

# Opportunities and challenges of emerging livestock feed markets in northern Ghana

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# Summary

Emerging livestock feed markets in northern Ghana were surveyed to collect information on feeds sale, prices and buyers. The survey covered three regional markets in northern Ghana namely Tamale, Bolgatanga and Wa markets in Northern, Upper East and Upper West Regions, respectively. Semi- structured questionnaire was used to gather quantitative and qualitative data and was administered in the markets by field enumerators. Samples of feedstuffs sold in the markets during the interview period were bought from 3 different sellers for each feed type per market to determine the price of feed per kg and nutritive value of the feed sold. The data was collected quarterly across seasons in the year. Crop residues (groundnut haulms, cowpea haulms and pigeon pea residue (pods, leaves and twigs)), agro-industrial by-products (bran of maize, rice and sorghum) and fresh grass (*Andropogon gayanus*) as well as local browse (*Ficus* species, *Azelia* species and *Pterocarpus evinacelus*) were sold in the markets. The crop residues and browses were packaged in bundles and the agro-industrial by-products (cereal bran) in bags and bowls for sale. Livestock feed prices were generally high in Bolgatanga market in Upper East Region than Tamale and Wa markets in Northern and Upper West Region, respectively. Prices of cereal bran (e.g. maize bran) generally had no significant difference across seasons but that of crops residue were significantly higher in early to late dry season than the rainy season ( $P < 0.05$ ). Income generation motivated feed sellers and feed shortage led to purchases. These two factors were the drivers of the emerging livestock feed market. The respondents were of the view that the feed market will expand in northern Ghana due to increasing livestock population and trade especially in peri-urban and urban areas as a result of increasing demand for livestock and livestock product.

# 1. Introduction

In Ghana, livestock farming contributes significantly in meeting human nutritional needs (meat, eggs and milk) and the demand for these livestock products continues to increase at higher rate than production especially in urban areas due to increasing earnings of the consumers (Osei, 2012). According to the report of Ghana 2010 population census, there is increasing urbanization reported to be 51% (GSS, 2012; African Development Bank, 2014). Associated with rapid urbanization is declining grazing areas for livestock and increased demand for livestock feeds to meet the feed need of growing number of animals in urban and peri-urban areas of Northern Ghana (Oppong-Anane, 2013).

The unavailability of feed resources for ruminant production is a major constraint to livestock productivity in Ghana, especially, in the dry season. In the wet season, accessibility of fodder becomes a constraint to production in some communities due to cultivation of crops at homestead (Awuma, 2012) and the necessity to tether or stall feed the animals become important factor for consideration. The major feed resources used in this system are natural pasture and crop residues, with agro-industrial by-products contributing much less (MoFA, 2011; Amankwah et al., 2012; Oppong-Anane, 2010). The declining availability of natural pasture especially in urban areas due to expansion of infrastructure has put more pressure on urban farmer to explore other sources of feed for their animals and contributed to high demand for crop residue. Similar trend has been reported in Ethiopian highlands in which about 70% of crop residues are being used as animal feed (Zinash and Seyoum, 1991).

The feed limitation for livestock production in the urban areas has led to high demand of feed in the markets and motivated feed sellers to harvest naturally occurring browses, crop residues and gather agro-industrial by-products in an increasing rate for sale (Huseini et al., 2011) especially to small ruminant traders for stall feeding and fattening of market oriented animals. As a result of increasing demand for collected fodder especially in urban and peri-urban areas, livestock feed markets are emerging in northern Ghana with the most visible commodity being crop residues to satisfy the growing feed demand. These feed markets can be considered as important factor that contributes to the alleviation of feed shortage in the urban areas. A feed market survey by International Livestock Research Institute (ILRI, 2009) in Ethiopia reported increased feed availability for sale to urban livestock farmers and traders. These feeds were graded and prices of low fodder going below 50% of the quality one due to availability at market. Also, feed buyers and sellers may have different perceptions about the quality of the fodder supplied to the market. For the development of these emerging feed markets in Northern Ghana, there is the need for scientific information on the types of feed, prices and nutritional characteristics of feed resources at the markets will be relevant to both feed buyers and sellers. There is however limited information on the feed markets in northern Ghana.

## 1.1 Objective

The objective of this study was to document the profile of feed market actors, types of feed offered for sale, their prices and nutritive values as well as the perception of the actors on feed for sale.

## 2. Materials and methods

### 2.1 The study area

This study was conducted in three feed markets located in the same place as livestock markets at Tamale in the Northern Region, Bolgatanga in Upper East Region and Wa in the Upper West Region of Ghana. The three regions are located within latitude 9° 38' S and 100° 24' N and longitude 20° 61' W and 0084° E in the Guinea and Sudan Savanna agro-ecological zones with mean annual rainfall of 1204, 937 and 947 mm for Northern, Upper East and Upper West regions, respectively (MoFA, 2011). The rainfall pattern is unimodal and begins in April/May to October (MoFA, 2011; Oppong-Anane, 2013). The vegetation consists of short, deciduous, widely spaced, fire-resistant trees and shrubs, which do not form close canopy and the general ground floral cover made of grass, forbs and herbaceous legumes of varying heights (Oppong-Anane, 2010; Kombiok et al, 2005). The soil surface is often bare in the dry season after bush fire. Common livestock species reared in Northern Ghana are cattle, sheep, goats and poultry (Amankwah et al., 2012; Oppong-Anane, 2010). Maize, millet, sorghum, groundnut, cowpea and soy beans are the major crops grown in the 3 regions (Kombiok et al, 2005).

### 2.2 Sample selection

Regional MoFA animal production officers of the three regions in the study areas were contacted for information on livestock feed markets in their regions and reconnaissance market survey done to determine the presence of feed on sale in all possible markets in the region. In each region, a market was selected based on dominant availability of feedstuffs for sale. All feed sellers and buyers present in the market during survey period were contacted, sought for their consent to be interviewed and those that accepted were interviewed on quarterly basis. Data on the feed type, prices and quality as well as respondents' socio-economic profiles were collected.

### 2.3 Data collection

Data was collected quarterly over duration of one year across 4 seasons. These seasons were; early dry season (November – January); late dry season (February – April); early wet season (April – June) and in the main wet season (August – October) in 2013 to 2014. The collection was done within 3 days in each feed market specifically in November, 2013, February, May and August, 2014.

A semi-structured questionnaire was used to collect qualitative and quantitative information of feeds on sale at the markets and their prices. The survey instruments were administered by two field enumerators per market. Samples of feedstuffs sold in the markets were randomly bought per quarter from 3 different sellers for each feed type per market to determine the price per kg of each feed sold.

The study gathered feed market data from a mean of 169 (54, 62 and 53 in Wa, Bolgatanga and Tamale markets, respectively). They comprised 48, 110 and 11 feed sellers, buyers and those who bought and sold feed respectively). The percentage distribution of the feed sellers and buyers interviewed in the three regional markets is presented in Table 2.1.

**Table 2.1:** Feed sellers and buyers interviewed in each market

Actor	Wa	Bolgatanga	Tamale	Sub-Total
Sellers %	22.5	2.4	3.0	27.8
Buyers %	8.9	30.2	26.6	65.7
Buy and sell %	0.6	4.1	1.8	6.5
Total %	32.0	36.7	31.4	100.0

Total number of respondents =169

To establish price of the feeds sold in the markets per kg on air-dry basis, the samples bought were air-dried, weighed and price per kg calculated. The three samples per feed type per market were then pooled, sub-sampled and processed for laboratory analysis. The dry matter was determined by oven drying of 10 g of each ground sample at 105 °C for 12 h and the weight difference taken as moisture (AOAC 2003). Other chemical analysis is ongoing for organic matter, nitrogen, fibre (Neutral Detergent Fibre and Acid Detergent Fibre), Acid Detergent Lignin and organic matter digestibility.

## 2.4 Data analysis

The data collected was analyzed using Statistical Package for Social Sciences (SPSS version 17.0, 2007) following analysis of variance, descriptive and cross tabulations analytical procedures to obtain means of feed prices and percentages of feed sellers and buyers. For the analysis of variance procedure, the independent variables were the regional markets surveyed and the four seasons of the year mentioned above and dependent variable was prices of feed per kg. The means were compared using LSD and significance level declared at  $P < 0.05$ . The laboratory analysis of feed samples collected is on-going and will be used to update the report on the nutritive quality of feed sold.

