



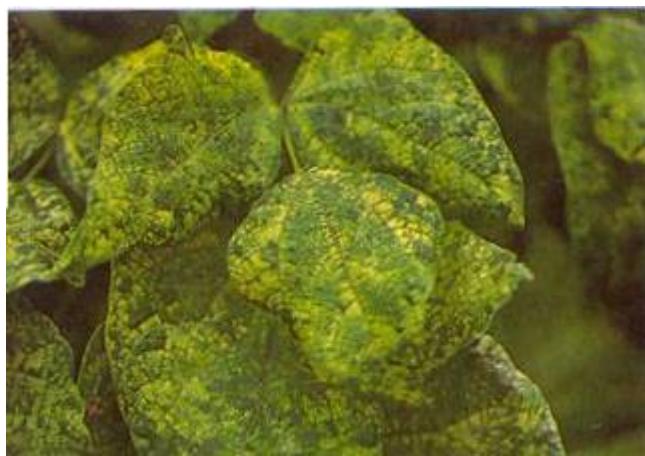
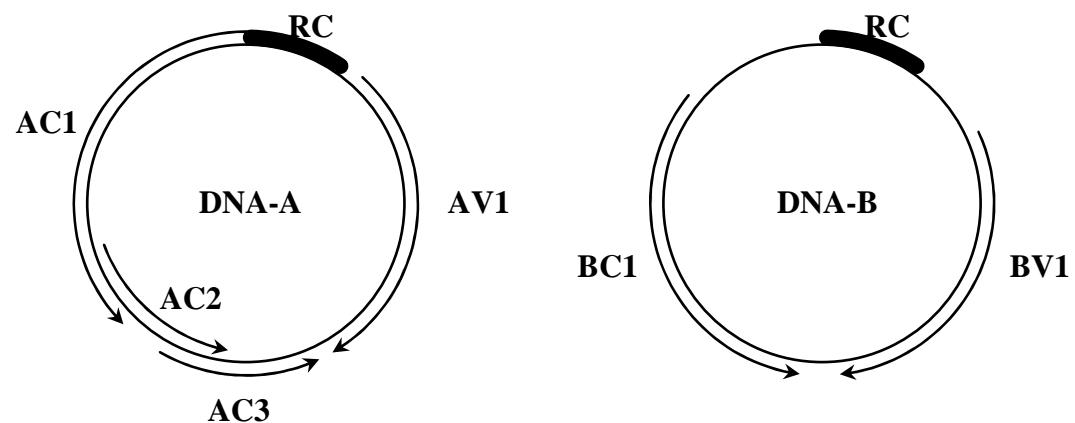
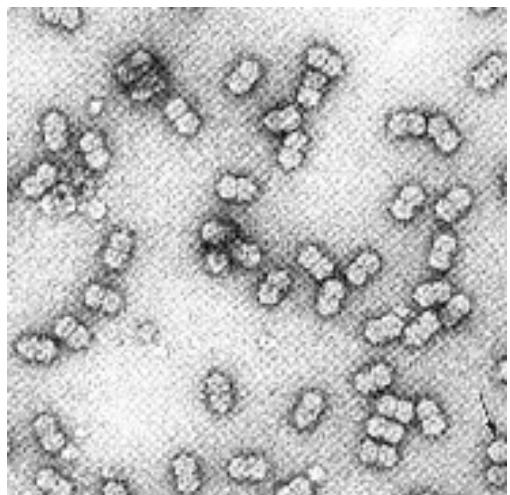
O feijão GM resistente ao mosaico dourado [evento Embrapa 5.1 (EMB-PV051-1)]

