CROPPING SYSTEM OF COFFEE WITH SPICE IN ETHIOPIA: REVIEW

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Synopsis

The collapse of world coffee prices is contributing to a socio-economic decline affecting an estimate of 125 million people world-wide. In Ethiopia, the fall in farmer and government trevenues amounted to 42% within a year. In the country some of the major coffee growing regions were visited and intensive discussions on coffee production and marketing with farmers, a divisors, traders and researchers were held on. The conclusion was drawn that Ethiopia has the potentials to produce certified organic high quality coffee due to favorable growing conditions and the high diversity of genetic resources in Coffee Arabica. Currently, certified organic coffee production accounts for only an estimate of 0.1% of the total national production. Coffee farmers convert to organic production in expectation of higher revenues. Conversion to organic coffee production may, however, result in a significant decrease of crop productivity. Multi-disciplinary research activities on sustainable organic coffee production systems are expected to boost production and promote high quality coffee. Various agronomic and socio-economic research programmes are highly needed. A key focal point is efficient nutrient management by composting coffee husks/pulps, and green manuring by mixed planting of suitable legumes. Moreover, a systematic screening of cultivars with respect to potential use in organic coffee production is recommended. Aspects of taste and quality of coffee deserve special attention as well. Fair Trade organic coffee impacts on rural development in Ethiopia by providing options to stabilise the market for organic growers. Furthermore, the consumer is provided with a range of new products. That could help alleviate the coffee crises and improve social and environmental stability.

Keyword; coffee, spice and farming system

1. Introduction

1.1 Background

Spices are used for flavour, colour, aroma and preservation of food or beverages (Anon et al. 2010). Spices may be derived from many parts of the plant: bark, buds, flowers, fruits, leaves, rhizomes, roots, seeds, stigmas and styles or the entire plant tops. The term “herb” is used as a subset of spice and refers to plants with aromatic leaves. Spices are often dried and used in a processed but complete state. Another option is to prepare extracts such as essential oils by distilling the raw spice material (wet or dry), or to use solvents to extract oleoresins and other standardized products. There are many texts which provide an overview of the industry in general (Weiss et al. 2009). During 2600 to 1000 B.C spice was used the construction of the great pyramid of Egypt. At that time thousands of labors engaged in this task well fed with onion and garlic to maintain their health. Therefore, the spices bear the antiquity of pyramid Age in Egypt (Shanmugavelu et al., 2010). The term spices and condiments applies to such natural plant or vegetable products or mixtures there for used in whole or ground form mainly for importing flavor, aroma, and pungency to food. They are low volume, high value crops which play a vital role in our national economy and provide strong footing in the international market. Five major spices (ginger, turmeric, challis, black pepper and cardamom corps) together account for about 75-89% of the total annual foreign exchange earnings from spices (Pruth, 2001). Significant number of collections and introductions of high valued spices had been carried out and evaluated under diverse agro ecology of south western Ethiopia where Jimma research center (JRC) had been carrying out its coffee research program. Therefore, in addition to the main center at Melko, evaluation of these in valuable crops of economic importance had been under taken at different sub centers and testing sites of JRC (Tepi, Mugi, Bebeka and Metu). Fruit full improvement works and thus been carried out and considerable achievements had been attained on black pepper and cardamom which are commonly known as the “king of spices” and “Queen of spices, respectively, elsewhere in the world. In addition, several studies had also been conducted and in valuable achievements had been documented on ginger and turmeric. These spice crops have several uses, either including food seasoning, in pharmaceuticals, perfumery, and/or cosmetics, as a whole or somehow processed. On top of these, some of these spices, like turmeric, are widely used in Ethiopia and elsewhere in the world for food coloring (Purthi, et al 1998). Almost all of their spices are commonly used for food and/or beverages flavoring in Ethiopia. However, unlike the others, ginger and turmeric are exported either in their dried forms and/or as oleoresin or essential oils extract, there by fetching some foreign currency to the country (Roukens et al., 2005).
Almost all of these spices crops were thus found well adapted to the hot – humid and low land agro ecologies of south western Ethiopia. On the average, the crops were observed to perform best in area with altitude ranging between 500 and 1500m, annual rainfall of 1200-7000mm and mean temperature of 20-35°C (Pruthi, et al. 1998). Virgin soils or alluvial soils that are rich in humus were also identified to be highly suitable fore the production of black pepper. However, well drained, fertile, and friable soils having sufficient humans, and neutral PH were reported ideal for the growth and production of ginger and turmeric (Uhl, et al, 2000). Likewise, cardamom requires humus- rich forest covered soils that could sustain prolific and luxurious growth of crop plants. Under small scale production, cardamom, black pepper, ginger, and turmeric were found to be intercropped successfully with other horticultural crops like inset, banana, and coffee. These technologies were hence proved well adapted to most parts of south western Ethiopia, where the farming system is commonly characterized with the growth of one or more of these complementary crop species (Boreget; 1998).