### 3. Results

#### 3.1 The socio-economic profiles of respondents

All the respondents interviewed were either feed sellers or buyers. Feed sellers were not necessarily producers and most of them collected the feed from crop fields of their own farms, other farms or from uncultivated fields. The buyers were peri-urban livestock farmers or livestock traders especially those involved in small ruminants. Other background information of the respondents are given in the following sub-sections

##### 3.1.2 Sellers and buyers age groups and gender

The respondents found selling feed was generally fewer than buyers and wider gap existed in Bolgatanga market relative to Wa and Tamale markets. The males were generally more than females but the reverse was observed in Wa market as in Figure 3.1.

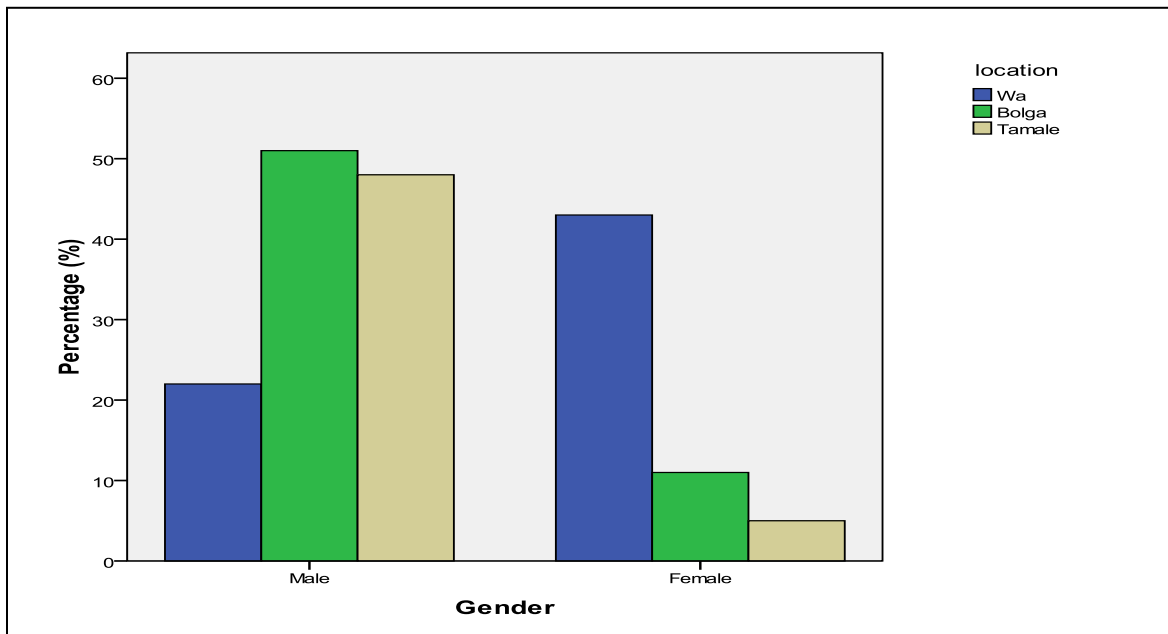


Figure 3.1: The gender of respondents



Table 3.1: Age distribution of the respondents

Age group (years)	Wa (%)	Bolgatanga (%)	Tamale (%)	Total (%)
Children ( $\leq 15$ )	13.3	0	0	13.3
Young adults (16-30)	5.0	1.7	4.4	11.1
Adults (31-45)	10.0	12.8	15.6	38.3
Elderly (46-65)	7.8	19.4	7.8	35.0
The old ( $\geq 66$ )	0	0.6	1.7	2.2
Total	36.1	34.4	29.4	100.0

Age grouping source; (GSS, 2012), Total number of respondents = 169

The age groups of the respondents showed that the adults were proportionally higher than the other age groups while the least age group was old people above 65 years (see Table 3.1). At the regional markets level children below 15 years were found trading in feed only in Wa market and was proportionally higher than the other age groups interviewed in that market.

### 3.1.3 Marital status, religion and education

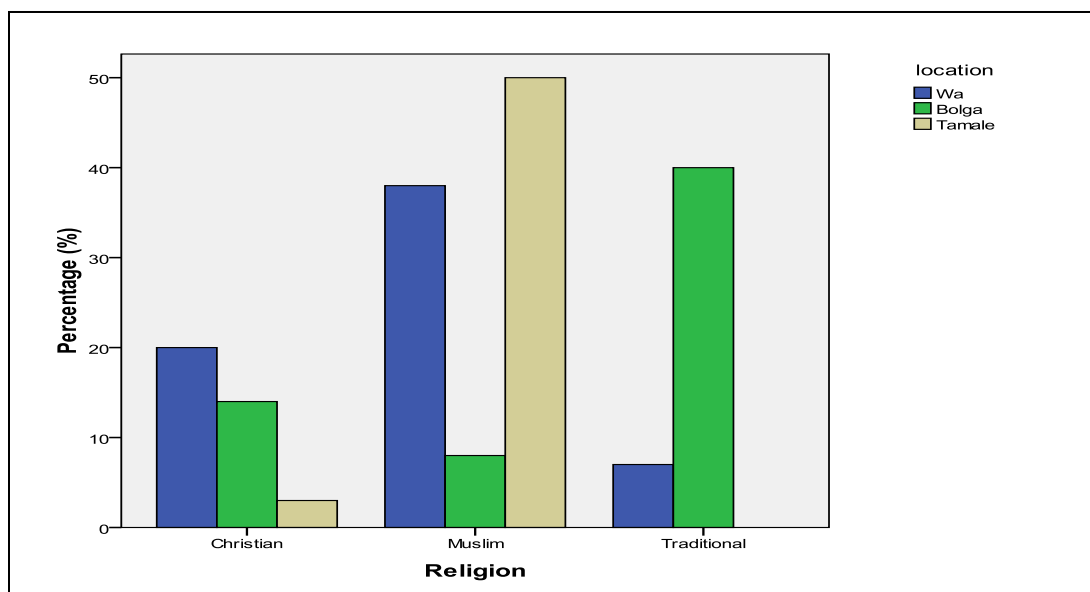
Generally, about 75% of the people interviewed were married. In Wa, market the proportion of the married and singles were close. Widows were not found among the feed sellers and buyers in Tamale market (Table 3.2).

Table 3.2: Marital Status of feed sellers and buyers

Marital status	Wa	Bolgatanga	Tamale	Total
Married (%)	16.3	29.8	29.2	75.3
Single (%)	16.9	1.7	0.6	19.1
Widow (%)	1.7	2.8	0	4.5
Others (%)	1.2	0	0	1.2
Total (%)	36.0	34.3	29.8	100.0

*Others; respondents who did not disclosed their marital status, Total respondents =169*

Majority of the respondents were Muslims but not found in Bolgatanga market as traditional believers dominated the people interviewed. The proportion of Christians found engaged in feed trade was low relative to the other two (Muslims and Traditional believers) as presented in Figure 3.2. Table 3.3 gives the educational status of all the respondents contacted. Over 50% of the feed sellers and buyers interviewed had no formal education and could neither read nor write. They were followed by about 18% respondents who started formal education but did not complete primary education. Most of the non-educated and partially educated were involved in the sale of the feedstuffs while those with good secondary and tertiary education were involved as feed buyers.



**Figure 3.2:** The religious groups of respondents

**Table 3.3:** Percentage educational status of the feed sellers and buyers

Educational level	Buyers	Sellers	Both	Total
Never been to school	37.3	10.2	3.0	50.6
Koranic	12.0	2.4	1.8	16.3
Some primary	4.2	12.0	1.8	18.1
Completed primary	3.0	0	0	3.0
Some secondary	3.6	0.6	0	4.2
Completed secondary	5.4	1.8	0	7.2
Tertiary	0.6	0	0	0.6
Total	66.3	27.1	6.6	100.0

*Number of respondents = 158*

#### 3.1.4 Seasonality of feed sale and purchase

Table 3.4a and b contains the details of respondents' feeds sales and purchases at the surveyed markets across seasons. The results indicated that feed sellers at Bolgatanga and Tamale markets sold feeds throughout the year. In the case of Wa market, some sellers sold livestock feeds only in the dry season or during special times of the year. Generally, the traders selling feed throughout the year have taken it as their main activity or additional income generation activity. Figure 3.3a and b illustrates the frequency of feed sales and purchases in the study area. Feed sellers who sold regularly were higher in Wa market than in Bolgatanga and Tamale markets while regularity of purchases was found higher in Bolgatanga and Tamale than in Wa market.