Embrapa

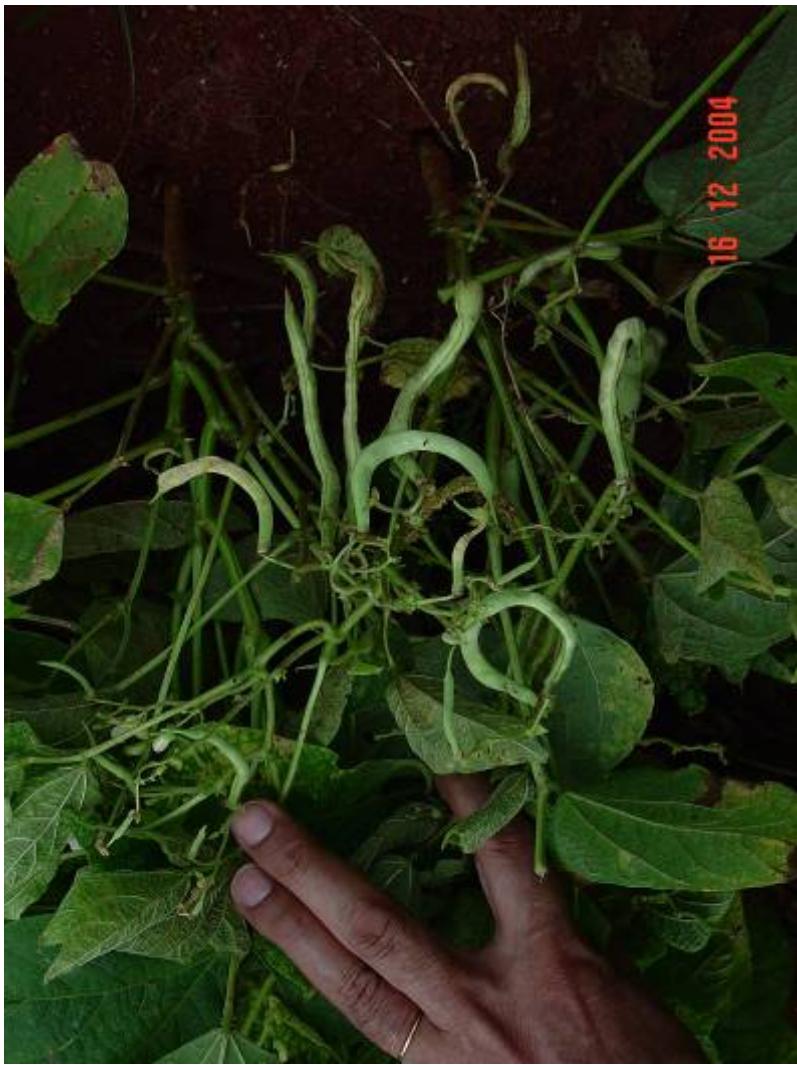
aragao@cenargen.embrapa.br
josias@cnpaf.embrapa.br



