parts such as belts, tires, and hoses deteriorate extremely fast. Places where water can collect and freeze are problem areas.

To determine whether a new machinery storage building will pay, a method to allocate building costs must be determined. The building may have alternate uses and will have a longer life than most implements, so the annual cost for the building must be determined. Then, compare costs to the expected increase in value of the machines stored on an annual basis.

Machines, including tractors, combines, planters, drills, forage choppers, trucks and pickups, should be kept inside. Tillage equipment should be the last to be placed inside. They take up a lot of space and decline in value only slightly faster when left out-

Figure 1 (Cont'd.)

Maintenance To Be Performed on Tractors

(Example)

Maintenance as Required

1. Inflate Tires
2. Adjust Brakes
3. Clean Cab Air Filter
4. Tighten Loose Nuts or Bolts
5. Repair Worn or Damaged Parts
6. Adjust Headlights

10 Hours (Daily)

1. Check Air Cleaner
2. Check Crankcase Oil Level
3. Check Cooling System Level
4. Lubricate Grease Fittings
5. Check Fuel Sediment Bowl
6. Check for Loose or Damaged Parts
7. Check for Leaks
8. Check Drive Belts and Chains

50 Hours (Weekly)

1. Check Battery Electrolyte Level
2. Check Hydraulic System Fluid Level
3. Check Transmission Oil Level
4. Clean Dry-Element Air Cleaner
5. Clean Crankcase Breather
6. Perform 10 Hour Maintenance

100 Hours (Every 2 Weeks)

1. Change Crankcase Oil and Filter
2. Perform 10 and 50 Hour Maintenance

250 Hours (Monthly)

1. Clean Battery
2. Adjust Clutch Pedal Free Travel
3. Check Belt and Chain Tension
4. Lubricate Clutch Throw-Out Bearing
5. Perform 10 and 50 Hour Maintenance

500 Hours (Every 2 Months)

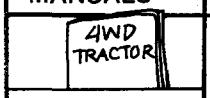
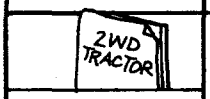
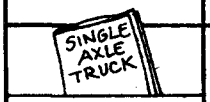
1. Replace Fuel Filters
2. Perform 10, 50, 100 and 250 Hour Maintenance

1000 Hours (Yearly)

1. Service Oil Bath Air Cleaner
2. Drain and Refill Transmission and Hydraulic System
3. Adjust Engine Governor if Recommended by Manufacturer
4. Clean and Repack Front Wheel Bearings
5. Drain, Clean and Refill Cooling System
6. Check Air Conditioning Components
7. Perform 10, 50, 100, 250 and 500 Hour Maintenance

Note: Be sure to follow your Operator's Manual Recommendations, as particular maintenance operations will vary with make and type of implement.

Figure 2. Hang a MASTER SHOP CALENDAR **on your shop wall, and write in the major repair and service operations to be carried out on each piece of machinery in the months ahead.**

OPERATOR'S MANUALS	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	REMARKS
													
													
													
													
													
													
													
													
													
													
													
													
													
													

LABORATORY ANALYSIS REPORT

Customer Name	Telephone Number	Unit Serial Number	Customer ID Number	Unit ID Number

Address	City, State, Zip Code	Type of Equipment

Item No.	Lab No.	Date	SAE Grade	Miles or HR on oil	Miles or HR on unit	Silicon	Copper	Chrom-ium	Iron	Sodium	Alum-inium	Lead	Magne-sium	Calcium	Zinc	Boron	Barium	Viscosity	Fuel Dilution	Water	Pentane Insolubles	Anti-freeze	Other	Total Solids	Oxida-tion	Total Acid #

Item	Recommendations	Corrective Maintenance

NOTES:

Figure 3. Example Oil Analysis Report Form.

side. After five years, tillage equipment kept inside is worth only about 5 percent more than if left outside. Usually, the deterioration that occurs to the tires and bearings is less than the cost of providing building space.

Machine storage building plans are available from your local county extension agent for a small fee. The following is a list of available plans.

Plan MW 74143	40' × 104' × 14'	Clearspan Poleframe Machinery Storage
Plan MW 74146	48' × 96' × 14'	Clearspan Poleframe Machinery Storage
Plan MW 74147	60' × 96' × 14'	Clearspan Poleframe Machinery Storage
Plan MW 74148	30' × 72' × 13'	Clearspan Poleframe Machinery Storage
Plan MW 74149	56' × 88' × 14'	Machinery Storage with 16' Wide Lean
Plan MW 81901	48' × 96'	Solar Machinery Storage and Shop (Underfloor Heat Storage)

Engine Tune-Ups - Diesel engines, like gas engines, require a periodic tune-up. As engines operate, they wear, lose power and efficiency. To obtain the optimum performance from an engine, the power produced and the fuel consumed should be checked and compared to Nebraska Tractor Test report figures.

