Heifer Tanzania's Alternate Training Methods

A study comparing the dairy cow husbandry practices of farmers trained in their villages by project supervisors to those of farmers trained by the Liti Tengeru Animal Husbandry Training Center

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ABSTRACT

This study was conducted in nine villages near Mount Meru, Tanzania between 14 April 2008 and 1 May 2008. The study question and methods were developed in conjunction with Heifer Tanzania. Heifer is a non-profit organization that provides dairy-cattle and other livestock to farmers in need. Heifer's agents also provide training in sustainable farming techniques, such as zero-grazing livestock husbandry, and building contours. Some farmers receive this training in their village from a project supervisor, and other farmers are sent to a government facility, Liti Tengeru Animal Husbandry Training Center. The aim of this study was to determine what differences exist in animal husbandry quality between a sample of in-village trained farmers and a sample of government-facility trained farmers. The purpose of comparing these two samples of farmers was to provide Heifer Tanzania with information that would be useful in deciding whether to spend extra funds to send farmers to the government facility, as opposed to less costly in-village trainings. It was predicted that in-village-trained farmers would have higher average rankings because they were trained in a familiar environment. The study was done by conducting an observation-based survey of fifteen animal husbandry indicators at ninety farms, half of which were from each sample. The results of the study showed that some of the indicators had higher averages for in-village-trained farmers. However, a majority of the indicators had greater average rankings for government-facility-trained farmers; four of these differences were statistically significant with $\alpha=0.05$.

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INTRODUCTION

"Peace begins when the hungry are fed," reads a sign hanging at the headquarters of Heifer Project Tanzania in Arusha. For ages, humans have fought over land and resources; sometimes it is to expand the power of an empire, sometimes it is simply because they are hungry or thirsty. The African continent is inundated with this debilitating poorness, and the country of Tanzania is no exception. By purchasing power parity, Tanzania is ranked 3rd lowest in the world, and 89.9% of people earn an income of less than two US Dollars per day (World Bank 2007). The distribution of the poor is not uniform among cities and other areas; 87% of those living below the poverty line live in rural areas (Heifer 2004). By far a majority of the population works in agriculture and/or relies on it for subsistence, but agriculture only constitutes approximately 50% of the GDP. In years of average rainfall, only 92% of food requirements are met; not only is production insufficient to meet needs, but transporting surplus to areas of deficit is a challenge with inadequate infrastructure, and revenues from agricultural production are dropping due to price declines (Heifer 2004).

Countless individuals and organizations have attempted to make dents in these statistics. One of these, Heifer International, has been operating in Tanzania since 1974; it is the largest and oldest of Heifer International's Africa programs (Kinsey and Murnyak 2006). "Heifer Tanzania's contributions to food security and to family incomes and assets are among the organization's most important impacts" (Clements 2007). Their mission includes:

> "[1] Responding to requests for development assistance, including livestock, training and technical assistance, which enables families to seek self-reliance in food production and income generation on a sustainable basis. [2] Enabling people to share in a way that enhances dignity and offers everyone the opportunity to make a difference in the struggle to alleviate hunger and poverty. [3] Educating people about root causes of hunger and poverty… [4] Supporting people in sustainable development and the stewardship of the environment through responsible management of animals and farm resources." (Heifer 2004)

Heifer Tanzania works toward these goals of alleviating hunger and poverty, and promoting sustainable agriculture, by facilitating a gift of livestock such as a dairy cow, dairy goat, pig, fish pond, or chicken, along with training in animal husbandry, to families in need. The animal is a catalyst to guide farmers toward overall improved and sustainable farming techniques (Kinsey and Murnyak 2006).

The funding to do this comes from several sources, the majority from North American donors to Heifer International, based in Little Rock, AK. Locally, Heifer has partnered with various Christian, Islamic, farmers', women's, and other organizations to sponsor Heifer Project in Tanzanian villages. These partners are typically stable, long-term, organized entities that request Heifer's help in a particular location. "Cooperating with local partners, primarily church dioceses, is more cost effective and sustainable than Heifer initiating its own projects and working alone" (Kinsey and Murnyak 2006). Heifer assists in assigning a government extension agent via the Tanzania Ministry of Water and Livestock Development to be the supervisor for that project. Heifer provides a budget for the supervisor to purchase a motor bike and to work with several villages (Kinsey and Murnyak 2006); overall Heifer agrees to pay one third of the supervisor's salary, and the partner is expected to provide the rest, although sometimes they do not follow through (Clements 2007).

