CHAPTER - I

INTRODUCTION

Agriculture is the backbone of Indian Economy. During 2013-14, from agriculture and allied sector (including agriculture, livestock and forestry and fishery sub sectors) in terms of Gross Domestic Product (GDP) was about 13.90 percent. Even now, the industry supports 58 percent of population as against about 75 percent at the time of independence. The growth rate target of 4 percent has been set for the agriculture sector for the 12th plan (2012-2017). Around 51 percent of India’s geographical area is already under cultivation as compared to 11 percent of the world average. The present cropping intensity of 136 percent has registered an increase of only 25 percent since independence; further rainfed dry lands constituted 65 percent of the total net sown area. The impressive achievements in agriculture were recorded in the country during three decades since the onset of green revolution in late sixties. This enabled the country to overcome widespread hunger and starvation, achieve self-sufficiency in food, reduce poverty and bring economic transformation in millions of rural families.

There is also an unprecedented degradation of land (107 million hectare) and ground water resource falls in the rate of growth of total factor productivity. Natural resource base of agriculture, which provides for sustainable production is shrinking and degrading and is adversely affecting production capacity of the ecosystem apart from lack of advanced scientific methods in agriculture, unavailability of modern machineries to the farmers and lack of financial support. This degradation needs to be arrested and agricultural productivity has to be doubled to meet growing demands of the population by 2050. Efficiency mediated improvement in productivity is the most viable option to raise production. During 2012-13, in India food crops were cultivated in an area of 123.29 million hectares, 26.71 million hectares of oil seeds, 4.70 million hectares of sugarcane and 10.98 million hectares of cotton (Source: Directorate of Economics and Statistics, Government of India 2014). Apart from these crops the area of 24.20 million hectares were covered by horticulture crops.
After green revolution in mid sixties it became clear that horticulture, for which the Indian geography and agro climate are well suited, is the best option. India has emerged as the largest producer of mango, banana and cashew and second largest producer of fruits and vegetable in the world. The most significant development that happened in the last decade is that horticulture has moved from rural confines to commercial production and this changing scenario has encouraged private sector investment in production system management. The last decade has seen technological infusion like micro-irrigation, precision farming, green house cultivation, and improved post harvest management impacting the development but during the process various issues have emerged.

The stressful work culture of the today’s human beings pushed them to take necessarily the fruits and vegetables. Consequently the sector is flourishing and opening up new prospects of employment and research. There by introducing a new dimension into the agriculture sector across the world as a matter of fact, horticulture is currently considered as a separate industry. India holds enormous potential for production of horticultural crops. However, despite ranking high in terms of overall production, in most species, the yields are far below the world average. Enhancement in productivity levels is not only necessary because land is a finite resource but also to remain cost competitive in the global market. Along with productivity, it is also imperative to improve the quality of the produce. This will not only enable the Indian farmers to compete with the imported products more effectively but also gear them to sell their produce in the international market. This communication highlights some of the strategies that could possibly be adopted to improve production, productivity and the quality of horticulture produce in the country. The horticulture sector encompasses a wide range of crops e.g., fruit crops, vegetable crops, potato and tuber crops, ornamental crops, medicinal and aromatic crops, spices and plantation crops. India, with its wide variability of climate and soil, is highly favourable for growing a large number of horticultural crops. It is the fastest growing sector within agriculture. It contributes in poverty alleviation, nutritional security and have ample scope for farmers to increase their income and helpful in sustaining large number of agro-based industries which generate huge employment opportunities.
Presently horticulture contributes 28 per cent of agricultural GDP. The national goal of achieving four percent growth in agriculture can be achieved through major contribution from horticulture growth.

India is at present witnessing a satisfying trend in horticulture growth in terms of technological adoptions, production availability and export. The expansion of horticulture in non-traditional areas resulted in area under fruits from 3.8 million hectares in 1999 to 5.81 million hectares in 2008 with an increased portion of about 20 million tonnes. The area under vegetable cultivation also showed a similar increase of 1.85 million hectares from 1999-2008 with an increased production of about 34.67 million tonnes. India has emerged as the second largest producer of fruits and vegetables and ranks first in the production of several horticulture crops. As per the Indian Horticulture database published by National Horticulture Board in 2015, India produced 88.98 million metric tonnes of fruits and 162.90 million metric tonnes of vegetables. The area under fruit cultivation stood 7.22 million hectares while vegetables were cultivated at 9.40 million hectares.

