

## **Field Trip Report Some Observations on Coffee Production in Zambia**

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### **1. Introduction:**

The primary aim of the visit to Zambia was to take part in the training programme on 'brand development and packaging design' convened by Inter-African Coffee Organisation (IACO) to be held in Lusaka, Zambia. However, my short visit to 'Chaloshi coffee farm' which belongs to the Coffee Board of Zambia and the discussions I had with Zambia Coffee Board Secretary, Mr. Penny Zimba; Coffee Growers Association Chairma, Mr Joseph Tajuma; and Director of Golden Valley Agricultural Research Trust, Dr. S.W.Muliokela, encouraged me to provide a brief account of my perception that may contribute some technical inputs to the coffee development programme in Zambia.

The species of coffee produced in Zambia is solely limited to arabica (*Coffea arabica* L.) and there is huge potential in terms of adequate agricultural land and suitable agro-ecology to expand coffee production. According to some reports, despite the presence of favourable conditions and the long history of Arabica coffee production which goes as early as 1920s, much attention has not been given to coffee development until late 1960s. Since the recent past, however, with the establishment of the Coffee Board of Zambia (CBZ) in 1989 and Zambia Coffee Growers' Association (ZCGA) which operate hand in hand as a regulatory and operating (implementing) body, respectively, in well organized system, the production is booming. The consistent increase in the volume of Zambian coffee export from 330 metric tones (Mt) in 1985 to 6500 Mt in 2005 and the projection of 10,000 Mt in 2010 and 12,000mt in 2013 is the direct reflection of this coordinated effort. This encouraging coffee development endeavour was an impetus for the present technical input and it is one of the major objectives of IACO to support member counties particularly those in the revitalization phase in all possible ways.

### **2. Visit to Chaloshi Coffee Farm**

The visit was made on 24 June 2008 for quite short time because of time shortage. This coffee plantation is established on a small area of land which may not exceed about 20 or 30 hectares. The coffee plants are at very early stage of bearing, first or second, and have produced very heavy crop. The plantation is fully irrigated using partly overhead- and partly drip- irrigation systems from motorised underground water. All the management practices are to the standard and in view of the growth and yield performance, the area appeared highly suitable for Arabica coffee production even if the altitude is near marginal, 1050m.a.s., which was in fact compensated by cool weather.

During my quick visit, I was curious about certain aspects of coffee production which are briefly explained below. It should be, however, noted that these observations or suggestions are by no means comprehensive or conclusive and more strict evaluation and visit to several varying agro-ecologies and farm conditions are recommended.

## **2.1 Coffee Varieties**

According to the manager of the farm, there are five varieties grown on the farm. These are SL28, F6, Catimor 129, Costa Rica and Yellow Catuai 13. At this juncture, it would be very useful to know the basic characteristics and background of these varieties in order to make proper management decision in their expansion programme.

**SL 28** – is an open type pure-line variety developed through selection from among FAO collections of 1964 or French collection of 1966 from Ethiopia. It is a popular and dominant variety in Kenya, but currently is being replaced by hybrid Ruiru 11. According to various reports it is also one of the traditional and popular variety in Zambia. In many counties where it is grown, Kenya, Tanzania, Zambia and Others, it shows consistent characteristics of being best in yield and quality but susceptible to coffee berry disease (CBD) and coffee leaf rust (CLR). Therefore to exploit its high yielding potential and best quality, fungicide spray is mandatory. Being a traditional variety, it is an advantage for Zambia to use it as recurrent parent in improvement programme to develop a hybrids that are as good in yield and quality as SL 28 and resistant to fungal diseases like CBD and CLR.

**F6** – is an Ethiopian origin collected and distributed to various countries by French coffee mission to Ethiopia in 1966. It has partial resistance to CLR, good in yield but susceptible to CBD. In Ethiopia, it is among high yielding accessions but not commercial variety. Because of their morphological similarity, I could not be certain, whether the one on Chaloshi farm is F6 of French collection or F6 line of Catimor as the farm manager also does not know much about its origin. In any case, it is a useful material that can be used in variety development programme.

