DATABASE FOR SILAGE ADDITIVES SELECTION

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ABSTRACT

Selection of optimal silage additives is critical for conservation quality. With 144 products on the Czech market, VÚŽV has maintained additive records since 1989 and developed an AI-assisted decision support system. The 2026 database includes 81 biological (56.3%), 55 chemical (38.2%), and 8 combined additives (5.5%), a net reduction of 8 products vs. 2025. Biological additives divide into homofermentative (34 products, 42.0%), heterofermentative (7, 8.6%), and combined (40, 49.4%). Multi-strain formulations dominate (49.4% contain ≥ 3 cultures; max. 6 strains) and 20% include enzymes (xylanase up to 716,810 nkat/g). Chemical additives are led by propionic acid (58%) and formic acid (47%); only 27% declare precise composition and 5% reach active ingredient concentrations >90%. The web application *Selection of Silage Additives* (www.vuzv.cz) provides AI-based personalised recommendations, application guidance, and ROI quantification via an Economic Efficiency Calculator. The database is updated within project *AISilageFeeding* (NAZV QL26010434).

Keywords: lactic acid bacteria, decision support system, artificial intelligence, economic efficiency

INTRODUCTION

The Czech silage additive market has grown from 7 products in 1989 to a current portfolio of 144. With products across three major categories and 24 distribution companies, evidence-based selection is increasingly supported by digital tools. This contribution reports the 2026 database analysis and the AI-assisted web platform developed to guide practical additive selection.

MATERIAL AND METHODS

Data were collected annually in January from 24 manufacturers and distributors via standardised questionnaires covering bacterial strain identity (updated per EU Regulation 2024/1196), CFU/g, enzyme activities, chemical composition, packaging, application rates, and target forage types. Statistical analyses used Python 3.x (pandas). The web application is hosted at www.vuzv.cz; the Economic Efficiency Calculator estimates ROI from DM loss savings, improved feed intake, and milk yield response.

RESULTS AND DISCUSSION

Market overview (Table 1):

Tab. 1: 2026 silage additive market structure in the Czech Republic (n = 144)

Category	N products	Market share (%)	vs. 2025	Key trend
Biological	81	56.3	−1	Multi-strain, enzymes
Chemical	55	38.2	+1	Propionic acid dominant
Combined	8	5.5	0	Stable niche
TOTAL	144	100	−8	Portfolio consolidation

The 2026 database registered 144 products—a net decrease of 8 vs. 2025, driven primarily by VOLAC Agro Best discontinuing four bacterial products (Agros Clamp, Agros XL40, Agros Hi-Dri, Agros Maize), Joachim Behrens Scheessel removing Harvest International Plus, and EW Nutrition discontinuing three Biotronic chemical products. Biological additives remain the largest category (56.3%), followed by chemical (38.2%) and combined (5.5%).

Biological additives:

The most notable shift vs. 2025 is the growth of combined biological products (40 products, 49.4% of biological)—pairing homofermentative LAB with *Lentilactobacillus buchneri* or *Levilactobacillus brevis* in a 2:1–3:1 ratio—at the expense of pure heterofermentative products (7 products, 8.6%). Strain complexity continues to increase: 49.4% of biological products contain ≥3 cultures (max. 6 strains). Enzymatic enrichment (20% of products) features xylanase up to 716,810 nkat/g and β-glucanase up to 333,400 nkat/g. A key taxonomic update: the strain previously classified as *Lactobacillus kefiri* DSM 19455 (EW Nutrition) was reclassified as *Lentilactobacillus buchneri* DSM 19455 per EU Regulation 2024/1196.

Chemical additives:

Propionic acid (58% of chemical products) now surpasses formic acid (47%) in prevalence, reflecting growing emphasis on aerobic stability for maize and high-DM silages. Formic acid retains broad utility for rapid pH reduction. Composition transparency remains limited: only 27% of chemical products declare quantitative composition, and only 3 products (5%) achieve active ingredient concentrations >90%—an important consideration for economic efficiency comparisons.

AI-assisted selection platform:

The web application *Selection of Silage Additives* at www.vuzv.cz uses AI filtering to match user-specified conditions (forage type, DM%, harvest method, storage duration) to the full 144-product database, generating ranked recommendations with application guidance, packaging availability, and distributor contacts. The Economic Efficiency Calculator estimates ROI across DM loss reduction (1–3%), improved voluntary intake (0.2–0.5 kg DM/cow/day), and production response (0.3–0.8 kg milk/cow/day). Both tools are embedded in project *AISilageFeeding* (NAZV QL26010434), which will further develop predictive AI models for fermentation outcome prediction and personalised additive recommendations.

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Tab. 2: Biological and chemical additive key data, 2026 (n = 81 biological; n = 55 chemical)

Parameter / Category	N	Share (%)	Notes
BIOLOGICAL ADDITIVES (n = 81)			
Homofermentative	34	42.0	*Lacticaseibacillus*, *Lactiplantibacillus*, Pediococcus, Enterococcus—rapid pH drop
Heterofermentative	7	8.6	*Lentilactobacillus*, *Levilactobacillus*—acetic acid, propandiol, aerobic, stability
Combined (homo + hetero)	40	49.4	2:1–3:1 homo:hetero ratio; fermentation quality + aerobic stability
With enzymes	16	20.0	Xylanase up to 716,810 nkat/g; β-glucanase up to 333,400 nkat/g
≥ 3 bacterial strains	40	49.4	1 strain: 18.5%; 2 strains: 32.1%; ≥ 3 strains: 49.4%; max. 6 strains
CHEMICAL ADDITIVES (n = 55)			
Propionic acid	32	58	Most prevalent; antifungal; aerobic stability; surpasses formic acid in 2026
Formic acid	26	47	Rapid pH drop; broad antimicrobial activity across forage types
Declared composition	15	27	Only 3 products (5%) reach active ingredient concentration > 90%

CONCLUSION

The 2026 Czech silage additive database documents a consolidating market of 144 products. Key findings: (1) combined biological products now dominate biological additives (49.4%); (2) heterofermentative single-type products declined to 8.6%; (3) multi-strain formulations prevail (49.4% with ≥3 cultures; max. 6); (4) propionic acid (58%) surpasses formic acid (47%) among chemical additives; (5) composition transparency remains limited (27% declare quantitative composition; only 5% reach >90% active ingredient). The AI-assisted selection platform at www.vuzv.cz provides evidence-based decision support, complemented by an Economic Efficiency Calculator. Integration into project *AISilageFeeding* (QL26010434) will enable closed-loop optimisation of silage management from field to feed-out.

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