Research Paper

Farmers' Perception and Profitability of Pasture Establishment: Evidence from Ashanti Region, Ghana

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ABSTRACT

This study, conducted in the Agogo Traditional Area of the Ashanti region of Ghana, where there are numerous conflicts between crop and animal farmers due to insufficient pasture for livestock, especially during the dry seasons, has yielded positive findings. The study used cross-sectional data from 150 farmers selected via a multi-stage sampling technique. Financial viability indicators such as Net Present Value (NPV), Benefit-Cost Ratio (BCR), Internal Rate of Return (IRR), and perception index based on a five-point Likert scale were used. The establishment of pasture for small ruminant production was positive. The study found the pasture business as a viable concept with a BCR of 1.18, a positive NPV of GH₵3,160, an IRR of 40.1%, and a payback period of 2.61 years. Farmers' positive perception of pasture establishment for small ruminant production was a significant finding. The SWOT analysis identified the prospects and potential challenges of the concept as follows: availability of land, support to the government policy of establishing 'fodder banks' for sustainable land use, low technical know-how, and land tenure issues, among others. The study recommends the establishment of pasture as a venture since it is financially viable and has the potency to significantly reduce farmer-herder conflicts, instilling hope in the audience about the positive impact of the study's recommendations. Concerned institutions should also empower farmers through technical education on pasture establishment.

Extended Abstract

1. Introduction

Ghana is an agrarian economy, with about 45% of its population predominantly engaged in agriculture (FAO, 2015). In 2016, the total contribution of agriculture to Ghana's Gross Domestic Product (GDP) was 18.9 percent, with livestock production contributing 1.2 percent of the total agricultural contribution to GDP (GSS, 2017). Agriculture is an economic sector that employs about 45% of Ghana's population. The country is blessed with adequately fertile soil to support plant growth. Animals

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reared in the country are used to feed the population, meet the protein requirements of citizens, and provide additional income to farmers. The agriculture sector provides a wide range of benefits comprising employment, food, income, and foreign exchange for the country. Crop farming and animal farming are interdependent and must complement each other (FAO, 2015).

Despite the benefits of agriculture, Ghana is not enjoying the sector's full potential due to several constraints. Specifically, there is the problem of inadequate pasture or grazing land for animals (Amankwah et al., 2012). This has reduced the total yield of livestock over the years and contributes to the low protein intake of Ghanaians and Ghanaians' low protein intake. Additionally, as these animals of the food search, they often contaminate water bodies, destroy crop farms, overgraze and destroy forest reserves, and destroy forest reserves, leading to deforestation (Ahunu & Boa-Amponsem, 2001). However, there is evidence that water bodies are preserved when there is enough pasture for livestock feeding (Baidoo, 2014). The destruction of crop farms by livestock usually leads to severe conflicts between crop farmers and animal keepers. As a result, animals are deliberately killed as a retaliatory measure for crops destroyed (MoFA, 2009; Baidoo, 2014). This consequently reduces yield and quality in animal and plant products, leading to malnutrition, low quality of produce and income to farmers, scarcity and high consumer prices, and social unrest.

Our daily protein consumption level in Ghana is lower than recommended, as most of our diets depend on that. Most diets largely depend on starchy foods (FAO, 2010). With a high livestock production yield, humans meet their protein intake requirements to help solve the problem of malnutrition (UNICEF, 2014). Unfortunately, there is less incentive for livestock production in Ghana, making it difficult to expand the industry. Moreover, there is a limited land area for pastures for livestock to graze, especially during the dry seasons (FAO, 2010). The availability of good pasture plays a crucial role in livestock production and sustainability, as livestock would have enough feed to produce quality milk and meat and meet their growth requirements (Osman, 2011). Farmers' income is likely to increase with favorable incomes, which are likely to increase with favorable prices of livestock and their products on the market (Markhura, 2001). From the national viewpoint, a good balance of payment position would be achieved. The importation of animal products can be reduced, and a good balance of payment position would be realized.

Crop farmers and livestock farmers are interdependent in terms of the use of resources for survival. Plant farmers provide good pastures, green leaves, and grazing land for livestock consumption. In contrast, these crop farmers, on the other hand, require from livestock farmers essential animal products like good quality meat and milk, hide, and draught animals for farm activities such as plowing and harrowing (Shettima & Tar, 2008). With this interdependency, the high availability of pasture to adequately feed livestock could avoid conflicts between crop farmers and livestock farmers (Tonah, 2005).

However, all these benefits from agriculture have been a dream awaiting realization due to inadequate pasture for livestock feeding. As a result, animals move from one place to another in search of feed, especially during the dry seasons when climatic conditions are very harsh (FAO, 2010). Continuous movement coupled with inadequate nutritious feed impedes the weight gain of animals, consequently adversely affecting economic gains for livestock farmers and food security. Eventually, these hungry animals invade and destroy nearby crop farms, causing considerable losses to crop farmers (Odoh & Chilaka, 2012). This has led to significant socio-economic problems (FAO, 2015). To supplement their protein intake, animals, including broilers, are imported by the government in large quantities every year (Awuah, 2017). The government imports significant food crops to feed the Ghanaian population (FAO, 2009).

Associated conflicts are inevitable, and a good instance is the Fulani herders and crop farmers conflict in Agogo in Ghana, where both human and animal lives were lost as a result of the conflict between these two parties. This event affects the natural peace of the community and retarded economic growth and development (REGSEC, 2012). The conflicts to curb the menace of malnutrition as far as protein intake is concerned, the low total yield of crops and livestock, crop farmers and animal farmers' collisions and conflicts, and other problems that follow, pasture establishment for livestock production should be adopted—and farmers perceptions of the financial viability of pasture establishment for small ruminant production in Agogo.