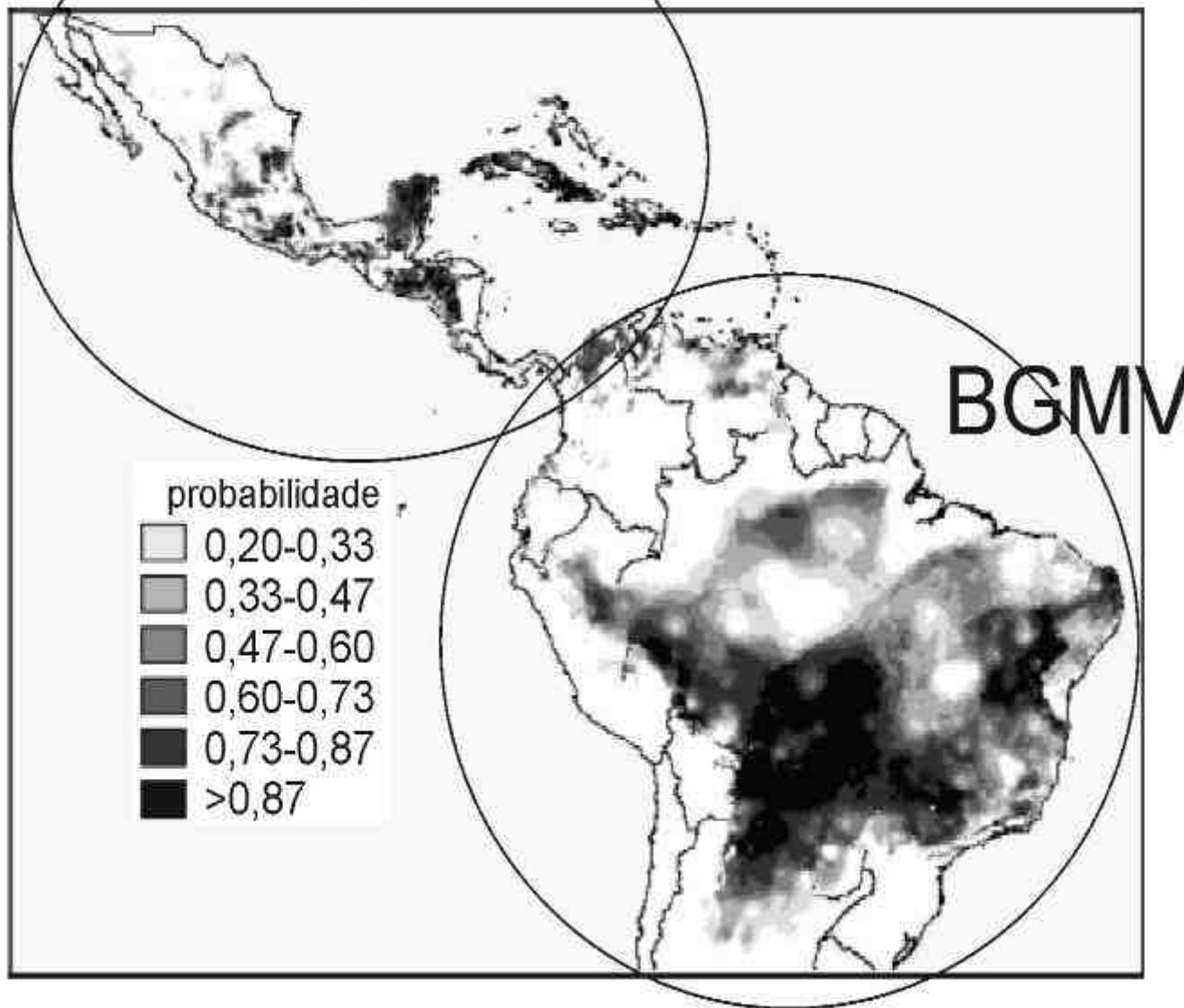
Perda anual 90,000 a 280,000 tons.
Suficiente para alimentar 6 M a 20 M de adultos.

