# Can Bt maize alleviate poverty in Africa?

*Hugo De Groote and Stephen Mugo*

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**Results of the Insect Resistant Maize for Africa (IRMA) project, a collaboration between the International Maize and Wheat Improvement Centre (CIMMYT) and the Kenya Agricultural Research Institute (KARI), with financial support of the Syngenta Foundation for Sustainable Agriculture**

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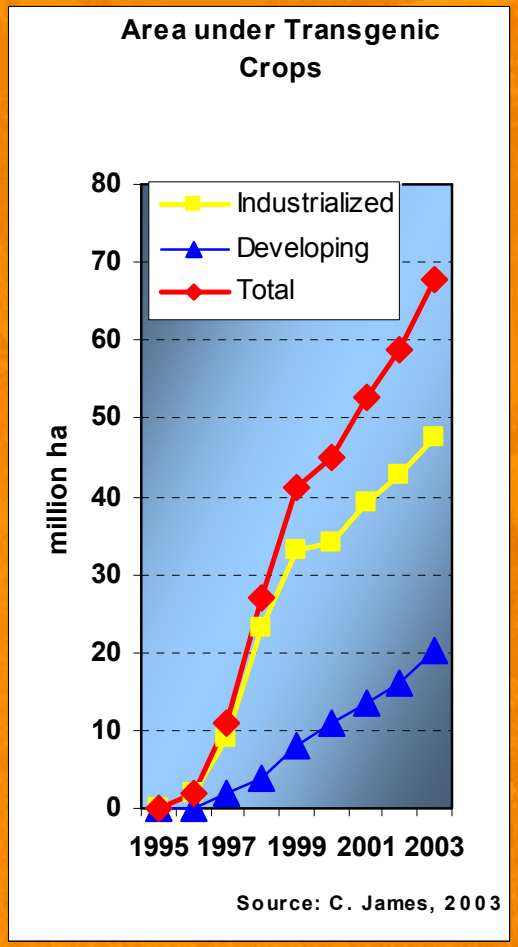
# Background

- IRMA: Started in 1999, the Insect Resistant Maize for Africa (IRMA) project aims to develop adapted maize varieties with resistance against stemborers for the small scale farmers of the different agroecological zones in Kenya, using biotechnology and conventional breeding methods
- The project is a joint CIMMYT-KARI project, with financial support of the Syngenta foundation for sustainable development
- Multi-disciplinary team (breeders, entomologists, social scientists) research results offer important insights in the potential of biotechnology, in particular Bt maize
- Currently: Bt maize is being tested in a biosafety greenhouse and adapted varieties are being developed for testing in an open quarantine site
- 2004: IRMA II launched to bring these varieties to the farmers, (expanded with new partners, RF, AATF, UNEP/GEF…)
- It is time to take stock and see where and how we can make a difference in the ultimate goal of public agricultural research: make a dent in poverty through improved food security

# GMOs: the debate




- GMOs are an amazingly successful technology, without adverse effects on environment or food safety
- Europe and Japan have been reluctant to embrace the technology: the expected benefits are small compared to the perceived environmental risk and apprehension by consumers
- In Africa, potential benefits are high:
  - stagnating economies and food production
  - decreasing per capita food production
  - the number of poor people is increasing
- But many concerns are raised:
  - Ethical
  - Environmental
  - Economical
  - Equity

