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Scenario of greenhouse cultivation: A country-wide analysis

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Abstract
Agriculture sector has been revolutionized with the introduction and adoption of greenhouse cultivation as the innovative technique to grow crops irrespective of seasonal conditions with high yield. Greenhouse cultivation has been introduced and adopted world-wide as it has been proved successful to meet-out the rising consumption demand. Since the technology is involved in this process and therefore, it requires orientation of the cultivators as well as requirement of finance, the technology cannot be considered so far popularly adopted. Further, involvement of skilled personnel is required to set the system and for cultivation. The system has been popularized mainly in China and Korea. Researchers have mainly paid emphasis to examine greenhouse cultivation to recommend in their own ways. The research paper endows to examine the scenario of greenhouse cultivation by highlighting the present scenario of area covered in different countries under greenhouse cultivation and also to focus upon the greenhouse cultivation in India and contribution of agriculture sector in the national Gross Value Added.

Keywords: greenhouse cultivation, agriculture sector, national gross value added

Introduction

Protected cultivation practices are outlined as a cropping technique where controlled micro-climate influences the growth and development of plant. With the advancement in agriculture, several protected cultivation practices have been adopted massively in commercial farming. Among these protecting cultivation practices, greenhouse, plastic house, polyhouse, artefact house, internet house, and shade house etc. is useful· (Pattnaik & Mohanty) Climate change is becoming an increasingly significant global problem that can no longer be ignored. The main underlying cause is anthropogenic that unsustainable use of fossil fuel, forest degradation for industrialization, and rapid urbanization with an over population· (Mukherjee *et al*) The use of poly house has played a vital role not only in overcoming the vagaries of nature, but also has triggered diversification to vegetable crop of high value. The thrust on protected cultivation of vegetable in addition to use of better varieties, better management practice etc. have played significant role in the productivity enhancement of cash crops in the state of Himachal Pradesh. (Spehia) Himachal Pradesh is a hill state where a majority of marginal and small farmers practice traditional farming, which is not remunerative. A manifold increase in the resource use efficiency in crop production can be obtained through protected cultivation compared to open field condition. Controlled environment cultivation can help marginal and small farmers provided the financial and extension services for infrastructural development and transfer of technology are speeded up to bring the desired technology to the region. (Chaudhary)

Agriculture sector has been revolutionized with the introduction and adoption of greenhouse cultivation as the innovative technique to grow crops irrespective of seasonal conditions with high yield. Greenhouse cultivation has been introduced and adopted world-wide as it has been proved successful to meet-out the rising consumption demand. Since the technology is involved in this process and therefore, it requires orientation of the cultivators as well as requirement of finance, the technology cannot be considered so far popularly adopted. Further, involvement of skilled personnel is required to set the system and for cultivation. The system has been popularized mainly in China and Korea. Researchers have mainly paid emphasis to examine greenhouse cultivation to recommend in their own ways. There are more than 55 countries now in the world where cultivation of crops is undertaken on a commercial scale under cover. Asia, china and Japan are the largest user of greenhouses. The development of greenhouse technology in china has been faster than in any other country in the world. In developed countries namely Japan, Holland, Russia, UK, Korea, and others, it is about two century old. China started protected cultivation in 1990s today the area under protected cultivation in China is more than 2.5 million Hectare and 90% of this area is under vegetables. Israel is one country which has taken big advantage of this technology by producing quality fruits, vegetables and flowers etc in water deficit desert areas**.** (Growlink.com)

Review of Literature

Kumar *et al*, (2016) [5] in their study made comparative economic analysis between poly houses and open fields and stated that in case of variable cost, maximum difference was observed for seed which was more than four times as compared to open field conditions. In case of open field

conditions, expenditure on irrigation and weed control was higher. Total cost of tomato in poly house was higher as compared to open field conditions. The gross return, returns over variable cost and net return were higher in case of poly houses as compared to open field conditions. Thus according to them, in terms of expenditure on irrigation and weed control, poly houses are better but in terms of gross return, returns over variable cost and net return, open fields are better.

Wang (2017) [6] have observed that modern solar Greenhouse is an important initiative. In China protected cultivation has history for its benefits in energy saving, pollution reduction, and comprehensive competitiveness of modern agriculture improvement especially in this low carbon production era. The most obvious obstacles of modern solar Greenhouse in China are characterized by the poor heating-preserving performance (of solar thermal Greenhouse) and the shadowing effect (of PV Greenhouse), and a series of advanced solar utilization technologies to mitigate the effect of heat loss, shadowing and poor light condition applicable for integration.

Khodke (2017) [7] states that poly house is a methodology used to grow plant under controlled environment for increasing yield and quality of the crops. The controlling and monitoring of poly house parameters play a vital role in overall development of plant. In Greenhouse, for proper plant growth soil nutrient parameters are equally important. Nutrient related parameters give the ability to correct issues before they become problems like plant losses and poor quality. Irrigation is also one of the most important inputs for increasing yield of crops and quality and poly house maintain necessary environment through web technologies instead of any kind of human interaction according to him.

