

Technical and economic indicators in the handling of mowed grass

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Abstract: The thesis monitors the metering and evaluates the acceptable technical economic indicators of reapers and harvesters. The target of the practical part is to obtain data in order to compare the effectiveness of different horticultural tools. The comparison of these instruments is included.

Key-Words: green vegetation, reapers and harvesters, founding of garths, mulching, maintenance of green vegetation

Introduction

The principle of the right foundation of garth in parks is not only the preparing of ground before seeding and using of quality grass mixture but also the maintenance of grass during several weeks and months since its foundation. If there is any failure (often caused by saving of finances) it necessary to make an effort to establish the greenery according of investor's request. [1, 2, 3]

The regularly mowing of grass areas supports tillering and contributes to plant density. [4, 5]

The mulching is a kind of a mowing when the grass is repeatedly cut by rotating knife. This type of mowing create grass sheet which isn't collected inside of rear grass catcher but it stays under the instrument in the garth. [6, 7]

The mulching is the process of recycling of grass and leaves which serves also as a fertilizer. The mulching declines the need of fertilizing in value of $\frac{1}{4}$. The humidity which is contained in the grass sheet declines the need of irrigation. [6, 7]

Material and Methods

Characteristic of maintained area

The monitored area of 11 353 m² is situated in the business area in the centre of Brno neighbouring with the river Svratka. The main point of the area is an artificially contracted lake which is composed of three separated parts. The lake disposes of several basic functions (visualization of aesthetic element of the area and formation of ecosystem of the area, in the summer days it declines the temperature of the

area and has a function of retention of rainwater. The main function is the ability of irrigation for green vegetation in the all area.

Tools

- Garden reaper LT 2223 CMA 2
- Trailer
- Garden rider FR 2218 FA
- Measuring cylinder
- Stopwatch MASTER JUNSO JS-6618
- Protective means

It is important to make sure that rotating knife is grinded every 40 motor hours (every 14 days in fully workload)

Both of those mowing instruments were tested in 12 acts of mowing. The cutter mechanism was set up in the high of 35 mm.

The high of garth cannot reach over than 150 mm. The degree of humidity has to be lower when the degree of wet grass. It is important to make sure that in the area of mowing there is not any object witch would intercept the mowing (for example parking cars).

The methods of measuring

To be able to repeat the measuring the following condition has to be satisfied:

- The size of flat surface is 0.5 – 1.5 ha
- Two mowers with vertical axis of rotation of power 10 – 20 KW
- Consumption of fuel in period of time

The evaluation will be determined by calculation of the power instrument.

- \bar{x} - The arithmetic mean

$$\bar{x} = \frac{1}{n}(x_1 + x_2 \dots + x_n) = \frac{1}{n} \sum_{i=1}^n x_i$$

- T_p – pulse width [h]
- S_p – the content of maintenance of the area [m²]
- Q_{PHM} - the quantity of consumption of fuel [l]
- C_{PHM} – the price of fuel [CZK]
- N_{PHM} – the costs for fuel [CZK]

The cost of fuel is composed by product of the quantity of consumption and of the price of fuel.

$$N_{PHM} = Q_{PHM} \times C_{PHM} \quad [CZK]$$

Q_{Tp} - The quantity of consumption of fuel/one working hour [l]

The quantity of consumption of fuel/one working hour is the quotient of quantity of consumption of fuel/working time of the instrument.

$$Q_{Tp} = \frac{Q_{PHM}}{T_p} \quad [l]$$

N_{JPHM} - the costs for 1 m² [CZK]

The cost for fuel for 1 m² is the quantity of the costs for fuel/the content of maintenance of the area.

$$N_{JPHM} = \frac{N_{PHM}}{S_p} \quad [CZK]$$

Q_{JPHM} - the quantity of consumption of fuel for 1 m² [l]

The quantity of consumption of fuel for 1 m² is quotient of the quantity of consumption of fuel/the content of maintenance of the area.

$$Q_{JPHM} = \frac{Q_{PHM}}{S_p} \quad [l]$$

T_{Jp} - the time necessary for mowing 1 m² [s]

The time necessary for mowing 1m² is quotient of the working time of instrument/ the content of maintenance of the area.

$$T_{Jp} = \frac{T_p}{S_p} \quad [s]$$

Results and Discussion

The values which were measured and calculated from the process of mulching are demonstrated in the table 1.