**Catimor 129, Costa Rica and Catuai 13** – These varieties are developed through long years of hybridization and selection mainly for low altitudes of Latin America. They are high yielding and resistant or tolerant to CLR but all are highly susceptible to CBD and poorly adapted to high altitudes.

Concerning ‘Catimor’, it is a hybrid developed from crosses between *Hybrido de Timor* x *Caturra* with the aim of introducing CLR resistant gene from *Hybrido de Timor* to the dwarf and compact commercial variety *Caturra*. *Hybrido de Timor* is a natural hybrid between *Robusta* x *Arabica* with two sets of chromosomes like *Arabica* that was obtained from Timor Island. *Catimor* is commonly low in quality compared to pure *Arabica* varieties because of its *Robusta* genetic background as described above. Therefore, it is important to repeatedly test its quality to determine the scale of its expansion. Agronomically, *Catimor* is a compact variety which is resistant to almost all CLR races,

tolerant to drought, high yielding and well adapted to hot and low altitudes, but susceptible to CBD. There are different lines of catimor such as catimor 129, which were developed through selection from repeated long generations of backcrossing and selfing.

In general, Arabica varieties are largely location specific in terms of adaptability; yield potential, quality and pest resistance. This natural behaviour of arabica necessitates identification and /or development of varieties that best fit to each agro-ecology.

## **2.2 Agronomic practices**

The field management (weeding, fertilization, fungicide and insecticide spray, and irrigation schedule) is generally very good and well organized.

**Spacing:** Regarding agronomic management practices, one of my concerns was about spacing. The compact (dwarf) and open (spreading) type varieties were both planted at 1.5m spacing between plants within row and 3m between rows (1.5m x 3m spacing) with two plants per hole. The 3m row spacing may be useful to facilitate picking, movement of workers and weeding practice. The planting of two seedlings and close spacing within row could also be an advantage at early bearing stage (first and second) to efficiently utilize the space and maximize yield per hectare. At later stages, however, because of vegetative growth, the plants become too dense especially with the open types and the branches become intermingled within row. Such conditions perpetuate disease and insect development, create picking difficulties and reduce efficiency of chemical sprays for diseases and insects since the chemical may not easily reach the lower and interior branches. Therefore, it seems imperative to conduct simple spacing trials for both open and compact types and determine proper spacing that produce economic yield

**Pruning:** Pruning is one of the most important agronomic practices in coffee production. At early bearing stage this practice may not be visible. However, as the plants get older, it becomes important even though the intensity of pruning varies depending on the growth nature of the varieties and climatic conditions of the growing area. Even at this early stage, the plants have become so dense and covered the within row space. Probably, this condition has been aggravated due to the planting of two plants per hole. It generally, however, appeared that in the very near future, may be starting from third bearing, at least some simple pruning practice becomes necessary in addition to proper spacing to facilitate aeration and light penetration and reduce build up of diseases and insect pests on old and dense branches.

**Irrigation:** Main flowering in the area is said to be August, September and October. In June where picking was at early stage, there was sporadic flowering in the farm. Presumably, this could be the effect of irrigation system, and fine tuning of the irrigation calendar and other related factors could be necessary.

### 2.3 Diseases and insect pests

Despite chemical sprays for both insect pests and diseases, certain level of both insect and disease damages were noted on the leaves and berries. This may suggest the seriousness of diseases and insect pests in the area and the need to make some correction measures (type of chemical, spray frequency, rate of application, time or stage of initial application, method of application, etc.) to the application of fungicides and insecticides. This is extremely useful to maximize the efficiency of chemicals and reduce their cost. In effect, it is necessary to start at least some preliminary trials in these aspects.

