Some Impressions on the State of Coffee Sector in Ghana  
(Field Visit Report)

The performance of one of the improved varieties at Tafo main Research Centre

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1. Background

Coffee is an important agricultural commodity, second only to oil in the international trade. About 25 million families supporting over 125 million people in more than 50 developing countries of Africa, Latin America and Asia that produce and sell coffee depend on it as their main source of income. In Africa, about 33 million people directly depend on coffee for their livelihoods and it is the pillar of the national economy contributing over 10% to the export earnings of some 14 African countries. Globally, coffee generates over US$12.44 billion annually to the coffee producing and exporting countries, with a retail values of about US$70 billion. In the 1970s and 1980s, the market share of Africa was about 30% and this has steadily dropped down to about 12% today. From this figures, one can easily estimate how much foreign earnings Africa is annually losing because of the decline of coffee production and export in the region. Ghana is one of the big losers as its annual production has gone down as low as 600 tons despite the enormous potential that the country owes for coffee production.

There are several reasons for the decline of coffee production and export in Africa. The collapse of quota system in 1989 followed by price crisis (1999 – 2004) and liberalization of the sector in the absence of strong private sector who can cover the gaps left by the public services; civil unrest (political instability) in several African counties largely in Robusta producers; old age of coffee trees and use of traditional varieties; lack of extension services to train on good management practices, supply improved planting materials and other extension services; diseases and insect pests; low coffee prices; and lack of well established internal marketing system are the major factors among others. All these problems are also true to Ghana coffee sector except the civil unrest which has never experienced in this most stable African country. Excited by discussions made during IACO Annual General Assembly held in Accra, Ghana, in November 20099 and realizing that Ghana is one of the big losers of foreign revenue that would have come from coffee export, the Cocoa Board of Ghana pleaded for strong support and requested IACO for its official visit to Ghana to discuss over the possible ways of revamping the coffee sector in the country. IACO swiftly accepted the invitation for the simple reason that assisting member countries in instituting measures to challenges facing coffee production and ensuring increased production, productivity, quality and remunerative price is one of the major mandates of the organization.

The current travel mission to Ghana which was carried out 29 August to 3 September 2010 is the direct reaction to the promise that IACO made to undertake an official visit to Ghana and the main objectives are: (1) to conduct a quick reconnaissance survey and sector analysis through discussion with the relevant authorities, farmers as well as private coffee traders on
various production and marketing issues, (2) identify key production and marketing constraints and (3) suggest possible means of addressing the problems to revitalize the coffee industry in Ghana.

2. Overview of the Current Status of Coffee Sector

Because of my short visit, the information collected and hence my comments are not comprehensive enough to provide a complete picture of the coffee sector in Ghana. However, the points raised can serve as platform from which more comprehensive development programs can be envisaged.

2.1 Coffee Production:

Similar to many other West African countries, Ghana solely produces *Coffea canephora*, commonly called Robusta coffee, because of ecological limitations to grow the other most important commercial species, *Coffea arabica*. The history of Robusta coffee production in Ghana may date back to early 1900s. It grows in almost all parts of the country where cocoa grows as well as in areas that are marginal to cocoa production. However, despite its age-old story or ranges of adaptation and the immense potential that the country owes to produce and generate considerable revenues to the nation, coffee has never been given due attention at any time in the past unlike cocoa. The Annual General Assembly of the Inter African Coffee organization (IACO0) held in Accra, Ghana, in November 2009 was a great impetus to reemphasise on coffee where the government through Cocoa Board has swiftly allocated some US$4.5 million for four years period to double the production.

The national average annual production and export is reportedly below 2000 metric tons (mt), excluding those smuggled to neighbouring countries like Togo and Cote d’Ivoire seeking for better prices. In other major coffee producing countries such as Brazil, Colombia, Vietnam and others, this quantity can be produced from a small estate farm of about 2000 hectare (ha) suggesting how much coffee production in Ghana has been neglected. The highest export level ever registered so far is 10,000 mt which was achieved during 1997/98 crop season (Oppong 2007; William, personal communication). This achievement was reportedly attributed to good price incentive and agricultural diversification project embarked in 1991 by the government through Cocoa Board. Such interesting program, however, did not continue due mainly to liberalization of the sector in 1992 and world coffee price crises, but apparently demonstrated the possibility to maximize coffee production and productivity in the country.

The annual export is unstable, which in some years literally collapses declining as low as 534 metric tons and in some years rises up as high as 6,774mt (Table 1). Even though biennial bearing is the natural habit of coffee, yield instability is predominantly attributed to poor
management practices and this has been clearly observed in all coffee farms visited in the farmers’ field.

Table 1. Coffee export between 2000 and 2008.

<table>
<thead>
<tr>
<th>Year</th>
<th>Export (mt)</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>6,741.5</td>
<td>F.K. Oppong (2007) (1)</td>
</tr>
<tr>
<td>2001</td>
<td>3,131.2</td>
<td></td>
</tr>
<tr>
<td>2002</td>
<td>1,326.0</td>
<td></td>
</tr>
<tr>
<td>2003</td>
<td>768.9</td>
<td></td>
</tr>
<tr>
<td>2004</td>
<td>584.2</td>
<td>W. A. Quaittoo (2)</td>
</tr>
<tr>
<td>2005</td>
<td>534.4</td>
<td></td>
</tr>
<tr>
<td>2006</td>
<td>1,376.8</td>
<td></td>
</tr>
<tr>
<td>2007</td>
<td>1,695.2</td>
<td></td>
</tr>
<tr>
<td>2008</td>
<td>929.6</td>
<td></td>
</tr>
</tbody>
</table>

The total area under coffee is estimated at 10,000 hectares of which about 87.2% is owned by smallholders while the rest 12.8% is under private estate or plantation developers (Oppong, 2007, unpublished). Currently, these coffee farms, i.e. those under smallholders and 19 big coffee estates of each about 630 acres (= 252 ha) established by Cocoa Board in the early 1980s through Agricultural diversification program have been largely abandoned or replaced by other crops mainly cocoa due to low coffee prices, lack of access to market, inadequate or lack of government support owing to liberalization of the sector, and several other factors. Reports indicate that over 60% of the farmers who regularly produce coffee have changed their farm to cocoa. In general, coffee production and its productivity is at its lowest level than any other country even though the country possesses great potential to maximize coffee production and the income generated from this lucrative commodity crop.

