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Status and position of apple crop in area, production and productivity in Himachal Pradesh

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Abstract
Apple farming is the fastest growing economic activity of the state and is being grown in 9 districts out of 12 districts. Due to varied agro-climatic conditions across the districts, there exists a large variation in the area output growth of apple fruit crop. Among all the fruits grown in the State, apple crop occupies a premier position in terms of production and productivity. Apple was found to be predominant amongst various types of fruits and commercially the most important temperature fruit. The present study and facts shows that the apple productivity is associated with changes and fluctuations. The main objective of the study was find out the trends of area, production and productivity of apple crop with applying mathematical and statistical methods to perform the study.

Keywords: production, productivity, horticulture, apple crop

Introduction
The importance and promotion of horticulture in Himachal Pradesh is a national priority, because undulating physiographic of land in the hill areas is more suitable for cultivation of horticulture crops and also playing a vital role in promoting environmental conservation. It has also proved that horticulture is significant for supplementing otherwise major income of the people of Himachal Pradesh (Attri & Rajendar, 2010) [4]. India is the fruit vegetable basket of the world. Indian being a home of wide variety of fruits and vegetables holds a unique position in production figures among the countries. India is a country with a variety of climate and land conducive to cultivation of various types of horticulture crops. The cultivation of tropical fruits and vegetables are confined to plain and coastal regions of India. whereas sub tropical horticulture crop find their place in the plains and foot hills of Indian mountains while the temperature fruits are the monopoly of hilly regions of India like Himachal Pradesh J&K and Uttaranchal (Azad, Horticulture development in Hill Areas, 1998) [5, 6], (Sikka & Swarup, 1985) [17].
Horticulture is the prime mover of economic growth in Himachal Pradesh and the state has also craved and a niche as a horticulture state and is also known as "Fruit Bowl Of Nation" (APEDA).Himachal Pradesh has emerged as the Horticulture state of India it has been recognized as the apple state of India for being adjudged as the best producer quality of apples. In the state of Himachal Pradesh, farmers are encouraged to grow the world's finest and choicest variety of apple. The state department of Horticulture helps them in the economic upliftment of rural population and has also generated employment. The total area under fruits in Himachal Pradesh is about 226799 hectares with a production of 928829 MT of all kinds of fruits. Apple is the major fruit accounting 46 percent of total Area under fruits and 88 percent of the total production (Economic Survey, 2015-16) [9].
Apple is a predominant fruit crop of Himachal Pradesh and in recent years it has emerged as the leading cash crop amongst fruit crops. Apple is the fourth major fruit crop of the country in terms of production after Mango, Citrus Fruit and banana. Apple is grown mainly in the state of Jammu and Kashmir, Himachal Pradesh, Uttarakhand and Arunachal Pradesh. Himachal Pradesh is the second largest producer of apple in India, After the Jammu and Kashmir. Himachal Pradesh is known for the production of quality apples. The state has agro-climatic and geographical conditions favourable for apple cultivation. Apple cultivation in Himachal Pradesh started in 19th century and first established in Bundrole in Kullu tehsil by Capt. R.C. Lee. The fruit occupied only 10 percent 134 hectares of the total area under fruits in 1955, which was confined to a few pockets namely Mashu, Kullu, Mandi etc. from where it diffused to other parts of the state. The major apple producing districts of Himachal Pradesh are Shimla, Kullu, Chamba, Sirmour, Lahaul and Spiti and Kinnaur. The apple fruit contributes more than 987 crore towards the gross domestic product. The production level has gradually touched to 540.30 mt with 5.6t productivity in 2006 (Anonymous, 2006) [2] and (Kaur N. 2002) [13].

