Relationship between Fodder Production Practices and Dairy Production in Homa Bay and Ndhiwa Districts, Kenya

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Abstract

Livestock Development Programme (LDP) was initiated to address constraints in dairy production among small scale farmers. The ultimate goal was to increase milk production and improve levels of living for dairy farmers in Homa Bay and Ndhiwa districts. The study determined the relationship between LDP package on fodder production practices and dairy production in the study area. Main findings indicated that respondents adopted LDP package on fodder production with some gaps. The study showed that respondents allocated less land for fodder production and grew fewer varieties of fodder than during the programme's implementation. It was also found out that respondents who had smaller pieces of land either leased land to grow adequate fodder or bought to supplement what they grew. Due to this, it was recommended that the Ministry of Livestock Development in collaboration with stakeholders should carry out demonstrations on diversified fodder production establishment for better animal nutrition.

Key Words*:* Dairy production, fodder production, livestock development programme, livestock development programme package, relationship

1. Introduction

Since independence, Kenya has relied heavily on the agricultural sector which includes Livestock production as the base for economic growth, employment creation and generation of foreign exchange. About 70% of the country's population lives in the rural areas and depends on agriculture and livestock production for livelihood (Government of Kenya (GoK), 2010; GoK, 2004; Njugiri, 2007 and Ministry of Livestock and Fisheries Development (MoLFD), 2007). Livestock sector provides food and cash needs of farmers, employment to about 10 million people and contributes ten percent to GDP through sales of milk, milk products, eggs, small stock like sheep, goats and chicken (GoK, 2010; Gangadhar, Satyanarayan and Veeranna, 2009).

Kenya is one of the largest producers of dairy products in Africa with about 3.5 million improved dairy cattle, 9 million zebu, 900,000 camels and 12 million goats (GoK, 2007; Ministry of Planning and Finance, 2010 and Omore, McDermontt, Muriuki and Thorpe, 2009). Dairy industry in Kenya is a relatively more developed livestock sector compared to dairy industries in other countries (Muriuki, 2009) and it's in view of this that implementation of Vision 2030 is expected to increase income from agriculture, livestock and fisheries production for development and consequent transformation of Kenya into a medium-income country that provides a high quality life to all its citizens (GoK, 2007).

Strategy for Revitalizing Agriculture (SRA) (GoK, 2004), observed that Kenya's ability to exploit fully its potential in livestock production is hampered by diseases and low quality feeds. According to Homa Bay District Development Plan GoK (2002), the Kenyan Government planned to develop livestock industry further through enforcing a new national policy to control livestock diseases through enhanced surveillance, vaccinations and controlled movement of animals from neighbouring countries. Dairy animals reared in the study area are crosses of Ayshires, Jersey and Friesians. Zebu dairy cows and their crosses with European breeds are also reared. The area produces less milk compared to other districts in the same province because most farmers rear local cows compared to grade cows (Ministry of Livestock Development (MoLD), 2008).

Livestock Development Programme (LDP) was initiated in Homa Bay and Ndhiwa districts in 2009. It was implemented in the following phases; 1991-1994, phase 1; 1995-1997, phase 2; 1998- 2002 phase 3 and the phasing out period was from 2002 to 2003 (Ministries of Foreign Affairs Finland, Finance, Agriculture and Livestock Development, Cooperative Development and Finnish Cooperative Centre, 2003). The programme was funded by the Finnish and Kenyan Governments and focused on upgrading Zebu, fodder production practices, disease control practices and socio economic status of LDP farmers. It was expected that the programme would address low genetic potential for Zebu dairy cows, high disease incidences, poor nutrition and low level of dairy management which were the main constraints to milk production. Target groups were small scale dairy farmers with special emphasis on women. LDP completion report by the Ministry of Foreign Affairs Finland et al. (2003) observed that the programme changed dairy farmers' belief that dairy animals could not survive in Homa Bay and Ndhiwa districts.

