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INTERNATIONAL UNION FOR THE PROTECTION OF NEW VARIETIES OF PLANTS

GENEVA

WORKING GROUP ON BIOCHEMICAL AND MOLECULAR TECHNIQUES AND DNA PROFILING IN PARTICULAR

Tenth Session
Seoul, November 21 to 23, 2006

REPORT

adopted by the Working Group on Biochemical and Molecular Techniques, and DNA-Profiling in Particular (BMT)

1. The Working Group on Biochemical and Molecular Techniques, and DNA-Profiling in Particular (BMT) held its tenth session in Seoul, from November 21 to 23, 2006. The list of participants is reproduced in Annex I to this report.

2. The BMT was welcomed by Mr. Eung-Bon Kim, Director of Plant Variety Protection Division, National Seed Management Office (NSMO), on behalf of Dr. Jae Chun Sim, Director General of NSMO. A copy of the welcoming address presented by Mr. Eung-Bon Kim is reproduced in Annex II to this document.

3. The session was opened by Mr. Henk Bonthuis (Netherlands), Chairman of the BMT, who welcomed the participants.

4. The BMT received a presentation on the crop functional genomics program in the Republic of Korea, from Professor Yang Do Choi, Director of the Crop Functional Genomics Center, Seoul National University, and on the plant variety protection situation in the Republic of Korea, from Dr. Keun-Jin Choi, NSMO. Copies of those presentations are reproduced as Annexes III and IV, respectively, to this report.

Adoption of the Agenda

5. The BMT adopted the Agenda as reproduced in document BMT/10/1.

Reports on developments in UPOV concerning biochemical and molecular techniques

6. The Office of the Union (the Office) provided a report on developments in UPOV concerning Biochemical and Molecular Techniques, on the basis of document BMT/10/2.

7. A representative of the Community Plant Variety Office (CPVO) of the European Community welcomed the fact that the Consultative Committee had noted that the BMT could provide a forum for discussion on the use of biochemical and molecular techniques in the consideration of variety identification. The BMT noted that, in that respect, the Consultative Committee had concluded that it was not necessary to change the terms of reference of the BMT in the way proposed by the *Ad hoc* Subgroup of Technical and Legal Experts of Biochemical and Molecular Techniques (BMT Review Group).

Reports on the Work of the Crop Subgroups

8. The BMT heard from Mrs. Beate Rücker (Germany), Chairperson of the Crop Subgroup for Maize, that there had been no meeting of the Crop Subgroup for Maize.

9. Mrs. Françoise Blouet (France), Chairperson of the Crop Subgroup for Oilseed Rape, reported that there had been no further meeting of the Crop Subgroup for Oilseed rape since its first meeting in 2001. That first meeting had identified the need to develop a suitable set of molecular markers, which had proved to be more difficult than for some other crops, such as maize. She noted that on-going work on a research project co-financed by the CPVO "Management of Winter Oilseed Rape Reference Collections", was presented in document BMT/10/11 and would be considered under the agenda item "Report of work on molecular techniques on a crop-by-crop basis". It was anticipated that the data from that project would be analyzed in time for a report to be made at the eleventh session of the BMT. The representative of the International Seed Federation (ISF) reported that ISF was working on oilseed rape in the context of essential derivation and could provide information on its work at the next meeting of the Crop Subgroup for oilseed rape.

10. Mrs. Beate Rücker (Germany), Chairperson of the Crop Subgroup for Potato, reported that there had been no meeting of the Crop Subgroup for Potato, but noted that document BMT/10/5 "Identification of Potato Cultivars on the European Union Common Catalogue Using Simple Sequence Repeat (SSR) Markers" would be presented under the agenda item "Report of work on molecular techniques on a crop-by-crop basis". She noted that no meeting was planned and anticipated that future meetings would be held as a part of the meeting of the Crop Subgroup for Vegetatively Propagated Crops.

11. The BMT heard that no meetings of the Crop Subgroup for Rose had been held since the ninth session of the BMT, but noted that document BMT/10/16 "A European Reference Collection of Rose Varieties" would be presented under the agenda item "Report of work on molecular techniques on a crop-by-crop basis" and that matters concerning rose would also be considered by the Crop Subgroup for Vegetatively Propagated Crops.

12. The BMT heard that no meetings of the Crop Subgroup for Ryegrass had taken place. The representative of ISF reported that results of its work in the context of essential derivation were expected in February 2007 and could be reported at a meeting of the Crop Subgroup for Ryegrass.

13. The BMT heard that no meetings of the Crop Subgroup for Soybean had been held since the ninth session of the BMT, but noted that document BMT/10/15 "DNA-Based Identification System for Soybean" would be presented under the agenda item "Report of work on molecular techniques on a crop-by-crop basis".

14. The BMT heard that no meetings of the Crop Subgroup for Sugarcane had been held since the ninth session of the BMT.

15. The BMT heard that no meetings of the Crop Subgroup for Tomato had been held since the ninth session of the BMT. An expert from the Netherlands reported that a project on an "Option 1(a)" approach for disease resistance in tomato had been started in the Netherlands.

16. The Office reported that Mr. Robert Cooke (United Kingdom), Chairman of the Crop Subgroup for Wheat and Barley, had explained that he would be unable to continue in the role of Chairman. The Office explained that a new Chairperson could be proposed by the Technical Working Party for Agricultural Crops in 2007, for endorsement by the Technical Committee in April 2008, but explained that an interim chairperson could be arranged if there was a need to hold a meeting in the meantime. An expert from the United Kingdom reported that he was unaware of any on-going work on wheat. An expert from Canada reported that there was work being done on barley in Canada, but that it was not anticipated that a meeting would be needed before a new Chairperson could be appointed.

17. The BMT Chairman recalled that a meeting of the Crop Subgroup for Vegetatively Propagated Crops would be held in conjunction with the tenth session of the BMT.

Short Presentations on New Developments in Biochemical and Molecular Techniques by DUS Experts, Biochemical and Molecular Specialists, and Plant Breeders

18. An expert from the United Kingdom reported on a Wellcome Trust Centre seminar which had been held in Cambridge earlier in 2006, which had demonstrated the advances which were being made in genome sequencing techniques.

19. An expert from Spain reported on work which was taking place in Italy to sequence the genome of grapevine and noted that this might be useful for developing "Option 1" approaches and for studying essential derivation. He reported that the gene which controlled grape color had been identified and noted that there were various other genomic projects underway for grapevine.

20. The representative of the Food and Agriculture Organization of the United Nations (FAO) reported that the first meeting of the Governing Body of the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA) was held in Madrid from June 12 to 16, 2006, hosted by the government of Spain. A key outcome of that meeting had been the approval of the standard Material Transfer Agreement (sMTA), which would allow the Treaty to come into practical effect. She noted the relevance of articles 5 and 6, concerning the characterization and utilization of genetic resources, in relation to molecular techniques

and reported that the FAO was keen to assist member countries to review how molecular techniques could directly contribute to the characterization and utilization of genetic resources.

21. An expert from the Republic of Korea reported on the work being done in Republic of Korea in the framework of "Option 1" and "Option 2" approaches, which had been presented at the Technical Workshop on the Use of Molecular Techniques in Plant Variety Protection held on November 20, 2006.

22. A representative of the CPVO recalled that it was important for plant breeders' rights to be granted on the basis of a robust examination of distinctness, uniformity and stability (DUS test) and then added that the CPVO considered that suitable support to enable breeders to enforce their right was also important. In that regard, the CPVO had held seminars on enforcement in Brussels in October 2005 and in Warsaw in 2006, with a further seminar planned to be held in Madrid in February 2007. He highlighted that, at the first two seminars, breeders had called for more effective tools to enable them to enforce their rights and he considered that the BMT might be able to help in the development of such tools. He also explained that the CPVO were co-financing a number of projects in that respect, reports of which would be presented at the tenth session of the BMT.

23. The representative of the International Community of Breeders of Asexually Reproduced Ornamental and Fruit-Tree Varieties (CIOPORA) reported that CIOPORA was working on a position paper on essentially derived varieties, which it was anticipated would be adopted at its board meeting in April 2007. He explained that the basis of their paper would be thresholds for similarity based on molecular tools and noted that this would require information on a lot of species, which might be assisted through the work of the BMT.

24. The representative of the International Seed Testing Association (ISTA) made a presentation on the work of ISTA in relation to molecular techniques, a copy of which is reproduced in document BMT/10/18.

25. The representative of ISF reported that ISF had initiated a new project on SSR markers in tomato in order to investigate the parent lines used in hybrid varieties. He anticipated that the results would be available for presentation to the Crop Subgroup for Tomato within 18 months. He informed the BMT that ISF had reaffirmed its position with regard to the possible use of molecular techniques in DUS testing and in variety identification in a paper which was published on the ISF website at http://www.worldseed.org/Position_papers/Use_DNA_Markers.htm.

26. The BMT was informed that, in China, there had been a substantial increase in the number of applications for plant variety protection filed with the Ministry of Agriculture. The number of applications had increased from 290 in 2002 to 950 in 2005. Applications for maize and rice varieties represented approximately 70% of all applications filed during that period. It was also reported that, in parallel to this, the number of cases of infringements of plant breeders' rights has also increased. The Government of China had decided to develop quick and reliable methods to facilitate the identification of protected varieties and to support the enforcement of plant breeders' rights. The Ministry of Agriculture had developed a methodology for 20 SSR markers to be used for the identification of maize varieties. For rice, 24 SSR markers had been selected. The use of molecular techniques for DUS testing was still under consideration. A database of maize variety DNA-profiles was under construction. Once established it would provide useful information for the management of reference

varieties and the selection of similar varieties in the course of DUS testing, and for the identification of protected varieties in the case of infringement.

Report of Work on Molecular Techniques on a Crop-by-Crop Basis

(a) Vegetatively Propagated Crops

Identification of Potato Cultivars on the European Union Common Catalogue Using Simple Sequence Repeat (SSR) Markers

27. The BMT received a presentation by Mr. Alex Reid (United Kingdom), based on document BMT/10/5.

28. An expert from Germany remarked that the project had highlighted potential problems arising from mislabeling of varieties and noted that such problems could have importance for decisions on the distinctness of varieties.

A Microsatellite-Based System for the Identification and Legal Protection of Grapevine Varieties

29. The BMT received a presentation by Mr. Javier Ibañez (Spain) based on document BMT/10/13. He clarified that a project had been initiated by the *Oficina Española de Variedades Vegetales* (OEVV) for the characterization of the reference collection of grapevine varieties, using the system of microsatellites presented in that document.

30. In response to a question by an expert from the United Kingdom, Mr. Ibañez clarified that chimeras had been identified in the same plant, noting that there had been reports elsewhere of mutations in one of the two meristem layers.

31. The representative of ISF requested clarification of the way in which the figure of 30,000 different genotypes had been calculated. It was explained by Mr. Ibañez that the number of genotypes was calculated by multiplying the number of plants by the number of microsatellites. It was agreed that it would be more suitable to use the number of plants as the basis for the number of genotypes.

