Chapter - Two

Research Methodology and Review of Literature

Strawberry is the reddish and delicious fruit in the fruits among the other horticulture fruits which are cultivates recently in India as well as Maharashtra. Almost we know all fruits which have been cultivating since our forefather and therefore this is the main reason behind a better acknowledge of its cultural practices to us. This Strawberry fruit is actually origin of Europe continent and cultivates mostly in hill station and hill tops in India from some yesteryears like as 25 or 30 years. In other words it is totally new to become familiar with cultivation operation, techniques and understand the pros and cones of its behaviors. On another hand there is unpublished information or data related this fruits cultivation practice. Though strawberry cultivations contribution in agriculture sector is very rare but the efforts offers by strawberry cultivators in Mahabaleshwar tahsil and other tahsil’s in Satara district should not be underestimated.

2. Research Methodology
2.1. Need of the Study

Though this pleasant climate and geographical locality of Mahabaleshwar and around tahsil's region ideal for tourist sector, it’s adversely affects on agriculture sector. Heavy rainfall and cloudy sky in these tahsil's not in favors of any kinds of cash crop to grow. Heavy rainfall allow these strawberry plants to grow until 7 – 8 months after then plants automatically going to putrefy and cultivator’s imports new mother plant every year for propagation purpose therefore every year strawberry cultivation taking place and it need fresh investment every year. Fresh investment every year in same cultivation operation harmfully impact on cultivator’s financial ability. This climate isolates strawberry
cultivation in Satara from world strawberry cultivation. The first stage involve nursery of mother plant and then its daughter plants cultivation is practiced. Every year after importing these mother plants from abroad it first sows in Medha, Wai, Koregaon, Satara, etc. tahsil’s for nursery purpose later then after clearing the monsoon these daughter plants use for cultivation. Until this is seems of foreign crop because we have to import it from abroad every year. This dependency of importing strawberry mother plant every year in India invites hike in plant price and new disorder.

Strawberry cultivation has been carrying out in Mahabaleshwar since last more than 30 years by limited farmers on tentative base. Then recently it production seems profitable to cultivators and that’s its carrying out on commercial base. The area under strawberry cultivation has been increasing as well as it is spreading over in Mahabaleshwar tahsil besides with these four tahsil's remarkable growth under area of cultivation. As area under the cultivation has been on increasing scale as year passes the cost of cultivation also increasing. The average per acre cost of strawberry cultivation is not similar in every tahsil. Beside this cultivation cost per acre average production is not similar too. The different fruit picking seasons are also different in these tahsil and create imbalance in produce price. Increase in production is a result of increase in area making constrains in marketing of this fruit conveniently. In other words area and production increase as year’s passes but the problems in cultivation and marketing increase combine with problems prone cultivators.

Central and State government yet not seek interest in this field regards research, encouragement and financial programs. Besides this the concern agencies and institutions are not showing much interest in the
same. This unsupportive nature engulfs the cultivator’s interest in loss-making and discourages them from this cultivation.

Its many sensitive and gentle attributes succumbs virus and ailments according to vagarious of climate. Due to lack of cultivar operation knowledge and proper guidance about it fails on problems occurs in cultivation. Lack of transport, storage facility and perishable nature and unawareness among the fruit eaters of strawberry fruit cultivators do sells their yield in market on unrevealed market price hence cultivators not gain expected returns. These all impels the need of the specific study in line of finding and remedies its.

2.2. Importance of the Study

Earlier strawberries were cultivates along with other horticulture crop across in Maharashtra. Across the hilltops, hill stations and poly houses in Pune district cultivates strawberry on tentative basis. There is no enough study and conclusion available about cultivation practice and marketing in agriculture research centers. A cultivator cultivates strawberry since more than 25 years also tackle with some cultural operations. Government excluded this crop from various scheme especially implements for horticulture program therefore several questions related to strawberry production and marketing of strawberry till unanswered.

Mahabaleshwar is single and lonely tahsil in Satara district who have about 80% land under the cultivation of strawberry out of whole country’s area under strawberry cultivation. Bedsides this Mahabaleshwar tahsil produces 85% share of national strawberry production. In other words Mahabaleshwar is a tahsil among the other specified tahsil's in Satara district for study. We find the spread of strawberry cultivation due to its successive execution in Mahabaleshwar and it replication in other tahsil's.
This district lion share in county’s strawberry production and in area under cultivation denoting its study importance. Besides several difficulties are arising in cultivation and marketing due to nature, financial and technical problems such as deficiency in operational knowledge because of lack of research and development. This is also insisting and implying the further study in light of these difficulties and thrusts.

2.3. Objectives of the Study
This study intends to carry out research with the following objectives
1. To study the cultivation of strawberry in Satara district.
2. To study the marketing of strawberry in Satara district.
3. To study the economical condition of strawberry cultivators in Satara district.
4. To study the future opportunities of strawberry growers in Satara district.
5. To study cost-benefit analysis.
6. To study the problems and prospectus of strawberry growers.

2.4. Hypothesis of the Study
1. Production and area under strawberry cultivation has been increasing year by year in Satara district.
2. Unavailability of government scheme for marginal cultivator’s impact on strawberry grower’s profit.