Perceptions raise the level of livestock production in Ghana; pasture establishment and proper management are needed for adequate growth, performance, and production of quality meat and milk (Arseneau, 2010; Adzitey, 2013). However, little research has been done concern-

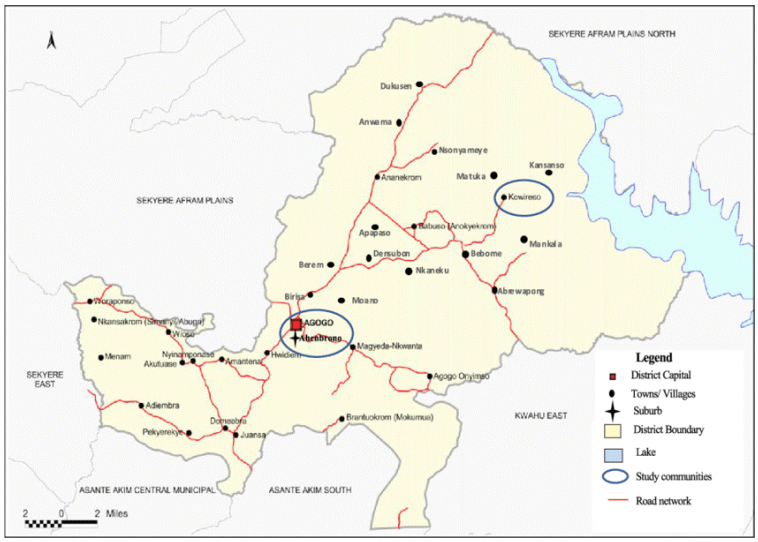
ing the viability and stakeholders' perceptions of pasture establishment.

Based on the abovementioned factors, the study thus examines farmers' perceptions of pasture establishment and the economic viability of small ruminant production. The specific objectives of the study are to identify the cost and returns for the establishment of an acre of pasture, to assess the financial viability of pasture establishment on a 'cut and sell' basis, to investigate farmers' perception of pasture establishment for ruminant production and to conduct a SWOT analysis of the feasibility establishing pasture in Agogo, Ghana. The study's novelty lies in the multi-dimensional approach that combines financial, perceptual, and strategic analyses, providing a more comprehensive understanding of the issues related to pasture establishment for ruminant production. The issue of the proposed 'Fodder Bank policy and its likely effect on crop and livestock production, as well as whether the proposed policy could generate adequate monetary returns to induce its adoption at the farm level, is a crucial feature of this study. The study seeks to provide evidence supporting the Sustainable Development Goals (SDG 2: zero hunger and SDG 12: responsible consumption and production) of the 2030 agenda for sustainable development. This is envisaged to provide valuable information to support policy initiatives that tackle the root cause of farmer-herder conflicts.

2. Methodology

Study area

The Asante Akim North Municipal is one of the 27 administrative Districts in the Ashanti region of Ghana. Its capital is Konongo- Odumasi. It covers a total area of 1160 square kilometers, which makes up 4.5% of the total length of the, which makes up 4.5% of the total size of the Ashanti region, and lies between latitude 6''west. To the east, it shares boundaries with Kwahu South District in the Eastern Region and Sekyere East District to the north. Asante Akim South District borders the district, which borders it to the south and Ejisu-Juaben Municipal to the west. The total population of the Asante Akim, which represents 1.4 percent of the total population of the North municipal, is 69,186, representing 1.4 percent of the total population of the Ashanti region. The sex distribution of the population shows a male population of 49.7%, implying that females dominate and dominate the area. According to the 2017 population census, the municipality has 68423 household population and 15480 households. It has an average household size of 4.5 persons. The economic activities engaged in by the people of the municipality are categorized into services, manufacturing, skilled agriculture, forestry, and fisheries. The predominant economic activity in the Municipality, according to the 2010 population census, is agriculture, constituting 60.7% of the total active population. According to GSS (2017), livestock rearing is the second-largest agricultural activity in the municipality. Notable crops include stem and root tubers, plantain and tree crops, and vegetables.



(Fig .1):Map of Asante Akim North Municipal

Population

The population for this study comprised livestock and crop farmers in Agogo. Asante Akim North Municipal was purposively selected for the study because it is noted for its agricultural abilities and massive food production in the Ashanti region. The study employed a descriptive survey, mainly quantitative. This method has the advantage of the judgment of the researcher, knowledge, and information previously acquired, which helps to precisely select the respondents directly related to the topic of study. It saves cost and time. It, however, has the disadvantage of making room for stereotypes.

Sampling technique and sample size

The multistage sampling was employed in this study. In the first stage, the Asante Agogo traditional area was selected using the purposive sampling technique because most inhabitants engage in agricultural activities. In the second stage, three communities in Agogo, namely, Hwidiem, Ananekrom, and Bebuso, were selected purposively. In the third stage, quota sampling was used to obtain a specific number of farmers from each of the three communities to sum up to 150 respondents. The simple random sampling technique was used to select farmers in these communities. A sample size of 150 respondents was obtained using Slovin's formulae, a scientific method of obtaining the sample size for a given population. The number of farmers interviewed from each of the three communities and the total sample are as follows: Ananekrom (70), Hwidiem (50), and Bebuso (30).

The formula is illustrated below:

$$\text{Sample size} = \frac{N}{1+N(\alpha)2}$$

Where N is population size (241)

α = margin of error (0.05)

Data collection, type, and source of data

Structured questionnaires consisting of open and close-ended questions were used to gather primary data from respondents through face-to-face interviews. Interviews were conducted using the local dialect mainly to enhance communication and to clear all language barriers. However, English was used so that the respondents could give accurate answers in English. Data gathered included costs and benefits/income of pasture establishment, respondents' perception of pasture establishment, and the assessment of the strengths, weaknesses, opportunities, and threats of pasture establishment. Validity and reliability checks were done to ensure accurate and meaningful data. The questionnaire was pretested, and the content was checked and verified by other experts to ensure that the content comprehensively covered our topic. For validity, we also checked how the questionnaire accurately measures the intended theoretical construct.

