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# L'IMPACT DES CONNAISSANCES EN ÉPIDÉMIOLOGIE POUR UN MEILLEUR CONTRÔLE DES MALADIES DU CAFÉIER: EXEMPLES DU COFFEE BERRY DISEASE (CBD) ET DU COFFEE WILT DISEASE (CWD)

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## Abstract

The main objective of plant epidemiology is to understand the development of diseases in cultivated plant populations with a view to better managing epidemics and therefore to reducing the damage caused as much as possible. In the case of coffee, which is a perennial and tropical plant, this objective is particularly important, as epidemics can develop over several years and cause significant damage. Furthermore, as some diseases are only present on certain continents, it is essential to understand the epidemic mechanisms in order to limit the propagation and spread of the most damaging diseases. To illustrate our point, we will focus on two major diseases that are only present in coffee trees in Africa: Coffee Berry Disease (CBD), and Coffee Wilt Disease (CWD). The first, CBD, attacks the fruits of the coffee tree and causes significant yield losses. The results we present indicate that this disease recurs every year from the same foci, and these foci are identifiable during the exponential phase of the disease expansion. After this exponential phase, the disease is present over the entire surface of the plots observed. Furthermore, the incidence of the disease is reduced in coffee trees located in the shade of fruit or forest trees, and several experiments have identified the mechanisms involved. The adoption of agroforestry systems to reduce the incidence of the disease is proposed. This measure, along with a selection of less susceptible varieties, should significantly reduce the damage caused by CBD. The second disease (CWD) attacks the aerial vegetative system of coffee trees and causes the death of trees more or less quickly. This disease also spreads in outbreaks, and agroforestry systems are also proposed to form barriers and thus slow the spread of the disease. Selecting less sensitive plant material may also help to better control the spread of this disease. For countries in Latin America or Asia, where these diseases are not present, it would be particularly judicious to test the varieties currently cultivated to know their reaction to these two important diseases. Agroforestry systems, useful for improving the quality of coffee and for the environment, should be developed and adapted according to the sanitary constraints that weigh on coffee farms.

**Key words :** epidemiology, spatial distribution, agroforestry system, disease control

# EVALUATION OF RELEASED ARABICA COFFEE VARIETIES FOR THEIR TOLERANCE TO BACTERIAL BLIGHT OF COFFEE (BBC) AT SIDAMA AND GEDEO ZONES, SOUTHERN ETHIOPIA.

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## Abstract

Bacterial blight of coffee also known as Elgon or Solai dieback, caused by *Pseudomonas syringae* pv *garcae* van Hall, is reported as a serious disease of Arabica coffee in Kenya and Brazil. Outbreak of bacterial blight of coffee was reported in three districts in southern Ethiopia where the famous Sidama specialty coffees is produced. The results of three years data showed that the disease syndrome on young, mature and older coffee plants were similar with bacterial blight of coffee documented elsewhere. The disease invariably attacks coffee leaves, branches and shoots with characteristic blight symptoms. The infected branches and shoots start die-back from the point of infection towards the tip while coffee berries on infected braches are also completely destroyed leading to total crop failure. Currently the spread of the disease was reported at Gedeo, Sidama, Wolita and Kembata-Tembaro Zone of SNNP regional state. To update the current status of the disease and evaluate the reaction of released Arabica coffee cultivars survey was under taken in six and three districts of Sidama and Gedeo Zones respectively. Nine coffee cultivars were evaluated for their tolerance to bacterial blight of coffee under field condition. The current survey result revealed the disease is observed in all released coffee cultivars at different locations at various levels of disease severities. The highest disease severity value of 12% was observed on Angefa at Aletawondo. Less than 3% disease severity was observed at Sidama Zone on coffee cultivars 74110, 74112 and 74158. On the other hand, at Gedeo Zone severity value of 10.8, 15 and 15.6 % was observed on coffee cultivars of Odicha, Koti and Angefa. Conversely coffee bacterial blight infection was not observed or negligible on compact released cultivars (74110, 741140). On local coffee land race disease severity varied between 12-42 and 12-25 % for Sidama and Gedeo respectively. In general, low infection was also observed on well managed coffee plantations. Farmer's preference increased to use coffee cultivars 74110 and 74112 due to moderately tolerance against bacterial blight of coffee. Further screening commercial coffee cultivars in laboratory is recommended to have reliable information's on their resistance level. Moreover, it is recommended to conduct successive year's field observations to look for the dynamics of the disease in the areas in order to understand and factors associated which favors the disease epidemics.

**Key words:** *Coffea arabica*, released coffee cultivars, Bacterial blight of coffee.

# MICROSATELLITE MARKERS SCREENING FOR COFFEE BERRY DISEASE (COLLETOTRICHUM KAHAWAE) RESISTANCE IN PROGENIES OF KP423 GENOTYPE AND ETHIOPIAN COFFEE ARABICA ACCESSIONS

