

Insect Resistant Maize for Africa (IRMA) Project

IRMA in 2005 Briefs



IRMA Project Document No. 21

November 2005



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CIMMYT

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IRMA IN 2005 BRIEFS

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The Kenya Agricultural Research Institute (KARI) was established in 1979 with the express mission of increasing sustainable agricultural production by generating appropriate technologies through research, and disseminating these to the farming community. Inherent to this mission is the protection, conservation, and improvement of the basic resources, both natural and human. Such resources are critical for Kenya's agricultural development and expansion of the nation's scientific and technological capacity. KARI has an extensive history of productive collaborators with national and international institutes and universities, as well as with the private sector.

CIMMYT® (www.cimmyt.cgiar.org) is an internationally funded, nonprofit scientific research and training organization. Headquartered in Mexico, the Center works with agricultural research institutions worldwide to improve the productivity, profitability, and sustainability of maize and wheat systems for poor farmers in developing countries. It is one of 16 similar centers supported by the Consultative Group on International Agricultural Research (CGIAR, www.cgiar.org). The CGIAR comprises about 60 partner countries, international and regional organizations, and private foundations. It is co-sponsored by the Food and Agriculture Organization (FAO) of the United Nations, the International Bank for Reconstruction and Development (World Bank), the United Nations Development Program (UNDP), and the United Nations Environment Program (UNEP). Financial support for CIMMYT's research agenda also comes from many other sources, including foundations, development banks, and public and private agencies.

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The Insect Resistant Maize for Africa (IRMA) Project was launched in 1999 as a collaborative effort between CIMMYT and KARI. Its primary goal is to increase maize production and food security for African farmers through the development and deployment of maize that offers resistance to destructive insects, especially stem borers. To achieve this goal, project scientists will identify conventional and novel sources of resistance to stem borers and incorporate them into maize varieties that are both well adapted to Kenya's various agro ecological zones and well accepted by its farmers and consumers. Varieties and technologies that are appropriate for other African nations may be extended to them for their use.

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AGROVOC Descriptors

Africa; Kenya; Maize; *Zea mays*; Plant production; Food production; Food security; Production factors; Pests of plants; Plant breeding; Transgenic plants; Pest resistance; Biological control; *Bacillus thuringiensis*; Production increase; Yield increases; Diffusion of research; Technology transfer; Innovation adoption; Research projects

Additional Keywords

KARI; CIMMYT

AGRIS Category Codes

E10 Agricultural Economics and Policies
E14 Development Economics and Policies
F30 Plant Genetics and Breeding

Cover Photo: The first Bt maize confined field trial at the Open quarantine Site KARI Kiboko during 2005B season

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Insect Resistant Maize for Africa (IRMA) Project - 2005 Briefs

1. Bt MAIZE EVENT ANALYSIS, DEVELOPMENT OF BT SOURCE LINE, & HUMAN HEALTH SAFETY ASSESSMENT

S. Mugo, J. Danson, C. Taracha, A. Pellegrineschi, S. McLean, G. Mwimali, J. Songa, D. Bergvinson, and S. Gichuki

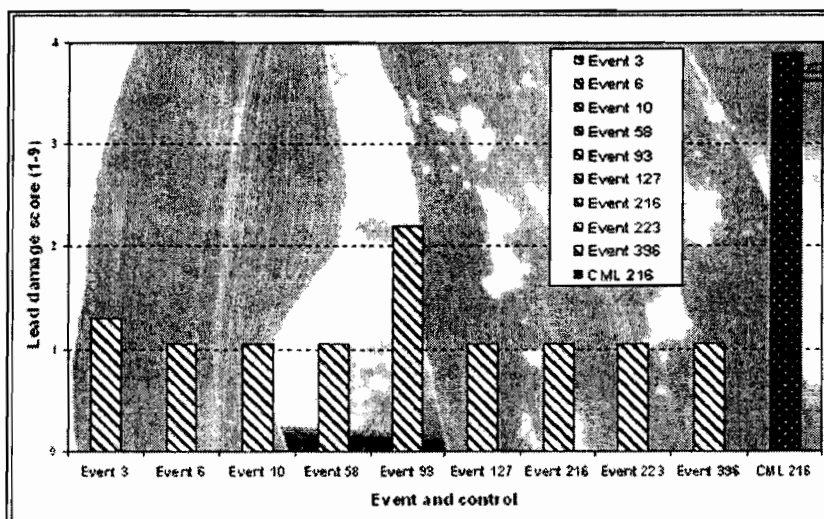
1.1 Bt Event Analysis

- In Kenya, J. Danson's work on the protocols for Bt gene detection using the PCR method for both Cry1Ab and Cry1Ba was tested and found to work on Events 10, 58, 216 and 223. The reliability of the PCR method offers an alternative during selection—one of the useful applications of molecular marker technology. The method can be used to detect gene flow/contamination when the Bt materials are grown commercially in farmers fields.
- KEPHIS contracted Kenyatta University to assist in developing Bt GMO detection protocols. The two institutions requested IRMA project to provide positive controls. The samples were taken from the backcross generations in CFT Trial 1 on 7 Sept 2005. No results from this analysis have been received by the time of reporting.

1.2 Development of Bt source lines

- The last of the mock trials at the open quarantine site (OQS) at Kiboko that were grown for the purpose of training staff and other stakeholders in advance of the Bt maize confined field trials was harvested in January 2005. Non-target organisms were collected from the maize both during cropping and after harvesting (maize-free conditions) to generate baseline data.
- In the laboratory in Mexico the development of 11 second generation lines of Cry 1C and the development of the Cry 2Aa events continued. The transformants with Cry2A events was effective against fall armyworm (*Spodoptera frugiperda*) that is closely related to *B. fusca* and had IRMA team excited for a while to the extent of drafting an application "Introduce Maize Seeds Containing the Bt Genes *cry2Aa* and *cry1Ca* for Evaluation, Seed Increase, and Make Crosses in a Biosafety Greenhouse Containment" as control of *Busseola fusca*, could be of real interest for use in Kenya. These events cannot be tested against *B. fusca* in Mexico as the pest is not found there. However, Southern blot analysis to confirm the number of copies of the gene for each of the five events showed the genes to be absent in the effective events, indicating presence of somaclonal effects. However, this was being confirmed at the time of reporting. It is also apparent that events 685 and 687 have a promoter for which FTO cannot be obtained. Other Cry2Aa events have the ST-LS1 promoter derived from chloroplast of potato that expresses in green tissue based on tobacco experiments. These control *S. frugiperda* and will be tested further. However, this promoter is similar to PEP-Carboxylase that mainly expresses in green tissue which means that the whorl of the plant may not be protected. This will be tested to provide guidance.
- The first insect-resistant transgenic Bt maize seeds were sown in Kenya on 27 May 2005, at the open quarantine site (OQS) at Kiboko in a confined field trial (CFT) of nine Bt maize events. A separate trial in the CFT was also sown for conversion of additional maize inbred lines to Bt using the backcrossing breeding method. Infestation with the spotted stem borer (*Chilo partellus*) was done on 17 June 2005. Leaf damage scores on plants two weeks after field infestations with *C. partellus* indicated that Bt maize events controlled *C. partellus*. Leaves from the CFT were harvested for bioassays with the African stem borer (*Busseola fusca*), the sugarcane borer (*Eldana saccharina*) and the pink stem borer (*S. calamistis*) on 29 June 2005. Leaf bioassays were done on 30 June - 7 July 2005. Tests using the leaf damage scores from these leaf bioassays with the three other pests in the biosafety greenhouse complex indicate that control was found for *E. saccharina* and *S. calamistis* but not for *B. fusca*. To achieve effective stem borer control in all maize growing ecologies in Kenya, additional Bt genes or events will need to be sought and tested.

- In early July 2005, it was found out that an unfortunate and regrettable inadvertent application of a systemic insecticide prevented the observation of the effects of the Bt delta-endotoxins beyond the early season vegetative stage of the crop in Trial 1. The evaluation of Bt *cry* gene events in the confined trial (CFT) at the KARI Kiboko OQS. The problem was identified on observation that newly emerging leaves were clean even on plants previously showing extensive leaf damage including the non-transgenic CML216 control. This indicated that the larvae may have died after feeding on the leaves and may not have burrowed into the stems to cause tunneling. While this may be expected in resistant plant on rare occasions, it has not been observed in CML216. It was, therefore, suspected that an additional factor may have caused the death of larvae, thereby preventing extensive damage even on susceptible plants. It was found that the field technician, with good reasons to control white grubs *Phyllophaga* spp. that were destroying plants thereby reducing the plant stand, applied Furadan®, a systemic insecticide without prior consultations with the principal investigators. Furadan® remains in the plant for up to 60 days after uptake and re-infestation would not offer solution to this problem. Without stem damage expected, carrying the trial to 14 weeks as planned was not to be worthwhile. The NBC was briefed and requested that the trial be terminated and a second season planting be done.
- Harvesting of the evaluation of the Bt Maize confined field trial (CFT) at the open Quarantine Site (OQS) at KARI Kiboko was done on 31 Aug 2005 when the plants were at the equivalent of grain filling stage. Leaves were stripped off the plants and the number of stem borer moth escape holes counted. The stems were then split and the cumulative tunnel length measured. As expected, there were no significant differences in insect damage among the nine Bt maize events and from the non-transgenic CML216 control, due to the pesticide reported above. To demonstrate compliance to biosafety condition of detasseling, ears on the plants in the test rows and in the hybrid border rows were dehusked to expose any seed. Only five seeds were recovered from the border rows, which were attributed to rudimentary anthers on the ear tips that are now known to be characteristic of H513. However, the 5 seeds compared to the potential of 1M seeds is a small percentage (5x10⁻⁶%), which shows that detasseling was effective as expected.
- The materials from harvest of trial 1 were disposed by cutting and drying on site for one week, followed by burning and covering the ashes in the trenches within the OQS on 7 Sept 2005. Though the disposal was successful by using kerosene and diesel, several lessons were learned. First, one week of drying the succulent stalks is not adequate. We need a minimum of two weeks to dry adequately. Second, the liquid fuels used are not efficient. It was thought that solid fuels like charcoal or firewood placed in layers could have been more efficient even if a little liquid fuel could be added. Third, the smaller tissue like leaves and stalk chippings should be taken directly to the trenches as they tend to disintegrate and could easily scatter, hence become difficult to recover fully when dried at the trial site. Fourth, since the regulators required that plant stumps be uprooted after



Leaf damage scores from *Chilo partellus* stem borer for Bt maize events

harvesting, it might be more efficient to uproot at harvest time to have whole plant dried out before burning.

- Following the harvesting of CFT trial 1, the trial site was marked out with permanent concrete beacons, irrigated and the first post harvest monitoring of Bt maize CFT Trial 1 at the open Quarantine Site done on 21 Sept 2005. Scouting was done by plot areas, borders, and the isolation. No volunteer maize seedlings were found at the site and in the isolation vicinity. Only sparse weeds were observed at the site. We propose to establish mucuna after the second month of post harvest monitoring.
- The request for the second planting of trial 1 was approved by NBC as detailed in the regulatory section. KEPHIS spelt out new phytosanitary conditions that includes monthly reporting on biosafety and general management practices. The trial was sown at Kiboko on 3 November 2005.
- Several other activities were performed in the BGHC:
 - BT-BGH-06A-1 - Conversion of nine maize inbred lines to Bt transgenic in the BGHC at KARI NARL during 2006A Season
 - BT-BGH-06A-3 - Seed increases of Bt maize events in the BGHC during 2006A season.
 - INS-BT-BGH-06A-4 - Formation of F₂ generation of crosses involving Bt maize inbred lines at the BGHC sown September 2005.
- Harvesting of transgenic Bt maize seeds in the BGHC was done on various occasions. In all cases, the cobs were shelled, and seeds dried, treated and stored in the appropriate biosafety seed cabinet in the secure seeds store. These seeds are being used for the various tests that are either in progress or planned, including non-target, IRM and expression studies, and crossings and field tests in the OQS.
- Tests were carried out to confirm homozygosity with progenies from 54 inbred plants from the nine events that will be grown in the OQS. Those plants that showed homozygosity will be advanced and used for various studies.

1.3 Human Health safety Assessment

- There were no major activities on this during the year. This will mainly be a literature study, which continues to be gathered.

2. DEVELOPMENT OF CONVENTIONAL AND BT PRODUCTS, AND COMPOSITIONAL ANALYSIS

S. Mugo, J. Ininda, M. Gethi, J. Songa, O. Odongo, G. Ombakho, J. Gethi, O. Oyoo, P. Likhayo, and D. Bergvinson

1.1 Conventional

- KEPHIS presented data from the NPT 2004B season to the 2005 NPT meeting on 2–3 February 2004. The meeting decided to have the six insect resistant varieties tested for a second year before making a decision on release. Early, medium and mid–late insect resistant OPVs are being grown in NPTs by KEPHIS at diverse locations in the country. Nine sites were sown with the insect resistant NPT special kit, where the IRMA team assisted KEPHIS technicians with infestations and data recording. Various IRMA scientists and technicians attended the 2005 maize national performance (NPT) tours where insect resistant maize OPVs entered by KARI Katumani, Embu and Kakamega centers and were being tested. These sites were harvested between August and October 2005, and data analysis is being done by KEPHIS. Descriptors for the OPVs in the NPT were developed from plantings plots at Kiboko during 2005B season. These will be forwarded to KEPHIS together with seed for DUS testing.
- Thirty-two (32) double cross hybrids were grown at Mtwapa, Kiboko, Embu, and Kakamega during 2005A season and good ones were identified and will be nominated to the 2006 NPTs. Thirty two (32) OPVs were evaluated at Mtwapa and Kiboko for resistance to *Chilo partellus*. Good ones were identified and some of these will be nominated to the 2006 NPTs.
- Forty-five (45) three way cross insect resistant maize hybrids were formed at Kiboko using single cross hybrids of insect resistant maize inbred lines identified from evaluations of diallel crosses. These 45 are being tested during the current 2006A season and good ones will be nominated to the NPTs in February 2006.
- Work on LGB resistance was advanced with six sets each of 250 S1 LGB-resistant lines being advanced to the S2 generation. These are now being screened for resistance to LGB in the laboratory. A further 129 S4 LGB-resistant inbred lines were advanced to the S5 generation.
- In Mexico, Dr. Bergvinson increased 280 white and 180 yellow lines and formed test crosses with three white African testers (CML312SR, CML395 and CML442). These lines and their test crosses are being tested for resistance to *B. fusca* at Embu and for *C. partellus* at Kiboko during the current 2006A season.



