

Ag Tractors vs. Wheel Loaders for Commercial Snow Plowing

Background

We are always trying to discover new ways to cut costs and implement new tools, equipment and systems to drive profits. In 2018, after months of research and sifting through the many options in the heavy machinery market, we decided to add three agricultural tractors with plows to our snow removal fleet. We were surprised by the low barrier to entry with tractors in terms of cost to purchase or lease compared to the amount of snow they can push. This realization prompted us to begin a four-year study on the short and long term cost and benefits of plowing with tractors vs. conventional loaders.

We have fairly detailed purchase, maintenance, and sales record data from the past eight years to use as a baseline for conventional loaders. Conversely, 2018 was our first year using tractors, giving us one year of personal data. Using manufacturer records, maintenance cost guidelines, service intervals, and general knowledge in tractor performance will help to accurately simulate data for tractors.



All six of our subject machines are equipped with Metal Pless Live Edge plows. Each machine's plow is sized per Metal Pless recommendations and guidelines. Each machine and plow was purchased new or very close to new in 2018, so the data should be apples to apples. Each

machine will be covered under full warranty transitioning into extended warranty during the four-year study period. Any warranty work that occurs during that time will be noted to see if any trends occur.

Each piece of equipment has been assigned to our most experienced operators. While we cannot guarantee each machine will maintain its same operator through the four-year test period, each operator has been assigned to a single machine. We specifically picked operators who have been with our company for three or more years and do not have any intention of leaving. If an operator does leave, we will replace that person with one of equal experience. We believe that over the course of four years, any discrepancies or inconsistencies will balance out.

Each piece of equipment is assigned to a route, but we have been servicing these route areas for a number of years. We know what the productivity numbers look like and know what sites are easier than others, so this will help ensure that productivity data is even. The three routes these six pieces of equipment service have an equal mix of large and small, as well as easy and complex sites.

All of the machines have the same Alliance 550 Multiuse Tires, except, we ran the factory tires last winter on the CAT 924k and will swap them out this fall for the same Alliance 550s; we just wanted to get a season of use out of the factory tires first. All the tires are fluid filled to 75% full with BioBallast.

Disclaimers-

**Your mileage may vary on equipment acquisition and upkeep costs

**Your mileage may vary on rental and leasing rates

**Our production rates in acres per hour are based on these machines clearing entire sites on their own, backdragging, curb lines and open areas. It was too difficult to get accurate data on sites with multiple machines and data in open areas is linear based on plow size.

**This study is not intended to sway you to a certain brand or equipment type, it is simply information we compiled and thought it would be interesting to share; every operation has different needs.

**This is year one of four of the study; we will update costs and production rates as we gather more data.

The Subject Equipment:

Loaders-

CAT 924k with Metal Pless MaxxPro 1248-24 Live Edge Plow
Two CAT 906ms with Metal Pless Plowmaxx 0830-13 Live Edge Plow

Tractors-

Kubota M7-151 with Metal Pless Agrimaxx 1242-19 Live Edge
Two Kubota M6-101s with Metal Pless Agrimaxx 1036-16 Live Edge

We like these matchups because in terms of operating weight, with loaded tires, are fairly comparable between the M7 and CAT 924k, as well as between the M6s and CAT 906ms. HP ratings are close as well, and road speed is nearly equal on all six machines (22-25mph).



Acquisition Cost

In terms of up front purchasing, there are a number of options. Every market and dealership may have slightly different pricing and incentives, so here is an official disclaimer: ****YOUR MILEAGE MAY VARY****

The CAT 924k was the only machine that was not new when purchased. It was a very low hour unit with the full factory warranty still in place. The 924k is loaded with ride control, backup camera, 3rd valve, fusion coupler with hydraulic attach, quiet cab package, etc. The 906ms have the high speed transmission (23mph), ride control, skid steer plate with hydraulic quick attach, etc.

The tractors are standard packages for Kubota with cabs, electronic locking differentials, electronic shift, etc. The M7 is the premium package, but that is just comfort and convenience items more so than efficiency items.