32. The representative of ISF asked Mr. Ibañez to estimate the level of genetic distance which would correspond to a difference of two alleles using nine microsatellites. Mr. Ibañez replied that nine microsatellites would not be sufficient to calculate a reliable genetic distance. The representative of ISF recalled that he had suggested at the ninth session of the BMT that it would be helpful to consult the breeders on the possible use of molecular techniques in DUS testing and wondered if Mr. Ibañez had been able to do so. Mr. Ibañez explained that the grapevine breeders he knew were not familiar with molecular techniques. However, he noted that the *Organisation Internationale de la Vigne et du Vin* (OIV) was revising its descriptor to include characteristics based on microsatellite markers and wondered if that would carry any obligations for the UPOV Test Guidelines. The Office clarified that UPOV was revising its Test Guidelines in order to seek to harmonize characteristics with the OIV descriptor as far as the characteristics were appropriate for both UPOV and OIV purposes. However, the OIV descriptor and UPOV Test Guidelines had different purposes and there were characteristics which were included in the OIV descriptor which were not appropriate for the purposes of the DUS examination in the context of plant breeders' rights. In

particular, he emphasized that the inclusion of characteristics in the OIV descriptor could not carry any obligations for the UPOV Test Guidelines and vice-versa.

33. An expert from France noted that, in his presentation, Mr. Ibañez had suggested to use more than nine microsatellites where a difference of only one allele difference was found between varieties and requested clarification of what the outcome would be if there was an allele difference in an additional microsatellite proposed by the breeder. He explained that he had in mind to use 20 microsatellites which were being used by different European research teams in grapevine, but which he reported had not been investigated with regard to uniformity and stability.

34. The Chairman noted that the project had been initiated by OEVV for the characterization of the reference collection of grapevine varieties and requested clarification from Mr. Ibañez on the views of OEVV with regard to the possible use of microsatellites for DUS testing. Mr. Ibañez clarified that the proposals in the document reflected his ideas as a researcher and emphasized that the OEVV did not accept microsatellite information for DUS purposes. A representative of the CPVO noted that the Spanish examination office conducted DUS testing of grapevine varieties on behalf of the CPVO and he recalled that the CPVO only accepted morphological characteristics for DUS testing.

A European Reference Collection of Rose Varieties

35. The BMT received a presentation by Mr. Ben Vosman (Netherlands) based on document BMT/10/16.

36. A representative of the CPVO noted that partly different markers had been used for garden roses and greenhouse roses and wondered if that indicated that the markers could differentiate between those types of varieties. Mr. Vosman clarified that it was not possible to differentiate the types by molecular markers: nine markers had been used for both types of roses, but a set of three markers had proven more informative for discriminating varieties of garden roses and a different set of three markers had been more discriminating for greenhouse roses.

37. The representative of ISF requested clarification of whether all mutant varieties had identical profiles. Mr. Vosman confirmed that that was the case for greenhouse roses, but the quality of the DNA had made it difficult to be sure with regard to garden roses. He explained that the problems in the quality of the DNA in garden roses probably arose because the material was collected in Germany, freeze-dried in the Netherlands and then transferred to the United Kingdom during the project and noted that this indicated the importance of having a suitable sampling protocol. In response to a further question, Mr. Vosman explained that there had been approximately 100 mutant varieties within the overall number of approximately 700 varieties.

38. An expert from Spain wondered if there were plans for data on all 30,000 rose varieties to be introduced in the database. Mr. Vosman replied that the project had been completed and no more data would be generated without further funding. An expert from the CPVO noted that the existing system of DUS testing had been shown to be very effective.

39. An expert from France noted that one of the proposals in paragraph 29 of document BMT/10/16 was a “strong reduction or replacement of permanent living reference collections at testing stations” and she wondered how it would be possible to conduct an effective

examination of distinctness with such a reduction. Mr. Vosman noted that the database included variety descriptions and photographs and where it was considered necessary to obtain living plant material of a variety for comparison in a growing trial, material could be obtained from the breeder and verified as necessary. An expert from Germany noted that such an approach was more difficult to establish for garden roses and explained that, for such types, it was more appropriate to maintain living plant material collections.

40. In response to a question from a representative of the CPVO on whether molecular data would be used on its own, Mr. Vosman clarified that NAKtuinbouw did not use the molecular data at all in the pre-screening / pre-selection of varieties.

41. The expert from the United States of America noted that rose varieties were grafted onto rootstocks and wondered how the effects of the rootstocks were dissociated from the grafted variety. The Chairman explained that, for DUS trial purposes, a single rootstock variety was specified to ensure that there was a common effect for rootstocks on all varieties.

Microsatellite Markers for Identification of Carnation Varieties

42. The BMT received a presentation by Mr. Ben Vosman (Netherlands) based on document BMT/10/17.

43. The representative of ISF noted that there was a curtailed distribution of similarity beyond 85% and wondered if that might indicate a possible threshold for essential derivation. Mr. Vosman agreed that this was consistent with the findings in rose, but recalled that there were 3 groups of possibly non-mutant varieties which needed to be investigated further before such a conclusion could be reached for carnation.

44. Mr. Ibañez questioned whether the cases which were assumed to be aneuploids might rather be chimeras. Mr. Vosman noted that this could be the case and explained that the markers had not been mapped.

45. The Chairman wondered whether the database could be used to examine the use of data for purposes other than for variety identification. Mr. Vosman confirmed that the database could be used to evaluate various different scenarios. One scenario could be to see what would happen if the markers were used for the assessment of distinctness: in that regard, in the case of hybrid tea rose (greenhouse), with the exception of mutant varieties, the same decisions would have been made. He also explained that the database had been developed in response to a request from breeders in relation to the need for a rapid method of variety identification for enforcement of plant breeders' rights.

(b) Self-Pollinated Crops

Functional SNP Markers for the vernalization requirement in Barley: A potential "Option 1" approach

46. The BMT received a presentation by Ms. Carol Norris (United Kingdom) based on document BMT/10/6. She explained that, as a next step, it would be necessary to investigate uniformity and stability of varieties in relation to the markers and to look at how to address the "alternative" types.

47. The representative of ISF noted that it was to be expected that it would not be possible to differentiate the "alternative" types from "spring" types, because "alternative" types were "spring" types with cold tolerance.

48. An expert from Germany considered that the approach was of particular interest because the examination of the characteristic required a separate growing trial. She also considered that it may not be necessary to discriminate between "spring" and "alternative" types.

49. The Chairman expressed surprise that vernalization was not controlled by a quantitative trait locus (QTL). Ms. Norris noted that vernalization in wheat, unlike in barley, was controlled by a QTL.

50. In response to a question from the expert from the United States of America, Ms. Norris undertook to check if *H2* was always a homeric dimer.

Examination of Pungency Characteristics in Pepper by "Option 1" Approach

51. The BMT received a presentation by Mr. Seung In Yi (Republic of Korea) based on document BMT/10/7.

52. In response to a question from an expert from the Netherlands, Mr. Yi explained that no mutations had been reported in other metabolic pathways.

53. In response to a question from the expert from the United States of America, Mr. Yi confirmed that it was DNA, not RNA, which had been amplified.

Seeking an Ideal Balance of Molecular and Phenotypic Characteristics for DUS Testing of Inbred Maize Lines

54. The BMT received a presentation by Mr. Jon White (United Kingdom) based on document BMT/10/8.

55. In response to a question from an expert from France, Mr. White agreed that the work was very dependent on the dataset used and explained that the dataset was based on inbred lines provided from the United States of America, predominantly inbred lines of Pioneer. He explained that it was intended to include some inbred lines from Europe at a later stage. He also noted the dataset was sufficiently large to split the data and use part of the data as a test data set.

56. The representative of ISF informed the BMT that the project presented in document BMT/10/8 would be considered by the Intellectual Property Committee of ISF at its meeting in January 2007.

57. The Office noted that Mr. White made reference in his presentation to constraints imposed by UPOV in the examination of DUS. It recalled that the role of UPOV was to provide an effective system of plant variety protection and that its recommendations in the form of Test Guidelines were developed by experts from members of the Union in conjunction with breeders through the relevant breeders organizations. The BMT was informed that the Test Guidelines for Maize were under revision by the Technical Working Party for Agricultural Crops and that the input of all interested experts in that process was welcomed.

58. The Chairman noted that the matters raised in the document would be considered by ISF and that, within UPOV, there was an opportunity for discussion in the framework of the revision of the Test Guidelines for Maize and, with regard to molecular techniques, within the BMT.

Possible Use of Molecular Techniques in DUS Testing on Maize. How to Integrate a New Tool to Serve the Effectiveness of Protection Offered Under the UPOV System

59. The BMT received a presentation by Mrs. Françoise Blouet and Mrs. Joëlle Lallemand (France) based on document BMT/10/14.

60. The expert from the United States of America requested clarification of the benefits of the approach for breeders. Mrs. Blouet explained that the benefits were that it would be possible to consider a larger number of the varieties of common knowledge without an increase in the amount of DUS field trial work and would allow a costs reduction by the replacement of electrophoresis with molecular techniques.

61. In response to a question from the Chairman, Mrs. Blouet clarified that the term “Super distinct” was synonymous with “distinct plus”.

62. The Chairman noted that graph 2 indicated that the molecular distance made a very powerful contribution to the reduction in the number of comparisons in the growing trial. Mrs. Blouet agreed and confirmed that the benefit of the approach would diminish if the morphological contribution was fixed at too high a level. The balance needed to be found between the contribution of morphology and molecular distance considering the risk of making a wrong decision.

63. An expert from Germany considered that it was a very interesting approach and expressed her agreement with such an approach where a morphological difference was required in conjunction with a molecular difference. She noted that it would be important to maintain a stable level of genetic difference, for example if the set of microsatellites was changed. Mrs. Lallemand explained that, as indicated in Figure 2, the same level of genetic difference was found with 51 markers as with 36, indicating that the difference was rather stable. The representative of ISF noted that it would be necessary to use suitable reference material if the set of markers was to be changed.

64. The Chairman noted that the approach fell within an Option 2 approach and noted that the last sentence of the document explained that the authors considered that “the introduction of DNA markers in a characteristic-by-characteristic approach would undermine the quality of protection granted to the varieties under the UPOV system”. He wondered if that meant that the use of a difference of one or two alleles in the case of vegetatively propagated crops would be precluded on that basis. Mrs. Blouet expressed concern at an approach where decisions on distinctness could be taken without any morphological differences between varieties. An expert from Germany wondered if the molecular distance was being considered as a characteristic. Mrs. Blouet clarified that the molecular distance was not considered as a characteristic.

65. The Chairman noted that the future work and perspectives set out in the document included discussion with breeders and official bodies.

A Research Project Co-Financed by CPVO "Management of Winter Oilseed Rape Reference Collections"

66. The BMT received a presentation by Ms. Carol Norris (United Kingdom), based on document BMT/10/11. She reported that the project would be completed in 2008 and explained that more results would be presented at the eleventh session of the BMT.

67. In response to a question from the Chairman, Ms. Norris confirmed that the varieties included in the work were predominantly open-pollinated varieties, rather than hybrids.

