Concluding Remarks

15th International Cocoa Research Conference

San Jose, Costa Rica, October 2006

Cocoa productivity, quality, profitability, human health and the environment

Martin Gilmour

Chairman, International Organising Committee

Opening ceremony

- Dr Pedro Ferreira - Director of CATIE
- Dr Martin Gilmour - Chairman International Organising Committee
- His Excellency Mr. Alfredo Volio - Minister of Production of Costa Rica
- Mr. Sona Ebai - Secretary General COPAL

Genetics: quantitative genetics

- Heritability of productivity in Togo, need to set up multiple sites
- Genetic gain in resistance to Black Pod in Trinidad, accumulate resistance genes
- Possible new sources of Black Pod resistance in French Guiana
- Pity not to hear about preventative breeding, new sources for resistance to Witches Broom...

Genetics: quantitative genetics

- Early maturity seen in tissue culture derived cacao trial, Ecuador, Côte d'Ivoire
- Morphological traits at ICG,T, pod hardness...
- Screening for high temperature tolerance, genotypic effect
- Initial selections for CPB/VSD/PPR in Sulawesi and for FPR in Costa Rica

Genetics: molecular biology

- Genetic structure of cocoa in West Africa, where's Amelonado gone…, quality implications ?
- More understanding where Nacional comes from
- Diversity measured in Witches Broom, FPR
- "Marker pipeline" for FPR resistance, EST bonanza from Genescope from many tissue/disease combinations

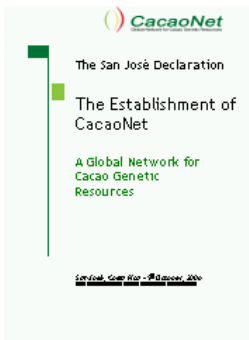
Genetics: molecular biology

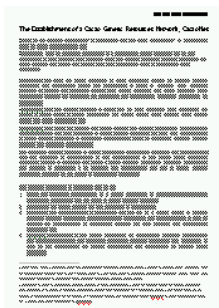
- Increased knowledge about main QTL for WB resistance, looking good for FPR resistance QTL
- ESTs with micro-satellites allow genetic maps to be combined
- Scale of mis-labelling in collections understood
- Epigenetic variation - selecting genotype to match environment ?
- Molecular biology of endophytes beginning

CacaoNet - cacao genetic resources

- CacaoNet launched !
- San Jose declaration circulated, large stakeholder meeting held (> 80)
- Coordinator and coordination unit established at IPGRI
- Working groups:
  - cocoa quarantine - already working
  - information management - already working
  - donor outreach/resource mobilisation - established
- Website set up

CacaoNet
Global Network for Cacao Genetic Resources





Crop protection: Phytopathology

- Overview of cacao pests and diseases, need to measure risks through Pest Risk Analysis
- Host pathogen biology of CSSV, its spread in Côte d'Ivoire, and huge attempts to eradicate/control in Ghana
- Precise conditions described for Phytophthora leaf disc test, seedling based screens for Ceratocystis, and BCAs developed

Crop Protection: Phytopathology

- Useful contact with farmers for potential resistant material
- Huge achievements of CODAPEC programme in Ghana
- Copper fungicides still have a place in WB management
- FPR movement throughout C. America relentless
- Trichodermas widely under investigation, in Cameroon, Ecuador, Costa Rica

Round Table Discussion on Biological Control/IPM:

Main gaps identified:

- **Sustained support for Research and Development**
- **Lack of commercial interests for biocontrol alone or as a complement to pesticides**
- **Lack of commercial development with private biopesticide companies (strict quality control must be maintained)**
- **A formalised Biological Control network and information on peer reviewed work needed**
- **Biological control viewed only as country specific solution**
- **Better co-ordination needed with the cacao breeders**
- **Assistance needed for countries developing registration procedures for biocontrol agents**
- **At present, farmer awareness and training on use of biological and chemical control not sufficient**
- **More research on application of cacao-associated biocontrol agents in nurseries (endophytes and mycorrhizae) or other cash or staple crops needed**

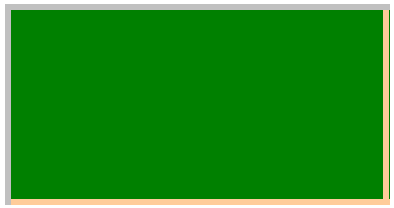
Crop protection: entomology, nematodes, rodents

- INCOPED encouraging cooperation, collaboration
- Potential for mirid pheromone traps, mirid population dynamics beginning to be studied
- Interaction of ants and BP better understood
- Stem Borers cause for concern in Côte d'Ivoire
- CPB pheromone potentially useful IPM tool
- Dry heat used for small scale fumigation
- Its now OK to be a pesticide scientist ?