**Table 3.4 a:** The proportions of respondents selling feed across seasons

Season	Wa (%)	Bolgatanga (%)	Tamale (%)	Total (%)
Early dry season (Nov-Jan)	13.2	3.1	0	16.3
Late dry season (Feb-April)	30.5	0	0	30.5
Early wet season (May- July)	3.1	0	0	3.1
Late wet season (Aug-Oct)	0	0	1.6	1.6
Throughout the year (Jan-Dec)	15.6	14.1	9.4	39.1
During special religious ceremony	9.4	0	0	9.4
Total	71.9	17.2	10.9	100.0

*Number of respondents =164*

The general quality of all feedstuff sold were rated by over 50% of both sellers and buyers to be good and few perceived it was fair in all the markets. In Wa market, most of the seller and buyers rated the feed to be very good for ruminants (Figure 3.4).

**Table 3.4 b:** Proportions of respondents buying feedstuff across seasons

Seasonal changes	Wa (%)	Bolgatanga (%)	Tamale (%)	Total (%)
Early dry season (Nov.-Jan)	1.7	14.3	1.7	17.6
Late dry season (Feb-April)	4.2	14.3	0.8	19.3
Early wet season (May- July)	0	0	5.9	5.9
Late wet season (Aug-Oct)	0	0	0	0
Throughout the year (Jan-Dec)	6.7	16.0	24.4	47.0
During special religious ceremony	1.7	0.8	7.6	10.1
Total	14.3	45.4	40.3	100.0

*Number of respondents =162*

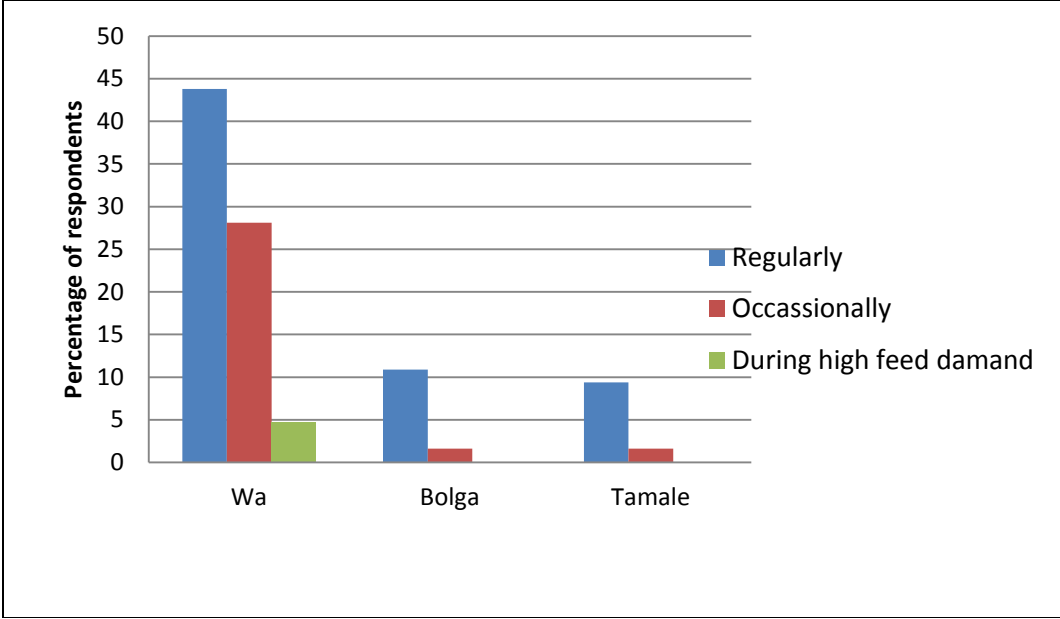


Figure 3.3 a: The frequency of feed sales

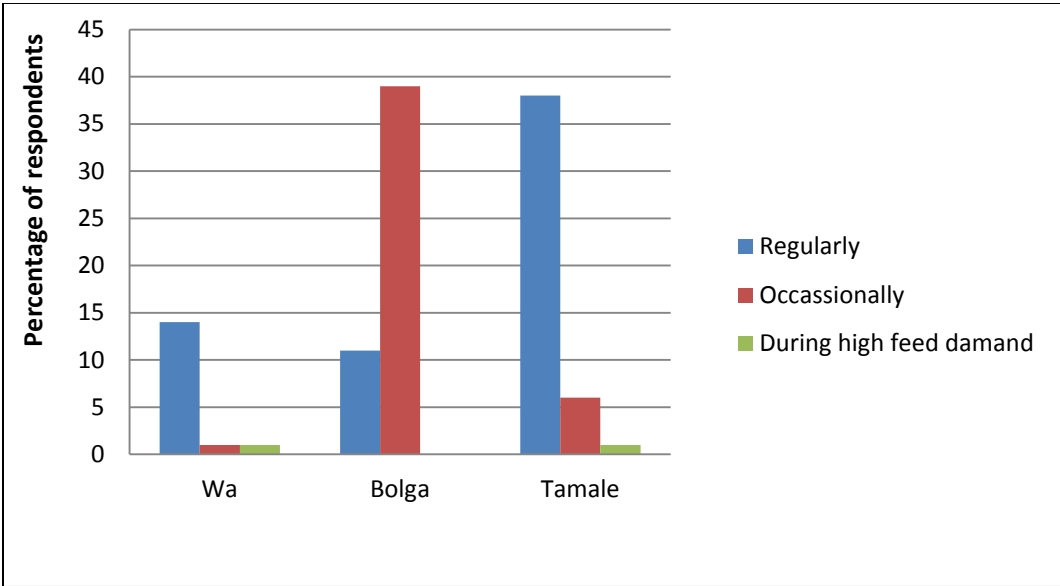
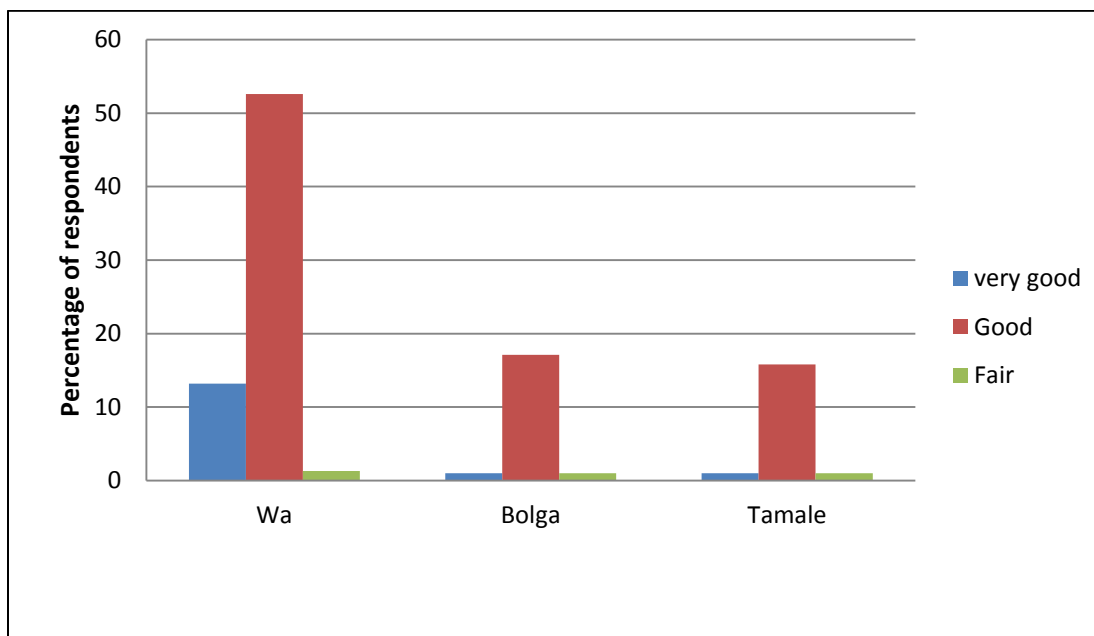


