(様式5)

二国間交流事業 セミナー報告書

令和6年4月30日

独立行政法人日本学術振興会理事長 殿

[日本側代表者所属機関・部局]
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1. 事業名相手国: <u>インド</u> (振興会対応機関: ICSSR)とのセミナー

2. セミナー名

(和文) 日本とインドとの気候変動対応型のレジリエントな農業技術の発展と共有

(英文) Climate Smart Farming Resilient Technologies and Practices in Japan and Opportunities

for Indian Farmers and Agri–Tech Start–up Entrepreneurs

3. 開催期間 2024 年 3 月 6 日 ~ 2024 年 3 月 8 日 (3 日間)

【延長前】 <u>年月日~ 年月日</u>(__日間)

4. 開 催 地(都市名)

カラグプール・Kharagpur; ハイデラバード・Hyderabad

5. 相手国側代表者(所属機関名・職名・氏名【全て英文】)

Agriculture and Food Engineering Department, Indian Institute of Technology

Kharagpur, Professor, Swain Dillip Kumar

- 6. 委託費総額(返還額を除く) 1,172,430 円
- 7. セミナー参加者数(代表者を含む)

	参加者数	うち、本委託費で渡航費または 日本滞在費を負担した場合*
日本側参加者等	8名	7名
相手国側参加者等	48名	0名

参加者リスト(様式 B2)の合計人数を記入してください。該当がない箇所は「0」または「-」を記入してください。 *日本開催の場合は相手国側参加者等の日本での滞在費等を負担した場合、相手国開催の場合は日本側参加 者等の渡航費を委託費で負担した場合に記入してください。

8. セミナーの概要・成果等

(1) セミナー概要(セミナーの目的・実施状況。第三国からの参加者(基調・招待講演者等)が含まれる場合 はその役割とセミナーへの効果を記載してください。関連行事(レセプション、見学(エクスカーション)その 他会合(別経費の場合はその旨を明記。)などがあれば、それも記載してください。委託費総額の50%に相 当する額を超える費目間流用については、その変更理由と費目の内訳を変更しても計画の遂行に支障が ないと考えた理由を記載してください。)

Short Summary Report:

The JSPS-ICSSR Bilateral seminar on "Climate Smart Farming Resilient Technologies and Practices in Japan and Opportunities for Indian Farmers and Agri-Tech Start-up Entrepreneurs" was a remarkable event jointly organized by the Global Research Centre for Advanced Sustainability Science (GRASS), University of Toyama, in partnership with the Indian Institute of Technology Kharagpur (IITK) and the International Crops Research Institute for Semi-Arid Tropics (ICRISAT). The workshop showcased an extensive range of innovative strategies and technologies aimed at promoting agricultural sustainability, and it provided a platform for crossborder exchange of knowledge. The experts highlighted the potential for collaboration among academia, industry, and research organizations to encourage climate-smart agriculture and sustainable practices. Through the discussions, it became clear that joint efforts are crucial in advancing agricultural resilience and tackling contemporary challenges. The workshop explored various aspects of organic farming, waste management technologies, and innovative startups, emphasizing the importance of documentation, farmer training, and strengthened industry-academia linkages to unleash the full potential of these initiatives and foster sustainable development in agriculture. These strategies and technologies are promising, and if implemented timely, they could revolutionize the agricultural industry and promote sustainable development in India and Japan.

Full Summary Report:

The JSPS-ICSSR Bilateral seminar on "Climate Smart Farming Resilient Technologies and Practices in Japan and Opportunities for Indian Farmers and Agri-Tech Start-up Entrepreneurs" was jointly organized by the Global Research Centre for Advanced Sustainability Science (GRASS), University of Toyama in collaboration with the Indian Institute of Technology Kharagpur (IITK) and the International Crops Research Institute for Semi-Arid Tropics (ICRISAT). The workshop aimed to facilitate collaboration and knowledge sharing between experts from both countries and brought together renowned scholars in the field of farm engineering, soil science, agribusiness, agrometeorology, waste management, organic farming and crop quality, crop modeling and simulations, agricultural economics, climate change and environmental science. The workshop covered several cutting-edge technologies and approaches for improving crop productivity and mitigating the impacts of climate change. The discussions revolved around three key themes such as climate-smart farming technology, conservation of agriculture, organic farming, and crop models for innovative climate change adaptation strategies.





Photo: Courtesy meeting with IITK Director, Kharagpur.

