

## Traditional vs Modern Varieties of Apple in Kashmir valley: A Comparative Economic Analysis

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### Abstract

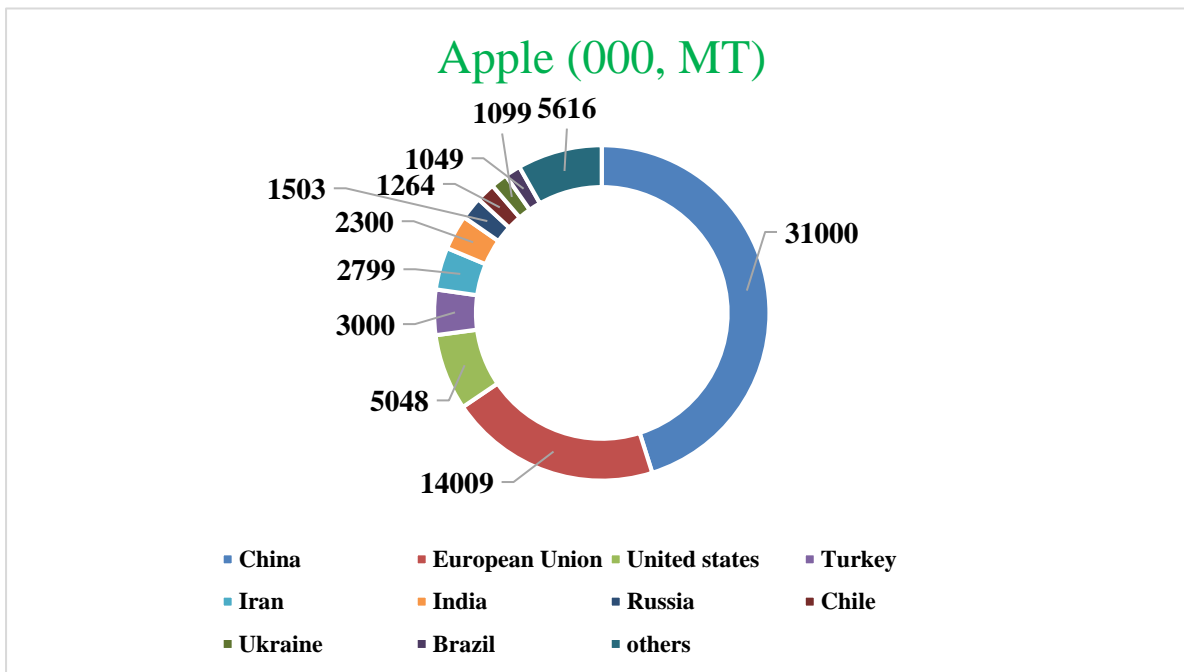
Traditional apple plantation system is having a hectic and cumbersome management process with a long gestation period of (8-9 yrs.) yielded too low with Grade (A) 1.1mt/ha, Grade (B) 1.1mt/ha, Grade (B-) 2.9 mt/ha and Grade (C) 2.2mt/ha per unit of land with a gross and net return of Rs.125000/ha and Rs.56803/ha respectively. The tree density in case of traditional orchards were 250-300 trees per hectare. In contrast to this, the ultra-high density apple plantation was introduced with the trend of optimum utilization of available space-both horizontal and vertical to achieve maximum level of production per unit of area by way of accommodating maximum number of plants (2000 to 3000 trees per hectare). In case of ultra-high density plantation the gestation period is very less (2-3 yrs.).The early bearing of ultra-high density covers its huge establishment costs within a few years of its plantation. The results of the study reveals that ultra-high density plantation is highly productive in terms of yield, quality and employment generation in the region than traditional orchards. One more positive and plus point of ultra-high density orcharding is that it provide a scope for intercropping which will result in enhancement of food security of the region.

**Key words:** Economic analysis, early bearing, inter cropping, productivity, employment, profitability.

### Introduction

About 69 million tonnes of apples were grown worldwide in 2019-20, with China producing almost half of this total (45%). The European Union, with more than 20 per cent of world production is the second-leading producer. Other important global players are United States (7.34%), Turkey (4.36%), Iran (4.07%) and India (3.34%). The export of apples in China in the year 2019-20 was 1 million tones but it was little affected due to price inflation. The import volume in China for the year 2019-20 was 100,000 metric tons. In the United States, more than 60 per cent of all the apples sold commercially are grown in Washington. Imported apples from New Zealand and other more temperate areas are competing with U.S. production and increasing each year. Most of Australia's apple production is for domestic

consumption. Imports from New Zealand have been disallowed under quarantine regulations for fire blight since 1921 (FAO, 2019-20) (Fig. 1.1).