Research Methodology
Secondary Data
Secondary data pertaining to the list of village households, cropped area production and productivity of apple fruit in Himachal Pradesh and India were recorded from the Directorate of Horticulture, government of Himachal Pradesh, National Horticulture Board, Economics and Statistical Survey, government of India, block development offices of respective blocks, respective revenue offices, directorate of

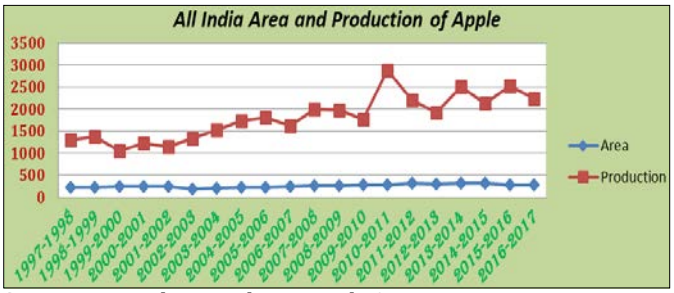
land records and other allied published and unpublished material.

Results and Discussion

Production of apple in India

Apple farming is an important activity and profession of farmer communities in the Himalayan states of India. Apple is the most favoured fruits of people and is a widely grown fruit in temperate regions of the globe. India produces all deciduous fruits including apple and pear and stone fruits in considerable quantity. These are mainly grown in the North-Western Indian States of Jammu and Kashmir, Himachal Pradesh, Uttarakhand and Hill areas of Uttar Pradesh, and the North-Eastern Hills region comprising of the States of Arunachal Pradesh, Nagaland and Sikkim also grown some of deciduous fruits on a limited scale. Due to introduction and adaption of low chilling cultivators of crops like peach, palm and pear, they are also grown commercially in these areas of the northern Indian plains. Out of these all deciduous fruits, apple is the most important fruit in terms of production and extent (Ghosh S. P., 2012) [11].

Apple was introduced into the country by the British in the Kullu Valley of the Himalayan State of Himachal Pradesh as far back as 1865, while the colored deciduous cultivators of apple were introduced in the Shimla hills of the same State in 1917. Apple production dominates the scene and systematic cultivation and marketing of apple can change the rural economy in the hills of North-Western of India (Kaur &. K., 2007) [12]. Apple has gained much popularity over the past few years and different cultivators of apples imported from different countries of the world and have now been spread all over the apple growing States in India. In detail the data are given below in figure1.



***Source*:** National Horticulture Board 2017

Fig 1: All India Area and Production of Apple during (1991-1992 to 2016-2017 in '000')

Table 1: Regression Analysis (Dependent variable = Production, Observations= 21)

Variable	Coefficient	Std. Error	t-Statistic	Sig.
Constant	-641.592	544.007	-1.179	0.253
Area	9.407	2.080	4.522	0.000
R- Squared	0.518	Mean Dependent Variable		1793.0952
Adjusted R^2	0.493	S.D of Dependent Variable		501.2944
S.E of Regression	356.936	Durbin-Watson statistic		1.793
Sum Squared Resid	2420654.577			
F-Statistic	20.449			
Sig (F-Statistic)	0.000			

***Source*:** Researcher own Compilation

The Table 1 shows that the production of apples was fluctuating during the last two decades. The production of apple increased from 1308 thousand metric tonnes in 1996-17 to 2242 thousand metric tonnes in 2016-17. The percentage increase in the area of apples from 223 thousand hectares in 1996-97 to 277 thousand hectares in 2016-17 and the productivity is marginally increased from 5.86 MT/HA to 8.09 MT/HA in the same study period. During the 1996-97 to 2016-17, the area under apple production increased by 80.51 percent but the production of apple increased by 58.40 percent. An attempt was made to estimate the annual exponential growth of apple production in India during 1996-97 to 2016-17 as follows:

