



## Terms of Reference (ToR)

For hiring Consultant for the “Safe Meat & Dairy Product Market Development Sub-project”

Implemented by: **Young Power in Social Action (YPSA)**

Supported by: **Palli Karma-Sahayak Foundation (PKSF)**

Ref. YPSAHO/872/RFP/BID- 011/23

### Summary

<b>Type of study</b>	<b>Comparative efficacy of single, multi-strain and combined inoculant on physical attribute, yield and quality of Napier (<i>Pennisetum purpureum</i>) silage</b>
<b>Purpose</b>	<ol style="list-style-type: none"><li>1. Compare physical attributes (color, flavor, texture and consistency) of Napier silage prepared with different types of inoculants</li><li>2. Compare yield (biomass, dry matter and organic matter) and chemical parameter (moisture, CP, CF, NFE, Ash, ADF, NDF, acetic acid, lactic acid, p<sup>H</sup> and ME)</li><li>3. Compare feed intake and milk yield by direct feeding trial</li></ol>
<b>Audience</b>	YPSA, PKSF, IFAD, Embassy of Denmark and Chattogram Veterinary and Animal Sciences University (CVASU)
<b>Reports to</b>	YPSA
<b>Expected start/end dates, number of work days</b>	June 01/September 30, 2023 (120 Days)
<b>Location</b>	Chattogram District (Chattogram City, Sitakunda, Mirersorai)
<b>Deadline for receiving applications</b>	<b>May 30, 2023</b>

### 1. Background

**YPSA** is implementing the sub-project titled "Safe Meat and Dairy Product Market Development" at Chattogram Sadar, Sitakunda and Mirsarai under Chattogram District of Bangladesh". This sub-project is jointly funded by the Palli Karma-Sahayok Foundation (PKSF), IFAD and DANIDA under Rural Microenterprise Transformation Project (RMTP) of PKSF. The sub-project will enable rural producers to expand sustainable micro-enterprises through efficient production methods and strong market connectivity, implemented for the overall business development of small entrepreneurs. The project is providing support to produce and distribute safe dairy and meat products following the Global GAP and HACCP protocols. Traceability and certification of those products will be introduced for the branding of dairy/meat products and help equip the participants with a valuable business tool for

compliance of product quality. The objective of the sub-project is to increase the income, food security and nutrition situation of marginal, small farmers and small entrepreneurs in the project area through value chain activities. Now, **YPSA** has taken the initiative to hire a consultant for the study of 'Comparative efficacy of single, multi-strain and combined inoculant on physical attribute, yield and quality of Napier (*Pennisetum purpureum*) silage' in the project area.

## 2. Sub-project Goal and Outcome

- a) Compare physical attributes (color, flavour, texture and consistency) of Napier silage prepared with different types of inoculants;
- b) Compare yield (biomass, dry matter and organic matter) and chemical parameter (moisture, CP, CF, NFE, Ash, ADF, NDF, acetic acid, lactic acid, pH and ME);
- c) Compare feed intake and milk yield by direct feeding trial

## 3. Study Overview

### a) Review of literature

On-farm feed preservation plays an important role in maintaining the nutritive value of feed while avoiding losses caused by micro-organisms and contamination with undesirable toxins, for instance, mycotoxins. Ensiling is a classic example of an anaerobic preservation technique. The practice of ensiling was originally a management tool used mainly in ruminant production to fulfill feed demand by storing and preserving any excess feed resources from periods of overproduction for later use during periods of lack. However, its importance has been increasing, especially in high input "zero-grazing" systems that enhance productivity per animal per area unit. Today, silage is the world's largest fermentation process, with an estimated 287 million tons produced in the EU alone.

Ensiling is a process in which lactic acid bacteria (LAB) convert sugars into mainly lactic acid and other by-products, such as acetic or butyric acid, under anaerobic conditions. This decreases the pH value, keeps the feed value, inhibits the growth of undesirable micro-organisms, and preserves forages for long periods of time under normal conditions of up to one to two years and even more. Though ensiling is used mainly to preserve voluminous feed, many other substrates including grains, by-products like fish residues, wet distillery grains with soluble or WDGS and brewer's grains can also be ensiled.

### b) Significance of the project

Constant supply of high-quality nutrients during periods of underproduction is a universal problem. Silage furnishes high-quality succulent green fodder to the livestock round the year throughout the globe. The key ingredient of ensiling, i.e., the inoculants work by shifting silage fermentation in a direction to better preserve the crop. It happens when lactic acid bacteria in the inoculant overwhelm the natural lactic acid bacteria of the crop. There are now two main types of silage inoculants, e.g., the traditional homofermentative type, *Lactobacillus plantarum*,

*Pediococcus spp.*, and *Enterococcus faecium* and the heterofermentative type, *Lactobacillus buchneri*. A third type, combining homo-fermenters with *L. buchneri*, is beginning to be introduced.

