

I.INTRODUCTION

The continuous growth of world's population, urbanization, industrialization and global warming imposes an additional burden on agricultural enterprises. As per World Bank experts prediction, the demand for agricultural products will increase twice by 2030. Therefore, countries that are major in agricultural production should increase their productivity to satisfy future excess demand, taking into account the availability of less land and water resources in the future. The importance of agricultural sector for initiating and sustaining economic growth in developing countries is a well recognized fact. In developing countries with limited cultivable land, growing population pressure and diminishing returns in agriculture, exploring the possibilities for achieving significant land-augmenting technical progress offered by the "organic farming" is of utmost importance. Whatever the final outcome be, a net inflow to or outflow from agriculture depends on the efficiency of resource use and genuine technological progress in the sector.

Worldwide 1.8 million farmers in 162 countries grow organically on more than 37 million hectares of agricultural land. One third of all global organic agricultural land is in Oceania (33 per cent), followed by Europe (29 per cent) and Latin America (18 per cent). Australia is the country with the largest organic agricultural area (12 million hectares) followed by Argentina (3.8 million hectares) and the United States of America (1.9 million hectares). The countries with the largest share of organic agricultural land of all farm land are the Falkland Islands (36 per cent), followed by Leichtenstein (29 per cent) and Austria (20 per cent). In India, organic agricultural land is 0.50 million hectares (Dinesh Kumar, 2014).

India has evolved a rich history of agricultural practices and continues to adapt technologies like bio-dynamic and other systems into its organic practices. India's organic farmers have been at the forefront in developing field based technologies ranging from vermi-compost to integrated livestock practices that facilitate their ability to improve soil fertility even in semi-arid or barren areas. Different parts of India have developed their own local or regional systems for ecological agriculture (Gayathri, 2014).

Agriculture is one of the largest economic sectors and it plays an important role in the overall socio-economic progress of India. It provides livelihood to about 64 per cent of the labour force, contributes nearly 27.4 per cent of gross domestic product and accounts for about 18 per cent share of the country's exports. During the last financial year, farm sector growth was estimated at 1.9

percent. The Eleventh five year plan (2007-12) witnessed an average annual growth of 3.6 per cent in the Gross Domestic Product (GDP) from agriculture and allied sector. Indian agriculture is benefitting a lot due to rising external demand and the sector's wider participation in the global economy (Vijaykumar, 2013). It supplies bulk of wage goods, required by the non-agricultural sector and raw material for a large section of industrial sector.

Recently it is opined by the scientists that, our farming system must look into present day agriculture and advocate that farming system that are ecologically, biologically and socio-economically sound and also dependent upon their crop production. At its origin, the farming system concept takes care of most important components like water, soil, crops, livestock, labour etc. Agriculture is carried out mainly through two types of farming systems namely inorganic farming system and organic farming system characterised by different types of inputs and agricultural management practices used for cultivation of land and production of crop.

In India's pre-independence era (before the 1950s), agriculture was a system of harnessing nature for the sustenance of human beings, similar to the presently defined organic farming. That is, Indian farmers relied on the use of crop rotation, crop residues, animal manures, legumes, green manures, off-farm organic wastes, and biological pest control to maintain soil productivity, supply of plant nutrients, and control insects, pests and other weeds on their farms. Following independence, rapid population growth in India placed great pressure on land and huge demands for food grains led to increased use of fertilizers and pesticides to boost production. Many of the gains in production during the last 4-5 decades resulted from the "Green Revolution," a campaign of technological interventions in agriculture widely adopted by farmers in developing countries. Expansion of irrigation to cover rainfed areas, popularization of hybrids/transgenic varieties of crops, and use of synthetic chemical fertilizers and pesticides were the major technologies that were promoted. Unfortunately, these positive developments have been accompanied by gradual and negative side effects such as secondary salinity, decrease in soil fertility, growing insect resistance to pesticides and increased costs of production, which are challenging the sustainability of conventional agricultural production at high levels.

Some of the factors that contributed to the present crisis in farming could be the shooting-up of the price of factory-made external inputs and the government's slow withdrawal of investment as well as market intervention and more significantly, shifting of subsistence farming (mainly with home

grown inputs) to commercial farming (largely with purchased inputs). In other words, local indigenous farm techniques have been wiped out and replaced by the modern techniques, resulting in an unviable and unsustainable farm enterprise. It is in this context that alternative farm techniques and strategies specifically prone to organic farming for growing crops ought to be found in the larger interest.

