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The Vice Chancellor's New Year Message

PAU's journey from achievement to aspiration

aligning science, society and sustainability

Satbir Singh Gosal

Vice Chancellor, Punjab Agricultural University, Ludhiana

As 2026 unfolds, it offers both a moment of reflection and renewed responsibility for the PAU fraternity. The experiences of 2025 have reaffirmed a simple but enduring truth that agricultural science matters most when it reaches farmers' fields, strengthens rural livelihoods, and sustains natural resources. Anchored in this belief, PAU continues to align academic excellence, research innovations and extension outreach with the evolving needs of Punjab's agriculture and its farming community.

2025: A year of academic and global impact

2025 was a year of academic vibrancy, research innovation, and expanding extension reach. Punjab Agricultural University today stands as a global knowledge hub, offering 91 academic programmes to over 4,300 students. Our classrooms increasingly reflect an international ethos, welcoming scholars from across Asia and Africa who have chosen PAU as their academic destination. This growing stature was reflected in several prestigious institutional benchmarks achieved during the year.

Ranked India's No. 1 State Agricultural University in the NIRF rankings for the third consecutive year.

Secured the 2nd position nationally in the IIRF 2025 rankings.

Emerged as the only Indian SAU in EduRank's Top 100 Agricultural Institutions.

Achieved A+ accreditation from NAEAB with a score of 3.59/4.00, effective from April 2024.

Appointed 22 Honorary Visiting Professors, including World Food Prize laureates, to strengthen doctoral supervision and collaborative research.

Nine students received the Prime Minister Fellowship for Doctoral Research, while one secured the 129th rank in the UPSC examination.

Research highlights

Research holds real meaning only when it translates into tangible gains for farmers. In 2025, PAU released 20 new crop varieties and hybrids across cereals, pulses, oilseeds, vegetables, fruits and ornamentals. Key innovations included:

Notable varieties: Wheat varieties PBW 872, PBW Biscuit 1, and the nitrogen-efficient PR 132 rice.

Diversification: PMH 17 maize hybrid, SML 2575 summer mungbean, Punjab Potato 103 and 104, PL 942 malt barley, PHR 127 raya hybrid (39.3% oil), high-yielding vegetable genotypes like Punjab Santri carrot and Punjab Maghri cauliflower along with several high-value horticultural and floricultural introductions.

Technology patents: Beyond varietal development, PAU made significant strides in technology innovation and crop protection. Patents secured during the year included a portable maize dryer to reduce post-harvest losses, a magnetic field-assisted freezing process for horticultural produce, and a ready-to-use zinc phosphide bait for safer and more effective rodent management.

Precision farming: In the domain of precision agriculture, the GNSS-based auto-steering system for tractors demonstrated meaningful reductions in input overlap and operator fatigue, reinforcing PAU's commitment to resource-efficient, technology-driven farming.

Infrastructure growth: With a Rs 20-crore capital grant from the Punjab Government, we inaugurated a new Agro-Processing Complex and Jaggery Processing Plant to boost rural enterprise.

Strengthening the research–farmer continuum

Science achieves scale only when it is effectively disseminated. In this pursuit, the Directorate of Extension Education at Punjab Agricultural University serves as the vital bridge between laboratory innovation and farmers' fields, supported by an extensive grassroots outreach network. PAU's Krishi Vigyan Kendras (KVKs), Farm Advisory Service Centres (FASCs), Plant Clinic, and Skill Development Centre functioned as frontline knowledge hubs—diagnosing field challenges, delivering timely advisories, and strengthening farmer capacities in value addition, mechanization, and subsidiary enterprises

Mohinder Singh Randhawa Library, PAU - nurturing the next generation of innovators in agriculture

Throughout the year, PAU's extension machinery remained intensively engaged through Kisan Melas, village-level demonstrations, crop residue

SNIPPETS

"We view our academic achievements not as milestones to rest upon, but as the foundation for a more ambitious future. These reaffirm our commitment to inspiring students and young researchers to dream bigger and face emerging challenges with confidence, vigour, and innovation".

