

2014 Seed Health Unit Annual Report

The Seed Health Unit (SHU), the single gateway for safe and efficient germplasm exchange and distribution, processes incoming and outgoing rice seeds/grains, non-seed biological materials, and soil samples for phytosanitary certification and/or post-entry clearance. In addition, SHU facilitates the processing of incoming and outgoing materials other than rice and transgenic rice seeds/grains for phytosanitary certification and/or post-entry clearance and assists the Plant Quarantine Service in monitoring crop health, disposals, and movements/transfers of transgenic materials, wild rice varieties, and introduced materials. Furthermore, SHU ensures that all incoming and outgoing seed shipments are accompanied by the appropriate Material Transfer Agreement.

Phytosanitary Certification

A. Rice seeds/grains

From January to December 2014, SHU issued 655 phytosanitary certificates covering 95,153 non-transgenic seedlots (6,133.863 kg), which were sent to 58 countries worldwide (Table 1). By region, Southeast Asia received the highest number of shipments in terms of total number of shipments and total number of seedlots, with 340 shipments and 55,448 seedlots, respectively. SHU also issued 23 phytosanitary certificates covering 526 transgenic seedlots (1.885 kg), which were sent to 8 countries worldwide (Table 2). By region, Europe and Central Asia received the highest number of total shipments and total seedlots with 10 shipments and 218 seedlots, respectively. The highest number of shipment and corresponding volume of materials sent by IRRI to different countries was rice seeds with 584 shipments covering 88,152 seedlots and weighing 5,966.854 kg (Table 3). The Plant Breeding, Genetics, and Biotechnology (PBGB) Division sent the highest number of non-transgenic rice seeds/grains with 423 shipments covering 75,436 seedlots, whereas the C_4 Rice Center sent the highest number of transgenic rice seeds with 399 seedlots (Tables 4a and 4b). Furthermore, 40 phytosanitary certificates

covering 30,410 seedlots (591.870 kg) were also issued to the International Network for Genetic Evaluation of Rice (INGER)-PBGB for their nursery seed distribution to 26 countries worldwide (Table 5). By region, South Asia received the highest total number of shipments and total number of seedlots with 12 shipments covering 16,984 seedlots (326.340 kg).

The different fungi and nematodes detected among corresponding affected seedlots and their detection level are shown in Table 6. Routine seed health tests conducted on 10,253 non-treated, non-transgenic outgoing seedlots showed that *Curvularia* spp. affected 96.74% of the seedlots, whereas *Pyricularia oryzae* affected only 1.29% of the seedlots. Non-transgenic rice seeds were cleaned for objects of quarantine importance, tested for health, and treated with prescribed Association of Southeast Asian Nations (ASEAN) standard seed treatment for rice—hot water at 52–57 °C for 15 min. This was followed by fungicide slurry treatment with benomyl and mancozeb both at 0.1% by seed weight, except for countries that do not allow seed treatment. Fumigation with phosphine was also administered to all outgoing seeds.

A total of 6,360 accessions from the T.T. Chang Genetic Resources Center (T.T. Chang-GRC) were processed for health status prior to storage. The different fungi detected with the corresponding detection level and affected accessions are shown in Table 7. Routine seed health testing revealed that *Curvularia* spp. affected 99.91% of the seedlots, whereas *Tilletia barclayana* affected only 0.06% of the seedlots.

B. Non-seed biological materials (NSBM)

A total of 269 shipments covering 39,763 various non-transgenic samples were processed for phytosanitary certification and sent to 18 countries worldwide (Table 8). In addition, a total of 4 shipments covering 827 various transgenic samples were processed for phytosanitary certification and then sent to 3 countries in Europe and North America (Table 9). For non-transgenic NSBM, East Asia received the highest total number of shipments with 145 shipments. However, North America received the highest total number of samples with 15,130 samples. For transgenic NSBM, Europe received the highest total number of shipments, but

North America received the highest total number of samples with 3 shipments and 723 samples, respectively. Table 10 shows the sources and nature of transgenic and non-transgenic NSBM sent to different countries worldwide. For both transgenic and non-transgenic NSBM, PBGB sent the highest total number of shipments (85 shipments) but the Crop and Environmental Sciences Division (CESD) sent the highest total number of samples (15,978 samples). The highest number of NSBM sent was *Setaria* (Poaceae) leaf samples—9,095 samples from the C4 Rice Center (CRC), followed by DNA from rice—4,781 samples sent by PBGB.

One hundred (100) incoming non-transgenic seed shipments covering 11,910 seedlots and weighing 560.137 kg from 24 countries worldwide were also processed for post-entry clearance from January to December 2014 (Table 11). By region, the highest total number of shipment and total number of seedlots came from Southeast Asia with 54 shipments covering 5,651 seedlots. In addition, five (5) incoming transgenic seed were also processed through SHU for post-entry clearance (Table 12). The highest total number of transgenic rice seeds came from Colombia with 20,212 seedlots. Table 13 shows that out of the 105 incoming non-transgenic and transgenic shipments, 74 shipments (excluding HRDC materials) were non-transgenic rice seeds covering 11,575 seedlots and weighing 442.042 kg. PBGB received the highest total number of incoming shipments (82) but the C4 Rice Center received the highest total number of incoming seedlots (20,243) (Table 14).

Out of the 3,061 incoming non-transgenic rice seedlots that were visually inspected, 3 seedlots were damaged by insects (Table 15a). In terms of general quality, 2,612 (85.33%) were under category 3 (Table 15b).

Seed health tests on 138 incoming, nontreated seedlots showed that *Curvularia* spp. affected 93.44% of the seedlots, followed by *Trichoconis padwickii*, 74.59% (Table 16). *Aphelenchoides besseyi* affected only 5.74% of the seedlots. The prescribed ASEAN standard treatments were also applied to all incoming seeds.

B. Non-seed biological materials (NSBM)

Sixty incoming NSBM shipments covering 4,890 various transgenic and non-transgenic samples from 14 countries worldwide were processed through SHU (Table 17). The highest number of incoming shipments came from Southeast Asia with 23

shipments covering a total of 3,162 various samples, among which 1,805 samples were DNA from rice. Table 18 shows that the GQNSL received the highest total number of incoming NSBM with 20 shipments, and CESD received the highest total number of samples with 2,330 samples, most of which are DNA.

Crop health inspection

Crop health inspections were conducted on post-entry plant quarantine areas and GRC, PBGB, CESD, and GQNPC seed multiplication plots during the 2014 dry and wet seasons at three different crop stages. Table 19 shows the total number of entries monitored for the different diseases. In addition, the table shows the different diseases observed with the corresponding percent incidence for incoming and outgoing materials. For incoming materials planted during the dry season, 0.12% of the seedlings were observed to be infected with sclerotium seedling blight, whereas during the wet season, 6.28% of the seedlings were infected with bacterial brown stripe. The most prevalent disease observed at the tillering and maturity stages was tungro with 0.62% incidence and 1.77% incidence, respectively.

On the other hand, for outgoing materials planted in multiplication plots, the most prevalent disease observed for both the dry and wet seasons is sclerotium seedling blight with an incidence of 0.78% and 0.21%, respectively. During the dry season, the most prevalent disease at the tillering and maturity stages was tungro with an incidence of 0.80% and 0.58%, respectively. On the other hand, for the wet season, bacterial leaf streak was the most prevalent disease observed during the tillering and maturity stages, with 29.75% incidence and 38.24% incidence, respectively.

Material Transfer Agreement (MTA)

The different types of MTA for outgoing and incoming transgenic and non-transgenic rice seeds/grains from January to December 2014 are shown in Tables 20a and 20b, respectively. A total of 883 various MTAs were issued covering 126,089 outgoing seedlots. Out of this number, 449 were standard MTA covering 30,849 seedlots. On the other hand, 31 incoming shipments covering 5,042 seedlots (126.750 kg) were accompanied by a standard MTA.

Monitoring of disposals and movements of transgenics

Part of SHU's task is to assist the Plant Quarantine Service (PQS) on disposals and movements/transfers of transgenic materials done by different organizational units (Tables 14 and 15). From January to December 2014, a total of 4,539 various samples were disposed, most of which are soil samples from PBGB. At the same period, 27,591 various samples were transferred/moved, most of which are seeds under the C4 Rice Center.

Workshops, training courses, visitors, information awareness drive

SHU also participated in the following activities coordinated by the Training Center (TC) and/or the Events, Visitors, and Exhibits Office (EVEO): (1) orientation of on-the-job trainees (OJTs); postdocs; fellows; BS, MS, and PhD research and thesis scholars; and interns from different countries/organizational units; (2) HRS orientation for new employees; and (3) training courses such as the Rice Production Techniques for Research Technicians (Africa) with 16 participants, and Rice Industry Agricultural Invoice Training Course (RIAS) with 14 participants.

SHU also conducted lectures and hands-on activities regarding seed health testing methodologies, identification of seed-borne organisms, and seed treatment for Agronomy 170 students from U.P. Los Baños (18); two on-the-job trainees from the Polytechnic University, Quezon

Province; and Abdul Wadud Khan from the Regional Seed Lab, Patuakhali, Bangladesh, who was on a month-long training.

