Archives of Current Research International

9(2): 1-16, 2017; Article no.ACRI.35727
ISSN: 2454-7077

Analytical Study of Soybean Value Chain: The Perspective of Sissala East District in Ghana

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Authors' contributions

This work was carried out in collaboration between all authors. Authors JAA and JKL designed the study, performed the statistical analysis and wrote the protocol. Author HA wrote the first draft of the manuscript. Authors JAA and JKL managed the analyses of the study. Author HA managed the literature searches. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/ACRI/2017/35727
Editor(s):
(1) Claudine Tekounegning Tiogué, University of Dschang,Faculty of Agronomy and Agricultural Science,School of wood, water and natural resources, Ebolowa Antenna,aboratory of Applied Ichthyology and Hydrobiology, Cameroon.
Reviewers:
(1) John Walsh, Shinawatra University, Thailand.
(2) Susana Ben Ohen, University of Calabar, Nigeria.
(3) Barry Silamana, Institute of Environment and Agricultural Research (INERA), Burkina Faso.
Complete Peer review History: http://www.sciencedomain.org/review-history/20831

Original Research Article

Received 27th July 2017
Accepted 26th August 2017
Published 6th September 2017

ABSTRACT

This study was carried out to assess the soybean value chain and its contribution to household food security in the Sissala East District of the Upper West Region of Ghana. The study critically examined the prospects and challenges of the soybeans value chain to household food security. A case study approach was adopted as a research design, involving random sample of one hundred and ten (110) farmers and purposive sample of ten (10) value chain actors. Self-administered-questionnaire was used as data collection instrument to solicit views from the farmers whilst interview guide was used to obtain information from the value chain actors. The results showed that the introduction of value chain approach in the district has been beneficial to the farmers with increased average farm acreages and seed yields from 5 to 11 maxi bags per acre; and improved linkages and access to soybean markets and processors. The soybean value chain however had some challenges such as untimely delivery of inputs, exploitation of farmers in the

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chain, high production cost, among others. To sustain the gains made through the interventions, there is the need for heightened collaboration between district assemblies, development partners, farmers and other relevant value chain actors. The policy makers also need to enact bylaws that could regulate the activities of middlemen in order to curtail the exploitation of farmers and other value chain actors. There is the need for government to subsidize agricultural inputs to reduce production cost and improve soybean productivity for enhanced household food security in the district.

Keywords: Farmer; soybean; value chain; food security.

1. INTRODUCTION

The majority of the world's extremely poor people (of about 74%) live in marginal areas and rely on small scale agriculture [1]. Agriculture is the 'life-blood' of every nation and still remains one of the fundamental instruments for sustainable development and poverty reduction. According to [2], Ghana's economy has been largely dependent on the agricultural sector which provides employment to over 60% of its total workforce. However, Ghana's agricultural sector has been experiencing a decline in its contribution to real gross domestic products (GDP) as compared to other sectors of the economy since 2010. Though there have been growth in the service and industrial sectors [3], the agricultural sector still plays a pivotal role in the provision of some basic raw materials to support production in those sectors.

Undoubtedly, agricultural growth is particularly effective in reducing hunger and malnutrition, and most of the extreme poor depend on agriculture and its related activities for significant part of their livelihoods [4,5]. So the growth in agriculture sector will be most effective in reducing extreme poverty and hunger when it increases returns to labour and generates employment for the poor small holder farmers especially women. As rainfall dependent agriculture, the small holder farmers in Ghana do not access their markets or buyers before producing crops and this does not enable them produce enough for their family upkeep and for the market.

In order to complement efforts of the government in agriculture value-chain (activities from production to consumption), there have been several non-governmental intervention programmes and projects designed to promote productivity and food security among Ghanaian households. Such intervention programmes are limited in Sissala East District of Ghana and have created knowledge gaps in agriculture produce value chain among producers. In modern integrated value chains, producers gain from increased knowledge, better quality and food safety, reduced costs and losses, higher sales and greater value addition in production. Unfortunately, many farmers are uninformed of these benefits in the value chain approach. The value chain approach seeks to link smallholder producers to buyers or markets and other value chain actors [6,7] for enhanced business linkages and opportunities. However, there are apprehensions about the capability of smallholders to adjust to the emerging environment because of several operational constraints they face in production and marketing [8].

In relation to an improved agricultural sector, a secured produce market would encourage producers and other support services from financial institutions (by way of loans), agricultural extension services (for improved farming practices and input usage) to farmers for enhanced productivity and food security. In Sissala East District, soybean is mainly produced for sale due to its high market value. This is because; the crop can be used in several dish preparations and serves as a protein supplement in households' diet due to its higher total digestible nutrient percentages (92%) than cowpea (80%). It also has more metabolic energy and a higher content of lysine (6 to 7%) than all other common vegetable protein sources [9,10]. The innovative uses and products from soybean make it a valuable and marketable crop, which can contribute to household food security [11] in Sissala East District of Ghana.

Clearly, an intervention that could help in bridging knowledge gaps and improving productivity and income of farmers could equally help motivate and disabuse the minds of the youth to embrace farming as a business. Such intervention also has the potential to discourage the youth from migrating elsewhere and indulging in illegal mining activities to earn a living.

1.1 Problem Statement

The Upper West Region is among the poorest in Ghana, with nine out of every ten people being poor. This high level of poverty is attributable to constraints to food production due to poor arable lands, limited farm sizes, heavy dependence on erratic and mono-modal rainfall for production and lack of viable alternative livelihood activities to support households [12]. The main economic activity is farming; rearing animals and cultivating crops of mostly cereals and legumes.

Among the cultivated legumes, the soybean crop has a huge and reliable market, especially for feed meal and edible oil producing companies in Ghana. However, the limited domestic production sometimes necessitates the soybean importation by domestic processing companies. This could be attributed to poor market linkages between soybean farmers and other value chain stakeholders. This could lead to limited market expansion, production, and household incomes, and could threaten household food security.

