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Farmer's preferences on selection of shade trees species for coffee production and management system in Assosa Zone, in northern western part Ethiopia

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Abstract
Coffee is a perennial woody shrub which is an important notable gift of our country. Small farmers lively hood predominately dependent on *Coffea arabica*. it ensures value either in economical and social benefits of country in addition to this some part of country uses coffee as discussing all aspect of problem around in their residence talk about social life, cultural and political aspects' of community around in their area. However, production and productivity is low because of a lack of management on coffee cultivation practices, lack of resistance in disease prevention. So far small holder farmers' around community at country level have a great potential of indigenous knowledge about practice of management and production mainly on package of coffee production. The main purpose of this study to undertake collect information on assessment of farmers preferences' on the role of shade tree species for coffee production and management system in Assosa zone, Northern western part Ethiopia. Data were collected through by semi –structured interviews and ideal shade tree species for coffee production in the area. An over view activity on research of work was done by respondents'. Farmers' revealed that Among We found that characteristics that farmers considered important were mostly comparable to those stated in the literature. There are a lot of signifance difference showed in selection criteria of species of tree primarily based on tree height,, root depth and shape of life and size Among shade tree species best meet with coffee such as *Cordia africana, millettia ferruginea, Acacia abyssinica* and *Albizia gummifera* mostly selected were highly favored in that order. Some of the respondents strongly stated the demerits of related with growing coffee with shade tree plants that cause negative which is nutrient depletion, water and sun light competition with coffee and creation favorable micro-environment for the prevalence of same coffee disease. According to analysis of data were in descriptive stat ices the e majority of the respondents has confirmed that other benefits of coffee shade trees such as honey production (58.92%), fire wood (30.35%), and improvement of soil fertility (10.75%). Half the study site community mainly depend on mining of minerals however other study sites is a potential of diversity of forest trees engaged in study area. These one who have given a lot information in study site were model farmers' s had excellent knowledge on coffee production practices, management option as well as coffee shade trees. their agronomic practices, and their association with beneficial soil microorganisms, involvement of microorganisms in organic matter transformation, and overall other interactions of coffee with shade trees should be provide to farmers to meet the desire need s of farmer local knowledge and ensure on selection of shade trees allowing for berries quality and maintain suitability of an envoirnoment and smeet food sufficance for small farmers near to an area of study. eventually, the shade trees, *Cordia africana Millettia ferruginea, abyssinica Albizia gummifera* and are recommended for the study area.

Keywords: Coffee Arabica, shaded coffee, coffee quality

Introduction
The coffee is one of the most important foreign exchange crop widely grown in diversified agro ecology of Ethiopia with range of 500 meter up to 2000meter attitudinal variation. The wild coffee plant (*Coffea arabica* L.), despite its name, is indigenous to Ethiopia and was discovered around 850 AD. It is still found in wild populations in the cool, shady environments in the understory of the highland forest of Ethiopia (Smith, 1985; Cambrony, 1992) [16, 5]. Ethiopia is a major producer of arabica coffee (Coste, 1992) [6] and It creates employment opportunity to about 25% of the population which account for 16 million people through its production, processing and marketing network (MCTD, 1985) [10]. It is the major source of rural household income and food security mainly in the coffee producing areas of the country (Biruk, 2000) [4].