Scientists visit maize NPT trial at KTI, Katus, Kirinyaga

- Gene flow study trials were carried out at three of the locations where they were planted, namely Kiboko, Mtwapa, and Kakamega. The Embu and Katumani sites will be planted during the 2006A (short rains) season. Gene flow studies will be repeated at Kiboko, Mtwapa, and Kakamega sites during the 2006A season as well.
- The development of maize with resistance to weevil (*Sitophilus zeamais*) and larger grain borer (*Prostephanus truncatus*) that was initiated in collaboration with CIMMYT-Mexico and CIMMYT-Zimbabwe, using germplasm identified at the three sites, progressed well in 2005. Six F1 Bulks of LGB resistant inbred lines with CML204, CMOL206, CML442, CML444, and an MBR-derived inbred line were formed, and advanced to the S1 generation. Out of these,
 1. A bulk was advanced to the F3 generation to form very early generation LGB resistant OPVs, while
 2. The S2 were being screened for resistance to LGB and the best advanced to the S2 generation for further improvement.
 3. Locally adapted and LGB resistant maize germplasm will be developed from those. The first lot of larger grain borer (LGB) resistant synthetics were evaluated for agronomic performance at five locations - Kiboko, Mtwapa, Embu, Katumani, and Kakamega. Screening for LGB resistance is going on in weevil warehouses at the various locations and from grains at a central location – Kiboko. Inbred line testercrosses were made to 104 LGB resistant inbred lines and are being evaluated for performance at Kiboko during the 2006A season and across environments and for resistance to LGB at various KARI centers during the current 2006B season.

1.1.1 Screening Maize Germplasm for Resistance to the Larger Grain Borer and Maize Weevil

- Maize germplasm from the breeding activities are evaluated to identify sources of resistance to *P. truncatus* and *S. zeamais* to be backcrossed to Bt maize to provide a broad-based resistance to both field and storage insect pests. Laboratory bioassays were carried out on 110 maize genotypes (46 inbred lines, 32 open-pollinated varieties and 32 double cross hybrids) during season 2004B and 62 genotypes (30 open-pollinated varieties and 32 double cross hybrids) in season 2005A. Thirty unsexed 3-week-old *P. truncatus* or *S. zeamais* were assayed in each of three replicates containing 50 g grain (moisture content =12.4%) and incubated for 90 days at 26±2 °C and 60±5% r.h. Flour production, grain weight loss and progeny emerged were parameters measured as indicators of resistance. For season 2004B, there were significant differences (p<0.05) for only *P. truncatus* damage to complete diallel inbred lines and LGB resistant inbred line parents. No significant differences were detected for the three parameters measured for both test insects on ITS varieties or double cross (DC) hybrids. Arbitrary progeny spread scores, on a scale of 0 – 20 (highly resistant), 21-40 (resistant), 41–60 (modestly resistant), 61–80 (susceptible) and 81 (highly susceptible) demonstrated that ITS and DC hybrids lack resistance to *P. truncatus*. There were no significant differences in progeny counts. Parameters measured during season 2005A differed significantly (p<0.05) among genotype for both test insects. Variety ITS2 TG2 Bcox751B POP.390 MIRT exhibited modest resistance to *P. truncatus* and ITS1 ST G1 Bco F2 Bulk to *S. zeamais*. Surprisingly, one of the checks (DH01) showed some resistance. These results will be confirmed in a repeat bioassay.

1.2 Development of Bt Maize germplasm

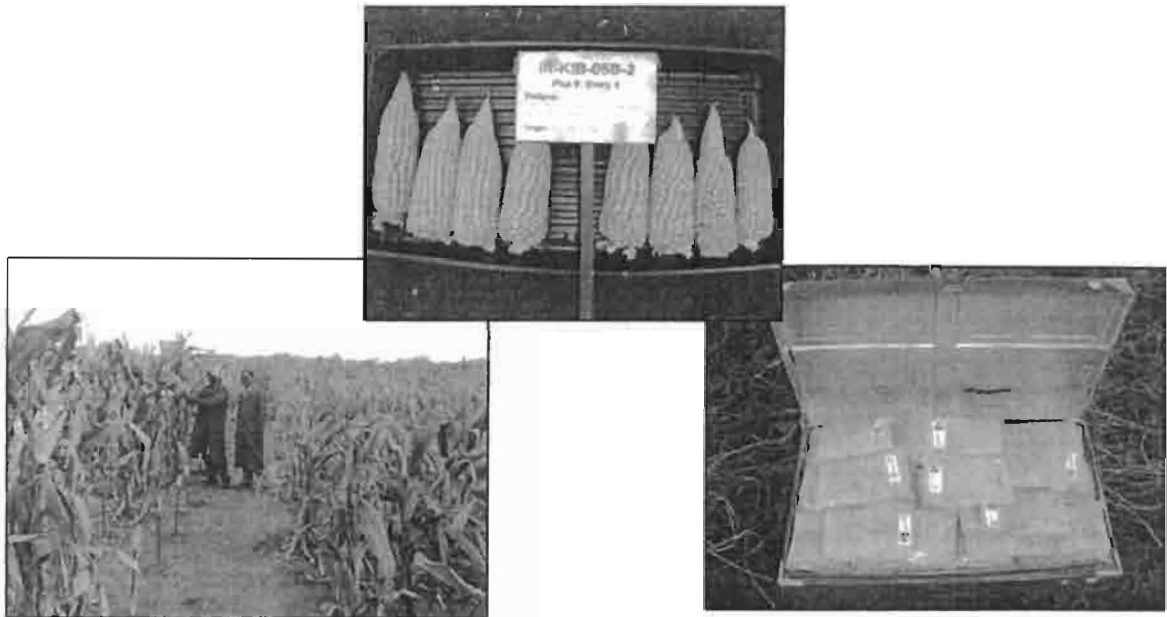
- A backcrossing program was initiated to convert Kenyan germplasm to Bt as mentioned in section 1.1. To start with, BC₀F₁s of six maize inbred lines and two OPVs and various Bt maize events were formed and advanced BCs made in the BGHC and the OQS at Kiboko. To ensure adequate Bt maize germplasm to cover the various maize growing ecologies of Kenya, conversion of 10 additional maize inbred lines to Bt transgenic was initiated in a mid-August planting in the BGHC at KARI NARL. The objective was to convert enough maize inbred lines to be used to develop germplasm for all maize growing environments where the spotted stem borer (*Chilo partellus* Swinhoe) is the major stem borer pest, which include the Humid Coastal Lowlands (HCL), Mid-altitude Early Maturity (MAEM), Mid-altitude Medium Maturity (MMM), Mid-altitude Late Maturity (MLM), as represented by Mtwapa, Katumani, Embu, and Kakamega area, respectively. Hybrids and OPVs will

be desirable and hence OPVs and inbred lines will be converted for the various ecologies. The activities are as follows

- 2005A season – BC0F1s of CIMMYT Germplasm - CML202, CML204, CML312, CML144, CML159, CML395, & Pool 15 QPM-SR-OPT-1 and KARI Germplasm - Katumani made in the BGHC.
 - 2005B season – BC1F1s of CIMMYT Germplasm - CML202, CML204, CML312, CML144, CML159, CML395, & Pool 15 QPM-SR-OPT-1 and KARI Germplasm – Katumani made in the OQS at Kiboko.
 - 2006A season – BC0F1s of CIMMYT Germplasm - BCML332, CML390, CML442, CML444, and KARI Germplasm - EM11-133, EM12-210, MUL-509, MUL-619, KML-1, KML-2 being made in the BGHC in a Sept 2005 planting.
 - 2006A season – BC2F1s of CIMMYT Germplasm - CML202, CML204, CML312, CML144, CML159, CML395, & Pool 15 QPM-SR-OPT-1 and KARI Germplasm – Katumani being made in the OQS at Kiboko in a 3 Nov 2005 planting.
- The backcrossing to convert Kenyan germplasm including inbred lines and OPVs was planted at the same time as the evaluation trial that was terminated earlier (see section 1.2). However, the conversion process went through the full season. BC0F1 crosses made in the BGHC at KARI NARL from the donor Bt maize events and the recipient non-Bt inbred lines were sown, and controlled pollination carried out successfully for all BC0F1s, and the trial was harvested on 26 October 2005. In all these crosses, Bt lines are the donor while non-Bt are the recipient recurrent parents. For biosafety reasons, the transgenic BCs served as the male parents to allow their detasseling.
 - Harvesting was done at full maturity and dry-down of the plants. The BC1F1 ears were harvested individually, shelled, and packaged into labeled cob envelopes. The cobs and undesirable kernels were collected into a garbage can and later burnt together with other plant materials. The seeds were then packaged into polythene Ziploc bags and the 207 seed envelopes packed into a metal box that was locked and transported under escort by KEPHIS plant inspectors Mr. Macharia and Mr. Nyamwaro to the BGHC at KARI NARL. The seed envelopes were counted and packaged into net bags and hung inside the double door spaces of GH-1, GH-2 and GH-3 for further dry down before storage in the secure seed store. The number of seeds from each ear was recorded; a total of 67,606 seeds were harvested.
 - As the plant materials were mostly dry, they were destroyed the same day in the following manner. Plants were uprooted by pulling them from the soil (this was facilitated by some rain the previous night and on the morning). Whole plants from among the Bt females, non-Bt recurrent parent males and the hybrid border plants were placed in small bunches at a time into the trenches and burning continued using alternating layers of plant material and a bag of charcoal, together with diesel fuel as a starter. Later all leaves and seeds were recovered, including by sweeping the trial area. The ashes were then buried in the trenches.



Formation of BC₀F₁s of germplasm conversion to Bt in the BCII during 2005A season



Left – BC₀F₁ plants (L) with recurrent male parents (R); Center, BC₁F₁ ears; Right. BC₁F₁ seeds packed in readiness for transport to the BGHC

- The trial area was irrigated the following day, 27 Oct 2005, to germinate any volunteer seeds which may have fallen during harvest. These will be uprooted and destroyed like the trial materials. Monitoring for volunteers will be done every 2 weeks for 6 weeks and later once a month over a period of 12 months after 26 Oct 2005.
- Mr. G. Murenga enrolled for his Master's degree in plant breeding at the University of Nairobi. His research thesis will focus on whether expression of Bt toxins changes with generations of breeding. Inbred lines, F₁, F₂ and F₃ generations of Bt x Bt, Bt x non-Bt and non-Bt x non-Bt plants will be compared for expression using insect bioassays, protein analysis and HPLC to determine the levels of expression. The non-Bt lines being used are CML144 and CML159, while the Bt lines are Events 127 and Event 223. The F₂s are being developed at the time of reporting.



Mr. Geoffrey Murenga with Bt cry-proteins expression experiments

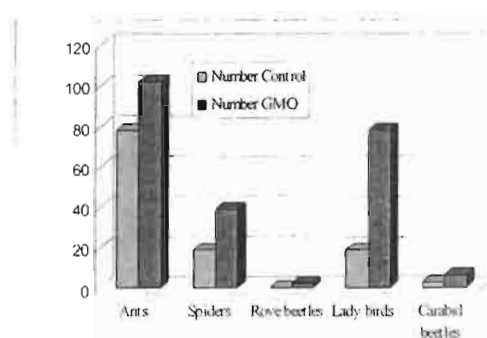
3 ENVIRONMENTAL IMPACT ASSESSMENT

J. Songa, D. Bergvinson, and S. Mugo

- *Preserving reference collections.* The preserved arthropod specimens were re-organized according to sites of collection, and family/species groups and into more preservation boxes, in order to facilitate technical referencing during the field monitoring phase.
- *Database:* A digital database was developed in MS Excel, to link digital images with data on location, trap type and date of collection. With this information, particular groups of insects can be monitored using a particular trap-type during specific periods of the cropping season.
- *Monitoring of arthropods in the confined field site.* A report on the non-targets arthropod biodiversity at the Kiboko OQS site during mock trials was attached to the compliance document to facilitate issuance of the permit to plant Bt maize confined trials at the OQS.
- *Monitoring of non-target organisms in Bt and non-Bt plots.* This was done at the CFT in Kiboko over the first season. Basin and pitfall traps were installed in the Bt and non-Bt trial plots to generate data that is comparable in the two environments. The arthropods trapped were sampled once every two weeks and then identified up to family level for the generalists. For the beneficial insects such as parasitoids, and some key predators, identification was up to the genus/ species level. The first results on the arthropod biodiversity at the confined field site at Kiboko during the long rains 2005 showed that the hybrid Bt maize plots (BC₀F₃s of Bt maize CFT Trial 2) had a higher number of some of the common predators such as the ants, lady bird beetles and spiders than the non-Bt maize inbred lines. The same case applied for other generalist arthropods such as the ones in the family Sarcophagidae. The traps have been set up for the second season trials, and monitoring will continue during the post-harvest monitoring period.
- Greenhouse/laboratory studies on impacts of Bt maize on bionomics of key parasitoids (*Cotesia flavipes* and *Cotesia sesamiae*) of maize stem borers: Mock trials using non-transgenic CML202 maize inbred line were carried out at the BGHC. The objective of the mock trials was to optimize the protocols to be used in the non-target studies and also to get basic information on the development of the stem borers and the respective parasitoids in the laboratory.
- Fate of pollen – Impact on non-target insects: Construction of traps for use in trapping of arthropods that may be potentially exposed to Bt maize pollen in farmers' maize fields, was completed. The traps will be set up in farmers' maize fields within a 10 m distance along the edges of farmers' maize fields in the five maize growing regions during the short rains season starting November 2005.
- It was confirmed that ecotoxicity studies on model animals among birds, fish, mammal, and an aquatic invertebrate could be done at the Chiromo Campus of the University of Nairobi. These will be done once adequate seeds of appropriate Bt maize germplasm are available.



Basins to trap non-target arthropods at the OQS Kiboko



Arthropod diversity in Bt and non-Bt maize plots at CFT OQS Kiboko during 2005B season

4. INSECT RESISTANCE MANAGEMENT AND CONTINGENCY PLANS

M. Muluu, D. Bergvinson, S. Mugo, M. Gethi, and J. Songa

- Using a Hot Spot Analysis (Getis-Ord G_i^*) within ArcView 9, specific regions where there is sufficient refugia at a significance level of 0.05 were identified. However, several districts do not contain adequate refugia within one or both of the maize growing seasons. For these districts, conventional resistance should be promoted along with other alternate hosts (e.g. sorghum or Napier grass) that are economically attractive for farmers to cultivate.
- Refugia suitability trials were harvested and data compiled over the four years of trials so as to provide robust estimates of refugia value for the different alternate crops commonly used in different mixed cropping systems within Kenya. Data analysis (2001-2005) was completed for stem borer damaged plants and exit holes, while analysis of yield data is still being done.
- One area where data was lacking was the relative value of rice as an alternate host for *Chilo partellus*. This information could be obtained by monitoring emergence holes in rice relative to those in neighbouring maize plots. This could not be done within the existing refugia trials, given the flooding requirement for rice cultivation. David Bergvinson and Stephen Mugo went to Mwea rice scheme for a day, and assessed stem borers in rice, with the hypothesis that rice could serve as a refugia crop for maize stem borers. However, no maize borers were present in rice. The results were verified in the greenhouse; the rice borer species collected at Mwea did not survive on maize, and vice versa.
- Regina Tende, a Master's degree student from the University of Nairobi, continued her studies on screening for resistance development in *B. fusca* and *C. partellus* to Bt delta-endotoxins. The project aims to complete four cycles of selection for *B. fusca* and eight for *C. partellus* (Eastern, Mixed and Coast colonies). Data were generated for second-generation *B. fusca* and *C. partellus* Eastern and for first-generation Chilo Mixed and Chilo Coast colonies. The information obtained from this study will be useful for development of IRM strategies for Bt maize in Kenya. Preliminary analysis of the number of surviving larvae over four generations showed no development of resistance in either *C. partellus* or *B. fusca*.



