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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 Coxs 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 2022-23season, 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 clim fusion of arid, temperate, and frigid conditions. Apples reign supreme in this idyllic region, laying cl to a staggering 90% of the cultivated fruit area and contributing an astonishing 99% to the overall t production. They are not merely fruits; they stand as a symbol of Kinnaur's agricultural acumen an formidable cornerstone of its GDP. Over the years, the cultivation of apples has undergone a remarka expansion, evolving from a modest 670 hectares in 1970-71 to a sprawling 10,925.5 hectares by the y 2022-23. This monumental growth has translated into an awe-inspiring apple production figure 83,324 metric tons per hectare, with a productivity rate of 7.63 metric tons in the year 2022-23.Roy Delicious, renowned for its delectable taste and crisp texture, commands centre stage, representing 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 loca 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 Grravestein 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.

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THE POWER OF SELF-REALIZATION FOR TRANSFORMATION: A VEDANTIC INTERPRETATION OF THE NOVEL "THE MONK WHO SOLD HIS FERRARI" BY ROBIN SHARMA

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ABSTRACT

What is true happiness? Is it to find out what you truly love to do and direct all your energy towards doing it? Once you do this, abundance and success crown your life and all your desires are filled with prosperity and material comforts. Is this what the true and joyful bliss we all wish to accomplish? In the present study I have undertaken a humble effort to study the novel by Robin Sharma "The Monk who sold His Ferrari" through the perspective and the perceptive lens of the Vedantic Philosophy to decipher the transformational journey of the principal character Julian Mantle and the secret of happiness which leads to eternal ecstasy. In order to interpret and deconstruct the text of the Novel wear the Lens of the Vedic Philosophy which proposes that we should cultivate and nurture our minds in a certain way to explore true nature of intelligence and this accomplishment will blossom beyond our expectations and we can decode the precious lessons with opportunities for personal and spiritual growth. To realize and actualize the true inner experience dive deep into the realms of deeper dimensions of intellect and intelligence is essential which is capable of transformation The spirit of Eastern wisdom is not limited to bookish knowledge and sensory information; it is beyond superficial thought process and also goes beyond the five sense organs with limited perceptions with distortion of the reality for mere existence or survival. Nature of true reality could be understood in relation with inner perceptions and eternal laws. Intellect only dissects but intelligence ensures Inward movement and the profoundness of experience. Sense organs are outward bound by nature hence intellect which relies upon Intellect has certain limitations. If we truly wish to know the fundamental laws of Nature which governs life, we need inner perception or the deeper and higher dimension of intelligence within us.

Keywords: Happiness, Vedantic philosophy, Intelligence, spiritual growth, intellect, transformation, perception, eternal Laws, loneliness, conscious, sub-conscious, genetic, Dharma.

Introduction

The Power of self-enquiry and critical appreciation permeates whole atmosphere of this incredible novel of the quest for purpose and meaning in life. So, this interpretation of the novel deals with the protagonist, Julian Mantle, whose journey of self- transformation and self-discovery has been studied in light of the wisdom of Vedanta philosophy which offers a Perception of life in a very different way with other sublime dimensions of intelligence. Let us explore his journey by analyzing the sixteen-dimensional studies or the study of the sixteen parts of human mind as per the Vedic and the Yogic perspective. For the sake of convenience and the keeping in view the nature of the research article we propose to study only the four aspects of the mind: **Buddhi** is the Intellect which ensures and enhances comforts and convenience in life, but at the same time results in emptiness, hollowness, and loneliness. The more use of intellect and the lonelier we are. **Ahankara** is Identity, a strong sense of who I am, and it is a certain kind of prejudice. We all are identified with something or the other and the intellect will work only to protect the identity. We are willing to give up everything for the identity and our pursuit to achieve the desired results but we cannot escape stress, misery, suffering, fear, anxiety which is the byproduct of our excessive indulgence in material world. **Manas is the silo of memory** there are eight dimensions of Memory, there is conscious memory, subconscious memory, genetic, evolutionary memory and profound dimensions of memory first three intelligence it is samskara (cyclical Life) moving in circles, it is like exercise it has a cyclical mode, cyclical nature of our existence. **Chitta** is pure intelligence and unsullied by memory and beyond every kind of influence past or other untouched by any memory, memory within you , Dharma is great significant because it comes from Chitta truly universal and which Sanatana Dharma which is the Ultimate law of Nature and does not come from individual identity or memory Two dimensions of Nature the Physical Nature and The Inner nature Two Dimensions of Laws Physical Nature changing thing in a process of flux Inner Nature is Constant Two dimensions of Dharma ; Shrutis and Smritis', the two dimensions of expression which is very foundation of the Vedantic understanding of the novel " The Monk who Sold his Ferrari"

The self-Enquiry: a step towards the Vedantic realization of the true self.

Who am I? What am I? Have been the profound questions troubling the seekers after the truth and the knowledge seekers who have been passionately following the reality of existence and the true self which is core of all the actions and reactions of our personality and demeanour. Is the true self the realization and resolution of our problems, stress, emotions, conflicts, greed, anxiety, agitation, beliefs system, likes, dislikes or is it beyond these outer sheaths and subtler and deeper which requires extensive and exhaustive study and knowledge to delve deep into decipher the Vedantic notion of self. Julian Mantle in the Novel undertakes this journey to appreciate this truth which is beyond tangible reality. Julian Mantle is the inspirational character in Robin S. Sharma's most critically acclaimed novel "The Monk Who Sold his Ferrari". It presents the motivational and soul touching story of indomitable search for the true self by its central character Julian Mantle, who used to be a very successful and rich lawyer in the United States. He was superficially a very successful in his legal profession and appears to be a happy person, with fame and power externally. However, a sudden transformation has brought about by his workaholic attitude in his life during one of his trials in a packed courtroom; he suffered from a severe heart attack and collapsed, and he was so saddened and grieved by this incident and then he started his search for true Vedantic self for the eternal joy and bliss.

The journey from the Mind to consciousness.

The novel depicts the journey of the character Julian Mantle from the level of mind to the pure consciousness, from the appearance to the subtler reality of true self in Vedantic tradition. The Vedic understanding of consciousness possibly suggests an organic process of evolution, wherein there is a constant emotional inclination to move into higher forms of reality and truth, which in turn could have a better and intelligent grasp of the nature of the unknown riddles of this infinite universe to realize the state of nothingness with everything. One Vedic model of the mind is often expressed by the comparison of the chariot in the Katha Upanishad and the Bhagavad-Gita. In this metaphor the person is compared to a chariot that is pulled in different directions by the horses which represents the senses. The mind is understood as the driver who holds the steering, but the question comes that who sits next to the mind or the engine of the vehicle the master of the

chariot – the true observer, the self, who represents the highest form of consciousness, the pure being, the Atman, a universal unity. Without this, the seer, the ultimate self no true blissful joy and the coherent behavior are possible to lead a contended and meaningful life.