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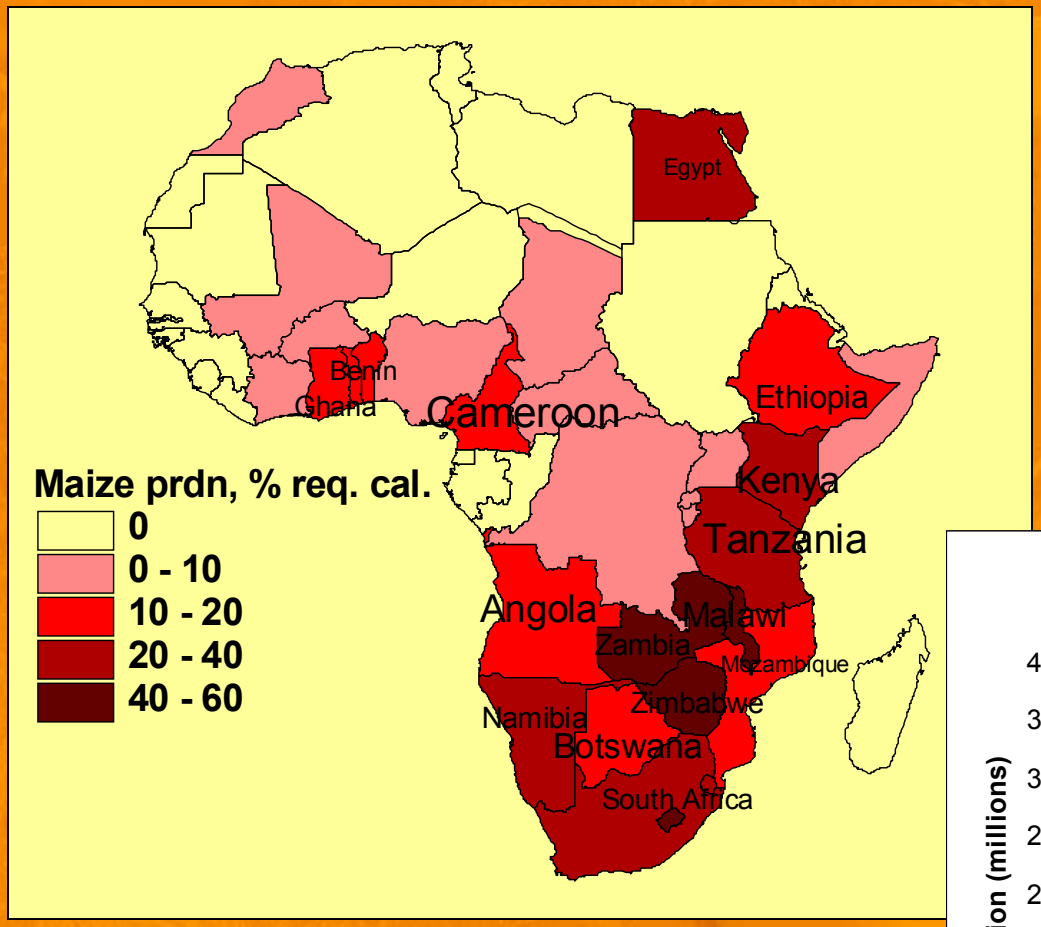
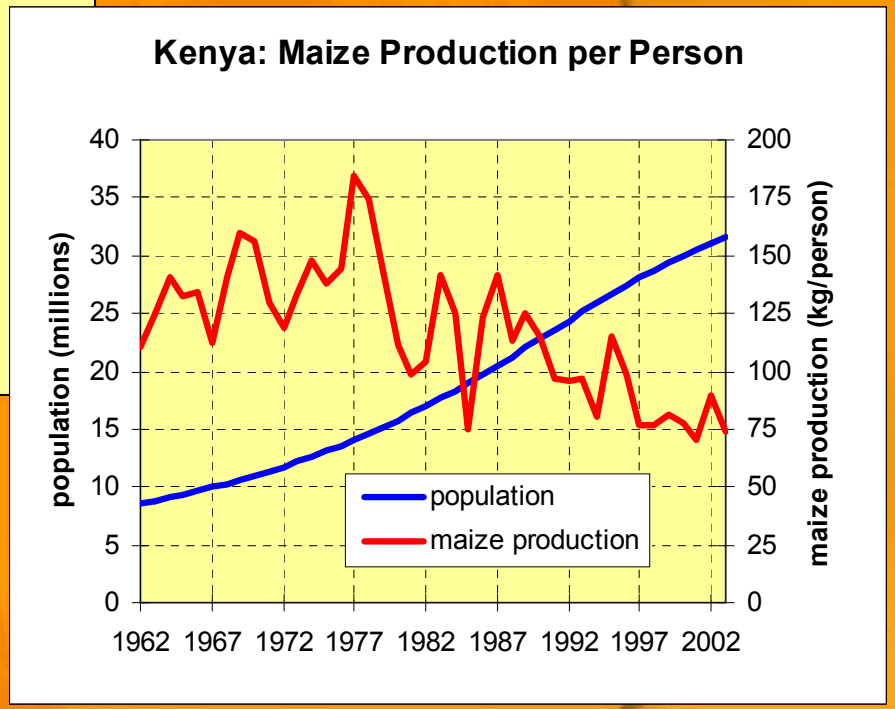
# Bt maize for Africa: The questions