—Dr MIS Gill
Dean PGS, PAU

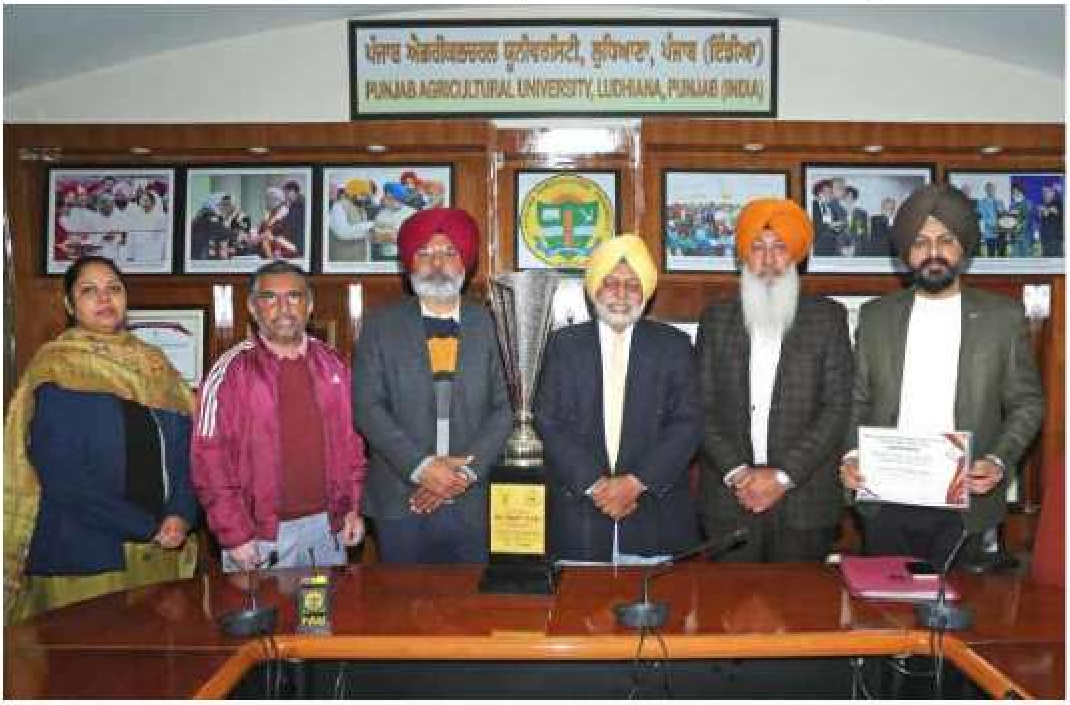
"Research finds its true purpose when it delivers measurable benefit to farmers, strengthens livelihoods, and secures the future of agriculture. Therefore, at PAU, science remains rooted in the soil, guided by society, and ready for the future"

—Dr. Ajmer Singh Dhatt
Director of Research, PAU

"Our greatest innovations are not those that stay in the laboratory, but those that take root in the farmer's field. Our commitment is to ensure that every scientific advancement at PAU is translated into a tangible advantage for the farming community by serving as a critical conduit between research and farmers"

—Dr Makhan Singh Bhullar
Director of Extension Education, PAU

management campaigns, seed support initiatives, and disaster-response advisories. Whether promoting zero stubble burning, advancing crop diversification, or supporting flood-affected farmers with 800 quintals of quality seed, the emphasis consistently remained on



science-led, timely, and compassionate engagement. This sustained, outcome-oriented approach received national recognition in 2025, when the Directorate of Extension Education, PAU, Ludhiana was conferred the prestigious ICAR Revolving Trophy (Chal Vaijayanti), adjudging it the Best Directorate of Extension Education in Zone-I during the Annual Zonal Workshop of KVKs. Instituted by the Indian Council of Agricultural Research, the honour stands as a testament to PAU's robust research–extension–farmer continuum and its unwavering commitment to translating scientific innovations into need-based technologies and advisory services.

Excellence in Extension - PAU's Directorate of Extension Education receives Best Directorate of Extension Education (Zone 1) Rolling Trophy (CHAL VAIJAYANTI)

Our vision for 2026

The challenges before us are complex and pressing—climate variability, water stress, soil degradation, market volatility, and the rising aspirations of a new generation. Addressing them demands sharper focus and deeper integration of science, policy, and practice. As we look ahead to 2026, Punjab Agricultural University will intensify its efforts in areas like accelerated breeding for climate-resilient & resource-efficient crops, AI-enabled genomics & water-smart technologies, and precision mechanization & value-added agri-enterprises. Strengthening research–extension–industry linkages, alongside nurturing the next generation of scientific talent, will remain central to our strategic agenda.

As we welcome the New Year, I extend my heartfelt gratitude to our farmers, students, scientists, extension personnel, and partners. Their trust and collaboration continue to inspire our collective mission. Together, we reaffirm PAU's enduring promise—to keep science rooted in the soil, responsive to society, and ready for the future.

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GNSS-based auto-steering in tractor operations

steering farming into the future

Aseem Verma and Manjeet Singh

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In Punjab's fields, rising input costs, narrowing profit margins, and a growing shortage of skilled agricultural labour are compelling farmers to rethink conventional operations. Long working hours during peak sowing and tillage seasons strain tractor operators, making sustained accuracy difficult. Even with experienced drivers, manual steering leads to overlaps that waste inputs, missed strips that reduce yields, and uneven row spacing that complicates subsequent operations. Over 10–12-hour workdays, operator fatigue further undermines efficiency and safety. GNSS-based auto-steering systems address these challenges through satellite-guided, centimetre-level precision—reducing wastage, improving efficiency, and easing operator workload to make mechanised farming more productive and sustainable.

Understanding auto-steering technology

At its core, an auto-steering system uses Global Navigation Satellite System (GNSS) signals to maintain precise steering control during field operations. Unlike driver-assistance features in passenger vehicles, agricultural auto-steering is designed for the unique demands of tillage, seeding, spraying and harvesting, where consistent parallel passes with minimal overlap or gaps are essential.

The system comprises four key components working in coordination:

Multi-constellation GNSS receiver: Captures positioning data from all major satellite constellations like GPS, Baidou, GLONASS and Galileo to determine the tractor's location with centimetre-level accuracy under varying field conditions.

Touchscreen console with ISOBUS software: Acts as the operator interface, displaying guidance lines, field maps and system status while ensuring compatibility across tractors and implements.

Wheel angle sensor: Monitors steering position and relays real-time feedback for accurate path correction.

Motorised steering unit: Executes precise steering adjustments by controlling the steering wheel based on guidance commands.