Cacao Research - Current Status

- Pathogen/pest
  - Biology
  - Genetics
  - Spread
- Breeding
  - predictive test
  - molecular biology
  - conventional breeding
  - supply to farmers
- Integrated Pest Management
  - Biocontrol
  - Agrochemicals
  - Cultural
- Farmer application
  - Extension, farmer intervention
  - Farmer Field Schools

Cacao Research - Classification

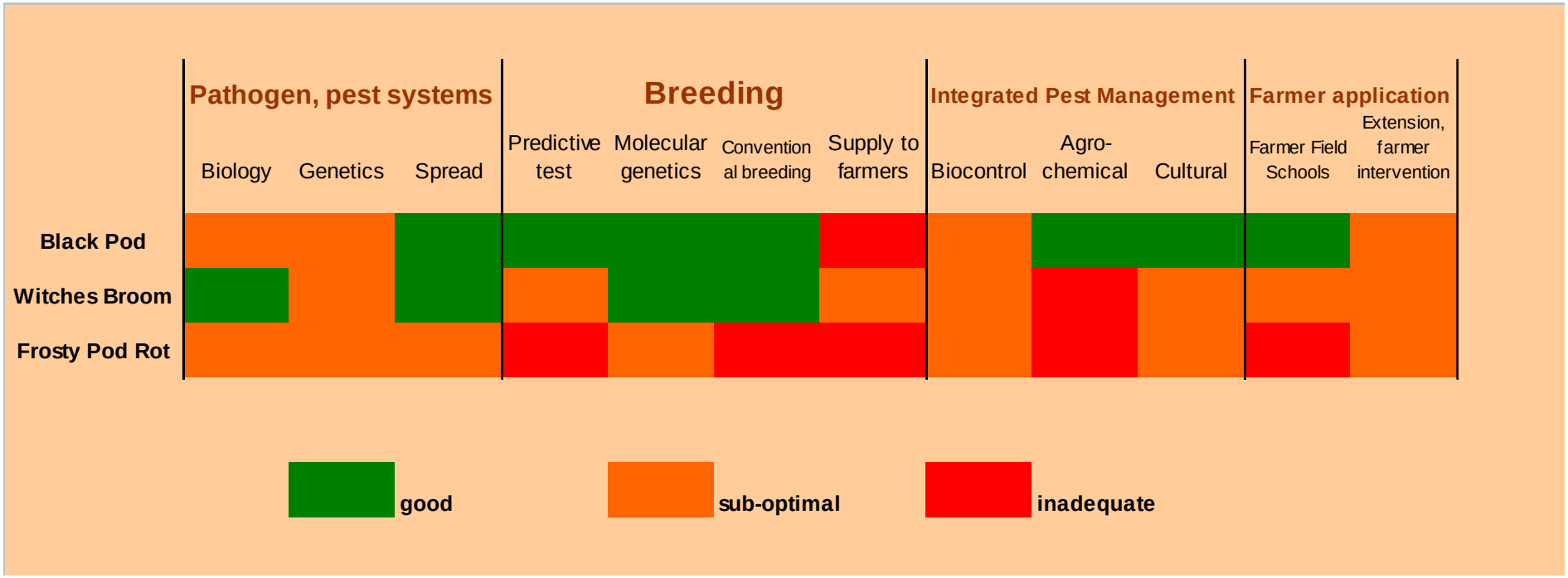


- Adequate resources, groups working together, strategy agreed, measurable progress

- Insufficient resources, some progress, isolated groups, developing strategy

- Insufficient resources, unclear way forward, problem yet to be fully scoped out