The principle of organic cultivation is attracting farmer's world over due to its various advantages over modern agricultural practices. Essentially, it is a farming system which supports and strengthens biological processes without recourse to inorganic remedies such as chemicals or genetically modified organisms. With this type of farming, cost of production can be reduced up to 10-30 per cent as compared to inorganic farming in irrigated areas. However, yield was comparable or slightly low in inorganic farming and that is easily compensated by premium price. In rainfed areas, organic farming yields 7-15 per cent more due to better nutrient and rain water management. Improving the efficiency of rainfed agricultural systems through organic practices is the most appropriate cost effective, environmentally sustainable and practical solution to ensure reliable food production. In rainfed areas, where shortage of rainfall and light soils is a constraint for intensive chemical input based inorganic farming, these constraints become opportunities for organic farming. Thus, organic farming is an integrated system providing round the year work. Input preparation is made at local level and there is ample opportunity for round the year employment and proper utilisation of human resource (Arun Sharma, 2014).

As per the definition of the USDA study team on organic farming "organic farming is a system which avoids or largely excludes the use of synthetic inputs (such as fertilizers, pesticides, hormones, feed additives etc) and to the maximum extent feasible rely upon crop rotations, crop residues, animal manures, off-farm organic waste, mineral grade rock additives and biological system of nutrient mobilization and plant protection". In another definition FAO suggested that "Organic agriculture is a unique production management system which promotes and enhances agro-ecosystem health, including biodiversity, biological cycles and soil biological activity, and this is accomplished by using on-farm agronomic, biological and mechanical methods in exclusion of all synthetic off-farm inputs". Many state-supported agencies, non-governmental organizations (NGOs) and individuals have started experimenting with organic methods of food production in the recent past.

The most popularly accepted definition of organic farming is: 'Organic agriculture is a holistic production management system which promotes and enhances agro-ecosystem health, including biodiversity, biological cycles, and soil biological activity. It emphasizes the use of management practices in preference to the use of off-farm inputs, taking into account that regional conditions require locally adapted systems. This is accomplished by using wherever possible, agronomic, biological and mechanical methods, as opposed to using synthetic materials, to fulfill any specific function within the system' (FAO, 1999). The term 'inorganic farming' refers to a production system which employs a full range of pre- and post-plant tillage practices (e.g. plough, disc plant, cultivator), synthetic fertilizers and pesticides. It is characterized by a high degree of crop specialization. In contrast, organic farming is characterized by a diversity of crops.

The 10th Five-Year Plan encouraged the promotion of organic farming using organic wastes, and integrated pest management (IPM) and integrated nutrient management (INM) practices (Gol, 2001). Even the 9th Five-Year Plan had emphasized the promotion of organic produce in plantation crops, spices and condiments using organic and bio-inputs for the protection of environment and promotion of sustainable agriculture. Presently, many states and private agencies are involved in the promotion of organic farming in India, these also include several ministries and government departments at both central and state levels.

Organic matter recycling has been in use in India for centuries. The shift towards organic production is supported by consumers who are aware of health hazards: demand for food grown organically is increasing by 20-25 per cent in developed countries where awareness is comparatively high. The organic agriculture is indeed being pursued in India and the National Programme of Organic Products (NPOP) was launched in 2000.

Currently, India ranks 10th among the top ten countries in terms of cultivable land under organic certification and 88th in agricultural land under organic crops to total farming area. States like Rajasthan, Tamil Nadu, Kerala, Madhya Pradesh, Himachal Pradesh and Gujarat are promoting organic farming vigorously. It is catching up fast in Tamil Nadu where several farmers in low productive rainfed regions, tribal areas, north east and hilly regions of the state where agricultural practices and production systems are essentially organic due to no or low fertiliser and pesticide use. The organic system promises maintenance of soil fertility and control of pest and diseases by enhancing natural processes and cycles in harmony with natural environment.

According to the reports of 12th five year plan (2014-17), Tamil Nadu has about 5.96 per cent of Nation's population, occupies 4 per cent of the land area and has 3 per cent of the water resources of the Nation. In the State, agriculture provides livelihood to about 40 per cent of the population. Hence, the state's economy swirls around agriculture and allied sectors. Therefore, any disturbance in the growth of the agriculture sector will influence the State's overall growth rate, ultimately leading to deceleration in its economic growth. Realizing agriculture sector's importance, the government of Tamil Nadu is taking all out efforts to usher in Second Green Revolution so as to enhance the farmers' income by 2-3 times from the present level through appropriate land use, farm level planning through Farm Crop Management System (FCMS), moisture harvesting, crop diversification, supporting secondary agriculture, value addition and facilitated marketing. An Average Annual Growth Rate (AAGR) of 5.1 per cent is envisaged for agriculture sector in Vision Tamil Nadu by 2023.

Tamil Nadu performs well in the all India scenario in the productivity of major food crops. It ranked second in productivity of rice next to Punjab (Agricultural Statistics at a Glance, 2011, GOI). The State ranked first position in the case of maize and oilseeds productivity. The State also holds first place in groundnut productivity surpassing Karnataka and Gujarat. Similarly, in the productivity of sugarcane, it is nearly 45 per cent more than the national average. Agriculture in Tamil Nadu at present however contributes only 9.92 per cent to the Net State Domestic Product (TNAU, 2014).