Apple the most important commercially temperate fruit in Kashmir and stands fourth after banana, orange and grape among the most widely produced fruits in the world (Hanan E., 2015). Apple is grown in all temperate regions of the world (Ahmad, M.F. and Rasool, F.N., 2013). Apple is grown only at higher elevation where temperature is moderate in summer and not too extreme cold in winters, therefore, Indian Himalayan region are best suitable for cultivation of such fruits. In Jammu and Kashmir 113 varieties of Apples, 62 varieties of Pears, 31 of Plum, and 14 of Cherry in early, medium, and late groups, besides scores of wild crabs/Pip etc were identified and the number has increased manifold with the introduction of new and modern high and ultra-high density varieties in the recent past (Bhat, T.A. and Choure, T., 2014). Apple is cultivated in almost all the ten districts of Kashmir region, among these; district Baramullah, Shopian, Kulgam and Pulwama leading from the front (Malik, Z.A., 2013). Jammu and Kashmir, Himachal Pradesh, Uttarakhand and Arunachal Pradesh are the major apple producing states of India. The two important states namely Jammu & Kashmir and Himachal Pradesh accounts for 96.57 per cent of the total production and about 89.16 per cent of the total area under apple in India (DSE, 2019). As far as productivity of apple is concerned Jammu & Kashmir has the highest productivity (12.25 tonnes/hectare) followed by Himachal Pradesh (4.45 tonnes/hectare) and Uttarakhand (2.70 tonnes/hectare)

(NHB, 2019).

Apple is the principle fruit crop of Jammu and Kashmir and accounts for 1.46 lakh hectares area in the state. The annual apple production in the state was 20.01 lakh MT (2019-20). Average yield of commercially important apple cultivars per unit area was highest in the country ranging between 11-13 tonnes/ha, but it compares poorly to the yields of 20-40 tonnes/ha in horticultural advanced countries of the world (Table 1)

**Table 1: State-wise area, production and yield of apple**

(2019-20)

State	Area (000, ha)	Production (000,Mt)	Yield
Jammu & Kashmir	136.54 (49.24)	1672.72 (74.62)	12.25
Himachal Pradesh	110.68 (39.92)	492.10 (21.95)	4.45
Uttarakhand	25 (9.02)	67.48 (3.01)	2.70
Arunachal Pradesh	4.73 (1.71)	7.35 (0.33)	1.55
Others	0.32 (0.12)	2.05 (0.09)	6.41
Total	311.5 (100.00)	1914 (100.00)	8.08

*Figures within parentheses indicate percentages Source: National Horticulture Board (NHB)*

Table 1 summarizes the exponential growth rate of area, production and yield of apple in Jammu and Kashmir from 1981-82 to 2001-02. During these years the data has been divided into three sub-periods i.e. 1981-82 to 1990-91, 1991-92 to 2000-01 and 2001-02 to 2010-11, besides overall period from 2001-02 to 2019-20. This decomposition of periods were considered appropriate to estimate the structural changes that have taken place in respect of area, production and productivity.

The area, production and yield witnessed growth momentum of 2.8 per cent, 4 per cent and 1.2 per cent respectively during the period of 19881-82 to 2011-02. During the bygone decade apple industry of state showed an overriding performance by achieving higher trajectory in area expansion besides production and productivity. Since the majority of area under apple is in transition phase, the period from 2001-02 to 2019-20 has shown a negative growth in the state (Naqash, F. 2015).

### **Present scenario**

Ultra-high density apple plantation is in initial stage of its adoption in the region. Almost all the orchards are of traditional root stock having very low planting density. The high density plantations are being raised only as gap fillers or a few new orchards (Michael Parker et.al., 2016). This is also very natural to expect as nobody will cut the existing orchard for growing high density apple plants. The availability of information concerning the benefits of high

density plantations and availability of desired root stock is crucial for popularizing these plantations (Terence L. Robinson, 2012).

