

Apple Revolution in the Tribal District of Kinnaur: From Tradition to Technology, Horticulture Redefined with Quality Assurance and Sustainability

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Abstract

Nestled amidst the breathtaking landscapes of Himachal Pradesh, Kinnaur has garnered renowned niche as a veritable paradise for apple orchards. Its distinction arises from the harmonious convergence of climatic conditions, featuring a unique blend of dryness, temperance, and cold that fosters the perfect environment for apple cultivation. Within this rich tapestry of crops, apples stand as the undisputed sovereign, commanding a remarkable 90% share of the total cultivated fruit area and making an astounding 99% contribution to the overall fruit production in the region. The significance of apples transcends mere Horticulture and agriculture statistics; it has become an emblem of Kinnaur's Horticulture expertise and a substantial pillar supporting its Gross Domestic Product (GDP). The orchards of Kinnaur are not just fruitful in terms of their produce but are also laden with the economic promise that this quintessential cash crop brings to the region. The growth trajectory of apple cultivation in Kinnaur reads like a tale of prosperity and ambition. Over the years, the cultivation of apples has witnessed a breathtaking expansion, evolving from a modest 670 hectares of apple orchards in the early 1970s to an expansive 10,925.5 hectares by the year 2022-23. This exponential surge in apple cultivation has yielded astounding results, with a record-breaking apple production of 83,324 metric tons per hectare, achieving a remarkable productivity rate of 7.63 metric tons during the year 2022-23. In this idyllic setting, the apple orchards of Kinnaur flourish, standing as a testament to the region's Horticulture and agricultural prowess, economic vitality, and its unceasing commitment to the cultivation of the 'fruit of kings.'

Royal Delicious, celebrated for its exquisite taste and crisp texture, rightfully commands the spotlight in Kinnaur's apple orchards, where it dominates the landscape, constituting a staggering 90% of the apple varieties grown. The year 2022-23 witnessed Kinnaur's apple production soaring to new heights, with the district proudly yielding a bounteous harvest of 84,192.93 metric tons of temperate fruits, sprawled across an expansive expanse of 12,142.6 hectares. However, even within this remarkable success story, the apple industry in Kinnaur faces a set of formidable challenges that demand attention and innovative solutions. One pressing issue lies in the prevalence of traditional apple cultivars, which, while deeply rooted in Kinnaur's heritage, often hinder the production of high-quality fruits. The rigid adherence to these time-honoured strains limits the potential for innovation and improvement. Compounding this challenge is the daunting topography of Kinnaur's terrain, marked by steep and treacherous slopes. This

rugged landscape presents an additional obstacle to the introduction of new apple cultivars, making the transition to improved strains an uphill battle, both literally and figuratively. Furthermore, the dearth of access to these new and improved apple cultivars, coupled with a knowledge deficit regarding their cultivation, adds complexity to the task of enhancing fruit quality. Another issue contributing to the challenge is the conventional orchard layout prevalent in most of Kinnaur's apple orchards. These orchards are arranged in a square method with low-density plantings of old standard apple trees. While this traditional approach may be deeply ingrained in our culture and has a unique manifestation of purity and nutrition. However, these modern systems feature high-density plantings of vibrant, good-colour strain apple trees, promising superior fruit quality. The shift to such high-density systems aligns with the changing preferences of consumers and the need to meet international export standards, making it essential for Kinnaur's apple industry to embrace innovation, adapt to modern practices, and invest in knowledge dissemination to maximize its full potential in apple cultivation.

Keywords: Apple, Cash Crop, Royal Delicious, Innovative, Conventional, Nutrition, High Density, export, Cultivars, High Quality, cultivation, knowledge Dissemination.

Introduction:

