



**Asia-Pacific Association of Agricultural Research  
Institutions (APAARI), Thailand**

and

**Council of Agriculture (COA), Taiwan**

Collaborative Program

**Progress Report**

(January 1, 2021 to December 31, 2021)



**Asia-Pacific Consortium on Agricultural Biotechnology and  
Bioresources (APCoAB)**

182, Larn Luang Road, Pomprab Sattrupai

Bangkok 10100, Thailand

## Progress Report

(January 1, 2021 to December 31, 2021)

Asia-Pacific Association of Agricultural Research Institutions and Council of Agriculture (APAARI-COA) collaborative program on biotechnology has been in operation since 2008 as the Asia-Pacific Consortium on Agricultural Biotechnology (APCoAB). Initially approved for three years (2008-2010) with a funding support of USD 35,000 per annum, the program was extended twice (2011-2013, 2014-2016) and funding raised to USD 50,000 per annum each by APAARI and COA. In view of the excellent performance of the APAARI-COA collaboration in terms of the number and range of activities conducted and benefits brought to APAARI members and other participants by way of knowledge enhancement, development of practical experience, networking and opportunities for partnership development, it was decided by both APAARI and COA to continue the APCoAB program for another term. Therefore, the program was extended for 4 years *i.e.*, from 2017 to 2020 with a total budget of USD 560,000 is to be shared equally (USD 280,000) by COA and APAARI and other partners. The commitment of COA to continue supporting this program was conveyed during the XVIII APCoAB Steering Committee Meeting, held on October 31, 2016 at Taichung City, Taiwan. As per recommendations of Executive Committee (EC; 2/2017) of APAARI, XIX Steering Committee of APCoAB and EC 1/2018 of APAARI, activities on conservation and sustainable use of bioresources were included. The program Asia-Pacific Consortium on Agricultural Biotechnology was renamed as 'Asia-Pacific Consortium on Agricultural Biotechnology and Bioresources' retaining the old acronym as 'APCoAB' and also the objectives of APCoAB were modified, which were approved in the meetings of XIX Steering Committee of APCoAB and EC (1/2018) of APAARI.

During XIX Steering Committee of APCoAB held on May 28, 2018 at Bangkok, COA committed to enhance the funding with effect from 2019 in view of inclusion of bioresources activities under APCoAB and suggested that a revised APAARI-COA collaborative proposal (APCoAB) should be submitted to COA. Consequently, a revised APAARI-COA proposal (2019-2022) was submitted to COA, which has been approved by COA with enhanced funding from USD 70,000 to USD 170,000 per annum for 2019-2022 with the provision of salary of a Technical Associate in APCoAB.

### Work Plan of APCoAB for 2021

Following is the Work Plan of APCoAB as approved by the Executive Committee (EC) of APAARI:

Area	Activities
Expert Consultation/ High Level Policy Dialogue	<ul style="list-style-type: none"><li>• High-Level Policy Dialogue on Gene Editing in Asia-Pacific (July-September 2021) Co-organizers: CLA/KBSH</li></ul>
Symposia/trainings/workshops/online surveys/feedback analyses	<ul style="list-style-type: none"><li>• Webinars on gene editing (April- May 2021) Co-Organizers: BCIL/ KBSCH</li><li>• Regional Expert Consultation on Agroforestry to Improve Quality of Rural People in Asia-Pacific (June-July 2021) Co-organizers: ICAR/CIFOR-ICRAF</li><li>• Investment in agricultural biotechnology and its impact on livelihoods of farmers in Asia-Pacific region (August-September 2021); Co-organizers: PCAARRD</li></ul>

	<ul style="list-style-type: none"> <li>• Biotechnological tools for conservation of animal or fish genetic resources (October-November 2021) Co-organizer: ICAR</li> <li>• Online Survey on Perception of Gene Editing and data analyses of survey and Feedbacks of Events</li> </ul>
Steering Committee of APCoAB	<ul style="list-style-type: none"> <li>• Steering Committee Meeting of APCoAB (June-July, 2021)</li> </ul>
Publication of proceedings/status reports/success stories	<ul style="list-style-type: none"> <li>• Proceedings of Expert Consultations and Workshops (January-December 2021)</li> <li>• Preparation of a Resource Document on Applications of Gene Editing in Sustainable Agriculture and Food Security in Asia Pacific Region (August-December 2021)</li> <li>• One Policy Paper on GM Maize and two success stories - (Success Story on Induced Systemic Resistance: A New Hope for Malaysian Papaya Industry; Tissue Culture Raised Apple Root Stock in India) (January-December 2021)</li> </ul>
APCoAB website	<ul style="list-style-type: none"> <li>• Regular updates on agricultural biotechnology and bioresources developments, news and events of specific relevance to Asia-Pacific</li> <li>• Update of existing databases; Regular updates of other content and additional databases</li> </ul>
One activity as suggested by COA	<ul style="list-style-type: none"> <li>• To be decided by COA (November-December 2021) Co-organizer: COA</li> </ul>

## Accomplishments

During the period of January 1, 2021 to December 31, 2021, following activities were carried out as mentioned in following sections in chronological order:

### A. Expert Consultation/Webinars/Conference /Training/Online Feedback Surveys

**High-Level Policy Dialogue on Gene Editing in Asia-Pacific** was planned to launch a Resource Document on Applications of Gene Editing in Sustainable Agriculture and Food Security in Asia-Pacific Region by engaging policy-makers and experts from various country. To develop above document, a Steering Committee was constituted consisting of representatives of partner organizations and key experts from Australia, India, Japan, Malaysia, Philippines, Republic of Korea, Taiwan and USA, under chairmanship of Executive Secretary, APAARI, who are strategically positioned and have appropriate expertise to drive the development of the resource document. Four meetings of Steering Committee were held to seek their guidance. As per advice of Steering Committee, 3 webinars were organized to engage the large number (>700) of stakeholders – experts, researchers, academicians, policy-makers, students, etc. to capture their viewpoints to include in the resource document which is still under preparation. The details of webinars are presented in following sections. Under the guidance of Steering Committee, the experts on gene editing were identified to write the 6 chapters on Introduction, Basics of gene editing, Regulations of plants in agriculture, Regulation and policies for gene edited plants, Agricultural trade of gene edited plants, and Way forward for Asia-Pacific region. Some of the chapters have been received and are under review, remaining are yet to be received.

Therefore, High-Level Policy Dialogue on Gene Editing in Asia-Pacific, in which resource document is to be launched, is postponed to next year *i.e.* 2022.