### **The need**

Due to increasing productivity and increase in income levels, the ultra-high density plantations are entirely different from the traditional orchards in almost all aspects be it plantation density, productivity, management practices cost structure etc.

### **The present study**

Keeping the profitability of ultra-high density in view, it becomes therefore, important to study the economics of such orchards in order to substantiate the fact of their economic superiority. The present study is therefore undertaken to analyse the economic benefits of ultra-high density apple plantations with the traditional apple cultivars in the region.

### **Research Methodology**

The present study utilises the scientific procedure for cost-benefit analysis of the apple in Kashmir valley. The study takes into account the life-span of both traditional and ultra-high density apple varieties and utilises the economic analysis model developed. The aggregate economic impact was assessed considering the rate and time of adoption.

$$\Delta CS = P_0 Q_0 Z (1 + 0.5Z\eta)$$

$$\Delta PS = P_0 Q_0 (K - Z) (1 + 0.5Z\eta)$$

$$\Delta TS = \Delta CS + \Delta PS = P_0 Q_0 K (1 + 0.5Z\eta)$$

Where,

$K$  is the vertical shift of supply function expressed as a proportion of the initial price,

$h$  is the absolute value of the elasticity of demand

$Z = Ke / (e + h)$  is the reduction in price, relative to its initial (i.e. pre-research) value, due to the supply shift.

$e$  is the elasticity of supply.

$\Delta CS$  is change in consumer surplus.

$\Delta PS$  is change in producer surplus.

$\Delta TS$  is change in total surplus.

### **Results and discussions**

#### **Traditional apple**

Apple cultivation in the state is highly capital-intensive with pest control alone accounting for

more than 54 per cent of variable costs. Pesticides applied on apple together constituted about 83 per cent of all the agro-chemicals utilized in the state. The steady increase in apple productivity during the past three decades was, by and large, achieved by increasing the use of fertilizers and pesticides. In the apple-growing belt of the state, chemicals are being used indiscriminately without following the scientific recommendations. The choice of chemicals/brand preferences are steered by traders and market functionaries (Baba et al., 2012).

Traditionally the apple varieties for the orchards consist of Delicious, Kullu Delicious, American Trel, Ambri, Moharaji and Golden Delicious. The life of traditional varieties ranges between 35-40 years with 7-8 years of its gestation period. The cost involvement and the revenue thereof with regard to the traditional apple varieties is presented in table 3. From the table it is evident that fixed costs like cost of planting material, trellises and other establishment and other miscellaneous cost per acre for traditional apple were Rs.7,700, Rs.2,200, Rs.2,00,000 and Rs.2,200 respectively. Similarly, there are involvement of certain annual recurring costs up to point of yields like cost of fertilizer (Rs.20,101), cost of plant protection/spraying (Rs.60,171) and labour costs (Rs.1,65,818) and annual recurring costs once getting commercial yields like cost of fertilizer (Rs.36,000) cost of plant protection/spraying (Rs.1,08,000), costs labour-pruning, thinning, weeding, harvesting (Rs.10,47,273) and Recurring expenditures (Rs.14,47,264). With a total cost of Rs.14,47,264. From the benefit or productivity side traditional apple cultivars provide four grades of apple with revenues/ACRE-Grade (A) (Rs.1,76,947), revenues/ACRE-Grade (B) (Rs.98,304), revenues/ACRE-Grade (B-) (Rs.1,25,829) and revenues/ACRE-Grade (C) (Rs.47,186) with a total revenue of Rs.9,98,999.