Photo: Tomato Experimental Fields, IIT Kharagpur, India

As part of theme-1, Dr. Somsubhra Chakraborty presented on sensor-based SOC mapping for better understanding of the global Carbon Cycle, highlighting IIT Kharagpur's Digital Soil Mapping course as an advanced alternative to conventional soil survey methods. He emphasized the use of the SCORPAN model for high-resolution carbon mapping and spectral data analysis from optical remote sensing. Dr. Kripan Ghosh discussed Seasonal Forecasting under the Agromet Advisory System, focusing on addressing challenges such as unpredictable rainfall trends and decreasing yields. Dr. Amarender Reddy proposed interventions based on a seven-pillar risk index for arid and semi-arid drylands, focusing on land development and market support to increase crop productivity and water use efficiency. Dr. T. Pratima highlighted Climate-Smart Agriculture's role in mitigating climate change impacts on agriculture, focusing on micro-level crop planning and training extension functionaries and farmers. Finally, Ms. Matsui Natsumi presented Toyama Kankyo Seibi Co. Ltd's Plastic Recycling Business Organization, highlighting waste treatment and the circular agriculture model utilizing waste heat energy for crop production, with technology like ICT and drones optimizing agricultural processes.



Photo: Group picture after inauguration session on Day-1

Photo: Inauguration closing remarks by Prof. Somsubhra Chakraborty

Under theme-2, Prof. Naoya Wada presented organic farming techniques utilizing fungal bed ways, wood chips, and combustion ash in PWC organic farming, with applications in paddy, rice, soybean, and vegetable sequence cropping. The study found high bacterial distribution and arthropod count in organic farming, along with elevated soil carbon and nitrogen levels, enhancing soil biodiversity and resistance to heavy rainfall.





Photo: Presentation by Dr. T Pratima from ANGRAU, India

Photo: Presentation by Ms. Matsui Natsumi from Toyama Kankyo Seibi, Japan

Mr. Yuto Miemura emphasized maintaining biodiversity for sustainable agriculture, focusing on high NDVI values and weed management in organic farming landscapes. Dr. Prithwiraj Dey discussed conservation practices' long-term benefits in reducing carbon and energy footprints. Dr. K. Ashok Kumar highlighted organic farming's importance in energy consumption and climate resilience, addressing principles, techniques, research findings, and challenges. Dr. Susanta Jena outlined REWARD activities, focusing on land resource inventory, hydrology assessment, and soil conservation planning for improved sustainable productivity in watersheds.





Photo: Presentation by Mr. Minemura from University of Toyama, Japan Photo: Presentation by K. Ashok Kumar from ANGRAU, India Under theme-3, Dr. Mukund Patil discussed five uses: Agri Advisory, Climate and Crop Modeling, AI/MLbased recommendation systems, AI/ML-based crop protection, and System Integration, highlighting their flexibility and benefits such as precise fertilizer application and hotspot identification. He also mentioned the PLANTIX App and emphasized IHUB's role in promoting Agri Entrepreneurship for increased rural income. Prof. Dillip Kumar Swain stressed the nutritional benefits of organic food and the health risks of excessive fertilizer, proposing technological solutions for climate-smart agriculture. Prof. Geetha Mohan illustrated climate change impacts on GDP and agricultural production through graphical representations, focusing on predictions for rice farming in Sri Lanka and Vietnam, salt intrusion adaptations in Vietnam, and fertilizer application patterns in Southeast Asia. After the end of the workshop, participants visited the Bio fly Proteins company to understand the conversion of domestic waste and black soldier flies into organic manure for agriculture.





Photo:Presentation by Dr. Mukund D Patil, ICRISAT, India.

Photo: Presentation by Prof. Dillip Kumar Swain, IITK, India

The workshop's second day focused on Innovative Allied Rural Technology for the Improvement of Farmers' Income, with an emphasis on startups and companies. Notably, Mr. K Binoy from ITC presented ITC's Climate Smart Agriculture promotion, which includes climate-smart agriculture, natural resource management, livelihood diversification, and institutional support. He highlighted the need for startups in areas like solar, agri machinery, biomass aggregators, decentralized micro-irrigation systems, biodiversity, tree plantation, and smaller livelihoods such as goat farming. During the workshop, four startups showcased their sustainable and eco-friendly agricultural practices. Yogita Biofarming promotes natural and organic farming methods through soil testing, while Dr. Amaresh Mahto Artificial Official Mushroom Pvt Ltd focuses on mushroom cultivation and empowering women in village areas. Mr. Gopal Bera addresses agricultural challenges through waste management and promotes mushroom cultivation for dietary health and sustainability, while Mr. Giayas Giasuddin Modal advocates water-saving practices and sustainability through vermicompost production and agricultural services. Toyama Kankyo Seibi Co. Ltd from Japan demonstrated waste management technology, producing electricity for farming and operating advanced greenhouse cultivation techniques, supporting a circular economy approach. The workshop also featured three farmers who shared their challenges, which were addressed by the experts.