68. In response to a question from the representative of ISF, Ms. Norris clarified that the DNA extracted from the 30 seeds was bulked into a single sample.

DNA-Based Identification System for Soybean

69. The BMT received a presentation by Ms. Ana Laura Vicario (Argentina), based on document BMT/10/15.

70. In response to a request for clarification by the Chairman, Ms. Vicario explained that the work was being undertaken as a complement for variety identification in relation to the enforcement of plant breeders' rights.

71. The expert from the United States of America wondered whether the occurrence of infrequent alleles was dependent on the locus. Ms. Vicario explained that that was not the case, although some loci had revealed more heterozygosity than others.

72. The representative of ISF noted that the bulking of 100 seeds was an interesting way of overcoming a lack of uniformity in the context of variety identification for the enforcement of plant breeders' rights.

(c) Cross-Pollinated Crops

73. No documents were presented for cross-pollinated crops

74. The Chairman summarized that, for vegetatively propagated crops, high quality databases had been developed with great potential for variety identification and DUS purposes. He noted that the crops presented had revealed seedlings with a high degree of heterozygosity and with a large amount of morphological and molecular differences. Discrimination with molecular techniques had been seen to be very powerful, except in the case of mutant and essentially derived varieties, but care was needed to avoid the use of such techniques in a way which could undermine the effectiveness of protection. An important step in any approach, whether under Option 2 or 3, would be discussion with the stakeholders, notably breeders and the plant variety protection authorities. He also remarked that the value of the databases was linked to the quality of data, which meant that competent laboratories were required.

75. With regard to self-pollinated crops, the Chairman noted that there had been some clear proposals within an Option 1(a) approach which offered significant cost and operational benefits. With regard to Option 2 approaches, he noted that these had focused on the calibration of molecular and morphological thresholds, rather than a correlation between morphological and molecular distances. Mistakes of a second order would arise when

varieties which were morphologically very different were included in the growing trial. However, mistakes of the first order would arise if varieties which were not distinct for morphological characteristics were excluded from the growing trial. He observed that more data was required to develop the Option 2 approach and saw that work was continuing in that respect for maize and oilseed rape, where synergies between molecular and morphological information indicated that an Option 2 approach might be feasible. He noted that the work on soybean had indicated that the issue of uniformity was an important one which had the risk of being underestimated.

Guidelines for DNA-Profiling: Molecular Marker Selection and Database Construction "BMT Guidelines"

76. The BMT considered documents BMT/10/3 and BMT Guidelines(proj.6), and made the following recommendations with regard to document BMT Guidelines(proj.6):

Section 1.2	first sentence: to amend "the data produced are independent of the equipment used to produce them" to read "the interpretation of the data produced are independent of the equipment used to produce them"
Section 4.3	The BMT noted that, at the twenty-fourth session of the Technical Working Party on Automation and Computer Programs (TWC), several experts considered that Section 4.3 "Sample size" should provide more guidance on the selection of the sample size, in particular in the case of cross-pollinated varieties. However, the BMT considered that it would not be appropriate to seek to develop detailed guidance on sampling in the BMT Guidelines.
Section 4.3.3	to add "However, there may be reasons, including cost, to analyze a bulk sample of an agreed number of individuals to represent the DNA profile of a variety."
Section 4.4	to add "The DNA sample should be stored in such a way as to prevent degradation."
Section 5.2.1	to delete all the text in brackets such that the section would read "It is important to agree on certain quality criteria concerning, for example: (a) the quality of DNA; (b) the primer sequences used; (c) the polymerase to be used in PCR-based methodologies; (d) for PCR-based methodologies, the amount/concentration of each PCR component and other components; (e) PCR cycling conditions"
Section 5.4.2	to be deleted
Glossary	In "Pig-tailing" to amend "short oligonucleotide sequence" to read "short specific oligonucleotide sequence"

77. In relation to Section 5.2.1 "Quality criteria", the expert from the United States of America noted that ISO and Codex guidelines had been developed. The BMT agreed that it would be useful to invite relevant experts to make a presentation on those guidelines at the eleventh session of the BMT.

78. The BMT agreed that, on the basis of the recommendations in paragraph 76, the document could be proposed for agreement by the Technical Committee.

Practical Exercise in the Development of an Exchangeable Database of Molecular Data of Plant Varieties

79. The BMT considered document BMT/10/4 and received a presentation from Mr. Alex Reid (United Kingdom), based on document BMT/10/9.

80. A representative of the CPVO noted that there was an error in the text of document BMT/10/4, paragraph 2. In the penultimate sentence, the text "the project to characterize all the varieties in the Common Catalogue of the European Union by 2007" should be amended to read "the project to characterize all the varieties of potato in the Common Catalogue of the European Union by 2007".

81. With regard to the invitation of the TC to suggest a small number of suitable crops where a practical exercise in the development of an exchangeable database might be appropriate, the BMT agreed to suggest oilseed rape, potato and rose. It was agreed that the terms of reference to be established by the TC for that work should clarify what was meant by an exchangeable database and whether it referred to the structure of the database or the quality of the data and whether it would involve a test data set rather than the complete set of data which an authority had for the crop concerned.

Statistical Methods for Data Produced by Biochemical and Molecular Techniques

82. The Chairman noted that no papers had been presented for that item and invited Mr. Sylvain Grégoire (France) and Mr. John Law (United Kingdom), as previous Chairmen of the TWC, to comment.

83. Mr. Grégoire noted that there were a number of statistical methods which might be appropriate in relation to molecular techniques. Among other examples, he recalled that the TWC had drawn the attention of the BMT to the risks in the interpretation of dendrograms.

84. Mr. Law explained that, in the past, some statisticians had built tools to address problems which had not arisen in practice. He noted that there were some on-going generic problems, such as missing data and "fuzzy" data, whilst some other issues were technology dependent according to the marker types used, e.g. AFLPs, SSRs etc. The TWC were willing to address any questions raised by the BMT and would continue to follow developments and to offer advice if they considered it would be appropriate.

The Use of Molecular Techniques in Examining Essential Derivation

85. The Chairman noted that no papers had been presented for that item and invited the representatives of the breeders organizations to comment.

86. The representative of ISF explained that he would make a presentation on the use of molecular techniques in relation to essentially derived varieties at the "Symposium on the Application of Molecular Techniques for Plant Breeding and in Plant Variety Protection" to

be held in Seoul on November 24. He noted that the majority of BMT participants would attend that symposium. On that basis he suggested to provide only a brief overview of the ISF situation. The situation in ISF was that, where there was some suspicion of essential derivation from an initial variety, it was possible to use molecular markers to assess genetic distance with a threshold which would act as a trigger for arbitration. ISF had established arbitration rules which were available on the ISF website (http://www.worldseed.org/Arbitration_EDV.htm). With regard to establishing an appropriate threshold for triggering arbitration, which was also the trigger for a reversal of the burden of proof, ISF was of the opinion that such a threshold needed to be established on a crop-by-crop basis taking into account the variability of varieties available in the market. The threshold took into account the curtailed distribution concerning the 1% or 5% closest varieties and a comparison of varieties of known parentage. The existing thresholds were: 85% for maize and oilseed rape; 87.5% for cotton; and 96% for lettuce. A threshold for ryegrass was planned to be established in 2007. ISF guidance on issues to be addressed by technical experts to define molecular marker sets for establishing thresholds for ISF EDV arbitration was published on the ISF website (http://www.worldseed.org/pdf/Technical%20rules%20EDV%20threshold.pdf).

87. The representative of CIOPORA recalled that CIOPORA was working on a position paper on essentially derived varieties, which it was anticipated would be adopted at its board meeting in April 2007. He noted that CIOPORA needed to address a much larger number of species than ISF, which posed difficulties in setting thresholds on a crop-by-crop basis. The representative of ISF informed the BMT that CIOPORA and ISF would have a joint meeting on November 30 to discuss harmonization of their approach to essential derivation.

88. The representative of the European Seed Association (ESA) explained that a number of its members were active in ISF and that discussions were kept within ISF.

The Use of Molecular Techniques in Variety Identification

The Use of Molecular Techniques in Variety Identification

89. The BMT received a presentation by Mr. José Elena (CPVO), based on document BMT/10/10.

90. The Chairman noted that the document and the presentation raised a number of issues of both a technical and legal nature and wondered if the BMT could address those matters without a clearly defined project being put forward. Mr. Elena acknowledged that a number of issues had been raised, but considered that if an authority took an initiative alone a unique opportunity to develop options for variety identification in a harmonized way could be lost.

91. The representative of ISF agreed that both legal and technical issues had been raised. With regard to technical issues, he considered that the establishment of BMT Guidelines would be an important step towards harmonization. An expert from the Netherlands noted that the BMT Guidelines did not address the use of some techniques, such as AFLPs, which would be important for some crops.

92. The representative of ESA noted that many of the issues raised were matters which needed to be considered with breeders, but he noted that there was a role for UPOV and wondered if it would be possible to study the issues on selected crops.

93. Mr. Elena explained that a harmonized approach to variety identification under UPOV should carry more weight in court cases.

94. The Office made a brief report on the Workshop on the Enforcement of Plant Breeders' Rights under the UPOV Convention, which had been held from November 15 to 17, 2006 in Tokyo. That workshop had highlighted a number of different activities which breeders and authorities had taken with regard to enforcement. It had also highlighted the limited involvement of plant variety protection authorities in court cases concerning possible infringements of plant breeders' rights.

95. An expert from France noted that the molecular methods being developed in the framework of an Option 2 approach would provide important descriptive information on the basis of an official test using a defined reference sample. Another expert from France noted that certification agencies were already using other complementary technologies. He noted that ISTA were also considering the use of DNA fingerprinting for identification purposes. The representative of ISTA explained that he would report on developments at the eleventh session of the BMT.

96. An expert from Germany observed that there would be different questions for different crops and applications and suggested to study a small number of crops. Mr. Elena noted that the development of tools for even a few crops, for example 20, would be of assistance to breeders.

97. The Chairman proposed that a more detailed proposal should be prepared for the eleventh session of the BMT. Mr. Elena anticipated that the CPVO would prepare such a proposal.

The Verification of the Varietal Identity of VCU Submission of Cereal Crops Using Biochemical Methods

98. The BMT received a presentation by Ms. Carol Norris (United Kingdom), based on document BMT/10/12.

99. The Chairman observed that the document demonstrated a very effective use of an existing technology to improve procedures for national list testing.

Recommendations on the Establishment of New Crop Specific Subgroups

100. The BMT heard that the *Ad hoc* Crop Subgroup on Molecular Techniques for Vegetatively Propagated Crops (Vegetatively Propagated Crop Subgroup), at its meeting on November 22, had agreed to propose to the BMT and to the Technical Committee that it organize specific sessions at the BMT for vegetatively propagated, self-pollinated and cross-pollinated crops, in order to facilitate discussions on horizontal matters and, subject to such an approach, agreed to propose to discontinue the Vegetatively Propagated Crop Subgroup. The BMT agreed with that approach.