Visitors included the following: a ten-man delegation from the Council for Biotechnology Information Japan through the Biotechnology Coalition of the Philippines; four students from Ubon Ratchathani University, Thailand; Marco van den Berg and Ogie Alvarez from IRRI ITS; Dr. Rajendra Prasad, Project Director, ICAR Directorate of Seed Research; Allan Philips and Kathy Lewis, Transgenic Auditors; Vietnam Delegation; Mark Candon, BCM Auditor and Virginia Maria Salazar, IAU, CGIAR; and Dr. Ibrahim Demir, Ankara University, Turkey.

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Table 1. Distribution by region and country of outgoing rice seeds/grains (January to December, 2014).

Region/country	Total shipments (no.)	Total seedlots (no.)	Total weights (kg.)
East Asia (7)			
Hongkong	4	86	1.670
Japan	19	968	11.358
Korea N	2	128	1.215
Korea S	14	9,374	268.353
Mongolia	1	13	0.160
PROC	26	6,004	46.680
Taiwan	4	43	1.230
Sub-total	70	16,616	330.666
Europe and Central Asia (13)			
Austria	1	2	0.026
Belgium	3	424	50.000
Germany	4	67	3.290
Italy	1	72	0.430
Kazakhstan	1	3	0.270
Netherlands	10	110	2.417
Portugal	1	51	0.700
Russia	1	72	0.420
Slovakia	2	45	0.470
Spain	2	5	0.056
Switzerland	2	27	0.280
United Kingdom	6	2,319	22.340
USSR	1	4	0.050
Sub-total	35	3,201	80.749
Latin America (5)			
Bolivia	2	157	1.090
Brazil	1	113	0.580
Chile	2	306	4.500
Colombia	11	2,066	28.280
Surinam	1	71	0.370
Sub-total	17	2,713	34.820
North America (2)			
Canada	2	11	3.010
USA	25	1,293	7.356
Sub-total	27	1,304	10.366
Oceania (2)			
Australia	10	2,475	31.936
Papua New Guinea	1	147	4.400
Sub-total	11	2,622	36.336

Cont...Table 1

Region/country	Total shipments (no.)	Total seedlots (No.)	Total weight (kg.)
South Asia (6)			
Bangladesh	23	1,958	148.495
Bhutan	2	444	9.330
India	77	5,080	287.044
Nepal	8	863	72.810
Pakistan	3	1,405	53.400
Sri Lanka	2	118	0.735
Sub-total	115	9,868	571.814
Southeast Asia (9)			
Cambodia	9	1,196	59.610
Indonesia	16	2,029	81.660
Laos	6	721	47.900
Malaysia	2	217	5.750
Myanmar	28	5,762	1,979.080
Philippines	244	41,589	2,595.922
Singapore	2	25	0.205
Thailand	8	320	14.640
Vietnam	25	3,134	99.290
Sub-total	340	55,448	4,884.057
Sub-Saharan Africa (11)			
Burkina Faso	1	7	.070
Burundi	13	2,117	141.940
Ethiopia	1	65	3.500
Ghana	1	1	1.600
Kenya	3	72	5.690
Mozambique	4	317	10.100
Nigeria	3	37	2.000
Rwanda	1	25	1.100
Senegal	1	115	1.100
Tanzania	6	186	9.930
Uganda	1	25	1.000
Sub-total	35	2,967	178.030
West Africa (1)			
Benin	2	311	4.145
Sub-total	2	311	4.145
West Asia & North Africa (2)			
Egypt	2	81	0.580
Turkey	1	22	2.300
Sub-total	3	103	2.880
GRAND TOTAL (58)	655	95,153	6,133.863

Table 2. Distribution by region and country of outgoing transgenic seeds/grains (January to December, 2014).

Region/country	Total shipments (no.)	Total seedlots (no.)	Total weight (kg.)
East Asia (2)			
Japan	1	3	0.008
Taiwan	1	6	0.004
Sub-total	2	9	0.012
Europe and Central Asia (3)			
Denmark	2	21	0.081
Germany	5	135	0.299
United Kingdom	3	62	0.134
Sub-total	10	218	0.514
North America (2)			
Canada	3	120	0.193
USA	4	54	0.080
Sub-total	7	174	0.273
Oceania (1)			
Australia	4	125	1.086
Sub-total	4	125	1.086
GRAND TOTAL (8)	23	526	1.885

Table 3. Nature of outgoing shipments and the corresponding total number of shipments, total number of seedlots, and total weight (kg) (January to December 2014).

Nature of shipment/destination	Total shipments (no.)	Total seedlots (no.)	Total weight (kg.)
Rice seeds			
East Asia	33	13,447	244.535
Europe and Central Asia	31	3,163	80.497
Latin America	15	2,577	34.150
North America	21	919	8.701
Oceania	4	1,259	17.280
South Asia	109	9,333	542.634
Southeast Asia	332	54,080	4,854.072
Sub-Saharan Africa	34	2,960	177.960
West Africa	2	311	4.145
West Asia and North Africa	3	103	2.880
Sub-total	584	88,152	5,966.854
Dehulled rice seeds			
East Asia	22	1,936	80.025
Oceania	3	1,088	16.678
Sub-total	25	3,024	96.703
Transgenic seeds			
East Asia	2	9	0.012
Europe and Central Asia	9	199	0.435
North America	7	174	0.273
Oceania	2	22	0.036
Sub-total	20	404	0.756
Wild Rice seeds			
East Asia	4	386	1.420
Europe and Central Asia	2	16	0.072
Latin America	1	23	0.090
North America	4	322	1.270
Oceania	2	88	0.352
Southeast Asia	1	131	0.500
Sub-total	14	966	3.704
Rice and wild rice seeds			
East Asia	4	212	2.150
Europe and Central Asia	2	22	0.180
Latin America	1	113	0.580
North America	1	60	0.260
South Asia	1	64	0.800
Southeast Asia	1	897	7.000
Sub-Saharan Africa	1	7	0.070
Sub-total	11	1,375	11.040

Cont...Table 3

Nature of shipment/destination	Total shipments (no.)	Total seedlots (no.)	Total weight (kg.)
HRDC seeds			
South Asia	4	404	28.200
Southeast Asia	4	320	22.400
Sub-total	8	724	50.600
Naked seeds			
East Asia	3	606	1.755
South Asia	1	67	0.180
Sub-total	4	673	1.935
Dehulled transgenic seeds			
Oceania	2	103	1.050
Sub-total	2	103	1.050
Ground rice seeds			
Oceania	1	161	2.000
Sub-total	1	161	2.000
Powdered rice seeds			
Oceania	1	26	0.026
Sub-total	1	26	0.026
Polished transgenic seeds			
Europe and Central Asia	1	19	0.079
Sub-total	1	19	0.079
Milled rice seeds			
East Asia	1	2	0.670
Southeast Asia	1	10	0.060
Sub-total	1	12	0.730
Dehulled rice and wild rice seeds			
East Asia	1	12	0.105
Sub-total	1	12	0.105
Pulverized rice seeds			
East Asia	1	12	0.0001
Sub-total	1	12	0.0001
Rice flour			
Southeast Asia	1	10	0.025
Sub-total	1	10	0.025
Polished rice seeds			
North America	1	3	0.135
Sub-total	1	3	0.135
Dehulled wild rice seeds			
East Asia	1	3	0.006
Sub-total	1	3	0.006
GRAND TOTAL	678	95,679	6,135.748

Table 4a. Sources of outgoing non-transgenic rice seeds/grains (January to December, 2014).

Organizational unit	Total shipments (no.)	Total seedlots (no.)	Total weight (kg.)
Crop and Environmental Sciences Division (CESD)			
Dehulled seeds	4	1,074	16.627
Ground rice seeds	1	161	2.000
Rice seeds	19	1,390	100.141
Sub-total	24	2,625	118.768
Donor Relations and Projects Coordination			
Office of the Director for External Relations (DER-DRPC)			
Milled rice seed	1	2	0.670
Sub-total	1	2	0.670
Grain Quality and Nutrition Service Laboratory (GQNSL)			
Milled rice seeds	1	10	0.060
Pulverized rice seeds	1	12	0.0001
Rice flour	1	10	0.025
Rice seeds	2	548	13.500
Sub-total	5	580	13.585
National Program Relations (NPR)			
Rice seeds	1	4	4.300
Sub-total	1	4	4.300
Plant Breeding, Genetics, & Biotechnology (PBGB)			
Dehulled rice seeds	13	1,308	74.376
HRDC seeds	8	724	50.600
Naked seeds	4	673	1.935
Polished rice seeds	1	3	0.135
Powdered rice seeds	1	26	0.026
Rice and wild rice seeds	1	5	0.060
Rice seeds	394	72,682	5,609.502
Wild rice seeds	1	15	0.030
Sub-total	423	75,436	5,736.664
T.T. Chang Genetic Resources Center (TTC-GRC)			
Dehulled rice seeds	8	642	5.700
Dehulled wild rice seeds	1	3	0.006
Dehulled rice and wild rice seeds	1	12	0.105
Rice and wild rice seeds	10	1,370	10.980
Rice seeds	168	13,528	239.411
Wild rice seeds	13	951	3.674
Sub-total	201	16,506	259.876
GRAND TOTAL	655	95,153	6,133.863

Table 4b. Sources of outgoing non-transgenic rice seeds/grains (January to December, 2014).

