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SATSA MUKHAPATRA

ANNUAL TECHNICAL ISSUE

VOLUME - 30

2026

"Regenerative Agriculture : Key to Future Farming"

STATE AGRICULTURAL TECHNOLOGISTS' SERVICE ASSOCIATION
WEST BENGAL

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মমতা ব্যানার্জী
ममता बनार्जी
ممتا بنرجی
Mamata Banerjee

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मुख्यमंत्री, पश्चिम बंगाल
وزیراعلیٰ مغربی بنگال
CHIEF MINISTER, WEST BENGAL

30th January, 2026

MESSAGE

I am happy to know that *the State Agricultural Technologists' Service Association (SATSA), West Bengal*, will be organising its **75th Annual General Meeting** and **Platinum Jubilee Celebration** at Dhono Dhanyo Auditorium, Alipore, Kolkata, on 7th February, 2026, and will also be publishing the scientific journal **"SATSA Mukhapatra – Annual Technical Issue, (Volume-30)"** on the occasion to commemorate this significant event.

I convey my heartiest greetings to all members of SATSA on this momentous milestone in the journey of their organisation and wish the celebration all success.

(Mamata Banerjee)

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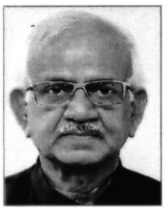
মন্ত্রী
কৃষি ও পরিষদীয় বিষয়ক বিভাগ
পশ্চিমবঙ্গ সরকার



Message

It's a pleasure to note that the annual scientific journal of State Agricultural Technologists' Service Association, West Bengal titled "*SATSA Mukhapatra – Annual Technical Issue, Volume-30*" is going to be published on the occasion of its 75th Annual General Meeting on 07.02.2026. "Regenerative Agriculture: Key to Future Farming" will be the theme of the publication. I expect the issue to provide the stakeholders an insight into the highly relevant subject in the present context. It is expected to promote sustainable farming keeping in mind the environmental concerns.

I express sincere thanks to the editorial team for bringing out this issue and convey my best wishes to the members of the association.

Dated, Nabanna, January 27, 2026

(Sobhandeb Chattopadhyay)

Sri Dulal Biswas
General Secretary,
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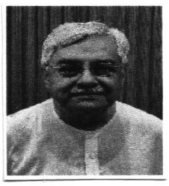
সমবায় দপ্তর
পশ্চিমবঙ্গ সরকার



Pradip K Majumdar
MINISTER-IN-CHARGE
Department of Panchayats &
Rural Development and
Department of Co-operation
Govt. of West Bengal

29/01/2026

Message

I am happy to extend my warmest felicitations to the State Agricultural Technologists' Service Association (SATSA), West Bengal, on the occasion of their 75th Annual General Meeting and Platinum Jubilee celebration.

As someone who has had the privilege of being associated with SATSA and its members for one & half decades, I have witnessed firsthand the unrelenting commitment and enthusiasm with which the organization has pursued its mission. SATSA's tireless efforts to implement Govt Schemes and empower farmers, promote inclusive growth, and improve the livelihood of the farming community have been truly commendable.

I also take this opportunity to appreciate SATSA's fulfilment of social accountability, especially during natural calamities; empowering the women and benefiting the children of the farming community demonstrating their dedication to holistic development of the society.

I convey my heartfelt appreciation and best wishes to each member of the SATSA family. I wish the organization continued success in its endeavors and sustained publication of the edition of *SATSA Mukhapatra*.

May the organization continue to thrive and make meaningful contributions to the lives of farmers and the farming community.

(Pradip K Majumdar)

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ICRISAT | INTERNATIONAL CROPS RESEARCH INSTITUTE FOR THE SEMI-ARID TROPICS
Transforming Dryland Agriculture

Message

I am happy to know that the State Agricultural Technologists' Service Association (SATSA), West Bengal has reached a historic milestone of 75 glorious years and is bringing out its annual publication, "SATSA Mukhapatra – Annual Technical Issue, Vol. 30 (2026)", on 7th February, 2026 at Kolkata. The journal has been consistently publishing important and contemporary issues related to agriculture and allied sectors. The present technical issue, focusing on "Regenerative Agriculture: Key to Future Farming," is both timely and highly relevant.

In the present societal context, the compounded impacts of climatic aberrations have highlighted the urgent need to build new perspectives on regenerative agriculture for restoring and conserving agricultural and food systems. Regenerative agriculture represents a paradigm shift, offering the promise of more sustainable, resilient, and climate-friendly farming systems. By focusing on practices that restore and enhance soil health, biodiversity, and ecosystem resilience, regenerative agriculture seeks to reverse soil degradation caused by conventional farming and promote long-term sustainability.