Coffee is shade tolerant plant, coffee plants grow under shade of trees in these coffee associations, studies have demonstrated that coffee shade trees have positive impacts on coffee quality (Muschler,2001, Vaast *et al* 2006; Avclint *et al*., 2007) [13], by lengthing of the maturation of period of coffee berries and hence a better bean filling also trough the modification of micro climate for the coffee plant growing underneath shade trees(Lin 2007). More over shade improves the quality of coffee by allowing the beans to accumulate greater amounts of sucrose as compared to sun grown beans (Steiman 2003) [18]. Arabica coffee is very sensitive to high light intensity and high temperature resulting in the early senescence of leaves and defoliation. Shade trees have positive effects on microclimate and soil biological properties which are the key to long term sustainability of coffee eco system. Furthermore, most common coffee shade trees are also acknowledged for their good capacity in formation of symbiotic associations with certain soil bacteria, rhizobia (Grossman *et al*., 2006) [9] and arbuscular mycorrhizal fungi (Wubet *et al*., 2003) [20] all of which play major role in improvement of soil fertility Paper Publications extension growth and also induce over-bearing and 'Die-back' which refers to the death of young tertiary branches. Shade trees have positive effects on microclimate and soil biological properties which are the key to long term sustainability of coffee eco system. Furthermore, most common coffee shade trees are also acknowledged for their good capacity in formation of symbiotic associations with certain soil bacteria, rhizobia (Grossman et al., 2006) [9]. Negative effects associated with such modernized plantations have come to light over the past two decades, however. These include increased soil erosion, loss of biodiversity, and high environmental and economic costs associated with the heavy use of fertilizers and pesticides required in these systems (Muschler, 2000) [13]. Farmers may also has grown some trees in their coffee farms for additional purposes (fruit trees, firewood or honey production) (Soto-Pinto et al. 2007; Muleta *et al.* 2011 [17, 22] it is now recognized that timber and fruit production from shade trees used in coffee plantations can provide significant income, which may equal or exceed that of coffee when coffee prices are low (Muschler, 2000) [13]. Indigenous shade trees for coffee production are very common features in coffee production systems of afromontane rainforests (Gole and Senbeta, 2008) [7]. Farmers retain shade trees in their coffee farms based on leaf and crown characteristics, tree height and their impact on coffee yield. The majority of their respondents reported that growing coffee in full sun resulted in stunted growth which ultimately resulted in coffee yield reduction and quick wilting of the coffee shrubs, bean size reduction, increases in weed problems, unfavorable effects of heavy rain and hail damage which pose withering/dropping of flowers, frost damage, soil erosion and exhaustion of soil fertility due to lack of fertilizing "shade tree leaves". The advantages of using shade trees, especially under suboptimal farmers' Perspectives on the role of Shade Trees in coffee production Systems 445 conditions for coffee, include both climate and site amelioration, such as buffering temperature extremes in the air and soil and maintaining soil fertility through the incorporation of organic matter from leaf litter and prunings (Beer *et al.*, 1998) [3]. Also, by regulating light transmission to coffee plants which regulates coffee yields shade trees can also extend the life of the coffee plantation (Beer, 1987) [2]. Farmers' uses the traditional coffee management systems in Northwest Ethiopia, farmers select certain species of trees as coffee shade tree and remove others which they believe having an adverse impact on the coffee shrub growth and productivity. Even though coffee production and management has been practiced for centuries in this part of Ethiopia, there are very few systematic studies on coffee shade tree selection criteria and management practices in South west Ethiopia forest coffee growing areas (Muleta *et al.* 2011) [22]. Thorough understanding of the traditional coffee management techniques is however, essential for promoting sustainable agro forestry systems based on the existing local knowledge or for eventually recommending sustainable alternatives. Therefore, This study was initiated to assess farmers' preferences on role of coffee shade tree selection for coffee production system in Assosa zone, in North west Ethiopia.

Materials and Methods

The study was carried out in selected three sites potential coffee growing areas for an in depth of understanding preferences of shade tree species in coffee production and management. The study sites were Bambasi, Homesha and Tongo special woredas mao komo districts of Benishangul gmuz region district areas Assosa zone in north west Ethiopia. Three study sites were selected may deeply know about preference of shade tree in coffee production system at farmer level Based on the Global Positioning System (GPS) the research location was lie between $09^{0}45'$ 44'' N latitude and $034^{0}47'22.5'$ E longitude with an altitude with range from of 1677 to 1820 m.a.s.l. of the area is characterized by rainfall with mean annual rainfall of 796 mm. The mean annual temperature is $21.^{0C}$ with a minimum of 19^{0C} and maximum of 28^{0C}. The area is characterized by rainfall with mean annual rainfall 796 mm.

Sampling Method

This study under taken randomly sampling methods from potential site of coffee production and management system, before under taking survey it was made reconnaissance survey conducted supposed to be more or less deeply have know to get sufficient information regarding on coffee production management system and status of shade trees. In the first phase three locality were selected randomly from each target zone of woredas to carried out survey type research. In the second phase, a total of four sample Kebeles were selected from these three r localities based on the following parameters: 1) potential on coffee producing PA from each woredas and 2) accessibility of the focal sites to transportation. In the third phase fourty thirty farm households per PA were selected to have a total of 280 farmer respondents on the basis of the following major parameters: 1) long experience and knowledge of growing coffee production and management under key shade tree species 2) the person interviewed falls into the category of either male or female household head 3) voluntary for providing sufficient information in investigation.