The observed highly successful growth and effective integration of the different indigenous and/or exotic high valued spice crops with of Arabica coffee in south western region of the country could be attributed to the prevailing conductive agro ecologic condition of the area of the exotics spices, black pepper, giner, turmeric and cardamom had proved well to fit with the existing coffee based farming system of the area. As this particular area is commonly characterized with mixed and/or multiple cropping system, integration of these crops with in the system had been success full as most of these spices require either shade and/or support for their grow (Edossa, 1998).

Such unique characters and growth requirements make these crops the best candidates in the coffee diversification, there by contribute to the national economy, through export and import substitution. Despite the achievements recorded so far with regard to generation of improved technologies for these crop species. To meet the multiple objectives of poverty reduction, food security, competitiveness and sustainability on small farms, several researchers (Norman, 1978, Byerelee at al, 1982, Shaner at al, 1982, Goldsworthy and de Vries 1994) have suggested the farming systems approach. This approach emphasizes the need to view the farm situation as a whole and considers the stakeholders’ perspective crucial for any development strategy. However, the area covered by forests is decreasing due to population pressure (including new settlements), expansion of crop production and commercial investments (e.g. tea and coffee estates). These practices seriously damage the genetic diversity of flora and fauna living within the ecosystem (genetic erosion) and may threaten sustainability of the production system (Abebaw,2009). Coffee and the spices in the forest zone, coffee and cereals in the transition zone and cereals in the deforested areas dominate the crop production. This review envisaged a movement of the farming systems towards one that is based specie and coffee, a high income generating tree crop that also protects the environment. In the light of constraints and opportunities identified several R and D options were identified and prioritized. Coffee cultivation provides a unique development strategy for Ethiopia in arresting the spate of deforestation and also raising the incomes of farmers (Habtamu, 2010). Therefore the general objective of this work is to review on spices with coffee based farming system in Ethiopia

2. LITERATURE REVIEW
2.1. Spices Production in Ethiopia
In Ethiopia Spice crops are produced in various regions of the country and predominantly by small farms as a cash crop traded primarily in domestic markets, but with increasing success also entering foreign markets. The spice sub-sector has an immense potential for economic development and poverty reduction through creation and expansion of employment opportunities and distribution of income and foreign exchange earnings (Maresha, 2010). However, despite all the potentials and opportunities of having such a long history and variety of them with a diversified conducive agro-ecology base, the spice sub-sector potential remained unexploited. The sub-sector is still not organized, low in productivity, and inefficient. The production of all types of spices, especially the technique employed by smallholders are mainly based on traditional and ancient knowledge that has been inherited and transferred from generations to generations.

Ethiopia is a homeland for many spices, such as korarima (Aframoun Korarima), long pepper, Black cumin, Bishops weed (Nech azmud), and coriander. As a result, the history of spice use in Ethiopia is an ancient one and spices have always been and remain as basic food items in the diet of the Ethiopian people. The cultivation of spice for centuries is predominantly stayed traditional by small scale land holding farmers. Recently the average land covering by spices has been about 222700ha and the production reached 244,000 ton/ annum. Similar to India, the
majority of spices produced in Ethiopia (80%) are absorbed domestically. But at the same time, export of spices is developing and brings increased foreign exchange. In 2009, spice exports reached 15,000 Mts, equaling a value of USD 11 million. The seed spices potentials area are Amhara and Oromia regions while for the low land spices dominantly produced and potential in SNNP and Gambela regions. In general the total potential for the low land spices is estimated to be 200,000 ha (Aipe, 2010). According to CSA, 2005 the House Hold consumption at the national level on average, spices has a 1.79% share of total house hold expenditure with major spice expenditure going to pepper whole and flour, followed by ginger, fenugreek, and then cinnamon, chilies, long pepper and mixed spices. The share of household expenditure for rural Ethiopia was higher at 1.87%, while the share for Urban Ethiopia was 1.46% (Masresha, 2010).