For a village to become part of Heifer Project, they must form a selection committee that is somewhat representative of the many kinds of people in the village. Upon receiving farmers' requests for an animal from Heifer, the committee visits the candidates' homes and makes a decision, usually based on Heifer's guidelines. These guidelines state that priority should go to poor families who could not buy livestock themselves, families taking care of AIDs orphans, widows with children, and the handicapped. Once the project supervisor approves the farmers chosen by the committee, those farmers must be able and willing to attend a training course, build a shed for the animal, and plant forage to feed it. Heifer checks the completion of these tasks and then searches for gift animals (Murnyak 2008). In the first several years of Heifer Project these animals would have come from other countries. Today, many of the animals are locally bred, even by Heifer farmers; "Village-based livestock projects can serve as effective breeding centers and credit institutions" (Kinsey and Murnyak 2006). The second part of this statement refers to the contract that farmers sign upon receipt of their animal. Until the farmer passes on the first (and sometimes second and third) female offspring to another farmer in the village, the animal still belongs to Heifer and may be taken away if the farmer does not carry out this agreement or does not care for the animal properly. Once these "pass-ons" have been fulfilled the farmer no longer has any obligations to Heifer (Murnyak 2008). In this sense, "gift" animals are actually loans, part of a practical credit system— they are loans provided to needy families who usually would not qualify for bank loans (Kinsey and Murnyak 2006).

In terms of cost-effectiveness, "For every US$2 expenditure, Heifer Tanzania initiates ongoing gains of over US$1 per year for a low-income family, in addition to Heifer's other program impacts" (Clements 2007). Other impacts include the network of support and continuing education that Heifer, its partners, and the project supervisors establish in project areas. Successful farmers often become "motivators" who are trained to support other farmers; others become "community animal health workers" and help prevent and treat animal diseases in their village (Kinsey and Murnyak 2006). This network of support is sustainable because its members are volunteers, non-reliant on outside funding.

As mentioned earlier, livestock are just a stepping stone toward more sustainable and productive farming. "Heifer tries to help subsistence farmers in this shift from traditional to more intensive livestock management systems…" (Kinsey and Murnyak 2006). Farmers are trained to build contours and plant grasses that prevent erosion on sharply inclined land; they learn zero-grazing practices with dairy cattle in order to avoid environmental degradation, and create a supply of manure, which, together with beginning to plant nitrogen-fixing trees, greatly increases soil fertility (Murnyak 2008). "Families were routinely doubling, tripling and quadrupling crop yields after fertilizing with animal manure" (Clements 2007). Not only do the farmers Heifer trains benefit from these techniques, but also their children and other community members with whom the farmer can share his or her knowledge.

Heifer Tanzania farmers receive their initial training in one of two ways. If they are the recipient of an original gift animal, they attend two weeks of training in a government animal husbandry training center. However, if the farmer is the recipient of a pass-on animal, the project supervisor provides the training in the village (Murnyak 2008). The training is often supplemented by the farmer who passed on the animal and by others, like farmer motivators. The length of training varies among supervisors and among villages. In this study, the length of training varied from three consecutive days to ten inconsecutive days (Mhindi 2008, Nnko 2008, Severe 2008).

In the north-eastern zone of Tanzania, the government training institute is located in Liti Tengeru. Heifer pays farmers for public transportation to and from the institute, where they stay for two weeks. Heifer also pays the institute to train these farmers, in groups of approximately 20; the course sometimes takes place in a classroom with blackboards, and any practical portion is conducted at their facility and instructed by government-employed trainers (Murnyak 2008).

Approximately US$12.50 per farmer, per day is spent on these trainings (Banzi 2008). Pass-on farmers are trained in their village, possibly at a rented space such as a school. Practical sections are conducted on the farmers' land, and instruction is carried out by the project supervisor of that village (Murnyak 2008). Between 5,000 and 8,000 Tanzanian Schillings, equivalent to between US$4.17 and US$6.67 (exchange rate 1 May 2008), per farmer per day is spent on this type of training (Banzi 2008).

Heifer sends some farmers to the government training center, even though it is a more expensive option than in-village training by the project supervisor. Based on the numbers listed above, the typical two-week government center training costs approximately US$175.00; whereas the typical in-village training (up to ten days) costs no more than US$66.67. This means that in-village training costs at least US$100.00 less per farmer than government facility training.

Until now, no study had been done to compare the animal husbandry practices of farmers trained at the government center to those of farmers trained by their supervisor. Such a comparison could indicate what differences in practice result from different types of training, and it may serve as a basis to determine whether there is a benefit to choosing the more expensive government center training. Heifer receives requests for livestock from more families than they can afford animals and training; verifying that their limited funds are fetching the greatest available returns is one way to improve the efficacy and breadth of their projects.

