ENSILLING OF FEEDING CROPS WITH THE BIOPREPARATIONS APPLICATION

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Abstract: The article describes the effects of biopreparation on feeding crops silages. The aim of this study was to investigate the impacts of local *Bacillus subtilis* strains on silage quality and preservation. *Bacillus subtilis* strains, namely TNP-3 and TNP-5, have been isolated from permafrost soils in Yakutia (probiotics Sakhabactisubtil and Nord-bact). They were shown to play the role of antagonists against harmful microorganisms and, in addition, provide improved preservation quality and nutritive values to robust feeds. In specific, the Sakhabactisubtil strain was shown to have a better ability to contributing to the feeding crops preservation. The content of digestible protein per 1kg of silage dry mass after 7 months of preservation was higher than in those in control by - 5,4% in oats, 26,9% in a vetch-oat mix and 14,2% in alfalfa. Application of Sakhabactisubtil and Nord-Bact during the ensiling process was shown to cooperate for the increase of beneficial microorganisms- spore-forming bacteria and lactobacterium by 98%, and decrease the amount of conditionally pathogenic and pathogenic microorganisms.

***Key words**: feeding crops, silage, bacteria, strains, Sakhabactisubtil, Nord-Bact, nutritive value, quality, preservation.*

Introduction

Among the number of unresolved issues in animal science, the principal role is entitled to the development of the long-lasting fodder bases, which provide animals with fully-fledged forage. Most of the households in Yakutia use silage as the substantial robust food for cattle during the winter housing period. Silage share usually needs to take up to 19% from the whole ration accordingly by its nutritive values (System of agricultural productions in Republic Sakha (Yakutia),2009) [1].

Silage preparation, the major cattle food during winter housing period, is available for the considerable number of independent households. However, the obtainment of the high-quality product is not always efficacious. The most known productive method of silage production is the mycotoxin neutralization, which is usually present in fodder. Generally, these microorganisms need to be neutralized before delivering the silage to cattle. By these means, one of the potential methods for the production of high-quality silage is overwhelmingly likely may be the application of the preventive measures against mycotoxins in the food substrate, during the ensiling procedure.

Previous studies of researchers from other regions revealed that the *Bacillus subtilis* have positive impact on the preservation state and quality of silage from silage-forming and even non-silage forming plants. The possible explanation for such phenomena might be that, primarily, during the ensiling, microorganisms, even though known by belonging to aerobic organisms, always show signs of anaerobic traits when cultivated in a growth medium. In addition, unlike typical putrefactive bacteria, these bacteria never degrade proteins up to its end forms, but only peptonize them. Lastly, *B.subtilis* produce exoenzymes amylase, maltose, aminoglycosides which with the production of organic acids and followingly catalyzing and increase the mass acidification [2]. Hence, with the above-mentioned knowledge regarding the fermentation process by these microorganisms, it is secure to assume that it is possible to implement this bacteria species for the silage production.

Researchers studying the antagonistic properties of TNP-3 and TNP-5 *B.subtillis* strain against Mucor, Penicillium and Aspergillus fungi. End results demonstrated the potential of its application for fodder sanitation. Notable attention was directed to the *Sakhabactisubtil*, the

probiotic produced by researchers from microbial preparators development group of [3,4]. Test strains application as preventive measures against food contamination by toxigenic fungi typically occurring during the hay preparation, haylage and silage laying are clearly relevant in the context of the production of food with high protein and carotene contents.

Methods

Experimental works on the effect of *Bacillus subtilis* TNP-3 and TNP-5 strains on silage quality were carried with the idea of application of different varieties of biopreparation to the alfalfa, oat, and vetch-oat silages. Variants were- Control (no added component), probiotic *Nordbact-fito*, probiotic *Sakhabactisubtil*.

Experiments were carried in air-tight containers with the total capacity of 0.05m^3. Container width- 0,25m; length- 0,5m; height- 0,75m.

Silage mass seizures for quality and nutritive values records were carried 3, 5 and 7 months post ensiling. The experiment was replicated 3 times.

Probiotics were introduced by perfusion methods with a concentration of 105 m.k. per 1g of plant mass accordingly to recommendations from "Mytotoxicity prophylaxis in agricultural animals under Yakutia's conditions" [5].

Mycological expertise of plants probes and different crops were carried via the method previously described in [6]. Experiments on the evaluation of antagonistic effects of *B.subtillis* strains took place in the laboratory of microbial preparators development.

Silage laying experiments were carried accordingly to the previously described methods. [7].

Active components of TNP-3 and TNP-5 B.subtilis strains differ by its suspension properties.

Results

Visual quality control analysis revealed no abnormalities in silage; good quality in all variants was observed. Alfalfa silage was dark green colored with olive shade, oats silage was light brown shade and green colored. The smell was standard to silage with fruit tones. Leaves, stem and flowers structure were properly preserved.

Silage total water content 3 months post laying was 58,5-61,2%, and after second checking, 5 months post laying, the water content was varying from 57,6% to 71,3%. After 7 months of storage, the water content of silage was 54-69%. Fermentation temperature was kept at 17,5-19,7*C.