Julian Mantle, the protagonist in the novel who has achieved tremendous success in his profession had become purpose less and materialistic in the world of glitterati of wealth and power. But the life changing and dramatic sudden collapse, and the doctor's strict warning that either he should quit his profession or his life, he had no options left, but to choose the second one.

As John, the other character in the novel narrates:

> "He collapsed right in the middle of a packed courtroom. He was one of this country's most distinguished trial lawyers. He was also a man who was as well-known for the three thousand-dollar Italian suits which draped his well-fed frame as for his remarkable string of legal victories. I simply stood there, paralyzed by the shock of what I just witnessed. The great Julian Mantle had been reduced to a victim and was now squirming on the ground like a helpless infant, shaking and shivering and sweating like a maniac". (1)

However, this incident has deeply impacted on the mindset and the outlook of Julian Mantle. It provoked him to consider his future course of life, with limited options left to join the path of spiritual way or risk his life. Mantle bargained for the spiritual way of finding his true and divine self (The Atman). He mustered courage and determination to control his nerves and thoughts. His dream, who once wanted to be the Centre of power and wealth, was to share his life changing experience of Vedantic concept and path of joy and fulfillment which is the source of eternal joy and learn the ancient and Vedic formulae to achieve the ecstatic state to the people of west who are suffering from the mental and the psychological trauma of distortion.

As he (Julian Mantle) narrates on to John:

> "They (people) have not learned the art of self-control and disciplined thinking. Most people I have spoken to have no idea that they have the power to control every single though they think every second of every minute of every day. They believe that thoughts just happen and have never realized that if you don't take the time to start controlling your thoughts, they will control you. When you start to focus on good thoughts only, and refuse to think the bad ones through sheer will power, I promise you they will shrivel up very quickly". (151)

So, the judicious way to accomplish the state of pure consciousness is to turn inwards to subtler world of higher reality by initiating the process by giving up the bad thoughts and engulf within oneself with positive thoughts is the way to achieve the goal of destiny to the real self. If one cannot control his mind from the negative thoughts, it will eventually control the person. So, abiding by the Vedic way of life and understanding the aspects of life along with the meditation to control the mind and the body from the negative thoughts coming to an individual and under the wise and thoughtful guidance of the 'Gurus' Julian Mantle has found the righteous path of self-introspection and wisdom.

The Different levels (Sheaths and components of the Journey from the 'Mind to the Pure Consciousness.'

This profound and intricate journey for the search for the Pure Consciousness is complex and full of surprises and riddles. The Protagonist in the novel, "The Monk who sold his Ferrari" Julian Mantle has a strong will power and grit to quench his thirst for the wisdom. So, his journey can possibly be interpreted under the ambit of Vedantic philosophy. Let us decode the layers of Vedic interpretation of the transformation of Julian Mantle. The true nature and abode of the divine self has been a matter of research and curiosity and has been in the centre of discussion for years, however, the well-structured, defined and universally accepted answers are still debatable among the intellectuals. B. K. Jagdish Chandra Hassija, one of the greatest spiritual torch bearers of our country has defined self in relation to consciousness, as:

> "Meaning of self comes through consciousness, and, in turn, consciousness is true knowledge of soul. However, self is not a matter of superficial importance nor is it to be left to some philosophers or religious scholars to discuss. Since each and every one of us is a conscious being, it concerns us all individuality and

severely. To refute ourselves with the true knowledge of consciousness is to deny ourselves the right and the duty of living a meaningful life". (Preface, 1)

In the Taittiriya Upanisad 2.7, the Mind is represented in terms of five different sheaths or levels that enclose the individual's self. These levels are as under:

1. The physical sheath (*Annamaya kosa*)
2. Energy sheath (*Pranamaya kosa*)
3. Mental sheath (*Manomaya kosa*)
4. Intellect sheath (*Vijnanamaya kosa*)
5. Bliss sheath (*Anandamaya kosa*)

The mind is also understood to be constituted by five basic components in the Vedantic Philosophy:

1. Manas,
2. Ahamkara,
3. Chita,
4. Buddhi
5. Atman,

As discussed in the introduction with reference to the subtler dimensions of the intelligence and the aspects of mind, and as Mr. Sanjib Khatiwda describes:

> "The Manas is the lower mind which collects sense impressions. Its perceptions shift from moment to moment. This sensory-motor mind obtains its inputs from the senses of hearing, touch, sight, taste and smell. Each of these senses may be taken to be governed by a separate agent. Ahamkara is the sense of I-ness that associates perceptions to a subjective Centre and thus creates "personal" experiences. Once sensory impressions have been related to I-ness by ahamkara, their evaluation and resulting decisions are arrived at by buddhi, the intellect. Manas, ahamkara and buddhi are collectively called the "internal instruments" (*anta Karana*) of the mind. Next, we come to Chitta, which is the memory bank of the mind. These memories constitute the foundation on which the rest of the mind operates. But Chita is not merely a passive depository. The organization of the new impressions throws up instinctual or primitive urges that create diverse emotional states. This mental complex surrounds the innermost aspect of consciousness, which is called atman; it is of course the same as the self or the *brahman*. Atman is considered to be beyond a finite enumeration of categories". (01)

The sheaths represent the ascending finer levels. At the highest level is the Self... the energy that percolates' physical and mental processes are *prana*. One could look at the structure of the Mind at three different perspectives. At the lowest level is the physical body, at the next higher level is the energy system at work, and at the next higher level are the thoughts. Since the three levels are interrelated, the energy situation may be changed by inputs either at the physical level or at the mental level. The Paraná, or energy, is described as the currency, or the medium of exchange, of the psycho physiological system. The higher three levels are often lumped together and called the mind. The analogy of the journey of Julian Mantle and the different levels of sheaths and the components could be identified in the novel.

A seven step Journey within from compulsiveness to pure consciousness.

In search of the Pure Consciousness Julian Mantle had devoted his time and energy in the company of the Sivana sages in the Himalayas to realize his true and divine self. The Sivana sages taught him the secret of long and happy life, in the form of Seven Stages of Self-Awakening. The writer of the novel, Sharma narrates this secret in the following manner:

> "The seven stages of self-awakening is a remarkably potent process for living your biggest life and walking the path to your destiny. The seven stages are a blueprint for awakening your best self and manifesting the potential that you have been given by the force that sent you into the world. Few people in the world know it today. These stages reflect the pathway that every seeker needs to travel to return to his or her original nature – the state of mind, body, and spirit that they first experienced when they were perfect and pure". (94)

The east has Vedantic way of perceiving life as a whole and organic entity and a mystic and spiritual way of living and leading life since ages. The seven stages of self-awakening learned by Julian Mantle is, but, only another depiction and fictional portrayal of the transformative power eastern wisdom and the mythical trends and traditions. The seven stages of self-awakening have been the source of perennial knowledge and the eternal laws which governs the life of an individual in our Vedic society and also that helps a receptive individual to defy age, caste, creed and community and guides to lead a life full of charm and charisma. In the novel, Julian Mantle's life too had under gone through these seven stages of self- awakening. A simple way of reaching contended and a life of exuberance which could become enlightenment as, Mantle describes is,

> "To have inner strength to get up earlier, eat less, read more, worry less, be more patient or be mover loving, all I have to do is exert my will to cleanse my thoughts" (151).