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## Abstract

Coffee berry disease (CBD), caused by *Colletotrichum kahawae*, is a major constraint for Arabica coffee cultivation in Africa. Several previous studies have revealed molecular markers associated with its resistance. CBD is a disease that attacks berries at different developmental stages. The current study was aimed at using of these markers to screen for resistance to the disease on genotypes and progenies developed from the Tanzanian commercial variety and Ethiopian accessions at seedling stage. Eleven Ethiopian genotypes were crossed to a variety KP423, F1 progenies plus their parental genotypes were used in the study. Physiological screening was applied on the hypocotyls of parental genotypes and F1 progenies using the procedure developed by Van der Vossen in 1976. Marker screening was applied on the DNA extracted from their young tender leaves using gene specific markers Sat 235 and Sat 207. The genotypes containing the resistance gene were expected to show phenotypic resistance to CBD and banding patterns similar to the resistance donors on marker screening while those lacking the genes were expected to show phenotypic susceptibility and banding pattern similar to susceptible commercial variety KP423. The presence of the coffee berry disease resistance genes was revealed in the studied coffee genotypes amplified by SSR marker Sat 235 and Sat 207. This was confirmed by production of bands similar to the progenitors of CBD resistance. This finding implied that marker screening can be used in coffee berry disease resistant genotypes selection at early stages of growth hence reducing the time of selection cycle.

**Key words:** Microsatellite markers, coffee berry disease.

# STATUS OF MAJOR COFFEE (*COFFEA ARABICA* L.) DISEASES IN MAJOR COFFEE GROWING AREAS OF EASTERN ETHIOPIA

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## Abstract

Ethiopia coffee is among the best quality coffee which is vital to the economy of Ethiopia, providing a major source by fetching good foreign currency earnings. However; its production and productivity has been decreasing due to limiting factors include major diseases, such as coffee leaf rust (CLR), coffee berry disease (CBD, branch dieback (BDB) and coffee wilt disease (CWD). Therefore, in order to establish the effective management of the diseases, there was a need to ascertain their current incidence and spread in Eastern Oromia coffee growing areas. The survey was conducted in four major coffee producing districts of West (D/Labu, Habro & Boke) and East (Beden) Hararghe zones. And then presence or absence and prevalence or volume of the diseases was determined as incidence and severity, respectively. The results reveal that CBD, CLR and BDB were highly affecting the coffee tree followed by BDB. However, CWD incidence was only observed in Daro Labu and Bedeno district at very low level to less than 3% with overall average of 0.92%. The mean severity of CBD was 29% with range of 0-89 and its highest (45%) severity in Bedeno followed by Boke (26%) district, while average CLR severity was 6.3% with the range of 0-19. Also, the mean severity of BDB is 25% with the range of 0-74 and highest (40%) in Boke followed by Habro (25%) district. The disease occurrence was very high across all study areas with an average incidence of 66%, 33% and 47% for CBD, CLR and BDB, respectively. Currently, in these study areas CBD, CLR and BDB are economically important diseases which cause sever loss of yield. Generally, from the results of the study, there was the major shift in the status of coffee diseases in the Hararghe. Therefore, the diseases in region should get due attention immediately.

**Keywords:** Major diseases, Hararghe coffee, incidence, severity

# STATUS OF MAJOR COFFEE INSECT PESTS IN MAJOR COFFEE GROWING AREAS OF EASTERN ETHIOPIA

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## Abstract

The yield and quality of coffee in the country had been significantly reduced by biotic factors (diseases, insects, weeds etc.) and abiotic factors (temperature, drought, and rain pattern). Harerge coffee is among the spaciality coffee which is vital to the economy of Ethiopia, providing a major source by fetching good foreign currency earnings. However; its production and productivity has been decreasing due to limiting factors include major insect pest, such as antestia bug (AnB), blotch leaf miner (BLM) and green scale (GrS). Therefore in order to establish the effective management of the insect pest, there was a need to ascertain their current infestation and spread in Eastern Oromia coffee growing areas. The extensive biological survey was conducted in August 2015. The study covered representative sites where truly known as high producing high cup quality Hararghe coffee brand from the Daro Labu, Habro, Boke and Bedeno districts of Hararghe zones. The assessment was done on coffee insect pests like Antestia bug, blotch leaf miner and green scale. And then presence or absence and prevalence or volume of the insect pest was determined as infestation and severity, respectively. The result showed that, the infestation Antestia bug was highly observed in all lowland PAs of all districts in which up to 15 Antestia bug per tree were recorded. This indicates that, highly severe infestation for coffee in the areas than before which required attention. The highest infestation of blotch leaf miner (18%) in D/labu and green scale insect (36%) in Boke and antestia bug (27%) in Habro were identified as the major pests of coffee which are becoming a big threat for coffee production in the areas. Green leaf scale was severe on berry (19.48%) in Boke while high antestia bug severity (2.22%) was observed in Habro districts. However, the severity of BLM in all studied areas was very low (0.81%). The outbreak of these pests might be due to the current climate change. Generally, from the results of the study, there was the major shift in the status of coffee insect pests in the Hararghe, therefore, the insect pests in region should get attention immediately,

**Key words:** Insect pests; Infestation; Severity



# ELABORATION D'UNE LUTTE INTÉGRÉE CONTRE LE SCOLYTE DES BAIES DU CAFÉIER DANS LES HAUTS PLATEAUX DE TOBA (NORD DE SUMATRA)

