Desarrollo y liberación comercial de frijol GM en Brasil

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Conferencia Regional Sobre Bioseguridad

Hotel Caribe, Cartagena de Indias Colombia. Junio 7 y 8 de 2012

LAC-Biosafety

Embrapa

Ministério da Agricultura, Pecuária e Abastecimento

GOVERNO FEDERAL BRASIL PAÍS RICO É PAÍS SEM POBREZA

Development of Biotech Crops by Embrapa

Science – Technology – Development – Delivery

Partnership

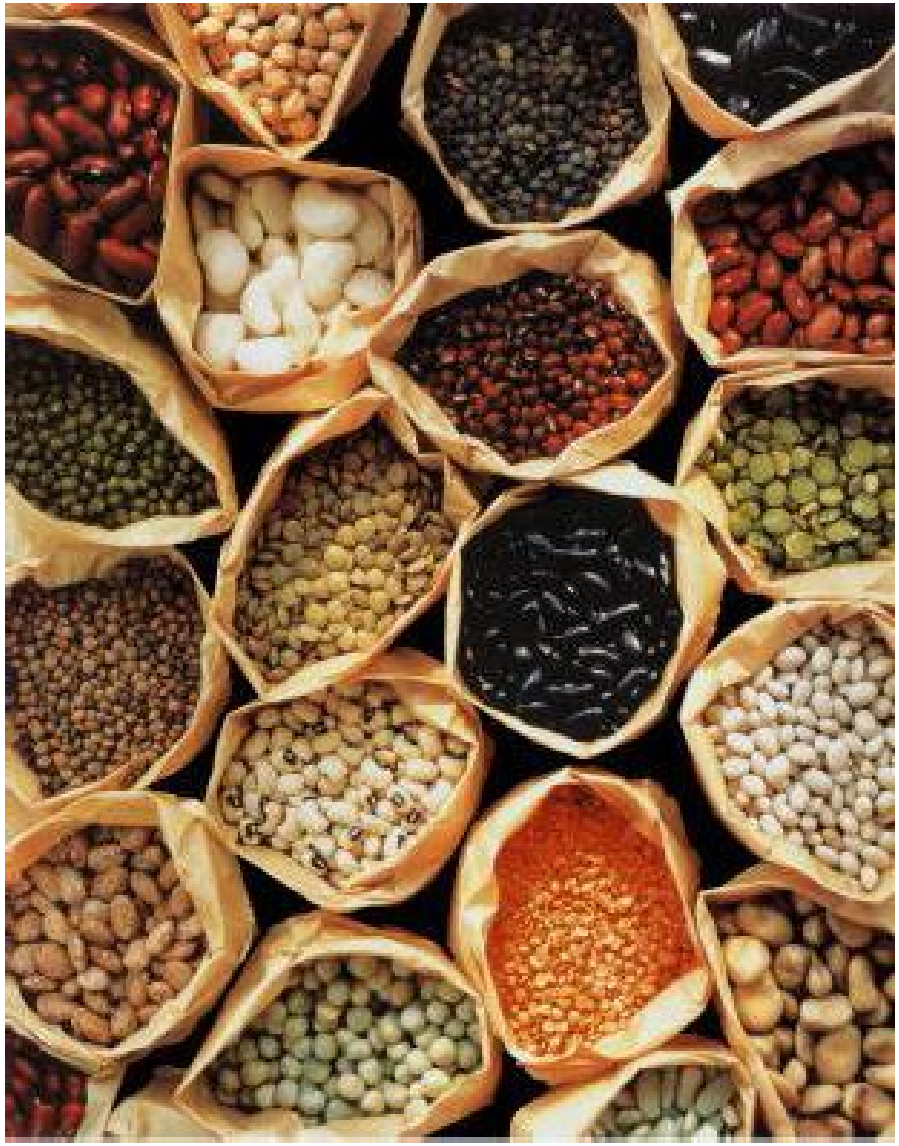
Public-public

Public-private

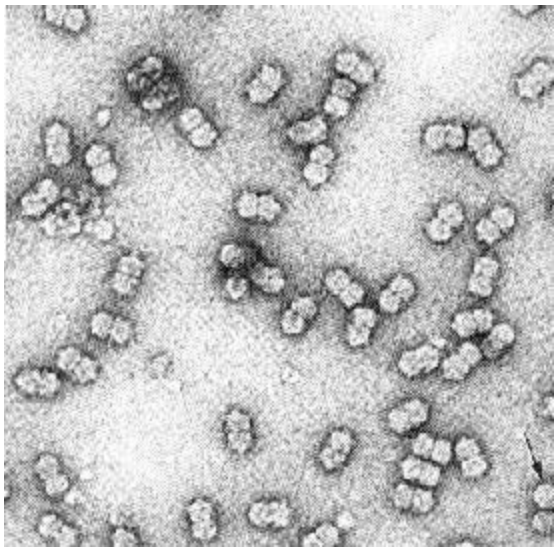
Golden mosaic causes annual reductions in the range of 90,000 to 280,000 tons (Brazil)

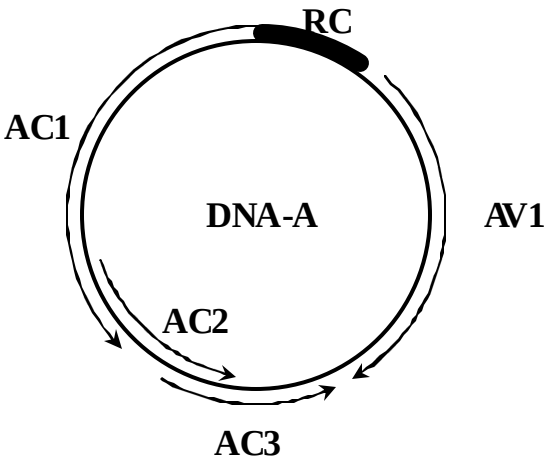
Embrapa

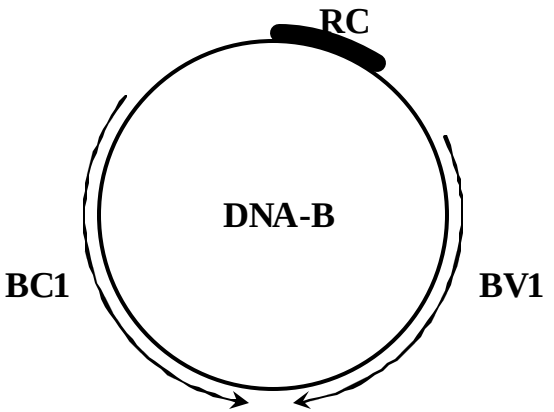
Chapada da Diamantina, BA, Brazil
Approximately 200,000 hectares are currently not apt



70s-
>15,000 accesses in Common Bean Germplasm Banks

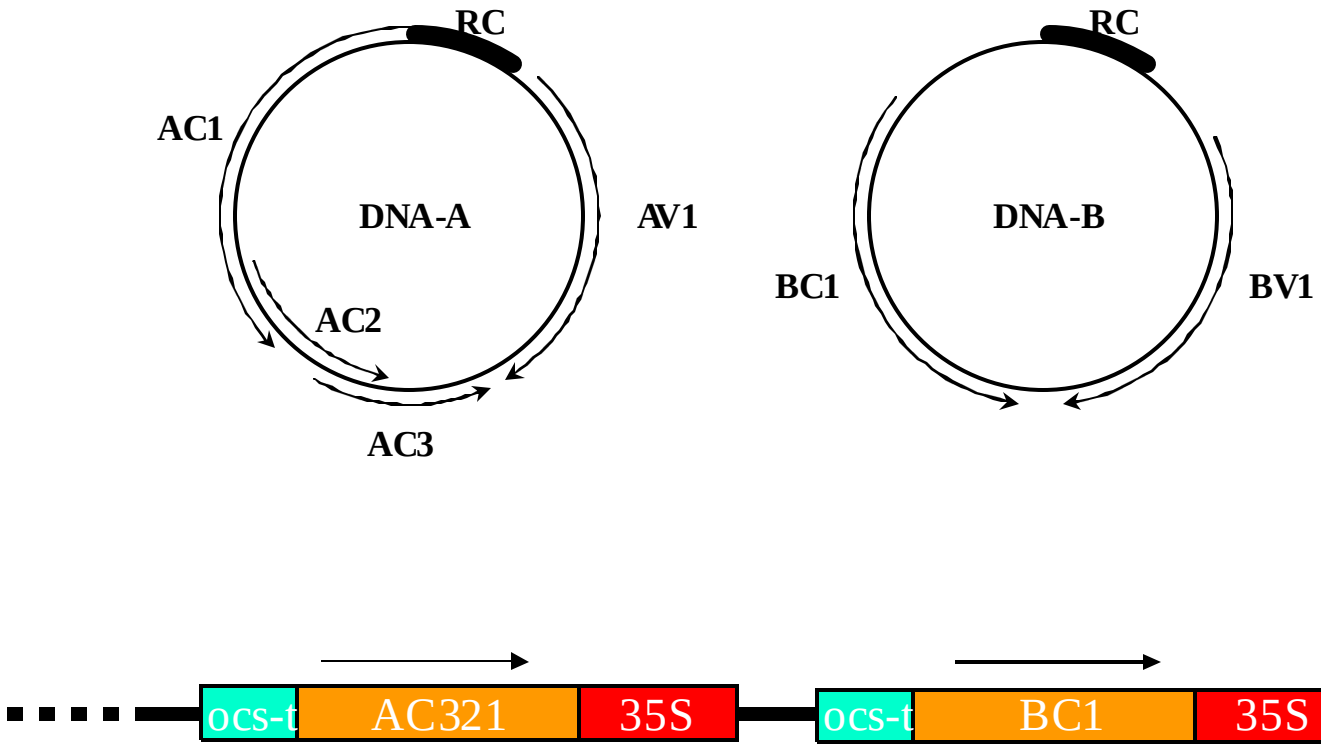


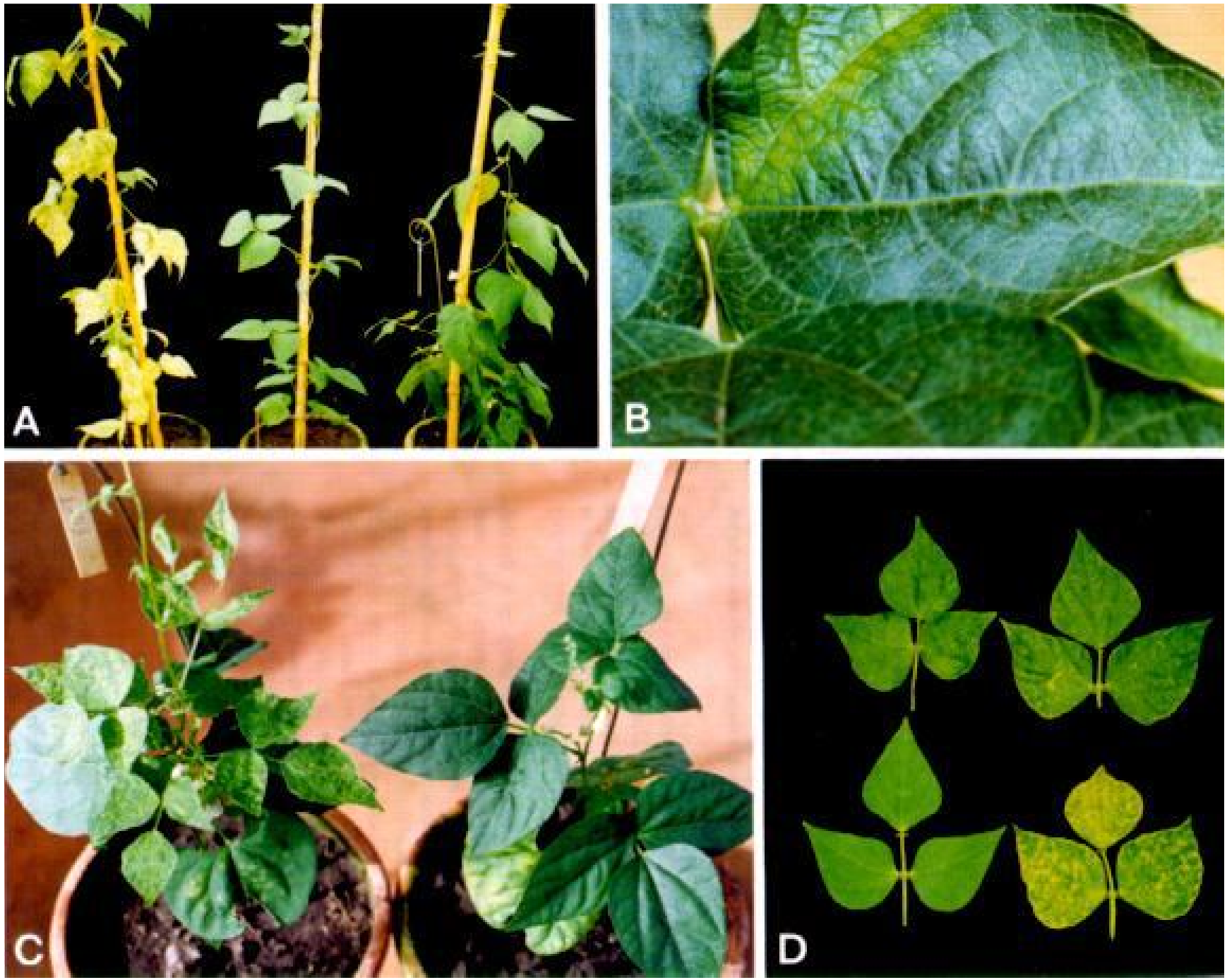




BGMV is transmitted by the whitefly *Bemisia tabaci* in a persistent, circulative manner