The following study was designed to provide a data set which, through several statistical analyses, could reveal whether differences in animal husbandry practices exist related to the type of training a Heifer Project farmer receives. Ideally, the results will be of use to Heifer Tanzania in allotting their training funds effectively. In order to establish a control, the study included only farmers with Heifer dairy cows. Dairy cows were chosen because they are frequent; Heifer provided 21,260 Tanzanian families with dairy cows between 1961 and 2006 (Kinsey 2007). They are the most economically beneficial of Heifer's animals in Tanzania, and also those that require the most care and investment by the farmer. For this reason, "Dairy cattle offer the greatest potential to move participating families from low- to middle-income" (Kinsey and Murnyak 2006). Due to the importance and frequency of dairy-cow Heifer farmers, they are not only more available to study, but data collected about them relates to a larger population of Heifer's projects than would studies of other livestock.

Data was collected in several villages surrounding Mount Meru. Each village was under the direction of one of three project supervisors, and any government facility training was conducted at Liti Tengeru Animal Husbandry Training Center because the villages lie in Heifer Tanzania's North-East Zone. Data collection was done by personal visit to each farm, and use of an observation-based ranking of animal health and husbandry indicators. Mount Meru was chosen as the study site due to the high population density as compared to other areas in the zone, making it possible to visit several villages in the three week time period of this study. The location also made support available from the Heifer Tanzania Headquarters in nearby Arusha.

The study was designed to address the following question: in the Mount Meru area of the North-East zone, what differences in the quality of animal husbandry practices exist between farmers who received a dairy cow from Heifer Project Tanzania and were trained by their village project supervisor, as compared to those trained by the government Animal Husbandry Training Center in Liti Tengeru? Before beginning data collection I predicted that farmers trained by their project supervisor would practice better quality animal husbandry than those trained at the government center because they are taught in a familiar setting, making it seemingly easier to apply the techniques than if they learned in a foreign situation from trainers less knowledgeable about their individual situation than the village supervisor may be. I also predicted the quality of animal husbandry practices would vary between villages with different supervisors due to different training techniques.

STUDY AREA

This study was conducted in nine different villages on Mount Meru that each have at least three Heifer Project dairy cow farmers who were trained at the facility in Liti Tengeru, and three who were trained in the village by their project supervisor**.** Each village was close enough to Arusha that I could travel there, conduct my survey (see Appendix A), and return the same day. Three of the villages, Ngejesosia, Mareu and Kingori, are supervised by Mr. Asoraeli Nnko; another three, Olasiti, Olgilai, and Marurani are supervised by Mr. Elirehema Severe; and the final three, Ngyeku, Imbaseni, and Kitefu are supervised by Ms. Theresia Mhindi (see Appendix B). Mr. Nnko started working as a government livestock officer in 1970, and has worked as a project supervisor for Heifer Tanzania since 1992; he currently supervises 22 villages (Nnko 2008). Mr. Severe began work as a government livestock officer in 1989, and in

1997 he started working as a Heifer project supervisor; he currently supervises 25 villages (Severe 2008). Ms. Mhindi began working with Heifer Tanzania in 1985; she currently supervises seven villages (Mhindi 2008).

During the first week of the study, three villages East of Mount Meru were visited; they are all on sloping terrain and border the protected forest. All three of these villages can be accessed by way of unpaved roads originating at King'ori junction on Moshi-Nairobi Road. The first two days were spent in Ngejesosia, surveying a total of six in-village-trained farmers and six government-facility-trained farmers. Heifer Tanzania works with the Maanga Shin Parish in this village; 541 families live in the village, a vast majority of which are farmers (Maanga Shin Parish 2008). The main crops listed among farmers' responses to survey questions were maize, beans, and a plant grown to make oil. The village has two primary schools, one secondary school, and a dispensary (Maanga Shin Parish 2008). Heifer has been involved in Ngejesosia since 1986, and in 2002 Asoraeli Nnko began his work as project supervisor here (Nnko 2008). During the third and fourth day, a total of six in-village-trained farmers and six government-facility-trained farmers were surveyed in Mareu. Heifer also works with the church parish in this village; more than 400 families, 98% of which are farmers, live in Mareu (Mareu Parish 2008). The crops most frequently mentioned in surveys were beans, maize, coffee, cassava and banana trees. There is a dispensary and two primary schools in Mareu, and plans for constructing a secondary school are under way (Mareu Parish 2008). Heifer Tanzania began work here, with Asoraeli Nnko as project supervisor, in 1992 (Nnko 2008). On the fifth day, three in-village-trained farmers and three government-facility-trained farmers were surveyed in King'ori. Again, Heifer works closely with the King'ori church parish; the village is home to 500 families, 90% of which are farmers (King'ori Parish 2008). The crops most frequently mentioned in surveys were maize, beans, cassava, coffee and banana trees. There are three primary schools, two secondary schools, and a dispensary (King'ori Parish 2008). In 1996 Heifer, and Nnko as project supervisor, began work in King'ori (Nnko 2008).

