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Baseline Farmer Survey of Smallholder Cocoa Farming Systems in Ghana

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Abstract

The effects of the prevalent low-input systems of production, over-aged farms, and unstable climate are worsened by weaknesses inherent in the formal system of production and distribution of recommended cocoa varieties. Generally, the purpose of the baseline survey was to obtain perception of the farmers in the target communities on the possibility of re-introduction of cocoa in denuded and marginal areas which were previously cropped to cocoa, but now food crops; determine farmers' interest in planting new cocoa varieties; and determine farmer behavior in the use of technologies of cocoa farm establishment and maintenance. The survey was conducted in the period starting from 10th December, 2013 to 5th July, 2014 at Asesewa (Konkoney) in the Eastern Region, Akomadan and Afrancho in the Ashanti Region, as well as Kenyasi (Atwidie), Bechem (Breme) and Acherensua (Kokontreso) in Brong-Ahafo Region. The project sites and 192 respondents were purposively sampled. A standard questionnaire was employed to interview the respondents. Data analysis indicated that 40.0% of the respondents would want their farms to be rehabilitated whereas 60.0% indicated they would not. Also, 98.4% of them reported a higher possibility of re-introduction of cocoa in the denuded and marginal areas whilst 1.6% indicated that it was impossible. Additionally, 79.6% of the respondents expressed interest in testing any new cocoa varieties on their farms as part of the project while 20.4% were disinterested. In conclusion, the survey has indicated that re-introduction of cocoa in marginal and denuded area is highly probable.

Keywords: baseline survey, sustainable intensification, farming systems, cocoa establishment, rehabilitation, Ghana

1. Introduction

Cocoa is an understorey tree and, in Ghana, the crop is traditionally cultivated under the shade of selectively thinned forest. The forest shade trees contribute to the build-up of organic matter, nutrient recycling and the maintenance of biodiversity. Poor farmland management and excessive timber extraction have resulted in the deforestation and degradation of most of the natural forest sites suitable for cocoa cultivation (World Bank, 1987).

Sustainability of the smallholder cocoa production systems in West and Central Africa is threatened by a myriad of constraints. The effects of the prevalent low-input systems of production, over-aged farms, and unstable climate are exacerbated by weaknesses inherent in the formal system of production and distribution of recommended varieties (Asare et al., 2010). Sustainable production can be achieved by increasing farmers' access to cultivars improved for tolerance to stress, and by providing a stimulating framework for rejuvenating aged farms with genetically improved varieties.

Three major constraints have largely accounted for the current low productivity and extensive systems of cocoa farming in West and Central Africa. First, access to, and adoption of improved varieties are between 10% and 40% across the sub-region (Gockowski, 2011). In spite of 75 years of development of improved varieties, inefficiencies in the formal system of seed delivery and lack of appreciation of improved varieties have accounted for this low adoption rates (Asare et al., 2010). Second, a large proportion of the commercial plantations have aged beyond their economic lifespan of 30 years. With lack of capacity and incentives to rejuvenate these farms, and the difficulties that are inherent in re-establishment of cocoa on previously used land, extensive systems of production have been adopted with a consequent destruction of available secondary forests. The effects of these challenges on productivity are exacerbated by a climate change phenomena that have created

an unstable production environment, with increasing frequency of droughts, increasing temperatures and reducing humidity (Anim-Kwapong & Frimpong, 2006). The rapidly changing climate is also increasing the susceptibility of current varieties to the major pests, and previously considered minor pests which are now gaining prominence. The most notable effect of the climate change phenomena on production is high mortality of tree stocks within the first two years of establishment (Gockowski, 2011).

To sustain the cocoa industry, a programme of re-establishing cocoa in denuded and degraded forest areas which previously had carried cocoa was started by Cocoa Research Institute of Ghana (CRIG) in 1986 (Anim-Kwapong & Teklehaimanot, 2001). The program was underpinned by the supply of improved hybrid varieties (MASDAR, 1998).

In Ghana, improved hybrid cocoa varieties were introduced for the past 25 years or more (MASDAR, 1998). There is evidence that hybrid varieties outperform the older varieties in two ways by producing trees that bear fruits in three years compared with at least five years for the older varieties and by producing more pods per tree (MASDAR, 1998). But hybrid cocoa trees require optimal weather conditions and good farming practices such as the application of chemical inputs, adoption of new planting procedures, pruning, and spraying. Hybrid varieties also require frequent harvesting throughout the year (MASDAR, 1998; Business & Financial Times, 2014).