Cacao Research Current Status - Fungal Diseases

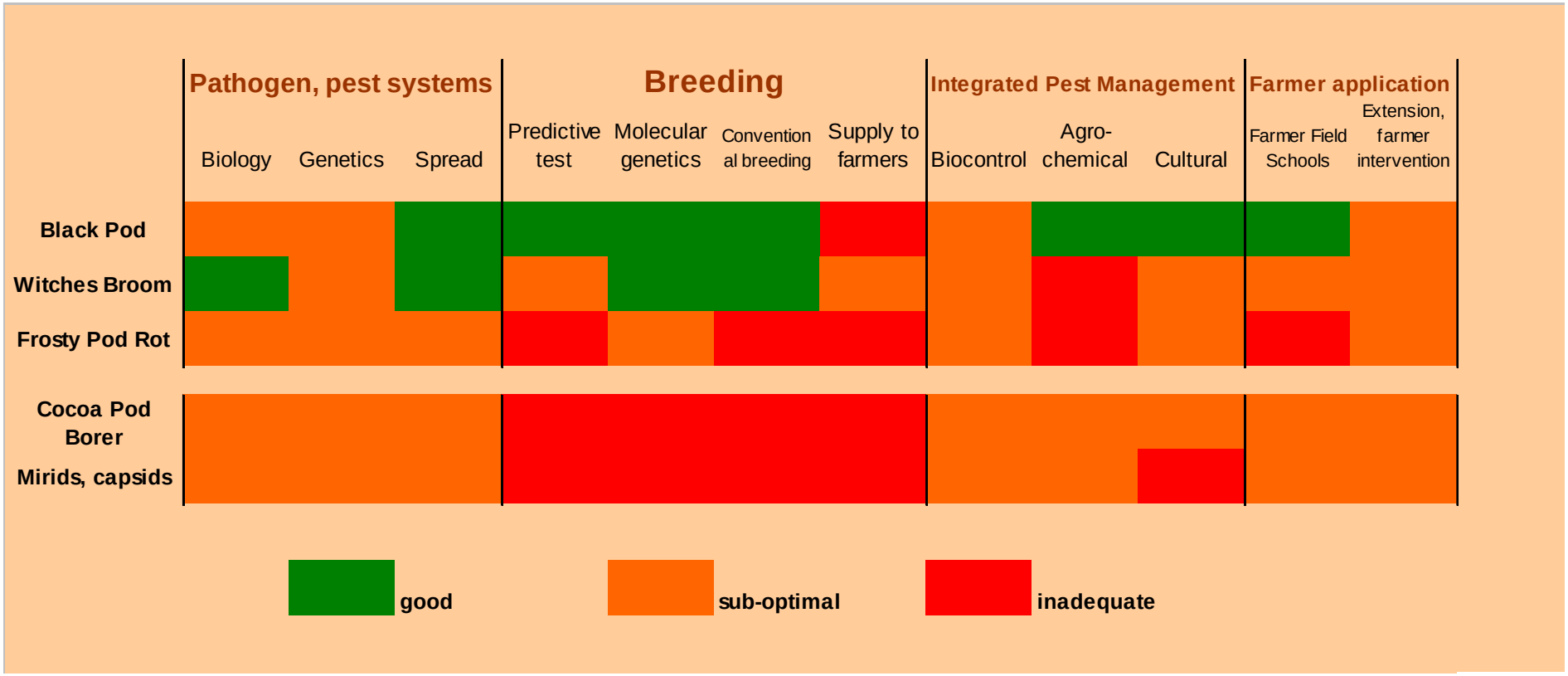


Cacao Research Current Status - Pests

	Pathogen, pest systems			Breeding				Integrated Pest Management			Farmer application	
	Biology	Genetics	Spread	Predictive test	Molecular genetics	Conventional breeding	Supply to farmers	Biocontrol	Agro-chemical	Cultural	Farmer Field Schools	Extension, farmer intervention
Cocoa Pod Borer												
Mirids, capsids												