To meet out the projected demand of population by 2020 AD, about 50 million metric tonnes of fruits and 143 million metric tonnes of vegetables would be required. Therefore by 2020 A.D. the production of fruits needs to be increased. Requirements of export and processing industry further add to the requirements of horticultural produce. In view of these, there is a lot of scope of increasing production and potentiality of horticulture crops.

Vegetables occupy an important place in diversification of agriculture playing a pivotal role in food and nutritional security of the growing population in our country. Globally India has contributed 15.80 percent and 14 percent in area and production of vegetables respectively (Source: Onion Production Technologies in India - 2015, NHRDF, Nashik).

As per the National horticulture data base 2015, Indian produced 162.90 million metric tonnes of vegetables from area of 9.40 million hectare during 2013-14. With an average productivity of 17.34 metric tonnes/ hectare, tomato (15.44%), onion (16%) and brinjal (11.17%) are major vegetables contributing 42.61 percent of the total production of vegetables in India excluding potato.
The area under vegetable has increased from 5.59 million hectares in 1991-92 to 9.40 million hectare and production from 58.53 million tonnes in 1991-92 to 162.90 million tonnes during 2013-14.

Similarly, India is the largest producer of ginger and okra amongst the vegetables and ranks second in production of potatoes, brinjal, cabbage. This vast production base offered India tremendous opportunities for export. During 2014-15 India exported vegetables to the worth of Rs.4202.78 crores. The major destinations for Indian vegetables are UAE, Bangladesh, Malaysia, UK, Pakistan, Saudi Arabia, Srilanka and Nepal. Onion is one of the major vegetable which is being exported from India. In our country West Bengal occupies highest area (1.38 million hectares) and producing 26.35 million tonnes of vegetables followed by Uttar Pradesh (1.13 million hectares) and producing 23.57 million tonnes and Bihar (0.84 million hectares) and producing 14.46 million tonnes, respectively. The share of onion production of West Bengal, Uttar Pradesh and Bihar in vegetable is 1.44, 1.75 and 8.62 percent respectively.

**Origin, History and distribution of onion**

Since pre-history times, onion is known to the mankind and its reference is mentioned in the religions books like Bible, Quran and inscriptions of ancient civilizations of Egypt, Greece and China. The Greeks and Romans have been using onion since 400-300 B.C. It is known to have been cultivated in India since ancient times and mentioned as a medicinal herb in the medicinal treaties like Charaka Samhita dated back to about 600 B.C and Susrutha Samhitha of 3rd – 4th century A.D. Onion has been cultivated since more than 5000 years on the earth.

It is through that onion has first domesticated in the mountainous regions of North-West India, Afghanistan, Pakistan, Tajikistan and Uzbekistan. Western Asia and areas around the Mediterranean seas seem to the secondary centres of origin. The Alliums are distributed through temperate, warm temperate and boreal zone of the northern hemisphere.
It is supposed that from Central Asia, the onion ancestor probably migrated first towards Mesopotamia, where onion is mentioned in Sumerian Literature (2500 BC), then to Egypt (1600 BC), India and South – East Asia. From Egypt, *Allium cepa* was introduced into Mediterranean area and from there to all Roman Empire. According to Valvilov (1926) South- West Asian gene centre is proposed as primary centre of domestication and variability of onion.

Further, Vavilov and Burkinich (1929), confirmed that Afghanistan and adjacent countries are the genetic centre of origin of cultivated forms of onion and garlic. More than 600 species of Allium are distributed in Afghanistan, Turkey, Iran and central Asia comprising Turmen SSR, Uzbek SSR, Tadzhik SSRF, Kirgiz SSR and Kazakh SSR and Mongolia. Adaptation of onion in India occurred from very early times before Christian era. Originally native of Central Asia of temperate region with perennial/ biennial habit and long day character, it has established well in India under tropical and short day (11-11.5 hours) photoperiodic conditions. Demand for highly pungent and pink-skinned bulbs from Gulf countries made farmers of western India to select such types, which could produce seeds under the same climatic conditions.

It is one of the potential foreign exchange earners and is one among the vegetables, where India figures prominently in the worlds export market. It is used by almost all the sections of the society in various ways for its characteristics pungency and wide ranging medicinal properties. The pungency of onion is due to the presence of sulphur compound. The main compound is ally-propyl-disulphide. Pungency varies with cultivars, growing conditions, package of practices, stage of maturity and storage conditions. The maximum pungency is found just before of tops falls in the field. The red colour of onion is due to presence of pigment anthocyanin while yellow colour is due to the presence of quercetin.