In $Y = 2.6 + 0.0104t$

$R^2 = 0.518$, $R^2 = 0.493$ and $n = 21$

Where, Y is the total production of apple in India

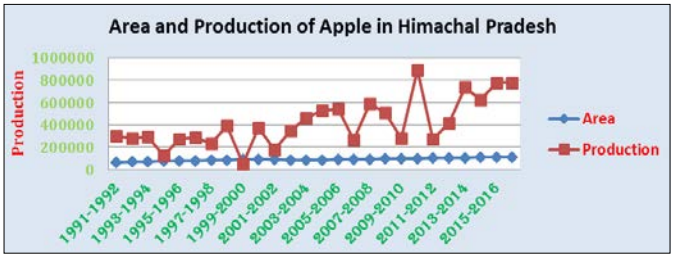
Table 1 reveals that there was steady increase in the production of apples in India during the period of 1996-97 to 2016-17. An attempt made to estimate the Karl Pearson Correlation of Coefficient between the area and production of apple in India which was found 0.518 at the 0.01 significant level. Thus it proves that there existed a high positive relationship between the area and production of apples in India. During the study period, it was found that the annual average exponential growth rate of apple production crop was 2.6 percent on the other hand, the area under fruit crop production also increased at an annual average rate of 1.04 percent. Therefore the productivity increased only marginally from 5.86 MT/HA to 8.09 MT/HA during the 1996-97 to 2016-17. Figure 1 analyses the trend of the fluctuation of the productivity of fruits during the period. Thus the production of apple in India grew at an average rate of 2.6 percent during 1996-97 to 2016-17.

Production of apples in Himachal Pradesh

Apple is the most important temperate fruit grown in Himachal Pradesh. Himachal Pradesh, Jammu and Kashmir and some areas of Uttarakhand are the major apple producing States of India accounting to about 95 percent of total production. Himachal Pradesh is the 2nd largest apple producing State in India that produces on large scale for commercial purposes and achieving a prestigious status "Apple State of India". Apple is the most cash crop of the hill State and constitutes 85 percent of the total production and 45 percent of land under apple production. The apple fruit having an economy of around 3700 crore and is grown mainly in the

districts of Shimla, Kinnaur, Mandi, Chamba, Lahaul & Spiti and some parts of Sirmour. The average production of apple is around 6 lakh tonnes or 2.5 crore boxes every year but the maximum production was recorded in 2010-11 when it crosses 9 lakh tonnes or almost 5 crore boxes. The State produced various varieties of Apple like Royal Delicious, Rich-A-Red, Red Golden, Red Chief, and Oregon Spur and Golden Delicious, and now starts Chinese Gala and Washington Apple from United States. The State gets around 10-20 tonnes of apple from per hectare against 35-40 tonnes of apple fruit producing in advancing countries. In Himachal Pradesh, apple being the main crop of the state occupies place of pride in its economy.

In table 2 regression of analysis reveals that the State witnessed an increasing trend in the area and production of apple. The area under apple cultivation was increased from 66.76 thousand hectares in 1991-92 to 111.89 thousand hectares in 2016-17, and the production of apple are also increased from 301.73 metric thousand tonnes in 1991-92 to 777.13 metric thousand tonnes during 2016-17. The productivity of apple was also increased from 4.52 MT/HA in 1991-92 to 6.94 MT/HA during the same period.



***Source*:** Directorate of Horticulture, Government of Himachal Pradesh Indian Horticulture Database 2012, 2014, 2016, 2017

Fig 2: Area and production of Apple Fruit in Himachal Pradesh State During 1991-1992 to 2016-2017

Table 2: Regression Analysis (Dependent variable = Production, Observations= 26)

Variable	Coefficient	Std. Error	t-Statistic	Sig.
Constant	-537072.774	237979.226	-20257	0.033
Area	10.495	2.594	4.046	0.000
R- Squared	0.637	Mean Dependent Variable		416252.658
Adjusted R^2	0.381	S.D of Dependent Variable		21505.3221
S.E of Regression	169751.6163	Durbin-Watson statistic		2.330
Sum Squared Resid	6.9161			
F-Statistic	16.368			
Sig (F-Statistic)	0.000			

