



HRMN-99: Transforming India's Apple Landscape

A Success Story

Dr Hariman Sharma





Trust for Advancement of Agricultural Sciences (TAAS)

GOAL

Harnessing the potential of agricultural sciences for the welfare of people of India.

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- To organize workshops, conferences, brainstorming sessions, seminars, policy dialogues and special lectures on emerging issues and new developments in agricultural sciences
- To disseminate knowledge among stakeholders through publication of proceedings, strategy papers, policy briefs and success stories
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Trust for Advancement of Agricultural Sciences (TAAS)

Avenue II, Indian Agricultural Research Institute,
Pusa Campus, New Delhi - 110012

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For copies and further information, please write to :

The Secretary

Trust for Advancement of Agricultural Sciences (TAAS)
Avenue II, Indian Agricultural Research Institute
Pusa Campus, New Delhi 110012
Tel: +91-11-25843243; +91-8130111237
Email: taasiari@gmail.com; Website: www.taas.in

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B6, DSIIDC Complex, Kirti Nagar, New Delhi - 110015
E-mail: vinay.malhotra@gmail.com

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Foreword

In the heart of India's vast agricultural landscape, where age-old traditional practices have long shaped the rhythm of rural life, a remarkable transformation has taken place in the hills of Himachal Pradesh. Dr Hariman Sharma, a visionary farmer from the district Bilaspur, Himachal Pradesh, has achieved what once seemed impossible- redefining the cultivation of apples beyond their traditional boundaries. Through determination, innovation, and relentless experimentation, he pioneered a breakthrough that challenges conventional agricultural wisdom and opens new horizons for apple farming in tropical and subtropical regions. His remarkable contribution not only transformed farming practices but also inspired a new era of sustainable agricultural innovation across India.

The HRMN-99 apple variety, developed through the keen observation, ingenuity and persistent experimentation by Dr Hariman Sharma, has transformed the possibilities of apple cultivation in the plains thriving in regions once considered unsuitable for apple farming. This remarkable innovation not only broadens the geographical scope of apple production but also offers farmers a climate-resilient alternative in the face of rising temperatures and changing environmental conditions.

Dr Sharma's remarkable journey—from nurturing a humble seedling in his backyard to receiving national recognition for his pioneering contribution to apple cultivation—exemplifies the power of grassroots innovation. His experience shows how indigenous ideas, supported by scientific validation and institutional collaboration, can evolve into impactful innovations benefiting farmers and strengthening agricultural diversity.

For aspiring entrepreneurs, Dr Sharma's success story stands as a testament to the transformative power of perseverance, adaptability, and community engagement. By empowering fellow farmers through training and the distribution of over 14 lakh saplings of the HRMN-99 apple variety across 29 states to date, he has nurtured a movement that extends far beyond individual success.



I congratulate Dr Haiman Sharma, *Padma Shri* Awardee for his commendable efforts in documenting this inspiring Success Story, "HRMN-99: Transforming India's Apple Landscape. His remarkable journey exemplifies the power of perseverance, innovation, and determination in challenging conventional wisdom and creating new possibilities for agriculture.

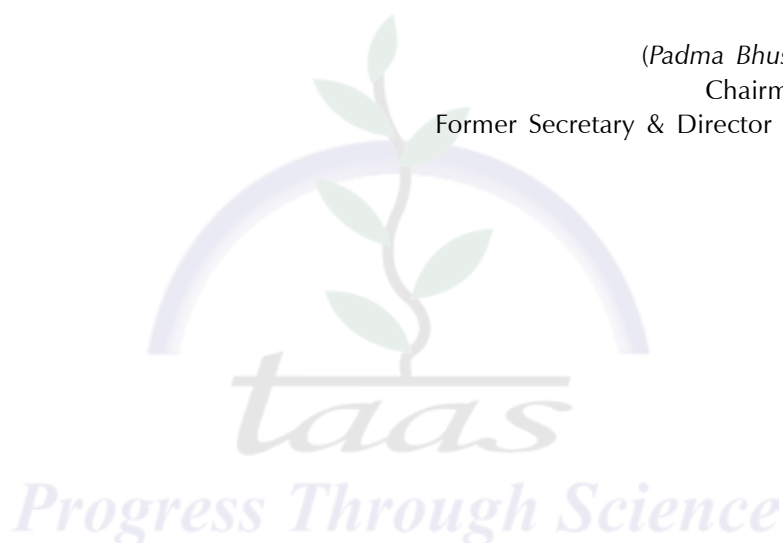
I am confident that this Success Story will serve as a valuable source of inspiration for researchers, farmers, entrepreneurs, and innovators, encouraging them to think differently, remain resilient in the face of challenges, and pursue their ideas and purpose with commitment and conviction.

Raj Paroda

(*Padma Bhushan Awardee*)

Chairman, TAAS and

Former Secretary & Director General, ICAR



Acknowledgements

Himachal Pradesh, often referred to as the “Land of Gods and Goddesses,” is renowned for its breath-taking landscapes—majestic hills, towering mountains, serene rivers, and verdant meadows. Among its picturesque locales, district Bilaspur stands out as the birthplace of a ground-breaking innovation in agriculture. In the village Paniala, of the district Bilaspur, I developed the HRMN-99 apple variety. My innovation transformed the agricultural landscape of Himachal Pradesh and also inspired farmers across India and beyond. In recognition of this significant contribution in horticulture, I was honoured with the *Padma Shri* award in 2025. The success of HRMN-99 underscores the potential of innovation in agriculture, demonstrating how perseverance and ingenuity can overcome climatic challenges to benefit farming communities globally. I extend my profound gratitude to all those who supported and guided me throughout my journey in horticulture, culminating in the development of the HRMN-99 apple variety.

I sincerely thank Prof. PL Gautam, Chancellor of Dr Rajendra Prasad Central Agricultural University, Pusa, Bihar and Pro-Chancellor of Career Point University, Hamirpur, Himachal Pradesh, for his invaluable mentorship and encouragement.

I am also grateful to Dr Sanjeev Sharma, Vice-Chancellor of Career Point University, Hamirpur, for honouring me with the position of Professor of Practice in Botany for my outstanding achievements and sharing my practical experiences with aspiring students. The guidance offered by Prof. KS Verma is also highly acknowledged.

I am highly indebted to Dr RS Paroda, Founder Chairman, the Trust for Advancement of Agricultural Sciences (TAAS) for providing me the opportunity to share my journey through the esteemed publication “*HRMN-99: Transforming India's Apple Landscaping – A Success Story*”.

I would like to thank Dr TR Sharma, Adjunct Faculty in the Department of Languages and Social Sciences, Career Point University, Hamirpur for his valuable contribution in editing the manuscript of success story.



I profusely thank Dr Umesh Srivastava, Former Assistant Director General (Horticulture), ICAR who visited me, discussed in detail and helped in refining the manuscript and Dr Priyanka Kaushal, Head of the Department of Languages and Social Sciences, Career Point University, Hamirpur, for documenting my success story under the guidance of Prof. PL Gautam and Dr SK Sharma, thereby inspiring many in the field of agriculture.

Their unwavering support has been instrumental in my endeavours to write this success story which aims to revolutionize apple cultivation in India.

Hariman Sharma

Village Paniala, P.O. Kothi, District Bilaspur (H.P.)

Acronyms and Abbreviations

ATARI	Agricultural Technology Application Research Institute
CSKHPKV	Choudhary Sarvan Kumar Himachal Pradesh Krishi Vishwavidyalaya
CPU	Career Point University
DAP	Diamonium Phosphate
DNA	Deoxyribonucleic acid
DSc	Doctor of Science
DST	Department of Science and Technology
FAO	Food and Agriculture Organization of the United Nations
FPOs	Farmers Producer Organizations
FYM	Farmyard Manure
GA	Gibberellic Acid
GoI	Government of India
GSBTM	Gujarat State Biotechnology Mission
IARI	Indian Agricultural Research Institute
ICAR	Indian Council of Agricultural Research
ICAR-NEH	ICAR Research Complex for NEH region
IIMR	Indian Institute of Millet Research
HP	Himachal Pradesh
HRMN-99	Hariman Sharma-99
HSAN	Hariman Sharma Apple Nursery
IFFCO	Indian Farmers Fertilizer Cooperative Limited
J&K	Jammu and Kashmir



KVKs	Krishi Vigyan Kendras
MIDH	Mission for Integrated Development of Horticulture
MoU	Memorandum of Understanding
MoA&FW	Ministry of Agriculture & Farmers' Welfare
MoDoNER	Ministry of Development of North Eastern Region
MoST	Ministry of Science and Technology
MSME	Micro, Small, and Medium Enterprises
NAA	Naphthyl Acetic Acid
NARCOMS	The North American Research Committee on Multiple Sclerosis
NIF	National Innovation Foundation
NERCORMP	North Eastern Region Community Resource Management Project
NPK	Nitrogen, Phosphorus, and Potassium
PPV&FRA	Protection of Plant Verities and Farmers' Rights Authority
RBD	Randomized Block Design
RPCAU	Dr Rajendra Prasad Central Agricultural University
SAUs	State Agricultural Universities
SDG	Sustainable Development Goals
SHGs	Self-Help Groups
SHUATS	Sam Higginbottom University of Agriculture, Technology and Sciences
SSR	Simple Sequence Repeats
TAAS	Trust for Advancement of Agricultural Sciences
TSS	Total Soluble Solids
YSPUHF	Dr Yashwant Singh Parmar University and Horticulture & Forestry

1

Background : A Seed of Innovation- The Birth of HRMN-99

1.1. A Humble Beginning

Every great innovation originates occasionally in the inquisitive mind of an individual who observes what others fail to notice. The remarkable story of HRMN-99, one of India's most celebrated farmer-developed apple varieties, belongs to this category. In this story science, observation, perseverance and faith in nature converged to challenge long-established beliefs about apple cultivation. At the centre of this extraordinary journey stands Dr Hariman Sharma, a farmer whose determination transformed a chance occurrence into a nationally acclaimed horticultural innovation.

The village of Paniala, situated in Ghumarwin Tehsil of Bilaspur district in Himachal Pradesh, is an unlikely place for the beginning of an apple revolution. Nestled in the lower Shivalik hills at an elevation of approximately 1,800 feet above mean sea level, the village experiences a subtropical climate with warm summers, where temperatures frequently rise to 40–45°C. The landscape is characterized by mixed farming systems, fruit orchards and seasonal crops. Mango, guava, pomegranate, citrus and other subtropical fruits have traditionally flourished here. Apple, however, has never been regarded as a crop suited to this environment. For generations, both farmers and scientists believed that quality apples could only be grown in the cool temperate regions of the Himalayas, where long winters provided the chilling necessary for flowering and fruit development

Destiny tested Dr Hariman Sharma, born on 4 April 1956 in Gillsin village of Bilaspur district, from the very beginning of life. His mother passed away merely three days after his birth, leaving the infant to be raised by his uncle, Shri Ridku Ram, and his family in Paniala. Although these early hardships deprived him of a mother's affection, they also instilled in him qualities that would define his entire life—resilience, patience, self-reliance and an unwavering determination to overcome adversity. Formal education was never the defining feature of Hariman Sharma's life. Financial and family circumstances limited his schooling to the



ninth standard, after which farming became both his livelihood and his classroom. While many might regard limited formal education as a disadvantage, but Hariman transformed it into his strength. The seasons, the soil, the trees and the countless observations he made while working in the fields became his teachers. Over the years, he developed an exceptional ability to observe subtle variations in plant growth, flowering behaviour and fruit quality—qualities that every successful farmer possesses but only a few fully utilize.

History often celebrates great inventions born in laboratories and research institutions. Yet, some of the most remarkable innovations emerge quietly from farmer's field, where keen observation, perseverance and faith in nature transform ordinary events into extraordinary achievements. The story of HRMN-99 is one such inspiring journey—a journey that began not with sophisticated scientific equipment, but with the curiosity of a humble farmer who dared to believe that nature had revealed something exceptional.

Unlike many farmers who confined themselves to traditional practices, Hariman Sharma constantly experimented with new crops and horticultural techniques. His farm reflected his inquisitive nature. Alongside field crops, he cultivated mango, plum, peach, apricot, pomegranate, kiwi and coffee. He believed that agriculture should continuously evolve through careful observation, practical experimentation and a willingness to learn from nature itself. Every season presented an opportunity to improve, and every plant had something new to teach.

Visitors to his orchard often noticed something distinctive about his approach. Hariman Sharma never regarded individual crops in isolation. Instead, he viewed his farm as an integrated biological system where different fruit species could coexist and complement one another. Long before concepts such as diversified farming systems and climate-resilient horticulture became widely discussed, he was already practicing them on his own land. His orchard was therefore not merely a source of livelihood; it was a living laboratory where ideas were tested patiently, often over many years.

Behind every successful innovator stands a family whose encouragement often remains unrecognized. Hariman Sharma's wife, Smt Kamla Devi, and other members

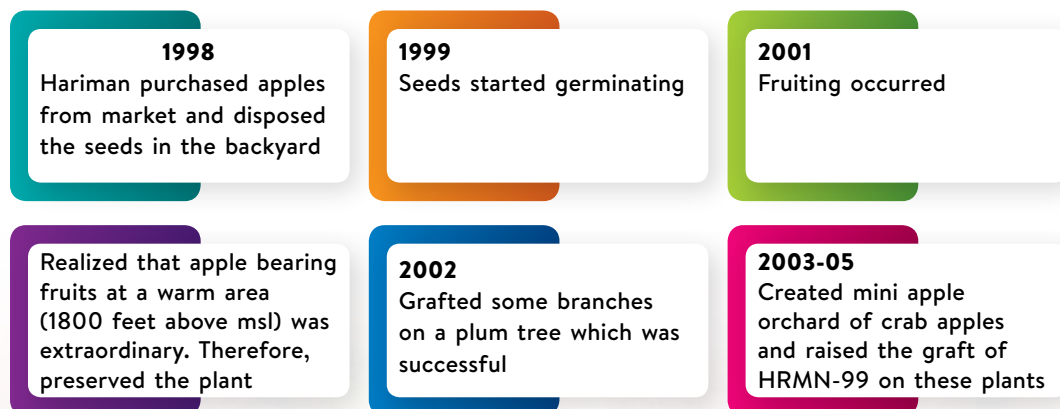


of the family quietly shared responsibilities and uncertainties that accompanied his experiments. Innovation in farming demands patience, perseverance and acceptance of risk. The family's unwavering support enabled him to devote years to nurturing ideas whose outcomes were uncertain but whose potential benefits could extend far beyond their own household.

Those who know Hariman Sharma closely often describe him as a man of quiet confidence rather than loud ambition. He speaks simply, works tirelessly and prefers practical demonstration to lengthy arguments. When confronted with skepticism, he seldom responds with words; instead, he allows his orchard to speak for itself. This calm conviction would later become one of his greatest strengths, particularly during the years when many found it difficult to believe that quality apples could be grown successfully in the warm lower hills of Himachal Pradesh.

Looking back, it is evident that Hariman Sharma possessed the qualities that distinguish true innovators. He was observant enough to recognize an unusual event, patient enough to study it carefully, courageous enough to challenge conventional thinking and determined enough to pursue his conviction despite widespread skepticism. Yet, at that stage, neither he nor anyone around him could have imagined that his small orchard in Paniala would one day become known throughout India as the origin of a revolutionary apple variety. Nature was quietly preparing to reveal one of its rarest gifts. All that was required was a pair of observant eyes capable of recognizing its significance.

Genesis of HRMN-99



Sources: <https://www.scribd.com/document/916004220/HRMN-99>



Before understanding how a discarded apple seed transformed into the remarkable variety HRMN-99, it is important to appreciate why this achievement was considered almost impossible. For more than a century, apple cultivation in India had remained closely confined to the cool temperate regions of the Himalayas, where prolonged winter chilling was regarded as indispensable for successful flowering and fruit production. The next section examines the evolution of apple cultivation in India, the emerging challenges posed by climate change, and the growing search for low-chilling cultivars that could expand apple cultivation into warmer regions.

Every remarkable innovation begins long before the moment of discovery; it begins with a mind that is prepared to recognize the seed of extraordinary hidden within the ordinary.

1.2. Apple Cultivation in India: Tradition, Challenges and New Possibilities

The apple, king of temperate fruits, has occupied a unique position among fruit crops in India for centuries. It symbolized nutrition, prosperity and horticultural excellence. Apple cultivation shaped the economy, culture and livelihoods of thousands of farming families across the Himalayan region, becoming one of the most successful examples of fruit-based agricultural development in the country.

The cultivation of apple in India is largely confined to the temperate regions of the western and eastern Himalayas. Jammu & Kashmir, Himachal Pradesh and the hill districts of Uttarakhand together account for nearly 90 per cent of the country's apple production. Smaller but significant apple growing areas are also found in the higher elevations of Arunachal Pradesh, Nagaland, Sikkim, Meghalaya and the Nilgiri Hills of Tamil Nadu. Over the decades, these regions have developed vibrant orchard economies, contributing significantly to farmers' income, employment and rural development.

Among the apple-growing states, Himachal Pradesh occupies a place of special significance. Often referred to as the "Apple State of India," its horticultural transformation stands as one of independent India's most remarkable agricultural success stories. Apple cultivation revolutionized the rural economy of districts such



as Shimla, Kullu, Kinnaur, Chamba, Mandi, Sirmaur and Lahaul-Spiti, converting subsistence farming into a vibrant commercial enterprise. The contribution of apple to the state's economy has steadily increased over the years, supporting thousands of orchardists, traders, transporters and allied industries. Hundreds of cultivars introduced from different parts of the world now enrich the state's orchards, with varieties belonging to the delicious group continuing to dominate commercial production.

Yet, behind this success lies an important biological limitation. Unlike tropical fruit crops, apples are naturally adapted to temperate climates. Most commercial cultivars require a prolonged period of chilling hours, to complete their annual growth cycle. During winter, apple trees enter a state of dormancy. Exposure to temperatures generally below 7°C for about 1,000 to 1,500 hours, depending on the variety, enables the trees to break dormancy, flower uniformly and set healthy fruits during the following growing season. Without adequate chilling, flowering becomes irregular, fruit set declines, yields fall sharply and fruit quality deteriorates. Consequently, successful apple cultivation has traditionally remained confined to higher elevations, generally between 5,000 and 8,500 feet above mean sea level, where these climatic requirements are naturally fulfilled.

For decades, this biological requirement was considered as unbreakable constraint. Farmers, scientists and horticultural planners alike accepted that quality apples could not be grown economically in the warmer lower hills or plains. Areas such as Bilaspur, Hamirpur, Kangra and the lower parts of Mandi in Himachal Pradesh, despite possessing fertile soils and entrepreneurial farmers, remained outside the apple-growing map simply because they lacked sufficient winter chilling. These regions instead specialized in subtropical fruits such as mango, citrus, guava and pomegranate.

However, the changing climate has gradually begun to challenge this long-held geographical distribution. Rising temperatures, declining snowfall and shifting snowlines have significantly affected the traditional apple-growing regions during the past few decades. The reduction in winter chilling has become a serious concern for orchardists, particularly in lower and mid-hill areas, where flowering and fruit set have increasingly become erratic. Many traditional orchards have experienced declining productivity, compelling growers to move plantations to progressively higher elevations where climatic conditions remain favourable. The visible upward shift of apple cultivation in several parts of Himachal Pradesh and neighbouring states has become one of the clearest indicators of the impact of climate change on temperate horticulture.



Recognizing these emerging challenges, horticultural scientists and research institutions across the world intensified efforts to identify or develop low-chilling apple cultivars capable of performing satisfactorily under mild winter conditions. During the latter half of the twentieth century, several countries developed cultivars requiring substantially fewer chilling hours. Varieties such as Anna, Dorsett Golden, Tropic Sweet, Ein Shemer, Maayan, Shlomit, Vered, Naomi, Michal and Tropical Beauty demonstrated varying degrees of adaptation to subtropical environments, requiring only about 150 to 450 chilling hours. Many of these cultivars were subsequently introduced into India for evaluation.

Institutions such as Dr Yashwant Singh Parmar University of Horticulture and Forestry, Nauni, Solan and the Department of Horticulture, Himachal Pradesh, played pioneering roles in introducing and evaluating low-chilling apple varieties from the early 1990s. Their efforts demonstrated that apple cultivation could gradually be extended into warmer regions under suitable management practices. Although some cultivars showed encouraging performance, widespread commercial adoption remained limited for several years because of issues related to adaptability, fruit quality, productivity and farmers' acceptance. The search for an apple variety that combined low chilling requirement with consistent performance under Indian conditions therefore continued. The need for such varieties assumed even greater urgency as agriculture increasingly confronted the realities of climate variability. A successful low-chilling apple would not merely represent another horticultural introduction; it could potentially redefine the geographical boundaries of apple cultivation in India. It could enable farmers in lower hills and selected plain regions to diversify into a high-value fruit crop, reduce dependence on traditional cropping systems, strengthen climate resilience and create new economic opportunities. Such a development would have profound implications not only for Himachal Pradesh but also for many other regions where conventional apple cultivation had long been considered impossible.

It was against this scientific and agricultural backdrop that an unexpected event occurred in the orchard of Dr Hariman Sharma at Paniala. What initially appeared to be an ordinary seedling would soon challenge decades of conventional horticultural wisdom. The discovery did not emerge from a planned breeding program or a sophisticated research laboratory. Instead, it arose from a farmer's keen observation, unwavering patience and willingness to trust what nature had quietly revealed.

Scientific breakthroughs often begin as simple observations. In 1998, a few discarded apple seeds found their way into the backyard of Hariman Sharma's



home. One of those seeds germinated, survived the warm climate of Paniala and within a remarkably short period, produced fruits where none were expected. That seemingly insignificant event marked the beginning of a journey that would eventually transform apple cultivation in India.

1.3. A Discovery that Changed Conventional Paradigm

Nature's capacity to conceal extraordinary possibilities within the most ordinary events has contributed significantly to new avenues for humans. Throughout the history of agriculture, many important discoveries have originated not from carefully planned experiments but from the ability of observant individuals to recognize something unusual in their surroundings. The discovery that ultimately led to the development of apple variety HRMN-99 belongs to this rare category of farmer-led innovations, where curiosity became the starting point of scientific progress.

The story began in 1998 in the modest courtyard of Dr Hariman Sharma's home at Paniala. Like countless households across India, the family occasionally purchased apples from the local market for domestic consumption. After eating the fruits, the seeds were casually discarded in the backyard. There was nothing unusual about this simple act. Similar seeds are discarded every day in thousands of homes without attracting the slightest attention.

Among those discarded seeds, however, one possessed an extraordinary genetic potential. With the arrival of the following monsoon, one seed germinated naturally and developed into a healthy seedling. At first, it appeared no different from any other young plant. Hariman Sharma continued his routine agricultural activities without attaching any special importance to it. Yet, unlike most volunteer seedlings that disappear unnoticed, this young seedling of apple survived the warm climatic conditions of Paniala and continued to grow vigorously. What happened over the next two years astonished even Hariman Sharma himself!

By 2001, the seedling had not only survived but had also produced flowers and subsequently borne fruits. Under normal circumstances, apple seedlings raised from seed require five to six years, and often even longer, before they begin fruiting. Commercial grafted plants generally start producing sample fruits during the third year after planting. For a naturally raised seedling growing in the warm lower hills of Bilaspur to bear fruits within such a short period was highly unusual (Fig. 1-8).

Paniala lies at an elevation of approximately 1,800 feet above mean sea level, where summer temperatures frequently reach 40–45°C. Such climatic



conditions were traditionally regarded as unsuitable for successful apple cultivation. Conventional horticultural wisdom held that apples required prolonged winter chilling and cool summers to complete their growth cycle. Yet this solitary seedling had quietly challenged those accepted limitations.



Fig. 1. Stage I: Initiation of 'Flowering bud'



Fig. 2. Stage II: Leafing and flowering



Fig. 3. Stage III: Flower blooming



Fig. 4. Stage IV: Fruit development begins



Fig. 5. Hariman Sharma with his Apple variety HRMN-99



Fig. 6. Full grown sweet & delicious HRMN-99 fruits on tree



Fig. 7. Hariman Sharma holding HRMN-99 fruits in his orchard



Fig. 8. A view of fruits and leaves of HRMN-99

Many people might have enjoyed the unexpected fruits and forgotten the incident. Hariman Sharma did not. Years of farming had trained him to notice even small differences that others often overlooked. He carefully observed the tree, its growth habit, flowering behaviour and fruiting pattern. Instead of dismissing the event as an accident, he began asking a simple but profound question- Why had this particular seedling behaved so differently? That single question marked the beginning of a remarkable scientific journey. Hariman Sharma understood that one successful season alone could not establish the value of a new plant. The tree had to be observed repeatedly over successive years. He, therefore, decided to protect the original mother plant and monitor its performance with patience rather than haste. Season after season, the tree continued to flower and bear fruits under the warm climatic conditions of Paniala, gradually strengthened his confidence that he was witnessing something genuinely exceptional rather than a chance occurrence.

The exceptionally elegant fruits provided yet another source of encouragement. They possessed an attractive appearance, pleasant sweetness and acceptable eating quality. More importantly, the tree remained healthy and productive under conditions where conventional apple varieties were never expected to perform satisfactorily. Every new season reinforced Hariman Sharma's conviction that nature had presented him with an opportunity that deserved careful investigation.

Yet he also understood an important principle familiar to experienced horticulturists: a single outstanding tree cannot transform agriculture unless its desirable characteristics can be faithfully reproduced. The challenge, therefore, was no longer simply to preserve the original tree but to determine whether its unique qualities could be transferred successfully to new plants through vegetative propagation. That realization transformed a curious farmer into an innovator.



Without access to sophisticated laboratories or formal research facilities, Hariman Sharma relied upon practical knowledge acquired through years of farming. He decided that the next stage would be to multiply the remarkable tree through grafting and carefully observing whether the new plants retained the same desirable characteristics as the original mother plant. It was a decision based not on institutional guidance but on practical wisdom, patience and confidence born from direct observation.

