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Ph.D. Thesis Summary

Evaluation of the Community-Based Breeding Program for Indigenous Sheep in the Sidama Region, Ethiopia

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A Community-Based Breeding Program (CBBP) has been viewed as a vital initiative to improve the genetic potential and overall productivity of many local sheep populations in many developing countries. As a productivity improvement intervention, CBBP has been implemented for the Abera sheep population reared in the Southern parts of Ethiopia since 2013. A total of six breeder cooperatives (Abera Gelede, Abera Atela, Abera Bongodo, Bochesa Gobe, Abera Doko and Abera Doko) have been organized under this breeding program. The overall aim of the breeding program was to improve the productivity of sheep and the income of producers while preserving indigenous genetic resources. The current study evaluates the performance of the mentioned breeding program in terms of sheep performance improvement and the income of producers. For the study, an eight-year sheep performance record was used to estimate non-genetic effects for productive traits and genetic effects for selected productive traits (litter size, total litter weight at birth and total litter weight at weaning). To complement evaluation, a total of 188 sheep producers, comprising 91 CBBP members and 97 non-members, were selected and interviewed. The Statistical Analysis System (SAS) was used to analyze growth data and the Univariate Animal Model under Wombat Software was employed to estimate variance components and genetic parameters. The survey result showed mixed crop-livestock production commonly practiced by sheep producers. The majority of interviewed households were male, with 20.9% of CBBP members and 18.5% of non-members being female. Sheep producers averaged 40.46 years old, with no significant variation between CBBP participants and non-participants. The CBBP members had a higher literacy rate (87%) than non-members (70%), which would have helped members to adopt a livestock improvement intervention program where recording is essential. Members of the breeding program have owned significantly ($p<0.05$) larger family sizes (7.8) and land sizes (1.84 ha) than non-members, who have owned 6.7 family sizes and 1.54 ha of land. Members of the breeding program further owned a significantly higher mean sheep flock (7.28 heads) than non-members (4.99 heads), which provides a good basis for selecting the best individuals. All members of the breeding program perceived implementation breeding program had a considerable contribution to sheep productivity improvement and the income of sheep producers. All sheep producers mentioned body size of sheep showed improvement while 82% of members witnessed considerable improvement in the sheep's ability to give multiple births. Members of the breeding program also perceived significant ($p<0.05$) reduction (duration) in lambing interval of ewe (from 8.63 to 7.31 months) and ram maturity (from 7.9 to 6.2 months) after implementation of a community-based breeding program. Participating sheep producers mentioned that their sheep are attracting the interest of buyers in the market and fetched a higher price than those owned by non-participating households in the breeding program. Further, survey results showed more market participation among CBBP members, who

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significantly ($p<0.05$) sold a higher mean of sheep (2.4) than non-members, who sold a mean of 1.3 sheep in a year, which would be associated with higher sheep ownership by members. The CBBP members, further, have obtained significantly higher ($p<0.05$) annual income (ETB 3877) than non-members, who earned an annual income of ETB 2007 from sheep sales which may indicate that the breeding program is deriving meaningful benefits to sheep producers involved in a breeding program. Analysis of on-farm sheep performance showed significant improvement for targeted growth traits. Body weight of sheep (kg) at birth, 3-month, 6-month and yearling age was recorded to be 3.1, 15.1, 20.8 and 28.6, respectively. Lamb sex significantly ($p<0.01$) influenced body weight at all ages, where male lambs were significantly ($p<0.001$) heavier than their female counterparts. Due to lack of competition for milk and resources, singletons were significantly ($p<0.01$) heavier than multiple contemporaries. Lambs from older dams (parity four to five) were significantly ($p<0.05$) heavier than compared with lambs of younger dams at birth and six age. The body weight of lambs showed significant improvement at all ages over the years, starting in 2013, when CBP was launched. This could be highly associated with a selective breeding program that targeted growth traits. Breeder cooperatives were other sources of variation in the growth rate of sheep which could be explained by differences in feed resource availability and the level and accuracy of selection programs. The body weight of lambs showed significant improvement at all ages over the years, starting in 2013, when CBP was launched. This could be highly associated with a selective breeding program that targets growth traits. Breeder cooperatives were other sources of variation in the growth rate of sheep, which could be explained by differences in feed resource availability and the level and accuracy of selection programs. The overall mean of daily body weight gain (g/day) during pre-weaning and post-weaning was observed to be 132.4 and 63.5, respectively and significantly ($p<0.01$) influenced by the fixed effects of lamb sex, parity, litter size, birth season and years. Direct additive variance components for litter size, total litter weight at birth and total litter weight at weaning across breeder cooperatives ranged between 0.009 and 0.002, 0.001 and 0.11 and 0.001 and 2.86, respectively, with corresponding heritability (h^2) estimate ranges of 0.04 and 0.11, 0.001 and 0.02 and 0.00 and 0.09. Heritability estimates of these reproductive traits were found to be very low, indicating these traits can be improved through improved management rather than selection. The genetic trend of litter size was observed to be positive in Abera Atela and Bochesa Gobe, which would be associated with a correlation of litter size with growth traits under selection and subjective approval of breeding rams by the selection committee. A positive genetic trend was also observed for other reproductive traits considered in some breeder cooperatives. This study concluded that CBBP has made an appreciable contribution to the community. Strong institutional arrangements and organizational support, as well as strong collaboration, are needed to increase the contribution of CBBP to the community and to take the breeding program to its expected performance level. Improving management, considering the variations observed in fixed effects and the use of the economic selection index, accommodating reproduction and other traits need to be considered to improve the overall benefit of the breeding program.

KEYWORDS

Abera sheep, CBBP, body weight, genetic parameters, reproductive traits

KEY CONTRIBUTIONS

This study added scientific knowledge to the field. It could be used as the basis for future improvement directions and add input for improvement strategies in the future.

FUTURE DIRECTIONS

Strengthening of selection schemes, technical support and scaling up of the program outputs.

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Declaration Letter

Subject: Declaration of Intent to Publish Thesis Summary in Science Digest

Dear Editor,

I, **Sunkurta Digesa Jilo**, hereby declare on behalf of all the authors involved in the research, that we have reached a unanimous agreement to publish the summary of our thesis, titled "**Evaluation of the Community-based Breeding Program for Indigenous Sheep in the Sidama Region, Ethiopia** "in Science Digest.

This research was conducted at the field of **Animal Breeding and Genetics, College of Agricultural and Environmental Science, Haramaya University, Ethiopia**, under the supervision of **Yosef Tadesse Mengesha (PhD), Tesfaye Getachew Mengistu (PhD), and Workneh Ayalew (PhD)**, during the academic year **2021.** The study represents the culmination of **Sunkurta Digesa Jilo's M.Sc**. research project, and we are excited to share the key findings with the global scientific community through the esteemed platform of Science Digest.

This declaration confirms the accuracy and completeness of the information provided in the submission.

Thank you for considering our work for publication.

Sincerely,

Sunkurta Digesa Jilo:

Signature: