Survey on Current Status, Challenges and Opportunities towards integration of Traditional Smallholder Crop-Livestock Systems in Kenya

Abstract

The current study reports the results of a baseline survey conducted to establish current status of optimizing productivity of crop-livestock systems in Kenya. Results from the study showed that 74% and 18% of the household head and respondents were male and female respectively, indicating a male dominance of household headship. The household head (69%) and respondents (16%) reported to have completed classes for formal school. On average, farmers were walking 1.83 Km, 5.18 Km, 4.65 Km, and 12.79 Km to the nearest village market, town market, extension office and farmers' training centers respectively. This shows that extension and communication services are still far apart from the farming communities, with a negative implication on technology adoption and household food and nutrition security. Majority of the farmers did not utilize organic nutrients for crop production (96%). Open heaping/piling, composting with other materials, use ofsolid and liquid manures was reported to be utilized on average 67 kg, 30 kg, 11 kg and 2 kg respectively. This implies a poor manure management, low adoption and utilization levels of organic manures, with subsequent impact on climate change, crop productivity and household food and nutrition security. The main constraint limiting the use of organic fertilizers were ranked as follows; ignorance of the technical aspects linked to the use of manure as an organic fertilizer (17.8%), low awareness of manure usefulness to improve soil fertility (16.4%), high affordability and timely accessibility of chemical fertilizers (16.3%). Results further show that majority of the respondent did not utilize Nitrogen fixing plants (66%), nutrient cycling (84%) and legume crops (75%). The main Nitrogen-fixing plants were faba bean (10%), Sesbania (9%), cowpea (5%), alfalfa (2%)and sunflower (1%) respectively. The survey recommends promotion of climate smart interventions and organic soil fertility managementapproaches, farmers capacity building and promotion of agribusiness.

Key words: *Crop-livestock integration, Nutrient cycling, Soil fertility, Organic farming*

Introduction

Despite the tremendous contribution of agricultural sector to Kenya's economy, the current reported productivity of major cereal crops such as maize still remains low. Given an average consumption requirement of at least 2700 thousand MT per year, the trend shows deficit in most of the years. These deficits are met through imports. Cereal yields have remained at an average low yield of 2 tons per hectare below the possible average of 6 tons per hectare. This situation is attributed to inadequate adoption of modern production technologies such as optimum fertilizer use because of their high input costs, lack of technological know-how on production of cost-effective home-made biofertilizers and manure management and storage technologies [1]. The chemical fertilizer uses in Kenya range about 65.2 kg per hectare, with an approximate yield of 1.806 tons per hectare of cereal crops, which is far below the optimum recommended rates of 200kg per hectare, with an expected yield of 4-8 tons per hectare [2].

Crop-livestock mixed farming is a process by which farmers produce crops and rear livestock simultaneously to ensure sustainable agriculture. This farming system is acknowledged as sustainable due to its complementary and synergy, contribution to welfare, food security, income, and poverty alleviation. Households who practice crop–livestock systems have improved 50% of productivity and farm income in other parts of the world as compared to smallholders that only raise crops[3].Among agricultural inputs for crop production, use of fertilizer is the most determinants of productivity. The supply sources of plant nutrients include organic manures, plant residues, biological fixations and commercial inorganic fertilizers.However, their price is not be affordable by small-scale farmers, and in most cases, they are not available at the right time in Kenya. Hence, exploring existing options that could serve the purpose of inorganic fertilizers is feasible. For instance, legumes play a key role in integrated soil fertility management due to their ability to fix atmospheric N_2 in symbiosis with rhizobia. They supply organic resources and can counteract other constraints by enhancing fertilizer uptake, suppression of weeds, among other benefits[4].

According to [5], a mature cow with about 640 kg live weight is estimated to produce about 60 kg of manure per day. Manure can have economic value if processed and utilized appropriately, such as for biogas and organic fertilizer. However, most dairy farmers in smallholder farming systems discharge row dairy cattle manure in the open air, sometimes heaped outside their gates along main roads. Animal manure is a liability in high-density livestock production areas where fertilizers are cheap. The issues related with manure include odor in residential areas. ammonia emission to air contributing to global warming, pollution of soil and water resources and hypoxia.

Unless these soil nutrients are renewed and properly managed, the agricultural productivity will decline. As chemical fertilizers are neither affordable nor readily available by smallholder farmers of many African countries, use of available alternative bio-fertilizers is vital. Nitrogen-fixing legumes, livestock manure and compost are organic fertilizers which could partially or fully replace the chemical fertilizers in Kenya and in Africa at large.

Livestock manure management has become potential challenge to livestock sector development particularly in the peri-urban and urban production systems. On the other hand, as shortage of chemical fertilizer is prevalent in Kenya, livestock manure will be an asset in the smallholder integrated crop-livestock production systems. In that regard, use of livestock manure, particularly dairy manure, and calibrating varieties of manure management and storage means have been accorded the credence to reverse the problem associated with chemical fertilizers.Prolonged use of chemical fertilizers degrades the soil and affects crop yields, with subsequent impact on food and nutrition security.

Therefore, support for research and innovation in the livestock sub-sector will be necessary to ensure supply of sufficient, safe and healthy high-quality food, reducing environmental impact, making better use of resources, respecting animal integrity, meeting needs of consumers and contributing to a viable economy in ways that are appreciated by society in a One Health Approach (OHA)in Kenya. The current survey study was aimed at describing the current challenges and opportunities in relation to nutrient use and animal feed in integrated crop-livestock production systems in Kenya.

STUDY METHODOLOGY

Survey Design and Context

This survey employed quantitative measures such as frequencies, means, correlational and statistical tests [6]. In addition, the survey typically relied on measurement tools such as ordinal scales, observation, checklists, and a pre-tested questionnaire. This approach was chosen to respond to survey questions using numerical data according to procedures described by [7].

The context of this survey was smallholder mixed crop-livestock value chain actors in Kiambu County of Kenya. Kiambu County was chosen due to its productivity and potential in the smallholder livestock dairying sub-sector in intensive and semi-intensive production systems. Kiambu County is one of the 47 counties in the Republic of Kenya. It is located in the Central region of Kenya, and covers a total area of 2,538.6 Km^2 according to the [8]. Kiambu County borders Nairobi and Kajiado Counties to the South, Machakos to the East, Murang‘a to the North and North East, Nyandarua to the North West, and Nakuru to the West. The County lies between latitudes 00 25‘and 10 20‘South of the Equator and Longitude 360 31‘and 370 15‘East. Figure 1 show the location of the County in Kenya.

Participants selection and Sample size determination

The desired sample size was determined using a sample size calculator. Using the sample size calculator, with 95% confidence level, 5% margin of error, 65,876 population size of 65,786, and 20% population proportion, a sample size of 245 was determined. The sample size was distributed proportionally to the 4 broad topographical zones(i) Upper Highland, (ii) Lower Highland, (iii) Upper Midland, (iv) Lower Midland). The population sampling frame was obtained from each Agro-ecological zone (P); and the determined sample size was allocated/distributed proportionally in the 4 topographical zones. The respondents were assigned unique numbers from the first to the last in the frame, i.e 1 to P and/or county proportional determined sampling frame. Using SPSS, data was navigated through data, select cases, random sample of case, and specified exactly number of respondents in each zone as proportionallyassigned. The random sampling was done in three sets for guiding replacement in case the first randomly assigned respondent was not available. The enumerators were adequately guided by the data supervisors who were on site.

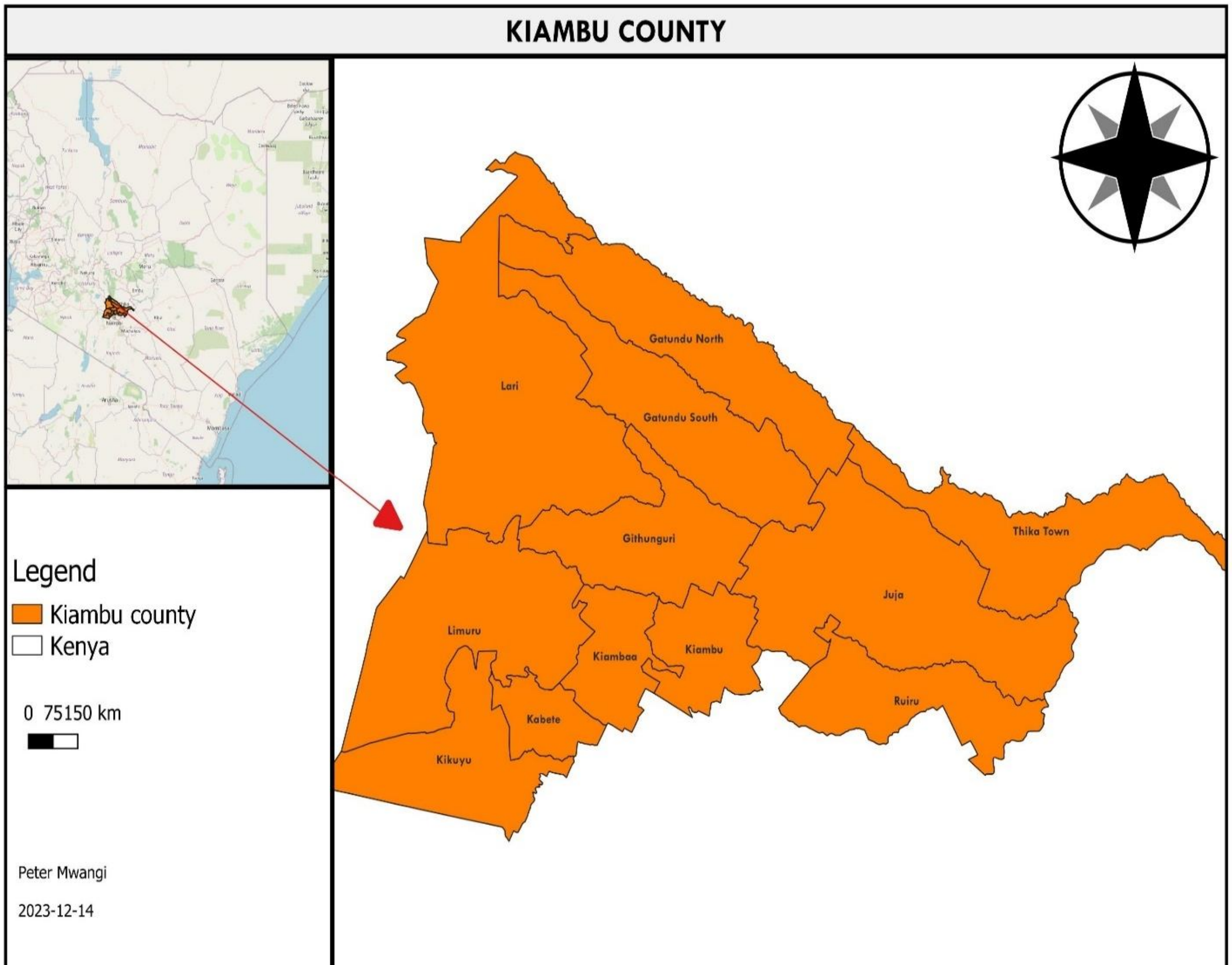

Figure 1. Kiambu County administrative units

(Source: Peter Mwangi (University of Nairobi-Kenya)

Data collection

This survey used quantitative data that were collected via a face-to-face survey. The survey was conducted with households, and data collected using researcher developed and pre-tested questionnaires that captured the required information as per the project objectives. The questionnaires were administered by 12 trained enumerators to 245 respondents using the open data kit (ODK) platform (Kobo Collect Toolbox). Enumerators were recruited from the survey areas to bridge gap on communication barriers as well as to acquire research assistants who were well versed with the survey areas. Recruitment of enumerators was done through interviews that were conducted by the research team. One enumerator was recruited in each sub county and worked for ten days of data collection. The survey data collection was collected during the months of September and October, 2023.

Statistical data analysis

Data were analyzed using Statistical Package for Social Sciences (SPSS version 25.0). Descriptive statistics were used to analyze the survey descriptive data. In addition, analysis of variance (ANOVA) and correlation were used for comparative and correlation analysis. The main descriptive indicators employed were frequencies and mean values because they are useful in analyzing demographic attributes as well as analyzing the relationship between variables. In addition, demographic attributes are important because the household head coordinates the main household activities and the head's decisions are most likely to be influenced by such aspects. The demographic attributes included gender, age, marital status, household size, occupation, farm size, education level, experience in farming, and access to information. Several studies have used descriptive statistics in surveys [9].

RESULTS AND DISCUSSION

Household categorical demographic characteristics

Results (Table 1) shows that 74% and 18% of the household head and respondents were male and femalerespectively. The household head (69%) and respondents (16%) reported to have completed classes for formal school. The results shows that majority of the respondents were spouses (16%). The findings show male dominance of household headship. In this regard it is important to recognize the basis behind gender and in this context, this finding can be utilized in planning and developing of gender-based research interventions. This will enhance the understanding of the relative position of both males and females in various value chains. In terms of education level, majority of the respondents were able to read and write (Table 1). This is encouraging as education level comes with capacity to understand and adopt flagged interventions. However, it is important to note that this survey focused on randomly selected value chain actors and therefore should not be implied that majority of the VCA were educated. According to [10], the relationship of the households can be used to determine the stability of households in African families. The results on relationship shows that livestock keeping was well accepted in the family dynamics.

Table 1. Houshold categorical demographic characteristics

Variable	Frequency	Percent
Gender household head		
Male	181	73.6
Female	65	26.4
Gender of respondnet		
Female	45	18.3
Male	11	4.5
Education level household head		
Classes completed for formal school	170	69.1
Able to read and write through informal school	65	26.4
Not able to read and write	11	4.5
Education level household respondent		
Classes completed for formal school	39	15.9
Able to read and write through informal school	15	6.1
Not able to read and write	2	0.8
Relationship to the household head		
Wife	39	15.9
Employee	7	2.8
Daughter	4	1.6
Sister	4	1.6
Son	3	1.2
Nephew	1	0.4

Household farming experience and distance to market and access to extension services

Agriculture extension is vital in availing technologies, innovations and management practices to the farming community. This is normally attained through provision of timely and relevant validated information for enhanced production and productivity. According to [11], extension programs have been the main conduit for disseminating information on farm technologies, support rural adult learning and assist farmers in developing their farm technical and managerial skills. In this survey, access to extension and communication services was explored in terms of distance and time taken in reaching and/or searching extension advisories. Table 2 indicate that on average, the respondents had about 20 years of experience. [12]pointed that farming experience is useful in enhancing the urge for searching extension advisories based on perceived and/or accrued benefits. On average, farmers were walking 1.83 Km, 5.18 Km, 4.65 Km, and 12.79 Km to the nearest village market, town market, extension office and farmers' training Centre, respectively. This shows that extension and communication services are still far apart from the farming community and there is great need to further devolve the functional extension advisory units. This has implications on technology awareness, adoption and subsequent impact on household food and nutrition security.

According to [13], the County has extension officers deployed in the ward, Sub-County and County levels. The staff to farmer ratio is 1:2000. Due to this large ratio, the main extension method used is group approach which targets farmer in groups of similar interests, informal or formal groups. Other approaches include field days/ exhibitions, trade fairs and on-farm demonstrations. However, efficiency, effectiveness and efficacy of these extension methodologies are wanting. The study reveals that farmers were travelling long distances (approximately 13 km) to reach farmer training centers. This is an indication of inefficiency in technology awareness and transfer.

Table 2. Household farming experience, Distance to to market and extension services

Variable	Mean	Range	Minimum	Maximum
Experience	20.35	59.00	1	60.00
Village market hours	1.33	0.45	0	0.45
Village market km	1.83	10.25	0	10.25
Town market hours	2.01	0.40	0	0.40
Town market Km	5.18	31.00	0	31.00
Extension office hours	1.75	0.36	0	0.36
Extension office Km	4.65	29.00	0	29.00
FTC hours	7.41	1.20	0	1.20
FTC km	12.79	70.00	0	70.00

Km=Kilometer; FTC= Farmers Training centers

Association between demographic characteristics of respondents and adoption of improved soil fertility management methods

A chi-square test was used to compare the association between independent variables influencing adoption of various improved soil improvement methods such as mulching, green manures, Nitrogen-fixing legumes and manure management practices. A significant ($p<0.04$) relationship was observed between the age of household head (HH) and adoption of soil improvement technologies (Table 3). However, the variables gender, income, education, and access to agricultural information did not ($p>0.05$) influence the use of soil improvement methods in the studied population. Based on the results of this current baseline study, aged household head (HHH) may lack the required technological know-how, energy and digital skills to implement these improved soil fertility improvement practices. Young people are encouraged and recommended to take up good agricultural practices and innovations, and more so as a business.

Table 3. Association between demographic characteristics of respondents and adoption of improved soil fertility management technologies

Variable	**Chi-square (χ^2)**	**df**	***p*-value $_{(0.05)}$**
Gender	1.02	1	0.312 ns
Age (of HH head)	1.53	1	0.047*
Income	2.00	4	0.735 ns
Education	0.50	2	0.767 ns
Access to agricultural information	1.82	1	0.177 ns

Significance: $^{*}p<0.05$; $^{**}p<0.01$; $^{***}p<0.001$; *ns=Not significant*

Organic Nutrient utilization for crop production responses by household

Household (HH) respondents on status of organic nutrient utilization for crop production is presented in Table 4.The results on nutrient utilization for crop production show that majority of the farmer do not utilize organic nutrients for crop production. Results in Table 4 show that those who utilized various sources of organic nutrients such as bio slurry, cover cropping, mulching, green manure, sewage sludge, solid manure, minimum tillage, other types of nutrients and terracing accounts for about 3.6 overall. The respondents who did not adopt the organic sources of nutrients accounted for 96% (Table 4).

Studies by [14]documented that adopting improved manure management practices not only enhances soil fertility and subsequent crop production, but also reduces environmental concerns such as contamination of adjacent farms and water bodies.

Although some crops are acid tolerant, most thrive in slightly in acidic soils with a pH range of 6-7. Plants have more access to soil nutrients in this pH range than in more acidic (pH<5) or basic (pH=7), a factor that is mostly contributed by inorganic fertilizers.

Table 4. Nutrient utilization for crop production responses by household (HH)

Variable	Frequency	Percent(Respondents)
Yes		
Bio-slurry	30	12.2
Cover cropping	23	9.3
Mulchng	13	5.3
Green manure	6	2.4
Sewage sludge	2	0.8
Solid manure	2	0.8
Minimum tillage	2	0.8
Other types of nutrients	1	0.4
Teracing	1	0.4
Overall mean		**3.6**
No		
Other types of soil nutrient management	245	99.6
Teracing	245	99.6
Sewage sludge	244	99.2
Solid manure	244	99.2
Minimum tillage	244	99.2
Green manure	240	97.6
Mulching	233	94.7
Cover cropping	223	90.7
Bio slurry	216	87.8
Overall mean		**96**

Adoption of Compost as organic fertilizer and main sources of the feedstock

Utilization of compost manure was reported by 29% of the respondents (Table 5). Composting materials were reported to be from dairy cattle (62%), improved poultry (13%), pig (4%), sheep (2%), goat (2%), and local cattle (1%), respectively.

Table 5. Utilization of Compost, liquid manure, solid waste, and wasting

Variable	Frequency	Percent
Composting		
No	174	70.7
Yes	72	29.3
Type of animal		
Dairy cattle	160	62.0
Improved poultry	32	13.0
Pig	9	3.7
Sheep	6	2.4
Goat	4	1.6
Local cattle	2	0.8
Donkey	1	0.4

Adoption level of various manure management practices

Open heaping/piling, composting with other materials, use of other livestock manure, solid manure, and liquid manure were reported to be utilized on average 67 kg, 30 kg, 41 kg, 11 kg and 2 kg respectively (Table 6). In general, the results implya poor manure management, low adoption and utilization levels of organic manures, and may have a significance on the yield, crop productivity and subsequent impact on household food and nutrition security. Open heaping of livestock manures has implications on the greenhouse gas emissions and climate change.

Table 6. Adoption level of various manure management practices

Variable	Mean	Range	Minimum	Maximum
Open heaping/pilimg	66.87	100	0	100
Composting with other materials	50.20	95	5	100
Use of other livestock manure	41.40	100	0	100
Solid manure	11.10	80	20	100
Liquid manure	2.14	100	0	100

Main constraints limiting utilization of organic fertilizers

Factors affecting adoption and utilization of organic fertilizers are presented in Table 7 below.The main constraints limiting the use of organic fertilizers were ranked using an ordinal scale of 1 to 7, with each rank having a distinct attribute. Table 7 shows the ranks from first choice through the seventh choice. The main constraint limiting the use of organic fertilizers ranked as first, second, third, fourth, fifth, sixth, and seventh choice were as follows; ignorance of the technical aspects linked to the use of manure as an organic fertilizer (17.8%), low awareness of manure usefulness to improve soil fertility (16.4%), high affordability and accessibility of chemical fertilizers (16.3%), lack of related machinery for handling, composting and transport (14.4%), distance between forage growing land parcels and the animal units and high costly operations (14.3%). About 6.5% of the respondents indicated that their soil fertility was sufficient and did not require manure application. The study revealed a lack of knowledge of various livestock manure management and storage practices (Table 7). By combining various soil management practices with the support of research and extension services, farmers can achieve long-term soil health and crop productivity. Farmers in high potential areas with limited land sizes continue to face challenges due to unsustainable land-use practices. These practices have taken a toll on food security in the country, especially in intensive farming systems, where sufficient food should be produced in the small land holdings. There is a need to empower more farmers to adopt sustainable organic soil management practices. This will enhance nutrient availability and reduce reliance on expensive chemical fertilizers. Biofertilizers are a sustainable and cost-effective solution for the small-scale mixed crop-livestock farmers in the Kenyan highlands.

Table 7. Main constraints limiting the use of organic fertilizers

Variable	% Respondents							
	Choice 1 (n=34)	Choice 2 (n=49)	Choice 3 (n=47)	Choice 4 (n=43)	Choice 5 (n=23)	Choice 6 (n=24)	Choice 7 (n=25)	Overall mean (N=245)
1. Ignorance of the technical aspects linked to the use of manure as an organic fertilizer	13.8	20.3	19.1	17.5	22.2	21.5	10.2	17.8
2. Low awareness of manure usefulness to improve soil fertility	21.1	17.9	15.4	16.3	17.1	8.9	17.9	16.4
3. High costs and accessibility of chemical fertilizer	10.2	10.6	6.9	9.3	10.6	30.9	35.4	16.3
4. Lack of related machinery for handling, composting and transport	31.7	13.4	16.3	12.2	10.6	9.8	6.9	14.4
5. Distance between forage growing land parcels and the animal units	13.0	18.3	16.7	25.2	12.2	8.9	5.7	14.3
6. High costly operations	7.7	13.4	17.1	12.6	17.5	14.6	17.1	14.3
7. Not useful, my soil is fertile sufficiently	2.4	6.1	8.5	6.9	9.3	5.3	6.9	6.5

Nitrogen fixing, nutrient cycling, chemical nutrients and recognition of Nitrogen fixing plants

Nitrogen cycle is an important part of the ecosystem. This is because it helps plants to synthesize chlorophyll from the Nitrogen compounds, converting inert nitrogen gas into a usable form for the plants through the biochemical process, enhance ammonification, releases Nitrates and Nitrites to the soil, forming crucial compounds which are important biomolecules for plants growth. Thus, Nitrogen cycle was explored in terms of fixation, cycling, cropping, chemical nutrients, and ability of farmers to recognize Nitrogen fixing plants. Results (Table 8) show that majority of the respondent did not utilize Nitrogen fixing plants (66%), nutrient cycling (84%), legume crops (75%), and chemical nutrients (84%). Furthermore, about 65% of the respondents were not able to recognize nitrogen fixing plants.