Figure 3.3 b: Frequency of feed purchases



**Figure 3.4:** Perceptions of sellers and buyers on quality of feed

### 3.2. Types of feed sold and common place of feed trading

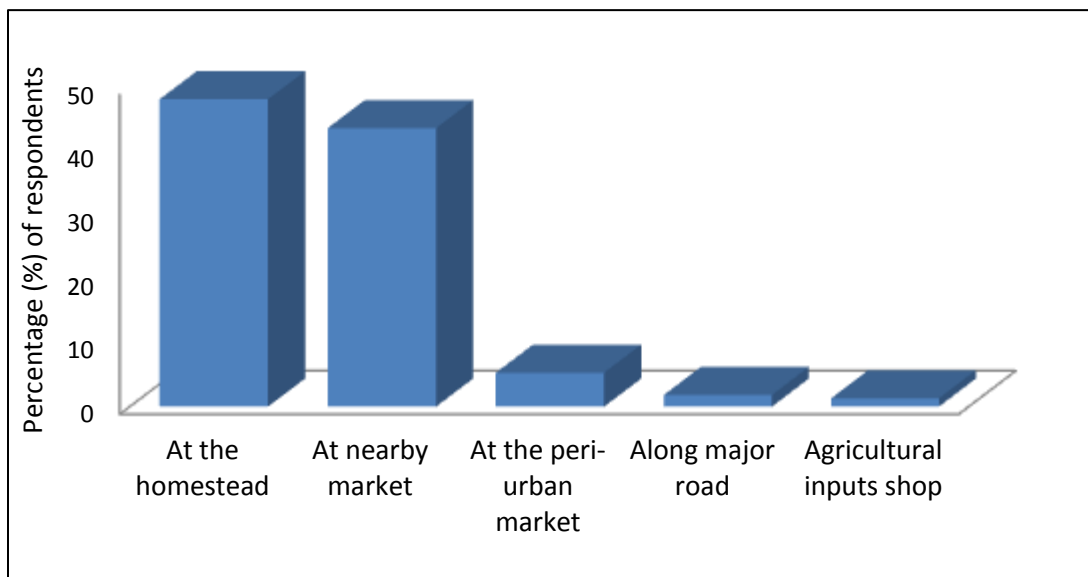
The respondents listed 17 different types of feedstuffs that were sold (Table 3.5). The results revealed that about 40 % of the feed sellers across the three markets sold groundnut haulms and it appears to be the most commercial crop residue in the surveyed area. Cereal straws such as sorghum straw were mentioned as the least sold feed by respondents but were not found in any of the markets. About 47 and 37% of feed sellers and buyers respectively traded in feedstuff during the early and late dry seasons (Table 3.4 a and b). Feedstuff traders found trading throughout the year constituted 40% sellers and 47% buyers respectively in all the markets.

Over 50% of respondents were of the view that the major point of feed trade transactions occurred at the homestead and nearby local markets. Other places listed by respondents are shown in Figure 3.5. It was observed that, the sellers and buyers knew each other's locations and moved to them or to the nearby markets to do business as and when the need arose. The least place of fodder sale and purchase occurred at agricultural input shops.

**Table 3.5:** Types of feeds listed by respondents (%) as feeds sold

No.	Feed name	Wa	Bolgatanga	Tamale	Total
1	Groundnut haulms	1.6	30.9	8.9	41.5
2	Cowpea haulms	0	3.3	2.4	5.7
3	Maize bran	1.6	0	7.3	8.9
4	Rice bran	0	0.8	1.6	2.4
5	Wheat bran	0.8	1.6	3.3	5.7
6	Sorghum straw	0	0.8	0	0.8
7	Rice straw	0	0.8	0	0.8
8	Leaves of <i>Azelia sp</i>	0.7	0	0	0
9	Leaves of <i>P. evinacelus</i> ,	9.8	0	0	9.8
10	Tree leaves ( <i>Ficus sp</i> )	1.6	0	0	1.6
11	Cassava peels	0	0	0.8	0.8
12	<i>Faidherbia albida</i> fruits	0	1.6	0	1.6
13	Pigeon pea pod and leaves	0	0	15.4	15.4
14	brewers' spent grain	0	2.4	0	2.4
15	Yam peels	0	0	0.8	0.8
16	Corn milling waste	0	0.8	0	0.8
17	Fresh cut annual grass	0	0	0.8	0.8
Total		15.4	43.1	41.5	100.0

Number of respondents = 165



**Figure 3.5:** Common trading place for feed sellers and buyers

### 3.3 Major constraints to livestock feed markets

There were five major constraints of the emerging livestock feed market in the study sites identified by the respondents. These included:

- Inadequate storage facilities which affect year-round availability of fodder especially crop residues.
- Lack of permanent market stalls or designated location for fodder sellers in the market.
- Transportation of fodder from production points to the market was challenging to sellers. This is aggravated by poor road conditions in most of the rural areas.
- Absence of baling technology to reduce feed bulkiness for easy transport and storage.
- Many actors also stated lack of access to credit facility as a constraint to their operations.

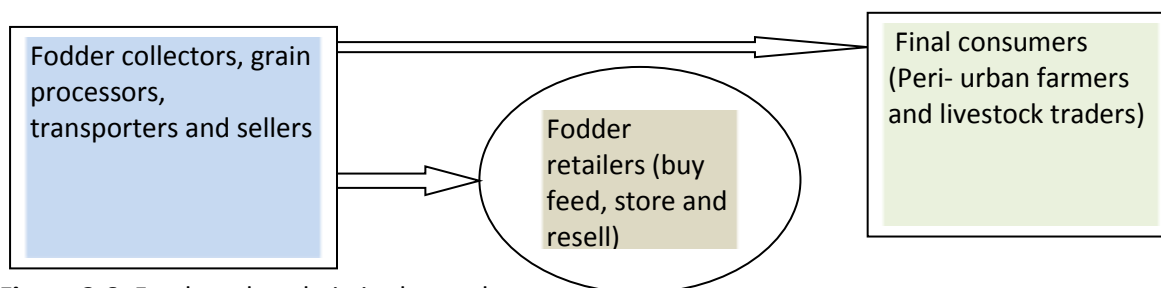
### 3.4 Feed prices at the surveyed markets

A total of 26 different feed types were found in the surveyed markets. These were put into three categories; crop residues (groundnut haulms, cowpea haulms, cowpea pods, potato vines, pigeon pea pods, cassava peels, yam peels and plantain peels), agro-industrial by-products (bran of maize, rice, sorghum, millet, and soyabean) and fresh cut grass (*Andropogon gayanus* (*kunth*)) and local browse species (*Pterocarpus evinacelus*, *Ficus sp*, *Azizelia sp*) shown in Plate 3.1a and b. The most common fodder sold in the markets is presented in Table 3.6 including the forms in which the feeds were packaged for sale. These feedstuffs went through two or three stages of market chain that is from field collection /grain processing to final consumers or through retailer to final consumer (Figure 3.6) the final consumer/buyer then offer the feed to his animals. Some of the feeds were sold on demand as producers did not have the primary intention of selling them. Examples of such feeds were agro-industrial by products like corn milling waste, bran of maize, sorghum and yam peelings, many of these were not listed by respondents as feed that are being sold.