Similar to other developing countries of Africa, the major constraint that facing the spices production sub sector in Ethiopia revolves around those four problems these are; pre-production, during production and processing as well as marketing stages (MOARD, 2010). As plant species spices have a wide possibility of being cultivated in different agro ecological zones of the country. Except pepper, spice cultivation is traditional, no improved seed or planting material and not market oriented. However, there is a limited business activity in production, processing and marketing of spices and spice products. The cultivation practice and technique are highly based on knowledge that passed from generation to generation, and the production level is low. Spices are used as flavoring material, source of essential oil, source of color and cash crop of many smallholders. The cultivation practice in smallholders’ farm is fragmented and planted as mixed crop within their main crop land and rain fed (ACP, 2010).

Ethiopia is the homeland for many spices, for example Korarima, long pepper, black cumin, Bishops weed and coriander. The average land covered by spices is approximately 222,700 ha and the production is 244,000 ton/annu (EIA 2010). More than 50 spices are produced in Ethiopia. The major spices cultivated in Ethiopia are ginger, hot pepper, fenugreek, turmeric, coriander, cummin, cardamom, and black pepper. About 122,700 ha of land are used for spice farming, with spice production reaching 244,000 tons per year. Potential areas for the cultivation of spices are Amhara; Oromiya; Southern Nations, Nationalities, and Peoples; and Gambella regions (EIC 20140). The total potential for low land spice farming is estimated to be 200,000 hectares.

According to another definition, a spice is a dried seed, fruit, root, bark or vegetative substance used in nutritionally insignificant quantities as a food additive for the purpose of flavoring, and sometimes as a preservative by killing or preventing the growth of harmful bacteria. For example, turmeric is also used as a preservative; licorice as a medicine; garlic as a vegetable and nutmeg as a recreational drug (Spice Sector Strategy Coordinating Committee, 2010).

Key actors in the spices value chain in Ethiopia include farmers and collectors in origin, input providers (seeds, fertilizer, packaging, transport), agents/brokers who act as an intermediate between collectors and European clients, traders who operate as principal, taking possession of the product and grinders. For instance, in the Netherlands there are Intertaste, Euroma and Handelsveem still actively grinding (NABC 2014).

Ethiopia is center of origin for several important spices that include Aframomum corrorima (Korarima), Trachyspermumammi (Bishop weed), Coriandrum sativum (coriander), Nigella sativa (Black cumin), Capsicum spp.(pepper), Cuminumcyminum (Cumin), Anethumgraveolens (Fennel, Ensilal), Ocimumbasilicum (BesoBila), Rutachalapensis and Piper longum (Timiz) (Addisu 2014). There are also a number of exotic spices such as ginger, turmeric, black pepper, cinnamon and cardamom that have been introduced and cultivated widely in the country. As many as 50 of the 109 spices listed by International Organization for Standardization (ISO), are produced in Ethiopia (Addisu 2014).

Ethiopia has a long history of spice and herb production for the domestic market and has a unique, indigenous product, Korarima cardamom (Aframomumkorarima). Modest quantities of several spices have been exported for centuries to countries in the Middle East and exports to Europe have developed over the past twenty years (NABC 2014). There are good potentials of the local spice market for household and institutional consumption, growing food processing sectors, beverage factories, soap and detergent factories, cosmetics and spa enterprises and spice retails that open wider room for investment in the sector (Addisu 2014). There is increasing number of buyers/traders/oleoresin extraction companies, pharmaceutical manufacturers, choose to buy spices directly from Ethiopia (NABC 2014).

According to the Ethiopian Investment Commission (2014), the following are priority areas that offer business opportunities with regards to the subsector: Commercial agriculture with opportunities include: Farming of spices.
Several manufacturing industries with backward linkages to herbal plants production also offer opportunities for commercial investment. These include. Pharmaceuticals industry: manufacturing of human and animal medicine, manufacturing of inputs of basic pharmaceutical products. Chemicals and chemical products industry – soap and detergent, Agro processing – processing of spices, processing of crude and edible oil from spices and herbs such as cumin. Manufacturing of food products that use herbal and aromatic products – baby food, tea, yeast, yeast, vinegar, mayonnaise and similar food products.

