

# International Research Strategies

Targeting International Research Reflecting Recent Changes  
Surrounding Agriculture, Forestry and Fisheries



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**Agriculture, Forestry and Fisheries Research Council**  
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**MAFF**  
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# I. Introduction

In September 2003, the Agriculture, Forestry and Fisheries Research Council formulated the “Guidelines for Promoting International Agricultural Research: Japan’s Challenge for Solving Food and Environmental Issues” (hereinafter referred to as the “Guidelines”) for international research activities. This policy clearly showed Japan’s basic views to the promotion of international research activities.

Under the “Basic Plan for Agriculture, Forestry and Fisheries Research,” which was devised in 2005, the emphasis was put on “the development of sustainable production technologies in an unstable environment” in international research and development for technologies on agriculture, forestry, and fisheries. In 2007, the idea of “Promotion of Science and Technology Diplomacy” was advocated in the Council for Science and Technology Policy. It calls for addressing the enhancement of cooperation in science and technology in Africa and other developing countries, and disseminating information of Japan’s outstanding environmental technology to the world. Furthermore, “Innovation 25”, long-term strategic guidelines adopted by the Cabinet council, calls for Japan’s international contributions on food, the environment and other issues.

Under the development of these policies and large changes in the worldwide situations in agriculture, forestry, and fisheries, such as changes in the recent global food situation and emerging global warming, it is urgently required to step up technical cooperation and support for research and development to enhance agricultural productivities and expand production itself to ensure food security and reduce poverty. For Japan, which relies on imports for 60% of its food supplies, it is important to contribute to the stability of worldwide food supply and demand now and in the future through technical cooperation in the agriculture, forestry, and fisheries industry and rural areas in developing countries.

Based on the background of the recent situation above, the Agriculture, Forestry and Fisheries Research Council has decided to formulate “International Research Strategies” in addition to the present “Guidelines.” The strategies, firstly clarify recent movements surrounding international research and then present important research topics to be tackled with and cross cutting policies for promoting international research, mainly for those developing countries that are important to Japan’s international research.

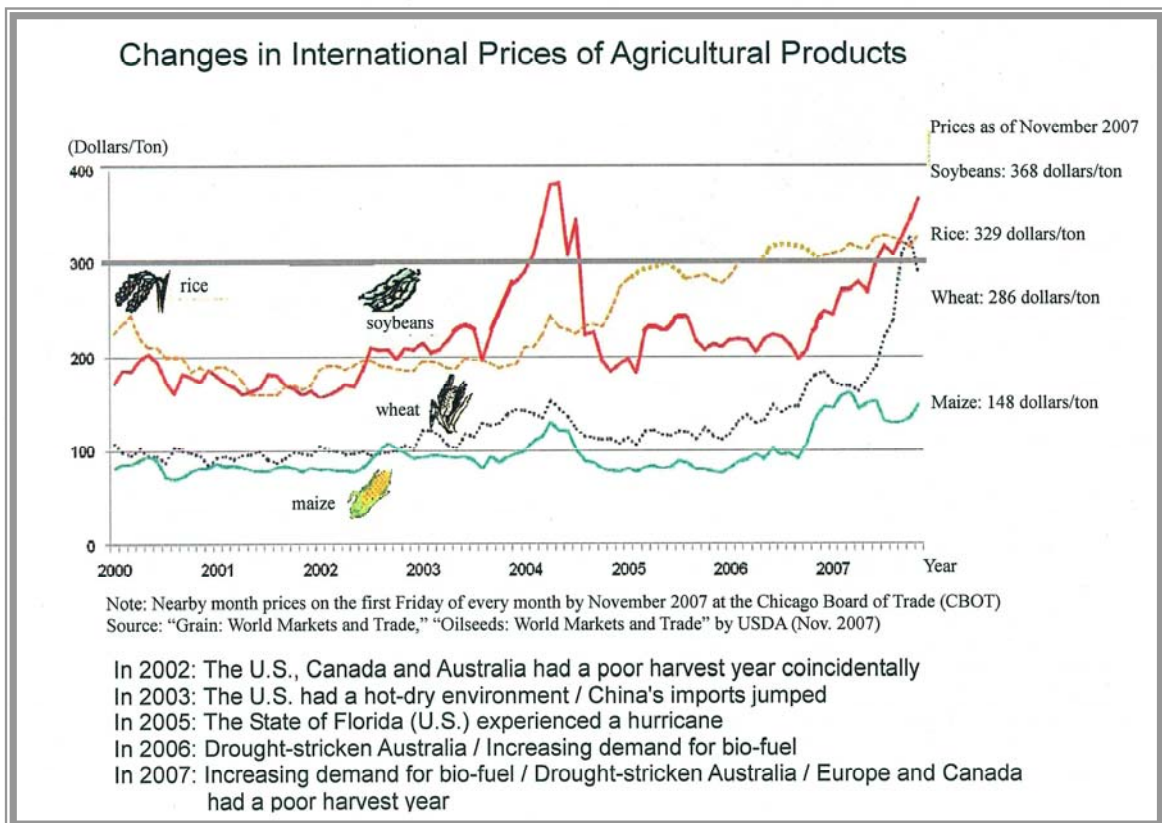




## II. Recent Movements Surrounding International Research

### *1. Changes in Global Food Supplies and their Impact on Japan*

Since the food crisis in the early 1970s, the global food supply and demand has relaxed. In recent years, however, international prices of grain and other farm products have increased sharply against the background of greater demand for feed grains as increasing population and economic growth of developing countries with large population such as China and India and of the conflicts between foods and bio-fuels.