Looking back today, the significance of those early decisions becomes even more apparent. Had Hariman Sharma ignored the unusual seedling, cut it down during routine field operations or regarded it as an insignificant curiosity, the story of HRMN-99 would probably never have been written. A unique genetic resource might have disappeared forever without leaving any trace. Instead, his ability to observe, question and preserve transformed an accidental event into one of the most remarkable examples of farmer-led innovation in Indian horticulture.

Every scientific breakthrough has a defining moment. For HRMN-99, that moment was not the first fruit itself—it was the moment Hariman Sharma chose to believe that the fruit deserved to be understood rather than merely consumed.

Discovery alone could not establish the value of this remarkable apple tree. The real challenge was in determining whether its exceptional characteristics could be reproduced consistently in future generations. With no institutional support and limited resources, Hariman Sharma embarked on the painstaking process of grafting, multiplication and field evaluation. Those efforts would eventually transform an extraordinary seedling into a distinct apple variety known throughout India as HRMN-99.

1.4. From Observation to Innovation

A remarkable discovery acquires lasting significance only when it can be repeated with consistency. Throughout the history of horticulture, countless unusual plants have appeared in farmers' fields, yet only a handful have influenced agriculture. The difference lies not merely in the uniqueness of the plant but in the vision of the individual who recognizes its potential, preserves it, and transforms it into a reliable genetic resource. Dr Hariman Sharma instinctively understood this fundamental principle.

Hariman Sharma realized that protecting the mother tree alone, which is showing exceptional performance, would not be enough. Unless its desirable



characteristics could be reproduced faithfully in new plants, the discovery would remain an isolated curiosity with little practical value. His next challenge, therefore, was to determine whether the remarkable qualities of the tree could be perpetuated through vegetative propagation.

Working entirely on his own and without institutional guidance, he began experimenting with grafting, the most dependable method of maintaining the genetic identity of fruit trees. During the initial years, suitable apple rootstocks were not available in the lower hills of Bilaspur. Rather than abandoning his efforts, Hariman Sharma displayed remarkable ingenuity by grafting scions from the original tree onto plum trees, an unconventional approach under the circumstances. The grafts established successfully and continued to grow, encouraging him to pursue his experiments with renewed confidence.

As his conviction strengthened, he sought more appropriate planting material. Around 2004–2005, he procured crab apple (*Malus sylvestris*) seedlings from Shimla, which served as suitable rootstocks for further multiplication. Using these rootstocks, he established a small experimental orchard around the original mother tree. The orchard was unlike conventional apple plantations in the higher Himalayas. Apples grew alongside mango, plum, peach, apricot, pomegranate, kiwi and other fruit species, reflecting Hariman Sharma's belief in diversified horticulture and his confidence that the new apple could coexist with subtropical crops under warm climatic conditions.

Within a few years, the grafted plants began flowering and producing fruits remarkably similar to those of the original mother tree. Their growth habit, fruit colour, taste and productivity closely resembled the parent plant, confirming that the desirable characteristics could be reproduced consistently through grafting. Initial yields of 5–7 kg per tree from young grafted plants provided convincing evidence that the unique attributes of the original tree were genetically stable rather than temporary expressions of environmental conditions.

Recognizing the importance of preserving both the identity of the variety and the story of its origin, Hariman Sharma gave it a distinctive name—HRMN-99. The prefix HRMN was derived from his own name, Hariman, while the suffix 99 commemorated the year 1999, when the unusual seedling first drew his attention and marked the beginning of this remarkable journey. The name was more than a convenient label; it became a permanent reminder that the variety originated not in a research station but in the orchard of an innovative Indian farmer whose careful observation transformed an accidental event into a national asset.



As additional grafted plants matured, they continued to demonstrate several remarkable characteristics. Unlike conventional apple varieties requiring prolonged winter chilling, HRMN-99 adapted well to the climatic conditions of the lower Shivalik hills. The trees flowered reliably, set fruits satisfactorily and produced attractive apples with pleasant sweetness, crisp texture and good consumer appeal. Under proper orchard management, mature trees eventually yielded 75–100 kg/year, while fruiting commenced within two to three years of planting under favourable conditions. These features significantly enhanced the commercial potential of the variety. Equally noteworthy was its early harvesting season. While most traditional apple cultivars entered the market from July onwards, HRMN-99 ripened during June, nearly a month earlier. This early maturity provided farmers an important marketing advantage, enabling them to receive premium prices when fresh apples were scarce in the market. Thus, the variety offered not only biological adaptation but also significant economic promise.

Throughout this period, Hariman Sharma meticulously observed and documented the growth and performance of trees growing in his orchard. Every flowering season, every fruiting cycle and every successful graft strengthened his belief that HRMN-99 represented a genuine breakthrough for horticulture in warm regions. Yet, despite these encouraging results, he remained aware that broader acceptance would require independent scientific evaluation and validation. Farmers in neighbouring villages admired the fruits but found it difficult to believe that quality apples could be grown successfully under such warm conditions. Even experienced horticulturists were initially skeptical.

Hariman Sharma, however, remained undeterred. He believed that evidence generated in the orchard would eventually speak more convincingly than any claim he could make. Instead of seeking publicity, he continued refining his orchard, multiplying planting material and patiently allowing the performance of HRMN-99 to establish its own credibility. By the middle of the first decade of the twenty-first century, the transformation was complete. A chance seedling had become a stable apple variety with the potential to redefine the geographical boundaries of apple cultivation in India. The next challenge was no longer to prove the variety to himself—it was to convince the scientific community, policymakers and farmers that conventional wisdom regarding apple cultivation needed to be reconsidered.

An innovation attains national significance after scientific scrutiny. Although HRMN-99 had demonstrated extraordinary promise in Hariman Sharma's orchard,



wider acceptance required independent validation by scientists and institutions. The next stage of the journey would bring the variety into contact with researchers, horticultural experts and national organizations, paving the way for its recognition, protection and eventual dissemination across India.

1.5. Dawn of a New Possibility

By the middle of the first decade of the twenty-first century, Dr Hariman Sharma had accomplished something--a stable, reproducible apple variety capable of thriving under climatic conditions where apple cultivation was believed to be impossible. The journey from observation to innovation had been completed; a new chapter in Indian horticulture was about to begin.

The significance of HRMN-99 is that it challenged one of the most deeply rooted assumptions of temperate fruit cultivation—that quality apples could be grown only in regions receiving prolonged winter chilling, which determined where apples could and could not be cultivated. HRMN-99 demonstrated that nature still possessed unexplored genetic diversity capable of expanding those traditional boundaries. The implications were profound.

Large areas of the lower Himalayan foothills and selected tropical and subtropical regions had remained outside the apple economy despite possessing fertile soils, enterprising farmers and favourable market access. Millions of farmers cultivating cereals or low-value horticultural crops had little opportunity to diversify into a premium fruit crop such as apple. HRMN-99 offered a glimpse of a different future—new opportunities for income generation and rural prosperity by apple cultivation beyond its conventional geographical limits.

The variety also represented a timely response to climate change. Rising temperatures, declining snowfall and reduced winter chilling are affecting traditional apple-growing regions across the Himalayas. As cultivation shifts towards higher elevations, farmers in lower hill regions face declining productivity and uncertainty. HRMN-99, a low-chilling variety assumes importance as a potential climate-resilient alternative capable of sustaining apple cultivation under warmer conditions.

Equally significant was the fact that this breakthrough was an organic event emerged from the careful observation, perseverance and practical wisdom of a farmer. Hariman Sharma's work reaffirmed a fundamental truth that has shaped agriculture throughout history: farmers are not merely adopters of technologies—they are also innovators, breeders and custodians who can create, conserve and



contribute valuable genetic resources. His journey demonstrated that scientific curiosity is not confined to academic institutions; it can flourish equally in farmers' fields when supported by keen observation and an open mind

A remarkable feature of HRMN-99 is its compatibility with diversified farming systems. Hariman Sharma successfully cultivated apples alongside mango, pomegranate, peach, plum, apricot, kiwi and other fruit crops in the same orchard. This demonstrated that the variety could become part of an integrated horticultural system rather than replacing existing cropping patterns. Such diversification strengthens farm resilience and also provides multiple sources of income, reduces production risks and improves the long-term sustainability of smallholder agriculture.

The variety possessed distinctive advantages making it attractive to farmers. Fruiting was relatively early, and harvesting over in June, well before the arrival of apples in the markets from traditional hill orchards, hence, fresh apples commanded premium prices. Mature trees, under proper management, produced 75–100 kg of fruits annually, demonstrating commercial viability and biological adaptability.

The greatest contribution of HRMN-99 is perhaps its ability to inspire confidence—a farmer in his own orchard with careful observation, persistence and faith in nature could lead to discoveries of national importance. For young farmers, students and rural innovators, the story of Hariman Sharma is a reminder that meaningful scientific contributions are not limited by formal educational qualifications but are often driven by curiosity, commitment and continuous learning. As word of the unusual apple spread gradually beyond Paniala, visitors, farmers and horticulture enthusiasts began visiting Hariman Sharma's orchard. Some arrived out of curiosity, others with skepticism, and many hoping that the remarkable claims might indeed be true. Standing beneath trees bearing healthy apples in the warm lower hills of Bilaspur, many found themselves witnessing something they believed impossible. The orchard is the most convincing evidence of Hariman Sharma's achievement.

Nevertheless, Hariman Sharma understood that if HRMN-99 is to benefit farmers across India, this personal success is not enough, it had to be scientifically evaluated, independently validated and systematically multiplied. Only then could the variety earn the confidence of researchers, policymakers and the farming community. The journey that begun with one vigilant farmer had reached a decisive turning point. A greater challenge lies ahead—establishing its scientific



merit, securing institutional recognition and ultimately transforming it into a national horticultural resource.

The whisper campaign about the remarkable performance of HRMN-99 attracted growing attention from farmers, horticulturists and public representatives. In following years the variety underwent detailed evaluation by national institutions, molecular characterization, multi-location testing and legal protection, establishing its credibility as one of India's most remarkable farmer-developed horticultural innovations.

1.6. Looking Ahead: A Farmer's Discovery Begins Its National Journey

Dr Hariman Sharma had accomplished what many considered impossible by patiently observing an unusual seedling, preserving its unique characteristics and transforming it into a stable apple variety.

This journey reached a point when a personal achievement begins to assume a larger public purpose, and from this point of view his journey had only just begun. The story of HRMN-99 was no longer confined to a single orchard in the village of Paniala. Gradually, the innovation began attracting attention beyond the boundaries of Bilaspur.

The journey of Hariman Sharma and HRMN-99 was now ready to enter a new chapter—one that would test the variety through scientific scrutiny, establish its credibility and ultimately carry it far beyond the hills where it was first discovered.

History remembers great discoveries, but it remembers even more the individuals who had the vision to recognize them. HRMN-99 is a remarkable apple variety; Dr Hariman Sharma is the visionary farmer who ensured that this remarkable gift of nature became a lasting contribution to Indian agriculture.

2

Beginning of Journey: From Farmer's Insight to Scientific Innovation

2.1. Breaking the Wall of Skepticism

A new idea is often questioned before it is accepted. Throughout agricultural history, innovations that challenged established beliefs have faced resistance—not because they lack potential, but because they contradicted existing understanding. The journey of HRMN-99 followed a similar path. Before it became recognized as a remarkable low-chilling apple variety, Dr Hariman Sharma had to overcome a formidable barrier: the disbelief that quality apples could ever be produced in the warm lower hills of Himachal Pradesh.

For generations, apple cultivation in India had been closely associated with the cool Himalayan regions. The apple is considered a gift of the mountains, thriving mainly at elevations between 1,500-2,500 m above mean sea level, where sufficient winter chilling allowed flowering and fruit development. Traditional apple-growing regions such as Shimla, Kinnaur, Kullu, Lahaul-Spiti and parts of Uttarakhand had built a successful horticultural economy around these agro-climatic regions. In this established system, the idea of growing commercially acceptable apples at approximately 500 m elevation in Bilaspur, where summer temperatures could reach 40–45°C, appeared almost impossible. The prevailing belief among farmers and many horticulture enthusiasts was that apples simply could not survive, flower and fruit successfully under such warm conditions. Therefore, when Hariman Sharma began sharing his experience of an apple tree bearing fruits in Paniala, many people remained unconvinced. Some considered it an unusual natural occurrence that might not be repeated. Others believed that even if the tree survived, the fruits would not possess acceptable quality or commercial value. The idea that a farmer in a warm lower hill region could develop an apple variety suitable for wider cultivation seemed beyond conventional imagination. However, Hariman Sharma was not making a claim based merely on observation of a single season. For several years, he had carefully preserved the original tree, multiplied it through grafting and observed its performance under local conditions. He had seen the plants grow, flower and bear fruits repeatedly.



For him, HRMN-99 was not a theoretical possibility—it was a reality growing in his own orchard. His confidence came from direct experience.

Standing among apple trees growing alongside mango, plum, peach and other subtropical fruit crops, Hariman Sharma witnessed something that challenged traditional horticultural boundaries. His orchard represented a new possibility: that apple cultivation need not always remain confined to cold mountain regions but could potentially expand into warmer and previously unsuitable areas. Yet, innovation in agriculture cannot spread through personal conviction alone. Farmers, scientists and policymakers require reliable evidence before accepting a new technology or variety. Hariman Sharma understood this challenge. He did not respond to skepticism through arguments; instead, he continued developing his orchard and allowing the performance of HRMN-99 to demonstrate its potential. Gradually, curiosity began replacing disbelief.

Farmers doubting the possibility of apple cultivation in Bilaspur visited his orchard, and observed healthy trees carrying fruits well before traditional apple orchards in higher regions that were following their own seasonal cycle. This sight of apples forced them to reconsider their earlier assumptions. The most remarkable aspect of Hariman Sharma's achievement was that he had not attempted merely to grow an apple tree. He had challenged a long-established geographical limitation of a major fruit crop. By developing HRMN-99, he opened the possibility of bringing apple cultivation to farmers living outside conventional apple-growing zones. However, acceptance among farmers was only the first step. For HRMN-99 to gain wider recognition-- the innovation had to move from a farmer's orchard into the domain of formal evaluation. The first significant opportunity for this transition came when Dr Hariman Sharma presented his remarkable achievement before the leadership of Himachal Pradesh.

Every revolutionary idea first appears impossible. It is evidence, perseverance and the courage of the innovator that gradually transform disbelief into acceptance.

2.2. The Turning Point- When HRMN-99 Reached the Doorsteps of Recognition

An innovation often reaches a decisive stage when it receives the attention of those who can help take it forward. For Dr Hariman Sharma, that turning point came



in 2007, when his remarkable apple variety was presented before the leadership of Himachal Pradesh. By this time, Hariman Sharma had already established that the tree was not an isolated curiosity but grafted plants were growing successfully, producing fruits with desirable characteristics and demonstrating the possibility of apple cultivation under conditions previously considered unsuitable. However, the larger agricultural community still needed convincing.

With this objective, Dr Hariman Sharma met Shri Prem Kumar Dhumal, the then Chief Minister of Himachal Pradesh, on 7 July 2007 at Shimla, and presented fruits of HRMN-99 apple along with mango fruits cultivated in the same orchard. The combination—apples and mangoes produced together in a warm lower hill region—challenged conventional perceptions about the ecological requirements of apple cultivation. The Chief Minister was surprised and impressed by the demonstration. Recognizing the potential importance of this achievement, Shri Dhumal convened a meeting involving senior officials from the Departments of Agriculture and Horticulture, Vice Chancellors of State Agricultural Universities (SAUs) and other experts to understand the significance of this farmer-led innovation.

The HRMN-99 fruit samples were analyzed at the ICAR-Indian Agricultural Research Institute, New Delhi. The analysis indicated a Total Soluble Solids (TSS) content of 13–14° Brix, confirming good fruit quality and demonstrating that the variety possessed desirable characteristics for consumer acceptance and possible commercial cultivation in lower elevations.

Soon after this event, senior officials and departmental representatives visited Hariman Sharma's farm at Paniala to personally observe the performance of HRMN-99 under natural field conditions. The visit was significant because the innovation was no longer being judged merely on the basis of a farmer's claim; it was being examined directly in the field where it had originated. The recognition that followed provided Hariman Sharma with renewed confidence. In August 2008, the Government of Himachal Pradesh honoured him with the "*Prerana Shrot Samman Award*" in recognition of his pioneering contribution. Yet Hariman Sharma understood that awards alone could not establish the scientific identity of a new variety. A far greater journey lay ahead. The variety needed systematic evaluation, scientific characterization, genetic confirmation and formal protection so that its uniqueness could be recognized nationally.

Dr PL Gautam, former Chairperson of the Protection of Plant Varieties and Farmers' Rights Authority (PPV&FRA), recognizing the significance of the



innovation, played an important role in connecting Hariman Sharma with the National Innovation Foundation (NIF), an organization dedicated to identifying and supporting grassroots innovations. The journey that had begun with a seed discarded in a backyard was now entering the world of scientific evaluation. HRMN-99 was moving from farmer's field to research institutions, where its identity, uniqueness and potential would be examined through modern scientific methods.

2.3. Journey Towards Scientific Validation

Dr Hariman Sharma, by 2007, had successfully demonstrated that HRMN-99 could grow and produce fruits under the warm climatic conditions of Bilaspur. The next phase of the journey marked a unique collaboration between traditional farming wisdom and modern agricultural science.

For Hariman Sharma, it was the first opportunity for his innovation to receive structured scientific attention at the national level. For NIF, HRMN-99 represented a rare example of a farmer-developed fruit variety that challenged established understanding regarding the climatic requirements of apple cultivation. As the first step scientific community was to determine whether -- HRMN-99 was genuinely distinct from existing low-chilling apple varieties; and its unique performance was genetically stable. The evaluation process involved detailed comparison of HRMN-99 with established low-chilling apple cultivars, particularly Anna and Dorsett Golden, which were already known for their adaptability to warmer regions. These comparisons were essential to prove that it possesses identifiable and stable characteristics. Researchers studied morphological features of the plant, including leaf characteristics, flowering behaviour, fruit structure, colour, size and other distinguishing traits. The fruits of HRMN-99 displayed attractive red blush over yellow skin, soft and juicy pulp, desirable sweetness and acceptable fruit size.

The studies confirmed that HRMN-99 possessed characteristics different from commonly cultivated low-chilling varieties. Its ability to flower and fruit successfully under warmer conditions, combined with its unique morphological features, indicated that it represented a valuable genetic resource for expanding apple cultivation. The molecular studies conducted through collaborative efforts, including those involving the Gujarat State Biotechnology Mission (GSBTM), Gandhinagar, helped establish the genetic relationship of HRMN-99 with other low-chilling apple varieties. The results demonstrated that HRMN-99 possessed



its own distinctive identity while sharing some similarities with other low-chilling cultivars. Such findings strengthened the scientific basis for recognizing it as a unique farmer-developed apple variety.

Fruit quality evaluation showed good sweetness, attractive appearance and satisfactory eating quality. Its early maturity period, with harvesting beginning around June in warmer regions, added significant commercial value by allowing farmers to access markets before the arrival of traditional apple varieties. HRMN-99 represented a new approach to agricultural innovation—where farmers' observations become the starting point for formal research. Hariman Sharma's orchard became a living laboratory, demonstrating how valuable genetic resources can emerge from farmers' fields. The collaboration between Hariman Sharma, NIF and research institutions established an important principle:

Innovation does not belong exclusively to laboratories. The scientific evaluation of HRMN-99 strengthened its potential. Yet another important task remained—to protect the variety legally and ensure that the farmer who developed it received rightful recognition and ownership.

2.4. From Observation to Scientific Evidence

A remarkable performance in one location may attract attention, but scientific acceptance demands systematic evaluation, comparison and validation. For Dr Hariman Sharma, this was a crucial phase as the scientific community needed answers to fundamental questions:

- Was HRMN-99 genuinely different from existing low-chilling apple varieties?
- Were its desirable characteristics stable and reproducible?
- Could its performance be attributed to a unique genetic identity rather than environmental influence alone?

To answer these questions, the National Innovation Foundation (NIF) facilitated studies on morphological characterization, fruit quality assessment and molecular analysis.

2.4.1. Morphological Characterization: Understanding the Uniqueness of HRMN-99

The first step in scientific identification of a plant variety is the careful study of its visible characteristics. Researchers examined the plant, leaves, flowers and



fruits of HRMN-99 and compared them with other low-chilling apple varieties, particularly Anna and Dorsett Golden. The studies revealed several distinguishing features of HRMN-99. The leaves of HRMN-99 showed characteristic shape and margin patterns; flowers displayed specific traits including free arrangement of petals; and distinct coloration during the balloon stage indicating that HRMN-99 possessed identifiable botanical features that could distinguish it from other varieties. The fruits of HRMN-99 displayed attractive and commercially desirable characteristics. They possessed:

- medium anthocyanin coloration,
- conical fruit shape,
- attractive red blush over yellow background skin,
- soft and juicy pulp,
- crisp texture,
- pleasant sweetness, and
- desirable fruit size.

These features contributed to its acceptance among farmers and consumers. One of the most important observations was that HRMN-99 combined adaptability to warm climates with acceptable fruit quality—a combination rarely found among low-chilling apple varieties.

2.4.2. Fruit Quality Assessment: Confirming Commercial Potential

Backed by NIF, Hariman's innovation gained national attention. From 2014 to 2018, the NIF undertook the large-scale planting of over 18,000 HRMN-99 apple seedlings across India to study their adaptability and fruiting capacity. These apple trees began fruiting within just two to three years in all 29 different states/Union Territories. One of his crowning achievements was the successful plantation of HRMN-99 in sprawling Rashtrapati Bhawan lawn, New Delhi, where the trees are now bearing fruits. Initially, his work struggled to gain attention, but in 2012, the National Innovation Foundation (NIF) identified the HRMN-99 variety and facilitated its validation through molecular studies and trials. With support from agricultural institutions and *Krishi Vigyan Kendras*, the variety was proven distinct and considered suitable for large-scale cultivation. Eventually, the innovative variety was scouted by the NIF – India. Detailed fruit quality analysis undertaken to determine whether HRMN-99 could meet consumer expectations, showed good sweetness and satisfactory eating quality. The variety recorded Total



Soluble Solids (TSS) values of approximately 13–14° Brix, indicating good sugar content and favourable taste characteristics. This was significant because earlier attempts to introduce low-chilling apples often faced challenges related to fruit quality. Many varieties could survive in warmer conditions but failed to match the taste and market acceptance of traditional apples. HRMN-99 demonstrated that adaptability and quality could exist together.

2.4.3. Molecular Characterization: Establishing Genetic Identity

Morphological data of plants and fruits was collected from fruit bearing trees of HRMN-99, Anna and Dorsett Golden varieties. The fruits of HRMN-99 exhibited several distinctive characteristics including medium anthocyanin coloration, conical shape, medium sized eye basin, long stalk length with shallow depth. The fruits of HRMN-99 were relatively large with soft, sweet crisp pulp, yellow skin and attractive red blush. The National Innovation Foundation (NIF) independently verified the innovator's claims and assessed the distinctiveness, uniqueness and potential of the variety by facilitating molecular and diversity analysis, along with comprehensive fruit quality testing. A morphological and SSR DNA fingerprinting study by NIF and Gujarat State Biotechnology Mission (GSBTM) confirmed HRMN-99's diversity and superiority over other low-chilling varieties. Dorsett golden fruits were smaller in size with slight red, yellow back ground skin and sour sweet pulp. Comparative studies were conducted with two well-known low-chilling apple varieties—Anna and Dorsett Golden. The Simple Sequence Repeat (SSR) DNA fingerprinting carried out at GSBTM, Gandhinagar indicated that the accessions of HRMN-99 and Anna have clustered together. However, Dorsett Golden formed a separate cluster with the other two accessions which differentiated it from HRMN-99 and Anna (Fig. 9). The results indicated that HRMN-99 possessed a distinct genetic profile. Although it showed some genetic relationship with Anna, it remained distinguishable from both Anna and Dorsett Golden. These findings supported the conclusion that HRMN-99 represented a unique genetic resource rather than merely an environmental variation of an existing variety. The molecular evidence was particularly important because HRMN-99 had originated through a farmer's selection from a naturally germinated seedling rather than through a conventional breeding program. Though apple crop is very sensitive and climate dependent, the cultivars HRMN-99 performs better if cultivated with appropriate soil management and crop practices. Morphological and molecular characterization showed that the HRMN-99 variety is less diverse from Anna variety than the Dorsett Golden variety. As these three varieties perform better in non-chilling areas, they can be cultivated together for better

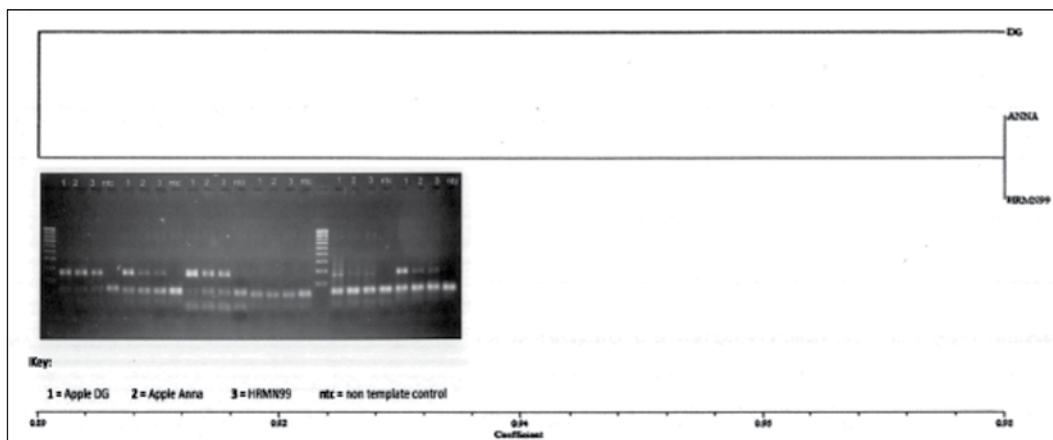


Fig. 9. SSR-DNA Gel photograph, and dendrogram showing Dorsett Golden (one cluster) and Anna and HRMN-99 in another cluster

performance, enhanced pollination and increasing fruit numbers in tropical and subtropical areas. Scientific confirmation gave credibility to the farmer's discovery and established its place within recognized plant genetic resources.