3. Results

Descriptive statistics such as frequencies and percentages were employed to analyze and summarise the respondents' socioeconomic characteristics. Project worth measures such as payback period, BCR, NPV, and IRR were used to measure the viability of the pasture establishment. Farmers' perception based on a five-point Likert scale labeled from strongly disagree (1), disagree (2), neutral (3), agree (4), and strongly agree (5) was used to obtain the mean scores of each perception statement under each perception categories (commercial, financial and economic, social, technical, and institutional issues) about pasture establishment was assessed through perception index. A test of association between farmer type (crop-based, livestock-based, and both) was also conducted. Moreover, the level of education and their perceptions of pasture establishment were also conducted. A SWOT analysis was also conducted to assess pasture establishment's prospects and potential challenges in the study area.

Financial viability of pasture establishment

Benefit-cost ratio: The cost-benefit ratio is the most comprehensive evaluation of a project's worthiness. It is the basic concept underlying a project's economic and financial analysis (Nunoo, 2012; Gittinger, 1982). It compares the benefits of a project with its costs. Using the benefit-cost ratio, the benefits are quantified in monetary terms and compared with the monetary value of the project's costs to determine the viability of the project. In other cases where the best option or technique has to be chosen, the cost-benefit ratio is essential (Adegeye & Dittoh, 1985). In this study, the summation of the discounted benefits was divided by the summation of the discounted costs; this is represented mathematically as:

$$\text{BCR} = \frac{\sum PV\ cash\ inflows}{\sum PV\ cash\ outflows} \quad (1)$$

Included in the cost are the fixed costs and the variable costs. The variable cost is obtained by multiplying the number of inputs used by the unit price. Fixed costs were accounted for in the year incurred. Operating and maintaining some fixed assets contributed to the total cost. A project (pasture business) is deemed viable when it has a benefit-cost ratio greater than one (1) but is considered not viable when it has a value less than one. However, a benefit-cost ratio equal to one represents a break-even.

Net present value (NPV) is the difference between the summation of the present values of all the cash inflows (benefits) and the summation of all the cash outflows (costs) over the project's life span.

The NPV is used in capital budgeting to measure the profitability of a project.

$$NPV = \sum_{t=1}^{T} \frac{C_t}{(1+r)^t} - C_0 \quad (2)$$

Where,

Ct = net cash inflow during the period t Co = total cost of investment

r = discount rate, and

t = number of periods

Decision rule for NPV: A positive NPV shows that the projected financial benefits will be greater than the anticipated costs. Conventionally, an investment with a positive NPV is profitable, whereas an investment with a negative NPV will result in a loss (Park, 2002). Thus, only investments with positive NPV should be accepted.

If NPV > 0, accept the investment

If NPV < 0, reject the investment

If NPV = 0, remain indifferent to the investment.

Internal rate of return (IRR): The internal rate of return is a valuable capital budgeting procedure for measuring the worth of a project in terms of profitability. It is a rate at which the present value of the project's benefits is equal to the present value of the cost stream of a project. IRR is the rate of return at which the NPV of the investment is zero. If the IRR of an investment exceeds a company's required rate of return, the project must be accepted. However, the project is rejected when it has an IRR that falls below the expected rate of return of the company.

IRR formulae (method of interpolation) are as follows:

$$IRR=NPV=0=LDR + (HDR-LDR) + \frac{NPV@LDR}{NPV@HDR} \quad (3)$$

LDR= Lower discount rate

HDR= Higher discount rate

NPV@LDR= NPV @ lower discount rate

NPV@HDR =NPV @ higher discount rate

The payback period refers to the years it will take a project to repay its initial capital investment. It is the time from the beginning of the project until the incremental cash flows sum up to the initial investment outlay. It has the advantage of being easy to calculate and understand. However, it does not consider the time value of money. It is undiscounted, and the decision rule is to accept a project that has a relatively shorter period.

Assumptions underlying the study:

Land usage is on a lease or rent basis and paid yearly at Agogo, the study area. The cost of operations is estimated to increase annually by 10% based on Ghana's inflation rate. NPK 20:20:0 fertilization is to be done three times throughout the entire project. This results from the trend of the inflation rate having an average of 10% over the past five years, and included in the maintenance cost is labor cost. The project is expected to run for ten years based on the knowledge that the useful life of the fixed assets, land, and fencing materials used can be productive within the first ten years of the venture without any problems. However, after ten years, the adverse effects of the depreciation of these fixed assets will be evident. In addition, the continuous use of fertilizer coupled with inefficient use of nitrogen could lead to soil acidity after long periods of fertilizer application, making the soil unproductive. Fixed assets are depreciated at 10% depreciation rate per annum. Napier grass is also expected to remain productive for the ten years of production.

According to the National Farmers Information Service (NAFIS), Kenya, the annual harvest of Napier grass is estimated to be between 20000kg and 40000kg. Based on this, the average weight of annual pasture harvest is estimated at 30000kg. The project will generate revenue on a cut-and-sell basis since most animal farmers in the study area and Ghana are used to buying animal feed. A bundle of cut grass is estimated at an average of 25kg, which is in line with the range of cut grass bundle weight

for sale in the Ashanti region, which ranges from 20kg to 35kg. The cost is estimated at GHC5 in the study area. Contingency cost is 3 percent of total cost as an amount put aside for future events. It is set aside to cater for future unforeseen occurrences, such as repairs and replacements of faulty parts of assets.