1. **Webinar Series on “Application of Gene Editing in Sustainable Agriculture and Food Security in Asia Pacific Region”** was organized in collaboration with Korea Biosafety Clearing House (KBCH), Republic of Korea and Biotech Consortium India Limited (BCIL), India, for preparation of a comprehensive “Resource Document on Applications of Gene Editing in Sustainable Agriculture and Food Security in Asia-Pacific Region” and spreading awareness among various stakeholders about gene editing techniques, recent advancements in Asia-Pacific region, differential status of regulations and intellectual property rights landscape with respect to gene editing applications. Several consultative meetings were organized during 2020 and 2021 with the experts and partners. A Steering Committee consisting of representatives of partner organizations and key experts from Australia, India, Japan, Malaysia, Philippines, Republic of Korea, Taiwan and USA, under chairmanship of Executive Secretary, APAARI, who are strategically positioned and have appropriate expertise to drive the development of the resource document has been set up to guide. Speakers/panelists were invited from Australia, Bangladesh, India, Japan, Malaysia, Philippines, Republic of Korea, Taiwan, Thailand and USA who made presentations and participated in the panel discussions.



Three webinars under the series on “Applications of gene editing in sustainable agriculture and food security in Asia-Pacific region” were organized in months of July-August. The brief summary of webinars is given below:

**(i) Webinar 1: Genome editing tools and its applications for targeted plant breeding, July 21, 2021**

The webinar 1 was chaired by Prof. Ryo Ohsawa, Dean, Faculty of Life and Environmental Sciences, University of Tsukuba, Japan. Two thematic presentations – (i) *Applications of gene editing in plants for agricultural sustainability and nutrition security - Gene-edited high GABA tomato for human health* by Dr Hiroshi Ezura, Professor/Director, Tsukuba Plant Innovation Research Center, University of Tsukuba and (ii) *Advances in genome editing for crop improvement* by Dr Jose (Jimmy) Botella, Professor of Plant Biotechnology, School of Agriculture and Food Sciences, University of Queensland, Australia, were made. Three panelists - Dr Zeba Islam Seraj, Professor. Department of Biochemistry and Molecular Biology, University of Dhaka, Bangladesh; Dr T.R. Sharma, Deputy Director General (Crop Science), Indian Council of Agricultural Research, India; Dr Donghern Kim, Vice President, Future Food Resources Forum, Korea; Professor Chwan-Yang HONG, National Taiwan University,

Taiwan; Dr Kok Gan Chan, Deputy Head of Department, Institute of Biological Sciences, Faculty of Science, University of Malaya, Malaysia, presented their views and participated in interaction with the participants.

**(ii) Webinar 2: Advancing genome edited plants from lab to land, August 4, 2021**

This was chaired by Dr Heidi Mitchell, Office of the Gene Technology Regulator, Australian Government Department of Health and co-chaired by Dr Ho-Min Jang, Korea BCH Focal Point, Korea Research Institute of Bioscience and Biotechnology, Republic of Korea. Dr Donald J. MacKenzie, Executive Director, Institute for International Crop Improvement, Donald Danforth Plant Science Center, USA, made presentation on – *Regulating genome editing in agriculture – context and status*; Dr. Peter Thygesen, Office of the Gene Technology Regulator, Australia, on *Status of discussions in international fora with a focus on OECD*; Dr Florida Carino, Retired Professor of Chemistry, University of the Philippines Diliman and Member, Biosafety Committee, Department of Science & Technology, Philippines, on *Status of discussions in International for a with a focus on Cartagena Protocol on Biosafety*. Dr Abraham J. Manalo, Executive Director, Biotechnology Coalition of the Philippines (BCP), Philippines; Dr Kodi Isparan Kandasamy, Member, Genetic Modification Advisory Committee (GMAC) and Science Advisor for Asia Plantation Capital Berhad, Malaysia; and Dr Vibha Ahuja, Chief General Manager, Biotech Consortium India Limited, India, participated in discussion as panellists.

**(iii) Webinar 3: Enabling policies for genome editing in agriculture, August 18, 2021**

Dr William D. Dar, Secretary, Department of Agriculture, Manila, Philippines; chaired the webinar. Dr Kanokwan (May) Chodchoey, Executive Director, Asia and Pacific Seed Association (APSA), Thailand, made presentation on *Need for harmonized policies on research, utilization and trade of genome-edited plants* and Mr Fabrice Mattei, Principal, Climate Change & IP Group Head and Myanmar Country Manager, ROUSE Yangon, Thailand on *Understanding the IPR landscape of gene editing*. Dr Roland Schafleitner, Head-Molecular Genetics, Flagship Program Leader – Vegetable Diversity and Improvement, World Vegetable Centre, Taiwan; Dr Okjae Koo, Director, Business Development, Plant and Animal Genome Editing, ToolGen Inc. and Co-founder, PLANTeDIT, Japan; Prof. Masahi Tachikawa, Graduate School Environmental Science, Nagoya University, Japan; and Dr Ravi Khetarpal, Executive Secretary, Asia-Pacific Association of Agricultural Research Institutions, Thailand, presented their views as panellists.

The webinar series evinced great interest from various stakeholders not only from Asia Pacific region, but also from other countries. More than 2500 participants from 60 countries registered for the events and on an average about 700 participated in each of the webinar. Of 700, 40% were women researchers. Participants benefited immensely with the deliberations from the excellent presentations and interaction in panel discussions.

Major observations from this webinar series were as follows:

- (i) Genome editing is a precise breeding tool. This technique can help breeders produce novel traits through the introduction of genetic changes that are predetermined and not random, adding speed, precision and efficiency to their breeding programs.
- (ii) Consistent approaches and standards internationally have been critical to the efficient operation of the global agri-food production system and will be equally important in enabling genome edited crops to make their greatest contribution to food and nutrition security.

(iii) There is a growing opinion that genome editing those results in the introduction of simple mutations or small insertions should not be subjected to the additional regulations imposed on transgenic crops, especially considering that products of mutation breeding or even conventional crossbreeding, which present the same risk profile, are not subject to such oversight.

(v) As agriculture policies embrace modernization to address food security, climate change and efficient agriculture production, it is pertinent to have an enabling legislation in place to, build confidence of researchers and public as end users.

(vi) The policies for meeting ethical, safety, economic and technical concerns associated with this technology in plant breeding vary among countries. The regulations also depend on the kind of the modification introduced into the genome, such as small deletions or insertions, oligonucleotide-mediated mutagenesis or site-directed insertion of a native or foreign DNA sequences.

(vii) Many countries have introduced policies that keep the regulatory burden for low-risk genome editing applications low enough to allow small and medium-sized enterprises and academic research institutes to clear the regulatory hurdles. This will likely favor the cost-effective development of improved crop varieties for food and nutrition security.

(viii) There is need of international harmonization in environmental risk/safety assessment and regulation of organisms produced with modern biotechnology. An appropriate regulatory environment is required for harnessing the benefits of the technology particularly for smallholder farmers. In addition, public private partnerships are required for use of protected technologies.

(ix) An understanding of the intellectual property (IP) implications involved in bringing genome editing-derived products to market is often lacking. Therefore, knowledge awareness about IP of the various genome editing methods is relevant.

