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Sustainable Development through Diversification of Agriculture Towards Horticulture

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ABSTRACT

Agriculture has been one of the important sectors for the steady growth of Indian economy and our country has made impressive progress in food production to meet growing demands of our increasing population. This sector is now facing challenging problems due to land holding fragmentation, reducing soil health, lowering water table, climate change and fluctuating prices of its perishable products. Small and marginal farmers are now distressed as agriculture is risky and no more profitable leading to increasing farmers' suicide cases. Crop diversification and value addition of agricultural product are suggested to tackle these problems. This paper focusses on diversification of cropping patterns including more horticultural crops for better returns to farmers. The horticulture based diversification in agriculture will also promote sustainable development practices in agriculture sector. Northern states like U.P., Punjab and Haryana have high potential for such diversification. Important recommendations are derived in this paper for more sustainability and productivity of horticulture based diversification in Indian agriculture.

JEL Classification: Agriculture Q1 Land Ownership and Tenure; Land Reforms; Land Use; Irrigation; Agriculture and Environment Q15 Environment and Development; Environment and Trade; Sustainability; Environmental accounts and accounting; Environment Equity ; Population Growth Q56

Keywords: Agriculture and development, Sustainability, Horticulture

1. INTRODUCTION

The agriculture and allied sector with more than 15 per cent share in GDP, over 50 per cent contribution in employment and 12 per cent in exports earnings, has a direct bearing on the macroeconomic growth prospects. These multiplier effects of the sector, through various backward and forward linkages, played a critical role in attaining the 11th Plan agenda of inclusive and sustainable development for the Indian

economy. During the 11th Plan period, against the targeted growth of 4 per cent, the country has able to achieve 4.1 per cent growth in agricultural GDP. However, on account of two consecutive drought years, agricultural GDP is estimated to grow at an average of 1.6 per cent in the first four years of the 12th Plan. What is worrisome, however, is that the adverse impact of climate change is likely to aggravate in future. According to IPCC's Fifth Assessment Report (AR5) the production of three major crops, viz., rice, wheat and maize will decline significantly by 2030 due to the increasing adverse weather effect of global warming. The increases in temperature and the frequency of droughts and floods is likely to affect crop production negatively, which could increase the number of people at risk from hunger and increased levels of displacement and migration. These frequent adverse climatic changes have also been one of the major reasons for increasing farmers' distress. To respond to these emerging challenges faced by the agricultural sector, there is an urgent need for: increasing diversification; changes in cultivation patterns; improving soil health; use of innovative farm practices; development of climatic resilient and short duration varieties of crops; mitigation of farmers risk through enhanced insurance cover; price interventions, etc. This paper focusses on how the diversification of the production basket towards horticulture and other high value crops can be used as an important tool to overcome these challenges. The following section examine the level of diversification in the country. Section III discusses about the arguments in favor of diversification, and how increasing the pace of diversification agriculture towards horticulture, will promote growth in agriculture sector. Section IV discusses about the policy initiative undertaken by the government for the growth of the agriculture sector. In section V, we examine the various constraints in the growth of horticulture sector in the country, and the last section is the conclusion of the study and few policy recommendations to improvise the growth of the emerging sector.

2. DIVERSIFICATION

Diversification of agriculture implies divergence from the regional dominance of single crop to the production of a multiple crops, however it is different from the concept of multiple cropping or succession planting in which multiple crops are planted in succession over the course of a growing season. Rather it take in account the use of environmental and human resources to grow a mix of crops with complementary marketing opportunities to meet ever increasing demand for pules, cereals, oilseeds, vegetables, fruits, fibres, fodder and grasses, fuel, etc , with the objective of not only improving the soil health only but to provide a dynamic equilibrium of the agro-ecosystem. It may be **Horizontal**, where diversification is done through crop intensification i.e add high value crops to the existing cropping system to raise productivity or **Vertical** where efforts have made to enhance product through branding, packaging or processing. So, crop diversification takes into account the economic returns from different value-added crops and hence a shifting of resources from low value crops to high value crops. Prospects for crop diversification depends upon the risks, opportunities and the viability of proposed within the agro-economic conditions.