Method of data collection

Two hundred Eighty (280) informants were purposely selected from the three localities (66 from the Bambasi locality, 80 from the Homesha and 134 Tongo special woreda locality), with support of kebeles leadership members and development extension workers, based on age

(more than 30 years), major coffee producing PA from each selected localities, Native languages in the two study areas are respectively the Rutanigha(Berta people) and Oromo(Tongo Special woredas). Interviews in both language were conducted using a translator. The study sites were chosen on the basis of 1) depth of knowledge, willingness to participate and investigation on this study. The researchers who conducted the field data collection had more than five years of field work experience in the localities and developed good working relationship with the farmers, spoke the local language and had a good knowledge of the site conditions. Information on the farmer's knowledge and practice on coffee shade tree selection and management was collected by administering semi-structured interviews, consisting of closed and open ended questions. The coffee management practice questions included shade tree selection criteria and management practices, knowledge about the selected shade tree attributes, and their effect on soil fertility coffee yield and quality, practice of intercropping and application of compost.

Data analysis

The collected data were analyzed accordingly using SPSS Version 22. Responses involving open ended questions were classed into categories and analyzed using the same statistical package..

Results

Demographic and Educational Characteristics of the Respondents

Age of the household head

All data age of the house hold head about two hundred Eighty respondents were interviewed in this study, of which the majority (33.2 %) of the respondents' age ranged between 27-37 years fallowed by the respondent (31.2%) with age ranged between 37- 55years. where as smallest proportions respondent (5%) with age ranged between 15-27 years. in line with this regarding to sex, 89.28 % of the respondents' were male and the rest 10.72% were females.

Education

Educational level of interviewed farmers With an adult literacy rate of 68% the study identified a good level of education. This result sowed it has important implications for understanding coffee production and management system in the study areas (Table 1).

Family size

Survey results showed that an increase in family size was observed in family members ranged with 1-6 members had greatest proportion composite of (49.28) fallowed by family size with range 7-12 members nevertheless the least family size was observed in no range with 12-17 members (Table 1)

Table 1: Demographic and Educational Characteristics of the Respondent

No	Items	Total	
		Frequency (f)	Percentage (%)
1.	**Age of respondent**		
	15-27	14	5
	27-37	95	33.92
	37-55	88	31.42
	.>55 years	83	29.64
2.	**Sex of respondent**		
	Male	250	89.28
	Female	30	10.72
3.	**Level of Education**		
	illiterate	87	31.07
	Elementary	120	42.86
	Secondary	73	26.07
4.	**House hold members (Family Size)**		
	1-6 members	138	49.28
	7-12 members	112	40
	12-17members	30	10.71

Experience on growing coffee

Almost from the total respondents 71.42 % were have experience on growing coffee range for 10 up to 20 year fallowed by 14.28% with 10 ars and the b 10.71 % respondent for 30 years finally the least respondent response were on experience on growing coffee 3.57 % for more than 30 years. similarly according to access to and land use from the total interviewed respondent 52.14% were have access of land range with 0.25-0.5 ha, the remaining 26.7 % were have 0.25 ha and finally interviewed respondent 16.07 % were have more than 0.5 – 1 ha and 5% were have more than 1 ha respectively 2). Regarding to coffee verities based on canopy nature, 50%, 35.71% and 14.28% of the respondents were cultivated open type, intermediate type and compact type of coffee varieties respectively. for almost all respondents concerning age of planted coffee trees 57.14%, 27.86%, 7.86 and 7.14% were mentioned between 15-20, greater than 25, between 1-7 and between 17-15 years, respectively (Table 2)

Table 2: The basic information considered to coffee and basic farm data

No	Items	Total	
		Frequency	percentage
1.	**Experience on growing coffee**		
	For 10 year	40	14.28
	For 10 up to 20 year	200	71.42
	For 30 years	30	10.71
	More than 30 years	10	3.57
2.	**Total farm area owned and rented**		
	0.25 ha	75	26.78
	0.25-0.5 ha	146	52.14
	0.5-1ha	45	16.07
	Morethan 1 ha	14	5
3.	**Coverage of land under coffee**		
	20	10	3.57
	30	200	71.42

	40	60	21.42
	50	10	3.57
4.	**Coffee Varieties based on canopy structure**		
	Open	140	50
	Intermediate	100	35.71
	Closed	40	14.28
5.	**Age of planted coffee**		
	1-7	22	7.86
	7-15	20	7.14
	15-25	160	57.14
	>25	78	27.86