Farmers' perception of pasture establishment as a business venture

Farmers' perceptions based on a five-point Likert scale (disagree (1) to agree (5) intensely) were used to assess farmers' opinions of pasture establishment through a perception index. A test of association between farmer type (crop-based, livestock-based, and both) and level of education and their perceptions of pasture establishment was also conducted.

$$\frac{[(fsd \times 1) + (fd \times 2) + (fn \times 3) + (fa \times 4) + (fsa \times 5)]}{x} \quad (4)$$

where $f$sd = frequency of strongly disagree,

fd= frequency of disagreement,

fn = frequency of neutral,

fa=frequency of agree,

$f$sa=frequency of strongly agree and

x = total number of responses

The mean of the various means (perception indices) of the perception statements in each category was also calculated to arrive at the perception index for each category. The formula for finding the perception index for each category is given by:

$$\frac{(M_{S1} + M_{S2} + M_{S3} + M_{S4} \ldots + M_{Sn})}{N} \quad (5)$$

Where MS1 = mean of perception statement 1,

MS2 = mean of perception statement 2,

MS3 = mean of perception statement 3,

MS4 = mean of perception statement 4, • MSn = mean of last perception statement and

N = number of means.

The mean of the means was computed to ascertain the overall perception index of pasture establishment using the formula as follows:

$$\frac{(M_{CEF} + M_{SOC} + M_{TECH} + M_{INS})}{N} \quad (6)$$

Where MS mean score for each perception category (CEF, social, technical, institutional).

CEF= commercial, economic, and financial perception index

SOC= social perception index,

TECH= technical perception index,

INS= institutional perception index and

N= number of perception categories

The chi-square test of independence was used to determine the socio-economic characteristics that significantly correlate with farmers' perception of pasture establishment. The same perception index was employed to analyze the strengths, weaknesses, opportunities, and threats associated with the Pasture establishment. They were ranked in order of importance per the calculated means. The statement of the hypothesis tested is as follows:

$\mathbf{H_1}$: There is an association between the gender, age, educational levels, household size, farmer type, and housing system of farmers and their perception of pasture establishment.

A SWOT analysis was also conducted to assess pasture establishment's prospects and potential challenges in the study area. Opinions of farmers relating to the strengths, weaknesses, opportunities, and threats of pasture establishment were assessed using a five-point Likert scale labeled from strongly disagree (1) to agree (5) strongly. The mean scores of each statement were calculated and ranked in order of importance. The formula for the mean score is as follows:

$$\frac{[(fsd \times 1) + (fd \times 2) + (fn \times 3) + (fa \times 4) + (fsa \times 5)]}{x} \quad (7)$$

where $f$sd = frequency of strongly disagree,

fd= frequency of disagreement,

fn = frequency of neutral,

fa=frequency of agree,

$f$sa=frequency of strongly agree and

x = total number of responses

4. Discussion

Socio-economic characteristics of respondents

The majority (about 83%) of the respondents were male farmers (Table 1). This agrees with the sex distribution of farmers in the district. About 64% are males, as the Ghana Statistical Service reported in 2017. This is also a reason for the conflicts, as more males are likely to retaliate to their opponents than females. Manu et al. (2014) stated that males are the ones who attack their opponents even when females dominate a farming community. The average age of the respondents in the study area was 47 years. This shows that most farmers in the study area fall within the youthful, energetic, and working categories. This is also a reason for the rampant farmer-herder conflicts. According to Boateng (2015), the younger and the more energetic the farmer is, the more the likelihood to retaliate violently to the destruction of crop farms by animals. This is confirmed as 75% of farmers who are between the ages of 25 and 44 years retaliated to the destructive acts of animals led by Fulani herders in 2015. With regards to the marital status of the respondents, 67.3 percent of them were married.

It was also realized that 73.3% of the respondents were full-time farmers. On the other hand, people who engage in other economic activities such as government work, private non-farm business, driving, and others constitute the minority, with a figure of 40 and 26.7 percent. The majority (88%) of the respondents were Christians. This is not surprising because the area is in the Ashanti region, which is dominated by Akans and a few others from southern Ghana who are mostly Christians. Close to half (44%) of the respondents had no formal education, and about 27% had primary education, implying a low level of education among farmers in the study area. This is consistent with the assertion by Olugbenga (2013) that one common characteristic of rural farmers is low education. This could be traced to the fact that the conflicts in the study area make the place insecure for educational activities.

From Table 1, 24% of the respondents were livestock farmers only. Farmers involved in crop farming alone were 27.3 percent, and the majority, 48.7 percent, were involved in crop and livestock production. The high number of crop farmers relative to animal farmers is in line with the farmer distribution of the district, as the majority of the farmers engage in crop production. However, the study area has the majority of people in both fields as a result of a conducive environment for animal activities and migrants who are involved in animal production. This is the reason for the presence of Fulani herders in the study area. Since most farmers are into crop and animal production, it can be said that they see the activities of Fulani herders as unnecessary and unhealthy competition to farming activities. This may explain the occurrence of the conflicts in the study area. A good number of respondents were into crop production. Notable crops in the study area include tree cocoa, cereals, maize, legumes, and fruits.

Land ownership in the study area for agricultural purposes is mainly on a lease basis. Farmers hire land annually for agricultural activities. From our results from the survey, it is clear that out of the 150 farmers, 46.7% have hired the lands. However, the rest of the lands are due to inheritance as indigenes or foreigners to the land but have gained ownership by purchase after extended usage as a lease. This system, where land usage is on a standard lease basis, is standard in rural areas. The lease basis is every day in rural areas.

In Ghana, people raise animals owned by others for a fee or raise their animals. In the study area, 96.5% of the people owned the animals they raised, which is common among sheep and goat farmers. However, 3.5% of the people raised them for other purposes.

In Table 2, results show that 78% of the farmers were unaware of pasture establishment. This is because most farmers are used to the extensive system where animals move around to search for their food. It also shows that information flow to farmers is poor, as only a few of the farmers in the study area are aware of a few farmers in the study area know pasture establishment. When animals are raised on a free-range system and semi-intensive system, crop farm destruction by animals often occurs. About 60% of the animal farmers agreed that their animals have several times destroyed crop farms in their communities. However, as others may think, it does not make their animals a nuisance to society.