Most tractor models have been tested at Nebraska. A test report can be obtained from your implement dealer or the Agricultural Engineering Department, University of Nebraska, Lincoln, Nebraska, 68583. Test results include several ratings for each tractor. For comparative purposes, look at the figures which indicate tractor PTO horsepower and efficiency at maximum PTO horsepower (horsepower-hours per gallon). The next step is to test your tractor.

Figure 4. Tractor engine efficiency is determined by measuring the horsepower produced and the gallons of fuel used.

Attach the tractor's power take-off to a dynamometer, warm the engine up and check to see if it produces rated horsepower. If tractor power is down by more than 5 percent, adjustments or a tune-up may be needed. A tuneup may include changing air and fuel filters, cleaning and adjusting injector nozzles and adjusting engine timing.

Another important part of tractor operation is checking engine efficiency. This can be done at the time the tractor is operating on the PTO dynamometer. After the tractor is warmed to oeprating temperatures, stop the tractor and fill the fuel tank completely full. Operate the tractor at rated speed and load for 30 minutes, then stop the tractor and refill the tank to the previous level keeping track of the gallons needed. With this information, tractor efficiency, which will give an idea of the engine's condition, can be determined.

Tractor fuel efficiency is measured in horsepower-hours per gallon, much as automobile fuel efficiency is measured in miles per gallon. To calculate the efficiency of the tractor, first determine the gallons of fuel it would use in one hour. For example, a diesel tractor producing 155 hp and using 5.5 gallons in 30 minutes, would use 11 gallons in an hour. Divide the 155 horsepower by 11 gallons per hours, which gives an efficiency of 14 horsepower-hours per gallon.

Compare this figure to Nebraska Test results showing PTO efficiency at rated horsepower when the tractor was new. If the current efficiency is 5 to 10 percent less than original, there may be a problem that needs correcting.

If an engine is showing a 5 percent reduction in efficiency, it is wasting about 5 percent of the fuel. In a 155 horsepower tractor burning 11 gallons per hour, this adds up to .55 gallons of fuel wasted every hour or 275 gallons wasted every 500 hours.

Don't Modify Tractor Engine - A tractor engine may be "modified" to get more power. The frequently heard claims about pulling bigger loads, getting new "life" from older models and more power from new models are true. Engine modification can be done by several means. The most common are overfueling, adding alcohol or LP gas injection, and turbocharging naturally aspirated engines.

These all sound tempting when an operator is faced with covering more acres in less time. But are the consequences of boosting engine horsepower beyond original ratings worth it?

The first problem is warranty. A modification aimed at increasing power is a touchy subject with

manufacturers. Most manufacturers do not allow any changes from standard specifications without voiding the warranty, so you're on your own with the changes.

The second problem with engine modifications is an almost sure reduction in service life. Every machine design is a compromise. The designer must compromise between strength, reliability and cost to come up with a tractor rugged enough to do a job, but still meet an affordable price. If horsepower is increased 15 percent on a tractor, you're assuming the manufacturer built the engine parts, clutch, transmission and final drive 15 percent stronger than originally needed. Maybe they weren't. Then, all parts will be overloaded, and service life will suffer. In the end, the tractor will probably end up in the repair shop long before it should.

The simplest, cheapest and easiest engine modification is done by changing the injector pump. If you pump in more fuel, the horsepower of the engine will probably go up, but another problem arises. Most tractors are set at the factory to their most efficient operational level. If the engine is overfueled, the efficiency will almost always go down. This means the power output for the fuel poured into the engine will be less, so in the long run, the extra fuel will cost money.

If more horsepower is needed, it is almost always better financially to trade for a bigger tractor. Larger tractors are built for higher horsepower from radiator to wheels and should give good service. Trying to get more power by modifying your tractor may prove to be extremely expensive.

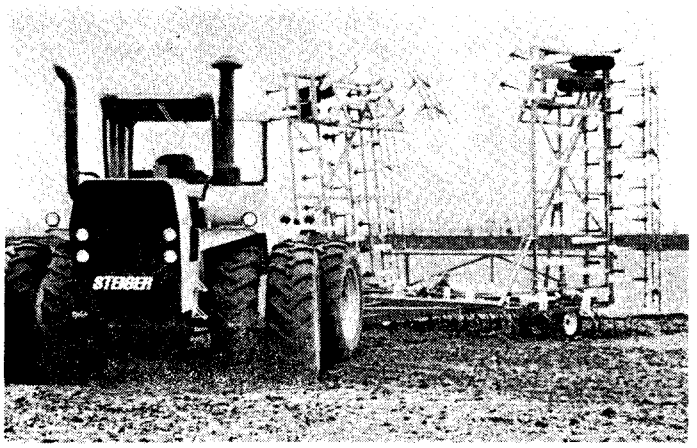


Figure 5. Machinery life can often be extended to make farming operations more profitable.

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