NIF also provided financial and technical support for establishing and expanding the nursery, besides aiding the registration of the variety under the Protection of Plant Variety and Farmers Right Authority, 2001. During 2014-2019, the multi-location trials of the variety in low chilling areas across the country were conducted by NIF by transplanting over 20,000 saplings at over 2,000 farmers' fields and 25 organizations in 30 states, including at Rashtrapati Bhawan. Fruit setting was reported from 23 states, and Union Territories so far. These are Bihar, Jharkhand, Manipur, Madhya Pradesh, Chhattisgarh, Uttar Pradesh, Maharashtra, Gujarat, Dadra, and Nagar Haveli, Karnataka, Haryana, Rajasthan, Jammu & Kashmir, Punjab, Kerala, Uttarakhand, Telangana, Andhra Pradesh, West Bengal, Odisha, Puducherry, Himachal Pradesh and Delhi.

Further analysis and research revealed that HRMN-99 plants having 3-8 years of age produced 5 to 75-100 kg fruits per plant a year in four districts of lower Himachal Pradesh, Sirsa (Haryana) and Manipur. It is bigger in size as compared to other varieties, with very soft, sweet, and juicy pulp and striped red over yellow skin colour during maturity. Commercial cultivation of this variety was initiated at twenty-six farmers' fields at eight different locations of Bishnupur, Senapati, Kakching districts of Manipur in the year 2015 by NIF along with other institutions wherein farmers were provided the requisite training on best practices for successful apple cultivation. A farmer from Manipur received recognition at various platforms



for his outstanding work on adoption of HRMN-99 apple cultivation. Capitalizing upon the ongoing success in Manipur, 200 more farmers commercially adopted the variety, and more than 20,000 plants of HRMN-99 apple variety are being grown in the state. Commercial adoption of this variety was also initiated in Jammu, low-lying areas of Himachal Pradesh, Karnataka, Chhattisgarh, and Telangana. The HRMN-99 apple is appreciated not only for its adaptability but also for its high yield, with each plant producing up to 75 kg fruit annually.

Its striped red-over-yellow skin and soft, juicy pulp have earned it widespread acclaim among farmers and consumers alike. The commercial adoption of the variety was supported by collaborations with state agriculture departments and initiatives like the North Eastern Region Community Resource Management Project (NERCORMP), which has led to over one lakh saplings being planted across north-eastern states. The NERCORMP under North Eastern Council (NEC), Ministry of Development of North Eastern Region (MoDoNER), Government of India, and NIF had entered into a Memorandum of Understanding (MoU) in November 2020. In the first phase, 15,000 grafted seedlings of the variety were transplanted in Arunachal Pradesh, Assam Manipur, and Meghalaya during January 2021. This backyard experiment has today become a national movement, opening up new horizons for apple cultivation in non-traditional areas and inspiring countless farmers across the country and elsewhere.

The validation of HRMN-99 represented more than the confirmation of a new apple variety. It represented a broader recognition of the value of farmer-led innovation. For decades, scientific improvement of crops was largely associated with research institutions and formal breeding programs. Dr Hariman Sharma's achievement was, therefore, not only about developing an apple suitable for warmer climates. It was about proving that innovation can emerge from any field, provided there is curiosity, dedication and scientific evaluation. However, scientific validation alone was not enough. For the innovator's rights to be protected and for the variety to be responsibly promoted among farmers, HRMN-99 required formal legal recognition.

2.5. Protecting a Farmer's Innovation – From Recognition to Rights

Scientific validation established that HRMN-99 was a unique and valuable apple variety. However, for Dr Hariman Sharma, the variety that had originated from his observation, experimentation and years of dedicated care needed formal



recognition and legal protection. In agriculture, a new variety represents not only a biological resource but also the intellectual contribution of the person or institution responsible for its development. Therefore, protecting the identity and ownership of HRMN-99 was essential to ensure that the farmer innovator received due recognition and that the variety could be responsibly promoted. To obtain formal protection Dr PL Gautam, former Chairperson of the Protection of Plant Varieties and Farmers' Rights Authority (PPV&FRA), recognized the importance of Hariman Sharma's innovation and facilitated his connection with the National Innovation Foundation–India (NIF). NIF initiated the documentation of the innovation, supporting scientific studies, facilitating evaluation and helping establish the distinctiveness of HRMN-99. The journey towards legal recognition was not simple. Since HRMN-99 had originated as a naturally occurring seedling rather than through a conventional institutional breeding program, detailed evidence was required to establish its uniqueness. The variety had to be compared with existing apple cultivars through morphological studies, fruit quality analysis and molecular characterization. The scientific reports generated through these studies provided the necessary foundation for seeking protection under the Protection of Plant Varieties and Farmers' Rights Act, 2001. The process involved detailed documentation, submission of technical information and repeated evaluation to establish that HRMN-99 possessed distinct, uniform and stable characteristics. The studies confirmed that the variety had its own identity and demonstrated special value because of its ability to grow and fruit successfully under warm climatic conditions where conventional apples could not be cultivated. After years of evaluation and procedural efforts, HRMN-99 received formal recognition and protection as a farmer-developed variety. This achievement carried special significance because it represented the spirit of the Indian legislation that recognizes not only institutional breeders but also the contribution of farmers in conserving, selecting and developing valuable plant genetic resources.

For Dr Hariman Sharma, this recognition was a historic moment. The seedling that had emerged unexpectedly in his backyard and the variety that he had nurtured through years of dedication had now received national acknowledgement. The protection of HRMN-99 also helped prevent misuse or unauthorized commercial claims regarding the variety. It established that the innovation belonged to its rightful creator and that farmer seeking genuine HRMN-99 planting material should receive authentic information. Beyond legal protection, the recognition of HRMN-99 carried a larger message for millions of farmers across India, who possess generations of practical knowledge about crops,



varieties and local ecosystems. The story of HRMN-99 demonstrated that such knowledge, when combined with scientific validation, can produce innovations of national and global importance.

The journey of HRMN-99 also highlighted an important principle: Farmers are not merely users of agricultural technology; they can also be creators of agricultural knowledge and innovation. The protection of HRMN-99 transformed Dr Hariman Sharma from an innovative farmer into a nationally recognized agricultural innovator. His achievement became an inspiring example of how grassroots creativity can be identified, scientifically validated and legally protected. Yet the ultimate success of any agricultural innovation is measured not only by recognition but by its impact on farmers' fields. The next phase of HRMN-99's journey would therefore be its large-scale evaluation and adoption across diverse regions of India.

Recognition honours an innovation, but protection preserves its legacy. HRMN-99 became not only a successful apple variety but also a symbol of farmers' right to create and contribute.

2.6. From a Village Orchard to a National Innovation

The journey of HRMN-99 represents a remarkable transition—from an unexpected seedling growing in the backyard of a farmer's home to a scientifically validated and nationally recognized apple variety. For Dr Hariman Sharma, the journey was never easy. The first challenge was to believe in something that appeared impossible. An apple tree bearing fruits in the warm foothills of Bilaspur challenged established understanding about the ecological requirements of apple cultivation. At a time when apples were considered the exclusive domain of cold Himalayan regions, Hariman Sharma saw a new possibility hidden within a single seedling. However, the true significance of his achievement emerged when his innovation entered the domain of scientific evaluation.

The collaboration between Dr Hariman Sharma, the National Innovation Foundation, research institutions and agricultural authorities created a powerful example of how different knowledge systems can work together. A farmer's practical wisdom provided the foundation, and scientific methods provided evidence, credibility and wider acceptance. The recognition of HRMN-99 also



came at an important time when Indian horticulture was facing new challenges due to climate change. Rising temperatures, changing snowfall patterns and declining chilling hours were beginning to affect traditional apple-growing regions. In this context, a low-chilling apple variety capable of performing under warmer conditions represented an important opportunity for climate-resilient horticulture. The journey of HRMN-99 also reflected the vision of Dr Hariman Sharma that farmers living in lower hills and warmer areas should also have the opportunity to benefit from apple farming. His innovation opened a new window of possibility for thousands of farmers who had never imagined growing apples in their own fields. So far, HRMN-99 had achieved three important milestones:

- (i) It had overcome the barrier of disbelief by demonstrating successful fruiting under warm climatic conditions.
- (ii) It had earned scientific credibility through systematic morphological, fruit quality and molecular evaluation.
- (iii) It had received formal recognition and protection, ensuring that the contribution of the farmer innovator was preserved.

Yet, the most meaningful chapter of HRMN-99's story was still ahead. The ultimate success of an agricultural innovation is not measured only by scientific papers, awards or registrations—it is measured by the number of farmers whose lives it has improved. The next challenge was to test HRMN-99 across diverse environments, understand its adaptability, and make it accessible to farmers across different regions of India. From the hills of Himachal Pradesh to the plains and warmer states of the country, the variety was now ready for a larger journey.

3

Initial Work: HRMN-99 Travels Beyond Paniala – From Experimental Orchard to Farmers’ Fields

3.1. The First Steps Beyond Paniala – Testing a New Possibility

The journey of HRMN-99 entered this decisive phase after its scientific validation and formal recognition. The variety had already demonstrated its extraordinary ability to produce quality apples in the warm conditions of Paniala, Bilaspur, but its wider agricultural value depended on one important test:

For Dr Hariman Sharma, had always believed that apple cultivation should not remain restricted to a few traditional mountain regions. The success of HRMN-99 in his own orchard had given him confidence, but he understood that a farmer’s experience alone could not transform national horticulture. The variety needed to travel beyond Bilaspur, face different environmental conditions and demonstrate consistent performance in farmers’ fields. This marked the beginning of a new chapter in the life of HRMN-99.

The systematic efforts of NIF were initiated to evaluate the performance of HRMN-99 under diverse agro-climatic conditions. The objective was not only to multiply planting material but also to understand how the variety responded to different temperatures, soils, management practices and ecological environments. In scientific terms, a promising variety must prove its adaptability, stability and usefulness before it can be recommended for wider cultivation. In social terms, it meant giving thousands of farmers the opportunity to explore a new horticultural option. The first phase involved multiplication of genuine planting material and its distribution to selected locations for evaluation. Farmers, institutions and organizations became partners in this journey. Their fields became extended testing grounds where HRMN-99 could demonstrate its ability to survive, flower and bear fruits under varied conditions. The significance of this approach was enormous. Traditional apple cultivation had always been linked with specific geographical regions having adequate winter chilling. HRMN-99 challenged this established pattern by introducing the possibility of successful apple cultivation



in areas where such a crop had never been considered commercially feasible. The variety's unique characteristics made it particularly suitable for this expansion:

- requirement of very low chilling hours compared to traditional apples,
- ability to withstand warmer climatic conditions,
- early flowering and fruit maturity,
- acceptable fruit quality, and
- potential for commercial production in non-traditional regions.

For farmers in lower hills and warmer areas, this represented a new opportunity. Many regions that traditionally depended on subtropical fruits such as mango, citrus and other crops could now consider diversification through apple cultivation. The journey beyond Paniala also reflected a broader transformation taking place in Indian agriculture. Climate change was gradually altering traditional production systems. Rising temperatures and shifting climatic patterns were creating new challenges for crops dependent on specific environmental conditions. In this changing scenario, varieties like HRMN-99 offered possibilities for adaptation and resilience. However, the movement of HRMN-99 to many regions required patience, scientific monitoring and farmer participation. Every new location provided valuable information about the strengths and limitations of the variety.

3.2. Multi-location Trials Across India

The National Innovation Foundation–India (NIF) initiated systematic multi-location evaluation of HRMN-99 to study its adaptability, fruiting behaviour and performance under different environmental conditions, ranging from the warm plains to lower hills and varied climatic regions. Between 2014 and 2019, NIF facilitated large-scale evaluation of HRMN-99 by providing planting material to farmers, institutions and organizations across different parts of the country. More than 20,000 saplings were planted at farmers' fields and institutional locations covering numerous states and Union Territories. These trials represented one of the most important phases in establishing the wider potential of HRMN-99. HRMN-99 was evaluated under conditions where conventional apple cultivation was previously considered difficult or impossible. The results were remarkable.



Successful fruit setting was observed in several states, demonstrating that HRMN-99 was not restricted to the climatic conditions of Bilaspur alone. The variety showed adaptability in diverse locations including Himachal Pradesh, Jammu & Kashmir, Punjab, Haryana, Uttar Pradesh, Bihar, Jharkhand, Madhya Pradesh, Chhattisgarh, Gujarat, Maharashtra, Karnataka, Telangana, Andhra Pradesh, Odisha, West Bengal, Kerala, Uttarakhand, Rajasthan, Delhi, Manipur and other regions. These multi-location observations provided valuable evidence that HRMN-99 had the potential to expand the geographical boundaries of apple cultivation in India. One of the most significant achievements was the successful performance of HRMN-99 in Manipur and other northeastern states. In regions where apple cultivation had little or no traditional history, farmers began adopting the variety after observing its growth and fruiting behaviour. The variety demonstrated that geographical limitations that once restricted apple cultivation could be challenged through suitable genetic resources.

The performance data also strengthened confidence among farmers. In different locations, HRMN-99 plants between 3 to 8 years of age produced approximately 5–100 kg fruits/plant annually under favourable management conditions. Such productivity demonstrated the commercial potential of the variety. The fruit characteristics further enhanced its acceptance. HRMN-99 apples developed attractive red blush over yellow skin, soft and juicy pulp, pleasant sweetness and good consumer appeal. Importantly, the variety matured earlier than traditional apples, allowing farmers in warmer regions to bring fruits to market during an advantageous period. The success of multi-location trials also highlighted an important principle of agricultural innovation: adaptability is as important as productivity. A variety that performs well only under one specific environment has limited impact. HRMN-99 demonstrated resilience by performing across different ecological zones and farming systems.

The journey of HRMN-99 during these trials was not merely a scientific exercise. Each farmer who planted the variety became a participant in validating Dr Hariman Sharma's vision. Every successful orchard strengthened the evidence that a farmer-developed innovation could contribute to national horticultural development. The results of these evaluations gradually changed the perception of apple cultivation in India. What was once considered a crop restricted to cold mountain regions began to emerge as a possibility for warmer and marginal areas.



The journey of HRMN-99 from a single orchard in Paniala to diverse landscapes across India proved a fundamental truth of agricultural innovation: a discovery becomes a legacy only when it reaches the fields of farmers. Each successful plantation added a new chapter to Dr Hariman Sharma's vision, transforming a humble farmer's experiment into a nationwide movement of hope, resilience and opportunity.

3.3. Farmers as Partners in Advancing the HRMN-99 Revolution

For Dr Hariman Sharma, the greatest satisfaction was not merely that HRMN-99 had been recognized as a unique apple variety; it was that ordinary farmers could now imagine growing apples in regions where such a possibility had never existed before. From the beginning, Hariman Sharma believed that the purpose of developing HRMN-99 was not personal achievement but the creation of new opportunities for farmers. As awareness about HRMN-99 spread, farmers from different parts of India began showing interest in the variety. The sight of healthy apple trees bearing fruits under warm conditions created confidence among farmers who had earlier considered apple cultivation impossible in their regions. The participation of farmers transformed HRMN-99 from an innovation into a shared agricultural movement.

With support from NIF and various organizations, planting material was supplied to farmers in different states. Training and guidance were provided regarding plantation management, pruning, irrigation, nutrition and orchard care so that farmers could successfully establish HRMN-99 orchards under their local conditions. One of the most encouraging examples came from Manipur, where farmers adopted HRMN-99 apple as a new opportunity. The variety performed successfully in the northeastern region, encouraging more farmers to establish orchards. Commercial adoption gradually expanded, and thousands of plants were established in the state through collaborative efforts involving farmers, government agencies and supporting organizations. Similarly, farmers in regions such as Jammu, Karnataka, Telangana, Chhattisgarh, Haryana and lower Himachal Pradesh began exploring HRMN-99 cultivation. In these areas, the variety offered a new option for diversification of farming systems. For farmers in lower Himachal Pradesh,



HRMN-99 represented a particularly important opportunity. The introduction of a low-chilling apple variety created possibilities for integrating apple cultivation into existing farming systems without completely replacing traditional crops.

One of the unique features of HRMN-99 was its compatibility with mixed farming approaches. This approach showed farmers that horticultural diversification could be achieved through careful planning rather than complete transformation of existing farms. The economic potential of HRMN-99 further encouraged adoption. The variety's early fruit maturity, good fruit quality and ability to produce under warmer conditions provided farmers an opportunity to enter apple markets earlier than traditional production regions. For many farmers, particularly those in non-traditional areas, this represented a new source of income.

The growing acceptance of HRMN-99 also strengthened the belief that farmers themselves can become important partners in agricultural innovation. Each farmer who successfully planted HRMN-99 contributed valuable field experience, helping refine cultivation practices and expand knowledge about the variety's performance.

At the centre of this growing movement remained Dr Hariman Sharma. Despite national recognition and widespread appreciation he shared his experiences, encouraged other farmers and remained committed to ensuring that genuine HRMN-99 planting material reached those who wished to cultivate it.

3.4. Expanding Cultivation – Breaking Geographical Barriers

For centuries, apple cultivation in India remained closely associated with the Himalayan mountains. The traditional understanding was that quality apples could only be produced in cooler regions located generally between 1,500-2,500 m above mean sea level. This geographical limitation shaped the entire apple economy of India. States such as Himachal Pradesh, Jammu & Kashmir and Uttarakhand became the major centres of apple production because they naturally provided the required cold conditions. Farmers living in warmer plains and lower hill regions could only watch this opportunity from a distance, as conventional apple varieties could not meet their climatic requirements.

The emergence of HRMN-99, developed by Dr Hariman Sharma, challenged this long-established perception. It demonstrated that the boundaries of apple cultivation were not as rigid as previously believed. His innovation showed that



the right genetic resource could allow apple cultivation in environments earlier considered unsuitable. The importance of HRMN-99 became even greater in the context of changing climate. Rising temperatures, reduced chilling hours and shifting climatic patterns were gradually affecting traditional apple-growing regions. Areas that once provided ideal conditions were experiencing new challenges, while warmer regions were seeking climate-resilient horticultural options. In this changing scenario, HRMN-99 emerged as a symbol of adaptation.

States and regions that had never been part of the traditional apple map began exploring apple cultivation. Farmers from Manipur, Jammu, Karnataka, Telangana, Chhattisgarh, Haryana and lower Himachal Pradesh started establishing orchards, creating new possibilities for horticultural diversification. One of the most remarkable aspects of HRMN-99 was its compatibility with existing farming systems. Unlike traditional approaches where farmers had to completely shift their production pattern, HRMN-99 could be integrated into diversified farms. Dr Hariman Sharma himself demonstrated this approach by successfully growing apple along with mango and other fruit crops in his orchard. This was a significant message for small and marginal farmers. He has shown his orchard and nursery block and discussing scientists and farmer of and on (Fig. 10-13). Also he used to discuss about redressal of his problems regarding cultivation of Apple HRMN-99 with



Fig. 10. Hariman Sharma with Dr Umesh Srivastava, ADG, ICAR discussing about HRMN99 variety



Fig. 11. HRMN-99 laden profusely with fruits



Fig. 12. Grafted Apple HRMN -99 plants



Scientists at Dt YS Parmar University of Horticulture And Forestry, Neri Campus in Hamirpur (Himachal Pradesh) (Fig. 14-15).



Fig. 13. Grafted apple HRMN-99 plants



Fig. 14. Dr Vikas Kumar and his team YSPUHF Neri campus, Hamirpur (HP) with Hariman Sharma and Umesh Srivastava



Fig. 15. Hariman Sharma with Umesh Srivastava and Vikas Kumar in the laboratory

Apple cultivation did not necessarily require abandoning existing crops; instead, it could become an additional source of income through intelligent farm diversification. The variety also provided an opportunity for farmers in warmer areas to enter the apple market during a favourable period. Since HRMN-99 matures earlier than traditional hill apples, farmers in these regions could potentially supply fresh apples during a time when market demand remained strong. The expansion of HRMN-99 also carried an important social dimension. Apple cultivation has traditionally been associated with prosperity in Himalayan regions, contributing significantly to rural economies. By extending apple cultivation possibilities to new areas, HRMN-99 created opportunities for farmers who had previously remained outside this economic benefit. The



transformation was not only about growing a new crop. It was about changing the mindset of farmers and society.

The story of HRMN-99 therefore represents a remarkable shift: From *“Apples belong only to cold mountains”* to *“Apples can be cultivated wherever suitable innovation meets farmer commitment.”*

3.5. Climate Resilience and New Opportunities

Agriculture has always been closely linked with climate. However, in recent decades, changing climatic conditions have begun challenging traditional agricultural systems across the world. Horticulture, particularly crops with specific environmental requirements, has become increasingly vulnerable to these changes.

Traditionally, apple a temperate fruit crop requiring prolonged winter chilling for proper flowering and fruit development. Most conventional apple varieties require approximately 1,000–1,500 hours of chilling below 7°C to overcome dormancy and produce satisfactory yields. This requirement naturally restricted apple cultivation to specific high-altitude regions of the Himalayas. However, rising temperatures and declining chilling hours started affecting traditional apple-growing regions. Changes in snowfall patterns, shifting snowlines and warmer winters created uncertainty for apple growers in many mountain areas. The need for climate-adapted varieties with lower chilling requirements has therefore become increasingly important. In this context, HRMN-99, developed by Dr Hariman Sharma, represents a significant step towards climate-resilient horticulture. The uniqueness of HRMN-99 lies in its ability to produce fruits under conditions whereas conventional apple varieties face limitations. Requiring much lower chilling compared to traditional apples, the variety demonstrated successful fruiting in warmer areas, including locations with summer temperatures reaching 40–45°C.

This characteristic opened a new dimension in apple cultivation. The significance of HRMN-99 is not limited merely to its ability to tolerate warm conditions. HRMN-99 provides an opportunity to diversify their farming systems and introduce a high-value horticultural crop suited to their local environment. Another important advantage of HRMN-99 is its early fruiting behaviour. HRMN-99 begins bearing fruits relatively early under suitable management conditions. Early returns are particularly valuable for small and marginal farmers who often cannot wait for long gestation periods before receiving income from horticultural investments. The variety also offers opportunities for integrated farming systems.



Such diversification can reduce production risks and provide farmers with multiple sources of income throughout the year. The climate-resilient nature of HRMN-99 also aligns with the broader goals of sustainable agriculture. By enabling apple cultivation in new areas, it can contribute to:

- diversification of rural economies,
- better utilization of available land resources,
- creation of new horticultural enterprises,
- employment generation, and
- adaptation to changing climatic conditions.

The journey of HRMN-99 proved - Innovation does not always mean creating something completely new; sometimes it means recognizing hidden potential within nature and developing it for wider benefit

Dr Hariman Sharma who once challenged the belief that apples could not grow in warm regions has now contributed to a new understanding of how horticulture can adapt to changing environmental realities. HRMN-99 therefore stands not only as an apple variety but also as a symbol of resilience—the resilience of nature, the resilience of farmers and the resilience of human innovation.

In a changing climate, the future of agriculture belongs to innovations that convert challenges into opportunities. HRMN-99 is a living example of how a farmer's vision, supported by perseverance and scientific validation, can create a pathway towards resilient and sustainable horticulture.

3.6. From Innovation to Impact – The Beginning of a National Movement

The journey of HRMN-99 was never limited to developing a new apple variety, it was to create opportunities for farmers living outside the traditional apple-growing regions. He believed that the benefits of horticulture should not remain confined to a few geographical areas but should reach farmers across diverse landscapes of India.



The success of HRMN-99 demonstrated the power of farmer-led innovation. The expansion of HRMN-99 across different states proved that the variety had significance beyond its place of origin. Farmers from diverse regions adopted the variety. And through their efforts, institutions and organizations, HRMN-99 reached several parts of the country. Successful fruiting demonstrated its adaptability under different environmental conditions. The variety also attracted interest beyond India, reflecting the wider relevance of low-chilling apple cultivation in regions facing similar climatic challenges. One of the most important outcomes of this journey was the confidence it generated among farmers. They found that apple cultivation was possible not only in cold mountain regions. It encouraged farmers to think differently, experiment with new crops and explore opportunities beyond conventional farming systems.

The variety also created possibilities for agricultural diversification. Farmers could integrate HRMN-99 into existing production systems along with other crops. In this way, the innovation represented not only a horticultural achievement but also a pathway towards livelihood improvement. The story of HRMN-99 also highlights the importance of collaboration between farmers, scientists, institutions and policymakers. This partnership between grassroots knowledge and scientific validation became a model for promoting farmer innovations. The recognition received by Dr Hariman Sharma, including the prestigious *Padma Shri* Award, highlights national appreciation of his extraordinary contribution. However, the true legacy of his work lies in the orchards established by farmers, the new opportunities created in non-traditional regions and the inspiration provided to countless innovators. Today, HRMN-99 stands as more than an apple variety. It represents:

- the power of farmer creativity,
- the importance of preserving indigenous innovation,
- the role of science in strengthening grassroots discoveries, and
- the possibility of transforming agricultural challenges into opportunities.

The journey from discovery to adoption established HRMN-99 as a landmark innovation in Indian horticulture. However, the greatest measure of any agricultural achievement lies in the lives it touches and the economic opportunities it creates. The next chapter explores how HRMN-99 has influenced farmers' livelihoods, rural economies and the future direction of climate-resilient horticulture in India.