Some refugia species

5. REGULATORY ISSUES

S. Gichuki, and S. Mugo

- An “Application for Field Testing Maize Seeds Containing the Bt Genes Cry1Ab and Cry1ba for Evaluation, Seed Increase and Backcrossing into Other Maize Lines Under Field Confinement in the Open Quarantine Site at Kiboko”, which had been approved by the KARI Institutional Biosafety Committee on 15 Dec 2004 went through the following steps:
 - 9 Feb 2005. Approval by the Kenya National Biosafety Committee (NBC)
 - 4 April 2005. NBC communicates its approval decision to KARI
 - 12 April 2005. KEPHIS phytosanitary conditions on the CFT sent to KARI
 - 20 April 2005. IRMA prepares a compliance document and KARI sends a copy of the same to KEPHIS.
 - 10 May 2005. KEPHIS sends an authorization permit (No. 1/kcft/2005) to conduct Bt maize CFT at Kiboko.
 - 20 May 2005. The Director-KARI signs letter of commitment to KEPHIS
 - 27 May 2005. The Bt maize confined field trials (CFT) sown at the KARI Kiboko OQS
- Kenya broke historic agricultural ground in a protected field on 27 May 2005 when it sowed its first transgenic maize seeds into local soil. The field trials were undertaken to verify the results from trials held at a biosafety greenhouse. The trials serve two purposes: first, to determine the effectiveness of various Bt genes against common Kenyan stem borers; and second, crossing with Kenyan maize lines as part of a breeding process that will produce Bt maize varieties adapted to Kenyan growing conditions. These trials were conducted in strict accordance with the terms proscribed by the KEPHIS, the KARI Institutional Biosafety Committee (KARI-IBC), and the National Biosafety Committee (NBC). The open quarantine site where the confined trials were planted was built to specifications that include many biosafety and security measures to ensure that pollen, seed, or plant materials do not escape the trial area or cross inadvertently with maize not included in the experiment.
- In early July 2005, it was discovered that an inadvertent application of a systemic insecticide had been made in Trial 1 of the OQS. This prevented observation of the effects of the Bt delta-endotoxins beyond the early season vegetative stage of the crop in Trial 1, the evaluation of Bt *cry* gene events in the CFT, as reported in section 1.2.
- Following the unfortunate interference in the evaluation trial of Bt maize CFT Trial 1 at the OQS at Kiboko in early July, the NBC was briefed on this during their visit to the site on 18 July 2005. The committee recommended that the trial be terminated, preferably at the 7-8 weeks stage, and a second planting be made so as to obtain results over a full season. It was worth noting that no biosafety conditions have been breached from planning, planting, transportation of materials as well as management of the trial. All major activities had KEPHIS inspectors participating as in the appended schedule of activities. All other records for compliance were up to date and available for inspection at the site. Secondly, the germplasm conversion to Bt run to date as planned as detailed under Bt maize development above. Preliminary results of efficacy of Bt maize Cry proteins against Kenyan maize stem borers - A Mid-term Report to the Kenya National Biosafety Committee (NBC) on the Bt maize Confined Field trial at KARI Kiboko, with a request to terminate the trial and approve second planting, was submitted to the NBC on 22 July 2005. Dr. S. Gichuki presented this report to the KARI IBC in July 2005 and attended the NBC meeting on 8 September 2005 where this report and request were discussed.
- An approval for second planting was granted subject to KEPHIS developing conditions for agronomic and phytosanitary practices within four weeks stating 8 Sept 2005. The NCST sent the NBC an approval for the second planting on 21 Sept 2005. KEPHIS sent the new phytosanitary conditions on 19 Oct 2005. KARI sent a notification to replant on 1 November 2005. Replanting of the trials was done on 3 November 2005.
- KEPHIS plant inspectors were involved on various occasions as detailed below:
 - Observation of harvesting of transgenic Bt maize seeds in the BGHC on 19 July 2005. These were selfed Bt maize plants for seed increase and the seeds were harvested, shelled, treated and stored in the appropriate biosafety seed cabinet in the secure seeds store.

- Observation of harvesting of transgenic Bt maize seeds from Bt x Bt and Bt x non-Bt crosses for Mr Murenga's MSc thesis research in the BGHC. The harvested seed were shelled, treated and stored in the appropriate biosafety seed cabinet in the secure seeds store.
 - Harvesting of the evaluation of the Bt Maize confined field trial (CFT) at the open quarantine site (OQS) at KARI Kiboko on 31 Aug 2005.
 - Disposal of plant material from CFT trial 1 through burning and covering the ashes in the trenches within the OQS on Wed 7 Sept 2005.
 - The first post harvest monitoring of Bt maize CFT Trial 1 at the OQS at KARI Kiboko on 21 Sept 2005. No volunteer maize seedlings were found at the site and in the isolation vicinity.
 - The second post harvest monitoring of Bt maize CFT Trial 1 at the OQS at KARI Kiboko on 5 Oct 2005. No volunteer maize seedlings were found at the site and in the isolation vicinity.
 - The harvesting of BC₁F₁ seeds from backcrossing of Bt and non-Bt maize germplasm at the CFT Kiboko on 26 Oct 2005. This included disposal of plant materials on site.
- Biosafety Regulatory Issues in Kenya have remained crucial to IRMA's success. There are regulations and guidelines for biosafety in biotechnology operating at ministerial level, while the Biotechnology and Biosafety Policy and a Biosafety Bill for Kenya are still under development. Through these regulations, the IRMA project has achieved guidance through CFTs twice, harvesting Bt maize including seeds, disposal, & post harvest monitoring.
 - IRMA Project's Contributions to the regulatory system in Kenya include direct inputs, such as training of regulators from KEPHIS and NBC through formal courses and visits to research sites in Kenya, Mexico and the USA. Other contributions are availing Bt maize as a product through which applications has offered opportunities for interaction with NBC and IBC on Bt maize dossiers, and IRMA scientists' participation in the development of the biotechnology and biosafety policy and bills. The results from this involvement are:
 - Shortening of time between application and decisions
 - Increased science based decision making
 - Improved communication among stakeholders
 - Increase in the number of applications.
 - The regulatory team continued to follow the developments in biosafety and bio-regulation in the Kenyan legislative system, as the draft Biosafety Bill continues to be debated by stakeholders. The ministry of Education, Science and Technology is committed to moving the Biotechnology Policy and Bill to parliament. A critical parliamentary motion that had been suggested during the last session was overtaken by events and will not be debated unless brought afresh during the current session. There is a particularly negative analysis of the proposed Biosafety Bill by ActionAid, which is leading a group of anti GMO activists in Kenya. ABSF has led the efforts to address these issues, and IRMA has contributed to these efforts.



Disposal of Bt plant materials

6. IPR/LICENSING

S. Mugo, D. Bergvinson, S. Gichuki, O. Oluoch

- Negotiations on the commercial use of the Ubi: *cryIAb* construct developed by the University of Ottawa (UoO) were carried out. Letters from CIMMYT were sent to Monsanto Technology, Bayer Bioscience, Dow Agrosiences, and Syngenta requesting that they release CIMMYT from a research-only MTA were sent off on 10 June 2005. Dr. Altosaar provided the history surrounding the development of the constructs in an affidavit that he sent to D. Bergvinson on 16 June 2005. The construct synthesis was based on a sequence published by Monsanto in 1986 for Bt cotton (*cryIAb* and *cryIAc*). While the University filed for patent protection, their application was filed much later than Monsanto's, and so for this construct to be used some type of sublicensing arrangement may need to be made between Monsanto and the University and between the University and CIMMYT. Dr. Altosaar (UoO) also clarified issues raised regarding an MTA from ICI-AstraZeneca that could potentially place Syngenta in a liability position; basically the technology associated with the MTA was not used to generate the constructs under consideration. He also mentioned that the University's legal council has been in contact with Monsanto, Canada and they had agreed to sign the letter of intent sent by CIMMYT. We await this action.

7 SEED PRODUCTION

O. Odongo, S. Mugo, W. Muasya

- Nearly 2 tons of seeds were produced for use in various activities, key of which was the national performance trials and associated activities. This included about 0.5 tons of seed produced during the 2005A season and from about 1.5 tons from about 500 rows harvested during the 2005B season. These were all produced at Kiboko and included various materials from nurseries (hybrid maize and seed increases from inbred lines and breeding populations).

8. MARKET ASSESSMENT AND ANALYSIS

Martins Odeno, Hugo De Groote, Lutta Mohammed, J. Wanyama

- The outlines for presentation of marketing component of the baseline survey were refined, and data cleaned further data, analyzed, and literature search made. Data on the impact of market liberalization on maize marketing was also analyzed. The work plans and budgets for the year's activities were refined, and planning for 2006 activities done.
- Major activities included a survey of millers and processors' awareness and attitudes towards GMOs. Maize millers and processors were identified, and survey instruments developed.
- A survey of grain traders and sources of grain was started and is ongoing. Preliminary data showed that maize surplus zones like Kitale account for 57% of the area, while maize deficit zones like Kakamega account for 27% of the area.
- A study on the analysis of the use of maize for feed (grain, stovers, by products) was deferred to 2006.
- A study of the Kenya seed and biosafety regulatory system showed that: The seed market was liberalized, a seed act is in place, and many new local, regional and multinational companies including KARI have come to the market, leading to new variety releases. However, the process of variety release is still costly, there is a problem with seed imports, and quality control at the retail level. There are no new entries for highlands, and hybrid 614 still accounts for 50% of seed sales. Biosafety regulations and a draft Biosafety Policy is in place, and the process of application for GMO introductions is improving in quality and speed. However, a law is not yet in place, and this could be problematic for IRMA at the commercialization stage.
- In Tanzania, maize seeds and grain market were liberalized but the regulations in place, and new companies have entered the market. However, TANSEED a major company collapsed and there have been decrease in sales of improved seed, while quality declared seed is now limited. In Ethiopia, a plant breeders' rights document has been finalized and awaits approval. However, the government still has monopoly. In the developments of biosafety guidelines, a Stakeholder workshop



Farmer interviews

took place in 2005 and a draft of biosafety guidelines is circulating for review. For Uganda, seed markets were liberalized, and many seed companies are now engaged. Biosafety regulations are in place which allowed the opening of a genetic engineering lab where experiments are planned for GM bananas.

9. ECONOMIC IMPACT ASSESSMENT

- Hugo De Groote , James Ouma Okuro, Lutta Mohammed,j. Wanyama, C. Bett, and K. Dada
- IRMA social scientists analyzed data from previous research, especially baseline data, and worked on editing and submitting papers for presentation and publication.
- A first draft of the CD of the IRMA I Social Scientists' papers and presentations was compiled and is being reviewed before printing copies and posting it on the Web. Papers presented at conferences last year (KARI conference, American Agricultural Economics Association, and African Association of Agricultural Economics) were also finalized for the proceedings or for submission to journals. A summary of our synthesis paper was published in the Information Systems for Biotechnology (ISB) News Report of February 2005 (<http://www.isb.vt.edu/news/2005/feb05.pdf>).
- The social science theme leaders took part in the IRMA II work plan meeting in Nairobi on 15 March 2005. The different activities we had planned in the annual meeting of November 2004 were reviewed and brought in line with the available budget. Some were cut and others reduced, and different members of the group were assigned to develop a more detailed work plan and budget for this year's activities.
- A proposal for geo-referencing and spatial analysis of the distribution of local OPVs at the coast was developed. The purpose is to quantify gene flow and develop control methods), literature review, developing and testing the methodology, sampling of the transects to be measured.

10 COMMUNICATION / PROMOTION, CAPACITY BUILDING & ADMINISTRATION

D. Ouya, D. Poland, G. Kimani, S. Mugo, and H. De Groot

Communication / promotion

Develop and produce publications that track the project's progress

- Mulaa, M., S. Mugo, B. Muli, and D. Poland (Editors). 2005. Report of a Workshop on Integrating Pastures, Fodders and Cereal Crops as Refugia for Stem Borers in the Farming Systems of the Humid Coastal Kenya, 26-29 July 2004: IRMA Project Document No. 17. Nairobi, Kenya and Mexico D.F.: KARI and CIMMYT.
- KARI and CIMMYT. 2005. Insect Resistant Maize for Africa Annual Report 2003-2004 KARI/CIMMYT IRMA Project. Project Document No. 20. Mexico D.F.: KARI and CIMMYT.
- KARI and CIMMYT. 2004. Insect Resistant Maize for Africa: IRMA in 2005 Briefs. KARI/CIMMYT IRMA Project. IRMA Project Document No. 21. Nairobi, Kenya: KARI and CIMMYT.
- D. Poland, S. Mugo, M. Mulaa, and D. Ouya (eds.). 2004. Insect Resistant Maize in Africa Project: Fourth Stakeholders Meeting. IRMA Project Document No. 19. Nairobi, Kenya: KARI and CIMMYT.
- Mugo S., M. Gethi, J. Songa, O. Odongo, G. Ombakho, J. Gethi, K. Njoroge, J. Ininda, and D. Bergvinson. 2003. Development of Locally Adapted Insect Resistant Maize in Kenya Data for 2005. KARI/CIMMYT IRMA Project. IRMA Project Document No. 18. Nairobi, Kenya: KARI and CIMMYT.

Solicit and convey public input to project scientists and managers

- The Fourth Annual IRMA Stakeholders Meeting was held on 9 December 2004 to solicit input and questions from project stakeholders and the media. Stakeholders were also shown the research in the biosafety greenhouse complex.
- The sixth Annual IRMA Stakeholders Meeting will be held on 25 November 2005. Stakeholders, including the media, will be shown the research in the biosafety greenhouse complex and the OQS at KARI Kiboko.
- The clipping service was maintained during 2004 with Picasso Productions.