***Source*:** Researcher own Compilation

The area under apple cultivation is increased by 59.67 percent and the production was increased by 38.82 percent during the 1991-92 to 2016-17. An attempt is made to estimate the annual exponential growth of apple production in Himachal Pradesh during 1991-92 to 2016-17 as follows:

In $Y = 3.71 + 0.0201t$

$R^2 = 0.637$, $R^2 = 0.381$, $N = 26$

Where, Y is the total production of apple in Himachal Pradesh, t is the time measured in years with origin at 1991-92 and the period was covered 1991-92 to 2016-17 with 26 observation. Table 2 reveals that the Karl Pearson correlation coefficient (r) was estimated between the area and production of apple in Himachal Pradesh was found 0.637, which was significant at 0.01 level. Thus, it proves that there existed a high positive relation between the area and production of apple in Himachal Pradesh and the increase in production of apple in Himachal Pradesh mainly due to the increase in area under apple production. The average of annual exponential growth rate of production was found 3.71 percent during the 1991-92 to 2016-17. The land under apple cultivation was also marginally grew by 2.01percent during 1991-92 to 2016-17, and also found 1.66 percent of annual growth increased from same period.

Table 3: CAGR of Area, Production and Productivity of Apple in the State of Himachal Pradesh over the years

Period	% of Area (in 000'Ha)	% of Production (in 000' MT)	% of Yield (in MT/Ha)
1991-92 to 2001-02	3.35	-5.01	-8.11
2001-02 to 2011-12	1.11	4.35	3.17
2011-12 to 2016-17	1.28	18.9	17.4
1991-92 to 2016-17	2.01	3.71	1.66

***Source*:** Directorate of Horticulture, Government of Himachal Pradesh Indian Horticulture Database 2012, 2014, 2016, 2017

Table 3 reveals that the Compound Annual Growth Rate of Area, Production and Productivity of apple crop in Himachal Pradesh during 1991-92 to 2001-02, 2001-02 to 2011-12, 2011-12 to 2016-17 and 1991-92 to 2016-17. The average of annual growth rate of apple production was found -5.01 percent, 4.35 percent, 18.9 percent and 3.71 percent during the decade wise 1991-92 to 2001-02, 2001-02, 2011-12 to 2016-17 and 1991-92 to 2016-17 respectively. It was found that during the first decade there was negative annual growth rate of production but also found during 2011-12 there was highest average annual growth was 18.9 percent because during 2010-11 highest production was recorded 2.5 times more than average growth. The area under apple cultivation was found 3.35 percent, 1.11 percent, 1.28 percent and 2.01 percent

during the same periods. And the yield of apple crop was found as per annual average growth rate was 1.66 percent during 1991-92 to 2016-17. Thus it proves that the area and production of apple fruit crop is increased and shows positive relation during the same periods.

District wise changes in area under apple cultivation

District wise Area, Production and Productivity of Apple in Himachal Pradesh. More than 2 lakh farmer's families are engaged in apple cultivation out of which nearly 90 percent are small and marginal with an average holdings of less than 0.6 hectares according to latest National Horticulture Board of India. Apple farming is the fastest growing economic activity of the state and is being grown in 9 districts out of 12 districts. Due to varied agro-climatic conditions across the districts, there exists a large variation in the area output growth of apple fruit crop. Among all the fruits grown in the State, apple occupies a premier position in terms of production. The district wise broad picture of changes in the Area under apple cultivation has been presented in Table 4. The details are as follows:

Table 4: District wise changes in Area of Apple in the State of Himachal Pradesh during (1990-91 to 2016-2017)

District	Base Ending Triennium (1992-93) (000' Ha)	Triennium Ending (2016-17) (000' Ha)	Percentage Change over base triennium ending (1992-93)	Compound growth rate (% per annum)
Chamba	4.56	12.74	179.38	4.44
Kangra	0.59	0.42	-28.82	-1.05
Kinnaur	4.45	11.17	151.01	3.68
Kullu	15.16	26.05	74.81	2.28
Lahaul and Spiti	0.14	1.67	1092.76	9.94
Mandi	10.61	16.39	54.47	1.81
Shimla	26.62	39.46	48.23	1.72
Solan	0.53	0.05	-90.56	-8.16
Sirmour	3.67	2.69	-26.71	-1.02
Himachal Pradesh	66.24	110.68	67.09	2.16