2.2 Marketing system:

Unlike the Cocoa sector, there is no well established internal coffee marketing system in Ghana. Farmers have no access to market and bargaining power for fair farm gate price. Price is the good will of smallholder local traders who offer incredibly low and unsustainable prices since there is no any control mechanism. Some of the coffee farmers that have been visited quoted the current farm gate coffee price at 30 Ghana cede (= US$ 20.00) per 65kg bag of un pulped dry coffee (= 32 kg clean beans). Big buyers like Produce Buying Company of Ghana has no much interest to buy coffee presumably because of the small quantity of coffee that is annually produced and difficulties to collect from farm gates. According to some reports (3), there are only two Licence Buying Companies (LBCs), Time Marketing and L.D. & Sons, currently
operating but these companies do not have the required financial capacity to buy and collect from all corners. Unlike cocoa, the government do not provide loan to coffee traders to have adequate cash at hand to buy coffee from farmers timely and at fair price. In addition, the government has fully liberalized the sector and hence has no control over the price and quality of coffee produced. Since there is no ready market access, farmers are often forced to store their coffee over long period, sell at very low price and quite often smuggle coffee to neighbouring countries for better market.

Lack of internal marketing system in general had considerable repercussions in Ghanaian coffee industry including abandoning or neglecting of coffee farms, replacing by other crops mainly by cocoa which is more dependable in many ways, lawless price, loss of interest by coffee producers and traders, and poor coffee quality which could badly brand Ghana coffee. These unfavourable attributes in turn have caused low annual production and productivity, poor coffee quality and loss of huge national income that could have been generated from the sector. It appeared that the major factors for the absence of internal marketing system are lack of attention and recognition to coffee sector development as one of the major sources of foreign currency earner, liberalization of the sector in the absence of strong private sector, unreliable and low coffee prices which is discouraging to the producers and traders, and low quantity of annual production which is unattractive particularly to the big coffee traders.

2.3 Coffee Research:

Despite the discouraging situation of coffee production and marketing in the country and full liberalization of the sector, the Cocoa Research Institute of Ghana through financial support from Cocoa Board has been seriously conducting coffee research since 1970. During this period, the institute had registered considerable achievements in generating appropriate technologies required for modern coffee production and processing. These package technologies have been compiled in to manual and ready for use while research has continued in all areas to refine the available technologies and generate new ones. The institute and dedicated coffee researchers and coordinators must be congratulated for the wonderful job they have accomplished. These technologies would greatly facilitate the revitalization of the industry in the shortest time possible once attention is given to the sector as part of national agricultural development strategy.

2.3.1 Breeding – Interesting works have been done and in progress in variety development, germplam collection and screening, and improved seed production.

a. Variety development – a number of experiments have been conducted and being conducted in variety development program mainly focusing on yield and quality improvement (Table 2). As
depicted in the table, variety development for yield improvement follows two approaches – (i) Hybridization between elite parental lines/clones and selection of high yielding hybrids which are further tested under multi-location for final selection, and (ii) development of compact varieties to increase yield per hectare through high density planting.

Table 2. Some completed and on-going trials in coffee breeding and results achieved

<table>
<thead>
<tr>
<th>Title</th>
<th>Year Initiated</th>
<th>Year Completed</th>
<th>Selected clones (No)</th>
<th>Yield (kg/ha)</th>
<th>100 bean weight (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Average (3 locations)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Bechrem</td>
<td></td>
<td></td>
<td></td>
<td>880 – 1260</td>
<td></td>
</tr>
<tr>
<td>• Tafo</td>
<td></td>
<td></td>
<td></td>
<td>2130 – 2860</td>
<td></td>
</tr>
<tr>
<td>2. Tafo Seedling trial 1</td>
<td>1999</td>
<td>2006</td>
<td>7 (hybrids)</td>
<td>1760 – 2030</td>
<td>12.5 – 14.09</td>
</tr>
<tr>
<td>• Top 5%</td>
<td></td>
<td></td>
<td></td>
<td>2980</td>
<td>14.89</td>
</tr>
<tr>
<td>3. Tafo seedling trial 2</td>
<td>2005</td>
<td>On-going</td>
<td>14 (early seln)</td>
<td>1000 – 1500</td>
<td>-</td>
</tr>
<tr>
<td>5. Breeding for high density planting, compact growth</td>
<td>?</td>
<td>On-going</td>
<td>3 (early seln)</td>
<td>1520 – 1780</td>
<td>-</td>
</tr>
<tr>
<td>• Experiment 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Experiment 2</td>
<td>?</td>
<td>On-going</td>
<td>9 (early seln)</td>
<td>1200 – 1900</td>
<td>-</td>
</tr>
<tr>
<td>6. Sib-mating (E x A families)</td>
<td>? (new)</td>
<td>On-going</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Bi-parental seed garden</td>
<td>2009</td>
<td>On-going</td>
<td>-</td>
<td>-</td>
<td>-</td>
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From the multi-location adaptation trial, the highly significant yield differences between Bechrem and Tafo locations indicated highly considerable location effects suggesting that (i) varieties high yielding in one location may not prove in another location, (ii) variety development for wider adaptation is difficult and (iii) development of adaptable varieties for each agro-ecology is a necessary approach. It is interesting that the coffee breeding department indicated that they have identified a number of promising hybrid clones following this approach and some materials are ready for distribution. At this stage it would be important to have an Standing or Steering Committee on Coffee Research which would be responsible to critically evaluate the performance of candidate varieties for desirable agronomic traits (yield, quality, disease and insect pest tolerance, adaptation, etc.) based on data summarized over years by
the breeder and approve the best candidates for official release and distribution to growers. The committee could also serve as an advisory committee on coffee research programs.

b. Germplasm collection, conservation and screening – Lack of adequate breeding materials at hand was one of the major problems mentioned as an obstacle to coffee improvement program. There is no long-term coffee germplasm collection, conservation and evaluation program that can be used as a base breeding population from where desirable materials can be selected and further used in advanced trials. Currently, there are some 180 accessions introduced from Togo, Congo and Cote d’Ivoire. These collections have been just planted in the field in Latin Square design in three replications at different research stations to screen for desirable traits. The other breeding materials used in different trials (Table 2) are those generated from crosses among limited number of parental lines.