Table 1. Socio-economic characteristics of respondents

Categorical Variables	Characteristics	Frequency	Percentages
Sex	Male	124	82.6
	Female	26	17.3
Religion	Christianity	132	88.0
	Islam	16	10.7
	Traditional	2	1.3
Marital status	Married	101	67.3
	Single	19	12.7
	Widowed	12	8.0
	Separated	18	12.0
Occupational status	Full-time	110	73.3
	Part-time	40	26.7
Farmer type	Livestock	36	24
	Crop	41	27.3
	Both	73	48.7
Educational background	No formal education	66	44
	Primary	40	26.7
	Secondary	32	21.3
	College/Polytechnic	9	6.0
	University	3	2.0
Land ownership	Leased		53.3
	Own		46.7
Ownership of animals reared	Own		3.5
	Caretaker		96.5
	Mean	Standard Deviation	Min/Max
Age	47	47	25/96 years
Farm size	11.07	7.10	2/50 acres

Source: Field survey

Table 2. Knowledge Responses

Knowledge	Frequency	Percent
Pasture establishment		
Aware	33	21.0
Unaware	117	78.0
Crop farm destruction by farmers' livestock		
Aware	90	60.0
Unaware	60	40.0

Source: Field survey

Financial viability analysis

Initial investment and the various financial indicators of a project of GH₵12,560.2 were estimated to be required to establish an acre of pasture (Table 3). The operating cost for the 10-year project lifespan is estimated to increase by 10% yearly. The plan also considers the projected revenue streams for the project, the discounted costs and benefits for the 10-year project lifespan, and the various financial indicators of a project's worth.

Table 3. Investment cost for establishing an acre of pasture

Item	Amount (GH₵)
Land preparation: Land clearing	100
Ploughing	100
Harrowing	80
Stems for planting	1,618.4
Preparation of planting materials and planting	480
Herbicides	400
Pump and hose	4200
Total Land preparation and planting materials cost Fencing	6978.4
Poles	600
Wire mesh	2,016
Artistry	1,400
Cement (10 bags)	350
Gravels & sand	650
T&T for Gravels & sand	200
Total fencing cost	5,216
Contingency cost (3%)	365.8
Subtotal	5,581.8
The total investment cost	12,560.20

Exchange rate: USD1.00 = GH₵5.75)

Source: Field survey

Operating cost for establishing an acre of pasture

From Table 4, the total cost of operation is estimated at GH₵1,830 with items including the rent on land, weeding, fertilization, fuel, remuneration for pump operator, and harvesting.

Estimated annual operating cost for an acre of pasture

Table 5 shows the total annual cost of operation for the project's 10-year lifespan. The costs for the first three years are GH₵1,830, GH₵1,573, and GH₵1,730.3, respectively. Operating costs are estimated to increase due to inflation and operational activities such as fertilization variations. The cost for the final year of the project is estimated to be GH₵3,371.9.

Table 4. Cost of operations for establishing an acre of pasture

Item	No. of times	Amount (GH₵)	Total cost (GH₵)
Land			200
Fertilization			400
Weeding(1st)	3	55	165
Weeding(2nd)	3	55	165
Fuel			500
Remuneration for the pump operator			200
Harvesting			200
Total operating Cost			1,830

Source: Field survey

Table 5. Annual operating cost for an acre of pasture

Year	1	2	3	4	5	6	7	8	9	10
Cost (GH₵)	1,830	1,573	1,730.3	2,488.9	2,093.7	2,303	3,312.8	2,786.7	2,065.3	3,371.9

Exchange rate: USD1.00 = GH₵5.75)

Source: Field survey

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Estimated revenue for an acre of pasture

Table 6 shows the estimated revenue for an acre of established pasture with a 10-year lifespan. The price of a kilo of pasture was estimated at GH₵0.20 but is expected to increase yearly by 10% (considering the inflation rate). The total quantity derived from an acre of established pasture is estimated to be 30,000 kg (30 tons).

Discounted cash flows

In Table 7, the cash inflows and cash outflows for the proposed venture were discounted over the project's lifespan of 10 years. A discount rate of 35%, which is the average commercial banks' lending rate, was used for these computations. The total discounted costs and benefits at 35% were GH₵17,745.4 and GH₵20,904, respectively.

Estimation of the project (pasture) worth: (BCR, NPV, IRR, and payback period)

Payback period

Payback period= Years before full recovery+ $\frac{Unrecovered\ cost\ at\ start\ of\ the\ year}{Cash\ flow\ duing\ the\ year}$

Payback Period= $2+\frac{3,363.2}{5,529.70}$ $= 2.61$ years = 31.32 months.

The venture will take almost three years (i.e., 31.32 months) to recoup the initial investment of GH₵12,560.20 (Table 8). Due to the short period required to pay back the initial investment, it makes the venture worth investing in. The amount GH₵3,363.2 constitutes the difference between the sum of the first two years and the initial capital.

Table 6. Estimated revenue for established pasture

Year	Price (GH₵)	Quantity	Amount (GH₵)
1	0.2	30000	6,000
2	0.22	30000	6,600
3	0.24	30000	7,260
4	0.27	30000	7,986
5	0.29	30000	8,785
6	0.32	30000	9,663
7	0.35	30000	10,629
8	0.39	30000	11692
9	0.43	30000	12,862
10	0.47	30000	14,148

Exchange rate: USD1.00 = GH₵5.75)

Source: Field survey

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Table 7. Discounted cost-benefit for pasture establishment

Year	Cost	Benefit	Discount Factor	Discounted Cost	Discounted Benefits
0	12,560.20	_	1.000	12,194.4	0
1	1,830	6,000	0.741	1,356	4,446
2	1,573	6,600	0.549	864	3,623
3	1,730.3	7,260	0.406	703	2,948
4	2,488.9	7,986	0.301	749	2,404
5	2,093.7	8,785	0.223	467	1,959
6	2,303	9,663	0.165	380	1,594
7	3,312.8	10,629	0.122	404	1,297
8	2,786.7	11,692	0.091	254	1,064
9	3,065.3	12,862	0.067	205	862
10	3,371.9	14,148	0.050	169	707
Total	36,750	95,625		17,745.4	20,904