Moreover, in the situation where investment fund is flowing in agricultural markets, financial markets influence grain markets, and international food prices tend to fluctuate rapidly. This situation threatens food security in those developing countries

heavily relying their foods on international food markets.

As Japan relies 60% of its foods on imported foods, it is susceptible to the global supply/demand situation of grain and other agricultural products. In addition, there arouse public concerns about the safety of imported food. In this context, Japan is under growing pressure to contribute to research on ways to increase and stabilize food production in developing countries and thus secure safety.

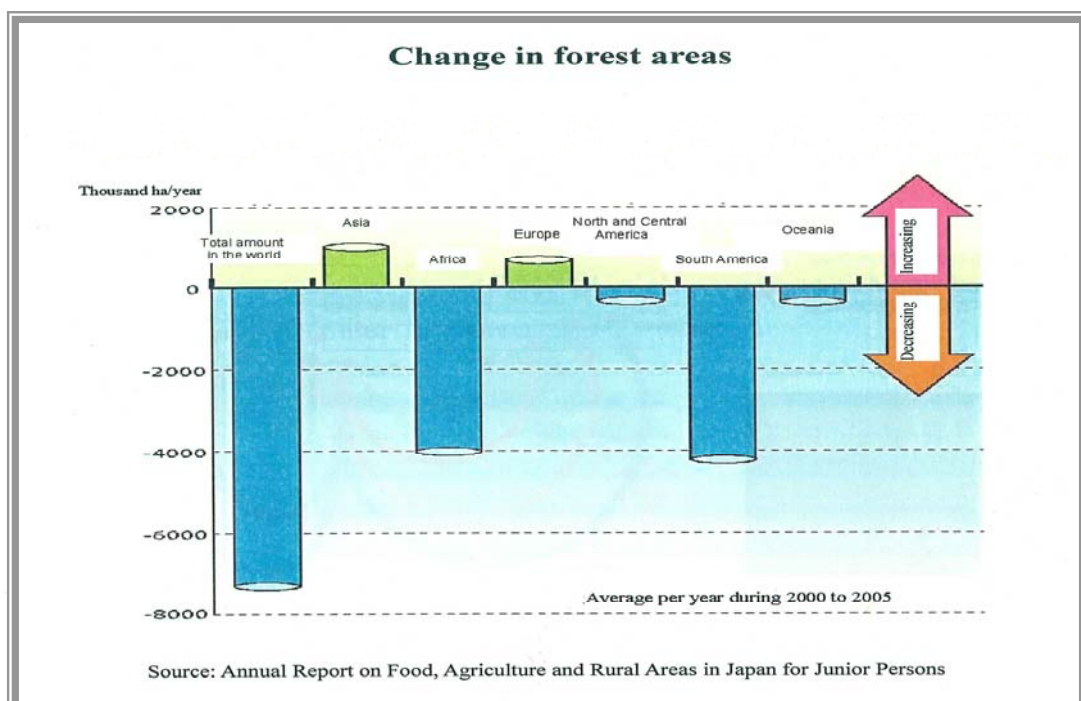
## 2. Emerging Global Warming



The 4th Report of the Intergovernmental Panel on Climate Change (IPCC) recently published concludes that an increase in greenhouse gases stemming from human activities will be the cause of global warming. The average world temperature has risen by 0.74°C over the past 100 years. Assuming a high growth society, the global temperature is estimated to rise by 2.4°C–6.4°C by the end of the 21st century. In the face of an ongoing

increase in global temperatures, many places in the world are already influenced on the climate and natural environment. It also predicts serious impacts on agricultural production.

Reflecting the situation surrounding global warming, focus is being placed not only on measures for “mitigation”, such as activities for reducing greenhouse gases (GHGs) emissions and promoting absorbing sources of GHGs, but also on measures for “adaptation.” In particular, developing countries are fragile to climatic changes, since their infrastructures are not well developed. Therefore, international joint research is highly expected as solutions for the problems related to global warming in these countries.



Forests and farmland have functions to absorb and store atmospheric CO<sub>2</sub>, a major cause of global warming, into themselves. They thus play important roles in preventing global warming. From 2000 to 2005, the world's forests, however, suffered a net loss of 7.3 million hectares on average per year, which is equivalent to 20% of Japan's land. This reduction may further aggravate global warming and other environmental problems.