Table 2: Economic structure of traditional apple in Kashmir valley

Cost elements	Year --->	0	1	2	3	4	5	6	6 to 20	21	22	23	24	25	Total
<b>Fixed and recurring expenses</b>															
<b>Fixed costs up front</b>															
Planting materials		₹4,400	₹132	₹132	₹132	₹132	₹132	₹132	₹132	₹132	₹132	₹132	₹132	₹132	₹7,700
Trellises and other establishment		₹2,00,000													
MIS		₹-	₹100	₹100	₹100	₹100	₹100	₹100	₹100	₹100	₹100	₹100	₹100	₹100	₹2,200
<b>Annual recurring costs up to point of yields:</b>															
Costs fertilizer			₹3,850	₹2,250	₹2,250	₹2,250	₹2,250	₹350	₹350	₹350	₹350	₹350	₹350	₹350	₹20,101
Costs plant protection/spraying			₹9,000	₹6,000	₹7,500	₹7,500	₹9,000	₹1,059	₹1,059	₹1,059	₹1,059	₹1,059	₹1,059	₹1,059	₹60,171
Costs labour			₹21,818	₹21,818	₹21,818	₹21,818	₹21,818	₹2,836	₹2,836	₹2,836	₹2,836	₹2,836	₹2,836	₹2,836	₹1,65,818
Intercropping costs			-	-	-	-	-	-	-	-	-	-	-	-	-
<b>Total expenditures</b>		<b>₹2,04,400</b>	<b>₹34,900</b>	<b>₹30,300</b>	<b>₹31,800</b>	<b>₹31,800</b>	<b>₹33,550</b>	<b>₹4,477</b>	<b>₹4,477</b>	<b>₹4,477</b>	<b>₹4,477</b>	<b>₹4,477</b>	<b>₹4,477</b>	<b>₹4,477</b>	<b>₹2,55,991</b>
<b>Annual recurring costs once getting commercial yields:</b>															
Costs fertilizer								₹1,800	₹1,800	₹1,800	₹1,800	₹1,800	₹1,800	₹1,800	₹36,000
Costs plant protection/spraying								₹5,400	₹5,400	₹5,400	₹5,400	₹5,400	₹5,400	₹5,400	₹1,08,000
Costs labour-pruning, thinning, weeding, harvesting								₹52,364	₹52,364	₹52,364	₹52,364	₹52,364	₹52,364	₹52,364	₹10,47,273
Electricity costs			-	-	-	-	-	-	-	-	-	-	-	-	-
Selling Expenses			-	-	-	-	-	-	-	-	-	-	-	-	-
<b>Total expenditures</b>			-	-	-	-	-	<b>₹59,564</b>	<b>₹59,564</b>	<b>₹59,564</b>	<b>₹59,564</b>	<b>₹59,564</b>	<b>₹59,564</b>	<b>₹59,564</b>	<b>₹11,91,273</b>
<b>Recurring expenditures</b>		<b>₹2,04,400</b>	<b>₹34,900</b>	<b>₹30,300</b>	<b>₹31,800</b>	<b>₹31,800</b>	<b>₹33,550</b>	<b>₹64,041</b>	<b>₹64,041</b>	<b>₹64,041</b>	<b>₹64,041</b>	<b>₹64,041</b>	<b>₹64,041</b>	<b>₹64,041</b>	<b>₹14,47,264</b>
Interest on loans			-	-	-	-	-	-	-	-	-	-	-	-	-
<b>Total Costs</b>		<b>₹2,04,400</b>	<b>₹34,900</b>	<b>₹30,300</b>	<b>₹31,800</b>	<b>₹31,800</b>	<b>₹33,550</b>	<b>₹64,041</b>	<b>₹64,041</b>	<b>₹64,041</b>	<b>₹64,041</b>	<b>₹64,041</b>	<b>₹63,941</b>	<b>₹64,041</b>	<b>₹14,47,264</b>
<b>PRODUCTIVITY &amp; REVENUE</b>															
% Productivity / Tree reached			0%	0%	25%	50%	75%	100%	100%	75%	50%	20%	15%	0%	
Yield / Tree (Kg)			0	0	5.2	10.4	15.6	20.8	₹ 21	15.6	10.4	4.16	3.12	0	
Yield / ACRE (Kg/acre)			0.0	0.0	362.1	724.2	1086.2	1448.3	1448.3	1086.2	724.2	289.7	217.2	0.0	
Yield / Hectare (MT/Ha)			0.0	0.0	0.9	1.8	2.7	3.6	3.6	2.7	1.8	0.7	0.5	0.0	
Yield (Kgs / Acre) - Grade A			0	0	54	109	163	217	217	163	109	43	33	0	
Yield (Kgs / Acre) - Grade B			0	0	54	109	163	217	217	163	109	43	33	0	
Yield (Kgs / Acre) - Grade B-			0	0	145	290	434	579	579	434	290	116	87	0	
Yield (Kgs / Acre) -			0	0	109	217	326	434	434	326	217	87	65	0	

