Chapter II : Growth of Floriculture in East and North-East Himalayas

2.1 Arguments for the area chosen for the study

A breakthrough in agricultural production and productivity in our country was ushered in by the Green Revolution in the mid-1960s. It was a new agricultural strategy of growth characterized by the use of high yield variety (HYV) seeds, fertilizers, irrigation facilities etc. It was an improved package programme comprising not only of extension of irrigation, use of fertilizers and introduction of HYV seeds, but also of plant protection, soil improvement and use of better agricultural practices.

According to the Report of the Working Group on ‘Agricultural Development in East and North-East India’ for the formulation of the Tenth Five Year Plan (2002-2007) constituted by the Planning Commission of the Government of India¹, the Green Revolution that was instrumental in bringing about a remarkable progress in agriculture, had a profound impact in the North-Western part of India but failed to find adequate expression in the East and Northeast states. In terms of development, the East and Northeast states may be scaled as among the most backward in the country. Thus with the aim to improve the quality of life of all citizens through the planning process, it is only natural that the East and Northeast regions demand foremost attention. Key issue of agriculture and allied sector if carefully addressed, a breakthrough in the human development graph of these regions can be successfully achieved.

Regions of the East and Northeast Himalayas are endowed with rich natural resources, congenial climate, sufficient land, cheap labour and other inherent strengths that make these areas extremely conducive to floriculture. Large variety of flowers can be grown round the year at protected environments at low cost leading to increased availability of varieties of good quality flowers to consumers at affordable prices. Therefore, the government has in the recent years recognized floriculture as an extreme focus segment for development initiatives.

Floriculture has proved to be a Prosperous occupation in different regions of India where it has been pursued professionally. In regions of East and North-eastern Himalayas, however, floriculture as a profession is at a nascent stage. Economic upliftment of a community with the help of the existing inputs has proved to be
inadequate in these areas. New avenues like floriculture can offer an added impetus in this regard which is being held back by certain factors that need to be addressed to ensure economic welfare.

With the recommendation of National Research Centre for Orchid (NRCO), APEDA has suggested North East states to emphasize on floriculture for a vibrant rural economy. NRCO has identified the region as a potential area for development of floriculture in view of the geo-climatic condition and opined that Cymbidium orchid of Sikkim, Anthurium of Mizoram and Nagaland, Gladiolus, Marigold and Chrysanthemum of Tripura are the thrust flowers.  

APEDA sanctioned Rs.7.65 crores exclusively for floriculture in North-east states and asked the state governments to chalk out a master plan for it. ‘The region offers good scope for cultivation of a wide variety of flowers because of its diversities in topography, congenial agro-climatic conditions coupled with fertile soil and well-distributed rainfall which ensure year-round production of tropical and sub-tropical flowers,’ opined APEDA Chairman Mr. Pravin Gupta. Senior Agronomist of ICAR, Narendra Pratap Singh commented that since the region is Christian and Hindu dominated, who traditionally use flowers for religious and other activities, there is a gap between demand and supply of flowers in the domestic markets while the UAE, the UK and Japan have good demand of Northeast orchids and flowers.

The Northeast can be viewed as a prospective commercial hub. It has borders with China in the north, Bangladesh in southwest, Bhutan in northwest and Myanmar in east. Thus, it can turn out to be a hub of international trade and commerce. Unlike the rest of India, Northeast India has an added demographic advantage in the sense that it occupies 7.8% of the country’s total land space but has a population of 3.8 crore i.e. 3.73% of the population. There is also a huge untapped emerging market which may prove to be of interest to large domestic and international investors. Northeast India also offers huge opportunities in sectors of strategic importance like energy and infrastructure, oil, natural gas, agro, food processing, horticulture, floriculture, IT, cement, defence etc. All northeast states have distinct advantages and provide immense economic and trade opportunities to domestic and international corporates.
The huge complimentarily arising out of India’s ‘Look East’ Policy and our Southeast Asia focus and the ‘Look West’ Policy of Southeast Asian nations like Thailand, gives rise to immense opportunities for India and ASEAN countries to develop their trade and investment relations, using the Northeast as a primary focal point. Despite the advantages, the Northeast has not grown at par with the rest of the country and the region’s potential has not been exploited adequately. India enjoys a position of strategic advantage to supply her produce easily to major world markets. She is conveniently located in the centre of two growing markets- the European and the Southeast Asian. She is also closer to the developing market of east Europe as compared to central and South African nations. She can cleverly make use of her proximity to the Southeast Asian market of namely Japan, Singapore and Hong Kong on the one side and growing market of the rich Gulf states, coupled with the fact that no major production area of flowers exist in the zone and emerge as a dominant supplier of flowers worldwide. In this respect, areas of East and Northeast Himalayas can prove to be a major contributor in increasing the total production of flowers in the country.

2.2: Special Characteristic features of this region

The states of Sikkim, Assam, Meghalaya, Manipur, Nagaland and Arunachal Pradesh can roughly be taken to cover the East and Northeast Himalayas. These areas, being a storehouse of exotic flora and enjoying congenial climate, harbour immense prospects in the growth and development of floriculture in India. Among them, the states of Meghalaya, Nagaland and Sikkim have already achieved phenomenal success in the spread of floriculture that has infused positive changes, locally as well as nationally, leading to economic upliftment on the whole. So, let us now discuss, in details, about the characteristic features of the states of Meghalaya and Nagaland since they play such a prominent role in highlighting the prospects of floriculture in our country.

MEGHALAYA

Introduction:

Tucked away in the hills of eastern sub-Himalayas is Meghalaya, one of the most beautiful States in the country. Nature has blessed her with abundant rainfall, sun-
shine, virgin forests, high plateaus, tumbling waterfalls, crystal clear rivers, meandering streamlets and above all with sturdy, intelligent and hospitable people.

Emergence of Meghalaya as an Autonomous State on 2nd April 1970 and as a full-fledged State on 21st January 1972 marked the beginning of a new era of the geopolitical history of North Eastern India. It also marked the triumph of peaceful democratic negotiations, mutual understanding and victory over violence and intrigue. The state of Meghalaya is situated in the northeast region of India, and extends between latitude 20°1’N - 26°5’N and longitude 85°49’E - 92°52’E. It extends for about 300 kilometres in length and about 100 kilometres in breadth. It is bounded on the north by Goalpara, Kamrup and Nowgong districts, on the east by Karbi Anglong and North Cachar Hills districts, all of Assam, and on the south and west by Bangladesh.

Shillong, the capital of Meghalaya is located at an altitude of 1496 metres above sea level. Shillong, which was made Assam’s capital in 1874, remained so till January 1972, following the formation of Meghalaya. The capital city derives its name from the manifestation of the creator called Shillong.

Meghalaya is subject to vagaries of the monsoon. The climate varies with altitude. The climate of Khasi and Jaintia Hills is uniquely pleasant and bracing. It is neither too warm in summer nor too cold in winter, but over the plains of Garo Hills, the climate is warm and humid, except in winter. The Meghalayan sky seldom remains free of clouds. The average annual rainfall is about 2600 mm over western Meghalaya, between 2500 to 3000 mm over northern Meghalaya and about 4000 mm over south-eastern Meghalaya. There is a great variation of rainfall over central and southern Meghalaya. At Sohra (Cherrapunjee), the average annual rainfall is as high as 12000 millimetres, but Shillong located at a distance of about fifty kilometres from Sohra receives an average of 2200 mm of rainfall annually.

The temperature range is approximately 2 degree centigrade to 36 degree centigrade depending upon the altitude ranging between 300 meters above mean sea level (MSL) to 2000 meters above MSL. Meghalaya is amongst the highest rainfall areas in the world with an annual average rainfall of 11,000 mm during the period of 1980-91, predominantly mountainous, lying between the Brahmaputra valley in the North and the Surma valley (Bangladesh) in the South.
The economy of Meghalaya is basically agrarian as it is rural based with Agriculture playing a predominant role in the state's economy. Since, 81% of the state's population depends on Agriculture, employment and income generation also depends on Agricultural developmental activities to a great extent. The State is yet to touch the National Level in economic and agricultural growth rate even after attaining full statehood more than forty three years ago.

The State is slowly and steadily progressing inspite of the numerous constraints and limiting factors. Practice of improved and modern methods of Agriculture by the farmers, using of Chemical fertilizers, Plant protection measures and introduction of High Yielding Variety (HYV) seeds of Paddy, Wheat, Maize etc has contributed to the increase in production of food grains. Mechanization of Agriculture has gone up to some extent. Progressive farmers are able to produce more and in turn, they supply seeds to the Department for distribution to small and marginal farmers.

As per Census of 2001, though, 81% of the population depends on agriculture, the net cropped area is only about 9.87% of the total geographical area of the State. The state is deficit in food grains by 1.22 lakh tonnes annually to feed a population of 2.3 million. This is due to a number of constraints, such as the undulating topography, transport and communication problem, population dispersal pattern, inadequate credit support, poor marketing system, etc. To overcome these hurdles, future programmes are proposed, like increasing agricultural/horticultural production and productivity, research system on the development of economically viable and location specific technologies in rainfed, flood-prone irrigated areas, and increasing the utilisation of irrigation potential etc.

**Soil :**

The soils of the hills are derived from gneissic complex parent materials; they are dark brown to dark reddish-brown in colour, varying in depth from 50-200 cm. The texture of soils varies from loamy to fine loamy. The soils of the alluvial plains adjacent to the northwest and southern plateau are very deep, dark brown to reddish-brown in colour and sandy-loam to silty-clay in texture.