The apple revolution in the Kinnaur District has not been a sudden phenomenon. The journey of the apple in this area has been a gradual one with challenges and various other difficulties which accounts for the resilience and fortitude of the Tribal, simple and hard working people of District Kinnaur. Apples have a rich history, originating more than 4000 years ago in the Middle East. They gradually made their way across Europe, arriving in England around the time of the Norman Conquest in 1066. In India, the first apple tree was planted by Capt. R.C. Lee of the British army in the Kullu valley in 1870. Unfortunately, the apples he introduced, such as Newton Pippins, King of Pippin, and Cox's Orange Pippin, with their sour and tangy taste, didn't find favor among local farmers who were accustomed to sweeter fruits like mangoes. It wasn't until 1915, during a visit to America, that Satyanand Stokes, also known as Samuel Evans Stokes, learned about the Red Delicious apple strain patented by the Stark Brothers nursery in Louisiana. He planted a few saplings in his Barobagh orchard in Thanedar in 1916. Later, in 1921, his mother sent him saplings of the Stark Brothers Golden Delicious Apples as a Christmas gift. The apples from these trees, known for their sweet taste and vibrant color, became an instant hit in the Indian market, prompting local farmers to switch from their traditional crops to apple cultivation. Stokes, considered one of their own, offered guidance, leading to a surge in Kotgarh apple plantations across Himachal Pradesh. This marked the beginning of Himachal Pradesh's journey as a major apple producer.

Kinnaur, a district in Himachal Pradesh, was carved out on May 1, 1960. It is a secluded, mountainous region with an altitude ranging from 1600 to 6816 meters, situated along the banks of the river Sutlej. The district boasts a temperate climate, with long winters from October to May and short summers from June to September. While apple cultivation reigns supreme in Kinnaur, other temperate fruit crops like plum, pear, almond, walnut, peach, and apricots are also cultivated. The horticultural sector has significantly transformed the economy of Kinnaur. Apple, in particular, has emerged as a leading cash crop among fruit crops, accounting for a substantial portion of the region's GDP. The area under apple cultivation has steadily increased, from 670 hectares in 1970-71 to 10,925 hectares in 2022-

23. During the 2022-23 season, a record-breaking 83324 metric tonnes of apples were produced, marking

a pinnacle in the district's economic growth and the well-being of its tribal community. While apple cultivation has been the cornerstone of Kinnaur's horticultural success, new introductions and innovations have paved the way for even greater potential. High-density orchards have been established to boost productivity and quality, particularly in response to changing climatic patterns. These orchards have the capacity to yield between 40 to 70 metric tonnes per hectare, significantly higher than the previous averages of 7 to 10 metric tonnes per hectare. The introduction of new apple cultivars, clonal rootstocks, and innovative systems has further contributed to the region's horticultural development. As Kinnaur continues to adapt and evolve, its farmers are encouraged to diversify their crops beyond apples to ensure long-term economic prosperity. The success story of Kinnaur's apple industry is a testament to the resilience and adaptability of its farming community, making it a true fruit bowl of Himachal Pradesh.

The Area, production and productivity of the apple cultivation in Kinnaur.

The remarkable journey of apple revolution in the Tribal District of Kinnaur is very well represented and demonstrated in the appended table:-

Sr No	Year	Area (Ha.)	Production (MT)	Productivity (MT/Ha.)
1	1970	670	2578	3.85
2	1971	733	3132	4.27
3	1972	827	600	0.73
4	1973	852	2985	3.50
5	1974	935	432	0.46
6	1975	1094	6622	6.05
7	1976	1234	2990	2.42
8	1977	1420	3203	2.26
9	1978	1703	4602	2.70
10	1979	1843	4551	2.47
11	1980	2026	7151	3.53
12	1981	2203	7768	3.53
13	1982	2403	4612	1.92
14	1983	2826	9529	3.37
15	1984	2929	5323	1.82
16	1985	3066	9788	3.19
17	1986	3279	11066	3.37
18	1987	3572	7326	2.05
19	1988	3829	10045	2.62
20	1989	4043	11582	2.86
21	1990	4302	9159	2.13
22	1991	4431	16530	3.73
23	1992	4608	12395	2.69
24	1993	4770	23190	4.86
25	1994	5116	16345	3.19
26	1995	5332	18219	3.42

27	1996	5516	17901	3.25
28	1997	5616	24639	4.39
29	1998	5836	18509	3.17
30	1999	6249	15432	2.47
31	2000	6369	21793	3.42
32	2001	6604	18808	2.85
33	2002	6840	22177	3.24
34	2003	7392	33074	4.47
35	2004	7720	38066	4.93
36	2005	8151	41101	5.04
37	2006	8473	40277	4.75
38	2007	8874	41550	4.68
39	2008	9671	55169	5.70
40	2009	9838	40289	4.10
41	2010	9999	63781	6.38
42	2011	10100	53290	5.28
43	2012	10116	52020	5.14
44	2013	10487	54044	5.15
45	2014	10953	59196	5.40
46	2015	11164	75202	6.74
47	2016	11219	60210	5.37
48	2017	11179	52189	4.67
49	2018	10973	61673	5.62
50	2019	10891	56864	5.22
51	2020	10891	73330	6.73
52	2021	10911	48678	4.46
53	2022	10925	83324	7.63

Source: - Department of Horticulture, Himachal Pradesh.