101. The BMT agreed that the crop subgroups should, in particular, provide a forum for focused discussion of proposals with stakeholders. In that respect, it noted that it may not be most appropriate to hold the meetings in conjunction with meetings of the Technical Working

Parties. On that basis, it agreed that meetings of the following crop subgroups might be appropriate:

Crop Subgroup for Rose: to meet in early 2007
Crop Subgroup for Potato: to meet in Spring 2007
Crop Subgroup for Maize: to meet around the end of 2007 or early 2008

Date and Place of Next Session

102. In response to the invitation received from the government of Spain, the BMT agreed to hold its eleventh session in Spain in May 2008.

Future Program

103. During its eleventh session, the BMT planned to discuss the following items:

1. Opening of the session

2. Adoption of the agenda

3. Reports on developments in UPOV concerning biochemical and molecular techniques

4. Reports on the work of the Crop Subgroups

5. Short presentations on new developments in biochemical and molecular techniques by DUS experts, biochemical and molecular specialists, plant breeders and relevant international organizations

6. Report of work on molecular techniques on a crop-by-crop basis:

   (a) vegetatively propagated crops
   (b) self-pollinated crops
   (c) cross-pollinated crops

7. Guidelines for DNA-Profiling: Molecular Marker Selection and Database Construction "BMT Guidelines"

8. International guidelines on molecular methodologies

9. Practical exercise in the development of an exchangeable database of molecular data of plant varieties

10. Statistical methods for data produced by biochemical and molecular techniques

11. The use of molecular techniques in examining essential derivation

12. The use of molecular techniques in variety identification

13. Recommendations on the establishment of new crop specific subgroups

14. Date and place of next session

15. Future program

16. Report of the session (if time permits)

17. Closing of the session

104. The BMT agreed that, in order to encourage the presentation of information in relation to the use of molecular techniques in examining essential derivation and in variety identification, it would be appropriate to dedicate a specific day to items 11 and 12 at the eleventh session of the BMT. In particular, breeders and other experts would be offered the possibility to attend for that specific day.

Meeting Presentations

105. The BMT agreed that, where agreed by the presenters, copies of the presentations made at the meeting should be prepared as addenda to the relevant BMT documents and posted on the BMT/10 area of the UPOV website.

Technical Visit

106. On the afternoon of November 23, 2006, the BMT made technical visits to: the National Agriculture Science Museum of the Rural Development Institute (RDA) in Suwon, where it was welcomed by Dr. Jae Kyu Kim; the Rice Breeding Center of the National Institute of Crops Science in Suwon, where it was welcomed by Dr. Yun Kyu Kim; and the genebank facilities of the National Institute of Agricultural Biotechnology in Suwon, where it was welcomed by the Director, Dr. Tae San Kim.

107. The BMT adopted this report at the close of its session.

[Annexes follow]

ANNEX I

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[Annex II follows]

ANNEX II

Speech by Dr. Jae-chun Sim
Director-General of National Seed Management Office

WELCOME ADDRESS

Mr. Henk Bonthuis, Chairman of the Working Group on Biochemical and Molecular Techniques, and DNA-Profiling in Particular,

Mr. Button, Technical Director of UPOV, and Mr. Makoto Tabata, Senior Counsellor,

and distinguished participants,

Welcome to the 10th UPOV BMT meeting!

Let me first extend my sincere gratitude to the Chairman and UPOV for giving us this opportunity to host the BMT meeting in Seoul, Republic of Korea.

In 2002, we hosted the UPOV Asian Regional Technical Meeting in this same place and discussed how to enhance cooperation in the field of plant variety protection among Asian countries. In 2004, the thirty-eighth session of the Technical Working Party for Vegetables (TWV) was held here and also the thirty-eighth session of the Technical Working Party for Ornamental Plants and Forest Trees (TWO) was held here in 2005.

We are also expecting to host the thirty-eighth session of the Technical Working Party for Fruit Crops (TWF) meeting from July 9 to 13, 2007, in the Republic of Korea. All these three meetings are thirty-eighth meetings which is a coincidental conjunction.

As such, the Republic of Korea has been a very active member of the organization. I hope that the Republic of Korea will also be the host country for the thirty-eighth Technical Working Party for Agricultural Crops (TWA) session.

Mr. Chairman,

The Republic of Korea legislated the Seed Industry Law in 1995 and has implemented its plant variety protection scheme since 1997. Joining UPOV as the 50th member country in January 2002, we have been fully committed to protecting plant varieties through cooperation with UPOV member countries.

As a member of UPOV, the Government of the Republic of Korea will continue to play a leading role in fulfilling its obligations as a member State and in actively protecting intellectual property rights of new varieties. In this regard, the workshop organized by UPOV yesterday was very helpful for the participants in their understanding of the UPOV system and the possibilities of using molecular techniques in DUS testing. Again, I would like to thank UPOV for organizing the workshop and all the speakers for giving us excellent presentations.

Mr. Chairman,

As of October 31, 2006, a total of 2,752 varieties have been the subject of an application for plant variety protection, of which 1,685 varieties were granted plant variety protection.

Around 835 varieties, or 35% of all PVP titles, are held by foreign breeders. The major species for which applications are made by foreign breeders are rose, chrysanthemum, kalanchoe and impatiens. The increase in overseas applications is stimulating domestic breeding.

The enforcement of breeders' rights is very important for the development of the seed industry in the Republic of Korea. One of the techniques for varietal identification is molecular technique. Therefore, we are trying to consider the possibilities of varietal identification by using molecular techniques when claims are raised. I hope that this BMT meeting will make a considerable contribution for Korean breeders in the Republic of Korea.

Earlier, I briefly mentioned that cooperation among UPOV members is important in harmonizing DUS testing for plant variety protection. I hope that your active participation, presentations and deep discussions in this meeting will provide member countries with an excellent opportunity to advance plant variety protection under the UPOV system.

Once again, I would like to thank Mr. Henk Bonthuis, Chairman of the BMT, Mr. Button and Mr. Tabata of UPOV for organizing this meeting, and I wish you all good health and a wonderful stay in the Republic of Korea.

Thank you very much for your attention.

[Annex III follows]

Crop Functional Genomics Program in Korea

Yang Do Choi, Seoul National University

Program Summary

○ Final Goal : To Characterize 500 novel genes through Functional Genomics technology

○ Period : 10 years (2001. 7. 1. ~ 2011. 6. 30.)

○ Funds : $113 M (Government $100 M, Private $13M)

- Phase 1 (01~04) : $32.8 M (Gov $30.0 M, Pvt $2.8M)
- Phase 2 (04~07) : $30.7 M (Gov $28.2 M, Pvt $2.5 M)
- Phase 3 (07~11) : $48.0 M (Gov $40.0 M, Pvt $8 M)

○ Granted Institutes : 27 (University 18, Research Inst 4, Industry 5)

○ Research Scientists : 637 (PhD 172, MS 221, etc 244)

Marker Insertion Mutant Pools of Rice

- **Goal :**
  1. to develop a large scale of insertional mutagenized population
  2. to obtain molecular information on tagged insertion sites
  3. to share resources for functional analysis of rice genes

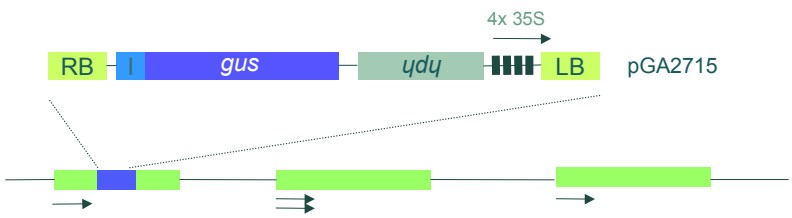
- **Systems :**
  1. T-DNA insertion Mutant Pool
  2. Ac/Dc Tagged Pool

- **Significance :**
  1. Mutant phenotype offers a direct way to relate a gene to its function
  2. Insertion tag offers a direct way to locate the mutated gene

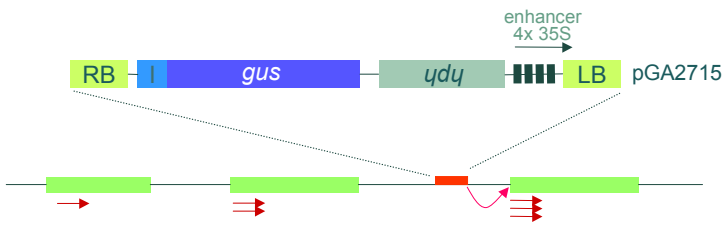
- News feature. A recipe for revolution? Nature 422: 796 (2003)
- Rice Mutant Resources for Gene Discovery. Plant Mol. Biol. 54: 325-334 (2004)

T-DNA Insertion Lines

Gene An's lab have generated 100,000 lines



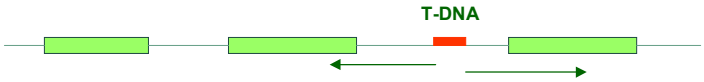
❖ Insertion of T-DNA knockout the gene function



❖ Insertion of an enhancer near a gene could activate the gene expression, generating dominant mutant phenotypes.

Flanking Sequence Tags

- To use the tagged lines more efficiently, they have determined the flanking sequences of the T-DNA insertions.



The number of independent sequences is currently > 80,000.

- The FST database can be found at www.postech.ac.kr/life/pfg/risd.
- Upon request, seeds are available to scientific community.
- Mutant seeds distribution

items	domestic	foreign	total
scientists	31	31	62
lines	1,510	530	1,949

DataBase Collection

http://signal.salk.edu/cgi-bin/RiceGE

- G An's T-DNA insertions generated hits in more than 50% of the rice genes.
- Together with other contributions, approximately 2/3 of rice genes have been hit by either T-DNA, Ds, or Tos17.

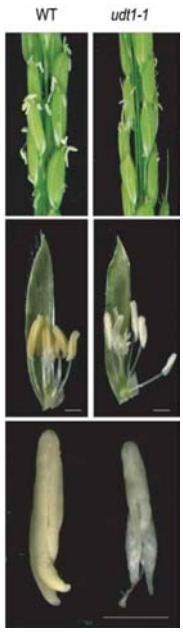
	PFG T-DNA	RTIM Tos17	RMD T-DNA	TRIM T-DNA	GP T-DNA	ZJ T-DNA	CSIRO Ac/Ds	UCDavis Ac/Ds	**GSNU Ds**	Total
Mapped	**80861**	17934	15668	6959	7173	707	588	6766	**1045**	137701
Exon	**7546**	2097	1420	978	517	58	156	726	**231**	11535
Intron	**7272**	1949	1612	879	640	68	76	508	**147**	10504
5' UTR	**4662**	417	747	330	343	15	40	232	**70**	6463
Promoter	**6886**	684	1397	561	567	38	53	372	**92**	9578
Unique Gene Hits	**19354**	3697	4714	2640	2001	179	312	1676	**516**	25103

NOTE : 5' UTR , 300 to ATG Promoter, 1000 to 300 bases away from ATG.

