

FORMIC ACID RECOVERY ANALYSIS AS A FARM ADVISORY TOOL

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Introduction

In Northern Europe, formic acid is widely used, especially to preserve wet, low-sugar, high-protein forages. However, inadequate application of the additive can result in failures in fermentation quality.

Formic acid recovery analysis is a valuable tool to support advisory work on farms. It verifies the accuracy of additive application and encourages farmers to weigh grass loads to ensure the correct application rate of silage additives.

A meta-analysis was conducted to confirm the usefulness of formic acid recovery analysis as well as to reveal factors influencing recovery rates.

Formic acid-based silage additives, 5 liters/ton

- Restrict fermentation
- Prevent proteolysis and clostridial fermentation
- Minimize losses

Consequences of underdosing of the additive compared to optimal silage

- Reduced silage and TMR (Total Mixed Ration) intake
- Deficiency in fiber and energy availability
- Decreased milk yield, milk fat and milk protein content
- Increased risk of health issues

Meta-analysis data

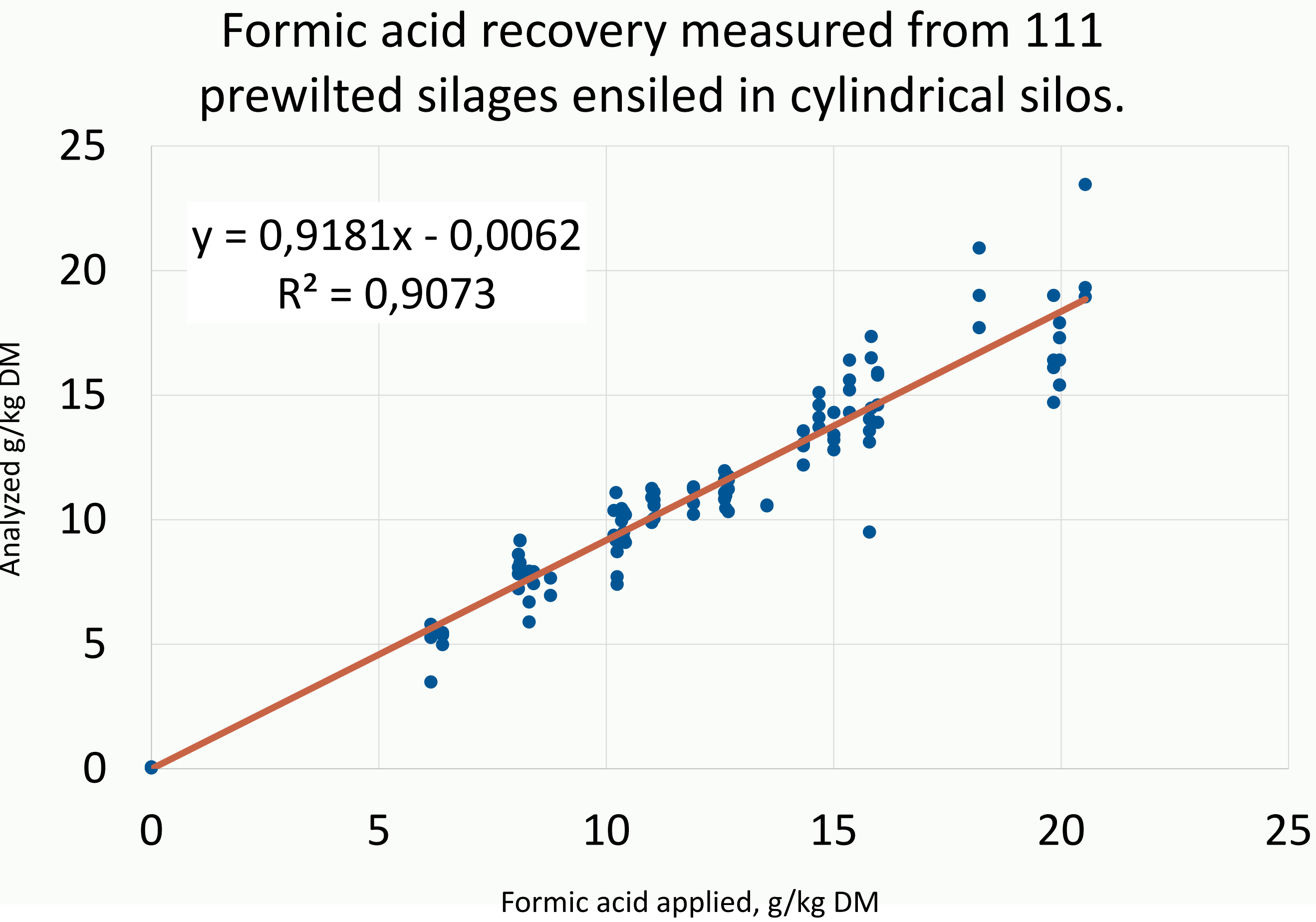
Table 1. The meta-analysis included 161 silages treated with formic acid-based additives and 11 untreated silages. Silo types included plastic vacuum bags (38 silages) and cylindrical silos (134 silages). Effluent production was recorded for 23 low dry matter silages. Formic acid was analyzed from water extracts using an enzymatic kit (R-Biopharm Art. No.: 10979732035) and a spectrophotometer.

Crop species	Number of silages	Dry matter, %
Grass silages (timothy-meadow fescue)	106	15-54
Corn silages	32	23-36
Pea-oat-wheat-whole crop silages	34	22

Results

Table 2. Causes of poor formic acid recovery included losses via effluent (in silages stored in cylindrical silos) and evaporation (in silages stored in plastic bags). A good recovery rate of 92% was measured in prewilted silages ensiled in cylindrical silos (Figure 1).

	Silo type	Crop and dry matter, %	Formic acid recovery
Poor recovery due to effluent losses	Cylindrical silo, gas tight silo wall	Grass, 15%	70%
		Whole-crop, 22%	46%
Poor recovery due to evaporation	Gas-permeable bag, effluent was not removed	Grass, 36%	83%
		Whole-crop, 22%	44%
Good recovery	Cylindrical silo, gas tight silo wall	Prewilted grass silages and corn silages, 22-54%	92%



Conclusions

Analyzing formic acid recovery is a valuable tool for identifying potential causes of poor silage quality. To ensure accurate results, proper sampling, packing, and storage practices are essential to prevent evaporation losses of formic acid from silage samples prior to analysis. Additionally, effluent losses must be considered when interpreting recovery results, particularly in wet silages.