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## Abstract

The coffee berry bark beetle *Hypothenemus hampei* (Ferrari) is the most common coffee pest in the world. It is also the most destructive, because it attacks the berries throughout the fruiting process, and the damage produced on the seeds causes significant crop losses. Influenced by an equatorial type climate, the Arabica coffee tree, cultivated in the highlands of the Toba region (North Sumatra), is characterized by a floral production spread over the year and a continuous fruiting on which the bark beetle develops until the end of the two annual harvests. Since 2012, CIRAD and IndoCafCo have been interested in the control of the bark beetle in this region, and the first study results allow us today to propose an integrated control scheme excluding any chemical component, easy to implement, affordable and of high efficiency allowing infestations to be reduced to economically acceptable levels. Among the most important components, the sanitary harvest, applied to the soil and to the branches, eliminates a large part of the infested berries, no matter their stage of ripening, at the end of each harvest and less than three months afterward the two main blooms. The permanent use of the BROCAP © trap allows bark beetle infestations to be halved, and even more so when the plantations are protected from neighboring plots by traps installed on the border line. In addition, the coffee pulping and drying areas, permanently controlled by traps, are all emergence sites where the return of bark beetles to the plantations is stopped. Finally, the periodic pruning of coffee trees helps stimulate fruiting and increase production while reducing infestation rates. Other components can be added to this control model, such as weeding and regular cleaning of plots, which in particular facilitate sanitary harvesting. Aqueous suspensions of *Beauveria bassiana* spores, regularly sprayed in the plantations, also contribute to the control, but with variable effectiveness. Finally, to assess infestation levels at any time, it is advisable to carry out sampling of berries in the plantations.

**Key words:** berry bark beetle, integrated pest management, *Beauveria bassiana*, *Hypothenemus hampei*, BROCAP ©

# DETERMINING THE IMPACT OF MULCHING PRACTICE ON THE EARLY SURVIVAL AND SUBSEQUENT GROWTH PERFORMANCE OF NEWLY TRANSPLANTED COFFEE SEEDLINGS

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## Abstract

The global temperature has been increasing over the years due to recurrent climate change and variability, which directly or indirectly affects the agriculture sector. This has made the necessary for the farmer to get the best out of the varying rainfall amount and distribution. Experiments were conducted with the objectives of identifying effective mulching materials and their optimum application thickness for newly transplanted coffee seedlings at Mechara Agricultural Research Center (MARC) on-station and Sakina on-farm during 2015 and 2016. Coffee seedlings of Mechara-1 variety and organic mulching materials of maize Stover and vetiver grass at 5cm and 10cm mulching depth were compared with farmers' practices of using soil as mulching material and no-mulch bare soils. The experiment was laid out in RCBD with three replications. Data were analyzed for seedling survival rate, soil moisture content, moisture stress score, weed density and subsequent early growth performance of the seedlings under different mulching treatments. The result showed that there are statistically a significant difference ( $p < 0.05$ ) among the treatment for most parameters studied at both locations and seasons. The highest seedling survival rate, soil moisture content and different growth parameters, and the minimum moisture stress score were recorded for coffee seedling treated with maize stover and vetiver grass mulches compared to the no-mulch bare soils and farmers' practices of using soil as a mulching material. However, vetiver grass mulches applied at 5 cm mulching thickness resulted in the highest combined over location and season percentage of coffee seedling survival rate (94.6%), soil moisture content (16.5%), the lowest moisture stress score (1.5) and the highest mean values of the different early growth measurement of coffee seedlings. Weed species and their densities were lowest of all under coffee seedlings treated by maize stover mulches at 10cm mulching depth. Therefore, from these results mulching newly transplanted coffee seedlings with vetiver grass at 5cm mulching depth can be the recommended to farmers in Daro-Labu district and similar moisture stress areas of Hararghe as this practice conserved soil moisture resulting in better seedlings survival through increasing their tolerance to moisture deficits..

**Key words:** Vetiver grass; maize stover; survival rate; soil moisture; moisture stress; coffee seedlings

# COFFEE PEABERRY AS A SEED SOURCE FOR PRODUCTION

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## Abstract

Coffee peaberry is a unique feature of coffee seed as the result of the berry producing a single bean instead of the normal two during fertilization at the field. This might happen by three major factors i.e. failure in one of the two ovules in the ovary to be fertilized and set seed, failure in the further development of the endosperm and incompatibility of the two parents during pollination.

Different coffee seed source type and stage were evaluated as compare to peaberries for growth and development at nursery and for peaberry up to potential yield at field level. For most Ethiopian coffee varieties, occurrence of peaberry % also studied for two seasons at Jimma agricultural research center.

Peaberry like the other normal bean can germinate, emerge and grow as good seedlings, and also the transplanted pea berry seedlings gave a potential yield as of the normal beans perform. On the other hand, the coffee varieties producing peaberry proportion (%) vary from variety to variety which accounts mean value of 7% for pure line and up to 16% for hybrid variety. The hybrid coffee showed two-fold higher pea berry than the pure line coffee. Peaberry may not be predominantly a heritable character, because seeds produced from coffee trees raised from peaberries will not develop all in to peaberries.