The organization of agriculture along the value chain framework has been conceived as one of the innovative and successful strategies for more efficiency in the agricultural sector [13]. However, in the Sissala East District, there is a challenge in the value chain framework, which brings soybean crop from the conception of raw materials and inputs sourcing, production, marketing and distribution to final consumption, for enhanced household food security. The farmers in the district are unaware of the prospects and benefits associated with the approaches soybean value chain.

It is in this light that this study is conducted to assess the soybeans value chain and its contribution to farmers' household food security in the Sissala East District of Ghana. It also seeks to identify and advance knowledge on the approaches of soybean value chain and its application to farmers' circumstances. This could help identify the challenges in the soybeans value chain sector and some mitigation measures to improve productivity and household food security in Sissala East District of Ghana.

2. METHODOLOGY

2.1 Research Design

The study employed the agronomic and case study approaches, and using the qualitative and quantitative methods to obtain the desired results. The combination of the methods permits the strengths of the various approaches to be captured, and thus the weaknesses of a single approach are avoided [14]. In this study, the quantitative method was used to capture the views of farmers using a structured questionnaire, whilst the qualitative method was used to capture the views of the value chain actors using an interview guide. Before administering the questionnaires and prior to the farming season, focus group discussions with soybean farmers were organized. The discussions were centered on some agronomic practices in soybean production, harvesting and storage, and its marketing potentials.

2.2 Scope of the Study

The study was conducted on assessing the soybeans value chain and its contribution to household food security, and this was limited to the Sissala East District in the Upper West Region of Ghana. The food security dimension in this study covered soybean production practices, availability, access, utilization and stability. It covered three major farming communities where the value chain approach has been implemented by some non-governmental organizations (NGOs) and to some extends Ministry of Food and Agriculture (MOFA). The study also sought to determine farmers' knowledge on the value chain concept and its usefulness to their agricultural production. It involved respondent soybean farmers/consumers, retailers and processors or manufacturers as well as input dealers.

2.3 The Study Area

The Sissala East District has the least inhabitant population of 56,528 (8.1%) in Upper West Region, and comprises of 48.7% males and 51.3% females. The District is located in the north-western part of Ghana, which falls between longitude 1.30° W to 2.40° W and latitude 10.00° N to 11.00° N, with Tumu as its administrative capital. The District shares boundary to the north with Burkina Faso, to the east with Kassena-Nankana East and Builsa Districts of the Upper East Region. Its extreme south-eastern portion is with Mamprugo-Moaduri District of the Northern Region; Sissala West to the South-west of Wa, the capital of Upper West Region [15]. The major occupation of the people in the District is farming involving 70% of the populace, with few others into trading, public and private sectors [16].

Table 1. The distribution of sample size

Type of value chain actors	Sample size	Cumulative sample	Sampling technique
Lilixia community farmers	39	39	Simple random
Tarsaw community farmers	37	76	Simple random
Vamboi community farmers	34	110	Simple random
Soybeans processors	2	112	Purposive sampling
Aggregators/Middlemen	2	114	Purposive sampling
NGOs	2	116	Purposive sampling
MOFA	1	117	Purposive sampling
Input dealers	2	119	Purposive sampling
Financial institution	1	120	Purposive sampling
Total (N)	**120**		

Source: Field survey data 2015

However, farming as the major source of livelihood and income of the people is limited during the dry season, apparently resulting in unavailability of food in the dry season. Major crops cultivated in the area are cereals such as maize, sorghum, millet and legumes such as soybeans, groundnut, cowpea, and many others [17]. Among these crops, soybean is mainly grown by most households purposely for the market, and it is regarded as the cash crop by farmers.

2.4 Sampling Size and Sampling Technique

The study targeted soybeans farmers and some selected value chain actors within three selected communities - Vamboi, Tarsaw and Lilixia in Sissala East District. These communities are the major soybean producers in the district and serve as stakeholders in the soybeans value chain. As a result, soybeans farmers were sampled in these communities with other value chain actors who had in-depth knowledge and information on the crop's value chain. 120 respondents, comprising 110 soybeans farmers and 10 value chain actors made up of processors, aggregators/middlemen, input suppliers, financial institution, MOFA and NGOs were sampled (Table 1). The entire population of the target farmer respondents was unknown, and so simple random quota method [18] was used to determine the number of farmers to be sampled from each community, whilst the value chain actors were selected using the purposive sampling method. Both primary and secondary data were respectively obtained through interviews and other relevant documents and/or sources.

2.5 Data Collection Procedure

The primary data was obtained using an administered questionnaire and in-depth interview guide. Farmers' knowledge and awareness on the importance of value chain approach to improved crop production was assessed. Whereas the soybeans farmers were administered with questionnaires, the value chain actor respondents were administered with in-depth interview guide. The questionnaire comprised of a 5-point Likert Scale, with both closed and open ended forms. All ethical issues concerning respondents and/or informants with regards to voluntary participation, anonymity, confidentiality and acknowledgement of other authors were adhered to.

2.6 Data Analysis and Presentation

Descriptive statistics was used to analyse data collected in order to portray an accurate profile of persons, events and situations [19]. For coherence and consistency of the information gathered, the data was edited, coded and analysed using the Statistical Package for Social Sciences (SPSS) (version 21.0). The analysed data was organized into tables, charts and graphs for interpretation.

3. RESULTS AND DISCUSSION

3.1 Socio-demographic Characteristics of the Actors in Soybeans in Sissala East District

The farmers were the main population of soybean value chain actors interviewed. The female farmers (70%) far exceeded that of the

males (30%), which attests to the fact that, soybeans is traditionally seen as a female dominated crop as it is usually cultivated by women. Most of the soybean farmers (38%) were aged between 31-50 years (Fig. 1), indicating that majority of the sampled population are active and can effectively carry out their farming activities as well as learn modern farming techniques for improved productivity. It is also an indication that those who patronize and cultivate soybeans have some level of experience in crop production.

As farming communities, most of the farmers (68%) were married, except that 25% were widowed (Fig. 2). Unfortunately the farm lands and other economic resources are not controlled by the widows and the young, though much passionate in farming ventures. There were few young farmer respondents because the youth are not interested in farming and often leave their communities for greener pastures.