Organizational unit	Total shipments (no.)	Total seedlots (no.)	Total weights (kg.)
C ₄ Rice Center			
Transgenic rice seeds	18	399	0.746
Sub-total	18	399	0.746
Plant Breeding, Genetics, & Biotechnology (PBGB)			
Dehulled transgenic seeds	2	103	1.050
Polished transgenic seeds	1	19	0.079
Transgenic seeds	2	5	0.010
Sub-total	5	127	1.139
GRAND TOTAL	23	526	1.885

Table 5. Distribution by region and country of outgoing rice seeds (nursery sets) through INGER-PBGB (January to December, 2014).

Region/country	Total shipments (no.)	Total seedlots (no.)	Total weight (kg.)
East Asia (4)			
Korea N	2	1,131	24.590
Korea S	1	573	10.690
Mongolia	2	155	2.580
PROC	6	851	13.370
Sub-total		2,710	51.230
Europe and Central Asia (1)			
Russia	1	641	14.310
Sub-total	1	641	14.310
Latin America (3)			
Bolivia	1	210	3.150
Colombia	1	370	10.620
Surinam	1	216	4.320
Sub-total	3	796	18.090
Oceania (1)			
Australia	1	49	1.000
Sub-total	1	49	1.000
South Asia (5)	3	1,439	
Bangladesh	1	167	27.800
Bhutan	5	13,254	3.340
India	2	1,081	258.220
Nepal	1	1,043	17.670
Sri Lanka			19.310
Sub-total	12	16,984	326.340

Cont...Table 5

Region/Country	Total Shipments (No.)	Total Seedlots (No.)	Total weights (Kg.)
Southeast Asia (6)			
Indonesia	1	264	12.000
Malaysia	1	303	4.210
Myanmar	1	896	18.200
Philippines	2	1,089	20.590
Thailand	1	2,285	39.100
Vietnam	5	2,694	54.140
Sub-total	11	7,531	148.240
Sub-Saharan Africa (3)			
Ethiopia	1	49	0.760
Gambia	1	135	2.700
Uganda	1	646	10.600
Sub-total	3	830	14.060
West Asia & North Africa (3)			
Egypt	1	503	10.500
Iran	1	316	5.800
Turkey	1	50	2.300
Sub-total	3	869	18.600
GRAND TOTAL (26)	40	30,410	591.870

Table 6. Seedborne pathogens detected on untreated outgoing seeds received by SHU for phytosanitary certification (January to December, 2014).

Pathogens	Affected seedlots (%)	Detection level (%)	Mean value (%)
<i>Curvularia spp.</i>	96.74	1 – 83	12.22
<i>Trichoconis padwickii</i>	94.75	1 – 89	16.50
<i>Phoma spp.</i>	78.19	1 – 71	5.60
<i>Sarocladium oryzae</i>	44.62	1 – 47	3.20
<i>Nigrospora spp.</i>	37.61	1 – 70	3.97
<i>Fusarium moniliforme</i>	26.87	1 – 18	1.69
<i>Bipolaris oryzae</i>	14.72	1 – 12	1.17
<i>Microdochium oryzae</i>	7.04	1 – 8	1.22
<i>Tilletia barclayana</i>	3.15	1 – 100	10.29
<i>Aphelenchoides besseyi</i> ^a	3.00	1 – 83	5.56
<i>Pyricularia oryzae</i>	1.29	1 – 62	2.49

Based on 200 seeds/seedlots could be drawn for testing (n=10,253)

^aActual nematode count using sedimentation test.

Table 7. Seedborne pathogens detected on untreated GRC seeds for long-term storage in 2014.

Pathogens	Affected seedlots (%)	Detection level (%)	Mean value (%)
<i>Curvularia spp.</i>	99.91	1 – 85	16.36
<i>Trichoconis padwickii</i>	98.21	1 – 76	15.76
<i>Phoma spp.</i>	77.08	1 – 59	4.93
<i>Sarocladium oryzae</i>	47.26	1 – 36	3.23
<i>Nigrospora spp.</i>	29.56	1 – 32	3.46
<i>Fusarium moniliforme</i>	26.65	1 – 16	1.94
<i>Bipolaris oryzae</i>	4.29	1 – 4	1.28
<i>Microdochium oryzae</i>	2.36	1 – 6	1.38
<i>Aphelenchoides besseyi</i> ^a	2.01	1 – 23	3.55
<i>Pyricularia oryzae</i>	1.08	1 – 25	3.29
<i>Tilletia barclayana</i>	0.06	1 – 2	1.25

Based on 200 seeds/seedlots which could be drawn for testing (n=6,360)

^aActual nematode count using sedimentation test.

Table 8. Distribution by region, country and nature of shipment with the corresponding total number of shipments and total number of samples of outgoing non-transgenic non-seed biological materials (January to December, 2014).

Region/country	Total shipments (no.)	Total samples (no.)
EAST ASIA (5)		
HONGKONG		
DNA from rice	3	60
DNA and RNA from rice	1	24
Rice leaf powder	1	9
RNA from rice	1	6
RNA from rice leaves	2	39
JAPAN		
DNA from rice	5	1,730
Rice anther	1	664
Rice meristem frozen	1	135
Rice shoot samples dead	1	48
RNA from rice	3	66
Soil Air-dried	1	2
KOREA S		
DNA from maize	16	272
DNA from rice	3	25
DNA from rice and sorghum	1	25
DNA from rice leaves	1	4
DNA and primers from maize	2	12
DNA and primers from rice	1	11
DNA and primers from sorghum	2	73
DNA and RNA from rice	1	13
Genomic DNA	2	7
PCR products	1	25
Plasmid DNA	68	656
Plasmid DNA and primers	14	184
Primers	4	17
Primers from rice	2	4
Primers from sorghum	1	2
RNA from rice	2	12
PROC		
Lyophilized culture of PXO isolate	1	1
Maize seeds	1	1
Sorghum seeds	1	2
TAIWAN		
DNA from rice	1	2
Subtotal	145	4,131

Cont... Table 8

Region/country	Total shipments (no.)	Total samples (no.)
EUROPE (3)		
FRANCE		
Bacterial cultures Xoo	1	2
Rat samples	1	92
Rice leaf samples freeze-dried	1	13
Rice stem freeze-dried	1	12
Rice straw dried	1	10
GERMANY		
Arthropods	1	262
Arthropods and snails frozen	1	150
Fruit juices from mango, orange, pineapple, four seasons (frozen)	1	10
Fruits and vegetables frozen	1	49
Herbarium specimens	1	297
Maize roots dried	1	9
Maize roots slurry	1	9
Maize shoots dried	1	9
Pore water	1	8
Rice Leaf samples frozen	2	988
Rice meristem frozen	1	234
Rice panicles frozen	1	280
Rice root samples dried	1	9
Rice root slurry frozen	1	9
Rice shoot and maize plants dried	1	36
Rice shoot samples dried	1	9
Rice spikelets frozen	1	217
Rice straw decomposed	1	17
Rice straw and roots dried	1	36
Rice straw, rice leaves, water oven dried	1	24
RNA from rice root & shoot samples	1	12
Root, soil, pore water Frozen	1	90
Soil	1	50
Soil core and slurry	1	36
Soil dried	1	72
Soil dry	1	636
Soil oven dried	1	10
Soil and water samples frozen	1	348

Cont... Table 8

Region/country	Total shipments (no.)	Total samples (no.)
EUROPE		
Water samples	1	579
Weeds leaf samples air-dried	1	2,409
UNITED KINGDOM		
DNA from rice	2	209
Rice plant samples dried	1	357
Root proteins from rice (frozen)	1	12
Soil wet and dry	1	112
Sub-total	41	7,723
NORTH AMERICA (1)		
USA		
<i>Azolla A. pinnata var imbricata, Azolla filiculoides, Azolla mexicana, Azolla pinnata var. pinnata, Azolla caroliniana, Azolla microphylla, A. rubra, A. nilotica</i>	1	143
<i>Azolla Azolla rubra, nilotica, microphylla, caroliniana, mexicana, filiculoides</i>	1	125
cDNA	1	30
DNA from bacterial isolates	2	8
DNA from bacterial strains	3	11
DNA from rice	10	3,484
Rice flower samples frozen	2	602
Rice leaf samples frozen	2	602
Rice leaf samples Lyophilized	1	4
Rice leaf tissues	1	30
Rice leaf tissues frozen	1	502
RNA from rice (purified)	1	490
Setaria leaf (poaceae) dried	3	9,095
Sorghum seeds	1	4
Sub-total	30	15,130
OCEANIA (1)		
Australia		
Rice stem oven dried	1	188
Rice straw ground	1	161
Sorghum leaves dried and ground	1	318
Sub-total	3	667