2.5. Research Methodology
Study is relevance to regional observation of Satara District where mainly four tahsil’s land is under the strawberry cultivation. In other tahsil’s e.g. Patan, Karad, Satara etc. the partially land comes under the strawberry nursery plantation not for strawberry cultivation. Mahabaleshwar, Medha, Wai and Koregaon tahsil’s are mainly
engaging in strawberry cultivation thus these four tahsil selected for this study. For select strawberry cultivators among these tahsil's simple random sampling method is being chosen. Strawberry cultivators in 15% ratio selected from tahsil's by following way.

Table No. 2.1 Selected Cultivators for Study

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Tahsil</th>
<th>Total Cultivators</th>
<th>Selected Cultivators With 15% Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Mahabaleshwar</td>
<td>1060</td>
<td>159</td>
</tr>
<tr>
<td>2</td>
<td>Medha</td>
<td>385</td>
<td>58</td>
</tr>
<tr>
<td>3</td>
<td>Koregaon</td>
<td>214</td>
<td>32</td>
</tr>
<tr>
<td>4</td>
<td>Wai</td>
<td>112</td>
<td>17</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>04</strong></td>
<td><strong>1771</strong></td>
<td><strong>266</strong></td>
</tr>
</tbody>
</table>

(Source: - Shriram Fal Udhyog, Bhilar - Mahabaleshwar)

Strawberry cultivation related information and data is not present in concern offices from start to till date. All India Strawberry Growers Association, New Delhi is an organization of strawberry growers came into exists in 2004. Shriram Fal Udhyog is a nodal agency which is look into matters of buying of mother plants and selling among in the cultivators in these tahsil's. They have enlisted cultivators name according to tahsil while distributing mother plants. The simple sampling method therefore applied for this study and selected cultivators on this prepared cultivators list in 2011-12.
2.6. Source of data collection

a) Primary Data: -

In this method of source questionnaires have been filled up from cultivators who are engages with cultivation in these four tahsil’s. There are 266 strawberry cultivators whose questionnaires have been filled up and information and statistic collected.

b) Secondary Data: -

Necessary data and information related to this study has collected from published publication on this topic. Author’s books,
Agriculture magazines, Newspapers and internet etc. referred for this specific study.

2.7. Tools for interpreting information and statistical data

For interpretation of collected primary data, statistical data primarily average, percentage, and moving average etc. have used. Besides these following statistics methods and test have brought in use.

1. **Standard Deviation:-**

To find out the various cultivation and marketing costs dispersion from mean since last ten years and to make comparison among them standard deviation of each tahsil, cultivates area and market have calculated by following way.

\[
S.D. = \sqrt{\frac{\sum d_a^2}{n}}
\]

If the S.D. value of series / category show its dispersion from its mean. Its big magnitude than its mean value implies it has been dispersing more from its mean and vice versa. Those category / series have big S.D. value than other category / series indicates it is more deviated than others.

2. **Co-efficient of Variation:-**

To find out the variation to make comparison in between various S.D. values C.V. calculates. This can be calculated by following way.

\[
C.V. = \frac{S.D.}{n} \times 100
\]

By this way we can derive the C.V. values and make comparison in more than two series. Higher the C.V. value in series higher the variation is there on contrary lower the C.V. value in series than others it seems it is more stable or uniform.
3. **ANOVA Single Factor Test**

To investigate the significance of the difference between overall averages of various costs in cultivation and marketing in tahsil's, markets and cultivates area as well as average price in markets this test have used and its results derived by following ways.

To test H0: \( \mu_1 = \mu_2 = \mu_3 = \ldots = \mu_k \)

\[
F = \frac{S_1^2/(K-1)}{S_2^2/(N-K)}
\]

\[
S_1^2 = \sum_j n_j(x_{.j} - \bar{x})^2
\]

\[
S_2^2 = \sum_j \sum_{i=1}^{q} (n_{ij} - n_j\bar{x}/N)^2
\]

If derived \( F \) value (observed value) is smaller than the table value (\( F \) critical value) its mean that the hypothesis is accepted and there is similarity in all averages. On other hand if the \( F \) value is more than the table value it mean there is dissimilarity between the means/ averages and the difference is significant to take into consideration.

4. **X^2 Test**

To investigate the interdependence between two attributes of same factor this test used. In this study it used for find the significance between markets and marketing cost, tahsil and cultivation as well as marketing cost etc. for finding out its result the attributes classified into two classes, the first attributes in \( P \) and second by \( Q \) class later the test result have found by following way.

\[
X^2 = \sum_{i=1}^{p} \sum_{j=1}^{q} \frac{(n_{ij} - n_jn_i/N)^2}{n_i,n_j/N}
\]

If the \( X^2 \) value exceeds the critical value then it accepts that the interdependence between two attributes and these two attributes are
interdependent to each others. Suppose the $X^2$ observed value is less than the tabulated / critical values it means that there is no interdependence between two attributes and these attributes are independent.

5. Cost-Benefit Analysis

To proper evaluation of strawberry cultivation cost-benefit analysis have brought in use. With the following criteria the annual cost-benefit ratios have computed.