The homo-fermenters get their name because they turn 6-carbon sugar molecules into one product, i.e., lactic acid. The hetero-fermenters on the other hand, produce multiple products. For example, they may turn one 6-carbon sugar into one lactic acid + one acetic acid + carbon dioxide (CO<sub>2</sub>); or turn one 6-carbon sugar into one lactic acid + one ethanol + CO<sub>2</sub>; or turn one lactic acid into one acetic acid + CO<sub>2</sub>. Lactic acid is a strong organic acid which is a moderate spoilage inhibitor and fermented by bacteria in the rumen. Acetic acid, on the other hand, a weak acid but good spoilage inhibitor and absorbed directly through the rumen. Ethanol is neutral, poor spoilage inhibitor which is partially fermented in the rumen.

The most common lactic acid bacteria (LAB) in commercial inoculants are *Lactobacillus plantarum*, *Enterococcus faecium*, *Pediococcus spp.* and other *Lactobacillus spp.* Species specific strains of LAB in commercial inoculants are selected because they grow rapidly and efficiently, and produce primarily lactic acid. They increase the fermentation rate, causing a more rapid decline in pH, with a slightly lower final pH. Lactic acid is stronger than acetic acid, and contains almost as much energy as the original sugars.

Because of the failure of homofermentative inoculants to increase aerobic stability in the silage, currently heterofermentative species *L. buchneri* has been popular. Laboratory studies with *L. buchneri* have shown that it consistently raises acetic acid concentration and results in a silage with a slightly higher pH. Because acetic acid inhibits yeasts and molds, the *L. buchneri*-treated silages have been more aerobically stable than the untreated silage. Hence, in situations where spoilage at feedout is an issue, the use of *L. buchneri* inoculant on corn silage may result in less mould and mycotoxins, improved palatability, better feed intake, and reduced total dry matter losses.

When combining two different types of inoculants in silage it is expected that good fermentation, no elevated acetic acid production, better dry matter recovery, good animal performance and increased aerobic stability of silage will take place. The current study, therefore, aims to compare efficacy of single, multi-strain and combined inoculant on physical attribute, yield and quality of Napier (*Pennisetum purpureum*) silage under existing farm conditions in Bangladesh.

## c) Methodology:

### (i) Study area

The study will be carried out in the commercial dairy farm at Mirersorai Upazila, Chattogram district, Bangladesh from June-2023 to September-2023.

#### **(ii) Study design, animals and housing**

Three different types of inoculants (homo-fermentative, hetero-fermentative and combined) will be used to prepare three types of super Napier silage. Animal trial will be carried out following completely randomized design. Total 9 milch cows of the same age, genotype and parity will be selected for the in vivo feeding trial. A double row face-out system stanchion barn will be selected.

#### **(iii) Farm selection and baseline survey**

Complete list of commercial dairy farms at Chattogram division will be collected from the department of livestock services, Bangladesh. A commercial dairy farm having at least 30 cows will be selected. The baseline survey will be conducted by two CVASU faculty headed by a senior professor. Verbal consent in advance will be taken from the farm for conducting the survey. A structured questionnaire containing closed and open-ended questions will be set.

#### **(iv) Immunization and medication**

De-worming will be done in every 3-month interval. Ivermectin will use at 10 mg/50 kg body weight. Moreover, Combination of levamisole and triclabendazole anthelmintics will be practiced. Vaccination program for different diseases, i.e., Foot and mouth disease, hemorrhagic septicemia, black quarter and anthrax will be maintained for preventing diseases.

#### **(v) Feeding system**

During study period, animals will be fed according to their stage of production, age, and physiological condition. Silage will be provided according to milk production. Total mixed ration will be formulated, mixed and measured by manual mixer and electric balance. Concentrate mixture will consist of broken maize 20%, wheat bran 40%, rice polish 15%, grass pea 10%, soybean meal 12%, dicalcium phosphate 1.75%, common salt 0.5%, molasses 0.5%, and vitamin-mineral premix 0.25%. Feeds will be provided twice a day- morning and evening.

#### **(vi) Data collection**

The requisite prospective data will be collected directly from the farm register. Data related to the farm type, breed, genotype, housing system, parity, type of feed, feeding systems and daily milk yield will be collected.

#### **(vii) Feed sampling and testing**

Representative feed samples will be taken in two different stages, i.e., one during ensiling immediate after harvest and another during feed out stages. Samples will be sent in airtight polythene bag for testing moisture, CP, CF, NFE, Ash, ADF, NDF, acetic acid, lactic acid, p<sup>H</sup> and ME in the postgraduate laboratory of Chattogram Veterinary and Animal Sciences University.

