JAICAF-WARDA-JICA Joint Seminar on NERICA Dissemination in Africa 2006

- As a part of the Implementation of Japan's Development Initiative -

December 2006

at GIMPA, Accra, Ghana

Japan International Cooperation Agency (JICA)

PROGRAM

JAICAF-WARDA-JICA JOINT SEMINAR ON NERICA DISSEMINATION IN AFRICA 2006

—AS A PART OF THE IMPLEMENTATION OF JAPAN'S DEVELOPMENT INITIATIVE—

December 6-8, 2006
at GIMPA (the Ghana Institute of Management and Public Administration), Accra, Ghana

Agenda

Session I: JAICAF-JICA JOINT SEMINAR
<<Sustainable Rice Farming System and Prospects of NERICA Dissemination in Ghana: from the Results of JAICAF-SARI,CRI,GIDA Collaborating Studies 2004-2006 as a part of the implementation of Japan's Development Initiative>>

Wednesday, December 6, 2006

Opening session:

09:00 - 09:10 Welcome Address
- ✧Mr. Masahiro Yoneyama, Director, 2nd Operations Dept., JAICAF

09:10 - 09:30 Keynote Address
- ✧Dr. Gyiele Nurah, Chief Director, Ministry of Food and Agriculture (MOFA)

09:30 - 10:00 General Situation of NERICA Dissemination in Ghana
- ✧Mr. Richard Twumasi-Ankrah, Coordinator, NERICA Dissemination Project, MOFA

10:00 - 10:20 Coffee break

<Co-Chair of the morning session: Dr. Hans Adu-Dapaah, Chief Research Scientist, CRI
Mr. D. L. Lamptey, Chief Executive, GIDA>

10:20 - 11:30 Results of the Study in Southern Ghana
- ✧Mr. Albert Swatson, Ghana Irrigation Development Authority
- ✧Ms. Faustina Annobil, Okyereko, Southern Ghana
- ✧Q & A

11:30 - 13:00 Lunch

<Co-Chair of the afternoon session: Dr. A. B. Salifu, Director, SARI
Mr. Manu Addae, Assistant Director,
Directorate of Crop Services, MOFA>

13:00 - 14:10 Results of the Study in Central Ghana

✧Dr. Kofi Dartey, Crops Research Institute (CRI)
✧Mr. Bari Modibo, Bibiani, Central Ghana
✧Q & A

14:10 - 15:20 Results of the Study in Northern Ghana
✧Dr. Wilson Dogbe, Savanna Agricultural Research Institute (SARI)
✧Mr. Yamali Shaibu, Golinga, Northern Ghana
✧Q & A

15:20 - 15:40 Coffee break (collecting comments and questions from the floor for the general discussion)

15:40 - 16:30 General Discussion
✧Commentators:
Dr. C. Kaneda, JAICAF
Dr. T. Takane, Institute of Development Economies (IDE), Japan
Prof. Chris Gordon, Department of Zoology/Volta Basin Research Project, University of Ghana
✧Panelists:
Dr. Adu-Dapaah, Mr. Lamptey, Dr. Dogbe, Dr. Dartey, Mr. Swatson

Session II: JICA-WARDA JOINT SEMINAR
(I) Result of NERICA experiments and plan for NERICA dissemination

Thursday, December 7, 2006

<Co-Chair of the morning session: Mr. Mitsutaka UCHIJIMA, JICA HQ >

09:00 - 09:15 Keynote Address
✧Mr. Makoto KITANAKA
Group Director of Africa, Rural Development Department, JICA Headquarters

09:15 - 09:30 Keynote Address
✧Dr. Inussa AKINTAYO
Coordinator of Africa Rice Initiative, WARDA Headquarters

09:30 - 09:50 Coffee break

Country Report Presentation (Part 1)

09:50 - 10:10 Country A (BENIN)
✧Mr. Cyriaque AKAKPO
Rice Program, Ministry of Agriculture, Animal Industry and Fisheries

10:10 - 10:30 Country B (BURKINA FASO)
✧Dr. Youssouf DEMBELE, Chef du Programme Riz, Institut de l'Environnement et Recherches Agricoles (INERA)

10:30 - 10:50 Country C (GAMBIA)
✧Mr. Ansumana GIBBA,

National Agricultural Research Institute (NARI)

10:50 - 11:10 Country D (KENYA)
✧ Mr. Washington KOUKO
Director, Kenya Agriculture Research Institute (KARI-Mwea)

11:10 - 11:30 Country E (MALAWI)
✧ Mr. Wiseman Anyelwiska KANYIKA
Assistant Chief, Lifuwu Rice Research Station

11:30 - 12:00 Question/Answer

12:00 - 13:20 Lunch

<Co-Chair of the afternoon session: Dr. Inussa AKINTAYO, WARDA HQ>

13:20 - 14:00 Seed multiplication on NERICA
✧ Dr. Ryoichi IKEDA, WARDA, Benin

14:00 - 14:40 The African Rice Initiative and NERICA Dissemination
✧ Dr. Yoshimi SOKEI, WARDA, Benin

14:40 - 15:00 Coffee Break

Country Report Presentation (Part 2)

15:00 – 15:20 Country F (GUINEA)
✧ Mr. Aly CONDE
Director General, Service National de la Promotion Rurale et de la Vulgarisation (SNPRV)

15:20 - 15:40 Country G (MADAGASCAR)
✧ Mr. Pierre Randrianarivony RASOLOFO
FOFIFA (Centre National de la Recherche Appliquee au Developpement Rural)

15:40 - 16:00 Country H (MALI)
✧ Dr. Yacouba DOUMBIA
ARI Coordinator, Institut D'Economie Rurale (IER)

16:00 - 16:20 Country I (SIERRA LEONE)
✧ Mr. Mohamed S. Mansaray
Chief, Seed Technology Programme, Rice Research Station, Rokupr

16:20 - 16:40 Country J (NIGERIA)
✧ Mr. Issc Enaifoghe ILEVBAOJE
Federal Agricultural Coordination Unit
✧ Mr. Mark Nwoye UKWUNGWU
National Cereals Research Institute

16:40 - 17:00 Question/Answer

Friday, December 8, 2006

<Co-Chair of the morning session: Dr. Ryoichi IKEDA, WARDA HQ>

09:00 - 09:40 Experimental method and cultural management of NERICA
✧ Mr. Tatsushi TSUBOI, NAARI, Uganda

Country Report Presentation (Part 3)

09:40 - 10:00 Coffee Break

10:00 - 10:20 Country K (SENEGAL)
✧ Dr. Karim Traore, WARDA (Saint Louis)
10:20 - 10:40 Country L (TANZANIA)
✧ Dr. Jeremiah HAKI
Director of Research and Training, Ministry of Agriculture Food Security and Cooperatives
10:40 - 11:00 Country M (UGANDA)
✧ Dr. George BIGIRWA
Head, Cereal Programme, Namulonge Agricultural and Animal Research Institute (NAARI)
11:00 - 11:30 Question/Answer
11:30 - 12:00 Discussion on the future dissemination of NERICA

12:00 - 13:30 Lunch

(II) Collaboration with International Organizations for NERICA Dissemination.

<Co-Chair of the afternoon session: Mr. Makoto KITANAKA, JICA HQ>

13:30 - 14:00 WARDA
✧ Dr. Inussa AKINTAYO, Coordinator, Africa Rice Initiative
14:00 - 14:30 International Organization A (FARA)
✧ Mrs. Boipelo FREUDE
Associate Resource Person-Research, Forum For Agricultural Research in Africa (FARA)
14:30 - 15:00 International Organization B (FAO)
✧ Dr. Brahim Kebe
Crop Production and Protection Officer, FAO Sub-Regional Office for West Africa, Ghana

15:00 - 15:20 Coffee Break

15:20 - 16:00 Discussion
16:00 - 16:30 Seminar Wrap Up
✧ Mr. Tatsushi TSUBOI, NAARI, Uganda
16:30 - 16:45 Closing
✧ Dr. Lawrence NARTEH, WARDA HQ

18:30 - Reception Dinner @ Shangri-la Hotel

KEYNOTE ADDRESS (JICA)

JAICAF-WARDA-JICA
Joint Seminar on NERICA Dissemination in Africa 2006
—As a part of the Implementation of Japan's Development Initiative—Opening Address from JICA
(6 December, 2006, Accra)

Makoto KITANAKA
JICA

1. On behalf of JICA, I would like to express my sincere gratitude to you all for attending this seminar.

2. This is our 4th seminar followed by the last seminar of last December in Kenya and Uganda. I am very much pleased to have such many participants again from 14 different countries considering NERICA dissemination. And I am very happy to hold this seminar as a joint styled with WARDA and JAICAF.

