

# Crops and Agro-ecological Zones of Ethiopia

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## Outline

1. A brief introduction
2. Crops and use of external inputs
3. Major crops grown in different zones
4. Agro-ecological zones of Ethiopia
5. Where to get information?
6. Conclusions

# 1. INTRODUCTION

- The assignment.....
- Crop information (enormous)
- Agro-ecological information  
(fragmented in nature)
- No synthesis was done to-date
- Thus, it seems a good opportunity

## Major crops grown:

- Cereals
- Pulses
- Oilseeds
- Vegetables
- Root and tubers
- Fruits
- Fibers
- Stimulants, and
- Sugarcane

- Grains are most widely grown
- 16.5 Millions of hectares
- 86% of the land
- Agro-ecological zonation (different ways)
- Traditional (6 zones)
- Elaborated zones (33 in number)
- There is high crop overlaps (not specific)
- Major external inputs (fertilizers, pesticides, other chemicals, etc)
- High and Low external input uses
- The paper (5 sections)

## 2. USE OF EXTERNAL INPUTS IN CROP PRODUCTION

- **Inorganic fertilizers** (DAP and Urea),
- **Chemical pesticides** (insecticides, herbicides, fungicides, etc),
- **Other chemicals** (defoliants, hormones, etc)
- **Importance rating** (1-3 scale) [Table 1.doc](#)
- **Use of external inputs** [Crops1.doc](#)