| Environmental and Economic concerns | Equity concerns |
|---|---|
| 1. Is maize important for the poor in Africa? | 6. Can the poor benefit from Bt maize? |
| 2. Does Bt maize tackle a real concern? | 7. Will the technology reach the poor? |
| 3. Can Bt maize solve the problem? | 8. Will all benefits go to multinational agrobusiness? |
| 4. Is it safe? | 9. Will the public accept it? |
| 5. Is it worth the money? | 10. Are consumers and small-scale farmers involved in the decision process? |

# 1. Is maize important for the poor in Africa?

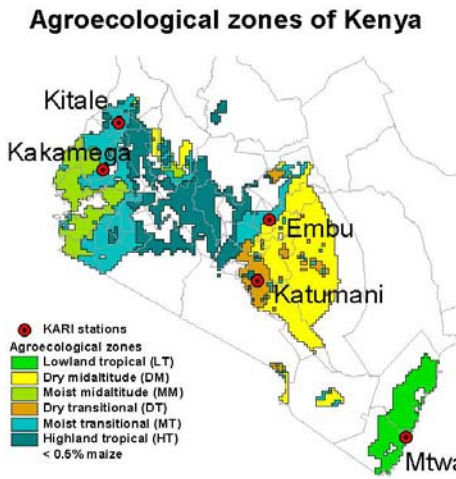


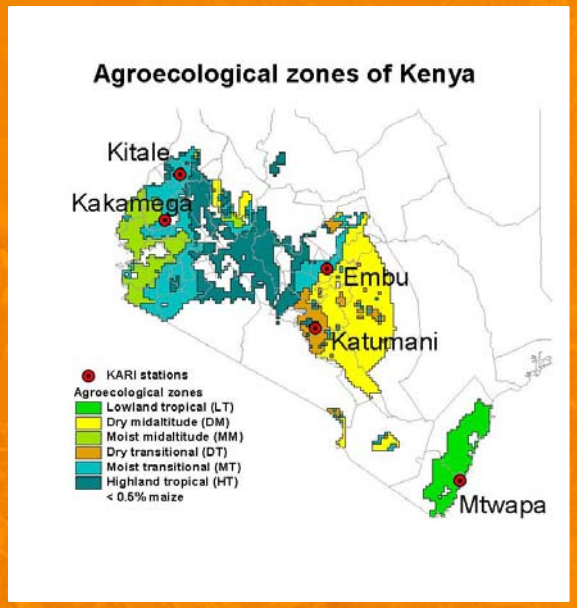



# 2. Does Bt maize address a real concern?

| Constraint | rank 1 | rank 2 | rank 3 | rank 4 | rank 5 | rank 6 |
|---|---|---|---|---|---|---|
| Embu | cash | rain | know-how | seed cost | **stem borer** | low fertility |
| Kakamega | farm implements | soil fertility | cash | extension (know-how) | certified seed availability | **pests** |
| Katumani DM | rain | **pests & diseases** | cost of inputs | seed availability | know-how | |
| Katumani DT | rain | know-how | **pests and diseases** | input cost | poverty | |
| Kitale | poor seed quality | seed price | fertility price | low maize price | cash | **pests** |
| Mtwapa | **field pests** | cash | soil fertility | wildlife | drought | |