Photo: Presentation by Mr. K. Binoy, ITC Ltd, India.

Photo: Presentation by Mr. Pandit, Agricultural Farmer, India.

Students and young researchers had the opportunity to showcase their research through a poster session on Climate smart farming and sustainable food systems, with the top three presentations awarded certificates. The panel discussions focused on strengthening industry-academia linkages between India and Japan and determining the way forward for the project. The panel emphasized the need to raise farmer awareness about sustainable practices like Organic Farming through cost-effective innovations and data collection to identify key problems. The integration of academia, Farmer Producer Organizations (FPOs), and private stakeholders plays a significant role in promoting sustainable farming practices. Japan has shown a keen interest in sustainable agriculture, while India needs to strengthen its efforts in scaling up climate-smart technologies. Collaborating with CIAE Bhopal can provide an opportunity to improve management models and create sustainable farming practices.



Photo: Poster Session on Day-2, IITK, Kharagpur, India.







Photo: Question and Answer Session Day-2, IITK, Kharagpur, India. Photo: Panel Discussion Session on Day-2.

On the third day of the ICRISAT workshop, Dr. Mukund D Patel hosted a series of events that involved visits to various departments, including the SAT Venture, GHG Monitoring Experiment and Composting Facility, Centre of Excellence on Climate Change Research for Plant Production, Gene Bank, and ihub. During the workshop, the Japanese team had an interactive session with ICRISAT scientists to discuss their ongoing research projects and explore the possibilities of future collaborations. The discussion revolved around the technical aspects of their work and the latest developments in the field of plant production under climate change conditions. The topics discussed included the implementation of advanced techniques in crop breeding, optimizing crop management practices to ensure maximum yield, developing climate-resilient crop varieties, and exploring innovative methods to reduce greenhouse gas emissions caused by crop production.







Photo: Visited Gene Bank, ICRISAT, India.





Photo: ICRISAT Team introducing crop experiment, India.

Photo: ICRISAT Team introducing their research activities, India

(2) 学術的価値(セミナーにより得られた新たな知見や概念の展開等、学術的成果)

The seminar was a significant platform for sharing cutting-edge research and innovative ideas regarding various agricultural themes. It showcased novel methodologies and approaches that aimed at addressing the challenges facing agriculture, such as unpredictable weather patterns and declining crop yields. The seminar discussed several topics, including sensor-based soil mapping, seasonal forecasting, climate-smart agriculture interventions, organic farming, waste management, and sustainable agricultural practices. Discussions on innovative farming techniques like vermicompost production and greenhouse cultivation underscored the potential for holistic and eco-friendly farming approaches. Participants gained a deeper understanding of the complex interplay between environmental factors and agricultural productivity, emphasizing the importance of initiatives like soil carbon mapping and precision agriculture. The interdisciplinary nature of the seminar fostered collaborative dialogue among researchers, scientists, farmers, and industry experts, paving the way for synergistic partnerships and cross-disciplinary collaborations. Through panel discussions and poster sessions, attendees were encouraged to explore new research avenues and practical implications of academic findings. The seminar's academic value transcends mere knowledge dissemination by encompassing the development of conceptual frameworks, the exploration of innovative methodologies, and the cultivation of interdisciplinary collaborations. By nurturing a culture of inquiry and innovation, the seminar has made significant strides in advancing agricultural sciences and fostering sustainable food systems, leaving a lasting impact on academia

and industry alike.