3. To open the 4th seminar, I would like to review the main outcomes of the last seminar. There are 3 main outcomes:

(1) The network for NERICA development and dissemination in the region was strengthened.
Ongoing efforts for NERICA research and dissemination in the region were realized through a strengthened network of stakeholders. The current state of NERICA-related research and development, as well as the dissemination of particular rice varieties, differs from country to country. While Africa needs a greater diversity of food resources in order to challenge persistent poverty and food insecurity, the sharing of information and the strengthening of stakeholders networks are critically important.

(2) Present status and research situation of NERICA and their direction were shared.
Each country developed and submitted an Action Plan for NERICA-related activities. These were presented at the seminar and shared by the participants.

(3) The standardization of field trials and seed multiplication for NERICA were identified as the current and future priority areas for NERICA's development in Africa and for JICA's technical cooperation.
JICA reaffirmed that it is committed to NERICA development and dissemination through support for various stakeholders in the region. JICA has dispatched three experts. Mr. Tsuboi was dispatched to Uganda, and Dr. Ikeda and Dr. Sokei were dispatched to WARDA to expand our technical cooperation.

5. Now, I would like to briefly review the JICA's intervention to NERICA dissemination in Africa.
(1) At the 2002 World Summit on Sustainable Development (WSSD) in Johanesberg and again at the 2003 Third Tokyo International Conference on African Development (TICAD III), Japan has committed itself to promoting dissemination of the New Rice for Africa (NERICA) developed by the West Africa Rice Development Association (WARDA). And Japan hosted the International Symposium to Celebrate the International Year of Rice in January and the World Rice Research Conference in Tokyo in 2004 when the United Nations declared 2004 the International Year of Rice.

(2) JICA dispatched the first NERICA expert, Mr. TSUBOI, to Uganda in 2003 followed by the dispatch of 2 experts to WARDA in 2004. Besides of these dispatches, JICA's agriculture projects located in different African countries also implemented NERICA trials. Aside from the overseas activities, we have newly commenced 3 months training program of upland rice in Japan this year. And we received 10 participants from different countries.

(3) This seminar is a important part of our intervention for NERICA dissemination. We recognized that sharing of information is very much important to understand and disseminate NERICA.

6. After the last three seminars held in Nairobi, we decided to organize this seminar in Accra with the

participants from Western and Eastern Africa. I would like to express my sincere gratitude to authorities of Ghana who helped us to organize this seminar, and the participants who made the best effort to make this opportunity fruitful.

7. I think that we are getting into the next step regarding the NERICA dissemination. NERICA is becoming popular among not only African farmers but in the world. We can observe many advanced examples of NERICA dissemination in Uganda and other areas. Famous English magazine TIME reported NERICA in last September.
Since NERICA can not be broadcasted automatically, I think there was many efforts made by the international organizations, NGOs like SG2000 and the governments of recipient countries.
I would like to say that NERICA is waiting for the next step, that is a wider extension to farmers.

8. As NERICA person, we have to consider the future NERICA for African development in terms of agriculture and food security. Each NERICA person such as government authorities, international organizations and NGOs should be ready for next action for NERICA dissemination. On behalf of JICA, I would like to make this seminar an opportunity to exchange ideas to get into the next step of NERICA dissemination. This is the objective of this seminar.

9. When we turn to the state of global supply and demand for rice, or when we consider the consumption of rice in sub-Saharan Africa, NERICA could be an answer to overcome these constrains.
In this way, we strongly hope that progress can be made toward achieving the seminar's objectives.
Thank you very much indeed for your presence here today.

KEYNOTE ADDRESS (WARDA)

Speech by Director General of WARDA, Dr Papa Abdoulaye Seck
at the Joint JICA-WARDA Seminar on the Promotion and dissemination of NERICA in Africa.

Held at the Ghana Institute of Management and Public Administration (GIMPA), Greenhill, Achimota. 6 December 2006

- Hon Minister of Food and Agriculture
- Representative of JICA, Tokyo, Japan
- Regional Director of JICA, Accra, Ghana
- Representative of JAICAF, Japan
- Representative of Institute of Dev Economics (IDE) Japan
- Directors of National Research Institutes and Programs from all over Africa
- National and International Scientists
- Ladies and Gentlemen of the Media and all assembled:

a.

It gives me great pleasure to address this keynote at this very important conference, the Director General of WARDA, a position I have assumed since October 2006. I wish to acknowledge the earlier contributions of my predecessor, Dr. Kanayo Nwanze under whose leadership we have dutifully carried out the dissemination of information on the New Rice for Africa (the NERICAs).

I am aware that JICA has held seminars on the promotion and dissemination of NERICAs in February 2004, February 2005 and December 2005 to:

- To share technical information on NERICA
- To exchange views on the direction of NERICA experiments and dissemination activities, and,
- To assist participating countries in establishing their action plans for experimental activities and dissemination of NERICAs

Mr Chairman, Hon Minister, ladies and gentlemen, I that, the historic partnership between Japan and WARDA is an important initiative that is contributing to the achievement of the Millennium Development Goals in SSA. Spanning over more than a quarter century, the Japan-WARDA partnership has paid rich dividends, adding value to WARDA's Africa-specific research products, such as the New Rice for Africa (NERICA), and helping disseminate them across the continent.

We also know that Rice is the most rapidly growing food source in Africa, where it is grown and consumed in about 40 countries in the continent. Rice availability and prices have become a major determinant of the welfare of the poorest segments of consumers. The demand for rice in West Africa is growing at the rate of about 6% per year, faster than anywhere else in the world. Since the 1960s, rice imports in the sub-region have increased eight-fold to 4 million tons per year, at an annual cost of more than US$1 billion.

In the development of NERICAs, WARDA scientists first focused their attention on upland rain fed ecology, because it represents about 40% of the total area under rice cultivation in West Africa and employs about 70% of the region's rice farmers. In the early 1990s, our scientists and partners successfully combined the toughness of *O. glaberrima* with the productivity of *O. sativa*. The fruit of this effort was NERICA which is now a flagship and hope for millions. For this pioneering work, Dr Monty Jones was selected as the co-laureate of the 2004 World

The development of upland NERICA involved the sustained support of the CGIAR and the participation of WARDA member countries, IRRI, CIAT, YAAS, University of Tokyo, JIRCAS, CIRAD and Cornell University.

The fine-tuning of upland NERICAs was carried out as part of the Inter-specific Hybridization Project (IHP), which was initiated in 1997 under the aegis of the Japan/ UNDP, Rockefeller and Gatsby Foundations, and DFID. IHP, coordinated by WARDA, is now in its Third Phase with continuous support from the Government of Japan.

As you probably aware, originally, seven upland NERICA varieties were named in 2000. In early 2005, based on their excellent performance and high popularity among farmers, 11 more upland NERICA varieties were named, bringing the total number of upland NERICA varieties characterized and named by WARDA to 18.

The NERICA name was coined in 2001 and trademarked by WARDA in 2004. Today, upland NERICAs are planted on more than 160,000 ha across Africa, including about 75,000 ha in Guinea, 60,000 ha in Nigeria and more than 20,000 ha in Uganda. By the end of this week, I believe we can get more up-to-date data on the scale of NERICA cultivation on the continent.

NERICA has been identified by NEPAD as one of Africa's 'best practices worth scaling up'. NERICA emerged as a byword for successful Asia-Africa cooperation and received high tributes from world leaders at TICAD III in September 2003.

It is well known that there is a long time lag between variety development, release and adoption. In Cote d'Ivoire, varieties introduced by the national program in 1973 began to have impact after more than 25 years. The first NERICA varieties were officially released in 1998, so should we expect them to have much impact so soon?

Yet our surveys show quite good results. WARDA economists have found that about 38% of farmers in the study area who had been exposed to NERICAs had adopted them by 2000. They project that NERICA adoption would raise rapidly from the 2000 level, reaching 68% by 2006. This suggested a huge potential impact for any large-scale NERICA dissemination project as we currently have.

I am informed that in 1997, a pilot NERICA dissemination model was initiated in Guinea to transfer NERICAs to farmers using PVS and CBSS with support from the World Bank and SPAAR. Later, this activity was expanded with support from Japan, UNDP, and SG 2000. Within 5 years, NERICA farmers in Guinea were grossing $65 per ha with minimum input and up to $145 per ha with a moderate level of input. In 2003, the country saved over $13 million in rice imports (check on figures and sources?).

Building on the Guinea success, WARDA launched the African Rice Initiative (ARI) in 2002 to serve as a coordinated channel for all NERICA dissemination efforts across SSA. ARI is now coordinating the $35 million African Development Bank (AfDB)-funded project to support NERICA dissemination in seven West African countries over 5 years. The project took off in May 2005.

Mr. Chairman, Hon Minister, members of the Diplomatic corps, ladies and gentlemen, let me turn my attention briefly to other Japan-WARDA partnership success that we are all proud about.