During the second week of the study, three villages to the south and southwest of Mount Meru were visited. In all of these villages, Heifer project works through the KKKT Diocese Arusha Branch. In each village, a total of five in-village-trained farmers and five government-facility-trained farmers were surveyed. The first village, Olgilai, is built on sloping land bordering the protected forests of Meru; it can be accessed from Moshi-Nairobi Road in Arusha

town. Olgilai is home to 2,000 people, 85% of which are farmers (Olgilai Village Office 2008). The crops most frequently mentioned in the surveys were maize, beans, cassava, potatoes, coffee and banana trees. There is one primary school, no secondary school, and one dispensary (Olgilai Village Office 2008). Heifer project was introduced in Olgilai in 1979, and in 1997 Mr. Severe began work there as project supervisor (Severe 2008). The second village visited was Olasiti. It is a flat, lowland area, separated from Mount Meru by Arusha town, and is accessible from Arusha Road. It has 6,248 residents; 75% are farmers (Olasiti Village Office 2008). The main crops mentioned in the surveys were maize, beans, cassava, fruit trees and potatoes. Including all public and private entities, there are seven primary schools, no secondary school and one dispensary (Olasiti Village Office). Heifer and Mr. Severe began work in Olasiti in 1998 (Severe 2008). The third of Mr. Severe's villages that was included in this study is Mzimuni; like Olasiti it is separated from Mount Meru by Arusha town. It is a flat, semi-arid area several kilometers from the nearest paved road, accessed by turning at Impala Circle. 1512 people live in Mzimuni, and 75% of them are farmers (Mzimuni Village Office 2008). The main crops mentioned in surveys were maize, beans and cassava. There is one primary school and one secondary school, but the village lacks a dispensary (Mzimuni Village Office 2008). Heifer project and Mr. Severe began work here in 1999 (Severe 2008).

During the third week of the study, three villages to the East of Mount Meru were visited. In the first village, Ngyeku, a total of nine in-village-trained and nine government-facility-trained farmers were surveyed. Ngyeku can be accessed via an unpaved road originating near Maji ya Chai on Moshi-Nairobi Road. It is home to 3000 people, 95% of which are farmers (Ngyeku Village Office 2008). The crops most frequently mentioned in surveys were maize, beans, coffee and banana trees. The village has a dispensary, a primary school, and a secondary school that is under construction (Ngyeku Village Office 2008). Heifer and Ms. Mhindi began working in Ngyeku in 1998 (Mhindi 2008). The second village visited was Imbaseni, in which a total of three in-village-trained and three government-facility-trained farmers were visited. Imbaseni can be accessed from Maji ya Chai on Moshi-Nairobi Road. The village is home to 8064 people; 80% are farmers (Imbaseni Village Office 2008). The main crops mentioned in surveys were banana trees, coffee, maize, beans, and other vegetables. There is one primary school in the village, but no secondary school or dispensary (Imbaseni Village Office 2008). Heifer and Ms. Mhindi began work in Imbaseni in 1988 (Mhindi 2008). The last of Ms. Mhindi's villages to be

visited was Kitefu, where three in-village trained and three government-facility-trained farmers were visited. Kitefu can be accessed from Moshi-Nairobi Road. The village has one primary school, a secondary school that is about to open for classes, and a dispensary. The main crops mentioned in surveys were maize, beans, cassava, and a plant used to make cooking oil. Heifer and Ms. Mhindi began work in Kitefu in 1989 (Mhindi 2008).

METHODS

The methods for this study were developed with the assistance of Mr. Dennis Murnyak, Dr. Alson Lyimo and Mr. Reese Matthews. Data collection was done by personal visit to each farm, and use of an observation-based ranking of animal health and husbandry indicators (see Appendix A). The sample frame consisted of Heifer dairy cow farmers in rural villages on Mount Meru who are supervised by Mr. Severe, Mr. Nnko or Ms. Mhindi. There were two sample populations: (Population A) Heifer dairy cow farmers trained at Liti Tengeru Animal Husbandry Training Center; (Population B) Heifer dairy cow farmers trained in their village by their project supervisor. Sample A was 43 farmers from Population A; Sample B was 43 farmers from Population B. These samples were randomly-selected from lists provided by the supervisors. Statistical analysis was done by comparing means between the two populations' data sets. T-test analyses between the two populations' data sets were used to determine whether differences were statistically significant. Means were also compared, and statistical significance calculated by way of t-tests, between the Population B data sets of each supervisor; this provided information on the distribution of in-village-trained farmer data among supervisors.