Obviously, the available breeding materials are not large enough to comprise high level of genetic diversity from which selection can be made for various desirable traits (yield, quality, pest resistance, tolerance to environmental stresses, bean size, compact growth, etc.). There are different ways of collecting genetic variability (germplam) for use in breeding program. The first and most important one is germplasm collection from the forest, semi-forest and farmers field on a sustainable basis. The centres of origin and genetic diversity of C. Canephora stretches from Guinea in the West to Uganda in the East. Launching a well coordinated and systematic long-term collection program between the countries of origin is the best way of collecting and conserving as much genetic variability as possible. Introduction of materials (both improved and unimproved materials) from other countries is the second method. There are a total of about 3200 accessions conserved in field gene banks in different countries and the bulk of these materials are found in Cote d’Ivoire (=1787 accessions) and Brazil (=1000 accessions). Selection from segregating population at nursery or field level is the third method. Canephora is strongly cross-pollinated species and there is a possibility to capture as much genetic variability as possible from the segregating F2 population for various characters of interest. Therefore, these methods could be used to stock adequate amount of breeding materials to increase the efficiency of the coffee breeding program at Cocoa Research Institute.

c. Propagation of improved varieties - As indicated earlier, there are a number of superior hybrids that have been identified through a series of tests and currently ready for release or distribution. Two propagation methods, seed and vegetative, are being used to multiply and distribute these improved materials.

Hybrid seed production – Bi-parental seed garden has been established in the field in 2009 at Tafo and Afosu using the male and female parents of the superior hybrids in 1:1 ration to facilitate cross-pollination and hybrid seed production for distribution to growers. In cross-
pollinated crops like *C. canephora*, bi-parental plot method is the cheapest, easiest and efficient method of multiplying sufficient quantities of seeds of superior hybrids of known parents. Therefore, the small bi-parental plots observed in the field must be expanded on a larger plot to produce required quantities of seeds per annum.

**Vegetative Propagation** – for superior progenies selected from segregating populations that evolved from natural out-crossing of unknown parental lines or bulk population, vegetative propagation like cuttings and tissue culture are the best methods to produce true-to-type planting materials. These methods can be used for any segregating materials, but for hybrids of known parental lines, the bi-parental seed production is more efficient and preferred.

The Cocoa Research Institute of Ghana has perfected the protocol for multiplication of clones through cuttings. The rooting efficiency of cuttings in the propagator and establishment rate after transfer to standard nursery media (polythene tube) was reported to be almost 100%. Currently several thousands of clonal seedlings are distributed to farmers through this method. Probably, the only comment in this method is on established clonal garden from which cuttings are harvested. Because of unlimited number of suckers per individual tree and closer spacing, the clonal garden appeared too dense (Fig.1). Under such condition, because of high competition between suckers, it is unlikely to have all suckers healthy and vigorous for use as good cutting materials. In this case, improving the spacing and limiting the number of suckers per tree could be helpful to obtain efficient and sufficient quantity of cutting materials. In some other countries, clonal garden is established by planting seedlings at 1m x 1m spacing and layering of one year old plant in Agobiado system. The number of suckers initiated from the
bended portion of the plant is limited to 6 – 8 suckers and these suckers are harvested when they develop 6 – 8 nodes. Probably, this practice can be tried to compare with the method already in use to learn more and maximize sucker harvesting efficiency.

The tissue culture method, however, is said to be a new introduction. Tissue culture technique is relatively expensive in that it requires skilled manpower and laboratory facilities, but more efficient than rooting of cuttings, once the protocol is properly optimized under the required environmental condition.

2.3.2 Agronomy – The Cocoa Research Institute has also made a lot of progress in generating improved agronomic practices, which are very essential for proper nursery-, field- and processing-managements and these have been compiled in to coffee production manual (4). As an eye witness, the following important agronomic practices were observed in the field at Afosu Research station.

a. Field management – The experimental fields clearly demonstrate the presence of full-package technologies for proper coffee management practices in the research station. The fields are weed free and mulched; the trees are planted at regular spacing in rows; stumping for rejuvenation of old coffee trees, topping of the trees to control height and facilitate picking, shade management and other field activities have been properly applied.

b. Stumping and pruning – Stumping is the best method of rejuvenating old coffee trees. The farmer looses crop only for one year since the suckers come to bearing just a year after stumping. The economic loss to a farmer from missing one year harvest owing to stumping can be minimized by splitting the farm land in to three or four or even five blocks depending on the

Fig.2 Perfect application of stumping techniques to rejuvenate old coffee trees
size of the farm and stumping one block each year. In Stumping technique, the most important aspect is time of stumping, height of stumping, number of suckers to be maintained.

In Robusta coffee, proliferation of secondary and tertiary branches is not common unlike to Arabica coffee. Therefore, in Robusta coffee, height control through topping is the most important pruning practice. It facilitates ease of harvest, spraying of chemicals, movement in the farm for different practices, and farm management in general. In addition, it limits the number of bearing primary branches which is useful to maintain well developed and good bean size contributing to good quality. The manageable size at which the tree should be cut back may vary from place to place but topping height between 1.6 and 2.0 m is a common practice in many countries. The topping height practiced at Afosu sub-station is about 1.6m and this height is well maintained (Fig.3). In topping, continuous removal of suckers emerging from the top part from time to time is the most important practice.