Over the years, Japan has provided both financial and technical support directly or through UNDP/TCDC. Core funding is channeled through the Ministry of Foreign Affairs (MOFA), while experts and visiting scientists are provided by JIRCAS and JICA. In recent years, the share of funding from Japan is about 20% of WARDA's total budget

JICA sent post-harvest processing and grain quality experts almost continuously from 1978 until 2000 to WARDA. About 250 national scientists and extension agents in SSA were trained in rice post-harvest technology and grain quality between 1980 and 1989. JICA helped establish the Grain Quality Laboratory at WARDA headquarters in Côte d'Ivoire.

Several Japanese experts have been involved in the IHP work. There have also been several Japanese researchers from outside WARDA who have collaborated with IHP, including Dr R. Ishii, former WARDA Board Member.

Continuing Japan's support to NERICA research and dissemination, R. Ikeda, Plant Breeder, and Y. Sokei, Agronomist, from JICA joined the African Rice Initiative (ARI) in 2004. Japan's collaboration with WARDA has been advanced by the Japanese members of the WARDA Board of Trustees: T. Takeda, Professor

Emeritus of Kyushu University; R. Ishii, Professor of University of Tokyo and T. Horie, Professor of Kyoto University. We expect more fruitful collaboration in the years ahead and particularly during the period of my tenure as the Director General of WARDA.

Let me suggest possible areas:
WARDA's partnership-based research has also led to several technologies other than upland NERICA, which are also benefiting many poor rice farmers and consumers in SSA. These include:

1. Lowland NERICA varieties with yield potential of 6-7 t per ha and good resistance to major lowland stresses: Another scientific breakthrough achieved in partnership with NARS through the ROCARIZ network, which is expected to make an even bigger impact than the upland NERICA. More than 60 lowland NERICA varieties have been selected by farmers and NARS scientists. Four varieties were released in Burkina Faso and two in Mali in early 2005. There are new inter-specific progenies (NERICAs) for irrigated paddies which are being tested currently by ROCARIZ.

2. For the irrigated systems, WARDA has developed improved varieties, integrated package and the ASI thresher. In 2003, the Center received the Senegalese President's Award for Science and Technology for ASI development and dissemination. About 500 ASI are being used today in W Africa, making it one of the most widely adopted rice threshers in the sub-region. We may wish to evaluate the scaling up direction of these technologies.

3. WARDA and its partners have developed a comprehensive policy strategy to revive the rice sector in Nigeria. International and national experts in rice policy research in West Africa led by WARDA have recently developed a common strategy to improve the impact of policy research and institutional arrangements on the competitiveness of the rice sector in the region.

Let me conclude by noting that:
Africa's economic renewal and sustainable development will not be achieved without effective investment in science and technology. And, SSA should not remain just a client of technology; it must take an active part in it, both as an innovator and as a user, so that it can achieve the Millennium Development Goals and usher in "the Doubly Green Revolution". This calls for a long and sustained effort in capacity building, human resource development and the necessary infrastructures to retain scientific competences in the region.

Mr. Chairman, Honorable Minister of Food and Agriculture, ladies and gentlemen, with these words, I wish successful deliberations and a fruitful conference to all participants. Long live Japan-WARDA collaboration. Long live the NERICAs.

Expert TSUBOI (NAARI, Uganda)

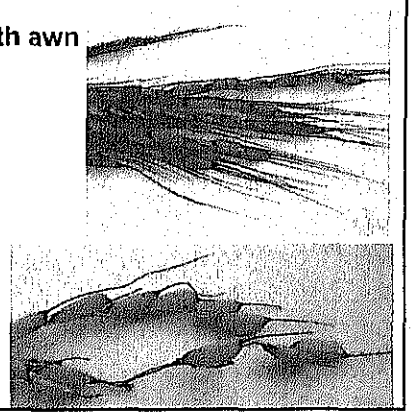
Guide for Upland Rice (NERICA) Experiments

Presented at the JAICAF-WARDA-JICA JOINT SEMINAR ON NERCA DISSEMINATION IN AFRICA
December, 6-8, 2006

By

Tatsushi TSUBOI
JICA Expert on promotion, development and dissemination of NERICA

NERICA 1 with awn



NERICA 10 with awn and without awn (Kenya)

NERICA 10 (Uganda)

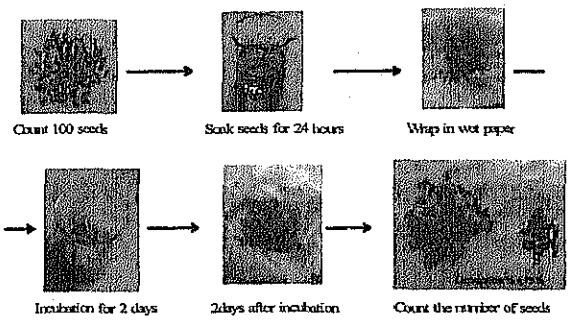
1. Seed requirement

Seed requirement calculation
Example 1: For dibbling
Plot size: 2.1 m x 7 m Plant spacing: 30 x 12.5 cm
7 seeds / hill
7 rows x 56 hills = 392 hills x 7 seeds / hill = 2744 seeds
1000 grains weight = 27.5 g (NERICA 4)
2744 / 1000 x 27.5 = 75.5 g

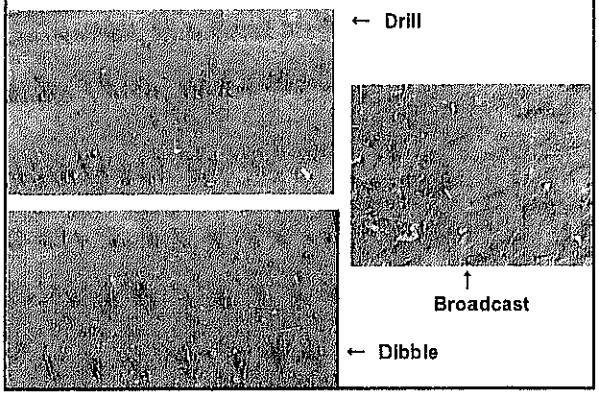
Example 2: For drilling
Plot size: 3 m x 6 m Plant spacing: 25 x 2 cm
200 seeds / m^2
18 m^2 x 200 seeds / m^2 = 3600 seeds / m^2
1000 grains weight = 27.5 g (NERICA 4)
3600 / 1000 x 27.5 = 99 g

2. Germination test

Before sowing, germination test should be done.

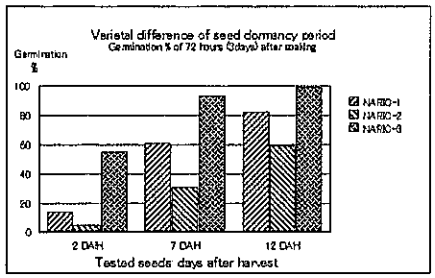


4. Method of planting



3. Seed dormancy

Rice seed has a certain period of dormancy. If you use newly harvested seed, conduct a germination test. If germination is less than 70 % you have to brake the dormancy.



5. Plant spacing and seeding rate

Method	Plant spacing	hills /m²	seed / hill	Seeding rate / ha	Seeding rate /acre
Broadcast	—	200	—	54 kg	21.6 kg
Drill	25 cm x 2 cm	200	1 seed / hill	54 kg	21.6 kg
	30 cm x 1.5 cm	222	1 seed / hill	60 kg	24 kg
Dibble	30 cm x 12.5 cm	26.7	7 seeds / hill	50 kg	20 kg
	25 cm x 12.5 cm	32	7 seeds / hill	60 kg	24 kg
	25 cm x 15 cm	26.7	7 seeds / hill	50 kg	20 kg

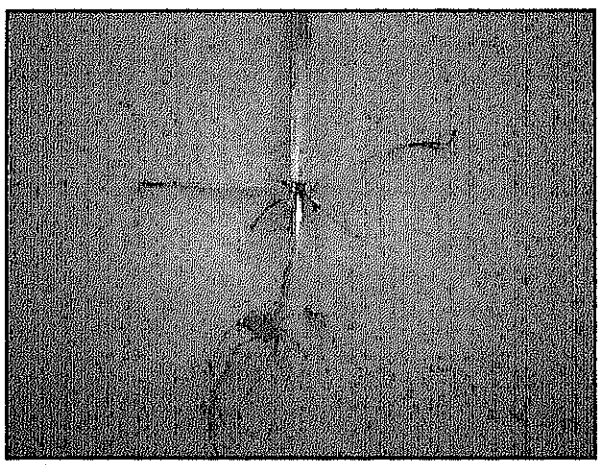
(1000 seeds wt. = 27 g)

Dibble: 20 cm x 20 cm 2-3 seeds / hill = Seeding rate 13.5 – 20 kg / ha ???