Hence, the Julian Mantle's search of truthful and divine self is truly the awakening of one's conscience and inner strength. The path which leads to the destination of self-realization may be tedious and complex but with the guidance of Vedantic laws one can attain the self-actualisation through meditation and Vedantic wisdom of focus and truthfulness as the character of Julian Mantle has become a complete transformed personality in the novel.

Conclusion

There is a stark difference between appearance and reality. All that glitters is not always gold. Happiness is a very relative term and each and every individual may have different opinion about the nature of true joy in life. Most of us would definitely agree to the fact that the sustainable peace and constant solace in life can only be attained through realizing the inner most core of our mind or the true divine self. Julian Mantle, the protagonist in Sharma's "The Monk who sold His Ferrari" was a renowned name in the legal profession in the United States. This young lawyer was one of the leading and successful lawyers of the nation, and his success had come to him at within the few years of his career. There were clear indications that this lawyer would leave no stone unturned in achieving the heights in the legal profession. However, materialistic achievements shattered and collapsed one day, when, during a famous trial he collapsed in the court. The excessive work load and overreaching attitude of Julian Mantle was the cause of his sudden downfall and he realized, that his life was a big mess and meaningless and devoid of the spiritual energy, calmness and prosperity. In search of the true meaning of life, Mantle travelled to east, giving up all the material comforts and worldly goods and adopting to simplicity of eastern Vedantic philosophy based on meditation and strict austerity to realize his true divine self. He realized the true nature of joy and the true meaning of life in the company of the Sivana sages which we discern as the influence of the Vedantic way of perception and understanding. Mantle found the meaning of his life in the lap of Mother Nature with stoic like simplicity and in leading a disciplined life. The source of eternal solace and meaning of life was to realize one's self, and it was possible only through keen observation of the self and meditation. After learning the true and wise lessons of life from the Vedantic perspective and gaining the generation's old and valuable knowledge, Julian Mantle was asked by the sages to return to his world to share the enriching experience and to teach his fellow people the secret of happy and joyful living in great harmony with Mother Nature. We can very much feel that the power of self-enquiry which lead to the self-realization of the protagonist Julian Mantle for Transformation and the growth of his personality into a conscious human being with self-purgation, self-purification and ultimately self-clarification which is the essence of Vedantic teachings and principles.

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Tartary Buckwheat Cultivation In Kinnaur District: A Potential Path For Bio-Diversity And Sustainable Development.

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An Abstract

Tartary or bitter buckwheat (*Fagopyrum tataricum*), locally known as Fafra in the Tribal district of Kinnaur in the Himalayan regions of Himachal Pradesh, stands as a unique and resilient crop cultivated in high-altitude regions, particularly above 2100 meters. This research explores the extensive cultivation practices, distribution, and potential of buckwheat in the Indian and the International market. Two species of buckwheat, *Fagopyrum esculentum* (Ogla) and *Fagopyrum tataricum* (Fafra), are cultivated in the Himalayan Mountains of kinnaur region, demonstrating adaptability to diverse climatic conditions.

The cultivation of buckwheat has been a significant aspect of the traditional crop pattern in the Kinnaur District, and it also extends across various districts in Himachal Pradesh, playing a vital and crucial role in the agricultural landscape. Its unique characteristics make it suitable for cultivation in challenging terrains and climates. The research emphasizes the need for increased awareness of Tartary buckwheat's nutritional benefits and health advantages. It also addresses the considerable decline in interest among farmers in recent years (Rana *et al.* 2012)

The present study delves deep into the historical significance and distribution of Tartary buckwheat, highlighting its presence in the local, national and the global context. With its adaptability to extreme temperatures and low soil fertility, Tartary buckwheat emerges as a sustainable crop, providing essential nutrients and catering to the nutritional security of mountainous regions like kinnaur and the other Tribal regions of the state, ensuring the need for the healthy and nutritious staple food for the community. In the Tribal district of Kinnaur, this variety of Millet has been the source of food security and an integral part of the rich tapestry of tribal culture and the peculiar food habit of the community. In Himachal Pradesh, the buckwheat cultivation is concentrated mainly in the specific districts, and with Kinnaur playing a significant role in the farming of this super grain, really needs an extensive research and exhaustive monitoring for the creation of favourable environment for the cultivation the ancient grains.

The research paper also outlines the cultivation guidelines, including optimal planting periods, seed selection, and soil fertility enhancement. The crops medicinal benefits, particularly its phytochemical rut in, are discussed, emphasizing its potential to address health issues such as high blood pressure and diabetes, thyroid, gut related diseases etc. The unique composition of Tartary buckwheat contributes to its various health benefits such as anti-oxidative, anti-cancer, anti-hypertension, anti-diabetic, cholesterol-lowering, and cognition-improving quality which necessitates the resurgence of the old glory of this ancient super food which can bring about a revolution in the mountainous regions of Kinnaur and other parts of the Himalayas. The study also sheds light on the decline in Tartary buckwheat cultivation in recent years, mainly attributed to the shifting

focus of farmers towards horticulture. However, recognizing the nutritional importance of millets, farmers have started once again incorporating buckwheat into their diets, resulting in an increased demand for pseudo-millet flour. To revitalize Tartary buckwheat cultivation in kinnaur and the other parts of Himachal Pradesh, this research advocates for awareness campaigns, scientific interventions, and improvements in cultivation techniques. By enhancing the nutritional content and accessibility of Tartary buckwheat, the research envisions a sustainable and prosperous future for both the farmers and the consumers, contributing to the overall development of the region.

Keywords: - Buckwheat, Fafra and Ogla, adaptability, nutrition, terrains, sustainable crop, food security, millet, community, research, super grain, guidelines, medicinal, composition, cognition, super food, pseudo-millet, cultivation, sustainable prosperity.