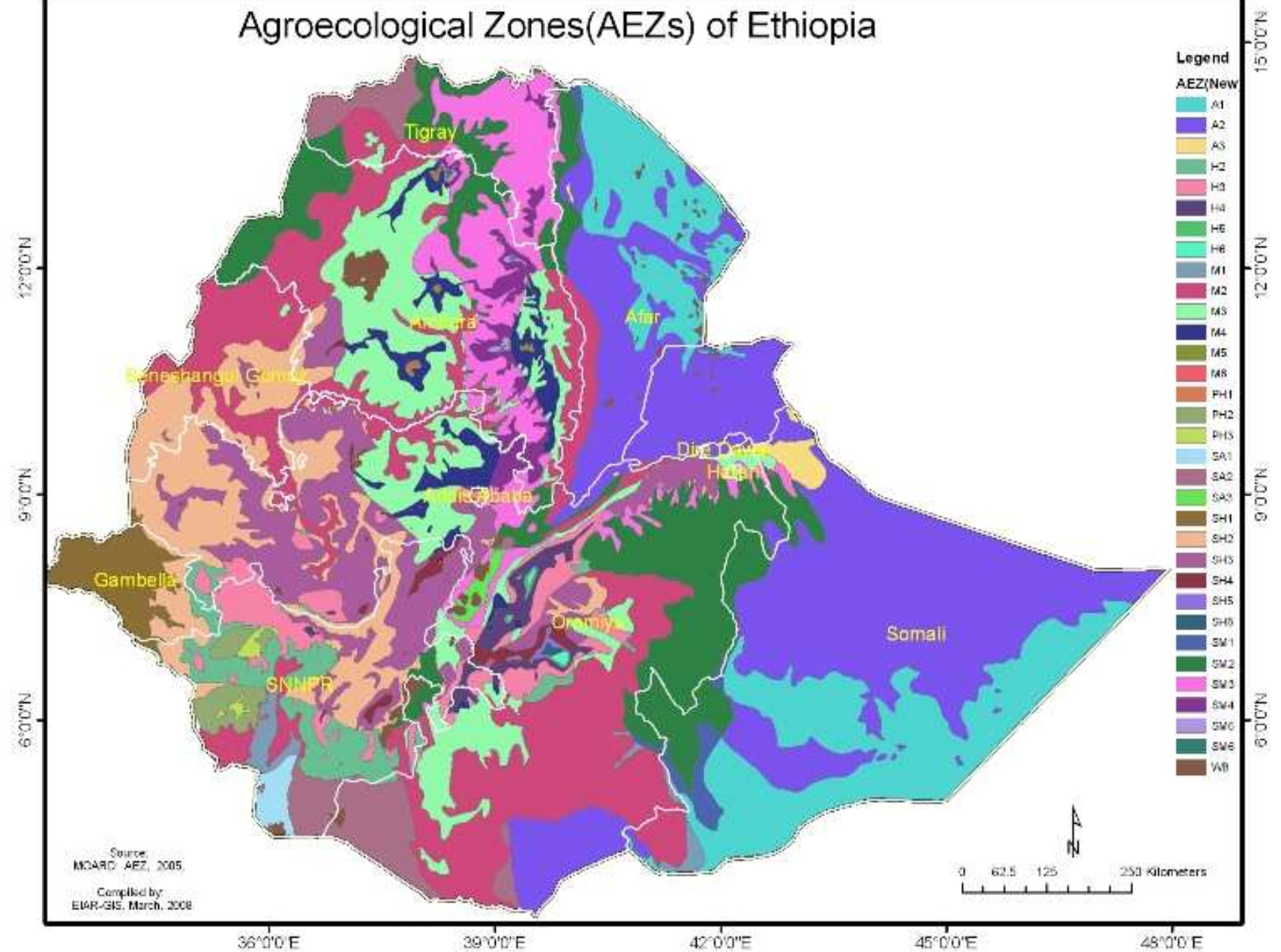


**3. MAJOR CROPS GROWN IN  
DIFFERENT AREAS [CROPS2.DOC](#)**

# **4. AGRO-ECOLOGICAL ZONES OF ETHIOPIA**

36°0'0"E 39°0'0"E 42°0'0"E 45°0'0"E

# Agroecological Zones(AEZs) of Ethiopia



Source: NCARD, AEZ, 2005.  
Compiled by: EIAR-GIS, March, 2008

0 62.5 125 250 Kilometers

36°0'0"E 39°0'0"E 42°0'0"E 45°0'0"E 48°0'0"E

## Traditional zone:

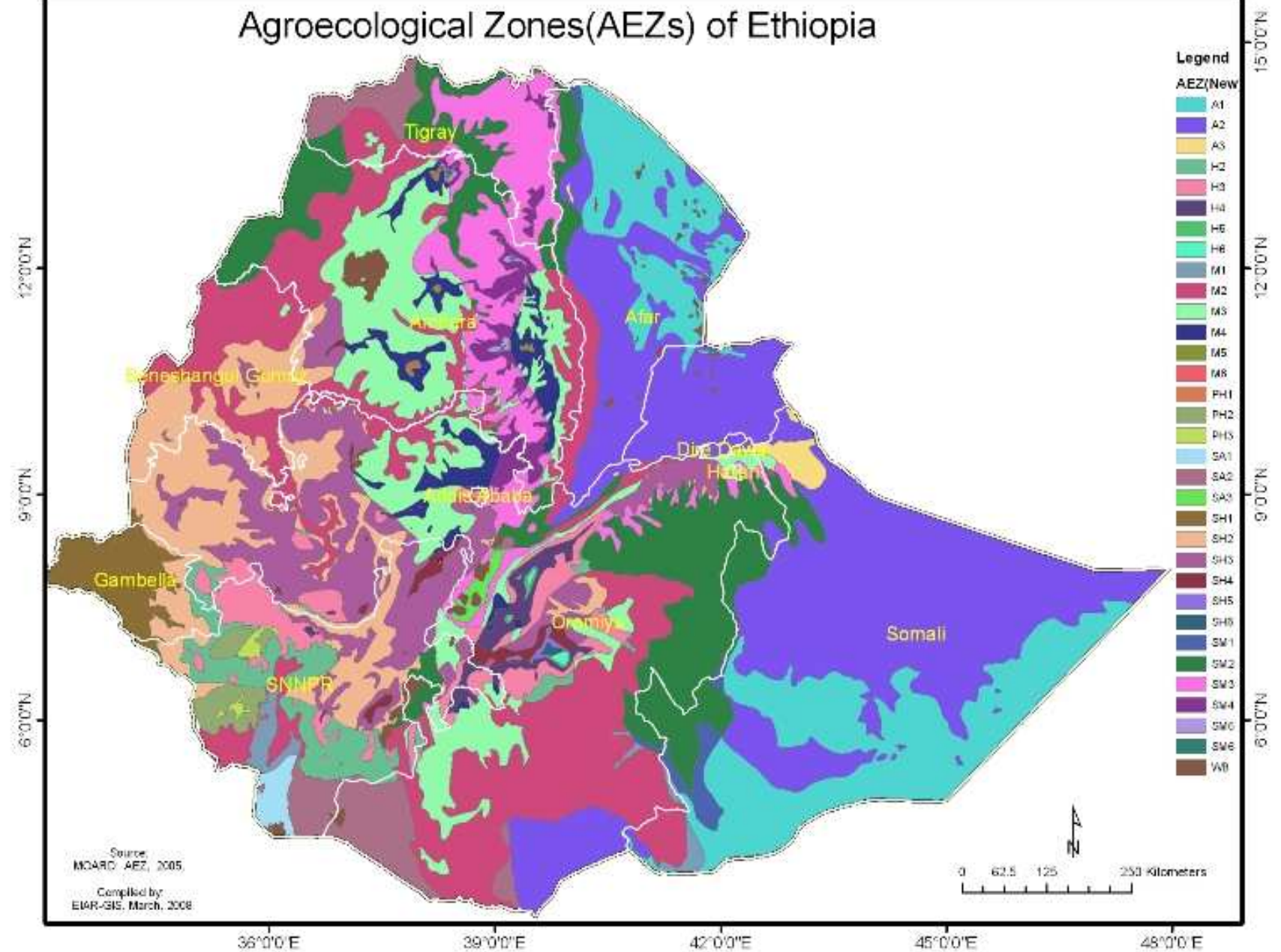
1. **Bereha** (hot lowlands, <500 meters, In the arid east, crop production is very limited , in the humid west root crops and maize are largely grown)
2. **Kolla** (lowlands, 500 - 1,500, sorghum, finger millet, sesame, cowpeas, groundnuts)
3. **Woina Dega** (midlands, 1,500 - 2,300, wheat, teff, barley, maize, sorghum, chickpeas , haricot beans)
4. **Dega** (highlands, 2,300 - 3,200, barley, wheat, highland oilseeds, highland pulses)
5. **Wurch** (highlands, 3,200 - 3,700, barley is common)
6. **Kur** (highland, >3,700, primarily for grazing).

## The Elaborated AEZs:

1. Temperature
2. Elevation
3. Length of growing period

36°0'0"E 39°0'0"E 42°0'0"E 45°0'0"E

# Agroecological Zones(AEZs) of Ethiopia



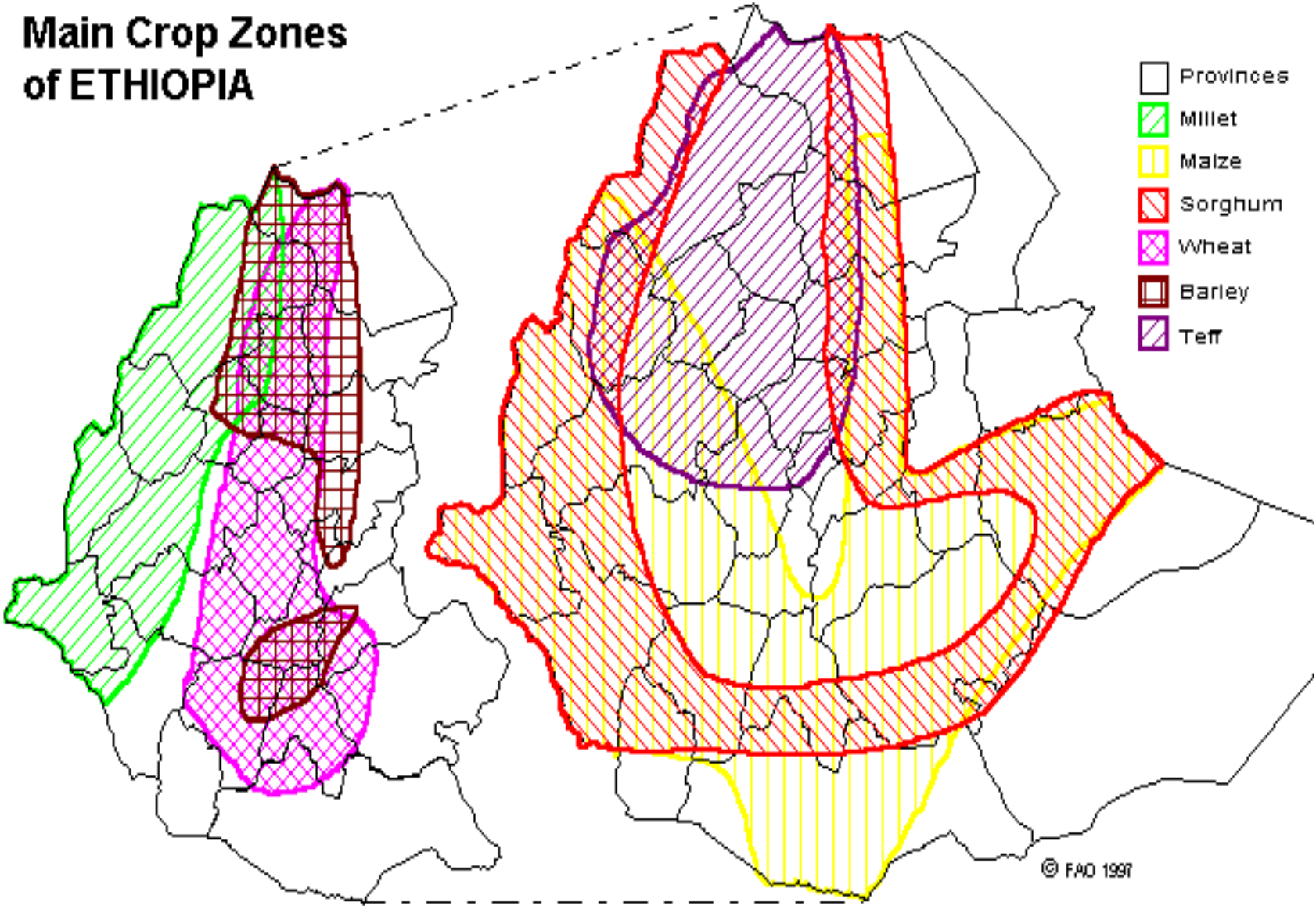
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Compiled by: EIAR-GIS, March, 2008