The Rich Traditional approach of Apple Cultivation.

Kinnaur has etched its identity as the ultimate apple orchard haven, thriving under the unique climatic fusion of arid, temperate, and frigid conditions. Apples reign supreme in this idyllic region, laying claim to a staggering 90% of the cultivated fruit area and contributing an astonishing 99% to the overall fruit production. They are not merely fruits; they stand as a symbol of Kinnaur's agricultural acumen and a formidable cornerstone of its GDP. Over the years, the cultivation of apples has undergone a remarkable expansion, evolving from a modest 670 hectares in 1970-71 to a sprawling 10,925.5 hectares by the year 2022-23. This monumental growth has translated into an awe-inspiring apple production figure of 83,324 metric tons per hectare, with a productivity rate of 7.63 metric tons in the year 2022-23. Royal Delicious, renowned for its delectable taste and crisp texture, commands centre stage, representing a dominant 90% of the apple varieties flourishing in Kinnaur. However, within this story of success, Kinnaur's apple industry grapples with challenges. Traditional apple cultivars, deeply entrenched in local heritage, present obstacles to producing high-quality fruit. The rugged terrain of Kinnaur adds another

layer of complexity, making the introduction of new cultivars an uphill battle, both literally and figuratively. Moreover, limited access to these novel strains, coupled with a dearth of knowledge on their cultivation, exacerbates the challenge of enhancing fruit quality. Yet, Kinnaur is not simply a victim of these challenges; it is a testament to resilience and adaptability. The region's progressive stance advocates for modernization and the embrace of high-density orchards. As it navigates the dynamic landscape of apple cultivation, Kinnaur remains at the vanguard of excellence in apple farming, poised to surmount these challenges and continue its legacy as the apple orchard paradise of Himachal Pradesh successfully. Another issue contributing to the challenge is the conventional orchard layout prevalent in most of Kinnaur's apple orchards. These orchards are arranged in a square method with low-density plantings of old standard apple trees. While this traditional approach may be deeply ingrained, it comes at the cost of fruit quality, lagging significantly behind the newer high-density planting systems. In stark contrast, these modern systems feature high-density plantings of vibrant, good-colored strain apple trees, promising superior fruit quality. The shift to such high-density systems aligns with the changing preferences of consumers and the need to meet international export standards, making it essential for Kinnaur's apple industry to embrace innovation, adapt to modern practices, and invest in knowledge dissemination to maximize its full potential in apple cultivation.

Despite the climatic changes and the challenges, the efforts at the Govt. and community level are promoted and encouraged to ensure the region's reputation as an apple paradise remains intact with its rich tradition of most delicious and pesticide free apple farming.. The aging standard orchards in Kinnaur present a conundrum that orchardists must grapple with. The prospect of replacing these aging orchards with new ones is undeniably a costly endeavour, which has led some forward-thinking orchardists to explore alternative methods of rejuvenation. One such method gaining attention is "top-working," which

involves grafting improved apple varieties onto older trees. While this approach has the potential to breathe new life into aging orchards, it also carries certain risks, particularly in Kinnaur's cold and dry temperate climate. The introduction of new grafts may increase the vulnerability of trees to diseases, making careful disease management and monitoring paramount. However, the orchardists in Kinnaur are not simply resigned to either maintaining outdated orchards or resorting to radical replacements. Instead, there is a growing consensus among them to adopt a more balanced approach. This approach advocates for the simultaneous coexistence of old and new orchards, emphasizing the importance of enhancing overall fruit quality while preserving the legacy of the older orchards. Crucially, orchardists are recognizing the need to embrace scientific studies tailored to Kinnaur's unique microclimate. This shift towards evidence-based practices promotes the exploration of new apple cultivars and modern techniques that can thrive in this specific environment. By integrating scientific insights into their orchard management strategies, they aim to strike a harmonious balance between tradition and innovation, ensuring that the apple industry in Kinnaur remains resilient and competitive. To address the challenges presented by international export standards and the ever-evolving impacts of climate change, Kinnaur's horticultural sector has embarked on a journey of innovation. It has actively sought solutions that can elevate apple production, increase productivity, and enhance fruit quality. Among these solutions, high-density and ultra-high-density orchards have gained prominence. These orchards feature improved, vibrant-colored apple strains that promise to significantly boost not only the quantity but also the quality of apple yields. In essence, the orchardists in Kinnaur are not merely adapting to change; they are actively embracing it. By striking a balance between the old and the new, leveraging scientific