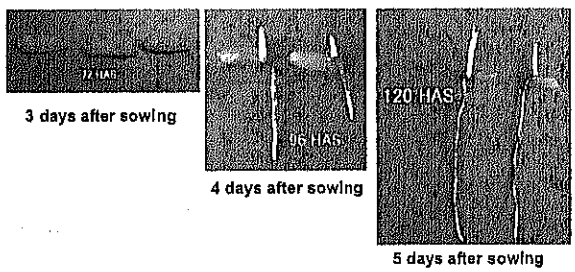
6. Sowing depth

2-3 cm is the optimum sowing depth.
Planting at a depth of more than 4 cm results in low and/or delayed seedling emergence.
If there is not enough rainfall after sowing, shallow planting (less than 1.5 cm) may result in low seedling emergence due to low moisture content of soil surface.

2 weeks after sowing **4 weeks after sowing**



7. Seedling emergence of upland rice



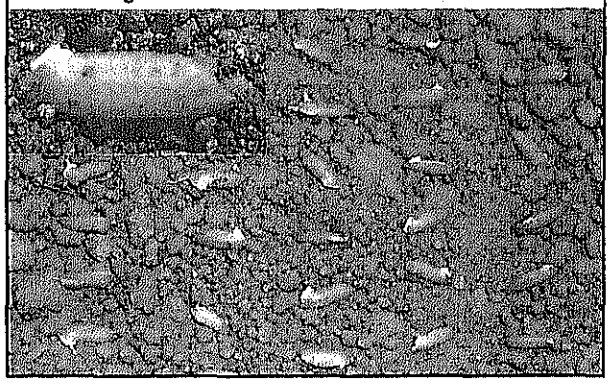
3 days after sowing
4 days after sowing
5 days after sowing

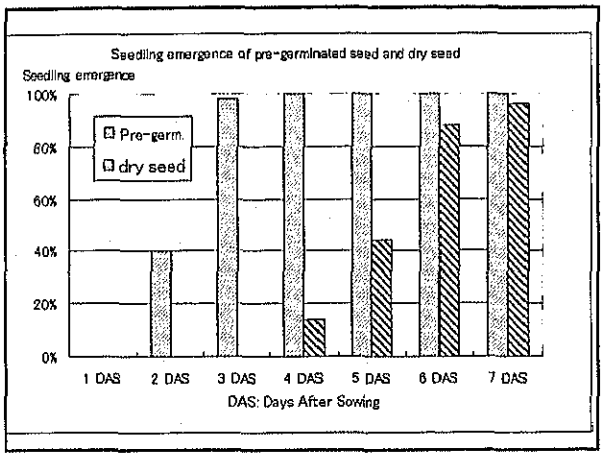
Maturity days of Upland rice =

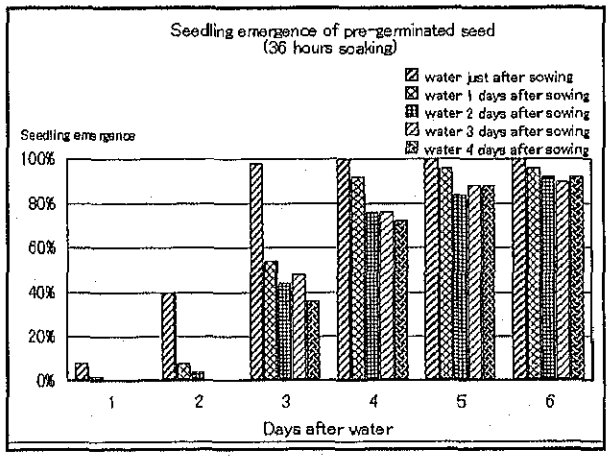
Seedling Emergence
to
50 % heading days + 30 or 35 days

8. Sowing pre-germinated seed

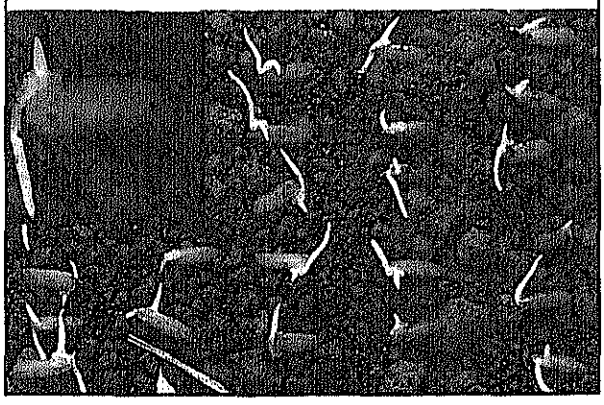
Sowing 36 hours soaked seeds

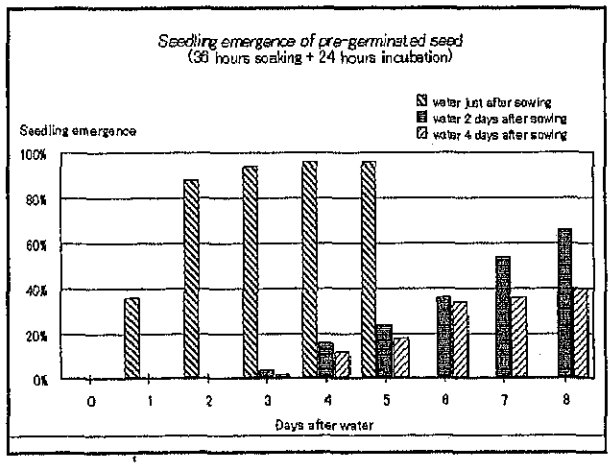




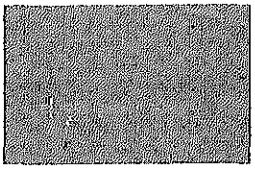


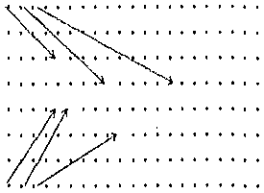
Sowing 36 hours soaked + 24 hours incubated seeds





9. Missing hills management





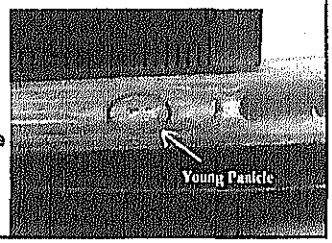
Fertilization

Fertilizer rate: 50-25-25 kg NPK / ha may be recommended.

Basal: Before sowing or 21 days after seedling emergence.
25-25-25 kg NPK / ha

Top dressing: At panicle initiation stage (PI stage).
25 N kg / ha

PI stage



Weeding

At least twice hand weeding are needed.

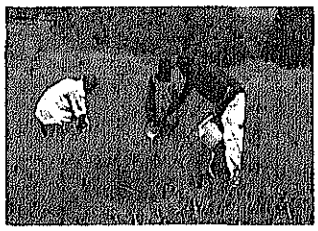
Pay attention to Striga (parasitic weed)

Supplemental irrigation

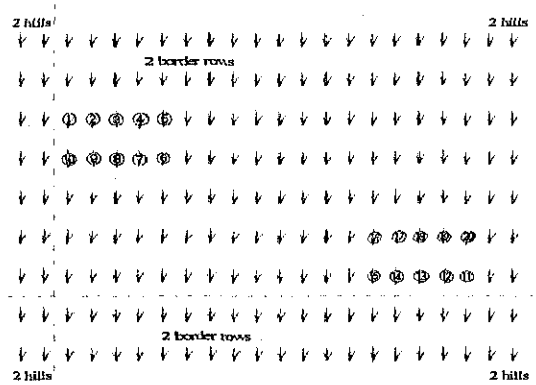
About 10 mm rain equivalent of the water is needed for extremely dry soil.

(1 mm rain = 1 liter water / m²)

Small container should be used for watering.



Sampling method



Heading date survey:

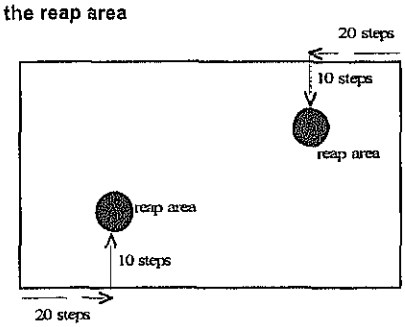
Example of heading date determination

Hill No.	June 4	June 5	June 6	June 7	June 8	June 9	June 10	June 11	June 12	June 13	June 14	June 15	June 16
1	0	0	0	0	2	4	5	7	8	8	9	9	9
2	0	1	3	5	6	7	8	10	12	12	13	13	13
3	0	0	1	3	5	7	8	9	10	10	11	11	11
4	1	2	3	5	7	8	8	11	12	12	12	12	12
5	0	0	1	2	2	4	5	6	7	8	9	9	9
6	0	0	0	2	4	6	6	8	10	11	12	12	12
7	0	1	2	4	5	7	7	9	11	12	12	13	13
8	0	0	0	2	3	5	7	10	12	12	13	13	13
9	0	1	2	1	3	4	6	8	9	11	12	12	12
10	1	1	1	3	4	6	7	8	11	12	13	13	13
11	0	0	11	2	2	4	5	6	7	8	8	8	8
Total	2	6	14	29	43	62	72	92	109	116	124	125	125
%	1.6	4.8	11.2	23.2	34.4	49.6	57.6	73.6	87.2	92.8	99.2	100.0	100.0

