CHAPTER- I

Introduction

During the last few years, there has been a significant increase in global food prices due to several structural and cyclical factors. Cereal prices in India increased only 23 per cent as compared to global price increase of 150 per cent during 2005 to 2008. Presently, the inflation for food article is higher (>10%) than the general inflation (<6%). The volatility of food prices is likely to continue and would harm the poor. Global financial crisis since the 3rd quarter of 2008, and the current financial crisis due to several factors have adverse impact on liquidity situation and the economic growth in India. This in turn can have adverse effect on the poor and food security of the country (Braun and Joachim von, 2008; Chandrasekar and Jayati Ghosh, 2008). Food and financial crisis potential exacerbate and deeper the existing vulnerabilities in India for the poor and disadvantaged groups including women and children. The combination of falling agricultural prices, reduction in agricultural investment and access to credit may have negative impact on agricultural production. It would have serious implication for food security (Mahendra Dev, 2011).

India currently has the world’s second largest population, which is expected to overtake China’s by 2050 when it reaches 1.6 billion, putting increase strain on water resources. Climate change is expected to accelerate the problem by causing erratic and unpredictable weather, which would drastically diminish the supply of water coming from rainfall and glaciers. India will face a slew of subsequent problems, such as food and water shortages, intrastate, interstate and international conflict. In 2006 India used approximately 8.29 billion cubic meters of water and by 2050 demand is
expected to double and consequently exceeded the 1.4 trillion cubic meter of supply (Somini Sengupta, 2006).

Despite the recent rapid growth in the services and industrial production, agriculture is still an integral part of Indian economy and society. Between 1947 and 1967 India underwent the Green Revolution, which concentrated on expanding farm yields by double-cropping in existing farmland and using seeds with improved genetics. The result was a huge increase in agricultural production, making India one of the world’s biggest exporters of grain. The availability of canal water led farmers to adopt highly profitable, but extremely water intensive crops, such as paddy, plantains and sugarcane. In addition, India achieved its goal of obtaining food security. The rural economy sustains two-thirds of India’s 1.1 billion citizens. Unfortunately, this huge surge in agriculture, required significant water resources for irrigation and accelerated the onset of present water shortages. Along with agricultural sector usage of about 90% of total water resources, industrial water use in India stands about 50 billion cubic meters or nearly 6% of total fresh water abstraction (Giridharadas and Anand, 2005).

Food and Agricultural organization most recent estimates indicated that 12.5 per cent of the world’s population (868 million people) are undernourished, 26 per cent of the world’s children are stunted, 2 billion people suffer from one or more micronutrient deficiencies and 1.4 billion people are overweight, of whom 500 million are obese. Social burden due to child and maternal malnutrition has declined almost half during the last two decades, while that due to overweight and obesity has almost doubled, yet the former remains by far the greater problem, especially in low-income countries. Economical and social development lead to the gradual
transformation of agriculture, characterized by rising labour productivity, declining shares of population working in agriculture and rising urbanization. New modes of transportation, leisure employment and work within the home cause people to lead more sedentary lifestyles and to demand more convenient food. These changes in activity and dietary pattern are part of a “nutrition transition” in which households and countries may simultaneously face the emerging challenge of overweight, obesity and related non-communicable diseases while continuing to deal with under nutrition and micronutrient deficiencies.