(x) The basic research using genome editing tools (since this type of research is exempt from the patent infringement regime under national laws or condoned by the institutions holding the patent rights), any therapeutic or commercial opportunities will have to wait, unless interested universities and researchers agree on a common platform for licensing their potential IP rights.

(xi) Genome editing using sequence-specific nucleases and epigenetic modifications are within the ambit of synthetic biology. Synthetic biology is a Convention on Biological Diversity (CBD) issue, and inclusion of genome editing in its operational definition makes genome editing a topic for discussion in both in CBD and in the Cartagena Protocol on Biosafety (CPB).

Resource document is under preparation; some chapters from experts have been obtained which will be reviewed to include in final resource document along with the recommendations emerged out from webinars.

- 2. Regional Workshop on Investment in Modern Agricultural Biotechnology and its Socio-economic Impact on Livelihoods of Farmers in Asia-Pacific** was organized virtually in collaboration with the Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development (PCAARRD), Philippines; Council of Agriculture (COA), Taiwan; CropLife Asia (CLA), Singapore; Federation of Seed Industry of India (FSII), India on August 2-3, 2021. Opening remarks were presented by Dr Ravi Khetarpal, Executive Secretary, APAARI, Thailand; Dr Reynaldo Ebor, Executive Director, PCAARRD, Philippines and Mr Vincent Lin, DG, COA, Taiwan. Eminent global experts from 17 countries contributed to the discussion during the regional workshop. A total of 984 participants registered for the workshop, out of which 424 (researchers and research managers from governments, academia, industry and NGOs) took part from 33 countries (Afghanistan,

Albania, Algeria, Angola, Argentina, Australia, Bangladesh, Bhutan, Canada, Fiji, India, Indonesia, Iraq, Iran, Japan, Republic of Korea, Malaysia, Nepal, Pakistan, Papua New Guinea, Samoa, Singapore, Sri Lanka, Switzerland, Tanzania, Taiwan, Thailand, The Czech Republic, The Philippines, The Netherlands, The United Kingdom, The United States, and Vietnam) including from NARS, universities, related ministries, and CG Centre. Of 424 participants, 35% were women researchers. The objectives of the Regional Workshop were (i) to assess the investment in agri-biotechnology and its impacts on livelihoods of farmers in Asia-Pacific region, and (ii) to scope innovative ways of enhancing the investment in important areas of agri-biotechnology in Asia-Pacific region, and (iii) to enable government policies to attract the investors from private sector for R&D and to promote agri-biotechnologies in the region.



Regional Workshop comprised of 4 Technical Sessions – (i) Investment Status and Impacts in Modern Agricultural Biotechnology, (ii) Case Studies: Investment and Impact, (iii) Impacts of Enabling Policies for Enhanced Investment and (iv) Panel Discussion on Scoping Investment in Modern Agricultural Biotechnology. A total 18 presentations were made by the experts related to investment and impact of agri-biotechnology.

The Major Recommendations arising from the Regional Workshop were related to:

- Prioritization of public and private investments towards Agri-biotechnology;
- National and Regional (Asia-Pacific) R&D collaborations and/or partnerships;
- Capacity-building activities focusing on crop development and varietal improvement using new breeding techniques;
- Investment in Knowledge Management and communication to promote biotechnology and address political and social concerns;
- Development of Agri-biotechnology-focused roadmaps for crop production; and
- Harmonization of biotechnology regulations across the region.

### **Feedback from the Participants of Regional Workshop on Investment in Modern Agricultural Biotechnology and its Socio-economic Impact on Livelihoods of Farmers in Asia-Pacific**

An online feedback form was developed composing simple questionnaire to collect their feedback about their organizations, objectives, rating of the different sessions, most valued and least valued sessions, how they will use gained knowledge in their research work, possible areas of collaboration,

relevance of the deliberations to their ongoing research work. The summary of the feedback analyses is presented below:

- (i) Of 424 participants, 47% (200) responded to and submitted their feedback; 69% participants from academia/universities followed by 10% belonged to National Agricultural Research System from 6 countries.
- (ii) Some 68% participants attended the Regional Workshop to gain knowledge and insight on agricultural biotechnology related topics in the Asia-Pacific...
- (iii) About 96% of participants rated 3 Technical Sessions as excellent or very good; and 97% mentioned as excellent or very good to Panel discussion.
- (iv) About 27% of participants regarded all aspects of topics were of most value followed by about 20% mentioned Technical Session 1B Case Studies: Investment and Impact is very valuable.
- (v) About 39% of participants agreed that they will integrate/take forward the information/knowledge received during the Workshop: (a) sharing gained knowledge/information with their networks/collaborators on various aspects of these topics (40%), and (b) to develop collaboration and networks in different research areas with experts (16%).

**3. Regional Expert Consultation on Agroforestry for Environmental Resilience and Sustainable Livelihoods of Farmers in Asia-Pacific (AFERSuLiF-AP)** was organized virtually and jointly with APAARI, Thailand; Center for International Forestry Research and World Agroforestry (CIFOR-ICRAF); Council of Agriculture (COA), Taiwan on October 13-14, 2021. Opening remarks were presented by Mr Tony Simons, Executive Director, CIFOR-ICRAF; Mr Vincent Lin, DG, COA and Dr Ravi Khetarpal, Executive Secretary, APAARI. Eminent global experts from 9 countries contributed to the discussion during the Regional Expert Consultation. Some 199 participants registered for the consultation, out of which 153 (researchers and research managers from governments, academia, industry and NGOs) took part from 23 countries (Australia, Bangladesh, Bhutan, Canada, Egypt, Fiji, Germany, India, Iran, Japan, Kenya, Lao PDR, Republic of Korea, Malaysia, Nepal, Pakistan, Papua New Guinea, Sri Lanka, Taiwan, Thailand, The Philippines, The United States and Vietnam) including from NARS, universities, related ministries, and CG Centre. Of 153 participants, 26% were women scientists/experts. The objectives of the Regional Expert Consultation were (i) to enlighten the stakeholders on sustainable development through agroforestry in the region, and (ii) mainstreaming agroforestry through enabling policies and scaling-up investment in agroforestry, and (iii) to share the lessons from the success and failure in agroforestry entrepreneurship, and (iv) to prioritize regional needs identified, especially to achieve SDGs during the Regional Expert Consultation.





## Virtual Regional Expert Consultation on Agroforestry for Environmental Resilience and Sustainable Livelihoods of Farmers in Asia-Pacific Date: 13-14 October, 2021



Expert Consultation comprised of 3 Technical Sessions and 1 Panel Discussion – (i) Sustainable Development through Agroforestry, (ii) Enabling Policies and Scaling-up Investment in Agroforestry, (iii) Agroforestry and Entrepreneurship: Lessons from Success Stories, (iv) Panel Discussion on Regional Priorities (Research Areas, Capacity Development, Regulatory Policy Development & Public Awareness, and Possible Partnerships) to Achieve SDGs. Total of 16 presentations were made by the experts related to the different themes of a session.