Grade C															
Yield (MT/Ha) - Grade A			0.0	0.0	0.1	0.3	0.4	0.5	0.5	0.4	0.3	0.1	0.1	0.0	
Yield (MT/Ha) - Grade B			0.0	0.0	0.1	0.3	0.4	0.5	0.5	0.4	0.3	0.1	0.1	0.0	
Yield (MT/Ha) - Grade B-			0.0	0.0	0.4	0.7	1.1	1.4	1.4	1.1	0.7	0.3	0.2	0.0	
Yield (MT/Ha) - Grade C			0.0	0.0	0.3	0.5	0.8	1.1	1.1	0.8	0.5	0.2	0.2	0.0	
Revenues / ACRE - Grade A			₹-	₹-	₹2,444	₹4,888	₹7,332	₹9,776	₹9,776	₹7,332	₹4,888	₹1,955	₹1,466	₹-	₹1,76,947
Revenues / ACRE - Grade B			₹-	₹-	₹1,358	₹2,716	₹4,073	₹5,431	₹5,431	₹4,073	₹2,716	₹1,086	₹815	₹-	₹98,304
Revenues / ACRE - Grade B-			₹-	₹-	₹1,738	₹3,476	₹5,214	₹6,952	₹6,952	₹5,214	₹3,476	₹1,390	₹1,043	₹-	₹1,25,829
Revenues / ACRE - Grade C			₹-	₹-	₹652	₹1,303	₹1,955	₹2,607	₹2,607	₹1,955	₹1,303	₹521	₹391	₹-	₹47,186
Intercropping revenues			₹-	₹-	₹-	₹-	₹-	₹-	₹-	₹-	₹-	₹-	₹-	₹-	₹-
TOTAL Revenues			₹-	₹-	₹6,191	₹2,383	₹18,574	₹24,766	₹24,766	₹18,574	₹12,383	₹4,953	₹3,715	₹-	₹4,48,265
NET REVENUES			₹-2,04,400	₹-34,900	₹-30,300	₹-25,609	₹-19,417	₹-14,976	₹-39,275	₹-45,466	₹-51,658	₹-59,087	₹-60,226	₹-64,041	₹-9,98,999

### Ultra-high density plantation

The ultra-high density apple plantation in Kashmir was introduced with the only aim of utilising available land space judiciously to achieve maximum level of production per unit area by planting maximum number of plants in given area. The traditional plantation system not only has low yield per unit of area but also gestation period is comparatively long and the management is very cumbersome. The ultra-high density plantations are entirely different from the traditional orchards in respect of plantation density, productivity, management practices etc. with a slightly higher cost structure than traditional orchards (Jon Clements, 2012). Being a different orcharding system and different in its management practices, it becomes therefore, important to analyse the economics of this type of orcharding in order to authenticate economic superiority of ultra-high density orcharding in Kashmir valley. Under ultra-high density orcharding system, it is possible to accommodate 2000 to 3000 trees per hectare (Rebecca Harbut, 2007), under this system as against 250-300 trees per hectare under traditional orcharding system presently being followed in Kashmir valley. The costs and returns of ultra-high density plantation in Kashmir valley is presented in table 3 and it is very much evident that during plantation stage the cost structure of ultra-high density is very higher than the traditional plantation system. From the expenditure side, the fixed costs for ultra-high density apple plantation includes planting cost materials (Rs.1,60,000), trellises and other establishment cost (Rs.20,000) and miscellaneous costs (Rs.4,22,200). Similarly, annual recurring costs up to point of yields that means years until trees produce include costs like fertilizer costs (Rs.1,90,545), cost of plant protection/spraying (Rs.5,67,273), labour costs (Rs.2,18,182), intercropping costs (Rs.10,000) and total expenditures (Rs.15,68,200). Likewise from cost side, ultra-high density plantation includes one more component like annual recurring costs once getting commercial yields and that starts after 6 to 20 years of plantation and includes fertilizer costs (Rs.8,72,727), cost of plant protection/spraying (Rs.26,18,182), cost of labour-pruning, thinning, weeding, , harvesting (Rs.34,90,909), electricity costs are very negligible, selling Expenses (Rs.5,79,755), total expenditures (Rs.75,61,573), recurring expenditures (Rs.91,29,773) and total costs comes to the tune of (Rs.91,29,773). From the productivity side ultra-high density apple orchards yields four grades of apple and revenue/ACRE- Grade (A) (Rs.68,80,896), revenue/ACRE-Grade (B) (Rs.25,48,480), revenue/ACRE-Grade (B-) (Rs.12,23,270), revenue/ACRE-Grade (C) (Rs.9,17,453), The ultra-high density plantation system not only ensures precocity in