Rathee *et al*, (2018) [8] have found that insect threats are prime to production and productivity of Greenhouse crops worldwide. According to them presence of warm & humid conditions and abundant food under protected structures provide a stable environment and habitat for pest development. They argue that the level of damage that can be tolerated is generally dependent on the type of crop. The damage inflicted by arthropod pests on Greenhouse crops varies from pest to pest and season to season.

Sarras and Grude (2018) [9] have brought forth that Soilless Culture Systems (SCS) are increasingly adopted as a major technological component in the modern Greenhouse industry. The core advantage of soilless culture, frequently referred to as 'hydroponics' is stated to be independent of the crops from the soil which, as a natural medium, is heterogeneous, accommodating pathogens, tends to degrade in monoculture systems and may be infertile, saline or sodic. According to the authors water culture system such as floating hydroponics, Nutrient film technique and aeroponics are mainly used for production of leafy vegetables.

Pattnaik and Mohanty (2021) [1, 10] have concluded that greenhouses are being commercially used for production of exotic (Non-Native) offseason vegetables, export quality cut flowers and also for raising quality seedling. Economic return from the high value agricultural produce can be increased substantially when grown under greenhouse condition

Objectives of the study

- To study Country-wise Area under Major Greenhouse Production
- To know about greenhouse cultivation in India

Analysis and Discussion

Country-wise Area under Major Greenhouse Production

The following table shows area under Greenhouses of major Greenhouse producing countries:

Table 1: Country-wise Area under Major Greenhouse Production

S.No	Country	Greenhouse Cultivation Area (ha)	%
1	China	2,76,000	52.48
2	Korea	57,444	10.92
3	Spain	52170	9.92
4	Japan	49,049	7.61
5	Turkey	33,515	6.37
6	Italy	26,500	5.03
7	Mexico	11,759	2.23
8	Netherland	10,370	1.97
9	France	9,620	1.82
10	United States	8,425	1.60
	Total	5,25,852	100

Source: Indian Horticulture Book 2015

It is obvious from the above data that although, greenhouse cultivation is being considered as a concept which is infancy in the sphere of primary sector production, yet, it has become much popular in a very short time spell in the countries like China which is being counted for encouraging people to use land for greenhouse cultivation extensively as out of total greenhouse cultivation area of the world, more than one-half (52.48 %) falls in this country. Further, Korea, Spain and Japan which are small countries in terms of total land area of the world, contribute between 7 to 10 percent of the total greenhouse cultivation area of the major cultivating countries by using greenhouses in the world. It implies that there has been an encouraging shift of accepting greenhouse cultivation as the mode of production by the countries; small or big, world-wide which necessitate effective management including resource provision, marketing and finance for propagating it.

Greenhouse Cultivation in India

India is one of the fastest developing agro-oriented economies of the World with a surplus in food grain production due to the wide adaptation of new emerging technologies and methods in production. The emerging socio-economic changes coupled with economic growth and high-income elasticity in the country is a major cause of rising demand of agricultural produce, fruits, flowers and vegetables due to which, the corporate houses have for the last few decades, ventured into hi-tech production including horticulture enterprises namely the protected cultivation. In this context, in India the technique of Greenhouse production was introduced in most of the agricultural Universities and Institutions for commercial purposes. After the year 1988, Greenhouses are becoming more and more popular for commercial purposes. As per 1994-1995 estimates, approximately 10 lack hectare of land is under Greenhouse cultivation. The Government is also providing financial and other support to it. National Horticulture Board is specifically initiating to strengthen and encourage greenhouse production keeping in view, diverse characteristics of such production and to meet-out the fast growing demand. Apart from it, financial institutions

including banks, state governments and local level agencies are supporting the initiative in their own ways.

During the winter season in North India, it is extremely difficult to grow vegetables in open field condition as vegetables are very sensitive to climatic condition. However, various types of protected structure have been developed for growing some high value crops continuously by providing favourable environmental condition and giving protection from the excessive heat and cold. In upper region of Himalayas, a majority of the population lives in rural areas and depends primarily on the agricultural based activities (70 %) for their sustence and prosperity. The agricultural production system is limited to the altitude of 2400 meters from mean sea level as the high altitude regions have a very harsh climate and short agriculture season **(**Negi *et al*)

Greenhouse cultivation has become popular in India since few decades. The technology of Greenhouse is first used for research purposes in Agricultural Universities, Research Centres and various Institutions but nowadays, it has become famous for agriculture purpose. The Indian Institute of Agriculture Research (ICAR) Bangalore has the maximum area under Greenhouse. There is 1500 sq.m land under glass and plastic Greenhouses. Central Potato Research Institute, Shimla has more than 1000sq.m land under different types of Greenhouses. Indian Agricultural Research Institute, New Delhi is also actively engaged in Greenhouse research with an approximate area of 500sq.m under Greenhouses located in different divisions of the Institute. Vishav Flora LTD Company located in Haryana has constructed a number of Hi- tech Greenhouses for cultivation of floriculture product for export. In just four years, since implementation of the new policies. In 1991, 103 projects with foreign investment of more than Rs. 80 crores have been approved to be set up in the country at an estimated cost of more than Rs.1000 /- crores around Pune, Bangalore, and Hyderabad. These projects are estimated to captivate around 300 ha land area. The crops being cultivated in the greenhouses include; agricultural crops, Fruits, Vegetables, Medicinal plants, Cut flowers and Spices.