Source: Field survey

Table 8. Calculation for payback period

Variable	Amount (GH₵)			
Initial investment outlay	12,560.2			
Undiscounted net cash flows	Yr 1 4,170	Yr 2 5,027	Yr 3 5,529.70	
Payback Period (Undiscounted)				2.61 years

Source: Field survey

In Table 9, the project shows a positive NPV of GH₵ 3,160, implying that the pasture establishment project is promising. This means that the projected earnings generated by the venture exceed its expected costs. It also suggests that the project can be valued presently at an amount of GH₵3,160. A benefit-cost ratio greater than one (1) shows that the project will recoup the resources invested in the venture and operate at an efficiency of 118%. In other words, the revenue generated in establishing and operating this venture exceeds the costs associated with the project. The project revealed a BCR of 1.18, meaning that a cedi invested in the project will bring about an extra GH₵0.18 pesewas, a little over the amount invested. Since the decision rule is to accept all projects with a BCR>1, the project is worthy and should have resources expended toward it. Although the BCR is a little over GH₵1.00, management will have covered all costs of running the venture, including the entrepreneurs' time and other non-accountable resources. The IRR represents the average earning power of the money or funds invested in the project over the life of the project. It shows at what rate the venture will earn back all the capital and operating costs spent on and pay interest for using the monies. The project has an IRR of 40.1%, which was interpolated between a lower discount rate (LDR) of 40% and a higher discount rate (HDR) of 45% with NPV's of -GH₵428 and GH₵1,161 respectively.

Table 9. Estimating NPV, BCR and IRR

Variable	Amount (GH₵)	NPV (GH₵)	BCR
Sum of Discounted Outflows	17,745.4	3,160	1.18
Sum of Discounted Inflows	20,904		
	Percentage (%)	NPVs for IRR	
LDR	40	1.161	
HDR	45	-428	
IRR	40.1		

Source: Field survey

Perception of respondents on pasture establishment

From Table 10, the overall mean of all the perception indices of the respondents concerning pasture establishment was 3.51 (agree), which is pretty positive. Respondents' perception concerning pasture establishment about the index obtained shows that respondents have a pretty good perception of the venture. It indicates that farmers in the study area will embrace pasture establishment, considering its socio-economic benefits in improving crop and animal rearing conditions, ensuring food security, and reducing farmer-herder conflicts. However, stakeholders' support in all relevant forms is needed to ensure sustainable pasture establishment.

The overall perception index of pasture establishment in the area regarding commercial, economic, and financial concerns was 3.72. This implies that respondents agree that pasture establishment will have a positive influence on these issues.

Farmers' perception regarding the potential of pasture establishment to increase livestock production was neutral. Also, their perception regarding pasture establishment increasing meat quality agreed (3.97). They also agreed (3.65) that pasture establishment is capital-intensive. Moreover, respondents had a perception that they agreed (4.19) with the fact that pasture establishment will increase the health of animals. Concerning the statement that pasture establishment will make the marketing of animals easier, the respondents had an agreeing perception (3.65). Farmers also agreed (3.68) that pasture establishment will increase the market size of livestock.

Under this category, statements meant to ascertain respondents' perceptions concerning the study area and its social support for the success of pasture establishment were considered. From Table 10, the overall perception index for this category of social perception of pasture establishment was 3.66, which means farmers agree that pasture establishment has many social benefits and will, therefore, be embraced by the community.

Respondents' overall perception of the technical issues of pasture establishment was neutral (3.15). This means that they were not entirely convinced of their technical abilities, even as the assertion that there is a need for technical knowledge of pasture establishment remains constant.

Farmers' perception of support from relevant institutions was an agreeing one, with an index of 3.51. This implies that farmers agree that support in terms of finances, resources, technical assistance, and other aspects from relevant institutions and associations is important for a successful pasture establishment.

Relationship between socio-economic characteristics of farmers Agogo and their perception of pasture establishment

The five-point Likert scale responses were regrouped into three categories (Agree et al.) to compute the perception indices of the various statements under each category. The chi-square test of independence was conducted to ascertain the relationship between some socio-economic characteristics and farmers' perception of pasture establishment. The specific socioeconomic characteristics included in this test are sex, age, education, household size, farmer type, and housing system. Farmer type and housing system were the only socio-economic characteristics significantly associated with certain perception statements. Further discussions, therefore, were focused on these characteristics. The results of these socio-economic characteristics (farmer type and education) and the perception statements with which they have significant relationships.

According to the chi-square test results (Table 11), there is a significant association between the type of farmer and the perception that pasture establishment will increase the general sales of livestock activities. Hence, there is an association between the type of farmer and the perception that general sales of livestock activities will increase when pasture is established. It is observed that farmers who are into both crop and animal farming are most likely to have an agreeing perception to the statement that general sales would be increased by pasture establishment. Crop farmers follow the category of farmers into both activities who agree that pasture establishment will increase general sales, and animal farmers are least likely to perceive that pasture establishment will increase sales. This can be explained in the light that crop and animal farming are interdependent, and for that matter, such farmers are likely to make more sales in the presence of pasture for animals, no crop farm encroachment, and the absence of conflicts as a result of pasture establishment (Shettimah & Tar, 2008).

Furthermore, the results revealed a significant correlation between the type of farmer and whether or not the perception statement that pasture establishment requires adequate knowledge is positive. It is observed that farmers who cultivate crops and rear animals at the same time are most likely to agree with the statement

that pasture establishment requires adequate knowledge, followed by crop farmers who are more likely to agree with the same perception statement. On the other hand, animal farmers are least likely to agree with the statement that pasture establishment requires adequate knowledge. Since animal farmers use pasture daily in feeding their animals, they have gained some experience in identifying and providing good pasture for their animals. This reduces their level of ignorance in pasture establishment.