![Fig.3 Topping of coffee practiced at Afosu Research Station to control plant height and facilitate good management practices.](image)

**d. Coffee shade management** – In Robusta coffee husbandry, shade is not a common practice in many countries even though the crop is shade loving. Coffee shade has several advantages. It protect the plant from direct sunlight, maintain regular bearing and soil moisture, suppress weeds, add organic matter to the soil through leaves defoliated, and improve coffee bean quality. It is interesting that shading is a common practice at Afosu Research Station where *Gliricidia sepium* commonly known as Gliricidia is widely used in experimental fields. It is a medium size leguminous tree plant of the Fabaceae family that fixes nitrogen. In addition, it has the highest coppicing or regeneration capacity, high biomass and fast growth that facilitate
periodical cutting down and chopping of the branches for using as mulch in order to add organic matter to soil and their by improve soil fertility, structure and porosity (aeration). Proper management of this shade tree has been well established at Afosu Substation (Fig. 4). However, use of different types of shade trees have not been frequently observed in the Research station. Therefore, it is necessary to launch a comprehensive survey across the country and identify other types of useful shade tree species or introduce known species from other coffee growing countries. Shade tree species that are evergreen, leguminous, spreading type (umbrella type of canopy), economically important (e.g. that used for timber) and deep rooted type are highly desirable. Therefore, during survey and Identification of shade trees species, these and other desirable traits need to be considered.

e. Intercropping – The principle of intercropping is to maximize income per unit area of land by inter planting compatible crops. In intercropping practice, identification of crops best compatible with the main crop (coffee in this case), determination of proper ratio of intercropping and computation of land-equivalent ratio to determine the economic return from intercropping are the most important tasks of research. Two intercropping trials, the first experiment established with coffee versus plantain and a timber tree called Cedrela and the second experiment established with coffee versus plantain were visited at Afosu research station.
In the first experiment, coffee trees were established using recommended spacing of 3m x 3m while plantain and Cedrela were intercropped in mixture at regular spacing. The population of plantain appeared very low and the plants are not well established presumably because of competition from coffee and cedrela trees. The cedrela trees, however, appeared very dense when planted at 6m x 6m spacing, i.e. every two rows of coffee (2:1 ratio of coffee to cedrela) (Fig. 5). Presumably, removing of the lower branches to the maximum height that allows entrance of sufficient light and normal growth of the coffee trees could be very useful exercise, but care must be taken while removing the branches not damage the stem part of the tree that may spoil the quality of timber finally produced. In India, interplanting of coffee with Gravillia robusta, a timber tree, is a common practice even at higher density but heavy pruning of the branches to almost the tip of the tree is applied and said to be highly economical. Presumably, it could be useful to design an experiment that comprise different ratios of coffee and cedrela intercrop to determine the best economic ratio and the effect of cedrela branch pruning on the quality of timber.

![Fig. 5 Coffee, cedrela and plantain intercropping trial at Afosu Research Station](image)

In the second intercropping experiment where coffee was intercropped with plantain at 2:1 ratio, the coffee trees showed stunted and poor growth because of the dominance effect of plantain. Apart from the closer ratio, the dominance effect of plantain on coffee was pronounced by unlimited number of suckers that freely grow to full growth extremely increasing the density of plantain. An intercropping trial of coffee with enset (Enset ventricosum) carried out in Ethiopia using 1:1, 2:1, 3:1 4:1 ratios and sole crop showed the 3:1 and 4:1 ratios to be the best. Both enset and plantain belongs to the same family and possess the same morphological character including the Pseudo stem, the leaves and the fruiting habits. Therefore, similar experiment may be redesigned with some modification if necessary to determine the best economic ratio of coffee and plantain intercropping.
2.3.3 Crop Protection – This research discipline has been staffed with two pathologists and an entomologist being the stronger in terms of skilled manpower. From our discussion with coffee research team, economic pests are not many in number. Among diseases, coffee leaf rust (*Hemileia vastatrix*) on narrow leaf types and cercospora leaf spot also known as brown eye spot (*Cercospora coffeicola*) and with respect to insect pests, coffee berry borer (*Hypothenemus hampei*) are the major ones that are economically important. All the rest known coffee diseases and insect pests were reported to be of minor importance. Interestingly, coffee wilt disease (*Giberella (fusarium) zylarioides*) is reportedly non-existent at the moment. However, care must be taken to prevent introduction of this devastating disease which can easily disseminate through exchange of planting materials if quarantine system is not strong enough.

Robusta coffee (*C.canephora*) is generally resistant to most fungal diseases including coffee leaf rust. However, the narrow leafed compact coffee types are said to be susceptible to coffee leaf rust and other diseases. Therefore, chances are very high to find resistant genotypes with narrow leaves and compact nature among the segregating populations through systematic germplasm collection and screening. There are over 30 races of coffee leaf rust and breeding for resistance to all could be difficult. It is necessary to introduce the complete set of rust differential clones from CIFC in Oeiras, Portugal, in order to identify the dominant races up on which the breeding program should focus. In addition, in rust resistant breeding program, development of efficient evaluation and screening method at both laboratory and field levels is very essential to maximize the efficiency for resistant screening from the segregating population. Concerning, brown eye spot disease which is also claimed to be important, it would be better first to carry out yield loss assessment and determine the threshold level to understand whether it is worthwhile to carry out research for control measure or not.

Considering insect pests, there is no doubt that coffee berry borer is the most problematic insect around the globe. It requires due emphasis from both breeding and entomological point to develop effective control measures. The different control measures include resistant variety, natural enemy, and bio- or inorganic-chemicals. At present, a lot research is being carried out looking control methods against this insect in many countries including Brazil, India, Colombia and several other countries. It is also one of the most problematic insect pests that has been given serious attention by International Coffee Organization (ICO). Therefore, it would be very useful to establish linkage with these national and international institutions to get technical as well as financial support and to work in collaboration. In general, it is advisable to carry out intensive survey program across coffee growing areas in the country to identify major and minor coffee diseases and insect pests and focus on the major ones to be more efficient in coffee pest control research program.
2.3.4 Soil Science – Because of good vegetation cover that adds organic matter to the soil and prevent soil erosion or because of flat nature of the land that do not perpetuate erosion, the fertility of the soil in many places may seem high. This situation has been observed in many breeding plots at Tafo where the trees were performing well without fertilizer application. This does not mean that the entire coffee growing areas are uniformly fertile enough and do not need additional fertilizer. During our field visit to one of the farmers’ field which was established in the middle of the forest, but the land is slightly sloppy, most of the newly planted one year old seedlings showed severe leaf yellowing which is typical symptom of nutrient deficiency (Fig. 6). During our discussion with coffee research staff, the problem of soil fertility in the coffee growing areas has also been mentioned even though use of fertilizer is not generally a common practice. It is, therefore, necessary to conduct an intensive soil survey in the coffee growing areas and identify the type of soil, determine the level of macro- and micro-nutrients in the soil, and carry out fertilizer trials to optimize the available blanket recommendation or determine specific fertilizer rate recommendations for different areas. It also must be known that fertilizer rate for one, two, three and above years old coffee trees, and fertilizer rate during heavy and light crop years vary greatly. Therefore, it could be useful to take in to account all the factors mentioned while designing research programs that support good soil fertility and plant nutrient management.