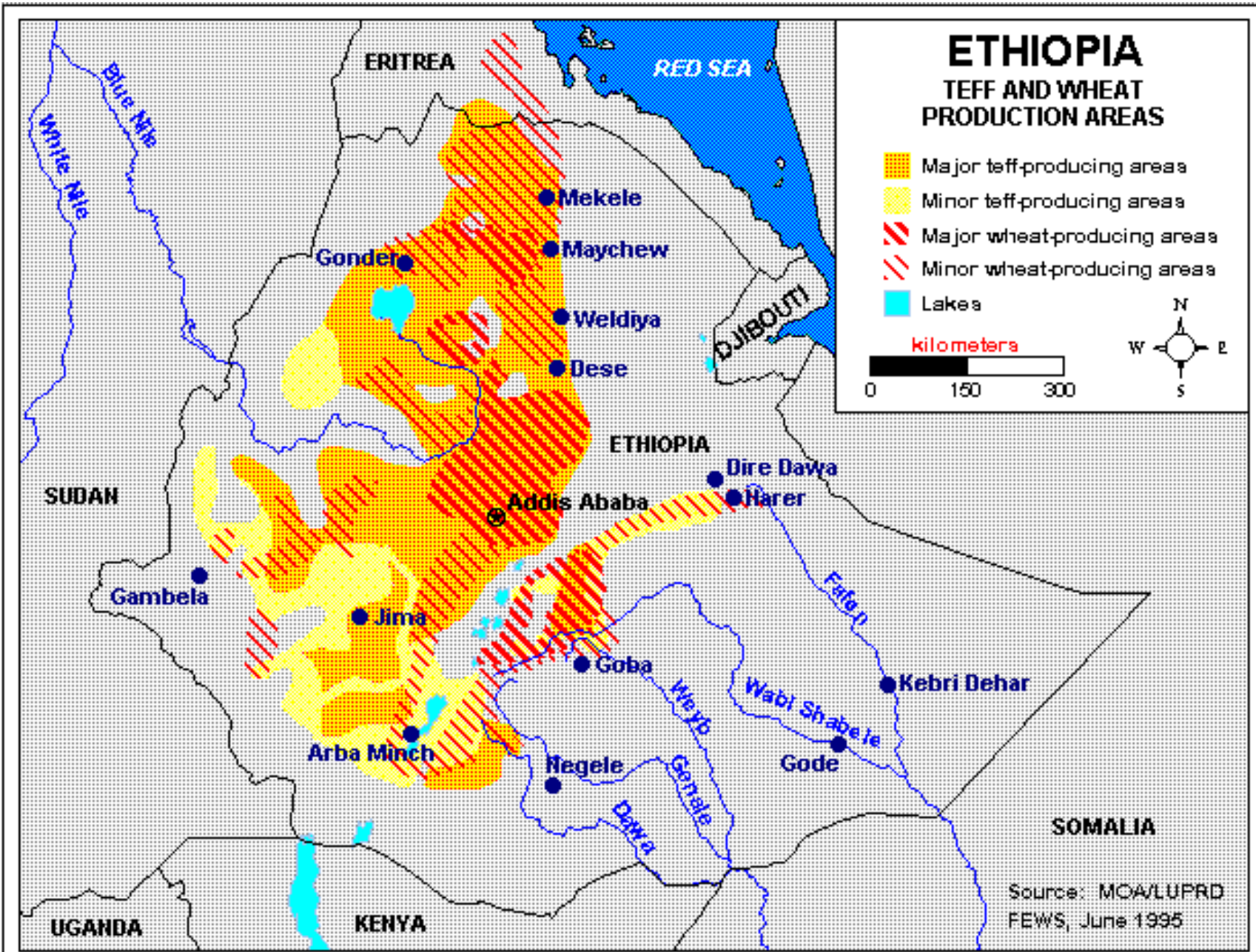
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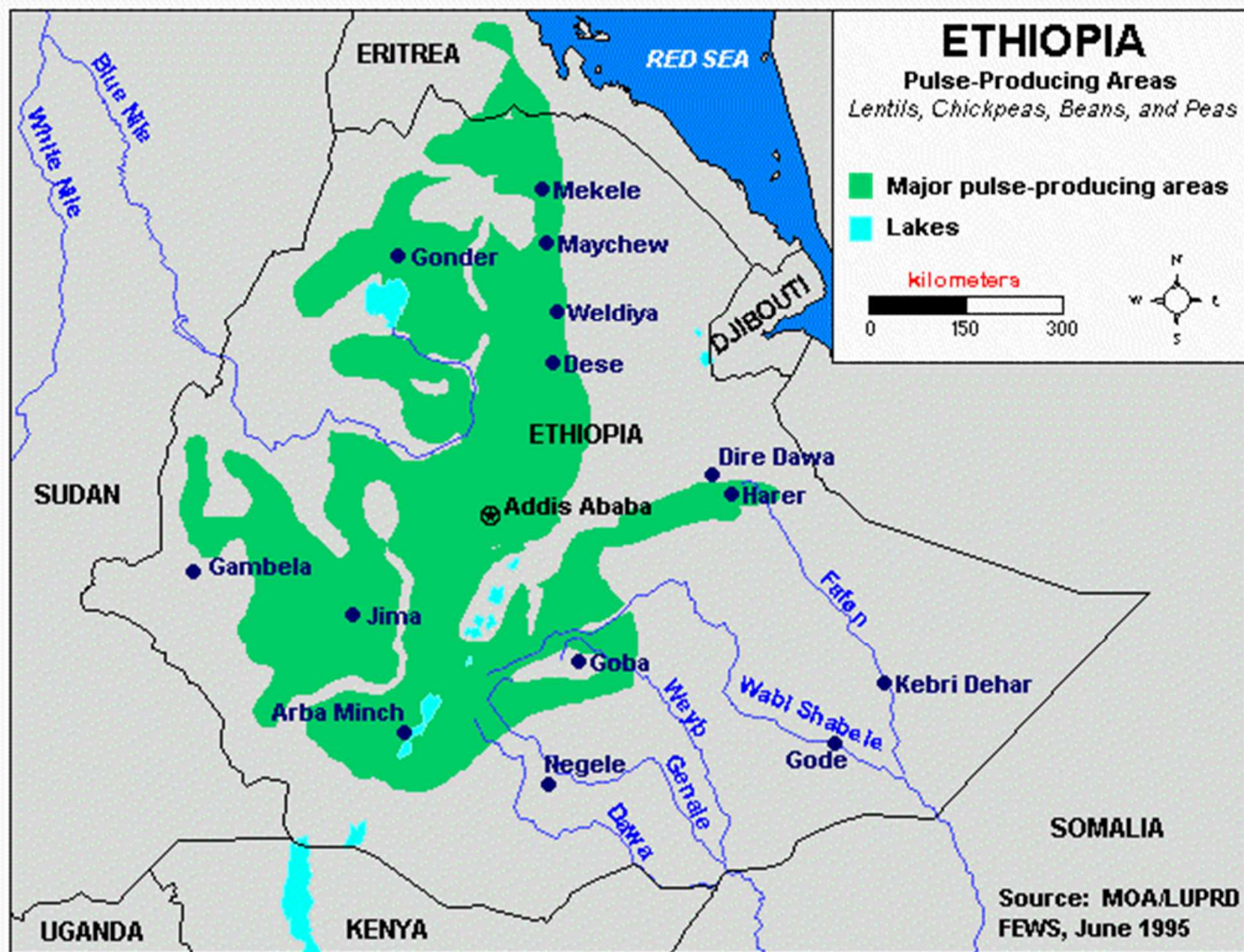


# Main Crop Zones of ETHIOPIA







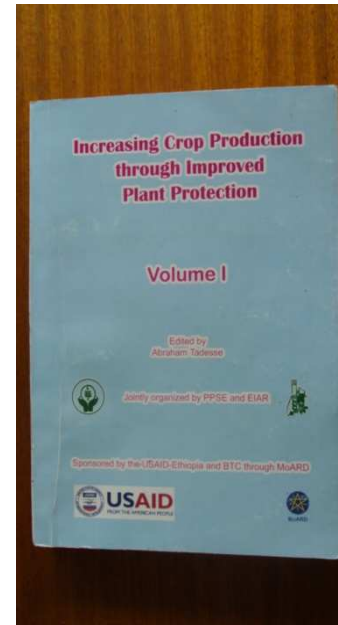
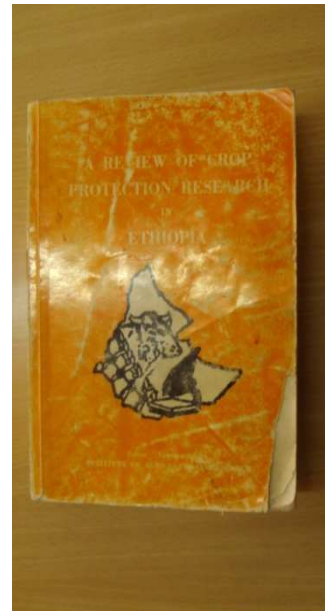
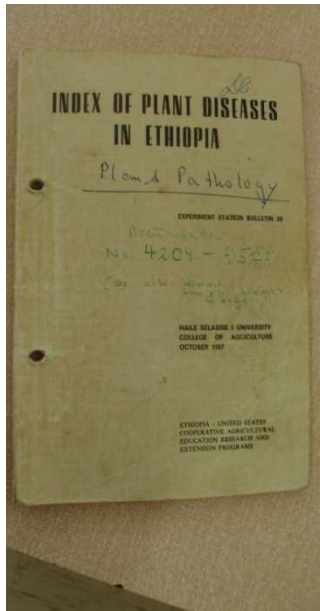