Table 8. Utilization and recognition of Nitrogen fixing plants, Nutrient cycling and Chemical nutrients

	Frequency		Percent	
Variable	**Yes**	**No**	**Yes**	**No**
Nitrogen fixing plants	83	163	33.7	66.3
Nutrient cycling	39	207	15.9	84.4
Legume crops	62	184	25.2	74.8
Chemical nutrients	40	206	16.3	83.7
Recognition of nitrogen fixing plants	85	161	34.6	65.4

Main Nitrogen fixing plants recognized in nearby farms

The results on Nitrogen-fixing plants, nutrient cycling, legume crops, chemical nutrients and recognition of Nitrogen fixing plants (Table 9) indicated that only 35% were able to recognize Nitrogen fixing plants. Further interrogation revealed that the main Nitrogen-fixing plants recognized were faba bean (10%), sesbania (9%), cowpea (5%), alfalfa (2%), grass (2%), and sunflower (1%) respectively (Table 9). Results also indicate that the main usage of the recognized Nitrogen-fixing plants was for forage/fodder (20%), human consumption (12%), and maintain soil fertility (2%), respectively.

Table 9. Main Nitrogen-fixing plants recognized by respondents

Variable	Frequency	Percent
Plants recognized		
Not applicable	161	65.4
Faba bean	25	10.2
Sesbania	22	8.9
Cowpea	11	4.5
Alfalfa	6	2.4
Grass	4	1.6
Sunflower	3	1.2
Field pea (ater)	2	0.8
Sweet potato	2	0.8
Field peas	2	0.8
Groundnut	2	0.8
Eucalyptus	2	0.8
Vetch	1	0.4
Clover	1	0.4
Usage of recognized nitrogen fixing plants		
Not applicable	161	65.4
Forage / fodder	49	19.9
Human consumption	30	12.2
Maintain soil fertility	6	2.4

Biofertilizer technology knowledge and main legumes used

Biofertilizers are biological preparations of efficient micro-organisms that promote plant growth by improving nutrient acquisition. They enhance soil productivity by fixing atmospheric Nitrogen, solubilizing soil phosphorus, and stimulating plant growth. Biofertilizers are crucial in restoring soil fertility. Prolonged use of chemical fertilizers degrades the soil and affects crop yield[15]. Biofertilizers, on the other hand, enhance the water holding capacity of the soil and add essential nutrients such as Nitrogen, Phosphorus and Potassium (NPK) to the soil[16]. In that regard, the respondents were subjected to express their knowledge and utilization of the technology. Results from the study show that only 4% of the respondents were aware of biofertilizers (Table 10). Results further indicate that those who were aware of the technology fully utilized the technology. The main legume crops utilized were faba beans (22%), sunflowers, lupins, cowpeas, sweet potatoes, lettuce and vetch (11% each).

Table 10. Biofertilizer technology knowledge and utilization

Variable	Frequency	Percent (%)
Knowledge		
No	237	96.3
Yes	9	3.7
Utilization		
Yes	9	100.0
For which legumes		
Faba beans	2	22.2
Sunflower	1	11.1
Lupin	1	11.1
Cowpea	1	11.1
Sweet potatoes	1	11.1
Lettuce	1	11.1
Vetch	1	11.1

Access to agricultural information

Access to information is critical in enhancing agricultural production and productivity[17]. The results (Table 11) shows that majority of respondents (~83%) had no access to agricultural information whilst 17% had access to information. The respondents accessing information were mainly getting information from local traders (60%), public extension (24%), private extension (12%) and wholesalers (5%). However, the quality of information is wanting as there are no information validation systems in place. This is risky as value chain actors may rely on un-validated agricultural information in making production and/or marketing decision. This implies that the information accessed is either of poor quality or untimely, a situation that does not enhance capabilities of value chain actors to make rational decisions. Access to quality and validated information is crucial for value chain actors to make informed decisions [18]. This is because information access helps value-chain actors to conceive potential benefits of each action to be undertaken. It also enhances technology adoption.