***Source*:** Directorate of Horticulture, Government of Himachal Pradesh Economics and Statistics Dept. Himachal Pradesh 2016-17 Statistical Abstract of Himachal Pradesh 2014, 2016, 2017

Table 4 reveals the change in Area between the districts of Himachal Pradesh during 1990-91 to 2016-17 has been showing a steady growth. On the whole state Himachal Pradesh, the Area under production was increased by nearly 67.09 percent during the ending triennium 2016-17 over the base triennium year 1992-93. In terms of average annual compound growth rate, it grew 2.16 percent per annum during the study period. The highest percentage change over base triennium year was found 1092.76 percent, 179.38 percent, and 151.01percent of Lahaul & Spiti, Chamba and Kinnaur respectively. Followed by Kullu, Mandi and Shimla are 74.81 percent, 54.47 percent and 48.23 percent respectively and also found negatively Area under apple percentage over triennium years was Kangra, Sirmour and Solan districts are -28.82 percent, -26.71 percent and -90.56 percent respectively during the study.

Changes in production of apple crop

The production of apple fruit is accounting 85 percent of total fruit production in Himachal Pradesh. The result of district wise analysis of change in production of apple has been presented in table 5.

Table 5: District wise changes in Production of Apple in Himachal Pradesh, during (1990-91 to 2016-2017)

District	Base Ending Triennium (1992-93) (000' Ha)	Triennium Ending (2016-17) (000' Ha)	Percentage Change over base triennium ending (1992-93)	Compound growth rate (% per annum)
Chamba	3.15	20.61	554.28	8.49
Kangra	0.25	0.31	24	-0.97
Kinnaur	12.69	64.86	411.12	8.11
Kullu	65.96	112.54	70.62	2.65
Lahaul and Spiti	0.045	0.28	522.23	8.93
Mandi	10.25	37.22	263.12	4.36
Shimla	214.42	309.49	44.34	2.57
Solan	0.168	0.017	-89.88	-5.79
Sirmour	0.679	2.59	281.44	6.83
Himachal Pradesh	307.62	623.48	102.67	3.09

***Source*:** Directorate of Horticulture, Government of Himachal Pradesh Economics and Statistics Department Himachal Pradesh 2016-17 Statistical Abstract of Himachal Pradesh 2014, 2016, 2017

Table 5 reveals that the apple production has taken new pace and has increased by about 102.67 percent during the ending triennium 2016-17 over base triennium year 1992-93. Production has increased at the annual compound growth rate of 3.09 percent during the 1990-91 to 2016-17 in the State of Himachal Pradesh. The above table reveals that the three districts produced highest apple crop viz, Sirmour, Chamba and Kinnaur has recorded a significant increase in the production of apple crop at the annual compound growth rate of 366.67 percent, 133.4 percent and 104.57 percent during

the period of 26 years. The districts of Kullu, Solan and Lahaul and Spiti recorded negative growth in the production of apples during 1990-91 to 2016-17. The enlargement of production of apple is effectively because of area expansion and the productivity of apple crop is quiet low as compared to advanced countries.