**Cost-Benefit Ratio** = $B/C$ (Benefit / Cost)

If $B/C = 1$, the project is marginal, if $B/C > 1$, the benefits are more than costs and it is beneficial to undertake the project. If $B/C < 1$, the benefits are less then costs and the project cannot be undertaken.

Similarly for finding Net present value of strawberry cultivation cost-benefit ratio since last ten years the NPV ration has computed of last ten year by following way.

$$NPV = \left[ \frac{B_1}{C_1(1+i)} + \frac{B_2}{(1+i)^2} + \cdots + \frac{B_n}{(1+i)^n} \right] - (\text{Minus})$$

Where $B_1, B_2, \ldots, B_n$ are series of gross present benefits in year 1, 2, … n; $C_1, C_2, \ldots, C_n$ are series of gross present costs in year 1, 2, … n; $i$ is the social rate of discount for annual compounding. If the NPV is positive then it implies the project is worthwhile and can be carried out in future.

6. Average Growth Rate

To investigate the growth in area and production year by year since last ten years average growth rate is being used. The positive AGR means positive growth per year and vice versa.
\[ K = \frac{1}{t} \ln \left( \frac{N}{N_0} \right) \] -------(1)

\[ K = \frac{1}{t} \ln \frac{N}{N_0} \] -------(2)

\[ K = \frac{1}{t} \times \ln = K \] -------(3)

Where \( K \) = Growth Rate, \( t \) = Time, \( N \) = End of the Interval Time, \( N_0 \) = Start of Interval Time, \( \ln \) = Natural Logarithm

2.8. Scope and limitations
Strawberry cultivates throughout India on across the hill tops but cultivation of strawberry in Mahabaleshwar region on big scale and intensive. Beside this strawberry cultivate area is distributed all over India in small scale therefore research study is relevance only to strawberry cultivation and marketing in Mahabaleshwar, Wai, Medha and Koregaon Tahsil, Dist- Satara. Lack of published data and information inadequate printed material regard this topics may act as a limitation.

2.9. Chapter Structure
2.9.1. Chapter One: - Introduction
Chapter one deals with Introduction and importance of agriculture sector in economy. Introduction of horticulture crops and one of the fruit in horticulture - strawberry, its introduction, origin, its production and area of cultivation in the world, its world trade and its introduction in India as well as Mahabaleshwar and Satara district. Along with the specific study of this fruits this chapter focused on social and economic status of Satara district with selected and important areas.

2.9.2. Chapter Two: - Research Methodology and Review of Literature
This chapter contains Research methodology opted for this study and review of literature regards this study. In first segment of this chapter need, importance, objectives, hypothesis, research methodology, tools for interpretations and limitation for this study have encompasses. In the
segment of review of literature published literature like as thesis, books, articles, research papers etc. refers and their abstract considers for study.

2.9.3. Chapter Three: - Strawberry Cultivation - Problems and Prospects
This chapter no. 3 deal with the introduction of strawberry cultivation operations, primary information of strawberry cultivator’s social and economic status, analytical study of strawberry cultivation throughout last ten years. Tahsil wise are and production trend, various costs includes in cultivation and total cost etc. have deeply analyzed. On the ground of this analytical study the major problems have bring into light to studied prospectus to subsidize the dimensions of problems in future.

2.9.4. Chapter Four: - Strawberry Marketing - Problems and Prospects
This chapter contains the information of strawberry marketing mechanism, basic areas where cultivators have to concentrate for fruit marketing and available markets. In analytical part of this chapter the market mechanism as well as the various costs includes in marketing have deeply analyzed. While analyzing marketing available markets, all costs, price of produce etc. have thoroughly considers. This analytical study subsequently helps to finds the difficulties arise in marketing and prospects for more convenient marketing.

2.9.5. Chapter Five: - Cost - Benefit Analysis of Cultivation and Marketing of Strawberry
This chapter contains fundamental information of cost-benefit analysis and its criteria for evaluation projects. The cost- benefit ratios of last ten years strawberry cultivation and marketing with the help of B/C criterion have computed. Besides this the Net Present value criterion cost-benefit ratio also estimated for the same period.
2.9.6. Chapter Six: - Conclusion, Suggestion and Testing of Hypothesis

This chapter contains the conclusions relevance strawberry cultivation and marketing and suggestions on ground of these finding. Besides, testing of hypothesis is also incorporated.

2.10. Review of Literature

2.10.1. Literature of Cultivation and Marketing in India


This book contains of various fruits information cultivates in India along with strawberry and strawberry familiar Barberry, Blackberry, Blueberry, and Raspberry. This book act as a guide for fruits, berries and nuts cultivates in the home garden, suitable climate, popular varieties and localities, soil and soil preparation, planting and its technique, plant propagation, irrigation systems, plants thinners method and importance, pruning, pest and their control, diseases and tier management with suitable fertilizers, nutrition’s and how to protect against animals etc. needful information put in this book.

Strawberry and it's botanical description, its 24 worldwide species, cultivate varieties and its localities, soil selection technique and preparation, planting methods, cultivation cultural and its practice in California, nutrition’s, Irrigation systems, pest and its control, disease management, Fertilizers and water managements in Florida and California etc. briefly under eyed.