The Major Recommendations arising from the Expert Consultation were as follows:

- A new paradigm of intersectoral planning and policy is essential for each country to scale up practice of agroforestry
- Context-specific local farm innovation with farmers as core innovator and focused around different stakeholders, especially private sector engagement is need of the hour
- Biophysical similarity mapping, digital augmentation are future technologies for scaling up site-specific agroforestry that help inter-link vital elements of complex smallholder farming systems transition
- Political, Scientific and practical implementation knowledge are interconnected, and their integration is essential for functions and roles of agroforestry to achieve SDG's
- Multi Chain Approach-portfolio of agroforestry value chain for diverse opportunity and mitigation is a key for promoting agroforestry in context of smallholder farmers
- Innovation in agriculture is not only just technology but also process, organizational forms, communication and awareness along with understanding of various actors and their roles in agroforestry need to be emphasized at national level.
- Experience, lessons and successful cases on agroforestry needs to be documented and disseminated in the region to promote agroforestry

- Dissemination of knowledge, modern science, policy and communication-awareness are interlinked and synergy is needed for scaling up of agroforestry in the Asia-Pacific Region

### **Feedback from the Participants of Regional Expert Consultation on Agroforestry for Environmental Resilience and Sustainable Livelihoods of Farmers in Asia-Pacific (AFERSuLiF-AP)**

An online feedback form was developed composing simple questionnaire to collect their feedback about their organizations, objectives, rating of the different sessions, most-valued and least-valued sessions, how they will use gained knowledge in their research work, possible areas of collaboration. The summary of analyses of the feedback is presented below:

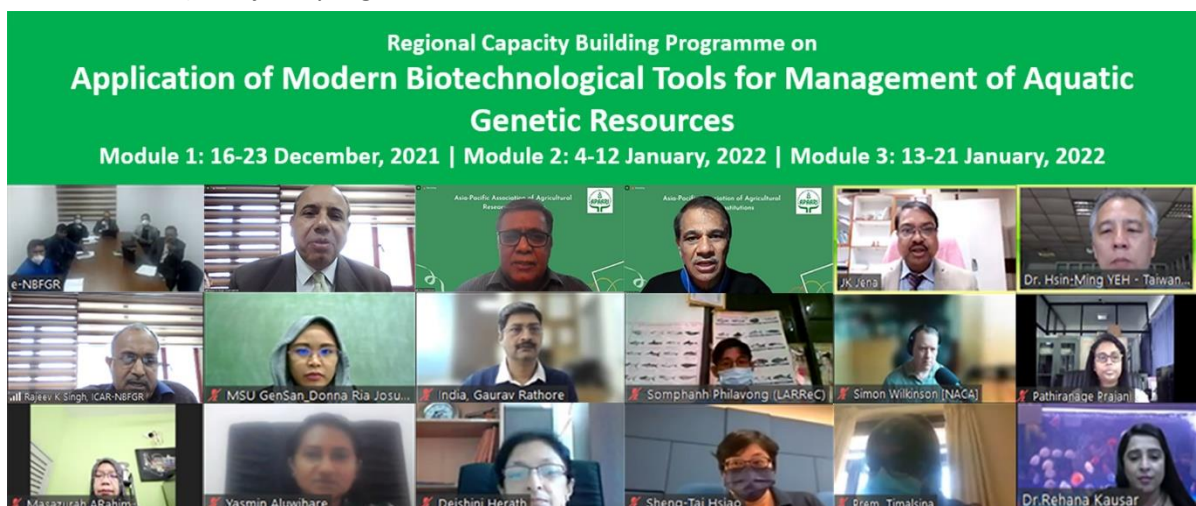
- (i) Of 153 participants, 43% (65) responded to and submitted their feedback; 40% of respondents belonged to National Agricultural Research System (NARS) followed by 35% from Academia/University from 16 countries.
- (ii) About 66% of respondents attended the Regional Consultation to gain/enhance more knowledge and understandings on sustainable development through agroforestry in the region and learn from case studies.
- (iii) About 94% of respondents rated 3 Technical Sessions as excellent or very good; and 93% mentioned as excellent or very good to Panel discussion.
- (iv) About 49% of respondents regarded Session 1 was of most value; Session 2 was regarded by 48%; Session 3 was regarded by 45%; Panel Discussion Session was regarded by 43%.
- (v) About 75% of respondents ascertained that they will integrate/take forward the information/knowledge received during the Consultation for:
  - (a) Implementation in terms of capacity building by doing research or project, *etc.* (39%)
  - (b) Knowledge sharing, recommendations or Extension to stakeholders (25%).
  - (c) Implementation in terms of policy aspects (6%).
  - (d) Networking or collaboration (6%).

4. **International Symposium on Innovation and Application of Animal Vaccines and Health-Promotion Feed Additives for Antibiotic-Free Era in Livestock Industry** was virtually co-organized in partnership with Taiwan Livestock Research Institute (TLRI), Council of Agriculture, and Food and Fertilizer Centre (FFTC) for the Asia-Pacific Region, Taiwan, on November 11-12, 2021. The objectives of symposium were to: (i) exchange knowledge on the development of animal vaccines and health-promotion feed additives and promote the feed industry; (ii) share the experiences and application of animal vaccines and health-promotion feed additives in livestock industry and stimulate the farm up-grading; (iii) increase the food safety and decrease the risk of antimicrobial resistance for human health; and (iv) exchange on the best practices and experiences on the regulations of animal vaccines and health-promotion feed additives as alternatives to antibiotics for the sustainable management of the livestock industry. The symposium had 4 sessions: (i) Keynote session; (ii) Animal vaccines; (iii) Food additives; (iv) Private sector introduction. The 2-day Symposium attracted more than 200 participants (off-site and on-site), with many eminent experts/speakers from Taiwan, Japan, Indonesia, Malaysia, Philippines and USA with focus on promotion of feed additives for antibiotic-free era in livestock industry. There were 4 keynote speakers and 17 other speakers, who have been invited representing government, research institutes, and private companies from 6 countries, to exchange and share knowledge on the development and application of animal vaccines and health-promotion feed additives, aiming for



global human health by ensuring food safety and reducing risk of antimicrobial resistance. During 4 sessions covering various topics mainly related to animal vaccines and animal feed additives through 4 keynote presentations, 12 speakers who will deliver country reports and other technologies related to the topic, and 5 other representatives of private companies. Through this symposium, it is expected to increase and promote the awareness and application of animal vaccines and health-promotion of feed additives in Asia’s livestock industry. APAARI as co-organizer, under its programme, namely, APCoAB, facilitated the participation from its member-countries in Asia-Pacific region. A total of 15 participants were sponsored from 7 APAARI-member countries (Bangladesh, Fiji, India, Iran, Philippines, Papua New Guinea, Thailand). About 33% were the women scientists/researchers. Policy makers, scientists, researchers, students, agriculturists, members of the private sector participated in the symposium.