good **sub-optimal** **inadequate**

Cacao Research Current Status - Pests and Diseases



Agronomy: agroforestry/cultural systems

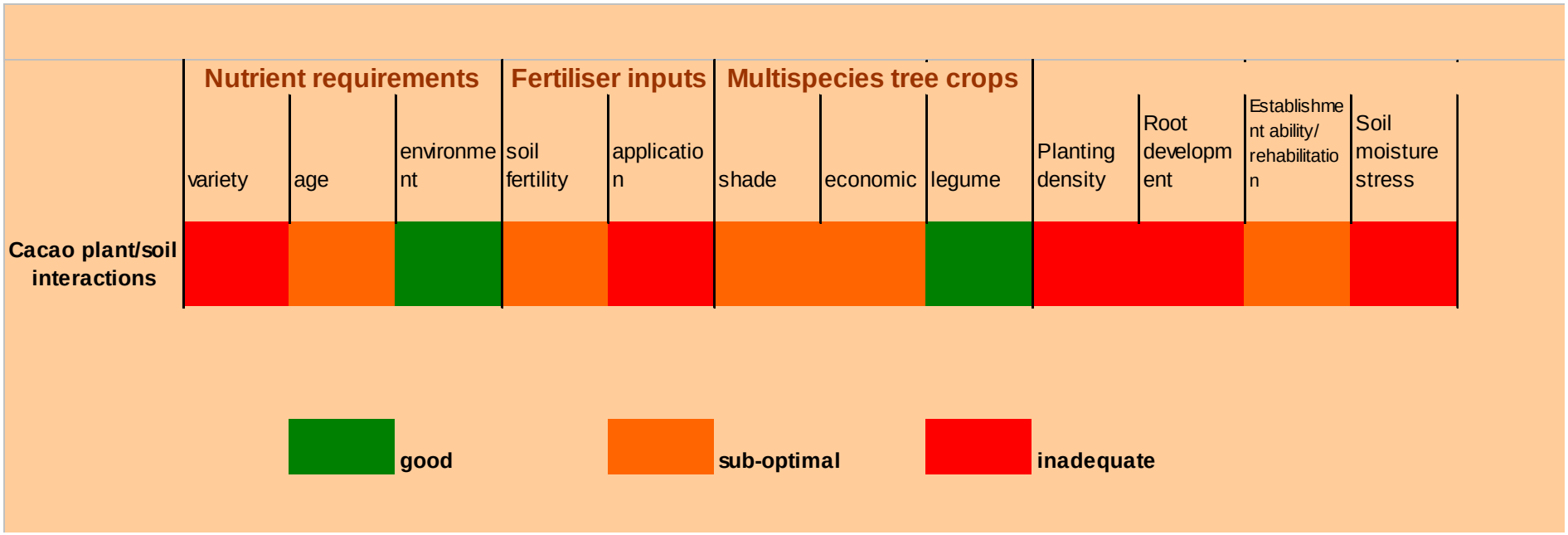
- Many agroforestry “opportunities” for cocoa
  - Inaforesta, real life examples, data coming in
- How to achieve agroforestry against farmer instincts ?
- Examples of re-establishment in Côte d’Ivoire
- Agroforestry examples with economic benefits, and problematic biodiversity
- Positive effects of agroforestry on soil fauna

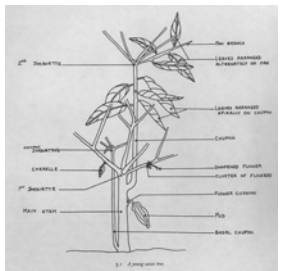
Agronomy: soils, nutrition, physiology

- Positive effects of foliar spraying (boron, NAA)
- Useful tool described for cacao soil diagnosis
- Disturbing tonnages of nutrients exported as cocoa

- First Meeting of Soils Group
  – collaborate, share information

Cacao Research Current Status - cacao plant/soil interactions





Round Table on Chocolate and Human Health

- Why and how to measure cocoa flavanols
- Effect of cocoa flavanols on cardiovascular disease, improved blood flow, vessel function
- Not linked to “how dark”, not a role of anti oxidants
- Real life example of Kuna Indians
- Provocative ideas - malaria, sickle cell, DVT
- Don’t forget, cocoa = happiness !