production but also increases yield substantially with better quality of the produce., in addition there is option of intercropping and yields a revenue of (Rs.25,000), in totality the total revenue generated from one acre of land with ultra-high density orcharding provide a farmer with (Rs.115,95,099). One acre of land with ultra-high density orcharding yields a farmer with a net revenue of Rs.24,65,326 (Table-3).

Table 3: Economic structure of ultra-high density apple in Kashmir

Cost elements	Year --->	0	1	2	3	4	5	6 to 20	21	22	23	24	25	Total
<b>Fixed and recurring expenses S</b>														
<b>Fixed costs up front</b>														
Costs planting materials		₹ 1,60,000	₹ -	₹ -	₹ -	₹ -	₹ -		₹ -	₹ -	₹ -	₹ -	₹ -	₹ 1,60,000
Trellises and other establishment		₹ 20,000												
Costs MIS		₹ 1,05,000	₹ 100	₹ 100	₹ 100	₹ 100	₹ 100	₹ 14,087	₹ 100	₹ 100	₹ 100	₹ 1,05,000	₹ 100	₹ 4,22,200
<b>Annual recurring costs up to point of yields. Specify years until trees produce</b>														
Costs fertilizer			₹ 56,000	₹ 32,727	₹ 32,727	₹ 32,727	₹ 36,364		₹ -	₹ -	₹ -	₹ -	₹ -	₹ 1,90,545
Costs plant protection/spraying			₹ 1,30,909	₹ 87,273	₹ 1,09,091	₹ 1,09,091	₹ 1,30,909		₹ -	₹ -	₹ -	₹ -	₹ -	₹ 5,67,273
Costs labour			₹ 43,636	₹ 43,636	₹ 43,636	₹ 43,636	₹ 43,636		₹ -	₹ -	₹ -	₹ -	₹ -	₹ 2,18,182
Intercropping costs			₹ 10,000	₹ -	₹ -	₹ -	₹ -		₹ -	₹ -	₹ -	₹ -	₹ -	₹ 10,000
<b>Total expenditures</b>		<b>₹ 2,85,000</b>	<b>₹ 2,40,645</b>	<b>₹ 1,63,736</b>	<b>₹ 1,85,555</b>	<b>₹ 1,85,555</b>	<b>₹ 2,11,009</b>	<b>₹ 14,087</b>	<b>₹ 100</b>	<b>₹ 100</b>	<b>₹ 100</b>	<b>₹ 1,05,000</b>	<b>₹ 100</b>	<b>₹ 15,68,200</b>
<b>Annual recurring costs once getting commercial yields. Specify year when begin:</b>														
Costs fertilizer								₹ 43,636	₹ 43,636	₹ 43,636	₹ 43,636	₹ 43,636	₹ 43,636	₹ 8,72,727
Costs plant protection/spraying								₹ 1,30,909	₹ 1,30,909	₹ 1,30,909	₹ 1,30,909	₹ 1,30,909	₹ 1,30,909	₹ 26,18,182
Costs labour-pruning, thinning, weeding, harvesting								₹ 1,74,545	₹ 1,74,545	₹ 1,74,545	₹ 1,74,545	₹ 1,74,545	₹ 1,74,545	₹ 34,90,909
Electricity costs			₹ -	₹ -	₹ -	₹ -	₹ -		₹ -	₹ -	₹ -	₹ -	₹ -	₹ -
Selling Expenses			₹ 1,250	₹ -	₹ 7,990	₹ 15,981	₹ 23,971	₹ 31,962	₹ 23,971	₹ 15,981	₹ 6,392	₹ 4,794	₹ -	₹ 5,79,755
<b>Total expenditures</b>			<b>₹ 1,250</b>	<b>₹ -</b>	<b>₹ 7,990</b>	<b>₹ 15,981</b>	<b>₹ 23,971</b>	<b>₹ 3,81,053</b>	<b>₹ 3,73,062</b>	<b>₹ 3,65,072</b>	<b>₹ 3,55,483</b>	<b>₹ 3,53,885</b>	<b>₹ 3,49,091</b>	<b>₹ 75,61,573</b>
Recurring expenditures		₹ 2,85,000	₹ 2,41,895	₹ 1,63,736	₹ 1,93,545	₹ 2,01,535	₹ 2,34,980	₹ 3,95,140	₹ 3,73,162	₹ 3,65,172	₹ 3,55,583	₹ 4,58,885	₹ 3,49,191	₹ 91,29,773
Interest on loans									₹ -	₹ -	₹ -	₹ -	₹ -	₹ -
<b>Total Costs</b>		<b>₹ 2,85,000</b>	<b>₹ 2,41,895</b>	<b>₹ 1,63,736</b>	<b>₹ 1,93,545</b>	<b>₹ 2,01,535</b>	<b>₹ 2,34,980</b>	<b>₹ 3,95,140</b>	<b>₹ 3,73,162</b>	<b>₹ 3,65,172</b>	<b>₹ 3,55,583</b>	<b>₹ 4,58,885</b>	<b>₹ 3,49,191</b>	<b>₹ 91,29,773</b>
<b>PRODUCTIVITY &amp; REVENUE</b>														
<b>% Productivity / Tree reached</b>			0%	0%	25%	50%	75%	100%	75%	50%	20%	15%	0%	
Yield / Tree (Kg)			0	0	4.4	8.8	13.2	17.6	13.2	8.8	3.52	2.64	0	
Yield / ACRE (Kg/acre)			0.0	0.0	7040.0	14080.0	21120.0	28160.0	21120.0	14080.0	5632.0	4224.0	0.0	
Yield / Hectare (MT/Ha)			0.0	0.0	17.4	34.8	52.2	69.6	52.2	34.8	13.9	10.4	0.0	
Yield (Kgs / Acre) - Grade A			0	0	2112	4224	6336	8448	6336	4224	1690	1267	0	
Yield (Kgs / Acre) - Grade B			0	0	1408	2816	4224	5632	4224	2816	1126	845	0	
Yield (Kgs / Acre) - Grade B-			0	0	1408	2816	4224	5632	4224	2816	1126	845	0	
Yield (Kgs / Acre) - Grade C			0	0	2112	4224	6336	8448	6336	4224	1690	1267	0	
Yield (MT/Ha) - Grade A			0.0	0.0	5.2	10.4	15.6	20.9	15.6	10.4	4.2	3.1	0.0	
Yield (MT/Ha) -			0.0	0.0	3.5	7.0	10.4	13.9	10.4	7.0	2.8	2.1	0.0	