Fig. 5 One year old coffee seedling showing nutrient deficiency in one of the farmers’ field in Kwahu Bepong area

2.4 Policy Support: Coffee is one of the most lucrative commodities in the world. For producing countries, coffee provides multiple advantages: it is the major source of foreign exchange earner, provides considerable job opportunity, serves as main source of cash for the resource poor community, and is an important resource for income diversification and stabilization of
national economy. Despite its significant role and the potential the country owes to grow, coffee production in Ghana has been nearly neglected and government support is almost non-existent. The situation has been exacerbated by full liberalization of the sector in 1992 that was enacted in the absence of any strong private sector that can bridge the gap left behind by the public services further collapsing the production of coffee in the country. In general, coffee is not part of national agricultural development strategy and there is no any form of policy support to coffee sector development.

3. Major Constraints

Obviously, there are several factors that contributed to the current low level of coffee production and neglect of the sector in Ghana. Based on the discussions made with the relevant authorities, coffee traders, research institution, farmers, and field observations, the following are key constraints among others which had greatly jeopardized coffee production and marketing in Ghana:

3.1. Lack of internal marketing system – As already discussed in detail under section 2.2 above, lack of proper internal marketing system is above all the most important constraint. Unlike the Cocoa sector, there is no well established internal coffee marketing system in Ghana. There are no big coffee buyers and the small buyers who collect coffee from the farmers do not operate on regular basis nor pay fair price. There is no any incentive mechanism such as loan for the buyers or any control system to protect the farmers. As a result, farmers have no access to market and bargaining power on price; often farmers are forced to store their coffee over long period or sell at very low price; and illegal cross-border trade or smuggle to neighbouring countries looking for better market is common. The devastating consequence is that most of the coffee farms have been abandoned, neglected and replaced by other crops mainly cocoa even in areas where cocoa does not perform well.

3.2. Low coffee price - The price of coffee is too low, 30 Ghana Cede per 65kg bag unhulled coffee, to cover the cost of production and further assist the livelihoods of the resource poor smallholder coffee growers. There is no floor price or indicative price set by the government. Farmers have no bargaining power and farm gate price is the goodwill of the smallholder coffee buyers.

3.3. Low productivity – The productivity per unit area extremely low. The annual production from an estimated coffee coverage of 10,000 hectares is less than 2000 tons suggesting that yield per hectare is less than 200kg, an extremely low figure compared to other coffee producing countries. The national average yield in Africa roughly lies between 400 and 700kg/ha which is also very low compared to countries like Vietnam (=1700kg/ha), Brazil (≥
1000 kg/ha) and others. It is possible to point out from the various discussions and observations made that the most important factors accountable for low production and productivity are poor management practices, abandoning or neglect of coffee farms, use of traditional varieties or lack of improved varieties, old age of coffee trees, poor soil fertility or land degradation and to some extent problem of diseases and insect pests.

### 3.4. Lack or inadequate extension services

- There is no intensive national extension program to carry our regular extension services such training and advisory services on proper coffee management and processing, facilitating input supply and credit system, providing planting materials, etc. to the farmers. Hence, Farmers’ knowledge about proper coffee management, harvesting, processing and storage is highly limited and the excellent work done by research and available technologies discussed under section 2.3.1 and 2.3.2 appeared to be largely on the shelf. In fact, the Cocoa Research Institute of Ghana is doing its level best in organizing farmers in to associations, training farmers on good agricultural practices and multiplying and distributing seedlings to the farmers. However, very little has been done compared to what is expected as it is beyond the capacity and mandate of research to undertake all extension services across the country. Currently, farmers are therefore still managing their coffee in a very traditional manner as noted during our visit (Fig. 6). Over aged coffee trees, poor management or neglected coffee farm, improper intercropping of coffee with cocoa, and improper spacing.

![Fig. 6 Over aged trees and neglected smallholder coffee farms](image)

and other practices are common with smallholder coffee farms and garden coffees. There are a number of farmers like the one shown in Fig.6 who are highly enthusiastic and have great wish to grow coffee, but maintaining such an old and poorly managed coffee in his home yard because of lack of knowledge about proper coffee management.

### 3.5. Inadequate Infrastructure and coffee processing facilities

- Among the basic systems and services, transport is the most critical problem that has been observed during our field visit in
coffee as well as cocoa growing areas. The available roads are not under good condition nor adequate enough to sufficiently network the coffee growing areas. Access to market and provision of various extension services is therefore are very difficult. Among processing facilities, shortage of hullers is the major problem. The available small-size hullers are limited in number and old models of diesel engine which could even spoil the flavor quality of the beans because of the proximity of the green bean tank to the engine (Fig. 7). There are no big hullers that simultaneously carry out hulling and bean grading. The idea of having small hullers at association level, however, is very appropriate to reduce cost of transporting un hulled bulk coffee and to economize storage space for the farmers.

Fig. 7 The type of small hullers available at farmers’ association level

3.6 Poor coffee quality – There are some practical problems observed contributing to poor coffee quality. These problems mainly include nonselective picking (stripping), mold problem owing to poor drying condition probably due to lack of facilities like drying table or cemented floor (fig 8), inadequate hulling mills at association or farmers group level, lack of modern

Fig. 8 Harvesting and drying problems (1st picture) resulting in to immature, foxy and broken beans after hulling (2nd picture). (Sample taken from one of the areas visited).
hullers that separate the beans and the pulps and simultaneously sort the beans into different grades based on size and weight, and long storage duration due to lack of access to market.