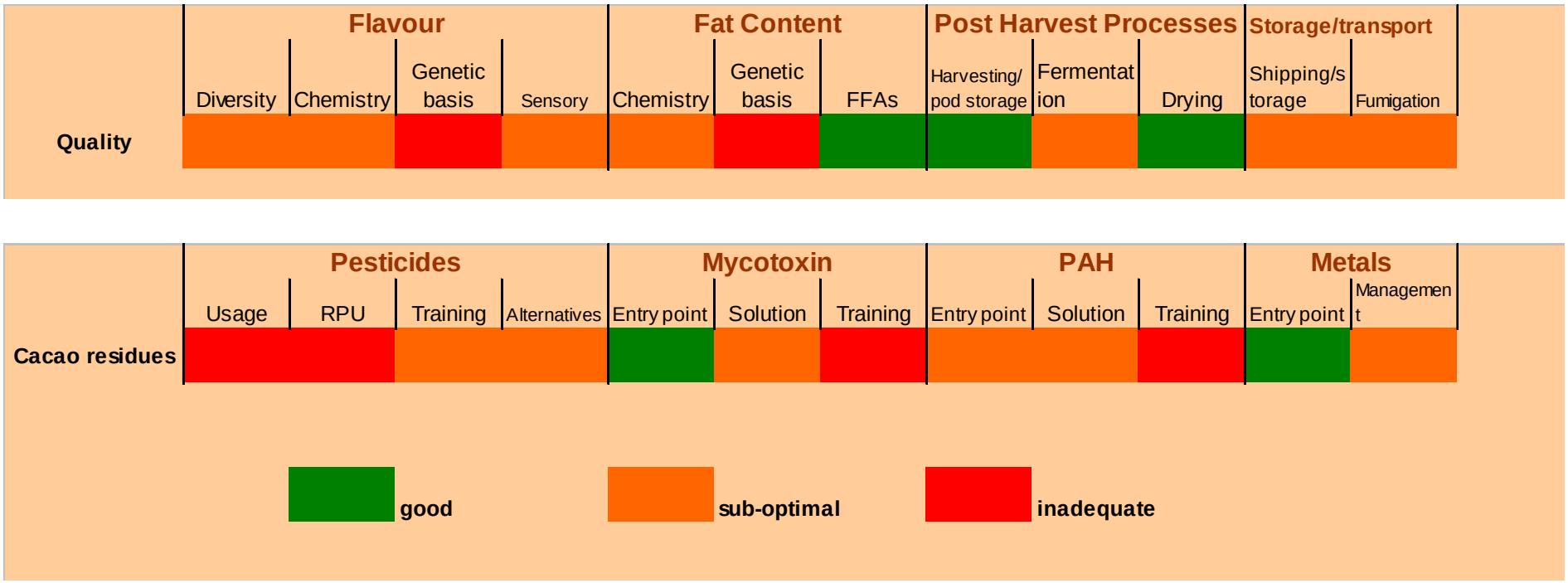
Chemistry, technology, quality

- Important role of testa permeability in fermentation, and optimal fermentation and drying conditions for specific bean types found necessary
- NIR can be used to measure fermentation, new insights into fermentation via molecular and metabolite analysis
- Bench marking of quality standards for a country carried out (Ghana)
- Residual enzyme activity found in traded cocoa