**Key words:** coffee, pea berry, growth, Yield

## RESPONSE FUNCTIONS OF TALL COFFEA ARABICA VARIETIES TO N, P AND K NUTRIENTS IN TANZANIA

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### Abstract

In the past years the Tanzanian coffee farmers used to grow traditional tall coffee varieties N39, KP162, KP- 423 and H.66. These are susceptible to coffee berry disease (CBD) and coffee leaf rust (CLR) which are mainly managed by chemical means as well as host plant resistance. But the use of inorganic fungicides is very expensive especially to smallholder resource-poor farmers and is also not environmentally friendly. As an effort to overcome the use of fungicides TaCRI has developed improved Tall coffee varieties with high yielding potential and resistance to CBD and CLR. The aim of this study was to assess the response of Tall *Coffea arabica* to Nitrogen, Phosphorus and Potassium nutrients. The experiment was established in December 2012 at Lyamungu, following a randomized complete block design with split plots and three replications. Five coffee varieties were treated as main factor (N39-8, N39-9, N39-11, N39-12 and KP- 423) and 4 fertilizer rates as sub factor (75 g of NPK 20:10:10 (recommended/tree, 112.5g of the same, 150g of the same and 37.5g + 10Kg of FYM) each rate applied three times per year with exception of FYM which is applied after every two years. Data collected included stem girth, number of bearing primaries, plant height, berry clusters and yields. The accruing data were exposed to ANOVA using STATISTICA V7 software. The means were separated using Fisher LSD method at 0.05 significance level. KP-423 variety resulted into significantly ( $p < 0.05$ ) wider canopy width and higher number of berry cluster than N39-8, N39-9 and N39-11 varieties. On the other hand, N39-8 variety resulted into significantly ( $p < 0.05$ ) higher number of branches, strong stem girth and higher tree height. Similarly N39-8 variety resulted into higher yield (1894c Kg clean coffee ha<sup>-1</sup>) which was significantly different ( $p < 0.05$ ) from other varieties; N39-9 (1606ab Kg clean coffee ha<sup>-1</sup>), N39-11(1454a Kg clean coffee ha<sup>-1</sup> and N39-12 (1630ab Kg clean coffee ha<sup>-1</sup> ). Interaction between N39-8 variety and 37.5g + FYM resulted into significantly ( $p < 0.05$ ) higher yield (2436 Kg clean coffee ha<sup>-1</sup>). Despite the significant difference the lowest yield obtained among the tested parameter was 1300 Kg clean coffee ha<sup>-1</sup>. It is tentatively recommended that 37.5g of NPK (20:10:10) + (10Kg of FYM applied after every two years) or 75g of NPK (20:10:10) if applied tree times per year is enough for N39-8, N39-9, N39-11 and N39-12 varieties under the age of four years.

**Key words:** NPK nutrients, *Coffea arabica*, Tanzania

## TOWARDS EXPANSION OF COFFEA CANEPHORA PRODUCTION IN TANZANIA: THE LAND SUITABILITY PERSPECTIVE

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### Abstract

As an effort to generate information that can be used to expand the Robusta coffee production in Tanzania, a study was conducted in six potential districts (Geita, Sengerema, Kibondo/Kakonko, Kasulu/Buhigwe, Uvinza and Mpanda) and two reference districts in Kagera (Muleba and Karagwe/Kyerwa) to assess the quality of land in general and soil fertility in particular. A total of 354 soil samples were taken from 118 survey sites across the study districts and were analyzed for routine soil fertility parameters. Land evaluation (qualitative, parametric method) was done, with climatic data adopted as proxy from nearby weather stations while other land characteristics (slope, drainage and soil depth) taken from the field. In fertility assessment, soil pH was used to establish the correction factors for available N, P and K (fN, fP and fK). Then relationships were empirically worked out between the correction factors, OC and the amount of total N, available P and exchangeable K to get the total available forms of each in kg ha<sup>-1</sup> which were divided by 1, 0.175 and 0.875 respectively and summed up. Then the percentages of total number of sites in each district with natural fertility levels of 400 kgE/ha and above were descriptively assessed. Geita and Sengerema compared fairly well with the reference districts in land suitability for Robusta. In the soil's point of view, they showed to be even more fertile than the reference districts. We recommend the two districts to be considered priority areas in Robusta expansion (with the Robusta type of choice being Nganda which appears to be specific to the lacustrine influence). The other four districts could constitute phase two of the expansion and because they are farther away from Lake Victoria, investors can adopt the Erecta type which appears to be better adapted to a diversity of agro-ecosystems.

**Key words:** *Coffea canephora*, Land suitability, soil fertility

# CARACTÉRISTIQUES DES CLONES DE CAFÉIERS CULTIVÉS ET VULGARISÉS AU TOGO

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## Abstract

In Togo, two species of coffee trees are cultivated: *Coffea arabica* L. and *Coffea canephora var robusta*. The plant material used in Togo comes from introductions from Côte d'Ivoire, Cameroon, Angola and the Central African Republic. This material is distributed to producers in the form of rooted cuttings or small plants produced in the cutting centers of the Agronomic Research Center of the Forest Zone (CRA-F) and the Coffee Cacao Technical Unit. *Coffea canephora var robusta* is mainly cultivated in the form of high producing clones. They are distributed as a mixture of clones. The objective of this study is to make a bibliographical synthesis on the characteristics of the clones of coffee trees cultivated in Togo. The disseminated clones have an average production of 2,600 kg / ha of marketable coffee in a research station, while in rural areas, their average yield is 800 kg / ha. Eight (8) high producer clones were selected but 6 are disseminated. Their characteristics are as follows. Clone 149 has an average production with good technological characteristics; its production is irregular with a staggered late maturation; its yield is 2860 kg / ha. Clone 181 has an average production with a yield of 2780 kg / ha; it reacts favorably to pruning and has a giant hard-rooted habit; it is difficult to harvest. Clone 182 has a yield of 2500 kg / ha with an average and regular production; it has a giant hard-rooted habit and is difficult to harvest. Clone 197 has a yield of 4420 kg / ha; its production is good and regular; it adapts to all areas; however, it is susceptible to rust and has low drought resistance. Clone 375: has good production and reacts favorably to pruning; its yield is 2600 kg of commercial coffee per hectare. Clone 461 yields 2350 kg of marketable coffee per hectare.

