Hannah Dairy Research Foundation

Produced in association with Scottish Dairy Growth Board

Research Paper Summary

Improving grass silage production with controlled traffic farming (CTF): agronomics, system design and economics

Short title: **Controlled traffic farming for silage production**

Key words: **Grassland; controlled traffic; economics; silage.**

Ref No

Practical point

Unlike arable fields, grassland silage management generally does not include an attempt to reuse wheel ways. With normal traffic systems, the total number of machine passes can be 15 or more, resulting in potentially large areas of direct damage to the crop and soil. Research suggests that normal traffic can cause grass dry matter yield reductions of 5-74% through compaction and sward damage, with a mean 13% yield reduction in the UK.

Background

Grassland silage management is generally conducted with no deliberate attempt to re-use wheel ways – a common practice with arable fields. Field traffic can cause damage to the sward through compaction of the soil, an increase in bulk density, shear strength, a reduction in porosity, air and water permeability. Introducing set wheel ways through controlled traffic farming for a multi-cut grass silage system is cost-effective, increasing yields due to a reduction in compaction and sward damage.

Work undertaken

The study by Hargreaves at al. (2019) explored effects of a controlled traffic farming system (CTF) over normal traffic (NT) on grass silage yields. Figure 1 shows the variation in the wheeling widths of each system. The study utilised an 8 ha permanent silage perennial ryegrass field in

Scotland split into two 3.5 ha areas. Areas were managed as a three-cut silage system, harvested in May, July and August. Following mowing, grass was spread, dried for 24 hours then raked into rows and harvested the following day. Inorganic fertiliser (urea) was applied at a rate of 60kg N ha after the first cut and dairy cow slurry applied twice during (May and July after cutting). A GNSS system was used to allow the CTF system to follow the same wheel tracks and the same system tracked all vehicle movements across both NT and CTF fields. Total yield from each area was recorded at each harvest with a static weighbridge, and dry matter (DM) analysed.

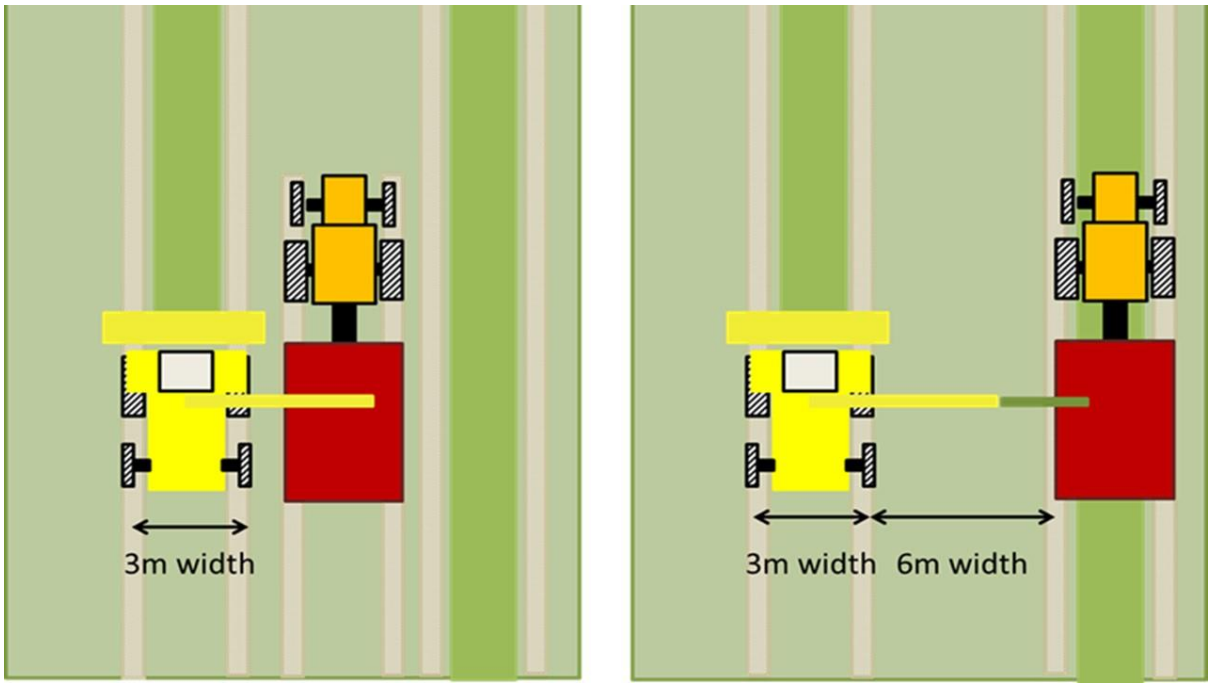

Figure 1: Normal traffic (NT) working widths on the left and controlled traffic farming (CTF) working widths on the right.

There was a non-significant difference in DM yield of 0.15 t ha^{-1} (p=0.27) between the two systems for the first silage cut. This was expected, as the CTF system was not established prior to the first cut and therefore, the same traffic pattern was applied to both field areas. Differences in yield between the NT and CTF areas increased for the 2nd and 3rd silage cuts. The DM yield of the 2nd and 3rd cuts combined showed a 13.5% (0.80 t ha^{-1}) increase for CTG in comparison to NT.

The study explored the potential saving in fuel costs which can be achieved via a CTF. Results showed that despite an increase in the total distance travelled for CTF (10%) and a reduction in work rate (-2.5%), fuel consumption per hectare was reduced by 2.16 l ha^{-1} (27%). The study noted that although there was an enhanced yield, improving cost margins,

the cost margins are heavily affected by scale – with the area to be harvested having a dramatic effect on cost per hectare of running a CTF system. Break-even points were shown to be reasonable for UK farm areas, from low level investment on smaller farms, i.e., 50 to 100 ha, to larger farms over 250 ha. However, for contractor harvested systems, the authors note that there would need to be a financial agreement between the farmer and contractor with some of the benefit of additional yield/revenue being offset against the extra cost and operational complexity experienced by contractors in a CTF system.

This work suggests it is possible, within one forage harvesting season, to gain a yield advantage of 13.5% by introducing a CTF system compared with operating under a normal traffic. However, the authors note this may be dependent on the individual growing season and could be reduced during less advantageous weather conditions. Overall, economic analysis showed that utilising CTF in grass silage production can be cost effective, provided navigation systems selected are based on the size of the operation. This paper and data provide useful information for farmers when considering the benefits and costs of grass CTF systems.

Reference

Hargreaves, P.R., Peets, S., Chamen, W.C.T., Misiewicz, P.A., Godwin, R.J. (2019). Improving grassland silage production with controlled traffic farming (CTF): agronomics, system design and economics. Precision Agriculture, 20: 260-277