Meghalaya soils are rich in organic carbon, which is a measure of nitrogen supplying potential of the soil, deficient in available phosphorous and medium to low in available
potassium. The reaction of the soils varies from acidic (pH 5.0 to 6.0) to strongly acidic (pH 4.5 to 5.0). Most of the soils occurring on higher altitudes under high rainfall belt are strongly acidic due to intense leaching. Base saturation of these soils is less than 35%. These soils are not suitable for intensive crop production.

There is not much difference in fertility classes of the soils of the State. Four soils fertility classes, namely, High Low Medium (HLM), High Medium Medium (HMM), Medium Medium Low (MML), Medium Low Medium (MLM) have been established from the soil test data so far compiled in the Soil Testing Laboratory of the State.

Regarding micronutrient status, it has been observed that almost all the acid soils of the North-Eastern region of the country are deficient in available Boron (B) and Molybdenum (Mo). Acid soils of Meghalaya are rated low in available B and Mo. Total Zinc, Copper and Manganese contents of these soils vary from 10.00 to 17.25, 17.00 to 71.00 and 110 to 770 ppm (parts per million), respectively and DIPA (Diethylene Triamine Penta Acetic Acid) extractable zinc, copper and manganese contents of these soils ranges from 0.72 to 3.20, 0.6 to 2.8 and 3.0 to 162.0 ppm respectively. A study conducted by the Indian council of Agricultural Research (ICAR) Complex, Shillong (2006) revealed that about 40% of the soils of the state contain micronutrients below the critical level.4

**Land use pattern:**

Land use pattern is envisaged on land capability profile. Since land capability in the mountainous region is determined by the characteristics of micro and mini watersheds, land use pattern is therefore envisaged on the capabilities of each watershed and thus the potential of each watershed is thus envisaged to be developed to yield sustainable land use.

Broadly the low lying areas were put under paddy during Kharif and with pulses, paddy, vegetables and oilseeds during the Rabi season depending on the availability of residual moisture and irrigation facilities. Gentle slopes up to 20% were put under other crops like wheat, paddy, maize, pulses, oilseeds, vegetables etc, which not only contribute towards food security but also yield substantial revenue returns per unit of land and labour. On such slopes the concept of watershed management of land and water would be encouraged.
Horticulture was taken up on slopes above 20% and Border Areas, which are traditional horticultural areas, received special attention. Forest cover in the State (42.01%) is below the national norm of 60% recommended for hilly areas. This is because a sizable proportion of the Forest area is reportedly under shifting cultivation resulting in depletion of the Forest Cover. A very meagre proportion of the geographical area (9.90%) is net sown area, including area under shifting cultivation. The potential net sown area could be increased if and when the fallow lands are utilised for cultivation purposes. The cultivable waste land of the state is 20.63% of the geographical area a part of which might be progressively utilised for cultivation purpose in the long run. The cropping intensity of the state is 120%\(^5\).

**Agrarian Structure- Land Holding:**

Land Holding in Meghalaya means the operational holdings\(^6\), as there is little concept of ownership under the traditional land system. The pattern of operational holdings in the State is characterised by the predominance of small and marginal farmers (below 2 Ha.) who operate 82.57% of the total cropped area. The table below shows the information on Number and Area of Operational Holdings by different size groups in the State during the year 2005.

**Table 2.2.1: Structure of Land Holding in Meghalaya in year 2005**

<table>
<thead>
<tr>
<th>Size Class of Operational Holding (Ha.)</th>
<th>Number of Operational Holdings</th>
<th>Area (Ha.)</th>
<th>Average Size of Holding (Ha.)</th>
<th>Percentage of Holding</th>
<th>Percentage of Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Below 0.50</td>
<td>53075</td>
<td>15688</td>
<td>0.3</td>
<td>26.11</td>
<td>6.52</td>
</tr>
<tr>
<td>0.50 – 1.0</td>
<td>59410</td>
<td>38994</td>
<td>0.66</td>
<td>29.33</td>
<td>16.2</td>
</tr>
<tr>
<td>1.0 – 2.0</td>
<td>55335</td>
<td>73387</td>
<td>1.33</td>
<td>27.23</td>
<td>30.5</td>
</tr>
<tr>
<td>2.0 – 3.0</td>
<td>20625</td>
<td>46983</td>
<td>2.28</td>
<td>10.15</td>
<td>19.52</td>
</tr>
<tr>
<td>3.0 – 4.0</td>
<td>8070</td>
<td>25977</td>
<td>3.22</td>
<td>3.97</td>
<td>10.79</td>
</tr>
<tr>
<td>4.0 – 5.0</td>
<td>3110</td>
<td>13086</td>
<td>4.21</td>
<td>1.53</td>
<td>5.44</td>
</tr>
<tr>
<td>5.0 – 7.5</td>
<td>2685</td>
<td>15010</td>
<td>5.59</td>
<td>1.32</td>
<td>6.24</td>
</tr>
<tr>
<td>7.5 – 10.0</td>
<td>685</td>
<td>5717</td>
<td>8.35</td>
<td>0.34</td>
<td>2.38</td>
</tr>
<tr>
<td>10.0 – 20.0</td>
<td>220</td>
<td>2666</td>
<td>12.12</td>
<td>0.11</td>
<td>1.11</td>
</tr>
<tr>
<td>20.0 and Above</td>
<td>30</td>
<td>3137</td>
<td>104.57</td>
<td>0.1</td>
<td>1.3</td>
</tr>
<tr>
<td>Total</td>
<td>150170</td>
<td>224957</td>
<td>1.50</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

*Source: [www.megaagriculture.gov.in](http://www.megaagriculture.gov.in)*
Meghalaya Population 2011:

As per details from Census 2011, Meghalaya has population of 29.67 Lakhs, an increase from figure of 23.19 Lakh in 2001 census. Total population of Meghalaya as per 2011 census is 2,966,889 of which male and female are 1,491,832 and 1,475,057 respectively. In 2001, total population was 2,318,822 in which males were 1,176,087 while females were 1,142,735.

Meghalaya Population Growth Rate:

The total population growth in this decade was 27.95 percent while in previous decade it was 29.94 percent. The population of Meghalaya forms 0.25 percent of India in 2011. In 2001, the figure was 0.23 percent.

Meghalaya Literacy Rate 2011:

Literacy rate in Meghalaya has seen upward trend and is 74.43 percent as per 2011 population census. Of that, male literacy stands at 75.95 percent while female literacy is at 71.88 percent. In 2001, literacy rate in Meghalaya stood at 62.56 percent of which male and female were 71.18 percent and 50.43 percent literate respectively.

In actual numbers, total literates in Meghalaya stands at 1,785,005 of which males were 913,879 and females were 871,126.

Meghalaya Density 2011:

Total area of Meghalaya is 22,429 sq. km. Density of Meghalaya is 132 per sq km which is lower than national average 382 per sq km. In 2001, density of Meghalaya was 103 per sq km, while nation average in 2001 was 324 per sq km.

Meghalaya Sex Ratio:

Sex Ratio in Meghalaya is 989 i.e. for each 1000 male, which is below national average of 940 as per census 2011. In 2001, the sex ratio of female was 975 per 1000 males in Meghalaya.
**Table 2.2.2 : Pattern of Demography of Meghalaya**

<table>
<thead>
<tr>
<th>Description</th>
<th>2001</th>
<th>2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>Approximate Population</td>
<td>23.19 Lakhs</td>
<td>29.67 Lakhs</td>
</tr>
<tr>
<td>Actual Population</td>
<td>2318822</td>
<td>2966889</td>
</tr>
<tr>
<td>Male</td>
<td>1176087</td>
<td>1491832</td>
</tr>
<tr>
<td>Female</td>
<td>1142735</td>
<td>1475057</td>
</tr>
<tr>
<td>Population Growth</td>
<td>29.94%</td>
<td>27.95%</td>
</tr>
<tr>
<td>Percentage of total Population</td>
<td>0.23%</td>
<td>0.25%</td>
</tr>
<tr>
<td>Sex Ratio</td>
<td>975</td>
<td>989</td>
</tr>
<tr>
<td>Child Sex Ratio</td>
<td>932</td>
<td>970</td>
</tr>
<tr>
<td>Density/Km²</td>
<td>103</td>
<td>132</td>
</tr>
<tr>
<td>Density/Mi²</td>
<td>268</td>
<td>343</td>
</tr>
<tr>
<td>Area Km²</td>
<td>22429</td>
<td>22429</td>
</tr>
<tr>
<td>Area Mi²</td>
<td>8660</td>
<td>8660</td>
</tr>
<tr>
<td>Total Child Population (0-6 Age)</td>
<td>467979</td>
<td>568536</td>
</tr>
<tr>
<td>Male Population (0-6 Age)</td>
<td>237215</td>
<td>288646</td>
</tr>
<tr>
<td>Female Population (0-6 Age)</td>
<td>230764</td>
<td>279890</td>
</tr>
<tr>
<td>Literacy</td>
<td>62.56%</td>
<td>74.43%</td>
</tr>
<tr>
<td>Male Literacy</td>
<td>71.18%</td>
<td>75.95%</td>
</tr>
<tr>
<td>Female literacy</td>
<td>50.43%</td>
<td>71.88%</td>
</tr>
<tr>
<td>Total Literacy</td>
<td>1157875</td>
<td>1785005</td>
</tr>
<tr>
<td>Male Literacy</td>
<td>614272</td>
<td>913879</td>
</tr>
<tr>
<td>Female Literacy</td>
<td>543603</td>
<td>871126</td>
</tr>
</tbody>
</table>

*Source: Census Report 2001 & 2011*

**Meghalaya Urban Population 2011:**

Out of total population of Meghalaya, 20.07% people live in urban regions. The total figure of population living in urban areas is 595,450 of which 297,572 are males and while remaining 297,878 are females. The urban population in the last 10 years has increased by 20.07%. Sex Ratio in urban regions of Meghalaya was 1001 females per 1000 males. For child (0-6) sex ratio the figure for urban region stood at 954 girls per 1000 boys. Total children (0-6 age) living in urban areas of Meghalaya were 77,944. Of total population in urban region, 13.09 % were children (0-6).

