Murska Profit calculator

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SUMMARY

This calculator is developed to help farmers and Murska distributors to calculate grain processing costs for animal feeding and comparing the cost of different methods. Traditionally cereals usually left in fields longer in order to harvest them as dry as possible, then put in industrial driers to prepare them for storage.

As, crimping is the most effective and most profitable substitution for drying. It is generally and scientifically known, that crimping comes with many advantages compared to drying. Details come later on the report.

In this calculator the focus was on direct energy consumption between drying and crimping. There are many researches for energy consumption with dry grain processing and similar researches that studied crimping method. Combining and exploring these studies have given us huge amount of data that we can work with. And the figures in the calculator are based on physics, which can be translated in to tracking energy usage and costs.

However, main idea in this calculator is calculating annual fixed cost on both methods. Crimping and drying. There are no fixed assets included which simplifies and ease the calculation.

Crimping is an environmentally friendly method for processing grain. With many advantages, such as time saving, dust free, longer time window for combining, low transport expenses, flexible storing etc.

Indrotuction

Based on Murska Oy´s request, this work was to create a simple calculation model to support farmers and contractors, on their turn they have provided reliable information on the cost structure of the various methods of processing cereals in the cereal processing for animal feed.

This calculation tool provides clear information about differences between methods in different situations. The main issue of the work is how to draw the costs of the energy such as crimping and drying to establish a simple and understandable calculation model to support any investment planning.

The different constants of the calculation models are derived from the research data. Therefore, results from farms calculations on an individual level might differ from the result of pre-calculator.

Due to the strong influence of the weather, the conditions and timetables of harvesting vary from one year to the other. This makes budgeting and cost planning difficult thus the existing methods might create loss and limit the input values can be solved by calculating costs for different conditions.

Energy is an excellent gauge of profitability, such as the price of energy in different production methods. In the case of grain drying, fuel and electricity are used, tractors and agricultural machinery also use fuel for energy source, so fuel is the common factor between drying and crimping.

The calculation model includes direct energy costs with drying and crimping cereals (fuel, electricity). In addition, the cost of preservatives, plastic tube and clamp sealing cover required in crimping storage, so they are included. The dry grain grinding costs, which are derived from the research data of the Finnish Työtehoseura society, are also included in the drying process.

Because each farm is unique, calculator does not interfere with existing or future fixed assets, but calculates method´s direct costs, which gives an image of a cost structure that is relatively stable. Other issues such as logistics, animal output, management are unrelated to the grain processing methods, more clarifications can be found in conclusions and recommendations.

Calculator

Calculation items:

Feed in tons:

This varies in every farm, depending on the size of the farm, number of cattle and the business structure of the farm. Figures are between 100 and even up to 5000 tons per year. Most of farmers process grain for own use only, the rest tend to hire contracting services, this latter helps in reducing machine investment costs.

Fuel price:

Varies by country.

Harvesting moisture:

Traditionally, farmers are trying to combine as dry as possible to keep the drying costs low which is the main variable factor. Average combine moisture depending on the country is around 20%. This is where the crimping steps in. In crimping method moisture should be 30-45%, which means a lot longer time for harvesting and less weather dependent.

Price of preservative:

There are many manufacturers of preservatives and alternatives to preservation of different farms. The main guideline is that 30% humidity requires 5 l and 45% humidity 3 L per ton of preservative. Prices varies by country and manufacturer, so to get the exact price you have to contact your local distributor.

Electricity Price

Total price/kwh. The price of electricity is also varied by country and region. About 7% of the energy used in drying is electrical energy.

Tube price:

The prices of the tube also vary by quality and size. Different tube manufacturers have their own tables, which can be used to calculate the price

per ton. There is a chart included in the calculator, which help you calculate tube cost per ton.

Silo covering:

Covering costs are dependent on clamp silo size. According to the Finnish Työtehoseura (2017) the cost is approx. 0.6 € per ton.

What do we get out of the calculator.

DRYING AND CRINDING

Drying *expense*:

Harvesting moisture sets energy requirements for drying. Water evaporation uses a certain amount of energy. This model is based on fuel and electricity consumption.