**5. Regional Capacity Building Programme on Application of Modern Biotechnological Tools for Management of Aquatic Genetic Resources (Module 1: Genetic Diversity and *Ex-Situ* Conservation)** was jointly organized in virtual mode with ICAR, on December 16-23, 2021, at ICAR-



National Bureau of Plant Genetic Resources (NBFG), India - one of the best institutes for aquaculture resources in the Asia with experts and technologies which are in vogue for characterization and *ex situ* conservation of aquatic genetic resources (AqGR). During Opening Session, Dr JK Jena, Deputy Director General, ICAR and Dr Ravi Khetarpal, Executive Secretary, APAARI delivered addresses and encourage the trainees to use the gained knowledge on AqGR management in their research work and develop new partnerships with other countries in the

region. On the basis of feedback obtained from the various participants attended this programme in 2020, this training programme was designed according to the needs of participants engage in various aspects of AqGR management. Therefore, 3 modules (Module 1: Genetic Diversity and *Ex-Situ* Conservation: 8 days; December 16 to 23 December, 2021; Module 2: Aquatic Animal Diseases and Biosecurity: 9 days; 4 January to 12 January, 2022; Module 3: Genomics and Bioinformatics: 9 days; 13 January to 21 January, 2022) were developed. A total of 44 scientists/researchers were selected to attend above courses from 13 countries (Fiji, India, Iran, Lao PDR, Malaysia, Nepal, Philippines, Pakistan, Papua New Guinea, Samoa, Sri Lanka, Taiwan, and Vietnam) of Asia-Pacific region. All the 44 participants were mid-career active researchers and 68% of those were women scientists/researchers. For Module 1, a total of 28 scientists/researchers attended the training this year. In addition, from ICAR institutes, the experts/faculty were also drawn from FAO, universities from France, Singapore, Taiwan and Thailand.

The 8-day training Module 1 comprised course content on AqGR covering (a) Genetic Diversity: Demonstration on methodologies such as DNA extraction, quality check, primer designing, PCR and sequencing including Sanger's and NGS for the following analysis; Molecular marker development and polymorphism (nuclear/mtDNA); Species discrimination with molecular markers and complimenting conventional taxonomy; Statistical methods in molecular marker data analysis, population genetics genetic variability on geographic spatial scale and use of software; (b) *Ex-situ* conservation tools: Sperm cryopreservation, freeze, thawing and fertilization; Cell culture, development, preservation and characterization, etc.

The training of Module 1 ended on a high note, with appreciation by the participants and opened up newer avenues for collaboration with institutes in various other countries working on similar lines or setting up their research facilities in the area of management of AqGR. The training provided the opportunities for South-South Cooperation and collaboration in capacity development in the area of biotechnology for conservation of AqGR. The Feedback about the success of Module 1 from the participants are being analysed.

## 6. Online Survey on the Perception of Gene Editing for Food and Agriculture

Gene editing has great potential and evidently has very special role in agriculture to increase the qualitative and quantitative agricultural production and productivity. The success and potential of this technique to contribute towards developing new varieties/breeds will depend on the prevailing regulation for gene editing and public acceptance of the products derived from the gene editing technology in a given country. An online survey on the Perception of Gene Editing for Food and Agriculture was conducted to get the feedback from the different stakeholders about the acceptance of gene editing technologies was planned to conduct in India, Philippines, Taiwan, Malaysia and Vietnam. Category-wise details of contact list for online survey is given below: Category-wise details of contact list for online survey is given below:

Category	India	Philippines	Taiwan	Malaysia*	Vietnam*
Researchers	1739	383	899	87	90
Academicians	937	886	1706	51	2
Industry	562	283	101	3	4
Policy-makers	620	302	25	425	6
Others	94	54	6	4	-

\*Collection of contacts yet to be completed

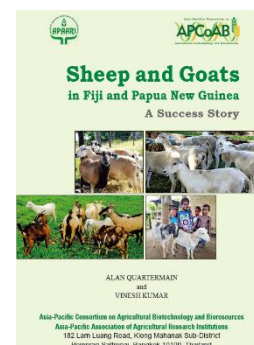
All the above stakeholders in India, Philippines and Taiwan were contacted through emails to respond a simple online questionnaire and polite reminders were also sent. Many of the emails (about 25-30% bounced back, due to either server errors or the person has changed the organization or the email IDs. Data from Philippines and Taiwan is being analyzed, however, analyses of data obtained from India was completed. Key observations are mentioned below:

- (i) A total 228 responses were received from researchers (44%), followed by academicians (24%), policy-makers (16%) and industry (14%) with either Masters (24%) or PhD degree (70%).
- (ii) About 83-88% are aware of all breeding methods and have read about gene editing also.
- (iii) 84% considered science papers, 63% researchers, science magazines as reliable source of information on innovations.
- (iv) Gene editing can contribute significantly for crop improvement (94%), treat animal diseases (87%) and conserve nature and environment (83%) was agreed upon.
- (v) 89-95% believed that gene editing will improve crop production with better nutritional qualities while 89% also believed for improvement in economy also.
- (vi) 53% and 48% perceived no risk of gene editing to health and environment, respectively, while 11% for health and 18% for environment perceived risk due to gene editing.
- (vii) 75-90% preferred to consume gene edited products if these are nutritionally better, cheap and easily available at grocery stores.
- (viii) 67% mentioned that gene edited products should not be either regulated as GM products or some may be regulated as GM products while 25% mentioned that should be regulated as GM products.
- (ix) 64% opined that regulatory process will be hurdle for development of gene edited products, however, 60% are optimistic that government will give the approval of gene edited products for consumption.
- (x) 67% were optimistic that consumers will accept the gene edited products.

Most of the respondents mentioned that vigorous awareness campaign and capacity building programmes should be launched in India about gene editing technology and products to meet challenges the food and nutrition security of ever-increasing population and to protect the environment by reducing the excessive usage of pesticides. This analysis will be useful for researchers and policy makers involved in agricultural biotechnology in Asia-Pacific countries to facilitate the formulation of the regulatory guidelines of gene editing on the basis of the public opinion to benefit the society.