That notwithstanding, the middlemen and processors (Table 1) who buy the soybeans in large quantities were of the view that some of the producers and/or sellers of the beans do not process them properly before sale and do not get value for money. They also raised concerns of most women selling few bowls of the bean at a time, with some grains invested thereby lowering its quality and market value. They regrettably stated that though huge potential exists in soybeans business, efforts are not being made to encourage farmers to produce in large quantities for the export markets and local processing industries.

Again, about 56.7% of the sampled population had no formal education, with only 1.7% attaining tertiary status (Fig. 3).

Predominantly Islamic and traditional religious communities, households are mainly headed by men (70.8%), which have some implications on household decision making on land, economic resources, crop cultivated, and sale of farm produce, among others. So women in those communities usually seek permission from men on land matters and these have implications on the farm sizes given to women for crop production. In fact, some interviewed widows (25%) were not living in their late husband's extended family compounds, and were their own household heads. As farming communities, 53.3% of households had ten and above members mainly to have competitive advantage in family farm labour force.

Most of the respondents (42-45%) have been engaged in farming over a decade (Fig. 6), indicating that most farmers in crop and animal production have some levels of experience in farming.

The smallholder farmer population (70%) was more than that of the nucleus farmers (30%) in soybeans production (Fig. 7). This is because soybean is mostly cultivated by female farmers who unfortunately had limited control and access to farm lands.

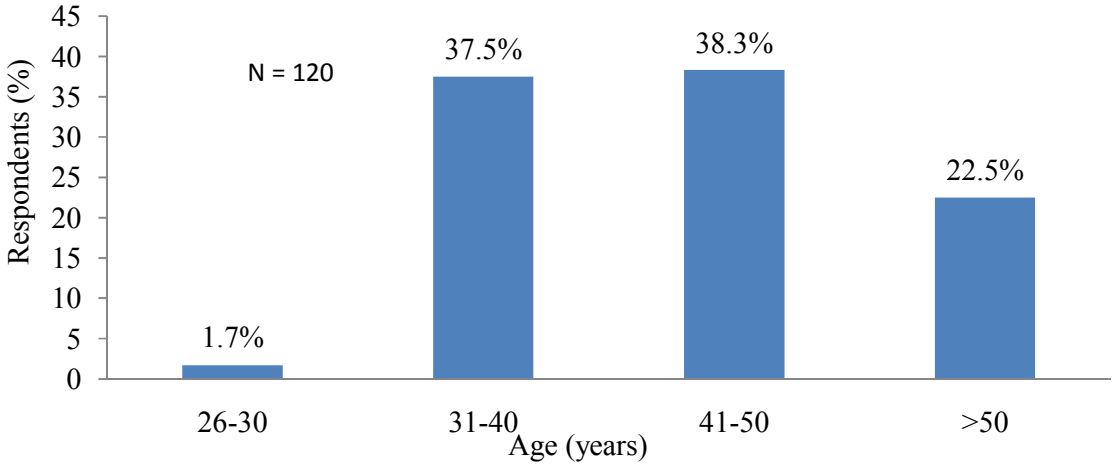

Fig. 1. Age group of soybean farmers

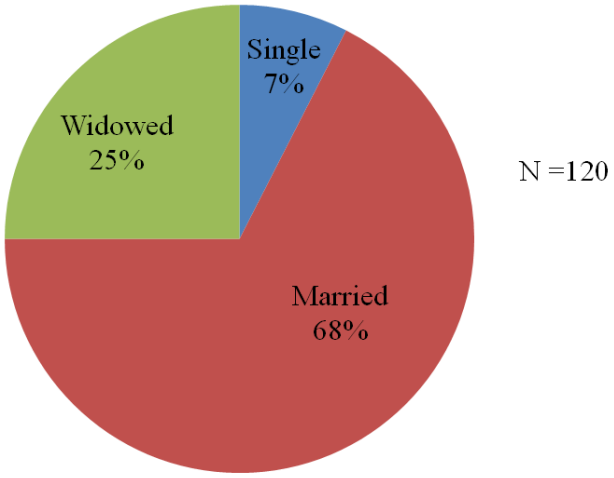

Fig. 2. Marrital status of intervieved farmers

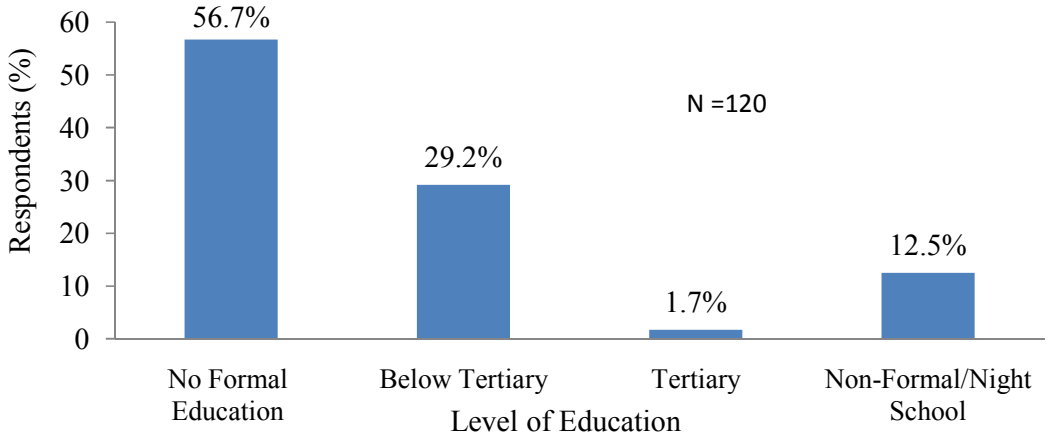

Fig. 3. Educational level of respondents

Generally, small holder farmers play vital roles in promoting household food security [5]. There is therefore the need for agricultural packages to be channeled towards development of these farmers' productivity. This agrees with [20] statement that "support value chain development and not just production, thus there should be a holistic view of smallholder farmers development with its network of activities with other stakeholders in the value chain".