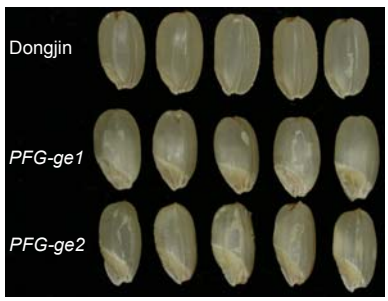
- 1. RMD : Rice Mutant Data, Huazhong Agricultural University, China [15,668]
- 2. TRIM : Taiwan Rice Insertion Mutant, Academia Sinica [6,959]
- 3. RTIM : NIAS Tos17 insertion mutants, Japan [17,934]
- 4. GP : Genoplante oryza tag lines, France [7,173]
- 5. ZJ : Zhejiang Univ rice T-DNA, China [707]
- 6. UCD T-DNA, USA [6,766]
- 7. CSIRO Ac/Ds, Australia [588]
- **8. PFG : Postech T-DNA, S. Korea [79,810]**
- **9. GSNU : Gyeongsang National University Ds, Korea [1,045]**

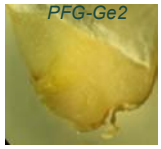
Flower Development Mutants

UDT1 : Plant Cell 17, 2705-2722 (2005)
OsMADS50 : Plant J 38, 754-764 (2004)
OsPPDKB : Plant J 42, 901-911 (2005) cover
OsMADS3 & 58 : Plant Cell 18, 15-28 (2006), cover
SUPERNUMERARY BRACT : Plant J, in press

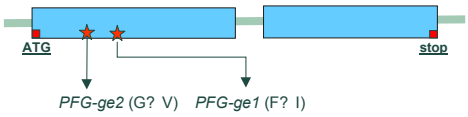


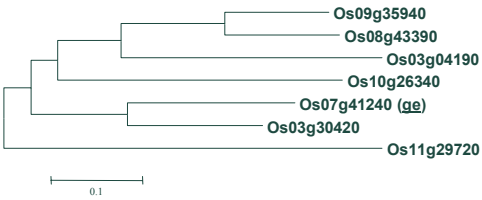
Giant Embryo Mutants : P450 mutation?





LOC_Os07g41240
(cytochrome P-450 family protein, 526 amino acids)

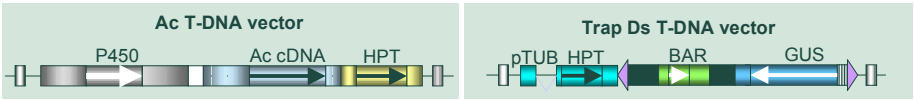




Cytokinin Degradation Pathway?

Ac & *Ds* Founder Lines

Transformation of *Ac* and *Ds* into Dongjinbyeo (Japonica)



Ac 'Founder' Lines

- Two lines that carry a single copy of *Ac* are developed into 'starter'
- They show consistent expression of *Ac* for several generations (BC_1F_4)

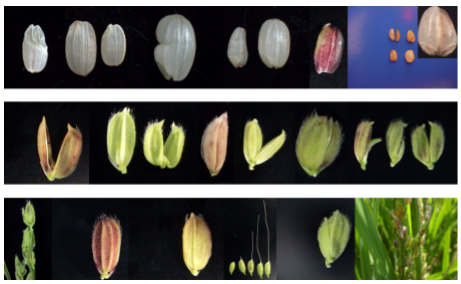
Ds 'Founder' Lines

- Lines carrying a single copy of *Ds* were selected and backcrossed to a parental line
- Homozygouse *Ds* lines become 'starter'
- Four lines are well transposed to all 12 chrom

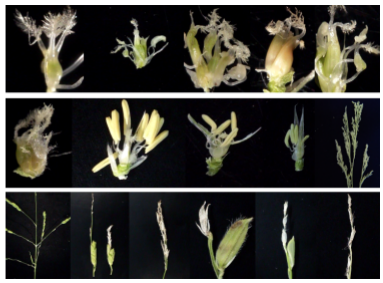
- Kim, CM, HL Piao, SJ Park, NS Chon, BI Je·B-y Sun, SH Park, JY Park, EK Lee, MJ Kim, WS Chung, KH Lee, YS Lee, JJ Lee, YJ Won, GH Yi, MH Nam, YS Cha, DW Yun, MY Eun, and CD Han. 2004. Rapid, large-scale generation of *Ds* transposant lines and analysis of *Ds* loci in rice. Plant J 39: 252-263.
- Hirochika, H, E Guiderdoni, G An, Y Hsing, MY Eun, CD Han, N Upadhyaya, S Ramachandran, Q Zhang, A Pereira, V Sundaresan and H Leung. 2004. Rice Mutant Resources for Gene Discovery. Plant Mol Biol 54: 325-334.

Phenotype mutants

1. Seed

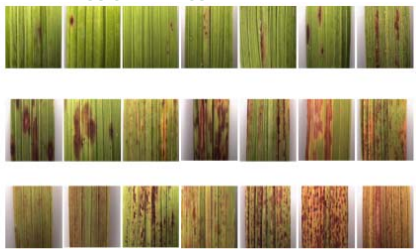


2. Flower Organs & Panicles

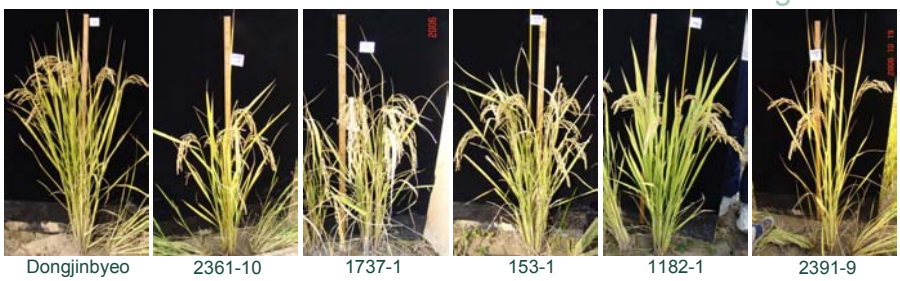


3. Chlorophyll Contents

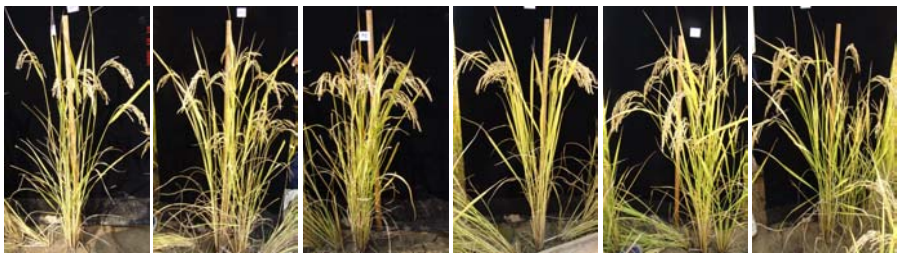
4. Lesion Mimics



Selection of Mutants Useful for Molecular Breeding



Dongjinbyeo | 2361-10 | 1737-1 | 153-1 | 1182-1 | 2391-9

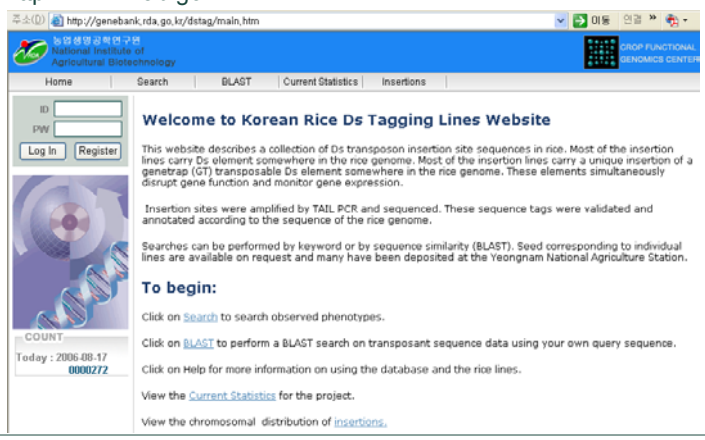


396-1 | 1217-3 | 819-1 | 725-8 | 1785 - | 3483-1

? Screening of desirable agronomic traits such as short culm, more grain, high fertility, and high yield, etc.

Ds Insertion Site Sequence & Annotation

http://www.niab.go.kr



Chromo-some #	1	2	3	4	5	6	7	8	9	10	11	12	Un-mapped BAC	Total Mapped Ds
Ds insertion sites	1,295	780	3,949	1,233	502	475	613	433	385	712	383	452	174	11,386
Proportion (%)	11.4	6.9	34.7	10.8	4.4	4.2	5.4	3.8	3.4	6.2	3.4	4.0	1.4	100

> Over 100,000 Ds trasposant lines will be generated by this year, 2006

Blade-On-Petiole1 Nahm, HG (POSTECH) Development 130: 161-172 (2003)

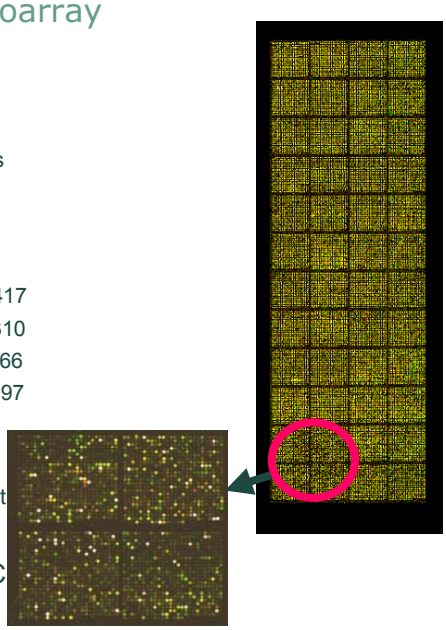
Rice 60K Oligomer Microarray

- 64,896 spots on two slides
  - 32,448 spots/slide x 2/set
  - 48 blocks of 12 rows and 4 columns
  - 676 (26x26) spots / block

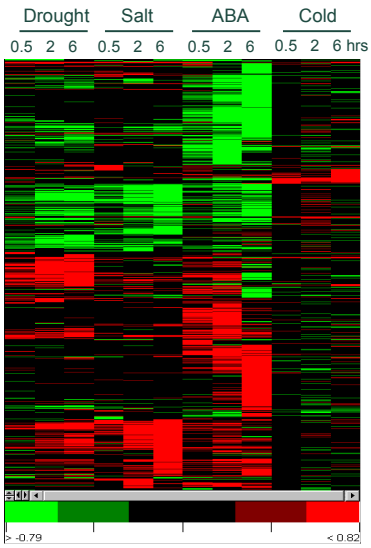
2. 60,727 oligomers
   - known and predicted genes : 58,417
   - antisense : 2,310
   - randomized DNA control : 66
   - blank spots : 4,097