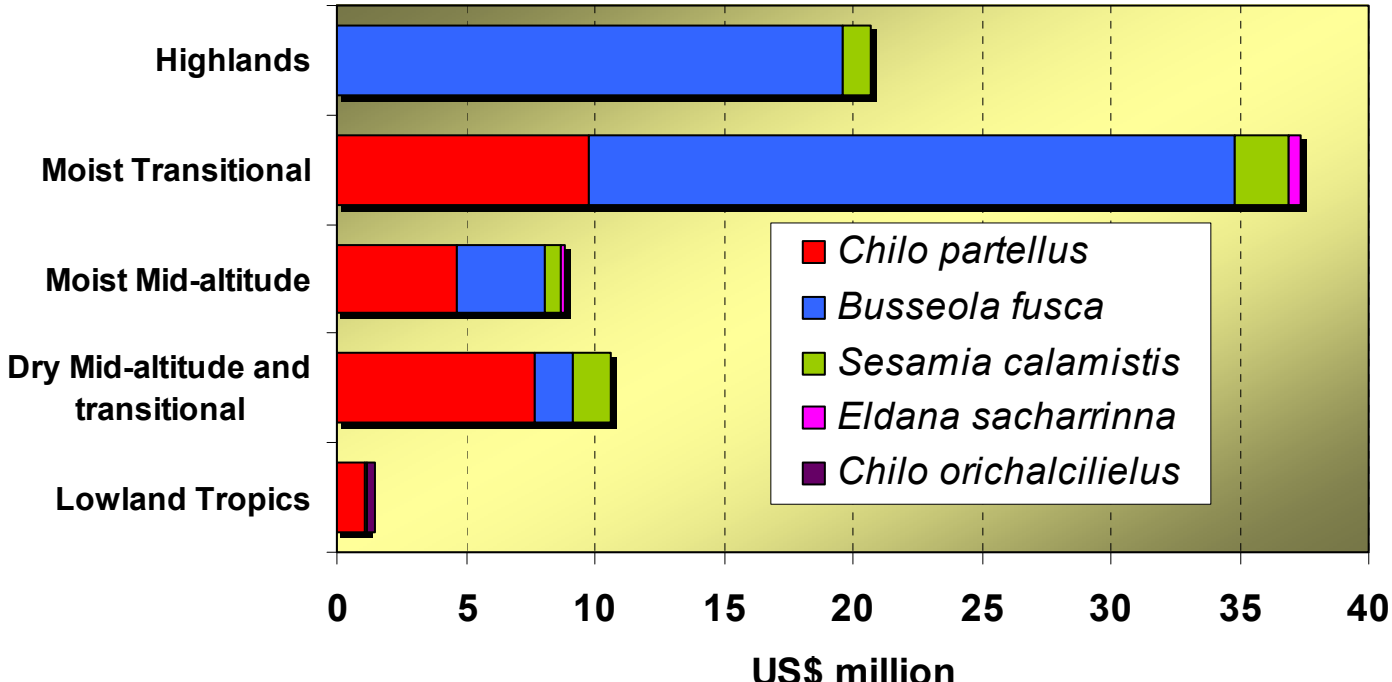
| Pests | rank 1 | rank 2 | rank 3 | rank 4 | rank 5 |
|---|---|---|---|---|---|
| Embu | **stem borer** | **weevils** | squirrels | | |
| Kakamega | **striga** | **weevils** | **stem borer** | termites | rodents |
| Katumani DM | **weevils** | **stem borer** | chaffer grubs | termites | |
| Katumani DT | **weevils** | chaffer grubs | **stem borer** | termites | squirrels |
| Kitale | **stem borer** | **weevils** | cutworms | rodents | |
| Mtwapa | rodents | **stem borer** | **weevils** | beetles | storage moths |





