White Paper

Understanding the Total Ownership Cost of Agricultural Equipment

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The Critical Role of Scheduled Maintenance in Reducing Costs and Enhancing Efficiency

The first gasoline-powered tractor was invented at the end of the 19th century, revolutionising agriculture. Over 125 years later, it's estimated that machinery costs account for 20 to 30% of total agricultural costs in the US, France, Germany and Canada: making accurate information on machinery costs an essential input for farm managers. [1]

While in countries like Brazil, those costs can be even higher due to import taxes and financing restrictions, which together can double the price of imported equipment such as tractors and combines. [2]

BREAKDOWN OF OWNERSHIP COSTS

While total ownership costs of agricultural equipment vary by market and geographic location, they can always be broken into three parts:

- Initial purchase price including insurance, taxes, and financing
- Cost of fuel
- Maintenance and repair

Determining the initial purchase price and the cost of fuel is relatively easy. However, determining the true cost of maintenance and repair is difficult, which is likely the reason it has received far less attention. Once this cost is analysed, the importance of regular maintenance to mitigate repair costs and lessen the need to replace equipment as often becomes apparent.

MORE MECHANISATION

After the pandemic, more and more farms turned to mechanisation. The global agriculture equipment market size is anticipated to grow from USD 163.4 billion in 2023 to USD 281.77 billion in 10 years—a 72% increase. [3]

And as agricultural practices have advanced, the equipment has become both more specialised and more expensive. For example, in Argentina, the purchase price of a tractor increased 47% – from USD 170,000 to USD 250,000 – in 2024 according to Ricardo Semino, a farmer from Lobos. [4]

Needless to say, the acquisition cost of equipment, which includes the purchase price and the cost of financing, is a significant investment for farmers. This higher price also factors in the average life cycle of the equipment, and the annual cost of equipment relative to its life cycle. This increased cost of acquisition also adds impetus to emphasising equipment maintenance.

On most farms, tractors and self-propelled machinery make up the majority of equipment used, with other farm machinery and trucks and other vehicles rounding out the field. The combination of numerous failure-prone moving parts, harsher farming conditions, and year-round use mean regular maintenance is vital to protecting farmers' investments.

FUEL COSTS

Fuel costs are a significant operating expense. The price per litre of diesel varies by location and rising costs can dramatically impact growers.

There are two methods for estimating fuel expenses. The number of fuel drums used annually is one approach. The tractor's diesel consumption per hour can be computed by dividing the total number of litres by the number of hours operated. Fuel consumption per hour can be precisely calculated for each operation if a fuel meter is connected to the tractor fuel line. And while the farmer can't control the cost of diesel, a regular maintenance schedule can help the equipment run at peak fuel efficiency.

REPAIRS AND MAINTENANCE

Repair and maintenance costs have often been either minimalised or ignored when figuring the total cost of ownership, since the variables that affect the costs are difficult to accommodate. Everything from the make and model of the equipment to weather

conditions and crop types play a role. Geographical differences in soil type, rocks, terrain, climate, and other factors can significantly affect repair costs for a given type of machinery. And of course, the way a piece of equipment is cared for and operated has a big impact. Management practices and operator skill levels can reduce damage and wear due to misuse. And finally, geographical variations in machinery utilisation, labour costs, and spare part pricing also contribute to differences in repair costs.

Significant operating costs resulting from the continued use of agricultural tractors are related to repair and maintenance costs. For Marques Andersson et al. (2015), the cost of mechanisation can reach 40% of the cost of production, denoting that maintenance, if well planned, can contribute to reducing this percentage. [5]

Another study found 53% of total machine expenses in developing countries were for repairs of machine breakdowns. [6]

When a piece of machinery is new, repair and maintenance costs typically account for 10% of the overall cost. [7] [8]

As agricultural machinery ages, these costs rise until they represent the greatest portion of the total cost of ownership and operation. Generally speaking, the older the machine, the higher the annual repair and maintenance costs. This makes sense when factoring in material fatigue and the higher costs of spare parts for older machines.

But in many countries, small profit margins keep farmers from purchasing new equipment. The average age of tractors in developing countries is around 20-25 years old. [9] Over 50% of Brazil's tractors are over 15 years old, which directly results in increased demand for repairs and aftermarket components. And while government policies, such as the 2023-24 Plano Safra, are aiming to reduce the total fleet age, farmers still have to contend with inflation and high interest rates when considering the purchase of new equipment. Most farm owners expect to extend equipment life until inflation and interest rates recover. [10]

Even when farmers invest in new equipment, they still have maintenance and repair costs. In many cases the actual unit repair cost is much higher than for specialised designs. It simply takes more expertise to repair the units, and parts are more costly. The knowledge of repair and maintenance costs is essential for making decisions related, among others, to the replacement of machinery and accurate preparation of the farm’s budget.

A nonfunctioning tractor means substantial losses.