# Agro-ecological coverage:

- Hectares covered [Table 2.doc](#)

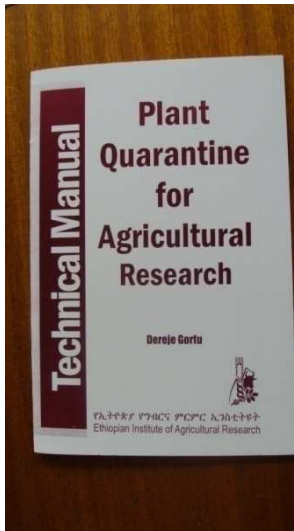
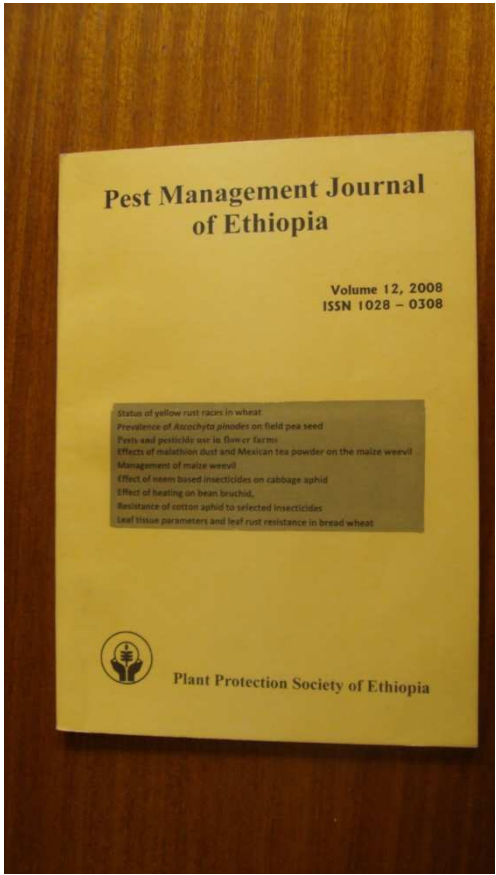
# Information:

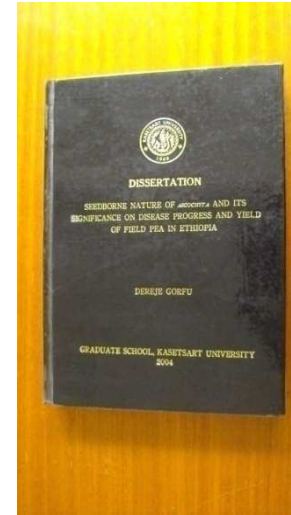
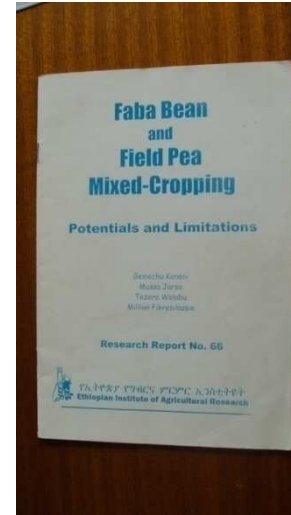
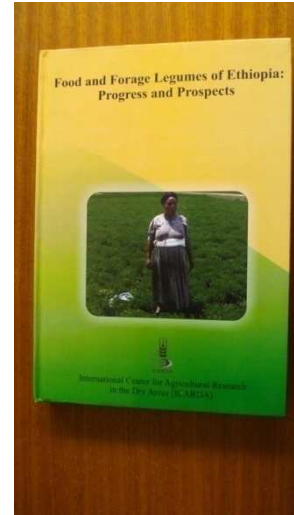
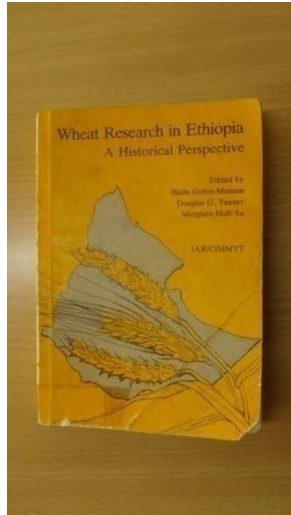
- Centers [Table 3.doc](#)
- References



Primary resources







## **5. CONCLUSIONS**

1. Many crops are grown in Ethiopia , 16.5 million hectares of land, grains occupying about 86% percent
2. Six traditional or 33 elaborated agro-ecological zones exist in Ethiopia
3. Different and the same crops grow in these agro-ecologies (not specific)
4. Crops can be grouped into high and low external inputs
5. Information on agro-ecological distribution of crops is important in controlling and regulating the distribution of external inputs
6. Information sources (references and centers)



Thank you !

# **CROPS AND AGRO-ECOLOGICAL ZONES OF ETHIOPIA**

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## **1. INTRODUCTION**

A large number of crops are grown in Ethiopia that include cereals (teff, wheat, barley, corn, sorghum and millet); pulses (faba bean, chickpea, haricot bean, field pea, lentil, soybean, and vetch); oilseeds (linseed, noug, gomenzer, sesame, and groundnuts), vegetables (pepper, onion, tomato, carrot, cabbage, and kale), root and tubers (potato, enset, sweet-potatoes, beets, yams); fruits (apple, peach, plum, grape, banana, citrus, papaya, pineapple, mango and avocado); fibers (cotton and sisal); stimulants (coffee, tea, chat and tobacco) and sugarcane (EIAR, 2007; 2011). About 16.5 million hectares of land is devoted to the cultivation of these crops in different agro-ecologies of the country (IFPRI, 2006). Among all crops, grains are the most important field crops occupying about 86% percent of the area planted (USAID, 2009).

Agro-ecological zonation is done in different ways in different countries. In Ethiopia, two classifications are known that include the traditional agroecological zones and the elaborated agro-ecological zones developed by MOA and EIAR. The traditional zones include Bereha, Kolla, Woina Dega, Dega, Wurch and Kur where many kinds of crops are grown in each of these ecological zones. On the other hand, 33 elaborated agro-ecological zones are recognized by many institutions at present where many kinds of crops are also grown in each zone. In these agro-ecological zones, major external inputs (fertilizers, pesticides and others) are used in crop production that have implications for input distribution and pest management.

This paper attempts to organize the information available on crop production and agroecological zone of the country in the form of a decision tool for regulating pesticide distribution in Ethiopia. It's organized in sections that include introduction, use of external inputs in crop production, major crops grown, agro-ecological zones in Ethiopia, and implications for crop and pest management and finally outline some conclusions.

