Development of a preservative for moist hay to extend the hay baling window

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Introduction:

- It is becoming increasingly difficult to produce high-quality hay. High mass coverage and unstable weather conditions make it almost impossible to dry uniformly and to reach a dry matter content higher than 85 %.
- After harvesting, residual moisture returns to the stems and leaves. This benefits certain microorganisms, especially moulds, which reduce quality and feed hygiene.
- In order to counteract such spoilage processes, the use of preservatives is gaining increasing attention.
- The aim of the investigations was to develop a user-friendly product, based on neutral salts as a alternative to the classic acid based products.



Materials and Methods:

- **Hay:**
  German grazing Grass (Lolium perenne) was dried and pressed into 25 kg square bales. The target value for the residual moisture was 22 %. As the bales were stored in such a way that the formed heat could escape easily, a temperature of 45°C was never exceeded.
- **Treatments:**
  The moist hay was treated with a special formulation of three anti-fungal chemicals (T3) (250 g / t, dissolved in water), propionic acid (T2) (99.8 %, 4.5 l / t), compared with the untreated control (T1).
- **Analyses:**
  During storage, the temperature development was recorded using a data logger. Samples were taken at the beginning, after 30 days and after 100 days (Table 2). The dry matter content, feed value and hygiene status were determined.

Table 1

Nutritional and microbial parameters of grass prior to baling

Parameter	Unit	Value
Dry matter	% FM[1]	78.0
Crude ash	% DM[2]	9.7
Crude protein	% DM	8.3
Crude fibre	% DM	28.2
Neutral detergent fibre	% DM	58.1
Acid detergent fibre	% DM	29.8
Lactic acid bacteria	log CFU[3]/g FM	4.67
Yeasts	log CFU/g FM	5.86
Moulds	log CFU/g FM	6.18
Enterobacteria	log CFU/g FM	4.96

1 - Fresh material, 2 - Dry matter, 3 - Colony forming unit

Results and Discussion:

- **Temperature development during storage (Figure 1):**
  There was a distinct warming in the untreated control, which was a clear indication of microbial spoilage processes.
  No increase in temperature was observed in all the replicates of moist hay treated with preservatives.
- **Hygiene status (Table 2):**
  Microbial spoilage quickly began in the untreated control. The mould count remained unchanged and high. In contrast, the number of moulds found in both preserved varieties decreased, with the largest decrease in the neutral salts mixture variant.
- **DM-Content and further parameters (Table 2):**
  There was a further increase in dry matter content during storage. Compared to untreated control, all preservative treated bales had a better feed value and higher energy densities. The new formulation was 2.1 % higher in digestibility and 0.12 MJ NEL / kg DM better in net energy.

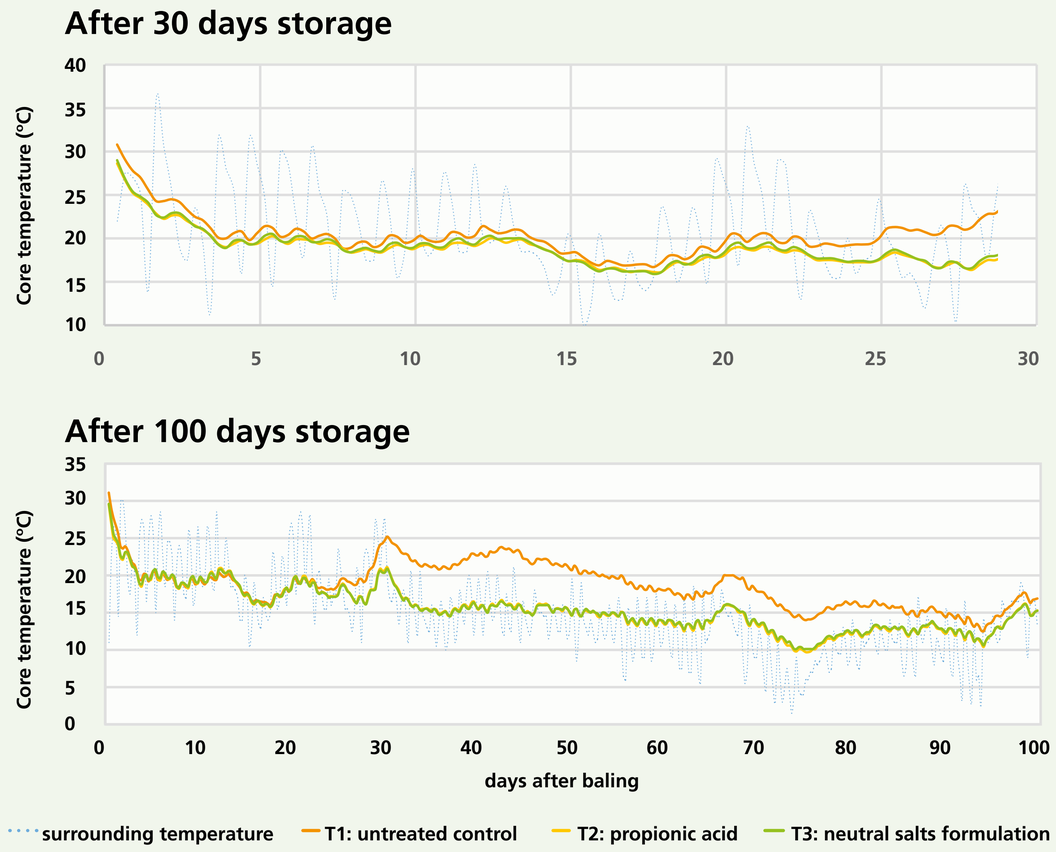
Table 2

Cumulative temperature, hygiene status and nutritional value after 30 days and 100 days of storage (5 replicates) (P<0.05)

	Cumulative temperature °C	Moulds log CFU / g FM	DM %	dOS[1] %	NEL MJ/ kg DM
30 days storage					
T1	2422 + 62	5.90	83.1	60.3	4.57
T2	2223 + 54	5.13	85.4	61.1	4.61
T3	2242 + 66	5.62	85.0	63.7	4.75
100 days storage					
T1	7458 + 198	5.60	84.0	60.1	4.54
T2	6134 + 40	4.85	84.2	60.8	4.59
T3	6168 + 22	4.65	84.1	62.2	4.66

T1 – untreated control / T2 – propionic acid / T3 – neutral salts formulation / 1 – Digestibility of organic matter

Figure 1 Bale temperature profile (5 replicates)



Conclusions:

With the help of preservatives, moist hay can be stored safely without losses. Heating and spoilage are prevented and quality is ensured. With the new product formulation based on neutral salts, a user-friendly alternative to the acid-based preservatives for moist hay is now available.