2.1. Diversification in India

Indian agriculture witnessed a structural change in its composition leading to diversification into horticulture, livestock and fisheries since the 1990s. Horticulture sector, viz., fruits including nuts; vegetables including potato, tuber crops and mushroom; ornamental plants including cut flowers; spices; plantation crops; and medicinal and aromatic plants has become a key driver of agricultural growth in many of the states and

at present contributes approximately 30 per cent to the overall agricultural GDP of the country. The area and production of horticulture crop have significantly increased over the last few years. The chart below shows the area under horticulture crops which was 18.5 million hectares during 2004-05 has increased to 23.33 million hectares during 2015-16. The total production during this period has increased significantly during this period. The increasing thrust of the government towards horticulture sector is also evident from its share in plan outlay for agriculture sector, which has increased from 3.9 per cent in Ninth Plan to 4.6 per cent during the current Twelfth Plan. A major intervention by the government towards promotion of horticulture sector was the implementation of National Horticulture Mission. Actual expenditure under the Scheme has increased from Rs. 917.33 crores during 2007-08 to Rs. 1809.56 crores during 2013-14. The significant increase in horticulture output also contributed in terms of major export earnings to the government. During 2013-14, the total value of export of horticulture produce from India to different countries was Rs. 14365 crores. Among the major fruit and vegetable producing countries, India ranks second after China. Figure 1 shows the area and production growth trend of horticulture crops.

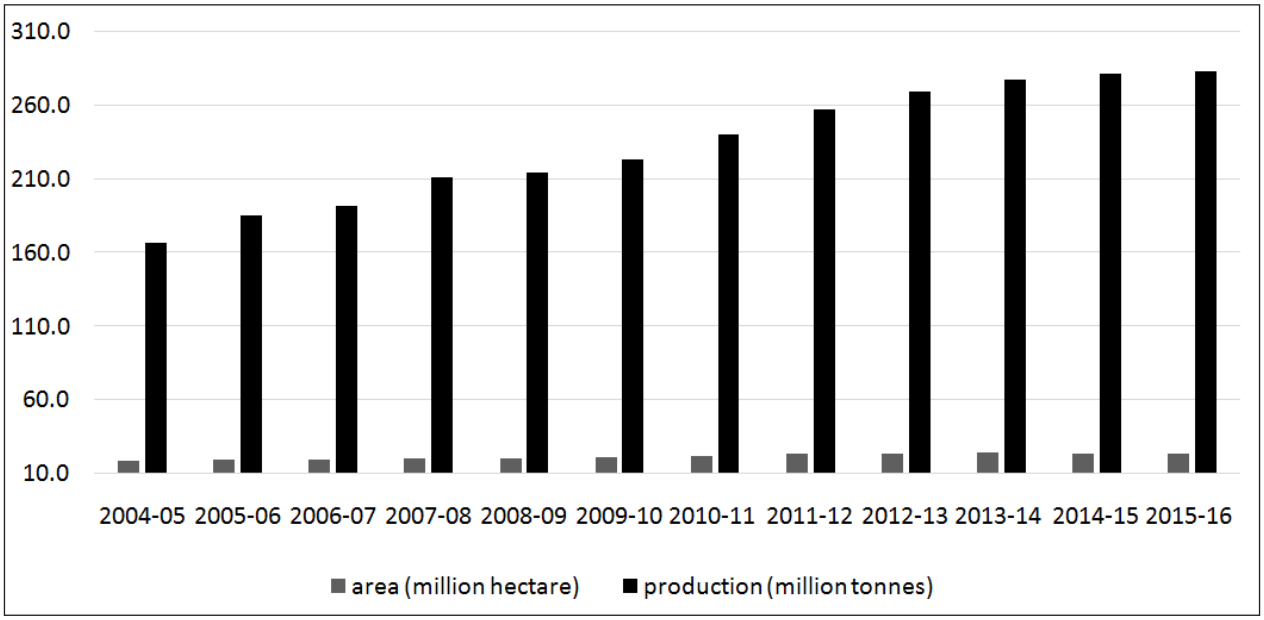

Figure 14.1: Area and production growth trend of horticulture crops

Source: Department of Agriculture, Cooperation & Farmers Welfare

Handbook of horticulture statistics, National Horticulture Board

Given the rising share of high value commodities in the total value of agricultural output and their growth potential, this segment is expected to drive agricultural growth in the years to come. However, being highly perishable in nature, this segment requires faster and better linkages between farms and firms in terms of logistics, processing and organized retailing. Towards this end, Indian Council of Agricultural Research (ICAR) has been playing a major role in fostering technology-led development in the horticulture sector through prioritizing research for genetic resource enhancement and its utilization, enhancing the efficiency of production, and reducing the losses in environment friendly manner.

