FLOW MASS MONITORING IN THE HARVEST OF SUGAR BEET

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Abstract. Precision agriculture is the higher level of work on the field by local different condition of soil with optimization of using product factors. The main aim of this system is modification of work operation to local conditions of field. By harvest of sugar beet is not solving the flow mass monitoring for yield maps creating. In this article is described one of possibilities for flow mass monitoring based on pressure type sensors. There is method of measurement dates made in laboratory conditions included.

Key words: sugar beet, hydraulic, pressure, yield map.

Introduction

The monitoring yield of sugar beet is important for the process of precession farming and creating yield maps [SCHMITTMANN 2002]. This action don't use by harvest sugar beet but this action use by harvest cereals. This article described to measuring flow mass sugar beet on the rod sifting conveyor by the laboratory conditions. The makers of machines for harvest sugar beet used the rod sifting conveyor almost all. The hydraulic motor drives this rod sifting conveyor. This is very good for monitoring the power parameters – specially the loss of pressure on the hydraulic motor. We assume to the loss of hydraulic motor is the parameter for determination of the flow mass of sugar beet. The monitoring of flow mass with the position of machines are using for yield mapping by the harvest sugar beet. The spoke wheel is the next element for separation of admixture. The roots are braking and decelerating by motion on the spoke wheel. The loss of pressure wasn't good for monitoring the flow mass of sugar beet we supposed.

Materials and methods

The aim of our measuring was the monitoring the loss of pressure on the hydraulic actuator by different flow mass of the sugar beet on the rod sifting conveyor. Next aim was to determined dependence between these values.

The hydraulic unit with the hydraulic system used for the measuring was too used for the measuring flow mass monitoring of potatoes [MAŠEK 2007a]. The sugar beet put by the belt conveyor. This belt conveyor was located before the sifting rod conveyor. On the part of belt conveyor we gave fix mass of sugar beets. The mass of sugar beets was between 101.82 kg (before the measuring) and 98.54 kg (along the measuring). The belt conveyor was driven by the frequency converter TAIAN, model N2-410-H3. The electric frequency was among 10 Hz (0.17 m/s the velocity of belt conveyor) and 50 Hz (0.85 m/s the velocity of belt conveyor). The same velocity was the rod sifting conveyor with hydraulic motor OMR 50. Thereby we followed the different the flow mass of sugar beet. All measured variable were recorded onto measuring apparatus Firm Hydrotechnik. This apparatus (Fig. 1 and Fig. 2) composed of:

- sensors to measuring pressure in front of actuator and behind actuator HT – PD in range from 0 to 200 bar;
- flow indicator GFM 30 in range from 0.2 to 30 $l.min^{-1}$;
- sensors to measuring temperature Pt 100 in range from -50 to + 200 ˚C;
- sensors to measuring the rotation frequency in range from 0 to 10 000 min^{-1};
- Data logger Multi System 5000.

After connection all of sensors to measuring centre had been necessary all apparatus calibrate. The measuring centre provides not only countdown the measured variable on display but provide communication with notebook too. In the notebook must be install software HYDROcomsys/WIN. Through the medium this software is possible the measuring variable from measuring centre to PC on table and after create the graphs.

The hydraulic unit used oil Fuchs Renolin VG 46. The temperature during measurement was on the same stage around (55 ˚C). It was very important in matter of viscosity of oil. All measured we repeated threefold.

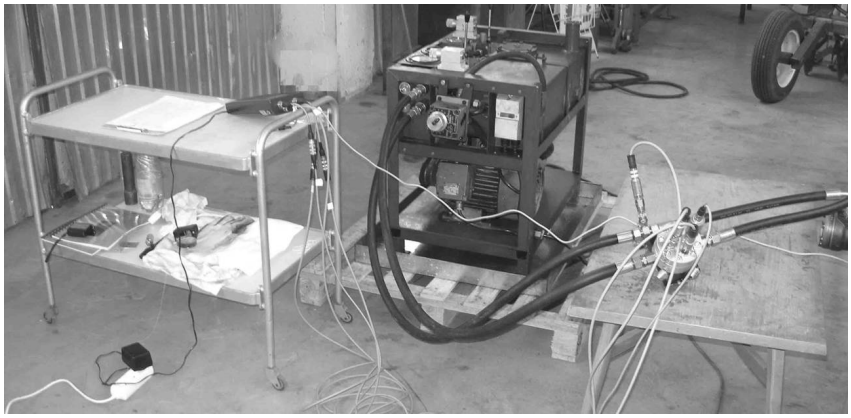

Fig. 1. **The configuration for drive the rod sifting conveyor and the measuring apparatus**

Fig. 2. **Data logger Multi System 5000 with notebook**

Results and discussion

The pressures (before the hydraulic motor, behind the hydraulic motor), the frequency of rod sifting conveyor, the temperature and the flow of oil were monitored by the sensors. These measured variables were transferred to notebook and were evaluated by the help of table processor MS Excel as graphs.