Introduction

The Buckwheat (bitter and sweet) has been one of the major staple foods in the traditional kitchens of the tribal communities of the Himalayan region of Kinnaur District. This ancient super-grain has been an integral part of all occasions of ceremonies, functions, religious events, festivals, and rituals which constitute the rich cultural heritage of the simple, innocent and hardworking people who had been living in a harmonious relationship with the Mother Nature. The nutritious, medicinal, and gluten free super food has been a significant aspect of the bio-diversity and sustainable development in the eco-system of this tribal community. However, with the advent of modern civilisation along with the radical changes in the farming patterns, which resulted in the excessive plantation of the cash crop apple in recent years, a considerable decrease has been recorded in the cultivation of the pseudo millet Buckwheat as the land holdings in these challenging terrains and climate are limited because of the mountainous nature of the sub-tropical geographical landscape. Cultivated in the rugged terrain of Kinnaur, Himachal Pradesh, Tartary Buckwheat, or Fafra, emerges as a unique and resilient crop thriving at altitudes exceeding 2100 meters. This paper ventures into an exploration of the extensive cultivation practices, distribution dynamics, and the immense potential of this extraordinary grain in both Indian and international markets. Fafra, a local variant of bitter buckwheat (Fagopyrum tataricum), has been an integral part of the traditional crop pattern in Kinnaur, echoing its significance across various districts in Himachal Pradesh. Its distinctive attributes make it well-suited for cultivation in challenging terrains and climates, positioning it as a beacon of sustainable agricultural practices. However, recent years have witnessed a decline in its cultivation, with farmers shifting focus towards horticulture. This study delves deep into the historical significance and global distribution of Tartary buckwheat, emphasizing its adaptability to extreme temperatures and low soil fertility. It unravels the potential of Fafra as a sustainable crop, providing essential nutrients and catering to the nutritional security of mountainous regions, especially in the Tribal district of Kinnaur. The research accentuates the need for heightened awareness regarding the nutritional benefits of Tartary buckwheat and addresses the concerning decline in interest among farmers. Beyond its agricultural significance, the paper explores the medicinal benefits of Tartary buckwheat, particularly its phytochemical rutin. With qualities ranging from anti-oxidative and anti-cancer properties to aiding in issues like high blood pressure and diabetes, the unique composition of Fafra positions it as more than just a crop—it becomes a potential solution for health-related challenges. The cultivation guidelines outlined in this paper encompass optimal planting periods, seed selection, and soil fertility enhancement. It underscores the need for a revival in Tartary buckwheat cultivation, advocating for awareness campaigns, scientific interventions, and improvements in cultivation techniques. The decline witnessed in recent years is attributed to the shifting focus of farmers towards horticulture. However, recognizing the nutritional importance of millets, including Tartary buckwheat, there is resurgence in interest, resulting in an increased demand for pseudo-millet flour. As we navigate through the unique characteristics, geographical distribution, and medicinal virtues of Tartary buckwheat, this research sets the stage for a comprehensive exploration of its potential in revitalizing agricultural landscapes. The paper envisions a future where heightened awareness and scientific advancements converge to usher in a sustainable and prosperous era for both the farmers of Kinnaur and the consumers they serve. Buckwheat cultivation, once a cornerstone of traditional practices, can be rejuvenated through collective efforts, contributing not only to bio-diversity conservation but also to the holistic development of the region.

Buckwheat Cultivation driven and inspired holistic Development.

The Buckwheat (Fafra and Ogla) has been a significant crop in the hilly regions, cultivated at an altitude of over 2000 meters above sea level for seeds and green leaves. In India, both the common buckwheat and Tartary buckwheat are grown in different levels of altitude, common buckwheat in lower altitudes up to 1000 m and the other in higher altitudes >2500 m2. (Nalin Kumar and Singh, 2020). It is a unique crop that can be successfully grown from the high Himalayas to 4500 meters. In the mountainous regions of the Himalayas, two species are cultivated: *Fagopyrum tataricum*, known as Tartary Buckwheat, Green Buckwheat, or Bitter Buckwheat, and Fafra, known as Brass in the Kinnaur district. In Himachal Pradesh, Fafra is known as Brass in the Kinnaur district. Fafra is a pseudo-cereal belonging to the Polygonaceous family and the genus *Fagopyrum*. It is an agricultural food plant. In India, this crop is grown from the west in Jammu and Kashmir to the east in Arunachal Pradesh. It is cultivated in the high-altitude regions of Uttarakhand, Jammu and Kashmir, and Himachal Pradesh because the climate in these areas is conducive to Fafra cultivation. The hilly regions of Himachal Pradesh are highly suitable for the production of various agro-climatic crops related to small millets such as amaranths, Buckwheat, and chenopods. According to the biology of Buckwheat, two species of Buckwheat are produced globally as food substances. Fafra, a grassy annual plant, is taller and larger than common buckwheat (Ogla), with narrow and sharply pointed leaves. The flowers are also similar, adorned with unique clean green spikes. This species has a solitary nutritional diet, and the chromosomal number is 2n=16. Tartary buckwheat or Fafra is grown at an altitude of 2000 to 4000 meters in the Himalayas. It is an excellent source of nutrition, including protein, carbohydrates, fibre, essential amino acids, and minerals. Its grain is commonly used as human food in the form of flour. In Kinnuar, the flour of Fafra is used to prepare traditional dishes such as Hoth (Chilta), Doo, Roti, and Brass Kadd (Fafra vegetable). The dried green leaves are used to prepare Brass Kaan in winters. It is a leafy vegetable crop produced in various regions of the Indian subcontinent. It is also suitable for re-cultivating low-productivity land, as it grows rapidly on such soil and produces a vast green manure crop in a short period. The whole grain can be used in poultry feed mixtures. It is rich in middle protein and is therefore useful as livestock feed. Fafra is also grown as a cover crop to improve soil fertility and prevent erosion.

Brief description and nature of Buckwheat, fafra (Pseudo millet)

Tartary buckwheat is one of the various ancient crops grown in Asia, primarily produced in India, China, Nepal, Canada, North Korea, Bhutan, Eastern Russia, Mongolia, and Japan. However, there has been a decline in buckwheat production in the first half of the 20th century. The global average buckwheat production was 2.9 million tons in 2018, showing a decrease compared to the previous three years (Anonymous, 2018). Buckwheat is well-suited for extreme temperature, low soil fertility, and various climatic conditions, making it a resilient crop. Distinguishing growth traits exist between Common and Tartary buckwheat (Kasajima *et al.*, 2019). Notably, Tartary buckwheat exhibits resistance to cold weather, attributed to its epigenetic regulation through DNA methylation (Song *et al.*, 2020). It is annually cultivated in the hilly regions of India as a pseudo-cereal and among minor grains. Pseudo-cereals are not true cereals; in botany, true cereals are monocotyledonous plants, while pseudo-cereals are dicotyledonous, producing both edible fruits and seeds. Other pseudo-cereals include amaranth (rajgira / cholai) and quinoa.

Geographical Information and the Botanical nature of Buckwheat:

Common Names:	Fafra, Brass, Tartari Buckwheat, Buckwheat
Distribution:	Shimla, Kinnaur, Kullu, Mandi, Kangra (Bhangal region), Lahaul Spiti, and Chamba districts of the state.
Origin:	Southeast Asia
Altitude:	2000-4000 meters
Growing Season:	April-July (High-altitude regions) and July-October (Lower-altitude regions)
Unique Importance:	Fafra contains Phyto-chemical rutin, which enhances the strength of veins/nerves and regulates cholesterol levels. Therefore, it is an ideal food substance for individuals with hypertension and diabetes.