Cont... Table 8

Region/country	Total shipments (no.)	Total samples (no.)
SOUTH ASIA (1)		
INDIA		
Bacterial cultures Xoo (dried)	1	1
Rice leaf powder dried	1	1,800
Sub-total	2	1,801
SOUTHEAST ASIA (6)		
CAMBODIA		
Primers	1	26
MALAYSIA		
DNA from maize	1	26
Plasmid DNA	6	27
Plasmid DNA and primers	6	114
Rice root samples	1	14
MYANMAR		
Primers	1	6
PHILIPPINES		
<i>Azolla Apinnata imbricata, Azolla filiculoides,</i>		
<i>Azolla mexicana, Azolla pinnata var. pinnata,</i>		
<i>Azolla caroliniana, Azolla microphylla</i>	1	29
<i>Azolla Azolla filiculoides, mexicana, nilotica,</i>		
<i>pinnata var. pinnata, caroliniana, microphylla,</i>		
<i>Pinnata imbricata</i>	1	42
<i>Azolla Azolla imbricata, mexiacana, caroliniana,</i>		
<i>microphylla</i>	1	11
<i>Azolla Pinnata imbricata, Azolla filiculoides,</i>		
<i>Azolla mexicana, Azolla caroliniana,</i>		
<i>Azolla microphylla, Azolla nilotica with agar</i>		
<i>solution</i>	1	33
<i>Azolla Pinnata imbricata, Azolla mexicana,</i>		
<i>Azolla caroliniana, Azolla microphylla</i>	1	11
<i>Azolla Pinnata imbricata, Azolla mexicana,</i>		
<i>Azolla caroliniana, Azolla microphylla, Pinnata</i>		
<i>var Pinnata</i>	1	46
<i>Azolla Pinnata imbricata, Azolla mexicana,</i>		
<i>Azolla microphylla</i>	1	12
Bacterial cultures Xoo	2	18
Blue green algae	1	5
DNA vectors	1	1
Inoculum	1	2
Insects and spiders	1	2,699

Cont... Table 8

Region/Country	Total Shipments (no.)	Total Samples (no.)
PHILIPPINES		
Rice leaf samples lyophilized	1	138
Rice straw oven dried	1	3
Sesbania seeds aquatic legumes	1	24
SINGAPORE		
DNA from rice	2	29
Lyophilized leaf punches from rice	1	754
Rice flour extract	3	72
Rice leaf punches from rice lyophilized	1	532
Rice leaf samples	1	3,808
Rice leaf samples lyophilized	3	1,773
VIETNAM		
Antibody	1	4
Bacterial isolates <i>Xoo</i> strains	1	14
Enzyme CEL1	1	5
Sub-total	46	10,278
SUB-SAHARAN AFRICA (1)		
SENEGAL		
Taq polymerase enzyme and Taq dilution buffer	2	33
Sub-total	2	33
GRAND TOTAL (18)	269	39,763

Table 9. Distribution by region, country and nature of shipment with the corresponding total number of shipments and total number of samples of outgoing transgenic non-seed biological materials (January to December, 2014).

Region/country	Total shipments (no.)	Total samples (no.)
EUROPE (2)		
GERMANY		
Rice tissue from transgenic rice (freeze-dried)	1	18
Transgenic rice leaves (dried)	1	32
UNITED KINGDOM		
Metabolites from Transgenic rice leaf	1	54
Sub-total	3	104
NORTH AMERICA (1)		
USA		
Transgenic rice leaves (dried)	1	723
Sub-total	1	723
GRAND TOTAL (3)	4	827

Table 10. Sources of outgoing transgenic and non-transgenic non-seed biological materials (January to December, 2014).

Organizational unit/ nature of materials	Total shipments (no.)	Total samples (no.)
C ₄ Rice Center		
DNA from maize	17	298
DNA from rice	1	16
DNA from rice and sorghum	1	25
DNA and primers from maize	2	12
DNA and primers from rice	1	11
DNA and primers from sorghum	2	73
DNA vectors	1	1
Maize Seeds	1	1
Metabolites from Transgenic rice leaf	1	54
Plasmid DNA	9	35
Plasmid DNA and primers	12	185
Primers	2	8
Primers from rice	2	4
Primers from sorghum	1	2
RNA from rice leaves	2	39
Setaria leaf (Poaceae) dried	3	9,095
Sorghum leaves dried and ground	1	318
Sorghum seeds	2	6
Transgenic rice leaves dried	2	755
Sub-total	63	10,938

Cont... Table 10

Organizational unit/nature of materials	Total shipments (no.)	Total samples (no.)
Crop and Environmental Sciences Division (CESD)		
<i>Arthropods</i>	1	262
<i>Arthropods & snails frozen</i>	1	150
<i>Azolla A. pinnata var imbricata, Azolla filiculoides, Azolla mexicana, Azolla pinnata var. pinnata, Azolla caroliniana, Azolla microphylla, A rubra, A nilotica</i>	1	143
<i>Azolla Apinnata imbricata, Azolla filiculoides, Azolla mexicana, Azolla pinnata var. pinnata, Azolla caroliniana, Azolla microphylla</i>	1	29
<i>Azolla Azolla filiculoides, mexicana, nilotica, pinnata var. pinnata, caroliniana, microphylla, Pinnata imbricata</i>	1	42
<i>Azolla Azolla imbricata, mexiacana, caroliniana, microphylla</i>	1	11
<i>Azolla Azolla rubra, nilotica, microphylla, caroliniana, mexicana, filiculoides</i>	1	125
<i>Azolla Pinnata imbricata, Azolla filiculoides, Azolla mexicana, Azolla caroliniana, Azolla microphylla, Azolla nilotica with agar solution</i>	1	33
<i>Azolla Pinnata imbricata, Azolla mexicana, Azolla caroliniana, Azolla microphylla</i>	1	11
Crop and Environmental Sciences Division (CESD)		
<i>Azolla Pinnata imbricata, Azolla mexicana, Azolla caroliniana, Azolla microphylla, Pinnata var Pinnata</i>	1	46
<i>Azolla Pinnata imbricata, Azolla mexicana, Azolla microphylla</i>	1	12
Blue green Algae	1	5
cDNA	1	30
DNA from rice	2	679
Herbarium specimens	1	297
Insects and spiders	1	2,699
Maize roots dried	1	9
Maize roots slurry	1	9
Maize shoots dried	1	9
Pore water	1	8
Rat samples	1	92
Rice flower samples frozen	2	602
Rice leaf powder dried	1	1,800
Rice Leaf samples freeze-dried	1	13
Rice Leaf samples frozen	3	1,572
Rice Leaf samples lyophilized	2	1,074
Rice Leaf tissues	1	30
Rice meristem frozen	2	369
Rice panicles frozen	1	280
Rice plant samples dried	1	357
Rice Root samples dried	1	9

Cont... Table 10

Organizational unit/nature of materials	Total shipments (no.)	Total samples (no.)
Rice root slurry frozen	1	9
Rice shoot and maize plants dried	1	36
Rice Shoot samples dead	1	48
Rice shoot samples dried	1	9
Rice spikelets frozen	1	217
Rice stem freeze-dried	1	12
Rice stem oven dried	1	188
Rice straw decomposed	1	17
Rice straw dried	1	10
Rice straw ground	1	161
Rice straw oven dried	1	3
Rice straw and roots dried	1	36
Rice straw, rice leaves, water oven dried	1	24
Root, soil, pore water Frozen	1	90
<i>Sesbania</i> seeds aquatic legumes	1	24
Soil	1	50
Soil air-dried	1	2
Soil core and slurry	1	36
Crop and Environmental Sciences Division (CESD)		
Soil dried	1	72
Soil dry	1	636
Soil Oven dried	1	10
Soil wet and dry	1	112
Soil and water samples frozen	1	348
Taq polymerase enzyme and Taq dilution buffer	2	33
Water samples	1	579
Weeds leaf samples air-dried	1	2,409
Sub-total	64	15,978
Grain Quality and Nutrition Service Laboratory (GQNSL)		
DNA from rice	1	12
DNA and RNA from rice	1	24
Rice flour extract	3	72
Rice leaf powder	1	9
Rice Root samples	1	14
Sub-total	7	131
Plant Breeding, Genetics, and Biotechnology (PBGB)		
Antibody	1	4
Bacterial cultures <i>Xoo</i>	3	20
Bacterial cultures <i>Xoo</i> (dried)	1	1
Bacterial isolates <i>Xoo</i> strains	1	14
DNA from bacterial isolates	2	8
DNA from bacterial strains	3	11
DNA from rice	19	4,781

Cont... Table 10

Organizational unit/nature of materials	Total shipments (no.)	Total samples (no.)
DNA from rice leaves	1	4
DNA and RNA from rice	1	13
Fruit juices from mango, orange, pineapple, four seasons (frozen)	1	10
Fruits and vegetables frozen	1	49
Genomic DNA	2	7
Inoculum	1	2
Lyophilized culture of PXO isolate	1	1
Lyophilized leaf punches from rice	1	754
PCR products	1	25
Plasmid DNA	65	648
Plasmid DNA and primers	8	113
Primers	4	41
Rice anther	1	664
Rice leaf punches from rice lyophilized	1	532
Rice leaf samples	1	3,808
Rice leaf samples frozen	1	18
Rice leaf samples lyophilized	3	841
Rice leaf tissues frozen	1	502
Plant Breeding, Genetics, and Biotechnology (PBGB)		
Rice tissue from transgenic rice freeze-dried	1	18
RNA from rice	5	78
RNA from rice (purified)	1	490
RNA from rice root and shoot samples	1	12
Root proteins from rice (frozen)	1	12
Sub-total	134	13,481
T.T. Chang Genetic Resources Center (TTC-GRC)		
DNA from rice	3	51
Enzyme CEL1	1	5
RNA from rice	1	6
Sub-total	5	62
GRAND TOTAL	273	40,590

Table 11. Origin and corresponding total number of incoming shipments, total number of seedlots, and total weight (kg) of non-transgenic rice seeds/grains (January to December, 2014).