Produce materials to inform diverse audiences about insect resistant maize technologies

Print, and audio materials

- A compiled IRMA Updates, Issues 1-3. Volume 6, were produced and distributed as hard copy and electronically.
- A press release was produced and distributed on the first planting of the Bt maize confined field trial at Kiboko on 27 May 2005.
- A press release was produced for fifth Annual IRMA Stakeholders Meeting (2005).
- An IRMA poster for use in agricultural shows in Kenya was prepared, printed and was used at agricultural shows in Kenya. Copies have been sent to all KARI centers and are being used for training purposes.
- The revision of IRMA brochure continues. This will reflect the IRMA II aspirations as well as capture the achievements of IRMA I.
- IRMA flyers - one describing the project, and the other on frequently asked questions about GMOs, were distributed at three Agricultural shows in Kenya, namely: Nakuru 13-16 July, Mombasa 24-28 August, Nairobi 26 Sept-2 October. Geoffrey Murenga and Grace Kimani were on hand to answer questions from show Goers. Although it had been planned to display the IRMA poster at the agricultural shows, this was not possible, since the KARI stands at the shows did not have a special biotechnology section.

Media relations

- The outstanding event was the first planting of the Bt maize confined field trials at Kiboko on 27 May 2005. Event press release and press packet were prepared, with quotations provided by KARI Director R. Kiome and IRMA Project Manager S. Mugo. Three media houses attended the event and

coverage on television, print and electronic media was extensive. The historic planting, and the IRMA project was covered on Nation and KBC Television broadcasts in Kenya. The project was also featured in an article in The New York Times, The International Herald Tribune (see below), The Standard, The Daily Nation, The East African, The Kenyan Spectator, and other newspapers and magazines in Kenya. The event also appeared on Reuters wire service; SciDev.net website; Lettrinfopgm website (a free info letter on transgenic plants from University of Grenoble I (<http://tamise.ujf-grenoble.fr/~wws/info/lettreinfpogm>): Truth about Trade Technology (<http://www.truthabouttrade.org/article.asp?id=3921>), and many other websites around the world.

- Daisy Ouya briefed a Senior Producer at BBC World Service (Mr. Gray Phombeah) on IRMA Project activities.
- The IRMA project was featured in an article in the February 2005 issue of the online journal New Agriculturist (www.new-agri.co.uk), which is published by WRENmedia and funded by DFID. The article titled 'An important milestone for Bt maize' is available at www.new-agri.co.uk/05-2/focuson/focuson8.html. It describes the project's background and important milestones, including the recent approval for field testing of Bt maize in open quarantine at Kiboko.
- The IRMA project was featured in an editorial entitled "Genes and Hoe," in the New York Times (15 June) and the International Herald Tribune (16 June), two of the most influential and prestigious newspapers at the international level. The NY Times interviewed Dr. Bergvinson, and support for the writing was provided by D. Poland and D. Mowbray at CIMMYT-Mexico.
- IRMA scientists Stephen Mugo, Simon Gichuki, Catherine Taracha, and KARI Director Dr. Romano Kiome, were interviewed by BBC journalist Andrew Luck- Baker for the program Discovery. Daisy Ouya accompanied the journalist to KARI Hq and Kiboko, and facilitated (translation to/from Kiswahili) the interviews with three farmers there. The broadcast was aired on 13 July. The BBC program *Discovery* was aired on 13 July, and it featured the project prominently. Archival CD copies of the broadcast have been received.
- CIMMYT Annual Report-05. A story on the IRMA project has been written, and will appear in the CIMMYT 2005 annual report.
- Coverage of the termination of the field trial at Kiboko, following the inadvertent application of Furadan, was intensive, in both the local and international media, giving the false impression that Kenya had stopped Bt maize experiments altogether.



BBC Reporter interviews S. Gichuki

Capacity building – Training

- The newly recruited Writer/Editor, Daisy Ouya, went to CIMMYT-Mexico for one month between February and March 2005, for orientation and training. Arrangements for covering IRMA editorial and PR duties were discussed, as well as logistical arrangements, which required consultations among the Head of Corporate Communications David Mowbray, ALP Director M. Banziger, D. Poland, and D. Ouya.
- Two trainings courses were held on operations and management of CFT, one at Kiboko and the other at Busia as mentioned in section 5. The first was held as a refresher training to prepare for planting the Bt maize confined field trial on Monday 18 April 2005. This was held at the site at KARI Kiboko Farm, and attended by 35 participants. The second was on-site compliance training for trial managers and inspectors of confined field trials held at Alupe, Busia, Kenya, 26-27 April 2005. This was attended by S. Gichuki, S. Mugo, J. Mbithi and E. Mwasame. The trainers were mainly from KEPHIS and Program for Biosafety Systems (PBS), USA.
- At their request, 12 members of the National Biosafety Committee (NBC), led by chairman J.K. Ng'eno, visited the Bt maize confined field trials in Kiboko on Monday, 18 July 2005 as mentioned in section 1.2. NBC members were informed of an experimental error—the application of a systemic pesticide to one of the plots in mid-June. Because of this, one trial (trial 1) had to be harvested and disposed, on August 31 and September 7 respectively. A fresh application was lodged for its replanting.
- Margaret Mulaa visited some institutions dealing with Bt maize in South Africa 28 May-1 June 2005. The objective was to learn procedures followed and methodologies used to manage insect resistance and conduct environmental risk assessments. In addition procedures used to screen for effective Bt genes, the regulatory system, and any other lessons that IRMA could learn from South Africa. She visited the Agricultural Research Council (ARC) in Potchestroon and Pretoria, and Monsanto Seed Company in Gauteng Province. Other Information gathered included statistics on total maize production and Bt maize acreage, varieties produced, yield loss due to stem borers, and the perception of Bt Maize in South Africa by the government, consumers, scientists, NGOs . farmers and other stakeholders. Other issues were the South African regulatory system and examples of applications made by Monsanto to plant Bt maize, as well as the procedures for storing and tracking germplasm through lab and field trials, marketing and monitoring of Bt maize in the field by Monsanto in South Africa, and use of refugia. Some farmers do not plant refugia and there is a risk of resistance developing. Stacked genes when back-crossed to some parents cause gene draft reducing yields Methodology to determining a discriminating dose for monitoring resistance for B.



NBC visits Bt maize CFT at Kiboko

fusca is being developed. The efficacy of Cry1Ab protein against second generation *B. fusca* larvae is lower, requiring stacking of genes (*cry 1Ab+ cry 2Ab*) or increasing the initial dose. South Africans do not conduct risk assessment studies because they are expensive; instead data generated from the USA and other countries is used to assess risks to non-targets arthropods, humans, and the environment. The South African Bureau of standards contracts a third party to verify what South African scientists are doing with the Bt technology.

- The BGHC continued to be a focal point for informal training through visits by major groups.
- Likewise, the OQS at Kiboko continued to be a focal point for informal training through visits by major groups. The most significant were the NBC and a group of 50 participants of a maize improvement course at CIMMYT. A total of 575 entrants were registered representing 55 national and international institutions at the OQS during the May – October 2005.
- Science within the IRMA Project was presented to a group of 50 Maize improvement course participants who also visited the BGHC and OQS during 29 Aug – 10 Sept 2005.

Capacity Building - Facilities & Capital items

- Minor works were done in the BGHC including fixing hooks to suspend shade netting in the BGHC from the inside and without affecting biosafety features of the facility.
- Each of the seven participating KARI centers received a digital camera to be used to capture important research and events.
- A photocopier and a scanner were purchased for the KARI communications office to enable production of important project materials.
- An LCD PowerPoint projector is being purchased for use at the KARI Biotechnology Center.
- One motor vehicle is yet to be purchased.

Workshops, Seminars, and Presentations

- S. Mugo attended a GMO cotton public forum organized by the cotton stakeholder's forum at the Safari Park Hotel, Nairobi, on 5 May 2005. The KARI Monsanto Cotton project activities were presented and responded to by a large number of mainly representatives of NGOs. KEPHIS and the NCST were very well represented and made presentations.
- S. Mugo attended the national maize variety release committee meeting at the Ministry of Agriculture headquarters in Nairobi on 26 May 2005. Mugo also attended a number of maize improvement meetings by Ministry in June 2005.
- S. Mugo attended and presented IRMA Project activities to the ABSF Regional Biotechnology Workshop, held 7 April 2005, Jacaranda Hotel, Nairobi, Kenya.
- IRMA Project was represented and presented at the First Syngenta Foundation for Sustainable Agriculture workshop, Basel, Switzerland, 4-10 June 2005. IRMA was represented by Stephen Mugo, Simon Gichuki and Hugo DeGroote. The purposes of the workshop were 1) For staff and key collaborators to meet and establish a cross-projects network, 2) to provide participants with an overview of the work of the Foundation. Other purposes were 3) to identify and discuss ways of measuring and improving impact, and 4) To look forward 5 and 10 years to the possible roles and activities of the Foundation. The workshop attracted about 40 participants (from various projects, SFSA staff, Syngenta Company, and SFSA consultants) from more than 10 countries. IRMA was one of the six projects at the workshop; others included projects from Mali, Eritrea, Brazil, Uganda, and India. Visual materials including posters and photos were available including one for the IRMA project. The presentations called for an in-depth analysis of the relevance of each project. The workshop was the first of a series of workshops with only a summary of the proceedings expected. More important was the creation of a common understanding among participants on the work of the SFSA.
- S. Gichuki and S. Mugo attended a Rockefeller funded and CIP organized "A Roadmap Towards Making the Benefits of GM Crops Available to Resource-poor Farmers in Africa", at the Bellagio Study and Conference Center – Italy, September 13-17, 2005. The IRMA Project was presented and various recommendations from that meeting will be available from CIP.
- Various IRMA scientists and technicians attended 2005 maize national performance (NPT) tours where insect resistant maize OPVs were entered by KARI Katumani, Embu and Kakamega centers and are being tested by KEPHIS. Fred Manyara from KARI Embu, Wilson Muasya and J. Mbithi

from KARI Katumani, and S. Mugo attended the Early Maturity Mid Altitude NPT sites at Kangundo, Kiboko, Kathiani, Katumani, and Isinya during 12-13 July 2005. F. Manyara, J. Mbithi and S. Mugo participated in the Mid-Altitude Medium Maturity Embu NPT kit at various sites across the country including Meru, Embu, Kirinyaga, Nyeri, Lanet, and Siaya during 9-12 August 2005. Christine Ndinya and S. Were from KARI Kakamega joined F. Manyara, J. Mbithi and S. Mugo in the Mid-Late Medium Maturity Kakamega NPT kit at various sites across western Kenya including Lanet, Siaya, Busia, Bungoma, and Kabianga during 10-12 August 2005. Kiboko and Katumani, Embu, and KTI, and Kabianga and Kakamega were the special sites where artificial infestation was done for the Early, Medium and Mid-Late NPTs respectively. The Kiboko and KTI sites were the only ones where very good infestation data will be found. The Katumani and Embu sites will give average data, while infestations at Kabianga and Kakamega were interfered with by heavy rainfall soon after infestation. Poor plant stands were common in the Early Maturity sites, while good results are expected from the Medium and Mid-Late kits. The official report of these tours will be prepared by KEPHIS and be presented to the NPT meeting in February 2006.

- S. Mugo presented IRMA Project to the visiting American Farm Bureau Federation (AFBF) organized by the Foreign Agricultural Service USDA Office in Nairobi and by ABSF, at the Nairobi Show ground on 29 Sept 2005. The six officials from the American Farm Bureau Federation (AFBF) were: Charles Kruse - President Missouri, Steve Bccus-President Kansas, Larry Wooden-President North Carolina, Barry Bushue-President Oregon, Craig Lang-President Iowa, and Michelle Gorman (AFBF). The visitors mainly focused on the adoption of biotech crops by American farmers, why American farmers grow biotech crops, the safety of biotech crops, the importance of science based regulatory process, opportunities for agricultural biotechnology in African agriculture (an American farmer's point of view) and international trade in biotech products among others. ABSF organized the meeting in collaboration with NCST.

Papers (journals and conferences)

- M. Mulaa, S. Mugo, B. Muli, and D. Poland (Eds). 2005. Report of a Workshop on Integrating Pastures, Fodders and Cereal Crops as Refugia for Stem Borers in the Farming Systems of the Humid Coastal Kenya, 26-29 July 2004: Insect Resistant Maize for Africa (IRMA) Project. IRMA Project Document No. 17. Nairobi, Kenya: KARI and CIMMYT.
- KARI and CIMMYT. 2005. Annual report 2003-2004. Insect Resistant Maize for Africa (IRMA) Project. IRMA Project Document No. 20. Nairobi, Kenya: KARI and CIMMYT.
- S. Mugo, S. Gichuki, D. Poland, D. Ouya, H. De Groote, and M. Mulaa (Eds). 2005. Insect Resistant Maize for Africa (IRMA II) "Delivering Products to Farmers"(2004-2008)Fifth Stakeholders Meeting, Hilton Hotel, Nairobi, Kenya. 9 December 2004. IRMA Project Document No. 19. Nairobi, Kenya: KARI and CIMMYT.
- De Groote H. and S. Mugo. 2005. Can Bt maize alleviate poverty in Africa? Paper presented at the XIIIth International Molecular Biology Seminar, Paris, February 24-15, 2005.
- De Groote H., S. Mugo, E. Sikinyi and F. Kanampiu. 2005. The regulatory system for maize seed in East Africa: Help or hinder for poor farmers? Paper prepared for presentation at the 9th International Conference on Agricultural Biotechnology: Ten Years After, organized by the International Consortium on Agricultural Biotechnology Research (ICABR), Ravello (Italy) July 6 – 10, 2005.
- CIMMYT and KARI. 2005. IRMA Updates Vol. 6, Issue 1, March 2005. CIMMYT, Mexico
- CIMMYT and KARI. 2005. IRMA Updates Vol. 6, Issue 2, June 2005. CIMMYT, Mexico
- CIMMYT and KARI. 2005. IRMA Updates Vol. 6, Issue 3, September 2005. CIMMYT, Mexico
- S. Mugo C. Taracha, S. Mclean, J. Songa, A. Pellegrineschi, and S. Gichuki. 2005. Status of Development of Insect Resistant Maize Using Bt Technology in Kenya. Paper presented to the ABSF Regional Biotechnology Workshop, held 7 April 2005, Jacaranda Hotel, Nairobi, Kenya
- Mugo S., H. De Groote, S. Gichuki, D. Bergvinson, J. Songa, M. Mulaa, and A. Pellegrineschi. 2005. Developing Bt Maize for Resource-poor Farmers – Recent Advances in the IRMA Project. Paper proposed for the special December review issue of African Journal of Biotechnology.
- S. Mugo and S. Gichuki. 2005. Preliminary results of efficacy of Bt maize cry proteins against Kenyan maize stem borers. A Mid-term Report to the Kenya National Biosafety Committee (NBC) on the BT maize Confined Field trial at KARI Kiboko, CIMMYT ALP< Nairobi, Kenya.
- Tende R.M., J.H. Nderitu, S. Mugo, J.M. Songa, F. Alubayo, and D. Bergvinson. 2005. Screening for development of resistance by the spotted stem borer *Chilo partellus* Swinhoe (Lepidoptera: Pyralidae) to Bt-Maize Delta-Endotoxins. Paper to be presented at the 7th Conference of the African Science Society, Kampala, Uganda.
- De Groote H., S. Mugo, E. Sikinyi and F. Kanampiu. 2005. The regulatory system for maize seed in East Africa: Help or hinder for poor farmers? Paper prepared for presentation at the 9th International Conference on

Agricultural Biotechnology: Ten Years After. organized by the International Consortium on Agricultural Biotechnology Research (ICABR), Ravello (Italy) July 6 – 10, 2005.