According to the manager of the farm, the most common insect pests and fungal diseases which I also noticed and currently controlled by chemical (fungicide and insecticide) method are the following:

#### I. Insect pests

- a. White and green scales
- b. Berry moth
- c. White and black stem borer

#### II. Diseases

- a. Cercospora leaf spot (brown eye spot)
- b. Cercospora berry blotch
- c. Coffee leaf rust

From my glance observation, cercospora berry blotch (*Cercospora coffeicola*) appeared more pronounced regardless of chemical (Copper oxychloride) spray, being commonly visible as a black sunken lesion on the pulps of red ripe cherries, a symptom which is more or less similar to coffee berry disease on ripe cherries. The disease also appears on green berries as brown sunken lesion with a bright red ring. The sunken lesions cause the pulp (skin) to lose its moisture and stick to the parchment that creates pulping difficulties and ultimately results in poor quality.

In general, it appeared that there is a potential risk of diseases and insect pests that requires serious follow up and attention. It is important to make regular assessment on the incidence and severity of each disease and insect pest to determine (1) the damage level caused by each disease and insect pest and (2) identify conditions that favour severe infection and infestation of the pests. This is particularly useful to identify the major diseases and insect pests and launch effective control measures. Minor diseases and insect pests which have no significant effects could be easily suppressed by proper management practices.

### 3. Visit to Golden Valley Agricultural Research Trust

The research centre is located about five kilometres before Chaloshi coffee farm on the way from Lusaka to Chaloshi. After a brief introduction by Mr. Penny Zimba on the objective of our visit to the centre, the director of the research centre, Dr.S.W.Muliokela,

briefed on the overall activities of the centre. The centre conducts research on various kinds of field crops with main emphasis on soil moisture management. The director also indicated that the centre has an interest to start research on coffee, but the major constraints are lack of budget and government support.

From our short discussion, it was realized that there is a dichotomy between policy makers and agricultural professionals as well as those involved in different aspects of coffee business with regard to coffee research and development. The potential value of coffee as one of the major sources of foreign exchange earning to the nation is not well recognized and included in the national agricultural development plan. In this regard, the Inter-African Coffee Organisation (IACO) may play an important role in sensitising policy makers to give due consideration for coffee research and development. This issue shall be communicated to the IACO secretariat for discussion and further consideration.

Discussion was also made on the possible initiation of coffee research in the shortest time possible. One possible option discussed was to develop a broad but simple project with several components that embrace practical agronomic problems and easily managed by an experienced agronomist or breeder under the supervision of a visiting consultant who is capable to provide all the necessary guidance. This could be a good start to provide some basic technical backstopping to the coffee producers until national coffee research Centre is established.

#### **4. Visit to Zambia Coffee Growers' Association**

A short discussion was made with the chairman of the association, Mr. Joseph Tajuma, on organization setup of the association and various aspects of coffee production. The Zambia Coffee Growers' Association is a well organized body with all the necessary organs to run the association effectively. As a rule, all large scale and small scale coffee growers are members of the association. The association is the operating wing of the Coffee Board of Zambia, the supervisory body. The association has its own board of directors and is responsible for extension services, marketing and promotion, milling, quality test and shipping of final product abroad.

Effective commercial coffee production in Zambia was reportedly started in 1978 and today the total area under coffee is estimated at 3,100 ha. This is extremely small relative to the potential area of land suitable for coffee in the country and suggests that Zambia is just at the beginning in coffee development and marketing. Large proportion of the coffee farm is owned by large scale private owners and the small holder coffee growers account for only small proportion.

In almost all coffee growing countries of the world, over 85% of coffee production comes from small-holder coffee producers. Promotion of small holder coffee growers is an important strategy for rapid expansion of coffee production, increase local consumption and minimize cost of production even if the yield per hectare is lower compared to large scale farming system which in fact involves high cost of intensive management (fertiligation, irrigation, chemical spray for controlling weeds, diseases and insect pests,

etc). I believe that the Coffee Board of Zambia and Zambia Coffee Growers Association had already realized this strategy and the initiated **‘small holder coffee mobilisation programme’** is part of this strategy which should be further strengthened.

The association owns a standard cup tasting laboratory which provides services to all members. The cuppers are said to be very busy particularly during harvesting season in tasting coffee samples coming from all producers and providing immediate feedback to each growers to take all the necessary correction measures in their processing practices in order to produce best quality coffee. This practice is an important norm that should be maintained and further strengthened to consistently supply best quality Arabica coffee from Zambia.