Studies (Addis 2014 and Beemnet 2014) also indicate the potential uses of herbal and aromatic plants that occur in Ethiopia in the preparation of the following products: Food flavoring and seasoning: they are used in food flavoring sweet meals (biscuits, sandwich and cakes), canning (fishes, meat, sauces and soups), in making chewing gum and confectionary (candies and chocolate). Medicines (anti-oxidant, antiviral, germicidal and stimulant): 90% of the animals and 80% of the human beings are reported to be treated with plant based traditional medicines which indicates existence of a huge local market and business opportunities in commercialization of herbal plants such as Artemisia. Cosmetics: used in the preparation of different cosmetic products such as body cream, hair foods, lotions, lipsticks, dandruff, perfumes and pedicure. Beverages: alcoholic beverage and soft drinks Aromatherapy.

2.1. Important of spice
Spice is abroad term used to describe herbal by products that add flavor and aesthetic, aromatic and the rapeutic treatments to food, drink and other items. Taken from the leaf, flower, root, bark or nuts of plant spices are usually dried and grouped to be mixed with other ingredients. spice appeal to the five senses and influence culture and societies though trade and daily use. Spice as flavoring material, the acceptance of food (Masresha, 2010). The other fact is that, it does not matter how good food is too look at or ho balanced it may be from nutritional point of view, if it does not smell and test good then there reflex senses are not stimulated and eating remains a mere choose father than a real pressure for this reason it is necessary to improve the favorer of the main groups of our staple food items. Source of essential oils get application in many products, as substitutes of the original plants material from which are dried. All automate plants have essential oils but all sources of sectional oils are not spices (MOARD, 2010).

Colors spices are dye extracted from space materials important colors and improve the appearance of the product, thus as coloring material species are widely used in food, cosmetics pharmaceutical, textile industries and other Spices and spices based essential oils and oleoleln in addition to their uses as flavoring agent, are used from medicinal purposes for they have preservative stimulating, curative as well tonic effect and antimicrobial properties. Spices bused coessential oils; oleoresin and alkaloids have curative carminative and aphorizing properties and thus are increasingly being used in current pharmacy cubical formulae (ACP, 2010). Source of cash income and employment, spice and spice products are highly essential. It is the nature of spice and spice products that they we labor intensive from cultivation up until utilization, small in bulk easy and cheap for transportation, but have higher unit aloes. Thus it developed, the production, processing and metehandlizing of these numerous and valuable crops can generate considerable job opportunity for the people whilst fetching seize able foreign currency for the nation (K.G shamugvelu et.al. 2010). Spices play an important role in the nutrition of our daily diet. Scientists have done a lot of research on this and have found out that spices contain more antioxidants that fruits and vegetables. The spices contain more oxidant whish they are raw. Halte tea spoon of spices will contribute more amounts of antioxidants then halt of a cup of fruit. Spice pay an active role by acting as medicines cloves, oregano, all spices enamor, sage, pepper mint, thyme and lemon balm are some of the spices. These spice any he a significant dietary source (Shan et al, 2010).

2.2. COFFEE PRODUCTION CONCEPTS
A markets emerging, many coffee-dependent developing countries such as Ethiopia are struggling with production and marketing of their coffee. In the early 2000s, a historic world market price slump hit millions of coffee farmers hard, especially smallholder producers in Africa and Latin America (Ponte, 2002) as cited inIAAE,2012. Therefore, the Ethiopian farmers at the time were take a measure to resist the market price fall by reducing coffee plantation replacing chate plantation in place of coffee. Settled agriculture began in Ethiopia some 2000 years ago, and as long as anyone can remember Coffee Arabica has been grown in the wild forests of the south-western massive highlands in the district of Kaffa. Coffees said to have taken the name of Kaffa, the region where it first discovered. Export began to Yemen, and was from there introduced to Indonesia, India, The Netherlands, Colombia and Brazil. Coffee in Ethiopia is not only an important export good but it is a part of the
culture; about 50% of the produced coffee is consumed domestically and there is even a cultural ceremony connected to it. Total production of washed and unwashed coffee is increasing (ToraBäckman, 2009).

According to (USAID, 2010) Coffee production systems in Ethiopia generally categorized into four areas i.e. forest coffee, semi-forest coffee, garden coffee, and plantation coffee. Forest coffee is a wild coffee grown under the shade of natural forest trees and it does not have a defined owner. Semi-forest coffee farming is a system where farmers thin and select forest trees to let sufficient sunlight to the coffee trees and to provide adequate shade. A farmer who prunes and weeds the forest area once a year claims to be the owner of the semi forest coffee. Garden coffee normally found in the vicinity (near) of a farmer’s residence. It normally fertilized with organic material and usually inter-cropped with other crops. The government or private investors for export purposes plant Plantation coffee. Fertilizers and herbicides usually used in the coffee plantation farming system.