1.1 Literature Review

1.1.1 World Fodder Production

With well managed fodder flow, livestock enterprises will show a positive margin over feeds if not overall costs. Since costs make up about 70% of all variable costs on a typical dairy farm, it is crucial to devote much attention to planning feed supplies (Jones, 2005). Fodder and feed scarcity is one of the major bottlenecks for livestock sector development. Enough land is hardly availed for its production due to reduced sizes and other competing crops (Yusufu, Zaman, Amin, Amin and Aktar, 2010). Globally, leaf meal is probably the most widely traded product from fodder shrubs and is found in Indonesia, China, India, Thailand and Philippines (Franzel, Wambugu, Nanok, Kavana, Njau, Aithal, Muriuki and Kitalyi, 2007). A study by Singh (2005) in Kashmir Valley discovered that holding other factors constant, milk production increased with feeding of digestible crude protein and total digestive nutrients until genetic limit of animals was reached.

1.1.2 Fodder Production in the Tropics

Tropical areas lie between tropics of Cancer and Capricorn that are on latitudes 23.5^0 North and 23.5^0 South of the Equator. These areas are characterized by warm temperatures because of receiving direct rays from the sun most of the year. High temperatures in the tropics reduce availability of adequate feeds and diseases caused by organisms that thrive well in hot areas are a challenge in tropics unless controlled. Due to this, East Africa experiences economic poverty, families are caught in a downward spiral of poverty, low food intake, poor education and health services. Despite this, smallholder dairy is a long lasting strategy to increase household income, provide reliable livelihood and promote women's social and economic status (East Africa Dairy Development (EADD), 2009). Milk production in the Tropics is based on bovine population with low productivity and conversion of feeds and fodders into milk.

Livestock production systems in Africa and the near East are inefficient and offer much scope for improvement and stocking density should provide enough forage to enable the cows to produce 90% of their potential and the balance to come from supplements (Phillips, 2001). Milk production in tropics is affected by inadequate and poor quality fodder. Such feeding results in protein deficiency that contributes to loss of body condition and low milk production in lactating cows (Honnappogol and Tandle, 2010). Few farmers feed their dairy animals on adequate legume forage which is usually rich in protein and contains a large portion of digestive amino acids hence essential for high milk yields (Singh, Chillar, Yadar and Joshi, 2010). Other farmers utilize non- protein nitrogen sources for example urea, to compensate for lack of nitrogen in fibrous feeds due to inadequate protein feeds than fibrous ones (FAO, 2007). In Ethiopia livestock farmers suffer from feed shortages due to seasonality in production which has led to increased use of crop residues and reliance on purchased feeds to support livestock production.

In view of this, the country has initiated Ethiopia Livestock feeds project funded by Australia Centre for International Agricultural Research (ACIAR) through ILRI to design feed based interventions (Thorpe and Duncan, 2012).

1.1.3 Fodder Production in Kenya

Dairy cattle are ruminants whose production is based on fodder. Majority of dairy herds in smallholder farms in Kenya largely depend on natural tropical grass pastures and crop residues for nourishment (Ouda, 2001). Semi-arid pastoral areas are susceptible to climate variability subjecting household and livestock to droughts and floods. In Dertu Millennium Village of northern Kenya, drought in 2006 led to deterioration of pastures and water supplies for livestock (Standing Committee on Nutrition (SCN), 2010). Yet proper feeding contributes to fertility required for initiation of the first lactation and dairy survival (Hare, Norman and Wright, 2006). Scarcity of animal feeds has been associated with a lot of losses of livestock, livelihood assets and rising poverty.

Fodder production and conservation have been identified as an appropriate intervention towards improving household nutritional status and alleviating poverty. This is possible through improved community managed disaster risk reduction against impact of drought by providing surplus feeds to dairy animals (ADESO (African Development Solutions), 2012). Planted fodder crops, both annual and perennials are becoming very important animal feed resources in Kenya because of their superiority in dry matter yield which is a requirement in dairy production (Thairu and Tessema, 2013).

1.1.4 Fodder Production in Relation to Milk Yields

Milk production from cross-bred cows previously fed on grasses and crop residues increase sustainably if their diet is improved with high protein fodder shrubs (Wambugu, Franzel, Cordero and Stewart, 2006). Major problem in dairy production in most areas is poor management of fodder resulting in low production from natural and improved pastures (Patil , Mathur , Patel, Patidar and Mathur, 2010). Without progress in agriculture, poverty and low productivity situation in dairy may not improve and agro- based industries are un- likely to prosper (Bhatia and Batra, 2003). Dairy science requires that a dairy animal consumes 3% of its body weight on dry matter (Agricultural Society of Kenya (ASK), 2010).