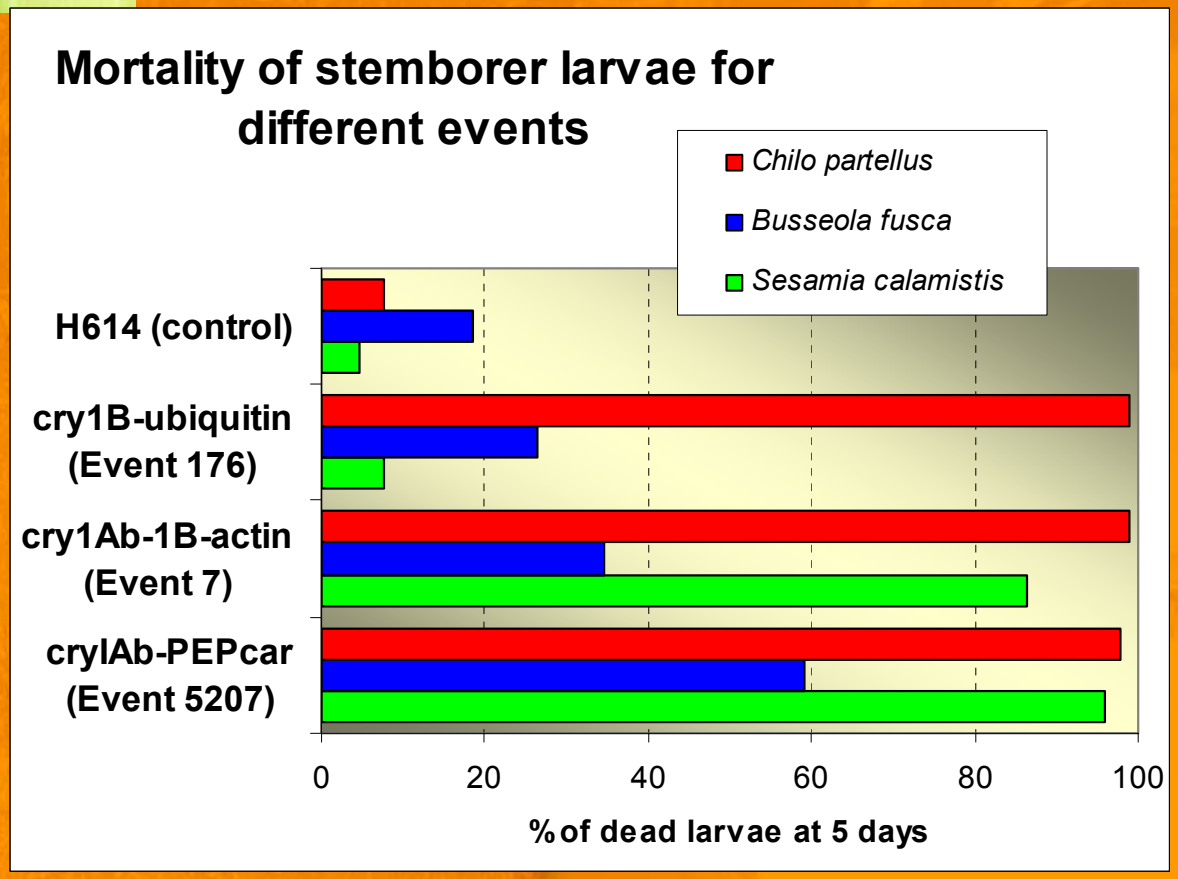

# 2. Does Bt maize respond to a real concern? (2)

- Farmers estimates: yield loss of 12.9% of potential
- field measurement: 13.5%,
  - 11% in the high potential zones
  - 21% in the low potential zones
- Total losses: 400,000 tons, US$ 80 million.



# 3. Can Bt maize solve the problem?

- Bt genes engineered in maize plants
- leaves brought to Kenya for bio-assays
- Leaves with different events fed to different species
- Good control of *Chilo*, not for *Busseola*




# 4. Is Bt maize safe to use?

- As food:
  - Toxicity and allergies: Bt maize as such is no different from other maize
  - However, Bt maize is less affected by fungal infections and therefore has generally much lower aflatoxin levels

For the environment:

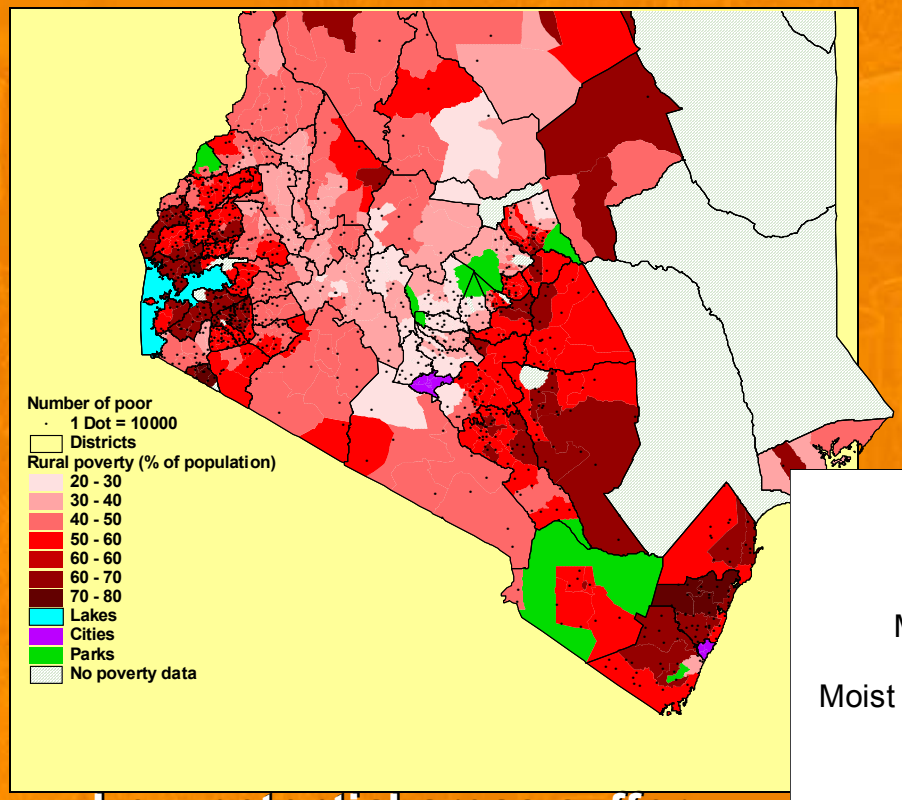
- target insects can develop resistance: need refugia
- Potential effect on non-target organisms: need monitoring
- Bt gene can cross into wild relatives and other varieties:
  - No wild relatives to maize in Africa
  - Bt gene (dominant) likely to flow into local varieties
    - Local varieties stored in Kenya Gene Bank
    - Farmers and extension officers need training

# 5. Is it worth the money?

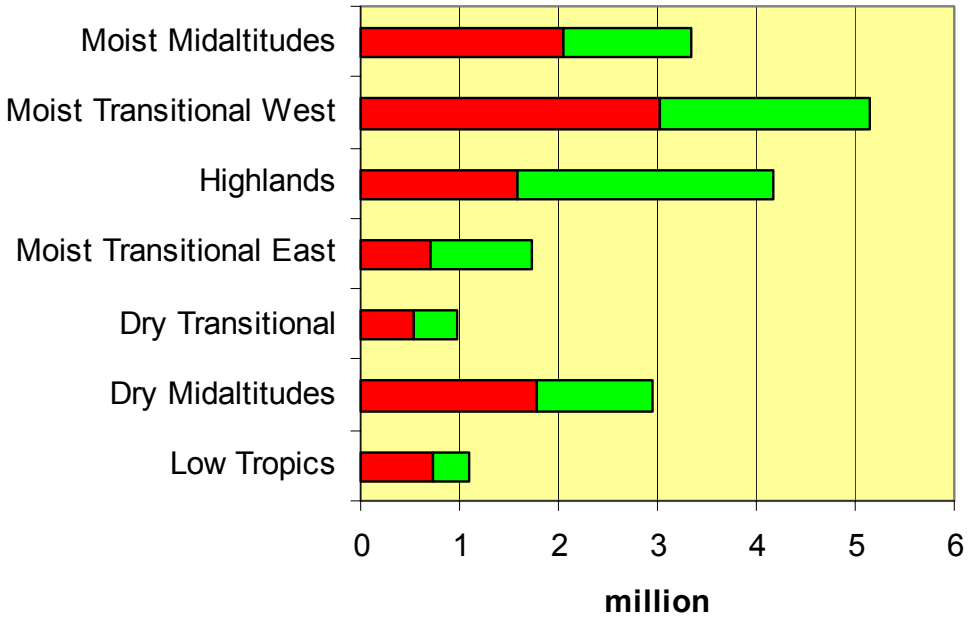
- Technology is likely to be highly profitable where the *Bt* genes are  are effective
- The success of the project depends heavily on the development of resistance against Busseola
- The cost of the project is estimated at $ 1 million/year, over 10 years, or 6.7 million discounted
- Economic surplus analysis: if resistance to all stem borers is found, the project is highly profitable (B/C = 31)
- Otherwise, it is  still profitable, but less (B/C=3.6), with most benefits going to low-potential zones
- More than half of the benefits go to consumers

| | | Economic surplus $ million | | | Costs ($m) | B/C |
|---|---|---|---|---|---|---|
| Scenario | period | producer | consumer | total | (discounted) | ratio |
| Resistance to all stemborers | 1 year | 16 | 33 | 49 | | |
| | 25 years | 70 | 139 | 209 | 6.76 | 30.8 |
| No resistance to B. fusca | 1 year | 2 | 4 | 6 | | |
| | 25 years | 8 | 16 | 24 | 6.76 | 3.6 |