3.2 The Land Acreage and Production Levels of Soybeans in the District

The farmers' average acreage of soybeans before and after the value chain intervention was explored. The intervention generally led to increased acreage of lands for soybean cultivation in Sissala East District. In fact less number of farmers (13%) were found cultivating soybean within half an acre of land, as compared to 54% of the farmers who were cultivating less than an acre before value chain intervention. The intervention also encouraged more farmers (from 16% to 41%) to cultivate within 6-11 acres of land for soybean production (Fig. 8). This agrees with the assertion that there are tremendous benefits of the value chain intervention towards improvement in household food productivity [21,22].

As value chain intervention measures, household were exposed to soybean industrial uses and ready markets avenues for the crop through education and training, coupled with extension services and NGOs roles. This farmer

sensitization resulted in increased average acreage and yield of soybean per acre from 5 to 11 maxi bags (25 to75%), with many farmers (80%), harvesting 12 and above bags per acre (Fig. 9). This positive outcome is an indication that the intervention has contributed to improved farmers' knowledge in soybean production.

From this outcome, farmers will more likely adhere to the core tenets of the intervention in order to continue having higher soybean yields and enhanced household incomes. This suggests that value chain intervention is of much essence to farmers [23] in farming communities, as it seems to guarantee household food security due to its roles in ensuring food availability and stability dimensions [22]. Again this study buttresses the statement of [21] that "value chain enhances soybeans production due to its inoculation of nitrogen fixation and a vision for increase in soybeans production".

As a result of increase in production and probably due to price fluctuations, farmers were selling few quantities of soybeans at harvest and storing larger quantities of between 10-20 bags or even higher (Fig. 10) for better prices in future.