2.10.1.2. Strawberry Cultivation², Khaire V. A.

While introducing of strawberry, author reviewed of its origin place and its introduction and beginning in India. Strawberry growing regions and approximate strawberry cultivated area in India as well as Maharashtra also glanced in book together with in between 1948 to 1978s worldwide strawberry production with reported major countries with their statistical
figurers.
Main 18 worldwide strawberry popular cultivars with ideal for India and Maharashtra also mentioned. Soil and its preparation for cultivation, ideal climate for best yield of strawberry and suitable places in India and as well Maharashtra. Propagation related information and its two types 1) from Seeds 2) from Runners briefly referred in this book. Suitable amount of fertilizers for per acre along with their specific purpose and period suggested. They also suggest solvent fertilizer through deep irrigation.

In internal cultivation of strawberry they mainly specified weed control management, water management, fertilizers management, pest and their insecticides, diseases and their controls, and prevalent irrigation systems in India. While discussing about pest management of strawberry they mainly focused of pests which especially seen in Maharashtra.

In this book they classified strawberry growing regions in India into four groups South India, Mahabaleshwar, Kashmir and Panjab and gave probably time for cultivation and harvesting, beside they given process of cold storage. Nutrition contents and its volume, Strawberries jam and Wine recipe has given in this book. Khaire gives estimates of strawberry for cultivators guide.

2.10.1.3. Modern Technique of Strawberry Cultivation³, Prof. Ambat, Patil, Nevkar and Kadam
When sharing of basic information of strawberry in India they introduced basic feature of strawberry fruits. Climate condition and soil related information given in this article. Propagation and modern cultivar varieties in Maharashtra are listed. Cultivation period, nutrition, water management, mainly affected disease and pest and their control, harvesting, storing and packaging also discussed in brief.
2.10.1.4. **Strawberry (Cultivation, Yield, Process and Marketing)**, Dr. Rahudkar V. B.
Under this title Dr. Rahudkar gives introduction of Strawberry and its familiars Raspberry, Gujberry and Mulberry along with their cultural practice. Suitable climate, soil, cultivation methods and marketing has also under eye. While acquainting the climate in India they also introduce California climate. In soil treatment they elude soil fumigation and soil solarization. Some Indian and worldwide species and their botanical description and formation of strawberry plant form tissue culture method as well as propagation and its method also discussed. Popular cultivar varieties in America, California and India, Maharashtra with their especially features have given in this book.
Short day and day neutral cultivation and its benefits with popular cultivar varieties, Indian strawberry cultivation method and suitable cultivar varieties for intensive cultivation, garden cultivation and earthen pot, Irrigation system, weed control, nutrition’s, pest - insects, diseases - their management, salinity and mulching briefly referred in this book.
Fruit harvesting, its handling, packing, pre-cooling and storage management, Strawberry packing and its grading, strawberry canning, strawberry freshening have briefly discussed. Juice, jam, Crush, wine, Beverages recipes regards information given in detail. packaging, pre-cooling and probable market, international market rate for international trading of strawberry, possibility of international trade from India and facilities provided from government given in briefly as well as they discussed Economics of strawberry for cultivators assist.

2.10.1.5. **Tiny Budget Management for Horticulture**, Prof. Thombre Shivajirao
Prof. Shivajirao Thombre studied of geographical and climate conditions of Maharashtra in this book. In pre-cultivation of horticulture crops they studied pre cultivate works like soil and its preparation, grafts, plants
from tissue culture and improved cultivars varieties for cultivation. Also management of nutrition, water management, pest - insecticide, diseases controls, plant wither and causes of plant wither and means for control them.

importance of mulching and inter crops, protection against frost, fruit harvesting, its storage, pre cooling, processing, packaging and marketing related consultation noted in this book.

2.10.1.6. Modern Fruit Culture, Barooh S.
S. Barooh reviewed of all fruits which are popular and grown in India. In this book they noted Fruit growing area and improved varieties of popular fruits in India. While discussing the physiology of fruits trees they mainly focused on structure, growth mechanism of fruit tree and chemistry of fruit tree, Soil and selection of soil for trees. Flower development- its growth, movement, sex expression and mechanism. manures and fertilizers for fruit crops, chemical weed control, soil - water co- relation and water requirement of fruit crops, method of irrigation, deficiency symptoms and their co- relation, fruit cultivation in sub tropical regions in India, intercrop and over crop management in fruit cultivation etc. points deeply focused.

2.10.1.7. Modern Strawberry Cultivation, Sharma R. M. and Yamdagni R.
Author Sharma and Yamdagni deeply make familiar us to delicious strawberry fruits, they denote strawberry origin and history as well as worldwide distribution of reddish and testier strawberry fruit thus they mentioned world strawberry production of year 1994s.

More than 56 worldwide popular cultivar varieties have noted with its origin and specific features, while breeding and improvement of strawberry crop they mentioned 4 basic existing or probable problems of genetic significance for strawberry Diseases, Insects / mitts susceptibility,
Adverse Soil and Environmental factors, factor affecting on fruit quality. Breeding technique and breeding system refers too. They deeply discussed about two kinds of propagation one is seeds and vegetative propagation.