Region/country	Total shipments (no.)	Total seedlots (no.)	Total weight (kg)
East Asia (4)			
Japan	1	174	0.400
Korea S	5	2,981	58.000
PROC	6	355	19.500
Taiwan	1	1	0.002
Sub-total	13	3,511	77.902
Europe and Central Asia (2)			
France	1	20	0.080
Kazakhstan	1	4	0.390
Sub-total	2	24	0.470
Latin America (1)			
Colombia	3	192	18.900
Sub-total	3	192	18.900
Oceania (1)			
Fiji	1	20	4.000
Sub-total	1	20	4.000
South Asia (4)			
Bangladesh	5	1,041	36.421
India	9	22	44.000
Nepal	1	1	.070
Sri Lanka	1	318	.600
Sub-total	16	1,382	81.091
Southeast Asia (4)			
Cambodia	2	831	11.000
Indonesia	4	12	3.150
Philippines	46	4,638	326.724
Thailand	2	170	8.810
Sub-total	54	5,651	349.684
Sub-Saharan Africa (5)			
Burundi	1	3	3.000
Mozambique	1	1	0.100
Nigeria	1	6	0.990
Senegal	1	296	10.000
Tanzania	4	728	10.600
Sub-total	8	1,034	24.690
West Africa (1)			
Benin	1	68	1.700
Sub-total	1	68	1.700
West Asia & North Africa (2)			
Iran	1	20	0.900
Turkey	1	8	0.800
Sub-total	2	28	1.700
GRAND TOTAL (24)	100	11,910	560.137

Table 12. Origin and corresponding total number of outgoing shipments, total number of seedlots, and total weight (kg) of transgenic rice seeds/grains (January to December, 2014).

Region/country	Total shipments (no.)	Total seedlots (no.)	Total weight (kg)
East Asia (3)			
Korea S	1	4	0.004
PROC	1	18	0.082
Taiwan	1	37	0.166
Sub-total	3	59	0.252
Latin America (1)			
Colombia	1	20,212	112.470
Sub-total	1	20,212	112.470
Southeast Asia (1)			
Philippines	1	16	0.733
Sub-total	1	16	0.733
GRAND TOTAL (5)	5	20,287	113.455

Table 13. Nature of incoming shipments and corresponding total number of shipments, total number of seedlots, and total weight (kg) (January to December 2014).

Nature of shipment/origin	Total shipments (no.)	Total seedlots (no.)	Total weight (kg)
Rice seeds			
East Asia	11	3,509	73.902
Europe and Central Asia	2	24	.470
Latin America	3	192	18.900
Oceania	1	20	4.000
South Asia	6	1,342	28.850
Southeast Asia	41	5,379	289.930
Sub-Saharan Africa	7	1,013	22.590
West Africa	1	68	1.700
West Asia & North Africa	2	28	1.700
Sub-total	74	11,575	442.042
HRDC seeds			
East Asia	2	2	4.000
South Asia	9	22	44.000
Southeast Asia	4	14	29.000
Sub-total	15	38	77.000
Transgenic rice seeds			
East Asia	2	55	0.248
Latin America	1	20,212	112.470
Sub-total	3	20,267	112.718
Golden rice seeds			
Southeast Asia	1	16	0.733
Sub-total	1	16	0.733

Cont... Table 13

Nature of shipment/origin	Total shipments (no.)	Total seedlots (no.)	Total weight (kg)
Milled Rice seeds			
South Asia	1	18	8.241
Southeast Asia	4	76	29.914
Sub-Saharan Africa	1	21	2.100
Sub-total	6	115	40.255
Dehulled rice seeds			
Southeast Asia	1	141	0.110
Sub-total	1	141	0.110
Dehulled transgenic seeds			
East Asia	1	4	0.004
Sub-total	1	4	0.004
Rice flour			
Southeast Asia	4	41	0.730
Sub-total	4	41	0.730
GRAND TOTAL	105	32,197	673.592

Table 14. Consignees and corresponding total number of incoming shipments, total number of seedlots and total weight (kg) of transgenic and non-transgenic rice seeds/grains (January to December, 2014).

Organizational unit	Total shipments (no.)	Total seedlots (no.)	Total weight (kg)
C₄ Rice Center			
Dehulled transgenic seeds	1	4	0.004
Transgenic seeds	2	20,246	112.636
Sub-total	3	20,253	112.640
Crop and Environmental Sciences Division (CESD)			
Rice seeds	6	674	14.650
Sub-total	6	674	14.650
Grain Quality and Nutrition Service Laboratory (GQNSL)			
Milled rice seeds	2	22	2.314
Rice flour	4	41	0.730
Rice seeds	3	851	15.000
Sub-total	9	914	18.044
Plant Breeding, Genetics, & Biotechnology (PBGB)			
Dehulled rice seeds	1	141	0.110
Golden rice	1	16	0.733
HRDC seeds	15	38	77.000
Milled Rice seeds	1	17	1.000
Rice seeds	63	9,225	403.792
Transgenic seeds	1	18	0.082
Sub-total	82	9,455	482.717

Cont... Table 14

Social Sciences Division (SSD)			
Milled rice seeds	3	76	36.941
Sub-total	3	76	36.941
T.T. Chang Genetic Resources Center (TTC-GRC)			
Rice seeds	2	825	8.600
Sub-total	2	825	8.600
GRAND TOTAL	105	32,197	673.592

Table 15a. Result of visual inspection conducted on incoming rice seeds received by SHU for post entry clearance (January to December, 2014).

Observations ¹	No. of infested seedlots	Percent (%)
Insect-damaged		
Sitophilus granarius	3	0.098

^a Based on 3,061 seedlots visually inspected

Table 15b. General quality of incoming rice seeds received by SHU for post entry clearance.

General quality ²	Number of seedlots	Percent (%)
Category 1	199	6.50
Category 2	0	0.00
Category 3	2,612	85.33
Category 4	250	8.17

^bBased on 3,061 seedlots visually inspected (observed x 100 / total seedlots)

Table 16. Seedborne pathogens detected on incoming rice seeds received by SHU for post entry clearance (January to December, 2014).

Pathogens	Affected seedlots (%)	Detection level (%)	Mean value (%)
<i>Curvularia spp.</i>	93.44	1 – 20	4.99
<i>Trichoconis padwickii</i>	74.59	1 – 38	3.16
<i>Bipolaris oryzae</i>	68.03	1 – 9	2.59
<i>Fusarium moniliforme</i>	51.64	1 – 41	4.27
<i>Phoma spp.</i>	45.08	1 – 2	1.13
<i>Nigrospora spp.</i>	45.08	1 – 8	2.31
<i>Sarocladium oryzae</i>	35.25	1 – 3	1.12
<i>Microdochium oryzae</i>	16.39	1 – 8	1.70
<i>Tilletia barclayana</i>	9.02	1 – 51	15.55
<i>Aphelenchoides besseyi</i> ^a	5.74	1 – 8	4.29
<i>Pyricularia oryzae</i>	1.64	1 – 1	1.00

^aActual nematode count based on 200 seeds/seedlot (n=122)

Table 17. Origin, nature of materials, total number of shipments and total number of samples of incoming non-seed biological materials (January to December, 2014).

Region/country	Total shipments (no.)	Total samples (no.)
EAST ASIA		
Korea S		
DNA from rice	2	133
Primers and PCR products of rice DNA	1	190
PROC		
DNA from rice	2	342
Plasmid DNA	1	2
Taiwan		
DNA bacterial isolates (<i>Xoo</i>)	1	17
Sub-total	7	684
EUROPE		
Germany		
Plasmid DNA	1	5
Netherlands		
Plant samples ground	3	12
Saw dust, oil palm (leaf), peppers, Chinese silver grass	1	4
Soil	4	16
United Kingdom		
Antibody	1	1
Plasmid DNA	5	86
Sub-total	15	124

Cont... Table 17

Region/country	Total shipments (no.)	Total samples (no.)
NORTH AMERICA		
USA		
Antibody	1	3
DNA from rice	1	100
DNA constructs	2	3
Plasmid DNA	5	24
Sub-total	9	130
SOUTH ASIA		
Bangladesh		
Rice leaf	1	20
Sub-total	1	20
SOUTHEAST ASIA		
Indonesia		
DNA from rice	1	82
Philippines		
Bamboo plant parts	5	180
DNA from rice	1	120
Herbarium samples oven-dried	1	297
Plant samples Ground	1	85
Rice leaf	1	317
Rubber plant samples	1	85
Soil	6	41
Soil oven-dried	1	10
Water samples	2	3
Weed leaf samples oven-dried	1	137
Vietnam		
DNA from rice	2	1,805
Sub-total	23	3,162
SUB-SAHARAN AFRICA		
Kenya		
DNA from rice	2	560
Nigeria		
Rice leaf	1	96
Rice leaf dried	1	74
Senegal		
DNA from rice	1	40
Sub-total	5	770
GRAND TOTAL	60	4,890

Table 18. Consignees/recipients of incoming non-seed biological materials (January to December, 2014).