Table 11. Agricultural information access

Variable	Frequency	Percent (%)
No	204	82.9
Yes	42	17.1
From whom		
Local traders	25	59.5
Public extension	10	23.8
Private extension	5	11.9
Wholesalers	2	4.8

Main constraints limiting use of Nitrogen-fixing legumes to improve soil fertility

As indicated in the results on Nitrogen cycle (Figure 2), it was evident that majority of the respondents did not have adequate capacity to fully explore the benefits of Nitrogen cycle. As a result, Nitrogen cycling and other nutrient enhancement approaches continue to be under-utilized. This was mainly due to ignorance of technical aspects on N-fixing legumes (27%), low-technological know-how on legume crop production and management (26%), legumes seed unavailability (19%) and low profitability of legume crops (19%). Weed issues in the study areas did not pose a major threat to legume crop production (6% (Figure 2).

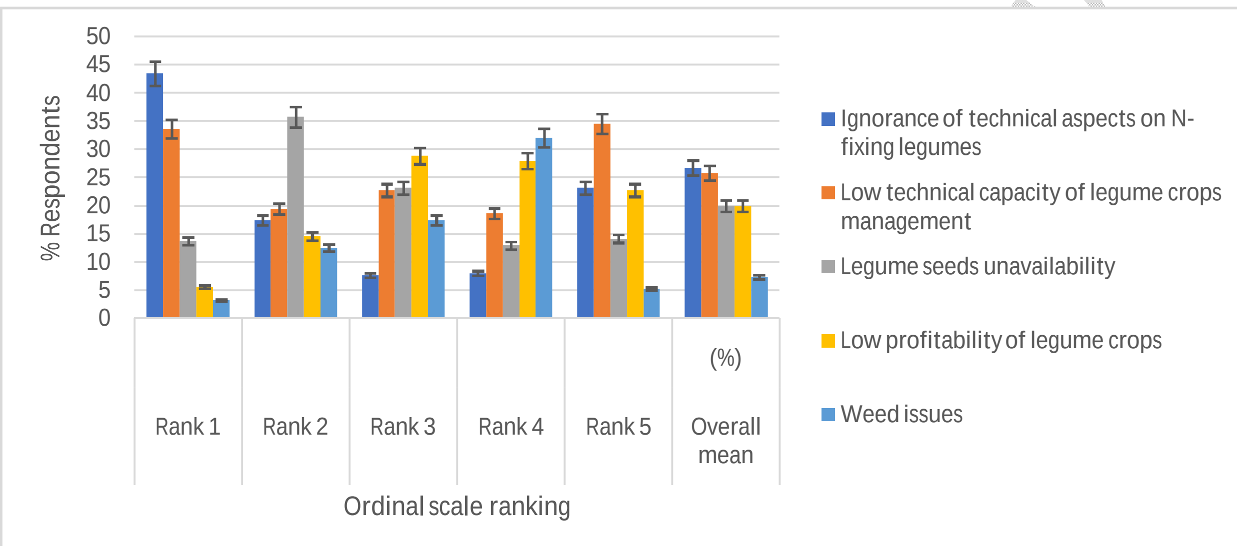

Figure 2. Main constraints limiting use of Nitrogen-fixing legumes

CONCLUSSIONS AND RECOMMENDATIONS

It has been observed that the livestock sector is evolving fast, and is operating in a dynamic and fast changing environment. As a result, farming communities need to adapt to these changes so that they can explore the full potential of these changes. Thus, this survey has endeavored to provide up-to-date information related to nutrient use, such as chemical fertilizer, animal manure, green manure and other organic materials, in small farms, various alternatives for chemical fertilizer and commercial animal feeds to improve crop and animal production, and means of effective nutrient use in various crop and animal production system, especially in small farms in Kiambu County-Kenya. The survey has found inefficiency and ineffectiveness of TIMPS (Technology, Innovation and Management Practices) despite high potential of the livestock value chain in the study areas. In addition, the results revealed that value chain actors (VCAs) have no capacity to sustain the transition from subsistence to agribusiness. This is of great concern, and the survey has recommended a number intervention. Key amongst them is promotion of climate smart interventions, soil fertility management and/or approaches; nutrient cycling, responsible use of fertilizers, farmers capacity building and promotion of agribusiness. Further, a causality study is suggested to allow for specific interventions to be undertaken to achieve desired results.

This is geared to positively contribute towards development of livestock value chain strategies in Kenya.

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