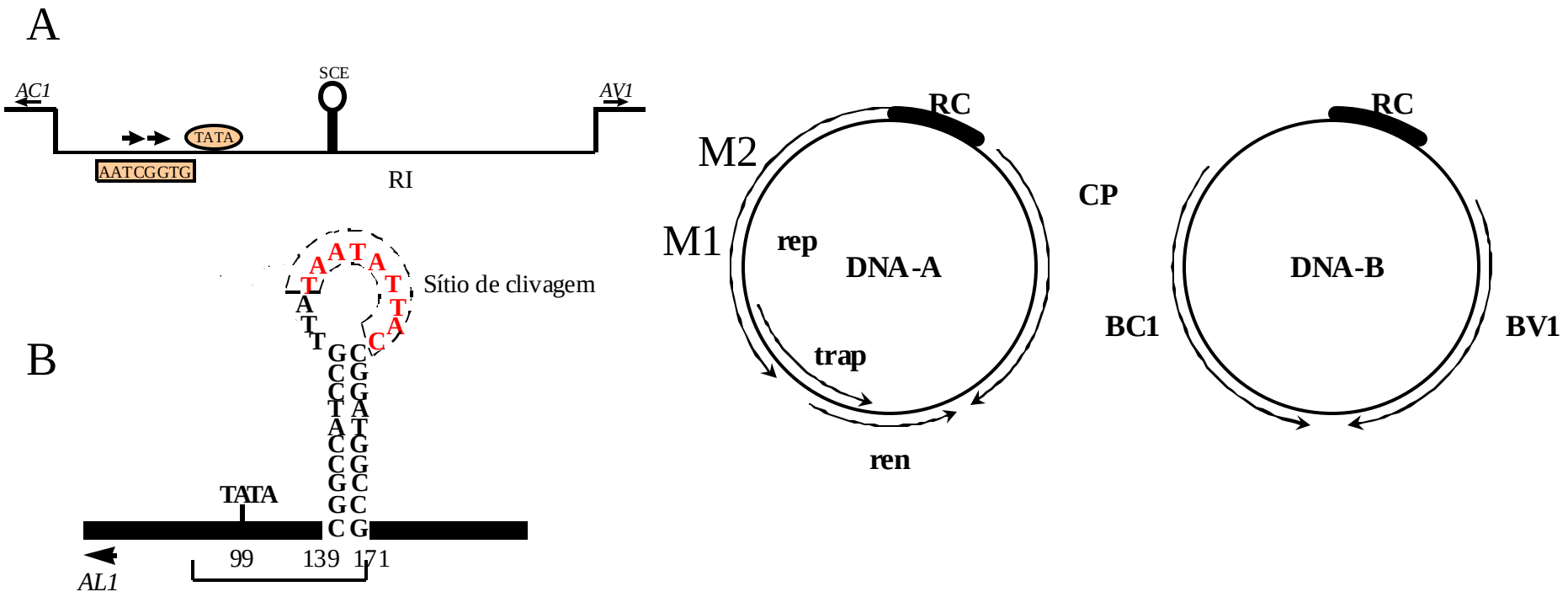
antisense RNA





Attenuated and delayed symptoms

Embrapa

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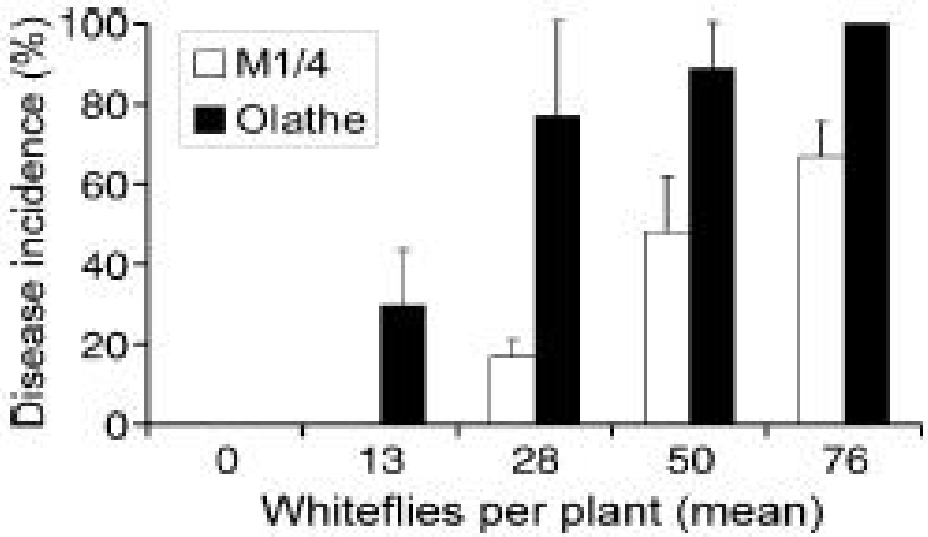
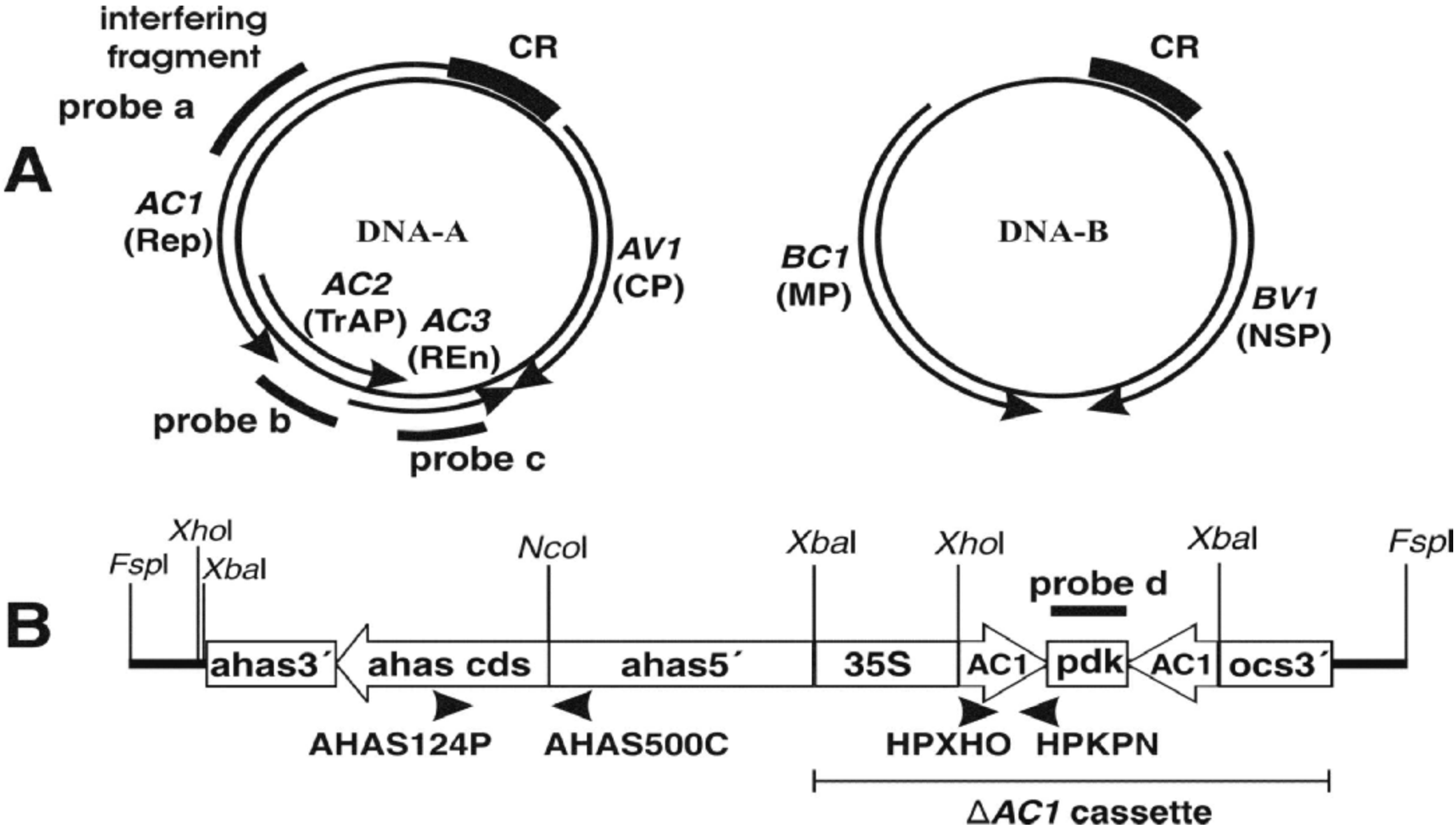
M A P P K R F K I N A K N Y F L T Y P QC S I T K E S A I E Q L Q N L Q T P V NK
K Y I R I C R E I H E N G E P H L H AL I Q F E G K F Q C T N C R V F D L K HP T
T S S V S H A N I Q S A K SS S D V K S A I E K D G D Y I E W G H F Q V D GR S A
R G G Q Q T A N D A A S E A L N A S S K E E A M Q I I K E K L P E K F L F Q Y H N
L S S N L D R I F T K A P D P WS P P Y H L S S F T N V P R E M Q E W A D D Y F G
R G A A A R P E R P I S I I I E G D S R T G K T M W A R A L G T H N YL S G H L D
F N S K V F S N H A E Y N VI R D I A P H Y L K L K H W K E L M G AQ K D W Q S N
C K Y G K P V Q I K GG I P S I V L C N P G E G A S Y K C F L D KE E N A A L K N
W T I H N A K F I F L NS P L Y Q S S T Q S C E E T S N Q T T S R *
```

Mutation in the NTP-binding motif (EGX4GKTX32DD


control
M1/4

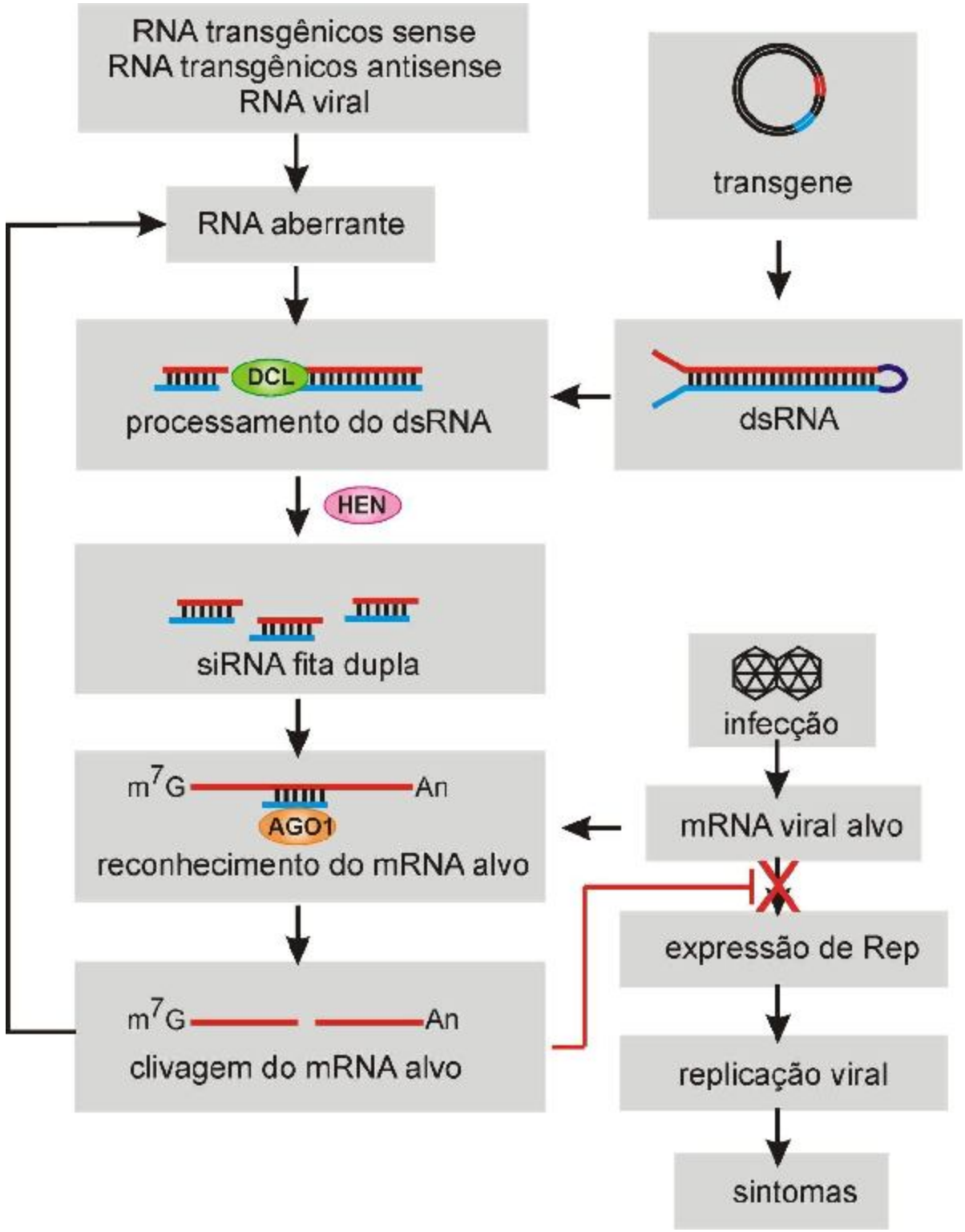

Disease incidence (%)
100
80
60
40
20
0
M1/4
Olathe
0
13
28
50
76
Whiteflies per plant (mean)

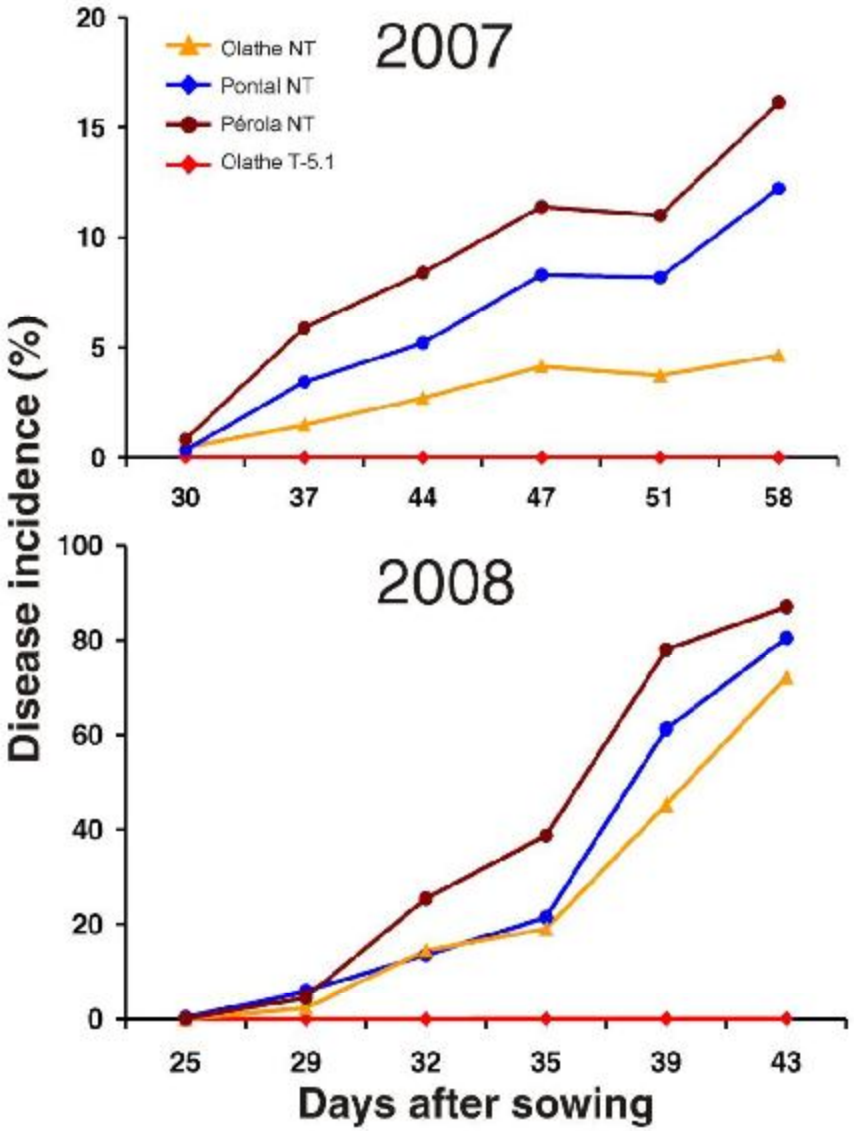
2000



Bonfin et al. MPMI 2007

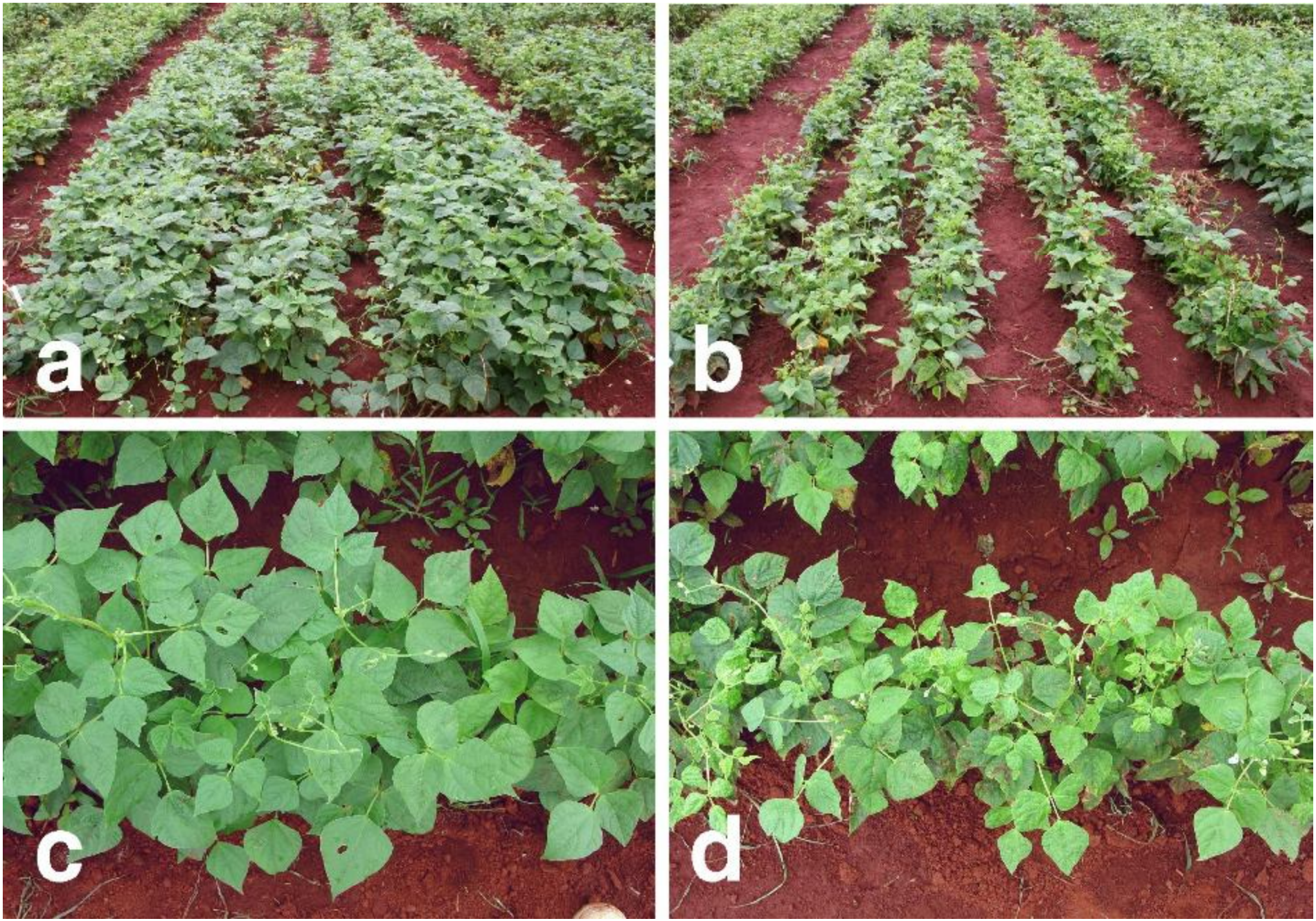
Embrapa


RNA transgênicos sense
RNA transgênicos antisense
RNA viral
transgene
RNA aberrante
DCL
processamento do dsRNA
dsRNA
HEN
siRNA fita dupla
infecção
m7G
An
AGO1
reconhecimento do mRNA alvo
mRNA viral alvo
m7G
An
clivagem do mRNA alvo
expressão de Rep
replicação viral
sintomas



Interfering RNA strategy

Aragão & Faria: Nature Biotechnology, 2009


a
b
c
d

NORMATIVE RESOLUTION NO. 05, MARCH, 2008