3.7 Lack or inadequate Government support – As already mentioned above directly or indirectly under different sections, government support to coffee sector was lacking except that the Cocoa Board through its financial support to research is carrying out coffee research and small development activities. There is no any national coffee development plan that service as policy guide to coffee development endeavor, there is no annual budget allocated for coffee, no enabling policy environment and no incentive mechanisms to encourage farmers and private investors. The coffee sector is full liberalized in the absence of strong private sector who can take over the responsibility of the public services. Rural feeder roads are inadequate or under poor condition to provide efficient transportation and extension services. In General government support is lacking unlike the cocoa sector.

3.8 Competition by other crops mainly Cocoa – Cocoa production has several advantages over coffee. The price of cocoa is high and stable; there is well established cocoa stabilization fund to maintain the stability of this good price; cocoa farmers are highly subsidized for agricultural inputs; market is readily available and cocoa buyers have access to loan; and above all there is a government body, the Cocoa Board, which is taking care of all matters for proper functioning of cocoa industry. Because of these privileges and comparative advantages which is lacking in coffee, considerable area of coffee farms have been abandoned and replaced by cocoa even in areas where cocoa does not perform well because of adaptation and disease problems.

4. Potentials and opportunities to revamp the coffee industry:

Ghana owes great potential for coffee production and expansion. The agro-ecology is highly suitable for Robusta coffee production like any other West African countries. There is vast area of untapped land suitable for coffee and the results of a survey recently conducted on hundreds of coffee farmers by Afosu Research substation clearly demonstrated this fact. According to this survey result, all the farmers visited still did not use over 50% of their potential coffee farm land. In addition, coffee can grow in areas marginal as well as suitable for cocoa production. All these conditions are golden opportunities to greatly expand coffee production and for the farmers to grow both coffee and cocoa at the same time in the same area.

Unlike many other West African countries, there are well established coffee technologies for intensive and extensive coffee production and processing. At this juncture it is worthwhile to thank Cocoa Board and Cocoa Research Institute of Ghana for their brilliant decision to continue to finance coffee research and the coffee research staff of the institute for their
dedication to make these technologies available, all despite the very discouraging situation of coffee production in the country. There is adequate and capable skilled human power in coffee research in different fields, viz, Agronomy, breeding, soil science, pest control, etc. who can provide training and technical backstopping, design national coffee development plan and lead coffee development program in the country.

There is also good market opportunity for Ghana coffee. During our discussion, the manager and owner of L.D and SONS Ltd, one of the two big coffee buying companies in Ghana, indicated that the company has the interest and the capacity to buy multiple folds of what is currently produced if the production is increased and the annual supply is stable. In addition, the company has expressed its interest and plan to involve in coffee planting, training of farmers on good coffee management and processing practices if there is government support. Farmers also have the enthusiasm to grow coffee and what they only demand is fair price, readily market access and government support. Furthermore, the coffee ecology of Ghana is said to be diverse to promote specialty coffee production for premium price. For example, coffee from Volata region is said to be unique in its flavour and quality. Hopefully, there could also exist several other regions of similar nature that need to be explored.

5. Suggested Measures to Revamp the Coffee Sector

According to various reports, about 70% of the foreign exchange income of Ghana comes from cocoa. There is a proverb saying that “Cocoa is Ghana and Ghana is cocoa” to signify this immense contribution of the crop to the national economy. On the other hand, one can easily understand that such heavy dependence on mono-crop is very risky to the national economy. What would happen if new outbreak of cocoa disease occurs similar to coffee leaf rust in Sri Lanka in 1869 that completely wiped out the coffee industry, similar to coffee berry disease in Ethiopia in 1971 that greatly jeopardized the country’s economy for about five years until the disease become under control, and similar to coffee wilt disease on Robusta coffee in Uganda in 1993 that left thousands of coffee farms without tree? What would happen if world cocoa price falls down similar to coffee price crisis that sustained over six years (1999 – 2004)? Cocoa is generally said to be less tolerant to environmental stress even compared to coffee, but is there any preparedness for resilience to the current global climate change with respect to cocoa production?

The situation is indeed frustrating and requires practical solution. To prevent the risk of monocropping, increase national revenue, and build sustainable national economy, diversification of income sources is an indispensable strategy. Ghana has started producing petroleum since
December 2011, which in the long run could share good proportion of the foreign exchange income of the country. However, this should not be considered enough and be reluctant as far there are more potential resources for diversification. In this regard, coffee is one of the most dependable and feasible strategic crop for income diversification and poverty alleviation in this country. As already indicated in the aforementioned section (section 4), the country has great potential for the promotion of coffee production, but this potential has not been exploited because of various constraints (section 3). Annual average production so far is less 2000 mt and the yield for 2010-11 is estimated at 1,260mt, which is extremely low. Therefore, to address key constraints and revamp the coffee industry, the following measures have been suggested for direct intervention. These measures by no means are exhaustive enough, but could serve as a template to prepare a comprehensive coffee development plan.

5.1. Establishment of internal marketing system

Coffee farms had been abandoned, neglected and replaced by cocoa due mainly to the lack of internal marketing system and incredibly low prices offered to the farmers. Therefore, first and for most, establishment of a viable internal coffee marketing system is necessary in order to guarantee market access and fair price to the farmers. Structurally, coffee is under Cocoa Board and regulation of the internal marketing system of coffee is one of the objectives and functions of the Board. Therefore, to be more practical and effective, it would be advisable to establish a fully fledged Coffee Marketing Unit within the Cocoa Board which is responsible for developing viable internal marketing system and coordinate as well as control effective application of the system. It could be wise to follow the cocoa experience in developing coffee internal marketing system since it has been already proved efficient.