The immediate causes of extortionate food prices, water scarcity, under nutrition and starvation are complex and multidimensional. The challenge is to find an alternative source of adequate, safe, diverse, nutritious food, avoiding pollution, unintervention with ground water and drinking water system. Seaweeds, a primitive group of plants without any true root, stem and leaves, belonging to Thallophyta in plant kingdom, inhabited in the marine environment, form an important renewable resource for food and medicine; have been a part of human civilization from time immemorial. Reports on the uses of seaweeds as food and medicine have been cited as early as 2500 years ago in Chinese literature (Tseng, 2004) and have been used as human food in China, Korean peninsula and Japan. Nowadays, edible seaweeds were widely consumed especially in Japan, China, Korea, Taiwan, Singapore, Thailand, Brunei, Cambodia, Vietnam, South Africa, Indonesia, Malaysia, Belize, Peru, Chile Scandinavia, South west England, Ireland, Wales, California, Philippines and Scotland (Berne kilinc et al., 2013) and associated with a significantly lower rate of cancer, thyroid disease, heart diseases, dementia and diabetes (Fitzgerald et al., 2011). Seaweeds grow primarily in the intertidal zone, and their constant need to protect
themselves against oxidative stress from ultraviolet radiation, desiccation and extreme temperature fluctuation at low tide explain the abundance of potent anti-oxidants such as carotenoids, phlorotannins, ascorbic acid (vitamin C), tocopherol (vitamin E), polyphenols, chlorophyll derivatives and mycosporine like amino acids found in them. In comparison with terrestrial plants seaweeds are particularly rich in iodine, which is essential to the functioning of the thyroid and of the nervous system. They are rich in vitamins, minerals, protein, polyunsaturated fatty acid and dietary fibers (Vinoj kumar and kaladharan, 2007; Thinakaran and Sivakumar, 2012) and numerous clinical studies have demonstrated the health benefits of seaweed consumption (Joel Fleurence, 1999; Shahidi and young, 2008). Colpomenia sinuosa, Rhodymenia palmata, Sargassum ilicifolium, Padina tetrastromatica, Hypnea musciformis and Turbinaria conoides are rich in primary metabolites like protein, carbohydrate, lipid and dietary fibre. In addition to their health benefits, seaweeds posses a wide range of important gastronomic and food-preservation properties (Bocanegra et al., 2009), antibacterial and antifungal potential (Pandurangan Aruna et al., 2010; kayalvizhi et al., 2012). Caulerpa scapelliformis, Sargassum tenerimum, Stoechospermum marginatum, Spathoglossum asperum, Padina pavonia, Acanthophora spicifera and Hypnea musciformis were found to be active against both human and plant pathogens (Vlachos et al., 1997; Hellio et al., 2000; Lima-Filho et al., 2002; Salem et al., 2011).

India (08.04-37.06N and 68.07-97.25E) a tropical South Asian country has a stretch of about 7500 km coastline, excluding its Island territories with 2 million km² exclusive economic zone, and nine maritime states. The seaweed flora of India is highly diversified with 271 genera and 1153 species (Anon, 2005) occupying rocky beaches, mudflats estuaries, coral reefs and lagoons along the Indian coast which
provide ideal habitats for the growth of seaweeds. Approximately 7.5 to 8 million tons of wet seaweeds are harvested worldwide per year. The total standing crop of seaweeds in the intertidal region of Tamil Nadu was estimated as 22,044 tons by fresh weight in a potential area of 9891.35 hectare, of the 20,000 hectare total area surveyed. Among the coastal states and union territories, Tamil Nadu ranks first in marine resource potential (Kaladharan and Jayasankar, 2003). In India seaweeds are utilized by the industries mainly for commercial production of agar, alginate and carrageenan, though various reports have mentioned their utilization in food, agriculture, cosmetics and pharmaceutical industries. (Darcy-Vrillon, 1993; Mishra et al., 1993; Flora and Maria Victorial Rani, 2013)

The human seaweeds consumption is increasing exponentially and with the rise in popularity, sea vegetables are gradually becoming more and more available in local shops. Numerous celebrity chefs and world-renowned restaurants all around the globe are boosting the integration of marine seaweeds into their menus (Joel Fleurence, 1999; Fitzgerald et al., 2011). In India popularisation of seaweeds food is still wanting, and seaweeds benefits as pharmaceuticals and green nanoparticles open out a new dimension in the field of biotechnology. This urge to analyse the seaweed resource available, and document their bio prospects in different levels: local, regional and national which would highlight and publicitize the necessity of sustainable utilization of seaweeds in neutraceutical, pharmaceutical and agricultural industries. Algal products can be easily integrated and blended into common food items such as bakery products, pasta, etc without affecting the taste or texture of the food. Also they grow fast compared to agricultural plants and they are well suited to shallow sea region, solving issues of freshwater supply, fertilizer, pesticides, pollution and fertile
land for cultivation of crop plants. Seaweed cultivation cost is much lesser, and provide comparatively higher novel products such as agar, alginates, amylase, carotenoids, carrageenan, dietary fibre, enzymes, cofactors, floridean starch, fucoidin, furcellaran, galactan, glucan, ulvan, polyunsaturated fatty acids, taurine, prebiotics etc.

Hare Island, part of Gulf of Mannar, National Marine Reserve Park is a rich repository of diversified marine flora and fauna. This Island is now seen connected with inland due to the construction of harbour (V.O.C. Chiambaranar port) harbouring different algal species (Mary Josephine *et al*., 2013) with biostimulant, and pesticidal properties (Flora and Maria Victorial Rani, 2012; Flora and Maria Victorial Rani, 2013). Seaweeds availability status, their economic importance, chemical composition, role in nutritive and pharmaceutical aspects is to be worked out to bring out the utilization value of the precious resource available. The study on localized seaweed flora will pave way for documentation and promote proper planning, husbanding and cultivation of these resources for food and pharmaceuticals in future.