Table 10. Farmers' perception of pasture establishment

Perception Statements	SD (1)	D (2)	N (3)	A (4)	SA (5)	Mean
Commercial, Economic and Financial Perception (CEF)						
Pasture establishment will go a long way to increase livestock production	14	18	52	35	31	3.34
Pasture establishment will increase the quality of meat from livestock	2	6	32	64	46	3.97
Pasture establishment is capital-intensive	1	15	54	46	34	3.65
Pasture establishment will increase the health of animals	2	1	16	78	53	4.19
Pasture establishment will make the marketing of animals more accessible.	1	22	37	59	31	3.65
An increase in the number of animals will increase the Market size	2	8	53	60	27	3.68
Pasture establishment will increase general sales	4	24	41	48	33	3.55
CEF perception index						3.72
Social statements						
Pasture establishment will help control animals.	-	5	17	54	74	4.31
The community has no problem with pasture establishment	2	7	64	33	44	3.73
Pasture maintenance will be done smoothly in this area	2	14	70	34	30	3.51
Farmers will embrace the idea of pasture establishment.	-	10	39	54	47	3.92
Community members have priority to invest in pasture establishment	4	37	75	17	17	3.04
The land is easily accessible in this area for pasture establishment	7	30	68	38	7	3.05
Pasture establishment will not cause conflicts among stakeholders.	-	9	51	61	29	3.73
Pasture establishment will not affect crop production	1	16	37	65	31	3.73
Pasture establishment will ensure food security.	-	8	40	62	40	3.89
Social perception						3.66
Technical Perception						
It is not difficult to manage pasture	5	16	79	36	14	3.25
It is not tricky selecting appropriate planting materials and weeds	4	23	84	27	12	3.0
Pasture establishment requires adequate knowledge	5	27	63	46	9	3.18
High technical know-how is required for pasture establishment	5	27	64	44	9	3.15
Technical perception						3.15
Institution statements						
Investment in pasture establishment is essential	2	24	56	47	21	3.41
MoFA will support with the necessary resources.	-	2	49	65	34	3.87
Support can be drawn from farmer-based associations.	-	25	73	37	14	3.25
Institutional perception						3.51
Overall perception index for pasture establishment						3.51

Source: Field survey

Additionally, the chi-square test results proved an association between the farmer type and the statement that high technical know-how is required in pasture establishment. This can be explained by the fact that more farmers in both crop and animal production are likely to agree that pasture establishment requires adequate technical know-how. The group that follows is crop farmers. However, more animal farmers will likely disagree that pasture establishment requires adequate technical know-how. This can be explained by the fact that animal farmers are already conversant with pasture as they have to provide feed for their animals every day. This knowledge means they require little technical know-how concerning pasture establishment compared to crop farmers and farmers who are into both crops and animals. Also, their knowledge base in pasture is due to the sharing of ideas and knowledge gained by other animal farmers. This is similar to the findings of Oduro (2014) that farmers increase knowledge through informal education.

Moreover, it was revealed that the type of farmer and whether or not the perception that support can be drawn from farmer-based associations will be positive depends on each other. This is to say that the type of farmer influences their perception of the statement. It was observed that farmers who cultivate crops and rear animals are more likely to agree with the statement that support can be drawn from farmer-based institutions. This group is followed by crop farmers, who are also more likely to agree with the same statement. Meanwhile, animal farmers are more likely to disagree that support can be drawn from farmer-based institutions. This is traced to the fact that most of the farmer-based associations in Ghana are into crop-related activities other than animals. Therefore, farmers in animal production have little experience with the support of farmer-based institutions.

In addition, the results of the chi-square test showed that there is a significant association between the educational background of the farmer and the perception of the statement that it is not challenging to select planting materials for establishing pasture. In other words, the literacy rate of the farmer has the potential to influence the perception of whether the selection of planting materials for pasture establishment is difficult or not. From the results, farmers who have had formal education are more likely to agree to the statement that it is not challenging to select planting materials for pasture establishment, while those with no formal education are more likely to disagree with the statement that it is not challenging to select planting materials for pasture establishment. This is because education increases the technical efficiency of farmers and the ability to make decisions about the selection of inputs to generate maximum output is enhanced as confirmed by of Reimers and Klasen (2012). However, the chi-square test results showed that these socioeconomic characteristics: age, household size housing system, and the perception of farmers on pasture establishment are independent. In other words, there is no significant association between farmers' age, household size, or housing system and their perception.

SWOT analysis

According to the respondents, the highest strength of pasture establishment is crop security. Another strength of the venture is the availability of labor. This is because there are more energetic, solid and youth people in Agogo to serve as labour for the venture. Available laborers who work on people's farms can be used to work on pasture as well. The land for agriculture in the rural study area is fertile and vast enough for pasture establishment. This also serves as a strength for the venture. The last strength identified with the venture is the availability of resources for the maintenance of pasture. Since most of the respondents are already involved in farming activities, the resources for pasture maintenance can easily be identified and utilised.

On the other hand, the highest weakness of pasture establishment is a lack of technical know-how. This is a result of the high illiteracy rate among the farmers in the study area. According to the survey, 44% of the farmers have no formal education. This confirms the assertion that farmers' technical efficiency has a direct relationship with the level of education. Reimers and Klasen (2012) stated that farmers' technical efficiency can be increased through education. Lack of maintenance know-how and lack of planting materials were also identified as weaknesses of the venture, as most farmers do not have any practical knowledge of pasture establishment since it is a new venture.

The venture's highest opportunity was government policy supporting pasture establishment. The decision of the government to establish 'Fodder Banks', which started in the Afram plains, was identified as a major opportunity for the venture since it would attract the support and attention of the government. Also, the high demand for meat on the local market was identified as an opportunity for the venture. From the study, pasture establishment can increase livestock production since there will be enough quality feed which will prevent issues of health, theft and attack from predators. This abil-

ity is an opportunity since it will attract the attention of investors. This leads to the next opportunity of increased market size for livestock production. The last opportunity is the availability of credit facilities from MoFA and other agricultural institutions.