Actions to combat global warming by controlling deforestation in developing countries are drawn worldwide attention. In order to realize this, discussion among countries has set out concerning technical and methodological approaches.

### ***3. Expanding International Cooperation to Secure Safety and Protect Lives***

In Japan and other developed countries, public concerns are growing about food quality and safety, as well as supplying food in quantity. On the other hand, there are many developing countries to be obliged to produce agricultural products, still focusing on the quantity. Like this, stemming from differences of economic, social



and food situations, there exists a wide gap among countries in addressing to secure food safety. In addition, there are outbreaks of BSE and avian influenza. In accelerating international transportation of human and goods, including food, anxieties are spread over the safety of imported food and the entry of zoonosis.

Responding quickly and adequately to these concerns, it is important to enhance quarantine and epidemic prevention schemes, based on latest scientific knowledge and by collecting overseas information. It is also necessary to tackle with these issues in a series of processes, from production to processing, distribution and consumption, through international cooperation and information exchange.

### ***4. Practical Use of Genetically Modified Technologies and the Expansion of Their Applicability***

Currently, genetically modified (GM) crops are grown in 23 countries, with the expansion of their cultivation areas to over 100 million hectares, more than 20 times Japan's cultivated land. Recently, the areas of GM crops have expanded noticeably in some developing countries as well.

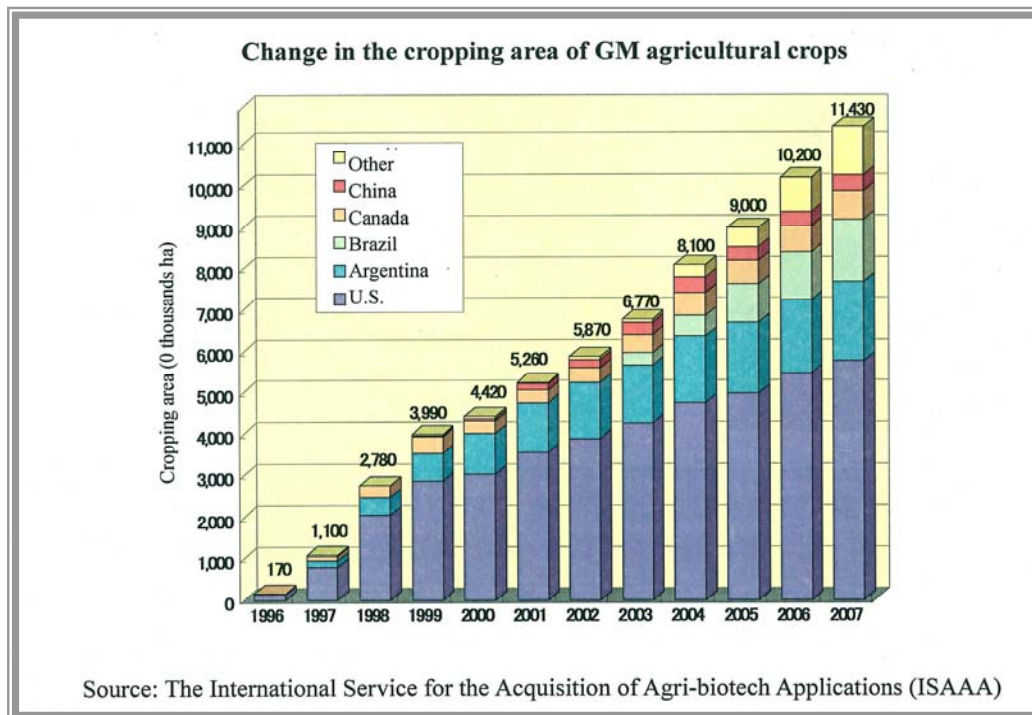
As described in the final report of "Conference on the Advancement of R&D for GM Crops" (adopted by the Agriculture, Forestry and Fisheries Research Council on January 15, 2008), most of GM crops cultivated in the world are concentrated in four field crops, i.e. maize, soy bean, rapeseed, and cotton, introduced some particular genes. They have new traits which could not be obtained in conventional technologies, such as herbicide tolerance and insect resistant, which bring benefit for



farmers through enhancing their productivities and profitability.

Several countries have started to develop more consumer-oriented GM crops, such as those with enhanced functional components (e.g. health-promoting effects).

As mentioned above, the use of GM technologies as a method for plant breeding has been utilized rapidly in the world's major agricultural countries since GM crops were commercialized in the past 10 years or so. The technologies are expected to contribute to development of epoch-making crops, including abiotic stress-tolerant crops that can survive environmental changes such as global warming, drought and cool weather.