Acquisition	Kubota M6	Kubota M7	CAT 906m	CAT 924k
Cash Price	\$ 66,400	\$ 109,200	\$ 86,558	\$ 166,410
Manufacturer Finance *	\$ 1,206	\$ 1,966	\$ 1,450	\$ 3,124

60 Month finance

Operating Lease- Fair Market Value (FMV)	\$ 705	\$ 845	\$ 1,241	\$ 2,250	4 year, 400 hours/year
Snow Lease **	NA	NA	\$ 2,250	\$ 3,600	6 months, 50 hours/month

* Based on financing 0% down, 0% interest

** Based on CAT Snowfighter lease program



Ownership Cost

One big factor to this study will be the cost of ownership. Some of this is to be seen, but we are trying to leave the “unexpected” out of the equation. This cost of ownership includes depreciation/resale value (by far the largest factor), maintenance and upkeep costs, and fuel consumption.

We represent the four-year 1600 hour resale value as our main depreciation number, but also will offer a longer term to get a clearer picture as things develop with the study. Resale is based on an average of the four median price points on Machinery Trader, Tractorhouse, Ironplanet and a few Facebook sales groups. We tried to cross reference those with sold listings on Auctiontime and Ebay to verify accuracy. I tried to stay within 15% of listed hours, equal tire wear advertised and equal features. It’s not a perfect process, and we are fully aware there are better deals to be had and people who sell their used stuff above market value, but this gives us an idea of current market conditions until we actually sell these machines in four years. Another cost factor we have assessed is affordability of leasing or snow rentals, as leasing is a very common practice across snow companies. Admittedly, lease prices could be all over the place, but the consensus countrywide seems to be that tractors are cheaper to lease than loaders. This is because they typically depreciate more slowly, and there is less to break or damage during a lease on a tractor than on a loader.

We could not find a snow lease program on ag tractors in my local market, but would love some feedback on this as we have heard these programs exist elsewhere.

The main issue we see with snow leasing tractors is that if you are going to take the time to mount an undercarriage and run hydraulic lines (6-8 hours for a Metal Pless install on a Kubota), it's not terribly practical to install and remove this each year. There is also no guarantee that your dealer will have the same tractor available next year and thus your undercarriage and lines may not fit.

We have heard of people snow leasing ag tractors with plows included and would love to hear some options and pricing for the sake of our data.

Ownership Cost/Depreciation - Per Hour	Kubota M6	Kubota M7	CAT 906m	CAT 924k
Cash Price*	\$ 17.00	\$ 20.00	\$ 20.00	\$ 28.00
Manufacturer Finance*	\$ 21.00	\$ 25.50	\$ 25.50	\$ 39.00
Operating FMV Lease**	\$ 21.00	\$ 25.00	\$ 37.00	\$ 67.50
Snow Lease***	NA	NA	\$ 45.00	\$ 72.00

*Cash purchases and manufacture finance sold after 4 years 1600 hours, based on median sales price

**Operating lease turn in to dealer after 4 years and 1600 hours or buyout at fair market value (FMV)

***Snow lease 5-6 months turn in at end of lease 300 hours

Maintenance and Consumables - Per Hour	Kubota M6	Kubota M7	CAT 906m	CAT 924k
Factory service intervals, fluids, filters, greasing	\$ 2.25	\$ 2.95	\$ 2.80	\$ 4.75
Average fuel use while plowing/roading	\$ 6.00	\$ 7.25	\$ 6.00	\$ 8.50

*Diesel at \$3 per gallon

According to our observations here — and again, your local dealers and costs may vary — Kubota seems to have lower pricing on their extended leasing programs compared to CAT. One person we talked to theorized that the tractor market is maybe a bit more stable in a down economy, and thus a company like CAT has to hedge their bets a bit more on reduced resale if the economy tanks during the lease period. The market for used CAT equipment is very high right now according to our local dealer making the purchase and sell costs per hour look much more appealing than the long term leasing in the current market conditions.

