Introduction

CHAPTER I

INTRODUCTION

World Health Organization (WHO) has estimated that about 80 percent of the world population relies on traditional systems of medicine for their primary health needs. These traditional systems are largely plant based. There are around 20,000 species of plants, which have been documented on a world-wide basis for their medicinal value. Of which approximately 5,000 species are phytochemically studied.

Out of the 1500 species identified, 1100 species are used in different systems of medicines and out of these, 600-700 species are used in India mainly by the indigenous industries (Rawat and Garg, 2005). There is a growing demand for herbal products as phytochemicals, neutraceuticals, food supplements and cosmetics in both domestic and international markets (Tewari, 2005).

With the increasing interest in natural products across the world the demand for medicinal plants and its trade is expected to grow upto US $ 5 trillion by 2050 AD. In the global market of herbal medicines, US ranks first with an estimated value of US $ 60-80 billion (Mathur, 2003). The turn over of herbal medicines in India as over-the counter products, ethical and classical formulations is about US $ 1 billion with an export value of about US $ 80 million (Kamboj, 2000). India's share in the global market of medicinal plants related trade is just 0.5 percent. Thus, there is a need to make relentless efforts to take substantial cultivation of medicinal plants in India to take active part in medicinal plants trade world wide. Considering the growing demand for raw materials of medicinal plants by the pharmaceutical companies and their depleting resource base due to unscientific gathering from the wild, it is of utmost necessity to take up *ex situ* cultivation and conservation of these medicinal plant species and *Aloe vera* is one among them (Hussain and Hore, 2007).

To provide quality medicinal plants, monitoring of cultivation, harvesting and processing of the plant materials, Good Agricultural Practices (GAP) are very essential to ensure that the plant raw material meets the demand of the consumer and the standard of the highest quality (Saini *et al*., 2007).

Aloe vera Linn. (2n = 14) is a succulent belongs to the family Liliaceae. It grows naturally in Africa, America, Europe and Asia. It has fibrous, spreading and shallow root system. Its bright green gelatinous delicate leaves contain a very small quantity of viscous yellow fluid known as *Aloe* juice or Aloe latex, which is embedded in the pericyclic cells of the vascular bundles of *Aloe vera* leaves. The main constituents of the latex are anthraquinones including the hydroxyanthracene derivatives, aloins A and B, barbaloin, isobarbaloin and emodin (Bradley, 1992). The dried latex otherwise known as Aloin is primarily used as a laxative or cathartic agent in traditional medicines for over two centuries and products containing aloes / aloin have been in market in major western countries (Joshi, 1998). It is an official drug in the U.S. pharmacopeia (Grindlay and Reynolds, 1986).

Aloe vera gel is the colourless mucilaginous substance obtained from the paranchymatous cells of fresh leaves of *Aloe.* The constituents of *Aloe vera* gel include mono and polysaccharides, vitamins, minerals, amino acids and enzymes. Other constituents include lipids and sterols (Bruneton, 1995). The leaf gel have been known to possess important biological properties such as anti-inflammatory, antibacterial, anti tumour, antiallergic, infected wound healing by immuno enhancement and general tonic. Based on these biological properties of aloe gel and pharmacological properties of aloin a number of formulations are widely available in the market; especially in USA, for the treatment of skin disorders, wound healing, inflammation based disorders and as general skin care, cosmetics and health food

(Joshi, 1998). It is reported that more than 40 percent of cosmetics used in USA have *Aloe* gel as an ingredient in them.

The current global turnover of raw *Aloe* leaves amount upto US $70-80 million, which is expected to grow at a rate of 35 percent in the next five years. For processed derivatives and value added products of *Aloe vera* the current global trade is estimated at around US $ 1 billion and 25 billions, respectively. USA supplies the major bulk of *Aloe* in world market having a share of 60-65 percent, whereas Latin American countries 20-25 percent and Australia, China and India cumulatively have a market share of only 10 percent (Das and Chattopadhay, 2004). The area under *Aloe vera* cultivation worldwide is 23,589 ha, of which American countries possess 19,189 ha, Australia 4,170 ha, Africa 300 ha and India possess only negligible area under this crop (Yoheeswaran *et al.,* 2005). The cultivation of *Aloe vera* has acquired great commercial importance for medical products and cosmetics preparations but information is scarce about agronomic management of this crop (Hemandez-Cruz *et al,* 2002; Rodriguez *et al,* 2007).

India is among the few countries endowed with the unique geographical and climatological features essential for the cultivation of *Aloe vera.* Because of its huge demand and vast uti lity, now it is widely collected indiscriminately from the wild source and thus this species is becoming commercially threatened due to over and destructive harvesting from natural stands (Ghate *et al.,* 2002). So far its commercial cultivation is not popular among the farming community and the reason is simple: lack of improved varieties or technical know-how on local strains or land races of *Aloe vera* and its package of practices. This is the need of this hour to bring *Aloe vera* into mainstream of cultivation by identification of correct type of *Aloe vera* strains for

commercialization and standardization of agronomic practices in order to meet its ever growing demand and to prevent the pressure on wild population.

After the advent of inorganic fertilizers, organic manures are no more the primary carriers of plant nutrients. Besides, with the increasing degradation of the soil through chemical fertilizers, the need to replace them with organic sources - the most viable alternative is become imperative (Meelu *et al.,* 1995). The organically grown herbal drugs are not only readily acceptable in global market but also fetch premium prices than those grown by conventional farming with the use of inorganics (Saikia and Srstisri, 2011). Further, the use of biofertilizers is found cheaper without having any drastic negative effect on crop yield. Increased yield was reported from most of the agricultural and horticultural crops by the application of biofertilizers like *Azospirillum,* phosphobacteria etc.

Hence, the present study was carried out with the following objectives:

(1) To assess the existing variability in *Aloe vera* and to find out desirable traits for further crop improvement programmes

(2) To evaluate the different accessions of *Aloe vera* for growth, yield, quality and drought tolerance

(3) To find out the relationship between different growth parameters and its contribution towards yield components of *Aloe vera*

(4) To standardize the spacing levels and to optimize the nutrient requirement of *Aloe vera* through organic sources of nutrients and bio-inoculants

(5) To work out the benefit cost ratio of *Aloe vera* cultivation