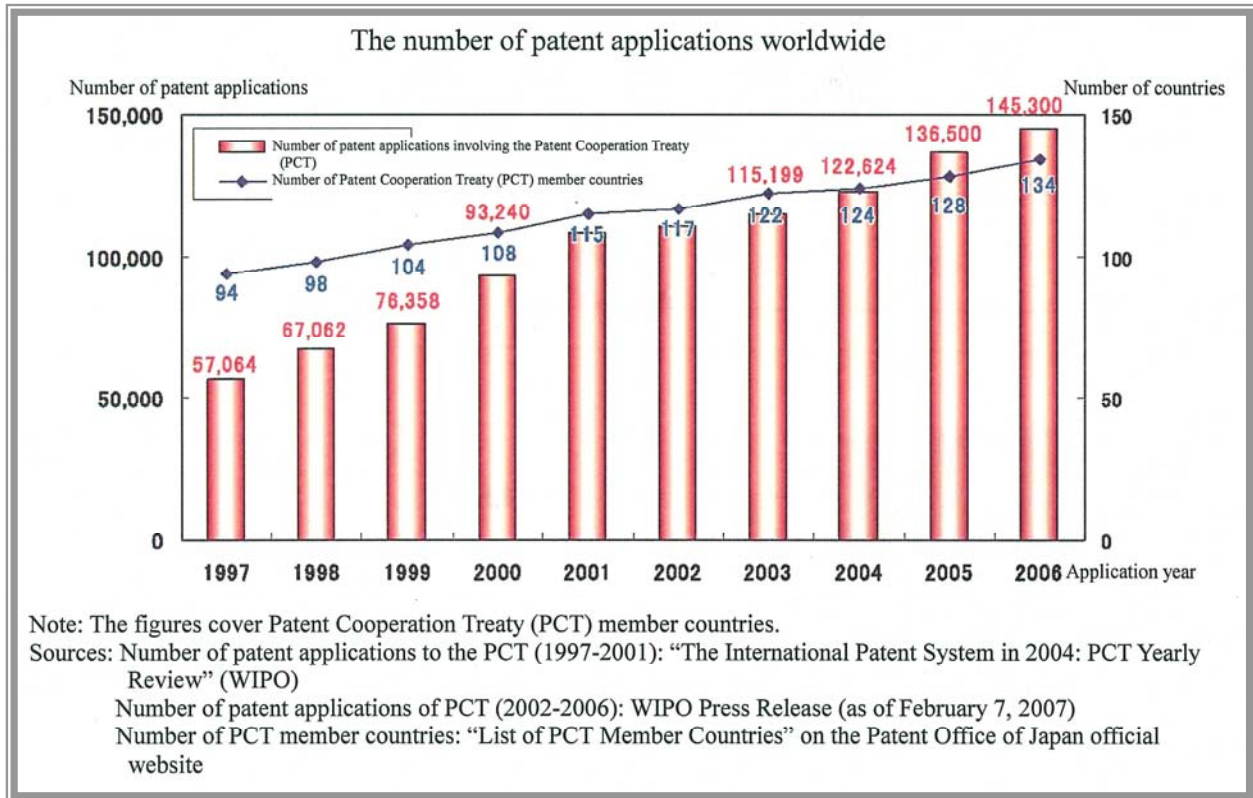
## 5. Growing Importance of Intellectual Property (IP) Rights and Genetic Resources

In 2002, Japan put forward “the IP-based nation”, an idea for creating, protecting and utilizing intellectual property as part of a national strategy (the “Intellectual Property Basic Act,” enacted on December 4, 2002). Then “Strategies of Assuring Intellectual Property for the Ministry of Agriculture, Forestry and Fisheries” was formulated on March 22, 2007. Through these actions, Japan is putting more emphasis on intellectual property.

With the growing awareness of intellectual property in the world, patent applications are increasing rapidly, in both developed and developing countries. On the other hand, in countries with insufficient protection systems, technology drain and infringements of the rights are frequent problems. Therefore, adequate management of intellectual property rights is required.

Useful genetic resources are essential for the progress of research in the fields of agriculture, forestry and fisheries in the world, and sustainable use of genetic resources under international cooperation is called for. Basic facilities for such sustainable use are, however, not well equipped yet in developing countries.