The highest threat to pasture establishment is land tenure issues. The farmers see land tenure issues as a threat because land cannot be acquired for farming purposes except through leasing in the study area. They, therefore, perceive owners who are not very conversant with pasture establishment may not be willing to release their lands for such a venture. Since agriculture in the district is mainly on rain-fed basis, respondents identified that dry weather conditions could be a threat to pasture establishment. However, irrigation facilities have been considered as cost items for the venture. Encroachment by other animals was also identified as a threat due to a large number of animals raised on the extensive basis in Agogo. However, fencing was included in the study to mitigate that. Other farmers perceive that the venture may threaten food security since the size of arable lands that could be used for the production of crops such as cereals, tuber and tree crops for human consumption will be reduced as a result of pasture establishment. Also, theft cases were also identified to be a threat to the venture. This will also be mitigated by the fence around the establishment. In the dry seasons, bush fires become rampant due to the activities of smokers, hunters of animals who use fire, bush burning activities of farmers and palm wine tapping activities involving fire. Hence, bush fires were identified as part of the threats to pasture establishment. These results are consistent with the findings of Addo (2007) who listed some problems associated low technical know-how, land tenure issues, low interest on the part of some farmers and occasional destruction by bush fires.

Table 11. Pearson chi-square test

Variables	Perception statement					
	Disagree	Agree	Neutral	Total	Pearson chi2(3)	Probability
Farmer type	Pasture establishment will go a long way to increase livestock production.					
Livestock	9	17	10	36		
Crop	14	14	12	40	8.995	0.061*
Both	9	34	30	73		
Farmer type	Pasture establishment will increase general sales.					
Livestock	7	18	11	36		
Crop	14	30	6	40	0.255	0.034**
Both	17	32	24	73		
Farmer type	Pasture establishment requires adequate knowledge.					
Livestock	5	16	16	37		
Crop	15	8	17	40	11.159	0.025**
Both	13	30	30	73		
Farmer type	High technical know-how is required for pasture establishment.					
Livestock	4	15	16	35		
Crop	14	7	19	40	10.493	0.033**
Both	14	32	29	75		
Farmer type	Support can be drawn from farmer-based associations.					
Livestock	5	19	12	36		
Crop	3	13	24	40	13.238	0.010**
Both	18	19	37	74		
Education	It is not tricky selecting planting materials for establishing pasture					
F.education: Yes	17	16	33	66	4.838	0.089*
No	10	23	51	84		

F. education = Formal education. * =Significant at 10%, ** at 5%.

Source: Field survey

Table 12. SWOT analysis of an acre of pasture

	Mean	Rank
Strength		
Ensure crop security	4.45	1
Resistant to harsh weather conditions	4.03	2
Availability of labour	4.02	3
Availability of land	3.7	4
Availability of resources for maintenance	3.5	5
Weaknesses		
Lack of technical knowledge	2.15	1
Lack of maintenance Know-how	2.08	2
Lack of planting materials	3.05	3
Opportunities		
Government policy in support of pasture establishment	3.29	1
High demand for meat in the local market	3.14	2
Increase in farmers market share	3.06	3
Availability of credit facilities	2.91	4
Threats		
Land tenure issues	3.65	1
Poor weather conditions	3.52	2
Incidence of pests and disease.	3.34	3
Encroachment by other animals	2.91	4
Threat to food security	2.83	5
Theft cases	2.82	6
Occurrence of Bush fires	2.54	7

Source: Field survey

5. Conclusion

It was revealed in the study that the majority of crop farmers have had their crops destroyed by ruminants, especially cattle, at least once. Additionally, the study showed that pasture establishment is one way crop farms destruction by livestock can be prevented as about 99% of farmers responded in the affirmative. The results for the financial viability of the venture under the assumptions used gave relevant results with BCR of 1.18 and NPV of GHC 3,160. The Internal Rate Return of the venture is estimated at 40.1% and a Pay Back period of 2.61 years. Therefore, it will be economically prudent for investors to commit resources towards establishing pasture.

Farmers generally agreed to the commercial, economic and financial concerns of pasture establishment. This implies that respondents perceive that the commercial, economic and financial results of pasture establishment will be positive. The perception index for the social category was 3.66 implying that pasture establishment will attract the support from the community and also bring more benefits to the society. The perception index for the technical concerns was 3.15 implying that there is fair technical know-how concerning pasture establishment. The perception index for the institution category was 3.51 which implies that support and involvement of relevant institutions in pasture establishment is necessary.

There is a statistically significant association between the type of farmer and the perception that support can be drawn from farmer-based associations, and the perception that pasture establishment will increase livestock production as well as the general sales of farmers. Lastly, the study revealed that there is a significant relationship between the educational background of the farmer and the perception that it is not difficult to select planting materials for pasture establishment. The study found the highest strength of pasture establishment to be availability of land for the venture. The highest weakness is low technical knowledge. Moreover, the analysis

showed that the greatest opportunity of the venture is government policy on pasture establishment whilst the greatest threat to the venture is land tenure issues.

Farmers in Asante Akim Agogo should adopt the establishment of pasture since it is financially viable. The establishment of pasture in Asante Akim Agogo should be encouraged since it has the potency to reduce the farmer - herder conflicts and ensure food security. For successful pasture establishment, technical know-how is essential. The chi-square test revealed that the uneducated farmers are more likely to lack technical know-how especially with the selection of planting materials. It is therefore recommended that education and training services be provided by MoFA and extension officers to farmers to enhance learning and improve technical knowledge on pasture establishment. The government should also provide farmers with planting materials occasionally. Intensive education should be done by MoFA, extension officers and the media to sensitize animal farmers on the importance of recommended pasture such as Napier grass which is of high nutritional value for animals as many farmers assume every grass is pasture and is good for animal consumption.

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Conflict of Interest

The authors declared no conflicts of interest

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