Farmers Preferences of Shade Tree Characteristics in Coffee Production and management Systems

In all aspect, preference of shade characteristic in coffee production had better for coffee by farmers' of which they stated that traditional experience used in dead shade trees by the original type species. The majority respondents (51.%) mentioned that the shade trees were older than 7-15 years, regarding their seed source 68.7% of interviewees had mentioned getting from Agricultural office, only 3% of respondents had obtained from NGos. Concerning on best compatible coffee shade trees, 66.07%, 23.21%, 10 %, and 0.71% of the respondents were said, Cordia Africana, Millettia ferruginea Acacia abyssinica and Albizea gumefera compatable with coffee, respectively. The way for Means of shade tree selection criteria 64.29%, 26.79%, 4.64%, and 0.71% of the respondents were selected based on better light interception, fast growth rate, less competitiveness and other, respectively. Eventually interviewing farmers' preferences on shade tree may need to have represent the result of an out come under study.

Other benefits of shade tree: More than 95% of respondents stated the benefits they obtained from coffee plants other than for drinking and main income source, honey /bee production (58.72%) firewood (30.35%),) and coffee plants get benefits from shade trees for nutrient acquisition and soil moisture improvement (10.71%) (Table 3). almost more than 50% farmers' were agreed on selection intense of indigenous shade trees need to be the major criteria the important for ensure quality of crop and trees There are about more than 75 farmers' were responded the respondents cited that there is no severe challenge associated with shade tree however most farmers' raveled that Coffee growing under the shade of these trees are considered as having higher productivity and superior cup quality. In areas of high population pressure, the shade t, the use of shade tress enhances important for a capturing of carbon in ecological stabilization of micro climate around the community as well as green economy with in the locality create and serve as light while we plant under shade trees, one respondent was said shade trees will create favorable micro-environment for the occurrence of same coffee disease

Table 3: Farmers preferences of Shade trees characteristics in coffee production

NO	Items	Total	
		Frequency	**Percentage (%)**
1.	**Year of planted (age) of shade trees**		
	Less than 7 year	20	7.14
	Between 7-15 year	140	50
	Between 15 – 25 year	80	28.57
	More than 25 year	40	14.29
2.	**Which shade trees species best compatible with coffee**		
	Millettia ferrugineae	65	23.21
	Gravilia robusta	2	0.71
	Cordia Africana	185	66.07
	Accacia abicinica	28	10
3.	**Where did you get these shade tree species**		
	NGos	8	3
	Model farmers'	30	10.71
	Market center	50	17.
	Agricultural office	192	68.57
4.	**What are your specific reasons on selections of shade tree species?**		
	Fast growth rate	75	26.79
	better light interception	180	64.29
	Less competitiveness	13	4.64
	others	2	0.71
5.	**Other benefits of shade tree**		
	improvement of soil fertility	30	10.71
	honey /bee production	165	58.92
	For fire wood	85	30.35

Coffee shade tree preference criteria by farmers at Assosa zone in Coffee management system

From a total of respondents' justification were required (58%) of the farmers interviewed preferred shade trees that were intermediate 7-10meter in height the other respondents about 29 percentage of farmers required to tree height less

than 6m and the reaming farmers' about (15%) of farmers' was found to be lived to tree height tall greater than 10 meter. similarly with this preference of on selection of shade tree criteria on number of tree species the majority of interviewer(72%) s reported that species greater than two planted on coffee tree for shade purpose was preferred as it would increase productivity, increase bean size and promoting of bean quality, increasing fertility status of soil as each species account for having different nutrient composition and the rest farmers' stated only 28 percentage of respondent was preferred on number of tree species composed of 2up to 3. Leaf size was considered an important characteristic by the majority of the farmers interviewed (63 %) (Table 4). The main reason given for mainly : small sized leaf allowed for light can easily filter through them as compared to larger leaves; small leaves do not harm coffee flowers and fruits when they are shedding as they do not accumulate on flowers and branches; and also the rate of decomposition is high, improving soil fertility. The majority of farmers (86%) preferred abroad or wide Crown to be more better than Narrow as it play major role shade for coffee plants and tree with abroad ones will make easy to mange than narrow crown. The majority of farmers (72%) preferred ever green shade trees to deciduous ones, stating that shade was necessary for the coffee plants during the dry season. Where as the least respondent were responded about(6%) of farmers stated that it did not matter. Regarding to organic matter almost all interviewed farmers' about (92%) responded that an availability of organic matter hence to enhance soil fertility, physiochemical properties of the soil and microbial activity in the soil. The majority of farmers (96.4%) preferred light shade, only (3.6%) justify would normally stated that shade quality did not matter. The main explanation was given for the preference of light shade was that coffee requires light to produce and less incidence and prevalence of disease occur compared as dense once, improves quality of berry.