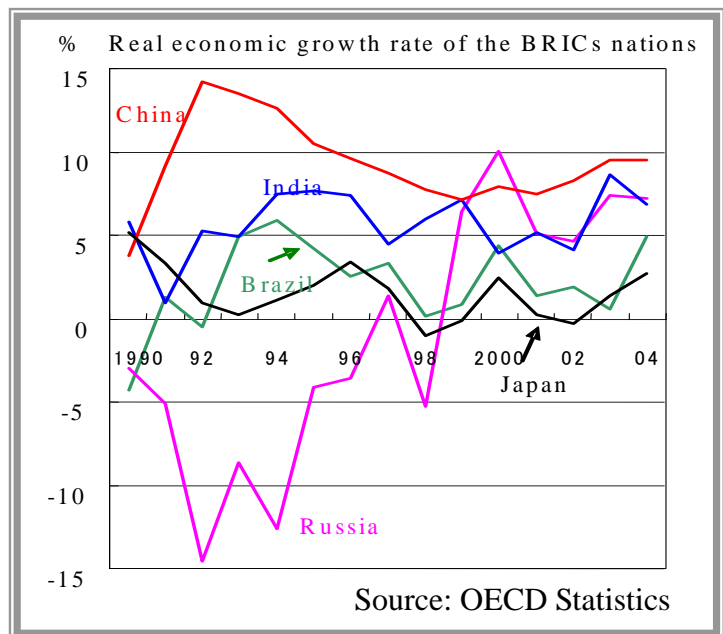




## 6. Economic Growth and Technology Improvement in Some Developing Countries

Recently, some developing countries have achieved significant economic growth. In particular, economic growth is rapid in the so-called BRICs countries—Brazil, Russia, India and China—backed by ample population, accumulated capitals, and improved labor productivities.

Some of these countries used to be recipients of Japan's active technical and economic cooperation. From the viewpoint of efficient and effective international research



cooperation, south-south cooperation of Japan's technologies via these countries help improve the general level of technology for other developing countries. In China and some other countries, research on GM technologies is making steady progress. It is important for these countries to be regarded as possible partners for joint research on advanced technologies.

## ***7. Changes in the Consultative Group on International Agricultural Research (CGIAR)***

The CGIAR is an important entity among international research institutions in the fields of agriculture, forestry and fisheries. It has strengthened the collaboration among its 15 affiliated research institutions and directed strategic and efficient activities with the aim of helping to solve global issues, such as exhausting resources, food shortage caused by increasing world population, and global warming. Recently, it has more focused on poverty reduction in Africa, research on climatic change, and utilization of genetic plant resources collection entrusted to the CGIAR, one of the largest ones in the world.

Japan's contributions to the CGIAR have been on the decline, along with its ODA budget cuts. In FY2007, they fell to about 800 million yen, 20% of the peak figure of 4 billion yen in FY1995.



**CGIAR Annual General Meeting (Beijing, 2007)**



### III. Important Research Topics

#### 1. Africa

Africa is still plagued by poverty in many parts of the continent, with problems such as hunger, epidemics, and civil wars hampering its economic development.

Because of these problems, Africa is the region with a high priority, in attracting much international attention, including Millennium Development Goals (MDGs) for its urgent need to reduce poverty and hunger.

Since many parts of Africa have fragile land and many of the farmers are poor, attempts at rapid technical innovations and economic improvement might not lead to sustainable agricultural production, but lead to destruction of forests and soil erosion. For this reason, utilizing local resources and traditional farming methods in Africa is important, making the best use of Japan's experience in research in Asia.



Recently, the development of NERICA (New Rice for Africa, which is basically upland rice) has promoted rice cultivation. To further expand rice cultivation, it is important to develop varieties that grow in rain-fed paddy and those varieties that are tolerant to drought and submergence.

In Africa, except for some parts of the continent, water is a limiting factor for agricultural production and soil fertility is low. The top priority is, therefore, the development of technologies being able to improve such unfavorable cultivation conditions. Moreover, there is an urgent need to improve the productivity of other important crops in Africa, such as roots and tubers, pulses (cowpeas, etc.) and coarse grains.

In Africa, there is growing movement in forming partnerships among various research institutes, development support groups, NGOs and others. Good examples for these coordinating organizations are the Forum for Agricultural Research in Africa (FARA) and the Alliance for Green Revolution in Africa (AGRA). Attention needs to be drawn to the activities of these organizations, since they play an important role in future agricultural research in Africa.

## Key Priorities for Research

i) Developing rice varieties for rain-fed lowland paddy by improving African rice including NERICA. Developing drought resistant varieties by introducing Dehydration-Responsive Element Binding protein (DREB) genes and using DNA assisted selection marker methods. Establishing cultivation methods on these improved varieties.



ii) Developing technologies for improving unfavorable conditions including those technologies for enhancing soil fertility by using organic resources such as harvest residue and introducing leguminous plants, and for effective use of water resources in lowland paddy.



iii) Improving varieties of crops which are suited to Africa, such as roots and tubers, pulses (e.g. cowpeas) and coarse grains. Developing technologies for efficient propagation of seed and seedlings.



## 2. Asia

Asia is a region with direct influence to Japan, regarding food security, trans-boundary environmental problems and other issues, because of its close relationship in terms of economy and the environment. Accordingly, the region, especially northeast Asia and southeast Asia has a high priority for international research of Japan.

### (1) Northeast Asia

Northeast Asia is a region with growing interest among people in improving the quality and safety of food, reflecting its economic growth and other factors. Moreover,





it could influence over Japan with regard to food safety and environmental problems, because of geographically and economically close relationship with Japan.