**Table 3.6:** Common fodder traded by feed sellers and buyers

Fodder type	Nature, local unit of measure and uses
Maize bran	The maize bran was popular feed and produced in the milling of grains to flour for use. It was sold in all the study sites and throughout the year Maize bran was sold in bags and bowls for sale at 0.23 - 0.68 GHS/kg ADB*.
Groundnut haulms	Haulms of harvested groundnuts were sold in bundles. Some vendors put the haulms into bags for sale at 0.08 - 0.62 GHS/kg ADB*.
Cowpea waste	Cowpea haulms were sold in bundles, pods and bran of the cowpea in bowls or bags for sale at 0.82-1.05 GHS/kg ADB* for the haulm and pods sold at 0.53 - 0.72 GHS / kg ADB*
Local browse leaves <i>Ficussp</i> , <i>Azizelia sp</i> and <i>Pterocarpus sevinacelus</i>	The browse leaves were harvested from the bush and sold in bundles at range of 0.25-0.43, 0.04-0.49 and 0.06-0.62 GHS/ kg ADB* for <i>Ficus sp</i> , <i>Azizelia sp</i> and <i>Pterocarpus evinacelus</i> , respectively
Sorghum bran	Bran of sorghum was sold in bowls or bags mostly bought by small ruminant traders at 0.25 GHS / kg ADB
Rice bran	The rice bran was found to be the cheapest feed at 0.04-0.23 GHS / kg ADB. It was commonly sold in bags and found in all the study sites. This was mostly used in a mixture of maize and sorghum bran.

**Key:** 1 USD ≈ 3.05 GHS, GHS; Ghana cedis, ADB; air dry basis



**Figure 3.6:** Feed market chain in the study area

**Table 3.7:** Prices of livestock feeds in the surveyed markets (GHS) per kg (ADB\*)

No.	Feed name	Tamale	Bolgatanga	Wa	SE
<b>Browses and grass forage</b>					
1	<i>Pterocarpus evinacelus</i>	0.063 <sup>a</sup>	-	0.622 <sup>b</sup>	0.056
2	<i>Ficus sp</i>	0.249	-	0.426	0.063
3	<i>Azalia sp</i>	-	-	0.487	0.065
4	<i>Andropogon gayanus</i>	0.22	-	-	0.069
5	Freshly cut annual legumes	0.084	-	-	0.045
<b>Crop residue feed</b>					
6	Groundnut haulm	0.426 <sup>b</sup>	0.615 <sup>c</sup>	0.083 <sup>a</sup>	0.053
7	Plantain peels	-	0.709 <sup>b</sup>	0.198 <sup>a</sup>	0.106
8	<i>Cajanus cajan</i> residue	0.243	-	-	0.053
9	Bambara bean hay	0.109	-	-	0.058
10	Cassava peels	0.147	0.272	0.161	0.039
11	Yam peels	0.330	0.422	0.277	0.070
12	Cowpea haulm	-	1.047	-	0.105
13	Bambara bean pods	-	0.586	-	0.109
14	Cowpea pods	-	0.723	-	0.240
15	Potato vines	-	0.333	-	0.103
<b>Agro- industrial by-products</b>					
16	Sorghum bran	0.255	-	-	0.018
17	Cowpea bran	-	0.550	-	0.095
18	Millet bran	0.196	-	-	0.015
19	Soya bean bran	0.392	-	-	0.044
20	Restaurants swill	0.684 <sup>b</sup>	-	0.254 <sup>a</sup>	0.105
21	Corn milling waste	0.246 <sup>a</sup>	0.399 <sup>b</sup>	0.222 <sup>a</sup>	0.042
22	Rice bran	0.041 <sup>a</sup>	0.225 <sup>c</sup>	0.117 <sup>b</sup>	0.025
23	Brewer's spent grain	0.238 <sup>a</sup>	0.673 <sup>b</sup>	0.334 <sup>a</sup>	0.083
24	Dawadawa pulp	-	-	0.108	0.057
25	Maize bran	0.353 <sup>a</sup>	0.676 <sup>b</sup>	0.259 <sup>a</sup>	0.042
26	Groundnut seed testa	-	-	0.142	0.077

Means with different superscripts along the rows are significantly different ( $P < 0.05$ ), 1 USD  $\approx$  3.05 GHS, ADB; air dry basis (10% mean moisture)



The results revealed that feed prices were generally higher in Bolgatanga market in the Upper East Region than in the other two markets. For instance, groundnut haulms had a mean price of 0.62 Ghana cedis per kg and was significantly higher than 0.42 and 0.08 Ghana cedis ( $P < 0.05$ ) in Tamale and Wa markets, respectively. Cowpea haulms registered the highest mean price of about 1.00 Ghana cedis in Bolgatanga market and rice bran had the lowest price of 0.12 Ghana cedis. Table 3.7 presents the details of the various prices of feeds in the three main markets studied.

The comparisons of feed prices in the markets across seasons are presented in Table 3.8a to c. Generally the prices were significantly higher ( $P < 0.05$ ) in early dry season (November – January) and late dry season (February – April) for all the three categories of feed sold. Price of *Ficus sp* and *Azizelia sp* (0.56 and 0.83 Ghana cedis, respectively) per kg in early dry season were significantly higher ( $P < 0.05$ ) than the prices in the other three seasons. Annual grass and leguminous fodder were only available in early dry season and in the main wet season (August – October) but not in late dry and early rainy (May – July) season. For all the feeds sold, cowpea had the highest price but was not significantly different in all the four seasons of the year. The prices of agro-industrial by-products were stable except for sorghum spent grain which was expensive (0.7 Ghana cedis) per kg in early dry season than other three seasons ( $P < 0.05$ ). Feed trading was relatively higher in the dry season to meet feed demand for animal fattening and feed shortages.

**Table 3.8a:** Seasonal prices (GHS/kg) of local browses and grass forage (ADB\*)

Feed name	Seasons				SE
	early dry	late dry	early wet	main wet	
<i>Pterocarpusevinacelus</i>	0.437 <sup>a</sup>	0.376 <sup>a</sup>	0.375 <sup>a</sup>	0.190 <sup>a</sup>	0.144
<i>Ficussp</i>	0.559 <sup>b</sup>	0.281 <sup>a</sup>	0.238 <sup>a</sup>	0.272 <sup>a</sup>	0.084
<i>Afzeliasp</i>	0.826 <sup>b</sup>	0.441 <sup>a</sup>	0.400 <sup>a</sup>	0.280 <sup>a</sup>	0.049
<i>Faidherbiaalbida</i>	-	0.631	-	-	-
Annual cut grass	0.429 <sup>a</sup>	-	-	0.476 <sup>a</sup>	0.027
Annual cut legumes	-	-	-	0.335	0.021

Means with different superscripts along the rows are significantly different ( $P < 0.05$ ), 1 USD  $\approx$  3.05 GHS, ADB= air dry basis (10% mean moisture)

**Table 3.8b:** Seasonal prices (GHS/kg) of agro-industrial by-products (ADB\*)

Feed names	Seasons				SE
	early dry	late dry	early wet	main wet	
Rice bran	0.150	0.150	0.081	0.130	0.039
Maize bran	0.424	0.370	0.444	0.480	0.079
Sorghum bran	0.270 <sup>b</sup>	0.310 <sup>b</sup>	0.259 <sup>ab</sup>	0.179 <sup>a</sup>	0.027
Millet bran	0.185	0.205	0.214	0.180	0.024
Soyabean bran	0.298	0.353	0.370	0.546	0.079
Restaurant swill	0.552	0.531	0.793	-	0.129
Cowpea bran	0.644 <sup>a</sup>	0.697 <sup>a</sup>	0.826 <sup>b</sup>	0.634 <sup>a</sup>	0.053
Brewer's spent grain	0.701 <sup>a</sup>	0.352 <sup>b</sup>	0.225 <sup>b</sup>	0.381 <sup>b</sup>	0.100

Means with different superscripts along the rows are significantly different ( $P < 0.05$ ), 1 USD  $\approx$  3.05 GHS, ADB= air dry basis (10% mean moisture)