Organizational unit/nature of materials	Total shipments (no.)	Total samples (no.)
C₄ Rice Center		
Antibody	2	4
DNA constructs	1	2
Plasmid DNA	7	98
Sub-total	10	104
Crop and Environmental Sciences Division (CESD)		
DNA	2	1,805
Herbarium samples	1	297
Rice leaf	1	74
Soil	2	17
Weed leaf samples	1	137
Sub-total	7	2,330
Grain Quality and Nutrition Service Laboratory (GQNSL)		
Bamboo plant parts	5	180
Plant samples	4	97
Rubber plant samples	1	85
Saw dust, oil palm (leaf), peppers, chinese silver grass	1	4
Soil	7	30
Water samples	2	3
Sub-total	20	399
Plant Breeding, Genetics, and Biotechnology (PBGB)		
DNA	11	1,394
DNA constructs	1	1
Plasmid DNA	5	19
Primers and PCR products of rice DNA	1	190
Rice leaf	3	433
Soil	2	20
Sub-total	23	2,057
GRAND TOTAL	60	4,890

Table 19. Incidence (%) of different diseases observed during field inspection at three different crop stages of rice of incoming and outgoing materials in 2014.

Crop stages/diseases	Incoming				Outgoing			
	DS	%*	WS	%*	DS	%*	WS	%*
Seedling								
Total entries	5329		239		20,138		6,879	
Without disease	5323	99.89	224	93.73	19,981	99.22	6,865	99.80
With disease ^a	6	0.12	15	6.28	157	0.78	14	0.21
Sclerotium seedling blight	6	0.12	0	0.00	157	0.78	14	0.21
Bacterial Brown Stripe	0	0.00	15	6.28	0	0.00	0	0.00
Bakanae	0	0.00	0	0.00	0	0.00	0	0.00
Tillering								
Total entries	5,329		239		20,138		6,879	
Without disease	5,296	99.38	212	88.71	19,974	99.19	4,863	70.70
With disease ^a	33	0.62	27	11.30	164	0.82	2,100	30.53
Tungro (RTV)	33	0.62	2	0.84	161	0.80	54	0.79
Bacterial leaf streak	0	0.00	25	10.46	0	0.00	2,046	29.75
Yellow Dwarf	0	0.00	0	0.00	3	0.02	0	0.00
Bakanae	0	0.00	0	0.00	0	0.00	0	0.00
Leaf Blast	0	0.00	0	0.00	0	0.00	0	0.00
Maturity								
Total entries	5,329		239		20,138		6,879	
Without disease	5,226	98.07	192	80.34	19,900	98.82	4,119	59.88
With Disease ^a	103	1.94	49	20.51	248	1.24	2,969	43.16
Tungro (RTV)	94	1.77	1	0.42	117	0.58	59	0.86
Bacterial leaf streak	0	0.00	32	13.39	20	0.10	2,630	38.24
Sheath blight	0	0.00	0	0.00	92	0.46	203	2.96
Leaf scald	3	0.06	0	0.00	2	0.01	13	0.19
Sheath rot	6	0.12	16	6.70	8	0.04	17	0.25
Narrow brown leaf spot	0	0.00	0	0.00	2	0.01	25	0.37
Neck Blast	0	0.00	0	0.00	0	0.00	0	0.00
False Smut	0	0.00	0	0.00	7	0.04	0	0.00
Bacterial leaf blight	0	0.00	0	0.00	0	0.00	22	0.32

Diseases observed on plants originating from incoming seeds were not of an introduced nature.

* Disease incidence (%) is calculated as the number of plant units infected expressed as percentage of the total units assessed.

Table 20a. Different types of Material Transfer Agreement (MTA) for outgoing transgenic and non-transgenic rice seeds/grains, including INGER nursery sets (January to December, 2014).

Type of MTA	Total MTA issued (no.)	Total seedlots (no.)
Standard MTA ^a	449	30,849
Standard MTA + OMTA	368	51,458
Signed SMTA + CMTA	21	1,499
HRDC MTEA	8	724
Amendment Letter	17	407
Transgenic MTA	2	23
Collaborative MTA	1	19
Restricted MTA	1	22
Non-IRRI Seed MTA	1	8
Transmittal Letter	2	4
Signed SMTA	5	1,012
Letter of intent	6	1,723
Other MTA	2	20
NO MTA ^b		38,321
TOTAL	883	126,089

^aTwo or more Standard MTA were issued in one shipment because of a large volume of ancestrals of lines under development (SMTA-UD) generated from the system or because there are different receiving institutions/ location sites in one seed request application.

^bNo MTA issued for the materials originally came from the sending institution/ country of destination (e.g., Korean seeds multiplied to IRRI, seeds for commercial analysis, IRRI to IRRI hubs seed transfer and seeds for IRRI experimental/ training purposes). A Transmittal letter is provided to a shipment with the previously approved MTA sending the same materials and an amendment letter for shipment using previously approved MTA with additional samples.

Table 20b. Different types of Material Transfer Agreements (MTA) and the corresponding total number of shipments, total number of seedlots, and total weight (kg) of incoming transgenic and non-transgenic rice seeds/grains (January to December, 2014).

Type of MTA	Total no. of shipments	Total no. of seedlots	Total weight (kg)
Amendment letter	1	2	2.000
Collaborative MTA	2	85	25.500
HRDC-MRYT MTEA	15	30	61.000
Letter of intent	16	3,125	64.960
NO MTA ^c	24	3,122	249.885
Other MTA	7	260	13.987
Signed SMTA	8	319	17.030
Standard MTA	31	5,042	126.760
Transgenic MTA	1	20,212	112.470
TOTAL	105	32,197	673.592

^cNo MTA accompanied by the seed package for the materials under Korean Seeds for Multiplication Project (KSMP), IRRI seeds sent back and seeds commercially obtained provided by invoice.

Table 21. Disposal of transgenic materials conducted by different organizational units of IRRI (January to December 2014).

Organizational unit/ nature of materials	Quantity
C₄ Rice Center	
Autoclaved seeds	50
Autoclaved seeds and panicles	21
Autoclaved unfilled seeds and panicles	21
Seeds	3
Seeds and panicles	11
Soil	193
Vegetative materials	37
Vegetative waste	66
Sub-total	402
Crop and Environmental Sciences Division (CESD)	
Autoclaved seeds	19
Autoclaved soil	31
Autoclaved vegetative materials	4
Rice straw	9
Soil	134
Vegetative waste	65
Sub-total	262
Plant Breeding, Genetics, and Biotechnology (PBGB) Division	
Autoclaved seeds	187
Half-filled/empty grains from GR2E crosses	45
IR 64, Rc82, BR29 and Ciherang parents	15
IR64 GR-2R	7
IR64 wt	7
Potted soil	660
pSARK-IPT DNA	3
Seeds	146
Seeds and panicles	6
Seeds attached to paper	2
Soil	2,605
Unfilled seeds	7
Unfilled seeds and rachis	8
Vegetative materials	47
Vegetative plant materials	1
Vegetative waste	129
Sub-total	3,875
GRAND TOTAL	4,539

Table 22. Movements of transgenic materials conducted by different organizational units of IRRI (January to December 2014).

Organizational unit/nature of materials	Quantity
C ₄ Rice Center	
Autoclavable seeds	6
Biomass	23
Crossed Lines	5
F ₁ seeds of IR64 derived lines	7
FOX Lines	125
IR64 and NB Lines (seeds)	51
IR64 and TRIM lines	146
IR64 crossed Lines (panicles)	602
IR64 derived lines (clothing case)	436
IR64 derived lines (panicles)	1,150
IR64 derived lines (plants)	362
IR64 derived lines (pre-germinated seeds)	24
IR64 derived Lines (root trainers)	326
IR64 derived lines (seedlings - 3 days old)	29
IR64 derived lines (seedlings)	763
IR64 derived lines (seeds)	730
IR64 derived lines (T2 seedlings)	61
IR64 derived lines (T6 seedlings)	109
IR64 lines	3,469
IR64 lines embryo (young panicles)	200
IR64 seedlings	314
IR64 T0 seedlings	99
IR64-IRS870	120
IRS499/485	192
IRS755	303
IRS756	94
IRS772	19
IRS826, 609, 783/784, 785,760, 761, 499	31
IRS834 and 784	10
NB-IRS828	220
NB-IRS830	258
Panicles (IR64 lines)	462
Panicles and unfilled seeds	7
Plants	2,301
Processed panicles, seeds, etc.	8
Seedlings	1,324

Cont... Table 22

Organizational unit/nature of materials	Quantity
Seeds	5,534
Seeds and panicles	6
Seeds of FOX Line -3D-02931	1
C ₄ Rice Center	
Seeds w/ panicles	6
Threshed materials	1
TN 67 and Nipponbare seeds	40
TRIM Lines	53
TRIM Lines pre-germinated seedling	22
TRIM lines pre-germinated seeds	90
Unfilled seeds and panicles	5
Sub-total	20,144
Crop and Environmental Sciences Division (CESD)	
DREB F ₁ and WT seedlings	4
DREB F ₁ seeds	6
DREB seedlings	132
DREB seeds	818
DREB T5 seedlings	2
DREB Wildtype	1
Drought grain yield samples	5
F ₁ plants	33
Plants with maturing grain	20
Pre-germinated seeds	42
Seedlings	500
Seeds	156
Seeds filled and naked	341
Seeds of IR87707-445-B-B-B	1
Threshed seeds	3
Wild Type	1
Wild Type seedlings	1
Sub-total	2,066
Plant Breeding, Genetics and Biotechnology (PBGB) Division	
Azygotes of GR2	6
Azygotes of GR2E and GR2T	4
Ciherang Sub1, Ciherang, BR11 Sub1, BR11, BR29, IR64 cross with GR2T, GR2E, GR2L, GR2W	18
Dehulled Seeds	29
F ₂ seeds	3
Fe biofortified seedlings	79