2.1.1. State level diversification

This section discusses results of a Simpson index of diversification (SID) which was used for assessing determinants of agricultural diversification in India. Agricultural diversification in this analysis is crop diversification, studied with the Simpson Index and per cent of area under non-food crops; the estimates for the years 1990-91, 2000-01 and 2010-11 are presented in Table 4.1. The Table presents the trends in crop diversification in the country. The indices are relatively higher for larger states as they consist of diverse agro-climatic regions suitable for cultivating different crops. Hence a considerable proportion of the gross cultivated area a large and diverse state is under different crops; diversification indices are also higher for such states. The increase in diversification index depicts movement towards non-food grain crops.

Table 14.1
Simpson index of diversification

State/Union Territory/ Year	*Simpson Index of Dversification (Area under (Total Cereals +Millets+Pulses) / Total Cropped Area)*			
	T.E. 90-91	*T.E 2000-01*	*T.E. 10-11*	*Difference*
ANDHRA PRADESH	0.40	0.45	0.46	0.06
ARUNACHAL PRADESH	0.23	0.22	0.25	0.02
ASSAM	0.29	0.30	0.33	0.04
BIHAR	0.10	0.11	0.12	0.02
CHHATTISGARH		0.69	0.08	0.08
GOA	0.57	0.60	0.65	0.08
GUJARAT	0.54	0.63	0.65	0.10
HARYANA	0.30	0.29	0.28	-0.02
HIMACHAL PRADESH	0.11	0.14	0.16	0.05
JAMMU & KASHMIR	0.17	0.18	0.19	0.02
JHARKHAND		0.70	0.10	0.10
KARNATAKA	0.39	0.38	0.39	0.00
KERALA	0.80	0.88	0.91	0.11
MADHYA PRADESH	0.24	0.33	0.41	0.16
MAHARASHTRA	0.33	0.38	0.46	0.13
MANIPUR	0.13	0.18	0.22	0.09
MEGHALAYA	0.44	0.51	0.61	0.17
MIZORAM	0.20	0.23	0.59	0.38
NAGALAND	0.14	0.29	0.35	0.21
ORISSA	0.26	0.22	0.14	-0.11
PUNJAB	0.25	0.21	0.18	-0.08
RAJASTHAN	0.34	0.40	0.40	0.06
SIKKIM	0.34	0.33	0.43	0.09
TAMIL NADU	0.41	0.45	0.45	0.04
TRIPURA	0.36	0.16	0.11	-0.25
UTTARAKHAND		0.73	0.19	0.19
UTTAR PRADESH	0.19	0.20	0.21	0.02

State/Union Territory/ Year	*Simpson Index of Dversification (Area under (Total Cereals +Millets+Pulses) / Total Cropped Area)*			
	T.E. 90-91	*T.E 2000-01*	*T.E. 10-11*	*Difference*
WEST BENGAL	0.25	0.30	0.34	0.10
A&N ISLAND	0.73	0.41	0.43	-0.31
CHANDIGARH	0.42	0.34	0.62	0.20
D & N HAVELI	0.62	0.16	0.14	-0.47
DAMAN & DIU	0.49	0.00	0.17	-0.32
DELHI	0.73	0.13	0.16	-0.56
LAKSHADWEEP	0.95	1.00	1.00	0.05
PONDICHERRY	0.28	0.26	0.28	0.00
ALL INDIA	0.30	0.34	0.36	0.05

Source : Department of Agriculture, Cooperation & Farmers Welfare

Land use statistics, Directorate of economics and statistics

Table 14.1 shows extent of diversification all over India and state level. All over India diversification increased more than 0.03. States like Andhra Pradesh, Assam, Himanchal Pradesh, West Bengal, Tamil Nadu, Kerela, Uttrakhand, and Rajasthan shows diversification level more than 0.03, while bigger state like Uttar Pradesh shows low level of diversification and Punjab and Orissa show negative diversification indices, as these provide major share of food grains of the country. Many eastern states like Nagaland, Mizoram, Meghalaya, and Sikkim show high level of diversification towards horticulture crops.