Table 4: Coffee shade tree preference criteria by farmers at Assosa zone in Coffee management system.

No	Tree characteristics	Total		
		Preference	Frequency	Percentage (%)
1.	Tree height	Short (< 6meter) Intermediate (7-10) Tall > 10	80 160 40	29 58 15
2.	Number of tree species	Greater than 2 2 up to 3 none	200 80	72 28
3.	Leaf size	Large Small none	66 176 37	24 63 13
4.	crown	Wide Medium Narrow	240 40	86 14
5.	Deciduous or evergreen	Deciduous Evergreen none	60 200 20	22 72 6
6.	Organic matter	An availability of organic matter Little organic matter None of	260 10 10	92 4 4
7	Shade quality	Light Dense none	270 10	96.4 3.6

Seven Species were mentioned by farmers' which is deeply discussed with them then they listed down those coffee trees in sequential order From the total respondents 71% were required shade trees for their field, from the total respondents who were required shade trees, (71%) *Cordia africana*, (50%) *Millettia ferruginea*, (42.85%) *Acacia abyssinica*, (35.71%)*Albizia gummifera*, (33.37) *Ficus vasta*(30.71) *Sesbania sesban* orederly had been preferred by interviewed farmer around the study area.. The major explanation were given from the respond ant preferred e these species based on the following criteria, improves soil fertility, increases productivity, Protects coffee from heavy sun, b/c of their compatibility to coffee and construction purpose, improve soil fertility, increase productivity, protect coffee tree from heavy sun, and in view of that the respondents were chosen the species.

Table 5: Tree Species widely used by Farmers as Growing in their Coffee Fields in Assosa zone, Northern Ethiopia

NO	Scientific name	Family	Frequency of respondents	Percentage (%)
1.	*Cordia africana Lam*	Boraginaceae	200	71
2.	*Millettia ferruginea*	Fabaceae	140	50
3.	*Acacia abyssinica*	Fabaceae	120	42.85
4.	*Albizia gummifera*	Fabaceae	100	35.71
5.	*Ficus vasta*	Moraceae	94	33.57
6.	*Sesbania sesban*	Fabaceae	86	30.71
7.	*Schefflera abyssinica*	Araiaceae	81	28.92

Discussion

This aim of this study was to identify farmers' preference criteria for selecting coffee shade trees in northern western part of Ethiopian Benishangul region district areas Assosa