Average Literacy rate in Meghalaya for Urban regions was 90.79 percent in which males were 92.46% literate while female literacy stood at 89.24%. Total literates in urban region of Meghalaya were 469,851.
Meghalaya Rural Population 2011:

Of the total population of Meghalaya state, around 79.93 percent live in the villages of rural areas. In actual numbers, males and females were 1,194,260 and 1,177,179 respectively. Total population of rural areas of Meghalaya state was 2,371,439. The population growth rate recorded for this decade (2001-2011) was 79.93%.

In rural regions of Meghalaya state, female sex ratio per 1000 males was 986 while same for the child (0-6 age) was 972 girls per 1000 boys. In Meghalaya, 490,592 children (0-6) live in rural areas. Child population forms 20.69 percent of total rural population.

In rural areas of Meghalaya, literacy rate for males and female stood at 71.46 % and 67.15 %. Average literacy rate in Meghalaya for rural areas was 69.92 percent. Total literates in rural areas were 1,315,154.

Table 2.2.3 : Comparison between Rural and Urban Population of Meghalaya:

<table>
<thead>
<tr>
<th></th>
<th>RURAL</th>
<th>URBAN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population (%)</td>
<td>79.93 %</td>
<td>20.07 %</td>
</tr>
<tr>
<td>Total Population</td>
<td>2371439</td>
<td>595450</td>
</tr>
<tr>
<td>Male Population</td>
<td>1194260</td>
<td>297572</td>
</tr>
<tr>
<td>Female Population</td>
<td>1177179</td>
<td>297878</td>
</tr>
<tr>
<td>Population Growth</td>
<td>27.17%</td>
<td>31.12%</td>
</tr>
<tr>
<td>Sex Ratio</td>
<td>986</td>
<td>1001</td>
</tr>
<tr>
<td>Child Sex Ratio (0-6)</td>
<td>972</td>
<td>954</td>
</tr>
<tr>
<td>Child Population (0-6)</td>
<td>490592</td>
<td>77944</td>
</tr>
<tr>
<td>Child Percentage (0-6)</td>
<td>20.69%</td>
<td>13.09%</td>
</tr>
<tr>
<td>Literates</td>
<td>1315154</td>
<td>469851</td>
</tr>
<tr>
<td>Average Literacy</td>
<td>69.92%</td>
<td>90.79%</td>
</tr>
<tr>
<td>Male Literacy</td>
<td>71.46%</td>
<td>92.46%</td>
</tr>
<tr>
<td>Female Literacy</td>
<td>67.15%</td>
<td>89.24%</td>
</tr>
</tbody>
</table>

Floriculture in Meghalaya

Introduction:

Floriculture may be defined as "the art and knowledge of growing flowers to perfection". Being a branch of Horticulture, it deals with the cultivation of flowers and ornamental crops from the time of planting to the time of harvesting. It also includes production of planting materials through seeds, cutting, budding, grafting, etc up to the marketing of the flower and flower produce.
In Meghalaya, floriculture is mostly practiced as a hobby by flower lovers. However, lately the high cost of planting materials, seeds, cut-flowers etc and the increase in their demand, has created awareness in the grower on the commercial aspects. Although commercial Floriculture is a recent development in Meghalaya, however, considering the natural advantages of having the most varied range of climatic conditions in the country, it has a very high potential for cultivation of all types of flowers. The rich flora and the many species of Orchids growing wild in the State which is the highest ever recorded in a single concentrated area is a testimony to this effect. The Floriculture development scheme has created a very good and positive impact to the farmers in terms of returns, creating new economic avenues and thereby enhancing the benefits within a short period to the existing assets of the farmers. The beneficiaries selected were made more aware of the benefits of cultivation of ornamental crops and through the incentives given in this scheme have become more motivated especially in the commercial aspects which will automatically improve their socio-economic conditions.

**Floriculture Development Scheme in Meghalaya:**

**Objectives:**

The objective of the scheme is to focus on the promotional and awareness aspects by providing incentives to the farmers and motivating them to grow traditional as well as 'non-traditional floral crops and house-plants for commercial purpose. However, with the understanding that area expansion of floriculture activities to be supported by Technology Mission Scheme, it was decided in a State level Departmental meeting that Floriculture Development Scheme (State Plan) will support the floriculture farmers in terms of infrastructure like green house etc with a minimum area of 100 sqm as per Government of India rates.

Each unit will serve as a demonstration for which the Department will provide technical guidelines through extension and training. Crop selection will be on the basis of existing popularity and market demands. A few of the recommended crops are orchids, Chrysanthemums, Gerberas, Carnations, Liliums, Strelitzia reginae, Gladiolus, Statice, Gomphrena, Helichyrsums, Roses and different kind of flowering shrubs and house plants etc.
Some component of the scheme like wages, material and supplies, tools and implement etc is also being implemented at the floriculture Nursery at Government Fruit Garden, Shillong. The nursery propagates seedlings of seasonal flowers, potted plants, sale of cut-flowers etc. This is also the only floriculture nursery in Shillong which supports floriculture activities through supply of planting material, training etc to the public and farmers who are interested in floriculture.

Another component of the scheme is to support the Tissue Culture Laboratory at Govt. Fruit Garden, Shillong, again through wages, material and supplies, Laboratory equipment etc. It was set up during 2003-04 under Technology Mission Scheme which started functioning during 2005-06. This Scheme was discontinued as it was a Central Scheme and hence subsume under this state plan -Scheme. The aims and objective of the Tissue Culture laboratory is to enhance the production of planting materials of all horticulture crops especially floriculture. Moreover, this is the only Tissue Culture Laboratory of the Department.

**Eligibility for availing the Scheme:**

All categories of farmers within Meghalaya

**Criteria for selection of beneficiaries under Floriculture:**

1. Beneficiary must have a minimum area of 0.2 ha. or more.
2. Preference will be given to highly enlightened progressive farmers, entrepreneurs who are willing to invest in non - food crops.
3. Beneficiary will be selected by the officer of the respective District Horticulture Officer.
4. Beneficiary must have some level of familiarity with ornamental crops.
5. Beneficiary must have the necessary financial support, economic base for expansion in terms of planting materials, infrastructure etc to improve the commercial potentiality as required/demanded in the cultivation of ornamental crops

**Components under the Scheme:**

1. Planting materials like seeds, seedlings, Plantlets Bulbs, Corms, Tubers, Mother Plants seeds/ bulbs (flower)/ Leather leaf fern/ polythene sleeve/bags/plastic &
Earthenpots/ U.V. films/ Shadenets/ Polythene pipes/ Protrays/ cocopeat/ Perlite/ soil rite/ PH meter/ EC meter/ rock wool/ labelling tags/ packing material for cut flowers, etc.

2. Purchase of Hybrid flower seeds, planting materials for distribution to the farmers at 50% subsidy.

3. Drip Irrigation @ Rs. 262/sq.m

4. Organic and Inorganic manure fertilizers, micro-nutrients, soluble fertilizer rooting hormones, plant protection chemicals etc.

5. Tools & Implements-Secateurs, Pruning Knives, watering cans. Digging spade (plastic handle) sickle (Datri) self sharpening serrated teeth model, Doa, Fork, measuring equipments, Rashi (Local, Knup, Khoh, Star, Hedge shear, Hanging basket, Watering can, lawn mowers etc

6. Green house for a minimum area of 150 sqm @ Rs. 935/sqm as per G.O.I. norms.

### Table 2.2.4 : District-Wise Horti-Hubs With The Types of Flowers They Specialize

<table>
<thead>
<tr>
<th>District</th>
<th>Specialization</th>
</tr>
</thead>
<tbody>
<tr>
<td>East Khasi Hills</td>
<td>Functions as a Hub for temperate zones</td>
</tr>
<tr>
<td></td>
<td>Catering to flower cluster</td>
</tr>
<tr>
<td></td>
<td>Specialised for Flowers, Orchids like Cymbidium, Lady Slipper, Carnation, Liliums and Alstomeria</td>
</tr>
<tr>
<td>West Khasi Hills</td>
<td>Rose, Carnations</td>
</tr>
<tr>
<td>Jaintia Hills</td>
<td>Rose, Gerberas, Carnation, Leather Leaf Fern, Orchids</td>
</tr>
<tr>
<td>East Garo Hills</td>
<td>Bird of Paradise, Leather Leaf Fern, Orchids</td>
</tr>
<tr>
<td>West Garo Hills</td>
<td>Anthurium, Carnation, Heliconia, Leather Leaf Fern, Strawberry, Coloured Capsicum</td>
</tr>
<tr>
<td>South Garo Hills</td>
<td>Anthurium, Coloured Capsicum, Leather Leaf &amp; Vegetables</td>
</tr>
<tr>
<td>Ri-Bhoi District</td>
<td>Rose &amp; Strawberry</td>
</tr>
</tbody>
</table>

### NAGALAND

**Introduction**

Nagaland is a state in North East India. It borders the state of Assam to the west, Arunachal Pradesh and part of Assam to the north, Burma to the east and Manipur to the south. The state capital is Kohima, and the largest city is Dimapur. It has an area of
16,579 square kilometres with a population of 1,980,602 as per the 2011 Census of India, making it one of the smallest states of India.

The state is inhabited by 16 major tribes - Ao Naga, Angami Naga, Chang Naga, Konyak people, Lotha Naga, Sumi Naga, Chakhesang Naga, Khiamniungan people, Bodo-Kachari people, Phom Naga, Rengma Naga, Sangtam Naga, Yimchunger, Thadou people, Zeliang and Pochury as well as a number of sub-tribes. Each tribe is unique in character with its own distinct customs, language and dress. Two threads common to all, is language and religion - English is in predominant use and Nagaland is one of three states in India where the population is predominantly Christian, with conversions starting in the British Raj era.