Table 2: Share of Agriculture Sector in Gross Value Added of India at Current Price (in Rs. Crores)

Year	Agriculture Sector	Growth	Other Sectors	Growth	Total	Growth
11-12	15,01,947 (17.2)	-	66,04,999 (82.9)	-	87,36,329 (100)	-
12-13	16,75,107 (16.8)	11.5	82,68,906 (83.2)	25.2	99,44,013 (100)	13.8
13-14	19,26,372 (17.1)	15.0	93,07,150 (82.9)	12.5	1,12,33,522 (100)	13.0
14-15	20,93,612 (16.8)	8.7	1,03,74,347 (83.2)	11.5	1,24,67,959 (100)	11.0
15-16	22,25,368 (16.1)	6.3	1,15,46,506 (83.9)	11.3	1,37,71,874 (100)	10.5
16-17	24,84,005 (17.9)	11.6	1,29,07,664 (82.1)	11.8	1,53,91,669 (100)	11.8
17-18	25,96,908 (15.2)	4.5	1,44,93,134 (84.8)	12.3	1,70,90,042 (100)	11.0
18-19	26,92,433 (14.2)	3.7	1,61,94,524 (85.8)	11.7	1,88,86,957 (100)	10.5
19-20	28,78,609 (14.1)	6.9	1,74,72,404 (85.9)	7.7	2,03,51,013 (100)	7.8
C.G.		8.5		13		11.2

Source: Agriculture Statistics of India and Economic Survey, Govt. of India.

As shown in the table, on an average during 2011-12 to 2019-20, contribution of agriculture sector in Gross Value Added in India at current prices has grown by 8.5 percent against the contribution of other sectors grown by 13 percent. The study analyzes that the Gross Value Added in the Country has grown by 11.2 percent during the same period which implies that the growth in contribution of the agriculture sector is comparatively very low. Further, as per the table, the share of agriculture sector in the Gross Value Added did not remain consistent. Initially, the contribution of agriculture sector in the Gross Value Added was around 11 to 15 percent which declined to 3.7 percent in the year 2018-19. It has shoot-up and touched to 6.9 percent in 2019-20 from the preceding year. On the other hand, growth in the Gross Value Added of the Country has been recorded 7.8 percent to 13.8 percent during the period under research. This analyses that the growth in Gross Value Added of the Country has recorded more consistent trend in comparison to the growth in the contribution of agriculture sector in the Country's Gross Value Added which means that the contribution of agriculture sector has not remained consistent which is a matter of concern and it can-not be considered a certain source of contribution to the economy of the Country and needs to be paid much attention to establish certainty.

Findings and Suggestions

The study finds that China and Korea have followed greenhouse cultivation in a massive manner. Spain, Japan, Turkey and Italy are also popularizing it. Setting- up of greenhouse is technical and it requires skill and orientation. In India, efforts have been made to propagate greenhouse cultivation. Although it is considered a contemporary phenomenon yet the technique was being applied in the Country since ages. Greenhouse cultivation has become popular in India since few decades. The technology of Greenhouse is first used for research purposes in Agricultural Universities, Research Centres and various Institutions but nowadays, it has become famous for agriculture purpose. Different institutions are involved in greenhouse cultivation and to assist the cultivators in India. This may help in boosting-up the economy of the Country. At this juncture, the growth in Gross Value Added of the Country has recorded more consistent trend in comparison to the growth in the contribution of agriculture sector in the Country's Gross Value Added which means that the contribution of agriculture sector has not remained consistent which is a matter of concern and it can-not be considered a certain source of contribution to the economy of the country and needs to be paid much attention to establish certainty. Based upon the findings of the present research, the following measures are recommended:

- There is a need to establish separate department of greenhouse cultivation in each state and the Ministry of Agriculture at the centre must have a separate wing of greenhouse cultivation to develop liaison with the

departments at the state level.
- The role propagation and promotion greenhouse cultivation can be performed by the promotional agencies of the development institutions and they must be instructed to take-up such assignments on targeted achievement basis.
- There must be follow-up mechanism of the role of promotional agencies to be performed to propagate and promote greenhouse cultivation in the states.
- The financial institutions should be encouraged to assist more and more persons by providing special benefits and concessions as it is to cater to the consumption demand, improve household earning and thereby grow the national economy.
- Technical and other assistance can be provided through different platforms including information, education, and communication (IEC) campaigns.

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