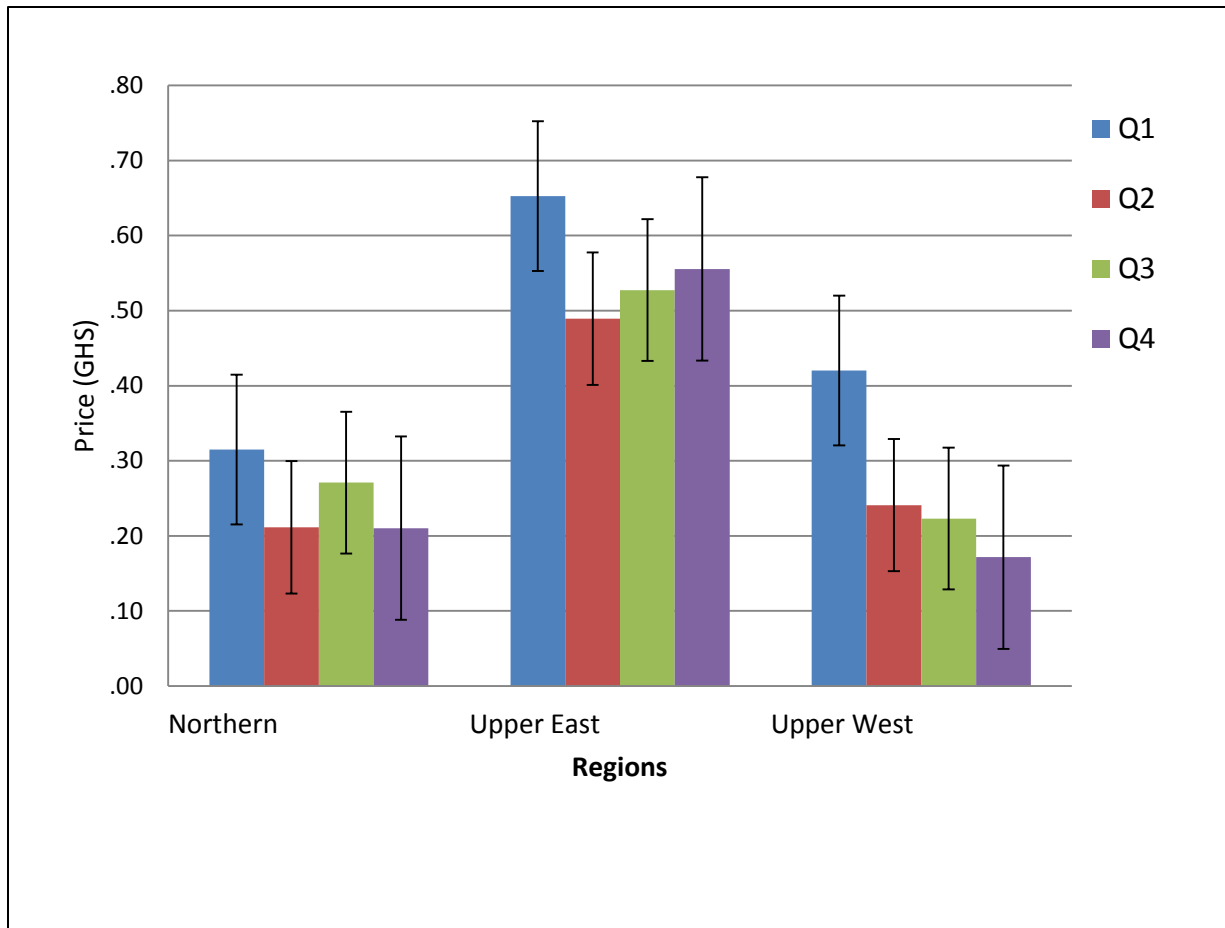
Cereal stover was not among the crop residues sold throughout the year. Prices of feed were similar across seasons for most crop residues with few like pigeon pea residue, and cassava peels prices in early dry season being significantly higher ( $P < 0.05$ ) than the prices in other seasons. Potato vines and Bambara nut hay were sold in dry seasons and not found in the market during rainy seasons (Table 3.8c). The results further showed that the most available and cheapest agro by-product was rice bran. Groundnut haulms were commonly sold in all the markets and throughout the year but not cheaper.

Air dried samples of the feeds have been processed and laboratory analysis is on-going to determine the nutritive values of the feeds traded to determine if any relationship exist between prices of feedstuff and their nutritional value. The general pictorial view of the seasonal prices of all the feeds traded is presented in Figure 3.7 in quarterly basis representing all the seasons. Prices were higher in early and late dry season (quarter 1 and 2) than the other quarters and among the regions, in Bolgatanga market than Tamale and Wa markets in the study area.

**Table 3.8C:** Seasonal prices (GHS/kg) of crop residue and agro-industrial by-products

Feed names	Seasons				SE
	Early dry	Late dry	Early wet	Main wet	
Dawadawa pulp	0.433	-	-	-	0.014
Corn milling waste	0.199	0.338	0.295	0.325	0.053
Groundnut seed	0.568	-	-	-	0.049
testa					
Groundnut haulm	0.413	0.264	0.420	0.402	0.097
Pigeon pea pods & leaves	0.400 <sup>b</sup>	0.280 <sup>a</sup>	0.292 <sup>a</sup>	-	0.066
Plantain peels	0.128	0.482	0.535	0.669	0.172
Bambara nut hay	0.438	-	-	-	0.027
Cassava peels	0.264 <sup>b</sup>	0.210 <sup>b</sup>	0.274 <sup>b</sup>	0.033 <sup>a</sup>	0.036
Yam peels	0.470 <sup>b</sup>	0.248 <sup>a</sup>	0.218 <sup>a</sup>	0.436 <sup>ab</sup>	0.076
Cowpea haulm	1.439	0.870	1.000	0.879	0.182
Bambara beans pods	0.692 <sup>b</sup>	0.040 <sup>a</sup>	0.800 <sup>b</sup>	0.810 <sup>b</sup>	0.121
Cowpea pods	1.905 <sup>b</sup>	0.330 <sup>a</sup>	-	0.656 <sup>a</sup>	0.236
Potato vines	-	0.667	0.667	-	0.051

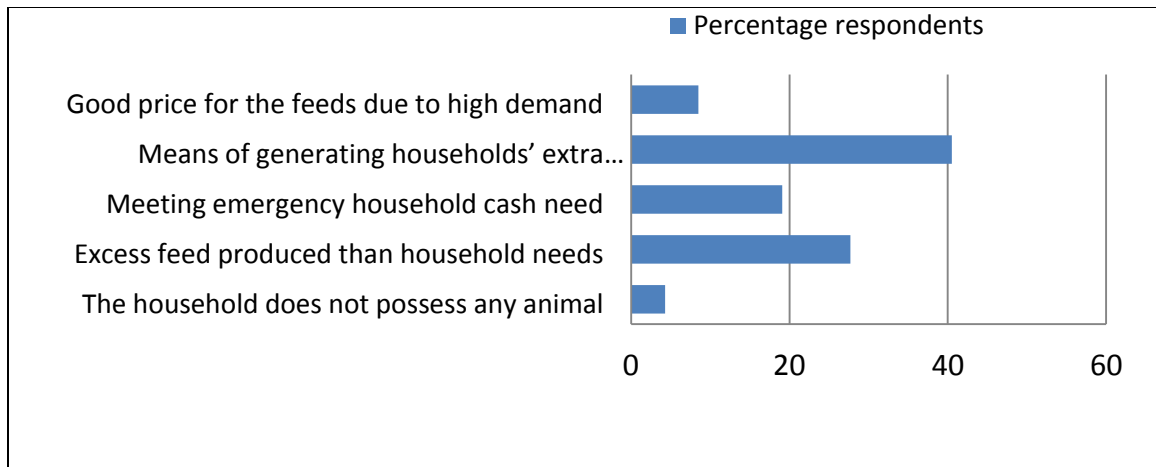
Means with different superscripts along the rows are significantly different ( $P < 0.05$ )



