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Prospect of Horticulture in Enhancing Farmers' Revenue –A Overview

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ABSTRACT

The role of agriculture in Indian economy is huge but the contribution of horticulture sector is quite commanding with an increased by 34 % in last ten years. The potential of Horticulture sub sector to enhance farmers income is gigantic through adoption of Hybrid technology for higher productivity and quality. Implementation of horticulture based cropping sequence is a potential option for enhancement of income of farmers. Adequate post harvest handling and value addition of horticulture produce can also escalate the farmers income by many folds. Organic horticulture holds a massive prospect in enhancing farmers income and scientific cultivation of aromatics and medicinal plants as well as spices, also has an incredible opportunity for doubling farmers income. Floriculture is another subsector which have a immense opportunity for the small and marginal farmers to enhance their revenue. The horticulture sector continues to be a fundamental source of employment and has a significant role to play in amplifying farmers income in near future.

1. Introduction

India has always been an agriculture based economy and though the share of agriculture in the Gross Domestic Product (GDP) has been decreasing, still a substantial population is reliant on agriculture for the livelihoods. In the year 2014-15, agriculture and allied sectors contributed 18% of India's gross domestic product (GDP) (Anonymous, 2017). A large proportion of which comes from the horticulture sub-sector. Since 2012-13, India's horticultural production has surpassed that of all other agricultural sub-sectors. In a decade (2006-07 to 2016-17), the area under horticulture had increased by 34 % from 18.7 million ha to 25.1 million ha. In the same period, horticultural production increased 56 % from 191.8 million tonnes in 2006-07 to 299.8 million tonnes by 2016-17. In terms of value share also the horticulture sector is generating 25% against a net area share of 7% only whereas crops -rice maize and wheat which has a net area of 42% , contribute only 20% of value share. In terms of gross value of output (GVO), fruits and vegetables constitute the second largest category among agricultural crops which contributed 25% in

the year 2014-15. Therefore, horticulture is seen as an ideal option for crop diversification with huge potential to enhance grower's income.

Role of Horticulture in Enhancing Farmers revenue: The importance of horticulture can be corroborated with its high returns per unit area, high export value, higher productivity, best utilization of wasteland/undulating lands, source of raw materials for industries, labour intensive, higher food energy per unit area, and women's empowerment through employment opportunities in processing, floriculture, seed production, mushroom cultivation, nursery activities, etc. Since 2012-13, the India's horticultural production and consumption trends indicate that the growth rate of demand in this sector will surpass all other agricultural sectors. This is evidence in last five years that fruits and vegetables registered a growth of 6.34 % in production and 4.7 % in area. However, the growth in productivity over the past decade was 1.57 % per annum. So, there is a huge possibility for the farmers to invest in the field of horticulture for doubling their income.

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1. Exploring the Hybrid technology for higher productivity:

The hybrid technology has the ability to compound the volume of production of vegetable crops by many folds. The hybrid seeds of cabbage, cauliflower tomato, chilli, cucumber and muskmelon are being produced by ICAR institutes and other private seed companies that are readily available to the farmers. Currently, only 10 % of total area under hybrid vegetable production which depicts a good scope for increase in production and productivity. Among the main advantages of F1 hybrids higher productivity, , earliness of the produce , superior and uniform quality and resistance to biotic and abiotic stresses .

2. Production of seed and planting material:

Quality seed and planting materials scarcity is a one of the major problems in the growth of horticulture sector. Utilization of quality seeds and planting materials is a must which not only increase yield and quality but also improves

the livelihood security. Likewise rootstocks are an integral part in the production system of fruit crops like grapes, citrus, apple etc which not only has the potential to enhance the yield of one crop but also modify the architecture of plants for efficient utilisation of resources , disease & pest resistance and can also ameliorate the soil, enhance nutrient and water use. For example, Citrus rootstock, *Rangpur lime* can adapt to water stress, calcareous soils and resist *Phytophthora*. The roles of nurseries in horticulture comprises of production of genetically pure nursery stock, export of nursery stock and employment generation. The projected area under fruits trees in the coming 5 years (2020-21 to 25-26) as indicated in table 2, citrus will be 1201 ha which will require 6.34 crore planting material, grapes as high as 35.69 crore. The rapid expansion will intensifies the need for establishment of nurseries for the production of good quality of seed and planting materials that can raised the farmers' income.