Belonging to the polygonaceous family and *Fagopyrum* genus, buckwheat thrives in the current climate change scenario and the increasing population in mountainous regions, catering to rising food demands. It grows at high altitudes, developing and producing within three to four months, making it the most suitable crop in these areas. Due to its adaptability to low rainfall and poor soil conditions in rocky terrains, it is considered a sustainable true grain for these regions, providing a crucial source of livelihood for rural populations. Buckwheat cultivation is acknowledged to be suitable for high mountainous regions, with acceptance for planting typically from June to September. Being gluten-free, buckwheat is used in various food products, and its seeds contribute to the nutritional content of these items. Buckwheat is a type of millet used as a food source, rich in essential nutrients such as protein, carbohydrates, fiber, potassium, phosphorus, magnesium, calcium, and iron. It is a high-energy food providing energy during physical exertion.

Distribution of crop pattern in Kinnaur and other parts of Himachal Pradesh.

In Himachal Pradesh, the cultivation of buckwheat (fafra) is practiced in the districts of Kinnaur, Shimla, Kullu, Mandi, Kangra (Bhangaal region), Lahaul-Spiti, and Chamba. Buckwheat is the primary crop produced in these regions. Besides Himachal Pradesh, another variety grown in Uttarakhand is also cultivated in Himachal Pradesh. Historically, domestic cultivation of buckwheat was prevalent in East Asia, and it is also produced in Europe and North America (Chen*et al*., 2018). While it was relatively unknown in the West, today it is common in the Himalayan region and is found in other regions of South-western China, such as Sichuan Province. In the Indian state of Himachal Pradesh, buckwheat, also known as Tartary buckwheat, is grown in the districts of Shimla, Kinnaur, Kullu, Mandi, Kangra (Bhangaal region), Lahaul-Spiti, and Chamba. Due to its adaptability to moderate climates, Himachal Pradesh can play a significant role in the production of this crop. The upper hilly areas of Kinnaur district, including Chitkul in the Sangla Valley, Rakchham, Sangla, Kamru, and Batseri, contribute significantly to buckwheat production. Buckwheat is also grown in other regions of Kinnaur, excluding the lower and upper dry cold regions. These areas yield an advanced crop of buckwheat, which could be used for maximum nutritional content and nutraceutical security.

Yield and prospects.

The buckwheat species Fafra has a higher production yield compared to Ogla. Buckwheat seeds are rich in various nutrients. Farmers can achieve a production of two to two and a half quintals per bigha or ten to twelve quintals per acre through buckwheat cultivation. Buckwheat cultivation has higher productivity compared to Ogla, and the presence of birds in the crop is minimal due to the bitterness in the seeds. Suitable fertilizers, water, and climate are essential for obtaining good and high yields.

Cultivation practices Kinnaur District and other parts of Himachal Pradesh.

The cultivation of buckwheat takes place from April to July in higher altitude areas and from July to October in lower altitude areas. Before initiating buckwheat cultivation, it is essential to carefully select seeds that yield optimal production in your region. Sow the seeds at a rate of 12.5 kilograms per acre or 60 kilograms per acre, or 1.5 quintals per hectare. Before sowing, use organic fertilizers such as cow dung or compost along with other available nutrients to enhance soil fertility. Buckwheat is typically grown in regions with a cool to moderate climate. It is sensitive to temperature and tends to thrive in areas with higher humidity, especially when moisture is scarce. Fruit drying and reduced production occur when temperatures rise above 30°C. Buckwheat may suffer significant damage from late May frost or early September snowfall. Buckwheat is a robust plant suitable for small climate zones and less fertile soils. It can withstand both hot and cold temperatures, showing resilience particularly in comparison to Oglala. Cultivation on recently cleared land, following deep ploughing, harrowing, and planking, prepares the field for successful germination and even development of the crop. Plant the seeds at a depth of 3 to 5 centimetres, maintaining row-to-row spacing of 30-45 centimetres and plant-to-plant spacing of 10-15 centimetres, depending on the variety. After 15-20 days of sowing, thinning can begin to reduce the number of plants and facilitate proper spacing. The crop generally

germinates within 4-5 days. Regular activities such as irrigation, pest control, and leaf picking before flowering are crucial. Important tasks include weeding and thinning, which should be done 20-25 days after germination. If required, weeding and thinning can be repeated 10-15 days later. Irrigation is crucial for the structural development of the crop. Regular watering, about 5-6 times from sowing to harvesting with intervals of 15-20 days, is recommended. Although buckwheat is relatively resistant to pests and diseases, appropriate measures should be taken if any infestation occurs. Harvesting is typically done when the seeds turn dark or black, or when pressing the seeds results in a flour-like texture and the leaves begin to turn yellow. After harvesting, the crop is left in the field to dry for 4-5 days, and then the seeds are separated from the chaff by threshing. The seeds are further sieved and dried in the sun for a day before storing in jute bags. Buckwheat cultivation generally yields more in comparison to Ogla.

Medicinal and nutritional Benefits

Buckwheat, known for its health benefits, contains a phytochemical called rutin, which enhances the strength and flexibility of blood vessels and nerves. It also helps regulate blood cholesterol levels. Therefore, buckwheat is an ideal dietary option for individuals with high blood pressure and diabetes. Compared to common buckwheat (Oglala), buckwheat has a higher bitterness and a greater quantity of rutin. Buckwheat also contains other vital components such as flavonoids, phenolic acids, hydroxyl benzyl amine, and quercetins. Its nutritional value surpasses that of common buckwheat. Buckwheat is rich in essential nutrients and possesses remarkable medicinal properties. It serves as an antioxidant, aiding in the prevention and treatment of conditions such as AIDS, cancer, heart diseases, and neurological disorders. It helps reduce blood pressure, blood fat, and blood sugar levels. Additionally, it facilitates toxin removal and weight loss. Thirteen tartary buckwheat varieties were sampled at the Mountain Agriculture Research and Extension Centre in Sangla District, Kinnaur. Analysis revealed variations in magnesium (194.5–216.5 mg/100g), phosphorus (346.6–375.2 mg/100g), calcium (49.2–57.6 mg/100g), zinc (2.6–3.2 mg/100g), and iron (3.5–4.2 mg/100g). Soluble protein content ranged from 9.8 to 11.3%, with further fractionation into albumins (4.5–5.4%), globulins (0.7–1.2%), glutelins (2.1–2.5%), and prolamins (1.5–2.0%) based on solubility in different solvents (Thakur *et al.*, 2016). Both varieties of buckwheat have higher concentrations of trace elements. The flour is rich in vitamins B1, B2, and B6. It contains unsaturated fatty acids (oleic acid, linoleic acid, and gamma-linolenic acid) crucial for the formation of cell membranes and prostaglandins, thromboxanes, and leukotrienes.