According to a recent report, data from the U.S. Department of Agriculture shows that repair costs have nearly doubled over the past two decades for equipment used to produce soybeans and corn, the nation's two most widely grown crops. [11]

And regardless of why equipment breaks down, it adds additional operational costs. For example, a breakdown that causes your crop to get planted late means missing out on crucial growing days – impacting both yield and quality. A study out of Ontario, Canada, showed that, for their region, every day delayed past the optimum seeding day for winter wheat resulted in a 1.1 bushel per acre loss in yield. At USD 7 per bushel, that's a loss of USD 7.70 per acre per day or USD 53.90 per acre per week before accounting for any loss in value from the impact to crop quality. [12]

Late-season breakdowns can create even more havoc. Even a few hours can allow other factors like weather to play a role in increasing costs or lessening crop values.

Ultimately, the financial implications of late-season equipment malfunctions go beyond repair bills, including lost productivity, degraded crop quality, and increased operational costs. These factors highlight the need for rigorous maintenance and contingency planning to face the harvest season without costly interruptions. [13]

REGULAR MAINTENANCE REDUCES COSTS

Studies show many farmers could reduce machinery repair costs up to 25 percent by improving routine tractor maintenance procedures. For example, a USD 80,000 tractor will typically require about USD 24,000 in repair costs during 5,000 hours of operation when receiving average maintenance. This cost can be decreased to approximately USD 18,000 if it is serviced in an optimal manner. [14]

Annual repair costs typically range from 2% to 4% of the original machine cost, offering a reliable budgeting guide. [15]

Creating a maintenance programme with service records for each machine will go a long way in tracking costs. Bearing in mind that agricultural machinery can easily be used for 15 years or more, detailed records kept by the farmer over decades are essential to effective financial management.

Typical machinery maintenance costs can be broken down into engine oils, lubricants (multifunctional fluids and specialised fluids for equipment protection), parts, and labour.

Key practices include:

- Lubrication of moving parts – giving special attention to areas prone to dirt build-up
- Checking engine oil and other fluids to avoid wear

- Inspecting and replacing worn fuel filters, air filters, oil filters, chains, gearboxes, and belts
- Inspecting tyre pressure and condition
- Storing equipment properly during off-season, covering sensitive parts and components – this can reduce costly repairs and time in the shop – cutting downtime by as much as 50%. One study found that machinery stored inside had only 7.6% downtime, while unhoused equipment had 14.3% downtime [16]

FARM EQUIPMENT MAINTENANCE CHECKLIST

To help you stay on top of your equipment maintenance, we've created a comprehensive checklist. This table outlines key maintenance tasks for various types of farm equipment, along with recommended frequencies and potential cost savings

Equipment Type	Maintenance Task	Frequency	Estimated Time Required	Potential Cost Savings
Tractor	Oil and Filter Change	Every 100-150 hours	1-2 hours	USD 500-1000 annually
Harvester	Belt and Chain Inspection	Daily during harvest	30 minutes	USD 2000-3000 per season
Sprayer	Nozzle Cleaning and Calibration	Before each use	1 hour	USD 1000-1500 in chemical savings
Irrigation System	Pump and Filter Check	Monthly	2-3 hours	USD 3000-5000 in water and energy savings
Baler	Knotter Adjustment and Lubrication	Weekly during use	1 hour	USD 1000-2000 in reduced downtime

By following this checklist, you can ensure that your equipment remains in top condition, reducing the likelihood of costly breakdowns and improving overall farm efficiency.[17]

EFFECTIVE LUBRICATION IS CRITICAL

The worldwide lifespan of an agricultural tractor is 22 years. [18] This lifespan is directly linked to the type of application, type of cultivated plant (sugarcane, for example, requires more work), and how often the equipment enters the field. Tractors are used for various operations, such as soil preparation and planting, but spraying is the most common use – a tractor sprays up to 20 times during the cotton cycle, for example. Therefore, the strength of the machine and daily and periodic revisions, preventive or corrective, are important points for maintenance and longer equipment life. It simply makes sense to take care of the engine and all moving parts. [19]

Effective lubrication offers protection against wear, oxidation, corrosion, and foaming, making it the most critical factor in preserving machinery lifespan and reliability – even under the most extreme conditions.

The amount of lubricating oil needed to keep a tractor operating properly is estimated using lubrication oil calculations. In a tractor, it makes up 30% of the total fuel utilised. Analysing oil samples is an effective way to monitor wear and oil contamination. When analysed on a regular basis, it establishes a baseline of normal wear and can indicate when parts need to be replaced before more costly damage occurs, keeping engines running longer.

Using quality oils matters. Tractor oils are formulated to operate optimally in different temperature ranges. Using the wrong oil can lead to decreased engine performance and even cause engine damage.

COST OF EFFECTIVE LUBRICATION

The cost of lubricating farm equipment is typically around 15% of the total fuel cost. To estimate the cost of lubrication, you can multiply the fuel cost per hour by 0.15. For example, if a tractor's

average fuel cost is USD 26.93 per hour, the average lubrication cost would be USD 4.04 per hour. And while it may be tempting to cut costs with a lower grade oil, the risks of shortening the lifespan of engines and increased maintenance costs outweigh the short-term benefit. [20]

CONCLUSION

Since machinery costs account for 20-53% of total agricultural costs, keeping tractors and other equipment in peak working order is vital. [21] Especially when scheduled maintenance and proper lubrication of agricultural equipment can reduce repair costs and extend the life of equipment. Factor in money saved by increasing fuel efficiency and mitigating risks of downtime losses, and the true value of scheduled maintenance and proper lubrication using premium oils cannot be underestimated.

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