Data collection for the study began on 14 April 2008, and ended on 1 May 2008. In Mr. Nnko's villages, each day I travelled with him to a village and met with the local church parish. Here, the supervisor and I greeted village representatives, introduced this study, obtained village information and history, and answered any questions they had. Five days were spent collecting data in Mr. Nnko's villages, visiting six farmers each day. In Mr. Severe's villages, I travelled with him to the villages, met with a farmer motivator or selection committee chairman and visited the village office for village information and history. Three days were spent collecting data in Mr. Severe's villages, visiting ten farmers each day. In Ms. Mhindi's villages, I met with her and a para-veterinarian for the village, then travelled to the village with the para-veterinarian.

Three days were spent in Ms. Mhindi's villages, visiting eighteen farmers one day, and six farmers on each of the remaining two days.

During meetings with the supervisors, I used their lists of farmers to randomly select equal numbers of in-village-trained and government-facility-trained farmers to visit each day. The order of the visits was determined by choosing the most efficient route, based on the farm locations. A member of the parish, a farmer motivator, the selection committee chairman, or a para-veterinarian accompanied the supervisor and me to each farmer's home, except in Ms. Mhindi's villages, where only the para-veterinarian went with me. Each visit lasted approximately fifteen minutes. Upon arriving, I greeted the family, asked a series of questions (see Appendix A) to obtain meta-data, and asked to be shown the cow. I also asked to see written records being kept about the cow. I ranked each of 15 indicators of animal health and husbandry that require little verbal information from the farmer. The indicators were derived from the *Heifer International Animal Well-Being Recommendations* booklet. The supervisor assisted in some cases to translate between Kiswahili and English.

Analysis was done by calculating sample means of each sample's data, comparing those means between samples, and using t-tests to determine whether those differences were statistically significant (α=0.05). Means were compared for the following:

- Total indicators (between the mean of Sample A and the mean of Sample B).
- Individual indicators (i.e. between mean "feed quality" of Sample A and mean "feed quality" of Sample B).

It should be noted that the t-test for total indicators was conducted by first averaging the data points of each farmer, then administering a t-test (α=0.05) comparing those 43 averages for Sample A with those 43 averages for Sample B.

In order to determine whether statistically significant differences existed among the in-village-trained farmer data of each supervisor, individual indicator means, and total indicator means, were calculated for Sample B data for each supervisor, then compared using t-tests (α=0.05) between each pair of supervisors (Mhindi and Nnko, Mhindi and Severe, Nnko and Severe).

RESULTS

Statistical analysis of the data revealed significant differences between the sample means of the two populations. Taking the mean of all indicators for all farmers in Sample A gave a government-facility-trained farmer population mean, with 95% confidence, of 2.7±0.1. Doing the same calculation for Sample B indicators gave an in-village-trained farmer population mean of 2.5±0.1. Conducting a t-test on this data, first calculating an overall mean for each farmer, returned a p-value of 0.01, indicating the differences between the two populations are highly significant, if α=0.05. To obtain more information, comparison of the sample data on the level of individual indicators was done. For eleven of the fifteen indicators, the Sample A mean was greater than the Sample B mean (see *Figure 1*); however, t-tests indicated only four of these comparisons were statistically significant. *Table 1* lists the indicators showing significance and their means; they included "Birthing Interval", "Milking Records", "Health Records", and "Breeding Records". Four of the fifteen indicators had higher means for