2.3. STATUS OF ORGANIC COFFEE PRODUCTION ETHIOPIA

The global production capacity of the organic coffee for export is estimated at 12,000 tones and 30,000 tones for the years 2000/2001, respectively (ICO, data base). Roughly, 50% world supply of organic coffee is produced by small farmers’ organizations which are members and non members of FLO-International (Fair Trade Labeling Organization). Brazil, Vietnam, Colombia, Cote d’Ivoire, and Mexico were the five major producing countries for organic Robusta coffee in 1999/2000, whereas Germany, Sweden, the Netherlands and Denmark were the major importing countries in year 2000 (Kilcher et al., 2002). The sales potential for organic coffee represents only a small fraction: globally about 0.5% of all coffee produced is sold as organic, thus, it is regarded as only niche market or cause coffee (ICO, data base).

As far as Ethiopian Arabica coffee is concerned, more than 90% of the coffee produced was accepted to be de facto organic, albeit a certification of small-scale co-operative organic coffee farmers by a small company (BCS* OKÖ-GARANTIE GMBH, GERMANY) exists since 1999. Small-scale farmers owning less than one ha of coffee trees first formed co-operative which was supported by USDA with close collaboration of a local bank (Bank of Abyssinia) to provide initial credits for inputs. Under the umbrella of those co-operative unions some of the farmers converted to be pioneer members of certified organic producers. Yet, the Oromia (OCFCU), Sidama (SCFCU) and Yirga Chefe (YCFCU) Coffee Farmers Co-operative Unions are the major producers and suppliers of certified organic Arabica coffee, which accounts for only less than 0.1 % of the total coffee production in the country. According to existing scattered information compiled from organic farmers cooperative unions, the number of farmers, the size of coffee plantations and estimated amount of annual green coffee yield for each co-operative farmer are compared in figures 2 and 3. About 60 to 70% of the production is supplied as washed coffee, and the rest as sun-dried coffee. Generally, the trend shows that the share of certified organic coffee export is very
Fig.1: The current status of farm size, affiliated farmer numbers and an estimated percentage of certified organic Arabica coffee production by the Oromia (OCFCU), Sidama (SCFCU) and Yirga Chefe (YCFCU) Coffee Farmers Co-operative Union’s in Ethiopia.

low, as compared to the existing immense potentials that the nation endowed with to meet the global needs of consumer’s. But almost everywhere, whereby conventional farmers were interviewed for their future farm strategy replied that they would prefer to convert certified organic coffee production, provided that reliable market situation and effective technology stabilizing the coffee yield and quality are well promoted.

2.4. Crop management
2.4.1. Land preparation
Location of a plantation site and the method of land preparation play critical roles in production and productivity of ginger and turmeric (Girma et al 1998). Little bit slant orientation of land to avoid water planting the turmeric rhizome ginger and cardamom the land should be free of any obstacle rolls stone etc). that could hamper the horizontal growth of the rhizome the soil should be very fine and workable free of marshy condition studies on identification of suitable land preparation methods were made and out of different land preparation methods raised bed preparation was first that gave maximum fresh rhizome yield 3335.5 q/ha Girma et al 1998).

Water logged stony and marshy areas are not suitable for the production of ginger and/or turmeric the effects different land preparation methods on rhizome yield of gofer ant turmeric had also been evaluated under bea tea condition therefore ginger planting on felt land had given the light yield as complied to the use of ridges and/or raised beds (Zenebe 1991). However fresh rhizome yield of turmeric was highly enhanced due to planting on raised beds (335.54 q/ha) under tepi condition (Edossa 1998b) black pepper thieves best on virgin soil which is rich in humus naturally, we drained red paretic soils or alluvial soils rich in humus are highly suitable (Borget 1993; purse glove et al., 1981 and pruthis 1998). From long period observation, results indicated that soils of the forest areas in south western parts of the country particularly coffee soils of Tepi and Bebeka are suitable for pepper, uremic ginger production.

