



CONFERENCE REPORT

A Comprehensive Report on AYUFARM 2025: A National level Certificate Course Integrating Modern Biotechnology and Soilless Cultivation with Traditional Vrikshayurveda Principles for Medicinal Plant Propagation

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Abstract

The escalating global demand for Ayurvedic medicine has placed significant pressure on medicinal plant resources, leading to challenges in supply, substitution, and quality control. To address this critical gap, the Department of Dravyaguna at the All India Institute of Ayurveda (AIIA), New Delhi, organized a five-day national certificate course, AYUFARM 2025, from 22nd to 26th September 2025¹. This intensive program was designed to provide a high-level, multidisciplinary training platform for 27 participants, including postgraduate scholars, doctoral researchers, medical officers, and faculty members from 13 states across India. The course curriculum was meticulously structured to synthesize modern biotechnological interventions with traditional Ayurvedic agricultural wisdom. Key modules covered: (1) **Plant Tissue Culture**, focusing on micropropagation, somatic embryogenesis, and synthetic seed production; (2) **Soilless Cultivation**, detailing hydroponic and cocoponic systems for standardized herb production; (3) **Vrikshayurveda**, exploring classical principles of soil science, plant nutrition, and propagation; and (4) **Sustainable Agriculture**, with practical training in organic pest management and vermitechnology. The program, led by six eminent scientists and educators, successfully merged theoretical lectures with hands-on practical demonstrations. This report details the pedagogical framework, technical content, and key outcomes of the course, highlighting its significance in building skilled human resources capable of advancing the sustainable cultivation, conservation, and quality assurance of medicinal plants, thereby aligning with national AYUSH mission objectives and global Sustainable Development Goals.

Introduction

The Strategic Imperative for AYUFARM 2025

The field of Ayurveda, a comprehensive system of traditional Indian medicine, is fundamentally dependent on the quality, efficacy, and availability of its *materia medica*, primarily derived from medicinal plants. In recent decades, the mainstreaming of Ayurveda has created an unprecedented demand for raw

herbal materials, resulting in a supply-chain crisis. This crisis is characterized by over-harvesting from wild populations, depletion of biodiversity, and a pervasive market issue of substitution and adulteration, which severely undermines therapeutic efficacy and safety.

It is within this pressing context that the Department of Dravyaguna (Ayurvedic Pharmacology and Pharmacognosy) at the All India Institute of Ayurveda (AIIA), New Delhi, conceptualized and executed the **AYUFARM 2025** initiative. This program represents a strategic academic response to a critical national need. The five-day "Certificate Course on Cultivation & Propagation of Ayurveda Herbs" was held from 22nd to 26th September 2025 at the AIIA academic block¹¹.

The course was not merely a training workshop; it was an interdisciplinary convocation designed to bridge the chasm between classical Ayurvedic knowledge and modern agribiotechnology. The event brought together a diverse and select group of 27 participants, including postgraduate (PG) and doctoral (PhD) scholars, medical officers, and faculty members from 13 different states. This "Training of Trainers" model was intended to create a cascading effect, empowering academic and clinical leaders to disseminate these advanced techniques within their respective institutions and regions.

The program's core objective was to advance knowledge in Ayurveda-based herbal cultivation by integrating four key pillars:

Conservation and Mass Propagation via plant tissue culture.

Standardization and Purity via soilless cultivation systems.

Holistic and Sustainable Practices via *Vrikshayurveda* (classical Ayurvedic agronomy).

Ecological Fidelity via organic farming and soil health management.

By engaging six renowned guest speakers, all eminent scientists and educators in their domains, AYUFARM 2025 aimed to equip participants with the theoretical expertise and practical skills necessary to lead the development of sustainable medicinal plant resources for the future of Ayurvedic medicine.

Inaugural Session: Setting the Academic and Policy Tone

The inaugural ceremony, held on 22nd September, established the program's academic and policy framework. The ceremony was graced by distinguished dignitaries whose presence underscored the confluence of forestry, conservation policy, and Ayurvedic science.