Gives provisions on rules for commercial release of Genetically Modified Organisms and their derivatives

Portuguese:
http://www.ctnbio.gov.br/index.php/content/view/11444.html

English:
http://www.ctnbio.gov.br/index.php/content/view/12857.html

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José Francisco Arruda e Silva
Edmar Cardoso de Moura
Vanderlino Moreira de Santana
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Paula Arielle Mendes Ribeiro Valdisser
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Érica Heringer Machado
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Universidade Estadual de Campinas
Jaime Amaya-Farfan

65 (89) members
10 Research centers

FEIJAOSEG

Embrapa

Ciência, Tecnologia e Inovação
Ministério da Ciência, Tecnologia e Inovação

GOVERNO FEDERAL BRASIL PAÍS RICO É PAÍS SEM POBREZA

Comissão Técnica Nacional de Biossegurança

CTNBio

BUSCA:

MENU

- CTNBio
- CIBio
- Gestão Administrativa
- Legislações
- Legislation
- Documentos
- Aprovações Comerciais
- Commercial Aprovals
- Eventos
- Outros Links
- Orgãos de Fiscalização
- Fale Conosco
- Audiência Pública - Feijão
- Requerimento de Cópias e Pedido de Vistas
- Oficio nº 786/11 do Presidente da CTNBio encaminhado ao Ministro de Estado da Ciência e Tecnologia

NOTÍCIAS

18/05/2012 00:29:00
CTNBio aprova duas liberações comerciais

19/04/2012 20:18:00
CTNBio realiza primeira reunião sob a nova presidência

23/03/2012 16:46:00
Flavio Finardi é o novo presidente da CTNBio

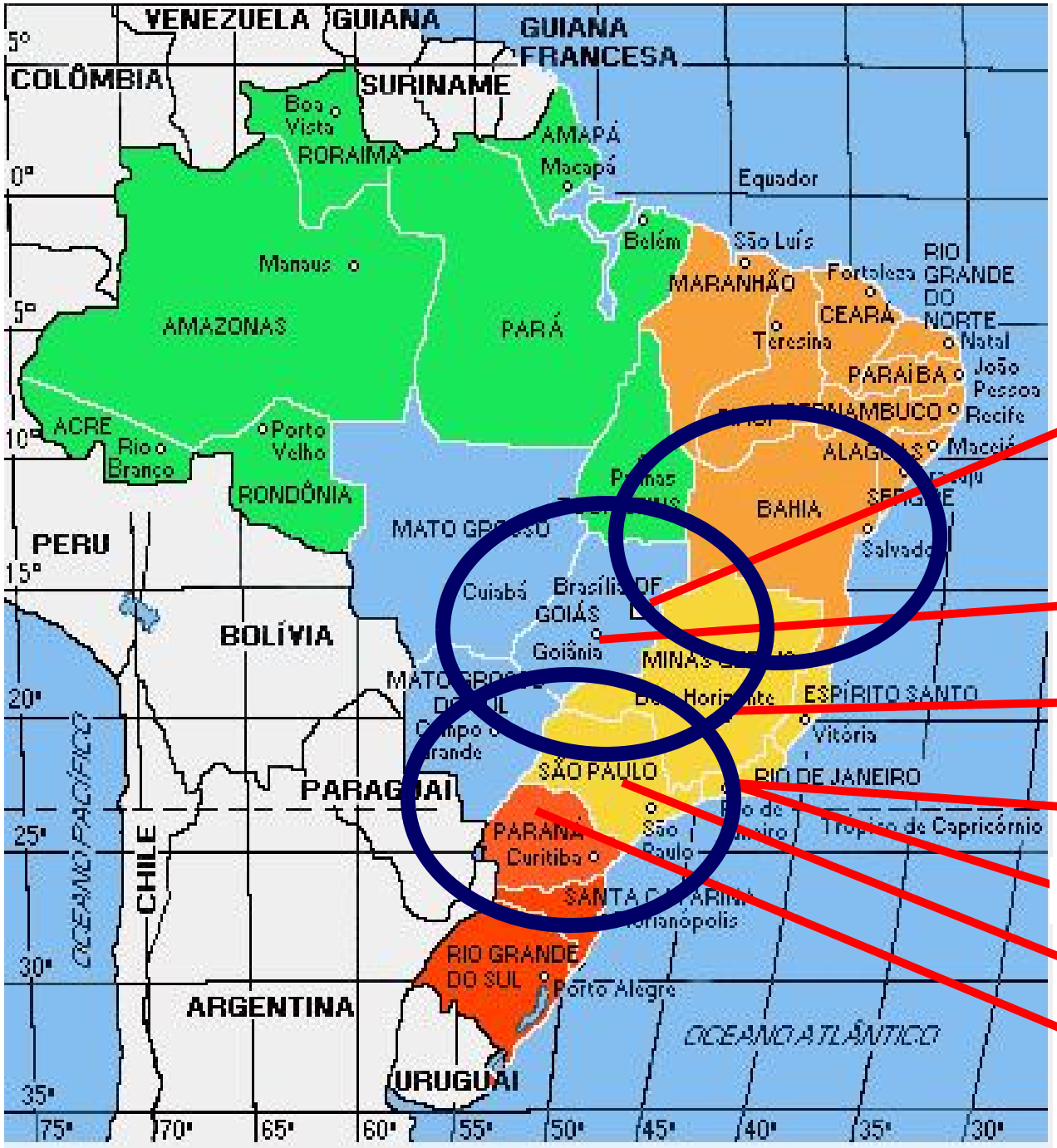
15/03/2012 15:10:00
CTNBio indica nomes para assumir presidência da comissão

Veja aqui a PAUTA DA 152ª REUNIÃO ORDINÁRIA, de 17 de maio de 2012