Table 1 Measurement of mulching and its values

Order of mowing	T_p [h]	Q_{PHM} [l]	Q_{Tp} [l]	N_{PHM} [CZK]
1. moving	5.46	12.56	2.3	452.40
2. moving	5.57	12.25	2.2	441.45
3. moving	5.00	12.50	2.5	450.31
4. moving	5.33	12.79	2.4	460.83
5. moving	4.80	12.48	2.6	449.59
6. moving	5.40	12.96	2.4	466.88
\bar{x}	5.26	12.6	2.4	453.58

The values which were measured and calculated from the process of moving into the rear grass catcher are demonstrated in table 2.

Table 2 Total costs of mowing into the rear grass catcher (mowing + transport of mowed grass)

Order of mowing	T_p [h]	Q_{PHM} [l]	N_{PHM} [CZK]
1. moving	8.16	17.69	637.14
2. moving	8.14	18.15	654.00
3. moving	7.97	17.94	646.32
4. moving	8.05	16.91	609.00
5. moving	7.98	18.45	664.73
6. moving	8.02	17.91	645.06
\bar{x}	8.05	17.84	642.71

The difference of saved fuel in between of two different instruments FR 2218 FA (mulching system) and LT 2223 CMA 2 (mowing in to rear grass catcher) is 5.24 litres. According of the price of natural 95 (2013) 36.025 CZK the saved finances are 189.13 CZK. FR 2218 FA is able to mow the grass area during 5 hours and 16 minutes in comparison to LT 2223 CMA 2. This mowing followed by discharging of second instrument takes 8 hours and 3 minutes. The difference is 2 hours and 47 minutes. It is demonstrated in the following figure 1, 2 and 3.

Fig. 1 The total comparison of consumption of fuel in between of LT 2223 CMA 2 and FR 2218 FA (in litres)

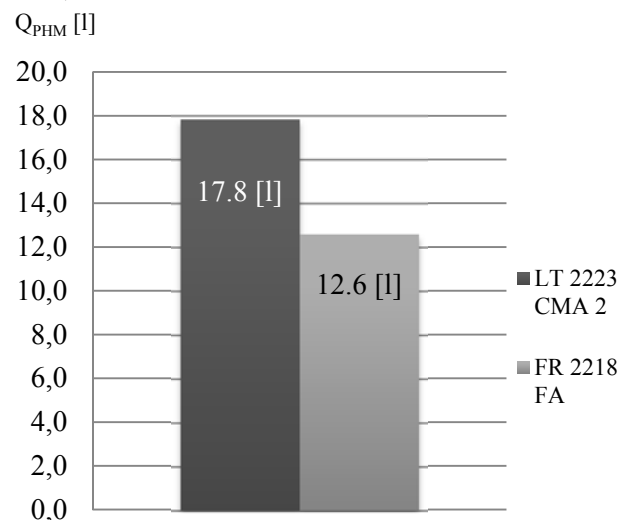


Fig. 2 The total comparison of time of completion between of LT 2223 CMA 2 and FR 2218 FA (in hours)