<b>Grade B</b>													
Yield (MT/Ha) - Grade B-		0.0	0.0	3.5	7.0	10.4	13.9	10.4	7.0	2.8	2.1	0.0	
Yield (MT/Ha) - Grade C		0.0	0.0	5.2	10.4	15.6	20.9	15.6	10.4	4.2	3.1	0.0	
Revenues / ACRE - Grade A		₹ -	₹ -	₹ 95,040	₹ 1,90,080	₹ 2,85,120	₹ 3,80,160	₹ 2,85,120	₹ 1,90,080	₹ 76,032	₹ 57,024	₹ -	₹ 68,80,896
Revenues / ACRE - Grade B		₹ -	₹ -	₹ 35,200	₹ 70,400	₹ 1,05,600	₹ 1,40,800	₹ 1,05,600	₹ 70,400	₹ 28,160	₹ 21,120	₹ -	₹ 25,48,480
Revenues / ACRE - Grade B-		₹ -	₹ -	₹ 16,896	₹ 33,792	₹ 50,688	₹ 67,584	₹ 50,688	₹ 33,792	₹ 13,517	₹ 10,138	₹ -	₹ 12,23,270
Revenues / ACRE - Grade C		₹ -	₹ -	₹ 12,672	₹ 25,344	₹ 38,016	₹ 50,688	₹ 38,016	₹ 25,344	₹ 10,138	₹ 7,603	₹ -	₹ 9,17,453
Intercropping revenues		₹ 25,000	₹ -	₹ -	₹ -	₹ -		₹ -	₹ -	₹ -	₹ -	₹ -	₹ 25,000
<b>TOTAL Revenues</b>		₹ 25,000	₹ -	₹ 1,59,808	₹ 3,19,616	₹ 4,79,424	₹ 6,39,232	₹ 4,79,424	₹ 3,19,616	₹ 1,27,846	₹ 95,885	₹ -	₹ 115,95,099
<b>NET REVENUES</b>	₹ -2,85,000	₹ -2,16,895	₹ -1,63,736	₹ -33,737	₹ 1,18,081	₹ 2,44,444	₹ 2,44,092	₹ 1,06,262	₹ -45,556	₹ -2,27,737	₹ -3,63,000	₹ -3,49,191	₹ 24,65,326