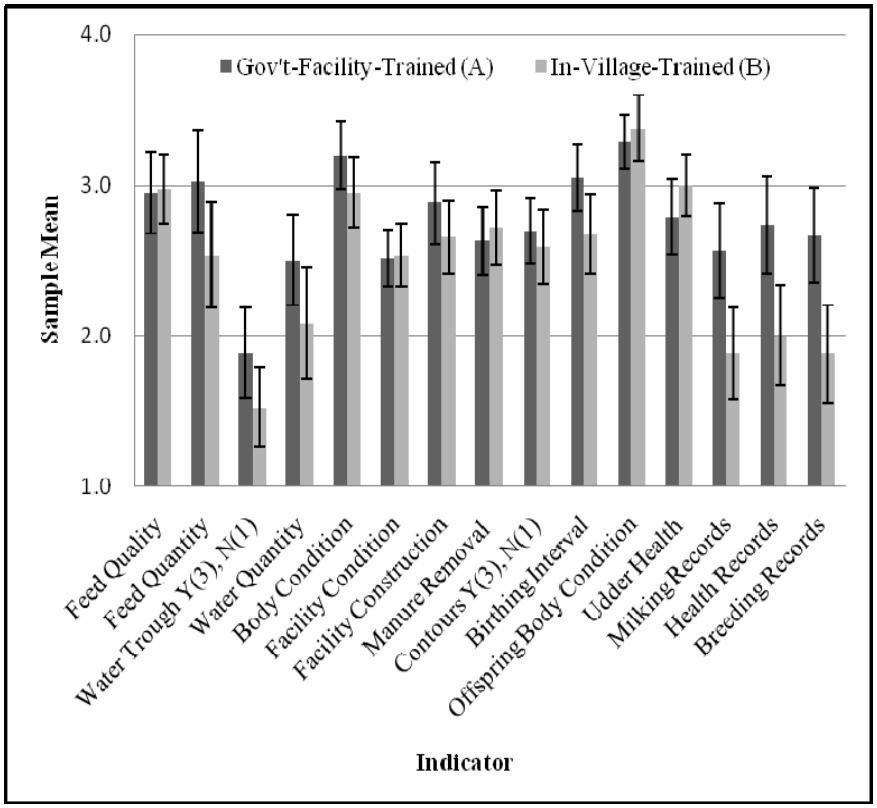

Figure 1: Sample Means by Individual Indicator*. Means were calculated from 43 indicator data points for each sample (A and B). Indicators were ranked on an interval scale from 1-4; a score of 1 denotes "very poor"; a score of 4 denotes "excellent". Error bars denote 95% confidence interval for population means.*

Indicator	Sample Means		T-Test
	Sample A	Sample B	P-Value
Birthing Interval	3.1	2.7	0.0497
Milking Records	2.6	1.9	0.0167
Health Records	2.7	2.0	0.0174
Breeding Records	2.7	1.9	0.0096

Table 1. *Sample means for Sample A and Sample B indicators for which t-tests between the sample data sets resulted in a p-value less than 0.05 (α).*

Sample B than Sample A, however t-tests indicated that none of these differences was significant (α=0.05).

Comparison among the means of the Sample B data sets (data from in-village-trained farmers) of each supervisor revealed several statistically significant differences. The population mean for all Sample B data from Mr. Nnko's villages, with 95% confidence, was 2.8±0.2. The same calculation done on Sample B data from Ms. Mhindi's villages gave a mean of 2.1±0.2. A t-test run between these data sets gave a p-value of less than 0.001, indicating Mr. Nnko's overall mean was significantly greater (α=0.05) than Ms. Mhindi's. *Table 2* lists the individual indicators for which t-tests showed significantly greater means for Mr. Nnko's villages than Ms. Mhindi's.

	Sample B Means		T-Test
	Nnko	Mhindi	P-Value
Water Trough	2.1	1.0	0.001
Facility Condition	2.9	2.0	0.000
Manure Removal	3.1	2.3	0.013
Birthing Interval	3.2	2.4	0.019
Milking Records	2.6	1.2	0.016
Health Records	2.4	1.2	0.024

Table 2. *Sample means of indicators for which t-tests between Sample B data sets from Mr. Nnko's villages and Ms. Mhindi's villages showed significant differences (α=0.05).*

Analysis of all indicators for Sample B data from Mr. Severe's villages gave a population mean of 2.6±0.2. Running a t-test between this data set and Ms. Mhindi's gave a P-value of less than 0.001, indicating that the overall mean for Mr. Severe's villages is significantly (α=0.05) greater than that of Ms. Mhindi's. *Table 3* lists the individual indicators for which the mean from Mr. Severe's data set was significantly (α=0.05) greater than that of Ms. Mhindi's. The final t-test, administered to the Sample B data sets of Mr. Severe's villages compared to Mr. Nnko villages indicated no statistically significant differences between the overall means of their indicator data. *Table 4* shows the individual indicator for

	Sample B Means		T-Test
	Severe	Mhindi	P-Value
Facility Condition	2.7	2.0	0.005
Milking Records	2.0	1.2	0.000
Health Records	2.7	1.2	0.005
Breeding Records	2.8	1.2	0.008

Table 3. *Sample means of indicators for which t-tests between Sample B data sets from Mr. Severe's villages and Ms. Mhindi's villages showed significant differences (α=0.05).*

	Sample B Means		T-Test
	Nnko	Severe	P-Value
Birthing Interval	3.2	2.4	0.006

Table 4. *Sample means of indicators for which t-tests between Sample B data sets from Mr. Nnko's villages and Mr. Severe's villages showed significant differences (α=0.05).*

which the mean from Mr. Nnko's data was significantly (α=0.05) greater than that of Mr. Severe's.

DISCUSSION

In discussing the comparative results of this study, it is first necessary to note that although the data for "in-village-trained farmers" has been discussed as one sample, there *are* significant (α=0.05) variations among the data sets of the three supervisors. These differences were evident in the individual indicator means for which t-tests resulted in statistically significant differences between data from the three supervisors' villages. This is evidence to the point that the results of this study are specific to the study areas and to the supervisor who conducted the training, and that the data and results should not be extrapolated to other villages and different supervisors without further information.