Conserved hay, agro-industrial by-products and commercial concentrate rations are the major feed resources used by dairy farmers (Tegegne, Gebremediun, Hoekstra & Alemayehu, 2010) and poor forages contribute to low milk production. Most dairy farmers in Kenya feed their animals on feeds that are deficient in quality, quantity, concentrate and mineral supplement besides limited access to fodder and water in dry season contributing to lower milk production than expected (GoK, 2007).

Nutrition plays important roles in keeping cattle healthy and strong therefore implementing an adequate nutrition programme can improve milk production and reproduction performance. Supplementing dairy cows that feed on tropical grasses with Lucerne can raise milk production from 10-12 to 14-15 litres per cow per day (Infonet, 2010). Poor quality forages complicate the delicate matter of energy balance due to lower voluntary dry mater intake by dairy animals yet for high milk production, dairy cows should consume enough dry matter possible (Guthrie and West, 2010).

A research carried out in Punjab, Pakistan by Javed (2004) on environmental factors that affect milk yields in Friesian cows, established that variations in seasons had an influence on milk production. Cows that calved down in autumn produced maximum levels of milk due to availability of fodder and cool temperatures. Those that calved down in spring were second in production while the poorest lowest production was experienced amongst cows that calved down when it was dry and hot. In Netherlands research findings by Elgersma, Dukstra and Tamminga (2006) showed that for every 10% increase in grazed grass in dairy cow ration, milk production costs reduced by 2.50 cents and lactating cows take between 20-50 % herbage more than none lactating ones. It was in view of this that LDP chose fodder production as one of its components in order to improve feeding levels of dairy animals in the study area and enhance dairy production with reduced nutritional deficiency disease. This study aimed at finding out relationship between fodder production and current dairy production.

1.1.5 Objective of the Study

To determine relationship between fodder production practices and current dairy production among LDP dairy farmers in Homa Bay and Ndhiwa districts

1.1.6 Hypothesis of the Study

H_{01}. There is no statistically significant relationship between fodder production practices and current dairy production among LDP dairy farmers in Homa Bay and Ndhiwa districts.

2. Methods

2.1 Research design

This was a survey that adopted a descriptive correlation design. The design was suitable because respondents had equal opportunities to participate, conditions were not altered and data was collected by asking all respondents in the sample similar questions through an interview schedule and a questionnaire. Data was collected at one point in time and results obtained could be generalized on a bigger population. The design enabled the researcher to gather data on what was going on and what existed (Borg and Gall, 1989) in relation to LDP programme packages and dairy production in Homa Bay and Ndhiwa districts.

2.1.1 Study Location

The study area has 366,620 people, constituted by 174,306 males and 192,314 females according to the 2009 census. The Homa Bay and Ndhiwa districts were purposively selected because LDP was implemented in the area. The research was carried out in Asego, Rangwe, Nyarongi, Ndhiwa and Riana divisions in Homa Bay and Ndhiwa districts. The two districts have an area of 1160.4 km^2. Ecological zones range from Lower $Midland_2$ to Lower $Midland_4$ (LM_2–LM_4). Rainfall patterns are bimodal with long rains being received from February to June (450mm-1000mm) per annum while the short ones are received from September to December (250mm–700mm) per annum with 60% and 25% reliability respectively. Livelihoods of the people in the study area are crop production, livestock rearing and some fishing.

2.1.2 Sample

Asego, Rangwe, Ndhiwa, Nyarongi and Riana divisions were selected through purposive sampling because they implemented the programme hence had the required information with respect to the objective of the study. Proportionate sampling was used to obtain numbers of respondents per division. LDP farmers' names per division were written on papers, folded and put in a container. Using simple random sampling, the numbers required per division were picked from the container until the target per division was attained to achieve 151 sample size. Using a sample size of 150, number of LDP farmers in each division was calculated and multiplied by 100% which gave 151. The study covered a sample size of 151 so as to reduce the sampling error.

Kathuri and Pals (1993) recommend not less than 100 for a survey research to reduce sampling error. Borg and Gall (1989) also recommend more than 100 respondents to reduce sampling error. The sample size chosen by the researcher gave a better representation of farmers since it was more than what is recommended for a survey research. This would have a smaller sampling error which would otherwise contribute to erroneous conclusions being made.