**Key words**: coffee, clone, characteristics, dissemination, Togo

# EFFECTS OF CUTTING POSITION ALONG MOTHER PLANTS ON ROOTING OF HYBRID COFFEE VARIETIES

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## Abstract

The study was conducted on-station at Tanzania Coffee Research Institute (TaCRI) from December 2013 to March 2014 to evaluate the effect of stem cuttings position along the mother plants on rooting of hybrid coffee varieties. Stem cuttings of coffee varieties were assessed in a rooting medium of forest soil and sand at a ratio of 2:1 by volume under semi-controlled environment. A split-plot experiment in a randomized complete block design (RCBD) with four replications was used. The main factor was five improved hybrid Arabica coffee varieties (N39-1, N39-2, N39-4, KP423-1 and KP423-2) and the sub-factor consisted of four types of positions (stem cuttings collected from the base, middle, apex and conventional treatment used was the mixture of the above cuttings applied as the control). Four months after planting, stem cuttings were evaluated for root growth characteristics. Data collected were subjected to analysis of variance (ANOVA) using CoStat software version 6.311 and treatment means were separated based on Tukey's test at ( $P \leq 0.05$ ). Results obtained indicated that the positions of stem cuttings along the mother plant had a significant effect ( $P = 0.04$ ) on rooting of coffee varieties whereas rooting was highly significant ( $P = 0.00$ ) affected by varieties. Further, interaction between varieties and position of stem cuttings significantly ( $P = 0.04$ ) affected the rooting percentage and number of lateral roots at ( $P = 0.01$ ). This study also indicated that clonal multiplication of coffee stems cuttings differed with varieties and position along the mother plant with stem cuttings taken from basal and middle positions having the highest rooting percentage. It is recommended that, stem cuttings from basal and middle position of mother plants be selected for massive production of varieties N39-1, KP423-1 and KP423-2.

**Key words:** Basal cuttings, Clonal propagation, Multiplication, Stem cuttings, Vegetative

# EFFET DE DIFFÉRENTS SUBSTRATS SUR LA CROISSANCE ET LE DÉVELOPPEMENT DE BOUTURE DE CAFÉ (COFFEA CANEPHORA VAR ROBUSTA) EN PÉPINIÈRE À L'IRAD BAROMBI-KANG (CAMEROUN)

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## Abstract

The availability of plant materials remains a major constraint to boost coffee production. The losses recorded during the provision of rooted cuttings to coffee growers remain high. To remedy this, the production of Robusta coffee plants by direct tunnel cuttings has been popularized. In order to offer coffee growers a better substrate that can promote rapid plant production in the nursery, this study was carried out in the nursery at the Barombi-kang / Kumba Polyvalent Research Station from April to September 2016. It was about " evaluate the effect of different substrates on the growth and development of cuttings. The cuttings were from the M5 Robusta coffee clone and were harvested from stems between 5-7 months old. The experimental setup was that of a complete randomized block with four repetitions made up of seven treatments: humus soil (T0), fine river sand (T1), decomposed sawdust ((T2), coffee parchment (T3), 2 / 3: 1/3 mixtures of: humus soil / fine river sand (T4), humus soil / decomposed sawdust (T5), humus soil / coffee parchment (T6). The evaluation of the percentage of regrowth was carried out at regular intervals of one week after the budding of the first cuttings with as measured parameters: the time required for the appearance of the first regrowth on different substrates; weekly regrowth at the level of the different treatments and by repetition; the total number of buds per treatment. At the end of the 90th day after planting, the parameters measured were: number of stems per plant, number of internodes per stem, average number of leaves per stem, average length of stems per plant in cm, average number roots per plant; the size of the longest root in cm; total weight of fresh vegetable matter in grams and the total weight of dry matter in grams. Data on growth and development parameters were collected and analyzed using R software version 3.0. The results obtained show that all the parameters measured were significantly influenced by different substrates. As a result, it could be concluded that the substrates T0, T3, T4 and T5 are indicated for the production of viable Robusta coffee plants and could be recommended as good substrates for better rooting and budding while T6 exhibited a high mortality rate, and finally T2 exhibited relatively poor performance for the measured growth parameters.