4

Apple HRMN-99: Transforming Farmers' Lives

4.1. From Apple Cultivation to Livelihood Transformation

For generations, apple cultivation in India remained closely associated with the Himalayan landscape of Himachal Pradesh, Jammu & Kashmir and Uttarakhand. For farmers in lower hills, plains and warmer regions, apple cultivation remained a distant dream. The climatic conditions that supported traditional apple varieties were absent, and attempts to introduce conventional apples in these regions often failed to provide satisfactory results. It was in this context that the contribution of Dr Hariman Sharma acquired extraordinary significance.

By developing HRMN-99, Dr Hariman Sharma opened a new possibility for thousands of farmers living outside traditional apple-growing zones. However, the true vision behind HRMN-99 was that it was a means of improving farmers' livelihoods. Coming from a farming background himself, he understood the challenges faced by small and marginal farmers. He believed that diversification into high-value horticultural crops could provide additional income opportunities and strengthen rural economies.. Instead of replacing existing crops completely, he successfully demonstrated that apple cultivation could coexist with other fruit crops such as mango and subtropical fruits. This integrated approach provided farmers with an opportunity to diversify their income while reducing dependence on a single crop.

Farmers in lower elevations, where traditional apple cultivation was not feasible, could now consider establishing apple orchards suited to their local conditions. The variety offered several advantages:

- ability to grow under warmer climatic conditions,
- low chilling requirement compared with traditional apple varieties,
- early fruiting and earlier market availability,
- suitability for diversified farming systems, and
- potential for additional farm income.



For many farmers, particularly in regions where agriculture faces challenges due to small landholdings, uncertain climate and limited income sources, HRMN-99 provided a new opportunity. The innovation also carried an important social message—a farmer's observation, experimentation and perseverance generated knowledge that later received scientific validation and wider acceptance.

Dr Hariman Sharma's journey showed that farmers are not merely users of technology; they can also be creators of technology. The transformation brought by HRMN-99 was therefore much deeper than the introduction of a new apple variety. It represented a change in thinking—from accepting geographical limitations to exploring new agricultural possibilities.

4.2. Empowering Farmers Beyond Traditional Apple Belts

Farmers in lower hills, plains and warmer regions often remained outside this economic opportunity because conventional apple varieties required specific cold conditions and higher elevations. Although many farmers aspired to grow apples, environmental limitations prevented them from entering this high-value horticultural sector. HRMN-99 changed this situation by offering a new possibility. Farmers from different parts of India began visiting Paniala as for many farmers, seeing was believing.

The sight of apple trees growing successfully alongside mango and other subtropical crops under the warm conditions of Bilaspur encouraged farmers to think beyond traditional cropping patterns and explore horticultural diversification. With support from institutions and organizations involved in dissemination of HRMN-99, farmers adopted it in lower Himachal Pradesh, Jammu, Manipur, Karnataka, Chhattisgarh, Telangana, Haryana and other non-traditional apple-growing areas.

For farmers in these regions, HRMN-99 provided several advantages.

- Firstly, it created an opportunity to introduce a high-value fruit crop into existing farming systems. Farmers did not necessarily have to abandon their traditional crops; instead, they could integrate apple cultivation as an additional source of income.
- Secondly, the relatively early fruiting behaviour of HRMN-99 reduced the waiting period generally associated with fruit orchards. This was particularly important for small and marginal farmers, for whom early economic returns are essential.



- Thirdly, the variety allowed farmers to access the market that had been dominated by growers from a few mountain states. By expanding apple cultivation into new regions, HRMN-99 helped democratize access to the apple economy.

One of the most significant examples of farmer empowerment came from the northeastern region, particularly Manipur, where HRMN-99 generated considerable interest. Farmers began establishing orchards. The success of early adopters encouraged more farmers to participate, creating a chain reaction of interest and adoption. Similarly, farmers in lower Himachal Pradesh viewed HRMN-99 as an opportunity to strengthen their horticultural economy. The variety offered a suitable option for areas where traditional apples were difficult to cultivate due to warmer conditions.

Despite receiving national recognition, Dr Hariman Sharma continued to maintain close contact with farmers, sharing his experiences and encouraging them to adopt scientific orchard management practices. His personal journey from a small farmer to a national innovator became a source of motivation for farming communities.

The HRMN-99 story also highlighted an important change in the relationship between farmers and agricultural innovation. They became active partners in testing, adapting and promoting a farmer-generated innovation. Every successful orchard established by a farmer strengthened the credibility of HRMN-99.

The movement demonstrated that when farmers are empowered with appropriate technology and knowledge, they can become agents of agricultural transformation. HRMN-99, therefore, represents more than expansion of apple cultivation—it represents expansion of opportunity. As HRMN-99 entered farmers' fields, its impact began extending beyond crop diversification. The variety started creating new economic possibilities through orchard development, nursery activities, employment generation and value-chain opportunities.

4.3. Economic Opportunities and Rural Entrepreneurship

Agriculture becomes truly transformative when it creates sustainable economic opportunities for farming communities. The success of HRMN-99 is significant not only because it enabled apple cultivation in warmer and non-traditional regions, but also because it opened the possibility of developing a wider rural



economy around apple production. The economic benefits of apple cultivation in India remained concentrated in traditional apple-growing regions. In Himachal Pradesh and Jammu & Kashmir, apple orchards became important sources of rural income, employment and prosperity. However, farmers in warmer areas were unable to take advantage of this opportunity because conventional apple varieties could not perform under their climatic conditions.

The innovation of Dr Hariman Sharma changed this scenario. The first economic advantage of HRMN-99 lies in its suitability for diversification. Farmers could introduce apple cultivation as an additional source of income. In areas where agricultural returns are often uncertain, a successful horticultural crop can provide greater economic stability because fruit crops generally offer higher value per unit area compared with many annual crops. The early fruiting nature of HRMN-99 further enhanced its attractiveness among farmers. Fruit trees usually require several years before generating commercial returns, discouraging small farmers from investing in horticulture. HRMN-99, with its relatively early fruiting behaviour under suitable management conditions, reduced this economic barrier and encouraged farmers to adopt orchard-based farming.

Another important advantage was its market opportunity. Since HRMN-99 fruits mature earlier than traditional apple varieties and this early market window provides an opportunity for better price realization and improved returns. The economic impact of HRMN-99 extends beyond individual orchards. As adoption increases, it creates opportunities for several associated activities:

- nursery development and production of quality planting material,
- skilled employment in orchard establishment and management,
- local services related to pruning, irrigation and plant care,
- transportation and marketing networks, and
- processing and value addition of apple products.

Thus, a single innovation has the potential to generate an entire rural value chain. The experience of Dr Hariman Sharma himself demonstrates this integrated approach. His orchard at Paniala became a learning centre where farmers, visitors and agricultural enthusiasts observed the possibilities of diversified horticulture. His ability to grow apple along with mango and other fruit crops provided a practical model of how farmers could optimize their land resources. The adoption of HRMN-99 also has special relevance for small and marginal farmers. High-value horticultural crops can provide opportunities to enhance farm profitability



without requiring large-scale land expansion. Furthermore, the establishment of apple orchards in new regions can stimulate rural entrepreneurship among youth. Nursery management, orchard services, fruit marketing and processing activities can create employment opportunities and encourage young people to remain connected with agriculture.

The story of HRMN-99 therefore represents a transition: From a '*single farmer's innovation*' to a '*farmer-driven economic opportunity*'. The journey of HRMN-99 reminds us that agriculture is not only about production—it is about livelihoods, dignity and economic empowerment. The economic possibilities created by HRMN-99 are closely linked with another major challenge facing agriculture today—climate change.

4.4. HRMN-99 as a Model of Climate-Smart Horticulture

Agriculture has always evolved in response to changing environmental conditions. Throughout history, farmers have selected, conserved and improved crop varieties that could survive and perform under diverse climates. In the present era, however, climate change has created unprecedented challenges, making adaptation an essential component of agricultural sustainability.^{ww}

Horticulture crops, particularly perennial fruit crops, are highly sensitive to climatic variations because their growth, flowering and fruit development depend on specific environmental conditions. Traditionally, successful apple cultivation in India depended on the availability of adequate winter chilling. Most commercial apple varieties require approximately 1,000–1,500 hours of chilling below 7°C to break dormancy and ensure proper flowering and fruit production. This requirement restricted apple cultivation mainly to the cooler Himalayan regions.

However, changing climatic patterns have started affecting these traditional systems. Increasing temperatures, reduced snowfall, declining chilling hours and shifting climatic zones have created new uncertainties for apple growers. Areas that once provided ideal conditions are gradually experiencing stress. In this changing scenario, HRMN-99 represents a practical example of climate-smart horticulture because of its ability to perform under warmer conditions demonstrates how crop innovation can help agriculture adjust to changing environmental realities.

Agriculture must continuously adapt through suitable genetic resources and farmer-led innovation. The development of HRMN-99 shows that climate challenges can be addressed through changing farming practices and also



through identifying and promoting crop varieties with suitable adaptation traits. For farmers in lower hills and warmer regions, this variety provides an opportunity to diversify their farming systems. Instead of being excluded from apple cultivation because of geographical limitations, they can now explore a new horticultural enterprise suited to their local conditions. The innovation also has relevance for traditional apple-growing regions. As climate change gradually alters the suitability of different locations, low-chilling and climate-adapted varieties may become increasingly important components of future apple production strategies.

Another important aspect of HRMN-99 is its contribution to sustainable farming systems. By allowing apple cultivation in new areas, it encourages diversification and better utilization of available land resources. Farmers can combine apple orchards with other crops, livestock activities and integrated farming approaches to create more resilient production systems. The story of HRMN-99 also carries a broader lesson for Indian agriculture. Many future challenges will require solutions that emerge from collaboration between farmers, scientists and institutions. While climate resilience explains the scientific importance of HRMN-99, the deeper impact of any innovation is reflected in the people it inspires

4.5. Social Impact – From Individual Innovation to Community Inspiration

The story of HRMN-99 represents a deeper dimension of innovation—how one farmer's determination inspired thousands of others to think differently about agriculture. When Dr Hariman Sharma first observed an apple plant bearing fruits in the warm environment of Paniala, many people around him found it difficult to believe. However, he continued his efforts with patience and determination without institutional support. He experimented with grafting techniques and gradually developed HRMN-99 through continuous observation and practical experience.

Innovation is not limited to laboratories; it can emerge from farmers' fields through curiosity, commitment and perseverance. His farm became a place of learning where people could directly observe the performance of a variety that challenged conventional thinking. Many farmers, realized that agricultural opportunities were not always restricted by traditional beliefs. With the right knowledge and suitable technology, new possibilities could emerge even under



difficult conditions. The social impact of HRMN-99 was particularly significant among farmers who had limited opportunities to participate in high-value horticulture. Many small and marginal farmers often struggle with uncertain returns from traditional crops. The possibility of integrating apple cultivation into their farming systems provided them with renewed hope and motivation.

The story also highlighted the importance of recognizing grassroots innovators. Dr Hariman Sharma's achievement demonstrated another pathway—where farmers themselves can generate valuable knowledge and technologies that deserve scientific recognition and wider dissemination. The recognition of his innovation at national and international platforms further strengthened the confidence of farming communities. The conferment of the *Padma Shri* Award acknowledged the development of HRMN-99 and also the extraordinary spirit of a farmer who transformed a personal observation into a national contribution. However, the greatest recognition of Dr Hariman Sharma's work is reflected in the farmers who continue to plant HRMN-99 and explore new possibilities in horticulture. Every new orchard established using HRMN-99 carries forward his message:

- observe nature carefully,
- believe in possibilities,
- experiment with dedication, and
- share knowledge for collective benefit.

The journey of HRMN-99, therefore represents a social movement as much as an agricultural innovation. It has encouraged farmers to become innovators, entrepreneurs and active participants in shaping the future of agriculture. Dr Hariman Sharma's life story demonstrated that vision and perseverance can overcome limitations and create opportunities for society at large. The journey of HRMN-99 from a farmer's backyard to a national symbol of innovation represents a remarkable transformation. The final section of this chapter will reflect on the enduring legacy of Hariman Sharma and HRMN-99, and how this achievement will continue to influence Indian horticulture in the years ahead.

4.6. The Legacy of Dr Hariman Sharma and HRMN-99

Every successful agricultural innovation carries two stories—one of the technology itself and another of the person who believed in it when others could not. The journey of HRMN-99 represents both these dimensions. It is



the story of a unique apple variety as well as of Dr Hariman Sharma, whose farmer-centric approach transformed an unusual observation into a national achievement. Dr Hariman Sharma noticed an apple plant bearing fruits in the warm environment of Paniala village, he could have ignored it as a natural curiosity. Instead, his farmer's instinct recognized a hidden possibility. Through years he nurtured that possibility into HRMN-99—a variety that challenged established perceptions about apple cultivation in India. The legacy of HRMN-99 lies in the barriers it overcame. It challenged the following:

- geographical barrier that apples could grow only in cold Himalayan regions;
- knowledge barrier that important agricultural innovations could emerge only from formal research institutions;
- economic barrier that farmers in warmer regions could not participate in the apple economy; and
- most importantly the psychological barrier that farmers should only follow established practices rather than create new possibilities.

The impact of HRMN-99 extends beyond the number of orchards established or the regions where it has been planted. Its deeper contribution lies in demonstrating that farmers, through observation and innovation, can contribute significantly to agricultural advancement. The recognition of Dr Hariman Sharma with the *Padma Shri* Award represents national acknowledgement of this exceptional contribution. However, the true measure of his achievement is reflected in the farmers who have gained confidence from his journey and are exploring new opportunities in horticulture.

The story of HRMN-99 also provides important lessons for the future of Indian agriculture.

- First, it highlights the importance of preserving and encouraging grassroots innovations. Many valuable agricultural discoveries may remain unnoticed unless farmers' knowledge is recognized and scientifically evaluated.
- Second, it demonstrates the importance of collaboration between farmers, scientists, institutions and policymakers. The wider acceptance of HRMN-99 became possible through the combined efforts of the innovator, scientific organizations, evaluation agencies and farming communities.
- Third, it shows the importance of developing climate-resilient agricultural solutions. As climate change continues to influence farming systems,



varieties such as HRMN-99 provide valuable examples of how agriculture can adapt through innovation.

The future potential of HRMN-99 represents a model of how farmer-led innovations can contribute to diversification, rural entrepreneurship and sustainable agricultural development. For future generations of farmers, Dr Hariman Sharma's journey carries a powerful message:

A farmer is not only a producer of food; he can also be a creator of knowledge, a discoverer of solutions and an agent of change. From a small village orchard in Bilaspur to farmers' fields across India, HRMN-99 carries with it the determination of an innovator, the aspirations of farmers and the promise of a more resilient horticultural future.

The legacy of Dr Hariman Sharma and HRMN-99 will therefore not be remembered only as the story of a low-chilling apple variety but also of courage, creativity and conviction. The next chapter will explore the scientific significance, institutional recognition and wider national relevance of HRMN-99 as an example of successful farmer–scientist collaboration.

The greatest legacy of an innovation is not the variety it creates, but the confidence it inspires. HRMN-99 stands as a symbol of Dr Hariman Sharma's belief that farmers can become innovators, and that a single idea nurtured with dedication can transform agriculture for generations to come.

5

Bridging Farmer Innovation, Science and Institutional Support

5.1. Recognizing a Farmer's Genius – From Observation to Innovation

In the late 1990s, among the discarded apple seeds in backyard, one seed germinated and developed into a young apple plant. Under ordinary circumstances, such a plant growing in a warm, low-altitude region would not have attracted much attention. However, when the plant survived and eventually produced fruits under the climatic conditions of Paniala, Dr Hariman Sharma recognized that nature was presenting an unusual opportunity. The possibility of an apple tree growing and fruiting successfully at around 500 m above mean sea level appeared contrary to established understanding.

With limited resources and without formal scientific facilities, Dr Hariman Sharma undertook years of practical experimentation. He used grafting techniques, maintained the plant carefully and gradually multiplied the material. His approach reflected the traditional strengths of Indian farmers—the ability to observe, adapt and innovate based on close interaction with nature. For more than a decade, Dr Hariman Sharma continued refining his innovation. He studied the plant's growth, fruiting behaviour and adaptability under warm conditions. His farm became an open field laboratory where every season provided new learning.

His achievement is remarkable because he questioned a deeply established belief: Could apples be grown beyond the traditional boundaries of cold mountain regions? HRMN-99 demonstrated that genetic potential can overcome geographical limitations. It showed that a crop's future is not determined only by where it has traditionally been grown, but also by the availability of suitable varieties and the commitment of innovative farmers.

Dr Hariman Sharma's achievement reminds us that many agricultural breakthroughs throughout history have originated from farmers who noticed



unusual characteristics in plants and preserved them for future benefit. HRMN-99 belongs to this tradition of farmer-led discovery. This apple variety reflects three essential qualities:

- **Observation** : recognizing an unusual phenomenon in nature.
- **Perseverance** : nurturing and improving the discovery over many years.
- **Vision** : understanding its potential benefit for millions of farmers.

The genius of Dr Hariman Sharma was that he found an unusual apple plant and understood its significance and dedicated himself to transforming it into an opportunity for others. The journey of HRMN-99 from a farmer's observation to an agricultural innovation established its uniqueness. However, for wider acceptance, every innovation requires scientific evaluation and validation.

5.2. Scientific Evaluation and Validation of HRMN-99

The remarkable performance of HRMN-99 in the orchard of Dr Hariman Sharma attracted the attention of farmers, its wider acceptance required systematic evaluation by scientific institutions. The journey of HRMN-99 from a farmer's field to a scientifically recognized variety illustrates the importance of combining indigenous knowledge with modern scientific validation. Recognizing the exceptional potential of the variety, Dr PL Gautam, former Chairperson of the Protection of Plant Varieties and Farmers' Rights Authority (PPV&FRA), facilitated its linkage with the National Innovation Foundation (NIF), India. This link proved to be a turning point in the history of HRMN-99 as now the variety entered a structured program of scientific evaluation to establish its uniqueness, adaptability and commercial potential.

The first objective was to determine whether HRMN-99 was genuinely distinct from other known low-chilling apple cultivars. Its morphological characteristics were documented--tree architecture, flowering behaviour, fruit quality, maturity period and adaptability under different climatic conditions. Particular attention was given to its ability to flower and fruit successfully under warm subtropical conditions where conventional apple varieties normally fail. To assess its stability and adaptability, multi-location trials were initiated across diverse agro-climatic regions of India. During 2015–2019, approximately 20,000 grafted plants were distributed through NIF to nearly 1,500 farmers and 25 research and developmental organizations across 35 States and Union Territories. These trials generated information on growth, flowering, fruiting behaviour and adaptability



under varied environmental conditions. Successful flowering and fruiting were recorded in numerous non-traditional apple-growing regions, confirming that the exceptional performance observed by Dr Hariman Sharma at Paniala was not an isolated phenomenon. The variety demonstrated remarkable adaptability under warm conditions and reinforced the possibility of expanding apple cultivation beyond the conventional temperate belt.

Scientists assessed fruit size, colour, texture, sweetness, total soluble solids, acidity and consumer acceptability. Comparisons with established low-chilling cultivars such as Anna and Dorsett Golden indicated that HRMN-99 possessed competitive fruit quality while offering the added advantage of early maturity and adaptation to warmer climates. Its attractive striped red-over-yellow skin, juicy flesh and pleasant flavour further enhanced its commercial appeal. An equally important milestone was the molecular characterization of HRMN-99. DNA fingerprinting studies confirmed that HRMN-99 possessed a distinct genetic identity and was not merely a duplicate or selection of an existing cultivar. This scientific evidence became fundamental for its recognition as a unique farmer-developed variety. The scientific validation of HRMN-99 demonstrated an important principle for Indian agriculture: farmer innovations deserve the same rigour of evaluation as varieties developed through formal breeding programs. Rather than replacing the farmer's knowledge, science strengthened it by generating objective evidence that could be accepted nationally and internationally.

The collaboration between Dr Hariman Sharma and scientific institutions created a powerful example of participatory approach to achieve success. His field observations identified the opportunity, while scientific research established its reliability, repeatability and wider applicability. The evaluation of HRMN-99 also highlighted the importance of interdisciplinary research. Plant breeders, horticulturists, molecular biologists, extension specialists and innovation-support organizations worked together to understand the variety from different perspectives. Such collaborative efforts ensured that the innovation was assessed comprehensively rather than through a single scientific lens. Today, the scientific credibility of HRMN-99 rests not merely on its impressive field performance but on a robust data generated through systematic experimentation, multi-location testing and molecular validation. This scientific foundation provided the variety the confidence of farmers, researchers, policymakers and horticultural institutions alike. Scientific validation established the uniqueness and performance of HRMN-99. The next crucial step was to secure legal recognition and protect the intellectual contribution of Dr Hariman Sharma.



5.3. A Comparison of low chilling Apple Varieties under North-western Plains

Three extremely low chilling apple cultivars HRMN-99, Dorsett Golden and Anna were compared on yield and production efficiency under North-western plains of Uttar Pradesh. The cultivars were taken into consideration as a factor, and each plant served as replication. Dates of first flowering and the full bloom which occurred in February and March were recorded (Table 1).

Table 1: Date of flower initiation and full blossom in the year 2019-20 and 2020-21

SN Cultivars		Date of flower initiation								Date of full blossom							
		R1		R2		R3		R4		R1		R2		R3		R4	
		19-20	20-21	19-20	20-21	19-20	20-21	19-20	20-21	19-20	20-21	19-20	20-21	19-20	20-21	19-20	20-21
1.	HRMN-99	14 Feb	11 Feb	14 Feb	12 Feb	14 Feb	16 Feb	14 Feb	12 Feb	28 Feb	5 Mar	28 Feb	4 Mar	1 Mar	6 Mar	1 Mar	5 Mar
2.	Dorsett Golden	13 Feb	18 Feb	15 Feb	20 Feb	25 Feb	20 Feb	13 Feb	23 Feb	24 Feb	2 Mar	24 Feb	1 Mar	22 Feb	2 Mar	20 Feb	6 Mar
3.	Anna	13 Feb	12 Feb	13 Feb	15 Feb	13 Feb	18 Feb	13 Feb	12 Feb	25 Feb	28 Feb	25 Feb	28 Feb	26 Feb	26 Feb	26 Feb	26 Feb

The results showed that the number of fruits per plant (176.62), and no. of branches per plant (28.5) were significant. On the other hand, canopy spread (4.84 m), stem girth (33.87 cm), plant height (4.06 m), number of flowers (1020.75), fruit length (57.12 mm), fruit width (52.61 mm), fruit weight/fruit (76.62 g), fruit weight (5 fruits) (383.12 g) were non-significant. The quantitative characters summarized in Tables 2 and 3, and Fig. 16. He has discussed a great deal about his success story while in Delhi to receive a medal from Late Shri Pranab



Fig. 16. HRMN-99 variety in bloom



Table 2: Mean values of different traits of three apple varieties during 2019-20 and 2020-21

SN	Character	2019-20						2020-21					
		HRMN-99	Dorsett Golden	Anna	SE mean	CD	CV	HRMN-99	Dorsett Golden	Anna	SE mean	CD	CV
1.	No. of flowers	846.5	654.5	911.5	60.02	N.S.	14.93	1028	1283	1130	128.71	N.S.	22.58
2.	No. of branches per plant	28	9	7.750	1.41	4.872	18.92	29	14	15	4.97	N.S.	52.83
3.	Canopy spread (m)	4.198	4.543	4.312	0.41	N.S.	18.84	4.37	5.15	4.94	0.38	N.S.	15.30
4.	Stem girth (cm)	33.00	29.25	29.50	2.67	N.S.	17.48	34.75	35.00	33.75	2.46	N.S.	13.37
5.	Plant height (m)	3.258	3.220	2.91	0.22	N.S.	13.99	3.66	4.91	4.00	0.42	N.S.	19.97
6.	No. of fruits per plant	67.50	92.50	81.25	3.82	13.17	9.50	174.00	288.00	272.00	19.99	68.99	17.38
7.	Fruit size (length) (mm)	55.75	54.375	54.243	1.91	N.S.	6.55	55.98	56.11	60.00	1.79	N.S.	6.27
8.	Fruit size (width) (mm)	57.583	52.99	52.53	2.52	N.S.	9.25	43.22	47.46	52.69	4.01	N.S.	17.08
9.	Fruit weight per fruit (gm)	71.5	71.75	73.25	7.21	N.S.	20.22	80	73	80	4.87	N.S.	12.80
10.	Fruit weight (5 fruit) (gm)	357.50	358.75	366.25	36.05	N.S.	19.98	400.00	365.00	400.00	24.32	N.S.	12.94



Mukherjee, Former President of India at his residence (Fig. 17).

The study indicated that the basis of their vegetative behaviour, Dorsett Golden appeared to be superior variety in terms of tree morphology and others as moderate. Further, variety Dorsett Golden had more productivity and the fruits of *Anna* and *HRMN-99* were having better marketable fruit traits. The study also revealed the diversity of the apple cultivars analyzed highlighting the significance of safeguarding these precious genetic resources and pursuing additional study to ensure their conservation, exchange, and utilization in upcoming breeding initiatives for the development of novel, improved apple varieties (Kumar *et al.* 2023).