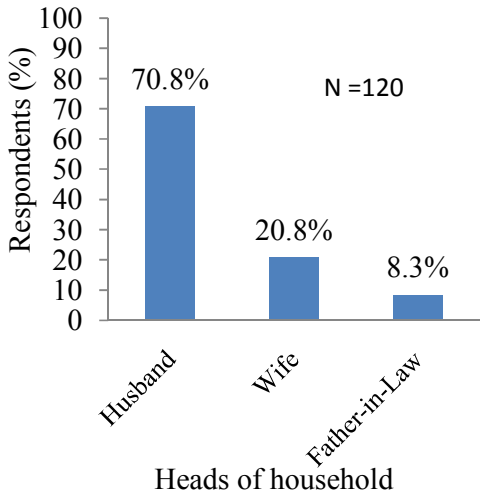

Fig. 4. Category of household heads

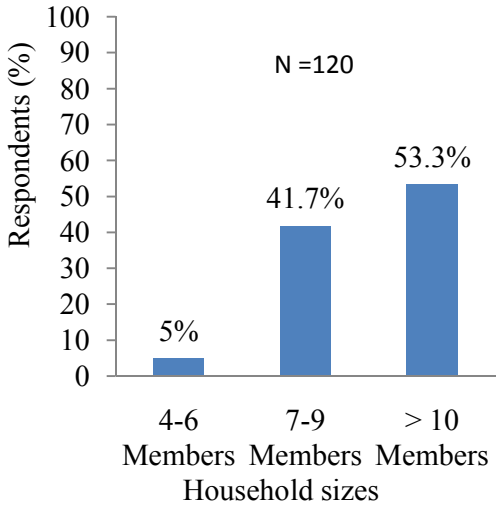

Fig. 5. Household size

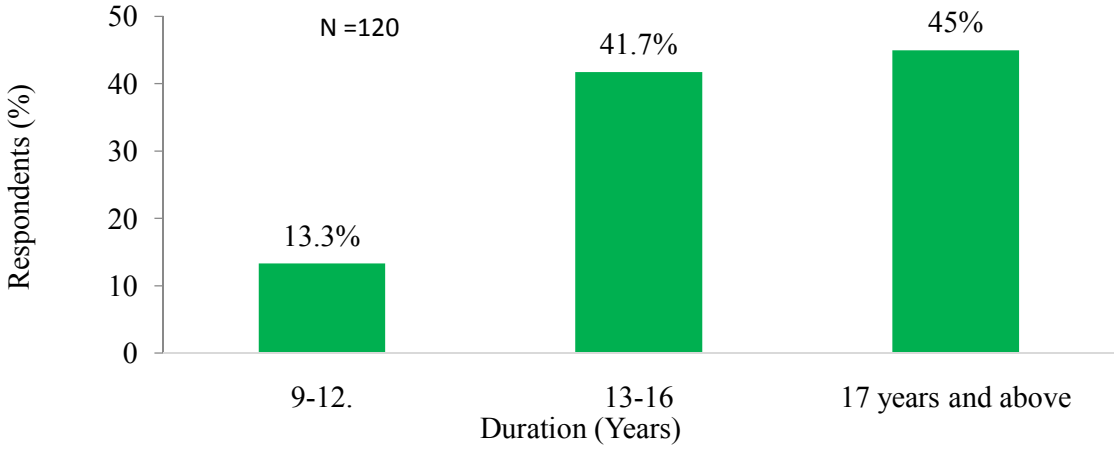

Fig. 6. Duration of farmers in crop production

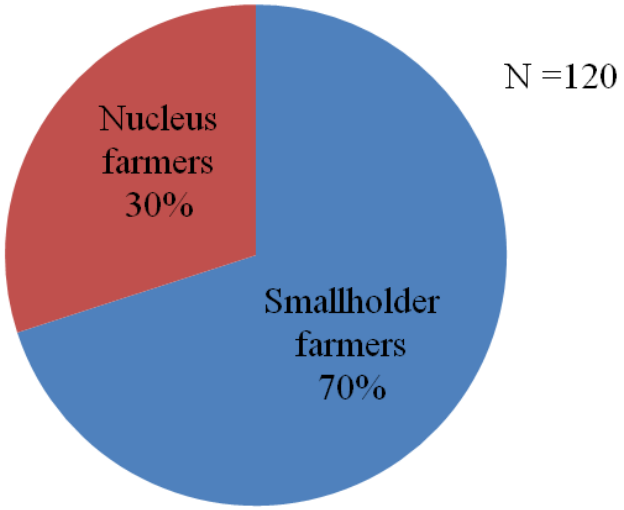

Fig. 7. Categories of soybean farmers

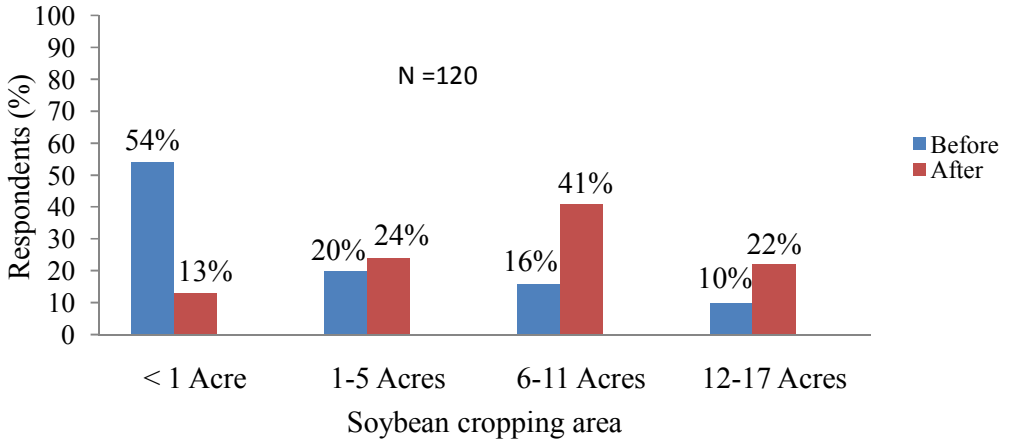

Fig. 8. Farmers' acreages of soybean before and after value chain intervention

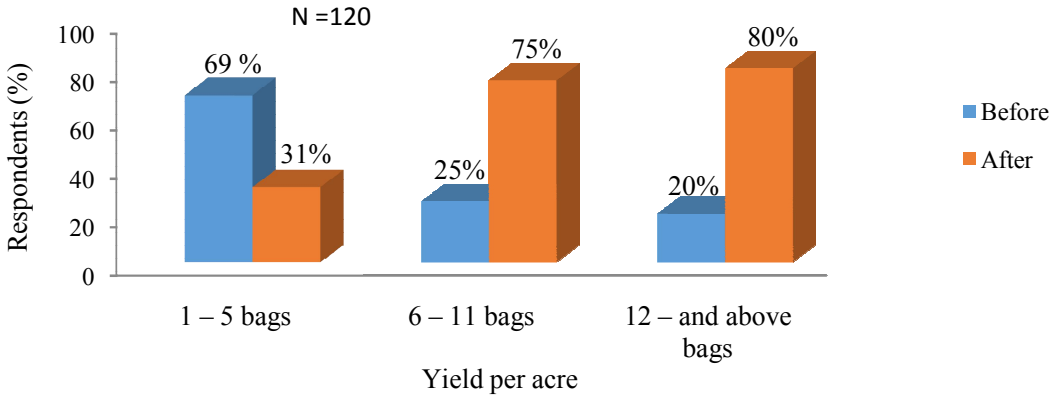

Fig. 9. Yield of soybean before and after value chain intervention

This practice in itself could guarantee food security since increases in production of the crop will necessarily lead to increased storage for future household consumption or sale. It will also invariably lead to a stable year round access to food, and this can help meet the dietary requirements for an active and a healthy household life [24].

3.3 The Levels of Farmers' Knowledge and Linkages with Value Chain Actors

The concept of the value chain has been implemented in many areas through the interventions of NGOs and other actors to enhance productivity, value addition and linkages to markets. However, most of the interviewed farmers (83.8%) in Sissala East District were unaware of the linkages and opportunities that exist under the value chain concept. The farmers were educated on the value chain approach and linkages and opportunities associated with it for enhanced household income and food security. This intervention led to 52% of the farmers having knowledge and linkages in the soybean value chain approach (Fig. 11).

The intervention of the value chain approach to soybean production also resulted in an increased access of farmers to agricultural inputs (including seeds and fertilizers) from 11.5% to 54.5% (Fig. 12). This could be attributed to the strengthening of linkages between farmers and input suppliers during the survey.

3.4 Linkage to Soybeans Processors and Markets

The value chain approach also helps in linking soybean farmers to processors such as Ghana Nuts, Golden Web, Vester Oils and many other markets. In fact some processors were establishing business relations with some farmers being pre-financed to produce soybeans. The awareness, availability and linkage to soybeans markets by farmers were quiet high as access to markets rose from 17% to 66% (Fig. 13). Due to value chain, buyers are assured of product quality, supply and safety through integrated systems from production to retail. Suppliers are also assured of a market and the benefits of economies of scale [23].

Apart from its financial rewards, farmers' motivation to cultivate soybean could stern from its numerous uses and benefits (Table 2). The positive impact of soybeans on household food and income generation [25] calls for the promotion of soybeans production in rural areas for improved household nutrition, good health and poverty alleviation.

3.5 Linkage and Assistance from Financial Institutions

Similarly, there was increased assistance from financial institutions to farmers for some loans to improve their production (Fig. 14). This will benefit small holder farmers and hence enhance food security and alleviate poverty of households, due to enhance linkages between buyers and producers [8].