Analysis of the data showed that contrary to my predictions, a majority of indicators had higher means for Sample A, government-facility-trained farmers, than for Sample B, in-village trained farmers. These disparities were statistically significant (α=0.05) for the overall means, the birthing interval means, and the health, milking and breeding record means. These results strongly suggest that farmers from the villages in this study who attended training at the Liti Tengeru Animal Husbandry Training Center kept more thorough and consistent written records about their Heifer cows, and that their cows gave birth to live offspring more frequently than those of in-village-trained farmers.

In the case of the written records indicators, farmers were given a score of 4 ("Very Good/Excellent") if their records on the record card provided by Heifer appeared fairly thorough until recent dates. They were given a score of 2 ("Poor") if they had the card but had written nothing or near nothing on it; and they were given a score of 1 ("Very Poor/None") if they did not have the card at all. Generally, farmers who did not have their card, and were therefore given the lowest score, were farmers who had never been given the card by their project supervisor. This was rarely, if ever, the case with government-facility-trained farmers. A disparity between the perceived importance of written record-keeping by supervisors as opposed to the trainers at the Liti Tengeru center may account for this less diligent distribution of record-keeping cards by project supervisors. This may also be related to the style of training conducted at the government training facility; it may be a more traditionally Western, classroom oriented method that would emphasize written records.

The difference in mean "Birthing Interval" between the government-facility-trained farmers and the in-village-trained farmers, may be a case of disparate degrees of emphasis being placed on breeding practices by the project supervisors and the trainers at the center in Liti Tengeru. However, there may also be less straightforward explanations. One of which is that successful breeding and birthing of healthy calves can be an indicator of overall good health and husbandry; perhaps the more frequent birthing of viable calves by the cows of government-facility-trained farmers is an indicator of better overall care. Not only may birthing interval be a good overall indicator, but a high number of offspring is an excellent way to further the benefits of the gift animal. After passing on the first animal as loan-repayment, all other calves are the property of the farmer, and as such more calves can directly translate into higher cash-income. One farmer in the study noted that his calf was going to sell on the market for TSH400,000, or US$333 (exchange rate 1 May 2008). The gift of a dairy cow through Heifer Project is firstly a stepping stone toward overall sustainable farming; however, high birth rates of healthy calves can also be of great assistance, monetarily, to farmers trying to rise out of poorness. In this respect, birthing interval is an important factor in making the most out of a gift animal, and therefore any training that can improve birthing interval is valuable, whether it be through providing information on breeding and finding bulls, or through overall improved health and husbandry that makes for successful pregnancies.

Looking at the overall statistical trends in the results, which were congruent with my personal impression from the visits, farmers trained at the Liti Tengeru Animal Husbandry Training Center, on average, ranked higher for the indicators used in this study, than did the farmers trained by their project supervisor in the village. Although any explanations for these discrepancies are pure speculation on my part, two possible explanations are listed here. Firstly, in every case, the training provided by the supervisors was shorter than that provided by the government center in Liti Tengeru. It is possible that the amount of money given to the supervisors for trainings is not sufficient to allow them to train for more days. In some cases, as one supervisor noted, in-village trainings have been conducted with no payment to the supervisor whatsoever; in these instances there was no seminar, only as much training as the supervisor was able to conduct voluntarily on her own time (Mhindi 2008). Perhaps increasing the funding for in-village trainings would encourage longer trainings. Secondly, more days of consecutive training may provide not only opportunity for more thorough training, but may also emphasize

the importance of the training from the viewpoint of participant farmers. If this is the case, than providing more days of consecutive training may lead farmers to take the in-village trainings more seriously and longer employ the practices they learn there.

LIMITATIONS AND RECOMMENDATIONS

The following logistical, surveyor-related and study design-related biases may have affected the results of this study and/or would provide room for improvement if the study were to be repeated:

I. Logistical

- Rain frequency and flooding increased as the study went on, possibly affecting "Facility Condition" rankings and therefore the resulting differences in mean "Facility Condition" between Mr. Nnko's and Mr. Severe's village data as compared to Ms. Mhindi's.
- During random selection, some selections were discarded and replaced because of flooding and poor road conditions.
- Some farmers were not home at the time of the visit so no data was obtained for written record indicators or "Birthing Interval".
- Four farm visits were unsuccessful, leading to an overall sample size of 43 farmers from each samples instead of the intended 45. The four failed cases are summarized below:
  1. The farmer was trained by the para-veterinarian only, not the project supervisor.
  2. Care of the cow had been transferred to the (untrained) children of the gift-recipient farmer.
  3. The farmer had finished their contract with Heifer, the cow was not at home, and did not live in a zero-grazing shed.
  4. The farmer had finished their contract with Heifer, the cow was not at home, and did not live in a zero-grazing shed.