2.4.2. Spacing of plants
From the preliminary observations made at Hebeke the ideal spacing for cardamom was found table either 2.5*2.5m or 3*3*m at the early stage at growth (IAR 1985b) on the other hand a general increase in ginger rhizome yield was observed with the reeducation of spacing between rows and plants accordingly 20cm between rows and 15cm between plants gave the highest yield (IAR 1995) how ever from practical observations. This spacing had some side effects as the rhizomes interning led and become very problematic for producing standard size rhizome and thus
30 cm * 15 cm spacing is recommended for the highest yield (305.93 q/ha) in turmeric. It was also obtained from the closely spaced plants (15*30 cm) (Zenebe et al., 1996) over the seed rate reared for hectare of land. Ranges between 1.7 and 2.5 that for both turmeric and black pepper which is approximately equivalent to 10-13 gram of each seed rhizome. (Girma unpublished, 2005) on the other hand loge rhizome pieces were proved to give higher yields that the smaller ones (IAR, 1997b). Likewise in turmoil whole mother rhizomes gave the best yield un like the cut mother rhizome that yielded the least (Dossall, 1998).

2.4.3. Support and shade management

Being a climber plant of the wet tropics, black pepper requires either living or non living shading Purzeglove et al., 1981; Borget, 1993: Ruth, 1998). Therefore, based on the evaluation at Teppi research sub centre, erythrina indica was proved the most effective support and shade tree for black pepper under more intensive management (Edossa, 1998b). However, long experiences from India as well as practical observations from the research at Tepi and Bebeke, and Tepi coffee plantation sites had revealed gravelier Robusta, as the best live support and five live trees including avocado, jackfruit, clythrina, militia and macadamia nut and dead log were evaluated and Eritrean was selected and recommended from its performance. On the other hand both cardamom and korari are shade loving plants, thus, as their original habitat is the tropical rain forest regions of the equator, provision of ideal shade level is critical for production and productivity. Based on the study conducted at JRC, 55 to 63% shade levels were the most ideal for production of both crop species under Tepi, Bekeba, and Jimma conditions. Among others, the most common coffee shade tree species including albezzia Spp, militia Spp, and gravelier Spp could also be used for provision of shade to card anor and korarima. To this end inter cropping of cardamom with coffee had been successful, while its integration with "inset" yield institute of agricultural research. Despite the significant potential of coffee agro-forests in biodiversity conservation, homogenization of coffee production standards, cooperative small growers, introduced species, population pressure and improved coffee cultivars that thrive under light conditions are ongoing biodiversity challenges in coffee landscapes (Tadesse, 2013). Growing demands for more land and coffee yield could increase transitions from shaded to un shaded, and from wild and semi-wild to garden coffee and plantations. Introduction of exotic shade and non-shade species, and subsequent biotic homogenization has already increased during the last 30 years. For economic reasons, many farmers are preferring fast growing, introduced Eucalyptus, which is replacing native tree species. Extension programs in the region have also been promoting fast-growing exotic agro-forestry tree species such as Grevillea robusta, Spathodea campanulata, Eucalyptus spp., and Sesbania sesban (Tadesse, 2013) as coffee shade, wind breaks, fuel wood and timber. The farmer preference and growth of fast growing and introduced Eucalyptus plantations for economic reasons is replacing native agro-forestry tree species (Jenbere et al., 2012). Current trends toward coffee intensification by reducing shade tree density and diversity threaten biodiversity on farm and in natural forest, as has been reported in several other coffee growing regions (Hundera et al., 2013b).

This could be attributed to the optional shade level that the coffee plant give to the cardamom as compared to the heavy shades that were provided by the other two crop species. Intercropping of ginger with coffee was found effective under the Tepi and Allow environments (Zenebe, 1991). Likewise no significant yield reduction was recorded nom the absence of any negative effect on rhizome yield from the growth of turmeric under modelers shade levels (LAR, 1997b).

2.4.4. Spice inter cropping with coffee

Three CBD resistant coffee cultivars (7440, 74110 and 74112) were intercropped with two ginger lines (Gine, 37/79) and local turmeric type at tepi research center result of this trial show that there was no significant differences between sole and intercropped coffee plots. Through the later exhibited inferior yield performance as compared to the former similarly mean yield difference, between the coffee cultivars was not significant. However, the intermediate type (7440) gave higher yield than did the compact coffeees (74112 and 74110) in both sole and intercropped plots (table 2). This confirms the high suitability of the laro land Teppi area for coffee lines like the former one (IAR, 1995).