Fig. 17. Hariman Sharma with the former President of India Sh Pranab Mukherjee and Dr Harshvardhan ji

Table 3: Pooled data of different traits of three apple varieties during 2019-20 and 2020-21

SN	Character	HRMN-99	Dorsett Golden	Anna	Mean
1.	No. of flowers	937.25	968.75	1020.75	975.58
2.	No. of branches per plant	28.5	11.5	11.37	17.12
3.	Canopy spread (m)	4.28	4.84	4.62	4.58
4.	Stem Girth (cm)	33.87	32.12	31.62	32.53
5.	Plant Height (m)	3.45	4.06	3.45	3.65
6.	No. of fruits per plant	120.75	190.25	176.62	162.54
7.	Fruit size (length) (mm)	55.86	55.24	57.12	56.07
8.	Fruit size (width) (mm)	50.40	50.22	52.61	51.07
9.	Fruit weight per fruit (gm)	75.75	72.37	76.62	74.91
10.	Fruit weight (5 fruit) (gm)	378.75	361.87	383.12	374.58



5.4. Effect of Plant Growth Regulators on Flowering and Fruit Setting in HRMN-99

Dr Hariman Sharma discovered in 1999 that the low chilling apple variety HRMN-99 was resistant to scab disease. This variety outperforms nearly all low chilling apple varieties in terms of sugar acid ratio, total soluble solids, beautiful colour, and self-life. In the current experiment, four-year-old uniform apple plants that were spaced 3 m x 1.5 m apart were collected. The manure, fertiliser, plant growth regulators, and other orchard management practices were used as per the recommended package of practices. The investigation was conducted at Sam Higginbottom University of Agriculture, Technology and Sciences (SHUATS), Prayagraj (Uttar Pradesh), on 40- month-old plant during January 2022 to July 2022. The experiment was conducted in randomized block design with three replications and nine treatments (T0 – Control, T1 – GA3 50 ppm, T2 – GA3 100 ppm, T3 – GA3 150 ppm, T4 – GA3 200 ppm, T5 – NAA 10 ppm, T6 – NAA 15 ppm, T7- NAA 20 ppm and T8 – NAA 25 ppm) were applied and data were analysed statistically (Jangid and Mishra, 2023).

5.5. Growth Parameters

The data on effect of GA3 and NAA on growth parameters of fruit are presented in Table 4. The maximum plant height (2.96 m) was recorded in the treatment T4 (GA3 200 ppm) after 4 years of transplanting followed by T3 (GA3 150 ppm) (2.86 m) and minimum plant height (2.48 m) was observed in the treatment T0 (Control) after 4 years of transplanting. Increment in plant height due to effect of GA3 and NAA. Similar result was observed by Singh and Mirza (2020). The maximum plant spread (11.83 cm) was recorded in the treatment T4 (GA3 200 ppm) followed by T3 (GA3 @ 150 ppm) and minimum plant spread (9.43 cm) was observed in the treatment T0 (Control). Increment in plant spread due to GA3. Similar result was given by Singh and Mirza (2020).

5.6. Flowering and Fruiting Parameters

The data pertaining to effect of GA3 and NAA on physical characteristics of fruit are presented in Table 5. The maximum bud burst to first flowering (21 days) was recorded from the treatment T5 (NAA 10 ppm) followed by T7 (NAA 20 ppm) and the minimum bud burst to first flowering (13.33 days) was recorded from the treatment T0 (Control). GA3 decreased the flowers and foliar spray of NAA increases flower production. Similar result was given by Yadav and Jadhav (2019).

**Table 4:** Effect of plant growth regulators on growth parameters of apple cv. HRMN-99

Treatment	Treatment combinations	Plant height (m)	Plant spread (cm)	No. of primary branches	No. of secondary branches	Stem diameter (cm)	Leaf Area (cm ²)
T0	Control (Water spray)	2.48	9.43	1.6	16.66	8.9	37.50
T1	GA3 (50 ppm)	2.71	11	2.33	25	15.06	39.62
T2	GA3 (100 ppm)	2.80	11.13	2.66	27.66	12.1	38.82
T3	GA3(150 ppm)	2.86	11.53	3.00	28.66	10.76	37.95
T4	GA3(200 ppm)	2.96	11.83	3.66	31.33	13.8	38.98
T5	NAA (10 ppm)	2.63	10.26	2.1	23	18.46	41.52
T6	NAA (15 ppm)	2.57	9.8	1.67	18.33	11.36	38.40
T7	NAA (20 ppm)	2.60	10.06	2.0	22.66	18.33	40.50
T8	NAA (25 ppm)	2.66	10.53	2.2	23.66	14.63	39.16
F-test	-	NS	S	NS	S	S	S
S.Ed	-	0.186	0.512	0.782	1.527	1.024	0.422
CD at 5%	-		1.08		3.23	2.17	0.89

The maximum bud burst to 50% flowering (40.67 days) was recorded from the treatment T5 (NAA 10 ppm) followed by T7 (NAA 20 ppm) and the minimum bud burst to 50% flowering (29.33 days) was recorded from the treatment T0 (Control). GA3 decreased the flowers and foliar spray of NAA increases flower production. The maximum no. of flowers (258) was recorded from the treatment T5 (NAA 10 ppm) followed by T7 (NAA 20 ppm) and the minimum no. of flowers (191) was recorded from the treatment T0 (Control). GA3 decreased the flowers and foliar spray of NAA increases flower production. Similar result was given by Yadav and Jadhav (2019). The maximum no. of fruits per plant (36.33) was recorded from the treatment T5 (NAA 10 ppm) followed by T7 (NAA 20 ppm) and the minimum no. of fruits per plant (10.33) was recorded from the treatment T0 (Control). Application of GA3 and NAA significantly increased the number of fruits per plant.

The increased number of fruits per plant by GA3 and NAA treatment might be due to rapid and better nutrient translocation from roots to apical parts of the plant. Similar result was observed by Singh and Singh (2001). The maximum fruit weight (110.55 g) was recorded from the treatment T5 (NAA 10 ppm) followed



Table 5: Effect of plant growth regulators on flowering and fruiting parameters in apple cv. HRMN-99

Treatment	Treatment combinations	Bud burst to first flowering	Bud burst to 50% flowering	No. of flowers	No. of fruits / plant	Fruit wt (g)	Fruit yield (kg/plant)	Fruit yield (t/ha)	Fruit set %	Fruit drop (%)
T0	Control (Water spray)	13.33	29.33	191	10.33	72.53	2.10	9.11	8.88	15.08
T1	GA3 (50 ppm)	19.33	38.00	36.33	25.33	98.24	7.20	16	8.70	14.53
T2	GA3 (100 ppm)	17.65	34.33	223.3	16.66	90.13	5.96	13.24	8.25	14.29
T3	GA3 (150 ppm)	14.33	31.65	192.3	11.67	80.38	4.72	10.48	8.99	13.95
T4	GA3 (200 ppm)	18.67	34.66	228.7	21.66	93.87	6.10	13.55	10.2	15.03
T5	NAA (10 ppm)	21.00	40.67	258.0	36.33	110.55	7.6	16.88	10.9	13.25
T6	NAA (15 ppm)	16.00	32.67	218.7	15.00	83.52	5.82	12.93	9.85	10.97
T7	NAA (20 ppm)	19.66	38.33	243.3	29.00	100.69	7.58	16.84	10.00	13.23
T8	NAA (25 ppm)	19.00	36.33	234.7	22.67	96.61	6.29	13.97	9.90	9.25
F-test	-	S	S	S	NS	S	S	S	S	S
S.Ed	-	0.866	0.660	3.789	9.007	15.519	0.175	0.427	0.309	0.547
CD at 5% -	-	1.83	1.39	8.03	-	1.59	0.37	0.90	0.65	1.16

by T7 (NAA 20 ppm) and the minimum fruit weight (72.53 g) was recorded from the treatment T0 (Control). The average fruit weight of fruit was significantly increased with the application of GA3 and NAA. This may be attributed to the increased supply of photosynthetic materials and its efficient mobilization in plants giving rise to increased stimulation of fruit growth ultimately resulting in increased fruit weight (Jangid and Mishra, 2023). The maximum fruit yield (kg/plant) (7.6 kg/plant) was recorded from the treatment T5 (NAA 10 ppm) followed by T7 (NAA 20 ppm) and the minimum fruit yield (4.10 kg/plant) was recorded from the treatment T0 (Control). The possible reason for increasing in fruit yield per hectare is due to increase in number of fruits per plant, average fruit weight and fruit yield per plant. The maximum fruit yield (t/ha) (16.88 t/ha) was recorded from the treatment T5 (NAA 10 ppm) followed by T7 (NAA 20 ppm) and the minimum fruit yield (9.11 t/ha) was recorded from the treatment T0 (Control).



The possible reason for increasing in fruit yield per hectare is due to increase in number of fruits per plant, average fruit weight and fruit yield per plant. The maximum fruit set percentage (10.9%) was recorded from the treatment T5 (NAA 10 ppm) followed by T4 (GA3 200 ppm) and the minimum fruit set (8.25%) was recorded from the treatment T2 (GA3 100 ppm). NAA affects the physiological process, hasten maturity and produces better quality fruits that's why NAA increased fruit set compared to GA3. The maximum fruit drop (15.08%) was recorded from the treatment T0 (Control) followed by T4 (GA3 200 ppm) and the minimum fruit drop (9.25%) was recorded from the treatment T8 (NAA 25 ppm). GA3 reduced total fruit drop percentage as compared to the control and NAA increasing in photosynthetic activity, fruit set by reducing fruit drop and thereby higher number of fruits. Similar result was observed by Hifny (2017).

5.7. Chemical Characteristics

Effects of GA3 and NAA on chemical characteristics of fruit are presented in Table 6. The maximum total soluble solids (19.7°Brix) was recorded from the

Table 6: Effect of plant growth regulators on chemical characteristics of fruit in apple cv. HRMN-99

Treatment	Treatment combinations	TSS (°Brix)	Acidity (%)	TSS: Acid ratio
T0	Control (Water spray)	14.98	0.6	20.1
T1	GA3 (50 ppm)	18.06	0.89	20.2
T2	GA3 (100 ppm)	16.12	0.77	20.9
T3	GA3 (150 ppm)	15.2	0.71	21.4
T4	GA3 (200 ppm)	17.02	0.8	21.2
T5	NAA (10 ppm)	19.7	0.98	20.6
T6	NAA (15 ppm)	15.9	0.65	24.4
T7	NAA (20 ppm)	18.8	0.91	24.9
T8	NAA (25 ppm)	17.67	0.86	20.5
F-test		S	NS	S
S.Ed		0.179	0.200	0.517
CD at 5%		0.38		1.09



treatment T5 (NAA 10 ppm) followed by T7 (NAA 20 ppm) and the minimum total soluble solids (14.98°Brix) was recorded from the treatment T0 (Control). Similar result was reported by Hifny *et al* (2017). The maximum acidity (0.98%) was recorded from the treatment T5 (NAA 10 ppm) and the minimum acidity (0.6%) was recorded from the treatment T0 (Control). Similar result was reported by HA Hifny, *et al.* (2017). The maximum TSS:acid ratio (24.9) was recorded from the treatment T7 (NAA 20 ppm) and the minimum TSS: acid ratio (20.1) was recorded from the treatment T0 (Control). It is concluded that among various treatments applied to enhance the vegetative and reproductive growth of apple cv. HRMN-99, treatment T5 (NAA 10 ppm) was superior as compared to others, followed by T7 (NAA 20 ppm) and the lowest was T0 (Control). Treatment T4 (GA3 200 ppm) was the best recommended for overall growth and development of plants like plant height, plant spread, primary and secondary branches. T5 (NAA 10 ppm) was the best treatment for leaf area, stem girth, no of flowers, fruit size, etc., and other growth and yield attributes. It also performed well for qualitative parameters like T.S.S and acidity. In contrast, T7 (NAA 20 ppm) recorded the highest TSS: acid ratio. T0 (Control) resulted in the lowest fruit drop percentage and was therefore the best treatment for minimizing fruit drop.

The HRMN-99 apple variety, developed from a seedling grown in warm conditions in Paniala, Bilaspur, was evaluated by ICAR-IARI, Shimla. It produced large, sweet, and soft fruits (84–178 g) with high TSS (11–14.2). Early blooming and harvesting avoid heavy rainfall, making it suitable for plains and tropical areas (up to 45°C). Over 6 lakh plants distributed across 23 states, boosting commercial cultivation.

5.8. Morpho-Molecular and Multi-Location Study on Apple Variety HRMN-99

The variety HRMN-99 got local popularity for successful fruiting in lower Himachal Pradesh. Dr Chiranjeet Parmar (Retd. Horticulturist) gave first expert comments on the variety as unique and then innovative steps taken toward low chilling apple cultivation in India were further followed by Dr PL Gautam who connected him with NIF, India for the evaluation and promotion of the variety. NIF has conducted morphological, fruit quality testing and molecular



characterization of the varieties cultivated in low chilling areas such as Manipur and lower Himachal Pradesh. The fruit of HRMN-99 exhibited medium anthocyanin coloration, conical shape, medium sized eye basin, long length and shallow depth cavity of stalk. All the three varieties were cultivated in seedling rootstocks, grown as spur type trees and capable of self-pollination. The fruit of HRMN-99 was bigger in size with very soft, sweet and juicy pulp. Skin colour was stripped red over yellow during maturity. Whereas, Anna variety has crispy pulp with red blush and yellow skin. Dorsett-golden fruit was comparatively smaller with slight red, yellow skin and sweet-sour pulp. The average fruit weight of Anna was 136 g followed by 129.4 g in HRMN-99 and 67.6 g in Dorsett-golden. The fruit length of HRMN-99 was 70.4 cm, whereas in Anna 69.6 cm and Dorsett Golden 50.2 cm. The average fruit width of HRMN-99, Anna and Dorsett-golden was 6.62 cm, 6.68 cm and 5.06 cm, respectively. The SSR finger printing studies exhibited that the accessions HRMN-99 and Anna clustered together with common accessions, whereas Dorsett-golden formed a separate cluster with the other two accessions and was different from HRMN-99 and Anna. Though apple crop is very sensitive and its performance depends on varying climate, the HRMN-99 performs better if cultivated with appropriate soil management and agronomic practices. HRMN-99 requires very little or almost no chilling hours for flowering while Anna and Dorsett Golden need about 100 chilling hours. HRMN-99 is self-pollinating, so it can set fruit without pollinator cultivar. Dorsett Golden requires pollinator Anna as it requires cross-pollination for fruit set. HRMN-99 has better fruit size compared to Dorsett Golden; fruiting starts around third year after transplanting, and matures in early to mid-June.

5.9. Fruit Quality Study in HRMN-99 Apple Variety

In different years (2011-12, 2016-2017, 2017-2018, 2018-19), HRMN-99 fruit analysis was undertaken at the ICAR-Indian Agricultural Research Institute's Regional Station, Shimla and ICAR Research Complex for NEH region for apples cultivated in Himachal Pradesh and Manipur, respectively. Fruit had up to 12.5 per cent sugar, 4.13 pH and 15.5°B of total soluble solids. HRMN-99 transplanted at Dr YS Parmar University of Horticulture & Forestry, Neri campus in District Hamirpur (Himachal Pradesh) where there was first flowering on 15 February 2025, full flowering on 28 February 2026 and harvesting is expected during 10-15 June 2026. The fruit quality was good for both domestic and commercial purposes (Tables 7-8).



Table 7: Fruit quality assessment of HRMN-99 at different locations

Sr No	Parameters	Value (IARI Shimla/ ICAR NEH Manipur)	Value (UHF Neri, Hamirpur Campus)
1.	Fruit weight	150 - 178 g	-
2.	Length of the fruit	61.5- 70.22 mm	-
3.	Width of the fruit	55.5 - 74.11 mm	-
4.	Shelf life (room temperature)	8 -10 days (without any treatment)	-
5.	Moisture content	85.83%	-
6.	Ash	1.91%	-
7.	Crude protein	0.15 – 0.32%	-
8.	Total carbohydrate	12.5 – 15.9%	-
9.	Crude fat (ether extract)	0.06 – 0.13%	-
10.	Reducing sugar	7 - 8.9%	07.2
11.	Non-reducing sugar (sucrose)	1.6 - 3.8%	2.75
12.	Total sugar	9.7-12.5%	10.1
13.	Titrate Acidity (%)	-	0.27
14.	Ascorbic acid (mg/100 g)	-	24.2
15.	pH	4.13	-
16.	Total soluble solids (TSS)	11.5 to 15.5° Brisk	12.0 0 Brisk
17.	Vitamin C	24.2-28.4/100mg	-

Table 8: Comparison of fruit characters of HRMN-99

Apple variety	Length (mm)	Width (mm)	Skin colour	Pulp texture	Appeal
HRMN-99	70.4	6.62	Striped red -over-yellow	Soft & Juicy	Farmers & consumers
Anna	69.6	6.68	Yellow Skin with slight red blush	Crisp, juicy, sweet-tart	Farmers and consumers
Dorsett Golden	50.2	5.06	Yellow skin and crisp	Tart flavor	Farmers and consumers



5.10. Why HRMN-99 is a Game-Changer

HRMN-99 is a game changer in apple cultivation due to following important factors:

- Makes apple farming possible in hot and plain areas.
- Boosts farmers' income due to high yields.
- Requires less pesticide due to natural disease resistance.
- Supports sustainable farming and better food security.

By growing HRMN apples, one can enjoy the pleasure of harvesting fresh, homegrown fruits with a naturally sweet and crisp flavour. The variety is well adapted to warmer climates and shows good tolerance to common heat-related stresses, enabling it to thrive with relatively minimal care. HRMN apple is an excellent choice for home gardens, offering a refreshing combination of nutritious fruit, attractive plants, and the joy of growing your own apples. Strong rootstocks provide exceptional strong root development and plant stability, promoting vigorous growth and improved nutrient absorption for healthier, and more productive trees.

The apple variety HRMN-99 which grows successfully in 45°C heat is rewriting the rules of apple farming in India. This breakthrough is helping growers from Rajasthan to Telangana, Andhra Pradesh and Kerala, shift to profitable apple cultivation. Across India, climate change and rising temperatures are forcing growers to rethink what can and cannot be cultivated. Apples, traditionally grown only in cool temperate zones like Himachal Pradesh, Kashmir, and Uttarakhand, were long considered impossible to produce in the plains or tropical regions. But the story changed with the emergence of HRMN-99, an innovative self-pollinating, heat-tolerant apple variety that does not require low temperature for long-term and can withstand summer temperatures of 40–45°C.

5.11. Protecting Innovation – Intellectual Property Rights

Throughout agricultural history, countless farmer-led discoveries have remained confined to local communities because they were never scientifically documented or legally protected. As a result, many innovators failed to receive either recognition or ownership of the contributors. The journey of HRMN-99 followed a different path. Once the exceptional performance of the variety



became evident and scientific studies confirmed its uniqueness, attention turned towards protecting the intellectual contribution of Dr Hariman Sharma. This was essential to acknowledge his pioneering work and also to establish HRMN-99 as a recognized farmer-developed variety with long-term national value. Dr PL Gautam, former Chairperson of the Protection of Plant Varieties and Farmers' Rights Authority (PPV&FRA), appreciated the significance of the innovation and facilitated its linkage with the NIF, India. Securing intellectual property protection for a perennial fruit crop is a demanding and time-consuming process. Every claim must be supported by convincing scientific evidence demonstrating distinctness, uniformity and stability (DUS) of the variety and ensuring that it is clearly different from all existing cultivars. To establish HRMN-99 with its uniqueness, detailed studies were undertaken with internationally recognized low-chilling cultivars such as Anna and Dorsett Golden. Morphological observations were complemented by molecular characterization and DNA fingerprinting studies, which confirmed that HRMN-99 possessed a distinct genetic identity rather than being a selection or duplication of an existing variety.

The documentation process extended over several years. Scientific reports generated through multi-location trials, laboratory investigations and field observations were compiled and submitted to the concerned authorities. Additional clarifications, supporting evidence and technical documentation were prepared whenever required, reflecting the rigorous standards followed for varietal protection. The successful completion of this process culminated in the registration and legal protection of HRMN-99, ensuring that the innovation was formally recognized as the creation of Dr Hariman Sharma. This milestone was significant not only for the innovator himself but also for India's system of protecting farmer-developed plant varieties. It demonstrated that grassroots innovations deserve the same legal respect and scientific scrutiny as varieties developed through organized breeding programs. Parallel to the process of intellectual property protection, the remarkable contribution of Dr Hariman Sharma began receiving recognition at state and national levels. His work attracted the attention of scientists, policymakers, extension agencies and innovation-support organizations, who recognized the extraordinary potential of HRMN-99 to expand apple cultivation into non-traditional regions.

The conferment of the *Padma Shri*, one of India's highest civilian honours, marked the highest national recognition of Dr Hariman Sharma's contribution to agriculture. The award celebrated far more than the development of a low-chilling apple variety. It honoured a farmer whose vision challenged conventional



wisdom, whose perseverance transformed an accidental seedling into a nationally important horticultural innovation, and whose work created new opportunities for thousands of farming families. Equally important was the recognition that HRMN-99 received from the scientific community. Interest from international scientists further demonstrated that the innovation possessed relevance beyond India's borders. The journey of HRMN-99 offers a valuable lesson for agricultural development. Recognition and intellectual property protection are not merely legal formalities; they encourage creativity, safeguard innovators' rights and inspire future generations of farmers to experiment, innovate and share their discoveries. These recognitions ensured that his contribution would be permanently recorded as part of India's agricultural heritage. Today, HRMN-99 stands as a powerful example of how farmer innovation, when protected through an effective intellectual property system and supported by scientific institutions, can evolve into a nationally celebrated achievement. It reinforces the principle that the future of Indian agriculture depends not only on discovering new technologies but also on recognizing and rewarding the individuals whose creativity makes such discoveries possible. The scientific validation and legal protection of HRMN-99 established its credibility and safeguarded the contribution of Dr Hariman Sharma. However, its wider success became possible because farmers, scientists, institutions and policymakers worked together towards a common goal.

5.12. Farmer-Scientist Partnership – A Model for Future Agricultural Innovation

The history of agricultural progress demonstrates that the most enduring innovations emerge when the practical wisdom of farmers is combined with the scientific expertise of researchers. Farmers understand the realities of the field through years of experience, while scientists provide the analytical tools needed to validate, refine and disseminate new knowledge. The development of HRMN-99 began entirely through the vision and perseverance of Dr Hariman Sharma. Guided by keen observation and practical experience, he identified the extraordinary potential of a naturally occurring apple seedling and nurtured it patiently over many years. His work reflected the spirit of experimentation that has long been an integral part of Indian farming traditions.

Scientific institutions recognized the importance of the variety and undertook rigorous studies to evaluate its distinctiveness, adaptability and performance. Multi-location trials, morphological characterization, molecular analyses and fruit



quality assessments generated the scientific evidence established the credibility of HRMN-99. This collaboration illustrates an important principle. Scientific research did not replace the farmer's innovation; it strengthened and validated it. Likewise, the farmer's experience did not compete with scientific knowledge; it enriched it by providing an original idea that formal research could investigate and authenticate.

The role of NIF, the Protection of Plant Varieties and Farmers' Rights Authority (PPV&FRA), and research organizations associated with the evaluation of HRMN-99 demonstrates the importance of creating mechanisms that recognize and support grassroots innovations. These organizations acted as bridges, enabling a farmer's discovery to enter the national innovation system. The HRMN-99 experience also highlights the value of multidisciplinary collaboration. Horticulturists, plant breeders, molecular biologists, extension specialists, nursery professionals and policymakers all contributed to different stages of the variety's journey. Their combined efforts ensured that the innovation was not only scientifically validated but also made accessible to farmers across diverse agro-climatic regions.

Another remarkable aspect of this partnership was the active participation of farmers themselves. Early adopters who planted HRMN-99 in different states generated valuable field-level information under varied environmental conditions. Their experiences helped refine cultivation practices and demonstrated the adaptability of the variety beyond its place of origin. In this way, farmers became collaborators in the continuing process of innovation rather than passive recipients of technology. The success of HRMN-99 offers valuable lessons for the future of Indian horticulture. As climate change, resource constraints and changing market demands reshape farming systems, solutions will increasingly require cooperation among farmers, scientists, extension agencies, entrepreneurs and policymakers. Innovations developed through such partnerships are more likely to be practical, locally relevant and widely accepted.

The journey of Dr Hariman Sharma also underscores the importance of institutional openness. By recognizing the value of a farmer-developed variety and subjecting it to the same scientific standards applied to formally bred cultivars, research organizations demonstrated that innovation should be judged by its merit rather than by its origin. HRMN-99, therefore, becomes more than a successful apple variety. It has become a model of participatory innovation, showing how traditional knowledge, scientific research and institutional support can complement one another to address emerging agricultural challenges. This



model deserves wider adoption. Across India, farmers continuously observe their fields, identify unusual traits and develop practical solutions to local problems. When these grassroots innovations are identified early, scientifically validated and institutionally supported, they can generate technologies of national importance, just like HRMN-99. The story of HRMN-99 reminds us that agricultural innovation is most powerful when every stakeholder contributes their unique strengths. Farmers provide insight born of experience, scientists contribute rigorous validation, institutions create enabling systems, and policymakers facilitate wider adoption. Together, they create a pathway through which a local discovery can become a national asset. The partnership between Dr Hariman Sharma, scientific institutions and farming communities transformed HRMN-99 into a nationally recognized innovation. Beyond its success as an apple variety, it has emerged as an inspiring example of grassroots creativity with implications for India's entire agricultural innovation ecosystem. The next section examines HRMN-99 as a national model of farmer-led innovation and its broader significance for agricultural development.

The journey of Dr Hariman Sharma represents the very essence of grassroots innovation. Without sophisticated laboratories or formal research infrastructure, he relied on careful observation, practical experience and unwavering determination to nurture an unusual apple seedling into a variety capable of transforming horticultural possibilities in warmer regions. HRMN-99 is now recognized as much more than a successful low-chilling apple variety. It has become a symbol of India's capacity to generate transformative agricultural technologies from the grassroots. One of the most significant contributions of HRMN-99 is the confidence it has inspired among farming communities. The success of Dr Hariman Sharma has encouraged farmers to observe their own fields more carefully, experiment with new ideas and believe that meaningful innovations can emerge from practical experience. In doing so, HRMN-99 has strengthened the spirit of creativity and self-reliance that lies at the heart of Indian agriculture. The significance of HRMN-99 also extends to the country's agricultural innovation ecosystem. It demonstrates the importance of identifying promising farmer-led innovations at an early stage, validating them through rigorous scientific research and supporting them through appropriate institutional mechanisms. Such an approach not only accelerates technological progress but also ensures that innovators receive due recognition and protection for their contributions.