With respect to securing a steady supply of safe and high-quality foodstuffs within the region including Japan, an important topic is improving technologies for ensuring food safety and quality. Meanwhile, a highly pathogenic avian influenza virus, which was found in Japan, is highly homologous to the viruses that were found in China, Mongolia and South Korea. Accordingly, Japan must be cautious against the prevalence of influenza virus in the region.

Furthermore, the region, along with its economic development, is confronted with increasing serious environmental problems including water pollution and salinization caused by agricultural chemical and nitrogen fertilizer. Yellow sand blown from Chinese and Mongolian deserts is another environmental issues in the region.

In conclusion, contribution to ensuring food safety and reducing the impact on the environment is important challenges Japan must address for the region.



### Key Priorities for Research

- i) Improving technologies to ensure food safety. Developing technologies that would help reinforce surveillance system to prevent from spreading avian influenza virus and that would contribute to controlling it.
- ii) Clarifying the dynamics of agriculture-related carbon and nitrogen, and developing technologies to alleviate environmental loads such as soil and water pollution. Developing technologies to recover devastated farmland and soil.



## (2) Southeast Asia



In Southeast Asia, while highly profitable agricultural activities are being carried out along with economic growth, there remains traditional farming under rain-fed condition in some areas. This results in economic disparity between the former and the latter areas. Hence, improving food productivities and agricultural incomes in the latter areas remains an essential challenge to be addressed in the region.

In recent years, resource crops and unused biomass resources for bio-fuels (e.g. felled oil palm trunks and wasted cassava pulp) and bioplastics have been drawn attention in Southeast Asia. Thus it is necessary to develop technologies for efficient energy conversion and new crop varieties. Moreover, CO<sub>2</sub> emissions from deforestation in developing countries become global issues. Asia is an expected region with high possibilities of the reduction in CO<sub>2</sub> emissions by controlling over deforestation.

There is a great risk of the outbreak of emerging zoonosis in developing countries, although the real situation about the infection to the people is not clear in these countries. As in the region there is anxiety about expanding infections of avian influenza virus and the outbreak of new strains of influenza virus, protecting against livestock diseases is yet another essential challenge to be addressed.





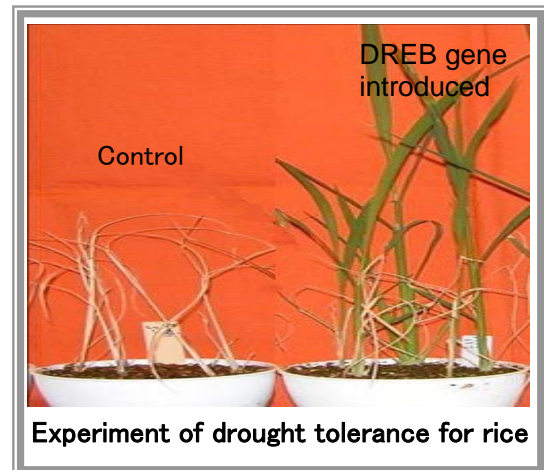
## Key Priorities for Research

- i) Promoting research for enhancing efficiency in water use, such as water-saving cultivation and the evaluation of the function in water collection and distribution by small irrigation facilities.
- ii) Developing high-yielding biomass crops and efficient energy conversion technologies in order to expand the production of bioenergy and biomaterials by utilizing unused local biomass resources, such as felled oil palm trunks and wasted cassava pulp.
- iii) Developing evaluation and forecasting techniques for sustainable agricultural and forestry systems contributing to reductions in greenhouse gas emissions resulting from the depletion and degradation of forests in developing countries.
- iv) Promoting research for sophisticating anti-infection technologies, including those to expedite inspection for avian influenza virus and the development of influenza vaccine for poultry.



### 3. Topics in Response to Global Environmental Changes

Concerning global environmental issues, research should target wider regions than each region mentioned previously. For ensuring developing countries to take part actively in projects toward the reduction in greenhouse gas emissions, it is necessary to promote research and development in collaboration with the CGIAR and other international research organizations.



#### Key Priorities for Research

- i) Developing technologies that could achieve reductions in greenhouse gas emissions from agriculture, forestry and fisheries, and new varieties adaptive to global warming including crops and trees tolerant drought and salinity (e.g. using DREB genes), and establishing cultivation technologies for them.
- ii) Carrying out research on forecasting possible impacts of global warming through continuous monitoring of the depletion and degradation of forests, in order to facilitate anti-global warming measures in developing countries.
- iii) Addressing in infectious diseases, developing a surveillance system and control/preventive technologies in cooperation with international organizations.





## IV. Cross Cutting Policies for Promoting International Research

### 1. Frameworks for Promoting International Research

#### (1) Constructing Networks to Promote Organizational Research

Nationwide cross-organizational networks are useful tools for Japan to take initiatives and to play leading roles in international research, since research activities by each individual researcher and research institution have certain limitations. To this end, the Japan Forum on International Agricultural Research for Sustainable Development (J-FARD)\* is worthwhile being used as a platform among national institutions, universities and private business enterprises, in order to push ahead with international research.