Ideal climate and soil concern information noted down with all particulars. Three types of planting systems, suitable time and suitable distance for planting and irrigation amount and probably time with irrigation system are also discussed. For controlling weeds they suggest four methods and recommend some nutrition for its best result, physiology of flower discussed and affecting factor while ripening fruits too. They state the benefits and loss of mulching technique in cultivation of strawberry.

Information about Albinism stated deeply in this book. Symptoms of this diseases, causes and means for cure this disease had noted. Pest and pest controls managements, sixteen different kinds of diseases and methods to restrain them also noted. Under the "Protected Cultivation” concept of strawberry they discussed "Tunnel method for cultivation of strawberry, they discussed its merits and technique of strawberry cultivation for best production results. After harvesting of strawberry crop they have mentioned of packaging process of fruits, it’s grading and storage related information.

2.10.1.8. Growing Strawberry, Dr. Sharma R. R.
Dr. Sharma introduced relish strawberry and its particulars nutrition contents together with its origin and worldwide history of its distribution. They also given worldwide production data and strawberry cultivated area of 1996.

Botanical and taxonomy description of strawberry plants has given in this book. They eluded four popular species of strawberry family and 45 worldwide famous cultivars varieties in their book. All need full
information about soil and suitable climate for cultivating of strawberry has given in details form.

While discussing about important cultural practice of strawberry they mentioned significance of soil preparation, planting techniques, planting times and density of plants. Hill, Spaced Row, Matted Row, Barbell and Pyramid planting system have given in details. Need of nutrition - fertilizers for plants as well as weed managements too. Flowering and its pollination, Fruit growth, its developments stages and stapes while ripening have thoroughly discussed. in main cultural practice they mentions plants pre- conditions, Bud and Shoot thinning, Removing of Flower stems, Defoliation, thinning of plants, removal of runners, cleanliness, renovation of old planting, Calyx or hull removals.

Importance of mulching in cultivation of strawberry and six types of mulching methods, its affects on yield of strawberry has given. They enunciate the “Hydroid Cultivation of Strawberry in Protected cultivation strawberry cultivation concept. Nuisance pest and their control, diseases and their managements, physiological and albinism dieses have deeply described in this book. After harvesting its grading and packaging norms have given as well as its secondary products also given for our known.

2.10.1.9. Horticulture Economy of Maharashtra

Dr. V.B. Jugale stated horticulture geography of Maharashtra. In this geography the make conceptually frame work of horticulture in Maharashtra as well as horticulture product too. As per Standard International Trade Classification (SITC) they make mention of horticulture products in 051,052,053,054 and 055 categories. they classified Maharashtra as per soil - rainfall in A+, B, C, D+ and E+ and zone -07, zone -09, zone -12 as per climate conditions.

They discussed about the fruits in Maharashtra with average yield and production of Maharashtra in 1994 - 95. While discussing the role of
horticulture products marketing in Maharashtra they mainly focused on different kinds of marketing management exist in Maharashtra, where they mentioned need and structure of channel marketing in Maharashtra. Thoroughly discussed problems and constrains in marketing, what is market cost and its efficiency. Under export of horticulture they explain volume and direction, problems in export and new introduced model for horticulture export. What are policies implemented in central and state government and their efforts for horticulture development have deeply observed. The role of financial institution in production credit, marketing, export and processing also mentioned.

2.10.1.10. Strawberry - Scientific Cultivation, Dr. Nafde Arun
Dr. Nafde had given details information of strawberry crop under this heading. Nutrition contents, climate, soil etc. points glanced in this article. Plant growing habit, its propagation from runners and its plantation related information given in details. Water managements, fertilizers management, harvesting, diseases and pest management, appropriate amount as per plant growing stages suggested in this articles. Modern improved strawberry cultivar varieties and recommendation of Poly house cultivation for highly yield experience.

2.10.1.11. Horticulture in India, Singh and Samuel
Writers reviewed accelerate development of horticulture in India during 10th plan. Investment - research development in between 10th plan. Various scheme implemented for horticulture mission, area under the cultivation of fruits in India and production and export trend of horticulture products. Commercialization and business opportunity in horticulture sector through schemes of national horticulture board, horticulture scenario in India its strength and weakness in Indian horticulture mission, objective and various scheme implemented udder the NHB.
Nutrition adequacy for fruits and its requirement, security against illness mainly denoted. Major fruits like Guava, Papaya, Pomegranate, Potato, Orchid, Coconut production and processing futures strategies mentioned. These fruits development in India, cultivars varieties and hybrids developments, its production technology, cultivation technique, fustigation, irrigation and its diseases management focused. Writer mainly focused on harvesting and post harvesting management in India and future research thrust, development of east regions and its potential and constrains, review of progress in horticulture in Karalla, Karnataka, Madhya Pradesh, integrated progress for developed horticulture in tribal and hilly area, WTO impact on Indian agriculture.

2.10.2 Literature of Cultivation and Marketing in Abroad

2.10.2.1 Botanical History, Cultivation, Traditional Breeding and New Technologies Hummer, Kin, Hancock, Jim Strawberry Genomic Author presents an introduction to genetic work with strawberry DNA. Botanical history, nomenclature, cultivation, traditional and mutational breeding, and new technologies are discussed. The taxonomic classification of the multiple species of strawberries is given and their origins are discussed. Old and new world cultivation is described and the origin of the cultivated hybrid strawberry is summarized. Advances in hybrid strawberry composition based on traditional breeding approaches are provided. New discoveries of genes and markers are described. Structural and functional genomics of strawberries are introduced. The chapter finishes with a section on Biotechnological approaches to genetic improvement.