The current project aimed at stimulating the adoption of intensive systems of production, and the attainment of sustained, increased productivity in the predominantly smallholder cocoa farming systems in Ghana. Specific objectives of the baseline survey were to:

- Determine the perception of the respondents on cocoa farm rehabilitation and the inherent constraints;
- Obtain perception of the farmers in the target communities on the possibility of re-introduction of cocoa in marginal areas which were previously cropped to cocoa, but now food crops;
- Determine farmers' interest in planting new cocoa varieties.

2. Materials and Methods

2.1 Study Areas

The study areas were Akomadan and Afrancho in the Ashanti Region; Asesewa (Konkoney) in the Eastern Region; as well as Kenyasi (Atwidie), Bechem (Breme) and Acherensua (Kokontreso) in Brong-Ahafo Region (Figure 1)

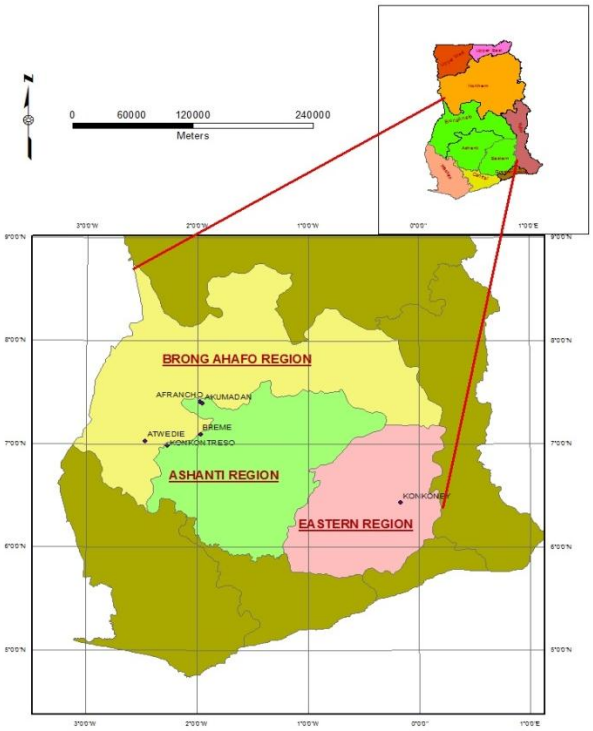

Figure 1. A map indicating the study areas

2.2 Sampling Procedure

The project sites were purposively selected based on the criteria that they are located in denuded and marginal cocoa areas while a sample size of 192 respondents was selected. In each community, the respondents were assembled at a meeting place and each was randomly interviewed. The number of respondents in each community is presented in Table 1.

Table 1. Study areas and number of respondents selected for the interview.

Region	District	Location	No. of farmers
Ashanti	Offinso	Akumandan	30
Ashanti	Offinso	Afrancho	60
Eastern	Oyoko-Nankese	Konkoney	14
Brong Ahafo	Bechem	Breme	32
Brong Ahafo	Goaso	Atwedie	43
Brong Ahafo	Goaso	Konkontreso	13
Total			192

2.3 Data Collection

The survey was conducted in the period starting from 10th December, 2013 to 5th July, 2014 at Asesewa (Konkoney) in the Eastern Region; Akomadan and Afrancho in the Ashanti Region; as well as Kenyasi (Atwidie), Bechem (Breme) and Acherensua (Kokontreso) in Brong-Ahafo Region. The project team interacted with a group of farmers who were first briefed on the purpose of the gathering, the objectives of the project and the expected contribution of the farmers to the project objectives. This was done to create awareness of the project activities in the target areas. Feedback was also obtained from the gathering in the form of questions and answers with some explanations to ensure the clarification of doubtful issues. Then respondents were individually interviewed with a questionnaire to obtain data on their demographic and farm characteristics, perception on possibility of rehabilitation of old cocoa and re-introduction of cocoa in the denuded areas, farmers' interest in planting new cocoa varieties, and willingness and ability of respondents to establish and maintain the project farms.

2.4 Data Analysis

Data were analyzed, after processing and computer entry, with Statistical Package for Social Science software (SPSS, Version 19) using quantitative analytical techniques such as frequencies, percentages, cross-tabulations, etc.