Veja aqui as DELIBERAÇÕES DA 152ª REUNIÃO ORDINÁRIA, de 17 de maio de 2012

A CTNBio é uma instância colegiada multidisciplinar, criada através da lei nº 11.105, de 24 de março de 2005, cuja finalidade é prestar apoio técnico consultivo e assessoramento ao Governo Federal na formulação, atualização e implementação da Política Nacional de Biossegurança relativa a OGM, bem como no estabelecimento de normas técnicas de segurança e pareceres técnicos referentes à proteção da saúde humana, dos organismos vivos e do meio ambiente, para atividades que envolvam a construção, experimentação, cultivo, manipulação, transporte, comercialização, consumo, armazenamento, liberação e descarte de OGM e derivados.

Embrapa



Common bean
Embrapa 5.1
EMB-PVØ51-1

Genetic Resources and Biotechnology

Rice and Bean

Maize and Shorgum

Agrobiology

Agroindustry

UNESP-Botucatu

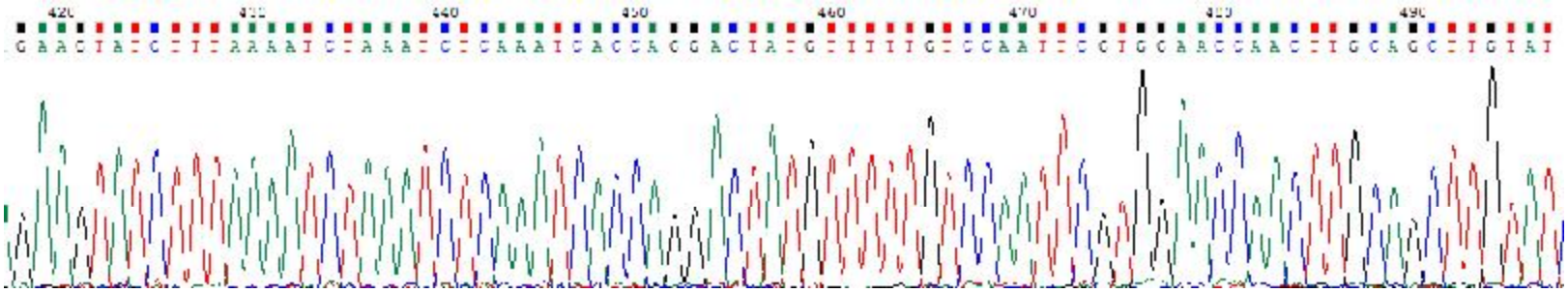
Soybean

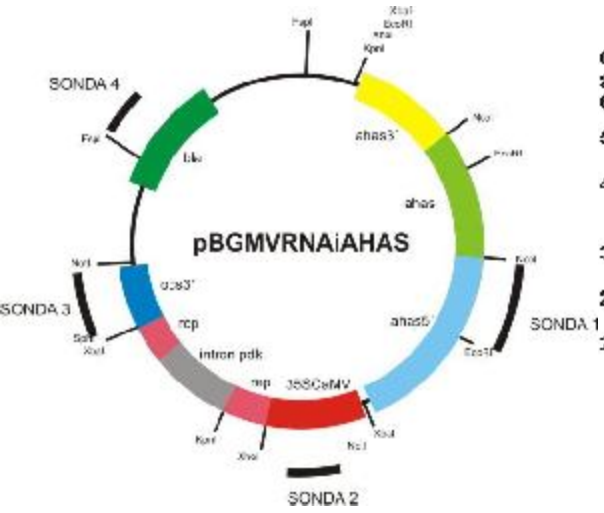
Embrapa

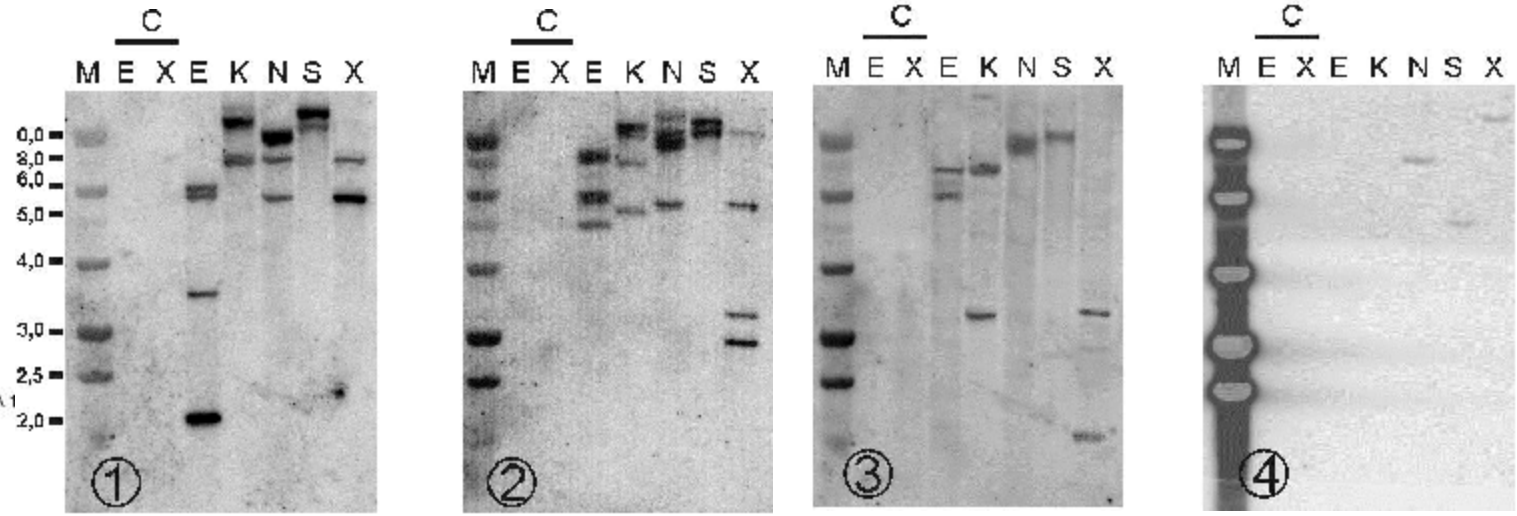
Molecular characterization

- Number of DNA inserts, insert stability
- Number of copies of genetic elements within the insert
- Integrity of gene cassettes
- Presence of additional DNA (backbone)
- Sequence of genomic flanking DNA
- Sequence of the inserted DNA
- DNA LandMarks

Embrapa

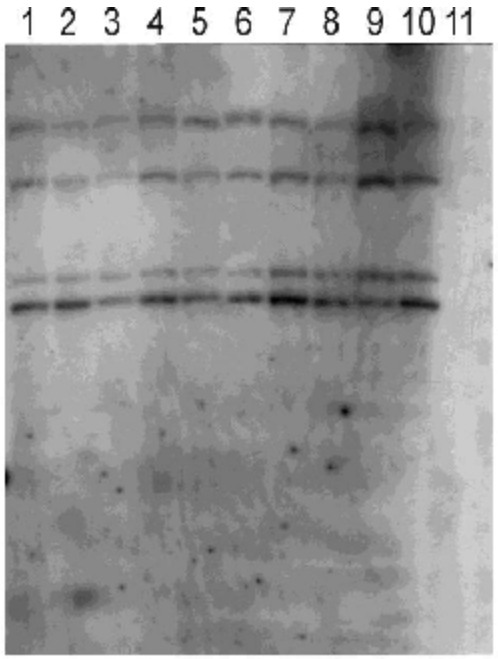






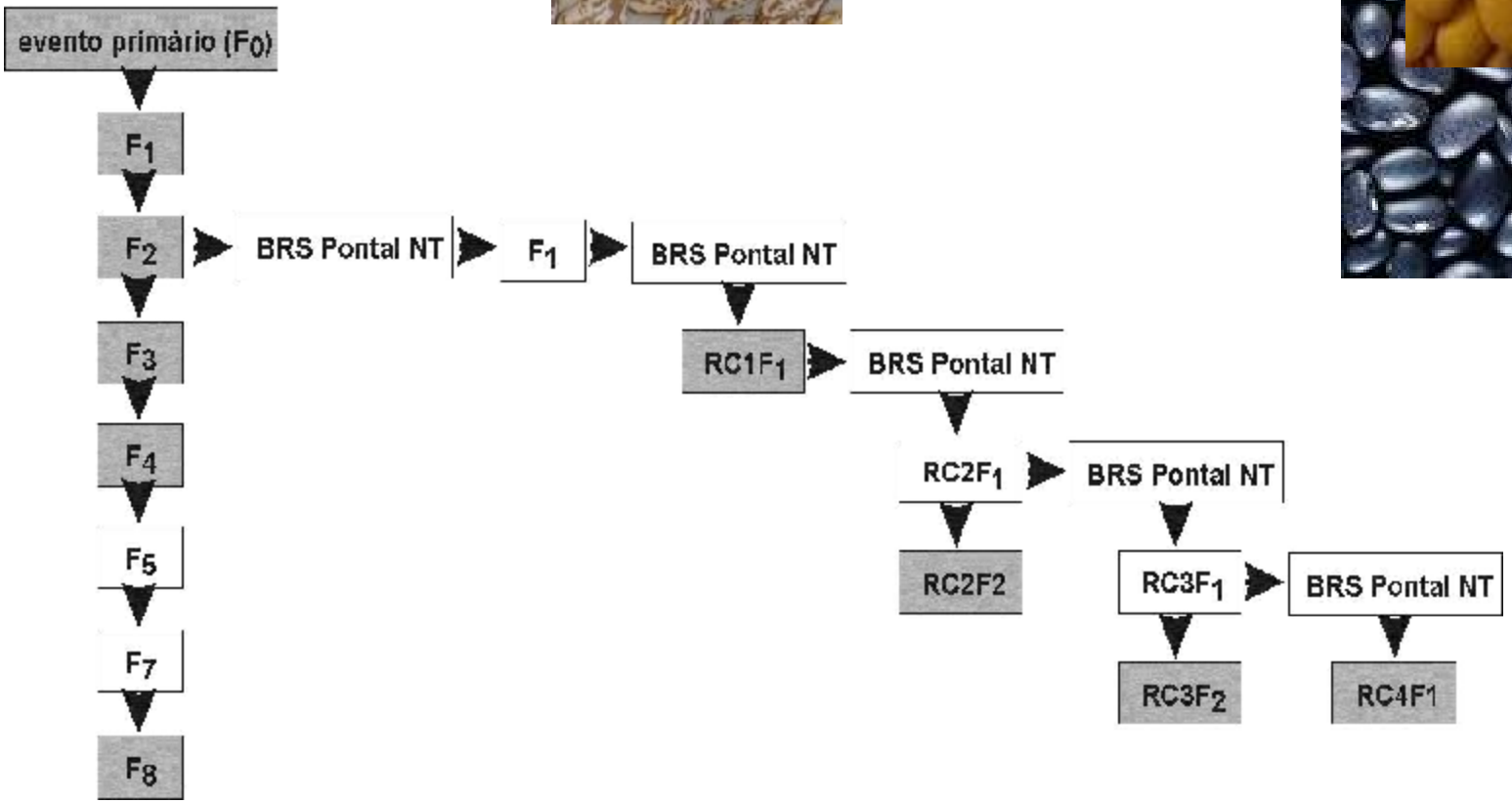
Gene *bla* não funcional

Single locus: segregation of: 3:1



Sonda: XbaI/35S Not/EcoRI

Stability
Generations x after sexual crosses



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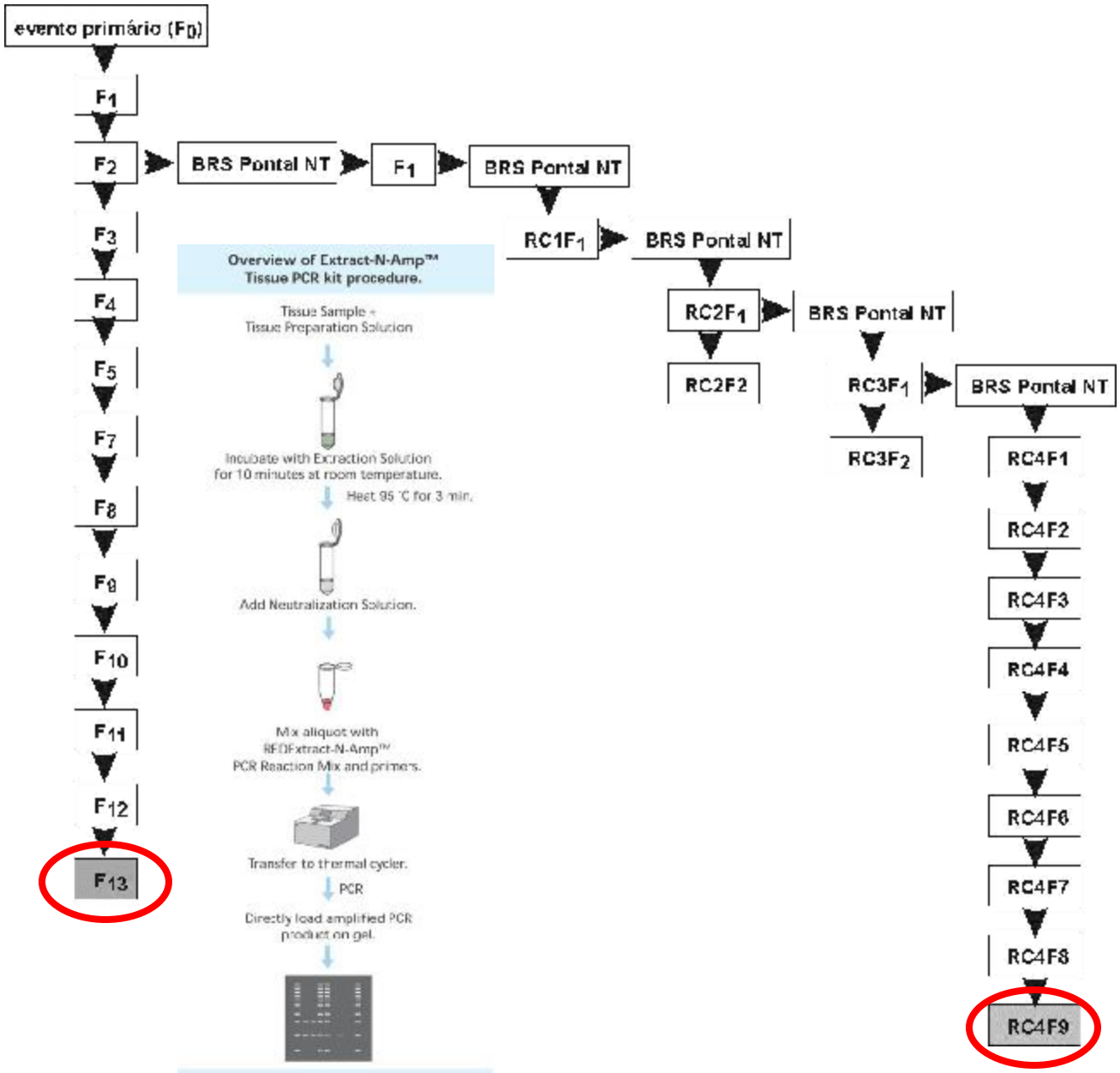
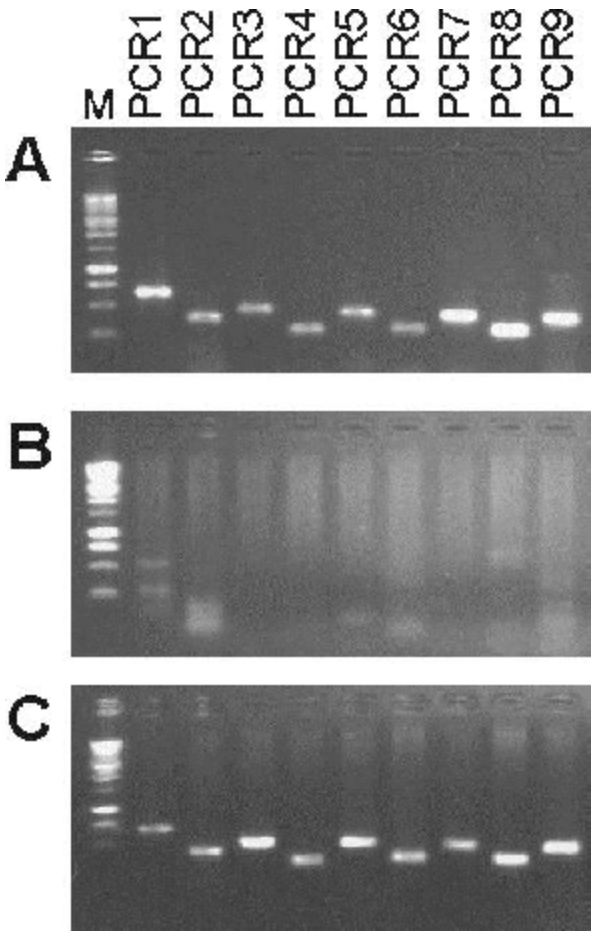