2.10.2.2. Grow Your Own Strawberries Monica Resingner Authors described culture of strawberry growing and Propagation. In interpretive summery of these heads she tells strawberry grow 6-8 inches tall spreading about one foot across with long runners. In mild winter
areas, planting season is late summer or fall. These plantings will produce a spring crop of strawberries. In other areas, plant strawberries in early spring. Ever bearers will produce a summer and fall crop. Types: - June Bearing and Ever bearing. Propagation: - Most strawberries produce offsets at the end of runners. If you want more plants, just let them grow. If you have enough strawberry plants, pinching off the runners will give you larger plants with small yields of big berries.

2.10.2.3. Research on the Automation of Strawberry Cultivation\textsuperscript{14}, Masaki Nasata
This paper is the summary of joint research between Miyazaki University and Kyushu Electric Power Co., and consists of research report (reports and presented material on the development of strawberry automatic harvesting robot system) and reference materials (relevant research and presented materials such as the development of pimento simple harvesting hand). The contents of research report are as follows: (1) conceptual design of harvesting robot based on three-dimensional position detection by two cameras, (2) adopted system composition, (3) trial product, (4) principle of position detection, (5) result of accuracy confirmation test, (6) evaluation on trial automatic harvesting robot system (result of action confirmation test and indoor plucking test).

2.10.2.4. Perennial Strawberry Production\textsuperscript{15}, Dr. Pritis Marvin
“Perennial Strawberry Production” Interpretive Summery - Rather than attempt to remove these runners, perennial strawberry growers often encourage runnering by planting at low densities and allowing plants to establish "matted rows" the first growing season. An alternative to the matted row is a "ribbon-row" high density planting system which produces some fruit in the planting year, and very high yields in the first fruiting year (up to 30,000 lb/A). Many matted row growers are converting from overhead irrigation to drip irrigation. Preplant cover
crops are usually plowed under in the late fall or early spring prior to planting. Establishing the Matted Row, Dormant transplants are planted between 12 and 24 inches apart in mid-spring (April – May), with 42 to 52 inches between rows (5,000 - 8,300 plants/A), on well-prepared soil. Later plantings are less successful because runnering decreases with planting date.

Matted row growers are rapidly adopting drip irrigation, although overhead irrigation is still the norm. Growers with drip irrigation can use row covers as an alternative to overhead irrigation for frost protection.

The Ribbon Row, The ribbon row produces some fruit in the planting year from new transplants, and high yields in the second year from the high density planting. Plants are set in late May through late June at a 3 to 6 inch plant spacing within a single row (29,000 - 58,000 plants/A). After planting, the alley between rows is mulched with straw. Following mulch removal in spring, the plants flower and fruit. Fruiting occurs at the same time as a matted row planting, but yields per acre are significantly higher than with matted rows, usually exceeding 20,000 lb/A.

2.10.2.5. Profitability of Different Technologies of Strawberry Cultivation

“Profitability of different technologies of strawberry cultivation”, Lille, T., Karp, K., Värnik, R.

“Profitability of different technologies of strawberry cultivation”, Interpretive Summary: - The effects of mulches and cultivars on strawberry yield and profitability were investigated in experiments conducted in Tartu, Estonia, in 1999-2000. The treatments comprised 2 cultivation types, i.e. plastic mulch and straw mulch with burning after harvesting, and 3 cultivars (Jonsok, Senga Sengana and Bounty). Straw mulch increased the yields of Jonsok and Bounty. In places where late-spring frost damages are usual, the growing of early cultivars with straw mulch would be practical. Plastic mulch suited better for cultivars susceptible to grey mould [Botrytis cinerea] (such as Senga Sengana).
The yield of the plant depended on the cultivar and on the cultivation technology. In 2000, Jonsok grown with straw was more productive and profitable than the other cultivars. In 2001, Senga Sengana grown with straw was more productive and profitable than Jonsok and Bounty. The burning of leaves controlled pests and weeds. Using straw mulch is more perspective for getting higher yields and profits.

2.10.2.6. Strawberries Integrated Pest and Disease Management in Greenhouse

Strawberries Integrated Pest And Disease Management In Greenhouse

Crops Interpretive Summary: - Strawberry planting and fruit harvesting take place in Europe over two growing seasons, winter and summer, respectively. In single growing seasons, transplants for production fields, originating from disease-free material, are propagated from mother plants in nurseries during the summer months. Successful methods begin prior to crop cultivation and include a thorough knowledge of cropping history, soil and water sampling for nutritional purposes and influence of weather on the crop.

2.10.2.7. Research on Strawberry Plug Plants in Soil less Cultivation

“Research On Strawberry Plug Plants In Soil less Cultivation”.