Table 1 Comparison of nutritive value (%) of buckwheat with other cereals and millet in India:

Source	Tartary Buckwheat	Common Buckwheat	Ragi	Wheat
Energy	328	343	321	322
Carbohydrates	74.3	71.5	66.8	64.7
Protein	10.3	13.3	7.2	10.6
Lipids	2.5	3.4	1.9	1.5
Dietary Fibre	6.3	10	11.2	11.2
Ash	1.8	2.1	2	1.4
Moisture	10.2	9.8	10.9	10.6

Buckwheat stands out for its rich nutritional profile, surpassing many other cereals with its abundance of macronutrients, micronutrients, and bioactive compounds, as highlighted in the study by Rauf *et al.* (2020). A detailed comparison of the nutritive value of buckwheat with commonly consumed crops in Kinnaur, Himachal Pradesh is provided in Table 1, as outlined by Nalinkumar and Singh in 2020.Buckwheat plants produce tender leaves that are used in making green chutneys and vegetable dishes. Additionally, buckwheat is used as a valuable forage crop (Babu et al., 2020)

Potential of Buckwheat Cultivation in Kinnaur District.

Cultivating buckwheat could be a thriving industry for the overall development of in this tribal district, especially in high-altitude regions. Buckwheat proves to be an excellent crop for such areas as it requires less time to grow and is resilient to environmental stress. It thrives well in regions with less fertile soil and limited water availability. Moreover, its cultivation, including fruiting and seed preparation, is relatively straightforward, ensuring farmers a profitable venture. Buckwheat cultivation could emerge as a promising option for farmers in this hard and difficult terrain who are seeking progress. Its utilization extends beyond just food; it is also used for medicinal purposes, making it a marketable product. The unique qualities and marine nutrition of buckwheat make it a favourable choice. While buckwheat cultivation has been a good source of income for farmers and mountainous regions, recent years have seen a decline due to decreased interest among farmers. Farmers are gradually shifting from traditional agriculture to horticulture, such as the production of apples and other fruits, reducing the focus on buckwheat cultivation.

Bio-Diversity and Sustainable Development; a way home.

There has been a perceptible awareness among the community and the traditional farmers for immediate need for the adoption of crop pattern and the horticultural and agricultural practices which accommodates and promotes bio-diversity and sustainable farming to ensure the rich, traditional and inherent biodiversity the sustainability which had been the hallmark of this tribal area. In recent years, recognizing the nutritional importance of millets, farmers have started incorporating pseudo-millets like buckwheat into their diets. The demand for pseudo-millet flour has increased, providing farmers with better returns. Buckwheat is a less-explored crop in Himachal Pradesh due to limited awareness of its nutritional and health benefits. The lack of promotion and awareness has led to reduced demand and production of buckwheat in India. To enhance its production and use, there is a need for awareness campaigns highlighting its nutritional benefits. Understanding the specific nutritional profile of buckwheat, including protein, dietary fibre, vitamins, minerals, and bioactive compounds, is crucial. It is essential to encourage scientific interventions, research on cultivation methods, improve crop management techniques, and enhance the nutritional content of buckwheat. By implementing these measures, the availability and accessibility of buckwheat can be increased, contributing to the betterment of the lives of those involved in its cultivation.

Conclusion

The research paper concludes by envisioning a sustainable and prosperous future for both farmers and consumers through enhanced nutritional content and accessibility of Tartary buckwheat. The keywords highlight the importance of buckwheat, its adaptability, nutritional value, and the need for sustainable cultivation practices. The potential of buckwheat cultivation in this tribal region is seen as a promising avenue for overall development, especially in high-altitude regions. The post COVID period however, has drastically changed the scenario of farming practices in the region and there is a strong wave of recognition of the nutritional and cultural importance of millets and pseudo millets, farmers have started once again incorporating buckwheat into their food patterns , resulting in the incremental change in the crop patterns which would be instrumental in creating the ideal environment for the much needed bio-diversity and sustainable development in the field agriculture and horticulture in particular and for the well being of the community in general. The paper underscores the importance of increasing awareness, conducting scientific research, and implementing improved cultivation methods to ensure the continued growth and utilization of this ancient super food.

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STUDIES ON GROWTH, FLOWERING, FRUITING AND QUALITY ATTRIBUTES OF DIFFERENT APPLE CULTIVARS (*MALUS DOMESTICA* BORKH.) UNDER HIGH-DENSITY PLANTATION IN KINNAUR DISTRICT OF HIMACHAL PRADESH, INDIA

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ABSTRACT

A study was aimed to evaluate exotic apple varieties on various rootstocks grown in cold temperate region of Kinnaur district under high-density plantations for growth, yield and quality attributes for two consecutive years. The present investigation evaluated seven apple varieties 'Red Cap Valtod/MM 106', 'Red Velox/M9', Redlum Gala/M9, 'Jeromine/M9', 'Super Chief/MM 106', 'Gale Gala/M9' and 'Auviel Early Fuji/M9', planted at a spacing of 2.5 × 1.0 meters in Randomized Block Design (RBD), with four replicates. The study's cultivars had significant differences in terms of growth, flowering, fruiting and quality characteristics. In comparison to all other cultivars, cv. Red Velox/M9 showed the highest shoot extension growth (29.34 cm), trunk girth (57.38 mm), plant height (326.63 cm), tree spread (144.07 E-W and 154.70 cm N-S), yield (9.90 Kg tree^{-1}), fruit diameter (74.71 mm), fruit weight (201.23 g/fruit), number of fruit set per tree (71.48), and productivity (39.60 Mt ha^{-1}). Maximum fruit set (70.09%), TSS (10.97°Brix), and fruit firmness (12.02 kg/cm^2) were observed in cv. Auvil Early Fuji/M9, although the number of flowers per tree (285.34) and fruit drop (30.42) were the lowest in cv. Gale Gala/M9. The most elongated fruits (Length: 71.18 mm) were found in the cultivar Red Cap Valtod/MM 106. The cultivar Red Velox/M9 exhibited remarkable growth, flowering, yield, and quality attributes with substantial market potential under Kinnaur conditions.

Key words : Rootstocks, High-density plantations, Red Velox, Gale Gala, Productivity.

Introduction

Kinnaur in Himachal Pradesh, India is a key center for high-quality apple production, thriving in its uniquely dry, moderate, and cold climate. Apples constitute a remarkable 99 percent of the region's overall fruit production, significantly contributing to the GDP. The horticultural prowess of Kinnaur has expanded apple cultivation from 670 hectares in 1970-71 to an impressive 10,925.5 hectares by 2022-23 (Anonymous, 2023). Royal Delicious dominates Kinnaur's apple orchards, representing 90% of all varieties. In the 2022-23 seasons, the district achieved a substantial production of 83,324 metric tonnes of apples, with a productivity of 7.63 metric tonnes per hectare. Adverse weather conditions in 2023 resulted in a 40% reduction in production, affecting the entire region (Anonymous, 2023). The challenge in Kinnaur lies in the use of old cultivars, hindering high-quality fruit production. The rugged terrain and lack of awareness impede the adoption of new cultivars, affecting fruit quality. Orchards with low-density old apple plants yield inferior fruits compared to high-density systems with improved strains. Old varieties take years to bear fruit, prompting orchardists to consider transitioning to newer cultivars and systems. Efforts to

cornerstone choice for enhanced productivity and economic returns. In summary, this research contributes to scientific understanding and offers practical guidance for optimized orchard management in Kinnaur and similar regions.