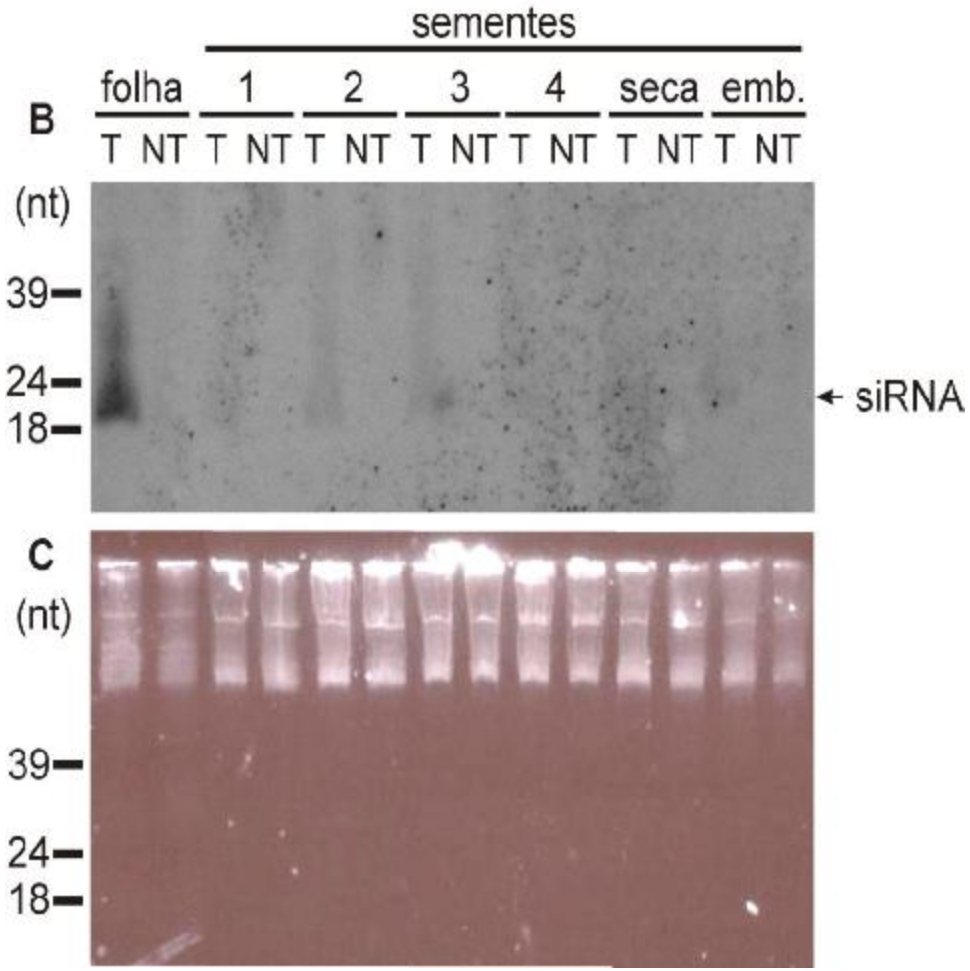
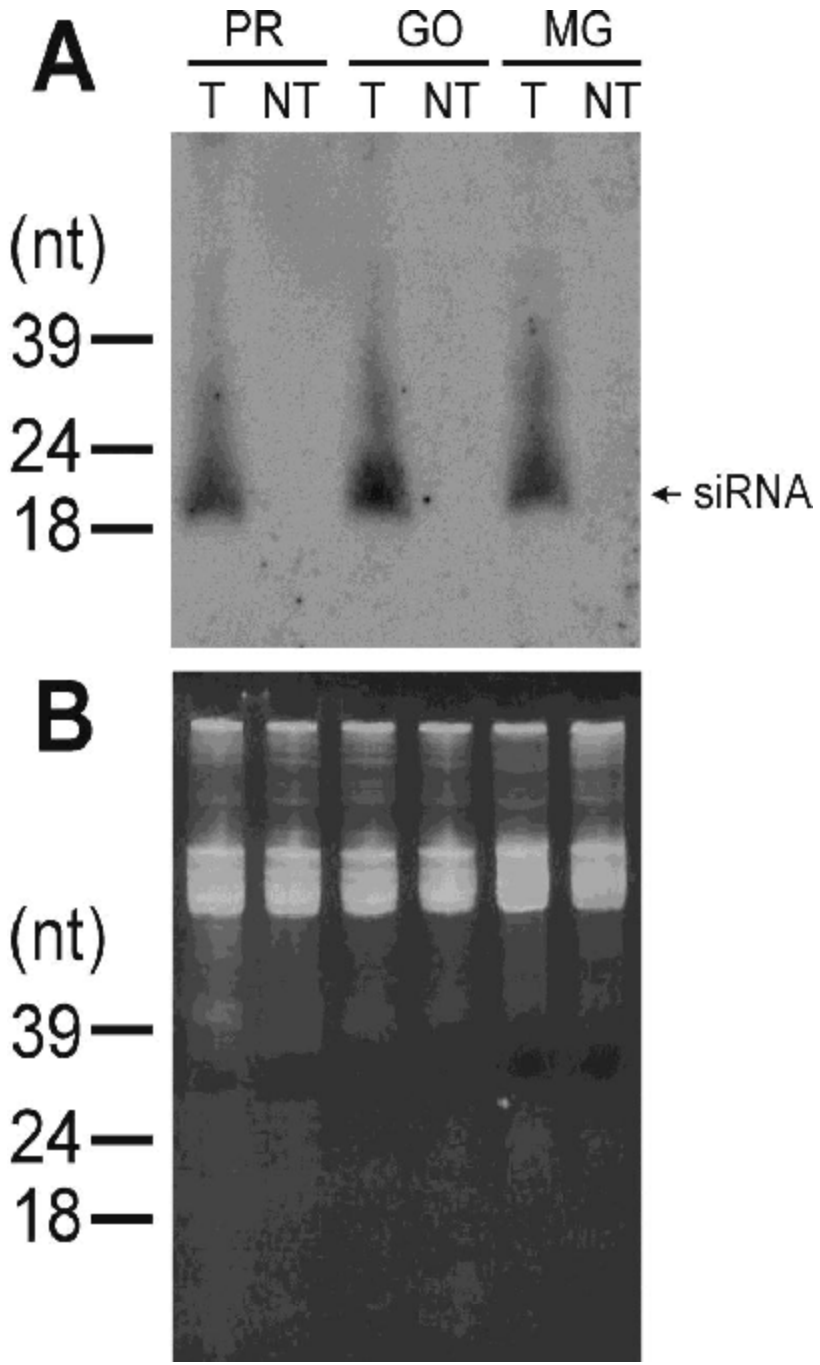

evento primário (F0)
F1
F2
BRS Pontal NT
F1
BRS Pontal NT
RC1F1
BRS Pontal NT
RC2F1
BRS Pontal NT
RC2F2
RC3F1
BRS Pontal NT
RC3F2
RC4F1
RC4F2
RC4F3
RC4F4
RC4F5
RC4F6
RC4F7
RC4F8
RC4F9
F3
F4
F5
F7
F8
F9
F10
F11
F12
F13
Overview of Extract-N-Amp™ Tissue PCR kit procedure.
Tissue Sample + Tissue Preparation Solution
Incubate with Extraction Solution for 10 minutes at room temperature.
Heat 95 °C for 3 min.
Add Neutralization Solution.
Mix aliquot with REDExtract-N-Amp™ PCR Reaction Mix and primers.
Transfer to thermal cycler.
PCR
Directly load amplified PCR product on gel.


M
PCR1
PCR2
PCR3
PCR4
PCR5
PCR6
PCR7
PCR8
PCR9
A
B
C

Embrapa


A
1
2
3
4

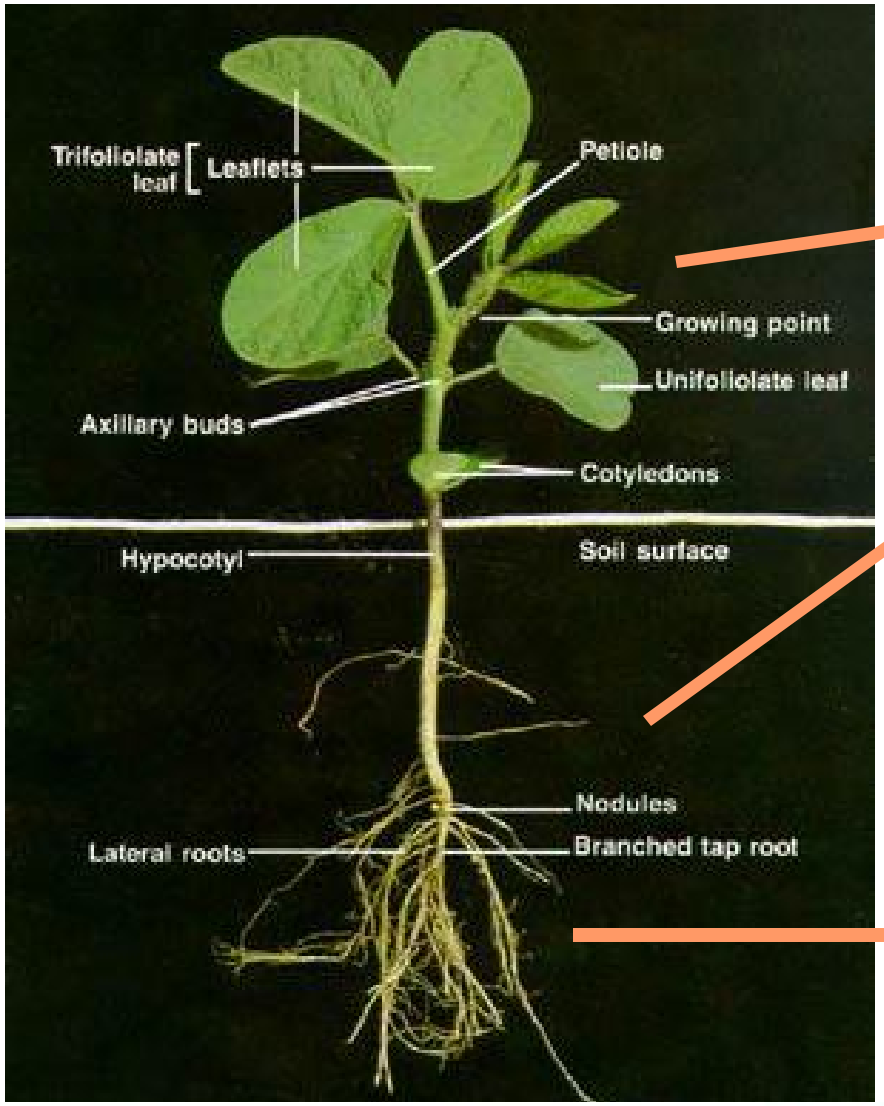

sementes
folha
1
2
3
4
seca
emb.
B
T NT T NT T NT T NT T NT T NT T NT
(nt)
39
24
18
siRNA
C
(nt)
39
24
18

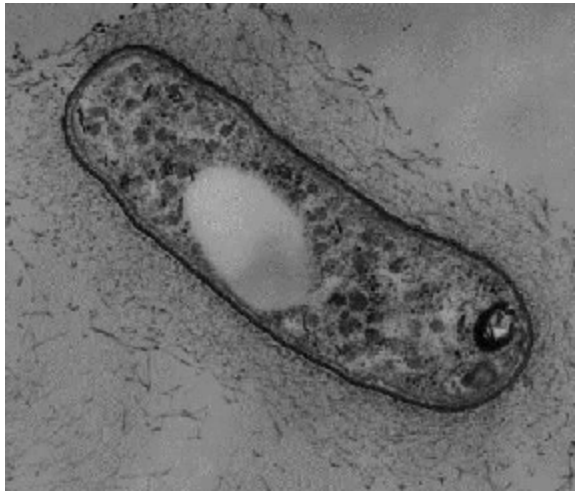

A
PR
GO
MG
T NT T NT T NT
(nt)
39
24
18
siRNA
B
(nt)
39
24
18

Embrapa

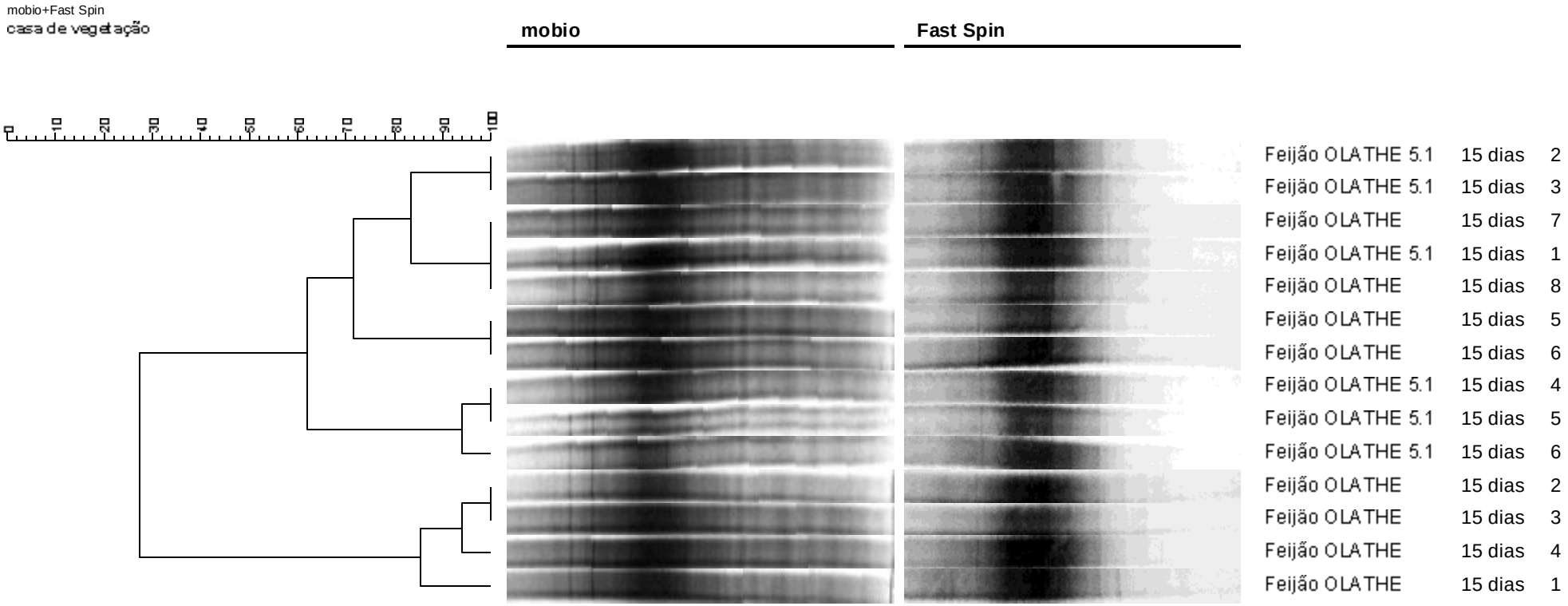
Agronomic equivalence, Environmental safety

- Agronomic / phenotypic assessments
- Weediness assessment (HT)
- Fitness
- Environmental safety
- Environmental fate


Trifoliolate leaf
Leaflets
Petiole
Growing point
Unifoliolate leaf
Axillary buds
Cotyledons
Hypocotyl
Soil surface
Nodules
Lateral roots
Branched tap root

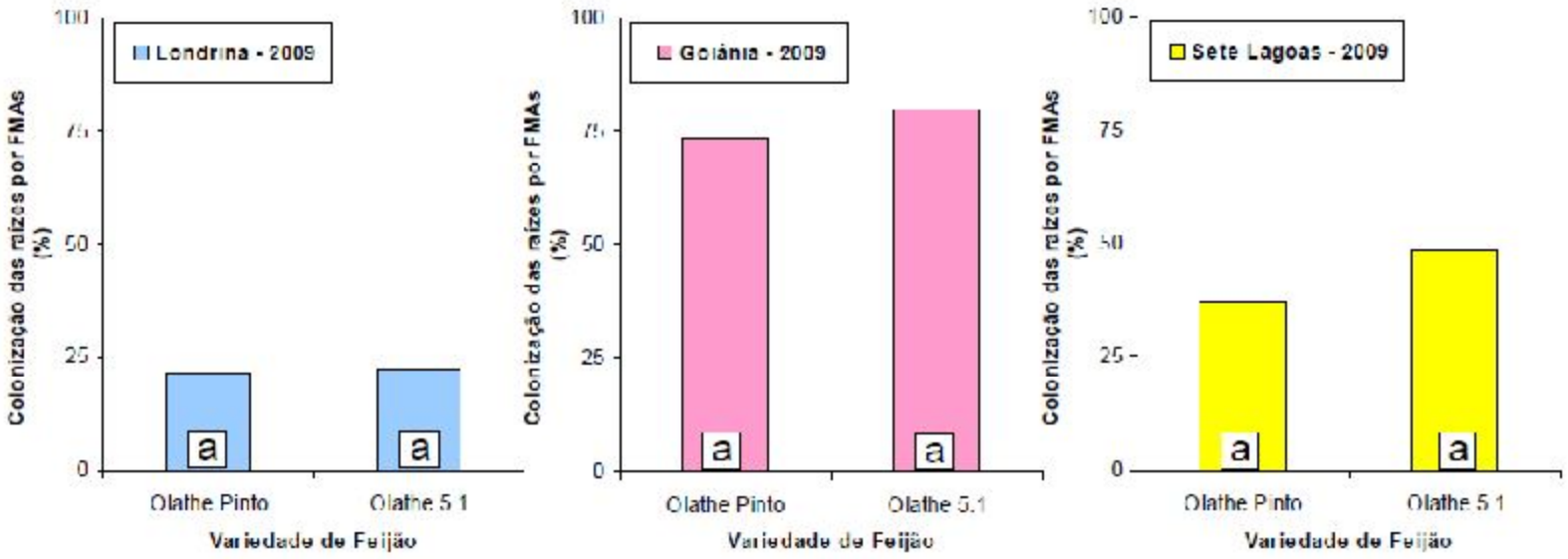


Embrapa

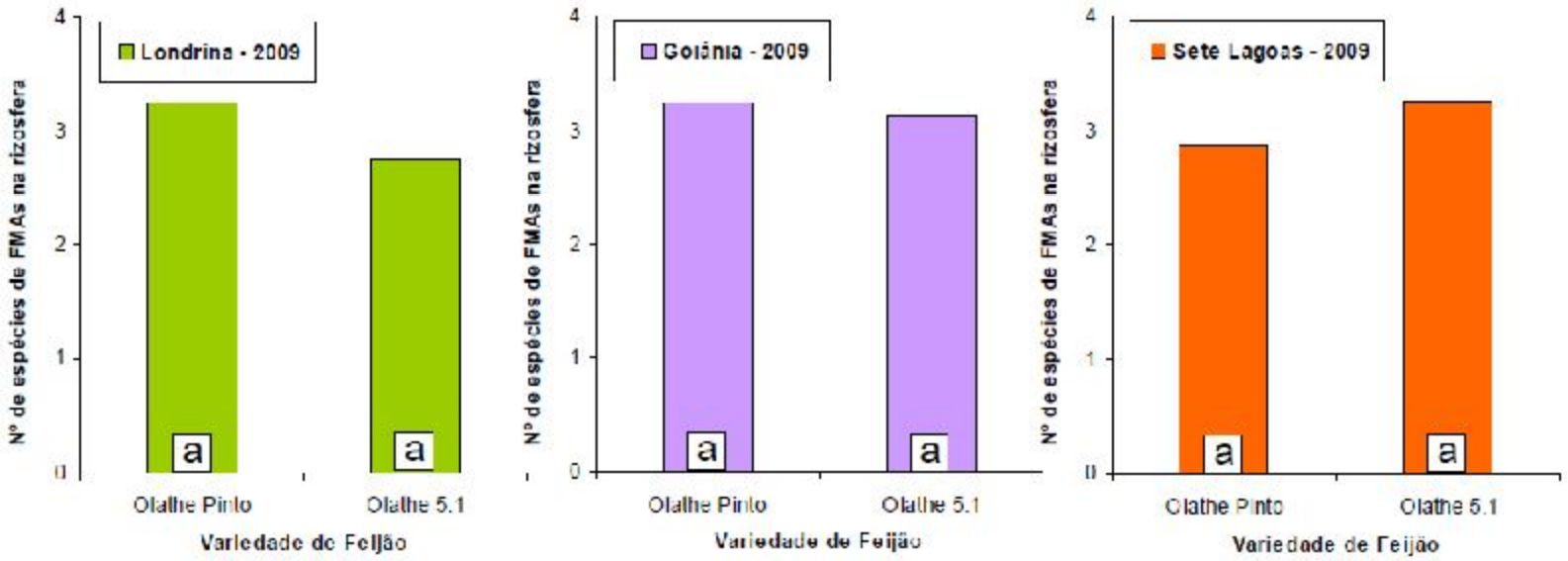


No consistent change of bacterial community based on 16s rDNA

Root colonization by indigenous NF mycorrhiza



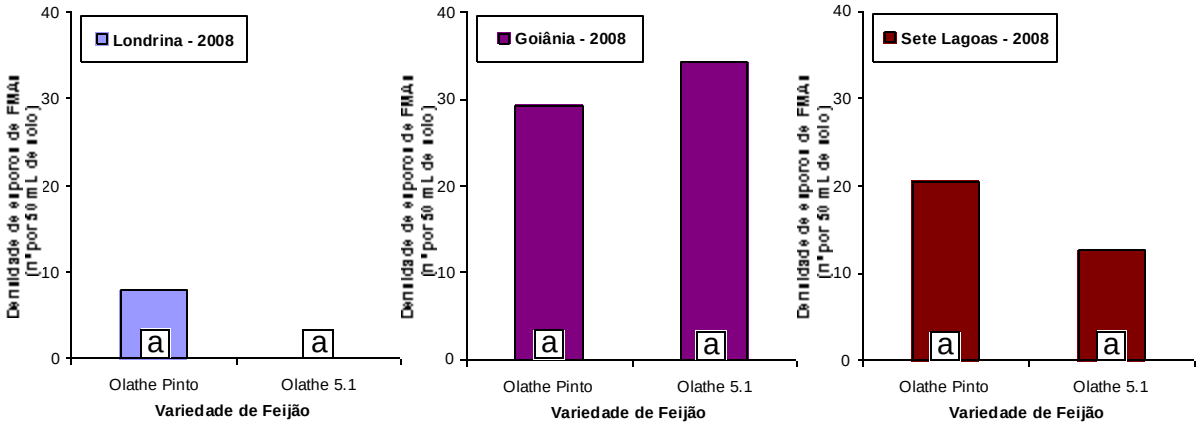
Populations of NFM in roots



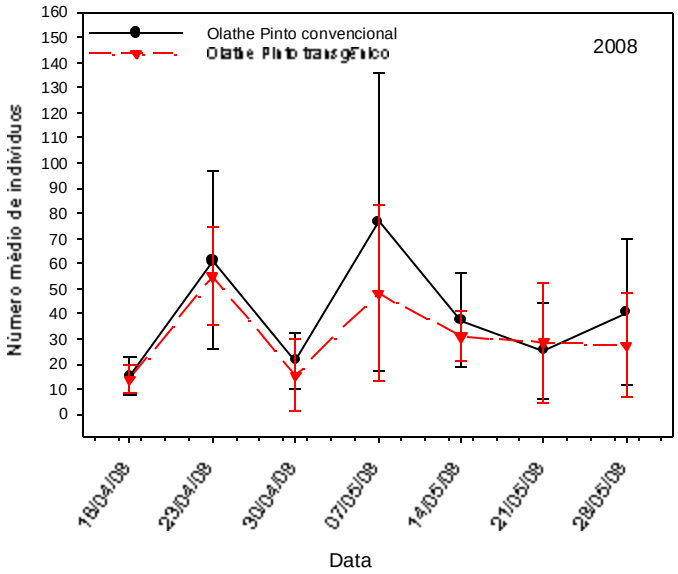