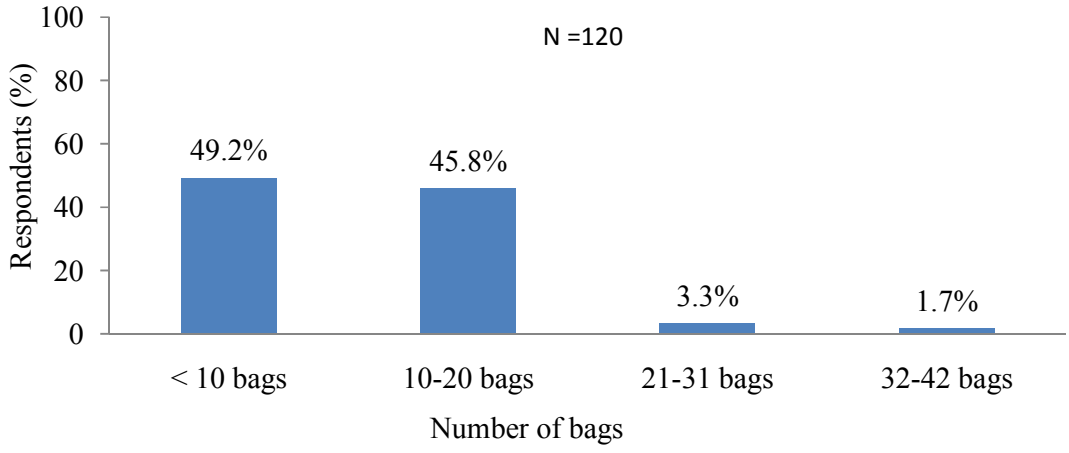

Fig. 10. Quantity of soybeans stored by farmers

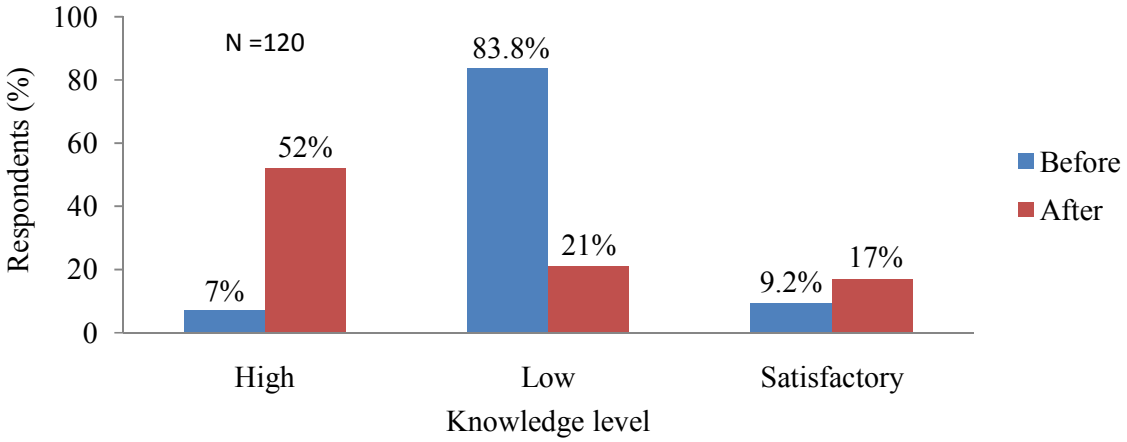

Fig. 11. Farmers' knowledge levels in soybean value chain

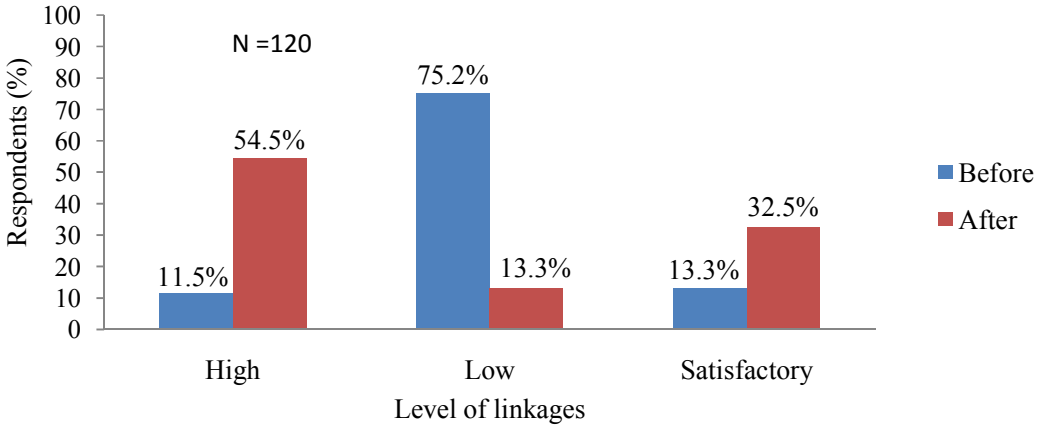

Fig. 12. Farmers linkages and acess to agricultureal inputs

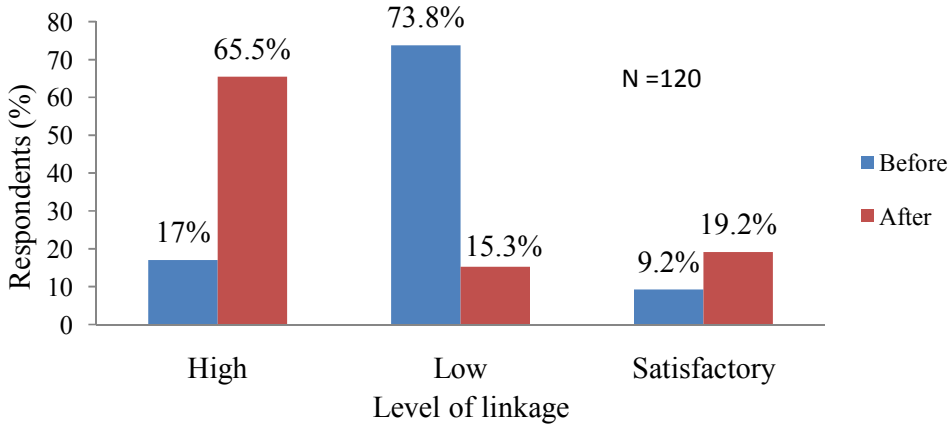

Fig. 13. Awareness level and linkages to soybean processors and markets

3.6 Capacity Development and Improvement in Crop Production

As part of value chain implementation processes various agricultural and business education and training have been under taken by mandated institutions such as MOFA with an aim to increase farmers' productivity and income. In Ghana the NGOs implementing agricultural product value chain often liaise with MOFA to provide extension education services to beneficiary farmers. The farmers in the sampled communities had these education and training on best land preparation methods, time of planting, right planting distances, usage of improved seeds, post-harvest management practices, which has the potential to increase farmers' yield (Figs. 15 and 17). Hence the value chain approaches in farming communities help improve productivity, which subsequently promote capacity development and improvement in agricultural production for enhanced livelihoods (Fig. 16). This is because, farmers' market power and profitability was enhanced, benefiting all stakeholders in the chain [26,27].