Cont... Table 22

Organizational unit/ nature of materials	Quantity
Fe biofortified seeds	74
Plant Breeding, Genetics and Biotechnology (PBGB)	
Filled T1 seeds	2
Golden Rice materials	170
GR2E crosses	208
GR2E events background of IR36,IR64, RC82 and BR29	43
GR2-E IR64 crosses	800
GR2-E IR64 Lines	151
GR2E Rc82 and BR29	261
GR2-R Lines	11
Half filledgrain from GR2E crosses	26
High Iron Biofortified Seeds	32
IR64 derived lines (Dehulled seeds)	5
IR64 GR-2R	85
IR64 lines	135
IR64 WT	75
IR64, Rc82, BR 29 and Ciherang parents	15
Panicles	39
Panicles for autoclaving	19
Panicles from T2 plants	4
pSARK-IPT DNA	3
Rachis	13
Reproductive parts	7
Seedlings	362
Seeds	2,286
Soil with ungerminated seeds	1
T1 to T3 seeds	13
T2 panicles	4
T2 seeds	305
T3 seedlings	43
Tissue culture control	5
Unfilled F ₁ seeds	7
Unfilled Seeds	36
Unfilled seeds and rachis (T2)	2
Sub-total	5,381
GRAND TOTAL	27,591

GRAIN QUALITY AND NUTRITION SERVICES LABORATORY (GQNSL): Update on support services

In January 2014, the two service facilities under GQNC— Analytical Services Lab (ASL) and Quality Evaluation Services (QES)—were merged to create the Grain Quality and Nutrition Services Laboratory (GQNSL). The integrated service lab is now located in the Kenzo Hemmi Laboratory Building where improvement in service facilities, enhancement of revenues under full-cost recovery (FCR), effective space utilization for both services and inclusion of grain quality service methods to its ISO accreditation certification were expected to be achieved. This GQNSL service lab comprises 19 staff members, managed by Ms. Lilia Molina under the GQNC operational unit.

The integrated GQNSL processed a total number of 30,757 samples and conducted 166,433 total analyses in 2014 (Fig. 1).

Grain samples for quality evaluation (QE) constitute 53% of the total samples processed, followed by plant and grain (36%) for analytical services. Of the total analyses performed, 48% came from grain QE and 44% from plant and grain for mostly macro and micronutrient and kjeldahl N analyses.

Quality evaluation services

GQNSL provides grain quality analysis to unravel the importance of various grain quality traits, as well as the nutritional value, of pre-breeding and breeding materials at IRRI. Table 1 shows how GQNSL supports PBGB breeders' requirements for grain quality testing

Table 1: GQNSL support services to IRRI breeding programs in 2014.

PBGB Group	TOTAL	
	No. of samples	Amount
Salinity tolerance	2.100	3.308
Multi-parent AG inter-cross	3.300	5.198
Cross cutting R&D	1.500	2.363
Plant Path. Genetics	0	0
Climate change-ready rice	2.250	2.738
Drought tolerance	15.403	24.415
Hybrid rice	14.490	17.630
IRRI Germplasm-INGER	3.600	5.670
Multi-envt. trial-MET	1.578	2.485
Heat tolerance	500	900
Irrigated rice	17.556	21.746
Flood tolerance	10.750	13.193
Super Green Rice	1.200	1.885
Biofortification	1.500	1.825
Rainfed rice	25.056	30.485
Total	100.783	133.838

of their various research work in breeding (based on the information provided by PBGB deputy OU head). Among the divisions at IRRI (Fig. 2), PBGB submitted the highest percentage (51%) of the total grain samples for quality evaluation services, followed by GQNC (41%). Some samples were also received from CESD (4%), external sources (3%), and SSD (1%).

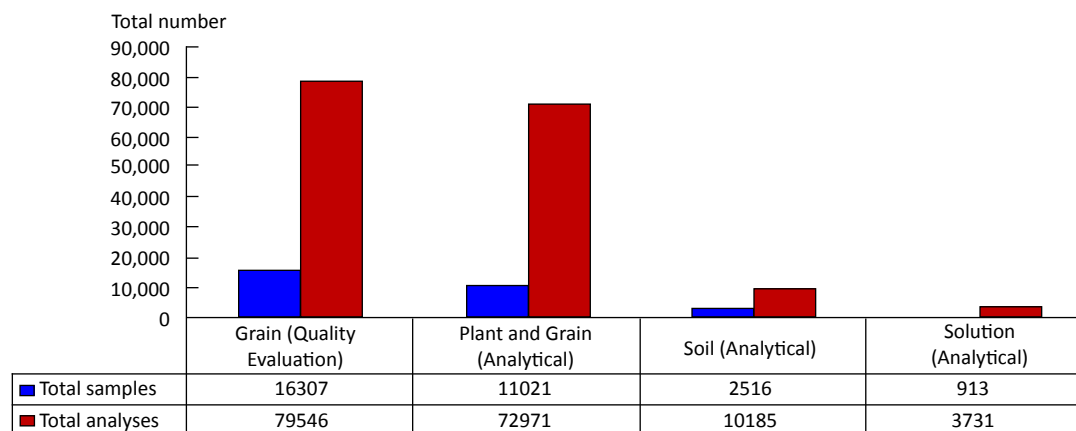


Fig. 1. Total number of samples and analyses processed by GQNSL in 2014 (by sample type).

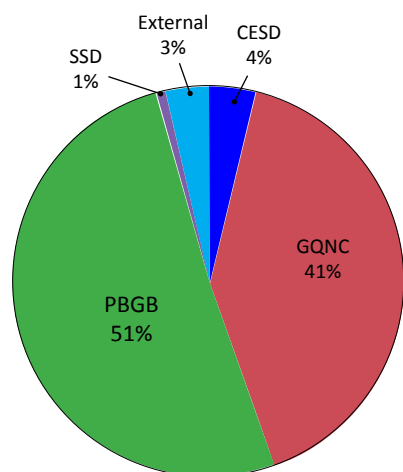


Fig. 2. Profile of grain QE sample submissions by division in 2014.

Analytical services

GQNSL continued to provide analytical testing services for plant, soil, and water samples. Plant and grain samples constituted the majority of the samples analyzed, which was 76%; soil was 17% and solution samples were 6%. In 2014, the number of samples decreased by 21%.

Performance of GQNSL under full-cost recovery (FCR)

In 2014, separate FCRs were maintained for QES and ASL to assess the monetary benefits of the integrated service laboratory. Table 2 shows the summary of QES and ASL operations from 2011-2014.

QES and ASL cost recovery analysis

The Quality Evaluation Services (QES) did well in 2012 with 100% recovery, but the Analytical Services Lab (ASL) showed only 32% recovery mainly because

of high staffing and facility costs and fees applied were based on 1990 computations.

This led Nese Sreenivasulu, GQNC head, to come to a decision to merge QES and ASL under a single umbrella known as the GQNSL, and cross-train staff to facilitate both grain quality and micronutrient services.

In 2013, the merging of services under GQNSL showed benefits of recovery of 76% for ASL (operating under 50% FCR scheme) and 80% for QES. The drop in QES recovery is attributed to restructured breeding efforts.

In 2014, QES cost-recovery rate further fell to 58% of the total expenditure. In addition, the ASL cost-recovery rate in 2014 is 39%, decreasing from 76% in 2013. There was a decline in the 2014 sample submissions and cost recovery for QES as a result of the structural changes in PBGB breeding programs. Likewise, ASL samples decreased according to the changing analytical needs of the biofortification programs, which opted to buy their own equipment instead of sending samples to ASL at the FCR rate.

In lieu of the laboratory's low sample submissions, GQNSL supported the GQNC research on its core collection samples, for which ASL processed 3,798 samples and QES evaluated 5,183 samples. However, only the cost of consumables was recovered and not the FCR as approved by the DDGR. This led the team to use the data in defining grain quality markers. Through The outcome of this work we could propose to establish a grain quality excellence cluster and use this platform to increase the revenue of services and research.

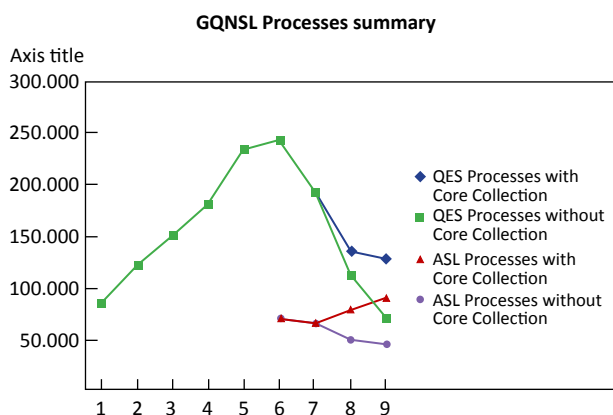
Investment from GQNC on the core collection:

- For consumables, USD 62,940.43 has been invested.
- Additional overtime money for staff during weekends has been covered. Calculation will soon be done to furnish the details of the investment.

Table 2. Operations summary for Quality Evaluation Services (QES) and Analytical Services Lab (ASL) from 2011-2014.