Installation, field configuration and operation

Installation involves replacing the tractor's original steering wheel with a motorised steering assembly using a manufacturer-specific adaptor. The system draws power from the tractor's standard 12-volt battery and requires no major electrical modifications.

Before field operation, the operator enters key parameters such as tractor wheelbase, implement width and working pattern. Field boundaries are recorded using the touchscreen console, enabling the system to calculate field area, optimise pass sequences and determine efficient turning patterns based on field geometry.

During operation, the GNSS receiver provides positioning updates guiding the tractor along predefined parallel paths. Any deviation from the guidance line is detected by the wheel angle sensor and corrected through the motorised steering unit, maintaining accuracy even on slopes, under crosswinds or during implement-induced lateral pull.

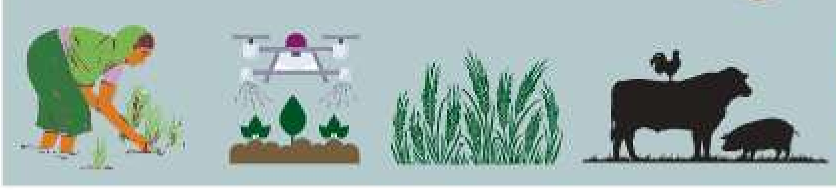
Advanced software features enhance flexibility and efficiency. Automatic headland management creates adjustable buffer zones, while multiple turn patterns accommodate different field shapes and crop requirements. Skip-row functionality supports specialised planting arrangements, including intercropping and controlled-traffic farming.

A manual override allows the operator to disengage auto-steering instantly when required and re-engage it seamlessly once normal conditions resume.

Field performance

Comparative field trials across multiple locations and crop systems demonstrate the clear advantages of auto-steering over conventional manual operation.

Overlap reduction: Manual steering typically results in 3–12% overlap during tillage and seeding, depending on implement width and operator skill. Auto-steering reduces overlap to about 1%, delivering substantial savings in seed, fertiliser and fuel.



Gap elimination: Missed areas, commonly covering 2–7% of field area under manual steering, are reduced to below 1%, ensuring more uniform crop establishment.

Pass-to-pass accuracy: Adjacent pass accuracy of ±3 cm enables consistent row spacing essential for mechanical weeding, precision spraying and efficient harvesting.

Operational efficiency: Reduced overlaps and gaps lower fuel consumption by 8–15% and increase effective field capacity by 10–20%, depending on field size and shape.

Reduced operator fatigue: By eliminating the need for constant visual alignment, auto-steering allows sustained accuracy over long working hours.

Improved subsequent operations: Uniform sowing lines enhance intercultural operations, fertiliser placement and combine harvester performance, extending precision benefits throughout the crop cycle.

Economic considerations

Although the initial investment in auto-steering systems ranges from ₹3–4 lakh depending on accuracy and features, returns are attractive for medium to large farms and custom hiring centres. Savings in inputs, higher field capacity and reduced operator strain generate cumulative benefits across seasons. For farmers with large land holding or service providers catering to multiple clients, auto-steering is increasingly a strategic asset. As skilled agricultural labour becomes scarcer and costlier, technologies that enhance operator productivity will play a decisive role in sustaining farm competitiveness.

Vice Chancellor PAU, Dr. Satbir Singh Gosal with team of scientists behind this innovation

Conclusion

GNSS-based auto-steering systems deliver measurable gains without altering existing farming practices. As Punjab's agriculture confronts rising resource constraints and climatic variability, precision technologies offer practical solutions. Auto-steering complements, and does not replace, operator judgment, allowing farmers to focus on crop and soil management while satellite guidance ensures precision. In an era where every input and every hour counts, such accuracy increasingly determines the margin between profit and loss.

Aerial view of a field cultivated with GNSS-based auto steering tractor

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Understanding frost trends and crop vulnerability

changing risks for rabi crops

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Winter frost has long threatened rabi crops in Northwest India, capable of undoing months of careful cultivation within hours. Yet winters are behaving differently now. While extremely cold nights are declining, climatic variability is increasing, making frost an unpredictable yet persistent risk. In this era of climatic uncertainty, farmers' strongest defence lies in proactive anticipation: monitoring forecasts, implementing crop-specific protection strategies, maintaining optimal crop health and having materials ready for rapid response. Understanding these shifting patterns is no longer just a precaution; it is a vital necessity for building climate resilience and securing our farming interests.

Understanding frost: types and triggers

Frost occurs when surface temperatures fall to or below freezing, causing ice crystal formation on soil, leaves and plant tissues, even when the air temperature a few feet above ground remains above zero. In Northwest India, frost is most common during December and January, occasionally extending into February.

Frost classification by severity

Light frost (−1.7°C to 0.1°C): Kills tender plants; minimal damage to hardy vegetation

Moderate frost (−3.9°C to −2.2°C): Widespread injury to fruit blossoms and semi-hardy crops

Severe frost (−4.4°C and below): Extensive damage to most plant species

Conditions favouring frost

The most common type, radiation frost, develops under specific conditions: clear skies, calm or light winds, low minimum temperatures, high relative humidity and low evaporation. Even when forecast air temperatures range between 0°C and 4°C, moisture and calm conditions can trigger damaging ground frost.