Simon Chege Kimenju, Hugo De Groote, Joseph Karugia, Stephen Mbogoh and David Poland (2005) Consumer awareness and attitudes toward GM foods in Kenya. *African Journal of Biotechnology*:Vol. 4 (10), pp. 1066-1075.

Administration

- The IRMA II Agreement was signed off among KARI, CIMMYT and SFSA to cover 2004-2008.
- Dr. Simon Gichuki was appointed Head of KARI Biotechnology Program, and KARI Biotechnology Center, following the demise of IRMA Co-Coordinator Dr. Benjamin Odhiambo. With this appointment, Gichuki assumed the role of KARI's primary contact on the IRMA Project, and also serves as the IRMA Project Internal Regulatory Affairs Officer. He has developed efficiency in applications for field-testing of Bt maize through to approval.
- A planning and budgeting meeting was held on 15 March 2005. This brought together various project theme team leaders to align the activities with the actual budget available. A total of 15 participants attended the one-day event at KARI Headquarters.
- IRMA project Technical Advisory Board. The composition was proposed as Dr. Romano Kiome, Dr. Willy De Greef, Dr. Rob Tripp, Mr. Obongo Nyachae, Dr. Carl Pray, and the Agro business consultant who will be joining the Rockefeller Foundation. This committee should be well placed to handle the technical issues associated with efficacy, regulation, and release. All were sent invitation letters and TORs and all accepted, save for the RF consultant position, which had not been filled. The project documents (including the decision tree) were sent to the team for their comments. Subsequently they were asked to provide an informal review and a set of questions sent out to them. IRMA-TAB was represented by Mr. Obongo Nyachae during the June 2005 EC meeting. A joint meeting of the TAB and IRMA scientists is planned for 23-24 November 2005 ahead of a joint meeting with the EC meeting on 25 November 2005.
- IRMA Executive Committee met and visited the Bt maize confined field trials at Kiboko on 13-14 June 2005. The IRMA Executive Committee is the body created to oversee IRMA II as IRMA I was run by a steering committee. EC members at the meeting included Dr. R. Kiome the Director KARI, Dr. Masa Iwanaga, Director General CIMMYT, Mr. J.K. Ng'eno representing the Director of Agriculture in the Ministry of Agriculture in Kenya, and Dr. Andrew Bennett, the Executive Director of the Syngenta Foundation for Sustainable Agriculture (SFSA). The representative of the Rockefeller Foundation sent an apology. Also present was Mr. Obongo Nyachae, the Executive Officer Seed Trade Association of Kenya (STAK) who was representing the IRMA –Technical Advisory Board (IRMA-TAB), Dr. M. Banziger, CIMMYT-ALP Director, and Dr. Jost Frei, SFSA consultant among other scientists and collaborators. The EC decided to meet during mid-year to deliberate on important issues facing the project. These included: project updates, workplans and budgets, Kenyan legislation and regulatory issues, MTA on *cry1Ab* and *cry2Aa* genes, new initiatives to support IRMA, IRMA-TAB, funding gap, and schedule of key events in 2005. After the meeting the EC toured the level 2 biosafety greenhouse complex (BGHC) at KARI-NARL, escorted by Ms. Catherine Taracha, Scientist-in-Charge. On Tuesday the 14th the EC visited the KARI-Kiboko Field Station, primarily to see the recently established Bt maize CFTs there. Minutes of the EC June meeting were prepared and circulated.
- The IRMA Annual Project Meetings will be held on various dates in November 2005 at the Safari Park hotel as follows:
 - 07 – 08 Nov 2005 - IRMA Annual Review and Planning meeting – To be attended by IRMA theme leaders, the complement of KARI and CIMMYT Scientists in the IRMA project, and any IRMA project Executive Committee (EC) Members or IRMA Project Technical Advisory Board (IRMA-TAB) members who may be available.
 - 23–24 Nov 2005 - Joint IRMA theme leaders and IRMA-TAB meeting
 - 25 Nov 2005 (Morning) - Annual Stakeholders' meeting – To be attended by more than 100 stakeholders' representatives, including the media.
 - 25 Nov 2005 (Afternoon) - Executive Committee meeting – Combined meeting with IRMA-TAB
 - 26 Nov 2006 - Optional visits to the Biosafety Greenhouse complex at KARI NARL and Confined field trials at the Open Quarantine Site at KARI Kiboko.



Participants at the IRMA Review and planning meeting held at Safari Park Hotel 7-8 Nov 2005

Appendix 1: Reviewed IRMA Project 2005 Work Plans

Group	Activity code	Products	Activities	Type of work	Group	Activity	Person responsible	Q1	Q2	Q3	Q4	Estimated cost (Cust US\$)	KJUR		CIMMYT		Status
													RF	BFSB	RF	BFSB	
1. BI Event analysis, Development of source line and human health safety assessment																	
1	1	Donor Organism	Maize biology description adapted to the region	Literature study	Breeders	Literature study	SM, AP, CT	X				500	0	0	250	0	Partially done/ongoing
1	2	Donor Organism	Molecular Biology: <i>Receptor Transgressors</i>	Literature study	Molecular Biology	Literature study	SM, AP, CT	X				500	0	0	250	0	Partly done
1	3	Donor Organism	Other inserted Genetic elements	N/A	N/A	N/A	AP		X			0	0	0	0	0	N/A
1	4	Vectors and transformation methods	Storage of reference samples of constructs	Long term storage	Molecular Biology	Plasmid isolation	AP	X	X	X		1,000	0	0	0	250	Partially done, Storage
1	5	Vectors and transformation methods	Storage of reference samples of constructs	Long term storage		Maintenance of the specimens		X	X	X		0	0	0	0	0	Done
1	6	Vectors and transformation methods	Genetic constructs description	Experiment description	Molecular Biology	Report	AP	X				1,000	0	0	0	250	Done/Report submitted
1	7	Vectors and transformation methods	Description of the effect of the gene	Lit. study / lab / BGH observation	Molecular Biology	Report	AP, CT, JD					1,000	0	0	0	0	Done/Report submitted
1	8	Vectors and transformation methods	Transformation experiment	Exp. city ZA / Descrip of the exp. protocol	Molecular Biology	Report/transgenic plants development	AP	X	X	X		30,000	0	3,440	0	10,000	Done/Report submitted
1	9	Molecular characterization of the event	No. of copies	Experiment	Molecular Biology	Report	AP	X				5,000	0	240	2,000	0	Partially done/Report submitted/Continuing
1	10	Molecular characterization of the event	Other inserted DNA	Experiment	Molecular Biology	Report	AP	X				5,000	0	240	0	2,000	Partially done/Report submitted/Continuing
1	11	Molecular characterization of the event	Structure of the insert	Experiment	Molecular Biology	Report	AP	X				10,000	0	480	0	4,000	Partially done/Report submitted/Continuing
1	12	Molecular characterization of the event	Sequencing of the insert	Experiment	Molecular Biology	Report	AP	X	X			5,000	0	240	0	2,000	Partially done/Report submitted/Continuing
1	13	Molecular characterization of the event	Insertion locus determination	Experiment	Molecular Biology	Report	AP	X	X			5,000	0	0	0	2,240	Partially done/Report submitted/Continuing
1	14	Molecular characterization of the event	Verification of no insert in ORF	Experiment	Molecular Biology	Report	AP	X	X	X		15,000	0	0	0	6,720	Partially done/Report submitted/Continuing
1	15	Molecular characterization of the event	Peer Review of the results	Report	Molecular Biology	Report	AP	X	X	X		5,000	0	1,240	0	1,000	Partially done/Report submitted/Continuing
1	16	Expression analysis of inserted genes	Study in contained environment	experiment	Molecular Biology	Protein sampling/ bioassays	CT, AP, JD	X	X	X		1,500	0	500	0	180	Done/Continuing
1	17	Expression analysis of inserted genes	Experiment stability in environment	experiment	Molecular Biology	Protein in different environments	CT, AP, JD	X	X	X		10,000	0	2,480	2,000	0	Done/Continuing
1	18	Expression analysis of inserted genes	Methods for categorization of new variants	Experiment	Molecular Biology	N/A	CT, AP, JD					0	0	0	0	0	N/A
1	19	Detection toolkit development	Dev. set of protein based detect. kits	A. available-oussance C/ylBb	Molecular Biology	Experiment		X	X	X		0	0	0	0	0	To our-source commercially
1	20	Detection toolkit development	Quantitative test for regulatory test	Outsource	Molecular Biology	Test effectiveness of the kit		X				0	0	0	0	0	Not done

Group code	Activity code	Products	Activities	Type of work	Group	Activity	Persons responsible	Q1	Q2	Q3	Q4	Estimated cost	Actual Cost (US\$)	KARI		CIMMYT		Status	
														RF	SFSA	RF	SFSA		
1	21	Detection toolkit development	Cheap Qualitative test for field use	Outsource	Molecular Biology	Test effectiveness of the kit	JD, CT, AP	X		X		0	0	0	0	0	0	Not done	
1	22	Detection toolkit development	Dev. a set of DNA based detection kit	Experiment	Molecular Biology	Experiment Ko/Mx (feedback)	JD, CT, AP	X	X	X		5,000	645	0	145	0	500	To out-source	
1	23	Detection toolkit development	Real-time PCR, event specific	Experiment	Molecular Biology	Experiment Ko/Mx (feedback)	JD, CT, AP	X	X	X		10,000	1,290	0	290	0	1,000	Not done	
1	24	Detection toolkit development	Real-time PCR, event specific	Experiment	Molecular Biology	Experiment Ko/Mx (feedback)	JD, CT, AP	X	X	X		10,000	1,290	0	290	0	1,000	Not done	
1	25	Detection toolkit development	Negotiate contract with commercial toolkit developer	Negotiation MTA	Management	Negotiation MTA	LC, KARI/CIMMYT	X	X	X		10,000	1,290	0	290	0	1,000	Not done - To purchase commercially	
1	26	Detection toolkit development	Discuss GMO detection standards with Kenyan authorities	Workshops	All	Workshops	JD, CT, AP, SM, GC	X	X	X		10,000	1,290	0	290	0	1,000	Not done - deferred	
1	27	Detection toolkit development	Organize production and availability of reference materials	Production commitment / publications	All	Production commitment / publications	JD, CT, AP, SM, GC	X	X	X		10,000	1,290	0	290	500	500	Not relevant	
1	28	Allergenicity	Stability in SGF	Experiment	Molecular Biology	Outsource (?)	?	X	X	X		2,000	258	0	0	0	0	260	Not done
1	29	Allergenicity	Confirm AA sequence identity	Experiment	Molecular Biology		AP, JD	X	X			5,000	645	0	0	0	0	645	Not done
1	30	Allergenicity	AA sequence analysis compared to database	Experiment	Molecular Biology		AP, JD					5,000	0	0	0	0	0	0	Not done
1	31	Allergenicity	Follow evolution of codex activities on allergenicity	Experiment	Molecular Biology		AP, JD					10,000	0	0	0	0	0	0	Not done
1	32	Allergenicity	Alternative: get file of another tech developer		Regulatory expert		??					0	0	0	0	0	0	0	Not done
													377,500	58,000					

2. Development of conventional and Bt products, and compositional analysis

2	1	Inbred lines	Inbred lines	Breeding	Breeding	Develop descriptors	SM, JG					4,800	0	0	0	0	0	0	Not done
2	2	Hybrids	Development of hybrids	Breeding	Breeding	Normalize for NPT	JJ					4,500	0	0	0	0	0	0	Not done
2	3	Hybrids	Development of hybrids	Breeding	Breeding	Evaluate NPT	GO, SM, JI					4,000	0	0	0	0	0	0	Not done
2	4	Hybrids	Development of hybrids	Breeding	Breeding	Monitor & evaluate NPT	GO, CM, WM, SM, JI, JG					1,750	0	0	0	0	0	0	Not done
2	5	Hybrids	Development of hybrids	Breeding	Breeding	Form TWC hybrids						0	2,000	0	500	2,000	-500	Done	
2	6	Hybrids	Development of hybrids	Breeding	Breeding	Conduct multi-location on-farm trials	CM, OM, MO, WM, GO, JI, JG		X	X	X	7,000	6,000	2,000	3,000		1,000	Done	
2	7	Hybrids	Development of hybrids	Breeding	Breeding	DUS tests	JG, SM, JI					5,400	0	0	0	0	0	0	Not done
2	8	OPVs	Development of OPVs	Breeding	Breeding	Pre-release OPVs	JJ					750	0	0	0	0	0	0	Not done
2	9	OPVs	Development of OPVs (2)	Breeding	Breeding	Evaluate in NPT	GO, SM, JI		X	X		4,000	4,500	2,000	2,500	0	0	0	Done
2	10	OPVs	Development of OPVs (2)	Breeding	Breeding	Monitor & evaluate NPT	CM, OM, MO, WM, GO, JI, JG			X		1,750	1,750	750	0		1,000	Done	

