System modelling in studying cultivation, harvesting and storage of grass forage

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Introduction

There are many different variables to be taken into account in cultivation, harvesting and storage of grass forage. In Finland the first harvesting period`s yield is the most critical for harvesting technology. According to Laine (1996) there are at least six days available for first cut harvesting of silage fodder if the harvesting season is 12 days in length (10 % / 20 % weather risk).

The objective of this study is to develop a working tool for farm advisors to compare methods in grass cultivation, harvesting and storage. With use of new working tool second purpose is to find means to cut 15 to 20 % of production cost of silage.

Material and methods

Modelling and simulation are the most important research methods used. The dynamic simulation model will be built up in the study that covers cultivation, harvesting and storage (Figure 1.).

The grass cultivars and mixtures, growing season conditions, field area, capacity and age of machines, machine chains, grass yields, dry matter content of grass, weather, available labour, storage type and other factors which have an effect on the production costs (Figure 2.) can be varied freely and an innumerable number of combinations of these factors can be made if wanted. Five dairy sizes (30, 60, 120, 200 and 500 cows) are selected with sensible machine chains in simulations. Target D-value is 68 to 70 and that decides harvest time.

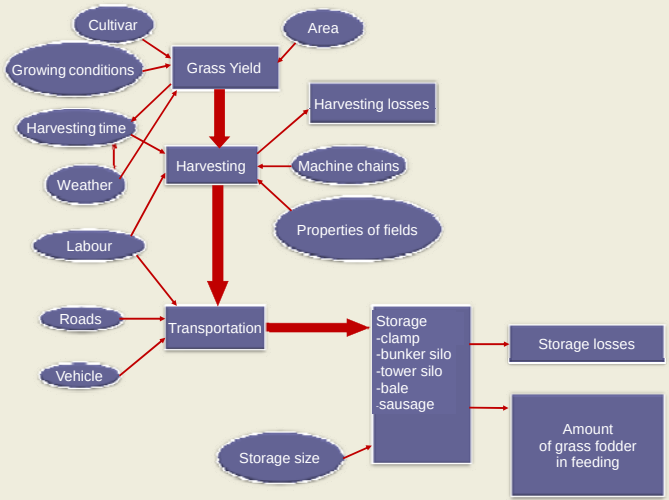

Figure 1. The principle of the model of cultivation, harvesting and storage of grass forage.

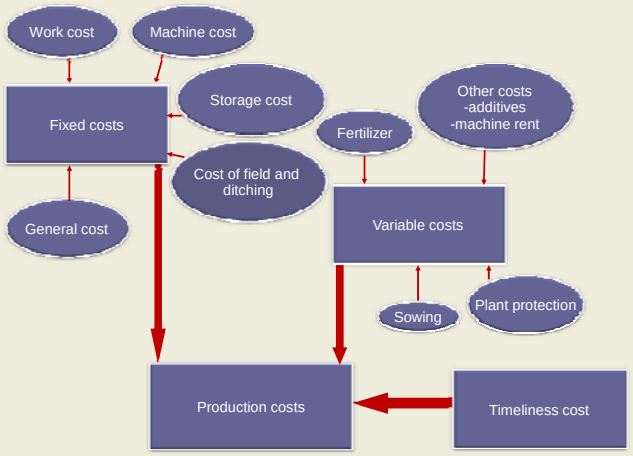

Figure 2. The principle of the model of production costs of grass forage.

Results and discussion

The model itself will be a valuable result of research work. It can be used in many ways to survey the meaning of new grass mixtures, different growing season of grass mixtures, longer harvesting season, bottle neck operations, harvesting chain, labour need, need of capacity and production costs. Sensitivity analysis can be used to find out the factors, which have the greatest impact on the production costs.

Conclusions

Research project has just started and this paper is an introduction of this study.

One example of working chain involved in model is loader wagon. Loader wagon method´s capacity is 2-2,5 ha in an hour, when transport distance between field and storage is one kilometre. One person drives tractor loader wagon combination and second person levels load and compact it in bunker silo using tractor with loader. Usually before harvesting phase two or three mowing working width are combined into one swath with windrower.