Nagaland became the 16th state of India on 1 December 1963. Agriculture is the most important economic activity and the principal crops include rice, corn, millets, pulses, tobacco, oilseeds, sugarcane, potatoes, and fibres. Other significant economic activity includes forestry, tourism, insurance, real estate, and miscellaneous cottage industries. The state has experienced insurgency as well as inter-ethnic conflict, since the 1950s. This violence and insecurity has long limited Nagaland's economic development, where it had to commit its scarce resources on law, order and security. In last 15 years, the state has seen less violence and annual economic growth rates nearing 10% on a compounded basis, one of the fastest in the region. The state is mostly mountainous except those areas bordering Assam valley. Mount Saramati is the highest peak with a height of 3,840 metres and its range forms a natural barrier between Nagaland and Burma. It lies between the parallels of 98-degree and 96-degree East Longitude and 26.6-degree and 27.4-degree latitude north of the equator. The state is home to a rich variety of flora and fauna; it has been suggested as the "falcon capital of the world".

**Geography and climate:**

Nagaland is largely a mountainous state. The Naga Hills rise from the Brahmaputra Valley in Assam to about 2,000 feet (610 m) and rise further to the southeast, as high as 6,000 feet (1,800 m). Mount Saramati at an elevation of 12,601.70 feet (3,841.00 m) is the state's highest peak; this is where the Naga Hills merge with the Patkai Range in which form the boundary with Burma. Rivers such as the Doyang and Diphu to the
north, the Barak river in the southwest, dissect the entire state. 20 percent of the total land area of the state is covered with wooded forest, a haven for flora and fauna. The evergreen tropical and the sub tropical forests are found in strategic pockets in the state.

Nagaland has a largely monsoon climate with high humidity levels. Annual rainfall averages around 70–100 inches (1,800–2,500 mm), concentrated in the months of May to September. Temperatures range from 70 °F (21 °C) to 104 °F (40 °C). In winter, temperatures do not generally drop below 39 °F (4 °C), but frost is common at high elevations. The state enjoys a salubrious climate. Summer is the shortest season in the state that lasts for only a few months. The temperature during the summer season remains between 16 °C (61 °F) to 31 °C (88 °F). Winter makes an early arrival and bitter cold and dry weather strikes certain regions of the state. The maximum average temperature recorded in the winter season is 24 °C (75 °F). Strong north-west winds blow across the state during the months of February and March.

**Demography:**

According to Census 2001, the population of Nagaland was nearly two million people, of which 1.04 million were males and 0.95 million females. Among its various districts, Tuensang had the largest population (414,000), followed by Kohima (314,000). The least populated district was Phek (148,000). 75% of the population lived in the rural areas. As of 2013, about 10% of rural population is below the poverty line; among the people living in urban areas 4.3% of them are below the poverty line.

The state showed a population drop between 2001 census to 2011 census, the only state to show a population drop in the census. This has been attributed, by scholars, to incorrect counting in past censuses; the 2011 census in Nagaland is considered most reliable so far.

**Religion:**

Christianity is the predominant religion of Nagaland. The state's population is 1.978 million, out of which 88% are Christians. The census of 2011 recorded the state's Christian population at 1,739,651, making it, with Meghalaya and Mizoram, one of the three Christian-majority states in India and the only state where Christians form 90% of the population. The state has a very high church attendance rate in both urban and
rural areas. Huge churches dominate the skylines of Kohima, Dimapur, and Mokokchung.

Hinduism, Islam and Jainism is also found in Nagaland. They are minority religions in the state, at 8.75%, 2.47% and 0.13% of the population respectively

**Economy:**

42% of Nagaland is covered by forests. Forest and agriculture are primary drivers of its economy. The Gross State Domestic Product (GSDP) of Nagaland was about ₹12065 crore (US$1.9 billion) in 2011-12. Nagaland's GSDP grew at 9.9% compounded annually for a decade, thus more than doubling the per capita income.

Nagaland has a high literacy rate of 79.55 per cent. Majority of the population in the state speaks English, which is the official language of the state. The state offers technical and medical education. Nevertheless, agriculture and forestry contribute majority of Nagaland's Gross Domestic Product.

Most of state's population, about 68 per cent of the total, depends on rural cultivation. Forestry is also an important source of income. Cottage industries such as weaving, woodwork, and pottery are also an important source of revenue.

Nagaland emerged as a separate State, carved out of the Naga Hills districts of Assam and North Eastern Frontier Agency (NEFA) province in 1963. The State has a population of 19.89 lakh with an area of 16.8 thousand Sq. kms as per the 2001 census. It has 11 districts and 52 blocks covering 1286 villages. There are 11 DRDAs and 1083 Village Development Boards (VDBs). The density of population is low at 120 per sq.km. Rural population constitutes 82.26% and urban population 17.74% of the total. Overall literacy ratio is high at 67.14%. Though Nagaland has heavy rainfall, it lacks adequate water storage facilities. This infrastructure limitation leads to greater challenges in bringing more areas under irrigation. The average net area irrigated to total crop area is low at 43%. This indicates that 57% of agriculture is being carried out under rain-fed irrigation condition. Agriculture is the main occupation of the people of Nagaland. About 65% of the population depends on agriculture as per 2001 census. Shifting (Jhum) and terrace cultivation remain the dominant form of the land use pattern of the State. Jhum cultivation has been devised over generations and terraced rice cultivation has been practiced for decades. Rice cultivation is mostly done in the plain area of Dimapur,
Wokha, Mokokchung and Mon districts. Government of Nagaland has promoted terracing as an alternative to jhum cultivation. Use of technological innovations in terms of improved seeds, fertilizers and better implements has been limited. The level of fertilizer consumption in Nagaland was 4 kg/ha of net sown area. This practice of harmonizing with nature and influence of environment has enabled Nagaland to experience and explore organic farming practices.  

**Horticulture:**

Till recently, for most farmers horticulture has been mainly a backyard activity as they are generally busy throughout the year in cultivation of food crops and have little time for development of horticultural crops on a commercial basis. Besides, due to the long gestation period involved in plantation and horticulture crops, the cultivation of these crops has been generally confined to small backyard gardens developed by almost every household. It is only in the past decade that there has been a more focused attention to the development of horticulture in the State. The plantation and horticulture sector plays an important role in the development of the rural economy of the State. The diverse agro climatic conditions, varied soil types and abundant rainfall prevailing in the State enables the cultivation of several plantation and horticultural crops covering fruits, vegetables, spices, flowers, mushrooms and medicinal and aromatic plants. The geographical conditions offer tremendous scope for horticulture development in the State.  

**Table 2.2.5 : Potential Crops in Nagaland**

<table>
<thead>
<tr>
<th>Category</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fruits</td>
<td>Passion fruit, orange, pineapple and banana</td>
</tr>
<tr>
<td>Vegetables</td>
<td>Cabbage, peas, onion and potato</td>
</tr>
<tr>
<td>Flowers</td>
<td>Gladioli, roses, lillium, orchids and anthurium</td>
</tr>
<tr>
<td>Spices</td>
<td>Ginger, cardamom, turmeric, and Black pepper</td>
</tr>
<tr>
<td>Medicinal &amp; Aromatic Plants</td>
<td>Patchouli, neem, agar and ginseng</td>
</tr>
<tr>
<td>Plantation Crops</td>
<td>Areca, coconut &amp; cashew</td>
</tr>
</tbody>
</table>

Source: Department of Horticulture, Government of Nagaland

**Floriculture:**

Floriculture has emerged as a major diversification option in the agri-business in recent years. The product wise groupings under floriculture are cut-flowers (fresh), bulbs and tubers, live potted plants, dried plants, dried flowers, etc. Floriculture has the potential to contribute substantially to the growth of the agriculture sector in the state. The State
Horticulture department has identified a few flowers for commercial production with an eye on the export market. Lillium, anthurium, carnation and Roses are the identified flowers. Commercial production of rose and lillium has since started and the same are being exported to both domestic and foreign markets. Accordingly, a number of flower growers have been given the requisite training for commercial production of these flowers. Necessary backward and forward linkages have been created / initiated by the Department to ensure viability of these units. The districts of Kohima, Mokokchung, Wokha and Dimapur have been selected for commercial production of these flowers based on their accessibility and agro-climatic suitability. The market for cut flowers is increasing with a parallel demand for potted plants, foliage, etc. The large-scale cultivation of flowers, fruits and vegetables transform the lives of the people of Nagaland. Nagas have always had a fondness for growing flowers, though it is only in recent years that people are taking up growing of flowers on a commercial scale, funded under the Horticulture Technology Mission. Nagas experience a “labour of love” or tending to the flowers rather than strictly for commercial gains. When just a few years ago Nagas were importing flowers from outside, Nagas can now take pride in the fact that their high quality home grown flowers are finding a market outside the State. Depending on the performance of the growers, beneficiaries are also given integrated components like vermiculture units and farm handling units, besides water tanks. The projection of Nagaland as a large scale producer of flowers, fruits and vegetables for internal/external consumption has been a big boost to the rural economy and it is now necessary to encourage floriculture and horticulture on a commercial basis with State Government help and to form Producer Companies and Farmers Association, to assist in marketing of perishable goods.