Of course if you purchase and plan to sell, you are taking the risk on a lower used equipment market instead of putting the risk on the leasing company. The nice thing about leasing or renting and then turning the unit in is that your costs are fixed, which makes bidding, costing,

and budgeting a bit easier and more bulletproof.

Another observation is that the acquisition cost per horsepower is quite a bit lower for tractors vs. loaders. This means that if you want to push the most snow possible with the least upfront cost, the tractors in this study are theoretically the better option. For example, a Kubota M6-101 Tractor can push a 30% larger plow and costs about 25% less to purchase than a CAT 906m.

Again, this does not factor for uses outside of snow, ease of use, type of sites where you need to use the equipment, or anything else; this is purely a mathematical analysis that can be applied to your own company's situation and needs.

Tractors definitely get better fuel economy at top speed than the loaders do. This is a simple relationship between gear drive vs hydrostatic. This is an important consideration if you do a lot of roading between sites.

The tractors have far fewer grease points to maintain than the loaders do. Besides the 3-point hitch grease points, tractors have only four requiring service every 100 hours. This could be a consideration for loaders that might sit on site since some grease point should be greased every 10-25 hours. Either your operators need to do it, or you have to send someone out to your sites to keep the machines properly greased and maintained.



Service intervals between the tractors and loaders were comparable. The biggest difference is that the hydraulic and transmission service on the loaders is a lot more expensive than on the tractors. This is not a major factor on a per hour basis, but it was one notable maintenance item that differed substantially in cost.

We have not put enough hours or miles on our tractors to know for sure, but it seems reasonable that the tires on the loaders would last longer due to less tire spin and slippage, as well as the articulated turning vs. the brake skid and locked differential turning on wet/snowy ground with the tractors. We weighted tire wear in favor of loaders for this reason.

The general consensus between both CAT and Kubota mechanics that we talked to was that tractors would be lower in cost to maintain and generally have longer overhaul intervals with proper maintenance. That means if you are someone who likes to buy used equipment, a properly maintained 3000 hour tractor may be a "safer" buy than a 3000 hour loader when comparing equally sized machines.



Ease and Comfort of Operation

We all know that finding quality operators, or even just finding bodies to fill machines/trucks in our industry can be difficult. Did you ever think we would see a day where companies avoid anything with a manual transmission because it virtually eliminates 75% of the labor pool from being a driver for their company?

From that standpoint, ease and comfort of operation on these machines is very important. After one full season of operations with these machines, we have some observations.

- The loaders are easier for new operators to use without being completely overwhelmed — fewer buttons, knobs, features, a smaller cab, no clutch, no gear shifting.

Even with the convenience of the electronic shifting in Kubota, the concept of having to clutch or shift to neutral as you roll to a stop without stalling feels foreign and complicated to those who have not operated a gear-drive tractor before. For large fleets, tractors could be a major obstacle for entry-level operators.

- On the flip side, one of the biggest challenges with running a plow — especially a large plow on a loader — is setting the wings and edges at the proper angle. Many of you can attest to the fact that you have had plow shoes worn down to nothing on the backside while the frontside is hardly scratched. Running the plow tipped back is human nature, as it creates the most consistent scrape regardless of terrain. Running with the front loader wheels off the ground is cringe-worthy for owners and fleet managers as the scrape is no better and the edges and shoes are wearing at twice or more the rate that they should be. Furthermore, plow damage occurs when obstacles are hit with this much pressure on the plow.

The beauty of plowing with a tractor with a plow on an undercarriage is that you set the perfect and proper angle and down pressure of that plow when you install the mounting subframe and lift cylinder. Once properly installed, the operator only needs to move the plow up or down and it will be set at the correct angle and down pressure each time without fail.

A hydraulic wing plow can then help the operator focus more on controlling the wings, as opposed to continually adjusting the tilt-angle of the blade and running the wings like they would on a loader.

We did not include cutting edge/shoe wear life on our maintenance calculations, but if we did it is a sure bet that the tractors are going to have a longer and more consistent wear life on the edge and shoe components than the loaders would.