	2011		2012		2013		2014	
	QES	ASL	QES	ASL	QES	ASL	QES	ASL
Recovery	180,582	121,548	214,960	119,700	163,162	161,381	108,080	138,250
Expenditure	230,850	341,544	186,216	371,511	203,721	212,020	187,706	358,744
% recovery	78	36	115	32	80	76	58	39

- Additional 620 samples under FCR has been submitted for profiling samples for QES and ASL analysis, where GQNC invested USD 11,240.
- Additional USD 25,000 investments on renovation facilities of the GQNSL were taken care of from the research budget.



The financial benefit of the integrated service lab is shown in Table 3, where cost savings for 2014 on personnel, GOC, and equipment depreciation were achieved. However, increased cost on facilities (due to high electricity and RO water consumption) decreased the savings for the total expenditure of the integrated GQNSL to USD 5,100 only.

IRRI's internal factors leading to low sample submissions in GQNSL under FCR

1. Structural changes in PBGB breeding programs. Routine quality evaluation tests formerly done from pedigree nurseries to replicated yield trials were either skipped or reduced to samples

2. Duplication of instruments/analyses available at GQNSL.

- a. Atomic Absorption Spectrophotometer (AAS) for macro and microelements.
 - i. The old AAS instrument from CESD and a high-resolution XRF are now fully used by CESD and PBGB for their biofortification projects.
 - ii. PBGB purchased a new AAS.
 - iii. PBGB group purchased 2 units of high-throughput XRF for quick micronutrient analysis of milled rice.
- b. Analysis of micronutrients. At GQNSL, we use ICP-OES for macro- and micronutrient analysis. A low-throughput XRF for finely ground rice samples is also available at GQNC.
- c. Large plant drying ovens. Before FCR, all plant ovens (8) are fully used throughout the year by IRRI research groups. Oven use was free of charge for ASL customers. When the FCR was implemented, a rental fee of USD 30/day was put in place and CESD decided to purchase their drying ovens, instead of renting from the GQNSL. At the Kenzo Hemmi Lab, there are 7 large plant ovens and 2 small ones on the 2nd floor, and 3 small ovens on the 1st floor being used by CESD. The GQNSL ovens have become underutilized and only external customers are renting them once in a while.

Table 3. Summary of transaction details and cost savings for ASL and QES as separate service facilities in 2013 and under the integrated GQNSL in 2014.

Transaction items	2013	2014	2014 Cost
	QES+ASL (USD)	GQNSL (USD)	Savings (USD)
Personnel costs	299,109.63	277,491.00	21,618.63
GOC	111,330.84	77,138.00	34,192.84
Depreciation	65,202.76	39,637.02	25,565.74
Facility costs	75,910.65	152,184.00	(76,273.35)
Total expenditure	551,553.88	546,450.02	5,103.86
Recovery	324,542.86	246,330.00	
% recovery	59	45	

- d. Capacity building of other IRRI research groups to perform grain quality tests offered by GQNSL.
 - i. Establishment of grain quality service facilities in the hubs at Hyderabad and Burundi
 - ii. Kjeldahl N analysis, QE tests such as MPS, chalk, and gel temperature by ASV to be done by PBGB research groups
- 3. Delay in analysis due to SHU sample clearance requirement prior to analysis of external samples.
 - a. Local external samples – 1-2 weeks processing time at SHU before sample is cleared for analysis at GQNSL
 - b. Foreign external samples – 1-2 months processing time at SHU before sample is sent and cleared for analysis at GQNSL

Status of ISO 17025 Accreditation

ASL maintains its compliance to its ISO 17025 accreditation and, under its new name, GQNSL, preparation for an additional 9 grain quality tests for inclusion in its Scope of Accreditation from the Philippine Accreditation Bureau (PAB) is in process. PAB also appreciates L. Molina's continuous sharing of expertise and active involvement as Technical Assessor to PAB surveillance visits for other laboratories applying for accreditation, and as a member of the Laboratory Accreditation Committee.

Staff training

All GQNSL staff participated in the 1st International Workshop on Grain Quality on 1-3 December 2014. ASL staff had a series of grain quality lectures and hands-on training to equip them for grain quality testing, whereas QE staff members were trained on ISO 17025 standards and proper documentation. ASL staff started to contribute an additional workforce for processing grain samples for QE tests in the 2nd quarter of 2014.

A demonstration training on Laboratory Information Management System (LIMS) was also provided for all GQNSL staff by OCIMUM Biotracker LIMS Business Analyst, Anurag Guduri, as part of the User Acceptance Training for the GQNSL commercial LIMS in December 2014.

Future targets to improve grain quality services

- (i) Implement a stronger program on hybrid rice to improve grain quality under public-private partnership in the form of excellence cluster initiative. Concepts have been derived by GQNC.
- (ii) Restructure the breeding programs at IRRI with focus on the irrigated breeding program to target higher head rice yield, less than 2% chalk, and good texture and aroma traits.
- (iii) Restructure the breeding programs for stress tolerance by enhancing head rice yield and cooking qualities.

Riceworld Museum and Learning Center

Riceworld Museum

Working with the Events, Visitors, and Exhibits Office, Riceworld received 25,724 visitors in 2014, ranging from walk-in visits to scheduled guided tours. Museum visitors included students, faculty members, university staff, donors, scientists, researchers, private sector, media, farmers, NGOs, religious groups, tourists, government officials, employees, and others.

Since the third week of November, Riceworld has been greeting visitors and passersby with a new entrance sign.

Exhibits

Riceworld organized, participated, and assisted in the design and installation of IRRI exhibits for the following events:

- (1) Nutritionist-Dieticians' Association of the Philippines Annual Convention, Crowne Plaza Hotel, Mandaluyong City, Philippines 28-30 February 2014
- (2) Mang Enteng and Friends: Through the Years, Salcedo Auctions, **Venue?**, 23 March-4 April 2014
- (3) Asian Festival for Children's Content, Singapore, 30 May-4 June 2014
- (4) Food and Nutrition Security Forum, Riceworld Museum, Los Baños, Philippines 23 July 2014
- (5) 10th Agriculture and Fisheries Technology Forum and Product Exhibition, SM Megamall, Mandaluyong City, Philippines, 8-10 August 2014
- (6) ASIAFLUX, IRRI, Los Baños, Philippines, 18-23 August 2014
- (7) Syensaya 2014 Los Baños Science Festival, Copeland Gym, Los Baños, Philippines, 10-12 September 2014
- (8) ASEAN Ministerial Meeting on Agriculture and Forestry (SOM-AMAF), Nay Pyi Taw, Myanmar, 21-26 September 2014
- (9) Farmers' Day, IRRI, Los Baños, Philippines, 1 October 2014
- (10) UP Rural High School Science-Math Fair, UPRHS, Los Baños, Philippines, 21-23 October 2014
- (11) 4th International Rice Congress, BITEC, Bangna, Bangkok, Thailand, 28-31 October 2014
- (12) Department of Agriculture's Rice Awareness Week Program, DA, Quezon City, 10-14 November 2014
- (13) 2nd International Conference on Agricultural and Rural Development in Southeast Asia, Makati Shangri-La, Manila, Philippines, 12-13 November 2014
- (14) IFAD/IRRI/CURE/Heirloom Exhibit at Bureau of Soils and Water Management, Quezon City, Philippines, 24-25 November 2014
- (15) 10th National Biotechnology Week, CHED, Quezon City, Philippines, 24-28 November 2014
- (16) Health and Heirloom Crops Symposium, Agronomy Bldg., 4-5 December 2014

Collections

There are two types of collections that are under the museum's care:

(1) The ethnographic collection has a total number of 598* objects. Majority of the objects are under the museum's safekeeping while others are on loan to institutions such as PhilRice and Science Centre Singapore. Some objects are on exhibit along the hallway of Umali Building at IRRI.

(2) The art collection has a total number of 190** objects. Majority of the objects in this collection are displayed inside office buildings in IRRI. This year, 3 artworks have been added to the collection, which includes 2 reproductions of Manansala's mural painting located in the IRRI main cafeteria and 1 rice mosaic donated by Singaporean artist Nidhi.

*as of July 2011

** as of July 2014

Educational Programs

This year, Riceworld spearheaded two events:

(1) "Si Manansala at ang Masaganang Ani" on 29 January 2014 in celebration of Vicente Manansala's birth anniversary

Activities included symposia on the life, works, influence, and importance of Manansala in Philippine

art; an exhibit of Manansala's works; sketching and painting sessions by the Saturday Group of Artists and, an art market. The event served as a platform for interaction among IRRI staff, visual artists, and museum/cultural workers.

(2) "Riceworld Museum @ 20: Where rice is twice as nice" on 21 November 2014 in celebration of Riceworld's 20th year anniversary and the National Rice Awareness Month in the Philippines

Sixty students from 5 public elementary schools in Los Baños and Bay, Laguna, spent the whole afternoon at Riceworld by participating in activities located in various places inside the museum. The program was designed to give students a different kind of museum experience as each group of students moved from one activity to another. The activities included storytelling (reading of "Legend of a Rice Plant") by Pinoy Storytellers, a rice art activity, rice science activities (discussions on "Rice and a healthy diet" and "Insects found in the rice fields and how they affect the rice plants"), and rice games. At the end of the program, the students were encouraged to share what they learned from the activities.