Prior to the value chain intervention, 15% of the respondents (120) were producing and earning income from the sale of soybeans. Farmers were encouraged to consider farming as business, which resulted in about 51% of respondents (120) increasing their production and earning enhanced incomes from soybean sales. This signifies why farmers are increasing their farm acreages and more farmers now cultivating soybeans. This could have been due to farmer linkages and assistance obtained from NGOs and processors (Fig. 15).

Table 2. Uses and benefits of soybeans

Uses and benefits	Number of respondents (N)	Respondents (%)
Process into soya milk	96	19.3
Process into poultry and other animal feeds	58	11.6
Process into cooking oil	77	15.5
Fortifying in baby food formulations	72	14.5
Process into dawadawa	115	23.1
Supplementing household foodstuff with soybeans	80	16.1
Total	498	100.0

Source: Field survey data 2015. The total number of respondents is more than 120 because of multiple responses

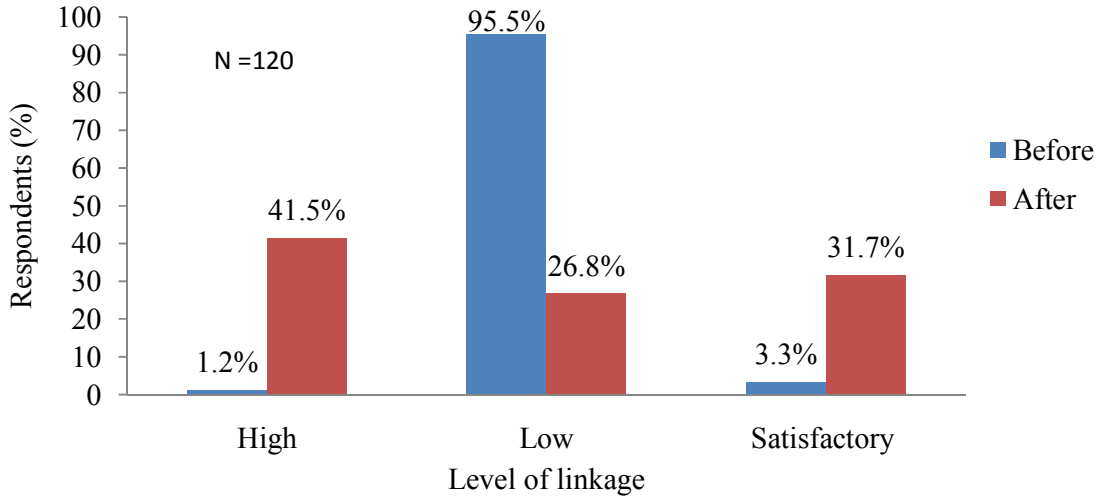

Fig. 14. Farmer linkage and assistance from financial institutions

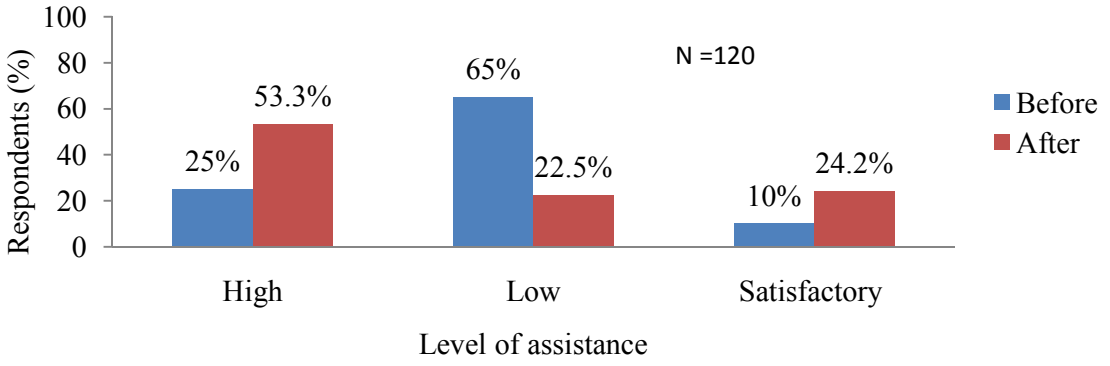

Fig. 15. Farmers' assistance by NGOs implementing value chain approach

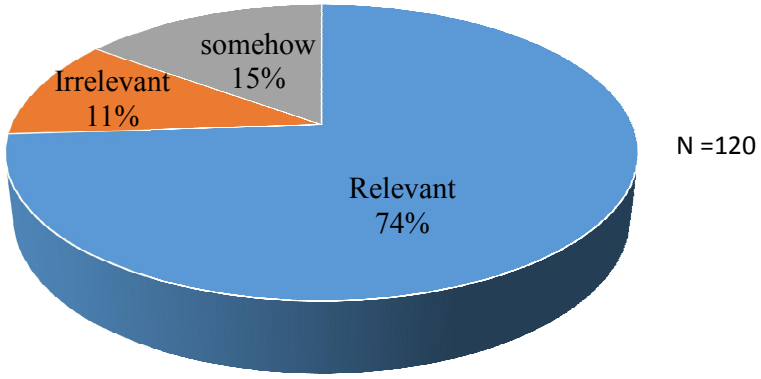

Fig. 16. Value chain approach relevance to soybean productivity

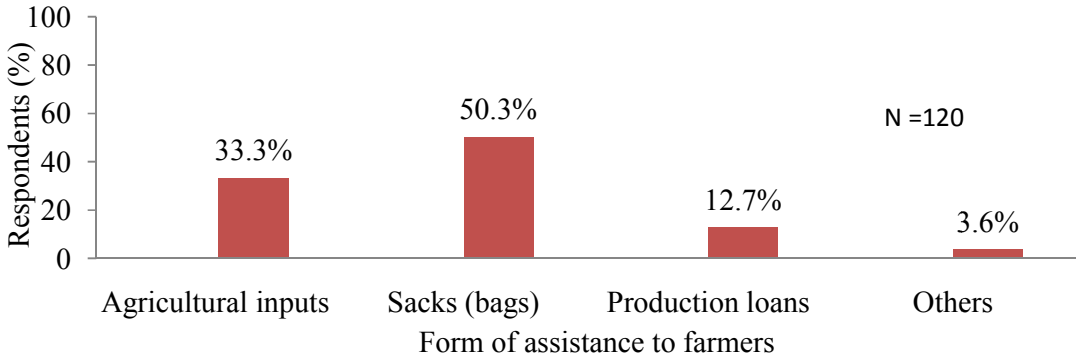

Fig. 17. Support farmers receive from processors or buyers

3.7 Soybean Value Chain and Household Food Security

The sustenance of households from harvested soybeans greatly depends on its benefits, number of years engaged in production, as well as quantities harvested over a given period. Farmers indicated relying on soybeans for household sustenance within periods of 1-10 years. However, more farmers depended on soybeans within 1-5 years than those beyond 5 years (Table 3). Clearly farmers who cultivate more of soybeans end up selling and using the money to buy other food stuff such as millet and maize for home consumption.

Table 3. Years in farmers' household sustenance from soybean

Response	10 years ago	5 years ago	last year
	%	%	%
Yes	15	64	83
No	85	36	17
Total	100	100	100

Source: Field survey data 2015

These soybean farmers in most cases have more food in their homes than non-soybean farmers because of its high market value than most staple foods sold in the market. In Sissala East District and in most parts of Northern Ghana, most household have shortage of food stuff during the dry season, particularly in the months of May-July (Table 4). Unfortunately, food prices are high within these months and most soybean farmers sell their produce at very high prices. These soybean farmers tend to have food at homes all year round, and except farmers who have animals and can sell them for foodstuffs, other farmers experience food shortages within the period.

So, most households in the lean (dry) season engage themselves in alternative livelihood practices such as sale of animals, petty trading, shea nut selling and/or processing shea butter for sale, as well as charcoal burning, among others (Table 5). Clearly, other avenues for income generation become the core challenges and responsibilities of most household heads. This will enable them sustain their families till farm produce are harvested somewhere between July-September, from which period through December foodstuff is abundance in the district.

3.8 The Soybean Value Chain Challenges and way Forward

There were challenges identified in the production and marketing of soybeans in Sissala East District (Table 6). The respondents indicated facing some major challenges in areas such as lowering market prices due to soybean importation into the district markets, untimely delivery of farm inputs leading to low productivity, exploitation of farmers by middlemen along the value chain, as well as high cost of production. Again, the uncertainties of rains with its associated risks in crop productivity often make most financial institutions unwilling to give loans to farmers. These challenges are quite similar to those identified by [28].

Table 4. Months household run-out of harvested foodstuff

Months households run out of harvested food	Number of respondents (N)	Respondents %
January and February	6	5
March and April	21	17.5