# 6. Can the poor benefit from Bt maize?




- Low potential areas suffer relatively more from stemborers
- more poor people live in the high-potential areas
- Small scale farmers are net consumers



# 7.Will the technology reach the poor?

- Generally, seed distribution networks have improved with the liberalizaton, but seed sales and adoption rates have not increased
- If seed prices stay affordable, the seed is likely to be popular
- Poor farmers, and farmers in low-potential areas, buy less seed and recycle more, even hybrids
- Bt maize is recyclable:
  - Bt genes are dominant,
  - many farmers select seed in the field
- IRMA is committed to produce Bt OPVs, and take into account recycling of hybrids (transforming both parents)
- A special effort is needed to bring OPVs to the resource-poor farmer
- Poor farmers use relatively more local varieties, and they are very interested in transforming these

# 8.Will all benefits go to multinational agrobusiness?

- Freedom To Operate (FTO) study found that:
  - no relevant patents have been filed in Kenya
  - Relevant patents in developing countries are more than 1 year old (companies have one year to file in Kenya after they file in a third country)
- IRMA:
  - Only uses technology of public institutions
  - Can make technology available at little or no cost to local seed companies
- Local seed industry is likely to benefit

# 9. Will the public accept it?

- farmers and extension are generally very enthusiastic about of *Bt* maize ( request that Bt genes be incorporated in local varieties)
- Yearly IRMA stakeholders' meetings: people generally optimistic, with some reserve.
- press: not very knowledgeable, but training is being provided
- consumers:
  - generally trust the regulatory agencies, and few object to the use of GM crops for food.
  - 38% of consumers aware of GM crops
  - 67% would buy GM maize at the same price
  - But consumers are concerned about non-target organisms (51%) and local varieties (50%)
- Policy makers: increasingly positive towards the technology

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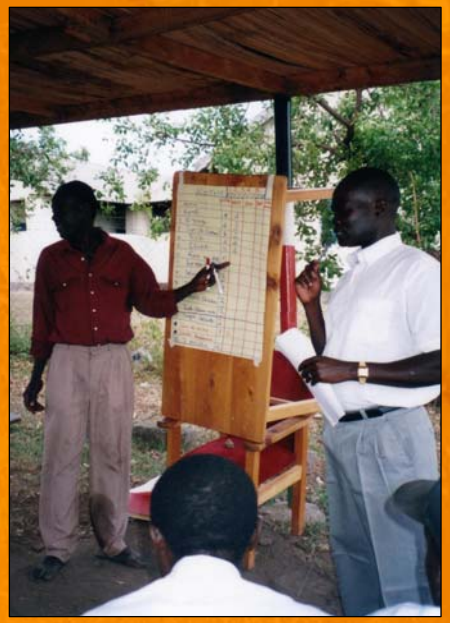
# 10. Are consumers and small-scale farmers involved in the decision process?



- Stakeholders meetings
- Surveys:
  - Farmers
  - Consumers
- Local press
- Agricultural extension
- Regulatory framework

# Conclusions

| Environmental and Economic concerns | |
|---|---|
| 1. Is maize important for the poor in Africa? | + + + |
| 2. Does Bt maize respond to a real concern of poor farmers? | + + |
| 3. Can Bt maize solve the problem? | + |
| 4. Is it safe to use? | -/+ |
| 5. Is it worth the money? | + / + + |

# Conclusions (2)

| Equity concerns | |
|---|---|
| 6. Can the poor benefit from Bt maize? | + + |
| 7. Will the technology reach the poor? | + |
| 8. Will the local seed industry benefit? | + + |
| 9. Will the consumers accept it? | + + |
| 10. Are consumers and small-scale farmers involved in the decision process? | + |

# With thanks to

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