3. Results

3.1 Demographic and Farm Characteristics

From Table 2 which describes the demographic and farm features of the respondents, 98.4% were cocoa farmers whereas 1.6% also food crop farmers. The respondents consisted of males (74.9%) and females (25.1%). In terms of ownership of the farm, 58.1% of the respondents were owners while 41.9% were caretakers. More of the respondents had one cocoa farm (67.4%) while those having two farms accounted for 22.1% (Table 2). Also, generally the educational level of the respondents was low. About 46% of them had middle/JHS education and 22.4% had no education at all (Table 2). From Table 3 which presents the summary of additional demographic and farm characteristics of the respondents, the average age of the respondents was 51 years, with a range of 23 – 95 years. The average year of farming experience was 24 years, having a range of 1 – 65 years. The mean farm size in hectares (ha) of the cocoa producers was 3.0. The mean age of the cocoa farms was 13 years. The cocoa farms produced a mean output of 614.4 kg per farmer with a range of 192.0 kg to 2 560.0 kg per farmer. The food crop farm characteristics were not reported due to unreliable data given by the respondents. It should be noted that the number of respondents in the results section keeps changing because of non-responses in the data.

Table 2. Distribution of demographic and farm characteristics of respondents in the study areas

Characteristic	Cases	Percentage (%)
Gender:		
Male	140	74.9
Female	47	25.1
Total	187	100.0
Educational Level:		
Non-formal	15	7.8
Primary	20	10.4
Middle/JHS	88	45.8
SHS	20	10.4
Tertiary	6	3.1
No education	43	22.5
Total	192	100.0
Cocoa farm ownership:		
Owner	68	58.1
Caretaker	49	41.9
Total	117	100.0
Status of farmer:		
Cocoa farmer	184	98.4
Non-cocoa farmer	3	1.6
Total	187	100.0
Number of cocoa farms:		
1	58	67.4
2	19	22.1
3	8	9.3
4	1	1.2
Total	86	100.0

Table 3. Summary of farmer and farm characteristics of the respondents in the study areas

Characteristics	**Mean**	**Minimum**	**Maximum**	**Sample Size (n)**
Farmer age (years)	51	23	95	191
Working experience (years)	24	1	65	185
Cocoa farm size (hectares)	3.0	0.4	16.0	182
Cocoa farm age (years)	13	1	56	187
Cocoa output (kg/farmer)	614.4	192.0	2 560.0	68

3.2 Perception on Rehabilitation (Planting Cocoa in Marginal Areas Which Were Previously Cropped To Cocoa, But Now Food Crops)

3.2.1 Knowledge about Rehabilitation

In inquiring about the knowledge status of the respondents relating rehabilitation of cocoa farms (Table 4), 92.9% indicated that they knew something about rehabilitation whereas 7.1% had no information of it. From those respondents who had information, 71.3% said that cocoa farm rehabilitation meant re-planting of a farm which is over 30 years, 38.8% stated re-planting of cocoa farm with new cocoa variety (hybrid), 26.3% indicated re-planting of cocoa farm infected with Cocoa Swollen Shoot Virus Disease (CSSVD), 12.5% said re-planting of cocoa farm of Amelonado trees, 7.5% also indicated re-planting of cocoa farm of abandoned cocoa trees while 2.5% of the respondents specified re-planting of cocoa farm with other types of cocoa varieties.

3.2.2 Willingness of Farm Rehabilitation

When asked whether they would want their farms to be rehabilitated, 40.0% said “yes” whereas 60.0% indicated “no”. Also, 66.7% of the respondents said they were willing to pay for the rehabilitation of their farms whilst 33.3% said “no”. The specific characteristics of cocoa the respondents prefer for the rehabilitation of their farms (Table 4) include early yielding cocoa (73.3%), high yielding cocoa (56.7%), big cocoa beans (8.3%), less susceptible to disease (8.3%), small cocoa trees (6.7%), less susceptible to pests (5.0%), and big cocoa pods (1.7%).

Information on whether respondents had plans for rehabilitation of their existing cocoa farms was obtained (Table 4). Only 53.6% said 'yes' and 46.4% 'no'. Of those who indicated 'yes', 71.0% planned to rehabilitate their farms by infilling the open spaces with young plants; 16.1% by decreasing or increasing the shade in the plantation, etc.