Silage active acidity remained in pH 5,0 levels. Free butyric acid was present in all studied variants. Carotene content after 3 months of preservation was 2,39-2,95mlg/kg in control; variants with biopreparations 4,57-14.04mlg/kg. Nitrate content in variants with preparators

application was within the normal range of 160-482mlg/kg. Silage preservation of oats, vetch-oat mix and hardly silaging alfalfa was qualified via Bacillus subtillis bactericide properties.

Based on data obtained by the laboratory of microbiology in it found that when Sakhabactisubtil and Nord- were applied to alfalfa and oat crops. The amount of spore-forming bacteria Bacillus was significantly increased (5,6ˣ10-5 – 0,7 ˣ10-3 CFU/g) and lactobacterium. Conventionally pathogenic and pathogenic microorganisms were absent. In the case of the mix, of spore-forming (6,9 ˣ10-3 - 0,4 ˣ10-2) and was observed in the III term, no enteropathogens detected.

By these means, application of either *Sakhabactisubti*l or *Nord-Bact* during the ensiling was found to contribute to the 98% increase in beneficial microorganisms, namely spore-forming bacteria; decrease in the quantity of conditionally pathogenic and pathogenic microorganisms was also observed.

By its nutritive properties, silage does not significantly differs from the quality of 1kg of dry silage mass with applications had preserved high values of gross energy 18,43-19,73MJ, exchange energy 8,82-9,58MJ. Amount of feeding units was 0,60-0,70; digestible protein-100,10-151,42g. Food quality by preservation periods did not significantly alter, and good nutritive quality was noted. Feeding units endowment by digestible protein in silage from alfalfa increase up to 197,13-216,31g with 5-7 months of storage (Tab.1).

Table 1

Silage sustenance by preservation terms

Culture	Biopreparat	Per 1kg of dry mass				Digestinble protein (g) per feeding unit
		Feed. units	Digestible proteins, g	Sum energy, MJ	Gross energy, MJ	
1	2	3	4	5	6	7
I term (post 3 month of preservation)						
Oat	Control	0,66	93,02	9,03	19,01	140,94
Oat	Sakhabactisubtil	0,70	123,11	9,29	19,26	175,87
Oat	Nord-bact	0,68	119,57	9,20	19,13	175,84
Vetch-Oat	Control	0,57	66,46	8,41	18,81	116,60
Vetch-Oat	Sakhabactisubtil	0,56	87,71	8,32	18,81	156,62
Vetch-Oat	Nord-bact	-	-	-	-	-
Alfalfa	Control	0,64	109,83	8,89	18,91	171,61
Alfalfa	Sakhabactisubtil	0,71	128,42	9,39	18,98	180,87
Alfalfa	Nord-bact	0,67	110,72	9,10	18,87	165,25

II term (post 5 months of preservation)						
Oat	Control	0,60	110,72	8,59	18,74	184,53
Oat	Sakhabactisubtil	0,66	107,18	9,00	18,81	162,39
Oat	Nord-bact	0,62	134,61	8,77	18,88	217,11
Vetch-Oat	Control	0,57	62,92	8,40	18,65	110,38
Vetch-Oat	Sakhabactisubtil	0,56	81,51	8,34	18,55	145,55
Vetch-Oat	Nord-bact	0,56	74,43	8,28	18,50	132,91
Alfalfa	Control	0,64	112,48	8,88	18,77	175,75
Alfalfa	Sakhabactisubtil	0,62	122,22	8,73	18,91	197,13
Alfalfa	Nord-bact	0,69	121,34	9,20	18,43	175,86
III term(post 7 months of preservation)						
Oat	Control	0,69	124,88	9,20	19,38	180,98
Oat	Sakhabactisubtil	0,68	131,96	9,16	19,41	194,06
Oat	Nord-bact	0,74	141,69	9,58	19,73	191,47
Vetch-Oat	Control	0,53	81,51	8,10	18,86	153,79
Vetch-Oat	Sakhabactisubtil	0,63	111,6	8,82	19,32	177,14
Vetch-Oat	Nord-bact	0,60	100,10	8,62	19,16	166,83
Alfalfa	Control	0,60	123,11	8,61	18,94	205,18
Alfalfa	Sakhabactisubtil	0,70	143,46	9,32	19,45	204,94
Alfalfa	Nord-bact	0,70	151,42	9,31	19,24	216,31

HCP_{05}	by Oat	0,07	29,43	0,52	0,31	42,25
	Vetch-oat mixture	0,44	68,74	6,36	14,21	112,95
	Alfalfa	0,12	24,08	0,82	0,26	19,20

Conclusion

To summarize, local strains of *Bacillus subtilis* TNP-3 and TNP-5 extracted from permafrost soils of Yakutia (probiotic Sakhabactisubtil and probiotic Nord-bact) act as antagonists against harmful microbes, contribute to the preservations, quality and nutritive properties of silage and haylage. Our results demonstrated that Sakhabactisubtil had the highest potential for quality preservation. Digestible protein in 1kg of dry mass after 7 months of preservation was higher in comparison with control silage- in oats – by 5,4%, vetch-oat mix- by 26,9% and in alfalfa- by 14,2%. Application of biopreparations with B.subtilis strains to silage primary products was found to assist to the 98% increase of beneficial microorganisms- spore-forming bacteria and decrease the amount of conditionally pathogenic and pathogenic microorganisms.

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