Diversification pattern based on the area allocated under different crops has indicated that the northern region (states like Punjab, Uttar Pradesh and Haryana) have specialisation towards the traditional crops *i.e* rice and wheat. Reason for such specialisation is the high yield of these crops and good rainfall, so the incentive to diversify is less in these areas. Moreover the minimum support price on traditional crop provide more incentive to the farmers in these area to produce rice and wheat instead of diversifying area towards horticulture crops. However states like Tamil Nadu, West Bengal, Karnataka, Andhra Pradesh, Gujrat, Assam, have shown allocation of resources from food grains towards non-food grains. During 2012-13, Andhra Pradesh led in fruits production with a share of about 17 per cent followed by Maharashtra (12% share) and Gujrat (10 % share).Tamil Nadu , Karnataka, UP, MP each contributed more than 5 % in total fruit production whereas West Bengal & Kerala were also significant fruit producing states with each contributing about 3-4%.Whereas West Bengal led in case of vegetable production with about 16 % share , followed by UP (12 % share) and Bihar (10 % share) . Madhya Pradesh, Andhra, Gujarat & Odisha each contributed more than 5 % in total vegetable production with Maharashtra, Tamil Nadu & Karnataka also contributing about 5 % .West Bengal accounted for about a third of cut flower production whereas Tamil Nadu(18 % share) , Andhra (13% share) ,Karnataka (12 % share) & MP (11% share) led in production of loose flowers. Maharashtra accounted for about 30 % of cashewnut production, Karantaka led in Arecanut with 59 % share in production, Kerala produced 56 % of total cocoa while Tamil Nadu (30% share), Kerala (26 % share) and Karnataka (27 % share), all the three contributed significantly in coconut production during 2012-13 .Andhra Pradesh was the leading spice producing state during 2012-13 & also accounted for about 38 % in production of citrus fruits & 31 % of papaya production. J&K accounted for more than 70 % in apple production, Maharashtra for more than 80 % in production of grapes and Bihar contributed more than 44% in litchi production. UP & Andhra each accounted for about a quarter

in mango production. The total horticulture production was highest in case of West Bengal (292 lakh MT) followed by Andhra Pradesh (289.13 lakh MT).Table 1 shows India is diversifying, but the pace of diversification is slow. While many states are picking up fast, many northern states are still specialising in production of conventional crops.

3. ADVANTAGES OF HORTICULTURE OVER TRADITIONAL CROPS

Diversification in cropping pattern is not only important for promoting sustainable agricultural practices, it also helps in maintaining soil health, judicious use of natural resources, and most importantly it caters to the changing demand patterns towards high value crops. Although India has grown vividly in the path of diversification, the progress has not very encouraging with high inter-state variability, *i.e.*, some states have achieved high level of diversification while many states are still lagging behind. Thus, there is a need for more focussed and integrated approach for promoting diversification in agriculture. Mentioned below are the advantages of diversification of agriculture towards horticulture over traditional cropping:

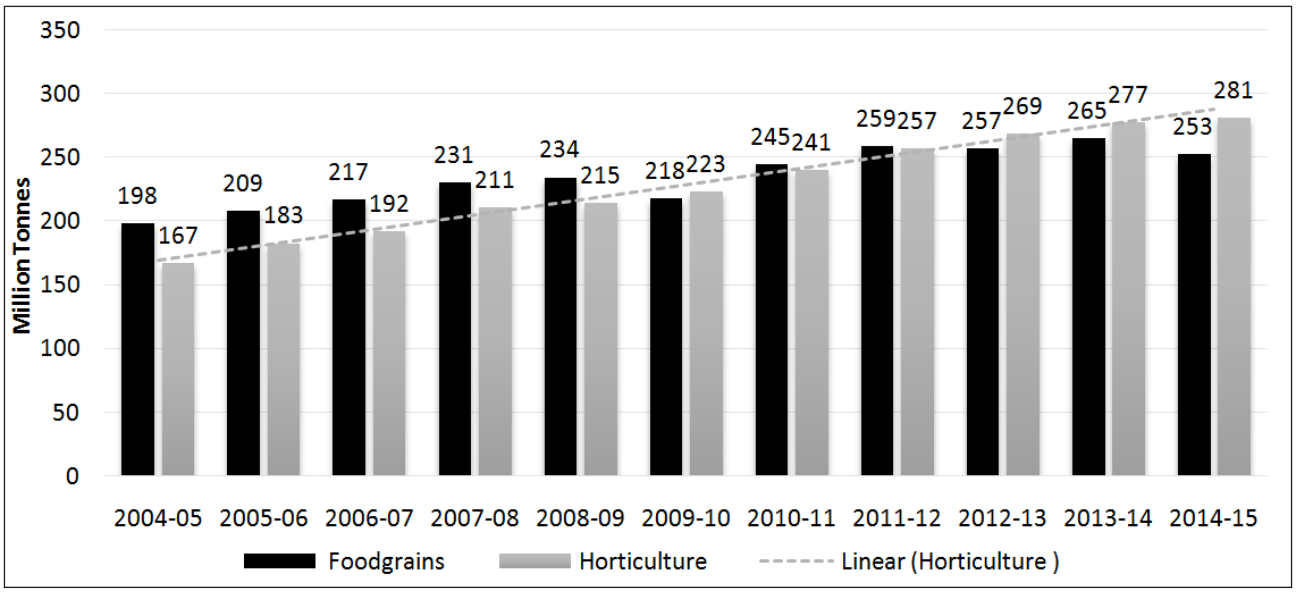

Figure 14.2: Production of horticulture and food grains

Source: Advance estimates of food grains, oilseed and other commercial crops, Department of Agriculture, Cooperation & Farmers Welfare

1. **Withstanding the adverse climatic changes:** The antagonistic effect of anomalous weather condition like scanty rainfall and drought is clearly visible in agriculture sector in the form of low productivity and low supply. Approximately 60% of area in India is still rain-fed. The increasing temperature, scarcity in rainfall and frequent droughts and 60% area still lacking the facility of irrigation, dependence on one or two major cereal, *i.e.*, rice and wheat is extremely risky. The production of food grains is tend to fall creating major demand supply gap, farmers' loss and hence price instability. To mitigate the effect of these ill weather conditions there is a need to diversify production through mixed/inter cropping. Diversification towards horticulture has been emerging as key sector withstanding these climatic changes. The low gestation period of

these crops have been main factor in mitigating the effect of vagarious weather conditions. **The figure 2 shows the production and growth of both food grains and horticulture crops. During last three years India experienced scanty rainfall. The trend shows the growth of horticulture crops have been more consistent and the growth has much higher than that in food grains. This clearly reflects the increasing resilience shown by the horticulture sectors and provides a strong case for diversification towards such crops.** Diversification of crops, towards new variety which has the potential to increase yield and deal with multiple stress, *i.e*, drought, flood, or salinity will help in stabilizing the food production and the growth of the sector.

2. **Shift in consumption pattern away from staple crops to high value commodities (both rural and urban sector) :** Several research claims that increasing consumption of high value commodity is the result of increasing income. As the income level increases there is a shift in consumption pattern, from staple crops such as wheat, rice to rich in protein commodities such as fruit and vegetable. Many studies have shown the trend of increase in demand for high value crops in recent year as a result of increasing income. Plus factor such as urbanisation, and change in taste and preferences found to be driving force behind changing dietary pattern. Joshi et al. (2007) have found that urbanisation is the most important factor be-hind the growth of high value crops.

   This change in demand preference towards high value commodities has created an opportunity for the farmers to diversify their production base and potentially increase their farm incomes (Birthal et al., 2007). Additionally, introduction of new technology contributed to crop diversification in India as this enabled shifts in cropping choices from cereal production to high value cash crop production (De and Chattopadhyay, 2010).
   The demand and supply gap of these high value crop can be seen in the food inflation index. There is the need to shift towards the increased production of these horticulture crops to curtail inflation rates in future. Plus diversification of production will also lead to diversification of consumption basket, hence low pressure on one commodity. Leading diversification of risk for farmers and diversification of consumption for consumers hence low price instability.
3. **Mitigating the environmental effect:** Agriculture accounts for 14% of global emission. Combined with the emissions due to fertilizer manufacturing, agricultural energy use and deforestation for farming, this sector becomes the largest contributor to global emissions. According to a study, agriculture sector, accounts for 17.6% of total emission, in India. The three main GHG are methane, carbon dioxide and nitrous oxide. Methane is 25 times and nitrous oxide is approximately 298 times more effective in heat trapping than carbon dioxide. One of the sources of methane emission from agriculture is rice cultivation. Methane emission is enhanced by increased water logging and increased irrigation. This requires huge water management practices. Rice cultivation requires huge amount of water in cultivation. High level of temperature will increase the demand of water for irrigation, which will lead to depletion of ground water level. The major source of nitrous oxide are soil cultivation, fertilizer, and manure. This represents loss of nitrogen from soil hence low nitrogen efficiency. To overcome this there is need for better fertilizer placement and reduce emission of nitrous oxide. Methane emission from ruminants can