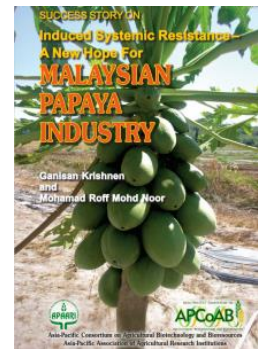
## B. Publications and e-Training Manual (7+1\*)

- (i) **Sheep and Goats in Fiji and Papua New Guinea – Success Story** was published and printed. This document provides details on Introduction; Early Introductions of Sheep and Goats; Historical Developments; Goat Keeping Development – Fiji and PNG; Sheep Development Programmes; Sheep and Goats – Health Issues; Regulatory Policies and Development Strategies; Development Issues and the Current Situation; Consumption and Marketing Systems – Fiji and PNG; Economic Benefits for Smallholder Farmers; Conclusions; and References. The soft copies were distributed to about 600 and hard copies to about 100 stakeholders. The publication was also downloaded from website by about 650 scientists/researchers. This document is available to all APAARI members and other stakeholders which can be

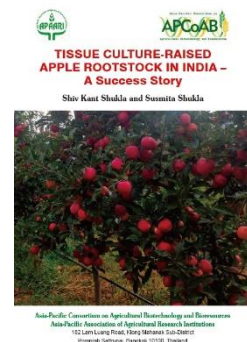


can be accessed on: [http://www.apaari.org/web/wp-content/uploads/downloads/2021/SuccessStory\\_Sheep\\_Goats\\_in-Fiji-PNG\\_Final.pdf](http://www.apaari.org/web/wp-content/uploads/downloads/2021/SuccessStory_Sheep_Goats_in-Fiji-PNG_Final.pdf)

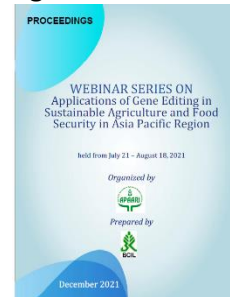
- (ii) **Success Story on Induced Systemic Resistance – A New Hope for Malaysian Papaya Industry** published and printed. The book contains chapters on Introduction; Papaya in Malaysia; Importance of Papaya; Papaya Cultivation Practices in Malaysia; Import/Export of Papaya in Malaysia; Papaya Industry in Malaysia; Constraints to Enhance Production and Productivity of Papaya; Development of Induced Systemic Resistance (ISR) Technology for Papaya Bacterial Dieback Control; Induced Systemic Resistance Era: A New Hope for the Malaysian Papaya Industry; Major Protocols; Challenges; Production and Distribution of Planting Material; Field Validation of ISR Technology; Technology Transfer; Adoption of Technology by Farmers; IPR Issues; Capacity Development; Potential Benefits to Farmers by adopting ISR technology over Conventional Planting; Perception of Farmers; Conclusions; and References. The soft copies were distributed to about 600 and hard copies to about 90 stakeholders. The publication was also downloaded from website by about 220 scientists/researchers. This document is available to all APAARI members and other stakeholders which can be accessed on: <http://www.apaari.org/web/wp-content/uploads/downloads/2021/Papaya%20Success%20Story%20Final%20High%20Res-28-6-21.pdf>



- (iii) **Tissue Culture-Raised Apple Rootstock in India – A Success Story** was published and printed (ISBN: 978-85-99249-50-5). This document covers Introduction; Importance of apple; Supply and demand of apple in India; Constraints in enhancing production and productivity of apple in India; Possible solutions; Apple Business; Traditional Cultivation and Constraints; Research and Commercialization of Tissue Culture of Apple in India; *In vitro* propagation of apple; Rootstock Tissue Culture; Suitable species as rootstocks for apple; Constraints and possible solutions; Tissue culture-raised rootstocks and its benefits; Commercialization; Role of National Certification System for Tissue Culture-Raised Plants as the comprehensive quality management system; Testing and batch certification of TC apple; Tissue culture standards for apple; Importance of implementing Standard Operating Procedures; Virus indexing protocol; Tissue Culture-Raised Apple Rootstock in India; Challenges; Production of TC rootstocks; Managing quality; Distribution; Technology transfer; Adoption by farmers; Capacity building; Economics of Apple Cultivation using TC Rootstocks; Cost of TC rootstock plantlets; Financial benefits to farmers using TC rootstocks over; conventional planting of apple; Scope of Agribusiness; Successful examples of established agribusiness unit; Potential Benefits to Farmers and their Perception to Use Tissue Culture-Rootstocks; Experience sharing by Progressive Growers highlighting their success stories who adopted tissue cultured rootstocks for apple production; Conclusions; and References. The soft copies were distributed to about 600. The publication was also downloaded from website by about 100 scientists/researchers. This document is available to all APAARI members and other stakeholders which can be accessed on: <https://www.apaari.org/web/tissue-culture-raised-apple-rootstock-in-india-a-success-story/>



- (iv) **Proceedings of Webinar Series on “Application of Gene Editing in Sustainable Agriculture and Food Security in Asia Pacific Region”** developed comprising of Steering Committee, background and webinar topics, programme, details of resources persons and participants, poll questions, all PowerPoint presentations, and key take aways (recommendations).



- (v) **Policy Paper on Scaling up the Adoption of GM Maize in Emerging Economies: Economic and Policy Lessons from The Philippines**, was published (ISBN: 978-85-99270-30-1). Using the near two decades of experience with GM maize in The Philippines, this policy paper seeks to illustrate the issues and lessons learned regarding this technology. It is intended for policymakers, legislators, and policy advisors such as academicians and researchers who are involved in proposing new policy instruments, or revisions to existing policies related to GM crop adoption. If GM maize adoption is considered, or rather any other GM crop, governments will need to invest in science-based regulations and expertise, a public awareness program, post-release monitoring, if required, and continued capacity building to address any unique emerging challenges.



Custodio C.G. Jr., J. Komen, V.R.G. Lee and R.K. Tyagi (2021) Policy Paper on Scaling up the Adoption of GM Maize in Emerging Economies: Economic and Policy Lessons from The Philippines. Asia Pacific Association of Agricultural Research Institutions, Bangkok, Thailand. p. v+25

- (vi) **Regional Capacity Building Programme on Application of Modern Biotechnological Tools for Management of Aquatic Genetic Resources – Brochure (7 pages)**. The brochure contains the needs for aquatic genetic resources (AqGR) management; genesis and purpose of the training; objectives; structure of course of 3 Modules principal components of each Module; Organizers’ details and application form to invite the trainees from APAARI-member countries (13).



- (vii) **e-Material for Demonstration for AqGR Management**

The demonstration video capsules were developed for virtually organized Regional Capacity Building Programme on Application of Modern Biotechnological Tools for Management of Aquatic Genetic Resources for participants during December 16-23, 2021. A training manual will also be prepared for the benefits of the participants. The above training material will be



available in open access to be used by researchers of any country in Asia-Pacific and beyond.