Changes in Productivity of apple crop

Productivity in fruit farming is most often assessed by measures of crop yield. The growth rate in productivity is an important determinant of agricultural transformation and is considered as the engine of growth to the farm economy and it is important to assess the fruit productivity, growth and know our stand and what ought to be done to achieve the international standards in the productivity. The growth of apple productivity is an indicator of use of farming knowledge, technology, infrastructural development, farm investments and development of suitable price policy. The productivity growth allows farmers to break out of poverty and low income equilibrium trap and contribute to overall economic growth. To achieve the productivity, there is need for strengthen the efforts and maintaining the increasing production. The details of district wise change in productivity of apples in the State of Himachal Pradesh are given below Table 6 as follows:

Table 6: District wise changes in Productivity of Apple in the State of Himachal Pradesh during (1990-91 to 2016-2017)

District	Base Ending Triennium (1992-93) (MT/Ha)	Triennium Ending (2016-17) (MT/ Ha)	Percentage Change over base triennium ending (1992-93)	Compound growth rate (% per annum)
Chamba	0.69	1.61	133.34	3.97
Kangra	0.42	0.72	71.42	0.25
Kinnaur	2.84	5.81	104.57	4.36
Kullu	4.36	4.32	-0.92	0.41
Lahaul and Spiti	0.30	0.17	-43.33	-0.76
Mandi	0.98	2.26	130.62	2.51
Shimla	8.10	9.77	20.62	0.86
Solan	0.31	0.29	-6.45	2.24
Sirmour	0.18	0.84	366.67	8.16
Himachal Pradesh	18.22	25.83	41.76	1.68

***Source*:** Directorate of Horticulture, Government of Himachal Pradesh Economics and Statistics Dept. Himachal Pradesh 2016-17 Statistical Abstract of Himachal Pradesh 2014, 2016, 2017

In the above Table 6 reveals that the productivity of apple crop has been increased by 41.76 percent on the whole State of Himachal Pradesh during the period of ending triennium 2016-17 over the base triennium of 1992-93. The compound growth rate of State is 1.68 percent per annum during the study period. In Shimla, Kinnaur and Kullu are the three districts, observed the growth rate was high in positive trend 9.77 percent, 5.81 percent and 4.32 percent respectively during the ending triennium year 2016-17, followed by Mandi and Chamba was found 2.26 percent and 1.61 percent respectively. There is declining trend shown in Kangra, Sirmour, Solan and Lahaul and Spiti was 0.72, 0.82, 0.29 and 0.17 percent during the ending triennium years. Sirmour, Chamba, Mandi and Kinnaur shown positive trend in apple productivity during the ending triennium years 2016-17 over base triennium years 1992-93 was 366.67 percent, 133.34 percent, 130.62 percent and 104.57 percent respectively during the same triennium years.

Relationship between Area, production and productivity of apple

They are the Area, production and productivity trends and contribution of apple fruit in Himachal Pradesh and would be to investigate statistically whether the area and production of apple shows any significant correlation with productivity. Karl Person's Coefficient of Correlation was computed for Area, Production with Productivity figures and finding are presented in the table 7. The interpretations follow the table as given below:

Table 7: Karl Pearson's Correlations

		Area	Production	Productivity
Area	Pearson Correlation	1	.637**	.427*
	Sig. (2-tailed)		.000	.029
	N	26	26	26
Production	Pearson Correlation	.637**	1	.925**
	Sig. (2-tailed)	.000		.000
	N	26	26	26
Productivity	Pearson Correlation	.427*	.925**	1
	Sig. (2-tailed)	.029	.000	
	N	26	26	26

**. Correlation is significant at the 0.01 level (2-tailed)

*. Correlation is significant at the 0.05 level (2-tailed)

Table 7 an attempt is made to estimate the Karl Pearson's Correlation of Coefficient between the area, production and productivity of apple crop in Himachal Pradesh as follows.

1. Correlation coefficient between Area under Apple crop and Productivity is 0.427 is significant at (p-value <.01), which indicates that as the Area increases Productivity also increases proportionately and vice versa.
2. Correlation coefficient between Quantity Produced of Apple crop and Productivity is 0.925 is highly significant at (p-value <.05), which indicates that as the Quantity Produced increases; Productivity also increases and vice versa.
3. Correlation coefficient between Quantity Produced and Area is 0.637 which is highly significant (p-value <.05),

which indicates that the Area under apple is directly proportional to the Production of apple in Himachal Pradesh.