The respondents gave their reasons for the preference of rehabilitation (Table 4) and 36.0% said it was because of low yields, 44.0% indicated old cocoa trees, and 8.0% reported that they want to plant hybrid because of obtaining higher incomes. However, some respondents rejected farm rehabilitation because the cocoa farm was young (83.2%), and that the farm size was too small for rehabilitation (2.1%).

3.2.3 Problem/Constraints in Farm Rehabilitation

For the problems/constraints that a cocoa farmer is likely to encounter in farm rehabilitation in the districts (Table 4), 22.7% of the respondents indicated loss of cocoa income, 29.5% reported the need of money to hire labour and purchase other inputs, 34.1% indicated initial financial hardship whilst 2.3% reported non-availability of inputs.

Table 5 summarizes the number of farms and farm size to be rehabilitated, and the costs of rehabilitation. Those who were willing to pay for the rehabilitation indicated an average amount of GH₵ 273.08 (n = 13), having a range of GH₵ 50.00 to GH₵ 1 000.00, as payment for an acre of farm to be rehabilitated. Also, they were prepared to offer one farm, on average, for rehabilitation with a range 1-3 farms. The average farm size they were willing to provide for rehabilitation was 3.9 acres (n = 32; 1 acre = 0.4 hectare), with a range of 1-5 acres.

Table 4. Distribution of respondents on perception on cocoa farm rehabilitation (planting cocoa in marginal areas which were previously cropped to cocoa, but now food crops)

Item	Frequency	Percentage
Knowledge of farm rehabilitation		
Yes (have knowledge)	79	92.9
No (have no knowledge)	6	7.1
Total	85	100
Meaning of cocoa farm rehabilitation*		
Replanting cocoa farm which is over 30 years	57	71.3
Replanting cocoa farm with new cocoa variety (hybrid)	31	38.8
Replanting cocoa farm infected with cocoa swollen shoot virus disease (CSSVD)	21	26.3
Re-planting cocoa farm of Amelonado trees	10	12.5
Re-planting cocoa farm of abandoned cocoa trees	6	7.5
Re-planting cocoa farm having other types of cocoa varieties	2	2.5
Total	80	158.9
Do you want cocoa farm rehabilitated?		
Yes	34	40
No	51	60
Total	85	100
Willingness to pay for rehabilitation		
Yes (willing)	20	66.7
No (unwilling)	10	33.3
Total	30	100.0
Specific characteristics of cocoa preferred for rehabilitation*		
Early yielding cocoa	44	73.3
High yielding cocoa	34	56.7
Big cocoa beans	5	8.3
Less susceptible to diseases	5	8.3
Less susceptible to pests	3	5.0
Small cocoa trees	4	6.7
Big cocoa pods	1	1.7
Total	60	160
Plans for rehabilitation of existing cocoa farms		
Yes (have plans)	37	53.6
No (have no plans)	32	46.4
Total	69	100.0

Item	Frequency	Percentage
For those who have plans to rehabilitate their farms		
Planned to rehabilitate farms by infilling of the open spaces with young plants	22	57.9
Planned to rehabilitate farms by decreasing or increasing shade in the plantation	5	13.2
Planned to rehabilitate their farms by drastic pruning of the old cocoa trees	3	7.9
Planned to rehabilitate their farms by spraying pesticides	4	10.5
Planned to rehabilitate their farms by applying fertilizer	3	7.9
Others	1	2.6
Total	38	100.0
Reasons given for cocoa farm rehabilitation		
Low yields	9	36.0
Old cocoa trees	11	44.0
Want to plant hybrid cocoa	2	8.0
Death of cocoa trees due to pest and disease attack	2	8.0
Higher income	1	4.0
Total	25	100.0
Reasons given against cocoa farm rehabilitation		
Because of young cocoa farm	40	83.2
Because the farm has already undergone rehabilitation	2	4.2
Because the farm still gives higher yields	3	6.3
Because the farm is too small for rehabilitation	1	2.1
Because the farm has no pest and disease attacks	2	4.2
Total	48	100.0
Problems/constraints likely to be encountered in the district		
Loss of income	10	22.7
Capsid infestation	1	2.3
The need of money to hire labour and purchase other inputs	13	29.5
The problem of farm maintenance	2	4.5
Initial financial hardship	15	34.1
Unfavourable weather conditions	1	2.3
No problem	1	2.3
Non –availability of inputs	1	2.3
Total	44	100.0