Bean growth under the effect of Rhizobium inoculation

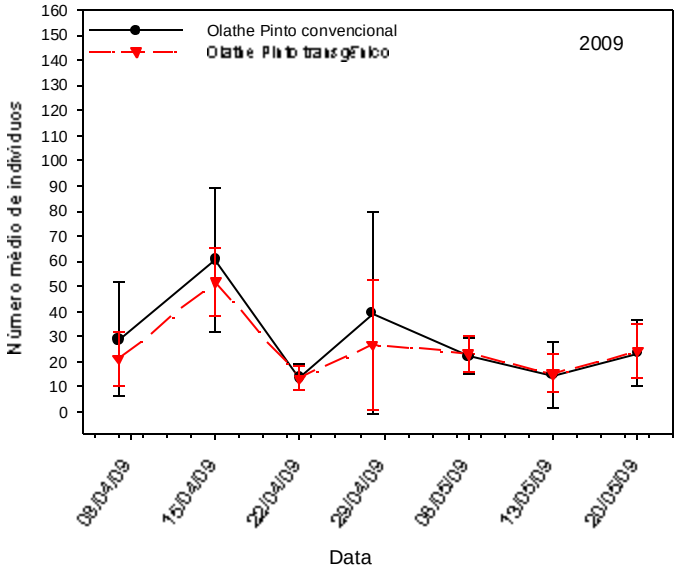
Nodulation and dependence by N fixation by bean plants

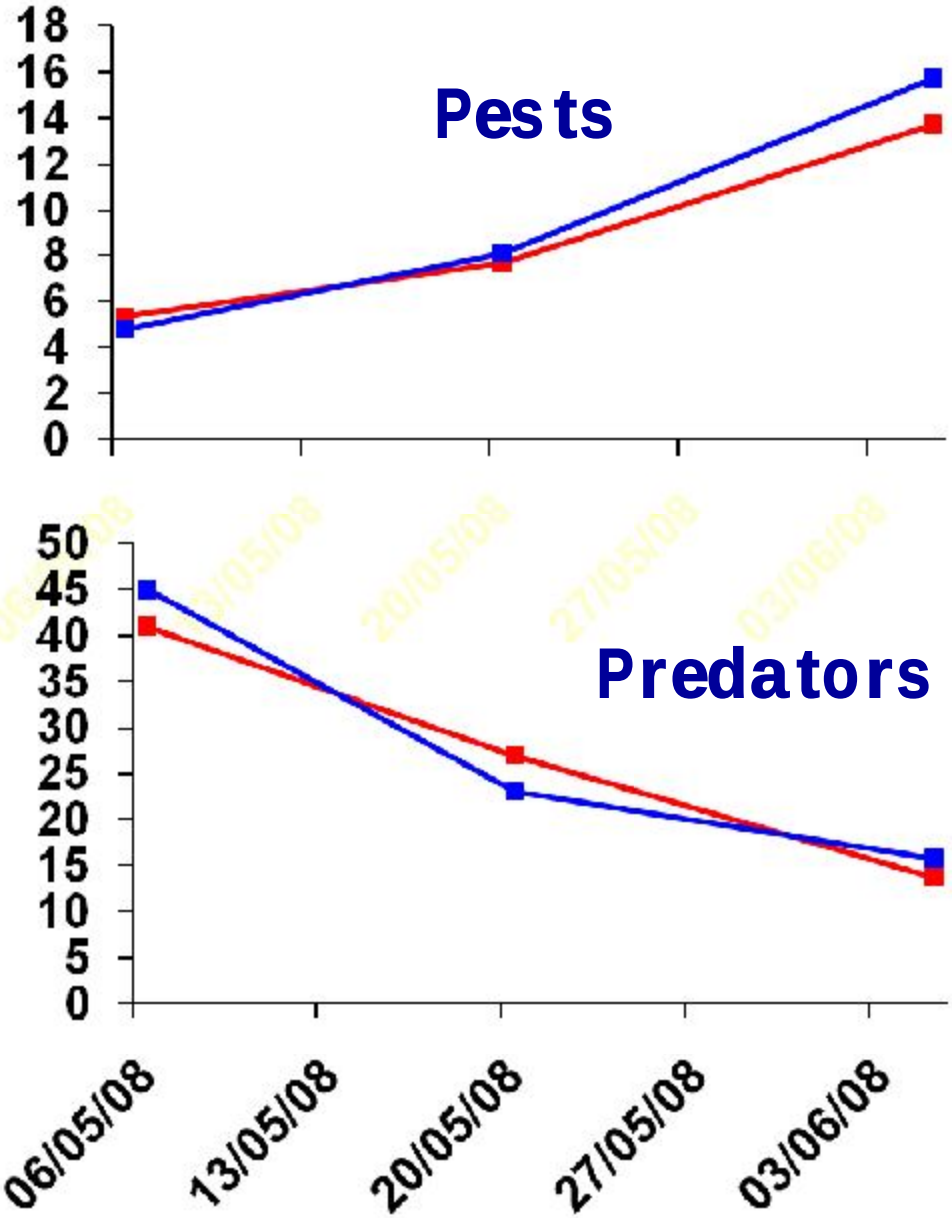
Community of arbuscular mycorrhizal fungi and their association with the roots of bean plants



Fluctuation of arthropod populations






Pests
Predators
FT
FC
18
16
14
12
10
8
6
4
2
0
50
45
40
35
30
25
20
15
10
5
0
06/05/08
13/05/08
20/05/08
27/05/08
03/06/08

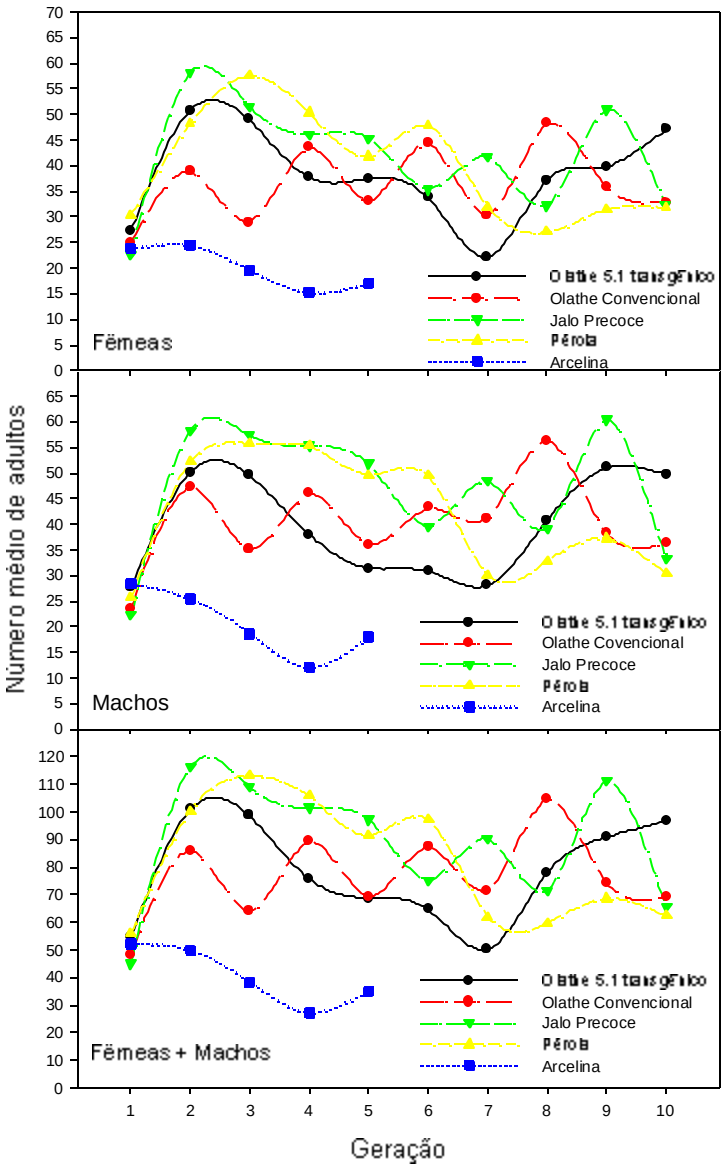
Embrapa

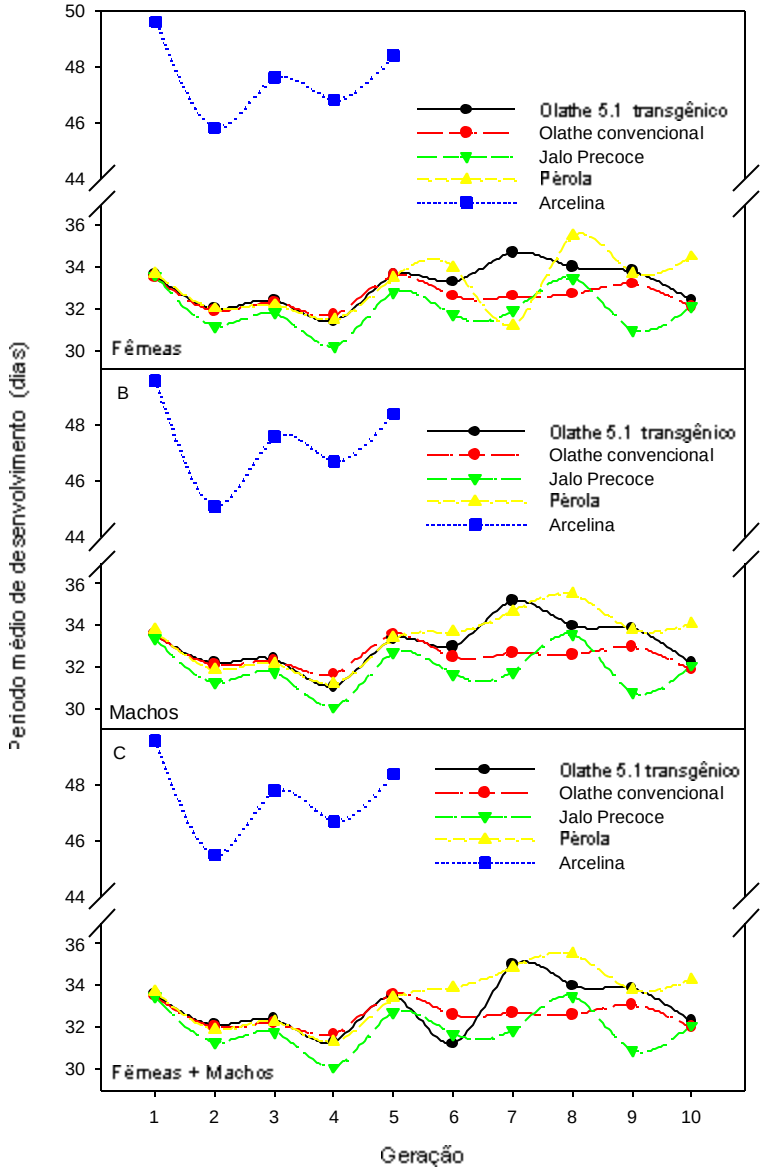
Effect on *Zabrotes subfasciatus*

- Number of eggs / grain (10 d after removal of adults);
- Number of emerged adults (daily), date of emergence;
- Number of holes / grain (after emergence of all adults);
- Dry mass of males and females;
- Sex ratio;
- The 10/1 emerged couples were used to infest new grain;

- We evaluated 10 generations of bruchids

Embrapa





Effect on *Zabrotes subfasciatus* for several generations

Embrapa

Agronomic characterization: Production, germination, early seedling height, maximum width of the primary leaves, maximum length of the primary leaves, number of seeds per pod, weight of 100 seeds, pod length, pod width, seed length, seed width, thickness of seeds, flowering

Table 1 Agronomic traits in bean transgenic line 5.1 cultivated in the field during low-disease-incidence season in three regions of Brazil

Trait	Goiás[a]		Minas Gerais[a]		Paraná[a]	
	Control	Transgenic	Control	Transgenic	Control	Transgenic
Yield (kg/ha)	770.8	628.1	2,460	2,476	2,268	2,344
Seed germination (%)	86.9	91.4	87.9	85.4	75.2	86.2
Initial plant height (cm)	10.4	10.2	13.6	13.5	9.9	9.7