- In terms of comfort, all machines were fairly equal. The Kubota cabs are much larger and have more glass which improves visibility. The downside is that in the coldest snow events (-15°F and colder) even the high output heater had a hard time keeping all of the glass clear of fog and frost, especially the rear window. We did add a defrost kit to an M6 to help combat this issue, and we will be adding it on the 2nd M6 this year as rear visibility is obviously very important.

The tractors don't bounce down the road as the weight is carried low and close. The Metal Pless undercarriages do have nitrogen accumulators on them to help absorb plow bounce while driving down the road. Kubota tractors tend to maintain road speed better than CAT while going uphill, so if you live in hill country, that may be a consideration. There are also "buddy seats" in Kubota cabs, so if carrying a passenger, (shoveler, friend, dog, etc.) the Kubota wins hands down for space and comfort.

The CAT cabs are also very comfortable and much simpler in terms of the number and location of buttons and switches. Also, CAT machines did a better job of keeping the cab warm on the coldest events. Ride control really makes the ride smooth, maybe even a bit smoother than the tractors according to our operators.

Overall, the consensus was that the cabs and comfort are very close to equal, and each has it's upside.

- In terms of plow controls, the loaders must use electronic solenoid valves to divert the hydraulic fluid from the center moldboard to left-wing and right-wing. The three way switch selects which plow section the auxiliary hydraulic switch on the loader joystick controls. Depending on where you mount the switch, this takes a little getting used to. Not a major obstacle for entry-level operators, but there is a learning curve.

One thing the operators did like better about the tractors is that with the four hydraulic remotes on each tractor, all of the functions (up, down, center, left, right, and each wing) can be controlled with the onboard hydraulic remote switches. You can also precisely control the hydraulic flow rate to each remote line from the cab. Each operator can set the sensitivity and speed of each hydraulic function independently, which is a nice feature.

We also feel that in the long term, the tractor hydraulic remotes are more reliable than an electronic valve, switch, and wiring harness. Electronic components are subject to corrosion, breakage, and failure.



Plow Efficiency, By The Numbers

When it comes down to sheer efficiency (acres/hours on like sites), the results and observations were fairly proportional in terms of plow size to production numbers across all test units. The loaders had an advantage on lots with more starts and stops, whereas the tractors edged the loaders on lots with longer pushes after backdragging was complete and curb lines were cut.

One area where the tractors surprised us was with how high the subframe mounted tractor plows could stack. All we read was how tractors can't stack snow, so we would need to bring loaders in to clean up or blowers to blow piles up. This was not the case.

While the Tractors by no means stacked snow as high as the CAT 924k, the pile height between the 906m loaders and tractors were comparable.

To show production rates, we want to show "real world" examples of what these machines and blades can do. We are not using wide open space windrowing or push boxes pushing up windrows of snow as our rates here. That would just show us a linear relationship between plow/box size and machine operating speed. While this information is no doubt useful, it is not relevant to this talking point.

Average Acres Cleared- Per Hour	Kubota M6	Kubota M7	CAT 906m	CAT 924k
Based on 1 year of production data,	2.25	2.70	1.80	3.00
Total Cost Per Acre of Snow Clearing				
Cash Price	\$ 11.22	\$ 11.19	\$ 16.00	\$ 13.75
Manufacturer Finance	\$ 13.00	\$ 13.22	\$ 19.06	\$ 17.42
Operating FMV Lease	\$ 13.00	\$ 13.04	\$ 25.44	\$ 26.92
Snow Lease	NA	NA	\$ 28.33	\$ 26.83

*Total cost per acre includes cost of ownership/leasing as well as maintenance and fuel per hour divided by the number of acres per hour each unit achieved on average

It was not surprising that all of the subject machines and plows performed very well. What was a bit surprising was the level of efficiency gains when compared to equipment we have used in past years; it was more of a testament to the hydraulic wing plow concept than anything else.