2.1.3 Instrumentation

Interview schedule and questionnaire containing open and closed ended questions were used. Interview schedule was suitable for dairy farmers because some farmers were unable to read and write and the researcher asked for more information and clarification from them. The tool enabled the researcher to obtain the data needed to meet a specific objective of the study and to standardize the situation to some degree. Interview schedule consisted of sections; A and B. Section A gathered demographic and education data while section B gathered data on fodder production practices.

2.1.4 Validity

Validity is concerned with extent to which an instrument measures what it is supposed to measure. It was determined by a panel of experts composed of supervisors in the Applied Community Development Studies Department and the researcher's colleagues. The researcher used expertise from the panel to improve the instruments.

2.1.5 Reliability

The interview schedule was pilot-tested among 20 (Borg & Gall, 1989) dairy farmers in West Kanyada location in Asego division. This location was excluded from the research to ensure that respondents in the research were different from the ones used in pilot-testing.

Responses captured were analyzed using Cronbach's alpha and corrections made to the tool in order to increase similarities in answers provided. Cronbach's alpha is more suitable since it takes less time to compute reliability, it results in conservative estimates of reliability which give lower coefficient that reduce chances of making erroneous conclusions. Other methods over-estimate coefficient which may result in erroneous conclusions being made (Mugenda and Mugenda, 1999).

Cronbach's alpha;

$$\alpha_{s\tan dardized} = \frac{K \bullet \bar{r}}{\left(1 + (K-1) \bullet \bar{r}\right)}$$

K- number of components (items or test lets)

$\bar{r}$ - the mean of the $\frac{K \bullet (K-1)}{2}$ non-redundant correlation coefficients (mean of an upper triangular, or lower triangular, correlation matrix).

The accepted coefficient value is 0.713

2.1.6 Data Collection Procedure

A research permit was sought from the then National Council of Science and Technology by the researcher through graduate school of Egerton University to authorize the study. Ministry of Livestock Development in the research area was informed about the study. Data was collected from farmers through face to face interviews.

2.1.7 Data Analysis

Data gathered was analyzed using Statistical Package for Social Science (SPSS). Descriptive and inferential statistics were used. The descriptive statistics included percentages and frequencies while multiple linear regression analysis was used for inferential statistics. Data was analyzed using regression by running acreage allocated for fodder production after LDP and varieties of fodder grown currently (independent variables) and moderator variables (marital status, age, gender, farm size and education level) were run against daily milk yield and current income from milk (dependent variables).

Regression analysis was applied to test hypothesis of the study and to determine the relationship between independent and dependent variables. Moderator variables were built into the study to assess any possible influence on the relationship between research variables. Variables that had nominal scales for example gender and marital status were assigned dummy codes to allow them to be used in the regression analysis. Nominal variables can be entered into regression as long as they are dummy coded (Moss, 2008). Data gathered for this study was on nominal, ordinal, interval and ratio scales therefore descriptive and inferential statistics were used in analysis. It was necessary to look at assumptions that guided the statistical procedures selected for analyzing data to establish whether they had been met or if not, the extent to which they had not. One of the assumptions in multiple regression analysis is accuracy of data. Data for all variables in this study were entered by the researcher who also checked the accuracy of the data entered. Each data point, minimum and maximum values for each variable were checked to ensure that they were valid. The determination of analysis for the hypothesis was as follows;

H_{01}. There is no statistically significant relationship between fodder production practices and current dairy production among LDP dairy farmers in Homa Bay and Ndhiwa districts

Data was calculated at interval scale level. Percentage, frequencies and multiple linear regression analysis were run.

3. Results and Discussions

3.1 Social and Demographic Characteristics of Respondents

Respondents comprised 64% women and 36% men. Women were more than men because LDP targeted women. Seventeen percent were between 43-48 years and 60% were in the age range of 49-60 years. The rest (23%) were over 60 years old. Majority of the respondents (76%) reported being married, 21% were widowed, 1% was separated while single constituted 1%. Study results indicated that most of the respondents were middle aged which was explained by the fact that many elderly engage in farming compared to the young. Regarding education, 43% had primary education, 25% secondary education and about 23% had tertiary education.