Table 1. Comparison of Efficiency Measures (Hybrid vs. Local)

Vegetables	Net Return (Rs/HA)		Extent of Income gain		Income per rupee of investment		Rate of Return (%)	
	Local	Hybrid	Local	Hybrid	Local	Hybrid	Local	Hybrid
Cabbage	9000	50400	41400 (460)	1.43	1.43	2.86	143	286
Cauliflower	10500	64200	53700 (510)	1.53	1.53	3.34	153	334
Brinjal	10800	54000	43200 (400)	2.20	2.20	3.00	220	300
Tomato	30000	105000	75000 (250)	1.40	1.40	1.88	140	188
Cucumber	9000	39000	30000 (330)	1.60	1.60	1.87	160	187

Note: Figures in the Parentheses indicate percentage

Source: DFI volume 8C

Table 2. Projected Demand of Nursery Plants

Fruit Plant	Area under fruits projected (*000 ha after years)			Projected Demand of Nursery Plants	
	5 years (2015-16 to 2020-21)	10 years (2020-21 to 25-16)	15 years (2025-26 to 30-31)	2025-26 (crore)	2030-31 (crore)
Apple	355	400	452	3.46	5.53
Citrus	1079	1201	1336	6.34	10.06
Grapes	186	283	430	35.69	68.48
Guava	303	370	453	3.36	5.62
Mango	2284	2326	2369	1.04	1.58
Papaya	176	249	353	38.59	70.65
Pomegranate	257	348	471	9.88	17.56

Source DFI Vol 8 C

The production of F1 seeds is a very beneficial venture which generate 350 times more profit. The requirement for quality seeds in india is very high. In tomato, the production from organised sector is 360 tonnes whereas the demand is 360 tonnes per year. Similarly the demand for onion seed is 1200 tonnes per year but the total production combining both organised and unorganised sector is only 600 tonnes. So the opportunities for the farmers to collaborate with various seed companies through participatory hybrid production programme is enormous to boost their revenue .

3. Horticulture-based cropping systems: Horticulture based cropping system involves the integration of crops using space and labour more efficiently and helps in better utilization of environmental factors, greater yield stability in diverse environmental condition, conservation soil and other resources. Agri-horticulture systems (i.e., integration of horticulture crops mostly fruit trees with the agricultural crops) or Horti-silviculture (i.e., integration of horticultural crops with forest crops) are recognised as an important agroforestry system for improving the productivity, reducing the risk in production with additional employment generation. Adopting intensive horticultural systems get a higher yield as the system maximise water use efficiency, maintain soil fertility, and minimise soil erosion, as well as merging the concepts of intercropping, multi-layer cropping, relay cropping, off-season cultivation and crop regulation to increase productivity of the same piece of land with more

crops throughout the year rather than the single crop. In case of fruits and plantation crops, they are perennial in nature and long pre-bearing period and majority of the crops have wider spacing and are tall growing and over 60-70 per cent inter space is not effectively utilised which can be effectively utilized by intercropping for more income. For example some of the crops like Banana, Cocoa, Turmeric, Ginger, Pineapple and Pepper etc are shade loving which allow them to be intercropped with fruit trees and plantation crops, additionally some crops encompass different harvesting time and period which facilitates for sustainable income. The following table illustrate the extra income from the intercropping system in orchard .

Intercropping of various vegetable crops with arecanut also gives a very good profit which is maximum in brinjal (B: C ratio 5.05) followed by cabbage(4.68) and cauliflower with a B: C ratio 4.24.(Table 4). Different summer crops like pumpkin (B:C ratio 1.17), ash gourd (B: C ratio 2.39), bottle gourd (B: C ratio 1.59)) and snake gourd (B: C ratio 1.53) are ideal for intercropping in arecanut due to higher cash outflows . (Bhat et al 2016)

High density planting system can also raise the farmers income effectively in fruit orchards, where the farmers can not only get higher yield and net economic returns per unit area in the initial years, but also facilitated more efficient use of inputs . Along with HDP, canopy management and rejuvenation of old and senile orchards can also be adopted for higher productivity