Interpretive Summary:- In recent years, the main advances in strawberry cultivation in Italy have regarded cultivation techniques, the use of alternatives to methyl bromide and the type of propagation material used. Fresh plants have taken over from cold-stored plants in 60% of cases. This prompted the need for new studies on the cultivation of fresh strawberry plants carried out in Sicilian nurseries. This report illustrates the results of a trial carried out in Sicily to find the best plug plants grown by four nurseries located at different altitudes (Madonie mountains, Sicani mountains, Nebrodi mountains) and on the plain (Marsala) and with an open cycle soil less system. The trial was carried out at our
experimental fields located in Palermo, in a cold greenhouse. Tudla plug plants originating from four areas of Sicily were planted in the last week of September. Plug plants produced by plants from high altitude nurseries ripen earlier than the others. The yield and average berry weight of plug plants from nurseries located in the high mountain areas (Sicani mountains, Nebrodi mountains) (yield 59 t/ha and average weight 21.5 g) are better than those from the plain (Marsala) (yield 41 t/ha and average weight 19.6 g) and the mid mountain area (Madonie mountains) (yield 34 t/ha and average weight 19.6 g).

2.10.2.8. Strawberry Production Trends in Poland\textsuperscript{19}, E. Zurawicz
In Poland's climatic conditions, strawberries usually ripen in June. The fruiting time of each cultivar is short, mostly 3–4 weeks. For many years, Poland has been a major world strawberry producer. During the period of 1980–87, strawberry production increased from 180 to 334 thousand tons. Three basic cultivars are grown: Surprise des Halles, Redgauntlet and Senga Sengana. In production Senga Sengana has continued to predominate. It comprises about 80% of the total amount of strawberries grown.

All strawberries produced in Poland are grown in an open field. The average plantation size is about 0.3 ha. Plantings usually are established in the fall or in the spring using certified plant material taken directly from propagation beds. Plantations are maintained usually for 3 fruiting seasons. Grey mould, white grubs, root weevils, leaf and bud nematodes and strawberry mites cause the most significant problems in strawberry plantings. About 70–80% of the harvested fruit is used by the processing industry, mainly for the production of compote, juice, frozen fruit and other products. A great part of Polish strawberries production is exported. During the period of 1980–87, export of fresh fruit and strawberry products increased from 52 to 112 thousand tons.
The present research program is comprised of different problems connected with agro technical factors influencing strawberry yield, development of more efficient methods for pests and disease control and with breeding new varieties. It is expected that in the coming years strawberry production in Poland will further increase.

2.10.2.9. *Strawberries Producing and Marketing for Direct Markets*, Charles D. Safley, E. Barclay Poling

Current and potential strawberry growers need production, marketing, and financial information to make informed decisions about starting, expanding, or leaving a direct-market business. Like all business owners, their main objective should be to make a profit so their farms will be financially successful”. Ideally, growers should keep detailed records that they can use to estimate production, harvest, and marketing costs. But many growers don’t have time to keep detailed records. This publication provides information that strawberries growers can use develop production, harvesting and marketing of strawberry, calculate prices and expenditure and search market for strawberries.

Therefore, this publication has two components. First, it provides information about the costs and returns of growing, harvesting, and marketing strawberries through direct markets: pick-your-own fields and fruit stands that sell pre picked berries. Second, it identifies direct-market strawberry customers and presents information about their buying behaviors. The expense, revenue, and marketing information reported here are based on research conducted by the authors at North Carolina state university. A complete description of the data is published in hort technology (January-march 2004).
2.10.2.10. **Strawberry Gingivitis as the First Presenting Sign of Wegener's Granulomatosis: Report of a Case**, CH Siar, KB Yeo and KNakano.

Wegener's granulomatosis is a rare multi-system disease characterized by the classic triad of necrotizing granulomas affecting the upper and lower respiratory tracts, disseminated vasculitis and glomerulonephritis. Oral lesions as a presenting feature are only encountered in 2% of these cases. Hyperplastic gingival lesions or strawberry gingivitis is a characteristic sign of Wegener's granulomatosis. The latter consists of reddish-purple exophytic gingival swellings with petechial haemorrhages thus resembling strawberries. Recognition of this feature is of utmost importance for timely diagnosis and definitive management of this potentially fatal disease. A case of strawberry gingivitis as the first presenting sign of Wegener's granulomatosis affecting a 50-year-old Malay male is reported here. The differential diagnosis of red lesions that may present in the gingiva is discussed.

2.10.2.11. **Strawberry production, research and marketing in Belgium**, Tom Van Delm.

Researcher introduced strawberry cultivation in Belgium. With acquainting the cultivation system researcher briefly introduced history of strawberry and its current cultivation system in Belgium. In this research paper he mainly focused on Combination cultivation systems in which he tress on following points Variety trials (4 levels), Cultivation techniques, Fertilisation, Energy, Water, Cultivation systems and technologies, Diseases and pests, Flower bud analysis, Propagation trayplants, Projects, History, Current cultivation systems and current marketing system.
2.10.2.12. The Nutritional Quality of Strawberries (*Fragaria x ananassa*) after Short-refrigeration: Genetic Influences, Sara Tulipani, Stefania Romandini, Franco Capocasa, Bruno Mezzetti, Maurizio Battino (Italy)