Group code	Activity code	Products	Activities	Type of work	Group	Activity	Persons responsible	Q1	Q2	Q3	Q4	Estimated cost (US\$)	Actual Cost (US\$)	KARI		CIMMYT		Status
														RF	SFSA	RF	SFSA	
2	11	OPVs	Development of OPVs (2)	Breeding	Breeding	Variety evaluation trials	JA, SM, WM	X	X	X	X	24,000	5,000	550	2,950	1,500	1,500	Done
2	12	OPVs	Development of OPVs (2)	Breeding	Breeding	Conduct DIUS trials	JG, SM, JT	X	X	X	X	4,800	3,000	0	3,000	0	0	Done
2	13	OPVs	Development of OPVs (2)	Breeding	Breeding	Increase seed	SM, WM					11,000	0	0	0	0	0	Done
2	14	OPVs	Development of OPVs (2)	Breeding	Breeding	Identify commercial seed production partners	JT					5,000	0	0	0	0	0	Not done - Not released
2	15	Resistance to storage pests	Postharvest	Breeding	Breeding	Screening for storage pests	PL, DB					1,800	1,800	0	0	0	1,800	Done
2	16	Resistance to storage pests	Insect infestations & evaluations	Entomology	Environ. Assessment	Reer, infest & rate trials	JS, SM	X	X	X	X	20,000	10,000	0	2,000	0	8,000	Done
2	17	Product Development- Bt	Development of cry2Aa source lines	Biotech	Mol/Biol	Development of cry2Aa source lines	AP	X	X	X	X	30,000	5,000	0	0	0	5,000	Done
2	18	Product Development- Bt	Evaluating CML216 cry1Ab	Breeding	Breeding	Evaluate in Kiboko QOS	SM, JG	X	X			15,000	10,000	0	2,000	0	8,000	Done & Ongoing
2	19	Product Development- Bt	Evaluating CML216 cry1Ab	Breeding	Breeding	Evaluate in BGH						0	6,000	0	4,000	2,000	0	Done
2	20	Hybrids	Backcrossing of cry1Ab into adapted lines	Breeding	Breeding	BC1F1 made with adapted lines to lead events in Kiboko QOS	SM, JT, JG			X	X	10,000	2,000	0	500	0	1,500	Done
2	21	Hybrids	Regulatory	Breeding	regulatory	Submit application to grow in Kiboko QOS	SM	X	X			2,500	2,000	0	200	1,800	0	Done
2	22	Hybrids	Regulatory	Breeding	regulatory	Develop BCOF1	SM, JG, CT	X	X	X	X	0	5,000	0	3,000	2,000	0	Done
2	23	Bt OPVs	Development of cry1Ab OPVs	Breeding	Breeding	BC1F1 made with OPVs to lead events in Kiboko QOS	SM, JG, JT			X	X	10,000	2,000	0	500	1,500	0	Done
2	24	Bt hybrids	Development of cry1Ab hybrids & OPVs	Breeding	Breeding	Expression analysis	GM					0	3,000	0	2,500	0	500	Ongoing
2	25	Bt OPVs	Development of cry1Ab OPVs	Breeding	Regulatory	Application for Kiboko QOS trials	SM, SG					2,500	0	0	0	0	0	Done
2	26	Resistance to stem borer pests	Insect infestations & evaluations	Entomology	Environ. Assessment	Reer, infest & rate trials	JS, SM	X	X	X	X	20,000	10,000	0	6,000	0	4,000	Done
2	27	Compositional analysis of Bt maize	Identify an analytical lab and make contract	Negotiation & Contract	Regulatory	Identify analytical lab	SM, BK, SG					1,000	550	0	0	0	550	Defreed
2	28	Compositional analysis of Bt maize	Identify an analytical lab and make contract	Negotiation & Contract	Regulatory	Contract negotiation	SM, BK, SG					4,000	0	0	0	0	0	Defreed
2	29	Compositional analysis of Bt maize	Identify 6 locs for rep. field trials	Search	Breeding							2,000	0	0	0	0	0	Initiated at Embu
2	30	Compositional analysis of Bt maize	Train staff at 6 locations & mock trials	Search	regulatory							6,000	0	0	0	0	0	Defreed
												200,000	20,000	5,000	37,600	8,500	32,100	

Group code	Activity code	Products	Activities	Type of work	Group	Activity	Persons responsible	Q1	Q2	Q3	Q4	Estimated cost	Actual Cost (US\$)	KARI		CIMMYT		Status	
														RF	SFSA	RF	SFSA		
3. Environmental Impact Assessment																			
3	1	Resistance to stem borer pests	Insect infestations & evaluations	Entomology	Environ. Assessment	Res. insect & rate trials	J.S. SM	X	X	X	X	20,000	20,000	5,000	15,000	0	0	0	On-going
3	2	Impact on non-targets	Impact on Lepidoptera herbivores <i>Helicoverpa armigera</i> : (BSGH/ lab --> OQS --> Open field)	Bioassays	Environ. Assessment		JMS, DB	X	X	X	X	1,000	1,000	0	0	1,000	0	0	On-going
3	3	Environmental toxicity	Ecotox	Experiment & Literature review	Environ. Assessment	Bird experiment	UON/ Chromo					10,000	0	0	0	0	0	0	Got information
3	4	Environmental toxicity	Ecotox	Experiment & Literature review	Environ. Assessment	Fish experiment	UON/Chromo					10,000	0	0	0	0	0	0	Got information
3	5	Environmental toxicity	Ecotox	Experiment & Literature review	Environ. Assessment	Mammal experiment	UON/ Chromo					10,000	0	0	0	0	0	0	Got information
3	6	Environmental toxicity	Ecotox	Experiment & Literature review	Environ. Assessment	Invertebrate experiment	UON/Chromo	X	X	X	X	10,000	7,000	1,500	500	0	0	5,000	Got information
3	7	Environmental toxicity	Ecotox	Experiment & Literature review	Environ. Assessment	Aquatic invertebrate experiment	UON/ Chromo	X	X	X	X	10,000	7,000	2,000	0	0	0	5,000	Got information
3	8	Impact on non-targets	Impact on Coreia flavipes (BSGH/ lab --> OQS --> Open field)	Bioassays	Environ. Assessment		JMS, DB, Student	X	X	X	X	2,000	2,000	1,000	0	1,000	0	0	Got information
3	9	Impact on non-targets	Impact on the development and survival of predators: lady bird beetles & Earwigs: (BSGH/ lab --> OQS --> Open field)	Bioassays	Environ. Assessment	Exper. & literature	JMS, DB, student?	X	X	X	X	5,000	5,000	1,000	0	2,000	2,000	0	Mock trials on-going
3	10	Impact on non-targets	Impact on the development and survival of honey bee larvae (BSGH & Lab)	Bioassays	Environ. Assessment		JMS, DB					1,500	0	0	0	0	0	0	Assembled Literature
3	11	Impact on non-targets	Impact on ants (predators) - OQS	Bioassays	Environ. Assessment		JMS, DB	X	X	X	X	1,500	3,500	1,000	0	1,000	1,500	0	Partly done from OQS
3	12	Impact on non-targets	Impact on soil micro-organisms. (BSGH/ lab --> OQS --> Open field)	Bioassays	Environ. Assessment		JMS, DB & collab.					9,500	0	0	0	0	0	0	On-going
3	13	Impact on non-targets	Monitor arthropods / Natural enemies in (OQS)	Bioassays	Environ. Assessment		JMS, DB	X	X	X	X	1,500	4,000	1,000	0	1,000	2,000	0	On-going
3	14	Impact on non-targets	Monitor arthropods / Natural enemies in the field: On-station --> on-farm)	Bioassays	Environ. Assessment		JMS, DB					4,000	0	0	0	0	0	0	On-going
3	15	Impact on non-targets	Impact on non-target non-lepidoptera: LGB & <i>Strophilus zeamais</i>	Bioassays	Environ. Assessment		PL, DB	X	X	X	X	5,000	1,000	0	0	0	1,000	0	Not done - Deferred to 2006
3	16	Impact on non-targets	Fate of pollen impact on non-target insects	Determine lepidoptera and weed species within 10 ml of maize	Environ. Assessment		JMS, DB					1,000	0	0	0	0	0	0	On-going

Group code	Activity code	Products	Activities	Type of work	Group	Activity	Persons responsible	Q1	Q2	Q3	Q4	Estimated cost	Actual Cost (US\$)	KARI		CIMMYT		Status
														RF	SFSA	RF	SFSA	
3	17	Gene flow information	1 Distance of pollen flow (Field / OQS, on-farm, Literature)	Gene flow exp	Breeding	Outcrossing rate to local maize var	SM,DB	X	X	X	X	5,000	4,000	0	2,000	1,000	1,000	Partly done from gene flow studies
3	18	Gene flow information	Competitiveness of the F1s (Literature)	Gene flow exp	Breeding	Outcrossing to other plant species (lit search)	SM,DB	X	X	X	X	0	0	0	0	0	0	Partly done from gene flow studies
3	19	Gene flow information	Gene flow experiments	Literature study	Breeding	Horizontal gene transfer	SM,DB	X	X	X	X	0	0	0	30,000	0	24,500	Partly done from gene flow studies
														12,500	47,500	7,000	42,000	
4. Insect resistance management and contingency plans														107,000	54,500	7,000	42,000	
4	1	Insect resistance management plan	Design IRM plan to take account of OPV route	Experiment	IRM		DM, MM					10,000	0	0	0	0	0	Partially Done
4	2	Insect resistance management plan	Quantify sensitivity of <i>Chilo</i> and <i>Buseola</i> to management plan	Experiment	IRM	Cycles of selection for resistance started	JS, DB	X	X	X	X	4,000	3,000	0	2,000	0	1,000	Done, Misc Project
4	3	Insect resistance management plan	Design IRM plan to take account of OPV route	Experiment	IRM		DM, MM	X	X	X	X	30,000	15,000	0	10,000	0	5,000	Partially Done
4	4	Insect resistance management plan	Quantify sensitivity of <i>Chilo</i> and <i>Buseola</i> to management plan	Experiment	IRM	4 cycles for Bf and 6 cycles for CP completed	JS, DB	X	X	X	X	7,000	4,500	0	3,500	0	1,000	Done, Misc Project
4	5	Insect resistance management plan	Design an introduction plan of OPVs	Design strategy	IRM	A seed recycling strategy is developed as a working paper to retain Bt in OPVs	SM, DB, JG, JI	X	X	X	X	500	500	0	200	0	300	Not done
4	6	Capacity built	training GIS	capacity building	IRM/SocEC	Training workshop GIS		X	X	X	X	15,000	12,000	0	6,000	0	6,000	Partially Done
														64,500	35,000	21,700	13,300	
5. Regulatory issues														0	21,700	0	13,300	
5	1	Regulatory developments	Interact intensively with Kenyan national regulations development	Develop intensive communication	Regulatory	Attend regulators meetings	SM / SG	X	X	X	X	300	450	150	300	0	0	Done
5	2	Regulatory developments	Interact intensively with Kenyan national regulations development	Develop intensive communication	Regulatory	Visit BGHC by regulators-	SM / SG	X	X	X	X	400	400	0	400	0	0	Done
5	3	Regulatory developments	Interact intensively with Kenyan national regulations development	Develop intensive communication	Regulatory	Visit field trial at Kiboko by regulators	SM / SG	X	X	X	X	800	800	0	0	0	800	Done
5	4	Regulatory developments	Follow regulatory developments in the region	Participate in meetings, offer experts	Regulatory	Visit other regulatory centres and organizations in the region, Familiarise with Regulatory developments in the region	SM / SG					2,000	0	0	0	0	0	Not done

Group code	Activity code	Products	Activities	Type of work	Group	Activity	Persons responsible	Q1	Q2	Q3	Q4	Estimated cost	Actual Cost (US\$)	KARI		CIMMYT		Status			
														RF	SFSA	RF	SFSA				
5	5	Regulatory developments	Follow developments in Cartagena Protocol	Participate in public sector consortium	Regulatory	Develop internet linkage. Participate in public sector consultations	SM / SG	X	X	X	X	3,000	3,000	3,000	0	0	0	0	Done		
5	6	Regulatory developments	Follow the developments on liability and readiness	Current literature	Regulatory	Organise a stake holders meeting to collect views	SM / SG	X	X	X	X	4,000	4,000	0	2,000	0	2,000	0	Ongoing		
5	7	Regulatory developments	Follow the developments on liability and readiness	Current literature	Regulatory	Attend regional meetings	SM / SG					5,000	3,500	0	0	0	3,500	0	Not done		
5	8	Regulatory skills development	Dev. functions of RA manager at KARI and CIMMYT	commitment of personnel	Regulatory	Attachment and training of project manager and regulator to a private company (e.g. SBI)	SM / SG	X	X			25,000	12,000	0	6,000	0	6,000	0	Deferred to 2006		
5	9	Regulatory skills development	Training of staff at KARI centers in handling GM maize	Development of training programme	Regulatory	Develop training materials	SM / SG	X				1,000	1,000	0	1,000	0	0	0	Not done		
5	10	Regulatory skills development	Training of staff at agricultural research stations in handling GM maize	Development of training programme	Regulatory	Conduct training at six KARI centers for scientists and technicians	SM / SG	X	X			4,000	4,000	0	3,000	0	1,000	0	Done in NARL. Kakamega, Kisumu and Alupe		
5	11	Regulatory skills development	Develop SOPs for all activities in the project	Administrative exercise	Regulatory	Drafting, Editing, publication SOP document	SM / SG / DP	X	X			4,000	1,000	0	500	0	500	0	Done with KEPHIS		
5	12	Contingency plan	Regulatory	Planting out varieties	Breeding	Characterization of local varieties	JG, SM, JI					39,000	0	0	0	0	0	0	Ongoing		
5	13	Contingency plan	Plan for withdrawal of the Bt maize if required	Design withdrawal plan, and foresee testing	Regulatory		SM, SG	X	X	X	X	10,000	5,000	0	2,500	0	2,500	0	Done within compliance docs		
													98,500	35,150	3,150	15,700	0	16,300			

6. IPR/licensing

6	1	IPR/licensing	IP	Negotiation	IPR	Inlicensing agreements AATF (?)	AATF (?)	X				1,000	5,600	0	600	5,000	0	0	0	Ongoing	
6	2	IPR/licensing	IP	Negotiation	IPR	Patenting of event(s)	AATF		X			8,000	0	0	0	0	0	0	0	Not done - not relevant. FTO more important	
6	3	IPR/licensing	IP	Negotiation	IPR	Training on IP for project members	AATF		X			15,000	5,000	0	2,500	600	1,900	0	0	Not done - Legal counsels left KARI & CIMMYT	
6	4	IPR/licensing	IP	Negotiation	IPR	Discuss the process outlicensing the IRMA events	AATF		X			10,000	1,000	0	500	0	500	0	0	Not done - not relevant. FTO more important	
													34,000	11,600	0	3,600	5,600	2,400			