Figure 1. Estimated vegetable seed requirement in India

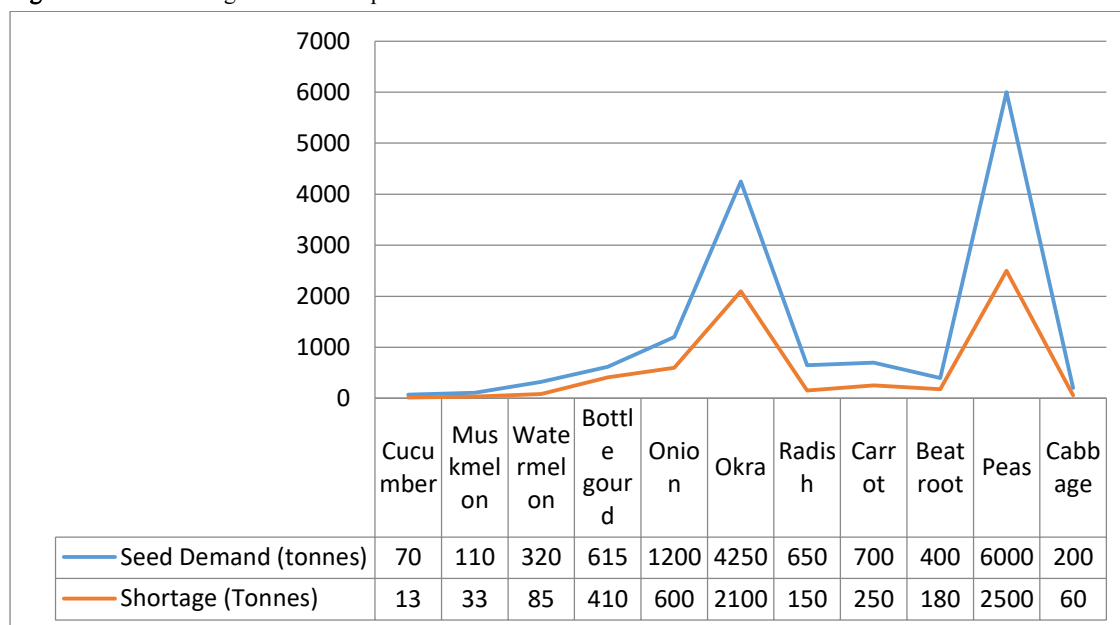


Table 3. Some successful model of multi storey cropping system on the horticultural crop basis

Coconut + Cocoa + Banana + Drumstick + Pineapple	The model recorded highest nut yield of 182 per palm and highest net income (Rs. 3.80 lakhs per ha) and B:C ratio (2.71)	Nimbolkar <i>et al.</i> (2016)
Coconut + Cocoa + Lime +Banana + Drumstick	This system recorded net income of Rs. 294810 per ha compared to mono crop (Rs. 68200 per ha.)	Roy <i>et al.</i> (2001) [
coconut + gerbera	The model recorded a net income of 380075/ha and B:C ratio of 3.5	Hegde NK and Sulikeri GS.
coconut + tuberose	The B:C ratio is 3.1 with a net return of Rs 323420/ha	Hegde NK, and Sulikeri GS.
Areca nut + Banana + Turmeric	The B: C ratio is 3.68:1 with net income of Rs. 36919.95/ha	Chandrashekhar G. <i>et al.</i> , 2018
arecanut + ginger	The benefit: cost ratio is (3.3:1)	(Hegde <i>et al.</i> , 2001)
areca nut + colocasia	This model recorded a B : C ratio of (3.15:1)	(Hegde <i>et al.</i> , 2001)
Arecanut+ cysanthum +	The B:C ratio is 2.43 with a net return of Rs 17550	Ray <i>et al.</i> , 2007
Arecanut+ pepper +cocoa + banana	B: C ratio is 4.5:1	Bhat <i>et al.</i> ,2016,

Table 4. Yield and economics (Rs./ ha) of arecanut garden) intercropping of vegetable with arecanut

Crop	Yield (t/ha)	Cost of production	Gross return	Net Return	B:C ratio
Radish	9.2	6,850	27,675	20,825	4.05
Knolkhol	4.2	7,350	14,735	7,385	2.00
Cabbage	21.4	9,150	42,750	33,600	4.68
Cauliflower	9.5	8,950	38,000	29,050	4.24
Tomato	6.6	12,713	32,750	20,037	2.57
Potato	5.9	12,765	28,925	16,160	2.26
Brinjal	10.2	8,045	40,600	32,555	5.05

source: (Ray *et al.*, 2007a)

4. Floriculture : Floriculture is another sub-sector which is growing at 10-15 % every year. Floriculture has blossomed into commercial activity with India emerging as second largest grower of flower cultivation after China. In the year 2012-13 about 232.74 thousand hectares area is under cultivation of flowers where as the production of flowers are estimated to be 1.729 million tonnes loose flowers and 76.73 million tonnes cut flowers . The N E region has a huge scope in floriculture where the cultivation generally include orchids, roses, lilies, bulbous ornamentals, bird of paradise, gerbera, marigold, tuberose, begonia, dahlia, etc . There is a tremendous scope for orchid production for increase income for farmers as out of 1331 species of orchids reported, 856 species are found in this region (Chowdhery, 2009; Nayar and Sastry, 1990). The important segments of this sector are cut floweres, loose flowers production, production of essential oils and perfumes, Flower seeds and bulbs production, Landscape gardening, Nursery, Floristry, Value addition etc.