Chief Guest: Dr. Sameer Sinha (IFS), Principal Chief Conservator of Forests (HoFF), Uttarakhand.

Guest of Honour: Dr. Chandra Shekhar Sanwal (IFS), Chief Conservator of Forests, Uttarakhand, and former Deputy CEO of the National Medicinal Plants Board (NMPB), Ministry of Ayush.

Program Chair: Prof. Dr. Mahesh Vyas, Dean (PhD), AIIA.

The presence of high-ranking officials from the Indian Forest Service (IFS) and the NMPB was highly significant. Their "valuable insights" provided a macro-level policy perspective, linking the course objectives to national

biodiversity conservation laws, CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora) regulations, and the NMPB's mandate to promote *ex-situ* cultivation to reduce pressure on wild floral populations.

Dr. Neelayathatchi introduced the course concept, emphasizing its design to address the critical need for "sustainable development of medicinal plant resources". Prof. Dr. Mahesh Vyas, in his capacity as Dean, framed the program within AIIA's broader mission to foster high-level research and academic rigor in Ayurveda. The ceremony effectively set a tone of urgent, collaborative action, positioning the participants as key stakeholders in the national mission for a sustainable and quality-driven AYUSH sector.

Technical Modules: A Synthesis of Science and Tradition

The five-day program was structured as an intensive, progressive immersion into five core modules, each building upon the last.

Module I (Day 1): Plant Tissue Culture and Micropropagation

The first day, led by Dr. Janhavi Mishra Rawat (Professor, Department of Biotechnology, Graphic Era, Dehradun), was devoted entirely to the principles and applications of Plant Tissue Culture (PTC)

Theoretical Framework: The sessions began by explaining the "fundamental principles of micropropagation", centered on the concept of **plant cell totipotency**—the innate ability of a single plant cell to regenerate into a whole, viable plant under suitable *in-vitro* conditions. This concept, first proposed by Gottlieb Haberlandt, is the biological basis for all plant cloning and biotechnological propagation. Dr. Rawat emphasized the critical importance of "aseptic conditions, sterilization techniques, and media preparation". This involves the use of specialized "laboratory requirements" such as **laminar airflow chambers** (providing a sterile HEPA-filtered work environment), **autoclaves** (for steam sterilization of media and instruments at 121°C and 15 psi), and sterile instruments.

Advanced Techniques: The lectures transitioned from basic micropropagation to advanced biotechnological tools.

Somatic Embryogenesis: The process of inducing somatic (non-reproductive) cells to develop into embryos. This is a powerful method for mass propagation, as a single gram of embryogenic callus can contain thousands of "somatic embryos."

Synthetic Seed Production: This technique, closely linked to somatic embryogenesis, involves encapsulating somatic embryos in a protective, nutrient-rich hydrogel (e.g., sodium alginate) to form a "synthetic seed". This technology was presented as a revolutionary tool for the conservation of rare and endangered species, as well as for the easy transport and storage of clonal planting material.

Protoplast Isolation and Fusion: The lecture covered the enzymatic removal of the plant cell wall to create "protoplasts" (naked cells)²⁸. These protoplasts can then be "fused" (somatic hybridization) to overcome sexual incompatibility barriers between two different species, opening avenues for novel hybrid development.

Practical Session: The afternoon was dedicated to hands-on exposure. Participants practiced "explant selection" (using healthy shoot tips, nodes, or leaves) and the multi-stage process of "preparation and sterilization of explants". A major highlight was the practical demonstration of synthetic seed production, where participants learned to encapsulate embryos³¹. Furthermore, they prepared "callus and cell suspension cultures". The session concluded by connecting these techniques to Dravyaguna, with a discussion on how cell suspension cultures in bioreactors can be stimulated (elicited) to "enhance" the production of specific "secondary metabolites" (the active medicinal compounds).