**Nutritional value**

Nutritive value of onions differs from variety to variety, it major value is in its flavor and ranks medium in calorific value, low in protein and very low in vitamins (Annexure - 1). The onions bulbs are rich in minerals like phosphorus and calcium, and vitamin ‘C’ (Aykroyd, 1963). The bulbs are eaten raw or in cooked form and added in food preparations.
Onions are used as spices condiments and vegetables almost daily in every kitchen as a seasoning for wide varieties of dishes the green leaves immature and mature bulbs are eaten raw as well as in preparation of vegetables. It is popularly called as “Queen of Kitchen” because of its characteristics flavor onion is used as salad or cooked in various ways in all curies, fried, example flakes, powder paste, crushed onion and pickles. The dehydrated flakes or powder, a part of fresh onion is in great demand in domestic and Americans prefer yellow onions. Indians prefer red onions.

**Medicinal values**

Onion is known as the dynamic of natural foods. It is a good cleanser and healer and if eaten more often it is also certain that tare would be fewer colds, less catarrh, less anaemia, fewer gastric ills and less insomnia. It is due to volatile oil containing ally-propyl disulphide which is excreted through the lungs when this is eaten giving the breath a characteristics odour. The onion also contains a peculiar form of sugar through which sweet flavor of roasted onion is observed.

It offers very excellent form of food iron and on this account may often be eaten freely by persons suffering from anemia. It is regarded in antiquity as a diuretic of the first order. The juice of onion is applied to burns, chilblains and bites or stings (Nadkarini 1927). The onion is very useful to cure sores, ulcers and certain kinds of dropsy. It is also a digestive stimulant as an anti-fermentative and anti-diabetic. Onions are useful in fever, dropsy, catarrh and chronic bronchitis and mitigate cough in phthisis. In case of bleeding by nose, an onion cut in halves if placed on the nose stop bleeding. Warts also some time disappear if rubbed with cut onions. Fresh onion juice promotes perspiration, relieves constipation, bronchitis, and induces sleep. Onion juice is given as antidote in tobacco poisoning.

**World onion scenario**

The onion is grown in more than hundred countries in the world. However, China and India are the leading countries in growing of onions. China produces 2,26,00,000 metric tonnes from 10,25,000 hectares and India produces 1,94,01,677 metric tonnes of onion from 12,03,565 hectares. While comparing the production
USA tops first and its productivity is 54.60 Mt/ha followed by Netherlands 49.70 Mt, China 22 Mt/ha respectively. Indian yield is only 16.10 Mt/ha while the world average yield is about 19.30 Mt/ha. The Indian average yield is very low as compared to other onion growing countries (Annexure - 2). (Source: FAO web-site year 2015)

**Indian scenario of onion**

Onion is an important vegetable crop grown in India and it is an integral component of Indian culinary. Being an essential food item, it is also a highly politically sensitive commodity. In India, it is grown in area about 12, 03,600 hectares and production is about 1,94,01,700 metric tonnes. The Indian average productivity is 16.10 Mt/ha. The average yield in Gujarat is higher and its productivity is 25.40 Mt followed by Madhya Pradesh 24.10, Bihar 24 Mt/ha. Maharastra, Karnataka, Madhya Pradesh, Rajasthan, Gujarat, Bihar, Andhra Pradesh, Tamilnadu and Odisha are the major onion producing states in India. (Annexure - 3). The area, production and productivity has increased from 2.15 lakh ha, 23.79 lakh tonnes and 11.04 Mt/ha during 1977 to 12.04 lakh ha (460% increase), 194.02 lakh tonnes (716% increase) and productivity 16.12 Mt/ha (46% increase) during 2013-14.

**Export of onion**

India is the third biggest exporter of onion, next to Netherlands and Spain, in the world. Major export is to Middle East countries, Malaysia, Singapore, Sri Lanka and Bangladesh. Depending on preference of colour and size of bulbs, different varieties are exported. Middle East countries prefer light red to dark red bulbs. In Malaysia preference is for dark red bulbs. In America and Japan, demand is for yellowish or brown onion having mild pungency. Europe and Japan markets prefer large sized bulbs while in Singapore, demand is for small onions.

Export of 4.4 lakh tones of fresh onion worth of Rs.332.43 crores during 2001-02 was increased to 14.80 lakh tones worth of Rs.3169.61 crores during 2013-14. Major importers for Indian onion are Bangladesh, Malaysia, UAE and Sri Lanka. About 90% of export from India is of big onion (4-6 cm diameter) and 10% of small onion (3-4 cm diameter) and multiplier onion.
Large onion exported to Malaysia, Middle East countries, Singapore, Sri Lanka and Bangladesh, the small and multiplier onion to Bangladesh, Singapore and Malaysia. Onion accounts for major share (nearly 75%) of vegetables exported from India.