5. Organic horticulture: The prospect of organic horticulture in near future is huge as demand for organic produces is growing at a hasty pace. Organically grown horticultural produce is nutritionally rich and also free from the hazardous pesticide and fertilizer residues. There is a continuous effort to upsurge the organic farming as this addresses soil health, human health and environmental health and it one of the options for sustainability. Among the organically certified products India mainly produceoil seeds, cereal & millets, cotton, pulses, medicinal plants , tea, fruits, vegetables , coffee, sugarcane etc which is around 1.35 million MT in 2015-16. The production is not limited to the edible sector but also produces organic cotton fibre, functional food products etc. There is a tremendous potential of organic farming in the North Eastern region of the country, and the farmers can take the advantage of the traditional organic cultivation system prevail in this region. The centre has also announced a scheme entitled “Mission for Organic Value Chain development for North Eastern Region” for implementation in the states of Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim and Tripura during the 12th plan

Table 5. potential flower crops for North East region

Name of state	Potential flower crops
Arunachal Pradesh	Gerbera, rose, carnation, gladiolus, orchids (cymbidium, paphiopedilum, vanda, oncidium), liliium, anthurium, foliage, succulent plants, begonia
Assam	Orchids (dendrobium, vanda), anthurium, marigold, tuberose, jasmine, gladiolus, gerbera, bird of paradise, chrysanthemum, liliium, rose
Manipur	Orchids (dendrobium), anthurium, roses, gerbera, carnation, Leather leaf ferns, marigold
Meghalaya	Anthurium, rose, carnation, asiatic and oriental lilies, calla lily, bird of paradise, heliconia, gerbera, golden rod, leather leaf fern
Mizoram	Anthurium, bird of paradise, rose, gladiolus
Sikkim	Anthurium, orchids (cymbidium, phalaenopsis, oncidium, cattleya), alstroemeria, calla lily, carnation, bird of paradise, gerbera, chrysanthemum
Tripura	Dendrobium orchids, anthurium, gerbera, liliium, tuberose, marigold, gladiolus, chrysanthemum

Source : L.C. De and D.R. Singh, 2016

Table 6. State wise farm area (excluding forest area) under organic certification during (2013–14)

Name of the state	Area under organic certification
Assam	2828.26
Arunachal Pradesh	71.49
Manipur	0.00
Meghalaya	373.13
Mizoram	0.00
Nagaland	5168.16
Sikkim	60843.51
Tripura	203.56
Total	69488.11

Source : Modified from APEDA (2012-13)

Table 7. State wise certified organic production (tonnes) including forest produce in NEH region

State	2009-10	2010-11
Arunachal Pradesh	710.02	2127.29
Assam	2328.89	14716.95
Manipur	4068.39	19239.25
Meghalaya	843.56	15674.64
Mizoram	14473.28	177509.02
Nagaland	11120.41	6627.47
Sikkim	2766.73	5174.44
Tripura	106.18	527.25
NER	36417.46	241596.3
India	1703465.70	38,87,197.19

(Source: APEDA Accredited Certified Agencies in Trace net)

There is a tremendous potentialities of North Eastern Region of India for Organic as the use of inorganic fertilizers and chemicals are limited which is 51.67 kg/hactor as compared to 144.33 kg/hactor of national average. The low chemical use input is a blessing as it will help to promote the North East region as an organic hub. According to Bujarbaruah, 2004, this region has a scope of production of 47mt of

organic manure including 37 mt from animal excreta and 9 mil tons from crop residues.

6. Post harvest handling and value addition: In horticultural products the post-harvest loss is very heavy which is around 30-35% accounting for an economic drain of Rs 2.40 lakh crore annually. Again only a minimal section of the total

products generally goes for processing and value addition. So, the scope for the farmers to increase the revenue in the processing sector is very high. Various post harvest management practices for major fruits and vegetables like harvest indices, grading, packaging and storage techniques like Including Packing materials like Corrugated Fibreboard boxes (CFBs), perforated punnettes, cling film wraps, sachets, etc. have been have already been developed and standardized for packaging of different fresh horticultural produce which can reduce the losses at farmers level. Therefore, the focus of the farmers should be in post-harvest management of fruits and vegetables as for major horticultural crops,. Applying these techniques practically will increased the price of the produces. With a change in food consumption patterns and habits there is demand for minimally processed products which are more convenient and hence the demand for products like pre-packed salads, vegetable sprouts, ready-to-cook fresh cut vegetables, packed mushrooms and baby corn frozen vegetables, etc. has increased. Small and cottage industry in food processing can play a big role in this market with farmers undertaking sun drying or local grinding and packages for some product chilli, turmeric ginger cardamom etc.