On the other hand, main yields of both coffee and spices were significantly higher for sole stands than for the intercropped plots. However, turmeric yield was higher for intercropped than for the sole plots only in the early years. Mean yield of species intercropped with coffee significantly decreased with increase population density and age of coffee significantly decreased with increase population density and age of coffee tree (TRC, 1998). This is probably because of the gradually increasing shade level by the upper strata coffee canopies and thus reduced light interruption by spice plants under neath during the letter years of production. The land equivalent ration also
depicted the yield advantage of growing coffee and spice together, suggesting their complementarities to utilize efficiently the available resources and their beneficial effects on each other. However, LER value less than one were obtained for ginger and coffee cultivar 74112 at the early crop year (1992/93) and for ginger and cultivar 7440 during the later years of production. In other worlds, higher relative yield was achieved where ginger and turmeric were intercropped with compact coffee types than with intermediate cultivar indicating the more suitability of the former coffee type for intercropping (Taye et al., 2001). The average values of LER were higher for coffee than spices. The total LER was greater during the first two cropping year and tended to decline then after indicating that intercropping coffee and spices is more advantages at early stages. Apart from this higher gross field benefit or income was obtained sole plot than intercropped stands of all the crop types.
Table 1. List of recommended spices and relevant agronomic information

<table>
<thead>
<tr>
<th>List of Spices</th>
<th>Propagation Method</th>
<th>Recommended planting and/ or nursery preparation time</th>
<th>Harvesting time</th>
<th>Spacing</th>
<th>Special requirements (shade/ support)</th>
<th>Commercial product</th>
<th>Yield (t/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black pepper</td>
<td>Cutting</td>
<td>Cutting: March Planting June- July</td>
<td>February - March</td>
<td>2.4mX15cm</td>
<td>Support</td>
<td>Fruits/ berries</td>
<td>1.97-2.85(</td>
</tr>
<tr>
<td>Ginger</td>
<td>Rhizomes</td>
<td>Planting: March – Mid April</td>
<td>December-January</td>
<td>30cmX15cm</td>
<td>Open sun</td>
<td>Rhizomes</td>
<td>15-24.1 (fresh)</td>
</tr>
<tr>
<td>Cardamom</td>
<td>Seed</td>
<td>Nursery preparation; Nov-Dec Planting; June – July</td>
<td>November December</td>
<td>3mX3m, or 2.5mX2.5m</td>
<td>Shade</td>
<td>Capsules</td>
<td>0.14-0.18(Dry)</td>
</tr>
<tr>
<td>Turmeric</td>
<td>Rhizomes</td>
<td>Planting March – Mid April</td>
<td>December-January</td>
<td>30cmX15cm</td>
<td>Open sun to partial interop shade</td>
<td>Rhizomes</td>
<td>20-25 (Fresh)</td>
</tr>
</tbody>
</table>

**Source:** Edossa, 1998b
Table 2: Clean coffee yield and fresh rhizome yield of spcie (QT ha) as influenced by intercropping at Teppi Research center (1992/93-1997/98)

<table>
<thead>
<tr>
<th>Coffee cultivar</th>
<th>Sole</th>
<th>Inter cropped</th>
<th>Mean</th>
<th>Spices</th>
<th>Sole</th>
<th>Inter cropped</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>74112</td>
<td>10.55</td>
<td>9.77</td>
<td>10.16</td>
<td>Gin,37/79</td>
<td>83.35</td>
<td>22.17</td>
<td>55.26</td>
</tr>
<tr>
<td>74110</td>
<td>10.40</td>
<td>8.28</td>
<td>9.34</td>
<td>Turmeric</td>
<td>220.00</td>
<td>161.27</td>
<td>190.63</td>
</tr>
<tr>
<td>7440</td>
<td>16.48</td>
<td>15.00</td>
<td>15.74</td>
<td>Gin,40/79</td>
<td>113.70</td>
<td>23.68</td>
<td>68.69</td>
</tr>
<tr>
<td>Mean</td>
<td>12.47</td>
<td>11.02</td>
<td></td>
<td></td>
<td></td>
<td>69.04</td>
<td></td>
</tr>
</tbody>
</table>

Figures followed by the same letter with in arrow are not significantly different at p=0.05

Table 3: Estimated gross field benefit (Eth, Birr ha⁻¹) from coffee and spices over three consecutive crop years (1995/96-1997/98).