10 % heading date: June 6
50 % heading date: June 9
90 % heading date: June 13

Crop Cut Yield Survey

Determine the reap area



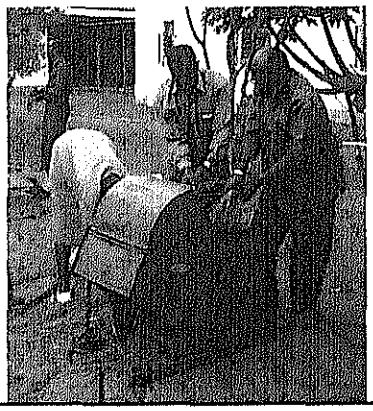
Measure the plant height (20 hills)

Reap 1 or 2 ㎡area

Count the number of hills in the reaped area

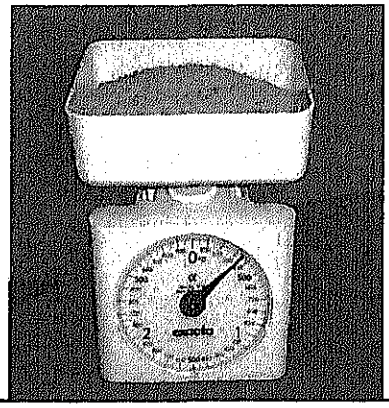
Put reaped rice plants into the sac

Thresh and separate filled and empty grains.

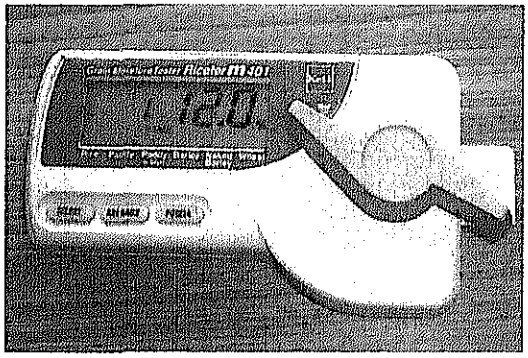


Count the number of panicles.

Weigh the filled grains



Measure moisture content of the filled grains
(Mean of 4 samples)



Calculate the number of panicles / hill and yield.

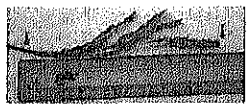
Yield components

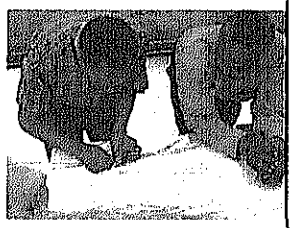
In the field

- Measure the plant height (20 hills)
- Reap 10 ~20 hills for yield components analysis

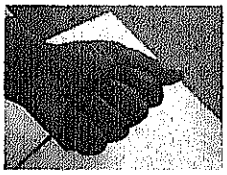
In the laboratory

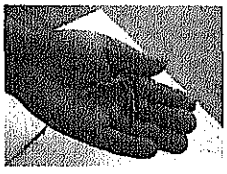
Measure the panicle length
(20 panicles)





Check the shattering habits

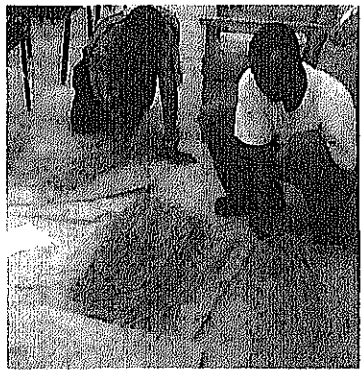




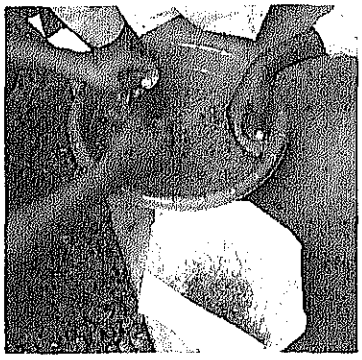
Thresh all the panicles

VD: Less than 9 %
D: 10 – 25 %
E: 26 – 59 %
VE: 60 – 100 %

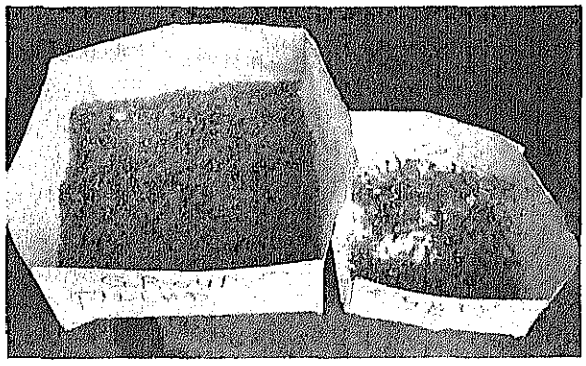
Count the number of panicles



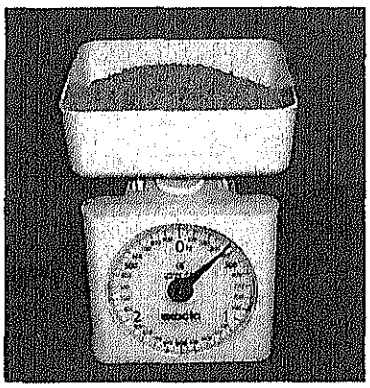
Separate filled and empty grains (put in to water)



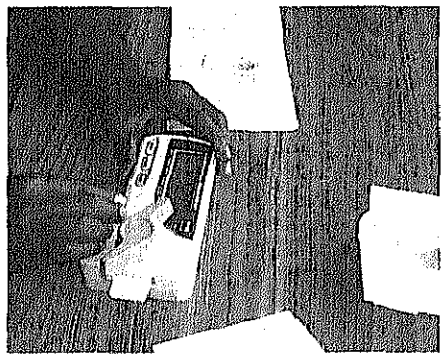
Dry filled and empty grains



Weigh the filled grains and empty grains



Measure the moisture of filled grains
(Mean of 4 samples)



Weigh 5 g filled grains (3 samples)
Weigh 1 g empty grains (3 samples)

Count number of 5 g-filled grains (3 samples)
Count number of 1 g-empty grains (3 samples)

Calculate yield components

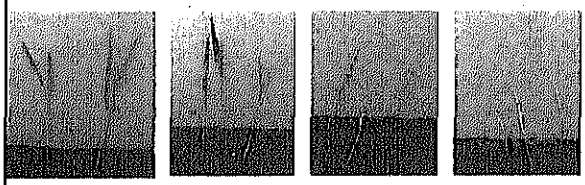
Upland rice were cultivated under paddy condition in the bucket

June 7, 2005 August 20, 2005

Fertilization for bucket:

Basal: 1 g NPK / pot
Top dress: 0.5 g N / pot x 2

Basal: Use 14-14-14 fertilizer 1 g ÷0.14 = 7.1 g
Top dress: Use Urea (46-0-0) 0.5 g ÷0.46 = 1.1 g



No fertilizer 1 g NPK 2 g NPK 3 g NPK

Rainfall and temperature data processing

Dairy rainfall → 5 days rainfall → Moving mean → Graph

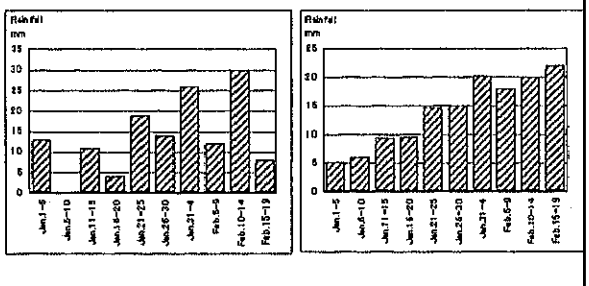
	rainfall mm	5 days rainfall
Jan. 1	4	
Jan. 2	0	
Jan. 3	0	
Jan. 4	6	
Jan. 5	3	13 mm
Jan. 6	0	
Jan. 7	0	
Jan. 8	0	
Jan. 9	0	
Jan.10	0	0 mm