7. Medicinal and aromatic plants : The global market for medicinal plants has always been large and has been on increase at the rate of 7-15 per cent annually. The trade of medicinal plants are expected to grow to 5 million US dollar by the year 2050 However, the gap in demand and supply is

very huge in this area and about 75% of the plant material used in indigenous medicines is collected from forests and wild habitats (GoI, 2000). Hence, the cultivation and management of medicinal plants could become highly remunerative both in financial and economic terms for the small-scale growers. As compared to the traditional crops, the cultivation of medicinal crops has many advantages which include: i) better returns ii) high domestic and export demand iii) largely drought tolerant, and not easily grazed by animals iv) low incidence of pest attacks and diseases v) low cost of cultivation vi) could be raised as inter-crops and vii) wide adaptability.

8. Spices and condiments: One of the most vibrant sector of Indian agriculture is Spices and condiment sector About 63 spices are produced from India of which economically important are ginger turmeric, chilli, black pepper, cardamom, coriander, fenugreek, cloves, nutmeg, cinnamon, saffron, vanilla, cumin, fennel etc (Sasikumar et al 1999) Spice sector export 6% annually of the total agricultural products of India which has a productivity of 2213 kg/ha in 2016-17.

The North East region has a very high scope for the production of with some unique niche quality spices like Naga Chilli (10 lakh SHU pungency), Birds eye chilli (the smallest chilli with high heat value), Lakadong turmeric (high curcumin content),Nadia ginger and large cardamaom among them. A typical ginger having rhizomes with bluish black tinge inside is grown in some areas of Mizoram and Assam which is generally use for medicinal properties. (Asati and Yadav 2004)

Table 8. Area and production and productivity of major spices in North East India

State	Area(ha)	Production (t)	Productivity (t/ha)
Arunachal Pradesh	8.2	47500	5.8
Assam	27200	18500	0.7
Manipur	8700	7700	0.9
Maghalaya	18400	80900	4.4
Mizoram	9000	38300	4.3
Nagaland	4500	26200	5.8
Sikkim	34000	42400	1.2
Tripura	4500	9400	2.1

Source: National Horticulture Board (2009).

Table 9. Important spices and condiments of North East India

Type	Spice	States having potential
Chilli	Birds eye chilli	Mizoram, Sikkim
	Bhut jolokia	Nagaland, Manipur, Assam, Arunachal Pradesh
	Local chilli	Assam, Arunachal Pradesh, Manipur, Mizoram, Meghalaya
Rhizomes and root species	Ginger	Assam Meghalaya, Arunachal Pradesh, Manipur, Sikkim
	Lokadong turmeric	Assam, Meghalaya, Manipur
Seed/Fruit Species	Large Cardamom	Sikkim, Arunachal Pradesh
	Long pepper	Manipur, Meghalaya

	Black pepper,	Meghalaya, Assam
	Mustard	Assam
	sesame	Assam
Leaf	Bay leaf	Meghalaya, Sikkim

Source : Gopalkrishnan (2015)

2. Conclusion

In the recent trend, horticulture is emerging as the main growth engine of Indian agriculture. For the small and marginal farmers, Horticulture can be a opted option for the new developed research, available technology and adequate policy intervention . This sector also has the scope of expansion of area which may results into enhanced yield by 60% which can pave way to 8 million additional employment opportunity. Along with that , value addition of fruits and vegetables is also expected to go up by 10 % hence jobs in processing industry is also likely to get added, There are also a lot of focus from the Government on promoting this industry which resulted in various sponsored schemes like the National Mission on Food processing etc. This every 1 % increase in processing will demand 2.5 to 3.0 million tonnes of additional fruit and vegetables. Export requirements will also pick up and may reach 10% of the production in near future. The diverse agro-climatic conditions prevalent in India are conducive for cultivating most of the horticultural crops in one area or the other, thereby facilitating almost round the year production and supply. Amid concerns of changing climate, horticulture has demonstrated its resilience to drought and other extreme weather events. Horticulture holds importance for industry as well other than engaging farmers. By way of supplying raw materials it sustains a large number of agro-based industries. These industries also generate large number of employment opportunities for youth in processing and marketing of horticultural products. The horticulture sector continues to be a fundamental source of employment and income generation in India. Hence there is vast scope for the growth of this sector within agriculture for farmers to look forward.

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