The experience gained from HRMN-99 offers valuable lessons for future agricultural development. Across India, countless farmers are experimenting with crop varieties, cultivation techniques, water management practices and



integrated farming systems. Many of these innovations possess the potential to address emerging challenges such as climate change, declining natural resources and the need for higher farm incomes. Establishing effective systems to identify, evaluate and promote such innovations will be crucial for building a resilient and sustainable agricultural sector. HRMN-99 has also highlighted the importance of strengthening collaboration among farmers, research institutions, universities, innovation-support organizations and policymakers. The success of this variety demonstrates that when these stakeholders work together with mutual respect, grassroots innovations can achieve national significance and deliver tangible benefits to farming communities.

Equally important is the inspiration that HRMN-99 provides to the younger generation. His journey encourages young farmers to look beyond conventional practices and to see innovation as an integral part of modern agriculture. The national significance of HRMN-99 therefore lies not only in expanding apple cultivation into non-traditional regions but also in changing the way agricultural innovation is perceived. It illustrates that solutions to complex agricultural challenges may emerge from the close interaction between farmers and nature, provided such ideas are recognized, nurtured and scientifically strengthened.

The story also carries an important policy message. Investment in grassroots innovation is an investment in the future of Indian agriculture. Every farmer's field has the potential to become a centre of discovery, and every innovative farmer deserves an opportunity to contribute to national development. By creating mechanisms that encourage farmer-led innovation, India can unlock an immense reservoir of creativity that has remained largely untapped. Today, HRMN-99 stands as a national benchmark for recognizing and promoting grassroots agricultural innovation. It showed that a single farmer's vision, supported by science and institutions, can redefine possibilities for an entire sector. More importantly, it has demonstrated that the future of Indian agriculture will be strengthened when innovation is viewed as a shared responsibility of farmers, scientists, institutions and society. The journey of HRMN-99 has already demonstrated its scientific, economic and social value. Yet every successful innovation also points towards the future. The concluding section of this chapter explores the immense possibilities that lie ahead for HRMN-99 and the role it can play in shaping climate-resilient, farmer-centred horticulture in the decades to come.



5.13. Looking Ahead – The Future of HRMN-99 and Farmer-Led Innovation

Agricultural innovations derive their true significance not only from their present achievements but also from their capacity to influence the future. The remarkable journey of HRMN-99, from a chance seedling in the backyard of Dr Hariman Sharma to a nationally recognized apple variety, demonstrated what determination, scientific validation and institutional support can accomplish. Yet, the full potential of this innovation is still unfolding. The success of HRMN-99 opened new possibilities for horticultural development in regions where apple cultivation was once considered impossible. As climate variability continues to reshape agricultural landscapes, the need for adaptable, resilient and location-specific crop varieties will become increasingly important. In this changing scenario, HRMN-99 offers valuable lessons on how farmer-led innovations can contribute to climate adaptation and sustainable agricultural development. The future of HRMN-99 will depend on continued scientific research and responsible dissemination. Long-term evaluation under diverse agro-climatic conditions, refinement of orchard management practices, studies on productivity and fruit quality, and the development of region-specific production technologies will further strengthen its commercial potential. Research on rootstocks, canopy management, nutrition, irrigation scheduling and integrated pest and disease management can help maximize the performance of the variety under different farming situations. Equally important is the availability of quality planting material. Establishing certified mother blocks, accredited nurseries and efficient propagation systems will ensure that farmers receive true-to-type, healthy grafts. Maintaining genetic purity and quality standards is essential for preserving the identity and reputation of HRMN-99 as its cultivation expands across the country.

The future also lies in building a complete value chain around the variety. Investments in nursery enterprises, orchard establishment services, post-harvest handling, grading, packaging, cold-chain infrastructure, processing and organized marketing can significantly enhance farmers' income. The development of farmer-producer organizations, cooperatives and market linkages will improve the commercial sustainability of HRMN-99 orchards. Another important dimension is knowledge dissemination. Demonstration orchards, farmer field schools, training programs and digital advisory platforms can help growers adopt appropriate production technologies and avoid common management mistakes. The experience of successful farmers will become an invaluable resource for those entering apple cultivation in non-traditional regions.



The story of HRMN-99 also points towards a larger national agenda. India possesses immense untapped potential in farmer-led innovation. Across the country, countless farmers are experimenting with new crop types, cultivation methods and resource-conserving practices. Many of these innovations remain undocumented despite their potential to address local and national agricultural challenges. The experience of Dr Hariman Sharma demonstrates that timely identification, scientific evaluation and institutional support can transform such grassroots discoveries into nationally valuable technologies. In this context, the HRMN-99 model deserves wider replication. Stronger linkages among farmers, research institutions, universities, innovation-support organizations, extension agencies and policymakers can accelerate the discovery and promotion of farmer-developed technologies. Such an approach will not only enrich India's agricultural innovation system but also strengthen the confidence of farming communities as active partners in scientific progress. For young farmers, researchers and students, the journey of Dr Hariman Sharma gives a message--innovation does not always begin with sophisticated equipment or large research programs. It begins with curiosity, careful observation, persistence and the courage to challenge accepted beliefs. With these qualities one farmer transformed an unexpected seedling into a nationally celebrated horticultural achievement. The future of HRMN-99 is therefore much larger than the future of a single apple variety. It symbolizes a new direction for Indian agriculture—one where grassroots creativity, scientific excellence and institutional commitment work together to create technologies that are productive, resilient and socially inclusive.

As the cultivation of HRMN-99 continues to expand and new knowledge emerges, its contribution will extend far beyond orchard boundaries. It will remain a living reminder that the most valuable innovations often originate from those who work closest to nature. The legacy of Dr Hariman Sharma and HRMN-99 is not confined to a single generation of farmers. It is a continuing source of inspiration that encourages India to recognize, nurture and celebrate the innovative spirit of its farming communities. In doing so, it strengthens the foundation for a more resilient, prosperous and self-reliant agricultural future. The first five chapters have traced the remarkable journey of HRMN-99—from an accidental seedling to a nationally recognized innovation that transformed perceptions of apple cultivation. Having understood its scientific evolution, social impact and future potential, the next chapter examines the wider lessons that this extraordinary journey offers for Indian agriculture, agricultural policy and the future of farmer-centred innovation.

6

Beyond an Apple Variety: The Legacy of Dr Hariman Sharma and HRMN-99

Great innovations are remembered not only for the technologies they create but for the people whose vision brings them to life. Dr Hariman Sharma and HRMN-99 together tell the story of courage, curiosity and perseverance—demonstrating that one farmer’s unwavering belief in nature can reshape agricultural thinking, inspire generations and leave an enduring legacy for Indian horticulture.

6.1. Changing Conventional Wisdom

Every generation witnesses a few individuals whose ideas quietly challenge established beliefs and gradually transform accepted knowledge. They may not possess academic qualifications or research facilities but their strength lies in their ability to observe nature carefully, ask unconventional questions and persistence in the pursuit of answers. Dr Hariman Sharma belongs to this category. The belief that commercial apple cultivation was possible only in temperate regions with prolonged winter chilling shaped production systems, research priorities and farmers’ expectations. Consequently, areas with warmer climates of the country remained outside the scope of apple cultivation.

Dr Hariman Sharma did not challenge this belief through theory or debate but let nature guide his thinking. When a chance apple seedling survived and fruited under the warm climatic conditions of Paniala, he saw it as an opportunity, and rather than dismissing it as an anomaly, observed its behaviour, protected the tree and devoted years in understanding its potential with patience and conviction. Working with limited resources, he propagated the promising plant, refined it through careful grafting and continued evaluating its performance season after season. During this long period, there were no assurances of success, no certainty of recognition and little institutional support. Yet he remained committed to his belief that the tree possessed exceptional value.

His perseverance gave rise to variety HRMN-99, that demonstrated the possibility of successful apple cultivation in regions previously considered unsuitable, challenging the assumption that geographical limitations were



unchangeable. It showed that innovation, supported by careful observation and scientific validation, can redefine agricultural possibilities. The significance of Dr Hariman Sharma's achievement is beyond the development of a single variety, it represents the spirit of inquiry, which is pivotal to agricultural progress. Agriculture has developed through important advances that originated from observant farmers who noticed unusual characteristics, preserved valuable plants and refined them through experience. HRMN-99 stands proudly within this tradition of farmer-led innovation.

By questioning accepted limitations, Dr Hariman Sharma not only developed a remarkable apple variety but also encouraged farmers, scientists and policymakers alike to view agriculture as a dynamic field where new possibilities can emerge from attentive observation, open-minded thinking and sustained effort. Today, HRMN-99 symbolizes a horticultural innovation, power of curiosity, the value of persistence and the enduring truth that transformative ideas often emerge from those who work closest to the land. His courage to challenge conventional wisdom helped develop HRMN-99. Its wider significance, lies in the way it reshaped the geographical possibilities of apple cultivation. The next section explores how this farmer-led innovation has expanded the boundaries of Indian horticulture and opened new opportunities across diverse agro-climatic regions.

6.2. Changing Geography of Apple Cultivation

The geography of apple cultivation in India was largely defined by nature. The crop was considered inseparable from the cool temperate climate of the Himalayan region, hence, commercial apple production remained concentrated in a few states, while rest of the country regarded as was unsuitable for the crop. The HRMN-99 demonstrated that genetic adaptability could extend the cultivation of apples into warmer environments. It did not replace the importance of traditional apple-growing regions; rather, it expanded apple- growing area.

This distinction is important. The significance of HRMN-99 lies in the fact that it opened the door for farmers in non-traditional apple regions. It helped them diversify their farming systems, explore high-value horticulture and generate additional income from apple orchard once considered beyond their reach. The successful evaluation of HRMN-99 across diverse agro-climatic regions reinforced this new perspective. Trials and farmers' experiences showed that under appropriate conditions and with suitable management, the variety could adapt to environments far different from traditionally apple cultivation regions.



This encouraged scientists and horticulturists to re-examine the role of low-chilling apple varieties in the context of India's changing climate and evolving agricultural landscape.

The changing geography of apple cultivation also carries important implications for climate resilience. Rising temperatures and shifting weather patterns are influencing the distribution of many crops worldwide. In such a scenario, varieties with broader adaptability will become valuable. HRMN-99 illustrates how genetic diversity and farmer-led innovation can contribute to the development of resilient horticultural systems capable of responding to environmental change. HRMN-99 generated new confidence among farming communities. Farmers imagined about planting an apple tree in their fields. As the variety inspired experimentation, encouraged entrepreneurship and demonstrated that innovation can create opportunities even in regions previously excluded from a particular crop. HRMN-99 reminds us that agriculture is constantly evolving. Crops are not confined forever to their historical boundaries. Through careful selection, scientific research and farmer innovation, cultivation practices can adapt to changing ecological and socio-economic realities, and it is true not only to apple cultivation but also to other crops facing the challenges of climate change and resource constraints. The contribution of Dr Hariman Sharma therefore extends beyond the development of a successful variety as he encouraged both farmers and scientists to think differently about the relationship between crops and climate. His work demonstrated that innovation can emerge from the field, challenge established perceptions and inspire new directions in agricultural research and development.

Today, HRMN-99 stands as a symbol of this changing landscape. It represents the convergence of nature's genetic potential, a farmer's vision and scientific validation. The changing geography of apple cultivation is only one dimension of the HRMN-99 story; as it offers lessons for the future of Indian agriculture. The next section explores how HRMN-99 provides valuable guidance for farmers, scientists, institutions and policymakers committed to building a more innovative and resilient agricultural system.

6.3. Recognizing Grassroots Innovators

India's agricultural progress was always driven by two complementary streams of knowledge—one from scientific institutions through systematic research and the other evolved in farmers' fields through observation, experimentation and generations of practical experience. Both streams enriched Indian agriculture,



yet the contributions of grassroots innovators often remained undocumented and under-recognized. The HRMN-99 proved that innovation is not confined to research laboratories or universities, and it can emerge from a village orchard, a field or observations made by one who understands nature through daily experience. These innovations are to be identified, validated and encouraged before they are lost. Across India's villages, farmers continuously experiment and many develop practical solutions to local agricultural problems through years of experience. Some identify unusual plants with valuable characteristics, others evolve techniques that improve productivity, conserve resources or reduce production risks. These innovations represent an enormous reservoir of knowledge waiting to be discovered.

Unfortunately, without proper documentation, scientific evaluation and institutional support, valuable ideas either remain confined to individual farms or local communities or disappear with time, depriving agriculture of technologies that could benefit millions of farmers. The experience of HRMN-99 demonstrates a more effective pathway—innovation was recognized, scientifically evaluated, legally protected and widely disseminated. This integrated approach transformed a local discovery into a national achievement, and can be replicated for many other farmer-led innovations across the country. Recognizing grassroots innovators is not just honouring individuals but a strategic investment in the future of Indian agriculture. Every successful farmer innovation may generate new technologies, strengthen climate resilience, improve farm incomes and enhance the sustainability of agricultural systems. Encouraging them expands the nation's capacity for innovation far beyond the boundaries of formal research institutions. The role of scientific organizations, extension agencies, innovation-support institutions and policymakers are crucial in establishing stronger mechanisms for identifying farmer's innovations, conducting timely scientific evaluations, protecting intellectual property rights and facilitating responsible dissemination. These efforts will ensure that valuable grassroots knowledge is integrated into the national agricultural innovation system. Students of agriculture should interact closely with farming communities, document local innovations and appreciate the scientific value of traditional knowledge as this will strengthen future research and foster mutual respect between farmers and future scientists.

Padma Shri award to Dr Hariman Sharma for his contribution affirms that the nation values creativity wherever it originates and that meaningful agricultural innovations deserve the highest respect. Such recognition inspires countless farmers to believe that their observations and ideas can contribute to national development. India with its extraordinary agro-biodiversity, diverse farming systems and millions



of experienced cultivators, possesses unparalleled opportunities for discovering new varieties, developing adaptive technologies and creating sustainable farming solutions. The strengthening of communication between grassroots knowledge and scientific research, India can unlock an immense source of innovation for the benefit of future generations. This lesson was revealed by HRMN-99. Recognizing grassroots innovators is only the first step towards solving the larger challenge of building a resilient, sustainable agricultural future that is capable of responding to climate change and emerging food-system challenges. The next great agricultural breakthrough may already exist in the field of an observant farmer. The legacy of Dr Hariman Sharma and HRMN-99 shows that when a nation recognizes its grassroots innovators, it honours individual achievement and unlocks a source of knowledge, resilience and progress for generations to come.

6.4. Climate-Resilient and Farmer-Centric Horticulture

Agriculture, today, stands at a defining moment. Climate change, declining natural resources, changing market demands and increasing pressure on food and nutritional security are challenging the way crops are grown and managed. The journey of Dr Hariman Sharma and HRMN-99 offers an inspiring vision of how Indian horticulture can respond to these emerging challenges. One of the most significant lessons from HRMN-99 is the importance of adaptability. Agriculture has never been static; it has evolved continuously in response to changing environments and human needs. As climatic conditions shift, farmers will increasingly require smart crops capable of performing under new ecological situations. HRMN-99 illustrated that genetic diversity, careful observation and scientific validation together created opportunities where conventional wisdom once saw limitations.

The future of Indian horticulture will depend increasingly on diversified farming systems, which strengthen resilience, improve resource use efficiency and reduce economic risks. By demonstrating the possibility of apple cultivation in suitable non-traditional environments, HRMN-99 has encouraged farmers to think beyond conventional cropping patterns and explore new horticultural opportunities that can supplement farm income while enhancing sustainability. Climate resilience, however, requires an integrated approach that combines improved planting material, efficient water management, healthy soils, balanced nutrition, integrated pest and disease management, post-harvest infrastructure and strong market linkages. The HRMN-99 experience reminds us that successful innovation depends upon the harmonious integration of genetics, management practices, institutional support



and farmer participation. Another important dimension is the conservation and utilization of plant genetic resources. Every successful variety is ultimately derived from nature's immense genetic diversity. Protecting this diversity and exploring it responsibly remain essential for developing future crops capable of adapting to changing climatic conditions. HRMN-99 serves as a reminder that valuable genetic resources may sometimes be discovered in unexpected places, reinforcing the need to conserve biodiversity while encouraging systematic exploration and evaluation.

The future of Indian horticulture have to remain farmer-centric because technological advances achieve their true purpose only if improve farmers' livelihoods, reduce production risks and create sustainable economic opportunities. The journey of Dr Hariman Sharma demonstrates that farmers are not merely beneficiaries of technology but active partners in its creation, refinement and dissemination. Their knowledge, experience and creativity must continue to occupy a central place in agricultural development. Equally important is the role of young farmers and rural entrepreneurs. Agriculture today offers opportunities that extend beyond production to include nursery development, protected cultivation, value addition, processing, branding, agri-tourism and digital marketing. HRMN-99 illustrates how a single innovation can stimulate an entire ecosystem of economic activities, generating employment and encouraging educated youth to view horticulture as a modern, knowledge-driven enterprise.

Scientific institutions, universities, extension agencies and policymakers will continue to play a pivotal role in this transformation. Their responsibility extends beyond developing technologies to creating an enabling environment in which innovations can be tested, refined and responsibly disseminated. The collaboration witnessed in the HRMN-99 journey provides an excellent model for future partnerships aimed at addressing complex agricultural challenges.

Farmer-led innovation should become an integral component of national research and development strategies to progresses towards a resilient agricultural future. The story of HRMN-99 demonstrates that the most effective solutions often emerge when scientific excellence is combined with the practical wisdom of farming communities. Such partnerships will become increasingly important in developing technologies capable of meeting the challenges of climate variability, resource conservation and sustainable production. The enduring contribution of Dr Hariman Sharma, therefore, extends beyond the development of a remarkable apple variety. His journey inspires confidence that Indian farmers, working together with scientists and institutions, will continue to shape a resilient and prosperous future



for the nation's horticulture. The journey of HRMN-99 moved from discovery to scientific validation, from local success to national recognition, and from individual innovation to a broader vision for Indian agriculture. One final reflection—the future of Indian horticulture will be shaped by technology along with harmonious partnership of nature, innovation, science and wisdom of farmers.

6.5. The Journey Must Continue

The story of Dr Hariman Sharma and HRMN-99 belongs to the rare category where a journey leaves behind a destination as well as creates a new beginning. What began as a chance seedling in a village courtyard has grown into a symbol of innovation, resilience and hope, demonstrating that the future of agriculture can be shaped by the vision of a single determined farmer. Throughout this book, the journey of HRMN-99 has unfolded as a remarkable sequence of observation, perseverance, scientific validation, institutional support and national recognition. The true significance of this story lies in the enduring values it represents—curiosity can challenge convention, that patience can overcome uncertainty and that a farmer's faith in nature can inspire scientific discovery and national progress. The life and work of Dr Hariman Sharma reaffirm an enduring truth: innovation is not defined by the place where it originates but by the impact it creates. His achievement demonstrates that—a farmer's field can become a centre of discovery; practical experience can complement scientific research; and extraordinary ideas often emerge from ordinary circumstances when guided by dedication and perseverance. HRMN-99 has become a symbol of possibility. It encouraged farmers to dream beyond conventional boundaries, inspired scientists to appreciate the value of grassroots innovation and reminded institutions that transformative ideas may emerge from anywhere. It strengthened the bridge between traditional wisdom and modern science, and created a model of collaboration relevant for generations.

The story also reminds us that agriculture is a live-organic-industry and ultimately about people. Here, technologies acquire meaning only if improve livelihoods, strengthen rural communities and create opportunities for future generations. As India advances towards a future shaped by climate change, technological progress and evolving food systems, the steps involved in the HRMN-99 journey will become increasingly important. India will require—inovations that are scientifically sound, environmentally responsible, socially inclusive; and institutions that recognize creativity, and encourage partnerships between farmers, scientists, entrepreneurs and policymakers. The legacy of Dr Hariman Sharma will come alive with every—



orchard established with hope, farmer encouraged to experiment, young researcher inspired to work closely with farming communities, and institution that recognizes the value of grassroots innovation. His contribution enriched not only Indian horticulture but also the philosophy of agricultural development by demonstrating that progress is strongest when knowledge flows freely between laboratory and field. The story of HRMN-99 also reminds us of a profound responsibility. Across India, countless farmers continue to observe nature and their ideas, discoveries and innovations deserve recognition, scientific evaluation and opportunities to benefit society. The future of Indian agriculture will be shaped by new technologies and by our collective ability to identify, encourage and celebrate such grassroots creativity. The seed of innovation that once germinated quietly in Paniala has now taken root in the imagination of a nation. The true measure of a legacy is not the number of awards received or the extent of public recognition. It is the lasting influence an individual leaves on people, institutions and society. By this measure, Dr Hariman Sharma through HRMN-99, has shown that one person's vision can expand the horizons of horticulture, inspire scientific inquiry and open new opportunities for countless farming families.

This Success Story of Dr Hariman Sharma and HRMN-99, therefore, celebrates more than an apple variety. It celebrates the indomitable spirit of an innovative farmer, the strength of collaboration between science and society and the limitless possibilities that emerge when curiosity is matched by perseverance. May this journey continue to inspire farmers, scientists, students, policymakers and all those who believe that the future of Indian agriculture will be built not only through technological advancement but also through the courage to question, the patience to learn and the determination to innovate.

Some legacies are measured by monuments; others by memories. The legacy of Dr Hariman Sharma is measured by orchards that continue to grow, by farmers whose confidence continues to flourish, and by the enduring belief that one inspired individual can change the course of agriculture. HRMN-99 is not the end of that journey—it is its living testament, carrying forward a vision that will continue to bear fruit for generations to come.

7.1. Major Contributions and Enduring Impact

The journey of Dr Hariman Sharma and HRMN-99, from an accidental apple seedling observed in a village orchard to a nationally recognized horticultural achievement, demonstrates how curiosity, perseverance, scientific validation and institutional support can together create lasting impact. The HRMN-99, a low-chilling apple variety, influenced scientific thinking, expanded horticultural opportunities, strengthened farmer confidence and highlighted immense potential of grassroots innovation.

- The foremost achievement of Dr Hariman Sharma was the identification, conservation and development of HRMN-99, a unique low-chilling apple variety capable of successful flowering and fruiting under climatic conditions previously considered unsuitable for commercial apple cultivation. Through years of careful observation, selection and propagation, he transformed a naturally occurring seedling into a distinct variety that challenged long-held assumptions regarding the geographical limits of apple cultivation in India.
- A second major achievement was that farmer-led innovation can make nationally significant contributions to agricultural science. The performance of HRMN-99 attracted scientific attention, leading to systematic evaluation through morphological studies, multi-location trials, fruit quality assessment and molecular characterization. The variety emerged as a scientifically validated innovation, illustrating the productive partnership that can exist between grassroots knowledge and formal research.
- The journey of HRMN-99 also established an exemplary model for collaboration among farmers, scientists, research organizations and innovation-support institutions. Scientific validation, documentation, legal protection and wider dissemination transformed a local discovery into a nationally recognized achievement. This collaborative approach demonstrated that agricultural innovation is most effective when a field experience is strengthened by scientific rigour and institutional commitment.



- Another outstanding achievement was the expansion of opportunities for apple cultivation in non-traditional regions. HRMN-99 broadened the scope of horticultural diversification by encouraging farmers to explore apple crop beyond conventional temperate zones. HRMN-99 created new possibilities in warmer environments where apple cultivation was considered impractical.
- The widespread evaluation and adoption of HRMN-99 across diverse agro-climatic regions further demonstrated its adaptability and national relevance. Multi-location trials generated valuable scientific evidence and practical experience, strengthening confidence in the variety and promoting its responsible dissemination. This process highlighted the importance of participatory research in accelerating agricultural innovation.
- The legal protection and national recognition accorded to HRMN-99 represent another milestone in the history of farmer innovation in India. The conferment of the *Padma Shri* upon Dr Hariman Sharma further acknowledged the national significance of his contribution and underscored the value that India places on grassroots creativity and agricultural excellence.
- Beyond HRMN-99, Dr Hariman Sharma inspired farmers to view agriculture as a field of innovation rather than mere production. His journey demonstrated that farmers are not only adopters of technology but also creators of knowledge capable of contributing to scientific advancement and national development. This new perception may prove to be one of his most enduring contributions.
- HRMN-99 also emerged as an important example of climate-responsive horticulture. Now the climate variability is influencing agricultural systems worldwide, and this variety illustrates how genetic diversity, farmer observation and scientific validation can support adaptive and resilient farming systems. It provides valuable lessons for future crop improvement and diversification strategies aimed at strengthening agricultural sustainability.
- The policy lessons generated by the HRMN-99, highlighted the need for stronger mechanisms to identify grassroots innovations, encourage collaboration between farmers and scientists, protect intellectual property, strengthen quality planting material systems and promote participatory research. These lessons are relevant to the broader agricultural innovation ecosystem of India.



- The greatest achievement of Dr Hariman Sharma is the confidence he instilled in farming communities across the country. His story demonstrates that meaningful innovation does not depend on sophisticated laboratories or extensive resources. It begins with curiosity, careful observation, perseverance and an unwavering commitment to learning from nature.

The legacy of Dr Hariman Sharma and HRMN-99 transcends the boundaries of a single crop or a single innovation. Together, they represent a model of farmer-centred agricultural development in which grassroots creativity, scientific validation and institutional support work in harmony to create productive, resilient and socially relevant technologies. Their story is a lasting testament to the transformative power of innovation rooted in the wisdom of a farmer strengthened by rigour of science.

8

Value Addition and Marketing

8.1. Current Marketing and Value Addition

Apple farmers currently sell primarily fresh plants (saplings) and fresh fruits, with minimal value addition. The absence of processing infrastructure limits processing of surplus or lower-grade fruits into value-added products. Great potential exists for processing HRMN-99 into juice, jam, preserves, dried apple products, and other value-added items. Sensory analysis, particularly of flavour profiles, should be conducted to better understand consumer preferences and optimize the processing methods accordingly.