These findings showed that most of the respondents had formal education. The average family size in Homa Bay and Ndhiwa districts was nine members per household at the time of the research.

Forty one percent (41%) of the respondents had 4 children who had completed form four, 27% had 3, 19% had 2, 8% had 1 child while 5% had no child who had completed form four. More than half (56%) of respondents had 3 children formally or informally employed, 25% had 2, 10% had more than 4, 7% had 1while 3 had no child either formally or informally employed.

3.1.1 Objective: The objective of the study was to determine relationship between fodder production practices and current dairy production among LDP dairy farmers in Homa Bay and Ndhiwa districts.

The information sought from respondents was on implementation of improved methods of production. Through LDP programme respondents were trained on fodder varieties and methods of production. Data was collected on acreage allocated for fodder production during LDP and after LDP implementation, number of varieties that were grown during and after LDP implementation. The study also gathered data on how frequent respondents applied manure to fodder crops, whether they grew sufficient fodder and how many kilogrammes of hay and silage were conserved. The researcher also sought to know the number of kilos of home-made feeds that were formulated every three months and kilos of napier fed to cows.

The number of respondents who allocated less than an acre of land for fodder production increased from 33 during LDP implementation to 45 after programme implementation, while those who allocated one acre decreased from 103 to 82. This was an indication that although the package on fodder production practices was adopted, the acreage allocated for the same reduced possibly due reduced land size caused by land segmentation and lack of subsidies in fodder production. However, those who allocated 2-2.99 acres increased from 13 to 21 respondents while those who allocated above 3 rose from 2 to 3.

The study also considered the number of varieties that were grown and the number respondents who grew them. Results indicated that number of respondents who grew 1-2 varieties increased from 59 to 110. Those who grew between 3-4 varieties reduced from 72 to 36 while those who grew above 4 varieties reduced from 20 to 5 respondents. This showed that although many respondents grew fodder, the number of varieties they grew reduced. Possibly sub division of ancestral land by fathers to their sons contributed to this and may be most land was used for other purposes. They may have leased land for fodder production and bought ready fodder. Since majority of the respondents were middle aged, this indicated that they were not very energetic to manage many varieties of fodder.

To improve on fodder quality, respondents were encouraged to apply manure in fodder fields. Majority of respondents (62%) applied manure at an interval of three months as recommended in the LDP package on fodder production and 10% applied after six months. More than half of the respondents (78%) reported planting insufficient fodder for their animals which was contrary to LDP package. This may have been due to the fact that most of them allocated one acre of land for fodder production because of reduced acreages owned by specific respondents. This resulted in 74% not conserving fodder into hay and silage. Additionally, 29% fed their dairy cows on less than 12 kg of napier grass/animal /day due to lack of enough conserved fodder. However seventeen percent fed 16 kg of napier grass to each dairy cow/day which was the recommendation in the LDP package. Although they allocated less land for fodder production, they ensured that there was enough napier for dairy cows.

The objective had a null hypothesis that stated that there was no statistically significant relationship between fodder production practices and current dairy production among LDP dairy farmers in Homa Bay and Ndhiwa districts. The independent variable for the hypothesis was fodder production practices that were measured by acreage allocated for fodder production and number of varieties of fodder grown currently while the dependent variable was dairy production measured by daily milk yield and current income from milk.

First regression examined the extent to which acreage allocated for fodder production and number of varieties grown currently, age, gender, farm size, marital status and education level explained variance in daily milk yield. The model was statistically significant indicating that there was a relationship between fodder production practices and dairy production ($F=2.373$; $df= 7; 150$; $p<=.05$). The independent variables explained 10.4 % of the variance in dependent variable.

Acreage allocated for fodder production and farm size were significant. The significance in acreage allocated for fodder production could be explained by the fact that, fodder availability, sufficiency and good management determined daily milk yield.