### \*Publication under preparation

- (i) Proceedings of Regional Workshop on Investment in Modern Agricultural Biotechnology and its Socio-economic Impact on Livelihoods of Farmers in Asia Pacific

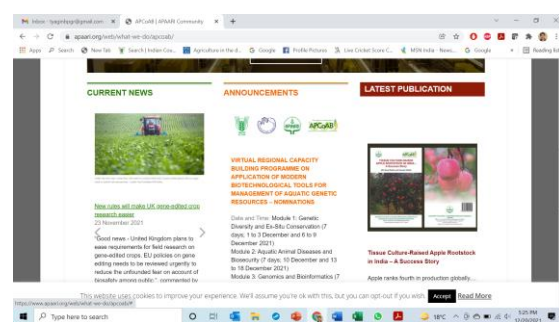
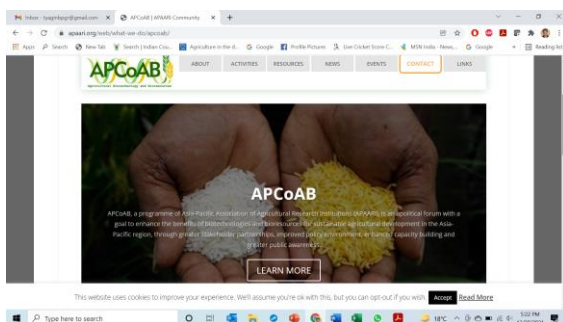
## C. APCoAB Website

### (i) Content update of databases

- (a) Institutional database: 20 new institutions from 23 countries (total: 322 institutions)
- (b) Educational Institutions: 44 new institutions from 23 countries (total 253 institutions)
- (c) Experts database: 152 new contacts from 23 countries (total 556 experts)

### (ii) Regular content update

News (122), events, announcements, infographics (111), uploading of publications, event proceedings updates, etc. Distribution of resource material (proceedings, country status reports, success stories, PowerPoint presentations, etc. of workshops/Expert Consultations to the participants and different stakeholders.



- (iii) Tweets: 973 with 223.5K impressions (from Coordinator's and APCoAB handles) were posted relating to the application and benefits of agricultural biotechnology, and conservation and use of bioresources. About 57% increase in followers for Twitter page; 17.4% increase in followers for APCoAB Facebook page were recorded.

## D. Major Inputs Provided

- (i) Medium-Term Review of APCoAB (Aug. 2017-Dec. 2020).
- (ii) Information related to APCoAB activities for APAARI Newsletter (July-Dec. 2020).
- (iii) Coordination/discussion for constitution of Steering Committee, modalities of work plan for preparation of a 'Resource Document on Applications of Gene Editing in Sustainable Agriculture and Food Security.
- (iv) Newsletter, qualitative benefits to members analyses, risk register, value proposition statement, APCoAB Status, Challenges in Governance (APCoAB), drafting of policy activities related to APCoAB in ECM Agenda.
- (v) Webinar on Regional Consultation on Forgotten Foods in Asia-Pacific - Developing a Regional Manifesto; Technical Agenda, (zero) drafted questions for speakers/panelists; Moderated a session on Panel Discussion on Transformation of Agri-Food Systems and Innovation in favour of Forgotten Foods.



- (vi) Concept Note and questionnaire of project on *ASEAN Ministry of Agriculture and Forestry Consideration: Leveraging STDF Grant to Benefit ASEAN Implementation of International SPS Guidelines*.
- (vii) Concept Note on Webinar on 'Risk communication to raise awareness of different stakeholders, including consumers, about the risks and benefits of pest mitigation and biopesticides' under Asia Pesticide Residue Mitigation Project.
- (viii) Drafting of the Regional (Asia-Pacific) Manifesto on Forgotten Foods.
- (ix) Re-designing of APAARI website.
- (x) Moderator, Pest Risk Analysis Training: Risk Assessment, Risk Communication and Risk Management in Bangladesh.
- (xi) Panelist, 1) Panel Discussion on Research to Policy Pathways; 2) Focus Group Discussion on Factors enabling/inhibiting uptake of Research in Policy; 3) Focus Group Discussion on whether researchers are engaging in the Research Process.
- (xii) Presentation on 'Strengthened Research and Innovations for Sustainable Agricultural Development in Asia and the Pacific', related to APCoAB and Forgotten Food.
- (xiii) 'Strengthening phytosanitary compliances and public private partnership for enhancing seed trade for the Asia Pacific region'.
- (xiv) 'Regional webinar: Women in Innovation'.
- (xv) Agricultural Innovation Forum for Asia-Pacific 2022 – APAARI-APIRAS Working Group discussion on Agribiotechnology under TAP-LOA.

#### **E. Participation in Webinars/Meetings Organized by Other Organizations (16)**

- (i) Participated in webinar on 'Gene editing research in agriculture: Key Initiatives in India', organized by Tata Institute of Genetics and Society (TIGS) and BCIL, India, February 17, 2021
- (ii) Participated in 11th Session of the Intergovernmental Technical Working Group on Animal Genetic Resources for Food and Agriculture organized by FAO-ITWG on AnGR, FAO, May 19-21, 2021)
- (iii) Participated in FARA Webinar: Development of Africa Manifesto and Plan of Action on Forgotten Foods Confirmation, May 20, 2021
- (iv) ACIAR-IDRC Independent Food Loss Dialogue, ACIAR, June 3, 2021
- (v) First meeting of NEDAC Committee on Agriculture Cooperatives and Food Security, NEDAC, June 5, 2021
- (vi) The WTO's Sanitary and Phytosanitary Agreement: Bangladesh Perspective - The Improving Phytosanitary Trade Compliance in Bangladesh Project, June 1, 2021
- (vii) Discussion for finalization of the Global Manifesto on Forgotten Foods, 28 and 30 June 20-30, 2021
- (viii) Asian Solanaceous and Cucurbits Roundtable (ASCRT) on Genome Editing and the Asian Regulatory Landscape, APSA, August 11, 2021
- (ix) TAP-AIS project Webinar - Joint rapid appraisal on strengthening agricultural innovation systems in Africa, Asia and Latin America; August 12, 2021
- (x) Delivered a talk on Harnessing the Benefits of Modern Agricultural Biotechnology in the Asia-Pacific Region - Challenges and Way Forward, ICAR, August 24, 2021
- (xi) Webinar on Achievements in Plant Mutation Breeding and Associated Biotechnologies, The Joint FAO/IAEA Centre, 20 Sept 2021
- (xii) Dialogue on innovation investment landscape and future food systems in Asia-Pacific, APAARI-CoSAI, September 28, 2021

- (xiii) Regional Community of Practices, GFAR, September 2021
- (xiv) Webinar on Enabling Food and Nutrition Security in Drylands, ICRISAT, 19 October 2021
- (xv) Decision support tools for increased investment in innovation, CoSAI-APAARI, October 21, 2021
- (xvi) Global Conference on Green Development of Seed Industries, November 4-5, 2021
- (xvii) Virtual 2nd International Agrobiodiversity Congress, CIAT-Bioversity Alliance, 15-18 November 2021,
- (xviii) Virtual ICGEB Board of Governors Meeting, ICGEB, 18-19 November 2021
- (xix) 8<sup>th</sup> Tropical Agriculture Platform (TAP) Partners Assembly, FAO-TAP, November 22, 2021
- (xx) 31st Governing Council Meeting (GCM31) of NACA, NACA, 29 November 2021