Furthermore, sector-specific international networks, such as the Monsoon Asia Agro-Environmental Research Consortium (MARCO)\*\*, are also effective for building international collaboration among research institutions. These networks could be functional to promote international research.

**\* The Japan Forum on International Agricultural Research for Sustainable Development (J-FARD):**

Established in 2004, as a cross-organization platform dedicated to international research in agriculture, forestry and fisheries. It is composed of researchers from Japanese academic, business, and governmental circles. It is designed to contribute to solving global issues, including sustainable development of developing countries suffering from serious famine, poverty, and environmental problems. The Secretariat is set in the JIRCAS (Japan International Research Center for Agricultural Sciences).

**\*\* The Monsoon Asia Agro-Environmental Research Consortium (MARCO):**

Established in 2006, as an international consortium made up of researchers, engineers and policy makers, with the aim of uniformly promoting agro-environmental research projects in the monsoon Asian region. The Secretariat is set in National Institute for Agro-Environmental Sciences (NIAES).

Besides the above human networks, information networks are also necessary. The International Research Information System (IRIS)\*\*\* has already established as information network. The expansion of its membership, for example, to NGOs and NPOs is important to share relevant information among those involved in international research.

**\*\*\* The International Research Information System (IRIS):**

Created in 2007, as a website to share the information necessary in conducting international research corresponding to international situations, including outcomes of international conferences and international agricultural research. It is managed and operated by the Ministry of Agriculture, Forestry and Fisheries (available only in the Japanese language).

It is also important to promote matching between researchers with experience at overseas research institutions and international research institutions which can accept those researchers. In this context, database containing information about human resources, including their research achievements, areas of interest, and expertise, and the provision of opportunities to researchers to present their studies and wishes are useful to identify and use human resources effectively.

**(2) Multilateral and Bilateral Research Cooperation – Enhancing the Collaboration with the CGIAR**

Japan's international research cooperation can be classified into multilateral ones with international agricultural research institutions, and bilateral ones based on bilateral agreements and other forms of research exchanges. Both forms of research cooperation are essential and should be continued, as both are closely related to each other, like a pair of wheel. Above all, the relationships with the CGIAR, a comprehensive international research institution group in the field of agriculture, forestry and fisheries, must be strengthened. Currently, the CGIAR calls upon Japan to render human and intellectual contributions. Considering that Japan's budget for contributing to the CGIAR tends to decrease along with its



overall ODA budget cut, focus should be shifted from financial support to human and intellectual contributions, such as dispatching and inviting researchers and human resources development. For example, Japan should make efforts in dispatching personnel to the CGIAR Secretariat and related governing councils (e.g. the Scientific Council) and sending researchers to institutions of the CGIAR in a systematic and positive manner.



### (3) Utilization of Japan's National Research Project

In conducting Japan's international research, the system of the "National Research Project", where research is advanced in a comprehensive and systematic manner by combining the efforts of domestic and overseas research human resources, is effectively used to address key priorities for research in line with Japan's national policies. The research topics whose outcomes should be extended worldwide, such as mitigation and adaptation for global warming, and the development of abiotic stress-tolerant crops (e.g. drought resistant crops), should be conducted in the National Research Project.

In addition, extension of technological seeds developed in Japan to overseas can improve the levels of research in Japan. For this reason, the important idea is that any domestic research for Japan could be extended to international research topics, being free from the ideas that domestic research and international research are different from each other.

### (4) Fulfilling the Functions of the Japan International Research Center for Agricultural Sciences (JIRCAS)

The JIRCAS is the only institution in Japan engaged in comprehensive research for developing countries in the fields of agriculture, forestry and fisheries. It also serves as a CGIAR focal point institution in Japan.

The JIRCAS operates programs that dispatch its researchers to overseas for long-term joint research and, to the contrary, that invite overseas researchers to engage in joint research in Japan. In addition, it has started development planning of agricultural and rural communities for developing countries including such topics as preventing desertification. It has been thus equipped with greater experience, know-how and human resources in the field of international research.

It is important for the JIRCAS to set priorities on regions and research topics for further enhancing its functions.



## ***2. Human Resources Development***

Human resources development is an extremely important element, aiming not only at improving the ability of each individual researcher, but also at constructing an important basis on international research toward the next generation.

### (1) Undergraduate and Graduate Students

In order to secure human resources for future international research, it is necessary to arouse interest in international research in the fields of agriculture, forestry and fisheries among undergraduate and graduate students, who will be major players in future.

To this end, it is important to hold seminars for students on world food issues or global environmental problems and to send interested students to international research institutions to give them opportunities for firsthand experience in the field of international research.