The association also possesses a standard hulling factory which performs all hulling, grading (according to size), regrading (according to weight) and packing operations. It appeared that this is a standard practice of preparing coffee for export. Bean grading is one way of adding value and is an important practice. To maximize the advantage of this practice, it would be useful to accompany it with some agronomic practices in the field that could increase the proportion of premium grades, bigger and heavier beans, and decrease the proportion of those grades fetching lower prices, the Ts and TTs. Even though bean size is an inherent factor, proper management that includes pruning, proper spacing, fertigation, clean weeding, shading, etc could considerably improve the proportion of bigger and heavier beans since it creates a favourable condition for maximum expression of the genetic potential. Probably, it could be useful to initiate some kind of observation trial in this regard

## **5. The Coffee Board and the Cup Tasting Centre**

The Coffee Board of Zambia is a higher body who plays a regulatory role and responsible for all aspects coffee research, development and marketing. A thorough discussion has been made with Mr. Penny Zimba, the board secretary, on the prospects of coffee development and research in Zambia at different times during my stay for three days. The major concern of our discussion has been directly or indirectly explained in the different sections of this report since we were together with Mr. Zimba at most of the discussion points and he was the organizer of the visits to different places. At this juncture, I would like to express my sincere appreciation for his concern and dedication and thank him for arranging and driving me to the different places.

The cup tasting centre, which is one of the four regional centres of IACO is located in the premises of the head office of the Coffee Board of Zambia. The laboratory equipment is nearly complete to run effective operation except the new moisture tester recently purchased through IACO/ADB capacity building project is not functioning. The coffee board is dealing with the concerned company for replacement. The laboratory room is, however, too small to serve for the intended purpose, training of cup tasters. The coffee board is looking for possibilities to build new complex in the near future.

## **6. Coffee Research**

At present there is no coffee research programme in Zambia. On the other hand, there is a robust arabica coffee expansion and development program through the promotion of large- and small-scale coffee growers by the Zambia coffee board and growers' association. Obviously, initiation of coffee research programme is mandatory parallel to such development endeavours. Research is an important tool to provide technical backstopping, reduce risks of technical failure, standardize all aspects of coffee management and processing practices to the local environment, and lay a base for any predictable problems related to variety, disease, and insect pest, management, etc., that may evolve along with the expansion of coffee production in different agro-ecologies.

As indicated in the aforementioned sections of this report, there are sparking signals for the immediate need of coffee research at least at lower scale, observation level or preliminary trials, in certain areas of agronomic practices. Some of these problems that may need immediate research intervention are briefly outlined below:

### **1. Breeding**

- a. Variety adaptation trial** - Arabica varieties are largely location specific and their performance in terms of adaptability, yield potential, quality and pest resistance greatly varies between varieties from location to location. Varieties that adapt well in one environment may not proof in another differing environment. This necessitates identification and or development of varieties that best fit to each agro-ecology. In this regard, it would be useful to evaluate the performance of the available commercial varieties for yield, quality, disease and insect resistance, tolerance to moisture stress under different coffee farms established in distinctly different agro-ecology and determine where each variety best adapt for good economic return.
- b. Germplasm collection and screening** - Collection is a means of gathering genetic variability for selection and breeding. In the absence of genetic variability (different coffee types) selection or variety improvement is impossible. Therefore, just as a long-term program, it would be wise to introduce known Arabica varieties and accessions from different coffee growing countries and screen them under different environment for various desirable characteristics.

### **2. Protection**

- a. Assessment of coffee diseases and insect pests** – Identification of major and minor diseases and insect pests prevailing in each specific agro-ecology is a primary activity in any pest management program. It helps to understand environmental conditions favouring each disease and insect pest, determine appropriate control measure and thereby minimize crop lose due to different pests. At Chaloshi farm various diseases and insect pests have been observed. Therefore it would be advisable to take regular records on the incidence, severity, weather condition, etc. for two or three cropping seasons to identify the most important

pests and conditions that favour their development to determine effective control measures.