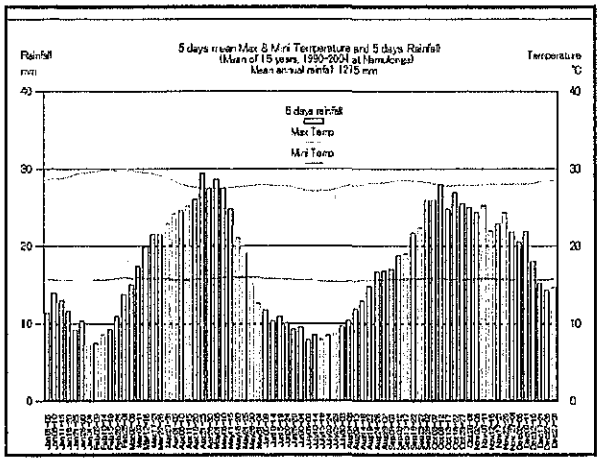
	rainfall mm
Dec.22-26	0
Dec.27-31	2
Jan.1-5	13
Jan.6-10	0
Jan.11-15	11
Jan.16-20	4
Jan.21-25	19
Jan.26-30	14
Jan.31-4	26
Feb.5-9	12
Feb.10-14	30
Feb.15-19	8
Feb.20-24	24
Feb.25-1 *	36
	↓

moving mean

(0+2+13+0+11)/5 = 5.2
(2+13+0+11+4)/5 = 6.0
(13+0+11+4+19)/5= 9.4
(0+11+4+19+14)/5= 9.6
(11+4+19+14+26)/5=14.8
(4+19+14+26+12)/5=15
(19+14+26+12+30)/5=20.2
↓

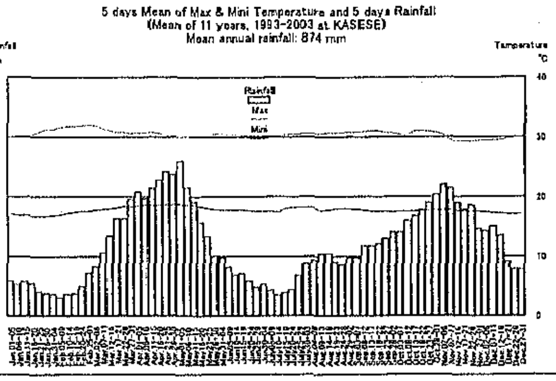
* leap year = 6 days rainfall

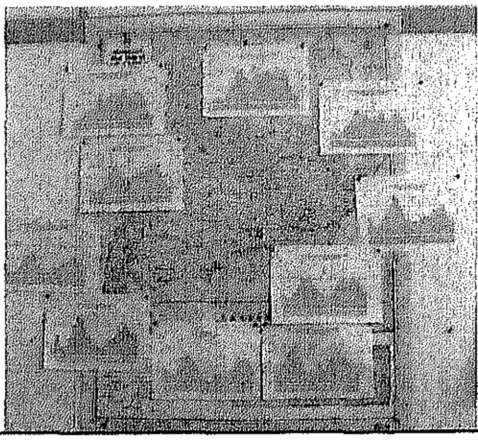




5 days rainfall at NAARI (1990 ~ 2004)

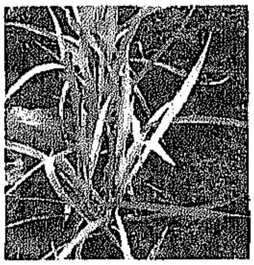
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	Mean
Jan 1-5	7.8	0.0	0.0	0.0	0.0	0.0	[illegible]	0.0	[illegible]	0.0	3.0	1.4	12.6	[illegible]	[illegible]	9.9
Jan 6-10	[illegible]	1.4	[illegible]	91.0	11.8	0.0	[illegible]	6.4	37.4	48.0	5.8	8.0	[illegible]	0.5	0.0	19.5
Jan 11-15	0.0	1.3	0.0	0.0	5.0	0.0	4.0	14.8	2.0	0.0	0.0	[illegible]	0.0	0.0	0.0	3.8
Jan 16-20	0.0	0.0	[illegible]	0.0	4.6	5.8	13.0	[illegible]	75.0	90.4	17.8	[illegible]	0.0	10.6	[illegible]	[illegible]
Jan 21-25	0.0	0.0	0.0	3.2	0.0	0.0	[illegible]	0.0	0.0	0.0	1.6	41.4	0.0	[illegible]	[illegible]	10.2
Jan 26-30	7.0	2.9	4.0	5.1	0.0	3.3	8.4	0.0	3.8	0.0	3.1	0.0	0.0	0.0	0.0	2.7
Jan 31-4	0.0	0.0	[illegible]	[illegible]	0.0	0.0	[illegible]	0.0	2.8	0.0	1.0	3.6	0.0	0.0	0.0	7.4
Feb 5-9	0.0	17.4	0.0	0.0	[illegible]	8.0	[illegible]	0.0	35.0	0.0	1.6	3.8	18.3	1.2	0.0	9.5
Feb 10-14	9.5	7.0	0.0	0.0	14.9	0.0	9.9	0.0	7.0	18.4	0.0	0.0	[illegible]	0.0	0.0	8.1
Feb 15-19	43.0	4.8	0.0	14.1	0.0	13.9	[illegible]	0.0	0.0	0.0	0.0	18.9	4.2	0.0	[illegible]	17.1
Feb 20-24	7.0	[illegible]	2.0	0.0	[illegible]	0.0	8.0	7.2	8.7	1.8	10.8	0.0	0.0	0.0	8.3	7.3
Feb 25-1	10.0	2.5	0.0	0.0	0.0	0.0	4.0	6.7	0.0	[illegible]	14.5	1.4	[illegible]	[illegible]	[illegible]	11.3
Mar 2-6	7.0	4.7	0.0	2.6	9.2	1.3	[illegible]	1.0	10.0	[illegible]	[illegible]	[illegible]	33.0	0.0	[illegible]	17.5
Mar 7-11	[illegible]	[illegible]	0.0	[illegible]	4.5	[illegible]	2.7	[illegible]	8.3	46.1	7.9	[illegible]	9.5	7.4	0.0	[illegible]
Mar 12-16	6.1	18.9	0.0	0.0	18.9	64.9	[illegible]	0.0	10.3	42.5	18.0	[illegible]	11.0	4.5	[illegible]	18.3
Mar 17-21	[illegible]	0.0	[illegible]	56.2	[illegible]	3.0	10.6	0.0	[illegible]	7.4	18.9	8.9	[illegible]	16.0	7.4	19.5
Mar 22-26	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	34.9	5.2	3.0	17.0	18.0	9.9	0.0	[illegible]
Mar 27-31	[illegible]	10.0	4.3	[illegible]	1.1	11.0	18.9	55.8	0.0	[illegible]	6.0	34.8	[illegible]	33.0	28.1	[illegible]
Apr 1-5	10.8	[illegible]	[illegible]	5.0	8.0	10.8	0.6	72.6	7.0	10.0	1.0	[illegible]	11.2	4.6	11.3	[illegible]
Apr 6-10	14.8	7.3	[illegible]	12.1	12.0	0.0	17.0	65.7	72.1	9.3	40.7	[illegible]	3.2	0.0	11.0	[illegible]
Apr 11-15	8.0	31.6	[illegible]	9.7	2.0	[illegible]	[illegible]	30.0	45.0	10.7	[illegible]	17.0	70.0	0.0	13.3	[illegible]
Apr 16-20	54.7	18.4	16.4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.0	12.0	[illegible]	[illegible]	[illegible]	17.2	11.8	[illegible]
Apr 21-25	0.0	[illegible]	0.0	[illegible]	9.5	64.8	[illegible]	[illegible]	90.0	19.8	[illegible]	[illegible]	[illegible]	5.8	16.1	[illegible]
Apr 26-30	0.0	87.5	0.0	[illegible]	50.1	9.4	0.0	[illegible]	0.0	51.5	12.4	[illegible]	19.8	83.0	0.0	[illegible]





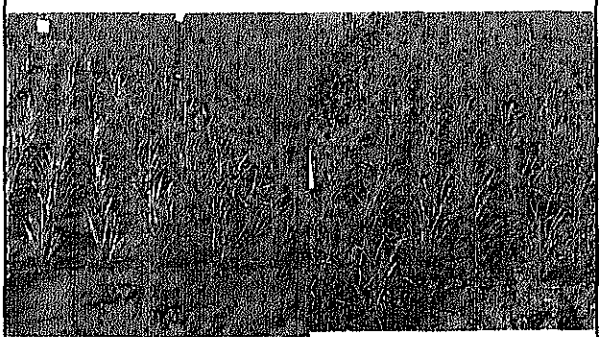
Rice Yellow Mottle Virus (RYMV)

- Usually, RYMV is not problem in upland rice.