Module II (Day 2): Soilless Cultivation of Medicinal Plants

The second day shifted focus from in-vitro to ex-situ cultivation, specifically on advanced soilless methods. The sessions were led by two eminent scientists from **ICAR-Indian Institute of Horticultural Research (IIHR), Bangalore**.

Morning Session (Hydroponics): Dr. K. Hima Bindu (Principal Scientist, ICAR-IIHR) delivered a detailed lecture on **hydroponics and cocaponics**. She framed soilless systems as a critical tool for "sustainable agriculture," especially for high-value crops in regions with "limited arable land" or contaminated soils. The lecture outlined the essential components of hydroponic setups (e.g., Nutrient Film Technique, Deep Water Culture), emphasizing the critical management of "nutrient solutions, water quality, and environmental controls".

Ayurvedic Application: The session's highlight was the presentation of ICAR-IIHR research on cultivating key Ayurvedic herbs—such as *Prishniparni* (*Uraria picta*), *Brhat Panchamula* species, and *Laghupanchamula* species—using soilless methods. Many of these plants are difficult to cultivate or are subjects of wild-crafting and substitution. Dr. Bindu demonstrated how hydroponics can enhance "yield, quality, and purity" by providing precise nutrient inputs and eliminating soil-borne pathogens. This directly addresses the Ayurvedic need for authentic, standardized raw material.

Quality Control: The session strongly emphasized **Good Agricultural Practices (GAP)** and **Good Harvesting Practices (GHP)**. This links cultivation science directly to regulatory and industrial requirements, ensuring the "quality and safety" of the final medicinal product.

Afternoon Session (Cocaponics & Biophotonics): Dr. D. Kalaivanan (Senior Scientist, ICAR-IIHR) expanded the discussion with a practical demonstration of **cocaponics**. This technique uses processed "coconut coir as a growing medium", a sustainable and inert substrate with excellent water-holding capacity. He detailed the specific "nutrient requirements for medicinal plants" and the advantages of cocaponics in reducing "soil-borne diseases". Dr. Kalaivanan also provided a "special introduction to biophotonics", explaining how "light-based interactions in biological systems" (such as chlorophyll fluorescence imaging) can be used as a non-invasive tool to monitor plant health, stress levels, and even phytochemical concentration. The day concluded with hands-on demonstrations, allowing

participants to assemble and manage "hydroponic and cocaponic systems".

3.3 Module III (Day 3): Vrikshayurveda and Advanced Laboratory Techniques

The third day brilliantly juxtaposed advanced biotechnology with ancient agricultural wisdom, exploring the synergies between them.

Morning Session (Advanced PTC): Dr. Kunal Ashokrao Kale (Assistant Professor, Bajaj College of Science, Wardha) led a deep dive into the practicalities of establishing a PTC lab. He provided detailed protocols on preparing **Murashige and Skoog (MS) media**, the gold standard in plant tissue culture. He explained the "precise ratios required" and the specific roles of "macronutrients (N, P, K, Ca, Mg, S) and micronutrients (Fe, Mn, B, Zn, Cu)" in plant development. The "principle of autoclaving" was revisited, explaining it as a process of "protein denaturation" that renders all microbial contaminants non-viable. Participants received further hands-on training in micropropagation, "callus induction" (stimulating undifferentiated cell growth), and "regeneration techniques" (coaxing callus to form shoots and roots).

Afternoon Session (Vrikshayurveda): Dr. Saroj Kumar V. (Assistant Professor-Horticulture, Kerala Agricultural University) introduced the participants to the fascinating and highly relevant discipline of **Vrikshayurveda**. This classical science, with extant texts like Surapala's *Vrikshayurveda*, provides a holistic, ecosystem-centric approach to plant health.

Classical Concepts: Dr. Kumar explained "Ayurvedic soil classifications", which categorize soil based on its *Panchamahabhuta* (five great elements) composition and *Rasa* (taste), linking soil type directly to the *Guna* (quality) of the plants grown in it. He also discussed plant nutrition from this perspective, including the role of "primary and secondary nutrients".