Apple was found to be predominant amongst various types of fruits. Apple is commercially the most important temperature fruit. The study and facts shows that the apple productivity is associated with changes and fluctuations. The productivity of apple crop depend on climate, serving days of chilling, pollination, irrigation facilities, orchid management and pesticides (Sikka & Swarup, 1985) [17], (Martin, 1985) [14], (Singh, Kalia, & lal, 2007) [18], (Panwar, 2011) [15], (Ajay, 2011) [1]. Production of several fruits was comparative advantage than vegetables in Himachal Pradesh. The income from Apple orchids was more compared to other field crops and the productivity of apples in Himachal Pradesh can be doubled if orchid management is improved (Sharda & Raman, 1996) [16]. The importance of Horticulture crops to the economic development of hills can't be over emphasised. The Horticultural production mainly the apple fruit cultivation is considered to best way to utilize the natural resources of the hills which gives significantly more remuneration than the field crops and generate more income and employment and thus turns has resulted in the farming shifting their area from field crops to horticulture (Chadda, 1987) [7], (Azad, 1998) [5, 6], (Ghosh S. 2000) [10], (Swarup & Sikka, 1987) [19], (Dalip & Gosain, 2007) [8].

References

1. Ajay B. Identification of Weed Flora in Apple Orchids of Himachal Pradesh. Journal of Himachal Pradesh University, 2011, 1-4.
2. Anonymous. Economy servey of Himachal Pradesh, Department of Economic & Statistics. Himachal Pradesh, 2006.
3. APEDA. (n.d.). Agriculture and processed food products export development authority. Ministry of Commerce and industry, Government of India, 2006.
4. Attri, Rajendar. "Horticulture" Himachal Pradesh: A Himalayan Dream Land. Shimla: Sarla publication, 2010.
5. Azad K. Horticultuaral Development in Hill Areas. New Delhi: Mittal Publications, 1998.
6. Azad K. Horticulture development in Hill Areas. New Delhi: Mittal Publications, 1998.
7. Chadda L. Horticultural Development in Hill Areas. New Delhi: Mitall Publications, 1987.
8. Dalip K, Gosain S. Diversification in Agriculture through Horticultural Crops. Asian Journal of Horticulture. 2007; 2(2):288-291.
9. Economic Survey. Economic and Statistic Department, Goveronment of Himachal Pradesh, 2015-16.
10. Ghosh S. Deciduos Fruit Production in India. New Delhi, India: Indian Council of Agricultural Research (ICAR), 2000.
11. Ghosh SP. Deciduous fruit production in india. Deputy Director General (Horticulture),Indian Council of Agricultural Research, New Delhi, India, 2012.
12. Kaur K. Problems and Prospects of Fruit Cultivation in Himachal Pradesh. Punjab Geographer. 2007; 3(1):95-105.
13. Kaur N. Spatial diffusion of Orchids in Himachal Pradesh. Phd thesis, Department of Geography, Punjab University, Chandigarh, 2002.
14. Martin L. Implications of Alternative Fruit Growing in France. Journal of Farm Economics. 1985; 47(5):1203-1207.
15. Panwar T. Apple Production in Himachal Pradesh: An Impending Crises. Economic and Poltical Weekly. 2011; 46(25):11-13.
16. Sharda N, Raman T. Diversification of Agriculture in Himachal Pradesh. Indian Journal of Agricultural Economics. 1996; 51(4):705-711.
17. Sikka B, Swarup R. Growth rates and cropping pattern changes in agriculture in Himachal pradesh. Agriculture station in india. 1985; 39(2):843-846.
18. Singh RR, Kalia V, lal H. Impact of Climate changeon Shift of Apple belt in Himachal Pradesh. ISPRS Archives XXXVIII-8/W3 Working Proceedings: Impact of Climate Change on Agriculture, 2007, 131-137.
19. Swarup R, Sikka B. Production and Marketing of Apples: An Economic Study of Himachal Pradesh. New Delhi, India: Mittal Publications, 1987.