Frost trend in Ludhiana (1970s–2024)

Frost incidence in Ludhiana has declined sharply over the past five decades, dropping by nearly 85 per cent as winters have steadily warmed (Table 1). Once a regular seasonal occurrence, frost is now infrequent but increasingly erratic. These sudden, short-lived events pose a heightened risk to sensitive and high-value crops, often striking without adequate warning. Thus, despite its reduced frequency, frost remains a significant and unpredictable climatic threat.

Table 1. Decadal analysis of average annual frost days in Ludhiana

Period	Average annual frost days	Per cent reduction
1970-1979	68	Baseline
1980-1989	61	10.3
1990-1999	45	33.8
2000-2009	39	42.6
2010-2019	29	57.4
2020-2024	11	83.8

Crop vulnerability and damage patterns

Rabi crops of tropical origin suffer physiological stress below 10–12 °C, with damage severity determined by frost intensity, duration, and crop growth stage. Punjab, Haryana, Himachal Pradesh, and Uttarakhand remain particularly vulnerable during the rabi season. Frost injury appears as browning or scorching, commonly termed "crop burning" by farmers. Potato, pea, tomato, and capsicum are highly sensitive. The risk was evident during December 2002–January 2003, when severe cold waves in Punjab's Shiwalik belt caused heavy orchard losses—mango suffered 40–100% damage, litchi 50–80%, while guava, ber, and kinnow recorded poor fruit size and quality.

Crop-specific protection strategies

Frost damage varies across crops, requiring targeted protection. In sugarcane, frequent irrigation during December–January and frost-tolerant varieties help protect seed crops. General field crops remain less vulnerable under balanced nutrition, timely irrigation, and prevention of lodging. Barseem benefits from protective irrigation during intense cold, while in raya, the second irrigation should be advanced if frost coincides with flowering.

Fruit crops require special care: mango seedlings and young litchi plants should be protected using locally available coverings such as sarkanda or polythene; dhaincha planting improves insulation. Banana can be safeguarded through irrigation and smoke generation during frost nights. Papaya should be grown only in frost-free sites, with young plants covered from November to February. Vegetables—including watermelon, bitter gourd, cucumber, tomato, brinjal, chilli, pea, and sweet potato—are highly vulnerable; post-frost irrigation, pruning, soil test-based nitrogen application, and protective covers aid recovery. Wetting plants before frost is discouraged unless continuous sprinkler irrigation is ensured.

Prevention measures

General: Monitor forecasts closely, maintain soil moisture through light irrigation, generate smoke on frost nights, use polythene sheets, straw mulch, sarkanda for sensitive crops, and avoid excess nitrogen.

Post-frost: Apply light irrigation, provide supplemental nitrogen based on soil tests, prune damaged portions, and allow time for crop recovery before taking corrective decisions.

Conclusion

The 85% decline in frost days at Ludhiana over five decades signals winter warming across Northwest India. Yet this warming paradoxically increases risk through greater unpredictability. The sporadic, highly damaging nature of frost events—particularly to high-value horticulture, demands heightened preparedness rather than complacency. Frost may visit Punjab's fields less frequently than in decades past, but when winter bites, preparation makes all the difference between loss and resilience.


Frost protection of tomato plants


Frost damage in potato


Frost damage in mango


Paddy straw mulching in Kinnow

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Minor fruit cultivation in Punjab

diversifying Punjab's fruit bowl

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As Punjab's agriculture diversifies beyond cereals, minor fruits are emerging as strategic crops for nutritional security and farm income enhancement. While major fruits occupy 90% of Punjab's 1.03 lakh hectares of fruit cultivation, minor fruits—including loquat, bael, karonda, cape gooseberry offer untapped potential. These nutrient-dense, climate-resilient crops can thrive in marginal conditions where conventional fruits struggle. However, their productivity remains constrained by limited availability of quality planting material, lack of characterized cultivars, and incomplete agronomic packages. Through precision farming techniques and improved varieties, these underutilized crops can transform Punjab's agricultural landscape, offering farmers profitable diversification options suited to changing climatic realities.

Minor fruits such as loquat, bael, karonda, cape gooseberry possess high nutritive, medicinal and economic value. Despite this, their productivity in farmers' fields remains far below their potential due to several factors discussed above. To address these constraints, scientists have developed precision farming techniques, improved management practices and are actively evaluating promising varieties for commercial cultivation. With appropriate varietal selection (Table 1) and timely planting, minor fruits can significantly enhance farm profitability, especially under changing climatic conditions.

Loquat

Loquat cultivation is well-suited to districts such as Gurdaspur, Hoshiarpur, Rupnagar and Patiala. Its greatest advantage lies in its harvest season (March–April), a period when fresh fruits are scarce in the market, enabling farmers to fetch premium prices. Loquat trees are hardy, tolerant to heat and drought, and their thick, leathery leaves allow them to withstand periods of neglect. However, a warm and dry climate during fruit ripening is crucial. Fertile, light sandy loam soils with good drainage ensure optimal growth and yield.

Bael

Bael, a medicinal fruit plant belonging to the citrus family, is exceptionally suited to water-scarce and marginal environments. The deciduous tree sheds its leaves during summer and thrives under hot summers and mild winters. Its fruits are rich in riboflavin, vitamin A and carbohydrates, and various plant parts have been used in Ayurvedic medicine since ancient times. The ripe fruit pulp has laxative properties, supports heart and brain health, and is commonly used to prepare refreshing summer drinks. Notably, bael can grow successfully in saline and alkaline soils, where many other fruit crops fail, although well-drained sandy loam soils remain ideal.