8.2. Market Linkages

Lack of organized market connections limits farmers' ability to access premium markets in major cities. Absence of cool-chain logistics restricts marketing radius and compels the farmers to sell locally or at lower prices. Various government schemes and agencies provided infrastructure support to Hariman Sharma's farm and nursery, for example:

- Assistance for nursery development and plant certification from State Department of Horticulture.
- Drilling of borewell to access groundwater for irrigation.
- Solar fencing- installation to protect orchard from animal damage.
- Power tiller- Mechanization support for land preparation and intercultural operations.
- Farm handling unit/packhouse- established in 2007 to improve post-harvest handling and packaging.

An agricultural innovation is successful if able to generate sustainable economic opportunities for farming communities. Recognizing this, Dr Hariman Sharma consistently viewed HRMN-99 not merely as a low-chilling apple variety but as a means of enhancing farmers' livelihoods through value addition, entrepreneurship



and improved market access. From the early stages of dissemination, emphasis was placed on producing healthy and true-to-type grafted planting material to ensure that farmers established orchards with authentic HRMN-99 plants. It became an essential component of the innovation, laying the foundation for successful orchard establishment and maintaining the genetic purity and reputation of the variety. As HRMN-99 cultivation expanded to suitable non-traditional regions farmers began exploring apple cultivation as an additional source of income, thereby improving farm resilience and reducing dependence on a single enterprise. The innovation also stimulated local establishment of nurseries, graft production units and orchard management services, generating employment opportunities in rural areas.

Dr Hariman Sharma has consistently encouraged farmers to look beyond primary production and recognize the importance of value addition. Fresh apples constitute the principal market, but surplus or lower-grade fruits can be utilized for producing juice, cider (where appropriate), jam, jelly, preserves, dehydrated apple slices, vinegar and other processed products. Such diversification reduces post-harvest losses, stabilizes returns and extends market opportunities beyond the fresh fruit season. Scientific harvesting, grading, sorting, packaging, storage and transportation are essential for maintaining fruit quality and ensuring better market prices. The adoption of these channels can substantially enhance the commercial value of HRMN-99 fruits while strengthening consumer confidence.

The growing popularity of HRMN-99 also presents opportunities for farmer collectives, cooperatives and Farmer Producer Organizations (FPOs) to undertake collective production, aggregation, branding and marketing. Thus improving bargaining power, reducing transaction costs and facilitating direct market linkages. In the long term, a distinctive identity for HRMN-99 has the potential to create a premium market segment based on quality, traceability and consumer trust.

Digital technologies can also facilitate knowledge exchange, enabling farmers to learn from successful orchard managers and adopt improved production practices. The experience of HRMN-99 demonstrates that successful agricultural innovation requires an integrated value chain extending from quality planting material to the final consumer. Scientific research, nursery development, orchard management, post-harvest technology, processing, branding and efficient marketing are all interconnected components that determine the long-term sustainability of the innovation.



By encouraging farmers to adopt a value-chain approach rather than viewing apple cultivation solely as fruit production, Dr Hariman Sharma broadened the economic significance of HRMN-99. His vision illustrates that agricultural innovation achieves its greatest impact when scientific excellence is combined with entrepreneurship, value addition and market-oriented development. The continuing success of HRMN-99 will therefore depend not only on expanding its cultivation but also on strengthening quality assurance, value addition, branding and efficient marketing systems. These efforts will ensure that the benefits of this remarkable farmer-led innovation are translated into higher incomes, greater rural employment and sustainable horticultural development for years to come.

9

Lessons Learnt

Every remarkable agricultural innovation leaves behind valuable lessons for future generations. The remarkable journey of Dr Hariman Sharma and HRMN-99 demonstrates how innovation rooted in observation, strengthened by perseverance and validated through science can transform agricultural thinking and create lasting benefits for farming communities. The experience provides important guidance for farmers, researchers, policymakers and institutions committed to building a resilient and inclusive agricultural future.

- The first and perhaps the most important lesson is that innovation begins with careful observation. The discovery of HRMN-99 emerged when Dr Hariman Sharma observed the exceptional performance of a naturally occurring apple seedling and patiently explored its potential.
- Another lesson is that perseverance transforms possibilities into achievements. The development of HRMN-99 was result of years of careful nurturing, propagation, observation and refinement. Innovation demands patience, resilience and long-term commitment. Dr Hariman Sharma's journey illustrates that lasting achievements are built through sustained effort rather than momentary success.
- The systematic evaluation, multi-location testing and molecular characterization of HRMN-99 established its credibility and enabled its acceptance beyond its place of origin. This demonstrates that farmer innovation and scientific research are complementary rather than competing approaches. One generates ideas; the other verifies and strengthens them.
- The journey also demonstrates that institutions play a vital role in nurturing innovation. The involvement of NIF-India, PPV&FRA, research institutions and extension agencies transformed a local innovation into a nationally recognized achievement HRMN-99. Their contribution highlights the importance of responsive institutions that can identify promising grassroots innovations, provide technical support and facilitate wider dissemination while protecting the rights of the innovator.



- When society honours innovator Dr Hariman Sharma, it sends a powerful message that agricultural creativity deserves respect. It not only acknowledges their individual contributions but also inspires countless others to observe, experiment and innovate.
- The HRMN-99 experience also highlights the importance of conserving and utilizing plant genetic resources. The discovery of HRMN-99 reinforces the need to conserve biodiversity, document unique genetic resources and evaluate them systematically for their potential contribution to climate resilience, crop improvement and sustainable agriculture.
- The story further teaches that climate resilience requires continuous innovation. With the changing climatic conditions, agriculture must adapt through the development of varieties and production systems suited to emerging environments. HRMN-99 demonstrates that solutions to emerging challenges can arise from farmer-led experimentation supported by scientific excellence. This approach offers a valuable pathway for developing technologies suited to India's diverse and changing environments.
- One of the most inspiring lessons is that farmers are innovators, not merely technology users. Their practical experience, intimate understanding of local ecosystems and willingness to experiment make them valuable partners in agricultural research and development. Strengthening collaboration between farmers and scientists will remain essential for generating technologies that are both scientifically sound and locally relevant.
- The story also provides important guidance for agricultural research. Scientists can gain valuable insights by working more closely with farming communities, documenting local innovations and integrating traditional knowledge with modern research methods. Such partnerships enrich scientific inquiry while ensuring that research remains closely connected to farmers' realities.
- For extension professionals, HRMN-99 highlights the importance of facilitating two-way communication. Extension is about transferring technology from laboratories to farms; it is also about bringing valuable ideas from farmers back into the scientific system. The experience of Dr Hariman Sharma demonstrates that innovation flows in both directions.
- For policymakers, the HRMN-99 experience underscores the need to invest in farmer innovation networks, quality nursery systems, intellectual property protection, climate-resilient horticulture and participatory research will



create an enabling environment in which many more transformative discoveries can emerge.

- The experience also demonstrates that successful innovation extends beyond varietal development. An integrated value-chain approach ensures that scientific innovations translate into improved livelihoods and sustainable rural development.
- Another enduring lesson is the importance of protecting the rights of innovators. Appropriate documentation, intellectual property protection and recognition encourage creativity to give innovators due credit for their contributions. This strengthens confidence among farmers and stimulate further innovation across the agricultural sector.
- Perhaps the greatest lesson of all is that one individual can inspire national transformation. Dr Hariman Sharma began with curiosity, determination and faith in nature. His story demonstrates that when vision is supported by perseverance, scientific collaboration and public trust, even a single innovation can influence research priorities, expand horticultural opportunities and inspire a nation.

Ultimately, the journey of Dr Hariman Sharma and HRMN-99 demonstrates that meaningful agricultural progress emerges when one farmer's observation and perseverance grows into a powerful example of innovation, partnership and possibility in Indian horticulture. Its greatest legacy lies in the orchards it has established, and also in the confidence it has inspired and the wider recognition that valuable agricultural innovations can emerge from India's villages. The story of HRMN-99 therefore invites us to look beyond conventional sources of innovation, identify and nurture the untapped creativity of farmers, and create an agricultural future that is more innovative, resilient, sustainable and inclusive.

10

Key Factors of Success

The extraordinary success of Dr Hariman Sharma and HRMN-99 emerged from the convergence of several interrelated factors that provide a valuable framework for understanding how grassroots innovations can achieve scientific acceptance, commercial relevance and national impact.

- The foremost factor was an observant and innovative mindset. Dr Hariman Sharma recognized the significance of an unusual apple seedling growing under non-apple cultivation area. He viewed it as an opportunity worthy of careful study. This curiosity became the foundation upon which the entire journey of HRMN-99 was built.
- The second critical factor was unwavering perseverance—years of patient observation, propagation, evaluation and refinement. Progress was achieved gradually through sustained effort rather than immediate success. Dr Hariman Sharma's determination to continue despite uncertainty reflects the resilience that characterizes many successful agricultural innovators.
- Equally important was confidence in nature and openness to learning. Dr Hariman Sharma allowed evidence from the field to guide his decisions. He combined practical farming experience with a willingness to learn from scientific observations, creating a balanced approach that respected both traditional knowledge and modern research.
- Another decisive factor was timely scientific validation of HRMN-99. The scientific evaluation through morphological characterization, multi-location testing, fruit quality assessment and molecular studies established its credibility. This validation transformed a promising local innovation into a technology accepted by researchers, extension agencies and farming communities across diverse regions.
- Effective collaboration between farmers and scientific institutions strengthened the success of HRMN-99. The constructive partnership—among Dr Hariman Sharma, research organizations, state agricultural universities, innovation-support institutions and extension agencies ensured



that the variety was rigorously evaluated, documented, protected and responsibly disseminated—demonstrated the value of integrating grassroots innovation with institutional expertise.

- Institutional support and policy recognition provided the necessary framework for recognizing and safeguarding the innovation. National recognition, including the conferment of the *Padma Shri* upon Dr Hariman Sharma, further enhanced public awareness and reinforced confidence in farmer-led innovation.
- A significant factor underlying long-term success was the emphasis on quality planting material and responsible dissemination. The availability of true-to-type grafts and the promotion of sound nursery practices ensured that farmers received authentic planting material, preserving the genetic identity and performance of HRMN-99 while supporting the establishment of productive orchards.
- The vision to promote value-addition and market orientation also contributed to the growing significance of HRMN-99. A greater thrust was given on orchard management, nursery enterprises, post-harvest handling, processing, branding and organized marketing created opportunities for higher farm incomes and sustainable rural entrepreneurship. This broader perspective enhanced the economic value of the innovation.
- Another important factor was the adaptability of HRMN-99 to suitable non-traditional environments (Fig. 18-19). This adaptability enhanced



Fig. 18. Location of Hariman Sharma apple nursery



Fig. 19. Low chilling HRMN-99 variety in different Indian states



its relevance in the context of climate variability and diversified farming systems.

- The HRMN-99 journey also benefited from effective communication and knowledge sharing. Transparent communication-built confidence among farmers, researchers and other stakeholders.
- Underlying all these achievements, the focus remained on creating practical opportunities for income generation, horticultural diversification and rural development. This farmer-centred vision ensured that the innovation remained socially relevant as well as scientifically important.

Ultimately, the journey of Hariman Sharma and HRMN-99 is a powerful testament to a farmer's ingenuity, perseverance and scientific excellence converge with institutional support and societal recognition. The HRMN-99 story transcends the success of a single apple variety; it demonstrates that transformative agricultural innovation can emerge from the grassroots when farmers are empowered, science is open to their insights, institutions provide enabling support, and society recognizes their contributions. Its enduring legacy therefore lies in the apples it produces, and in the inspiration and blueprint it offers for discovering, validating, nurturing and scaling the next generation of farmer-led innovations across India.

11

Popularization and Dissemination of HRMN-99

The journey of HRMN-99 began when the innovation moved beyond the orchard of Dr Hariman Sharma and reached scientists, institutions, extension agencies and farmers across the country. It transformed HRMN-99 from a local discovery into a nationally recognized example of successful farmer-led innovation.

- The first stage of HRMN-99 dissemination was driven by demonstration under local conditions alongwith Anna and Dorsett Golden (Fig. 20-21), when neighbouring farmers, horticulturists and visitors developed a keen interest in the variety. Field observations and direct interaction with Dr Hariman Sharma enabled many growers to appreciate its unique characteristics and potential for cultivation in suitable non-traditional regions.
- In the next important phase researchers and horticultural experts undertook systematic evaluation — field observations, morphological characterization, fruit quality assessment, multi-location trials and other scientific studies. These investigations generated credible evidence regarding the distinctiveness and adaptability of HRMN-99 (Fig. 22).
- The involvement of innovation-support organizations and agricultural institutions in documentation, technical evaluation, recognition and protection of the innovation ensured that HRMN-99 receives the scientific attention and institutional support necessary for wider acceptance. This



Fig. 20. Apple variety Anna



Fig. 21. Apple variety: Dorsett Golden



Fig. 22. HRMN-99 apple variety

collaboration established a strong bridge between grassroots innovation and formal agricultural research.

- The availability of quality grafted planting material played a decisive role in expanding cultivation. Responsible nursery development and quality assurance became essential components of the dissemination strategy.
- Farmer-to-farmer communication proved to be another powerful mechanism for HRMN-99 popularization. Successful farmers became ambassadors of the innovation by sharing their experiences with neighbouring growers. Demonstration orchards, field visits and informal interactions helped build confidence among prospective adopters and encouraged the exchange of practical knowledge on orchard management.
- Media coverage and public recognition further enhanced the visibility of HRMN-99. National recognition of Dr Hariman Sharma's contribution, culminating in the conferment of the *Padma Shri*, brought unprecedented public attention to the variety and reinforced the importance of grassroots innovation in Indian agriculture.
- Extension agencies, horticulture departments and agricultural universities also contributed to awareness creation by sharing information on the



potential of HRMN-99, organizing technical interactions and encouraging scientific evaluation under diverse agro-climatic conditions.

- The growing interest in HRMN-99 encouraged its evaluation and cultivation in several suitable regions of the country. Although performance naturally varies with climate, soil, management practices and local environmental conditions, the experience gained from these efforts enriched scientific understanding and demonstrated the wider adaptability of the variety.
- The long-term success of HRMN-99 depends on responsible dissemination—expanding its cultivation, maintaining varietal purity, supplying authentic planting material, providing technical guidance and promoting sound orchard management practices. Such measures safeguard the credibility of the variety while protecting the interests of farmers.

The dissemination of HRMN-99 is much more than the spread of a new apple variety. It demonstrated that a farmer's innovation with combined efforts of the innovator, scientists, institutions, extension agencies and farming communities can become a national asset. This collaborative model offers valuable guidance for promoting future grassroots innovations across India. Today, journey of HRMN-99 from a single tree in Paniala to orchards in diverse regions of the country reflects the success of one variety and the strength of a dissemination process founded on scientific validation, institutional partnership, quality planting material and the confidence of farmers themselves.

11.1. Channels of Popularization

The widespread recognition of HRMN-99 is a result of a systematic process involving multiple stakeholders who collectively transformed a local innovation into a nationally acknowledged success. Each channel (Fig. 23) played a distinct role in creating awareness, validating the technology, building confidence among farmers and expanding its reach. Together, these channels established an effective model for disseminating farmer-led agricultural innovations.

- **The Innovator as the First Ambassador:** The journey of popularization began with Dr Hariman Sharma. His orchard served as a living demonstration of the variety's potential. By maintaining the original tree, propagating planting material and openly sharing his experiences with visitors, he became the first ambassador of HRMN-99.
- **Demonstration Orchards:** Standing orchards provided the strongest evidence of the performance of HRMN-99. Farmers, scientists, extension personnel



and policymakers could directly observe flowering, fruiting, yield and fruit quality under field conditions.

- **Farmer-to-Farmer Learning:**

One of the most effective channels of popularization was the informal exchange of knowledge among farmers. Such peer learning greatly accelerated adoption and strengthened trust in the innovation. Growers who successfully established HRMN-99 orchards shared their experiences, management practices and economic benefits with neighbouring farmers.

- **Scientific Validation and Research Institutions:**

The involvement of horticultural scientists in morphological characterization, fruit quality evaluation, molecular studies and multi-location trials established the credibility of HRMN-99 and strengthened confidence among researchers, extension agencies and progressive farmers.

- **Innovation-Support and Regulatory Institutions:** Organizations working in the areas of innovation promotion, varietal protection and agricultural development played an important role in documenting, evaluating, recognizing and protecting HRMN-99. They provided the innovation a scientific recognition while safeguarding the interests of the innovator and facilitating responsible dissemination.

- **Quality Nursery Network:** The propagation and distribution of certified planting material maintained varietal purity, ensured uniform orchard establishment and protected farmers from spurious or inferior planting material. A strong nursery network remains essential for the long-term success of HRMN-99.

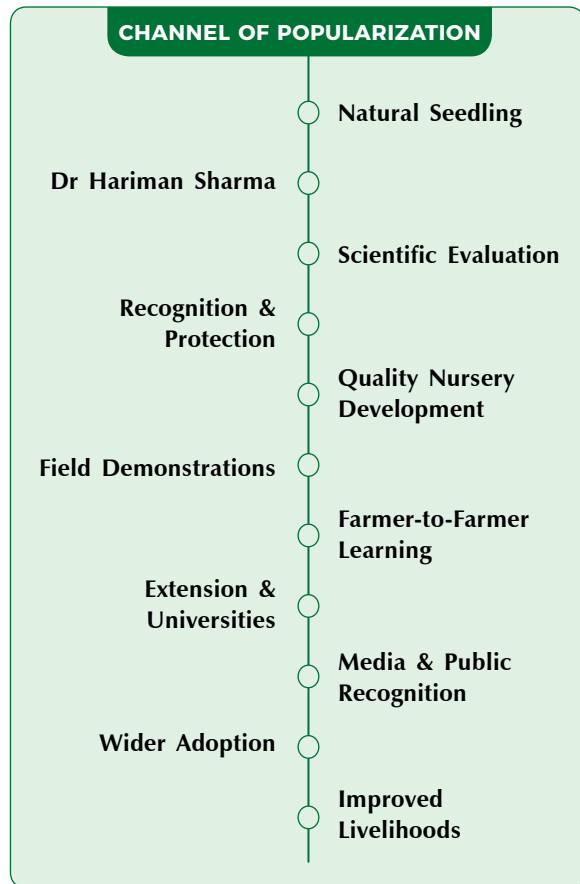


Fig. 23. Channels of popularization of HRMN-99



- **Extension Services and Training Programs:** State horticulture departments, *Krishi Vigyan Kendras*, extension agencies and state agricultural universities held field demonstrations, farmer training programs, technical advisories and orchard management guidance to improve growers' technical knowledge and promote scientific cultivation practices.
- **Agricultural Exhibitions, Workshops and Conferences:** Participation in exhibitions, farmers' fairs, horticultural expos, scientific seminars and training programs provided opportunities to showcase HRMN-99 before diverse audiences. These platforms facilitated interaction among farmers, researchers, entrepreneurs, nursery operators and policymakers, thereby broadening awareness and encouraging collaboration.
- **Print, Electronic and Digital Media:** Newspapers, magazines, television programs, radio broadcasts, agricultural journals, websites and social media platforms significantly enhanced public awareness of HRMN-99. Media coverage highlighted the story of Dr Hariman Sharma and its importance in Indian agriculture to millions of people.
- **National Recognition:** The conferment of the *Padma Shri* upon Dr Hariman Sharma became one of the most influential channels of popularization. National recognition honoured an outstanding farmer-innovator and inspired confidence among farmers, scientists and the general public. It reinforced the message that grassroots innovation deserves national appreciation and can make meaningful contributions to agricultural development.



Fig. 24. Performance of HRMN-99 in Uttar Pradesh



Fig. 25. Performance of HRMN-99 in Puducherry



Fig. 26. Performance of HRMN-99 in Andhra Pradesh



Fig. 27. Performance of HRMN-99 in Odisha



Fig. 28. Performance of HRMN-99 in Chhattisgarh

- **Knowledge Networks:** Interactions among scientists, horticulturists, extension personnel, policymakers, entrepreneurs and farmers created a dynamic knowledge network that facilitated the exchange of experiences and technical information strengthening the dissemination process.
- **Farmers' Success Stories:** Every successful HRMN-99 orchard became a new centre for dissemination. Thus, each successful adopter became a new ambassador for the innovation, creating a self-sustaining cycle of knowledge sharing.

The experience of HRMN-99 demonstrates that multi-channel approach help popularization. The efforts of innovators, scientists, institutions, extension agencies, media and farming communities integrate scientific credibility with field experience, ensuring that innovation reaches farmers in a reliable, responsible and sustainable manner.

12

Impact of Innovation and Specific Suggestions

The development of HRMN-99 by Dr Hariman Sharma is an outstanding example of how a farmer-led innovation, when strengthened through scientific validation and institutional support, can influence agricultural research, horticultural diversification, farmer confidence and public policy. The impact of this innovation extends beyond the boundaries of a single crop and offers valuable insights for strengthening India's agricultural innovation ecosystem.

- Expansion of opportunities for HRMN-99 apple cultivation in suitable non-traditional regions. While traditional apple-growing regions continue to remain the backbone of Indian apple production, HRMN-99 demonstrated that genetic adaptability can create additional opportunities in selected warmer environments.
- Success of HRMN-99 strengthened confidence in farmer-led innovation. Dr Hariman Sharma inspired many farmers to observe nature more carefully, experiment with new ideas and actively participate in agricultural innovation. This shift in perception is one of the most enduring contributions of the HRMN-99 experience.
- This strengthened the collaboration between farmers and scientific institutions. The systematic evaluation, documentation and validation of HRMN-99 created a productive partnership among innovators, researchers, extension agencies and policy institutions. This collaborative approach provides a replicable model for identifying and promoting future grassroots innovations.
- The HRMN-99 innovation contributed to horticultural diversification, which enhances farm resilience, improves resource utilization and provides additional income opportunities, thereby contributing to sustainable rural development.
- The HRMN-99 experience also highlighted the importance of conserving and utilizing plant genetic resources. It demonstrates that valuable genetic variability may exist outside conventional breeding programs and that



systematic exploration, conservation and evaluation remain essential for future crop improvement and climate resilience.

- Equally important has been the national recognition accorded to grassroots innovation—several honours, and *Padma Shri* award, received by Dr Hariman Sharma reinforced public appreciation of farmer creativity and demonstrated that outstanding contributions from rural communities deserve national recognition.

12.1. Impact on Farmers and Society

Hariman Sharma's exceptional innovation has significantly impacted Indian agriculture and society by:

- empowering thousands of farmers with increased income and sustainable livelihoods;
- making apples more affordable for the common man, breaking the perception of apples as a luxury fruit;
- contributing to food security and economic growth, aligning with the Sustainable Development Goals (SDGs);
- increasing crop diversification, reducing farmers' dependence on traditional crops;
- enhancing climate resilience by introducing a variety that thrives in warmer conditions;
- reducing post-harvest losses due to HRMN-99's adaptability and durability;
- boosting rural employment opportunities through orchard expansion and apple-based agro-industries; and
- encouraging sustainable farming practices, inspiring innovation in fruit cultivation beyond traditional apple-growing regions.

Hariman Sharma's ground-breaking contribution revolutionized apple farming in India and also provided farmers with new opportunities for income generation. His journey from a small village farmer to a *Padma Shri* Awardee exemplifies resilience, innovation, and dedication. By making apple cultivation accessible in warmer climates, Sharma has set a new precedent in Indian agriculture, ensuring that fresh, nutritious apples reach more people across the country.



12.2. Specific Suggestions

The significant achievements of HRMN-99 generated opportunities for further strengthening its long-term impact. The following suggestions are offered for consideration by researchers, extension agencies, policymakers and development organizations.

- **Strengthen scientific research:** Continued multi-location evaluation, long-term performance studies and research on physiology, stress tolerance, pest and disease management and post-harvest quality will further enhance scientific understanding of HRMN-99.
- **Ensure availability of quality planting material:** Establishing certified mother blocks, accredited nurseries and effective quality-control systems will maintain genetic purity and ensure that farmers receive authentic planting material.
- **Promote climate-resilient horticulture:** HRMN-99 should be evaluated as part of broader strategies for horticultural diversification and climate adaptation in suitable agro-ecological regions, while recognizing that site-specific evaluation remains essential.
- **Expand farmer capacity-building:** Regular training programs, establishment of demonstration orchards, exposure visits and digital advisory services should be strengthened to improve orchard management, productivity and fruit quality.
- **Support value addition and market development:** Higher investments in grading, packaging, cold-chain infrastructure, processing, branding and promoting Farmer Producer Organizations (FPOs) will increase farmers' income and improve market competitiveness.
- **Encourage documentation of grassroots innovations:** Mechanisms should be strengthened to identify, evaluate and document farmer-developed technologies across the country so that valuable innovations are not lost before they receive scientific attention.
- **Strengthen policy support:** Farmer innovations should receive timely technical guidance, intellectual property protection and appropriate institutional support to facilitate responsible dissemination and long-term sustainability.
- **Promote collaborative innovation:** Closer partnerships among farmers, research institutions, universities, extension agencies, innovation-support



organizations and the private sector will accelerate the development and dissemination of climate-resilient technologies.

12.3. From a Farmer's Field to a National Legacy

The experience of Dr Hariman Sharma and HRMN-99 demonstrates that agricultural innovation achieves its greatest significance when it benefits farmers, advances scientific knowledge and contributes to national priorities. Its impact extends far beyond apple orchards and fruit production; it has strengthened confidence in grassroots innovation, fostered collaboration between farmers and the scientific community, and expanded the horizons of Indian horticulture. At a time when climate change, resource constraints and the need for sustainable agricultural development are reshaping farming systems, the HRMN-99 experience offers an inspiring and practical model. By recognizing and nurturing farmer innovators, investing in rigorous scientific validation, strengthening institutional support and ensuring responsible dissemination of proven technologies, India can utilize the creative potential of its farmers. The enduring legacy of Dr Hariman Sharma is the success of HRMN-99, and it sets a powerful example for generations to come: transformative agricultural innovation can emerge from a farmer's field and, through vision, perseverance and partnership with science, evolve into a contribution of lasting value to national agricultural development.