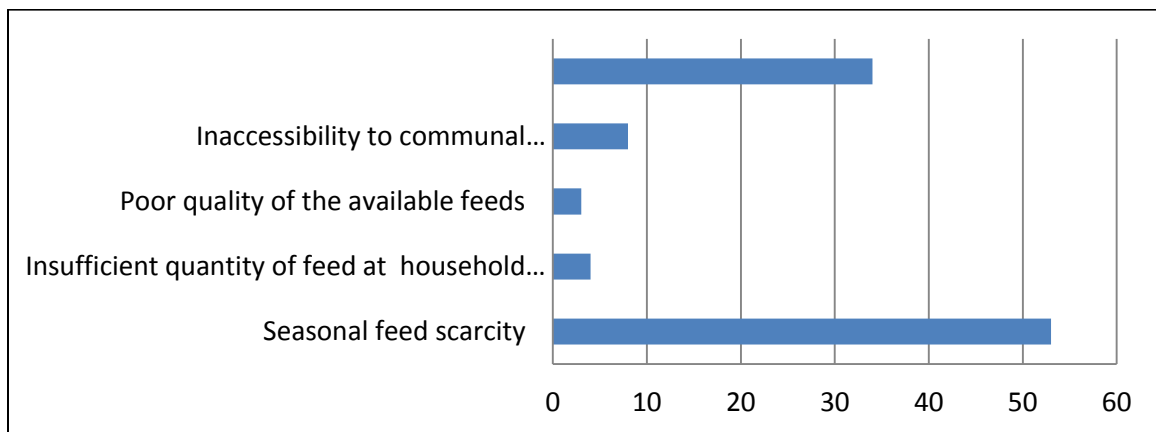
**Figure 3.7:** Quarterly mean feed prices in the study areas

### 3.5 Reasons for feed sales, purchases and seasonal effect on the market

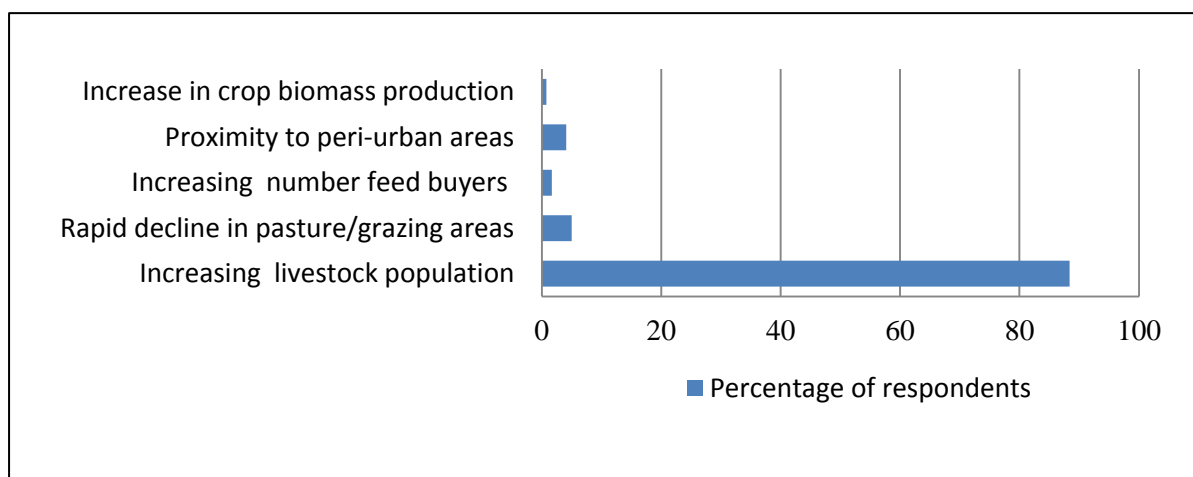
About 40% of the sellers sold feed as a means of generating extra income for the household and over 50% of feed buyers purchased feed due to seasonal feed scarcity. Income generation and feed shortage were therefore the main drivers of feed trading. Other reasons that were provided by the feed sellers and buyers for trading in feedstuffs are presented in Figure 3.8a and b.



**Figure 3.8a:** Reasons for selling feed



**Figure 3.8b:** Reasons feed purchases



**Figure 3.9:** Drivers of feed market expansion in the study area

The results further revealed that 94% of the respondents perceived the emerging feed market to have very good growth potential as opposed to 6% who thought the feed market does not have the potential to grow. Those who perceived that the feed market has good growth potential were of the view that the major driving factor was growing feed demand due to

increasing livestock population and trading in livestock and livestock products. Figure 3.9 presents the details of the drivers of the emerging feed market expansion.

A study of the proportion of the feed types purchased on seasonal basis indicated changes of feed types across the seasons and the rate of purchase of the same feed type differed from one season to another. Maize bran was the most purchased feed by most actors throughout the year whereas groundnut haulms sales peaked in dry season above that of maize bran (Table 3.9). Generally, there were changes in the types of feed purchased by buyers as the season changes, which was attributed to change in the feed availability in the markets.

**Table 3.9:** The effects of seasons on respondents' feed purchases

Feed	Percentage of feed buyers per season				
	early dry	late dry	early wet	main wet	year round
Groundnut haulms	21.4	20.7	18.2	33.3	12.5
Cowpea haulms	10.6	17.2	9.1	-	4.2
Millet bran	2.1	6.9	9.1	-	-
Maize bran	17.0	13.8	27.3	66.7	66.7
Rice bran	6.4	3.4	-	-	8.3
Maize straw	2.1	3.4	-	-	-
Rice straw	-	-	-	-	4.2
Browses	27.7	6.9	9.1	-	4.2
Cassava peels	8.5	10.3	9.1	-	-
Pigeon pea leaves and pods	-	6.9	-	-	-
Dawadawa pulp	2.1	-	-	-	-
Brewers' spent grain	-	6.9	9.1	-	-
<i>Faidherbia albida</i> fruits	-	3.4	9.1	-	-
Total	100.0	100.0	100.0	100.0	100.0

### 3.6 Uses of purchased feed

About 50% of the feed buyers used the feeds to fatten animals for market whereas others offered the feed to all their animals for increased productivity of the flock. Ten percent of the feed buyers in Wa and Bolgatanga markets retailed the feed they bought from producers or aggregators (Figure 3.10). Few respondents (5%) bought feed for meeting higher nutritional demand of their animals due to their physiological conditions. This included pregnant and lactating dams.

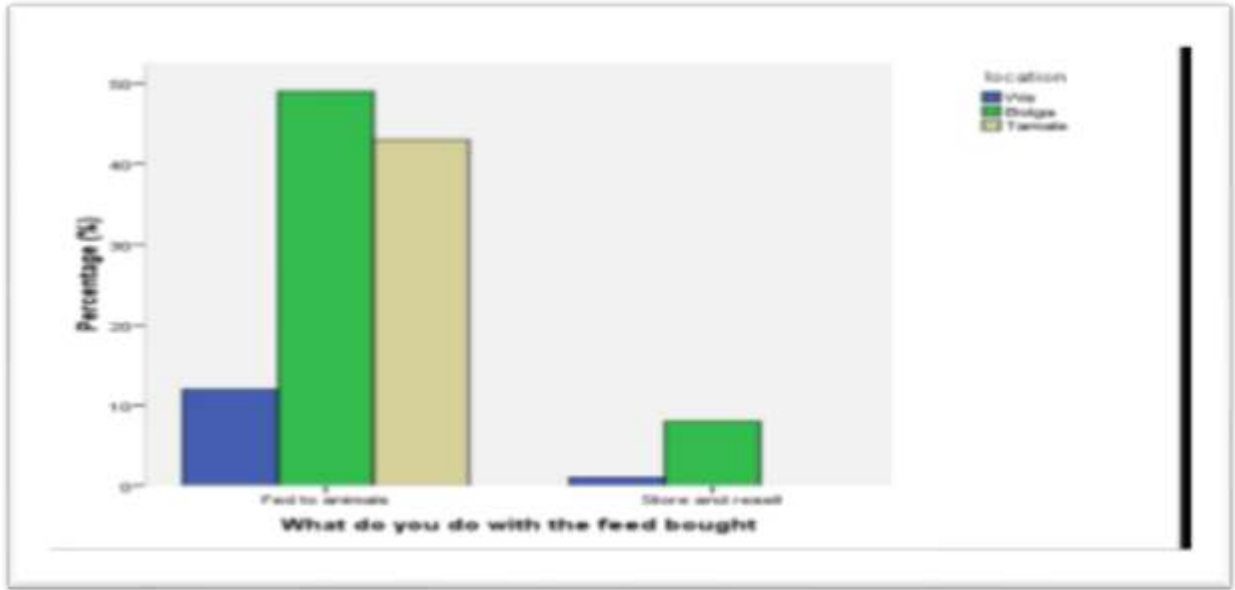


Figure 3.10: Uses of purchased feed

Plate 3.1a: Fodder vendors selling their wares at the market

Crop residues



Local browse plants



Some feedstuffs at Bolga market



Some browses at Wa market



**Plate 3.1b:** Assorted feedstuff on sale at the market

**Agro-industrial by-products  
(bran of cereal grains)**



**Fresh cut grass forage**



## 4. Discussion

### 4.1 Actor profile

About 40% of the people engaged in feed trading were in the economically productive age group of 31 – 65 years. This supports the report of Dicko and Sangare (1981) that in addition to *in situ* exploitation of fodder by domestic animals, it is being harvested and sold as a source of income for rural folks. This age group saw fodder marketing or the need to buy fodder to produce animals as an alternative source of supplementing family income and it confirms the report of Huseini et al., (2011) on browse plant trade in Upper East region of Ghana. The involvement of both males and females in the feed markets further agrees with their findings. However, the high proportion of males found in this study is contrary to Huseini et al., (2011) findings that females dominate in the trading of browse plants. This deviation is attributable to the categories of actors interviewed in this study which included both fodder sellers and buyers while they interviewed only feed sellers.