Karonda

Karonda is an evergreen, thorny shrub known for its resilience and medicinal importance. Its fruits, though generally sour to astringent and less preferred for fresh consumption, are rich in pectin, making them ideal for processed products such as preserves. Nutritionally, karonda fruits are excellent sources of iron and vitamin C, making them valuable in preventing anaemia and scurvy. Medicinally, they are used for stomach ailments and as an anthelmintic. The plant is highly drought tolerant, adaptable to wastelands and suitable for rainfed conditions. While it grows across diverse soils, deep, fertile and well-drained soils support better fruiting; excessively wet soils promote vegetative growth at the cost of yield.

Cape Gooseberry (Rasbhari / Golden Berry)

Cape gooseberry, locally known as *Rasbhari*, is a short-duration annual herbaceous crop gaining attention due to its excellent dietary and sensory qualities. Packed with vitamins A, C and B, along with essential

Table 1. Recommended varieties, spacing and planting time of important minor fruit crops

S. No.	Fruit crop	Recommended cultivars	Spacing (m)	Planting time
1	Loquat	Golden Yellow, California Advance, Pale Yellow	6.5 × 6.5	February–March and August–September
2	Bael	Kagzi	6.0 × 6.0	February–March and August–September
3	Karonda	Konkan Bold, Pant Manohar	1.5 × 1.5	February–March and August–September
4	Cape gooseberry	Punjab Rasbhari 1, Punjab Rasbhari 2	0.75 × 0.60	First week of September

micronutrients like iron, calcium and phosphorus, it also exhibits anti-inflammatory, antioxidant and anti-hepatotoxic properties. Traditionally valued for its blood-purifying ability, this fruit is now being recognized as a high-value diversification crop, particularly in the context of climate change and evolving food habits. The crop performs well under Punjab conditions, tolerating light frost, though temperatures below 0°C during nights can be damaging. Well-drained soils are essential, while heavy clay soils should be avoided for successful cultivation.

Conclusion

Minor fruits may occupy a modest share of Punjab's orchards today, but their potential to reshape the state's agricultural future is substantial. With proven nutritional value, inherent climate resilience, and capacity to productively utilize marginal lands, these crops offer farmers a strategic pathway toward sustainable diversification. Looking ahead, success will require coordinated efforts: ensuring access to quality planting material, strengthening extension support for adoption, and developing value chains for processed products. By integrating these fruit crops into farming systems, Punjab's growers can cultivate a future marked by nutritional abundance, ecological sustainability, and economic resilience.


Loquat


Bael - Kagzi


Karonda - Konkan Bold


Cape gooseberry - Punjab Rasbhari 1

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Bioenzyme-based home-care products

redefining cleanliness the eco-friendly way

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The COVID-19 pandemic fundamentally altered household hygiene practices, pushing cleaning and disinfecting to unprecedented levels. Yet as sanitizing became routine, a quieter concern emerged: What are we cleaning with, and at what cost? Conventional cleaning products perform admirably against dirt and germs, but their ingredient labels tell a troubling story. Scientists at Punjab Agricultural University now offer a compelling alternative, a bioenzyme-based home-care products that deliver effective cleaning without the chemical baggage, while transforming citrus waste into valuable household essentials.

Most conventional cleaners contain chemicals like : surfactants, phthalates, glycol ethers, and quaternary ammonium compounds (QACs). While individually functional, their cumulative health effects may warrant serious attention. Prolonged exposure to alcohol-based disinfectants, bleach and hydrogen peroxide correlates with respiratory complications. These conventional cleaners also contain non-biodegradable components that persist in water systems and accumulate in ecosystems.

Bioenzymes: natural cleaning solution

Bioenzymes harness nature's decomposition power through controlled fermentation. When organic materials—typically citrus peels, jaggery and water—undergo anaerobic fermentation for several months, they produce enzymes, organic acids and beneficial metabolites with remarkable cleaning, degreasing and antimicrobial properties. PAU has developed a complete range of home-care formulations like bioenzyme-based hand wash, dish wash and liquid detergent. While the bioenzymes clean effectively, low viscosity and minimal foaming traditionally limited consumer acceptance. The new formulations developed by PAU solve both challenges while preserving bioenzymes' core effectiveness without toxicity.

Formulation and ingredients

PAU's bioenzyme products blend citrus bioenzyme with natural, food-grade additives:

Citrus bioenzyme provides primary cleaning and degreasing through enzymatic action that breaks down organic stains, oils and residues.

Soapnut (Reetha) contributes natural saponins—plant-based cleansing compounds used for centuries in traditional cleaning.

Coco-glucoside derived from coconut oil and fruit sugars, acts as a mild plant-based surfactant.

Xanthan gum provides viscosity, giving products the gel-like consistency that consumers expect.

Essential oils add natural fragrances while providing antimicrobial benefits.

These formulations gently remove dirt and stains, assist in drain declogging, and offer antibacterial and antifungal properties, without respiratory irritants, skin allergens or environmental persistence.

Directions to use:

Hand wash: Apply a pea-sized quantity on wet hands, rub gently and rinse thoroughly with water.

Liquid detergent: Add 20 ml to 10 litres of water. Soak clothes for 15 minutes, gently rub and rinse with clean water.