Before the introduction of Horticulture Mission in the State, Floriculture was merely confined to kitchen gardens in small patches. But with the active support of the Technology Mission for the North-East, Floriculture activity has been taken up commercially in the State through allocation of various funds. Cultivation of flowers on a commercial scale was initiated from the year 2004-2005 and is now recognized as one of the main thrust areas for trade within and outside the State.
The progress of business in Floriculture has been rapid and quite satisfactory. Naga flowers presently command a popular and prestigious name in the Floriculture world today. Commercial cultivation of flowers has been flourishing, opening a huge prospect for the state to emerge as a major producer of fresh cut flowers. Floriculture has emerged as a major business option for unemployed youths of Nagaland, with the trade registering annual turnovers in crores of rupees in recent years. The Nagaland flowers being of international quality, were high in demand in both India and abroad. The State Horticulture Department has identified a few flowers like lillium, anthurium, carnation and roses for commercial purposes with an eye on the export market. Nagaland receives its share of the funds for integrated development of horticulture in the State. 15% of the State’s flower growers were aware of the fact that the flower business would give them fastest returns. With this aim in mind, more and more educated Naga youths were adopting floriculture as an income avenue, more importantly as an alternative means of earning their livelihood.

2.3 Types of Flowers and their Techniques of Cultivation:

GERBERA

A. Introduction:

Gerbera (Gerbera jamesonii) is an important commercial flower crop grown throughout the world in a wide range of climatic conditions. It is ideal for beds, borders, pots and rock gardens. The flowers come in a wide range of colors and lend themselves beautifully to different floral arrangements. The cut blooms when placed in water remain fresh for a reasonable amount of time.

Gerbera belongs to the family “Compositae”. Plants are stem less and tender perennial herbs, leave radical, petiole, lanceolate, deeply lobed, sometimes leathery, narrower at the base and wider at toe and are arranged in a rosette at the base. The foliage in some species has a light under surface.

The daisy-like flowers grow in a wide range of colours including yellow, orange, cream-white, pink, brick red, scarlet, maroon, terracotta and various other intermediate shades. The double cultivars sometimes have bicolor flowers, which are very attractive. The flower stalks are long, thin and leafless.
B. Soil Structure:
To be successful in Gerbera growing, soil selection is very important. The main factors to consider are as under:
1] Soil pH should be in between 5.5 to 6.5 or it should be maintained at this level to get maximum efficiency in absorption of nutrients.
2] The salinity level of soil should not be more than 1 mS/cm. Therefore, as soon as the site is selected, the soil should be analyzed to decide its further reclamation.
3] The soil should be highly porous and well drained to have better root growth and better penetration of roots.
The roots of Gerbera go as deep as 50-70 cm.

C. General Disinfection of Soil:
Before plantation of Gerbera, disinfections of soil is absolutely necessary. In particular, the fungus Phytophthora is a menace to Gerbera. The various methods of sterilization are:
1. **Steam:** Not feasible for Indian conditions.
2. **Sun:** The soil is to be covered with plastic for 6-8 weeks. Sunrays will heat up the soil, which will kill most fungi with time.
3. **Chemical:** Hydrogen peroxide (H₂O₂)

Procedure:
- Bed material is to be mixed properly
- Flat beds are to be made of 8m X 4m each.
- Normally to sterilize 500 M² area 150 lit. H₂O₂ in 1,00,000 lit. Water is needed. But there may be change in water quantity depending on the initial moisture level of the soil.
- For 8m X 4m bed i.e. 32 m² area the water requirement is approximately 5700 lit.
- The requirement of H₂O₂ for 32 m² area is 8.55 lit. i.e. 8.55 lit. to be mixed in 5700lit. water.
- It is necessary to know the discharge of electric motor (E.M.) available at site.
• Now the time required to pier up 5700 lit. water as per motor discharge is to be calculated
• While \( \text{H}_2\text{O}_2 \) sterilization, most important factor to be taken into consideration that the 8.55 lit. \( \text{H}_2\text{O}_2 \) will be continuously discharged with 5700 lit. water for 32 m² area in desired time. If the \( \text{H}_2\text{O}_2 \) will be discharged earlier than the water then the procedure is wrong, as it does not give proper sterilization.

D. Bed Preparation:

In general, Gerberas are grown on raised beds to assist in easier movement and better drainage. The dimensions of the bed should be as follows:

Bed height : 1.5 ft. (45 cm)
Width of bed : 2 ft. (60 cm)
Pathways between beds : 1 ft. (30 cm)

If soil is black cotton gravels or murum (6” layer) can be added at the bottom for better drainage. Recommended quantity of soil and sand is added along with organic manures. Organic manure is recommended to improve soil texture and to provide nutrition gradually.

At the time of bed preparation (After fumigation) neemcake (@1kg/Sq.M.) is added as prevention against nematode. All material should be mixed thoroughly for optimum results.

The composition of bed material should be such that it should be highly porous, well drained and provide proper aeration to the root system.
Table 2.3.1: Bed Material Composition of Gerbera

<table>
<thead>
<tr>
<th>Material</th>
<th>Clay soil</th>
<th>Silty loam soil</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red soil</td>
<td>55%</td>
<td>60%</td>
</tr>
<tr>
<td>Sand</td>
<td>15%</td>
<td>10%</td>
</tr>
<tr>
<td>FYM</td>
<td>30%</td>
<td>30%</td>
</tr>
<tr>
<td>Rice husk</td>
<td>4kg/m²</td>
<td>2.5kg/m²</td>
</tr>
</tbody>
</table>

Basal fertilizer dose (After bed preparation):

<table>
<thead>
<tr>
<th>Area</th>
<th>Chemical</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>100 sqft.</td>
<td>Single Super Phosphate</td>
<td>2.50 kg</td>
</tr>
<tr>
<td>100 sqft.</td>
<td>Magnesium Sulphate</td>
<td>0.50 kg</td>
</tr>
<tr>
<td></td>
<td>Biozyme granules</td>
<td>200 gm</td>
</tr>
<tr>
<td></td>
<td>Humigaurd Granules</td>
<td>200 gm</td>
</tr>
</tbody>
</table>

This is to be mixed well in upper 6” soil layer, water is to be applied and at Vapsa condition (Field capacity level) EC and PH of soil is to be checked before plantation.

E. Green House for Commercial Cultivation:

1. Criteria for site selection:
   a. The land should be levelled.
   b. No wind breaks or multi storied structures present upto 30 meters.
   c. Good connectivity to nearest market
   d. Electricity at the site
   e. No high tension electricity wire upto 5 meters
   f. Availability of good quality of water

2. Specification:
   a. Height: 5 to 6.5m
   b. Length: North-South
   c. Gutter direction: North-South
   d. Polythene thickness: 200microns
e. Vent opening: Along the wind direction
f. Distance between two adjoining poly houses should be minimum 4m.

3. Sufficient ventilation space is required on top and sides.

4. To protect the plants from the rain in the monsoons, without affecting the air circulation side curtains should be kept open in slanting position.

5. To control light intensity and solar radiation, white shade net (50%) is used. Approximately 400w/m² light intensity is required on the plant level.

**Top shade net opening and closing:**
- During cloudy climate it is to be kept open, otherwise closed from 10.00 am to 4.00 pm.
- During cold nights the shade nets are to remain closed
- In summer they var to be kept closed from 9.30 am to 5.00 pm.

6. The ideal temperature for Gerbera flower initiation is 23°C and for leaf unfolding is 25-27°C. The flowering of Gerbera is harmed below 12°C and above 35°C.

```
12°C     35°C
Bud initiation will stop
Frequency of flowers will be very low and abortion of buds will
```

7. The optimum humidity inside the greenhouse should be 70-75%, which will maintain the health of the plants.

8. The top of the plastic should be washed in every one month interval to remove the dust and get maximum benefit of sunlight.

9. White wash is to be applied to East, west and north sides of green house to protect plants from bright light intensity during summer season.

**F. Planting:**

While planting Gerbera plants, the crown of plants should be 1-2 cm above soil-level. As the root system establishes; the plants are pulled down. Therefore, the crown must be above the ground level at planting and also throughout the life cycle.
The seedlings are to be planted without disturbing the root-ball. Generally two rows should be planted on one bed at 37.5 cm distance between the rows and 30 cm distance between the plants in one row i.e.

- Row - Row = 37.5 cm = 1.25’
- Plant – Plant = 30.0 cm = 1’

The soil surrounding the plant needs to be raked every fortnight for aeration. After plantation, the humidity is to be maintained at 80 – 90% for 4-6 weeks to avoid desiccation of plants.

*Excessive watering to Gerbera should be strictly avoided.*

**G. Irrigation:**

1. Water quality should be as follows:
   - a. pH- 6.5-7.0
   - b. Ec- < 0.7 ms/cm.
   - c. T. D. S. < 450ppm
   - d. Hardness < 200ppm

   To lower the pH of water, acids in the water tank are to be added which should be rinsed properly and then the water should be used for irrigation and spraying.

2. Immediately after plantation, the plant should be irrigated with overhead irrigation for three weeks to enable uniform root development. Thereafter a gradual change to drip irrigation is advisable. Drip irrigation is mainly for correct doses of fertilizers.

3. Generally one drip per plant is required. The aim is to provide sufficient irrigation in the 2nd year for the extra foliage. The water requirement of Gerbera
Plant is approximately 300 to 700 ml per plant per day depending upon the season. In hot summer, foggers can be used to maintain the humidity of the air.

4. Before irrigation the soil column is to be observed and the soil visually checked for moisture content. Then the quantity of irrigation required is to be decided.

5. During summer season, water to the edges of the beds is to be applied frequently by using shower to minimize the evaporation losses and to maintain micro climate. For this purpose provision for water outlets (1” diameter pipe) should be made inside the poly house. Number of outlets depends on size of the poly house.