**Key words:** Coffee Robusta cuttings; Clone M5; substrate; coffee production; Nurseries



## RÉDUCTION DES EFFETS DE L'ALLONGEMENT DE LA SAISON SÈCHE SUR LA PRODUCTION DU CAFÉ ROBUSTA

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### Abstract

The coffee tree is a tropical plant that is grown in areas where the dry season does not exceed three months. However, in Togo, recent decades have been marked by obvious climate change, expressed by the lengthening of the dry season, which is detrimental to flowering, fruit set and coffee tree production. This reduces the quantity of commercial coffee and the export earnings of producing countries. This situation made it necessary to seek measures aimed at reducing the per verse effects of this climatic phenomenon. It is in this context that, from 1995 to 2018, a trial to combine four agroforestry legumes with robusta coffee cultivation was set up on the station. They are: *Albizzia adianthifolia*, *Samanea saman*, *Erythrophleum guineensis* and *Albizzia lebbeck*. The first results were obtained in 2001. Observations continued from 2003 to 2018 on station on the crown diameter of agroforestry species and the yield of commercial coffee. In a peasant environment, *Albizzia adianthifolia* and *Erythrophleum guineensis* are associated with two densities, 118 plants / ha and 59 plants / ha, with robusta coffee in a trial in 2000. The observations focused on the yield of commercial coffee. In the Tové resort, *Albizzia adianthifolia* has an overlap of 86 m<sup>2</sup> at 5 years, 217 m<sup>2</sup> at 10 years, 226 m<sup>2</sup> at 15 years, and 235 m<sup>2</sup> at 20 years. *Erythrophleum guineensis* grows in the following speed: 44m<sup>2</sup> at 5 years, 132 m<sup>2</sup> at 9 years, 175 m<sup>2</sup> at 15 years and 216 m<sup>2</sup> at 20 years. *Samanea saman* grows slowly the first year, after he grows rapidly the first 3 years. In Togo, the horizontal development of this species expressed by the ground cover is 126 m<sup>2</sup> at 5 years, 254 m<sup>2</sup> at 9 years, it reaches 290 m<sup>2</sup> at 15 years and 327 m<sup>2</sup> at 20 years. *Albizzia lebbeck* covers the ground on 139 m<sup>2</sup> at the age of 5 years, at 9 years it reaches 197 m<sup>2</sup>. The yields of marketable coffee under forest legumes are: *Albizzia adianthifolia* 851 kg/ha, *Samanea saman*: 1024 kg/ha, *Erythrophleum guineensis*: 1068 kg and *Albizzia lebbeck*: 1492 kg / ha; NPK 20.10.10 to 400 kg/ha: 1336 kg/ha, and Control: 986 kg/ha. On farm and at three years, the yields are: *Albizzia adianthifolia* 563 kg/ha, *Erythrophleum guineensis*: 527 kg/ha, NPK 281 kg/ha and Control 195 kg/ha.

**Key words:** robusta coffee, elongation, dry season, agroforestry legumes.

# CHARACTER ASSOCIATION AND PATH COEFFICIENT ANALYSIS AMONG YIELD AND YIELD RELATED TRAITS IN COFFEE (COFFEA ARABICA L.) IN ETHIOPIA

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## **Abstract**

Coffee is the world's most widely traded agricultural commodity surpassed only by oil and it is the back bone to the Ethiopian economy and it contributes 25-30 % export revenue and more than 20- 25 million people depends on coffee for their livelihoods. The coffee bean yield is a complex character that can be determined by several components which reflect positive or negative effects upon this trait. In view of this, the present investigation was carried out at Agaro, Southwest Ethiopia, to determine the extent of correlation among 26 coffee yield and yield related traits of 49 Limmu coffee accessions and to assess the direct and indirect effects of yield components on coffee yield. The result revealed that significant ( $P < 0.05$ ) differences among the coffee germplasm accessions for all traits except for percent of bearing primary branches, leaf area, bean thickness and rust incidence and in general, the genotypic correlation coefficient was higher in magnitude than its corresponding phenotypic correlation. Morphological traits that exhibited positive and significant ( $P < 0.05$ ) correlation with coffee bean yield, namely, average inter node length on stem, stem diameter, angle of primary branches, fruit length, fruit width and fruit thickness, are important components to improve coffee yield. The positive and significant correlation between coffee yield and other morphological traits indicates that these highly associated traits are controlled by one major gene. Thus, improving one leads to simultaneous improvement of the others. Besides, path coefficient analysis showed that average-inter nodes length on main stem, stem diameter, angle of primary branches, fruit length and thickness, having positive direct effects, exhibited positive and significant genotypic correlation with coffee yield per tree. Therefore, in the current study, average inter node length of main stem, stem diameter, angle of primary branches, fruit length and thickness can be used as indirect selection criteria to improve coffee yield per tree.

**Key words:** Coffee accessions, Correlation, Direct effect, Path coefficient, Primary branch

# DIVERSIFICATION ET IDENTIFICATION DES AGROFORETS A BASE DE CAFEIERS ARABICA (*COFFEA ARABICA* L.) DANS LES HAUTS PLATEAUX DE L'OUEST DU CAMEROUN

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## Abstract

This study aims to identify agroforests based on Arabica coffee trees in view of the analysis of floristic diversity. In 2004, agricultural and perennial species were recorded in 100 Arabica coffee plants distributed at the following altitude levels: low (<1200 m), lower middle (1200-1450 m), middle (1450-1700 m) and high altitudes ( $\geq$  1700 m). The results show that *Cola spp.*, *Dacryodes edulis*, *Eucalyptus robusta*, *Mangifera indica*, *Persea americana*, *Raphia mabilensis* and *Spathodea campanulata* represent 26.8% of the population at low, 72.2% at lower middle altitude, 71.4% on middle and 77% at high. Fisher's test reveals a significant influence of the altitudinal variable on the Shannon index. The coffee plants of lower average altitude are the best distributed (Pielou fairness of 0.87) and diversified (3.49 bits). Based on the coffee loss rate and the SNK comparison test, the coffee regression observed in this region not only highlights systems with restricted types (20.3-31.5% coffee loss) and moderate (7-12.7% loss), respectively in lower and upper altitudes, but also, coffee systems under uncontrolled tree legumes and those poorly enriched at low altitude, at lower middle altitude, those under *Musa spp.* - fruit trees, and those under fruit trees and under *R. mabilensis* respectively at medium and high altitudes.

