SUMMER CATCH CROPS FOR FORAGE CONSERVATION

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ABSTRACT

A range of dicot and monocot summer catch crops were grown on a small scale with the aim to test their ensilability. They were harvested in autumn and ensiled directly without wilting, in part with straw. After three months of anaerobic storage their fermentation quality and aerobic stability were determined. The average fermentation coefficient was reasonably high, while the aerobic stability without straw was rather low. The dry matter content < 200 g/kg of most dicots requires an absorbent to prevent silage effluent in practice.

Keywords: Brassicaceae, Asteraceae, Gramineae, ensilability, fermentation coefficient

INTRODUCTION

Catch crops are grown in the period between two main crops to build up biomass and humus, to diversify crop rotation, cover the soil, protect from soil erosion, improve soil life and fertility, increase yield of main crops, inter alia. Moreover, some have the potential to be used as feed, especially in times of feed scarcity. The aim of the study was to evaluate this potential with a broad range of commercially available summer catch crops including their ensilability.

MATERIAL AND METHODS

A total of 12 different catch crops belonging to the families of Gramineae, Brassicaceae and Asteraceae were sown at the end of July 2024, after the harvest of barley, a minimum of 1 ha each, in the area of Northern Saxony. It is a region of arid months in spring and summer with a total rainfall of 460 mm in 2024. Plant height, stocking density and phenological stage were determined every two weeks starting from the beginning or mid of September respectively to monitor plant growth and development. Forages were sampled regularly to determine fermentability (Schmidt *et al*., 1971). From these species, 6 were finally ensiled on laboratory scale as Rostock Model Silages (ROMOS): *Sinapis alba* (mustard), *Eragrostis tef* (teff), *Avena strigosa* (lopsided oat), *Helianthus annuus* (sunflower), *Brassica oleracea* (wild cabbage), *Guizotia abyssinica* (ramtil). All forages were ensiled being chopped without wilting. The following treatments applied: untreated control (CON) and a mix of *E. faecium*, *P. pentosaceus* and *L. plantarum* (LAB). Furthermore, dicotyledons were either mixed with straw of winter barley or not to achieve a target dry matter (DM) of >30 % applying the aforementioned treatments. Laboratory scale silages were opened after three months of storage at ambient temperature. Feed value, fermentation quality (DLG, 2006) and aerobic stability for 7 d (Honig, 1990; Martens *et al*., 2022) were assessed.

RESULTS AND DISCUSSION

The DM concentrations of the grasses were >200 g/kg while the dicotyledons remained mostly between 110-200 g/kg throughout the autumn (Table 1) making necessary an adsorbing ensiling partner such as straw. Straw though limited fiber digestibility, which was highest in wild cabbage and teff (700 g/kg DM). The fermentability coefficient (FC) predicted that all forages were moderately difficult to easy to ensile at all times (FC>35) except for ramtil, which presented a high BC with a low DM resulting in a borderline mean FC (Table 1). All silages were very well fermented as butyric acid was not detectable, and acetic acid remained in an acceptable range (Table 2, DLG 2006). Ammonia formation was limited with the highest values of lopsided oat and sunflower/straw with 90 g/kg total N (Tab. 2). However, fermentation losses were high for the grasses, sunflower and wild cabbage (CON) between 150-180 g/kg (Tab.2). Sunflower silages were aerobically least stable, increasing in temperature only after 2 d, probably because of their high sugar contents (Table1) followed by cabbage during the fourth day (data not shown). In the aerobic phase, yeast growth was highest in the grasses and sunflower silages coupled with high condensation from oxidation (Fig.1).

Tab. 1: Theoretical mean ensilability of catch crops across time, cut between September – November 2024

Forage	Scientific name	n	DM	WSC	BC	WSC/BC	FC	NO_3
Abyssinian mustard	*Brassica carinata*	12	168^{fg}	252^{bc}	67.6^{b}	3.76^{de}	46.9^{de}	0.02
Wild cabbage	*Brassica oleracea*	17	148^{g}	278^{ab}	63.5^{bc}	4.40^{bcd}	50.0^{de}	0.10
Turnip rape	*Brassica rapa*	15	190^{ef}	228^{c}	41.4^{e}	5.54^{ab}	63.3^{ab}	0.02
Summer forage rape	*Brassica napus*	11	177^{f}	240^{bc}	54.5^{d}	4.45^{bcd}	53.3^{bcde}	0.03
Yellow mustard	*Sinapis alba*	3	241^{bc}	162^{d}	68.6^{ab}	2.38^{f}	43.1^{ef}	0.32
Sunflower	*Helianthus annuus*	23	171^{f}	318^{a}	56.2^{cd}	5.71^{a}	62.8^{abc}	0.85
Ramtil	*Guizotia abyssinica*	15	125^{h}	217^{c}	76.6^{a}	2.88^{ef}	35.5^{f}	0.57
Spring oat	*Avena sativa*	17	250^{b}	162^{d}	36.7^{ef}	4.43^{bcd}	60.5^{abc}	0.63
Lopsided oat	*Avena strigosa*	16	226^{cd}	162^{d}	32.4^{f}	5.14^{abc}	63.6^{a}	0.39
Teff	*Eragrostis tef*	18	275^{a}	120^{d}	34.1^{ef}	3.52^{def}	55.7^{abcd}	0.42
Sudan grass	*Sorghum sudanense*	19	209^{de}	163^{d}	41.3^{e}	3.96^{cde}	52.6^{cde}	0.34
Ryegrass/clover	*Lolium multiflorum, Trifolium incarnatum, T. pratense*	9	170^{fg}	223^{c}	58.4^{cd}	3.85^{de}	47.8^{de}	0.16
s.e.			1.351	3.012	0.512	0.076	0.628	0.06