- b. Chemical spray trials** – There are diseases and insect pests being observed with certain damage level regardless of the application of chemicals. Therefore, it would be very useful to design simple spray trials that aimed at fine tuning of the rate, volume, frequency, method of application and time or stage of spraying in order to maximize its efficiency and minimize cost.

### **3. Agronomy**

- a. Determination of proper spacing for open and compact varieties** – The compact types are characterised by short height (dwarf), shorter branches and shorter internodes (e.g. Catimor, Caturra), while the open types are characterised by tall height, long branches (large canopy radius) and long internodes (e.g. SL 28, SL 34). In deed, they require quite different spacing and population per hectare for good yield, growth, and quality as proper spacing avoids unnecessary competition between plants which has negative repercussion on these desirable traits. Therefore, it may be advisable to conduct some spacing trials under different environments and determine appropriate spacing for each type of variety.
- b. Observation on light pruning practices on open and compact coffee types** – Pruning is an essential operation in coffee husbandry. It encourages new shoot growth for next season crop, maintain balanced crop to leaf ration, avoid overbearing, improve bean size and quality, avoid biennial bearing habit, avoid build up of diseases and insect pests in the older and denser branches, etc. When we say light pruning it is just the removal of dead, diseased and intermingling branches, thinning of dense branches, desuckering of shoots emerging from the main stem, and height control to facilitate good aeration and light penetration. This practice is particularly becomes important as the trees get older and the branches become too dense.
- c. Refinement of irrigation system** – There are some sporadic flowering observed while coffee harvesting is at the beginning and/or pick time. Probably, fine tuning of the irrigation time, frequency, and volume may minimize such abnormal flowering.
- d. Observation trials on coffee shade trees** – Arabica coffee is naturally a shade loving plant species. Most coffee farms in Zambia are reportedly grown without shade under irrigation and high management inputs which are unaffordable by the small holder coffee producers. Among several others, coffee shade is advantageous to maintain soil moisture, avoid the coffee plant from direct sun shine and suppress weeds providing the opportunity to grow coffee under rain fed condition with minimum input. With the ‘small holder coffee mobilization programme’, introduction of shade tree planting and management practices could encourage resource poor small-holders to grow coffee. Therefore, it would be

important to quickly start some observation trials of the following type to see the response of shade under Zambia conditions.

- Response of shade grown and sun-grown coffee for yield and other agronomic characters
- Comparison of shade grown and sun-grown irrigated coffee for yield and other agronomic traits
- Collection and establishment of known shade trees

The first two trials could be simply established under already established shade trees that could be maintained while clearing forest areas for establishment of the trial just to save time as perennial shade trees requires several years to establish.

- e. Improvement of bean size by using prominent management practices –** Coffee marketing based on bean size appeared a standard practice in Zambia. The proportion of bigger beans can be considerably improved by using proper management practices such as pruning, proper spacing, fertigation, clean weeding, shading, etc. Probably, it could be useful to initiate some kind of observation trial in this regard.

The recommended research areas could be conducted as simple observation trials at initial stage when skilled human power is not available, and could also be conducted as a well designed standard experiment in the presence of well qualified researchers in the respective discipline.

I believe that there exists potential skilled human power resource in different organisations to at least start small observation trials around the suggested areas. In effect, the coordinated efforts of the coffee board of Zambia, Zambia Coffee Growers' Association, Zambian Agricultural Research Institute, Golden Valley Agricultural Research Trust, and the Ministry of Agriculture and Commerce becomes very important. Probably, the Coffee Board of Zambia may take the lead to convene a discussion forum among the different organisations to discuss and devise strategies for raising research fund and assigning researchers, at least one for each of the three disciplines indicated above viz. breeding, agronomy and protection.

It would be very useful to provide a practical training of about one month to the researchers at coffee research institutes in east Africa before they start the research activities. Coffee Research Foundation in Kenya and Jimma Agricultural Research centre in Ethiopia could be possible centres to stay for two weeks at each.

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