Propagation Principles: The lecture provided a comparative analysis of "sexual (seed-based) and asexual (vegetative) propagation". While sexual propagation is vital for genetic diversity, asexual methods—"grafting, budding, and layering"⁵⁶—are essential for cloning. This is crucial in medicinal plants to maintain the phytochemical fidelity of a high-yielding "mother plant." The session included demonstrations of the specialized "tools and instruments" required for these vegetative techniques.

Module IV (Day 4): Integrated Agronomy and Organic Formulations

The fourth day, also led by **Dr. Saroj Kumar V.**, translated the principles of Vrikshayurveda into modern, actionable agricultural practices.

Plant Protection: The session began with an in-depth study of "common pests and diseases" that afflict high-value medicinal plants like *Ashwagandha* (*Withania somnifera*), *Brahmi* (*Bacopa monnieri*), *Vacha* (*Acorus calamus*), and *Asparagus* (*Asparagus racemosus*). Dr. Kumar recommended "preventive and control measures" based on an organic and integrated pest management (IPM) philosophy.

Organic Products: Participants were introduced to a suite of effective organic tools, including "foliar sprays" (such as neem oil-based azadirachtin), "BTK" (*Bacillus thuringiensis* var. *kurstaki*, a microbial toxin specific to caterpillar pests), and "sticky traps" for physical monitoring and control of flying insects.

Vrikshayurveda Formulations: A significant part of the lecture was dedicated to organic formulations inspired by Vrikshayurveda. These included "Jeevamrit" (a fermented bio-inoculant made from cow dung, cow urine, jaggery, and pulse flour), "fish amino acid," and "egg amino acid". These substances function not as direct fertilizers, but as potent "soil enrichers" and plant growth promoters, fostering a rich soil microbiome.

Package of Practices: The lecture then focused on the specific agronomy for two commercially vital herbs: **Amla** (*Phyllanthus emblica*) and **Ashwagandha** (*Withania somnifera*). Dr. Kumar provided a comprehensive "package of practices," discussing "geographical conditions, soil requirements, planting methods, irrigation practices, yield optimization, and storage methods" for each.

Field Practicum: In the afternoon, the cohort moved to the herbal garden for a crucial "live demonstration" session⁶⁴. Participants "actively practiced layering methods" and "grafting techniques," such as T-budding and patch grafting, on live rootstock. This interactive session was vital for "fostering skill development" and translating theory into a physical, practiced skill.

Module V (Day 5): Soil Health Enhancement and Vermitechnology

The final day of the program was dedicated to the "cornerstone of successful herbal cultivation"—soil health⁶⁷. This session was conducted by Smt. S. Premalatha, Head of the Department of Organic Farming at **NARDEP, Kanyakumari**, a pioneering institution in sustainable agriculture technology.

Soil Science: Smt. Premalatha delivered comprehensive lectures on "soil health concepts, soil testing methods, and enhancement techniques". She explained the importance of understanding key soil parameters (pH, electrical conductivity, organic carbon, and NPK status) to "optimize plant growth and ensure agricultural productivity". Participants learned about various methods for "improving soil fertility using natural amendments and organic formulations".

Vermitechnology: The highlight of the day was the detailed demonstration of **vermicomposting techniques**. This biotechnology utilizes epigeic (surface-dwelling) earthworms, such as *Eisenia fetida* or *Eudrilus eugeniae*, to efficiently convert organic waste into a highly valuable soil conditioner.

Process and Benefits: Smt. Premalatha explained the "step-by-step process of preparing vermicompost," including bed preparation, selection of "types of earthworms used," inoculation, feeding protocols, and harvesting.

Ecological Impact: She emphasized the profound "benefits of vermicompost", which extend far beyond simple NPK supplementation. Vermicast improves "soil structure" (aeration

and water retention), enhances "nutrient availability" (by converting locked nutrients into plant-available forms), and introduces a high concentration of beneficial microorganisms to the soil. This was presented as a cornerstone technology for "sustainable agriculture".