#### **(viii) Statistical Analysis**

Data will be compiled into Microsoft excel professional 2020 (Microsoft corporation, USA). Outliers in the data set will be tested by Mahalanobis and Jackknife distances and multicollinearity will be checked by the variance inflation factors. Equality of variances in the response variable will be tested by the Shapiro Wilk test.

The restricted maximum likelihood (REML) method will be used to calculate the least square mean. Profile plots of least square means will be used to measure the interactions of the covariates. The data will be finally used for fitting generalized linear mixed model (GLMM) considering adult weight as the main response variable, genotype, as the fixed effect, parity as the random effect. When effects will be deemed significant ( $p < 0.05$ ), the Duncan's New Multiple Range Test (DMRT) will be used to compare the means. All statistical analyses will be performed by using Stata 14.1 SE (Stata Corp LP, College Station, Texas, USA) and SAS JMP Pro 16.2 (SAS Inc., USA). The following statistical model will be used:

$$Y_{ijklmno} = \mu_i + A_{ij} + B_{ik} + C_{il} + D_{im} + E_{in} + F_{io} + (A \times B \times C \times D \times E \times F)_{ijklmno} + e_{ijklmno} \text{ Where,}$$

- $\mu_i$  = Overall population mean for the trait i;
- $A_{ij}$  = Fixed effects of  $j^{\text{th}}$  genotype for the trait i ( $0=1,2,\dots,n$ );
- $B_{ik}$  = Fixed effects of  $k^{\text{th}}$  parity for the trait i ( $0=1,2,\dots,n$ );
- $C_{il}$  = Fixed effects of  $l^{\text{th}}$  season for the trait i ( $0=1,2,\dots,n$ );
- $D_{im}$  = Fixed effects of  $m^{\text{th}}$  dry off period for the trait i ( $0=1,2,\dots,n$ );
- $E_{in}$  = Fixed effects of  $n^{\text{th}}$  calving interval for the trait i ( $0=1,2,\dots,n$ );
- $F_{io}$  = Random effects of  $o^{\text{th}}$  parity and calving season for the trait i ( $0=1,2,\dots,n$ );
- $e_{ijklmno}$  = Random sampling error distributed as  $N(0, I\delta^2e)$ ;
- $Y_{ijklmno}$  = Observed effects of the trait i for  $j^{\text{th}}$  genotype,  $k^{\text{th}}$  parity,  $l^{\text{th}}$  season,  $m^{\text{th}}$  dry off period,  $n^{\text{th}}$  calving interval and  $o^{\text{th}}$  feeding systems.

### (e) Expected outcome

When combining two different types of inoculants in silage it is expected that good fermentation, no elevated acetic acid production, better dry matter recovery, good animal performance and increased aerobic stability of *silage will take place*. The current study, therefore, aims to comparative efficacy of single, multi-strain and combined inoculant on physical attribute, yield and quality of Napier (*Pennisetum purpureum*) silage under existing farm conditions in Bangladesh.

#### 3.1 Sample size determination of project participants:

10 Livestock farms

#### 3.2 Services and Facilities to be provided by YPSA:

YPSA will help to find required field and also will cooperate existing project employee for better management of study

#### 3.3 Services and Facilities to be provided by the consultant:

- a) Data collection/survey/sample collection/analysis
- b) Report writing, printing and binding

#### 4. Duration of the study and schedule of the reports:

The total time duration of the assignment will be 90 days.

The consulting firm should finalize the report by incorporating comments and queries of YPSA/PKSF. The final report of study should be submitted within 120 days from the date of agreement signing.

## 5. Quality and Ethical Standard

The consultant hired should take all reasonable steps to ensure that the study is designed and conducted to respect and protect the rights and welfare of people and the communities of which they are members, and to ensure that the study is technically accurate, reliable, and legitimate, conducted in a transparent and impartial manner, and contributes to organizational learning and accountability.

1. Utility: Evaluations must be useful and used.
2. Feasibility: Evaluations must be realistic, diplomatic, and managed in a sensible, cost effective manner.
3. Ethics & Legality: Evaluations must be conducted in an ethical and legal manner, with particular regard for the welfare of those involved in and affected by the evaluation.
4. Impartiality & Independence; Evaluations should be impartial, providing a comprehensive and unbiased assessment that considers the views of all stakeholders.
5. Transparency: Evaluation activities should reflect an attitude of openness and transparency.
6. Accuracy: Evaluations should be technical accurate, providing sufficient information about the data collection, analysis, and interpretation methods so that its worth or merit can be determined.
7. Participation: Stakeholders should be consulted and meaningfully involved in the evaluation process when feasible and appropriate.
8. Collaboration: Collaboration between key operating partners in the evaluation process improves the legitimacy and utility of the evaluation.