insights, and adopting innovative approaches, Kinnaur's apple industry is positioning itself to not only meet the demands of the present but also thrive in the face of future.

Technology and Innovation

The shift towards high-density plantations has been a game-changer, increasing both productivity and quality. It has also helped overcome the challenge of labour shortage, with yields ranging from 40 to 70 metric tonnes per hectare. As of 2020-21, apple production in Kinnaur reached 73,330 metric tonnes with a productivity of 6.67 metric tonnes per hectare. The district's tremendous success in horticulture has opened new avenues for economic growth, transforming the lives of its farmers. Looking ahead, Kinnaur continues to explore new opportunities for horticultural expansion. Despite challenges such as limited access to water facilities and connectivity in certain areas, the future appears promising. With ongoing innovation, diversification, and a resilient farming community, Kinnaur remains at the forefront of horticultural excellence in Himachal Pradesh, poised for further growth and prosperity. With the introduction of latest and eco friendly Technology along with cultivation of new fruit varieties, Kinnaur has expanded its horticultural potential. The cultivation of pears, almonds, cherries, hazelnuts, and apricots, among others, has added a rich tapestry of flavours and colours to the region's orchards. High-density plantation techniques have further revolutionized the industry, allowing farmers to achieve remarkable yields and overcome labour challenges. The district's shift towards high-density apple cultivation, in particular, has resulted in productivity levels that were previously unthinkable. The success of Kinnaur's horticulture sector has not only significantly boosted the local economy but also empowered its farming communities. It has provided an alternative to traditional crops, reducing dependency on them and offering more sustainable livelihoods. Looking forward, Kinnaur remains committed to innovation and diversification, with the introduction of new apple and pear cultivars, as well as the exploration of clonal rootstocks for enhanced productivity. These efforts are essential to meet evolving market demands and climatic challenges.

Quality Assurance and Sustainability

To adapt with the changing scenario of apple farming and the harvesting the focus on the quality and the sustainability are the basic requirements for the sustenance and survival in the highly competitive and global market. Kinnaur's journey as a fruit bowl of Himachal Pradesh is marked by significant milestones in horticultural development. The introduction of various fruit crops beyond apples has added diversity to the region's agricultural landscape. Pear cultivation began in the region in 1985, with varieties like Kashmir Pear, Beuree Hardy, China Pear, Dr. Julius Goyout, Bartlett, and William Bon Chriton being planted. Almond cultivars like Drake, Telengi Selection, Non-Pareil, Dhebar, Katha, Thin Shelled, White Brandis, Briggs Hard Shell, and California Paper Shell were introduced in 1988. Other apple varieties like Golden Spur, Red Spur, Well Spur, Oregon Spur, Red Chief, Silver Spur, and Standard cultivars like Vance Delicious, Top Red, Tydeman, and Royal Gala were introduced in 1993. The diversification didn't stop there. Cherries like Lambert, Black Heart, Durone Nero I, Black Heart, Durone Nero II, Van, Sunburst, and Durone Nero II were introduced in 1994. Hazelnut cultivars Tonda Romana, Tonda Giffoni, and Tonda Gentile Langle were planted in 2001. In 2004, exotic apple cultivars like Scarlet Spur, Gold Spur, Compact Winter Banana, Early Red One, Braeburn, and Red Ggravestein were introduced, along with pomegranate cultivars like Muhammad Ali and Kandhari Kabuli. Apricot cultivation was also initiated in 2004, featuring varieties like Halman, Charmagaz, Nari,

Shakarpara, Rackchey Karpo, Suffaida, and Afgani. The introduction of new apple cultivars continued, with Scarlet Spur, Gold Spur, Akane, and Red Fuji among those brought in during the following years. Pecan nut cultivar Mahan was planted in 2012. The year 2017 saw the arrival of Jeromine, Red Velox, Scarlet Spur-II, Modi, and Buckey Gala apple cultivars. In 2020, further diversification took place with the introduction of new apple cultivars like Schlect Spur, King Roat, Schnico Gala, Dark Baron Gala, Chelan Spur, and Scarlet Spur. Pear cultivars such as Red Clap, Olympic, Shinko, Yoinashi, Bronze Beauty Bosc, Sheandoah, Sun Rise, and Golden Russet Bosc were also introduced.