## **2. USE OF EXTERNAL INPUTS IN CROP PRODUCTION**

Major external inputs used for crop production include inorganic fertilizers (DAP and Urea), chemical pesticides (insecticides, herbicides, fungicides, etc), and other inorganic chemicals used for general and processing purposes. These external inputs are used mainly to increase the production and productivity of crops in the different agro-ecologies of the country. Among major crops grown in the country, cereal crops (teff, wheat, maize), pulses (haricot bean, lentil, soybean), an oilseed (sesame), vegetables (onion, tomato, cabbage), root and tubers (potato), fruits (apple, grape, citrus), a fiber crop (cotton) and a stimulant (coffee) receive much of the external inputs purchased and imported by the country from different sources (Table 1). On the other hand, some crops in cereals (barley and sorghum), pulses (faba bean, chickpea, field pea, vetch), oilseeds (linseed, noug, gomenzer, groundnut), vegetables (pepper, carrot), root and tubers (enset, sweet-potatoes, beets, yams), fruits (peach, plum, banana, papaya, pineapple, mango, avocado), a stimulant (chat) do not at all or receive a minimum amount of external inputs. Information on the agro-ecological distribution of crops is important in controlling and regulating the distribution of external inputs in any country, in which Ethiopia is no exception.

Table 1. The relative use of external inputs in major crop production in Ethiopia

No	Crop	Major external inputs for crop production*				
		Fertilizers	Insecticides	Herbicides	Fungicides	Others
1	Teff	3	1	3	1	1
2	Wheat	3	1	3	2	1
3	Barley	1	1	1	1	1
4	Maize	3	3	3	1	1
5	Sorghum	1	1	1	1	2
6	Faba bean	1	1	1	1	1
7	Field pea	1	2	1	1	1
8	Chickpea	1	2	1	1	1
9	Haricot bean	3	2	3	1	1
10	Lentil	3	2	1	1	1
11	Soybean	3	1	1	1	1
12	Vetch	1	1	1	1	1
13	Linseed	1	1	1	1	1
14	Noug	1	1	1	1	1
15	Gomenzer	3	1	1	1	1
16	Sesame	1	3	1	1	1
17	Groundnut	1	1	1	1	1
18	Pepper	2	1	1	2	1
19	Onion/shallot	3	3	1	3	1
20	Tomato	3	3	1	3	1
21	Carrot	2	1	1	1	1
22	Cabbage	3	2	1	1	1
23	Potato	3	1	3	1	1
24	Enset	1	1	1	1	1
25	Sweet-potato	1	1	1	1	1
26	Apple	3	3	3	1	1
27	Peach	1	1	1	2	1
28	Grape	3	2	2	1	1
29	Banana	1	1	1	1	1
30	Citrus	3	3	2	1	1
31	Papaya	1	1	1	1	1
32	Mango	1	1	1	1	1
33	Avocado	1	1	1	1	1
34	Cotton	3	3	3	1	1
35	Coffee	3	2	3	2	1
36	Chat	2	2	1	1	1
37	Tobacco	3	3	1	1	1
38	Sugarcane	3	1	1	1	1

\* Relative use of external inputs in a 1-3 rating scale indicating 1 = not used, 2 = rarely used, and 3 = often used.

### **3. MAJOR CROPS GROWN IN DIFFERENT AREAS**

#### **A. Cereals**

##### **(i) Teff (*Eragrostis tef*)**

Teff is a cool weather crop grown predominantly in the Ethiopian highlands at optimum altitude range of 1800 to 2200 meters. This crop occupies the largest area (about 1.4 million hectares of land) and has relatively large amount of grain production. It is an indigenous to Ethiopia, forms the staple diet of many Ethiopians and it furnishes the flour to make *injera*, an unleavened bread that is consumed in the highlands and in urban centers throughout the country. Teff is, however, very delicate and fragile crop that requires a lot of work and care, and it has one of the lowest yields of the cereal crops grown in the county. The production of teff requires high external inputs, particularly fertilizers and herbicides.

##### **(ii) Wheat (*Triticum spp.*)**

Wheat is an important cool weather crop grown predominantly in the Ethiopian highlands at optimum altitude ranging from 1000 to 2300 meters above sea level. Wheat occupies large area (0.8 million hectares) of land and produces large amount of grain every year. It furnishes the flour to make bread and *injera* that is consumed throughout the country. Wheat production like that of teff receives large amount of inorganic fertilizers and herbicides; to some extent fungicides against rust diseases.

##### **(iii) Barley (*Hordium spp.*)**

Barley is a cool weather crop grown in the extreme highlands of Ethiopia with an optimum altitude range of 2000 to 3500 meters above sea level. Barley occupies about 0.4 million hectares. It is used as staple diet of many Ethiopians in the highlands and is eaten in many ways and also used in the production of *tella*, a locally produced beer. Barley is a subsistence crop, grown mostly without external inputs. Pesticides are used to some extent, particularly for aphids control.

##### **(iv) Maize (*Zea mays*)**

Maize is a common warm weather cereal crop widely grown in Ethiopia. It is cultivated mostly at lower altitudes along the country's western, southwestern, and eastern peripheries. Now-a-days

maize is competing for land with wheat and teff in the high and mid-altitudes. Maize is grown chiefly between elevations of 1500 and 2200 meters and requires large amounts of rainfall to ensure good harvests. It is particularly important in southwest Ethiopia, with the Oromiya Region State being the highest producer. Maize receives high external inputs mainly fertilizers, insecticides, and herbicides.

#### **(v) Sorghum**

Sorghum is a common warm weather cereal grown in Ethiopia where it is cultivated mostly at lower altitudes along the country's western, southwestern, and eastern peripheries like maize. Sorghum grain is the staple foods for a large part of the population and is a major item in the diet for pastoralists. Sorghum is drought resistant and is grown well at low elevations where rainfall is less reliable. Sorghum is particularly important in northern Ethiopia, including in the highland areas of western Tigray. Sorghum doesn't receive much of external inputs except for avian control, which is ecologically regulated pest in the Great Rift Valley system.

#### **B. Pulses**

Pulses (faba bean, field pea, chickpea, haricot bean and lentil) occupy about 13% of the croplands in Ethiopia, and they are the second most important element in the national diet, providing principal protein sources and important dietary supplement to cereal consumption. Pulses are used primarily for making *wot*, an Ethiopian stew, which is sometimes served as a main dish to be eaten with *injera*. Faba bean, field pea, chickpea and lentil widely grow in the highlands while haricot bean is grown in the low and intermediate altitudes. Pulses recently have regained significance as export commodities. Most external inputs used for pulses production include insecticides against bollworms and aphids.

#### **C. Oilseeds**

Sesame is the most important oilseed produced in Ethiopia. Among oilseeds sesame and groundnut grow in warm weather areas while linseed, noug and gomenzer grow in the highlands with cool weather. These crops do not usually receive external input other than inorganic fertilizers.

#### **D. Vegetables, Roots and Tubers**

A large number of crops are known under this group. Among these crops onion, tomato, cabbage, and potato receive most and large amount of external inputs. Fertilizers, insecticides and fungicides are must in the production of these crops whether they are cultivated in high or low altitudes. Since they grow in all seasons, particularly with irrigation in the off-season, they are grown with highest care and farmers' attendance. Being high value crops, farmers do give enough attention in vegetable production. However, vegetables such as pepper and carrot, root and tubers such as enset, sweet-potatoes, beets, and yams do not receive any external input.

#### **E. Fruits**

Among fruit crops grown in the country, apple, grape and citrus receive high external input, particularly for insect control. However, fruits such as peach, plum, banana, papaya, pineapple, mango and avocado do not receive any substantial amount of external input.

#### **F. Fiber crops (particularly cotton)**

Cotton is one of the most important fiber crops grown in Ethiopia. Its production demands high external inputs particularly insecticides against African bollworms, aphids, thrips, etc. Defoliants are also used in cotton production while pesticide residue does not seem to a problem if seeds were not used in oil mills.