Dish wash: Dilute 5 ml in 100 ml of water and scrub utensils with a gentle scrubber.

Availability and technology access

PAU's bioenzyme-based cleaners are available from the Department of Microbiology, PAU, Ludhiana:

200 ml: ₹60 | 500 ml: ₹130 | 1 litre: ₹250

The technology is open for commercialization, offering excellent opportunities for green entrepreneurship and waste valorization. Interested individuals may contact the Department of Microbiology, PAU, Ludhiana.

Conclusion

Clean homes should not come at the expense of human health or environmental well-being. By harnessing the power of bioenzymes and agricultural waste, PAU's green home-care technology presents a thoughtful balance between hygiene, safety and sustainability. As households, institutions and policymakers seek safer alternatives, bioenzyme-based products offer a quiet but powerful shift from chemical dependence to nature-friendly cleanliness.

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Scientific poultry farming pays off

a six-fold rise in income

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In Punjab's evolving agricultural landscape, where fragmented landholdings and escalating input costs threaten farm viability, diversification has emerged as an economic imperative. Yet the transition from traditional cropping to alternative enterprises demands more than courage—it requires scientific knowledge, technical precision, and sustained institutional support. The remarkable journey of S. Karamjit Singh from village Ramana Chakk, Amritsar district, exemplifies how enhanced technical competence, acquired through structured training and evidence-based practices, can convert a struggling poultry unit into a thriving rural enterprise.

The initial challenges

In 2023, forty-year-old Karamjit Singh confronted a familiar challenge like many marginal and small farmers do. His three-acre ancestral holding generated insufficient income through conventional cropping. Observing the commercial potential of poultry farming in his region, he established Mand Poultry Farm—a 5,000-bird broiler operation under contract with a private firm, which provided chicks, feed and medicines.

The initial enthusiasm, however, quickly gave way to harsh realities. Without adequate technical knowledge in breed selection, feeding protocols, disease management and housing specifications, the farm faced recurring problems: high mortality rates, disease outbreaks and disappointing returns. Despite seeking assistance from various agencies, practical solutions remained frustratingly out of reach.

Skill upgradation

The turning point came in 2024 when Karamjit Singh enrolled in a seven-day vocational training programme on *Scientific Poultry Farming* at the PAU Krishi Vigyan Kendra, Amritsar. The structured curriculum addressed all critical pillars of commercial poultry production—scientific housing design and ventilation, balanced nutrition and feed formulation, breed-specific management practices, systematic vaccination and deworming schedules, and strict biosecurity protocols for disease prevention.

Beyond classroom learning, the programme emphasised experiential exposure through visits to high-performing commercial farms, hands-on demonstrations such as egg candling, and sustained post-training support via a dedicated social app. Regular on-farm visits by KVK scientists ensured personalised mentoring, enabling the seamless translation of technical knowledge into measurable farm-level improvements.

Implementation and expansion

Equipped with scientific understanding and ongoing institutional support, Karamjit Singh systematically restructured his operation. Within twelve months, the transformation was remarkable. Farm capacity expanded fourfold from 5,000 to 20,000 birds. Scientific feeding regimens dramatically improved the Feed Conversion Ratio from 1.72 to 1.48, enabling birds to reach market weight faster with less feed. Rigorous implementation of vaccination schedules, deworming protocols and biosecurity standards reduced mortality from 7.20% to 3.42%, cutting losses by more than half.

Demonstrating entrepreneurial innovation, he established an Azolla unit to produce this protein-rich aquatic fern as a natural feed supplement. This strategic addition not only reduced feed costs but also enhanced bird immunity and growth performance. Active family participation in daily operations further optimized labour expenses. The restructured farm now completes six production batches annually with only 15-day intervals between cycles, ensuring consistent cash flow throughout the year.

Quantifying Success

The economic impact is striking as the annual net income surged from ₹2.5 lakh to ₹15 lakh—a six-fold increase. Net return per batch jumped from 74,700 to 3.08 lakh, while the benefit-cost ratio improved from 2.22 to 2.51 (Table 1), indicating enhanced profitability and efficiency.

Table 1. Performance of poultry farm before and after scientific intervention

Parameter	Before Intervention (2023)	After KVK Intervention (2024)
Number of birds	5,000	20,000
Feed Conversion Ratio (FCR)	1.72	1.48
Mortality (%)	7.20	3.42
Number of batches/year*	5	6
Gross cost (Rs./batch)**	61,400	2,04,000
Gross income (Rs./batch)	1,36,100	5,12,050
Net return (Rs./batch)	74,700	3,08,050
Benefit–Cost Ratio	2.22	2.51
Annual net income	₹2.5 lakh	₹15 lakh

**Each batch duration: approximately 35 days*

***Includes labour, electricity, bedding and miscellaneous inputs; excludes cost of chicks, feed, medicines and transportation supplied under contract farming*

Recognition and ripple effects

The steady improvement in production efficiency and income at Mand Poultry Farm gradually made it a model unit for scientific, contract-based broiler farming in the area. The farm clearly demonstrated that following recommended practices in feeding, health care, and day-to-day management can lead to stable and dependable returns. Its visible success increased confidence among nearby farmers, especially small and marginal landholders, who began viewing poultry farming as a practical diversification option. By sharing his experiences and practical lessons, Karamjit Singh has helped spread awareness about the benefits of scientific poultry management and encouraged others to consider poultry as a viable livelihood enterprise.