## **F. Networking and Partnerships**

- (i) With BCIL, India and KBCH, Republic of Korea to organize webinar series on “Application of Gene Editing in Sustainable Agriculture and Food Security in Asia Pacific Region”
- (ii) With CLA, Singapore and FSII, India, to develop and implement a project on “Outreach and communication strategy for gene editing acceptance in India”
- (iii) With PCAARRD, Philippines to Regional Workshop on Investment in Modern Agricultural Biotechnology and its Socio-economic Impact on Livelihoods of Farmers in Asia Pacific
- (iv) Discussion Meetings for future collaboration with ICRISAT, Research Information System (RIS), India; CropLife International, US; BIRAC/DBT, India in areas of agriculture/agri-biotech
- (v) With CIFOR-ICRAF to organize Regional Expert Consultation on Agroforestry
- (vi) With FFTC and TLRI, Taiwan to co-organize International Symposium on Innovation and Application of Animal Vaccines and Health-Promotion Feed Additives for Antibiotic-Free Era in Livestock Industry
- (vii) With ICAR, India to co-organize Regional Capacity Building Programme on Application of Biotechnological Tools for Management of AqGR
- (viii) Discussion Meetings with CropLife officials for future collaboration Concept Note developed: Enabling Coordination in selected Asian Countries for Harmonization of Regulatory Policies for Genetically Engineered Crops
- (ix) Discussion with Earth University officials about internship in APAARI

## **Memorandum of Understanding (MoU)**

- (i) MoU signed among CLA-APAARI-FSII for implementation of the project “Outreach and Communication Strategy for Gene Editing Acceptance in India” for Phase II.

## **G. Governance**

### **(i) Steering Committee Meeting of APCoAB**

The XXII Steering Committee Meeting (SCM) of the Asia-Pacific Consortium on Agricultural Biotechnology and Bioresources (APCoAB) was due in June-July 2021. However, it could not be held as Executive Secretary informed that Chair of Steering Committee will discuss with COA, Taiwan for organizing the meeting of Steering Committee.

### **(ii) Executive Committee Meeting (1/2020)**

Executive Committee Meeting (1/2021) was held virtually on 30-31 March 2021. The Progress Report (June 2020 to February 2021) and biennial Work Plan (January 2021 to December 2022) was presented and approved by the Executive Committee.

**(iii) 16<sup>th</sup> General Assembly Meeting (2021)**

General Assembly Meeting (2020) was held virtually on 8-9 April 2021. The Progress Report (January 2019 – February 2021) and biennial Work Plan (January 2021 to December 2022) was presented and approved by the General Assembly.

**H. Project Proposal Approved**

**Approved and completed**

- (i) Outreach and communication strategy for gene editing acceptance in India (Phase II) (USD 29,500)

## I. Revised Work Plan of APCoAB for 2022\*

Area	Activities
Expert Consultation/ High Level Policy Dialogue	<ul style="list-style-type: none"> <li>• High-Level Policy Dialogue on Gene Editing in Asia-Pacific (July-September 2021) Co-organizers: CLA/KBSH</li> </ul>
Webinar/trainings/workshops/online surveys/feedback analyses	<ul style="list-style-type: none"> <li>• Application of Modern Biotechnological Tools for Management of Aquatic Genetic Resources               <ul style="list-style-type: none"> <li>• Module 2: Aquatic Animal diseases and Biosecurity</li> <li>• Module 3: Genomics and Bioinformatics (January 2022)</li> </ul> </li> <li>• Webinar on Use of certified tissue-cultured planting material (April-June 2022) Co-organizer: ICAR/BCIL</li> <li>• External Evaluation of APCoAB (March-August 2022) (to be outsourced)</li> <li>• Online feedback data collection of gene editing survey and impact analyses of above activities.</li> </ul>
Steering Committee of APCoAB	<ul style="list-style-type: none"> <li>• Steering Committee Meeting of APCoAB (July-August, 2022)</li> </ul>
Publication of proceedings/success stories/resource document	<ul style="list-style-type: none"> <li>• Proceedings of Regional Workshop on Investment in Modern Agricultural Biotechnology and its Socio-economic Impact on Livelihoods of Farmers in Asia Pacific (January-May 2022)</li> <li>• Proceedings of High-Level Policy Dialogue (June-December 2022)</li> <li>• Policy papers/success stories/resource document on successful adoption of biotechnology and bioprospecting of bioresources in agriculture (January-December 2022)</li> </ul>
APCoAB website	<ul style="list-style-type: none"> <li>• Regular updates on agricultural biotechnology and bioresources developments, news and events of specific relevance to Asia-Pacific</li> <li>• Update of existing databases; Regular updates of other content and additional databases</li> </ul>
One activity as suggested by COA	<ul style="list-style-type: none"> <li>• To be decided by COA (November-December 2022) Co-organizer: COA</li> </ul>

\*Subjected to approval of Executive Committee

**J. Table 1: Summary of Account Statement of APCoAB (January 1, 2021-December 31, 2021)**

	(In USD)	(In Kind)	
Receipts		Name of Partners	Amount in USD
COA, Taiwan	170,000.00	ICAR-NBFG*	29,883.94
APAARI and Partner Contribution	70,000.00		
Balance Forward	45,348.00		
<b>Total</b>	<b>285348.00</b>		
<b>Payments</b>			
Salary costs	107,996.65		
<b>Other Direct Costs</b>			
Meetings/Trainings/Workshop**	43210.00		
Consultancy	35000.00		
Telephone	367.64		
General communication	389.81		
Computer Hardware and Software	2292.34		
Courier	1476.54		
Hospitality	2000.30		
Publications	15738.10		
Miscellaneous Charges	6312.50		
Facilities from Secretariat	31862.34		
<b>Total Expenditure</b>	<b>246645.92</b>		
<b>Balance</b>	<b>50,702.08</b>		

*\*Includes cost of preparing the video film demonstration in virtual class room and staff time for three modules of AqGR management training*

*\*\*This cost includes the staff time of KM and Policy team*

**Table 2. Summary of Expected Income and Expected Expenditure for the APCoAB activities during January 1, 2022-December 31, 2022**

	USD
<b>Receipts</b>	
COA, Taiwan	170,000.00
Sponsorship	12000.00
APAARI and Partner Contribution	70,000.00
Balance Forward	50702.08
<b>Total</b>	<b>302,702.00</b>
<b>Payments</b>	
Salary costs	120,000.00
<b>Other direct costs</b>	
Meetings/Trainings/Workshop	60,000.00
Consultancy	35000.00
Telephone	500.00
General communication	500.00
Travel	25,000.00
Computer Hardware and Software	3000.00
Courier	3000.00
Hospitality	2000.00
Publications	20,000.00
Miscellaneous Charges	3000.00
Facilities from Secretariat	30,000.00
<b>Total</b>	<b>302000.00</b>
<b>Balance</b>	<b>702.00</b>