The strawberry (*Fragaria x ananassa*, Duch.) has recently received great commercial development and represents the most commonly consumed berry. The strawberry is also a relevant source of micronutrients and phenolic substances, most of which are natural antioxidants and contribute to the high nutritional quality (NQ) of the fruit. In addition to genetic heritable differences, several pre- and post-harvest environmental conditions seem to strongly influence the NQ of strawberry. The short-refrigeration of the fruits is the most common method to control the decay of strawberries. However, little is known on the influence of cold storage on the antioxidant, phenolic and micronutrient contents in strawberries, and on the genetic influence on the storability of these fruits. In this work, five strawberry cultivars were analyzed for total antioxidant capacity, total phenolics, flavonoids and anthocyanins, and for micronutrient contents of both fresh and stored fruits. Three consecutive years of harvest were studied to assess the combined effect of genotype and pre-harvest environmental conditions on the NQ and storability of the fruits. Significant cultivar-to-cultivar differences were observed in the NQ parameters studied, confirming how the genetic background may significantly affect the nutritional value of strawberries. Short-refrigeration did not seem to affect either negatively or positively the main NQ attributes of the strawberries, with the exception of the folate content, which significantly increased after storage in all three years. These findings are particularly concerned with some varieties in this study, suggesting a genetic influence on fruit response to storage.
2.10.2.13. *The Quality of Strawberry Plants in Relation to Carbohydrate Reserves in Roots*, J. Schupp, B. Hennion
Among the research projects proposed by the French Strawberry Working Group on “Plant quality” in 1989, it appeared necessary to initiate a study on plant reserves and the rhizogenesis potential to understand why strawberry plants which appeared healthy before transplanting subsequently showed poor development.

Researchers have looked for a relationship between this phenomenon and levels of carbohydrate reserves. Reserves were monitored during plant storage to determine the relative influence of geographic origin and of possible storage disorders.

Measurements of rhizogenesis showed that lots originating from certain nurseries as well as those stored for the shortest period produced the highest number of rootlets.

The carbohydrate status appeared to be a component of plant quality but many questions remain unanswered regarding the causes and mechanisms of carbohydrate deterioration.

2.10.2.14. *Black Plastic for Weed Control in Camarosa Strawberries*, Richard Molinar and Michael Yang,
Black plastic mulch applied in February reduced the amount of weed growth considerably as compared to the clear mulch. Yield was not adversely affected, and in fact, was increased significantly (p< .10) in the black plastic. Fruit did not appear to be injured where it contacted the black plastic.

2.10.2.15. *Black Plastic for Weed Control in Chandler Strawberries*, Richard Molinar and Michael Yang,
There was no significant difference in yield between black and clear plastic mulches applied in February on the Chandler variety. There was also no difference in berry size between the treatments. Black plastic mulch did provide effective weed control without sacrificing yield. Fruit
quality was not affected by the black plastic, and there was no evidence of fruit burn as mentioned in several sources.

2.10.2.16. The Effect of Red and Black Plastic Mulch on Chandler Strawberry Production

Red plastic mulch significantly reduced the yield of Chandler strawberries (p=.10) compared to a black plastic mulch. Strawberry runner plants were able to survive and grow under the red mulch, competing with the mother plants and reducing yields. There was no growth under the black mulch. There was also no difference in berry size.

2.10.2.17. The Effect of Planting Dates on Yields of Two Varieties of Strawberries

Chandler and Camarosa varieties planted September 11 and August 26 resulted in higher yields than plantings made on September 24 and October 3. Chandler plants stored and planted on the four different dates resulted in poorer crown survival than Camarosa plants on the later planting dates.

2.10.2.18. Traditional Close Shearing vs. Moderate Thinning in Two Fields of Chandler Strawberries

Two trials were conducted in 1996-97 to determine the effect of light winter pruning vs. the traditional shearing of plants prior to laying clear plastic. The results in two separate Chandler fields showed no significant difference between close shearing and only moderate thinning of plants.

2.10.2.19. Comparison of Camarosa, Gaviota, Carlsbad, and Chandler Varieties of Strawberries in Fresno County

Camarosa, Chandler, and Carlsbad all yielded significantly more total berries (p<.05) than Gaviota in a replicated trial in Fresno County. Yields from the three varieties were 34-54 percent higher than the new University of California variety (Gaviota). Both Camarosa and Chandler also yielded significantly more marketable berries than Gaviota. Carlsbad
was the largest berry at 29 grams, followed by Camarosa (26.6 gm.), Gaviota (23.5 gm.), and Chandler (23 gm.).

**Further Need of Study**

We came to know after reviewing the literature regarding our study that the material which is published has very few in compare to other leading fruits. Maximum numbers of books and research have completed or done in abroad on other hand this fruit appearance is new in Indian region that’s why there is not enough study undertaken by researchers and enthusiastic peoples. Agriculture research Centers in India and Maharashtra also not taken keenly interest in this relevance study. Whatever the study have completed in India / Maharashtra is in limited direction of cultivation only. Cultivation techniques, method and relevance cultural operations of strawberry fruit have only guideline in these researches and books in India.

Study which is related to strawberry fruits in India and Maharashtra is focusing only on the cultivation and its related operations. Besides this marketing of this reddish and testier fruit is not focused very well that’s why this study is intensely spotlighting on both sides cultivation and marketing. However, studying marketing of strawberry domestic as well as international market is going to studying in this present research.
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