## 6. Reports and deliverables:

The consulting firm should provide the following deliverables:

- i) **An inception report** with a detailed work plan, schedule (Gantt chart) in line with the time limit mentioned in this ToR
- ii) **Final study presentation.** The consulting firm will have to give a presentation at YPSA on the draft report highlighting major findings on baseline status. The final report of the study should be written in common English. The final report should have the reflections of the comments made by the YPSA/PKSF officials on the draft report. The hard copies (if applicable) of all filled up questionnaires must be submitted along with the final report. The report should include the list of respondents with their contact details. Five copies of the final report and a soft copy with data sets exported to SPSS files in a CD/DVD must be submitted to YPSA.
- iii) **Findings brief.** The consulting firm should provide a brief of the findings corresponding to the objectives of the study that can be widely circulated. The brief of the study could be within three pages.

- iv) **Indicator Table with Value:** The consulting firm should provide an indicator table including the values which got in the baseline study.
- v) **Final Report will sketch with the following headings:** The final report will contain a short executive summary (not more than 1,000 words) and a main body of the report (not more than 10,000 words) covering the background of the intervention evaluated, a description of the evaluation methods and limitations, findings, conclusions, lessons learned, recommendations and action points related to these.
- Acknowledgements
  - Acronyms
  - Glossary
  - Executive Summary
  - Introduction/Background
  - Rationale and Objectives of the Baseline Study
  - Scope of the Baseline Study
  - Evaluation Methodology
  - Findings and Discussion
  - Recommendations
  - Conclusion and lessons learned (if any)
  - References
  - Annex (including a copy of the ToR, cited resources or bibliography/reference, a list of those interviewed, case studies and any other relevant materials etc.).

#### **7. Qualifications of the consultant (National):**

- Proven extensive experience in being the lead in conducting livestock research
- The lead consultant should have University degree at the post-graduate level in Livestock /Animal Husbandry
- Strong analytical skills and ability to clearly synthesize and present findings, draw practical conclusions, make recommendations and to prepare well-written reports in a timely manner;
- Excellent in English and Bangla writing and presentation skills
- Immediate availability for the period indicated
- Must have necessary computer skills with necessary hardware.
- Should have good understanding of the local language.
- Minimum 3 years' experience in conducting similar study/assignment.
- Experience of conducting study in Govt. and development partners funded project is preferable.

#### **8. Individual Consultant (National) Selection Process:**

Individual Consultant Selection (ICS) method and Standard Request for Application (SRFA:PS-3) Documents on lump-sum contracts of Schedule 1 of the Public Procurement Rules-2008 of the Government of Bangladesh should be followed in preparation of short-listing and evaluation the consultants, negotiation, and signing of contract.

#### **9. Mode of Payment:**

YPSA will pay the cost of the study to the assigned firm subject to the completion of all deliverables and reports acceptance of PKSf by deducting VAT and TAX at source as per

the Government rules of Bangladesh. Payments will be made based on the following percentages and milestones:

a) **1st Payment (40% of total contract value):** The 1st payment will be made upon submission and acceptance of the inception report by YPSA & PKSf.

b) **2nd Payment (60% of total contract value):** The 2nd payment will be made upon submission and acceptance of the report by YPSA & PKSf.

#### **10. Timeframe**

The study shall be conducted expectedly in three months from start of the study, and is scheduled to preferably start in the June 01, 2023. The consultant will submit the final report latest by October 15, 2023.

#### **11. Disclaimer**

The YPSA management reserves the right to amend the terms of reference at any time as required upon mutual discussion with the lead researcher. YPSA reserves the right to terminate the contract at its sole discretion in case of non-compliance of the terms and conditions that will be finally agreed.

#### **12. Proposal Submission/ Application and Selection Details**

The proposal should include the following below six items. Please note that any proposal which does not contain all six items will be rejected.

**Cover letter:** Clearly summarizing your experience and competency as it pertains to this assignment

**Technical proposal:** Not exceeding eight (08) pages expressing an understanding and interpretation of the ToR, the proposed methodology, relevant experience and time and activity schedule.

**Financial proposal:** Itemizing estimated costs for services rendered (daily consultancy fees), accommodation and living costs, transport costs, stationery costs, and any other related supplies or services required for the review in BDT and modality of payment. Please also attach a TIN/Registration Certificate.

**Detailed CVs** of all professionals who will work on the process. CVs of proposed study team, please attach a table describing the level of effort (in number of days) of each team member in each of the Baseline activities.

**Professional references** needed to provide two or three references from your previous clients.

**Professional references** Minimum 3 years

**13. Application Procedure:** Please email complete applications to [ypsaprocedure@gmail.com](mailto:ypsaprocedure@gmail.com) & Copy email to [newaz.ypsa@gmail.com/imamdvm@gmail.com](mailto:newaz.ypsa@gmail.com/imamdvm@gmail.com)

**14. Deadline for Application:** The application deadline is May 30 ,2023