Group code	Activity code	Products	Activities	Type of work	Group	Activity	Persons responsible	Q1	Q2	Q3	Q4	Estimated cost (US\$)	KARI		CIMMYT		Status	
													RF	SFSA	RF	SFSA		
7. Seed Production																		
7	1	Seed production	Seed production	NFT	Seed production	Seed production	WM	X				400	1,700	1,150	0	550	0	On-going
7	2	Seed production	Seed production	DUS	Seed production	Seed production	WM		X			260	1,700	1,150	0	550	0	On-going
7	3	Seed production	Seed production	Descriptors	Seed production	Seed production	WM	X				260	1,600	1,200	0	300	100	Done
7	4	Seed production	Seed production	Ear to row planting	Seed production	Seed production	OO		X			400	400	0	0	0	400	Not done/ varieties
7	5	Seed production	Seed production	Ear to row planting	Seed production	Seed production for on-farm trials	WM		X			500	500	1,000	0	0	500	Not done/ varieties not released/ year
													2,500	1,400	1,000			
8. Market analysis																		
8	1	Report on cooperation and seed trade in the regions	Market analysis	Administration activity	market assessment	Literature review, survey and analysis	LM			X		1,000	1,000	1,000	0	0	0	Partly done- to complete in 2006
8	2	Report describing major processors, activities and opinion on GM	Communicate with food processors, millers and distributors as needed	Describe sector, quantitative, and opinions	market assessment	Survey on these groups, distribute handouts, pass education on GM	KD, JW & SK		X	X		11,000	11,000	2,500	6,500	2,000	0	On going & to complete in 2005, Nairobi in 2006
8	3	Recommendation of how IRMA can collaborate with other countries	Seed subsector analysis	Cooperation with seed traders in the region	Market assessment	Informal and formal discussions	HdG, SM, & LM		X			2,000	0	0	0	0	0	On going
8	4	A description of current patterns of maize grain trade	Commercial grain sub-sector analysis	market analysis	Market assessment	Survey of grain traders and sources of grain	MO & KD	X	X			5,000	5,000	4,000	0	1,000	0	On-going in collaboration with FAO
8	5	Description of the seed systems in East Africa (Kenya, Tanzania, Uganda and Ethiopia)	Seed subsector analysis, and international collaboration	market analysis	market assessment	Visit Tz, Ug and Ethiopia	HdG, LM & OO	X	X	X		10,000	10,000	4,000	0	2,000	4,000	Visits to Ethiopia done. Visits to Ug & Tz in 2006
8	6	Report on the use of maize for feed	Market analysis	survey (PRA and quantitative)	market assessment	Analysis of the use of maize for feed (grain, stover, byproducts)	HdG & 6 KARI econs.	X	X	X		30,000	0	0	0	0	0	Deferred to 2006
													40,000	20,500	6,000	5,000	4,000	
9. Socio-economic Impact assessments																		
9	1	Report on crop loss/increase and economic analysis of new varieties	economic impact assessment	Feed trials and economic analysis	Econ impact asses.	collection of input/output data, analyze and write	CB					9,500	2,000	0	0	0	2,000	Not done. Deferred to 2006 in the kat area
9	2	Georeferencing of OPVs	IRM (economics)	Mapping and modeling of opv patterns by place and time	Econ impact asses.	Document growing patterns of OPVs in the region (group and hb in)	KD, CB, & SK	X	X	X		10,000	7,000	6,000	0	1,000	0	Done at the coast. 2006 for mid-altitude areas
9	3	Development of varieties acceptable to all stakeholders	PRA's and farm evaluations	Participatory variety evaluation	Econ impact asses.	Conduct participatory farmer evaluation	CB	X	X	X		10,000	8,000	1,500	5,500	1,000	0	Deferred to 2006

Group code	Activity code	Products	Activities	Type of work	Group	Activity	Persons responsible	Q1	Q2	Q3	Q4	Estimated cost (US\$)	Actual Cost (US\$)	KARI		CIMMYT		Status
														RF	SFSA	RF	SFSA	
9	4	Contingency plan	Regulatory	Planting out varieties	Econ impact asses.	Collection and analysis of local varieties	HOC	X	X	X		8,000	7,000	0	4,000	3,000	0	To be done during SR 2003 season at Kari, MTP. Western in
10. Communication / promotion / Training and Administration																		
10	1	IRMA brochure	Communications	Writing, editing publishing	Comm.all	writing, publishing, distribution	DP, DO, GK, SM, RN	X				8,000	7,000	2,000	0	0	5,000	Done (as poster)
10	2	IRMA folder	Communications	Writing, editing publishing	Comm	writing, publishing	DP, DO	X				2,000	2,000		0	0	2,000	New folder drafted, still using old one.
10	3	IRMA Updates	Communications	Writing, editing publishing	Comm, all	writing, publishing, distribution	All, DP, DO, GK	X	X	X	X	1,000	2,000	500	0	0	1,500	done
10	4	IRMA Document compilation	Communications	Writing, editing publishing	Comm	Collecting, publishing, organizing, publishing	DO, DP, GK	X	X	X	X	500	500		0	100	400	Partially done
10	5	IRMA Fact Sheets	Communications	Writing, editing publishing	Comm	editing, review, publishing.	All, DP, DO, GK	X				5,000	5,000	1,500	0	3,500	0	not done
10	6	Ag industry flyer	Communications	Writing, editing publishing	Comm, Socio-Econ	writing, publishing	DO			X		200	3,200	800	0	2,400	0	Partially done
10	7	Kilimo News, ag papers, monthly/ Nation	Communications	Writing, editing publishing	Comm, ISAAA, ABSF	writing, scanning news	DO, DP, GK, RN, AO	X	X	X	X	0	2,000	2,000	0	0	0	Deferred
10	8	Ag Fairs 5+	Communications	Preparing materials & participating	Comm, Ext/MOA/KARI	Develop materials for booth and handouts, video, familiarization of those manning booths, monitor (Surveys)	DO, DP, GK, RN		X	X	X	5,000	5,000	3,000	0	2,000	0	Done
10	9	Press event 1 or 2? for BI planting at OOS	Communications	Preparing materials & participating	Comm, All	Organizing, press release, video documentation	GK, DO, DP, SM, contractor	X				5,000	2,000	1,000	0	0	1,000	Done
10	10	Press event for pre-release of Conv Res Maize	Communications	Preparing materials & participating	Comm, Prod., Reg, Prod Deve	Organizing, press release	DO, GK, DP, SG, SM	X				1,000	0		0	0	0	Not done, maize not yet released
10	11	Junk Sci Wksp	Communications	Preparing materials & participating	Comm, ISAAA, ABSF, universities, others	Presentations, organization	DP, DO, MK, others		X			2,000	2,000		0	0	2,000	Not done
10	12	Press monitoring	Communications	Follow up	Comm, contract	Clipping service, web browsing	DP, DO, GK, collaborators	X	X	X	X	3,600	3,000	100	0	0	2,900	Done
10	13	Policy briefs	Communications	Writing, editing publishing	Comm, ISAAA, ABSF, others	Writing, editing, review, distribution	DO, MK, DP, GK, all	X	X	X	X	500	1,800	400	0	0	1,400	Partially done
10	14	Stakeholders Meeting	Communications	Preparing materials & participating	KARI, CIMMYT, Comm	Organization, publications, media relations	GK, DP, DO, CIMMYT office			X		10,000	0		0	0	0	Done
10	15	IRMA documents	Communications	Writing, editing publishing	Comm	Writing, editing, publishing.	DO, DP, GK	X	X	X	X	8,000	7,500	1,500	0	0	6,000	Done
11	16	Capacity Building	Develop & disseminate security plan for BGH & OOS	Preparing materials & participating	Regulatory	Develop & disseminate security plan for BGH & OOS	JD	X				10,000	0	0	0	0	0	Partly done

Group code	Activity code	Products	Activities	Type of work	Group	Activity	Persons responsible	Q1	Q2	Q3	Q4	Estimated cost	Actual Cost (US\$)	KARI		CIMMYT		Status			
														RF	SFSA	RF	SFSA				
11	17	Capacity Building	BGH operations course @ NARL	Preparing materials & participating	Regulatory	BGH operations course @ NARL for scientists	JD					10,000	10,000	2,000	3,000	5,000	0	Done for NARL scientists			
11	18	Capacity Building	OQS operations course at Kiboko (Technicians)	Preparing materials & participating	Regulatory	OQS operations course at Kiboko (Technicians)	SM			X		10,000	10,000	1,000	2,000	7,000	0	Done as part of preparations for Bt maize CFT			
11	19	Capacity Building	OQS operations course @ Embu OQS	Preparing materials & participating	Regulatory	OQS operations course @ Embu OQS	SG					10,000	4,000	200	800		3,000	Not done - OQS not established			
11	20	Capacity Building	Genetic engineering course @ NARL	Preparing materials & participating	Regulatory	Genetic engineering course @ NARL	JD			X		10,000	5,000	2,000	0		3,000	Partly done for NARL scientists			
11	21	Capacity Building	Establish OQS @ Embu	Administrative exercise	Breeding	Establish OQS @ Embu	SM	X	X	X		30,000	10,000	0	8,000	8,000	-6,000	Not completed - isolation problem			
													131,800	82,000	18,000	13,800	28,000	22,200			
Total													\$911,170	\$403,750	\$61,450	\$161,405	\$66,300	\$170,095			

Appendix 2: List of participants and program for the IRMA Review and Planning Meeting, November 7-8 2005

Appendix 2a: List of Participants

No.	Name	Institution	Title/Discipline
1.	Dr. Mugo Stephen	CIMMYT - Kenya	IRMA Coordinator
2.	Dr. De Groot Hugo	CIMMYT - Kenya	Agricultural Economist
3.	Ms. Daisy Ouya	CIMMYT - Kenya	Science Writer/Editor
4.	Dr. Simon Gichuki	KARI - Biotechnology	Molecular Breeder
5.	Mr. Simon Kimenju	CIMMYT - Kenya	Agricultural Economist
6.	Mr. Charles Bett	KARI - Katumani	Agricultural-Economist
7.	Dr. Lutta Mohammed	KARI - Katumani	Senior Research Officer, Socio-economist
8.	Dr. Josephine Songa	KARI - Biotechnology	Maize Component Manager
9.	Ms. Catherine Taracha	KARI - NARL	Senior Research Officer
10.	Mr. Paddy W. Likhayo	KARI - Biotechnology	Research Officer (Entomologist)
11.	Dr. Omari Odongo	KARI - Kakamega	Center Director
12.	Mr. Martins Odendo	KARI - Kakamega	Socio-Economist
13.	Dr. Jane Ininda	KARI - Muguga	National Maize Research Coordinator
14.	Mr. Wilson Muasya	KARI - Kiboko	Maize Breeder
15.	Dr. Macharia Gethi	KARI - Embu	Center Director
16.	Dr. Charles Mutinda	KARI - Embu	Principal Maize Breeder
17.	Mr. James Ouma	KARI - Embu	Socio-Economist
18.	Dr. George Ombakho	KARI - Kitale	CRO/Breeder
19.	Mr. Danda Kengo	KARI - Mtwapa	Research Officer
20.	Mr. Japhether Wanyama	KARI - Kitale	Socio Economist
21.	Dr. Margaret Mulaa	KARI - Kitale	SPRO Entomology
22.	Ms. Grace Kimani	KARI - HQ	Information Officer
23.	Ms. Regina Tende	KARI - Biotechnology	Student
24.	Mr. Geoffrey Murenga	KARI - Biotechnology	Student



Appendix 2b: Program for Annual Review and Planning Meetings, 7-8th November 2005

Chair: Dr. Hugo De Groote

Sunday, 6 Nov. 2005

Arrivals

D. Nanzala

MONDAY, 7 NOVEMBER 2005

Session 1: Opening

08:30 Registration

D. Nanzala

09:00 Welcome and Introductions

S. Mugo

Brief Reports - highlights

09.15 Bt maize Event analysis, & human health safety assessment

J. Danson / C. Taracha

09.30 Product Development (convent. Bt) and comp. Analysis

S. Mugo / J. Ininda

09.45 Environmental Impact Assessment

J. Songa / D. Bergvinson

10.00 Insect resistance management and contingency plans

M. Mulaa / D. Bergvinson

10.15 Regulatory

S. Gichuki / S. Mugo

10:30 *Tea Break*

10.50 IIPR/Licensing

Oluoch / H. De Groote

11.05 Seed production

O. Odongo / S. Mugo

11.20 Market assessment and analysis

M. Odendo / H. De Groote

11.35 Economic impact assessment

H. De Groote / O. Okuro,

11.50 Communication / Promotion

D. Ouya / G. Kimani

12.00 Session II - Discussions on key issues affecting IRMA Project

1. Germplasm conversion to Bt - appropriateness of methods and types - **S. Mugo**
2. Bt testing methods in lab, BGHC and field - appropriateness of methods - **C. Taracha**
3. Strategies for the release of Bt Maize across Kenya and for the post release resistance monitoring and management - **M. Mulaa**

01.00 *Lunch Break*

02.00 Session II - Discussions on key issues affecting IRMA Project (continued)

4. The status of biosafety legislation and how this affects IRMA project - **S. Gichuki**
5. Lack of control for *B. fusca* by *cry1Ab* and *cry1Ba* genes - should Bt maize carrying these genes should be released in Kenya - **M. Mulaa**
6. The IPR issues surrounding *cry1Ab*, *cry2Aa*, and *cry1Ba* genes - **O. Odongo**
7. Should IRMA project consider testing and using a commercial Bt events - **M. Odendo**

8. IRMA - ICIPE collaboration - J. Ouma
9. Publicity - Giving / receiving, how to deal with unfavorable publicity - D. Ouya
10. How can IRMA intra-project collaboration be improved to enhance progress - / J. Ininda
11. Environmental Impact assessment - J. Songa

04.00 SESSION III - DEVELOP ELEMENTS OF WORK PLANS FOR 2006 BY 10 PROJECT THEMES

Chair: S. Gichuki

- | | |
|--|---------------------------|
| 1. Bt maize Event analysis, & human health safety assessment | J. Danson / C. Taracha |
| 2. Product Development (convent. Bt) and comp. Analysis | S. Mugo / J. Ininda |
| 3. Environmental Impact Assessment | J. Songa / D. Bergvinson |
| 4. Insect resistance management and contingency plans | M. Mulaa / D. Bergvinson |
| 5. Regulatory | S. Gichuki / S. Mugo |
| 6. IPR/Licensing | Oluoch / H. De Grootte |
| 7. Seed production | O. Odongo / S. Mugo |
| 8. Market assessment and analysis | M. Odendo / H. De Grootte |
| 9. Economic impact assessment | H. De Grootte / O. Okuro, |
| 10. Communication / Promotion | D. Ouya / G. Kimani |

05.00 Adjourn

TUESDAY, 8 NOVEMBER 2005

08:00 am Develop detailed work plans for 2006 by the 10 project themes (Continued)

- | | |
|--|---------------------------|
| a) Bt maize Event analysis, & human health safety assessment | J. Danson / C. Taracha |
| b) Product Development (convent. Bt) and comp. Analysis | S. Mugo / J. Ininda |
| c) Environmental Impact Assessment | J. Songa / D. Bergvinson |
| d) Insect resistance management and contingency plans | M. Mulaa / D. Bergvinson |
| e) Regulatory | S. Gichuki / S. Mugo |
| f) IPR/Licensing | Oluoch / H. De Grootte |
| g) Seed production | O. Odongo / S. Mugo |
| h) Market assessment and analysis | M. Odendo / H. De Grootte |
| i) Economic impact assessment | H. De Grootte / O. Okuro, |
| j) Communication / Promotion | D. Ouya / G. Kimani |