(3) 相手国との交流(両国の研究者が協力してセミナーを開催することによって得られた成果)

The seminar brought together agricultural, social, environment and waste management researchers from these two countries to collaborate and share knowledge on addressing pressing agriculture and environmental challenges. The presentations covered various themes and showcased innovative methodologies and technologies aimed at improving agricultural practices and sustainability. For example, the researchers presented sensor-based soil mapping and seasonal forecasting techniques, which offer novel insights into understanding the global carbon cycle and mitigating climate-related risks in agriculture. The discussions on organic farming techniques and waste management highlighted the potential for eco-friendly approaches to enhance soil biodiversity and crop productivity. Additionally, the seminar provided a platform for startups to present sustainable farming solutions, which enriched the discourse on agricultural innovation. The collaborative spirit of the seminar emphasized the importance of interdisciplinary cooperation in tackling complex agriculture and environmental issues. Finally, the seminar served as a catalyst for forging stronger industry-academia linkages between India and Japan, laying the groundwork for future collaborations and initiatives to promote sustainable agriculture and enhance farmer livelihoods.

(4) 社会的貢献(社会の基盤となる文化の継承と発展、社会生活の質の改善、現代的諸問題の克服と解決 に資する等の社会的貢献はどのようにあったか)

The seminar showcased significant social contributions from various entities, including ITC, startups, and Kankyo Seibi Co. Ltd., in the agricultural sector. ITC's promotion of Climate Smart Agriculture highlighted initiatives aimed at improving natural resource management, livelihood diversification, and institutional support, reflecting a commitment to sustainable farming practices. Startups like Yogita Biofarming and Dr. Amaresh Mahto Artificial Official Mushroom Pvt Ltd demonstrated a dedication to empowering local communities by promoting natural and organic farming methods, soil testing, and mushroom cultivation, which not only enhance dietary health but also contribute to environmental sustainability and economic empowerment, especially of women in village areas. Moreover, Kankyo Seibi Toyama Co. Ltd's highlighted innovative waste treatment practices and circular agriculture models, leveraging technology like ICT and drones to optimize agricultural processes while addressing environmental concerns. The organization's use of advanced technology in waste treatment and recycling can revolutionize the agricultural sector as it is a significant contributor to plastic waste generation. These social contributions collectively reflect a shared commitment to societal wellbeing, environmental stewardship, and sustainable development in the agricultural sector, through the adoption of innovative technologies and sustainable practices.

(5) 若手研究者養成への貢献(若手研究者養成への取組、成果)

The seminar proved to be an invaluable contribution to the growth of young researchers in the agricultural

science field. It served as a platform for them to engage with cutting-edge research and innovative agricultural practices through thematic presentations and workshops. The seminar exposed young researchers to state-of-the-art methodologies like sensor-based soil mapping, seasonal forecasting, and organic farming techniques, which are crucially important in addressing contemporary agricultural challenges. Furthermore, interdisciplinary collaboration was fostered, allowing young researchers to interact with experts from diverse fields and gain insights into integrated approaches for sustainable agriculture. The poster session provided a forum for young researchers to showcase their own research initiatives, promoting knowledge exchange and networking among peers and experts. Additionally, the panel discussions on industry-academia linkages and the way forward for agricultural development highlighted the significance of empowering young researchers to drive innovation and address pressing issues in agriculture. The seminar played a pivotal role in nurturing the next generation of agricultural scientists, equipping them with the necessary tools and knowledge to tackle complex agricultural problems, and contribute to the sustainable development of the agricultural sector.

(6) 将来発展可能性(本事業を実施したことにより、今後どのような発展の可能性が認められるか)

The seminar highlighted the potential for future development in climate-smart agriculture through collaboration between academic, industry, and research organizations. The seminar discussed themes like sensor-based soil organic carbon (SOC) mapping, seasonal forecasting, and interventions for arid and semiarid drylands and their potential in research and implementation. Additionally, the seminar emphasized climate-smart agriculture, organic farming techniques, and waste management technologies as sustainable agricultural practices. Startups and established organizations like ITC presented innovative solutions, and collaborative platforms like the proposed joint multidisciplinary proposal can contribute significantly to advancing agricultural sustainability. Engaging farmers, students, and young researchers provides opportunities for practical implementation and knowledge exchange. Strengthening industry-academia linkages, promoting collaborations, and enhancing documentation and training efforts will be essential for realizing the full potential of these initiatives in addressing contemporary agricultural challenges and fostering sustainable development.

(7) その他(上記(2)~(6) 以外に得られた成果(論文発表等含む)があれば記載してください)

The University of Toyama's news section features the published outcomes of the JSPS-ICSSR bilateral project workshop. To learn more, please visit <u>https://www.u-toyama.ac.jp/en-news/85866/</u>. As a result of our bilateral seminar, we are in the process of compiling an edited book series to be published in a reputable journal. We are currently reaching out to presenters who are interested in contributing full chapters to the edited book.