Width of the leaves (cm)	6.8	6.7	7.4	7.3	6.4	6.3
100-seed weight (g)	27.3	29.7	31.0	32.1	31.4	32.7
Flowering time (days after germination)	31	31	32	32	30	30
Seeds per pod	5.8	5.7	5.3	5.4	5.6	5.7

*Statistical analyses revealed no significant differences ($P < 0.05$; Tukey studentized range test, $n = 8$) between transgenic and control lines. [AU: * not found in table; [a] not explained in legend. Does the * refer to the [a] instead? If the P value applies to all data in the table, it is not necessary to include a footnote on all columns — just state in legend.]

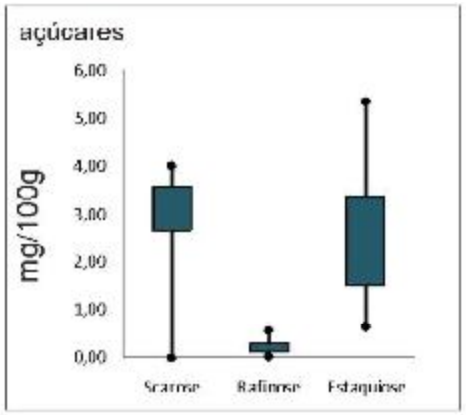
Aragão & Faria, Nature Biotechnology, 27:1086-1088 (2009)

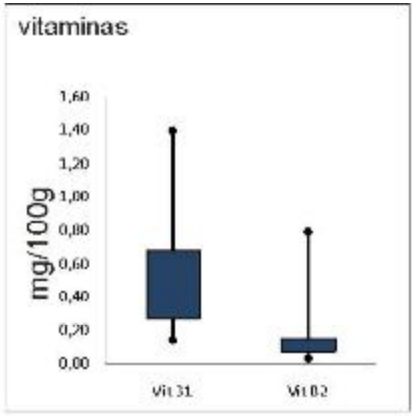
Embrapa

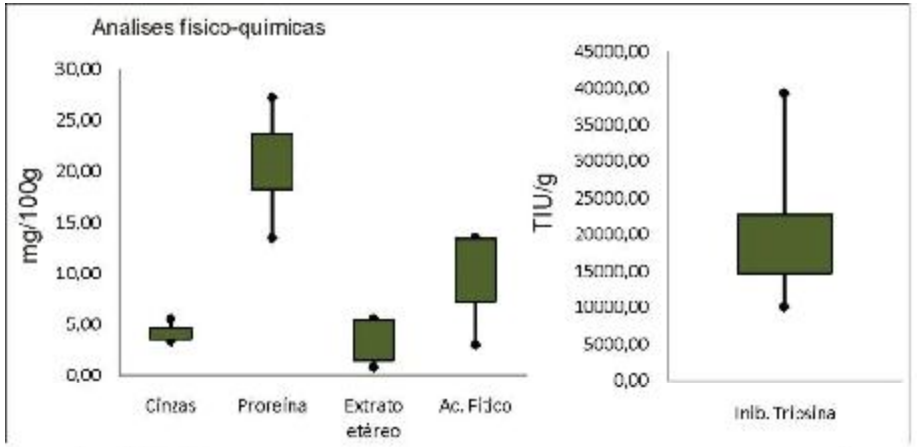
Composition equivalence, Nutritional equivalence

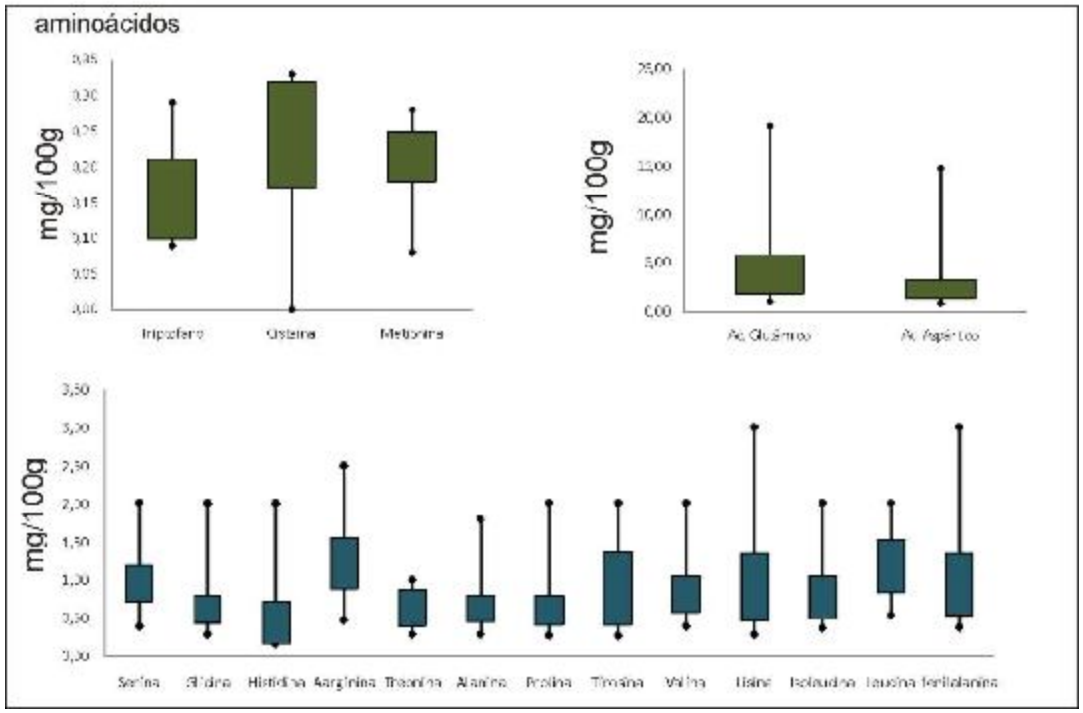
- Grain samples from multi-location, multi-year, replicated field trials
- Secondary metabolites
- Pilot scale processing, nutrient / antinutrient analysis (validated methods)
- Confirmation of food/feed safety
- Animal feeding studies

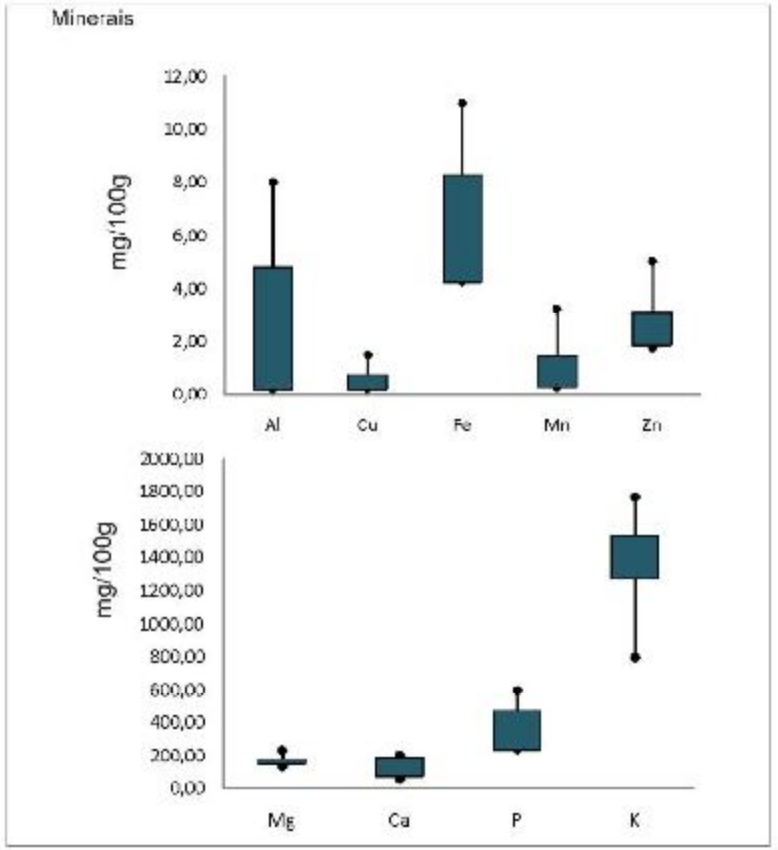
Sugars: Sucrose, raffinose, Stachyose
Vitamins: Vitamin B1, Vitamin B2
Amino acids: Tryptophan, Cysteine, Methionine, Glutamic Acid, Serina, Glycine, Histidine, Arginine, Threonine, Alanine, Proline, Tyrosine, Valine, Lysine, Isoleucine, Leucine, Phenylalanine.
Physic-Chemical Analyses: Moisture, ash, protein, phytic acid, trypsin inhibitor, etc
Minerals: Aluminum, Calcium, Lead, Cobalt, Copper, Chromium, Iron, Phosphorus, Magnesium, Molybdenum, Potassium, Selenium, Sodium, Zinc
Sensorial Analyses


açúcares
mg/100g
6,00
5,00
4,00
3,00
2,00
1,00
0,00