be reduced by altering the feed composition, either to reduce the percentage which is converted into methane or to improve the milk and meat yield (Pathak 2010).

Moreover the cultivation of these crops is leading to soil erosion and water stress on the other hand horticulture crop due to its short duration, and crop rotation method increases the soil fertility and water consumption of these commodities is less than in cultivation of rice.

From the foregoing analysis, it is evident that horticulture provides an important alternative source to sustainable agriculture growth. Moreover, it is important to note that while the food grains production increased at Compound Annual Growth Rate (CAGR) of 2.24 percent during 2004-05 to 2015-16, the horticulture sector registered a significant growth of 4.9 per cent during the same period. This is indicative of the significant potential in the horticulture sector and calls for concerted actions at the centre and state level to harness the potential of the sector and to emerge as the world leader in the horticulture output.

4. POLICY INITIATIVES TAKEN BY THE GOVERNMENT

1. **National mission for sustainable agriculture (NMSA) :** NMSA derives its man-date from Sustainable Agriculture Mission which is one of the eight Missions out-lined under National Action Plan on Climate Change (NAPCC). Initiative by the government, in the era of adverse climatic changes, to define strategies for climate adaptation and mitigation within agriculture sector. The core focus of NMSA includes rain-fed areas.

   Organic farming is environment friendly based on non-chemical application such as rotating crops and using biological based pesticide like neem, green manures and decomposed organic matter. In other words any technique that increments productivity and yield without harming environment. . Organic farming unlike industrial farming practices environment friendly techniques, this not only reduce environment degradation caused by heavy use of chemical pesticides and fertilizers and produce more nutritious food but also this sustainable form of agriculture is beneficial for farmers. Sikkim has recently been declared as the first organic state in the country. In spite of the additional benefits of organic farming, the total area under organic farming is much less as compared to the net sown area of 140 million hectare. To promote organic farming NMSA launched programme called **"Paramparagat Krishi Vikas Yojna",** this scheme is basically supporting organic farming via cluster approach. This will encourage farmers to reduce their dependence on chemical based fertilizers and increase use of more environment friendly ways of cultivation to improve yield. Also to increase efficient irrigation practices, in 2015 Government launched **"Pradhan Mantri Krishi Sinchayee Yojana (PMKSY)".** This scheme has been bought up for efficient allocation of water resource in agriculture.

2. **National initiative on climate resilient agriculture (NICRA) :** The scheme was launched in February 2011. The four modules of NICRA aimed at making farmers self-reliant are: improving soil health, livestock, natural resource management and crop production. The major objective of the project is to improvise technology to enhance farm productivity vis-à-vis management of natural resource.