zone. farmers' attitude on shade tree selection criteria and management of coffee shade trees were related to their indigenous knowledge on tree penology and structure such as leaf deciduousness, leaf size, crown width and tree height,. most of the preference characteristic coffee shade tree selection criteria by farmer of the study area.The majority of the farmers preferred moderate shade conditions which is also considered favorable for good coffee growth since photosynthetic rates of coffee are generally at a maximum at intermediate shade levels in the tropics (Beer et al., 1998) [3]. Even though there are also some differences. Regarding life span of leaves for example, the farmers in our study area preferred evergreen as compared to deciduous trees.since the selected most sites were located in low altitude regarding to this location often need the shrubs which was required shade was necessary for the coffee plants during the dry season. The result of this confirm with this raveled that previously studied report. Albertin and Nair (2004) reported that the majority of farmers in Nicoya Peninsula, Costa Rica, preferred evergreen trees capable of providing shade throughout the year. With exception of cordia africana All the preferred shade tree species with Ecexaption of Cordia africana in our study area belong to Fabaceae family and are believed to have capacity of nitrogen fixing (Beer et al. 1998) [3], contributing to the improved soil fertility reported by farmers. period of time, selection criteria form a combination of reducing the canopy shade and other economic and ecological services generated from the shade trees, notably honey production in the forest, which is the second major source of income for the local people.in their large flower production.. The majority of the interviewed farmers stated that other desirable benefits derived from shaded systems. Some of the expressed advantages such as firewood, timber value, construction and honey /bee production. Apart from shade provision to coffee bushes, some farmers strongly underlined that one of the principal reasons of organic matter to coffee production systems. As farmers expressed promptly, the contribution of massive amounts of organic matter to shaded coffee systems is well documented (Beer et al., 1998; Faminow and Rodriguez, 2001) [3]. Moreover, cacao farmers in Ecuador (Bentley et al, 2004) have also mentioned that shade trees improve soil fertility and help to maintain soil moisture for extended period of time on all Most interviewed farmers cited C. africana, M. ferruginea, A. abyssinica,and A. gummifera and. in that order as the best coffee shade tree species to have in their farm. The first three are commonly mentioned by all farmers. The respondents mostly associated the helpful roles of coffee shade trees with their leaves for incorporation of quality organic matter and shade provision as well as roots for storing water. Some of the characteristics considered favorable by farmers for the legume shade tree species were increase in soil organic matter (Beer, 1998; Grossman, 2003;) [3, 9]. In traditional shaded coffee production systems, shade trees are perceived as a necessity by almost all interviewed farmers, principally to mitigate coffee bushes from the suboptimal climate and ensure sustainable production by contribution of massive litter. Leguminous shade trees and C. africana are highly favored and there is a great need for further propagation of their seedlings on large scale. Shaded coffee systems are vastly favored by the majority of the respondents due to higher yield and better coffee attributes. Farmers could derive a wide array of benefits from shaded systems which can alleviate weighty dependence on a single product, coffee, which may suffer from either production failure or sudden slump in prices in international markets. Moreover, the shaded systems can be viewed as a conservation-oriented cultivation strategy which complies with interest of global organic coffee consumers. The preferred shade tree attributes mentioned and the tree species associated to these attributes (Table 5) were also in contrary to what is observable in the field. The species diversity of common coffee shade trees (n=7) mentioned by the interviewed farmers seemed very few as compared to the previous studies conducted in traditional coffee cultivation in Costa Rica (Albertin and Nair, 2004). In this investigation, farmers gave special emphasis to those shade trees which they mainly retained on their fields/farmlands for their favorable characteristics Most interviewed farmers cited Cordia africana, M.ferruginea, Acacia abyssinica,and Albizia gummifera in that order as the best coffee shade tree species to have in their plots. The dominance of the species in the farm is mainly from the ecological value as like C.african Therefore, farmers should better considering the compatibility of shade tree species with coffee shrubs

Conclusions

A major objective of this study was to gain a better understanding of farmers' preferences on shade trees in their coffee systems and literature-reported attributes that represented researchers' perceptions. Some farmers' on the study sites mainly depend on mining though they do have huge diversity shade trees according to semi structured questionnaire aim of farmer attitude and perception clearly understood based on these characteristics that farmers consider important for shade trees are e, although some differences were noted between farmer preferences and literature reports. The diversity of tree species used as shade for coffee, by farmers of the Peninsula of Nicoya is greater than what found in the majority of coffee plantations of Costa Rica, one of the most modernized coffee-producing countries. Farmers are the source of enormous indigenous knowledge and tackle problem on coffee shade trees. They stated that various efforts have made to ward to conservation and management coffee system in the way they are presented in the scientific view. Therefore, the result of this research work out in new finding is coffee is an important perennial woody trees and income for small holder in order to increase quality of crop and increasing production of coffee there is a need of using shade trees species in study area, their management practices, and inter cropping with legumes crops of may induce microorganisms in organic matter transformation, so far majority of farmers' expressed their interest intercropping annual crops into their coffee system with shade trees should be provide to farmers to enrich their local knowledge and build capacity to better production and management system. Indeed, the shade trees *Cordiaafricana*, *Millettia ferruginea*, and *Acacia abyssinica* and *Albizia gummifera* are recommended for the study area.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper

References

1. Anthony F, Combes MC, Astorga C, Bertrand B, Graziosi G, Lashermes P. The origin of cultivated Arabica L. varities revealed by AFLP and SSR markers. Theor. Appl. Genet. 2002;104:894-900.
2. Beer J. Advantages, disadvantages and desirable characteristics of shade trees for coffee, cacao and tea. Agroforestry System, 1987.
3. Beer J, Muschler R, Kass D, Somarriba E. Shade management in coffee and cacao plantations. Agroforestry Systems. 1998;38:139-164.
4. Biruk Debebe. Remark made on the CBD control workshop. pp. 121-132. Proceedings of the workshop on control of Coffee Berry Disease (CBD) in Ethiopia, 13-15 August 1999, Addis Ababa, Ethiopi, 2000.
5. Cambrony HR. Coffee growing. CTA/ The Macmillan Press LTD., London, 1992.
6. Coste R. Coffee: The plant and the product. The Macmillan Pres Ltd., London and Basing Stoke, 1992.
7. Gole TW, Denich M, Teketay D, Velke PLG. Human impacts on coffee arabica gene pool in Ethiopia and it's in situ conservation. In: Engels J., Ramanatha Rao V., Brown A.D.H., and Jackson M (eds). Managing plant diversity: CAB international Oxon, UK. Pp 237- 247. Gole, T.W., T. Borsch, M. Denich, 2002.
8. Gole TW, Borsch T, Denich M, Teketay D. Floristic composition and environmental factors characterizing coffee forests in southwest Ethiopia. Forest Ecology and Management. 2008;255:2138-2150. http://www.oromiyaa.com/english.
9. Grossman JM, Sheaffer C, Wyse D, Bucciarelli B, Vance C, Graham PH. An assessment of nodulation and nitrogen fixation in inoculated Inga oerstediana, a nitrogen-fixing tree shading organically grown coffee in Chiapas, Mexico. Soil Biology and Biochemistry. 2006;38:769-784.
10. MCTD. Ministry of Coffee and Tea Development (MCTD): National coffee area and results of yield estimate survey. Planting and programming unit, Addis Ababa, Ethiopia, 1985, 468.
11. Meyer FG. Notes on wild Coffea arabica from Southwestern Ethiopia, with some historical considerations. Economic Botany. 1965;19:136–151.
12. Laércio Zambolim. Management of soil borne fungi on coffee. Int. J Res. Agron. 2021;4(1):47-58. DOI: 10.33545/2618060X.2021.v4.i1a.63
13. Muschler RG. Arboles en Cafetales. Modulo de Ensenanza Agroforestal No. 5., Proyecto Agroforestal CATIE/GTZ, CATIE, Turrialba, Costa Rica, 2000.
14. Tesfaye Shimber. Influence of watering frequency, mulching and shading on seedling growth of Araica coffee. M.Sc. Thesis Alemay University of Agriculture, Ethiopia, 1995, 112.
15. Schmitt, Christine B. Montane rainforest with wild Coffea arabica in the Bonga region (SW Ethiopia): plant diversity, wild coffee management and implications for conservation. Ecology and Development Series No. 47. Cuvillier Verlag, Göttingen, 2006.
16. Smith RF. A History of Coffee: Coffee Botany, Biochemistry and Production of Bean and Beverage. Croom Helm, London, New York, Sydney, 1985.
17. Soto-Pinto L, Villalvazo-López V, Jiménez-Ferrer G, RamírezMarcial N, Montoya G, Sinclair FL. The role of local knowledge in determining shade composition of multistrata coffee systems in Chiapas, Mexico. Biodiversity and Conservation. 2007;16:419–436
18. Steiman S. Shade Versus sun Coffee areview, 2003. http:// www.grayskies. net/honey beer/ shade.htm.
19. Workafes Woldetsadik, Kassu Kebede. Coffee production system In Ethiopia. Proceedings of the Workshop on Control of Coffee Berry Disease (CBD) in Ethiopia. Addis Ababa, 13-15 August, 1999, 99-106.
20. Wubet T, Kottke I, Teketay D, Oberwinkler F. Mycorrhizal status of indigenous trees in dry afromontane forests of Ethiopia. Fore. Ecol. Manage. 2003;179:387-399
21. Yacob E, Tesfaye S, Alemseged Y, Taye K, Mohammed Nur A, Anteneh N, *et al*. Advances in coffee agronomy research in Ethiopia. Proceedings of IACO Workshop Kampala, Uganda, 4-6 Sept. 1995. African Crop Science Society, 1996, 40-55
22. Muleta D, Assefa F, Nemomissa S, Granhall U. Socioeconomic Benefits Of Shade Trees In Coffee Production Systems In Bonga And Yayuhurumu Districts, Southwestern Ethiopia: Farmers' Perceptions. Ethiopian Journal of Education and Sciences. 2011;7:39-56.