Number of varieties grown was not significant, this could be explained by the fact that respondents were able to buy from other farmers what they did not grow on their farms. The negative relationship could probably be due to the fact that the respondents who grew many varieties were fewer than expected and possibly had other ways of making up for lack of variety in their fodder through buying of fodder or leasing land to grow it (Table 1).
Farm size was significant but negative. This showed that respondents allocated less land for fodder production due to reduced land sizes caused by sub division of ancestral land. The respondents possibly accessed more fodder through leasing land to grow it or buy from neighbours. Leasing land to produce fodder is a common practice for dairy farmers who own small pieces of land. Age, gender and marital status did not influence daily milk yield. Young, elderly, men, women, single and married had equal opportunities to increase daily milk yield.
A second regression analysis was run to determine the extent to which acreage allocated for fodder production, number of varieties grown currently, age, gender, farm size, marital status and education level contributed to variance in current income from milk. The analysis indicated that the model was significant showing the relationship between fodder production practices and dairy production ($F=2.209$; $df=7$; 150; $p <.05$) and could account for 9.8 % of the variance in current income from milk.

Acreage allocated for fodder production and the number of varieties grown currently was significant. This could be explained by the fact that when more land was allocated for fodder production and well managed, milk yield increased which in turn contributed to high current income from milk (Table 2). Number of varieties of fodder grown currently was significant and this could be explained by the fact that planting different varieties enhanced availability of diversified nutrients needed by animals for better health which would translate in increased milk yield hence high current income from milk. The negative relationship showed that the number of respondents who grew more than 2 fodder varieties were fewer than it was expected. Explanation could be that respondents were able to buy what they did not produce or lease land and produced them.

Farm size had a negative and insignificant relationship. Possibly respondents who had reduced or big pieces of land had equal opportunities to increase current income from milk. Respondents with less land had other ways of increasing current income from milk which was not related to their land for example buying fodder, leasing land for fodder production and using mineral supplements that increased milk yields which reflected in high income from milk. It also indicated that respondents who grew many varieties of fodder were fewer than it was expected and they ensured that dairy cows got enough fodder.

Age, gender, farm size, marital status and education level were not significant. This could be because respondents of all ages, men, women, married, single, educated and none educated had similar opportunities to increase current income from milk. These findings agree with a study by Infornet (2010), on importance of nutrition that keeps cattle healthy, strong and that running an efficient nutrition programme can also improve milk production and reproduction performance.

Results indicated that no moderator variable influenced variance in the dependent variables except farm size. It is an indication that any variance in the dependent variables was influenced by independent variable. Respondents adopted fodder production practices although number of varieties grown reduced. Low number of varieties of fodder grown needs to be addressed. Analysis to test null hypothesis showed that a relationship existed between LDP package on fodder production and current dairy production therefore the null hypothesis was rejected.

4. Conclusions, Recommendations and Implications

4.1 Conclusion

There was a significant relationship between the independent and dependent variables. This was an indication that respondents still implemented some of the skills passed to them on fodder establishment. It was concluded that respondents adopted fodder production despite the fewer varieties they grew. This showed that some packages on fodder production were not being implemented. Data generated in this study may add to existing knowledge and literature on dairy production in the study districts and in Kenya.

4.1.1 Recommendations

Analysis showed that respondents adopted fodder production practices passed to them through trainings although they did not grow many varieties. Due to this, it was recommended that Ministry of Livestock Development and stakeholders should carry out more demonstrations on diversified fodder establishment for better animal nutrition.

4.1.2 Implication

The results indicated that fodder production technology had been adopted and could spread to other farmers. Therefore, staff in the Ministry of Agriculture and Livestock could be used to disseminate fodder production practices to other farmers for improved performance in the dairy sector.

Table 1: Summary of Sampling Procedure for LDP Farmers

Division	Dairy farmers	Divisional Percentage (%)	Respondents per Division
Asego	252	$\frac{252}{1044} \times 100 \equiv 24\,\%$	$\frac{24}{100} \times 150 \equiv 36$
Rangwe	324	$\frac{324}{1044} \times 100 \equiv 31\,\%$	$\frac{31}{100} \times 150 \equiv 47$
Ndhiwa	198	$\frac{198}{1044} \times 100 \equiv 19\,\%$	$\frac{19}{100} \times 150 \equiv 29$
Nyarongi	162	$\frac{162}{1044} \times 100 \equiv 16\,\%$	$\frac{16}{100} \times 150 \equiv 24$
Riana	108	$\frac{108}{1044} \times 100 \equiv 10\,\%$	$\frac{10}{100} \times 150 \equiv 15$
Total	1044	100	151