**Demand for processed foods**

The demand for the processed products from onion is increasing day by day due to its convenience to handle and use. Onion can be processed into a wide variety of products. Minimally processed ready to use or ready to cook fresh onions, onion paste, dehydrated onion flakes, onion powder, onion oil, onion vinegar, onion sauce, pickled onion, onion wine and beverage. As per the Directorate of Onion and Garlic Research (DOGR) estimation approximately 6.75% of the onion production is going for processing. Among processed onions, dehydrated onion powder has a good market potential.

The importing countries are Africa, Australia, France, Tanzania, Canada, Spain, USA, Belgium, New Zealand, Argentina, Singapore, Russia, Japan, Kuwait, Switzerland, Denmark, Sri Lanka, Libya, Uruguay and Oman. Preserved onions in vinegar have a market in Singapore, Malaysia, Germany, Netherlands, UK, Spain, Japan, Belgium, Indonesia and Switzerland.

**Tamilnadu onion scenario**

In Tamil Nadu the area under onion during 2013-14 was about 40,000 hectares and production is about 4,72,700 metric tonnes. The productivity is low 11.80 Mt/ha as compared to Indian average yield of 16.10 Mt/ha. (Annexure – 6).

**Table 1.1 Year wise Area, Production and Productivity of onion in Tamilnadu**

<table>
<thead>
<tr>
<th>Year</th>
<th>Area (ha)</th>
<th>Production (Mt)</th>
<th>Productivity (Mt/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011-12</td>
<td>37100</td>
<td>556500</td>
<td>15.00</td>
</tr>
<tr>
<td>2012-13</td>
<td>37700</td>
<td>429700</td>
<td>11.40</td>
</tr>
<tr>
<td>2103-14</td>
<td>40000</td>
<td>472700</td>
<td>11.80</td>
</tr>
</tbody>
</table>

*Source: Directorate of Agriculture & Co-Operation, Data base 2015.*

Tamilnadu state has three percent share in area and two percent share in production (Annexure - 4). The major onion growing districts are Perambalur, Trichy, Namakkal, Erode, Tiruppur, Coimbatore, Dindigul, Theni, Madurai, Virudhunagar,
Tirunelveli and Tuticorin. A distinct feature that differentiates Tamil Nadu from other onion producing states is that area under common big onion is very meagre (18%) of total onion area and rest 82 percent of the area is covered with aggregatum onion (Reddy, P.K. 2004).

The big onions are majorly grown in Kundadam, Udumalpet and Palladam regions in Tiruppur district and Tenkasi, Pavoorchatram and Alangulam regions in Tirunelveli districts. The other onion growing districts are covered by aggregatum onion.

Not like as a common big onion, the aggregatum type of onion has 6 - 8 bulblets per plant and lesser duration. Apart from the local variety there are eight varieties of aggregatum onion namely Co-1, Co-2, Co-3, Co-4, Co-On-5, MDU-1, Agrifound Red and Arka Ujwal (Onion and Garlic Varities – 2012, NHRDF, Nashik).

Out of these varieties except Agrifound Red and Arka Ujwal all others were released by Tamilnadu Agricultural University (TNAU) and Agrifound Red was released by National Horticultural Research and Development Foundation (NHRDF), Nasik and Arka Ujwal was released by Indian Institute of Horticultural Research (IIHR).

The varieties of Co-1, Co-2, Co-3, Co-4, MDU-1 and Agrifound Red are of bulb propagated type and Co-On-5 and Arka Ujwal are seed propagated type since both the varieties are free flowering types. The bulb propagated type has 6 to 8 bulblets per clump with red in colour and 2 - 3 cm diameter in size where as the seed propagated type has 3 - 5 bulblets per clump with bolder size of more than 3 cm diameter in size and appealing pinkish red in colour. Because of its bigger size and attractive colour, the Co-On-5 bulbs fetches higher price always in the market. Moreover for export during the period of March to September the bulbs of bigger size such as Co-On-5 is preferred. The main difference between the bulb and seed propagated type is, investment on seed component. In bulb propagated type (Allium Cepa L. Var: Aggregatum) farmer requires 500 to 600 kg of seed bulbs for planting an acre which is higher in cost. Whereas in seed propagated type (Allium Cepa L. var Don) it requires only 1.5 - 2 kg of seeds for an acre which is economically cheaper as compared to seed bulbs (Sharmila 2015).
The seed propagated aggregatum (*Allium Cepa L. Var. aggregatum Don*) onion was grown initially in seashore villages in Cuddalore district such as Gnanamedu, Thengaithittu and Manjakuppam. This onion was locally called as "Mutlore onion". Because of its poor keeping quality, it cannot be stored for a longer period. During the 1990's the research work on varietal improvement on Mutlore onion was initiated by Tamilnadu Agricultural University, Coimbatore. As a result of the research work, the variety Co-On-5 was released in 2001 (Source: Innovation in production, post harvest handling and marketing of horticulture crops – Souvnier 2012, NHRDF, Nashik).