*multiple choice items (total of the percentage figures is not equal to 100%)

Table 5. Summary of number of farms and farm size to be rehabilitated, and the costs of rehabilitation

Characteristics	Mean	Minimum	Maximum	Sample Size (n)
Number of farms to be rehabilitated	1	1	3	23
Farm size to be rehabilitated (ha)	1.6	0.4	2	32
Amount to be paid for farm rehabilitation (GH₵)	273.0	50.00	1 000.00	13

3.3 Possibility of Re-Introduction of Cocoa

The respondents were questioned on the possibility of re-introduction of cocoa on their land (Table 6). Only 98.4% said ‘yes’ whilst 1.6% said ‘no’. The reasons stated for the possibility of cocoa re-introduction by the respondents consisted of the land was already/currently planted to cocoa (35.5%), the land/soil was good for cocoa production (33.5%), the land was previously planted to cocoa (19.0%), the observation of indicator crops such as plantain showed that cocoa could be grown in the study areas (1.2%), etc. For possible chance of success after re-introduction of cocoa (Table 6), 93.3% of the respondents indicated that it could grow very well whereas 6.7% reported that cocoa could grow well. Also, the respondents indicated how successful cocoa establishment could be achieved in the area (Table 6). Their views included planting of temporary shade such as plantain, cocoyam, etc. for successful cocoa establishment (32.0%), planting of permanent shade trees (1.6%), and other activities (1.0%) such as providing assistance in the form of credit, forming association of farmers to combat bush fires, etc. On condition that cocoa could be successfully grown in the area, they were asked to indicate what percentage of their land holdings they would be happy to plant solely to cocoa. They reported an average of 46.98% (n = 154), with range from 10% to 100% (Table 7).

Table 6. Distribution of respondents on perception on the possibility of re-introduction of cocoa in the study areas

Item	Frequency	Percentage
Possibility of re-introduction of cocoa		
Yes (possible)	184	98.4
No (impossible)	3	1.6
Total	187	100
Reasons for possibility of cocoa re-introduction		
The land is already/currently planted to cocoa	61	35.5
The soil is good for cocoa production	58	33.5
Cocoa is additional source of income	13	7.4
The increase in incentives (e.g. increase in cocoa producer price) of cocoa production	1	0.6
The reduction of bushfire outbreaks	2	1.2
The land was previously planted to cocoa	16	9.0
The weather conditions are good	2	1.2
The observation of indicator crops such as plantain shows that cocoa can be grown in the study areas	2	1.2
The education received on the new cocoa varieties	4	2.4
Others	14	8.0
Total	173	100.0
Possible chance of success after re-introduction of cocoa		
Cocoa can grow very well	166	93.3
Cocoa can grow well	12	6.7
Total	178	100.0
How successful cocoa establishment could be achieved in the study areas*		
Planting of temporary shade trees	17	8.9
Planting of permanent shade trees	3	1.6
Providing extension officer to educate cocoa farmer on the use of good agronomic practices	15	7.8
Planting cocoa varieties that are easy to establish	10	5.2
Others	2	1.0
Total	192	24.5

*multiple choice items (total of the percentage figures is not equal to 100%)

Table 7. Summary of the percentage of land holdings the respondents are willing to offer for planting solely cocoa

Characteristics	Mean	Minimum	Maximum	Sample Size (n)
Percentage of land holdings to be planted to solely cocoa (%)	46.98	10	100	154

3.4 Perception on Farmers' Interest in New Cocoa Varieties

Concerning the interest the respondents had in testing any new cocoa varieties on their farms as part of the project (Table 8), 79.6% of them indicated "yes" and 20.4%, "no". Upon enquiring whether they had plans for extending their farms, that is, establishing new farms, 94.4% indicated 'yes' whereas 5.6% said 'no'. Of those respondents who opted for infilling to rehabilitate their farms or establishment of new farms with hybrid varieties, 81.9% chose to plant seeds from cocoa stations as seedlings, 16.1% preferred to plant seeds from cocoa station for direct planting at stake, and 2.0% decided to use clones from cocoa stations.