Source: Adapted from LDP project completion report 2003

Table 1: Relationship between Acreage Allocated for Fodder Production, Number of Varieties Grown Currently and Daily Milk Yield

Variable	b	Standard error	Beta (Standardized Coefficient)	Zero order Correlation coefficient	Partial correlation coefficient	t
Acreage allocated for fodder production	.347	.114	.267	.159	.247	3.050*
Number of varieties grown	-.166	.144	-.095	-.052	-.091	-1.151
Age	.099	.065	.124	.052	.125	1.508
Gender	.051	.165	.027	-.029	.026	.309
Farm size	-.268	.096	-.239	-.152	-.227	-2.790*
Marital status	-.009	.047	-.015	.002	-.016	-.186
Education level	.081	.061	.107	.136	.111	1.330
Constant	2.214	.477				4.638*

R=. 323; R^2 .104; df=7; 150; F=2.373; p<.05; * significant at .05 level

Table 2: Relationship between Acreage Allocated for Fodder Production, Number of Varieties Grown Currently and Current Income from Milk

Variable	b	Standard error	Beta (Standardized coefficient)	Zero order Correlation coefficient	Partial correlation coefficient	t
Acreage allocated for fodder production	.310	.119	.229	.129	.213	2.606*
Number of varieties grown	-.447	.151	-.245	-.216	-.241	-2.965*
Age	.090	.068	.109	.080	.109	1.310
Gender	-.013	.173	-.006	-.084	-.006	-.074
Farm size	-.129	.100	-.110	-.107	-.102	-1.287
Marital status	-.029	.049	-.050	-.050	-.048	-.602
Education level	.005	.064	.006	.029	.006	.077
Constant	3.038	.500				6.081*

R=.312; R^2=.098; df= 7; 150; F=2.209; p<.05; * significant at .05 level

5. References

ADESO (African Development Solutions). (2012). *Supporting Livelihoods through Fodder Production in Garissa, Kenya*. Retrieved on 12/2/2013 from, http://www.adesoafrica.org.

Agricultural Society of Kenya (ASK). (2010, July-August). Animal feeds. *Kenya* Farmer magazine, 156 (23)

Bhatia, B. & Batra, G. (2003). *Rural Commercial Entrepreneurship*. New Delhi; Deep & Deep publications PVT ltd.

Borg, W. & Gall, M. (1989). *Educational Research: An Introduction* (5th edition). New York; Longman.

East Africa Dairy Development. (2009). *Why Dairy is Important.* Retrieved on12/2/2009 from http//www.eadairy.org/contact-us.php?article=11

Elgersma, A, Dukstra, J. & Tamminga, S. (2006). *Fresh Herbage for Dairy Cattle.* Dordrect, Netherlands; Springer. Retrieved on 6/3/2010 from http://library.Wur.nl/fronts/perenial_ryegrass/10_elgersma.pdf

FAO. (2007). *Animal Production and health.* Rome; Publication division.

Franzel, S. , Wambugu, C. , Nanok, T. , Kavan, P. , Njau, T. , Aithal, A. , Muriuki, J. & Kitalyi, A. (2007). *Production and Marketing of leaf meal from Fodder Shrubs in Tanga Tanzania.* Retrieved on 12/2/2013 from www.worldagroforestry.org

Gangadhar, K. S. , Satyanarayan, K. & Veeranna, K. C. (2009). Livestock Economics: *Marketing, Business Management and Accountancy*. New Delhi: New India Publishing Agency.

Government of Kenya. (2002). *Homa Bay District Development Plan* (2002- 2008). Nairobi; Government Printers.

Government of Kenya. (2004). *Strategy for Revitalizing Agriculture* (SRA) (2004- 2014). Nairobi; Government Printers.

Government of Kenya. (2007). *Vision 2030*. Nairobi; Government Printers.

Government of Kenya. (2010). *Agricultural Sector Development Strategy*. Nairobi; Government Printers.

Guthrie, L. D & West, J. W. (2010). Nutrition and Reproduction Interactions in Dairy Cattle. *Nutrition Journal*, 10(107). Retrieved on 5/14/2010 from http://www.nuritionj.com/content/10/107

Honnappagol, S. S. & Tandle, M. K. (2010). *Artificial Insemination and Treatment of Infertility in daily animals.* Jodhpur: Scientific Publishers, India.