II. Surveyor-Related

- I am not educated in livestock husbandry, and thus it is questionable whether I was qualified to rank the indicators used in the survey. My ability and confidence to recognize differences and judge consistently varied from the beginning to the end of the study. If this study were to be repeated or extended it would be valuable for the surveyor to have some training or experience in livestock husbandry.

- ❖ I was aware of whether the farmer I was visiting was trained in the village or at the government facility at the time I did the survey. This could have affected the results, although I do not believe it did.

III. Study Design-Related

- ❖ Comparison of "Body Condition" may have been questionable because each cow was of a slightly different breed, possibly cross-breeds of Friesian, Ayreshire, Boran, and/or Jersey cross-breeds (Kinsey and Murnyak 2006). However, it is possible that these variations were equivalently distributed in both samples, cancelling out this bias.
- ❖ Some villages were on flat and low land, whereas some were on sloping land, possibly affecting the necessity and presence, or lack thereof, of contours.
- ❖ During random selection, some selections were discarded and replaced because the animal had died or been transferred to a different person. There were also some farms visited where one cow had died and then been replaced by Heifer with a new cow. If deceased animals had been taken into account, some differences in survival rate between the two samples may have become apparent.
- ❖ After visiting several farms in the second and third week it became clear that some farmers do not consistently practice zero-grazing. If the study were to be repeated or extended, this would be a useful indicator to include, based on its importance in Heifer's sustainable farming goals.

After collecting and analyzing data for this study, areas of further exploration are apparent. Now that data has been obtained on differences between the animal husbandry practices of government-facility-trained and in-village-trained farmers, data from which to derive the explanation for these differences would be useful. A study comparing the actual trainings provided by the Liti Tengeru Animal Husbandry Training Center to the trainings provided by each supervisor in the zone would be helpful in doing this; however, trainings are infrequent so it may be difficult to complete such a study.

CONCLUSION

The aim of this study was to determine what differences exist between Heifer dairy cow farmers who were trained at the Liti Tengeru Animal Husbandry Training Center as compared to those trained by their project supervisor in the village. The study was done to provide Heifer Tanzania with information that may be of assistance in determining the most effective use of their training budget. If the results, as predicted, were to have shown in-village-trained farmers to be practicing equal or higher quality dairy cow husbandry (as determined by the indicators in the observation-based survey used), it would indicate that the more expensive training in Liti Tengeru may not be necessary. However, the data collected showed, contrary to predictions, that government-facility-trained farmers had overall higher means for a majority of the indicators used in the survey; t-tests showed four of these differences were statistically significant (α=0.05).

This study focused purely on current husbandry practices, it obtained no data to support explanations for *why* these differences exist. However, after completing the study, my impression is that important differences exist between the in-village trainings and government-facility trainings, which result in differing animal husbandry practices. Supervisors provide organized group trainings, sometimes, but not always, in the form of seminars, for as little as two days. Training at the Liti Tengeru Animal Husbandry Training Center consists of two weeks of organized group trainings. Although it is a hardship to remove a farmer from home for two weeks, I speculate that, in the eyes of farmers, this process puts greater emphasis on the importance of the training than does the shorter in-village training. It is also possible that important differences exist in the thoroughness and breadth of training between the two, possibly a result of the very fact that less money is spent on in-village trainings. If this is the case, perhaps increasing funding for in-village trainings could encourage improvement.

It is important to take into account, however, that only birthing interval and written-record-keeping indicators showed statistically significant differences. So, although government-facility-trained farmers may have performed better in those categories, it is questionable whether that is sufficient reason to re-examine the entire training process. Further analysis of the data showed significant differences between indicator means of each supervisor's in-village-trained farmers. This is consistent with the fact that length and method of training varied among supervisors. This emphasizes that results are specific to the study areas. This study was conducted in nine villages near Mt. Meru; as such the results of this study speak for those

villages only. Further data collection would be required to form conclusions about farmers in other villages.

Heifer Tanzania's ideals center around promoting sustainable food production in order to alleviate poverty. The sustainable farming practices they teach include creating fertile land by way of manure collection from zero-grazing dairy cow husbandry, and planting animal forage on contours. During my ninety visits to farms in villages near Mt. Meru it was clear that, overall, Heifer farmers are putting these techniques into practice. It was also clear that people who are part of Heifer leadership in the villages, such as committee chairmen, para-veterinarians, farmer-motivators and project supervisors, all work very willingly, often without pay, to make the project a success. So, although variations in training and animal husbandry practices exist, Heifer Project is having very real effects on animal husbandry and agricultural practices, and hopefully as a result, helping families to step out of poorness and ensure success in the future through sustainable farming.

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