### (2) Postdoctoral Researchers

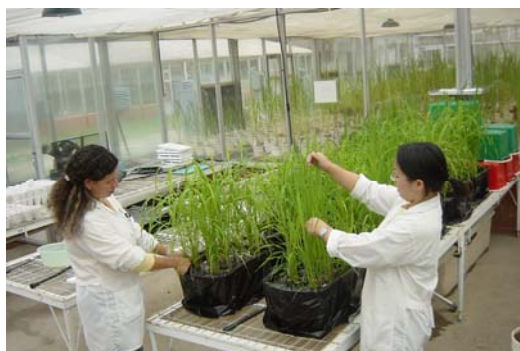
Doctorate degree holders have dramatically increased in number in Japan but personnel numbers at research institutions and universities have been cut, resulting in a number of young researchers who hold doctorate degrees but are unable to find permanent jobs.

The bigger pool of talented human resources engaged in international research is crucial in pushing ahead with international research projects in the future. In this regard, it is important to provide opportunities to these young promising researchers to experience research activities at international research institutions and to acquire advanced research abilities and international perspectives.



### (3) Researchers at Incorporated Administrative Research Agencies

In order to foster Japanese researchers with good international experience, it is effective to reinforce the cooperation between Japan's incorporated administrative research agencies and overseas research institutions. It is important to provide researchers with opportunities to acquire practical experience for future engagement in international research through participation in international academic conferences and symposiums, and visiting and inviting programs.



Personnel exchanges and joint research between the JIRCAS and other incorporated administrative research agencies of Japan will provide a good chance for researchers in the latter to engage in international research.



Few Japanese researchers are well acquainted with Africa because of its geographical distance, historically not close relationships, and unfamiliarity with its cultures. On the other hand, reflecting international attention to Africa, it is an urgent topic to foster Japanese researchers with expertise in the fields of agriculture, forestry and fisheries of Africa. Accordingly, these researchers will be developed through dispatching them to, or joint research with those overseas research institutions with acquainted with Africa.



#### (4) Fostering Supporting Staff

In order to promote international collaboration efficiently, it is essential to develop staff who engage in clerical work and international public information activities.

In addition, because of recent increasing duties that cannot be handled within the Japanese legal system, such as intellectual property rights and transfer of genetic resources, it is important to employ staff accompanied both with expertise on these issues and language proficiency. On that occasion, it is more efficient to employ those with basic knowledge and develop their abilities through trainings. It is necessary to deal systematically with fostering each personnel.

#### (5) Capacity Building and Exchanges of Overseas Researchers



Overseas research partners are essential for future Japan's international research cooperation. For developing countries whose technological capabilities has been improving, research cooperation should be focused on cutting-edge technologies, rather than the traditional forms of research cooperation aimed at technology transfer or capacity building of counterpart researchers. On the other hand, for the least developed

countries like some of African countries, capacity building of research partners of Japanese researchers is still effective.

### ***3. Enhancing Awareness of Intellectual Property Rights***

Reflecting growing international concern over the protection of intellectual property rights and the infringement of these rights in some developing countries, intellectual property rights should be fully taken into consideration in conducting

international joint research.

As for highly valuable research outcomes in particular, it is important that the rights should be secured by international application so as to prevent overseas business operators from free riding. Therefore, at the stage before commencing international joint research, it is essential that each research institution should lay down a definite policy, including how to establish intellectual property rights of research outcomes and how to set conditions in exporting to Japan those products resulted from the research outcomes.

#### ***4. Promoting the Use of Genetic Resources***

In order to facilitate obtaining genetic resources into Japan and developing new varieties, it is necessary to create information networks regarding current status, analysis and utilization on genetic resources in developing countries. To this end, in cooperation with the Food and Agricultural Organization (FAO), information sharing system on genetic resources kept by Asian developing countries must be established.

It is also important to promote the utilization of useful genetic resources by assisting them in establishing technologies for genetic resources conservation, sustainable use of these resources, and activities for diffusion of these technologies.

#### ***5. Dissemination of Outcomes Resulted from Research and Development***

In order to ensure to disseminate outcomes of international research, local administrative agencies and agricultural extension services are essential to be involved. However, these agencies and organizations may sometimes fail to function adequately or they may often be poorly structured in some developing countries. Accordingly, it is important to take into account the following issues in the collaboration with ODA-financed development projects and agricultural extension projects:

- i) the involvement of extension services at the planning stage of the research concerned;
- ii) collaboration between research and development projects; and
- iii) including the joint research project concerned in development plans of the countries where it is conducted.





## V. Conclusion

The International Research Strategies have summarized key priorities for international research that should be addressed in the fields of agriculture, forestry and fisheries with due consideration to turbulent situations in the world. Japan's international contribution should be made successful by ensuring that governmental and university research institutions address the issues incorporated in the strategies.

The world economy and the global environment have been changing ever more rapidly in recent years. The optimum approach to international research will therefore continue to change and those involved in international research must constantly monitor the world's situations and ensure their research meets the current needs.





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The photographs in this booklet are provided by Japanese researchers.