Upon asking them whether the new varieties they were interested in were available (Table 8), 77.6% said they were available whilst 22.4% indicated they were not. The respondents appeared to source their planting materials from the seed gardens (83.1%), that is, from Seed Production Unit (SPU) of Ghana Cocoa Board (COCOBOD); from Cocoa Research Institute of Ghana (CRIG) (3.2%); from other farmer's farm (11.3%); from their own farms (1.6%); and other sources (0.8%).

Giving reasons for non-availability of the new cocoa variety (Table 8), 26.3% of the respondents reported inadequate supply of pods from the cocoa stations, 2.6% reported inadequate number of cocoa stations, 60.5% indicated difficulty in getting pods from the cocoa stations while 10.5% indicated unawareness of the place to get the new variety.

Of those who were willing to test the new cocoa varieties (Table 8), 10.8% desired to infill the open spaces in existing cocoa farms whereas 89.2% wished to establish new cocoa farms. Data on willingness and ability of respondents to establish and maintain the project farms were elicited (Table 8). Those who agreed to clear the land for the new cocoa plantings accounted for 98.9% of the respondents, to plant temporary shade trees in the cocoa farm formed 99.4%, to plant permanent shade trees in the cocoa represented 99.4%, to harvest and break the cocoa pods constituted 99.4%, to count the total pods harvested per tree accounted for 98.9%, and to count healthy and diseased pods represented 97.7%. The difference between these percentage figures and 100% gives you the percentage of respondents who did not agree to perform the activities. Further, the percentage figures would not add up to 100% because of multiple choice items. In addition, 89.8% of the respondents were willing to pay for the new varieties whereas 10.2% were unwilling.

Table 8. Distribution of respondents on perception on interest in planting new cocoa varieties

Item	Frequency	Percentage
Interest of respondents in cocoa varieties		
Yes (interested)	129	79.6
No (disinterested)	33	20.4
Total	162	100
Plans for extending their farms (i.e. new establishments)		
Yes (have plans)	157	94.4
No (have no plans)	9	5.6
Total	161	100
For those who opted for infilling to rehabilitate their farms or make new plantings with any type of planting materials		
Plant seeds from cocoa stations as seedlings	24	81.9
Plant seeds from cocoa stations for direct planting at stake	122	16.1
Use clones from the cocoa stations	3	2.0
Total	149	100.0
Availability of interesting new varieties		
Yes (available)	118	77.6
No (unavailable)	34	22.4
Total	152	100.0
Source of planting materials		
Seed gardens (cocoa stations)	103	83.1
Cocoa Research Institute of Ghana (CRIG)	4	3.2
Other farmers' farms	14	11.3
Own farm	2	1.6
Others	1	0.8
Total	124	100.0
Reasons for non-availbility of the new cocoa varieties		
Inadequate supply of pods from the cocoa stations	10	26.4
Inadequate number of cocoa stations	1	2.6
Difficulty in getting pods from the cocoa stations	23	60.5
Unawareness of the place to get the new variety	4	10.5
Total	38	100.0
Interest in testing new cocoa variety as part of the project		
Yes (interested)	98	98
No (disinterested)	2	2
Total	100	100
Type of planting method for testing the new cocoa varieties		
Desired to infill open spaces in existing cocoa farms	9	10.8
Wished to establish new cocoa farms	74	89.2
Total	83	100.0
Willingness and ability to establish and maintain the project farms*		
To clear the land for the new plantings	173	98.9
To plant temporary shade trees in the cocoa farm	173	99.4
To plant permanent shade trees in the cocoa farm	173	99.4
To weed, spray and prune cocoa trees	173	99.4
To harvest and break the cocoa pods	173	99.4
To count the total pods harvested per tree	172	98.9
To count healthy and diseased pods	169	97.1
Total	174	692.5
Willingness to pay for the new varieties		
Yes (willing)	141	89.8
No (unwilling)	16	10.2
Total	157	100.0

*Multiple choice items (total of the percentage figures is not equal to 100%)

The possible pod and seedling prices, and number of trees for infilling are summarized in Table 9. The respondents were willing to pay an average price of GH₵ 0.47 per pod or cuttings (n = 73), ranging from GH₵ 0.20 to GH₵ 10.00 and GH₵ 0.36 per seedling (n = 56), ranging from GH₵ 0.10 to GH₵ 2.00. In addition, the average number of new cocoa trees to plant for filling of the open spaces in the old farm, or newly established farm was 2,097 (n = 81) with a range of 100-18,000 trees (450 trees per acre of land).