I sincerely appreciate the efforts of the SATSA family in celebrating this Platinum Jubilee and extend my best wishes for the successful publication of this landmark issue.

Himanshu Pathak
Director General

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IRRI 65 YEARS

MESSAGE

It gives me immense pleasure to extend my warm greetings and heartfelt congratulations to the State Agricultural Technologists' Service Association (SATSA), West Bengal, on the occasion of its Platinum Jubilee - marking 75 years of dedicated service to the agricultural sector. This significant milestone reflects SATSA's enduring commitment to strengthening agriculture through science, innovation, and dedicated service to farming communities.

Over the decades, SATSA has played a pivotal role in nurturing a strong cadre of agricultural technologists who have made notable contributions to enhancing the productivity, sustainability, and resilience of agriculture in West Bengal. The Association's consistent efforts in knowledge dissemination, capacity building, and professional development have substantially supported the effective implementation of state and national agricultural priorities at the grassroots level.

I particularly appreciate the sustained contribution of SATSA Mukhapatra – Annual Technical Issue, which, since 1996, has evolved into a credible and well-recognized scientific platform. Over the years, the journal has established itself as a respected forum for sharing scientific knowledge and field-based insights. By effectively bridging research, extension, and field-level experiences, it has facilitated the translation of scientific knowledge into practical solutions for farmers and other stakeholders.

The theme of the Platinum Jubilee special issue, "Regenerative Agriculture: Key to Future Farming" is both timely and forward-looking. As agriculture confronts complex challenges arising from climate change, natural resource degradation, and evolving socio-economic demands, regenerative approaches offer a promising pathway to restoring soil health, enhancing biodiversity, improving water-use efficiency, and ensuring the long-term sustainability of food systems. Integrating regenerative principles with modern science, digital innovations, and inclusive extension systems will be crucial for advancing resilient and climate-smart agriculture.

Associations such as SATSA play a vital role in mainstreaming these approaches by fostering knowledge exchange among professionals, policymakers, and farmers. Strengthened collaboration among state departments, research institutions, and international partners will further accelerate the adoption of sustainable and regenerative farming practices.

I also recall with appreciation my earlier professional engagements with SATSA and its members, during which I witnessed first-hand the Association's vibrancy, professionalism, and strong sense of purpose. The enthusiasm and active involvement of the SATSA team in technical deliberations, field-oriented initiatives, and policy-relevant discussions have always been commendable and reflect the Association's deep commitment to advancing agriculture in the state.

On this momentous occasion, I commend the leadership and members of SATSA for their unwavering dedication and collective vision. I am confident that the Association will continue to serve as a catalyst for positive change in agriculture, contributing meaningfully to farmers' welfare, environmental stewardship, and national food security.

I extend my best wishes to SATSA for continued success in the years ahead and congratulate the editorial team for bringing out this landmark Platinum Jubilee edition of SATSA Mukhapatra.

Dr. Sudhanshu Singh
Director IRRI South Asia Regional Centre (ISARC) Varanasi – 221 006, Uttar Pradesh, India

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Dr. Ashok K. Patra, ***Ph.D (IARI)***
FNASc, FNAAS, FAScT, FISSS, FRMSI
Vice Chancellor

No. VC/BCKV/114/
Dated: 07.01.2026

MESSAGE

I am pleased to learn that the State Agricultural Technologists' Service Association (SATSA), West Bengal is bringing out the Platinum Jubilee Edition of its scientific journal *"SATSA MUKHAPATRA – Annual Technical Issue"* on the theme "Regenerative Agriculture: Key to Future Farming." This landmark publication, coinciding with the 75 years of dedicated service of SATSA, reflects a commendable legacy of knowledge dissemination and professional commitment to the farming community of West Bengal.

Over the decades, *SATSA MUKHAPATRA* has served as a valuable platform for showcasing scientific research, technological innovations, and field-level experiences that bridge the gap between research and practice. The focus on regenerative agriculture is timely and relevant, as sustainable intensification, soil health restoration, climate resilience, and resource-use efficiency are central to ensuring food and livelihood security in the years ahead.

I congratulate SATSA for its sustained efforts in strengthening agricultural extension and research linkages, and for nurturing a culture of scientific inquiry among agricultural technologists and researchers. I am confident that this Platinum Jubilee Edition will enrich the scientific fraternity and inspire stakeholders to adopt practices that promote sustainable and inclusive agricultural development.

I extend my best wishes to SATSA, the Editorial Board, contributors, and all members associated with this prestigious publication for its grand success.