DM (g/kg); WSC water soluble carbohydrates (g/kg DM); BC buffering capacity; FC fermentability coefficient; NO_3 (g/kg DM); different superscript letters within a column mean significant differences between forages ($p < 0.05$)

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Tab. 2: Fermentation parameters (g/kg DM) of catch crops ensiled without or with barley straw after 90 d storage

Forage species	Treatment	Ensiled on	DM (g/kg)	pH	Lactic acid	Acetic acid	Ethanol	NH3-N (g/kg N)	Fermentation losses
Wild cabbage	CON	28. 10. 2024	143	3.89	145	27.3	11.7	68.9	160
Wild cabbage	LAB	28. 10. 2024	146	3.83	155	23.6	9.23	57.7	75.7
W.cabbage/straw	CON	28. 10. 2024	361	4.21	63.6	15.6	4.65	83.7	76.5
W.cabbage/straw	LAB	28. 10. 2024	362	4.07	81.7	12.1	3.05	77.1	37.2
Yellow mustard	CON	04. 09. 2024	233	4.31	104	25.3	5.50	70.7	56.3
Yellow mustard	LAB	04. 09. 2024	230	4.14	116	14.8	1.32	52.1	49.1
Y. mustard/straw	CON	04. 09. 2024	377	4.33	69.7	19.9	3.84	61.2	-16.7
Y. mustard/straw	LAB	04. 09. 2024	383	4.25	77.3	15.0	1.04	64.8	89.0
Sunflower	CON	28. 10. 2024	160	4.04	93.7	16.5	27.9	60.1	176
Sunflower	LAB	28. 10. 2024	159	3.81	127	15.7	20.7	61.4	180
Sunflower/straw	CON	28. 10. 2024	351	4.21	65.0	13.6	7.47	89.5	87.0
Sunflower/straw	LAB	28. 10. 2024	364	4.04	69.0	10.0	4.67	54.9	33.6
Ramtil	CON	01. 11. 2024	136	4.29	108	32.9	2.66	63.7	77.2
Ramtil	LAB	01. 11. 2024	136	4.07	148	24.3	3.22	50.5	103
Ramtil/straw	CON	01. 11. 2024	299	4.32	67.6	13.3	2.80	64.4	45.4
Ramtil/straw	LAB	01. 11. 2024	300	4.24	79.1	15.6	2.31	61.4	98.3
Lopsided oat	CON	19. 09. 2024	187	3.91	119	21.9	2.48	89.1	146
Lopsided oat	LAB	19. 09. 2024	183	3.85	125	12.2	0.90	56.1	161
Teff	CON	19. 09. 2024	257	4.03	73.6	15.9	2.92	53.6	181
Teff	LAB	19. 09. 2024	256	3.92	86.5	11.0	2.50	47.7	182
s.e.			0.69	0.00	0.71	0.17	0.29	0.81	2.31
P									
Forage			<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Inoculant			0.204	<0.001	<0.001	<0.001	<0.001	<0.001	0.661
Forage*Inoculant			0.258	<0.001	<0.001	<0.001	0.178	<0.001	<0.001

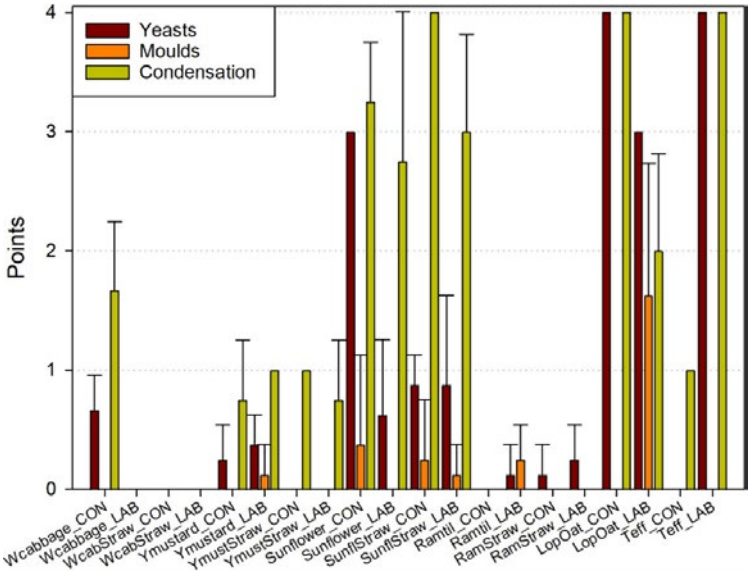

Fig. 1: Yeasts, moulds and condensation scored by visual assessment after 7 d of aerobic stability test (0-4 points); CON Control, LAB Inoculated

CONCLUSION

Ensiling a mixture of catch crops with straw in small units such as bales is recommended to minimize losses from effluent and aerobic deterioration, at the expense of digestibility. A technological on farm solution is required.

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