#### **G. Stimulants**

##### **(i) Coffee**

Ethiopia produces one of the best highland coffees in the world and coffee is the major cash crop. Its coffee is almost exclusively of the *arabica* type, which is native to Ethiopia and is the type of coffee produced in Latin America. In contrast, other parts of Africa grow *robusta* coffee, which typically bears both flowers and fruits simultaneously throughout most of the year, whereas *arabica* coffee has definite and short harvesting season. Coffee grows best at altitudes between 1000 and 2000 meters and it grows wild in many parts of Ethiopia, although most Ethiopian coffee is produced in the southern and western regions of Kefa, Sidamo, Ilubabor, Gamo Gofa, Welega, and Harerge. Coffee area is estimated at about half million hectares, and

about 98 percent of all coffee is produced by peasants on smallholdings of less than a hectare, and the remaining two percent is produced by commercial (state and private) farms. Rainfall distribution in the southern and eastern parts of the country is bimodal and the western part is monomodal. This distribution pattern enables the country to harvest coffee at different times of the year which makes the supply of fresh coffee possible all year round. Coffee production in the country receives relatively high amount of external inputs that include fertilizers, herbicides, and fungicides.

**(ii) Chat (*Catha edulis*)**

Chat (*Catha edulis*) is one of the major cash crops grown in Ethiopia and is shrub. In some years it stands second major agricultural export commodity. It is a mild stimulant harvested as fresh leaves and chewed. Chat is popular in the arid regions of Ethiopia, Kenya, Djibouti, Somalia and Yemen. Domestically, chat is a major source of revenue in the southeastern areas of Ethiopia, with the bulk of the crop being ferried daily by air and truck to Djibouti and Somaliland via Harar and Dire Dawa. For farmers it offers far quick returns on investment, although much of the sale price accrues to the merchants and distributors. No external input is recorded for chat production, though some farmers informally reported to use some DDT and fertilizers.

#### **4. AGRO-ECOLOGICAL ZONES AND THEIR CROPS**

Our major source in developing this section (agro-ecological zones and crops of Ethiopia) is the book published by IFPRI (International Food Policy Research Institute) in 2006. Atlas of the Ethiopian Rural Economy. IFPRI and the Central Statistical Agency, Ethiopia. Washington DC. ISBN-10: 0-89629-154-5. Formerly in Ethiopia, agroecological zones were classified in traditional ways. These traditional classes include Bereha, Kolla, Woina Dega, Dega, Wurch and Kur. Major crops associated to these traditional classes of agro-ecological zones are briefly described. However, at present more elaborated agro-ecological classes that are, more or less, established for the country by different workers of different institutes including EIAR, MOA, and IFPRI is given at the end with supported of Table 2.

The Traditional Agroecological Zones indicate major physical conditions that are grouped into relatively homogenous area having similar agricultural land uses. Under Ethiopian conditions,



elevation has a strong influence on temperature and rainfall. Therefore, this parameter (elevation) is the basis for traditional agroecological divisions. These different zones are:

1. **Bereha** refers to hot lowlands of less than 500 meters above sea level. In the arid east, crop production is very limited while in the humid west root crops and maize are largely grown.
2. **Kolla** refers to lowlands between 500 and 1,500 meters. Predominant crops are sorghum, finger millet, sesame, cowpeas, and groundnuts.
3. **Woina Dega** refers to midlands between 1,500 and 2,300 meters, in which predominant crops include wheat, teff, barley, maize, sorghum, chickpeas and haricot beans.
4. **Dega** refers to highlands between 2,300 and 3,200 meters. Predominant crops include barley, wheat, highland oilseeds, and highland pulses.
5. **Wurch** refers to highlands between 3,200 and 3,700 meters. Barley is a common crop.
6. **Kur** refers to highland areas above 3,700 meters, which are primarily used for grazing pasture.

The Ministry of Agriculture (the then MOARD) developed a system of agroecological zonation in which 18 major zones were defined to characterize the country based on temperature and moisture regimes. Each AEZ has characteristic crops found within it. These two main factors used to characterizing AEZ in the country are mainly governed by Elevation (altitude). Besides, elevation is the prim determinant of agricultural land-use in Ethiopia because it influences the temperature largely and rainfall to some extent. The country has very diversified agro-ecologies that are may be difficult to correctly describe. Hence, most recently the agro-ecology of the country has been divided into 33 major zones (Table 2). Generally, crop distribution is mosaic in Ethiopia. Some crops are found within several zones while others are restricted to only one or two agro-ecological zones. In this recent classification, length of crop growing period (LGP) was taken into account.

The LGP generally refers to the cumulative time in a normal year when moisture conditions are adequate for plant growth. It's defined as the number of days per year that sufficient water is available in the soil profile to support plant growth. LGP captures multiple factors (rainfall, potential evapotranspiration, and soil moisture storage properties) that together define the most important dimensions of agricultural potential. Accordingly, 33 major agro-ecological zones are recognized (Table 2) and information could be obtained from focal centers (Table 3).

Table 2. Major agro-ecologies and total area coverage in the country (source: EIAR, 2011)

No	Major Agro-ecology	Area in hectare	Percentage
1	A1 (Hot arid lowland plains)	12 202 265	10.79
2	A2 (Warm arid lowland plains)	22 356 361	19.76
3	A3 (Tepid arid mid highlands)	488 143	0.43
4	H2 (Warm humid lowlands)	2 592 647	2.29
5	H3 (Tepid humid mid highlands)	3 001 630	2.65
6	H4 (Cool humid mid highlands)	926 331	0.82
7	H5 (Cold humid sub-afro-alpine to afro- alpine)	62 620	0.06
8	H6 (Very cold humid sub-afro-alpine)	50 577	0.04
9	M1 (Hot moist lowlands)	672 104	0.59
10	M2 (Warm moist lowlands)	17 109 776	15.12
11	M3 (Tepid moist mid highlands)	9 101 288	8.05
12	M4 (Cool moist mid highlands)	1 963 109	1.74
13	M5 (Cold moist sub-afro-alpine to afro-alpine)	78 829	0.07
14	M6 (Very cold moist sub-afro-alpine to afro-alpine)	15 246	0.01
15	PH1 (Hot per-humid lowlands)	13 088	0.01
16	PH2 (Warm per-humid lowlands)	765 390	0.68
17	PH3 (Tepid per-humid mid highland)	152 281	0.13
18	SA1 (Hot semi-arid lowlands)	449 789	0.40
19	SA2 (Warm semi-arid lowlands)	3 114 607	2.75
20	SA3 (Tepid semi-arid mid highlands)	218 624	0.19
21	SH1 (Hot sub-humid lowlands)	1 893 410	1.67
22	SH2 (Warm sub-humid lowlands)	8 046 859	7.11
23	SH3 (Tepid sub-humid mid highlands)	7 504 025	6.63
24	SH4 (Cool sub-humid mid highlands)	589 049	0.52
25	SH5 (Cold sub-humid sub-afro-alpine to afro-alpine)	68 815	0.06
26	SH6 (Very cold sub-humid sub-afro to afro- alpine)	34 889	0.03
27	SM1 (Hot sub-moist lowlands)	637 276	0.56
28	SM2 (Warm sub-moist lowlands)	10 890 128	9.63
29	SM3 (Tepid sub-moist mid highlands)	5 850 115	5.17
30	SM4 (Cool sub-moist mid highlands)	1 314 156	1.16
31	SM5 (Cold sub-moist mid highlands)	76 819	0.07
32	SM6 (Very cold sub-moist mid highlands)	18 021	0.02
33	WB (Water body)	870 795	0.77
	<b>Total</b>	<b>113 129 062</b>	<b>100.00</b>

Table 3.Responsible research organization to avail crop technologies on focal commodities

<b>Responsible center/ university</b>	<b>Focal commodity</b>
Adet Agricultural Research Center	Rice, millet and potato
Ambo Plant Protection Research Center	Biotechnology, plant protection
Areka Agricultural Research Center	Enset
Bako Agricultural Research Center	Maize
Chiro Agricultural Research Center	Sorghum
Debre Zeit Agricultural Research	Tef , chickpea, lentil, alliums and grape
Gambella Agricultural Research Center	Soybean
Haramaya University	Ground nut
Hawassa Research Center	Sweet potato, cassava, taro
Holetta Agricultural Research Center	Potato, highland oilseeds, pulses, temperate fruits
Humera Agricultural Research Center	Sesame
Jimma Agricultural Research Center	Coffee
Jimma University	Tea
Kulumsa Agricultural Research Center	Wheat
Melkassa Agricultural Research Center	Haricot bean, vegetables, tropical fruits
Sinana Agricultural Research Center	Barely
Teppi Agricultural Research Center	Spices
Werer Agricultural Research Center	Cotton
Wondogenet Research Center	Essential oil and medicinal crops

Source: EIAR, 2011

## **CONCLUSIONS**

Many crops are grow in Ethiopia that include cereals, pulses, oilseeds, vegetables, root and tubers, fruits, fibers, stimulants and sugarcane in 16.5 million hectares of land. Grains occupying about 86% percent of the area planted.