<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Sole</td>
<td>Intercrop</td>
<td>Mean</td>
</tr>
<tr>
<td>Coffee</td>
<td>1947</td>
<td>8665</td>
<td>9206</td>
</tr>
<tr>
<td>Turmeric</td>
<td>6659</td>
<td>3609</td>
<td>5084</td>
</tr>
<tr>
<td>Ginger</td>
<td>12394</td>
<td>1933</td>
<td>7164</td>
</tr>
<tr>
<td>Total</td>
<td>28800</td>
<td>14107</td>
<td>21454</td>
</tr>
</tbody>
</table>

The money field prices of dry coffee for the respective crop years were 225,475 and 591 birr. And the, money field prices of processed turmeric and fresh ginger yields were 150,100 and 200 birr and 100,75 and 50 birr during the 1996,1997 and 1998 crop years, respectively.

2.5. Farming systems of coffee and specie

Coffee and spices occur naturally in the forests. Farmers collect coffee and spices from household forest plots for consumption and sale. The coffee and spices are hardly maintained. Consequently, yields are very low and of poor quality. Few farmers are planting coffee seedlings in their own plots on the fringes of forest. Coffee holds the potential to turn the fortunes of farmers in this zone having rich forest soils and favorable climatic conditions to develop coffee and tea plantations. Bee-keeping and livestock rearing are integral part of this farming system (Goldsworthy et al. 1994).

In essence, coffee and the spices in the forest zone, the deforested areas dominate crop production. Farmers gather different spices such as 'korarima’ timiz’ and coffee from the natural forest. However, nowadays, farmers exchange their indigenous knowledge and at present their livelihood much depends on small holding mixed cropping based on a range of food and cash crops (Norman, 1978). The high value cash crops such as coffee and spices are highly suitable for local agro-ecological conditions and would be beneficial for sustainable natural resource management (NRM) and income enhancement. However, little efforts have been made to encourage the above crops in the area.

3. Conclusion

Agriculture is the back bone for Ethiopians, it’s contributing 95 % of gross domestic product, from this the production spice and coffee are the major one. Coffee and spices occur naturally in the forests. Farmers collect coffee and spices from household forest plots for consumption and sale. The coffee and spices are hardly maintained. Consequently, yields are very low and of poor quality. Few farmers are planting coffee seedlings in their own plots on the fringes of forest. The production status of this intercrop with coffee with spice is the major agronomic practice in Ethiopia. On the other hand some part of Ethiopian country framers of produce as solo crop. Coffee and the spices in found in the zone the forest, the deforested areas dominate crop production. Farmers gather different spices such as korarima, timiz and coffee from the natural forest. The sales potential for organic coffee represents only a small fraction: globally about 0.5% of all coffee produced is sold as organic, thus, it is regarded as only niche market or cause coffee. As far as Ethiopian Arabica coffee is concerned, more than 90% of the coffee produced was accepted to be organic. The prevalence of suitable climatic condition for the production of these in valuable spices in the country is the other opportunity to be further exploited by the small holder farmers and private investors, the varieties of these spices crops that are currently available at hand had proved comparable in yield and/or quality. Main yields of both coffee and spices were significantly higher for sole stands than for the
intercropped plots. However, turmeric yield was higher for intercropped than for the sole plots only in the early years and mean yield of species intercropped with coffee significantly decreased with increase population density and age of coffee tree. This is probably because of the gradually increasing shade level by the upper strata coffee canopies and thus reduced light interruption by spice plants under neath during the latter years of production. The land equivalent ration also depicted the yield advantage of growing coffee and spice together. Intercropping coffee and spices is more advantageous at early stages. Apart from this higher gross field benefit or income was obtained sole plot than intercropped stands of all the crop types. However, nowadays, farmers exchange their indigenous knowledge and at present their livelihood much depends on small holding mixed cropping based on a range of food and cash crops.

4. Future line of work

Very conducive environmental condition and promising varieties of black pepper, ginger, turmeric and cardamom had been identified and relapsed for the south western parts of Ethiopia and beyond, where similar agro ecological conditions prevail, the recent preliminary successes of in vitro protocol optimization for large-scale colonial propagation of some of these spices these spice crops like cardamom, vanilla and black pepper could resolve the outstanding crucial problem of clean planting material supply. Moreover, as the government is giving due attention for the development of these crop species, the research system is also gaining strong attention. Those with the current special support giving to strengthen the program, the problem of technical staff will be resolved, thereby creating a possibility to address the area that still require research attention. Consequently, with popularization of existing improved technologies together with their further generation, there is a high chance for the production of quality products that could enable the country compete in the world market. Finally all the desired success could be attained through devising ways and means for employing effective technology shopping to shorten the time span required to generate some of these technologies.

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