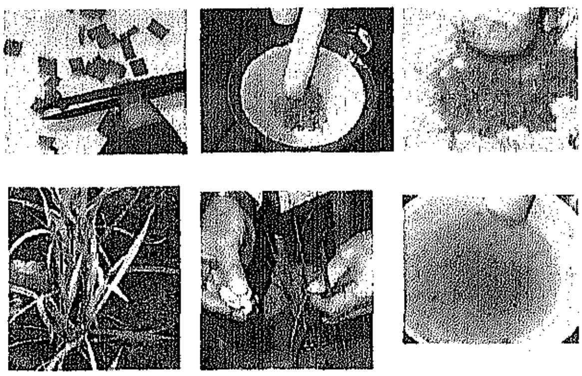


Varietal Difference of RYMV Resistance

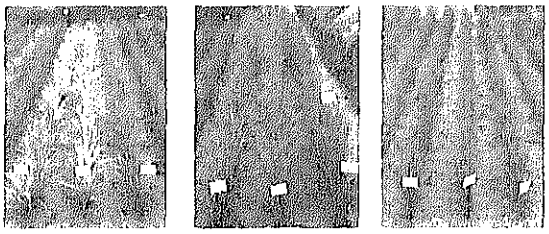
Natural Infection



RYMV resistance test



RYMV Trial



NS-4 K-85 NERICA 4

18 Days after inoculation

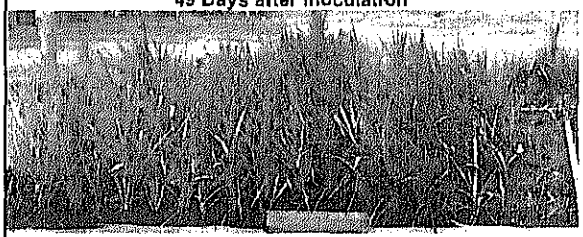
Resistance to RYMV on NERICA and other upland rice

RYMV inoculation
July 21, 2006

49 days after inoculation

Resistance to RYMV on NERICA and other upland rice

49 Days after Inoculation



NERICA 1 – 18, ITA 257, 325, O. Glaberrima Koshihikari, Indica (IR)

Strong ITAs, 14 → 11,12, 13, 18, 7, 6 → 8, 9,15,17, →

→ 3,4,10,16,O.G, → 2,5, → 1 → Indica (lowland) Weak

Iron toxicity (Lowland)

NERICA 1

Iron toxicity (upland)

NERICA 1

Thank you

2006

1955

Expert IKEDA (WARDA, Benin)

Seed multiplication for NERICA varieties

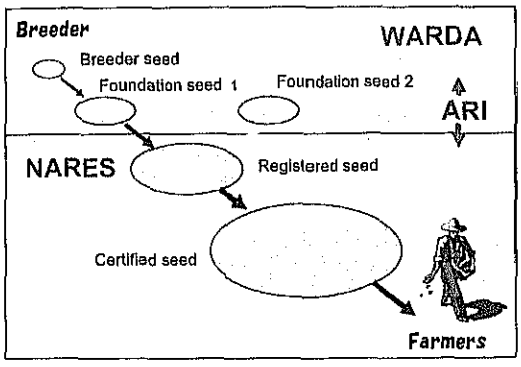
7 December, 2006

Ryoichi Ikeda
JICA/WARDA/JIRCAS

JICA-WARDA Joint Seminar

Contents

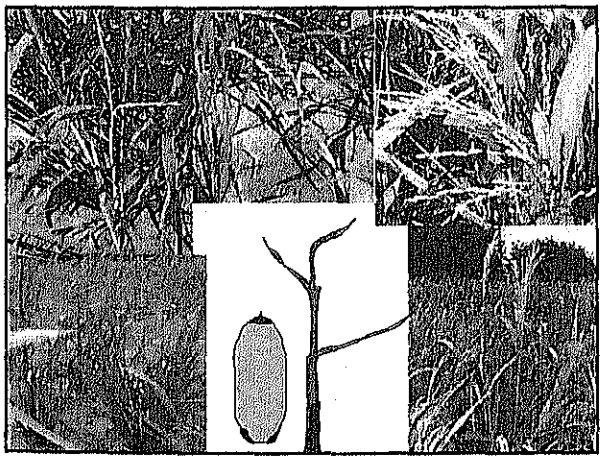
Flow of Seed Multiplication for NERICA



1. Seed Multiplication for NERICA

1) **Multiplication of foundation seed for NERICA varieties**

- Planting space: 20 x 30cm, single plant per hill
- Any offtypes are recorded and removed immediately.
- Foundation seed which was harvested after removing offtypes in the foundation seed farm last year is used.



Offtypes in foundation seed farm 2006

variety	No. of plants	Chlo. Mut.	Plant & panicle	Ex-early	Awn & Apic. color	Sterility	Offtype (%)	Delayed plants
NERICA1	66,125	st 7	Tall 2 dwarf 2			Full 34 semi 6	106 (0.16)	3,210
NERICA2	33,226	st 29	Tall 3 Open 1 *glab.* 2	49	No awn 10 No APC 1	Full 3 semi 13	111 (0.33)	2,168
NERICA3	25,799	st 7 xa 7	Tall 4 Abn.1		Awn 1 APCP 5	Full 1 semi 16	42 (0.16)	771
NERICA4	25,108	st 6 xa 2	dwarf 8		Awn 1 APCP 1	semi 29	47 (0.19)	440
NERICA6	23,800	st 4 xa 2	Tall 1 GlmP 2		Awn 1 APCP 7	semi 34	51 (0.21)	745
NERICA7	32,204	st 1	LS P 8 GlmP24		Awn 1 APCP 23	semi 131	188 (0.58)	649

Probable causes of offtypes

st (striata), xa (xantha), dw (dwarf): ← Mutation

GlmP (Glumes color purple): ← Out-crossing

Apcp (Apiculous color purple), awnness, LsP (Leaf sheath purple): ← Seed mixture

Full- & semi- sterility, Op (opened panicle), *glab* (*O. glaberrima* type): ← Inter-specific crossing

Extra-early plants: ← Segregating

Delayed plants: ← Others

Comparison of the results of 2005 and 2006

variety	Sterility 2005	Offtype (%) 2005	Sterility 2006	Offtype (%) 2006
NERICA1		86/ 34,750 0.25%	Full 34, semi 61	106/ 66,125 0.16%
NERICA2	semi 2	1,779/ 24,080 7.39%	Full 3 *semi 13*	111/ 33,226 0.33%
NERICA3	semi 3	179/ 18,070 0.99%	Full 1 semi 16	42/ 25,799 0.16%
NERICA4			semi 29	47 / 25,108 0.19%
NERICA6	semi 4	1,534/ 24,250 6.33%	semi 34	51/ 23,800 0.21%
NERICA7	semi 3	56/ 15,500 0.36%	semi 131	188/ 32,204 0.58%

1-1) Foundation seed for NERICA varieties

Variety	2005 Area (ha)	2005 Product (kg)	2005 Yield (t/ha)	2006 Area (ha)	2006 Product (kg)	2006 Yield (t/ha)
NERICA1	0.44	467	0.93	0.69	1,325	1.92
NERICA2	0.42	265	0.64	0.30	852	2.84
NERICA3	0.23	280	1.20	0.30	516	1.72
NERICA4	-	-	-	0.21	310	1.48
NERICA5	0.14	90	0.64	-	-	-
NERICA6	0.28	200	0.71	0.21	315	1.50
NERICA7	0.21	165	0.78	0.30	470	1.57
Total (aver.)	1.72	1,467	(0.85)	2.01	3,788	(1.89)

1. Seed Multiplication for NERICA

2) Reselection of NERICA varieties

- Breeder seed of NERICA at WARDA is not always homogeneous.
- Some varieties are not yet fixed genetically and are still segregating.
- So, we reselect the individuals of each variety as the breeder seed.

1-2) Reselected of NERICA varieties

Variety	Plants	Select.	Variety	Plants	Select.
NERICA1	1,648	28	NERICA10	1,219	13
NERICA2	1,642	27	NERICA11	814	15
NERICA3	1,203	12	NERICA12	578	11
NERICA4	807	14	NERICA13	1,573	33
NERICA5	1,262	20	NERICA14	1,392	14
NERICA6	1,601	31	NERICA15	924	15
NERICA7	1,032	11	NERICA16	812	17
NERICA8	587	13	NERICA17	1,397	11
NERICA9	1,488	14	NERICA18	1,317	35

334/11,270; selection rate is 1.57%

2. Characterization of NERICA varieties

1) Analysis of genetic traits in NERICA varieties

The cross compatibility of each NERICA variety with *Oryza sativa* and *O. glaberrima* is analyzed.

If NERICA has cross compatibility with both cultigens, it will become an effective 'bridge variety' to transfer the useful gene(s) from *O. glaberrima* to *O. sativa* and *vice versa*.

2-1) Crossing activity

Each NERICA variety is crossed with *O. sativa* and *O. glaberrima*

O. sativa : **Yumenohatamochi** (*japonica*)
Takanari (*indica*)

O. glaberrima : **CG14** (parent of NERICA)
IRGC Acc. 104038

Takanari was used as the female parent because it did not synchronize of flowering time with any NERICA varieties.