10.30 am Tea / Coffee Break

11.00 pm Plenary - Presentations of Workplans 2006

- | | |
|--|--------------------------|
| a) Bt maize Event analysis, & human health safety assessment | J. Danson / C. Taracha |
| b) Product Development (convent. Bt) and comp. Analysis | S. Mugo / J. Ininda |
| c) Environmental Impact Assessment | J. Songa / D. Bergvinson |
| d) Insect resistance management and contingency plans | M. Mulaa / D. Bergvinson |
| e) Regulatory | S. Gichuki / S. Mugo |
| f) IPR/Licensing | Oluoch / H. De Groot |
| g) Seed production | O. Odongo / S. Mugo |
| h) Market assessment and analysis | M. Odendo / H. De Groot |
| i) Economic impact assessment | H. De Groot / O. Okuro, |
| j) Communication / Promotion | D. Ouya / G. Kimani |

01:00pm **Lunch Break**

02:00pm **Preparations and inputs for other IRMA 2005 Annual meetings**

1. IRMA Technical Advisory Committee (IRMA-TAB) and Theme leaders meeting
 - Program
 - Presentations
 - Inputs - documents
 - Outputs
 - Field visits
2. IRMA Annual Stakeholders meeting 2005
 - Program
 - Presentations
 - Inputs - documents
 - Field visits
3. IRMA Project Executive meeting 2005
 - Program
 - Presentations
 - Inputs - documents
 - Optional visits to the BGHC and OQS Kiboko

05:00pm Closing remarks and adjourn

WEDNESDAY, 9 NOVEMBER 2005

09:00am **Departures**

Appendix 3: List of invitees and program for joint IRMA-TAB and IRMA scientists on 23-24 November

Appendix 3a: List of Invitees

No.	Name	Institution
1.	Dr. Mugo Stephen	CIMMYT - ALP
2.	Dr. Hugo De Groote	CIMMYT - ALP
3.	Dr. Simon Gichuki	KARI - Biotech
4.	Mr. Charles Bett	KARI - Katumani
5.	Dr. Lutta Mohammed	KARI - Katumani
6.	Dr. Josephine Songa	KARI - NARL
7.	Mr. Paddy W. Likhayo	KARI - NARL
8.	Dr. Omari Odongo	KARI - Kakamega
9.	Mr. Martins Odendo	KARI - Kakamega
10.	Dr. Jane Ininda	KARI - Muguga
11.	Dr. James Gethi	KARI - Katumani
12.	Mr. Wilson Muasya	KARI - Kiboko
13.	Dr. Macharia Gethi	KARI - Embu
14.	Dr. Charles Mutinda	KARI - Embu
15.	Mr. James Ouma	KARI - Embu
16.	Dr. George Ombakho	KARI - Kitale
17.	Mr. Danda Kengo	KARI - Mtwapa
18.	Mr. Japhether Wanyama	KARI - Kitale
19.	Dr. Margaret Mulaa	KARI - Kitale
20.	Ms. Grace Kimani	KARI - HQ
21.	Ms. Regina Tende	KARI - Biotech
22.	Mr. Geoffrey Murenga	KARI - Biotech
23.	Mr. Maurice Oyoo	KARI - Mtwapa
24.	Ms. Catherine Taracha	KARI - Biotech
25.	Dr. David Bergvinson	CIMMYT - Mexico
26.	Mr. David A. Poland	CIMMYT - Mexico
27.	Jost Frei	Syngenta Foundation for Sustainable Agriculture
28.	Juerg Buergi	Syngenta Foundation for Sustainable Agriculture
29.	Willy De Greef	Syngenta Foundation for Sustainable Agriculture
30.	Mr. Obongo Nyachae	STAK
31.	Ms. Daisy Ouya	CIMMYT - ALP
32.	Dr. Jedidah Danson	CIMMYT - ALP
33.	Mr. Simon Kimenju	CIMMYT - ALP
34.	Dr. Marianne Banziger	CIMMYT - ALP
35.	Dr. Romano Kiome	KARI - HQ
36.	Dr. Joseph De Vries	Rockefeller Foundation



Appendix 3b: Program for the Joint IRMA Team and IRMA Technical Advisory Board (IRMA-TAB), 23-24th November 2005

Chair: Dr. Ephraim Mukisira

Session 1: Opening

08:30	Registration	<i>D. Nanzala</i>
09:00	Welcome and Introductions	<i>S. Mugo</i>
09.15	Introductory remarks by KARI	Director
09.25	Introductory remarks by CIMMYT	<i>M. Banziger</i>
09.35	Introductory remarks by Syngenta Foundation	<i>J. Frei</i>
09.45	Introductory remarks by Rockefeller Foundation	<i>J. DeVries</i>

Progress Reports by theme leaders (1999-2005)

10.00	Product Development (conv & Bt maize) and comp. Analysis	<i>S. Mugo</i>
10.15	Bt maize Event analysis, & human health safety assessment	<i>J. Danson</i>

10.30 Coffee/Tea break

10.45	Environmental Impact Assessment	<i>J. Songa</i>
11.00	Insect resistance management and contingency plans	<i>M. Mulaa</i>
11.15	Regulatory	<i>S. Gichuki</i>
11.30	IPR/Licensing	<i>D. Bergvinson</i>
11.45	Seed production	<i>O. Odongo</i>
12.00	Economic impact assessment	<i>O. Okuro</i>
12.15	Market assessment and analysis	<i>M. Odendo</i>
12.30	Communication / Promotion	<i>D. Ouya</i>

12.45 Lunch Break

01.45 Session II – Discussions on key issues affecting IRMA Project

Chair: H. De Groote

- 01.45 pm Bt testing methods in lab, BGHC and field – appropriateness of methods – **C. Taracha**
- 02.15 pm Germplasm conversion to Bt – appropriateness of methods and types – **S. Mugo**
- 02.45 pm Lack of control for *B. fusca* by *cry1Ab* and *cry1Ba* genes – should Bt maize carrying these genes be released in Kenya – **M. Gethi**
- 03.15 pm Should IRMA project consider testing and using a commercial Bt events – **G. Ombakho**
- 03.45 pm **Coffee / Tea Break**
- 04.00 pm The IPR issues surrounding *cry1Ab*, *cry2Aa*, and *cry1Ba* genes – **D. Bergvinson**
- 04.30 pm Strategies for the release of Bt Maize across Kenya and for the post release resistance monitoring and management – **M. Mulaa**
- 05.00 pm Feedback from IRMA-TAB**
- 05.30 pm Adjourn**

Day 2 – Thursday 24 Nov 2005

08.00 am Session II – Discussions on key issues affecting IRMA Project (Continued)

Chair: Dr. O. Odongo

- 08.00 am Environmental Impact assessment – **J. Songa**
- 08.30 am The status of biosafety legislation and how this affects IRMA project – **S. Gichuki**
- 09.00 am Publicity – Giving / receiving, how to deal with unfavorable publicity – **D. Ouya**
- 09.30 PM SESSION III - FEEDBACK FROM THE IRMA-TAB ON PROGRESS REPORTS AND MAJOR ISSUES** **O. NYACHAE**
- 10.00 am Coffee / Tea Break**
- 10.30 am SESSION IV – TOWARDS A FEASIBLE DECISION TREE**

Chair: Dr. M. Gethi

- 10.30 am Draft decision tree **S. Mugo**
- 11.00 am Discussions on elements of the decision tree **Chair**
- 12.00 noon Break out groups to flesh out technological options (Conventional, public, private) **Chair**

01.00 pm	Lunch break	
02.00 pm	Continue break out groups (milestones)	Chair
03.00 pm	Plenary – presentations from breakout groups (Groups 1-3)	Group reps
03.00 pm	Coffee / Tea break	
03.30 pm	Feed back from IRMA-TAB	Willy Degreef
04.00 pm	Way forward	S. Mugo
04.30 pm	Closing remarks for Joint Meeting	
	- SFSA	J. Frei
	- RF	J. DeVries
	- KARI	Director
	- CIMMYT	M. Banziger

Appendix 4: List of invitees and program for the IRMA Stakeholders Meeting, November 25 2005

Appendix 4a: List of invitees

No.	Name	Institution	Title/Designation
1.	Mr. Michael Omondi	Topic Africa Magazine	Journalist
2.	Ms. Agatha Muthoni		Farmer, Embu
3.	Ms. Ruth W. Ngaruiya		Farmer, Githunguri
4.	Mr. Drecky E. Okeno		Farmer, Butere
5.	Mr. Paul Omondi Okong'o	Tatro Central Farmers' Group	Farmers Representative
6.	Ms. Odhiambo	C/o KARI/Mtwapa RRC	PDA Coast Province
7.	Dr. Rahab Muinga	KARI/Mtwapa Regional Research Center	Center Director
8.	Dr. Charles Kariuki	KARI/Katamani NDFRC	Center Director
9.	Mr. Elias Njiru Ndwiga	KARI/Kiboko National Range Res. Center	Officer-in-Charge
10.	Dr. Francis M. Ndambuki	Kenya Seed Co. Ltd.	Research Manager
11.	Dr. Chagama Kedera	KEPHIS	Managing Director
12.	Prof. Norah Olembo	African Biosafety Stakeholders Forum (ABSF)	Director
13.	Mr. Henry Wahinya	The People Daily	Journalist
14.	Mr. Otula Owour	African Sciences	
15.	Mr. Arthur Okwemba	African Women and Children Information Network Ltd.	
16.	Mr. Francis Miano	BAYER East Africa	Technical Manager
17.	Dr. Dennis Rangi	CAB International	
18.	Prof. Christian Borgemeister	ICIPE	Director General
19.	Dr. Florence M Wambugu	A Harvest Biotech Foundation International (AHBF)	Executive Director
20.	Dr. Samuel Wakhusama	ISAAA Africentre	
21.	Ms. Mercy Karanja	Kenya National Farmers Union	
22.	Mr. Benjamin Sogomo	Horticultural Crops Development Authority (HCDA)	Managing Director
23.	Mr. Gachanja	Pest Control Products Board	Managing Director
24.	Mr. Harrison K. Macharia	National Council for Science and Technology (NCST)	
25.	Prof G. King'oria	National Council for Science and Technology (NCST)	
26.	Mr. Barack Gogo	Picasso Production	
27.	Dr. Joseph Agunda Aloo	CARE Kenya	Senior Technical Officer
28.	Dr. T. Remington	Catholic Relief Services	
29.	Dr. Nguyo	Tegemeo Institute of Agricultural & Policy Development	Director
30.	Dr. Patricia Kameri-Mbote	Faculty of Law	Chair Department of

			Private Law
31.	Ms. Grace Thitai	Kenya Wildlife Services	
32.	Mr. Jacob Pwanali	MOARD	PCO R/V
33.	Mr. John Njoroge	Kenya Institute of Organic Farming (KIOF)	
34.	The Managing Director	Department of Resource and Survey & Remote Sensing	
35.	Dr. John Ndiritu	University of Nairobi, Kabete	
36.	Dr. Alubayo	University of Nairobi	Crop Scientist
37.	Dr. Fred Kanampiu	International Maize & Wheat Improvement Center (CIMMYT)	
38.	Mr. John Smith	Uchumi Super Markets	The Managing Director
39.	Mr. Atul Shah	Nakumatt Holding Ltd.	The Managing Director
40.	Prof Ratemo Michieka	National Environment Management Agency (NEMA)	The Director
41.	Hon. Prof. Wangari Mathai	Green Peace and Greenbelt Movement	The Director
42.	David Nyameino	Cereal Growers Association	Chief Executive Agricultural Economist
43.	Dr. Paul Rwambo	Biosystems Resource Management (K) Ltd.	The Director
44.	The Director	Broadbase Promotions Ltd.	
45.	The Director	Agro-Business Consultants	
46.	The Director	National Cereals and Produce Board	
48.	Mr. Hosea K. Sitienei	Kenya Seed Co. Ltd.	The Managing Director
49.	Mr. Craig Neilson	Pannar Seed (K) Ltd.	Marketing Development Manager
50.	Dr. Charles Gbedemah	United Nations Environmental Programme	Regional Coordinator for Africa - Biosafety
51.	The Managing Director	Unga (K) Ltd	
52.	Mr. Evans Mwasame	KARI/Biotechnology Center	Technologist
53.	Dr. Pete Veal	Syngenta EA Ltd	Managing Director
54.	Mr. Johnson Thaiya	Monsanto	Manager
55.	Mr. Saleem Esmail	Western Seed Co. Ltd	Chief Executive Officer
56.	Mr. Spencer Muthoka	Kenya Industrial Property Institute	Director
57.	Dr. Stanley M. Wokabi	KARI- NARL	Center Director
58.	Mr. Maurice Oyoo	KARI - Mtwapa	Research Officer
59.	Mr. Joel Mbithi	KARI - Kiboko	Farm Manager
60.	Ann Mikia	KBC	Journalist

61.	Daniel Otunga	ABSF	Journalist
62.	Dann Okoth	East African Standard	Journalist
63.	Dennis Nauki		Journalist
64.	Otula Owuor	ABSF	Journalist
65.	Kimani Njoroge		Journalist
66.	Naisola Supiyo		Journalist
67.	Musa Radoli		Journalist
68.	Irene Odero		Journalist
69.	James Okeno	AHBF	Journalist
70.	Leakey Soukoyo		Journalist
71.	Merecia Juma		Journalist
72.	Aghan Daniel	BTA	Journalist
73.	Regina Ndolo	UTAFITI	Journalist
74.	Anne Nyokabi		Journalist
75.	Ben M. Kanyenji		Journalist
76.	Charles Njeru		Journalist
77.	Ebby Wamatsi	Biosafety News	Journalist
78.	Mildred Barasa	Kenya Times	Journalist
79.	Hussein Mohammed	The Standard	Journalist
80.	Cryspin	Citizen T.V.	Journalist
81.	Ann Kamondi	The Standard	Journalist
82.	Lilian Omariba	AFP	Journalist
83.	Zablon Odhiambo	East African Business Week	Journalist



**Appendix 4b: Program for IRMA Stakeholders Meeting - 25 November 2005,
Safari Park Hotel, Thika Road, Nairobi**

Chair: To be determined

Rapporteurs: Dr. M. Mulaa (Entomologist, KARI Kitale) and
Mr. Paddy Likhayo (Entomologist, KARI NARL).

Thursday 24 Nov 2005

5.00 p.m. Arrival Ms. D. Nanzala

Friday 25 Nov 2005

Stakeholders Meeting

9.30 a.m. Registration
10.00 Welcome and introductions
10.15 Opening speech by Director- KARI
10.45 IRMA Project: Status and Progress (CIMMYT)
11.00 Remarks by Syngenta Foundation for Sustainable Agriculture
11.15 Remarks by the Rockefeller Foundation
11.30 Remarks by CIMMYT
11.45 Question and answer session
12.30 p.m. Vote of thanks
12.30 Press Conference

Lunch & departure