Infornet. (2010). Fodder and Pasture Production (for Ruminants). *Biovision* Foundation for Ecological Development. Retrieved on 3/30/2010,from www.infornet-biovision.org-Fodder production

Javed, K. (2004). *Environmental factors affecting milk yields in friesian cows in Punjab,Pakistan.* Retrieved on 12/8/2009 from http://pvj.com.pk/pdf_files/24 2/5

Jones, R. I. (2005). Fodder Production Planning for the Dairy Herd. Retrieved on 12/2/2013 from http://agriculture.kzntl.gov.za/agriPublications/guidelines/

Kathuri, N. J. & Pals, D. A. (1993). *Introduction to Educational Research*. Egerton University, Njoro, Educational Media Centre.

Ministries of; Foreign Affairs Finland, Finance, Agriculture and Livestock Development Cooperative Development & Finnish Cooperative Centre. (2003). *Programme Completion Report Volume II*. Plancentre limited; Nairobi.

Ministry of Finance and Planning- Central Bureau of Statistics. (2010). *Population and Housing Census for 2009*. Nairobi; Government printers.

Ministry of Livestock and Fisheries Development. (2007). *Draft sessional paper on Dairy Industry Development.* Nairobi; Department of Livestock Development.

Ministry of Livestock Development (2008). *District annual report*. Homa Bay district

Mugenda, O. M & Mugenda, A. G. (1999). *Research Methods: Qualitative and quantitative Approaches.* Nairobi; Acts Press.

Muriuki, H. G. (2009). *Smallholder Dairy Production and Marketing*. Retrieved on 10/1/2009,from http://www.ilri.org/Infoserv/Webpub/fulldocs/south_south/ch16.htm#P74-

Njugiri, C. (2007). Economic Importance of Livestock. *Mifugo News.* 2 pp 4 – 5.

Omore, A. O. , McDermott, J. , Muriuki, H. & Thorpe, W. (2009). *Smallholder Dairy Herd Management in Kenya*. Retrieved on 12/8/2009, fromhttp://www.smallholder.dairy.org/publications/Conference/Omore%20al-1998smallholder%20herd d%20management.IDC.pdf

Ouda, J. , O. (2001). Fodder Production. Retrieved on 12/2/2013 from www.Infonet-Biovision: fodder production

Patil, N.V. , Mathur, B. K. , Patel, A. K. , Patidar, M. & Mathur, A. C. (2010). *Feeding* and Management of Livestock during Drought and Scarcity. Jodhpur: Scientific Publishers. India.

Phillips, C. (2001). *Principles of Cattle Production*. Wellingford; CABI Publishers.

Singh, H. (2005). *Dairy Farming*. New Delhi; Nangia Publishing Corporation.

Singh, J. V. , Chillar, B. , Yadar, B. D. & Joshi, U. N. (2010). *Forage legumes*. Jodhpur: scientific Publishers. India.

Standing Committee News. (2010). Food and Nutrition Security implications. *Climate Change Bulletin,* No. 38 ISSN 1564-3743.

Tegegne, A. , Gebremediun, B. ,Hoekstra D. & Alemayehu, N. (2010). *Rural Urban linkage in marketing orientated Dairy Development in Ethiopia: Lessons from the Ada'a Dairy Cooperative.* Retrieved on 3/8/2010, from http://www.wikimediafoundation.org.

Thairu, D. , M & Tessema, S. (2013). *Research on Animal Feed Resources*. Retrieved on 12/2/2013 from http:/www.fao.org/wairdocs/ilri/x5548e0d.htm#TopofPage.

Wambugu, C. , Franzel, S. , Cordero, J. & Stewart, J. (2006). *Fodder shrubs for Dairy* Farmers in East Africa: *Making decisions and putting them into practice*. Retrieved on 12/2/2013 from, http://www.worldagroforestry.org/downloads/publications/PDFS/B14.

Yusufu, M. , A. , Zaman, S. , M. , Amin, M. , Amin, M. , R. , & Aktar. , S. (2010). *The Agriculturalists* 8(2): 1-7. Retrieved on 12/2/2013 from http://www.banglajol.info/index.php/AGRIC/issue/view/448