Scarose
Rafinose
Estaquiose


vitaminas
mg/100g
1,60
1,40
1,20
1,00
0,80
0,60
0,40
0,20
0,00
Vit B1
Vit B2


Analises fisico-quimicas
mg/100g
30,00
25,00
20,00
15,00
10,00
5,00
0,00
Cinzas
Proteína
Extrato etéreo
Ac. Fítico
TIU/g
45000,00
40000,00
35000,00
30000,00
25000,00
20000,00
15000,00
10000,00
5000,00
0,00
Inib. Tripsina


aminoácidos
mg/100g
Triptofano
Cisteína
Metionina
mg/100g
Ac. Glutâmico
Ac. Aspártico
mg/100g
Serina
Glicina
Histidina
Arginina
Treonina
Alanina
Prolina
Tirosina
Valina
Lisina
Isoleucina
Leucina
Fenilalanina


Minerais
mg/100g
12,00
10,00
8,00
6,00
4,00
2,00
0,00
Al
Cu
Fe
Mn
Zn
mg/100g
2000,00
1800,00
1600,00
1400,00
1200,00
1000,00
800,00
600,00
400,00
200,00
0,00
Mg
Ca
P
K

Embrapa

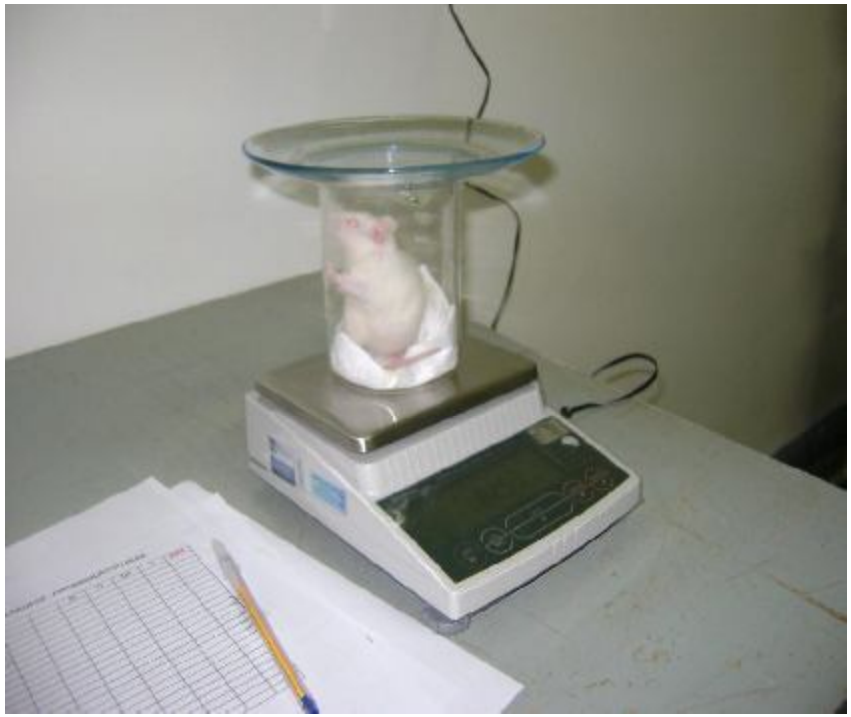
- Growth
- food consumption
- histomorphological studies
- biochemical analyses

Rattus norvegicus

siRNA and cooked grains

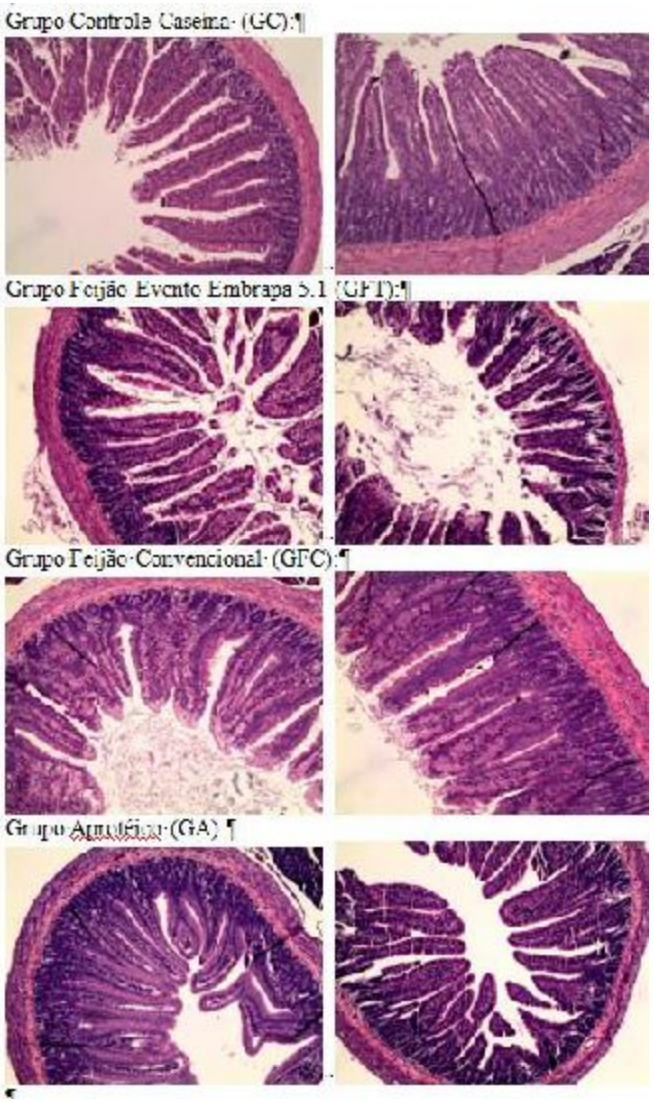
Experimental Protocol
(67/08-CEEA-UNESP)

Embrapa

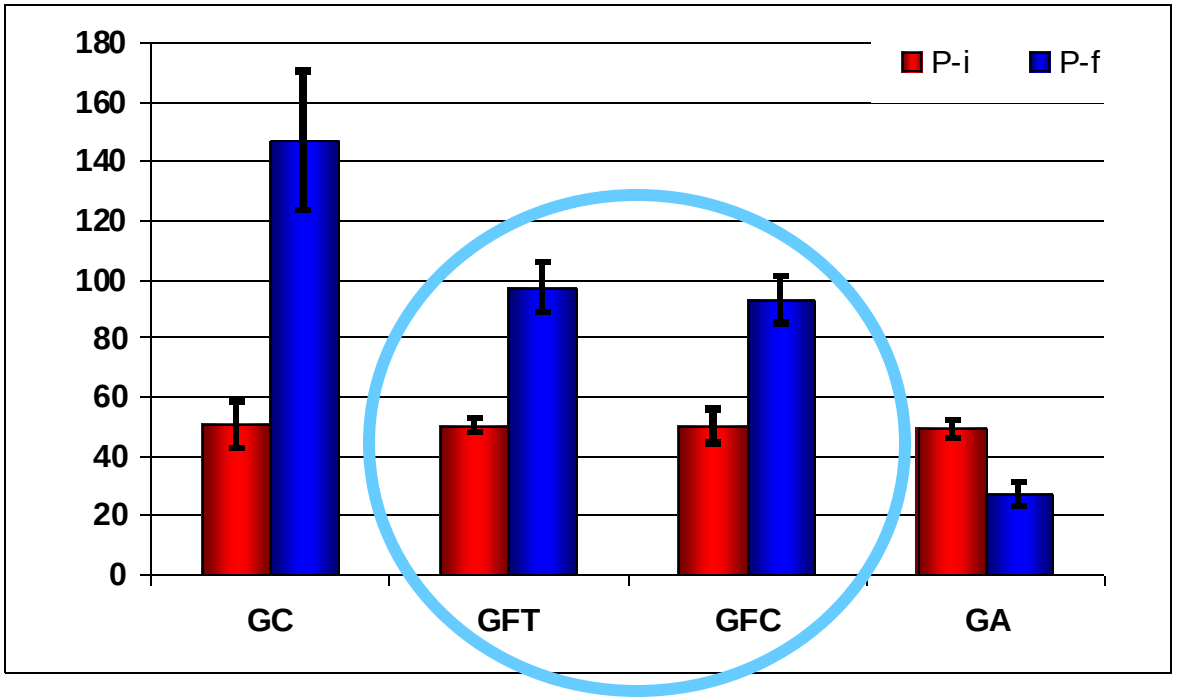


Rattus norvegicus

Embrapa



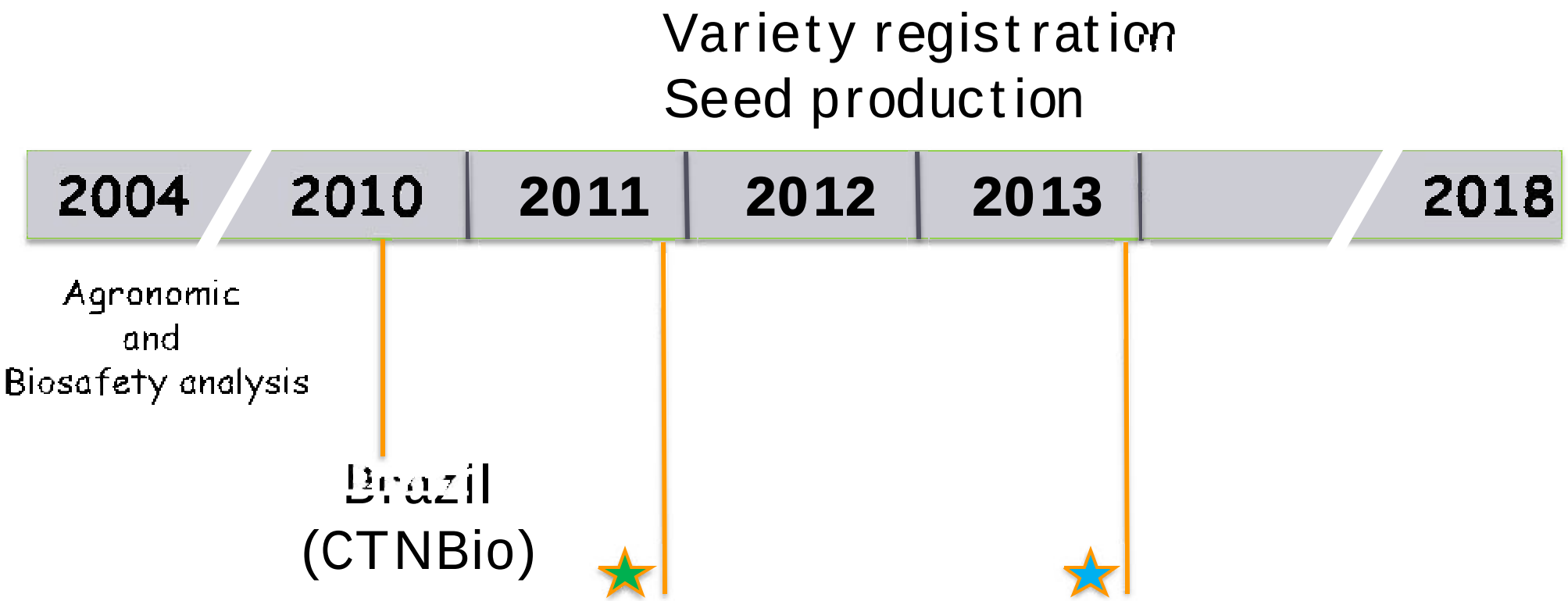
Stomach, intestine, duodenum, jejunum, uterus, hepatocytes, liver, kidneys, heart, thymus, ovaries, testicle and femur



Biochemical analyzes (two generations)

renal dysfunction
injury to the liver
hepatic dysfunction

Embrapa



Post commercial evaluations
(5 years ?)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Muchas Gracias !

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CNPq
Conselho Nacional de Desenvolvimento Científico e Tecnológico

FINEP

Embrapa

Ministério da Agricultura, Pecuária e Abastecimento

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