3. **Mission for integrated development of horticulture- MIDH :** Was launched during 12th plan, for holistic development of horticulture sector in the country. The integrates the ongoing scheme of National horticulture mission (NHM), National bamboo mission, Horticulture Mission, Horticulture Mission for North East and Himalayan states, National horticulture board, and Coconut Development board and Central Institute for Horticulture, Nagaland.
4. **Crop insurance(Fasal bima yojna) :** January 2016, the NDA Government has launched a new Crop scheme **Pradhan Mantri Fasal Bima Yojana** which tries to improve upon the models used so far; Minimum risk, maximum insurance for farmer welfare. New crop insurance scheme has the potential to deal with the vagaries of nature on Indian farming; lowest premium, full coverage of insurance, post-harvest coverage, and covers localised risk such as hailstorm, flooding etc. all these features make the new scheme far better than all the previous scheme under same head.
5. **Krishi vikas yojna :** Rashtriya Krishi Vikas Yojana is a special Additional Central Assistance Scheme which was launched in August 2007 to orient agricultural development strategies. The scheme was launched to incentivize the States to provide additional resources in their State Plans over and above their baseline expenditure to bridge critical gaps. RKVY covers all sectors including horticulture, fisheries, forestry and wildlife, plantation and agriculture marketing, agriculture research and education, etc. some sub-scheme under programme are Bringing Green Revolution to Eastern India (BGREI), Integrated Development of 60,000 Pulses Villages in Rain-fed Areas Promotion of Oil Palm Initiative on Vegetable Clusters, National Mission for Protein Supplements. reason of focus of these schemes has been Seeds, fertilizers, IPM Testing laboratories, Horticulture, Farm Mechanization, Extension, Crops, Marketing and Cooperatives,, animal husbandry etc.
6. **Price stabilisation fund :** Price Stabilisation Fund (PSF) refers to any fund constituted for the purpose of containing extreme volatility in prices of selected commodities. The amount in the fund is generally utilised for activities aimed at bringing down/up the high/low prices say for instance, procurement of such products and distribution of the same as and when required, so that prices remain in a range. India first created a price stabilisation fund for some export oriented plantation crops in 2003, and this ceased to exist in 2013. Prices of horticulture crops are highly volatile. The direct of which is faced by consumer by paying high price.

   To mitigate hardship of consumer the new scheme "price stabilisation fund" is introduced in May 2015. The intervention is expected to regulate price volatility through procurement by State/UT Government and Central agencies of selected produce, maintenance of buffer stocks and regulated release into the market. The interventions are limited to onions and potatoes only. However, other commodities may be added later.

7. **Soil health card :** In 2015, the Narendra Modi government launched Soil Health Card scheme. Under this programme, government will issue soil card to farmers to help them get a good harvest by studying the quality of soil. According to the scheme, the objective is to issue the soil cards to about 14 crore farmers spread all over India. The card is a printed report. It will be given to farmers once in three years for his farm or land holding. This scheme was introduced first in Gujarat during 2003-04 by PM Narendra Modi during his tenure as chief minister of the state. In Gujarat, over 100 soil laboratories were set up and the result of scheme was found quite satisfactory. A soil health card carries details about the health of the soil, the diseases, if any, in it

and the nutrient it needs. Availability of the information through such cards helps in increasing crop productivity as well as keep land in cultivation for long time. Till now, only about one crore social health cards have been issued. Thus, the agriculture ministry's target to provide soil health cards to all 14 crore farmers by end of 2017-18 looks unlikely to be met in the absence of adequate financial allocations.

5. CONSTRAINTS IN DIVERSIFICATION TOWARDS HORTICULTURE

Even though diversification has been most sustainable form of cultivation in agriculture, it has its own constraints in the path. India has grown vividly in the path of diversification but the pace of the growth has been very slow as shown in the above analysis, *i.e*, some states have achieved high level of diversification while many states are still lagging behind; The major problems and limitations in crop diversification are mainly due to the following reasons with varied degrees of influence:

1. Poor infrastructure such as transport, rural roads, communications, power etc.
2. Inadequate infrastructure and technology for handing of perishable horticultural product,
3. Feeble agro-based industry.
4. Weak research and market linkages.
5. Lack of trained man power coupled with persistent illiteracy amongst farmers.
6. Lack of database for horticultural crops.
7. Decreased investments in the agricultural sector over the years.
8. High insurance premium cost for horticulture crops.
9. High cost of switching from traditional crops to horticulture crop.
10. No minimum support price for horticulture crops.

6. CONCLUSION AND RECOMMENDATION

In view of the multidimensional problems caused by the frequent climatic variations discussed in the foregoing sections, diversification of agriculture towards horticulture can play a significant role in bringing sustainable development in the agriculture sector. Dependence on traditional method of cultivation will be perilous venture, both from consumption and production perspective. For sustainable Agriculture growth, there is a need to switch from traditional practices to new methods of cultivation. Diversification of agriculture can be used as an effective tool to bring sustainable development of the sector. Development of new cultivars of horticulture crops that are resistant to pest and diseases, short duration and produce good yield under stress condition and tolerant to high temperature as well as adoption of environment friendly technology (organic farming) and judious use of land and water resources are the most effective way to sustain the productivity and minimize the effect of climate changes. The overall rate of diversification is slow in the country. At state level the result is varying many states are diversifying fast with the changing level of competition and demand while other states are stagnated and many other northern states like Uttar Pradesh, Punjab and Haryana which have the potential of diversification and increased productivity

in the area are still specialising in the old conventional crops (rice and wheat). The major constraints in diversification that are still prevailing are: poor agriculture marketing structure, meagre post-harvest facilities, inefficient supply chain and lack of funds. Proper strategies have to be envisaged to meet the challenges of vagaries of climatic changes and its detrimental effect on environment, agriculture productivity and future food security of the country.