Forty years back the seed propagated aggregatum onion was only grown in Cuddalore district and some of the villages near Chidambaram area in Tamilnadu in small level whereas the farmers in other parts of state were growing the bulb propagated aggregatum onion. During the year 1995 there was heavy scarcity for seed bulbs of aggregatum onion at the time of planting season and at that time; farmers used seeds of aggregatum onion instead of bulbs because of its higher cost.

Afterwards farmers slowly converted to seed propagated aggregatum onion and now the seed propagated type has been spread over to all the onion growing parts of Tamilnadu. As per the Season and Crop Report 2015 of Director of Seed Certification Tamilnadu, the maximum quantity of seeds of aggregatum onion was consumed in Tiruppur district.

Even though, there has been a rapid shift from conventional bulb propagated type to seed propagated type among onion growers, there exists a wide gap in the adoption of recommended production technology among the onion growers across different districts of Tamil Nadu. It is reported that most of the onion growers are not fully knowledgeable on the nursery management, fertilizer and pesticide application which in turn, results in the reduction of the onion yield.

Hence, there is an urgent need to explore the gap in the awareness, knowledge and adoption of seed propagated onion among farmers and the constraining factors responsible for the non adoption of recommended technology packages. With this end in view, the present study is undertaken in one of the leading district namely Tiruppur, where extent of spread of seed propagated onion production was found to be more when compared to other districts of Tamilnadu state.
Keeping this in view, the present research study was formulated with the major objectives of “Adoption of Improved Production Technologies in Seed Propagated Aggregatum Onion - An Exploratory Study in Tiruppur District of Tamil Nadu” was designed. The specific objectives of this study are as follows:

**Objectives of the study**

The overall objective of the study was to explore the level of awareness, knowledge of onion growers and its impact on the adoption of improved production technologies in seed propagated aggregatum onion in the study area.

**Objectives**

**The specific objectives of the study are**

1. To study the socio economic profile of the seed propagated aggregatum onion growers in the study area
2. To examine the awareness and knowledge level of the onion growers on improved production technologies of seed propagated aggregatum onion
3. To assess the extent of adoption of production technologies followed by seed propagated aggregatum onion growers
4. To examine the association between the level of awareness, knowledge and adoption on improved production technologies of seed propagated aggregatum onion and socio economic variables of the onion growers
5. To find out the constraints faced by the growers of seed propagated aggregatum onion in adoption of production technologies
6. To suggest appropriate policies and strategies needed for improving the adoption level of production technologies of seed propagated aggregatum onion

**Scope and importance of the study**

The very approach and brief statement of objectives stated earlier would indicate the practical utility of the study. The study would describe the personal, socio-economic and psychological profile of onion growers. This would give an overall picture of *status quo* of onion growers.
The study would further delineate differential characteristics of onion growers in categories viz., awareness, knowledge and adoption of improved production technologies in aggregatum onion. This would help the planners, policy makers and development workers to plan their strategies to reach and teach them.

**Limitations of the study**

a) The present study suffered from usual limitations of time and finance.

b) Since the researcher had to restrict the study to a limited area and sample size, its findings are likely to hold good for similar agro-climatic conditions in other areas.

c) It is a qualitative study, which largely relied on the responses received from the farmers about what they knew and felt about. Therefore, the validity of responses and generalisations made out of them may be applicable in similar situations.

In spite of the above limitations, it can be hoped that this study would provide better insight into the improved onion production, which may help in formulating better strategies for aggregatum onion crop production.

**Presentation of the study**

The study is presented as five chapters and each chapter has been devoted to a clear exposition of the various aspects of the main theme. The first chapter **Introduction** gives a brief account of the need, specific objectives, as well as scope and limitations of the study. This is followed by the second chapter **Review of literature**, which deals with the past studies related to the present study. The third chapter **Research methodology** describes the locale of the study with reference to the selection of district, taluk, block, villages and respondents, selection and measurement of variables, data collection and statistical tools used. Chapter four presents the **Analysis and Discussion part**. The **Summary, Findings and Conclusion** constitute the last chapter. References, Annexure and appendices are added at the end.