## **Data Collection for Genetic Improvement from Smallholder**

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Smallholder dairy farmers are vital contributors to rural livelihoods, food security, and national economies. However, the potential of smallholder dairy systems often remains underutilized due to limited resources and inadequate access to advanced breeding technologies. To address these challenges, a systematic and sustainable approach is necessary for enhancing genetic potential and productivity.

The Enhanced Genetics Project (EGP) by BAIF Development Research Foundation demonstrated an innovative framework to achieve meaningful genetic improvement in smallholder dairy systems. The program integrates accurate data collection systems and genomic selection strategies to create a robust foundation for genetic evaluation and improvement.

The key highlights include the deployment of a platform-independent, digital data collection system that facilitates multitrait phenotypic recording like production, reproduction, body weight, linear type traits, and adaptability traits. However, implementing the data collection under smallholder dairy system isn't a straight-forward way.

A highly diverse dairy management and environmental conditions, small herd size, mixed dairy population, varying breed compositions and performance recording at farmers doorstep itself posed major challenges. Considering the possibility of genotype by environmental interaction and its effect on animal performance, in India, we have initiated the performance recording dairy animal population under diverse management and environmental conditions ensuring various production systems. A dedicated enumerator aligned with artificial insemination (AI) technician have been appointed to collect multi-trait phenotype data collection. To ensure data quality and accuracy, a hierarchical system at each region is in place to monitor the activities at ground level. In addition to this, the system makes certain that data quality through comprehensive validation checks, real-time GPS and Bluetooth-enabled weighing scales & milk analysers provided accurate measurements. To maintain accuracy in the process of biological sample collection and genotyping purpose, a laboratory management system was put in place from smallholder farmers' herd to laboratory to avoid errors.

We have collected over 74 thousand animal's performance records for various traits pertaining to 21 thousand farmers through our data collection system. The BAIF's Enhanced Genetics Project showcases how comprehensive data collection and systematic genetic improvement can transform smallholder dairy systems, delivering value to farmers and fostering sustainable livestock development.

Keywords: Digital data collection system, performance record, dairy animal.