I. INTRODUCTION

Sugarcane is a traditional crop in India grown since time immemorial. There are mentions of sugarcane in vedic literature. In fact, its westward movement was through India. Sugarcane is an important cash crop about 115 countries of the world cultivates sugarcane and produces about 133 million tonnes of sugar which is three fourth of the sugar production (169 million tonnes) of the world (Anonymous, 2011).

In India, sugar industry, the second largest in the country in the agro processing sector, next to textiles, is playing a vital role in the socio-economic transformation of the country and it represents the principal livelihood of 50 million farmers and their dependants. In India, sugarcane is cultivated in an area of 5.08 million hectare with a cane production of 347.80 million tonnes (Agricultural Statistics, 2012). Among the sugarcane growing countries, India ranks first in area and production even in problematic issue about the cost of price to the commercial cane. However, the per hectare productivity in India is comparatively lesser than to the countries like Brazil, Australia, Canada, Indonesia, China and Thailand. Taking into account the population growth, increase of per capita consumption of sugar and other sweetening agents derived from sugarcane and emerging alternative uses, it is projected that the sugarcane requirement by 2030 would be around 600 million tonnes (Sundara, 2011).

Among the states in India, Uttar Pradesh occupies half (2.16 m.ha) of the total area followed by Maharashtra (1.02 m.ha). Though UP dominates in production with 122 million tonnes followed by Maharashtra with 81 million tonnes, in terms of
productivity, Tamil Nadu ranks first with 102.83 t ha\(^{-1}\) followed by Karnataka (90.25 t ha\(^{-1}\)), Maharashtra (80.10 t ha\(^{-1}\)) and Uttar Pradesh (59.58 t ha\(^{-1}\)), against the national average of 70.31 t ha\(^{-1}\). In Tamil Nadu, the area under sugarcane is around 3.46 lakh hectares with a production of 36.54 million tonnes (Agricultural Statistics, 2012).

Despite, its long tradition and large area in India, in terms of productivity, sugarcane yields are not impressive, especially under irrigated condition. Not only the cane yield is low, but also, the sugar yield was typically at less than 10 per cent of cane weight. The Australian sugar industry, for instance, is regularly typified by sugar yields of around 14 per cent while yields up to 25 tonnes of sugar per hectare have been reported in Hawaii (Gujja et al., 2009).

Sugarcane agriculture can be sustained only if profitability can be ensured through reduction of cost of cultivation and improving productivity per unit area. This is only through technological interventions and appropriate extension strategies (Nair, 2009). As such, there are quite a few technologies in sugarcane that can minimize the cost of cultivation with increased returns. This includes use of bio fertilizers, bud chip settlings, wide row spacing etc., (Rajula Shanthy et. al., 2007). Based on the aspects, International Crop Research Institute for Semi-Arid Tropics and World Wide Fund for Nature [ICRISAT-WWF] project has designed the sustainable sugarcane initiative, (SSI).

SSI is a method of sugarcane production that involves raising nursery using single budded chips (use of less seeds), transplanting young and healthy seedlings (25-35 days old), maintaining wide spacing (5 \(\times\) 2 feet) in the main field, less water and optimum utilization of fertilizers and land to achieve more yields. In this method
seed cost is reduced up to 75 per cent compared to conventional practice (Radha Jain et al., 2010). The main concern in SSI is producing high quality, vigorous and healthy seedling in the nursery itself by using organic manures such as coco pith, vermicompost, humic acid etc., along with microbial agents for nutrients supply. Though many mediums are used in the nursery, coco pith (coconut coir waste) is the primary medium used to raise cane seedlings. But, there is a need to identify best combinations of mediums, considering the issues like costs and nutrient availability of the mediums. Organic manures are not only sources of major nutrients, but they also provide other micronutrients and plant growth-promoting molecules, which together lead to good crop yields (Mader et al., 2002).

Humic acids are excellent source of natural and organic way of supplying concentrated dose of essential nutrients, vitamins and trace elements to plants and soil. Humic acid is not a fertilizer. It acts as conditioner for the soil and as biocatalyst and bio-stimulant for the plant (Griffin et al., 2003). Compared to other organic products, humic acid enhances plant growth particularly bio mass production and fertility of the soil. It’s high cation-exchange capacity (CEC), the oxygen content as well as the above average water holding capacity are the reasons for the high value of humic acids for improving soil fertility and plant growth.

Several kinds of microbial agents are capable of fixing N or mobilizing P and other nutrients and thus becoming an integral component of crop production. Acetobacter diazotrophicus (now its renamed as Gluconacetobacter diazotrophicus), a N fixing bacteria associated with sugarcane as an endophyte, is present in high
numbers (as high as $10^6$ counts g$^{-1}$ plant tissue) in root, shoot and leaves (Cavalcante and Dobereiner, 1988).

Sugarcane is normally planted in rows spaced at 60-120cm in India. At present, wide row planting at 150-180cm is becoming a practice in some southern states to facilitate mechanized harvest. In fact, wide row planting is a development in response to need for mechanization of sugarcane farming in a view of the labour shortages experienced. Wide row planting facilitates, easy labour movement within the field, permits mechanized interculture, saves cost, seeds and fertilizers, gives better ratoons and allows in-situ trash management. Mini tractors or power tillers can be employed for intercultural operations and weed control if planting is under wide rows. However, the acceptance of the technology by all the cane growers is still a reservation. Keeping these in view the present study was taken up with the following objectives.

- To evolve a suitable nursery production practice with various organic amendments in order to produce healthy and vigorous seedlings,
- To compare the productivity enhancement of sugarcane by adopting SSI method over conventional method of planting,
- To study the impact of various plant populations on growth, development and yield of sugarcane in main and ratoon crops, and
- To work out the economics of different nursery production techniques combined with optimization of plant population in sugarcane cultivation.