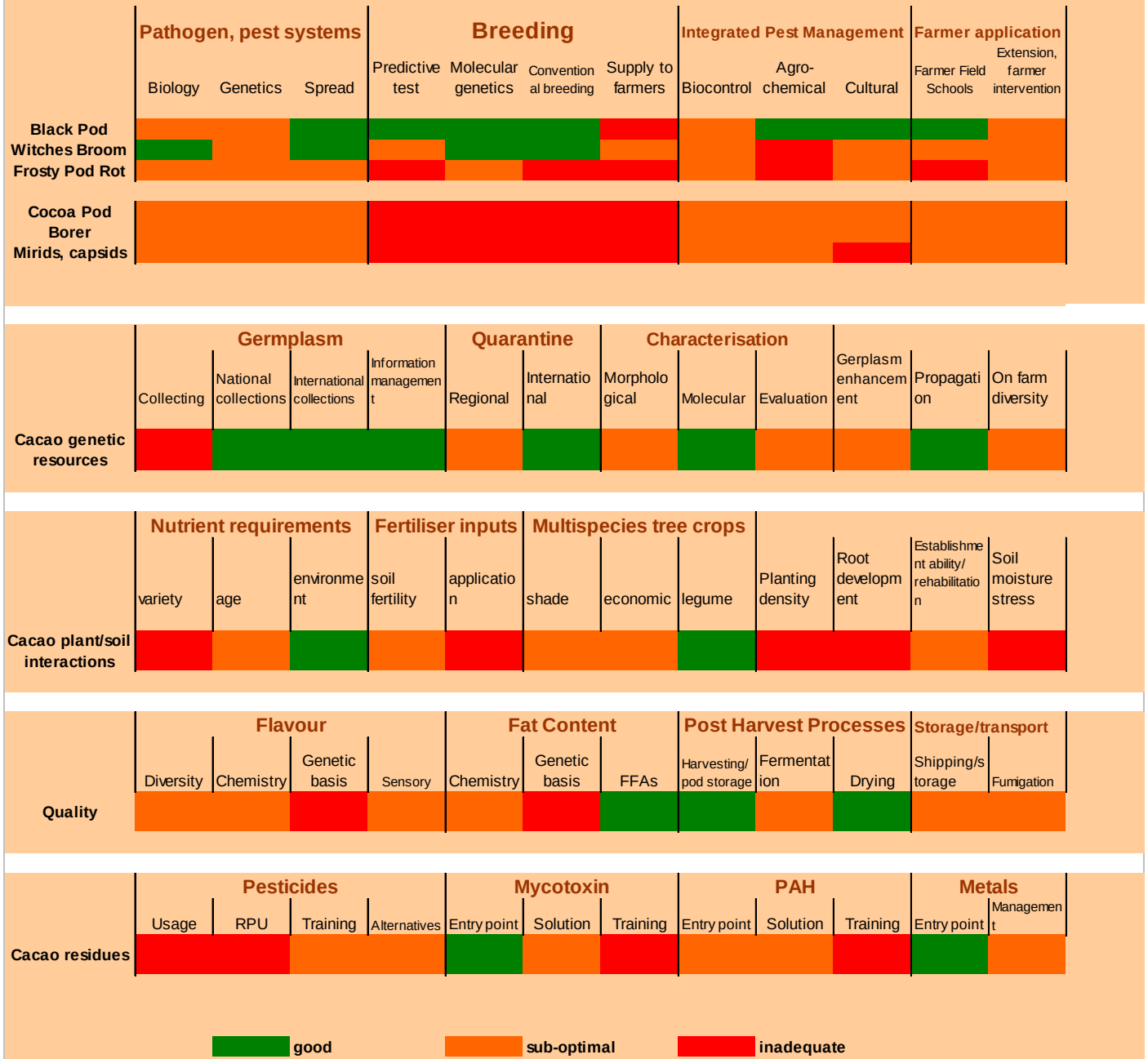
Chemistry, technology, quality

- Genetic contribution to flavour confirmed in Trinitario/Criollo
- Evidence for role of environment on flavour
- Conditions identified which favour/minimise OTA
- New studies underway to satisfy EU requirements on PAH, pesticides

Cacao Research Review - Quality



Cacao Research - Global Status



Cacao Research - the big challenges

- Cacao genetic resources

CacaoNet
Global Network for Cacao Genetic Resources

- Fungal diseases and their spread
  - Witches Broom - promising progress
  - Frosty Pod Rot - more work needed urgently
  - Black Pod (*P. megakarya*) - solutions available

- Insect pests and their spread
  - Cocoa Pod Borer - beginnings of a network
  - Capsids/Mirids - more work needed

Cacao Research - the big challenges

- Cacao plant/soil interactions (nutrient requirements, soil fertility, shade, establishment)
  - find appropriate agroforestry models, understand diversification, more work needed on soil fertility
- Residues
  - pesticides - promote RPU, surveys needed
  - mycotoxins - develop FFS
  - others

The Cacao Research Community, our future is in your hands !