3. 160 μm intervals
   - average diameter of 120 μm / spot

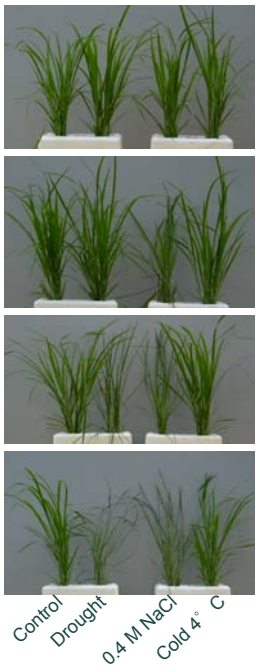
4. 70-mers with avg Tm of 68° C



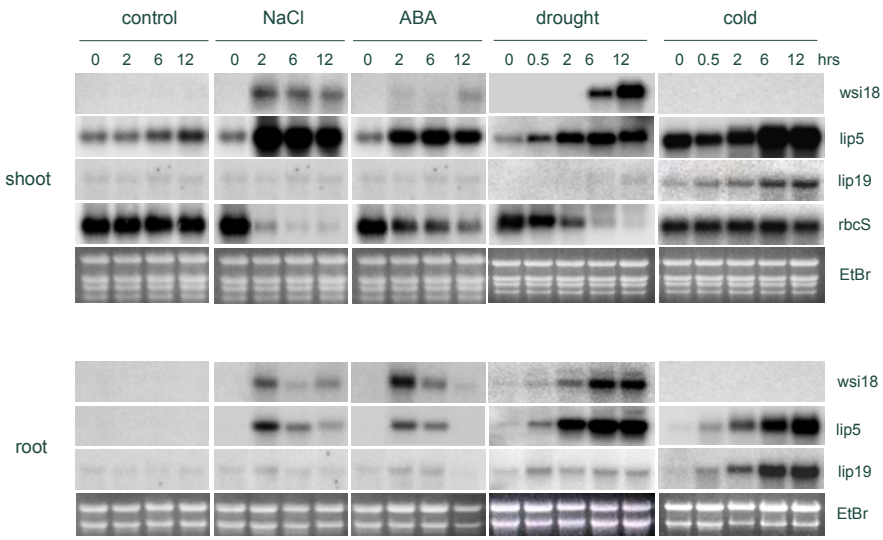
Rice under Stress



Hierarchical clustering of 16,520



Northern Blot Analysis of Rice under the Stress



Rice Whole Genome Exon Microarray (emv2.0)

Characteristics

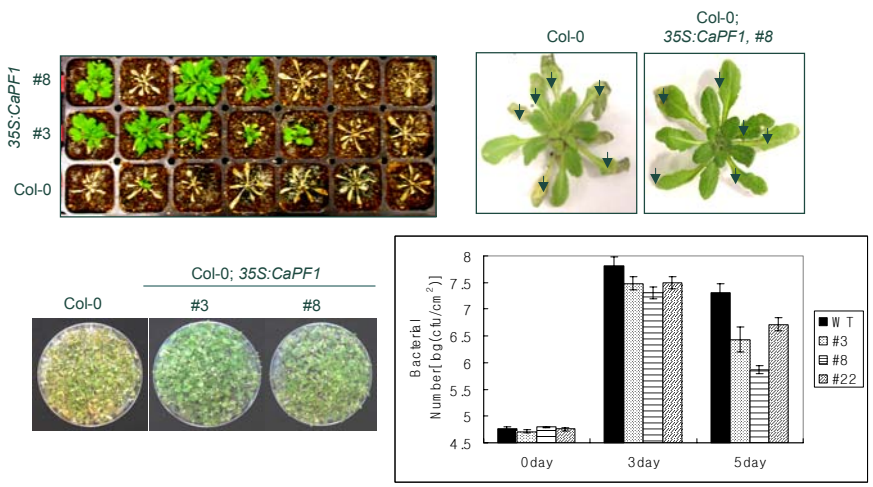
- 355,168 probes / slide
- 1 probe / 300 bp exon, 5.5 probes / gene
- Genes with definite direction and ORF: 37,398
- Genes with definite direction and no ORF: 15,102
- Genes with inconclusive direction: 4,449
- Predicted Genes: 17,537
- Mitochondria (123), Chloroplast (74)
- Markers (5) : Gus, GFP, Bar, Kan, Hyg

Advantages of Exon Microarray

- Samples as low as 5 ug of total RNA
- to test alternative splicing
- to test cross-hybridization
- Markers confirm the transformation

Freezing & Disease Tolerance of *CaPF1* in Transgenic *Arabidopsis*

Doil Choi (KRIBB) Plant Physiol 136:1 (2004)



Chip Distribution by Green Gene Biotech

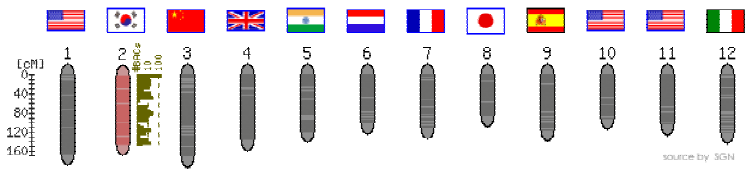
http://www.ggbio.com

The 60K Rice Whole Oligomeric DNA Microarray representing rice whole genome has been developed by GreenGene BioTech Inc. (GGB), a bio-venture company (Dr. Baek Hie Nahm, Myongji University) .... [more]

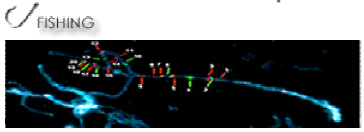
The International Solanaceae Genome Project

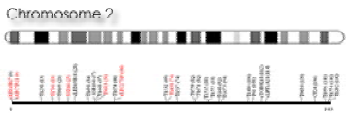
Doil Choi, KRIBB

- 19 countries including USA, the Netherlands, etc



- Euchromatin 12 Mbp on chromosome 2 of tomato (12% of total)





International Collaboration II

Development of transgenic rice through the TraitMill™

- Collaboration with CropDesign, Belgium
- 37 genes 67 constructs from 10 Korean scientists

cropdesign

Drought Tolerant Rice

Plant Physiol 131: 516 (2003)
PNAS 99: 15898 (2002)

CNN.com/SCIENCE & SPACE

CNN Europe | CNN Asia | Languages | On CNN TV | Transcripts | Headline News | CNN International

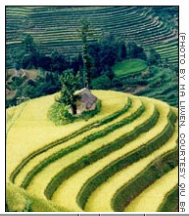
Hardy new rice strain offers Asia hope

By staff and wires
Tuesday, November 26, 2002 Posted: 5:07 AM EST (1007 GMT)

WASHINGTON -- Using sugar-making genes from a common bacterium, biologists have created a strain of rice that will grow in places that have been impossible before.

Writing in the Proceedings of the National Academy of Sciences, the scientists from Cornell University in New York and Seoul National University in South Korea said they hope to counter mounting environmental stresses that are threatening global agricultural pro

In a move that will offer hope to far in many parts of Asia and around t



朝鮮

2002년 11월 27일 수요일

TIMES ONLINE PRINT THIS ARTI

New GM rice could transform the fight against famine

BY MARK HENDERSON, SCIENCE CORRESPONDENT

A STRAIN of genetically modified rice that can grow in droughts, salty soils and cold climates has been developed by scientists, paving the way for a new agricultural revolution for the developing

CBSNE

November 26, 2002 10:59:

SCITECH

Brave New Rice

Nov. 25, 2002

Scientists believe their breakthrough may allow rice - one of the oldest food crops - to grow in places where it has never grown before. (CBS/AP)

(CBS) It was a solution fo rice outpace for the job.

Biologists sa rice that is m and salt wat to grow it in p would be imp

The develop closely by ag said that the going to have

BBC NEWS

You are in: Science/Nature

Tuesday, 26 November, 2002, 03:26 GMT

GM rice can tough it out

The rice plant on the left has been genetically modified

The New York Times

Researchers: Tough Ri

By THE ASSOCIATED PRESS

Filed at 2:19 a.m. ET

WASHINGTON (AP) -- Biologists ha to drought, cold and salt water by a The hardy new rice strain is expec where the grain previously could n

사막에서도 자라는 '수퍼 벼' 나왔다

한·미 과학자들이 기존 벼보다 수확량이 30%나 더 많고, 혹독한 자연환경에서도 잘 자랄 수 있는 새로운 '수퍼 벼' 품종을 개발했다.

서울대 농생명과학대 최양도(사진 왼쪽) 교수는 30일 "미국 코넬대학 레이 우 교수, 명지대 생물학과 김주곤(사진 오른쪽) 교수와 함께 박테리아에서 추출한 트레할로스라는 유전자를 기존 벼에 주입, 다(多)수확·고(高)지향성의 새로운 벼품종을 개발하는 데 성공했다"고 밝

이 번 에 개발된 새

韓美과학자 공동개발
수확량도 20% 늘려

CMV Resistant Transgenic Pepper

CH Harn (Nongwoo Bio)
YS Kim (Cheonbook Univ)

Transgenic, CMVP0-CP

control

control Transgenic, PepEst1

2004년 4월 1일 목요일 (제4694호) 국민일보 21

고추 탄저병 치료기술 개발

김영순 박사, 유전자이식 활용

탄저병은 곰팡이의 침입으로 고추 열매를 썩게 하는 병으로, 매년 전체 노지 고추의 10%이상이 감염되고 있으며, 이로 인한 농민 손실은 연간 1000억원에 이르는 것으로 추정되고 있다.

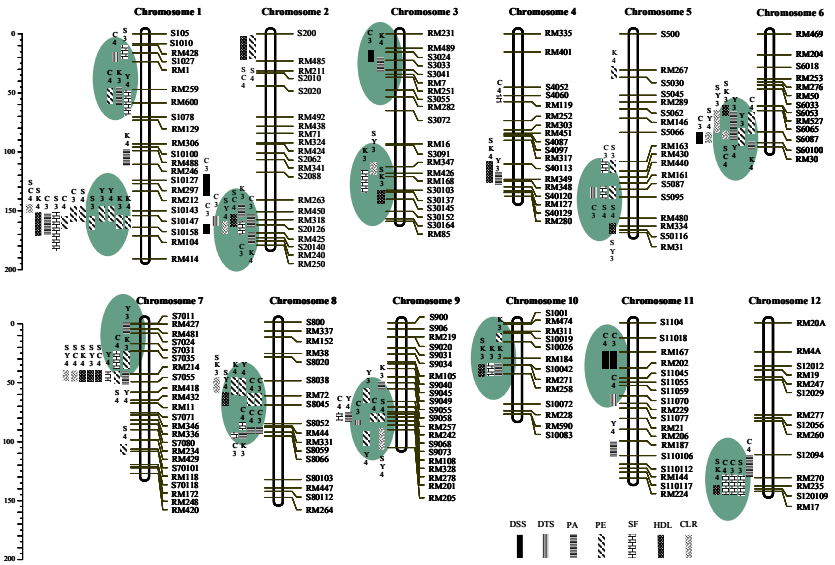
김 박사는 "탄저병 저항성 고추는 화학농약에 들어가는 비용을 줄일 수 있을 뿐 아니라 품질 향상 및 농업 생산성 증가에 크게 기여할 것으로 기대된다"고 말했다. 한태원기자