Conclusion

The future of Kinnaur's horticulture sector is promising, and there is ample room for further expansion and innovation. Here are some key areas and strategies that can help shape the district's horticultural landscape in the coming years:

Climate-Resilient Cultivars: Given the changing climate patterns, continued efforts to identify and introduce climate-resilient apple and other fruit cultivars will be crucial. Varieties that can withstand temperature fluctuations and adapt to new environmental conditions will ensure consistent yields.

Advanced Orchard Management: Implementing modern orchard management practices, such as precision agriculture, automated irrigation systems, and disease control measures, will optimize fruit production and quality. This will also help address labor shortages.

Diversification: While apples remain a vital crop, encouraging further diversification into high-value fruits like cherries, walnuts, and pears can provide farmers with additional income sources and reduce dependence on a single crop.

Research and Development: Investing in research and development, particularly in collaboration with agricultural universities and research institutions, can lead to the discovery of new cultivars, improved farming techniques, and sustainable practices.

Infrastructure Development: Expanding road networks and improving transportation infrastructure to remote areas will reduce the logistical challenges faced by farmers. Additionally, addressing water scarcity through efficient irrigation systems is essential for sustaining horticultural growth.

Market Access: Strengthening market linkages, both within India and for export opportunities, can help farmers secure better prices for their produce. Encouraging the processing and value addition of fruits can also enhance income.

Knowledge Dissemination: Promoting awareness and providing training to farmers on modern horticultural practices, pest and disease management, and post-harvest handling will empower them with the knowledge needed to succeed.

Government Support: Continual support from government agencies, including subsidies, loans, and insurance schemes, can safeguard farmers against risks and encourage investment in horticulture.

Sustainable Practices: Emphasizing sustainable farming practices, such as organic farming and reduced chemical usage, not only benefits the environment but also appeals to health-conscious consumers, potentially leading to premium prices.

Community Collaboration: Encouraging collaboration among farmers and farmer cooperatives can help them collectively negotiate better prices and share resources for improved horticultural practices. Kinnaur's horticulture sector has come a long way, but its journey is far from over. By embracing innovation, diversification, and sustainable practices, Kinnaur can continue to thrive as a horticultural paradise and a source of pride for the state of Himachal Pradesh. As the district faces new challenges and opportunities, its rich agricultural heritage and resilient spirit will undoubtedly lead the way toward a fruitful future.

References:

1. T. Singh, "Apple production in Himachal Pradesh: An Impending Crisis?" *Economic & Political Weekly*, 46(25), 2011, ISSN (Print) - 0012-9976 | ISSN (Online) - 2349-8846.
2. B.Pirayesh,R. Adelka,E. Hossein,A.R. Gholam, Hossein, "Investigation effects of mallingmerton rootstocks and density planting on the quality and quantity characteristics apple cv.reddelicious in Meshkinshahrregion," 2005.
3. S. Sansavini, D. Bassi, Giunchi, "Tree efficiency and fruit quality in high density apple orchards," *ActaHortic*, 1981,DOI:10.17660/ActaHortic.1981.114.13.
4. N. Singh, D. P. Sharma, C. Hukam, "Impact of Climate Change on Apple Production in India: A Review," *Current World Environment*, 11(1), pp.251-259, 2016.
5. R. S. Mehta, "It all began with an apple," *Jetwings* (A monthly magazine of Jet Airways, India), Issue 2, pp.108-115, February 2003.
6. <https://hds.hp.gov.in/GeneralpageWithTemplate.aspx?key=HOMEKEY0001>
7. <https://eudyan.hp.gov.in/Department/Portal/CitizenServices.aspx>
8. <https://www.yspuniiversity.ac.in/>
9. <https://www.yspuniiversity.ac.in/sharbo>
10. <https://www.yspuniiversity.ac.in/kvk-kinnaur>
11. <https://agriculture.hp.gov.in/en/home-english>