13

Returns Over Investments

The success of HRMN-99 demonstrated that a farmer-led innovation can generate substantial economic, social and environmental returns when supported by scientific validation, quality planting material and effective dissemination. Although the magnitude of returns varies with location, orchard management, market conditions and scale of cultivation, the overall experience indicates that investment in HRMN-99 can yield multiple long-term benefits.

The first and most visible return is economic. The introduction of a high-value fruit crop into suitable non-traditional regions created opportunities for farm diversification and additional income generation. Farmers adopting HRMN-99 have the potential to supplement conventional cropping systems with a perennial horticultural enterprise capable of providing sustained returns over many years. As orchards mature, annual income from fruit production may increase significantly.

The second important return arises from the production and sale of quality grafted planting material that contributes to the long-term sustainability of the innovation. HRMN-99 nursery development emerged as a complementary enterprise, creating opportunities for rural entrepreneurship, employment generation and local business development.

The innovation generated social returns by enhancing farmers' confidence in experimentation and innovation. The success of Dr Hariman Sharma inspired many cultivators to believe that they can develop meaningful agricultural innovations. This change in attitude encouraged greater interaction between farmers and scientists and strengthened the culture of innovation in rural communities.

The institutions also got benefited as the collaborative efforts of research organizations, innovation-support institutions, horticulture departments and extension agencies demonstrated an effective model for validating and disseminating farmer-led innovations. The HRMN-99 experience strengthened confidence in participatory approaches to agricultural research and technology development.

The innovation contributed scientific returns by stimulating research on low-chilling apple varieties, climatic adaptability, orchard management and horticultural

diversification. It broadened scientific understanding of the potential for apple cultivation in suitable non-traditional environments.

Environmental returns are equally significant. Perennial fruit trees contribute to improved vegetation cover, carbon sequestration, soil conservation and biodiversity enhancement. HRMN-99 can become part of environmentally responsible farming systems that support long-term ecological stability.

The innovation also produced human capital returns by creating opportunities for training, skill development and knowledge exchange among farmers, nursery operators, extension personnel and young entrepreneurs. Exposure visits, demonstration orchards and technical programs enhanced the capacity of farming communities to adopt improved horticultural practices.

Perhaps the greatest return is the creation of a replicable innovation model. The journey of HRMN-99 (Fig. 31), compared with Dorsett Golden and Anna (Fig. 29-30) demonstrated that careful observation, scientific validation, institutional support and farmer participation can together transform a local discovery into a nationally significant achievement.



Fig. 29. *Dorsett Golden variety in fruiting*



Fig. 30. *Anna variety in fruiting*



Fig. 31. *HRMN-99 variety in fruiting*



Viewed comprehensively, the returns from HRMN-99 cannot be measured solely in monetary terms. Its benefits encompass increased farm income, employment generation, scientific advancement, institutional learning, environmental sustainability, farmer empowerment and national recognition. These returns illustrate the value of investing in farmer-led innovation and reinforce the importance of identifying, supporting and scaling similar initiatives across India.

The experience of Dr Hariman Sharma demonstrates that the highest return on agricultural innovation is not the financial profit but the creation of lasting value for farmers, science, society and the nation.

13.1. Apple Nursery (HSAN)

Hariman Sharma Apple Nursery is the wholesale supplier of fruit plants, custard apple tree and other products since 1995 in Bilaspur, Himachal Pradesh. Saplings of all low chilling apple varieties, namely, HRMN99 (Fig. 31), Anna (Fig. 30), and Dorsett Golden (Fig. 29) are also available for sale.

- **Revenue from Nursery Sales:** Hariman Sharma Apple Nursey (HSAN) reportedly holds around 90,000-1,00,000 saplings, sold at ₹ 100 per plant, generating a revenue of ₹ 80-90 lakh annually.
- **Income from Apple Production:** HSAN sells around 50-60 q of apples locally each June. Traditional varieties are late maturing and fruits are not ready for sale in market during the early season, allowing HRMN-99 to fetch good market prices. Across his diversified farm (including mangoes, and other fruits), his total annual income reaches ~ ₹ 90-95 lakh.

13.2. Cost Considerations

- **Sapling Cost:** Tissue culture-grafted plants are available at ₹ 270 per plant (nursey rate)
- **HSAN Time to Yield:** Fruiting begins after 2-3 years. Full yield efficiency (1 q per plant) reaches by years 7-10

13.3. Economic Benefits and Growing Adoption of HRMN-99

HRMN-99 demonstrated considerable potential to provide farmers with an additional and economically viable source of income, particularly in non-apple regions. Its adaptability encouraged farmers to adopt the variety for ornamental,



household and commercial production. A survey undertaken by the NIF during 2017–18 to assess the economic benefits of low-chilling apple cultivation received encouraging feedback from farmers engaged in both domestic and commercial production. Reported seasonal incomes ranging from approximately ₹ 7,000 to ₹ 15.60 lakh, depending primarily on the number and age of fruit-bearing trees.

The growing popularity of HRMN-99 reflects its expanding acceptance among farming communities. NIF's intensified efforts towards its dissemination further accelerated its adoption. From an initial distribution of about 5,000 saplings to 410 farmers during 2013–14, the reach of Dr Hariman Sharma's initiative expanded substantially, encompassing around 6,000 farmers by 2019–20, while preparations were underway to produce approximately 75,000 saplings. This expansion illustrates growing confidence of farmers in HRMN-99 and its potential to diversify farm incomes and extend apple cultivation into new agro-climatic regions.

13.4. Business Potential of HRMN-99 in Bilaspur District

Bilaspur district has strong potential for agricultural entrepreneurship owing to its favourable connectivity, diverse agro-climatic conditions, natural resources and growing market opportunities. Besides traditional mango, citrus, litchi and peach, the HRMN-99 apple variety, offers a new opportunity to expand apple cultivation into the district's warmer, lower-elevation areas. Its adoption can stimulate businesses in nurseries, orchard development, fruit production, processing, packaging, marketing and agritourism, while generating additional income and employment for farmers and rural youth. Supported by government schemes, improved infrastructure and rising demand for locally produced fruits, HRMN-99 can become a catalyst for crop diversification, agribusiness development and sustainable rural economic growth in Bilaspur (Kumari and Devi, 2026).

HRMN-99 offers a promising opportunity to expand apple cultivation into the lower hills and several tropical regions of India, where temperatures may reach 40–45°C and conventional apples cannot be grown because of their high chilling requirement. Its low-chilling adaptability enables farmers in these regions to diversify into apple cultivation while retaining year-round greenery. With trees spaced about 15 feet apart, farmers can also grow vegetables, wheat, maize and pulses between rows, generating additional income. Dr Hariman Sharma's vision is to make HRMN-99 an apple for every region and every farmer, taking apple cultivation beyond the mountains and, contributing to agricultural diversification and enhanced farm income across India.



The Types of Return and Their Impact

Type of return	Impact
Economic	Additional farm income, orchard enterprise, nursery business
Social	Farmer confidence, innovation culture, rural entrepreneurship
Scientific	Research opportunities, climate-resilient horticulture
Institutional	Stronger farmer–scientist partnerships, validation mechanisms
Environmental	Tree cover, soil conservation, carbon sequestration, biodiversity
Human resource	Training, skill development, youth engagement
National	Recognition of grassroots innovation, policy influence

13.5. Start Growing HRMN-99 Today

The HRMN-99 apple variety is a ground-breaking cultivar, which has capacity of growing in regions with summer temperatures reaching up to 45°C, trees reach a height of approximately 3.6-4.6 m, begins to bear fruit after the third year of planting flowers emerge in early January, with fruits maturing for harvest by June; ripe apples exhibit a yellow-red hue, are of standard size, and possess a sweet taste; and shows tolerance to scab disease, a common affliction in apple cultivation. A mature tree (10–12 years old) can produce approximately 100 kg of fruit. The fruits have a shelf life of about 10 to 12 days at room temperature.

Category	Insight
Innovation	HRMN-99 grows in low-chill, warm climates; disease-tolerant
Yield	~100 kg/plant, fruiting by year 3, full maturity by 7–10 years
Revenue potential	Nursery sales alone can generate ₹ 30–40 lakh/year
Overall income	All farm operations ~₹ 60–70 lakh/year
Impact	Currently grown in 29 states in India; adopted in a few other countries

In view of the huge success of HRMN-99, some vendors are cheating farmers by selling fake HRMN-99, so all farmers are requested to ask for a bill if any seller asks to provide HRMN-99 plants to you besides the certified sellers. The nursery plant in the district of Bilaspur provides a great opportunity for the people



to explore their business. Over time, numerous nursery plants are flourishing and enhancing their local business. HRMN-99 variety is registered under the Protection of Plant Varieties and Farmer's Rights Authority, Ministry of Agriculture, Govt. of India and also protected by National Innovation Foundation, Ministry of Science and Technology, Govt. of India's Letter No. D.S.D./2-20/128155 dated 07-09-2020 has authorized Hariman Sharma to grow and sale the HRMN-99 variety. Hariman Sharma has the sole right to prepare HRMN-99 variety. So, beware of duplicate sellers who are misleading farmers to earn money. Hariman Sharma Apple Nursery offers three varieties of low-chilling apples—HRMN-99, Anna, and Dorsett Golden—on a large scale. Grafted plants on seedling rootstock are available at ₹ 70 per plant, while tissue-culture-grafted plants are available at ₹ 270 per plant. HRMN-99, a low-chilling apple, can successfully grow with mango and pomegranate in the lower Himachal Pradesh, which is only 700 m above sea level and where temperature is 40 to 45°C during summer. If any seller tells farmers that they can provide HRMN-99 plants besides us, please inform us.

Hariman Sharma Apple Nursery provides mainly three low-chilling varieties: HRMN-99, Anna, and Dorsett Golden as detailed below:

1. HRMN-99 Per Seedling Grafted Plant (New grafted plant with long roots): ₹ 70
2. HRMN-99 Per Seedling Grafted Plant (One year old mature grafted plant)- ₹ 100
3. HRMN-99 Per Clonal Rootstock grafted Plant- ₹ 150
4. HRMN-99 Per Tissue Culture grafted Plant- ₹ 270
5. HRMN-99 Per Tissue Culture grafted Plant, One year old- ₹ 300

The HRMN-99 variety has been successfully cultivated in various Indian states, including Delhi, Uttar Pradesh, Uttarakhand, Karnataka, Haryana, Himachal Pradesh, and Manipur. Its adaptability to warmer climates and lower altitudes makes it a promising option for regions traditionally unsuitable for apple farming. For those interested in cultivating the HRMN-99 apple in different Indian States and elsewhere in other countries, it is advisable to consult local agricultural nurseries or extension services to obtain saplings and region-specific cultivation guidance; or to get seedlings /grafted plants by contacting/writing to:

Hariman Sharma

Village Paniala, PO Kothi, Tehsil Ghumarwin,
District Bilaspur, Himachal Pradesh, India Pin Code 174021
Mob: 7018520244, 9418867209, 9817284251
Email: sharmaharimanfarm@gmail.com

14

Conclusion

The journey of Dr Hariman Sharma and HRMN-99 is a remarkable legacy. It began with the careful observation of an unusual apple seedling that gradually evolved into a nationally recognized example of farmer-led innovation, scientific collaboration and agricultural transformation. The story presented in these pages is not merely about the development of a low-chilling apple variety, but is about an inquisitive mind, courage to challenge accepted beliefs and the determination to pursue an idea despite uncertainty. It also illustrates the indispensable role of scientific institutions in validating, strengthening and disseminating grassroots innovations for the benefit of society.

Throughout this Success Story, one message has remained constant: innovation is strongest when farmers and scientists work together. Farmers contribute practical wisdom born of daily interaction with nature, while scientists provide rigorous evaluation, refinement and wider application. Institutions create the enabling environment that allows such partnerships to flourish. When these strengths are combined, agricultural innovations acquire the capacity to improve livelihoods, strengthen food and nutritional security and contribute to national development. The journey of HRMN-99 also reminds us that agriculture is continuously evolving. Climate change, changing consumer preferences, shrinking natural resources and the need for sustainable production systems demand fresh thinking and continuous innovation. Solutions to many future challenges may already exist in farmers' fields, waiting to be recognized, scientifically validated and responsibly disseminated.

This Success Story on Apple HRMN-99, therefore celebrates not only the achievements of Dr Hariman Sharma but of every farmer who observes nature with curiosity, every scientist who values grassroots knowledge, every institution that supports innovation and every policymaker who recognizes the importance of investing in agricultural creativity. Together, they represent the foundation upon which the future of Indian agriculture will be built. The legacy of Dr Hariman Sharma and HRMN-99 strengthened confidence in farmer-led



innovation, encouraged constructive partnerships between science and society and demonstrated that meaningful change can originate from the vision and perseverance of a single individual. Such examples enrich Indian horticulture and also the philosophy of agricultural development itself.

May this success story inspire researchers to seek knowledge beyond laboratories, encourage farmers to continue experimenting, motivate young students to pursue innovation and remind institutions that some of the nation's agricultural innovations may still be growing in the fields of farmers. The journey of Dr Hariman Sharma and HRMN-99 is therefore not the conclusion of a story but the beginning of many new possibilities. If this book inspires even one farmer to innovate, one scientist to collaborate more closely with farming communities or one policymaker to strengthen support for grassroots creativity, it will have fulfilled its purpose. The seed of innovation planted by Dr Hariman Sharma has grown into a tree of knowledge and its branches extend far beyond an orchard. Its fruits will nourish Indian agriculture for generations to come.

14.1. An Enduring Legacy for Farmers Worldwide

Every great agricultural journey begins with a seed. Most seeds grow into crops that nourish families; a few grow into trees that sustain generations. Very rarely, a seed grows into an idea that transforms agriculture and inspires the world. The journey of Dr Hariman Sharma and HRMN-99 is one such extraordinary story.

From a single apple seedling growing in a backyard orchard emerged an innovation that challenged conventional thinking, expanded the possibilities of apple cultivation and demonstrated the extraordinary potential of farmer-led innovation. It is a powerful reminder that groundbreaking ideas are not confined to laboratories or research institutions—they can emerge from the keen observation, perseverance and wisdom of a dedicated farmer. The enduring contribution of Dr Hariman Sharma lies not only in developing HRMN-99, but in demonstrating that farmers are creators of knowledge, innovators and partners in scientific progress. HRMN-99 is no more a remarkable apple variety but a symbol of hope, resilience and the limitless possibilities that emerge when grassroots innovation is recognized, scientifically validated and responsibly shared. As agriculture faces the challenges of climate change, resource limitations and increasing demands for sustainable food production, the lessons of HRMN-99 become more relevant. The future will depend upon innovation that is rooted in nature, guided by science and strengthened by the experience of farmers.



This book is dedicated not only to celebrating the achievements of Dr Hariman Sharma but also to honouring every farmer who dares to observe, experiment, innovate and dream and whose ideas hold the key to a more resilient and sustainable agricultural future.

May the orchards established through HRMN-99 continue to flourish across suitable regions of the world. The true legacy of Dr Hariman Sharma and HRMN-99 is not measured by the number of trees planted or the awards received. It is measured by the confidence they have instilled in farmers, the partnerships they have fostered between science and society, and the hope they continue to plant in the hearts of those who believe that agriculture can transform lives and build a better world.

Every great innovation begins with one idea, one observation and one determined individual. The legacy of Dr Hariman Sharma and HRMN-99 will endure wherever farmers believe in the power of nature, innovation and their own potential to change the world. "Dr Hariman Sharma and HRMN-99 together represent far more than the story of an innovative farmer and a remarkable apple variety. They symbolize the transformative power of curiosity, perseverance and scientific collaboration. Their journey demonstrates that when grassroots innovation is recognized, validated and nurtured, it can reshape agricultural thinking, inspire generations and contribute meaningfully to sustainable farming across the world. This Success Story preserves not only the history of an extraordinary innovation but also a timeless philosophy—that the next breakthrough in agriculture may already be growing in the field of an observant farmer.

Awards and Honours

National Awards (22)

1. **“Padma Shri” Award 2025** - One of the highest Civilian Award by Smt Droupadi Murmu ji Mahamahim Rashtrapati Ji at Rashtrapati Bhawan, New Delhi on 28 April 2025
2. **Innovative Farmer Award-2016** by Hon’ble Union Agriculture Minister, Government of India at ICAR-IARI, Pusa Campus, New Delhi
3. **Ninth National Biennial Grassroot Innovation and Outstanding Traditional Knowledge Award-2017** by Shri Pranab Mukherjee, Mahamahim Rashtrapati Ji at Rashtrapati Bhawan, New Delhi
4. **Ninth Biennial Green Grassroot Innovator Award-2017** by National Innovation Foundation of Dept of Science & Technology (DST), Government of India New Delhi
5. **Doctor of Science-DSc (Honoris Causa) 2020** by Vice Chancellor, Career Point University, Hamirpur (Himachal Pradesh)
6. **Doctor of Science-DSc (Honoris Causa) 2023** by Vice Chancellor, Mahatma Jyoti Rao Phoolle University, Jaipur (Rajasthan)
7. **Kheton ke Vaigyank Award** by Rajasthan University of Veterinary & Animal Sciences (RAJUVAS), Bikaner (Rajasthan)
8. **IARI Fellow Award-2017** by Union Minister of State Agriculture and Farmers’ Welfare, Government of India at ICAR-IARI, Pusa Campus, New Delhi
9. **Utkrisht Krishak Puraskar 2017** by Managing Director, Indian Farmers Fertiliser Cooperative Limited (IFFCO), Gujarat
10. **Amit Udyan Award-2017** by Minister of State Agriculture and Farmers’ Welfare, Government of India at Junagarh (Gujarat)
11. **Krishak Vaigyanik Samman-2017** by Vice Chancellor, Maulana Azad Vishwavidyalaya, Jodhpur (Rajasthan)



12. **Pride of Punjab, Haryana and Himachal** by His Excellency Governor of Himachal Pradesh
13. **Krishi Vaigyanik Upadhi-2018** by Deputy Director General, ICAR, New Delhi at Udaipur (Rajasthan)
14. **Best Farmer Award with National Silver Medal 2018** by Union Agriculture Minister, Government of India at Varanasi (Uttar Pradesh)
15. **Krishak Samrat Samman-2018** by Union Agriculture Minister, Government of India at Hotel Ashoka, New Delhi
16. **Best Green Grassroot Innovator Award** by Agriculture Minister, Government of Bihar at Bihar Agricultural University, Sabour, Bhagalpur (Bihar)
17. **Jagjivan Ram Krishi Abhinav Puraskar 2019** by Director General Indian Council of Agricultural Research, New Delhi
18. **National Innovation Award 2016** Government of India, New Delhi
19. **Certificate of Appreciation** by PPV&FR Authority, Government of India, New Delhi
20. **ICAR-IARI Fellow Award 2017** by ICAR-IARI, New Delhi
21. **Prashasti Patra** by Amit Shah, Union Minister of Home and Cooperation, Government of India, New Delhi
22. **Innovative Farmer Award 2021** by Sher-e-Kashmir University of Agricultural Science and Technology, Jammu (J&K)

State Awards (20)

1. **Block Level Best Horticulturist 2006** by Sub-Divisional Magistrate, Ghumarwin, Dist Bilaspur (Himachal Pradesh)
2. **Krishi Pandit 2007** by Director of Horticulture, Government of Himachal Pradesh, Shimla (Himachal Pradesh)
3. **Prerana Shrot Puraskar-2009** by Chief Minister Government of Himachal Pradesh, Shimla (Himachal Pradesh)
4. **Sarv Shreshth Himachali Kissan Khitab 2010** by Divya Himachal Media Group, Himachal Pradesh
5. **Utkrisht Krishak Puraskar 2010** by Deputy Speaker of Himachal Pradesh Vidhan Sabha, Government of Himachal Pradesh, Shimla (Himachal Pradesh)



6. **Krishi Kshetra Mein Sarahniy Yogdan 2010** by Chief Minister, Government of Himachal Pradesh, Shimla (Himachal Pradesh)
7. **NABARD Kisan Gosthi Per Samman 2010** by Deputy Commissioner, Una District, Himachal Pradesh
8. **Best Farmer Award 2010** by Chief Minister, Government of Himachal Pradesh, Shimla (Himachal Pradesh)
9. **Best Apple Cultivator Award 2016** by His Excellency Governor of Himachal Pradesh
10. **Best Apple Farmer Innovation Award 2016** by Chief Minister, Government of Himachal Pradesh, Shimla (Himachal Pradesh)
11. **Successive Apple Grower Award 2018** by MLA Vidhan Sabha, Government of Himachal Pradesh, Shimla (Himachal Pradesh)
12. **Sarshreshtha Bagwan Puraskar 2018** by Member of Parliament (MP) Hamirpur, Government of Himachal Pradesh, Shimla (Himachal Pradesh)
13. **Samaj Rattan Puraskar 2019** by Dr Kashma Metre of Chinmaya Foundation for Rural Development.
14. **Best Horticulturist Award 2019** by Vice Chancellor, Career Point University, Hamirpur (Himachal Pradesh)
15. **Special Revolution in the Field of Apple Cultivation Award 2018** by Education Minister, Government of Himachal Pradesh, Shimla (Himachal Pradesh)
16. **Pride of Punjab** by Zee Media
17. **Him Ratna Award** by Rajesh Dharmani, Cabinet Minister, Government of Himachal Pradesh, Shimla (Himachal Pradesh)-September 2025
18. **Award of Honour** by (i) Vice Chancellor, CSK University of Agriculture & Technology, Palampur (Himachal Pradesh) at KVK Berthin & by (ii) Shri Jit Ram Katwal, MLA Jhanduta (Himachal Pradesh)
19. **Himalayan Shri Award** by Bollywood Star Ranjit Singh
20. **Himalayan Grassroot Innovation Award 2024** Vice Chancellor, HN Bahuguna University, Shrinagar, Garhwal (Uttarakhand)



Hariman Sharma meeting with Pranab Mukherjee, Former President of India



Minerva, Ghumarwin, Bilaspur (HP) felicitated Hariman Sharma in function organized by Amar Ujala



Padma Awardees-Hariman Sharma and Nek Ram Sharma honoured by Government of Himachal Pradesh



Eco-Club run by student and staff of Government College, Bilaspur honoured Hariman Sharma



With Jagdeep Dhankar then Vice President of India along staff at YSPUHF, Nauni-Solan



Anurag Thakur, then Union Minister, Gol felicitating Hariman Sharma



Hariman showing nursery cuttings to then Hon'ble President APJ Abdul Kalam



Hariman felicitated by alliance of BI&CIAT, presence of Drs PL Gautam, JC Rana and RK Tyagi



Hariman Sharma honoured by the Government of Himachal Pradesh



Padma Shri Awardees - Hariman Sharma and Nek Ram Sharma with Jagdeep Dhankar, Former Vice President of India



Hariman Sharma receiving the award



Hariman Sharma meeting with Hon'ble Prime Minister Dr Narendra Modi



Hariman Sharma conferred with prestigious "Padma Shri" by her excellency Smt. Droupadi Murmu, President of India

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About the Author

Dr Hariman Sharma, *Padma Shri* awardee, was born on 4 April 1956 in Paniala village, Tehsil Ghumarwin, District Bilaspur, Himachal Pradesh. His early life was marked by hardship. His mother left him when he was only three days old, and he was adopted and raised by his uncle. Financial constraints limited his formal education to the IX Standard. Yet, limited schooling never constrained his curiosity or ambition. Farming became his passion, and he learned through close observation, experimentation and practical experience.



His remarkable journey began in 1998, when apple cultivation in India was largely confined to cooler, high-altitude regions because conventional varieties require prolonged winter chilling. Sharma planted seeds from apples discarded after household consumption in his backyard. One seed germinated in 1999 and, remarkably, produced fruit by 2001 despite the warm climate of his village, situated at about 1,800 feet altitude. Recognizing its potential, Sharma patiently nurtured the plant and experimented with selection, propagation and grafting. Over the following years, he developed the low-chilling apple variety HRMN-99, named after his initials and the year of its emergence.

HRMN-99 represents a significant grassroots innovation in Indian horticulture. Its ability to perform under comparatively warm conditions has opened possibilities for apple cultivation in lower hills and subtropical and tropical regions where conventional high-chilling varieties are difficult to grow. This has expanded the geographical possibilities of apple cultivation and provided farmers with an opportunity to diversify crops and generate additional income. Its relatively early maturity can also offer a market advantage by allowing fruit to reach consumers when traditional apple supplies are comparatively limited.

The dissemination of HRMN-99 was strengthened through the combined efforts of Dr Hariman Sharma, farmers, ICAR institutions, Krishi Vigyan Kendras (KVKs), agricultural universities, State Departments, volunteers and field personnel. The variety reached farmers across numerous states and Union Territories, including several warmer regions previously considered unsuitable for conventional apple cultivation. Planting material has also reportedly reached countries such as Nepal, Bangladesh, Germany and South Africa.

Sharma's contribution has received wide recognition, through conferment of 22 National awards and 20 State level awards including the National Grassroots Innovation and Outstanding Traditional Knowledge Award in 2017, the prestigious *Padma Shri* award one of India's highest civilian honours, for his contribution to agriculture and grassroots innovation.

The story of Hariman Sharma is remarkable because his innovation emerged not from a sophisticated laboratory but from a farmer's curiosity, perseverance and close observation of nature. His journey demonstrates that transformative agricultural innovations can originate at the grassroots when farmer ingenuity is supported by science and institutions. By sharing knowledge, distributing planting material and encouraging young people to approach agriculture creatively, Sharma has inspired a new generation of farmers and innovators.



Trust for Advancement of Agricultural Sciences (TAAS)

Avenue II, ICAR-Indian Agricultural Research Institute (IARI)

Campus, New Delhi - 110012, India

Ph.: +91-11-25843243; +91-8130111237

E-mail: taasiari@gmail.com; Website: www.taas.in