CROP FUNCTIONAL GENOMICS CENTER

QTL Analysis of Cold Tolerance Traits

(Milyang23/Tong88-7 population)

HJ Koh (Seoul Univ)



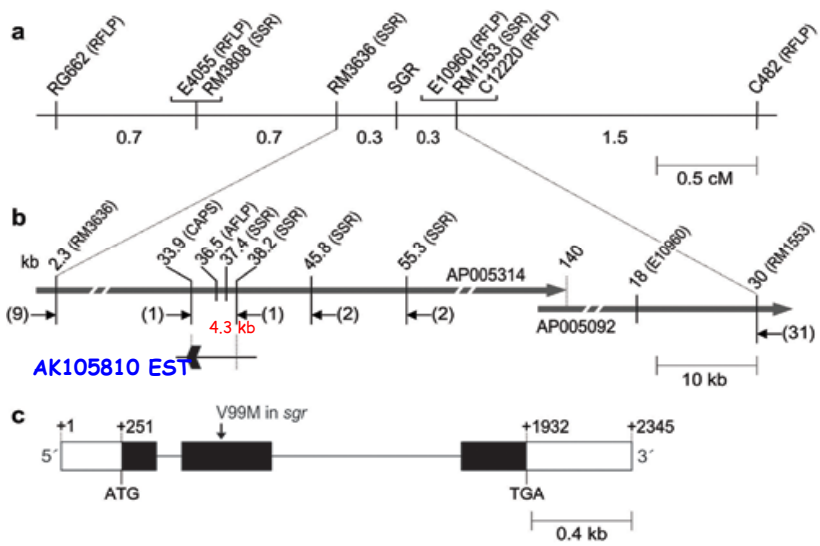
Map-based cloning of Stay-green gene

Nam-Chon Paek, Seoul U

9-day dark treatment at heading 40 days after heading

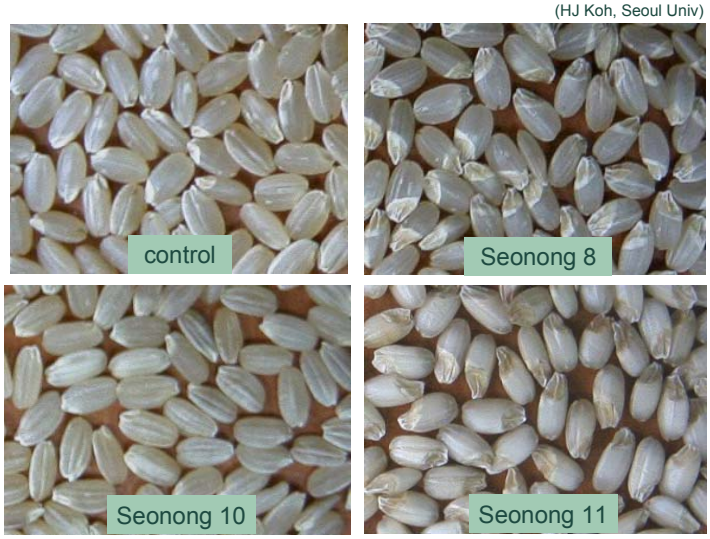
Map-Based Cloning of Stay-Green Gene

Nam-Chon Paek, Seoul Univ



Rice, New Varieties

(HJ Koh, Seoul Univ)



Soybean, New Varieties

2005년 11월 4일 금요일 매일경제

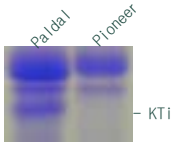
비린내 안나는 콩 나왔다

정종일 경상대 교수팀

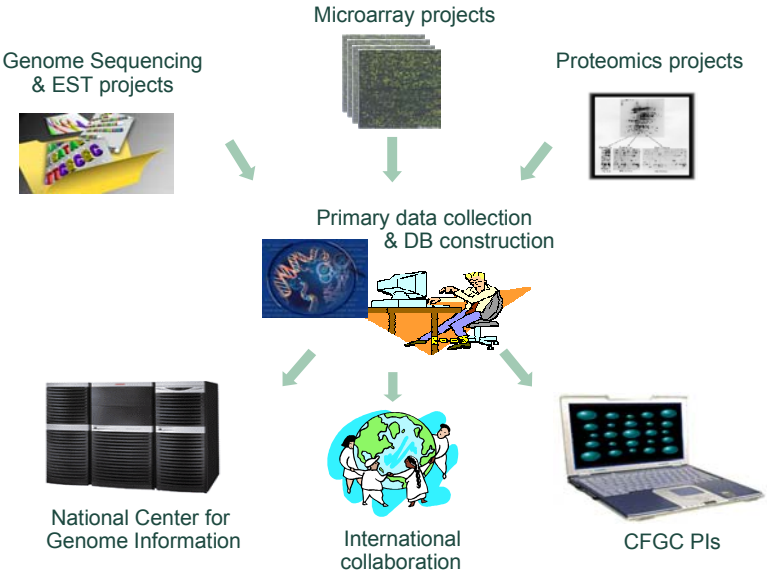
? **Gyeongsang 1 & 2** (JI Chung, Gyeongsang Univ)
lipoxygenase deleted ; reduced beany flavor
black or yellow seed coat
Variety Protection, applied (2005-516 & 517)

? **Pioneer 1 & 2** (JI Chung, Gyeongsang Univ)
lipoxygenase & Kunitz trypsin inhibitor deleted
Field test in 2006

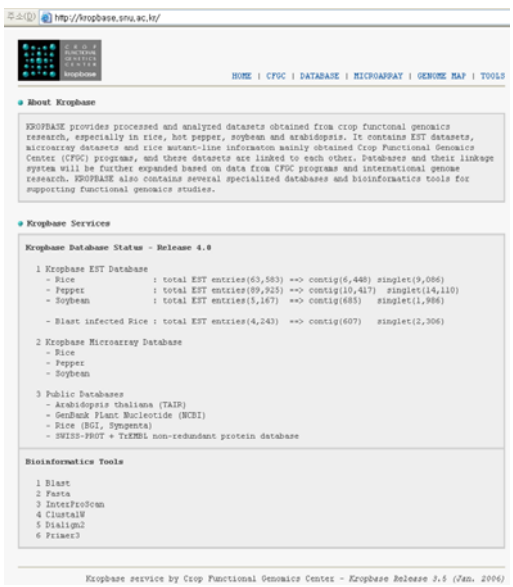
? **Youngyang & Soyoung** (E Park, Yeungnam Univ)
for soybean sprouts
Variety Protection, applied (2005-511, 512)



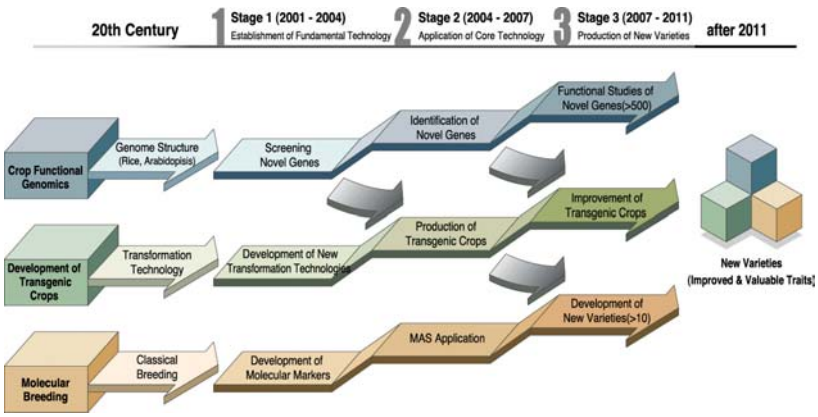
Bioinformatics support



http://kropbase.snu.ac.kr



Technology Road Map



Acknowledgement

This work was support by the Crop Functional Genomics Center,
the Ministry of Science & Technology and
Rural Development Administration,
Republic of Korea

and

I apologize to those whose work could not be cited owing to time limitation.

Plant Variety Protection of Republic of Korea

10th BMT Meeting, Seoul, Korea, November 21-23, 2006

Table of Contents

Seed Industry Law

<9 Chapter, 176 Article, 13 Addenda>

1. Plant Variety Protection
   - DUS test, Novelty, Denomination
   - Protection Period : 20, 25 years

2. Management of Variety Performance
   - VCU test for yield, quality, resistance to stress, etc.
   - 5 species (rice, barley, soybean, maize, potato)

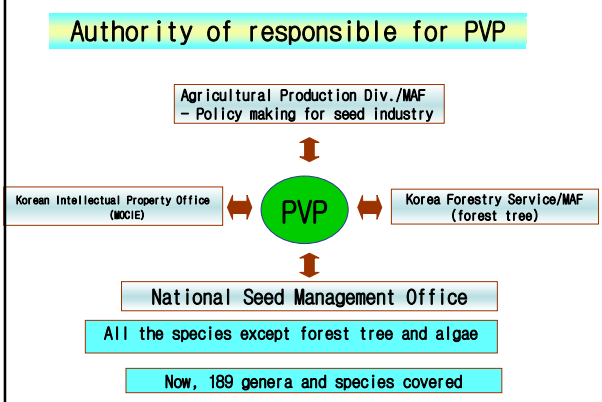
3. Seed Certification
   - With a certificate after field and seed test

4. Controlling Seed Market
   - Investigation of seed circulation
   - Seed quality indication

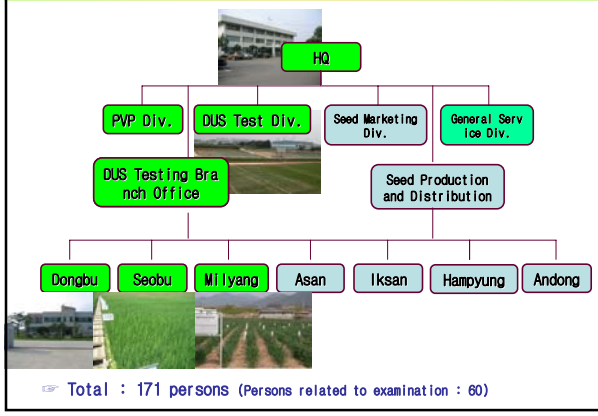
Enforcement of Seed Industry Law

- Established and published for public in December 3, 1995
- Enforced on December 31, 1997
- Revised a few article of Law,
  - in 1999 (Law No. 5668), - in 2000 (Law No. 6190)
  - in 2001 (Law No. 6374), - in 2003 (Law No. 6999)
  - in 2006 (revising)
- Conformed with 1991 UPOV Act
- Membership of UPOV
  - 50th member of UPOV on January 7th, 2002

Authority of responsible for PVP



Organization of National Seed Management Office



☞ Total : 171 persons (Persons related to examination : 60)

Genera and species eligible for PVP and Test Guideline for DUS test

		1997	2000	2001	2002	2004	2006	Total
No. of species		27	30	31	25	42	34	189
Test Guide line	UPOV TG*	26	11	7	5	20	-	133
	National TG	1	19	19	11	8	6	
	Not Available	-	-	5	9	14	28	56