**Key words:** Diversification, arabica coffee trees, altitude, indices, systems.

## SEED AND IN VIVO CUTTING MUTAGENESIS FOR BROADENING GENETIC VARIABILITY IN COFFEA ARABICA

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### Abstract

Coffee, after crude oil, is the second most valuable commodity exported by developing countries and supports the livelihood of more than 75 million people. Coffee markets have a preference for established cultivars making improvements via conventional breeding difficult. Moreover, the long juvenile period of the coffee tree means that conventional breeding takes many years to produce a new cultivar. Arabica coffee production is based almost entirely on coffee cultivars developed decades ago with a narrow genetic base (Davis, 2006), leaving the crop vulnerable to new threats of diseases and pests emanated from climate change effects. Mutation breeding has proven to be effective in broadening genetic variability in plant species therefore has great potential in improvement of tree crop specie such as *Coffea* spp (Bado et al., 2017). Prior to starting a mutation breeding programme, radio-sensitivity tests need to be performed to determine the optimal dose treatment for mutation induction. The susceptibility of seeds and in vivo cuttings of three selected *Coffea arabica* cultivars Kents, Mundo-novo and Geisha to Gamma irradiation was determined. A wide range of irradiation doses between 0 and 300 Gy for seed mutagenesis and between 0 and 25 Gy for in vivo cuttings were used. Subsequently germination percentage, success takes percentage and seedling vigour was used as a measure of radio-sensitivity. This study corroborated the high sensitivity of vegetative cutting compared to seed. Results showed that genotype and dosage of irradiation significantly influenced response to irradiation treatments ( $p < 0.05$ ). As for seeds, the effect of the irradiation on treated cultivars was inversely proportional to the emergence of the radicle, hypocotyls which were less affected while all treated seeds developed hypocotyls. The optimal mutation induction dose for seeds (LD50) ranged from 105 to 150 Gy for the Gamma irradiation, while the optimal mutation treatment (GR50) of cuttings was in the range of 12 Gy in all the treated Arabica varieties. Germination percentage, success takes, plant height, root length, number of roots and number of leaves were all affected. The optimal mutation treatment (GR50) of cuttings was in the range of 12 Gy in all the treated Arabica varieties. This study presents a pioneer work of *Coffea* spp. mutation breeding and provides first data on suitable irradiation doses for mutation induction in seeds and in vivo cuttings. The work is part of the FAO/IAEA Co-ordinated Research Project on 'Efficient Screening Techniques to Identify Mutants with Disease Resistance for Coffee and Banana (D22005).

**Key words:** Seed, selection, mutation, varieties, genetic variability

# LES FILIÈRES AGRICOLES COMME MOTEURS DE POLES DE COMPÉTITIVITÉ: CAS DE LA FILIÈRE CAFE EN COTE D'IVOIRE

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## **Abstract**

The Ivorian coffee sector has experienced many upheavals, following political and social crises, as well as drops in world prices. These crises caused a severe drop in production, and a slowdown in the implementation of policies to intensify production and local processing. This study is intended to contribute to the organization of the Ivorian coffee sub-sector, by developing the attractiveness of value chains and to demonstrate that the latter can constitute a real lever for development, both at the regional and national level. This study provides an analysis of the coffee sector, through value chains, and aims to provide a better understanding of the success factors of a coffee-based competitiveness cluster. The partial results of the research, carried out between June 2016 and August 2018, made it possible to identify the stakeholders of the coffee sub-sector, with the interactions they have, or may have, both at the regional and national; they also provide a better understanding of the organization of the sub-sector, the performance of actors at the local level, in particular producer organizations and manufacturers. The work is continuing and will make it possible to promote links between the players (can coffee build a network around it?), Likely to help them improve their practices and their performance.

**Key words:** Ivory Coast, coffee, agricultural sectors, competitiveness cluster, value chains

## **SOCIO-ECONOMIC APPRAISAL OF THE COFFEE REHABILITATION PROGRAMME IN GHANA**

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### **Abstract:**

Coffee production increased to its highest level in 1999/2000 due to the good price incentives enjoyed by farmers at the time. However, between 2001 and 2004, the price of the crop on the international market suffered major decline that seriously affected the internal coffee trade. Consequently, farmers in Ghana diverted from coffee farming to other cash crop farming, especially, cocoa. Since 2010, the government of Ghana through the Ghana Cocoa Board (COCOBOD) implemented a four-year Coffee Rehabilitation Programme (CRP) in order to promote the production of coffee with a target of 10,000 metric tonnes of coffee within the four-year period, enhance productivity and to attract more farmers to cultivate coffee for export. The main strategy to achieve this was to support and motivate farmers with inputs including extension to rehabilitate and maintain their abandoned farms and to attract new farmers to establish new coffee farms. The support programme was even extended for one more year. Having run the programme for over four years, the question is whether the objectives set were achieved? Are farmers motivated to sustain coffee cultivating in Ghana now? This socio-economic study was initiated to assess the programme in respect of these questions, gains made and to track any other unintended outcomes that may have arisen. A total of 448 coffee farmers were interviewed from 36 communities in all coffee growing regions in Ghana between July and September 2018 using pre-tested and structured questionnaires. Results are highlighted in this paper.