6. The plants are to be always watered before 12 noon.

7. The relative humidity of air should not exceed 90-92 per cent, as it will lead to deformity of flowers.

8. As a thumb rule, the soil should be moderately moist-however never having excessive water.

9. Always fresh water should be used for irrigation i. e. Water is not to be stored for more than 4 to 5 days.

H. Fertilization:

1. After three weeks of plantation apply N:P:K 1:1:1 (e.g. 19:19:19) @ 0.4 gm/plant every alternate day with Ec 1.5ms/cm for first three months during the vegetative phase to have better foliage.

2. Irrigation and fertilization is to be conducted frequently in small quantities for optimum results with care to fulfill the crop requirement.

3. Micronutrients should be given daily or weekly as per the deficiency symptoms (e.g. Fertilon Combi II, Microsole B, Rexolin, Sequel and Mahabrexil @ 40g per 1000lit of water)

4. Organic manures with Ec less than 2ms/cm is to be added at every 3 months interval to maintain proper C:N Ratio.

5. As a layman, whenever one enters the greenhouse the plants should look very healthy and glossy.
I. Cropping Patterns and Harvesting of Flowers:

Gerbera is a 24-30 months crop. The first flowers are produced 7-8 weeks after plantation when plants are with 14 to 16 leaves. The average yield is 240 flowers per sq. mt. (6 plants/sqmt.).

1. The flowers are harvested when 2-3 whorls of stamens have entirely been developed; this will decide the vase life of flowers.
   a. The flowers are to be plucked in the morning or late in the evening or during the day when temperature is low.
   b. The flower is to be plucked from the plant rather than cutting them.
   c. The heel of the stem is to be given giving an angular cut.
   d. Immediately the flowers are to be put in 2-3 cm water after harvesting for four hours at 14-15°C.
   e. Always commercial bleach/Sodium Hypochlorite (@ 7-10 ml) or Citric acid + Ascorbic acid @ 5ml each/lit of water is to be added.
   f. The individual flower is 66leeved with poly thin bag of size 4.5”x4.5”
   g. Bundle of 10 flowers is prepared.
   h. The flowers are packed in a box with following dimensions. Generally 250 to 300 flowers are packed per box.

   ![Diagram of box dimensions](image)

A good flower is:
1. Stalk length = 45 – 55 cm.
2. Diameter of flower = 10 – 12 cm.

A Gerbera cut flower has a minimum vase life of 8-10 days.
CARNATION

Carnation Cultivation

Introduction:
Carnation is one of the most important cut flowers of the world. Carnations are grown in almost every climate. In temperate zones mostly in glasshouses, in sub tropic areas, in plastic and glasshouses as well as in open air and in tropic areas more or less shaded. Carnation belongs to the family Caryophyllaceae, the genus Dianthus and species caryophyllus.

The carnation varieties can be divided into two main groups:

1. Standard varieties:
The standard carnation has one large flower on an individual stem. It was the first type of carnations used for large-scale production.

2. Spray varieties:
The spray carnation has several shorter branches with smaller flower on each branch. These varieties were developed less than 50 years ago in United States.

Importance and uses:
Carnations are excellent for cut flowers, bedding, pots, borders, edging and rock gardens. Due to its excellent keeping quality, wide range of forms, ability to withstand long distance transportation and remarkable ability to rehydrate after continuous shipping. Carnation is preferred by growers to rose and chrysanthemums in several flower-exporting countries.

Although cut carnations are sold in the western countries all the year round, they are in particular demand for the Valentine’s day, Easter, Mother’s day and Christmas.

India too has the potential for growing good quality carnation. Places having cool climate like Kalimpong, Kodaikanal, Bangalore, Pune, Nasik, etc. are most suitable areas for the production of cut flowers, which may also be exported to Europe.

Soil: Carnations can be successfully grown in any type of soil but the soil should be well drained and be in good physical condition. Soil must be worked upto 40 cm as carnation roots go as deep as 25 to 30 cm. The ideal soil pH is between 5.5 to 6.5. The optimum
EC during vegetative stage is 1.2 ms/cm. and during generative stage is 1.5 to 1.7 mS/cm.

A rich sandy loam or loamy sand is considered to be the most ideal soil for successful production of carnation. Soils with higher amount of clay or silt should be amended by incorporating organic matter or compost.

It is indispensable to sterilize the soil to keep pace with problem of *Fusarium* and nematodes (usually with Methyl Bromide). Before planting, soil sample should be analyzed with respect of main and trace elements to advice on basic fertilization.

**General disinfection of soil:**

Before plantation of Carnation, disinfections of soil are absolutely necessary. In particular, the fungus *Phytophthora* is a menace to Carnation. The various methods of sterilization are:

1. **Steam:** Not feasible for Indian conditions.
2. **Sun:** The soil is to be covered with plastic for 6-8 weeks. Sunrays will heat up the soil, which will kill most fungi with time.
3. **Chemical:** Hydrogen peroxide (H₂O₂)

**Procedure:**

- Bed material is to be properly mixed.
- Flat beds of 8m X 4m each are to be made.
- Normally to sterilize 500 M² area 150 lit. H₂O₂ in 1,00,000 lit. Water is needed. But there may be change in water quantity depending on the initial moisture level of the soil.
- For 8m X 4m bed i.e. 32 m² area the water requirement is approximately 5700 lit.
- The requirement of H₂O₂ for 32 m² area is 8.55 lit. i.e. 8.55 lit. Which is to be mixed in 5700lit. water.
- While H₂O₂ sterilization, most important factor to be taken into consideration is that the 8.55 lit. H₂O₂ will be continuously discharged with 5700 lit. water for 32 m² area in desired time. If the H₂O₂ will be discharged earlier than the water then the procedure is wrong, as it does not give proper sterilization.
Climate:

1. **Temperature:** Temperature is the major factor that influences the growth and flowering of carnation. Best quality carnations are produced in areas having high light intensity during winter and at the same time the temperatures during summer months are mild. In case of carnation growing, moderate temperatures are preferred. Temperature at night is very important for quality. The difference between day and night temperature should be big enough and the night temperature low enough to grow carnations of best quality. Higher day and night temperatures especially during flowering results in abnormal flower opening and calyx splitting. Ideal day and night temperature is 28°C and 16 to 18°C, respectively.

2. **Light:** The carnation is a facultative long day plant, which means that they form the flowers faster during long days than in short days. Carnations require high levels to produce high quality flowers. Cyclic lighting from dusk to dawn increases the flower fresh weight and the strength of flower stalk. The photoperiod is more important factor than light intensity in flowering, which influences the lateral shoot development and flowering in carnation. Carnation handles lot of light i.e. upto 50000 lux.

3. **Humidity:** At the initial stages of growth and development, humidity should be maintained around 80 to 85 per cent. Whereas at full growth stage it should be 60 to 65 per cent. Hot and humid climate is not suitable for carnation cultivation.

4. **Optimum CO₂ concentration:** Should be around 800 to 1000 ppm.

**Greenhouse for commercial cultivation:**

1. Criteria for site selection
   a. The land should be leveled.
   b. No wind breaks or multi storied structures should be present upto 30 meters.
   c. Good connectivity to nearest market
   d. Electricity at the site
e. No high tension electricity wire upto 5 meters
f. Availability of good quality of water

2. Specification for green house:
   a. Height: 5 to 6.5m
   b. Length: North-South
   c. Gutter direction: North-South
   d. Polythene thickness: 200microns
   e. Vent opening: Along the wind direction
   f. Distance between two adjoining poly houses should be minimum 4m.

3. Sufficient ventilation space is required on top and sides.

4. To protect the plants from the rain in the monsoons, without affecting the air circulation side curtains should be kept open in slanting position.

5. To control light intensity and solar radiation, white shade net (50%) is used. Approximately 400w/m² light intensity is required on the plant level.
   Top shade net opening and closing:
   i. During cloudy climate it is to be kept open, otherwise closed from 11.00 am to 3.00 pm.
   ii. During cold nights the shade nets should be closed.
   iii. In summer it should remain closed from 10.00 am to 4.30 pm.

6. Top of the plastic should be washed at every one month interval to remove the dust and get maximum benefit of sunlight.

7. White wash is to be applied to East, west and north sides of green house to protect plants from bright light intensity during summer season.

Support Material, Bed Layout and Irrigation System:

Support System:
The carnation crop needs to be supported with 4 or 5 layers of support material. Good support material is essential for the success of the cultivation. If the crop is not supported well enough, it will collapse. This will result in bent stems and a stagnation of the crop development. Good support material is metal wire. Minimum at every 3
meters, the wires should be supported with poles. The poles at the beginning and the end of each bed should be strong enough and be cast concrete.

For an optimal support of the crop an increasing width of the meshes may be used e.g. the bottom net 7.5 X 7.5 cm, then one net of 10 X 10 cm and two nets of 12.5 X 12.5 cm. Distance between first three nets should be 10 cm and between 3rd and 4th net 20 cm. Usually, 36 plants per net m² (= per m² of bed) and about 20 plants per gross m² (per m² of greenhouse) are planted. This plant density is to be strictly maintained. More plants per m² will just give a higher production in the first flush, afterwards this advantage disappears and more problems with disease will occur.

**Bed layout:**

Normally, the beds are 0.8 meter wide and the path is 50 cm. In order to prevent the crop from being washed away, the carnations are cultivated on raised beds. The beds have to be raised 20 to 25 cm to achieve improved drainage. To create favourable growing conditions a good quantity of organic matter along with basal dose of NPK fertilizer should be applied and mixed into the soil.

**Table 2.3.2 : Bed Material Composition of Carnation**

<table>
<thead>
<tr>
<th>Material</th>
<th>Clay soil</th>
<th>Silty loam soil</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red soil</td>
<td>55%</td>
<td>60%</td>
</tr>
<tr>
<td>Sand</td>
<td>15%</td>
<td>10%</td>
</tr>
<tr>
<td>FYM</td>
<td>30%</td>
<td>30%</td>
</tr>
<tr>
<td>Rice husk</td>
<td>4kg/m²</td>
<td>2.5kg/m²</td>
</tr>
</tbody>
</table>

Source : Growing manuals of www.kfbioplants.com

Basal organic dose: Neem cake (@1kg/Sq. m.) should be applied after fumigation, at the time of bed preparation as preventive against nematodes.

