# CHAPTER 1
# GENERAL INTRODUCTION

Sweet potato (*Ipomoea batatas* (L.) Lam.) belongs to the family Convolvulaceae. It is a herbaceous dicot widely grown throughout the tropics and warm temperate regions of the world between latitudes 40$^{o}$N and S of the equator and between sea level and 2300 m altitude (Shukla, 1976; Hahn, 1977a; Bourke, 1982; Jana, 1982). Globally sweet potato is the seventh most important food crop after wheat, rice, maize, potato, barley, and cassava. Sweet potato is the second most important root and tuber crop in the world after potato (Horton, 1988). In Sub-Saharan Africa sweet potato is the third most important tuber crop after cassava (*Manihot esculenta*) and yam (*Dioscorea* spp.) (Ewell & Mutuura, 1994). More than 140 million tons of sweet potato is produced globally per year (FAO, 2000). The world average storage root yield of sweet potato has been estimated to be 14.8t ha$^{-1}$ (FAO, 2000). Asia is the world's largest sweet potato producing continent, with 129 million tons annual production. China with 121 million tons accounts for 86% of world sweet potato production. Nearly half of the sweet potato produced in Asia is used for animal feed, the remaining primarily used for human consumption, either fresh or as processed products.

Although African farmers produce only about 9 million tons of sweet potato annually, most of the crop is cultivated for human consumption. African yields are quite low at 4 to 5 tons per hectare, about a third of the Asian yields, indicating huge potential for future growth. In Africa the crop is grown on small scale, primarily to help ensure food security of the rural households (Ewell & Mutuura, 1994).

Sweet potato is cultivated in Ethiopia mostly for human consumption and as animal feed. It ranks third after Enset (*Ensete ventricosum* (Welw.) Cheesman,) and potato *(Solanum*

*tuberosum L.*) as the most important root crop produced in the country. Sweet potato is mainly grown by small scale, resource poor farmers. According to FAO (2000) the Ethiopian national average storage root yield of sweet potato is 8t $ha^{-1}$. Experimental storage root yields ranging between 30 and 73t $ha^{-1}$ have been reported by Hossain *et al*., (1987), Siddique *et al*., (1988), Hall & Harmon, (1989), Bhagsari & Ashley, (1990) and Varma *et al*., (1994).

Yields obtained in Ethiopia are generally low, but there is good potential for the crop since climatic and soil factors are largely favourable. Ethiopia has an area of 1,122,000 $km^2$, 65% of the land is arable, with 15% presently cultivated. Ethiopia is in the tropical zone and has three climatic zones according to elevation. Tropical zone (Kwolla) is hot and humid, below 1830 masl and has an average annual temperature of 27$^oC$ with annual rainfall of about 510 mm. Subtropical zone (Woina dega) is warm, and includes the highland areas of 1830 to 2440 masl and has an average annual temperature of about 22$^oC$, with annual rainfall between 510 and 1530 mm. Cool zone (Dega) is above 2440 masl with an average annual temperature of about 16$^oC$ and annual rainfall between 1270 and 1280 mm. There are two seasons, the dry and rainy seasons. The dry season prevails from October to May. The rainy season is bimodal the short and the long rainy seasons the short rainy season is from February to April, while the long rainy season extends from June to September. Sweet potato is adapted to the tropical zone (Kwolla) and subtropical zone (Woina daga) areas of southern, southwestern and eastern parts of the country (http://www.ethiotreasures.plus.com/pages/climate.htm ) (2002).

The crop has relatively few pests and diseases, and pesticides are rarely used. Sweet potato can be grown in poor soils with little or no fertilizers. Sweet potato grows best where average temperatures are 24$^oC$, the thermal optimum is reported to be about 24$^oC$ (Kay, 1973). At

temperatures below 10$^{o}$C growth is severely retarded. The crop is damaged by frost, and this fact restricts the cultivation of sweet potato in the temperate regions to areas with a minimum frost-free period of 4 to 6 months. Even where the frost-free period is sufficiently long, it is still essential that temperatures are relatively high during much of the growing period. In the tropics, yields decline with increasing altitude as do the number of storage roots and the proportion of roots that are marketable (Negeve *et al*., 1992). Increasing altitude also delays maturity.

Growers of sweet potato in Ethiopia are faced with a number of problems in trying to improve the yield and quality of the crop. There are natural and technical limitations in the production of the crop. The natural limitations include drought, high temperature at low altitudes, frost at high altitudes, and lack of irrigation. Poor land preparation, lack of high yielding and adapted cultivars, lack of sufficient quantity of good quality cuttings, sub or supra-optimal plant population, improper method and depth of planting, careless harvesting, poor post-harvest handling, and lack of crop rotation are some of the factors that contribute to poor crop establishment and low yield.

Since sweet potato is the most important food crop in the densely populated areas of Ethiopia, and is also considered a potential cash crop for small-scale farmers, more information is needed on the yield physiology and management of the crop. Basic information on the origin and structure of sweet potato storage roots is still limited. Information on the contribution of individual nodes to total storage root mass and number is very limited. Such information will help to develop appropriate and affordable technologies to improve crop yield and quality in

Ethiopia. In this study the main objective was a better understanding of the yield physiology and agronomy of the crop in order to improve production in Ethiopia.

The approach was to:

1. Investigate the origin, structure and function of the adventitious roots (Chapter 3). Practically no information is available about the origin or the relationship between origin and structure.

2. Quantify the effect of temperature and soil water content on root and shoot growth in pot experiments (Chapter 4).

3. Establish the contribution of individual subterranean nodes from different types of planting material to storage root number and mass (Chapter 5).

4. Analyse dry matter production and partitioning of three sweet potato cultivars by means of standard growth analyses, specifically crop growth rate, tuber growth rate and net assimilation rate in field trials in Ethiopia (Chapter 6).

5. Determine effect of cutting characteristics on yield and yield components (Chapter 7).

6. Establish the effect of planting density and cultivar on yield and yield components by conducting field experiments (Chapter 8).

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