### Ultra-High density on apple system and its impact in Kashmir valley

The ultra-high density apple has revolutionised the game of apple production in the world. The fact that ultra-high density plantations are entirely different from the traditional orchards in respect of plantation density, productivity, management practices etc. and their cost structure may be significantly different Rs.68196/ha (traditional system) and Rs.877862/ha (ultra-high density orcharding) with a percentage change of 1187.26 respectively. The adoption of ultra-high density plantation increased the yield of Grade A apples from 1.1mt/ha to 20.9mt/ha with a percentage change of 1800, Grade B apples from 1.1mt/ha to 13.9 mt/ha with a percentage change of 1163.64, Grade B<sup>-</sup> apples from 2.9mt/ha to 13.9mt/ha with a percentage change of 379.31 and Grade C apple from 2.2mt/ha to 20.5mt/ha with a percentage change of 850 meaning thereby that ultrahigh density orphaning has increased the yield of apple in Kashmir more than 5 fold. After shift from traditional to ultra-high density orcharding, gross and net returns increased from Rs.125000/acre to Rs.1879500/acre with a percentage change of 1403.6 and Rs.56803/acre to Rs.1001638/acre with a percentage change of 1663.35 respectively, thus could result in increase in the marketable surplus from 6205kg/ha to 67512kg/ha with a percentage change of 988.03 respectively. The potential of the ultra-high density could be judged from the increase in per rupee invested which has been estimated at 1.83Rs/ha to 2.14Rs/ha with a percentage of 16.94 in traditional and ultra-high density apple respectively. Ultra-high density apple orcharding has increased the employment man-days/ha from 125 to 3637 with a percentage change of 2809.6. The results are in conformity with (Ranveer Singh, 2012) (Table 4).

**Impact of ultra-high density plantation on apple growers**

<b>Particulars</b>	<b>Ultra-High density</b>	<b>Traditional Apple</b>	<b>(%) Change</b>
<b>Apple Yield (MT/ha)</b>			
Grade (A)	20.9	1.1	1800
Grade (B)	13.9	1.1	1163.64
Grade (B <sup>-</sup> )	13.9	2.9	379.31
Grade (C)	20.9	2.2	850
<b>Gross returns (Rs/ha)</b>	1879500	125000	1403.6
<b>Net returns (Rs/ha)</b>	1001638	56803	1663.35
<b>Cost of cultivation (Rs/ha)</b>	877862	68196	1187.26
<b>Cost of production (Rs/kg)</b>	12.61	9.34	35.01
<b>Returns per rupee invested (Rs/ha)</b>	2.14	1.83	16.94
<b>Marketable surplus(kg/ha)</b>	67512	6205	988.03
<b>Employment (human days/ha)</b>	3637	125	2809.6
<b>Domestic consumption (kg/ha)</b>	2088	1095	90.68

### Conclusion

Apple is the commercially grown fruit in Kashmir with 70-80 per cent of its positive role in employability and livelihood security of the region. Kashmir apple is world famous in terms of its quality and texture. The fruit has a great share in SGADP. Traditionally, the commercial apple varieties are limited, but with the introduction of high density and now ultra-high density apple cultivars, the choice of varieties has increased to hundreds. The ultra-high density plantation in the valley has opened a new epoch of economic advancement and development as well by not only increasing the production and productivity of apple in the valley but also increased the employment avenues and income of growers. The ultra-high density apple orcharding has increased production of Grade (A) apple and reduce the Grade (B) and Grade (C) apples meaning thereby the quality of the apple has also enhanced. The new orcharding system has also reduced food insecurity to some extent by providing vent for intercropping. Though the establishment cost of the ultra-high density is higher than traditional orcharding system, but due to early bearing the cost gets neutralised.

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