**Irrigation system:**

During the first three weeks after planting, overhead sprinklers are needed to prevent young plants from drying out. Afterwards, it is possible to gradually change to drip irrigation (3 tubes per bed). The water needs to be filtered with a sand filter to prevent obstruction of the drip tubes. It is to be ensured that there is sufficient supply of good quality water. To ensure even distribution of water, the drippers should be placed at a
distance of 30cm. When a carnation crop is in full growth and healthy, it absorbs 6 to 7 liters of water per m² per day.

1) Support Material:
(Front and Side View)

2) Bed Lay-Out:
Plant Diagram (Top View)

The size of the strong pole (angle) 40x5mm
The size of the support pole (angle) 25x3mm
Cultivation:

Planting:

It is vital that the cuttings get a good start:

- The Ec and pH of the soil is to be checked after application of basal dose and before plantation. Ec should be less than 1mS/cm
- The soil prepared should be prepared in good time. The planting substrate is to be moistened evenly. Shallow planting is essential in tropical areas. The netting is to be put on the beds before planting. Ideal condition for planting is a warm, humid and fairly bright day.
- One should not actually ‘plant’ the cuttings but make a small depression with ones fingers or knuckles and ‘stand’ the cuttings as shallow as possible. One should not firm it in or move soil or peat around the base of the cutting. After planting, the white perlite in the root ball should still be visible.

Correct instructions and regular checks are essential. The cuttings must be prevented from drying out just after planting. Depending on weather conditions; it may needed to start giving overhead watering for 5 minutes. Too much watering during the first week should be avoided. High air humidity is to be maintained. The path as well should be sprayed, not just the plants. During intense sunshine it is necessary to shade the plants slightly, until new roots are visible. The aim should be to get them growing as quickly as possible.
**Pinching:**

Pinching is an important cultural operation in the successful production of top quality carnations. After planting, the cutting continues to grow a main stem. If left unpinched, this main stem produces a “Crown flower”. Pinching means to remove the head of this main stem at an early stage. This allows the side shoots to develop. These shoots produce the first flush. Pinching involves breaking out the head of the cutting by bending, leaving 6 pairs of leaves (internodes). The easiest time to break the top of the cutting is in the morning when the cutting is still fresh and fully turgid. The plants are usually pinched for the first time about 3 weeks after planting. Immediately after pinching it is good to make a spray treatment with Captan or Bavistin - (0.1%).

![Image of pinching carnation](image)

**Disbudding:**

The practice of removing undesirable immature flower buds to provide either a small number of large flowers or large number of small flowers is called disbudding. Only the central terminal bud is removed in case of spray carnations to encourage lateral flower buds to develop. Identifying which bud to remove often confuses the beginner. Identification is easiest at an early stage, when the terminal bud is just showing some first color. From standard carnations, the side buds have to be removed to give main flower a chance to develop. Care must be taken to avoid any injury to the main stem.
**Standard Carnation**  

**Crop handling:**

It is very important to raise the nets at the right time. Raising too soon makes picking very difficult. Raising too late allows the crop to fall to one side. Once this happens, stems bend and crop losses are inevitable. Watch the crop carefully and raise the nets a little at a time. Netting is a priority job, even when you are very occupied in the middle of a flush. Shoots growing into the path have to be tucked back into the netting. If not, it will reduce your production. It is advisable to maintain 5 to 6 strong shoots per cutting for good quality of the flower. Extra shoots should be removed.

**General Fertigation Schedule:**

1. A soil analysis is to be made before planting.
2. If there are no big excesses or shortness, a base dressing is to be applied to the soil per 100m² of:

<table>
<thead>
<tr>
<th>Amount</th>
<th>Fertilizer Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.0 kg</td>
<td>Biozyme granuals</td>
</tr>
<tr>
<td>2.5 kg</td>
<td>12:61:0</td>
</tr>
<tr>
<td>5.0 kg</td>
<td>12:6:18</td>
</tr>
<tr>
<td>2.2 kg</td>
<td>Ca(NO₃)₂</td>
</tr>
</tbody>
</table>
2.5 kg  –  MgSO₄
0.250 kg  –  Borax

3. Right after planting: 3 weeks clean water (no fertilizers). The roots are not able yet to absorb any nutrition.

4. From the 4th week onwards NPK and Calcium Nitrate are to be applied in suitable quantities.

5. It is to be noted that small amount on a frequent basis is better than large amounts of fertilizers. It is better to give something every day.

The ideal water EC during generative growth should be around 1.6 ms/cm.
The above is to be continued until the end of the first flower production peak. Then clean water is to be given for one full week, no fertilizers. The soil is to be washed and got rid of excess nutrients.

**Grading and packing: (Quality standards for flowers)**

- Stems should not be damaged by pest, disease or handling, chemical deposit should be unobstructive.

- Flower should be at a uniform stage of development within the box, not immature or over mature.

- Flowers must be cut at opening stage appropriate to time of year.

- The main stem should be of sufficient strength so that the flower can be held upright with little bending.

A range of polythene, polypropylene and paper sleeves is available. A good quality sleeves should protect the bunch from damage and enhance the appearance. Perforated sleeves are generally used. Flowers need to be cooled before sleeving.
One should use good quality box, pack firmly, fill the box completely, but keep the heads away from the end of the box.

**Packing:**
After grading and treatment with a flower preservative, the flowers are packed in bunches and sleeved in plastic sleeves or paper sleeves, according to the demand of the buyer. The standard carnations are packed in a bunch of 20 flowers and spray
carnations of 10 flowers. Box used for packing is of size 98X30X12cm. Generally 300 flowers are packed per box.

**Good flower is:**

- Stem length : 80cm
- Bud size : 8 to 10cm circumference

**Duration of the crop:** 24months
- First flowering : 3.5 to 4 months after plantation
- Yield : 200flowers/Sq. M. (20plants/Sq. M.)

**PHALAENOPSIS**

**Introduction:** Phalaenopsis belongs to the largest family in the plant kingdom, the Orchids (Orchidaceae). It represents just one genus, with approximately 50 different species, including the well-known white *Phalaenopsis amabilis*. The Phalaenopsis generic name means Moth like, and is derived from the Greek phalaina (moth) and Opsis (similar). The flower structure of Phalaenopsis orchid is characterized by the figure three, three sepals, three petals and a triangular ovary. These plants exhibit a monopodal form of growth (no lateral shoots), whereby the main stem continues to grow throughout the year and only one spray of flowers can develop from each leaf axils. Phalaenopsis has fleshy and distichous leaves.

**Climate:**

**A. Temperature:** The phalaenopsis is a tropical plant and it requires temperature range between 15 to 32°C. It is necessary to maintain average temperature of 26 to 27°C during the growth phase, 19 to 21°C during flowering phase. A temperature drop up to 18°C is required for spike induction.

**B. Relative humidity:** An ideal range of relative humidity is 60 to 80 per cent. However high relative humidity with high temperature increases the risk of bacterial diseases.

**C. Light intensity:** The provision of sufficient light during the cultivation is of importance to development of suitable foliage and roots. Excessive light intensity will results in burning of the foliage. Inadequate light intensity
results in straggly and poor quality plants, with an inadequate spray and insufficient root development. Following light intensity at the level of the plants can be employed for various phases of cultivation;

- **Growing:** 5000 to 8000 lux
- **Flowering:** 8000 to 15000 lux

**D. CO₂:** Phalaenopsis is a CAM plant (Crassulacean Acid Metabolism), which means that it takes up CO₂ at night, this is in contrast to most other plants, which takes up CO₂ during the day. CO₂ requirement is between 600 to 800 ppm.

**Benches:** Growing of phalaenopsis usually takes place on open benches that have good air circulation.

**Pots:** Phalaenopsis growing should take place in transparent pots. Transparent pots will ensure a more active growth and better root quality. Generally, white coloured transparent pots of two different sizes are recommended for growing phalaenopsis.
Potting Media: Selection of media is very important to ensure proper retention and distribution of water and nutrients as well as drainage of excess water. The media should provide firm support to plants. Hence coconut fibres along with coco peat are frequently used as a media for phalaenopsis.

For 5” pot coco peat requirement is 85g (1.1lit).

For 9” pot coco fibre and coco peat requirement is 175g and 500g (6lit.), respectively.

Shadow hall for phalaenopsis cultivation:
As phalaenopsis requires low temperature for flower production. It can be maintained under shadow hall.
**Specification:**

1. Total height: 4m
2. Gutter height: 3m
3. Top Shade net: 75% green or white
4. Side shade net: 50% green
5. Plastic: 200micron
6. Bay size: 4x4m

**Advantages:**

1. Better cooling efficiency because light intensity gets reduced before reaching to plastic.
2. Effective cross ventilation due to nets on side.
3. No need to run foggers quite often as temperature remains low due to better air circulation than normal green house. Hence this avoids disease attack.
4. No direct watering on the plants, which will help to minimize burning, corking and salt deposition on leaves and flowers.
5. Cost effective than naturally ventilated poly houses.

**Planting:** Initially planting is done in 5” pots filled with only coco peat. After 6 months plants are transferred to 9” pot, which contains bottom layer of coco fibre and top layer of coco peat.