•: UPOV TG was applied with necessary modification
All genera and species will be designated to PVP in 2009

Examination

- Examination
  - Examiner is responsible for examination
  - Plant Variety Protection Div.
- Examiner
  - Document test (Novelty, Denomination)
  - Growing test (Planning for DUS test (2 years in 1 site) Examination by DUS Report)
  - Making decision (Ruling of registration)

Trademark check from KIPO

Publication of official gazette

Variety denomination

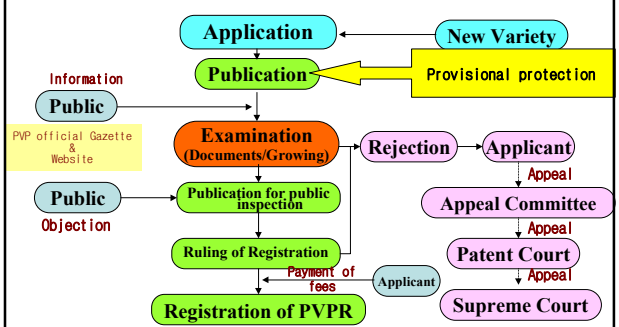
DUS testing

Variety Testing Division : Middle part of country
- DUS field test
  * Laboratory Work (DNA & Molecular)

3 Branch Office
- Eastern Branch Office : Highland Area
- Western Branch Office : Southwestern Area
- Milyang Branch Office : Southeastern Area

DUS testing

Procedure of Examination for PVP



Number of Applications & Registrations for PVP

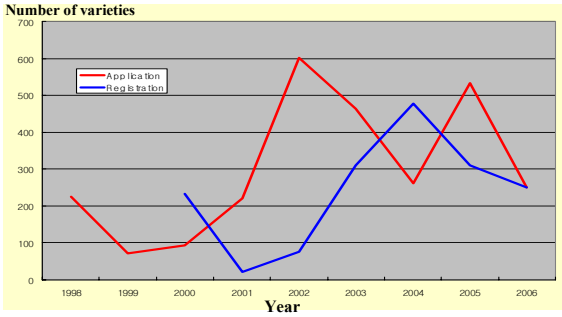
Sept. 31, 2006

	Total			Application						
	App.	Rej.	Reg.	1998-2000	2001	2002	2003	2004	2005	2006
Total	2,722	230	1,680	390	221	602	463	262	533	251
Agriculture	496	10	396	235	41	49	42	34	48	47
Vegetable	452	44	206	68	45	53	57	83	79	67
Fruit	135	10	85	46	19	10	18	9	18	15
Ornamental	1,480	155	877	33	46	473	329	122	369	108
Forage	15	-	6	3	1	-	4	1	2	4
Industrial	123	7	100	5	66	17	9	8	13	5
Mushroom	21	3	10	-	3	-	4	5	4	5

App. : application, Rej. : rejection, Reg. : registration

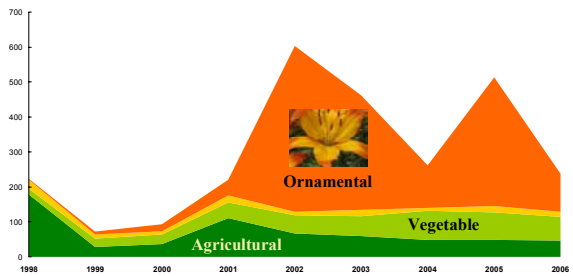
Number of varieties for PVP

(As of end of September 2006)



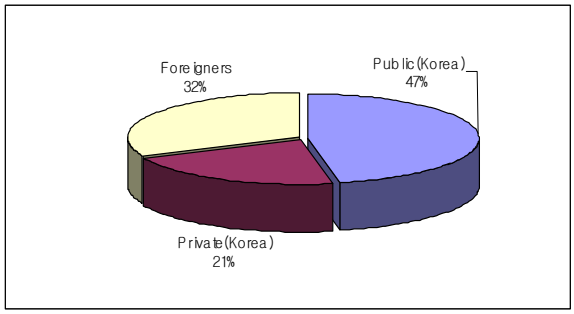
Number of applications for PVP by crops

(As end of September 2006)



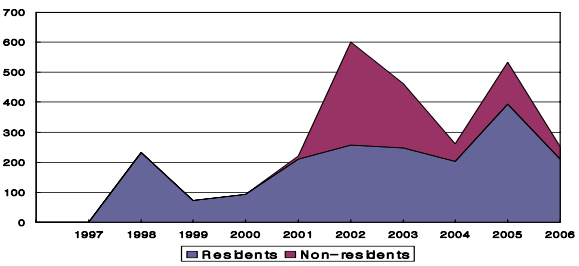
Total number of applications for PVP by applicants

(As end of Sept. 2006)



Number of application for PVP by applicants from 1997-2006

(As end September 2006)



Fee Schemes

	Fees
Application fee	30,000won(30 USD)/Variety
Examination - Document test - DUS test	 50,000won(50 USD) 200,000won(200 USD)/test

From Registration	Annual fee		
	Group 1	Group 2	Group 3
1st to 5th year	70,000	35,000	20,000
6th to 10th year	105,000	50,000	30,000
11th to 15th year	225,000	112,000	67,000
16th to 20th year	337,000	168,000	101,000
21st to 25th year	506,000	253,000	151,000

1,000 won=1USD

Example of Crop Group

Group		
Group 1	Group 2	Group 3
Rice, Radish, Chinese cabbage, pepper, Apple, Pear, Grapevine, Rose, Lily, Tulip ...	Maize, Tomato, Cucumber, Carrot, Peach, Hibiscus, Alstromeria, Gladious, Ginseng, Ochardgrass...	Barley, Soybea, Brocoli, Citrus, Impatiens, Stork, Sesame, Groundnut, rape...

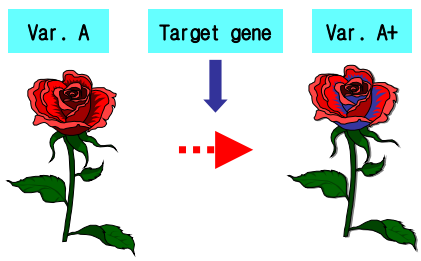
Effect of PVP Rights

- Scope of protection
  - exclusive right to exploit the protected variety commercially and industrially.
    - harvested material of the protected variety
    - product produced directly from the harvested material.
- A variety deemed to be a protected variety
  - Essentially derived variety from protected variety
  - Varieties not clearly distinguished with protected variety
  - Varieties requires the repeated use of the protected variety
- Protection period : 20 years (25 years for tree and fruits)

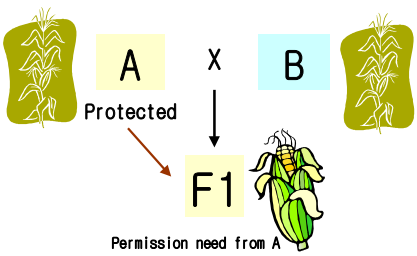
Scope of PBR

Seeds	Harvest	Process
Exploitation	X	X
X	Exploitation	X
X	X	Exploitation

Essentially Derived Variety (Example)



Repeated use of the protected variety for seed production (Example)



PROTECTION OF THE VARIETY PROTECTION RIGHT HOLDER

- Injunction and Prevention against Infringement
- Right to Claim Compensation for Damage
- Presumption of Negligence
- Recovery of Reputation of Variety Protection Right Holder or Exclusive Licensee

Penalty for infringement of PVPR

- Infringement of PVPR
  - imprisonment for not more than five (5) years or a fine not exceeding thirty million (30,000,000) Won:
  (1) infringes a variety protection right or exclusive license;
  (2) infringes a provisional protection right, only where the variety protection right has been registered
  (3) rendered a variety protection ruling or trial decision through a fraudulent act or any unlawful method.
- Prosecution for offenses shall be initiated upon filing of a complaint by an injured party.

Scope of No Effect of PVP rights

- Self-consumption and non-commercial purposes;
- Experimental and research purposes;
- Breeding other varieties.

4. Farm saved seed
(Minister of MAF may restrict a variety protection right for a variety, if a farmer collects the seeds of the variety for himself for the purpose of self-production)

Variety Protection Appeal Committee

- Established in MAF with 8 members (1 standing member)
- Roles
  - Trial against Rejection Ruling
  - Invalidation Trial of Variety Protection
- A trial shall be conducted by a collegial body composed of three trial members.
  - The collegial body shall make its decisions by a majority vote.

Appeal Committee → Patent court → Supreme court

Activities for raising awareness of PVP

(For Farmers and Growers)

- Meetings
  - Farmers corporation (Rose production corporation, Strawberry .....)
- Publish of brochures for PVP
- Publish Variety Protection gazette
- Korean version of report of PVP impact of UPOV

Activities for raising awareness of PVP

(For Farmers and Growers)

Activities for raising awareness of PVP

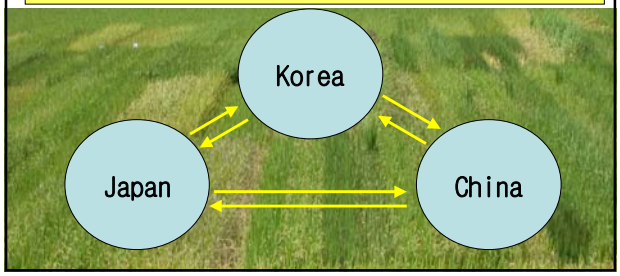
(For Breeders)

- Meetings
  - Seminar by MAF, NSMO, KOSID, and etc.
  - International workshop correspondence UPOV meeting
- Workshop : NSMO, KOSID and field trip on breeders field
- Publish of brochures for PVP
- Publish Variety Protection gazette
- Korean version of report of PVP impact of UPOV
- Training for the DUS test for application for PVP

Activities for raising awareness of PVP

(For Breeders)

To check the possibilities to establish same set of example varieties and cooperation of examination among North-East countries, to make harmonization and efficiency of examination



Ring test of rice among three countries

In 2006

No.	Korea	No.	Japan	No.	China
1	Hwaseong	11	Asamurasaki	21	Guang Lu Ai 4
2	Dasan	12	Yumetoiro	22	Lu Chuan Zao
3	Heugnam	13	Koshihikari	23	Gui Hua huang
4	Odae	14	Manyoumochi	24	He Jiang 18
5	Daerip 1	15	Sariqueen	25	Zhu Jin Sui
6	Ilpum	16	Hoshiyutaka	26	Zhu Yun Nuo
7	Heugjinju	17	Kusahonami	27	Li Shui Nuo
8	Hwaseonchal	18	Tsukushiakamochi	28	Che Chon 9
9	Hyangnam	19	Beniroman	29	Li-Jiang-Xin-Tuan-Hei-Gu
10	Jinbuol	20	Nipponbare		
	10		10		9

Cooperation of examination

2nd step : Agreement for cooperation of examination

3rd step : Ring test with harmonized way

or establishment of central testing system

Thank you !

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End of Annex IV
and of document