The session concluded with a highly "engaging and informative" interactive discussion, where participants' queries were resolved with field-tested success stories.

Valedictory Ceremony: Synthesis and Future Directives

The valedictory ceremony on 26th September 2025 served as the program's academic synthesis, featuring keynote addresses that framed the course's content within the larger landscape of Ayurvedic research and national health policy.

The chief guest was the illustrious **Vanaushadhi Vidyapati Dr. Mayaram Uniyal**, former Director of CCRAS (Central Council for Research in Ayurvedic Sciences). The event was also graced by Prof. (Dr.) Mahesh Vyas and Prof. (Dr.) Anand More, Former Dean (PG Studies), AIIA.

Program Synopsis: The ceremony commenced with the traditional lamp-lighting and Dhanvantari Vandana. Dr. Neelayathatchi presented a "comprehensive workshop report," summarizing the key technical sessions and practical activities. Dr. Meena Deogade (Additional Professor and Head, Department of Dravyaguna) delivered the welcome address, articulating the program's vision of "integrating traditional Ayurvedic knowledge with modern research perspectives."

Keynote Reflections:

Prof. (Dr.) Anand More highlighted the workshop's significance in the context of global health, specifically "its alignment with the Sustainable Development Goals" (SDGs). The course directly addresses **SDG 3** (Good Health and Well-being) by promoting quality-assured medicines, **SDG 12** (Responsible Consumption and Production) through sustainable cultivation, and **SDG 15** (Life on Land) by advocating for biodiversity conservation over wild harvesting.

Dr. Mayaram Uniyal delivered the ceremony's keynote address, which was a "highlight of the ceremony". Drawing on his vast experience, he discussed the "evolving trends of drug research in the AYUSH system". He stressed the critical need for a dual strategy: (1) **Basic Research** (e.g., pharmacognostical and phytochemical standardization, reverse pharmacology) and (2) **Applied Research** (e.g., developing standardized, stable, and clinically-validated formulations) to "enhance the global recognition of Ayurveda".

Prof. (Dr.) Mahesh Vyas, in his presidential address, reinforced Dr. Uniyal's points, underlining the "importance and value of this training program" as a vital tool for achieving these national research goals and the SDGs in Ayurveda.

Following the distribution of certificates, Dr. Shivani Ghildiyal (Associate Professor, Department of Dravyaguna) delivered the vote of thanks. The program concluded with the National Anthem and a group photograph, marking the end of an "enriching" workshop.

Conclusion

The AYUFARM 2025 was a resounding success, achieving its objective of "merging theoretical and practical aspects" of Ayurvedic herbal cultivation. The curriculum's unique strength lay in its "carefully curated" balance, juxtaposing high-science innovations like **plant tissue culture** and **hydroponics** with the time-tested, sustainable principles of **Vrikshayurveda**. This "holistic approach to agriculture", reinforced by hands-on demonstrations, ensured a comprehensive and enduring learning experience.

The diversity of the participants—from young scholars to senior faculty—and the expertise of the resource persons created a "collaborative learning atmosphere" that will undoubtedly foster future research collaborations.

The program's conclusion is, in effect, a commencement. The 27 participants now serve as skilled ambassadors, equipped to:

Integrate these advanced cultivation techniques into their "academic research, professional practice, and community-based initiatives".

Innovate by conducting further research, such as comparative phytochemical profiling of hydroponically-grown vs. Vrikshayurveda-grown herbs.

Disseminate this knowledge by establishing similar training programs and cultivation centers at their home institutions, amplifying the impact of AYUFARM 2025.

In conclusion, this certificate course represents a significant and scalable model for building the technical capacity of the AYUSH sector. It directly addresses the industry's most fundamental challenge—the quality and sustainability of its raw materials—by professionalizing and standardizing the very first step of the medicinal supply chain.

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