Lifting curtains during day to promote ventilation

Conclusion

Karamjit Singh's transformation earned him recognition as one of Amritsar's top-performing poultry farmers. His enterprise has generated local employment and evolved into a practical learning hub, hosting exposure visits and interaction programmes for farmers and extension personnel. In March 2025, Punjab Agricultural University honoured him with an Award of Honour at the Kisan Mela held at KVK Amritsar. He is now regularly invited as a resource person in KVK training programmes, motivating aspiring poultry entrepreneurs. Looking ahead, he plans to expand to 50,000 broilers, establish a layer–cum–fish farming unit, and explore value addition in poultry.


Monitoring body temperature of chicks


Providing balanced feed to birds


Installing brooders during winter to keep chicks warm

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A new era of precision composting for mushroom growers

faster composting for higher yields

Shivani Sharma and Jaspreet Kaur

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High-quality compost is the foundation of every successful button mushroom (Agaricus bisporus) crop as it guides mycelial growth, shapes biological efficiency, and ultimately determines a farm's profitability. For decades, growers relied on the traditional long composting method, 28–30-days process demanding intensive labour, large working spaces, and constant supervision. Despite the effort, results often varied, and the long method carries several drawbacks, including greater exposure to contaminants, high dry-matter and nitrogen losses, increased dependence on pesticides, lower productivity, and significant environmental concerns due to emissions and open fermentation. The short method of composting has now emerged as a far superior alternative. By completing the entire process in just 14–18 days, it produces uniform, nutrient-rich compost that supports higher yields while sharply reducing disease incidence and resource wastage. This precision approach offers faster turnaround, more reliable performance, and climate-aligned scalability for mushroom growers.

The short method advantage

Unlike the 28–30-day long method, the short method completes the composting cycle in 14–18 days, while offering greater control over moisture, aeration, temperature, and ammonia dynamics. This method integrates controlled aeration, thermophilic microbial activity, and precision supplementation, ensuring that the substrate fully meets the biological needs of button mushroom. The short method holds immense potential to transform the mushroom industry by delivering nutrient-rich and contamination-free compost.

The method involves two well-defined phases:

Phase-I: Outdoor composting (10–12 days)

Phase-II: Pasteurisation and conditioning inside an insulated chamber (about 7 days)

The science behind the process

The strength of this method lies in its controlled handling of ammonia, temperature, and microbial succession. During pasteurisation and conditioning, free ammonia is converted into microbial proteins, preventing nitrogen loss, a major problem in the long method. The selective high-temperature treatment destroys insect pests, nematodes and competitor moulds, ensuring a cleaner cropping environment. Moreover, the enhanced thermophilic microbial biomass improves compost structure, selectivity and yield, raising compost recovery to about 2.5–3.0 tons per ton of dry straw, compared with only 1.8–2.0 tons under the long method.

Step-by-step process of the short method

Phase-I: Outdoor composting

Pre-wetting: Substrates are thoroughly wetted until they hold about 75% moisture.

Leachate management: Water draining from the stack is collected in a *guddy pit* for regular spraying over the stack.

Filling the bunker: The pre-wetted substrate is filled into a bunker—a specialized three-walled structure with perforated flooring connected to a blower for regulated aeration.

Turning and amendment: Turning is done every two days; gypsum is added during the third turning. By the 8th–10th day, the compost is ready for Phase-II.

Quality indicators of Phase-I compost

Uniform brown colour

75% moisture

1.5–2.0% nitrogen

Strong ammonia smell (800–1000 ppm)

Straw becomes soft, sticky and easily breakable

Phase-II: Pasteurisation and conditioning

Filling the pasteurisation tunnel: Phase-I compost is transferred to an insulated tunnel where Phase-II occurs in three steps.

Pre-pasteurisation conditioning (PPC): Compost temperature is raised to 45–52°C for 24–48 hours, ensuring uniform microbial activity.

Pasteurisation: Compost is held at 58–59°C for 4–6 hours, which destroys harmful insects, nematodes and competitor fungi while conserving nutrients essential for mushroom growth.

Post-pasteurisation conditioning: Over 3–4 days, thermophilic microbes regenerate and fix maximum ammonia at 45–50°C. Fresh air is gradually introduced to bring the temperature down to 25–30°C. The compost is then ready for spawning.

Physical characteristics of final compost after Phase-II

Compost should be ark brown to black in color.

Final compost is soft and has a granular, non-greasy or non-slimy texture

It should has a pleasant smell, with no detectable ammonia odor (ammonia levels below 10 ppm).

Ideal moisture content ranges between 64% and 68%.

When squeezed firmly, no liquid should ooze out.

The final compost has a high nitrogen (N) content, typically greater than 2.0% (on a dry weight basis).

The pH is slightly alkaline, in the range of 7.2 to 7.8.

Conclusion

The short method of composting is a major advancement that speeds up mushroom cultivation, reduces labour requirements and provides growers with cleaner, nutrient-rich compost containing 2–2.5% nitrogen and improved bulk recovery. Its precision-controlled environment minimises contamination and boosts yields, translating into higher profitability. The Punjab Agricultural University encourages commercial mushroom farmers to adopt this method for assured productivity and economic gains. For small and emerging growers, the Department of Microbiology at PAU also provides short-method, pre-spawned compost at Rs. 50 per 5-kg bag on prior booking. With precision composting, mushroom farming in Punjab is stepping confidently into a cleaner, faster and more productive future.