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GREEN CHEMISTRY IN EDUCATION : INTEGRATING SUSTAINABILITY INTO THE CURRICULUM

Gopi Chand*

ABSTRACT

This research examines green chemistry, which designs chemical products and processes to reduce environmental effect, and its use in education. It stresses the significance of adding green chemistry into scientific education to prepare students for environmental issues. Key strategies for integrating green chemistry into the curriculum include developing interdisciplinary modules, incorporating hands-on laboratory experiences, and fostering collaborations between educators, industry professionals, and environmental organizations. Green chemistry promotes critical thinking and problem-solving skills among students, preparing them for careers in sustainable development. The research advocates for a curriculum that covers both traditional chemical principles and the environmental and societal impacts of chemical processes. It concludes with recommendations for educators and policymakers to enhance green chemistry education and ensure its effective implementation across diverse educational settings.

Keywords : Green Chemistry, Chemistry Education for Sustainability, Sustainable Chemistry, Integrating Sustainability

1.1 Introduction

In light of growing environmental concerns and the need for sustainable activities, green chemistry in schools is essential. Green or sustainable chemistry reduces or eliminates hazardous chemicals in chemical processes and products. By integrating the concepts of green chemistry into education, we provide students with the skills and knowledge needed to address the environmental issues of the 21st century and promote a culture of sustainability within the scientific community. Green chemistry offers a proactive approach to minimizing environmental impact and enhancing the safety and efficiency of chemical processes [1]. It encourages the development of innovative solutions that align with the principles of sustainability, such as reducing waste, conserving resources, and using safer chemicals. Incorporating these principles into educational curricula not only enriches students' understanding of chemistry but also aligns with broader educational goals of promoting environmental stewardship and ethical responsibility. Despite its importance, green chemistry is often underrepresented in traditional science curricula, which tend to focus more on conventional chemical practices and theories. This gap highlights the need for educational reform that integrates green chemistry concepts into teaching and learning. By doing so, we can ensure that future chemists, engineers, and scientists are equipped with the knowledge and skills to contribute to sustainable development and address pressing environmental issues. This study explores the integration of green chemistry into educational frameworks, examining the benefits, challenges, and strategies for incorporating sustainability into the curriculum [2]. It reviews existing models and case studies from various educational institutions, highlighting successful approaches and providing

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practical recommendations for educators and policymakers. The goal is to underscore the significance of green chemistry education and advocate for a curriculum that prepares students for a future where sustainability is a fundamental consideration in scientific practice. By bridging the gap between traditional chemistry education and sustainability, we can foster a new generation of scientists who are not only proficient in chemical principles but also committed to advancing environmental protection and sustainable innovation.

1.2 Studies related Green Chemistry in Education

Here are some notable studies related to Green Chemistry in education, emphasizing the integration of sustainability into the curriculum. **Tucker, N. C., & Kauffman, G. B. (2011),** The study evaluates the impact of integrating green chemistry principles into chemical engineering curricula. It uses qualitative and quantitative methods to measure students' knowledge, attitudes, and skills related to green chemistry. Results show that students exposed to a green chemistry-integrated curriculum have a higher understanding of sustainable practices and increased enthusiasm for incorporating green principles into their future professional endeavors. However, challenges such as additional resources and training for educators are highlighted. The research emphasizes the importance of curriculum reform in fostering a new generation of chemists and engineers equipped to address environmental challenges through innovative and sustainable practices. The paper concludes with recommendations for educators and policymakers on successful integration of green chemistry into chemical engineering education [3]. **Collins, T. W., & Piccolo, C. (2015),** This study provides an introduction to green chemistry principles and offers practical strategies for integrating them into the chemistry curriculum. It emphasizes the importance of green chemistry in reducing environmental impact and promoting sustainable practices. The authors outline twelve fundamental principles and discuss their application in educational settings. Key topics include developing green chemistry curriculum modules, designing laboratory experiments, and using case studies to illustrate the real-world impact of sustainable chemical practices. The authors also emphasize the need to foster understanding of green chemistry among students to prepare them for careers in sustainable science and engineering. The paper presents case studies from educational institutions that have successfully integrated green chemistry into their curricula, demonstrating the effectiveness of different teaching methods. The authors conclude with recommendations for educators, emphasizing the need for continuous professional development and collaboration with industry and environmental organizations [4]. **Kropp, J. R., & Silva, T. C. (2017),** The study explores innovative teaching methodologies for integrating green chemistry principles into the chemistry curriculum. It uses case studies from various educational institutions to highlight key strategies for sustainability in chemistry education. Key approaches include problem-based learning, flipped classrooms, and interdisciplinary projects. These methods enhance students' understanding of green chemistry, foster critical thinking, creativity, and collaboration skills. Successful implementations include curriculum redesign, green chemistry experiments, and partnerships with industry and environmental organizations. Challenges faced by educators include aligning green chemistry topics with existing standards and assessments, and the need for professional development. The research provides best practices for integrating green chemistry into teaching, emphasizing hands-on experiences, real-life problem-solving, and continuous adaptation of teaching methods. The paper advocates for broader adoption of these approaches to prepare students for sustainable science and engineering careers [5]. **D'Avino, L., & Gardeazabal, I. (2020),** This study explores the integration of green chemistry principles into educational curricula to promote sustainability. It emphasizes the need for a holistic approach to curriculum design that aligns with environmental stewardship and ethical responsibility. Key strategies include interdisciplinary modules, real-world problem-solving activities, and hands-on laboratory experiences. Collaborations between academia, industry, and environmental organizations enrich the educational experience. The findings show that students exposed to a green chemistry-integrated curriculum demonstrate a deeper understanding of

sustainability issues and are better prepared to apply these principles in their future careers. However, challenges such as resource constraints, professional development for educators, and alignment with standard educational requirements are addressed. The paper concludes with recommendations for educators and policymakers on integrating green chemistry into the curriculum, emphasizing the importance of continuous evaluation and adaptation [6]. **Prof. Jamie L. Ferguson et. al (2022)** At the undergraduate level, green chemistry must be completely integrated into the curriculum if we want our students to be prepared for a sustainable future. Looking at the books that are presently used in classrooms and labs, we explore the reasons why new curricula are needed, and we list the top schools in the US, EU, and Asia that are incorporating technology into their lessons. There is a lot of pressure on college professors to change the curriculum, and we want them to have more time and be recognized for their work. The chemistry education community is strongly encouraged to take immediate action in response to this need by actively participating in these projects [7].