Agro-ecological zonation in Ethiopia has two facets namely the traditional and the elaborated agro-ecological zones. The traditional zones include Bereha, Kolla, Woina Dega, Dega,Wurch

and Kur where many kinds of crops are grown in each of these ecological zones. On the other hand, in the elaborated agro-ecological zones there are 33 where many kinds of crops are also grown in each zone.

In the different agro-ecological zones, major external inputs used in crop production include fertilizers, pesticides and others. Among major crops grown in the country, cereal crops (teff, wheat, maize), pulses (haricot bean, lentil, soybean), an oilseed (sesame), vegetables (onion, tomato, cabbage), root and tubers (potato), fruits (apple, grape, citrus), a fiber crop (cotton) and a stimulant (coffee) receive much of the external inputs purchased and imported by the country. Information on the agro-ecological distribution of crops is important in controlling and regulating the distribution of external inputs.

In the traditional agro-ecological zones many crops are grown with some specific indicator crops known for some zones. However, there is no specificity in the use of external inputs for a specific agro-ecological zone. Similarly, in the 33 elaborated zones no specific trend exists for external inputs except some indicator crops for agro-ecological zones.

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### **A. High external inputs:**

- Cereals (**teff, wheat, maize**),
- Pulses (**haricot bean, lentil, soybean**)
- Oilseed (**sesame**),
- Vegetables (**onion, tomato, cabbage**),
- Root and tubers (**potato**),
- Fruits (**apple, grape, citrus**),
- Fiber crop (**cotton**) and
- Stimulant (**coffee**)

### **B. Low external inputs:**

- Cereals (**barley and sorghum**),
- Pulses (**faba bean, chickpea, field pea, vetch**),
- Oilseeds (**linseed, noug, gomenzer, groundnut**),
- Vegetables (**pepper, carrot**),
- Root and tubers (**enset, sweet-potatoes, beets, yams**),
- Fruits (**peach, plum, banana, papaya, pineapple, mango, avocado**), and
- Stimulant (**chat**)

**\* Information on the agro-ecological distribution of crops is important in **controlling and regulating the distribution of external inputs** in any country, in which Ethiopia is no exception.**

### **3. MAJOR CROPS GROWN IN DIFFERENT AREAS**

#### **A. Cereals**

##### **(i) Teff (*Eragrostis tef*)**

Teff is a cool weather crop grown predominantly in the Ethiopian highlands at optimum altitude range of 1800 to 2200 meters. This crop occupies the largest area (about 1.4 million hectares of land) and has relatively large amount of grain production. It is an indigenous to Ethiopia, forms the staple diet of many Ethiopians and it furnishes the flour to make *injera*, an unleavened bread that is consumed in the highlands and in urban centers throughout the country. Teff is, however, very delicate and fragile crop that requires a lot of work and care, and it has one of the lowest yields of the cereal crops grown in the county. The production of teff requires high external inputs, particularly fertilizers and herbicides.

##### **(ii) Wheat (*Triticum spp.*)**

Wheat is an important cool weather crop grown predominantly in the Ethiopian highlands at optimum altitude ranging from 1500 to 2700 meters above sea level. Wheat occupies large area (0.8 million hectares) of land and produces large amount of grain every year. It furnishes the flour to make bread and *injera* that is consumed throughout the country. Wheat production like that of teff receives large amount of inorganic

fertilizers and herbicides; to some extent fungicides against rust diseases.

**(iii) Barley (*Hordium* spp.)**

Barley is a cool weather crop grown in the extreme highlands of Ethiopia with an optimum altitude range of 2000 to 3500 meters above sea level. Barley occupies about 0.4 million hectares. It is used as staple diet of many Ethiopians in the highlands and is eaten in many ways and also used in the production of *tella*, a locally produced beer. Barley is a subsistence crop, grown mostly without external inputs. Pesticides are used to some extent, particularly for aphids control.

**(iv) Maize (*Zea mays*)**

Maize is a common warm weather cereal crop widely grown in Ethiopia. It is cultivated mostly at lower altitudes along the country's western, southwestern, and eastern peripheries. Now-a-days maize is competing for land with wheat and teff in the high and mid-altitudes. Maize is grown chiefly between elevations of 1500 and 2200 meters and requires large amounts of rainfall to ensure good harvests. It is particularly important in southwest Ethiopia, with the Oromiya Region State being the highest producer. Maize receives high external inputs mainly fertilizers, insecticides, and herbicides.

### **(v) Sorghum**

Sorghum is a common warm weather cereal grown in Ethiopia where it is cultivated mostly at lower altitudes along the country's western, southwestern, and eastern peripheries like maize. Sorghum grain is the staple foods for a large part of the population and is a major item in the diet for pastoralists. Sorghum is drought resistant and is grown well at low elevations where rainfall is less reliable. Sorghum is particularly important in northern Ethiopia, including in the highland areas of western Tigray. Sorghum doesn't receive much of external inputs except for avian control, which is ecologically regulated pest in the Great Rift Valley system.

### **B. Pulses**

Pulses (faba bean, field pea, chickpea, haricot bean and lentil) occupy about 13% of the croplands in Ethiopia, and they are the second most important element in the national diet, providing principal protein sources and important dietary supplement to cereal consumption. Pulses are used primarily for making *wot*, an Ethiopian stew, which is sometimes served as a main dish to be eaten with *injera*. Faba bean, field pea, chickpea and lentil widely grow in the highlands while haricot bean is grown in the low and intermediate altitudes. Pulses recently have regained significance as export commodities. Most external inputs used for pulses production include insecticides against bollworms and aphids.



### **C. Oilseeds**

Sesame is the most important oilseed produced in Ethiopia. Among oilseeds sesame and groundnut grow in warm weather areas while linseed, noug and gomenzer grow in the highlands with cool weather. These crops do not usually receive external input other than inorganic fertilizers.

### **D. Vegetables, Roots and Tubers**

A large number of crops are known under this group. Among these crops onion, tomato, cabbage, and potato receive most and large amount of external inputs. Fertilizers, insecticides and fungicides are must in the production of these crops whether they are cultivated in high or low altitudes. Since they grow in all seasons, particularly with irrigation in the off-season, they are grown with highest care and farmers' attendance. Being high value crops, farmers do give enough attention in vegetable production. However, vegetables such as pepper and carrot, root and tubers such as enset, sweet-potatoes, beets, and yams do not receive any external input.

### **E. Fruits**

Among fruit crops grown in the country, apple, grape and citrus receive high external input, particularly for insect control. However, fruits such

as peach, plum, banana, papaya, pineapple, mango and avocado do not receive any substantial amount of external input.

### **F. Fiber crops (particularly cotton)**

Cotton is one of the most important fiber crops grown in Ethiopia. Its production demands high external inputs particularly insecticides against African bollworms, aphids, thrips, etc. Defoliants are also used in cotton production while pesticide residue does not seem to be a problem if seeds were not used in oil mills.