“Energy needed for drying is usually obtained from light fuel oil and carried into the grain by air. Water enthalpy of vaporization is ca. 2.3 MJ kg-1, and this is thus the minimum amount of energy needed to evaporate 1 kg of water. In practice there are always some heat losses caused by unsaturated dryer exhaust air and heat convection and radiation through the dryer structures. Therefore, the energy consumption measured from practical grain dryers varies between 4 to 8 MJ kg-1 [water], depending on dryer type and design (Peltola, 1985; Nellist, 1987; Suomi et al., 2003). In this paper an average value of 6 MJ kg-1 was used as base for calculations.” (Source 1)

This means you need 0,167 litre fuel per evaporized water kg. At the end of report is a table for detailed information. (Attach. 1)

So, with this data, we can calculate total energy use for drying and how much does it would cost.

Electricity expenses

“The amount of electric energy is relatively small, ca. 5–8% of total direct energy consumption (Peltola, 1992). The figure used in calculations was 7%., which equals to 43.4 kJ kg-1 [grain DM].”

When we take this % off the total energy and multiply it with electricity price and total tons, we get our electricity expenses per year.

Grinding dry grain

Grinding dry grain costs according Palva, TTS (2017), is approximately 2€ per ton. This includes transfers and controlling the mill. Due to different currency used in calculator, this is average 6 kw/ton multiplied with electricity price so you get cost, wich is not dependable from currency

CRIMPING

Crimping cost

Mills input power set requirements for energy used in crimping. Input power in crimping variates between 2 and 10 kw, depending on the cereals, crimper model and it`s parameters etc. Average readings with Murska 1400 s 2x2 crimper is 6,67 kwh/ton. This reading is average from (Dr. Zoltán Bellus Ministry of Agriculture and Rural Development, Hungarian Institute of Agricultural Engineering (MARD, HIAE), 2004.) test. The test was made with winter corn and maize with Murska 1400 S2x2 crimper. And moisture contents were, maize 36,8%, winter corn 27,8%, which is relatively low moisture for crimping and takes more power from tractor.

According to Ahokas .2013, average specified fuel consumption in diesel engines is 0,267 kg/kwh, which means 0,316 l/kwh. That means 31% efficiency. The variation with this reading was 0,220 – 0,358 kg kwh.

With average 6,67 kwh/ton you need 6,67*0,316 = 2,11 litres fuel per crimped ton to run a crimper.

(Polttoaineen kulutus peltotöissä Ahokas J. Helsingin yliopistomaatalous-metsätieteellinen tiedekunta. 2013).

Preservative cost

There are many manufacturers of preservatives and alternatives to preservation of different farms. The main guideline is that 30% humidity requires 5 l and 45% humidity 3 L per ton of preservative. Prices varies by country and

manufacturer, so to get the exact price you have to contact your local distributor.

In the calculator you can choose between 4 to 8€ per ton cost.

Silo protection cost

Plastic covering is around 0,6€ per ton in Finland.

Tube cost

The prices of the tube also vary by quality and size. Different tube manufacturers have their own tables, which can be used to calculate the price per ton. There is a chart included in the calculator, which help you calculate tube cost per ton.

Conclusions

This calculator was developed to help farmers as well as contractor keep track of their production costs and to help them see the different savings. That would be made by switching or changing their old traditional methods to more modern and more efficient ones.

It is a tool that has been long waited for, that would eventually contribute in the environment sustainability by decreasing costs. Which will spur energy use efficiency, as our Murska logo says “Productivity in harmony with nature”

Appendices

Source 1

(Agronomy Research 12(1), 81–94, 2014, T. Jokiniemi*, S. Jaakkola, M. Turunen and J. Ahokas) and (Laitinen, A., Orava, R., Peltola,A. ,Salasmaa, O. ja Ylönen, A-M. 1985. Energiansäästö viljan korjuussa. Työtehoseuran julkaisuja 272. 121s.)

Attatch 1

Grain moisture %	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
Water kg / ton of grain	12	24	36	49	62	75	89	103	117	132	147	162	178	194	211	229	246	265	284	303	323
Oil needed litres / ton	2,0	4,0	6,1	8,2	10,3	12,6	14,8	17,2	19,6	22,0	24,6	27,2	29,8	32,6	35,4	38,3	41,3	44,3	47,5	50,7	54,1

References

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