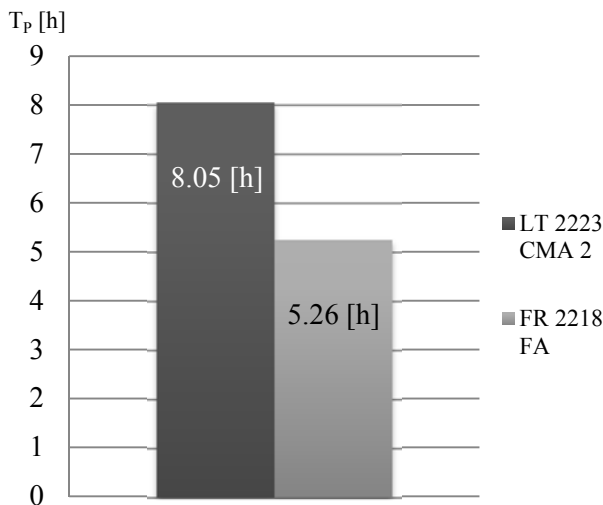
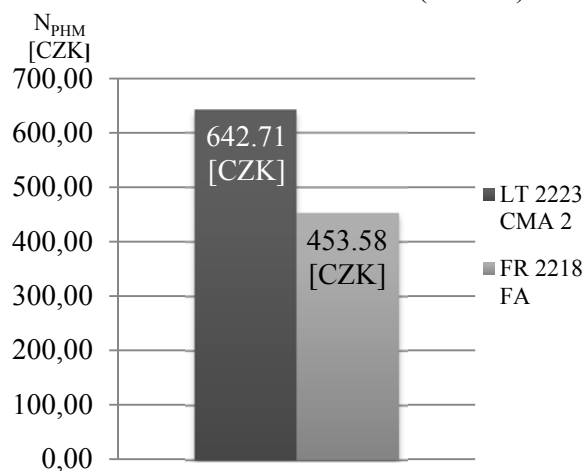


Fig. 3 The total comparison of total costs between of LT 2223 CMA 2 and FR 2218 FA (in CZK)



According of all results of measuring the mulching of greenery is technically-economic more profitable act. If the mulching should be used on different areas of greenery and should reach the same values of saving it is necessary to use an appropriately prepared area and keep the principles of mulching. The results say that using of rear grass catcher and following discharge of the catcher is more expensive than mulching.

According of the primary judgment was supposed that the act of mulching was energetic more exacting and its average of value of consumption was higher. It was caused by dividing of mass of the grass.

According of result it is perceptible that the average consumption of fuel increased. This growth is inconsiderable. During the mowing act into the rear grass catcher the total weight of the instrument

changes and it causes the growth of consumption of fuel. The mowing act into the rear grass catcher causes the lost time (the time for discharge), the total working time of the instrument is about 35% longer than the time of using of the mulching instrument. The instrument using the rear grass catcher has to work on a wider distance. It is necessary for transport of mowed mass. The growth of consumption of fuel is about 20 % higher than using of the mulching instrument.

The basic problem which causes an abysmal difference in respect of finances between mowing into the rear grass catcher and mulching can be obvious on example of different recycling possibilities. If there is not any possible place for collecting of mowed grass in the neighbourhood area or if the capacity of this place is not satisfactory in comparison with the size of maintenance area it is necessary to ensure a container, its transport and following recycling of mowed grass. The price of one container is in between of 2 500 CZK and 5 000 CZK. The price contains recycling and transport of waist. This amount can be added to costs of mowing in to the rear grass catcher.

Conversion of units

To be able to apply the resulting values for different maintained grass areas as well, I accomplished the conversion of resulting values into the units. The resulting values are demonstrated in the table 3 and 4.

Table 3 Conversion of values (mowing in to the rear grass catcher and transport of mowed grass)

N_{JPHM} [CZK]	Q_{JPHM} 1 m ² [l]	T_{Jp} [s]
0.057	0.0016	2.55

Table 4 Conversion of values (mulching)

N_{JPHM} [CZK]	Q_{JPHM} 1 m ² [l]	T_{Jp} [s]
0.040	0.0011	1.67

These values can be used for the grass areas which have similar parameters as the monitored area.

Conclusion

The results of measuring confirmed that the act of mulching saves about 35% of time and 20% of consumption of fuel in comparison with the act of mowing into the rear grass catcher.

If the mulching should be used on another grass areas and the mulching should reach the same amount of saved finances it is necessary to have prepared an

appropriately area and follow of instruction of mulching.

The results say that the mowing with the rear grass catcher with following discharge of mowed grass is more expensive than the mulching. In addition the mowing grass catcher with following discharge takes nutrients from the grass area off. It causes a requirement of fertilizer which takes the nutrients back to the grass.

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