The Gross Cropped Area in Tamil Nadu is around 58.43 lakh hectares of which the Gross irrigated Area is 33.09 lakh hectares which is 57 per cent and the balance 43 per cent of the area are under rainfed cultivation. Major efforts are required to increase the productivity of rainfed crops by overcoming the various challenges such as; erratic monsoon rains, soil with low nutrient and poor water holding capacity, soil and water erosion, etc. The labour scarcity especially during the peak cropping season is also causing difficulty to the farmers to take-up timely field operations. In respect of agricultural crops, the crop cultivation is taken up in two to three seasons annually. Hence to achieve sustainable development and break-through in agricultural production, continuous concentration on technical advancement, input supply, credit and market supports are required (Marie, 2012).

In Tamil Nadu, 90 per cent of the farmers belong to small and marginal category and their operational holdings account 56 per cent of the total areas. The distribution of landholding is skewed towards small and marginal farmers and the average size of holding is low. The semi-medium,

medium and large farmers accounted for a small proportion (9 per cent) of the holdings but operated at a higher proportion (41 per cent) of the total area. The average size of holding was higher in the case of large farmers (20.59 ha.) followed by medium farmers (5.61 ha). The overall average size of land holding had come down from 0.83 ha.in 2005-06 to 0.80 ha.in 2010-11. The reduction in the land holding size in Tamil Nadu directly affects the productivity as the farmer would not be able to afford the investments required for technological improvements.

In order to retain the farmers especially the younger generation to take up agriculture as a profession, the income from the farm holdings requires to be increased considerably. In this context, organic farming is one of the important solutions to face this peculiar situation because in organic farming the different farms can be carefully undertaken and the location specific system can be developed based on available resources which will result in sustainable development. For this purpose the concept of efficiency in agriculture needs special attention.

Measurement of efficiency is fascinating and important subject not only to producers but also to policy makers. The presence of shortfalls in efficiency indicates that output can be increased with given inputs and existing technologies. If this is the case, then empirical estimations of efficiency are important to determine the gain that could be obtained by improving the performance in agricultural production with existing technology. It also helps to find out whether the yield variability is due to random influences beyond the control of the farmers or to the factors under the control of the farms. For achieving the above said objectives, concentration is needed regarding different forms of efficiency, and production function estimates. In economics, the Cobb-Douglas functional form of production functions is widely used to represent the relationship of an output to inputs. A production function can be defined as the specification of the minimum input requirements needed to produce designated quantities of output, given available technology. In the same context, the researcher also had applied Cobb-Douglas production function to assess the resource use efficiency of both organic and inorganic farming system.

Despite the attention which has been paid to organic and inorganic farming over the last few years, very little accessible information actually exists on the costs, returns and efficiency of organic farming in Tamil Nadu. However, only a very few studies has focused on the potential contributions of individual farmer's agricultural production to enhance the productivity and efficiency of organic and inorganic farmers in Tamil Nadu. Given this back drop, the present study assesses the factors

influencing organic and inorganic farming, resource use efficiency and farmer's technical, scale, cost and allocative efficiency by applying DEA models to have a better understanding of the problem, so as to delineate the area for remedial action. This model is an extension to the efficiency studies in that it compares farms' performance in the presence of environmental inputs. An improved understanding of these relationships can help the farmers to allocate scarce resources more efficiently and may assist policy makers to design and formulate agricultural policy to increase agricultural production in Tamil Nadu. Similarly, only a few attempts have been made for comparing efficiency between organic and inorganic farming systems in Tamil Nadu. Therefore, this present study focuses mainly on the issues like economics and efficiency of organic farming vis-à-vis inorganic farming in Tamil Nadu.

Objectives

The major objectives of the study are

- To find out the socio-economic characteristics of organic and inorganic farmers
- To analyse the resource use efficiency of organic and inorganic farming system
- To compare the efficiency of organic and inorganic farming system by technical, scale, cost and allocative efficiencies
- To identify the factors influencing gross returns of organic and inorganic farming system and
- To bring out the constraints as perceived by farmers in operationalising the existing farming systems and to suggest appropriate policy options for enhancing organic farming.

Limitations

The present study is based on primary data since there were limitations to classify the study area across villages due to paucity of village wise, secondary data on organic and inorganic farming. The primary data is based on the memory recall of the sample respondents as farmers seldom keep records. Besides theoretical consideration, the choice of variables was guided by the availability of data. Despite these limitations the findings of the study offer scope for further research in future.

The outcome of the present investigation will be of immense importance to evolve, develop and implement the location specific organic farming systems, in study area, as well as the area with similar situations elsewhere. It will help farmers, academicians and policy makers to decide the strategies which will lead to overall development of agriculture in the region.