Crossing: July 12～Aug. 9

NERICA	LINE CODE	PARENTS
NERICA 1	WAB 450-HBP-38-HB	WAB 56-104 / CG 14//2*WAB 56-104
NERICA 2	WAB 450-1-1-P31-1-HB	WAB 56-104 / CG 14//2*WAB 56-104
NERICA 3	WAB 450-HBP-28-HB	WAB 56-104 / CG 14//2*WAB 56-104
NERICA 4	WAB 450-HBP-91-HB	WAB 56-104 / CG 14//2*WAB 56-104
NERICA 5	WAB 450-11-1-1-P24-HB	WAB 56-104 / CG 14//2*WAB 56-104
NERICA 6	WAB 450-HBP-160-HB	WAB 56-104 / CG 14//2*WAB 56-104
NERICA 7	WAB 450-HBP-20-HB	WAB 56-104 / CG 14//2*WAB 56-104
NERICA 8	WAB 450-1-BLI-136-HB	WAB 56-104 / CG 14//2*WAB 56-104
NERICA 9	WAB 450-BLI-1-136-HB	WAB 56-104 / CG 14//2*WAB 56-104
NERICA 10	WAB 450-11-1-1-P41-HB	WAB 56-104 / CG 14//2*WAB 56-104
NERICA 11	WAB 450-1e-2-BL 2-DV 1	WAB 56-104 / CG 14//2*WAB 56-104
NERICA 12	WAB 880-1-38-20-17-P1-HB	WAB 56-50 / CG 14//2*WAB 56-50
NERICA 13	WAB 880-1-38-20-28-P1-HB	WAB 56-50 / CG 14//2*WAB 56-50
NERICA 14	WAB 880-1-32-1-2-P1-HB	WAB 56-50 / CG 14//2*WAB 56-50
NERICA 15	WAB 881-10-37-39-1-P1-HB	CG 14 / WAB 181-18//2*WAB 181-18
NERICA 16	WAB 881-10-37-48-9-P1-HB	CG 14 / WAB 181-18//2*WAB 181-18
NERICA 17	WAB 881-10-37-18-13-P1-HB	CG 14 / WAB 181-18//2*WAB 181-18
NERICA 18	WAB 881-10-37-18-12-P1-HB	CG 14 / WAB 181-18//2*WAB 181-18

2-1) Results of crossing -1

M / F	CG14 *glaber.*	104038 *glaber.*	Yume-nohata	M / F	CG14 *glaber.*	104038 *glaber.*	Yume-nohata
N1	6 (1)	209 (3)	23 (3)	N10	8 (2)	79 (2)	32 (2)
N2	43 (3)	149 (3)	60 (2)	N11	28 (4)	58 (2)	52 (3)
N3	44 (3)	69 (4)	24 (1)	N12	16 (2)	43 (4)	57 (2)
N4	3 (1)	82 (2)	4 (1)	N13	3 (1)	148 (3)	36 (2)
N5	16 (2)	103 (6)	24 (1)	N14	0	90 (2)	11 (2)
N6	68 (2)	128 (6)	36 (1)	N15	7 (2)	56 (4)	47 (2)
N7	15 (2)	161 (7)	74 (3)	N16	14 (1)	147 (5)	110 (2)
N8	46 (2)	111 (3)	46 (2)	N17	1 (1)	37 (4)	23 (2)
N9	9 (1)	138 (2)	19 (1)	N18	4 (1)	178 (3)	52 (3)

( ): number of female plants.

2-1) Results of crossing -2

M / F	N1	N2	N3	N4	N5	N6	N7	N8	N9
Takanari	9 (3)	0	13 (3)	16 (1)	8 (1)	4 (2)	17 (3)	6 (1)	42 (4)
M / F	N10	N11	N12	N13	N14	N15	N16	N17	N18
Takanari	2 (1)	51 (4)	7 (1)	16 (2)	16 (3)	11 (4)	8 (2)	6 (1)	24 (2)

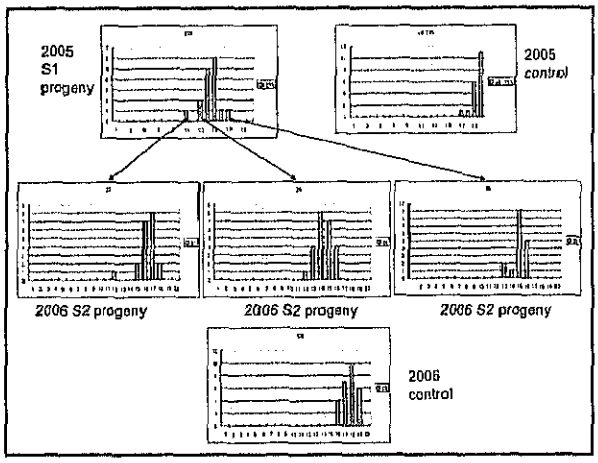
( ): number of female plants.

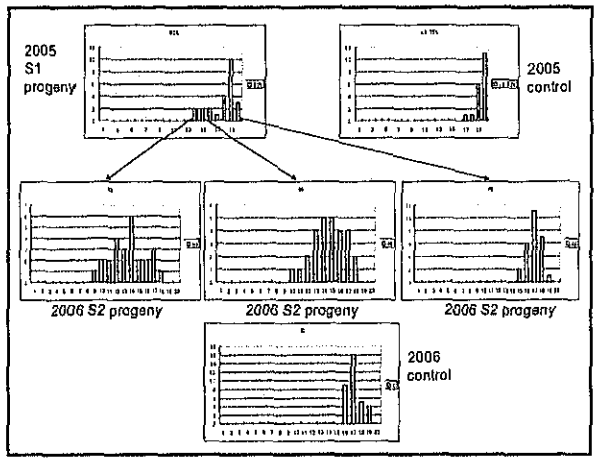
2. Characterization of NERICA varieties

2) Analysis of semi-sterility on the panicles of NERICA17

The semi-sterility in NERICA17 is analyzed from the segregation pattern in those progenies (S_2).

Generation 1 (S_0): semi-sterile (15-50%) & normal (75-95%)
Generation 2 (S_1): semi-sterile to near normal & normal





3. Training course for seed multiplication

To train technicians in seed production, through lectures and practices, they learn the basics of,

(1) Seed multiplication technologies of upland rice,
(2) Conservation and/or maintenance for foundation seed, and the seed multiplication technologies for registered seed and certified seed,
(3) Planning the seed multiplication of upland rice varieties.

Training (Continued.)

☆5 days (14~18 August, 2006) in English. French in next year.
☆Songhai Project farm, Porto-Novo
☆Sponsored by UNDP,
☆*Assisted by*
Paul van Mele,
Koichi Futakuchi,
Ines Sanchez
and
ARI staff.

Contents of training course

- *Presentation of country reports (trainees)*
- Concept of plant breeding (RI)
- Principles of seed multiplication (RI)
- Reading & drawing maps (RI)
- Morphological characters of rice plants (RI)
- Observation of morphological characters on rice plants (RI)
- Technology for seed multiplication (RI)
- How to detect of offtypes (RI)
- Physiology of rice plant (KF)
- Rice improvement for resistance to stresses (RI)
- Key steps for quality seed production (RI)
- Review of seed multiplication and feedback & Test (RI & VR)
- Conservation of rice seed (FO)
- Post-harvest management for seed (JS)
- Making action plan for seed multiplication in your country (trainees)
- Presentation of action plan and feedback (trainees)
- Review of training course, evaluation and planning (RI & VR)

Summary (1)

- A total of 3.8t foundation seed of NERICA varieties was produced in the field of 2ha.
- The detection rates of offtypes were in 0.2~0.6% this year because we used the foundation seed of last year.
- However, more plants of the panicles with semi-sterility were found than in last year in all NERICA varieties. This may be a fateful thing coming from a inter-specific hybridization between *O. sativa* and *O. glaberrima*.
- Some plants were reselected from each NERICA variety in the field. The next generation will be examined by each lines in the field.

Summary (2)

- To analyze the characteristics of NERICA varieties, each variety was crossed in both cultigens, *Oryza sativa* and *O. glaberrima*. Out of 72 cross combinations, we got F_1 seeds by 70 combinations.
- The semi-sterility on the panicles of NERICA17 was observed. Most S_2 lines of semi sterility origin were distributed from semi sterility to normal fertility widely, but some fixed lines with normal fertility were found, too.
- The training course of seed multiplication has been held for 5 days (from 14 Aug. to 18 Aug.) for 14 trainees from 5 countries at Songhai farm, Porto-Novo.

Working Plan for 2007

1. Seed multiplication
   1) Foundation seed of NERICA
      Main season: at upland field, WARDA
      Dry season: at Irrigated paddy field, Lokossa
   2) Development of reselected NERICA for breeder seed

2. Characteristics of NERICA varieties
   1) Observation of fertility % of F_1 plants
   2) Continue to analyzing of semi-sterility on NERICA17
3. Training for seed multiplication
   For people in Francophone countries

Future issues

- Seed: Continuing the foundation seed multiplication for NERICA varieties at ARI.
- Capacity building: Maintaining the training course of technicians for seed multiplication of each country.
- Manual: Manuals for seed multiplication in each country. How to get the registered seed and certified seed.
- Guidance: Support for development of the seed multiplication which balanced with the situation of each country.