### **G. Stimulants**

#### **(i) Coffee**

Ethiopia produces one of the best highland coffees in the world and coffee is the major cash crop. Its coffee is almost exclusively of the *arabica* type, which is native to Ethiopia and is the type of coffee produced in Latin America. In contrast, other parts of Africa grow *robusta* coffee, which typically bears both flowers and fruits simultaneously throughout most of the year, whereas *arabica* coffee has definite and short harvesting season. Coffee grows best at altitudes between 1000 and 2000 meters and it grows wild in many parts of Ethiopia, although most Ethiopian coffee is produced in the southern and western regions of Kefa, Sidamo, Ilubabor, Gamo Gofa, Welega, and Harerge. Coffee area is estimated at about half million hectares, and

about 98 percent of all coffee is produced by peasants on smallholdings of less than a hectare, and the remaining two percent is produced by commercial (state and private) farms. Rainfall distribution in the southern and eastern parts of the country is bimodal and the western part is monomodal. This distribution pattern enables the country to harvest coffee at different times of the year which makes the supply of fresh coffee possible all year round. Coffee production in the country receives relatively high amount of external inputs that include fertilizers, herbicides, and fungicides.

**(ii) Chat (*Catha edulis*)**

Chat (*Catha edulis*) is one of the major cash crops grown in Ethiopia and is shrub. In some years it stands second major agricultural export commodity. It is a mild stimulant harvested as fresh leaves and chewed. Chat is popular in the arid regions of Ethiopia, Kenya, Djibouti, Somalia and Yemen. Domestically, chat is a major source of revenue in the southeastern areas of Ethiopia, with the bulk of the crop being ferried daily by air and truck to Djibouti and Somaliland via Harar and Dire Dawa. For farmers it offers far quick returns on investment, although much of the sale price accrues to the merchants and distributors. No external input is recorded for chat production, though some farmers informally reported to use some DDT and fertilizers.

Table 1. The relative use of external inputs in major crop production areas in Ethiopia

No	Crop	Major external inputs for crop production*				
		Fertilizers	Insecticides	Herbicides	Fungicides	Others
1	Teff	3	1	3	1	1
2	Wheat	3	1	3	2	1
3	Barley	1	1	1	1	1
4	Maize	3	3	3	1	1
5	Sorghum	1	1	1	1	2
6	Faba bean	1	1	1	1	1
7	Field pea	1	2	1	1	1
8	Chickpea	1	2	1	1	1
9	Haricot bean	3	2	3	1	1
10	Lentil	3	2	1	1	1
11	Soybean	3	1	1	1	1
12	Vetch	1	1	1	1	1
13	Linseed	1	1	1	1	1
14	Noug	1	1	1	1	1
15	Gomenzer	3	1	1	1	1
16	Sesame	1	3	1	1	1
17	Groundnut	1	1	1	1	1
18	Pepper	2	1	1	2	1
19	Onion/shallot	3	3	1	3	1
20	Tomato	3	3	1	3	1
21	Carrot	2	1	1	1	1
22	Cabbage	3	2	1	1	1
23	Potato	3	1	3	1	1
24	Enset	1	1	1	1	1
25	Sweet-potato	1	1	1	1	1
26	Apple	3	3	3	1	1
27	Peach	1	1	1	2	1
28	Grape	3	2	2	1	1
29	Banana	1	1	1	1	1
30	Citrus	3	3	2	1	1
31	Papaya	1	1	1	1	1
32	Mango	1	1	1	1	1
33	Avocado	1	1	1	1	1
34	Cotton	3	3	3	1	1
35	Coffee	3	2	3	2	1
36	Chat	2	2	1	1	1
37	Tobacco	3	3	1	1	1
38	Sugarcane	3	1	1	1	1

\* Relative use of external inputs in a 1-3 rating scale indicating 1 = not used, 2 = rarely used, and 3 = often used.

Table 2. Major agro-ecologies and total area coverage in the country

No	Major Agro-ecology	Area in hectare	Percentage
1	A1 (Hot arid lowland plains)	12 202 265	10.79
2	A2 (Warm arid lowland plains)	22 356 361	19.76
3	A3 (Tepid arid mid highlands)	488 143	0.43
4	H2 (Warm humid lowlands)	2 592 647	2.29
5	H3 (Tepid humid mid highlands)	3 001 630	2.65
6	H4 (Cool humid mid highlands)	926 331	0.82
7	H5 (Cold humid sub-afro-alpine to afro- alpine)	62 620	0.06
8	H6 (Very cold humid sub-afro-alpine)	50 577	0.04
9	M1 (Hot moist lowlands)	672 104	0.59
10	M2 (Warm moist lowlands)	17 109 776	15.12
11	M3 (Tepid moist mid highlands)	9 101 288	8.05
12	M4 (Cool moist mid highlands)	1 963 109	1.74
13	M5 (Cold moist sub-afro-alpine to afro-alpine)	78 829	0.07
14	M6 (Very cold moist sub-afro-alpine to afro-alpine)	15 246	0.01
15	PH1 (Hot per-humid lowlands)	13 088	0.01
16	PH2 (Warm per-humid lowlands)	765 390	0.68
17	PH3 (Tepid per-humid mid highland)	152 281	0.13
18	SA1 (Hot semi-arid lowlands)	449 789	0.40
19	SA2 (Warm semi-arid lowlands)	3 114 607	2.75
20	SA3 (Tepid semi-arid mid highlands)	218 624	0.19
21	SH1 (Hot sub-humid lowlands)	1 893 410	1.67
22	SH2 (Warm sub-humid lowlands)	8 046 859	7.11
23	SH3 (Tepid sub-humid mid highlands)	7 504 025	6.63
24	SH4 (Cool sub-humid mid highlands)	589 049	0.52
25	SH5 (Cold sub-humid sub-afro-alpine to afro-alpine)	68 815	0.06
26	SH6 (Very cold sub-humid sub-afro to afro- alpine)	34 889	0.03
27	SM1 (Hot sub-moist lowlands)	637 276	0.56
28	SM2 (Warm sub-moist lowlands)	10 890 128	9.63
29	SM3 (Tepid sub-moist mid highlands)	5 850 115	5.17
30	SM4 (Cool sub-moist mid highlands)	1 314 156	1.16
31	SM5 (Cold sub-moist mid highlands)	76 819	0.07
32	SM6 (Very cold sub-moist mid highlands)	18 021	0.02
33	WB (Water body)	870 795	0.77
<b>Total</b>		<b>113 129 062</b>	<b>100.00</b>

Source: EIAR, 2011

Table 3.Responsible research organization to avail crop technologies on focal commodities

<b>Responsible center/ university</b>	<b>Focal commodity</b>
Adet Agricultural Research Center	Rice, millet and potato
Ambo Plant Protection Research Center	Plant protection
Areka Agricultural Research Center	Enset
Bako Agricultural Research Center	Maize
Chiro Agricultural Research Center	Sorghum
Debre Zeit Agricultural Research	Tef , chickpea, lentil, alliums and grape
Gambella Agricultural Research Center	Soybean
Haramaya University	Ground nut
Hawassa Research Center	Sweet potato, cassava, taro
Holetta Agricultural Research Center	Potato, highland oilseeds, pulses, temperate fruits, Biotechnology
Humera Agricultural Research Center	Sesame
Jimma Agricultural Research Center	Coffee
Jimma University	Tea
Kulumsa Agricultural Research Center	Wheat
Melkassa Agricultural Research Center	Haricot bean, vegetables, tropical fruits
Sinana Agricultural Research Center	Barely
Teppi Agricultural Research Center	Spices
Werer Agricultural Research Center	Cotton
Wondogenet Research Center	Essential oil and medicinal crops

Source: EIAR, 2011