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When to act against mustard aphid

ETL-guided field decisions

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Mustard is an important winter season oilseed crop in Punjab, yet its success hinges on overcoming biotic stresses like insect-pests, alongside other challenges. Among these, the mustard aphid (chepa) stands out as the most destructive pest. Active from January to March, both nymphs and adults suck sap from leaves, branches, buds, flowers, and pods, causing leaves to turn pale and yellow, flowers to dry, pods to shrivel, and severe yield losses up to 96% if left unchecked. Because the damage progresses rapidly and often goes unnoticed in its early stages, timely vigilance and systematic field monitoring become critical for protecting the crop. Such informed and well-timed interventions not only prevent avoidable losses but also help sustain mustard productivity under Punjab's winter growing conditions.

The mustard aphid (*Lipaphis erysimi*) population generally builds up during the period from January to March, infesting tender plant parts such as leaves, branches, buds, flowers, and developing pods. Continued feeding in unmanaged fields may result in serious yield losses.

The threat posed by mustard aphid is further intensified by its unique reproductive biology. Females reproduce parthenogenetically, giving birth to female offspring without mating, and each generation matures within just 8–10 days. This rapid turnover enables explosive population build-up, with 34–45 generations in a year. During summer, aphids persist on wild or cultivated cruciferous plants in damp, shaded habitats, particularly in hilly regions. They migrate to mustard crops during October–November, multiply swiftly, yet generally maintain low population levels through December and early January.

Favourable weather conditions

Weather conditions play a decisive role in aphid population dynamics. Low temperatures (minimum 4–12°C; maximum 16–30°C) combined with moderately high relative humidity (50–78%) favour rapid multiplication of the pest. Prolonged spells of cold and cloudy weather during winter therefore serve as a clear warning of increased aphid infestation risk.

Integrated management strategy

Punjab Agricultural University advocates an Integrated Pest Management (IPM) approach for effective and economical control of mustard aphid, beginning from sowing. From January onwards, all management decisions should be guided strictly by ETL-based field assessments.

Aphids infesting mustard plant

Monitoring

Effective aphid management must be guided strictly by the Economic Threshold Level (ETL) rather than by casual field observations. Accurate assessment of aphid population is therefore essential before making any control decision.

For determining aphid infestation, observe 12–16 widely scattered plants per acre twice a week starting from the first week of January, using the following method:

Divide the field into four quadrats.

Randomly select 3–4 widely spaced plants per quadrat, covering a total of 12–16 plants per field.

From the top 10 cm of the central twig of each selected plant, count the number of aphids.

Calculate the average aphid population across all sampled plants.

If the average population reaches 50–60 aphids per plant or higher, pest management measures should be initiated.

Alternatively, when counting individual aphids becomes difficult, farmers may rely on simple visual indicators. Control measures should be initiated without delay if the top 0.5–1.0 cm of the central twig is completely covered with aphid colonies, or if 40–50 per cent of plants in the field are found infested (based on observation of about 100 plants per acre).

Preventive measures

Early sowing: Complete sowing preferably by the third week of October, as late-sown crops are more prone to aphid infestation.

Balanced fertilization: Apply fertilizers at recommended doses; excessive nitrogen application should be avoided as it encourages aphid multiplication.

Regular monitoring: Initiate weekly field inspections from the first week of January to detect early population build-up.

Chemical control

Chemical intervention should be adopted only when the aphid population exceeds the Economic Threshold Level. Once the threshold is crossed, spray the crop with either of the following:

Actara 25 WG (thiamethoxam) @ 40 g per acre, or Rogor 30 EC (dimethoate) @ 400 ml per acre, dissolved in 100 litres of water.

If necessary, a second spray may be applied after 15 days, avoiding repeated use of the same molecule.

Conclusion

Effective management of mustard aphid depends on informed and timely decision-making rather than hasty chemical intervention. Although the impulse to spray at the first sight of pests is natural, it is often counterproductive. Regular field monitoring, correct identification of pests and beneficial insects, and strict adherence to ETL-based interventions can significantly reduce yield losses while conserving natural enemies. By following ETL-guided and PAU-recommended practices, farmers can manage mustard aphid effectively and avoid unnecessary sprays.

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As Kheti Sandesh steps into 2026 with its eighth edition, our focus is firmly set on the road ahead. Punjab's agriculture is changing—quietly, unevenly, but undeniably. Farms continue to face familiar pressures from unpredictable weather, declining water tables, and costs rising faster than returns. Yet within these constraints, farmers are finding ways forward through better seeds, precise input use, and the power of shared knowledge. Encouragingly, farm decisions today are increasingly guided by weather awareness, environmental responsibility, and economic viability, reflecting a more informed and future-ready approach of farmers in Punjab.

In this shifting landscape, Kheti Sandesh remains true to its purpose—a trusted platform that connects research insights with real-world farming experience, keeps ideas practical, and helps farmers, scientists, and extension professionals learn together. The year ahead calls for sharper strategies, smarter practices, and deeper resilience, and we will walk this path with all of you.

Warm wishes for a healthy, blessed, and forward-looking New Year

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