**Key words:** socio-economics, farmers, coffee, rehabilitation, production

## COFFEE QUALITY RESEARCH IN ETHIOPIA

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Coffee is the first most traded Agricultural commodity in world market. Arabica coffee contributes more than 65% of world's coffee supply. Ethiopia is center of origin and diversity of Arabica coffee. About 20-25 million Ethiopian people directly and indirectly depend on coffee for their livelihood. Vast agro-ecology and genetic variability in Ethiopia creates opportunity to have different distinct coffee quality characters. Despite the vast majority of coffee quality has not been improved as expected. Besides, though Jimma Agricultural Research Center (JARC) has been conducting coffee quality research for the last five decades, the results were not compiled in a way that can be used by different users. Therefore, these review papers was aimed at compiling the results of coffee quality research by JARC. From the coffee quality research conducted for the last five decades by JARC, appropriate method and optimum time coffee fermentation, use of shade during coffee fermentation, depth and expositor time of parchment coffee during drying and some coffee quality profile mapping for some coffee growing areas were the major output. Therefore, coffee growers in Ethiopia should use these improved coffee quality management options to improve their coffee quality. However, as the demand of coffee buyers is growing from time to time, coffee quality research should focus on advanced coffee processing and postharvest handling methods.

**Key words:** Coffee quality, drying, fermentation, profile map, processing

# PERCEPTIONS DES CHANGEMENTS CLIMATIQUES ET STRATÉGIES ENDOGÈNES D'ADAPTATION DES PRODUCTEURS DE CAFÉ AU TOGO

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## Abstract

Climate change has been recognized as a threat to African agriculture, as it is more vulnerable due to its weak adaptive capacities. This study examines the possibilities for adapting coffee production in Togo to climate change. It has set itself the general objective of contributing to increasing the resilience of coffee production to the effects of climate change. Specifically, it involves knowing the impressions of coffee producers on climate change in their environment and identifying the endogenous measures used for adaptation. To do this, data was collected through a questionnaire survey in the West of the Plateaux Region. A two-stage stratified sampling retained 182 coffee producers, to whom the questionnaire was administered. The main results show that producers are aware in 98% of cases of climate change in their environment. They assert changes in the elements of the climate linked to rainfall and temperature. All the producers surveyed indicate a reduction in the average annual rainfall and an increase in the average annual temperature. These claims are confirmed by analysis of meteorological data from the study area. Coffee producers mention the late start of the rainy season (90%), the early end of the rainy season (85%), pockets of drought (80%) and heat waves in the dry season (45%). The endogenous climate change adaptation measures used by coffee producers help conserve moisture for the benefit of coffee plants. These measures are the construction of shadehouses or the installation of nurseries under the shade of trees (100%), the displacement of the installation period of the coffee plants (100%), the replacement of dead plants (100%), strengthening shade in plantations by combining fruit trees (100%), conserving agroforestry species (*Albizzia*) in their plantations (85%), mulching rounds around young plants (74%), installation of nurseries near rivers (60%) and conservation of soil moisture by no-tillage in the dry season (56%). However, the measures identified are very limited in relation to the impacts of climate change on coffee production. The actions to be taken to increase the resilience of coffee production in Togo must take into account the endogenous adaptation measures identified in this study.

**Keywords:** Climate change, coffee production, perceptions, endogenous adaptation measures, Togo



# **DOES COFFEE CULTIVATION HAVE A FUTURE IN GHANA IN THE FACE OF CURRENT GHANAIAN FARMERS' OUTLOOK, ATTITUDE AND MARKETING CONSTRAINTS: EVIDENCE FROM PRIMARY DATA**

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## **Abstract**

Although coffee was introduced in Ghana around the same time in the 18th century as cocoa by the early missionaries, its cultivation has lagged behind cocoa for many years since it has not received the much-needed attention as cocoa. However, coffee cultivation received a major boost in 1991 when the Government of Ghana embarked on the Agricultural Diversification Project to revamp the coffee industry (Oppong et al. 2009). Efforts included improved pricing, liberalized markets and intensification of research as well as enhanced extension services for farmers. CRIG, a subsidiary of the Ghana Cocoa Board continues to research on coffee planting materials, and on other important aspects of the crop. In 2016, a Coffee cultivation Manual was developed by CRIG (CRIG, 2016). The recent coffee rehabilitation programme in Ghana, between 2011 and 2015, also, yielded some results. However, in the face of current marketing regulations, policies and constraints facing farmers, what future does coffee cultivation have? Could coffee cultivation be a crop of choice and livelihood option for the rural poor in Ghana based on the growing evidence of health benefits and economic potential to reducing poverty? This paper shares some insight into Ghanaian farmers' views, perceptions, attitudes and constraints.

**Key words:** coffee outlook, coffee production, farmer attitude, marketing, constraints