May and June	38	31.7
July and August	32	26.7
September and October	23	19.1
November and December	0	0
Total	120	100

Source: Field survey data 2015

Table 5. Alternative livelihood activities of farmers

Responses	Number of respondents (N)	Respondents %
Income from salaried job	1	0.2
Sale of farm produce (yam, sorghum, maize, etc.)	120	18.7
Sale of animals	103	16.1
Remittance from relatives	52	8.1
Petty trading	110	17.2
Shea picking and processing	102	15.9
Charcoal burning	87	13.6
Others	66	10.2
Total	641	100.0

Source: Field survey data2015. Frequency is more than 120 because it is multiple responses

Table 6. Challenges in producing and marketing soybeans

Responses	Number of respondents (N)	Respondents (%)
Untimely delivery of inputs	91	16.9
Exploitation from middlemen in the chain	88	18.4
Importation of soybeans to our markets lower prices	108	20.1
Lack of trust from financial institutions to give loans	84	15.5
Low patronage of soybeans at harvest period	79	12.7
High cost of production	88	16.4
Total	538	100.0

Source: Field survey data 2015. Frequency is more than 120 because it is multiple responses

Therefore, in order to sustain productivity in soybean and enhance household income and food security through the value chain approach, the farmers and other actors were appealing for actions and improvement in the following:

a) Pragmatic efforts be made by government to provide enhanced subsidies for agricultural inputs
b) The district assembly provides favorable policies and agreements for farmers and the credit facility providers
c) Platform be created for soybean price negotiations between sellers and buyers
d) There should be improved education and trust building relationships among soybean value chain actors.

4. CONCLUSION

The introduction of soybean value chain approach in Sissala East District has contributed substantially to increased average farm acreage and yields, and this helps improve farmers' livelihoods. The soybean crop is much valued because it serves as both cash crop and substitute or supplement for other foodstuffs for the market, which indirectly improves and ensures household food availability. The Sissala District is a rain fed dependent agricultural production area, and needs timely delivery of inputs and other services to farmers for improved soybean productivity.

That notwithstanding, the soybean value chain is associated with some challenges that can threaten the soybean production in the Sissala East District. So the soybeans value chain in the district need further strengthening to promote and ensure household food security. To achieve that, the district assembly should collaborate with farmers and value chain stakeholders for continuous dialogue on mitigation measures that will promote and sustain interventions aimed at empowering soybean farmers.

There is also the need for pragmatic policies by government on soybean production and marketing that can help protect the local farming industry and ensure that people take up farming as a livelong business venture. Again the linkage of farmers to market as an ultimate objective of the value chain approach should be strengthened through the Soybeans Marketing Board with a taskforce that will negotiate good prices and regulate middlemen activities which exploit the ordinary farmer. In furtherance of the course for improved success of the soybeans value chain, its intervention approaches can be adopted and applied to other food crops in the district.

5. LIMITATIONS

Most of the roads to the hinterland communities in the district were inaccessible and far apart, economically constraining and limiting the number of communities covered in the study.

Most of the respondents were illiterates and native Sissala language interpreter was engaged to interpret, which had its challenges.

The questionnaires were administered in the rainy (farming) season and most respondent farmers could hardly spare time for the exercise, resulting in several visits at homes and/or farms before questionnaires could be administered.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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Peer-review history:
The peer review history for this paper can be accessed here:
http://sciencedomain.org/review-history/20831