**Irrigation:** As phalaenopsis is grown on very porous substrate, it is important to supply the water to the crown portion by using sprinkler. The water must be free from any harmful chemicals or contamination. The quantity of water required by the plants depends on climate, substrate and the age of crop. The irrigation system must be capable of supplying between 5 to 12 liters of water per meter per hour. It is very important to ensure that plants are provided with appropriate drainage.
Irrigation Layout

Table 2.3.3: Water quality standards for Phalaenopsis

<table>
<thead>
<tr>
<th>Quality</th>
<th>pH</th>
<th>EC (mS/cm)</th>
<th>Sodium Mmol</th>
<th>ppm</th>
<th>Chlorine Mmol</th>
<th>ppm</th>
<th>Bicarbonate Mmol</th>
<th>ppm</th>
<th>Calcium Mmol</th>
<th>ppm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Good</td>
<td>&lt;6.5</td>
<td>&lt;0.5</td>
<td>&lt;1.0</td>
<td>23</td>
<td>&lt;1.0</td>
<td>35</td>
<td>&lt;0.5</td>
<td>&lt;31</td>
<td>&lt;1.0</td>
<td>&lt;40</td>
</tr>
<tr>
<td>Acceptable</td>
<td>6.5-</td>
<td>0.5-1.0</td>
<td>1-3</td>
<td>23-69</td>
<td>1-3</td>
<td>35-105</td>
<td>0.5-1</td>
<td>31-62</td>
<td>1-2</td>
<td>40-80</td>
</tr>
<tr>
<td>Poor</td>
<td>&gt;7.2</td>
<td>&gt;1.0</td>
<td>&gt;3</td>
<td>&gt;69</td>
<td>&gt;3</td>
<td>&gt;105</td>
<td>&gt;1</td>
<td>&gt;62</td>
<td>&gt;2</td>
<td>&gt;80</td>
</tr>
</tbody>
</table>

Source: Growing manuals of www.kfbioplants.com

Fertilizers:

Nutritional composition for Phalaenopsis. These values are calculated in relation with 100% rain water.

Table 2.3.4: Nutritional composition for Phalaenopsis

<table>
<thead>
<tr>
<th>Main Element</th>
<th>Trace Element</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nutritional Element</td>
<td>Mmol/lit.</td>
</tr>
<tr>
<td>NH₄⁺</td>
<td>1.6</td>
</tr>
<tr>
<td>K⁺</td>
<td>3.5</td>
</tr>
<tr>
<td>Ca²⁺</td>
<td>1.3</td>
</tr>
<tr>
<td>Mg²⁺</td>
<td>0.4</td>
</tr>
<tr>
<td>NO₃⁻</td>
<td>6.2</td>
</tr>
<tr>
<td>SO₄²⁻</td>
<td>0.4</td>
</tr>
<tr>
<td>P⁻</td>
<td>1.5</td>
</tr>
</tbody>
</table>

Source: Growing manuals of www.kfbioplants.com
Table 2.3.5: Standard Fertilizer solutions for the Phalaenopsis

*(Concentration 100 times in 1000 lit. water)*

**A-Tank solution**

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Nutrient</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Calcium Nitrate</td>
<td>28 Kg</td>
</tr>
<tr>
<td>2</td>
<td>Ammonium Nitrate</td>
<td>12.8 Kg</td>
</tr>
<tr>
<td>3</td>
<td>Iron chelate (DTPA) 3%</td>
<td>3 Kg</td>
</tr>
<tr>
<td>4</td>
<td>Potassium Nitrate</td>
<td>3.5 Kg</td>
</tr>
</tbody>
</table>

**B-Tank solution**

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Nutrient</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Potassium Nitrate (KNO₃)</td>
<td>16.5 Kg</td>
</tr>
<tr>
<td>2</td>
<td>Mono Potassium Phosphate (KH₂PO₄)</td>
<td>21 Kg</td>
</tr>
<tr>
<td>3</td>
<td>Magnesium Sulphate (MgSO₄)</td>
<td>10 Kg</td>
</tr>
<tr>
<td>4</td>
<td>Borax</td>
<td>100 gm</td>
</tr>
<tr>
<td>5</td>
<td>Manganese Sulphate</td>
<td>55 gm</td>
</tr>
<tr>
<td>6</td>
<td>Zinc Sulphate</td>
<td>55 gm</td>
</tr>
<tr>
<td>7</td>
<td>Copper Sulphate</td>
<td>50 gm</td>
</tr>
<tr>
<td>8</td>
<td>Na-Molybdate</td>
<td>25 gm</td>
</tr>
</tbody>
</table>

Source: Growing manuals of www.kfbioplants.com

**Flower Production:** On an average there are 12 plants per square meter. The complete growing period is approximately 5 years. Generally flower production starts 8 months after plantation. In order to obtain high quality production, it is important that the plants are large enough (it should have 5 adult leaves) and pots have good root system before harvesting of flowers.

**Premature Flowering:** The premature flowers will need to be removed during growing phase. If this is done immediately flower stick will till be soft and can be pinched off. If however the flower stick is little older it will need to be cut away. The minimum temperature to limit premature flowering during growing phase should be 27°C.
**Harvesting and Yield:** The phalaenopsis flower stem are supported with stick when flower buds begin to swell. The branches are harvested when the last flower is still in bud.

Average flower production is 6 to 7 stems per plant per year.

**Post Harvest and Packaging:** After harvesting stems are kept in bucket containing water and stored under a temperature between 7 to 10°C. The vase life varies between 5 days to 6 weeks depending on climate and variety.

The flowers are packed in single used boxes that have dimensions of 100x15x11.5cm. Depending on the number of flowers per stem, 25 to 30 stems are packed per box¹³.

### 2.4: Floriculture as an alternative source of livelihood in the Region

Indian floriculture, over the years, has groomed itself from a backyard gardening activity into a commercially viable enterprise. Its origin as an important income generating activity by small farmers laid the foundation for an economically viable diversification option for corporates in the agribusiness sector.

Floriculture promises sustainable livelihood. It not only ensures present occupation and earnings but also makes way for scope of employment and income opportunities in the future.

Floriculture offers various career options for both the skilled and unskilled sector. The employment opportunities in this field are as varied as the nature of work itself. One can work as farm or estate managers, plantation experts and supervisors, project coordinators etc. Employment may be generated in research, training and marketing of floriculture products. Teaching, Research and posts of Extension scientists/teachers are prospective areas of work in all State Agricultural Universities and National Agricultural Research System. One can also work as consultant or landscape architect with proper training. Service career opportunities may be created by floriculture to serve as floral designers, ground keepers, landscape designers and horticultural therapists. Attractive avenues for self-employment can be worked out. As floriculture offers its aspirants good growth prospects, one can become an entrepreneur himself and offer employment to others.
Floriculture is not limited only to commercial production of cut flowers, ornamental plants etc. but also creates scope for subsidiary agro-business like export/import, nursery and seed production, organic manure production and agro industries like manufacturing of horticulture implements, drip and sprinkler irrigation systems, bio fertilizers, tissue culture, modern packaging etc. All these in turn, create a huge potential for sustainable employment generation, both directly and indirectly.

The cut flower industry makes an important contribution to the economy. Cut flower industry provides important contributions to fertilizer and agricultural chemical industry since it is an intensive agricultural production activity by having short-term production, requiring intensive fertilizer and plant protection techniques. Packaging is one of the most important elements in post harvest processes for cut flower products. During supplying of products to market and for transport, lots of packaging material originated from cellulose and plastic is used, by this way cut flower industry also provides an important contribution to this industry. When such industries flourish, they open up more avenues of gainful employment.

Multiple livelihood opportunities under floriculture can lead to income enhancement by utilizing local strength and resources. Being economically rewarding, it can be used to attract and retain educated young men and women in rural areas. As an effective tool for employment generation, a production plant may employ people from nearby villages. For the needy and unemployed people from villages as well as hilly areas where alternate source of employment is inadequate, such sources of earnings are welcome. Thus, this proves to be a boon both for the employer and the employee.

A self-employed youth can initiate with a humble effort of growing flowers for his living. Fresh flowers may then be delivered door-to-door on a regular basis in nearest towns or developing cities where the ascending disposable income of the increasing population and diminishing space for homestead flower gardens, keeps the demand for flowers soaring. This kind of low scale flower business can be kept simple, with little investment and with no interference of a middleman.

Professional entrepreneurs owning state-of-the-art showrooms may also cash in the latest floriculture developments. Their business can be diversified from a traditional flower business of artificial and natural flower arrangement to exotic flower
decorations and even venturing into online marketing, taking assignments of flower decoration in gorgeous functions, both public and private, in and outside their state. Instead of a seasonal occupation, floriculture has now diversified to become a rewarding business that is operational round the year.

Till recently, entrepreneurs in floriculture in areas of East and Northeast Himalayas had to depend mainly on outside markets like Kolkata, Siliguri and Bangalore for fresh flowers. But presently, most of the species of cut flowers, loose flowers and bulbous flowers having high market demand are now available locally to a large extent. The ever-increasing demand for flowers in urban growth centres has also encouraged quite a few commercial flower growers in many East and North-eastern states.

Floriculture is a labour-intensive activity. Even a modest floriculture programme can generate millions of jobs, predominately for young women, quite apart from significantly contributing to national income. One of the significant peculiarities of the floriculture industry’s employment pattern is the significant inclusion of women because of their manual skills, abilities in terms of innate, fine and developed aesthetic sense and delicacy. By and large, women are engaged in cultivation, harvesting and post harvesting activities including packaging while men perform activities linked to pre-cultivation, maintenance of nurseries, irrigation and fumigation since these involve hard work and health and safety considerations. A preference for women labour in production work is based on the argument that floriculture is similar to childcare where women ensure the responsibility for the entire process of growth. Considering the potential of floriculture in generating higher levels of income, employment opportunity, greater involvement of women farmers and increase in exports, it has been identified as an extreme focus area by the Government of India.\textsuperscript{14}
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