The findings that all classes of people in the study areas were involved in the feed trade as either sellers or buyers of feedstuff suggests that social status had no effect on the feed trade. The educational status however had an influence on the sale of fodder as 60% of the fodder sellers never had any form of formal education. The other category of people who were involved largely in fodder sale was those who did not complete their primary and secondary education programmes and could not seek formal employment. Few feedstuff sellers and buyers (7.8%), who had secondary and tertiary education participated in the feed trade largely as feed buyers for their backyard small ruminant.

### 4.2 Feed types

The study suggest that most of the feedstuff sold in the study area were collected from crops fields and communal range lands and were not cultivated fodder as reported by Nyangaga et al., (2009) in a fodder market survey in Ethiopia, in which all the fodder sold were cultivated by riverine agro - pastoralist. The absence of cultivated fodder in the surveyed markets is an indication of an emerging feed market and that commercial feed production is at the rudimentary stage in Northern Ghana due to lack of cultivated pasture and high dependence of livestock farmers on natural pasture and crop residue for feeding animals (MoFA, 2011).

The findings of this study that crop residues, agro-industrial by-products, annual forage and perennial browse plants were the feed traded on show the importance of these feed sources for smallholder livestock production in the study areas surveyed and is consistent with other findings (Ayantunde et al., 2014; Fuseini et al., 2011) in the study of feed trade . The results also agree with the report of Singh et al., (2013) in their exploratory study of fodder market in Bihar, India and other reports of fodder study in Ethiopia (Zinash and Seyoum, 1991; ILRI, 2009) in which crop residues were found to contribute greatly to ruminant feeding. The presence of agro-industrial by products in feed market such as maize bran, corn milling waste and rice bran creates an opportunity for the formulation of balanced feed rations or concentrates which were not found at all in all the surveyed markets.



The observation that the fodder trading activities goes on throughout the year in the areas suggests that it is a promising venture and could be a source of livelihood for the feed sellers. The further revelation that fodder trading peaks in early and late dry seasons is an indication of the existence of feed shortage in these seasons (Oppong- Anane, 2013). The low feed trading activity observed in the wet season implies that some of the feed buyers such as per-urban livestock farmers are able to get feed from the natural pasture for their animals during the period. This shows the undeveloped nature of the emerging feed market relative to similar volumes of seed sales throughout the year reported in developed feed markets (Nyangaga et al., 2009). There is however, a high potential for the growth of the fodder market in the study areas in that about 90% of both feed sellers and buyers believed it will grow due to the growth of livestock sector and is confirmed by over 50% of the sellers and buyers who perceived that the feed sold is of good quality for animals by their physical appraisal.

### **4.3 Feed prices and uses**

The higher price of cowpea haulm than all other feeds is attributable to the perception of farmers that it is high quality feed and very good for ruminant livestock (Ayantunde et al., 2014). It is also partly due to pricing of the feed based on size of bundle or units of measure (bowls, bundle or bags) but not by weight. This makes the voluminous and lighter feeds like cowpea haulm bundles to attract higher price per kg than other crop residues. For instance, the same size of groundnut and cowpea haulm bundles may cost the same price but the groundnut haulms bundle would weigh more than the cowpea haulm bundle and consequently has a lower price per kg than the cowpea haulms. Other reason for the price of cowpea haulm is due to high demand per the farmers general believe that is relatively good feed and as a commodity, it obeyed the economic principle the higher demand and the higher price. It is therefore worth stating that, the feedstuffs with higher price per kg may not be necessarily the best quality feed. This makes the nutritional evaluation of the feeds very important for recommending the best feed to purchase.

The price of groundnut and cowpea haulms (0.62 and 1.00 Ghana cedis per kg respectively) in this study were lower than the prices reported by Ayantunde et al., (2014) in similar studies at Bamako, Mali who had 617 and 658 FCFA per kg DM for groundnut and cowpea haulms respectively when converted to Ghana cedis. The difference in feed prices could be attributed to the availability of alternative feed resources that are not being sold in Ghana. This and other sources of income generation activities in Ghana contributed to fewer people getting involved in fattening animals relative to that of Mali and consequently demand for feed will be lower which in turn lower feed prices in Ghana.

The general higher feed prices in Upper East Region at Bolgatanga market is attributable to higher livestock population per unit area and less vegetation for grazing due to pressure on land for other uses in the region compared to Northern and Upper West regions where there were lower animals numbers per unit area and more natural vegetation for grazing (Amankwah et al., 2012; MoFA, 2011). Similar findings were reported in browse plant harvesting and marketing study (Huseini et al., 2011) in Northern Ghana.

The observed higher prices of feed in early and late dry seasons emanate from increased animals fattening by farmers and livestock traders during these seasons. They mostly fatten

their animals for sale for two or more weeks at retail market before selling them to satisfy the demands for the end of year festivities in early dry season. At late dry season to early rainy season (February to May), there is a high feed demand from peri-urban livestock farmers as feed shortage intensifies due to depletion of forage in the natural communal pasture (Oppong-Annane, 2013; Addah et al., 2014).

#### **4.4 Reasons for feed sale and purchase**

The findings that about 50% of the responding feed sellers sold feed as a means of generating extra income for the household and over 50% of buyers purchased feeds due to seasonal feed scarcity are similar to the report by ILRI (2010) on fodder market study in India. Other reasons that were provided for the sale and purchase of feeds by the feed sellers and buyers suggested that the marketing of feedstuffs is one of the poverty coping strategies among low income households in the study areas (Huseini et al., 2011).

## 5. Conclusions and recommendations

### 5.1 Conclusions

The study revealed that over 50% of feed sellers and buyers were youth who form the working age group, and about 50% of feed sellers did not have any form of education and can neither read nor write.

The feeds on sale in the study areas were unformulated ruminant feeds and were mainly crop residues (groundnut haulms, cowpea haulms, and pigeon pea residue ), agro-industrial by-products (bran of maize, rice and sorghum) and fresh grasses as well as local browse leaves (*Ficus* sp, *Azizelia* sp and *Pterocarpus* *evinacelus*). The crop residues and browses were packaged in bundles and the agro-industrial by-products (grain bran) in bags and bowls for sale.

The feed prices were generally higher in Bolgatanga market in Upper East Region than in Tamale and Wa markets in Northern and Upper West Region, respectively. Prices of grains bran (maize bran) were generally the same across seasons but those of crop residues were higher in early to late dry season than in the rainy season.

Income generation and feed shortage were the main drivers of feed trade and respondents were of the view that the feed market would expand in Northern Ghana due to increasing livestock population and trade especially in peri-urban and urban communities as a result of increasing demand for livestock and livestock products.

### 5.2 Recommendations

Further studies should be made to determine the volume of feed sold across seasons and the income generation levels of feed sellers and other feed value chain actors involved in the feed trade.

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## Appendix 1: Pictures of feed trading activities in the surveyed markets

Crop residues



Browse for sale



Grass forage vender ready to serve costumers at Tamale