5.2. Increasing production, productivity and quality

The ultimate goal of every endeavour in coffee development program must gear towards increasing production, productivity and quality. There are several factors affecting productivity and quality of coffee. It is necessary to carefully identify the key factors that are very practical and realistic to bring an impact. From the observations made as per the aforementioned discussions, the following could be the most important factors that may greatly assist to increase productivity and quality of coffee and revamp the industry:

5.2.1 Increase production and productivity

a. Rehabilitation of existing neglected coffee farms – Most coffee farms have been abandoned or neglected and others had been replaced by cocoa due to various factors already pointed out earlier. Therefore, one of the most important actions is to aggressively campaign on the rehabilitation of these neglected coffee farms to bring them back to productive state.
Rehabilitation can be done in two ways depending on the state of the trees. If the trees are in productive stage and the problem is management, it easier and cheaper to simply revive the trees through **application of proper agronomic practices**, which mainly includes brushing of the bushes, pruning of the coffee trees, refilling of empty spaces, application of fertilizer and management of shade trees to the proper density and shade level. On the other hand, if the trees are old enough to produce economic yield, **rejuvenation of trees through stumping** and proper application of other management practices is the best way.

**b. New planting** - The existing coffee farms are small in size, estimated at less than 10,000 hectares in total. Obviously, rehabilitation of these farms alone cannot bring significant change to total production. Therefore, it is necessary to launch a sound expansion program through new planting that applies to both small-scale and large-scale coffee farmers.

**c. Introduction of good agricultural practices** – In Ghana, coffee is almost entirely produced by smallholder coffee farmers. The knowledge of these farmers in proper coffee management practices, however, is very poor. In both rehabilitation and new planting programs indicated above as a strategy to increase production and productivity, introduction of good coffee husbandry practices through training of extension agents and thereby smallholder coffee growers is mandatory (see section 3). Good agricultural practices include use of improved varieties, application of proper agronomic practices – spacing, weeding, fertilizer application, shade management, pruning, diseases and insect pests control, etc.

### 5.2.2 Improve Quality

Quality is the most important component of coffee business that determines the final price and market availability. If the quality is poor, it is difficult to find buyers and the price would be very low which may not even cover the management cost resulting in to great crisis to the growers. Therefore, it is necessary to launch a sound quality promotion program and carryout the following major activities among others:

**a. Training of farmers and traders on proper processing practices** – the farmers must be well educated on proper harvesting, drying, hulling, storing, transporting, etc. It is also very important to educate specially the smallholder buyers on proper quality maintenance during storage and transportation to central market.

**b. Capacity building**

- **Credit service** – The farmers are resource poor and do not have the financial capacity to construct standard drying tables or cemented floor, build separate coffee storage room, and generally adopt the available processing technologies on their own. It is necessary to
facilitate credit services to capacitate the farmers so that they can adopt and implement the available technologies.

- **Supply of processing machines** – inadequate hulling mills was one of the most important bottleneck to quality coffee processing pointed out during various discussions and during field visit. The available small hullers are few in number, old models and do not sort out coffee beans in to different grades. It is important to supply farmers group or association at least with small hullers and the unions with bigger hullers in order to carry out proper hulling and bean grading for premium price. Hulling specially at producers level is also important to reduce transportation cost of unshelled bulk coffee to distant central market. The other important processing machine is aqua pulper for wet coffee processing, but does not seem feasible to recommend at this stage of coffee production in the country, but good to start practicing it at research level.

- **Construction of quality testing laboratories** – Establishment of central quality testing laboratory and smaller regional laboratories is very important to: (i) provide analytical services and advise the farmers and (ii) carryout proper quality inspection at farm gate and export level.

5.3 Establishment of a viable Extension System

To effectively implement the coffee production productivity and quality improvement program, a strong extension system must be in place that provides basic extension services to the farmers. In effect, it would be necessary to establish **Coffee Extension Service and Development Unit** within the Cocoa Board that is solely responsible for designing extension service and development plans including budget, and coordinating and supervising proper implementation of the plans. The unit must work hand-in-hand with Coffee Research Directorate of Cocoa Research Institute which is responsible for technical backstopping in the process of technology transfer to the grassroots level coffee growers. Among others, the most important extension services include the following:

a. **Intensive sensitization and training of the farmers** – The low price, absence of internal marketing system, high management cost, and lack of incentives unlike cocoa sector has marked negative image on coffee production and trading in the past. To reverse this negative image and develop interest in the minds of the farmers and traders, it is necessary to launch an intensive sensitization program focusing on the economics of coffee, its significance as a means of income diversification and poverty alleviation, possible maximization of coffee prices
through proper pricing that involve the farmers themselves and value addition, and all the current changes that has been made to revamp the coffee industry.

In addition, farmer’s technical knowledge about proper coffee husbandry practices (nursery and field management, harvesting, processing, storage and quality maintenance) is limited. Parallel to the sensitization and awareness creation activities, intensive training program on all aspects of coffee production, processing and marketing practices need to be provided on a regular basis.

b. Training of Subject Matter Specialists and Extension Agents – To carry out intensive and extensive training program across coffee growing regions and effectively transfer available technologies, it is necessary to produce sufficient number of skilled human power with adequate knowledge on coffee production, processing and storage that could later serve as trainers. In this regard, it is necessary to launch training of trainers program and train Subject Matter Specialists (SMS) and higher level Development Agents (DAs) that would later on serve as trainers themselves to train other development agents. The later development agents in turn shall train the coffee farmers. In many countries, this approach has been proved efficient to rapidly educate large number of farmers in short period and effectively disseminate improved technologies. The training of Subject Matter Specialists and Development Agents shall be the responsibility of research. Research must also involve in the monitoring and evaluation of extension services to check proper application of the transferred technologies, provide technical back stopping and find out socio-economic problems in adoption of new technologies.

c. Multiplication and distribution of improved planting materials – The available coffee farms and garden coffees were planted with traditional cultivars. In addition, the trees are old and poorly managed or completely neglected for long period. The available coffee coverage is also very small compared to the potential area suitable for coffee. It is therefore, necessary to carry out massive multiplication and distribution of improved planting materials on regular basis to replace these traditional coffee cultivars and unproductive old farms and also to establish new plantations in order to boost production and productivity.