Table 9. Summary of possible prices of pods and seedlings, and number of cocoa seedlings for infilling

Characteristics	Mean	Minimum	Maximum	Sample Size (n)
Possible price to be paid for new cocoa varieties (GHs per pod or cuttings)	0.47	0.20	10.00	73
Possible price to be paid for new cocoa varieties (GHs per seedlings)	0.36	0.10	2.00	56
Number of cocoa seedlings for infilling	2 097	100	18 000	81

4. Discussion

The findings have demonstrated that the majority of the respondents have some information or knowledge of cocoa farm rehabilitation and were willing to offer their farms for rehabilitation. They were also willing to bear the expenses on the rehabilitation in which they would want to use seedlings of hybrid cocoa varieties for infilling of the open spaces in the existing cocoa farms. The main reasons given for the preference of rehabilitation were that the cocoa farms were old with low yields. However, some respondents rejected the rehabilitation of their farms because of initial loss of cocoa income which can lead to financial hardship that would limit the hiring of labour and purchasing of other non-labour inputs. This implies that farmers in the project areas may be interested in the COCOBOD's cocoa rehabilitation programme. Also, it is likely that farmers may encounter financial constraints in labour hiring and other non-labour input purchasing. Additionally, this might affect the adoption of the recommended cocoa establishment technologies of CRIG. The current project is not capable in providing credit to the interested farmers as was done in the Eastern Region Cocoa Rehabilitation Project (World Bank, 1970), but can only assist in supplying free hybrid seedlings to the project farmers for the cocoa farm establishment. According to MASDAR (1998), in 82% of cases replanting has been undertaken on a 'spot' basis of replacing individual dead or low yielding trees. Older and younger trees therefore get mixed together and exact proportions become difficult to determine. This is also an agronomic problem in that it leads to an uneven canopy structure that attracts capsids and weeds. The existing shade may be inappropriate for young trees and there is evidence that older trees also transfer diseases to the young ones (Petithuegenin, 1995).

Most of the respondents indicated that it was highly possible to re-introduce cocoa in the study areas mainly because the land/soil is good for cocoa production and the fact that the land is already or currently planted to cocoa. They also reported that successful cocoa establishment could be achieved in the area after re-introduction, and this could be made possible by planting temporary shade trees such as plantain as well as the control of insect pests and, if necessary, fertilizer application among other practices (World Bank, 1970; Adebiyi & Okunlola, 2013). Despite the perception of good soils and cocoa being already planted in the areas, the soils in the project sites should be tested for its real suitability for cocoa. This is because the soils might be exhausted of nutrients having been under prolonged cultivation for food and other perennial crops after the bush fire disasters which caused cocoa farm abandonment. Effects of degraded soils and soil acidity on germination and root development of seedlings have been reported in the literature (Turner et al., 1988; Marschner, 1991; Anim-Kwapong & Teklehaimanot, 2001). Temporary and permanent shade trees should be planted to ensure good seedling establishment and subsequent development of the cocoa trees as anticipated in the COCOBOD's cocoa rehabilitation programme, and as indicated by some studies (Anim-Kwapong & Teklehaimanot, 1995; Osei-Bonsu & Anim-Kwapong, 1998).

Majority of the respondents were interested in testing new cocoa varieties on their farms as part of the project since they have plans for extending the farms by planting seedlings from the cocoa stations, that is, the seed gardens of Seed Production Unit (SPU) of Ghana Cocoa Board (COCOBOD). However, some respondents stated that it was difficult in obtaining hybrid pods from the cocoa stations due to inadequate supply. Most of them wished to establish completely new cocoa farms with the new cocoa hybrid varieties instead of infilling of the open spaces in existing cocoa farms. The implication of this is that the current project must establish cocoa nurseries at the project sites to serve as ready sources of hybrid seedlings for the rehabilitation and re-introduction efforts to be successful. Good government policies to increase incentives for cocoa rehabilitation

and re-introduction are very important. The decline of cocoa production in Ghana from the mid 1960s to the early 1980s was blamed on poor government policies including: lack of support funds to stabilize producer prices in the face of falling world prices; the establishment of a new internal marketing system which disrupted the efficient marketing system it replaced; and disbanding of extension and disease control service. These factors among others led to the neglect of existing cocoa farms and loss of interest in replanting (World Bank, 1970; Ghana Government &World Bank, 1978).