(Ashok K Patra)

উত্তরবঙ্গ কৃষি বিশ্ববিদ্যালয়
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Date: 15.01.2026

MESSAGE

It is a matter of great pleasure to note that the ***State Agricultural Technologists' Service Association (SATSA), West Bengal*** *is celebrating its* ***Platinum Jubilee****, commemorating seventy-five years of dedicated service to agricultural advancement and the farming community of the State. This milestone reflects the enduring contribution of professional agricultural graduates who have steadfastly upheld the ideals of science, service, and social responsibility.*

Agricultural technologists occupy a unique and vital space in the development continuum—translating scientific knowledge into field-level impact, shaping policy through evidence, and guiding farmers through changing agrarian realities. Through its sustained efforts, SATSA has nurtured professional excellence, strengthened extension outreach, and fostered a culture of continuous learning, thereby significantly enriching the agricultural ecosystem of West Bengal.

The ***Scientific Journal "SATSA MUKHAPATRA – Annual Technical Issue"*** *stands as a commendable intellectual endeavour of the Association. Its academic recognition and national and international indexing testify to its quality and relevance. The forthcoming* ***Volume 30****, themed* ***"Regenerative Agriculture: Key to Future Farming,"*** *is both timely and visionary, resonating with the global imperative to harmonize productivity with ecological stewardship and climate resilience.*

Regenerative agriculture represents a renewed covenant with nature—restoring soil vitality, conserving resources, and ensuring sustainability for future generations. In this transformative journey, professionally trained agricultural graduates and their associations have a defining role in guiding farmers, informing policy, and advancing innovation with compassion and wisdom.

On this auspicious occasion, I extend my warm congratulations to SATSA and its members. I am confident that the Association will continue to inspire excellence, uphold scientific integrity, and serve as a beacon of progressive agricultural thought and action in the years to come.

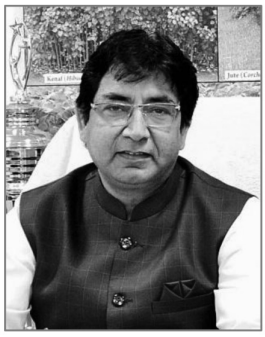
With best wishes.

(Prof. Debabrata Basu)
Vice-Chancellor

DR. GOURANGA KAR
Director, ICAR-CRIJAF

28th January 2026

MESSAGE



Greetings!

It gives me immense pleasure to extend my warm greetings and sincere congratulations to the State Agricultural Technologists' Service Association (SATSA), West Bengal, on the occasion of the Platinum Jubilee of its prestigious scientific journal, *SATSA MUKHAPATRA – Annual Technical Issue*. This landmark celebration reflects decades of dedicated service by SATSA in promoting agricultural science, technology dissemination, and professional excellence for the benefit of the farming community.

Over the years, *SATSA MUKHAPATRA* has emerged as a credible platform for sharing research findings, field innovations, and policy-relevant insights, effectively bridging the gap between research, extension, and practice. The journal has significantly contributed to strengthening sustainable agricultural development in West Bengal and beyond by encouraging knowledge exchange among scientists, technologists, and extension professionals.

The theme of the Platinum Jubilee Edition (Vol. 30), *"Regenerative Agriculture: Key to Future Farming,"* is timely and forward-looking. In this context, jute and allied fibre crops assume a strategic role in regenerative agricultural systems**.** These crops are inherently resource-efficient, climate-resilient, and ecosystem-friendly, contributing to soil organic carbon build-up, improved soil structure, enhanced microbial activity, and reduced dependency on synthetic inputs. Their integration in diversified cropping systems, coupled with residue recycling and eco-friendly retting technologies, supports circular bioeconomy principles while providing sustainable livelihoods to millions of small and marginal farmers.

I am confident that the scholarly contributions presented in this special issue will provide valuable insights into regenerative pathways for Indian agriculture and inspire the adoption of resilient, low-carbon, and farmer-centric production systems. I commend SATSA and the editorial team for their unwavering commitment to quality and relevance, and I wish *SATSA MUKHAPATRA* continued success in its mission of advancing agricultural science and sustainable farming.

With best wishes for the continued growth and excellence of this esteemed journal.

(Dr. Gouranga Kar)
Director

भाकृअनुप-राष्ट्रीय प्राकृतिक रेशा अभियांत्रिकी एवं प्रौद्योगिकी संस्थान
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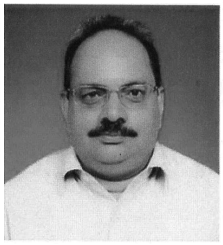

Message

I am pleased to extend my warm greetings and heartfelt congratulations to the State Agricultural Technologists' Service Association (SATSA), West Bengal, on the occasion of its Platinum Jubilee (75th Anniversary) and the publication of the Platinum Jubilee Edition of the Scientific Journal "SATSA MUKHAPATRA – Annual Technical Issue" (ISSN: 0971-975X), Volume 30.