In multiplication and distribution of planting materials, the major problems are the quantities and transportation cost of planting materials to target areas, especially when the number of nursery sites is limited. In order to reduce the cost of transportation and able to supply required quantities of planting materials every year, it is important to establish several nursery sites across coffee growing areas that would be managed by well trained development agents. The training of development agents and establishment of nurseries may incur high initial cost,
but very effective and this has been well demonstrated in Angola under coffee rehabilitation project financed by CFC/ICO.

d. **Facilitating input supply and credit facilities** – The resource poor smallholder coffee growers cannot easily access to credit services or afford to buy the necessary agricultural inputs and farm tools on their own. These types of services should be facilitated through extension agents and this is one way of encouraging the farmers and capacitating them to adopt improved practices.

e. **Organizing Farmers** – It is necessary to organize farmers in to groups, associations and unions to facilitate training, credit services, supply of required quantities of coffee to the customer on sustainable basis, quality control, and so forth. The associations and unions could hold several responsibilities including price setting together with relevant bodies, buying and exporting, etc.

5.4 Government Support

It has been reported that coffee sector in Ghana has been fully liberalized in 1992 and since then there is no government intervention in any form in coffee development program. The liberalization policy was in acted in the absence of strong private sector that can take over and cover the gap left by the public services. This had resulted in far reaching repercussions. The internal marketing system was completely abandoned and coffee price was the good will of small coffee buyers. Cross-border trade become a common practice looking for market and better price. Large coffee farms developed by government financed project in 1991 were abandoned. Over 60% the smallholder coffee farmers had abandoned their farm and replaced by cocoa even where cocoa does not do well. There is no any form of incentive to coffee farmers and traders unlike cocoa growers. All these unfavourable environments have caused the coffee industry to collapse limiting the annual coffee production constantly below 2000 mts.

On the other hand, even in the presence of strong private sector, there are areas where private sector never wants to involve and invest. These areas mainly include research, designing and implementing national coffee sector development strategy, allocation of annual budget for continuous coffee development program, establishment of national coffee quality control unit, training and employment of development agents and subject matter specialists responsible for technology transfer and organizing farmers, among others. The fact is that government intervention and support is indispensable even in the presence of liberalization policy to keep any development program on track. Therefore, to reverse the bad image that coffee growers and buyers had developed and revamp the national coffee industry government support is
certainly needed in many ways. Probably, the following are some of the most important areas for government intervention:

a. Implementation of the recommendations given above under section 5 (No 5.1 – 5.3) – the recommendations given above requires strong policy support to create enabling environment and budget for its implementation by the relevant body (ies).

b. Allocation of adequate annual budget for regular coffee development activities until the sector be able to stand on its own, which without doubt would later on support other sectors like it does in many other countries.

c. Formulating national coffee development plan and articulated vision as an integral component of national agricultural development strategy that would assist as government directive to aggressively campaign on coffee development activities on a sustainable basis.

d. Infrastructure development specifically feeder-roads and transport facility to facilitate extension services, ease of access to market and collection of harvested coffee from farm gates to other market centers.

e. Incentives to both farmers and private investors – Currently smallholder coffee producers account for about 87.2% of the country’s total production and private owners account for the remaining 12.8%. Even in global coffee production, smallholder coffee growers are the main engine accounting for about 80% of the total production. Therefore, it is highly strategic to provide different types of incentives to the smallholders and the private large scale coffee producers and traders just similar to cocoa to revitalize the coffee industry.

f. Strengthening coffee research – The Coffee Research Department of the Cocoa Research Institute of Ghana has done an excellent job in generating and optimizing improved coffee management technologies and developing improved varieties. This research work must continue to fine tune the existing and generate new technologies to fit to the changing climate, soil, diseases and insect pests, and consumers’ preference. In view of this, it would be necessary to strengthen coffee research in order to further advance the quality of research and provide competent technical services to the sector. To my little knowledge, it is very useful to strengthen the department in different ways.
   - Skilled human power development through training and experience sharing with other relevant institutions
• Establishing additional research disciplines that are missing to manage the whole spectrum of coffee issues and provide complete package recommendation. If not mistaken, the missing ones are: (1) Coffee Processing Research - responsible for conducting research on processing practices, quality test (physical, organoleptic and biochemical), storage, roasting and packaging; provide analytical services to the grower; and provide training on proper coffee processing and quality coffee production, (2) Research Extension Linkage - responsible for transferring research technologies and linking research with extension agents, and (3) Socio-Economics – responsible for socio-economic studies, impact assessment of new technologies, studying adoption rate of technologies among coffee growers, and providing feedback information to research.

• Strengthening laboratory facilities mainly that of breeding (tissue culture and molecular laboratory to assist in hastening the breeding cycle and multiplication of improved clonal varieties), protection (pathology and entomology), and soil and plant nutrition.

• Adequate annual budget for proper execution of planned research activities

V. Conclusions:

Coffee is one of the most lucrative commodity crops that generate over US$12.44 billion to coffee producing countries with retail values of about US$70 billion. Despite its great potential, Ghana did not benefit much from this important resource. However, Ghana is in a butter position compared to many other West African countries to easily revitalize coffee production and benefit out of it like any other coffee producing countries. Most important elements like skilled human power, required package recommendation (technologies), vast area of land and suit environment for coffee production are all available.

Among others, the critical problems in coffee are lack of internal marketing system, low price, and lack or inadequate government support that caused coffee production to nearly collapse. In view of the potential the country owes to revamp coffee production, the economic importance of the crop as foreign exchange earner, and the risk of heavy dependence on cocoa, it is of paramount importance to refocus on coffee industry as a great opportunity to diversify income sources, build more stable national economy and improve the livelihoods of the resource poor smallholder coffee growers. In effect, just similar to cocoa, government support in: (1) creating enabling policy environment to the farmers and private sector that would encourage them to grow and trade coffee and (2) financial support for the implementation of
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Coffee development and marketing program is indispensible. In general, the experience in cocoa is very useful to revamp coffee production and trade.

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