5. Conclusion

The conclusions drawn from the results are as follows:

- The respondents appeared to have knowledge about cocoa farm rehabilitation, and majority of them were unwilling to rehabilitate the cocoa farms. The respondents reported rehabilitation problems/constraints such as initial financial hardship, the need of funds to hire labour and purchase other farm inputs etc.
- The survey revealed that majority of the respondents reported that re-introduction of cocoa in marginal or denuded land was highly probable since the land/soil was already good for cocoa production, etc.
- Majority of the respondents were observed to have interest in testing any new cocoa varieties on their farms as part of the project. They were also willing to provide land, pay for and test the new hybrid cocoa to be supplied on their farms, and prepared to perform all the farm establishment, maintenance and harvesting activities in support of the project.

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References

Adebiyi, S. & Okunlola, J. O. (2013). Factors affecting adoption of cocoa farm rehabilitation techniques in Oyo State of Nigeria. *World Journal of Agricultural Science, 9*(3), 258-265.

Anim-Kwapong, G. J., & Teklehaimanot, Z. (2001). Albizia zygia (DC) Macbride, a shade tree for cocoa: The effect of duration of acid scarification and substrate acidity on the germination of seeds. *Forests Trees and Livelihoods, 11*, 47-55. http://dx.doi.org/10.1080/14728028.2001.9752370

Anim-Kwapong, G. J., & Frimpong, E. B. (2006). *Vulnerability and adaptation assessment under the Netherlands Climate Change Assistance Programme Phase 2 (NCAP2):Vulnerability of agriculture to climate change-impact of climate on cocoa production*. Final report submitted to Environmental Protection Agency, Ghana. 122pp.

Asare, R., Afari-Sefa, V., Gyamfi, I., Okafor, C., & Mva Mva, J. (2010). Cocoa seed multiplication: an assessment of seed gardens in Cameroon, Ghana and Nigeria. STCP Working Paper Series 11 (Version August 2010). Sustainable Tree Crop Program, International Institute of Tropical Agriculture, Accra, Ghana.

Business & Financial Times (2014). Is cocoa still our economic backbone? Wednesday, March 6th, 2014.

Ghana Government /World Bank (1978). *Evaluation of Ghana Government /World Bank Cocoa Rehabilitation Projects in the Eastern and Ashanti Regions*. A report submitted to the Commissioner of Cocoa Affairs, Ghana Government/World Bank Cocoa Project Evaluation Committee. 200pp.

Gockowski, J. (2011). Agricultural intensification as a strategy for climate mitigation in Ghana: an evaluative study of the COCOBOD high tech program, rural incomes, and forest resources in the Bia (Juaboso) district of Ghana.

Sustainable Tree Crop Program, International Institute of Tropical Agriculture, Accra, Ghana.

Marschner, H. (1991). Mechanisms of adaptation of plants to acid soils. *Plant and Soils, 134*, 1-2. http://dx.doi.org/10.1007/978-94-011-3438-5_78

MASDAR (1998). *Socio-economic Study*. A Final Report. Accra, Ghana: Ghana Cocoa Board (COCOBOD)/ MASDAR Consultants, 384.

Osei-Bonsu, K., & Anim-Kwapong, G. J. (1998). Preliminary evaluation of some forest trees for cocoa cultivation. *Journal of Ghana Science Association, 1*, 141-150. http://dx.doi.org/10.4314/jgsa.v1i1.17796

Petithuguenin, P. (1995). *Regeneration of cocoa cropping systems: The Ivoirian and Togolese experience*. In: Ruf F. & Siswotputrano, P. S. Cocoa Circle-the Economics of cocoa supply. Abington Woodhead, 1995. http://dx.doi.org/10.1016/b978-1-85573-215-5.50008-9

Turner, G. D., Lau, R. R., & Young, D. R. (1988). Effect of acidity on germination and seedling growth of *Paulownia tomentosa*. *Journal of Applied Ecology, 25*(2), 561-567. http://dx.doi.org/10.2307/2403844

World Bank (1970). *Ghana Eastern Region Cocoa Project*. A Project Report, Agriculture Projects Department, World Bank Association.

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