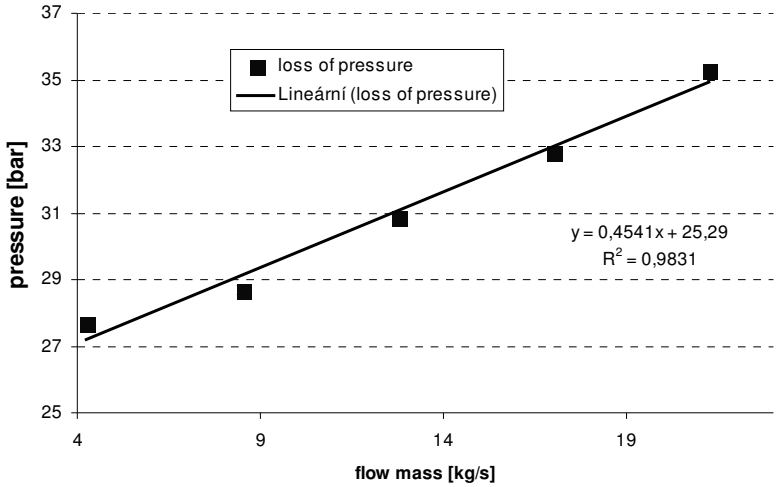

Fig. 3. **The loss of pressure on the actuator dependence on the flow mass sugar beets**

The implied assumption was correct in arrangement with the measured variables. The loss of pressure blow up by linear behaviour depending up the flow mass by the relation $y = 0.454x + 25.29$ (Fig. 3). This linear dependence the loss of pressure the flow mass on the rod sifting conveyor is very close – coefficient determination $R^2 = 0.9831$. Conclusion of our measurement is the possibility of exact measurement of the flow mass on the rod sifting conveyor according to loss of pressure on hydraulic motor.

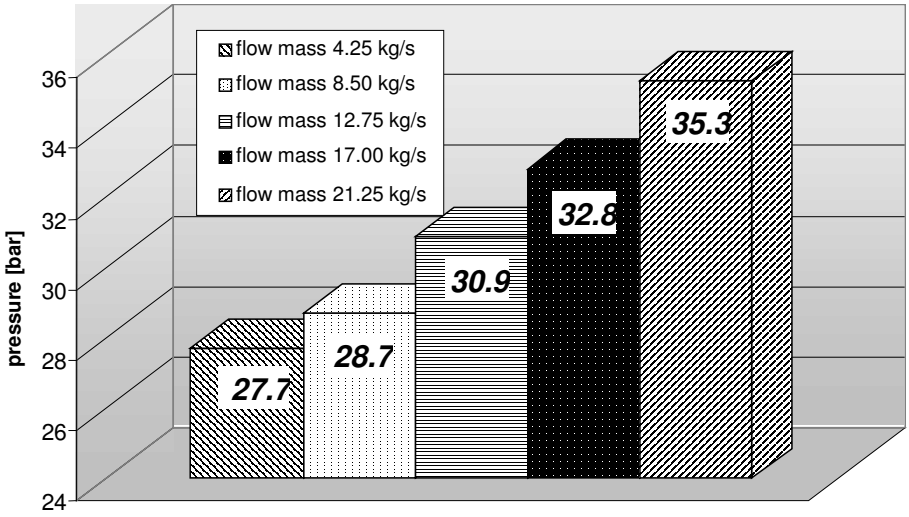

Fig. 4. **The loss of pressure on absolute values on the flow mass sugar beets**

Conclusion

Because the absolute values (Fig. 4) was the range from 27 to 36 bar for next measurement is necessary to try the sensors of pressure with lower range (to 10 MPa). We suppose that in conformity with that will decrease sensitivity of measurement of pressure and flow mass. After successful attestation in laboratory conditions we change suitable system for measurement pressure in hydraulic circuit for driving force rod sifting conveyor on practical sugar beet harvester in real field conditions.

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