Some examples of those efficiency gains in our operation are below:

- The CAT 906m with the Metal Pless plow outperformed our previous years production rates on average 3:1 on the same sites from previous years using a 1 ton truck with 8.5 V-Plow with wings.
- The Kubota M6 with the Metal Pless plow outperformed our previous years production rates on average 3.75:1 on the same sites from previous years using a 2 ton truck with a 10' V-Plow (36" flared moldboard).
- The CAT 906m with the Metal Pless 0830-13 outperformed previous years production from 2:1 all the way up to 3:1 using a CAT 906m w/12' Kage, depending on the type of site.
- The CAT 924k with the Metal Pless plow outperformed our previous year's production rates almost 4:1 on the same sites using an equal weight/hp loader with a 14' pushbox. This one was a major eye-opener.

Yes, the hydraulic wing plows cost far more than a push box — probably three to four times as much — but replacing nearly four machines with just one machine more than negates this increased plow cost in the right circumstances. Even if it replaced just one loader, you would be hard pressed to get an old used loader this size for the price of the MaxxPro 1248-24 plow.



The beauty of all of these machines and plows is that they can do it all. They can backdrag their own parking spots and docks. They can cut around odd shaped curb lines and curb islands. They can capably windrow large swaths of a lot of space at a time. Last but far from least, they can turn into highly efficient, clean scraping push or backdrag boxes with the push of a button.

So much production data you find out there assumes a fixed side push box is being fed by other equipment, or a truck is windrowing snow after a skid loader backdrags and cuts around curb islands, light poles, and loading docks. Obviously these are the most conventional methods of snow plowing, but does that mean it is the best? With the difficulty in finding labor, why not take one machine and make it capable of handling the job of two or three machines and operators?

The real eye opening data for our company was that in the 2018-2019 season. Our per snow event (per push) revenue increased by 50% compared to the previous season, but we fielded 15% fewer pieces of equipment than the year prior - we ran 20 trucks/loaders prior, but 17 this past season. This is purely efficiency gains on behalf of the equipment and operators working to their maximum potential. In the 2019-2020 season we have invested further in wing plows and have pulled all trucks off our routes except for de-icing purposes. We fully expect to again decrease our overall number of machines and operators but increase revenue per push. Doing more with less is almost always a good thing.

Summary: Wingplows = a lot more production with a lot fewer machines, plain and simple.



Other notes and observations

The maintenance and upkeep on the tractors, overall, is less. Fewer grease points and longer service intervals on transmission/hydraulic systems. The tractors consistently use 30% less fuel per hp, primarily due to efficiency loss with a hydraulic drive system vs. a gear drive system. The tractors also seem more efficient due to the drive system, range of gears and consistency of throttle, and peak power use that inherently comes with a gear drive system vs. hydraulic drive.

One big advantage that CAT loaders have going for them is that they hold their value incredibly well compared to other brands. We are consistently amazed at what used CAT iron sells for. I would be curious to compare some of these numbers on brands that do not hold resale/residual value as well. The same would seem go for Kubota tractors vs. John Deere or Case. While Kubota is gaining market share, you still see used Kubota equipment selling at a discount on the used market compared to the Green and Red.

Speculation is that the divide in cost per hour could widen between the loaders and tractors if a different loader brand and different tractor brand was tested, but we did not collect data to back those claims.



Conclusion after 1 year

Tractors are currently our primary acquisition target for the snow plowing needs of our company and our market. Between cost of ownership, operation, efficiency, and summer use in our company (wide area mowing), it simply makes more sense for us.

If we have summer use for another loader, we will certainly get one and utilize it in our snow operation. At the moment our loaders primarily act as yard loaders, (all of our yards have a loader at them) so we don't have a demand for more at this time. We do have a need for more snow pushing equipment for the 2019-2020 season, so tractors are what we are acquiring to fill that need.

Leaving summer usage out of the equation, we are still bullish on tractors based on these study results. We will see if future years of data change that mentality.

Thanks for reading! Please share any comments, questions, or ideas with us on whatever forum or post you may have seen this on, or feel free to reach out to us directly.

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