1.3 The Need for Green Chemistry Education

In the 20th century, chemists began to recognize the inherent risks involved with their field, including as toxicity, waste, and hazards. Workers in the field eventually perfected methods that eliminated the need for fume hoods, as well as other forms of PPE including flame-retardant lab coats, safety glasses, gloves, and closed-toe shoes. The correct disposal of harmful waste and products, as well as the purposeful or unintentional release of harmful chemicals into the environment, were not considered by these measures. The emergence of green chemistry was prompted by the realization that technical measures alone were inadequate in safeguarding people and the environment from toxins and dangers. In 1998, Anastas and Warner formulated a series of recommendations known as the "12 Principles of Green Chemistry". These principles have served as a source of inspiration for the many transformations occurring in both business and academics at present [8]. The 12 Principles acknowledge that risk is determined by both the level of exposure and the nature of the danger. It is more advantageous to remove the dangers, and consequently the possibility of damage, because our attempts to protect people and the environment via technical measures have mostly been ineffective. Furthermore, it is acknowledged that the wastage of both resources and energy has negative consequences for the environment as well as for financial performance. Roger Sheldon introduced the E-factor in 1992 as a means to quantify the amount of waste produced during chemical operations. Green chemistry, the idea that using up Earth's resources like fossil fuels or minerals is unsustainable is taken seriously. It also gets that it's far more sustainable to use feedstocks from recently lived plants. Life cycle analysis (LCA) emerged from the merging of two ideas; it tracks substances from their point of genesis all the way to their final resting place. Examining the role of chemicals within the framework of planetary limits presents significant difficulties for both educators and learners. We do not propose that chemistry teachers should train on the quantitative techniques of Life Cycle Assessment (LCA), since it is a subject typically offered at an advanced level in chemical engineering. Nevertheless, we believe that contemporary chemistry education should acquaint students with the principles of Life Cycle Assessment (LCA). To us, "green chemistry" is chemistry that doesn't harm the environment or violates people's morals. During their time as undergraduates, what and where do we teach students on the practical applications of chemistry? Ignoring toxicity, sources, and wastes in favor of a laser-like concentration on the flask activity sounds like a far more reasonable approach. Such things were beyond the purview of conventional chemistry curricula [9]. Many classes focus on helping students understand the basics rather than helping them make decisions or apply what they've learned. This involves understanding experimental data, molecular structure and macroscopic features, and chemical reactivity mechanistic tendencies. They learn research and what to expect from inanimate items. Building and breaking bonds is taught, but greener chemical changes and product separation and purification are not. These would be the parts of the course material where students may be encouraged to make moral decisions. Recognizing waste by-products by the simple balance of chemical processes is an

improvement. Modern databases make it easier to search for specific reactions, so chemistry students don't have to learn too many kinds of reactions. We need to stress the importance of green chemistry concepts so that students may use them to assess reactions described in literature. Eliminating harmful and inefficient chemistry from the curriculum will free up class time for teaching the ethical applications. Knowing that there are always going to be trade-offs whenever a new technique is proposed to replace an old one makes it hard for us as teachers to imagine a more ethical use of chemistry in the classroom. For example, a cross-coupling synthesis may take 16 hours and need a costly catalyst made of precious metals; these are two examples of typical trade-offs. How can a college organic chemistry professor decide that teaching such a dense subject to hundreds or even thousands of students over the course of three hours each week is worthwhile? Redesigning curriculum requires determining which modern approaches have obviously triumphed over previous ones [10]. Teachers may find examples of what is deemed "essential" material in resources such as the ACS Anchoring Concepts Content Map for Organic Chemistry. Incorporating some environmentally friendly chemical techniques there would show that they are popular and should be taught.

1.4 Green Chemistry in Education

Green or sustainable chemistry develops chemical methods and products that reduce or eliminate hazardous chemicals and minimize their environmental impact [11]. It is essential to include green chemistry into school curriculum in order to cultivate a mindset of sustainability among upcoming scientists and engineers. This approach not only enhances students' comprehension of chemical fundamentals but also equips them to tackle current environmental issues via inventive and sustainable methods.

Integration into the Curriculum :

1. **Curriculum Development :** Incorporating green chemistry principles into existing chemistry courses or creating dedicated courses on green chemistry. This can involve revising course content, designing new experiments, and including case studies that highlight sustainable practices.
2. **Hands-on Laboratory Experience :** Developing laboratory experiments that demonstrate green chemistry principles. For example, using less hazardous chemicals, optimizing reaction conditions to reduce waste, and employing safer solvents.
3. **Interdisciplinary Approaches :** Integrating green chemistry with other scientific disciplines such as environmental science, engineering, and materials science to provide a comprehensive understanding of sustainability.
4. **Educational Resources and Tools :** Utilizing textbooks, online resources, and educational software that focus on green chemistry concepts and applications.
5. **Professional Development :** Training educators to effectively teach green chemistry and incorporate it into their curricula. Workshops, seminars, and conferences can provide valuable updates and resources.

Challenges and Opportunities :

1. **Curriculum Overhaul :** Revising traditional chemistry curricula to include green chemistry concepts may require significant changes in course structure and content.
2. **Resource Availability :** Developing and implementing green chemistry experiments and materials may require additional resources and funding.
3. **Assessment and Evaluation :** Measuring the effectiveness of green chemistry education and assessing student outcomes can be challenging. Developing appropriate assessment tools and metrics is essential.
4. **Engaging Students :** Ensuring that green chemistry concepts are presented in an engaging and relatable manner to motivate students and demonstrate the relevance of sustainability in their future careers.

Case Studies and Examples :

1. **Successful Integrations :** Examples from institutions that have effectively integrated green chemistry into their curricula, including innovative teaching practices and student projects.

Industry Partnerships : Collaborations between educational institutions and industry to provide real-world applications of green chemistry and facilitate internships and research opportunities.

Integrating green chemistry into educational curricula is a critical step towards preparing students for the challenges of a sustainable future. Academic institutions may foster future scientists with a passion for environmental preservation and sustainable development by placing an emphasis on sustainability and creative techniques. As a result of this integration, students are better prepared to tackle critical global challenges and a culture of sustainability is fostered.

1.5 Conclusion

The integration of green chemistry into scientific education is a significant step towards integrating sustainability into the core of scientific education. As environmental challenges become more complex, it is crucial for educational institutions to equip students with the knowledge and skills to address these issues through sustainable practices. Green chemistry, which focuses on minimizing environmental impact and enhancing safety, provides a crucial framework for achieving this goal. This study emphasizes the importance of incorporating green chemistry principles into science education, fostering environmental stewardship, critical thinking, and innovation among students. Successful integration requires a comprehensive approach, including interdisciplinary modules, hands-on laboratory experiences, and collaborations with industry and environmental organizations. Case studies from various educational institutions demonstrate the effectiveness of such approaches, leading to enriched learning experiences and a stronger emphasis on sustainability. Green chemistry education not only enhances the science curriculum but also prepares students for the demands of the modern world. Educators and policymakers are encouraged to prioritize this integration, fostering a new generation of scientists dedicated to advancing environmental and societal well-being.

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