7. RECOMMENDATIONS

1. **Extension of MIDH scheme :** Horticulture production in the country witnessed a phenomenal increase during the 11th and 12th Plan period. This may be attributed to the focussed intervention by the government through the implementation of NHM/ MIDH. In view of this, it is advisable that the scheme should be continued in the future fiscal framework of the country, with more emphasis on promotion of organic farming.
2. **FDI in organised retailing :** Post harvest losses of fruits and vegetables is the matter of major concern in India. Horticulture crops are perishable in nature and with poor storage, packaging, transportation and handling technologies there is less incentive for farmers to produce these high value crops. Studies by ICAR have shown that post-harvest losses in different fruits crops ranges from 7 percent to about 16 percent of the value of output. For vegetables this ranges from about 5 per cent to over 12 percent. In view of the high level of food losses, there is an urgent need to step up investment in post-harvest management. In this regard, liberalizing FDI in organised retail will encourage investment in the sector particularly in warehousing, cold storage and setting up better market infrastructure hence filling up the gaps in supply chain inefficiencies and as a result farmers will get better returns for the produce.
3. **Increased role of state in promoting agriculture :** Agriculture being a state subject, it is primarily the responsibility of state to undertake timely measures for holistic development of the sector. Government of India supplements the efforts of state governments through implementation of various central sector and centrally sponsored schemes. In order to pro-mote the spirit of fiscal federalism, the fourteenth finance commission (FFC) has enhanced the share of States in divisible net proceeds of taxes from 32 per cent to 42 per cent which is the biggest ever increase in vertical tax devolution. This will provide more autonomy as well as flexibility to State Governments to undertake activities/programmes best suited to their needs and requirements. In view of the increasing climatic variations, schemes/ programmes formulated by the state governments should focus on promoting environment sustainable agricultural practices, which may include, inter alia, promotion of horticulture activities and organic farming.
4. **Minimum support price for horticulture crops :** In order to ensure remunerative returns to the farmers for their horticulture produce and to check price volatility there is a need to formulate a mechanism similar to minimum support price (MSP) applicable on various agricultural commodities.
5. **National agriculture market :** The slow progress in implementation of Model APMC Act 2003 has been a major source of distortion in the market in the form of uneven levies/mandi tax, VAT, etc. This has also contributed to the high price of commodities. Taking note of these deficiencies, government in the Union Budget 2015 announced the decision to set up **National**

Agriculture Market (NAM) to overcome the loopholes in current marketing system. More states should come on board and participate in NAM to develop an integrated unified agricultural market in the country.

6. **Farmer centric approach :** To increase the agriculture output in sustainable-environment friendly way there is a need to focus on the root of the agriculture sector, i.e.,the farmers. Farmers are heart of the whole system, they manage land, safeguard environment and grow crops. There will be 1.7 billion extra people to feed by the end of 2030. This calls for the urgent need to focus on source of food security; Working together to promote especially small holder farmers. The new technologies, innovation, have increased but farmers still struggle to achieve basic level of these facilities. All these benefits should be made available to all the farmers, which will lead to more equitable and efficient production system. To enhance farming system there is a need for better market functioning which requires a stable policy framework where farmer can invest and work. Major constraint in any policy is availability of funds; for development of agriculture there is a need to enhance national financial innovation of the country.

7. **Reduction export of water intensive crops-** India is a leading producer and exporter of rice. Estimates suggest that cultivation of 1kg of rice requires approximately 1300-1500 mm of water. Since the pressures of depleting ground water table are looming large in the country, the conventional cropping patterns and practices need a complete overhauling. This en-tails switching towards production of less water intensive crops and focus on increasing the efficiency of water use through micro-irrigation using drip and sprinkler systems. Moreover, there is a need to gradually decrease the export of rice to conserve the water resource of the country.

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