For nearly three decades, SATSA Mukhapatra has served as a credible platform for the dissemination of scientific knowledge, technological innovations, and practical insights in agriculture. Its consistent recognition by the National Academy of Agricultural Sciences (NAAS) and indexing in reputed national and international abstracting services stand testimony to the journal's academic rigor, relevance, and commitment to excellence. The sustained efforts of SATSA in bridging research, extension, and field-level application have significantly contributed to strengthening the agricultural ecosystem of West Bengal.

The theme of this landmark edition, "Regenerative Agriculture: Key to Future Farming," is both timely and forward-looking. In the face of climate change, soil degradation, biodiversity loss, and resource constraints, regenerative agriculture offers a holistic pathway toward resilient, sustainable, and climate-smart farming systems. By integrating soil health restoration, ecological balance, efficient resource use, and farmer-centric innovations, regenerative approaches hold the potential to redefine future agricultural practices while ensuring food security and environmental sustainability.

The role of agricultural technologists, researchers, extension professionals, and administrators—such as the members of SATSA—is pivotal in translating scientific advancements into field-level impact. Through knowledge dissemination, capacity building, and policy support, such professional bodies play a crucial role in empowering farmers and promoting sustainable rural livelihoods. I am confident that the peer-reviewed articles, technical reviews, and case studies featured in this special volume will provide valuable insights and serve as a useful reference for researchers, practitioners, and policymakers alike.

ICAR–NINFET appreciates and acknowledges the contributions of professional scientific associations like SATSA in fostering innovation-driven agriculture and promoting evidence-based decision-making. I trust that SATSA Mukhapatra will continue to evolve as a respected knowledge resource, contributing meaningfully to the advancement of Indian agriculture in the years to come.

I extend my best wishes to SATSA, its leadership, editorial team, and contributors for the grand success of the Platinum Jubilee celebrations and this commemorative edition of the journal.

निदेशक Director

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From the Desk of General Secretary

"We must cultivate our land in harmony with nature, not in conflict with it."
– Rabindranath Tagore

Global agriculture is under mounting pressure from climate variability, soil degradation, biodiversity loss and rising demands for food and nutritional security. These challenges call for production systems that sustain yields while restoring ecological balance. In this context, the present issue of ***SATSA Mukhapatra – Annual Technical Issue*** is devoted to Regenerative Agriculture, an approach that integrates environmental restoration with economic and social sustainability.

Regenerative agriculture challenges Conventional yield-driven agricultural models by viewing farms as living ecosystems, emphasizing soil regeneration, biodiversity enhancement and resilient production systems. Central to regenerative agriculture is the revitalization of soil health through improved biological activity, nutrient cycling and increased soil organic matter. Practices such as residue recycling, composting, green manuring, cover cropping and integrated nutrient management reduce dependence on synthetic inputs, lower energy use and enhance climate resilience. Through carbon sequestration in soils and biomass, regenerative systems also contribute to climate change mitigation and adaptation.

Adoption of regenerative practices, however, is context-specific and influenced by agro-climatic, socio-economic and institutional factors. This issue therefore presents both empirical evidence and critical perspectives, highlighting the need for locally adapted approaches, robust indicators, long-term field research and transparent evaluation.

The relevance of this issue is further strengthened by the United Nations' declaration of 2026 as the International Year of Women Farmers, acknowledging the indispensable role of women in agriculture, food systems and rural livelihoods. Regenerative agriculture, rooted in local knowledge, resource stewardship and inclusive development, aligns strongly with the leadership and empowerment of women farmers in building resilient agricultural futures.

This volume brings together contributions from researchers, extension professionals and practitioners examining regenerative agriculture from agronomic, environmental, economic and policy perspectives, with particular relevance to smallholder and resource-constrained systems.

Since 1996, the **State Agricultural Technologists' Service Association (SATSA)** has been publishing its official scientific journal, the ***SATSA Mukhapatra – Annual Technical Issue (ISSN: 0971-975X)***, a NAAS-rated journal indexed in CABI and national scientific repositories. The journal remains committed to strengthening the linkage between research and field application.

This issue (Vol.30; 2026) assumes special significance as SATSA, West Bengal, celebrates its 75th Anniversary, marking a distinguished legacy of service, professionalism and commitment to agricultural advancement. Dedicating this issue to ***Regenerative Agriculture: Key to Future Farming*** reaffirms **SATSA's vision of promoting sustainable, inclusive, and science-driven agricultural progress**.

(Dulal Biswas)
General Secretary,
SATSA, West Bengal

SATSA MUKHAPATRA-ANNUAL TECHNICAL ISSUE 30 : 2025

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