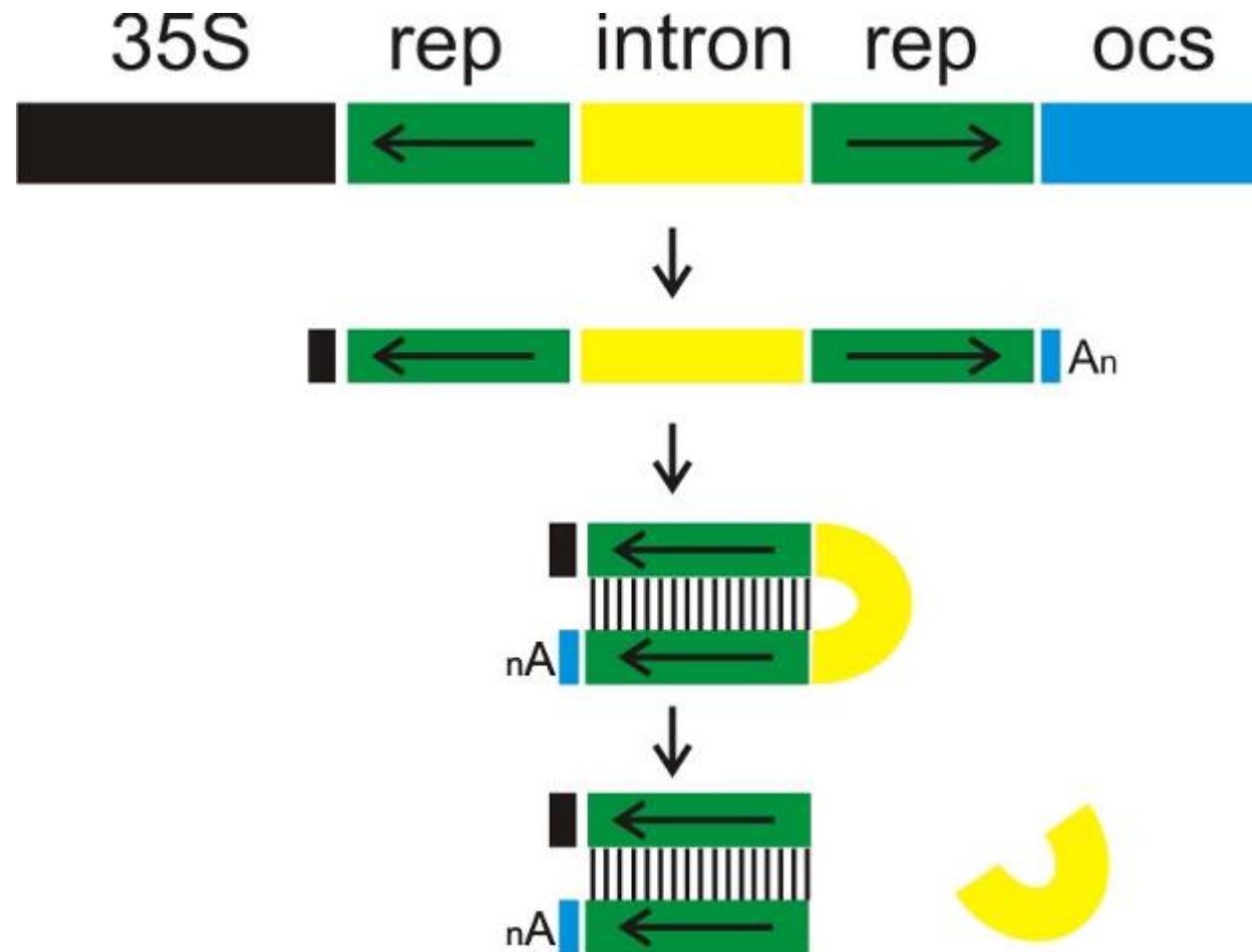






BGYMV

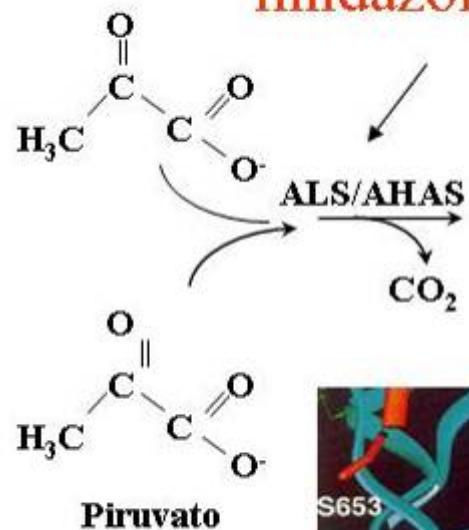




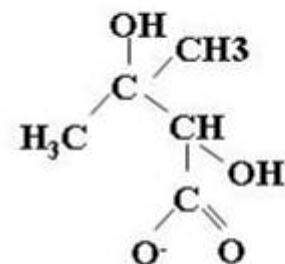
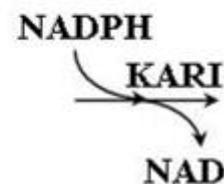
RNA interferente
(RNAi)

Piruvato

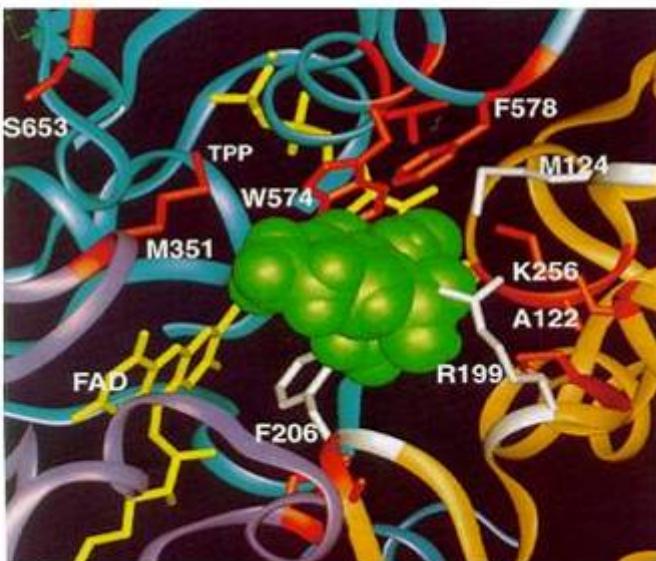
imidazolinonas



α - Acetolactato



Valina
Isoleucina
Leucina

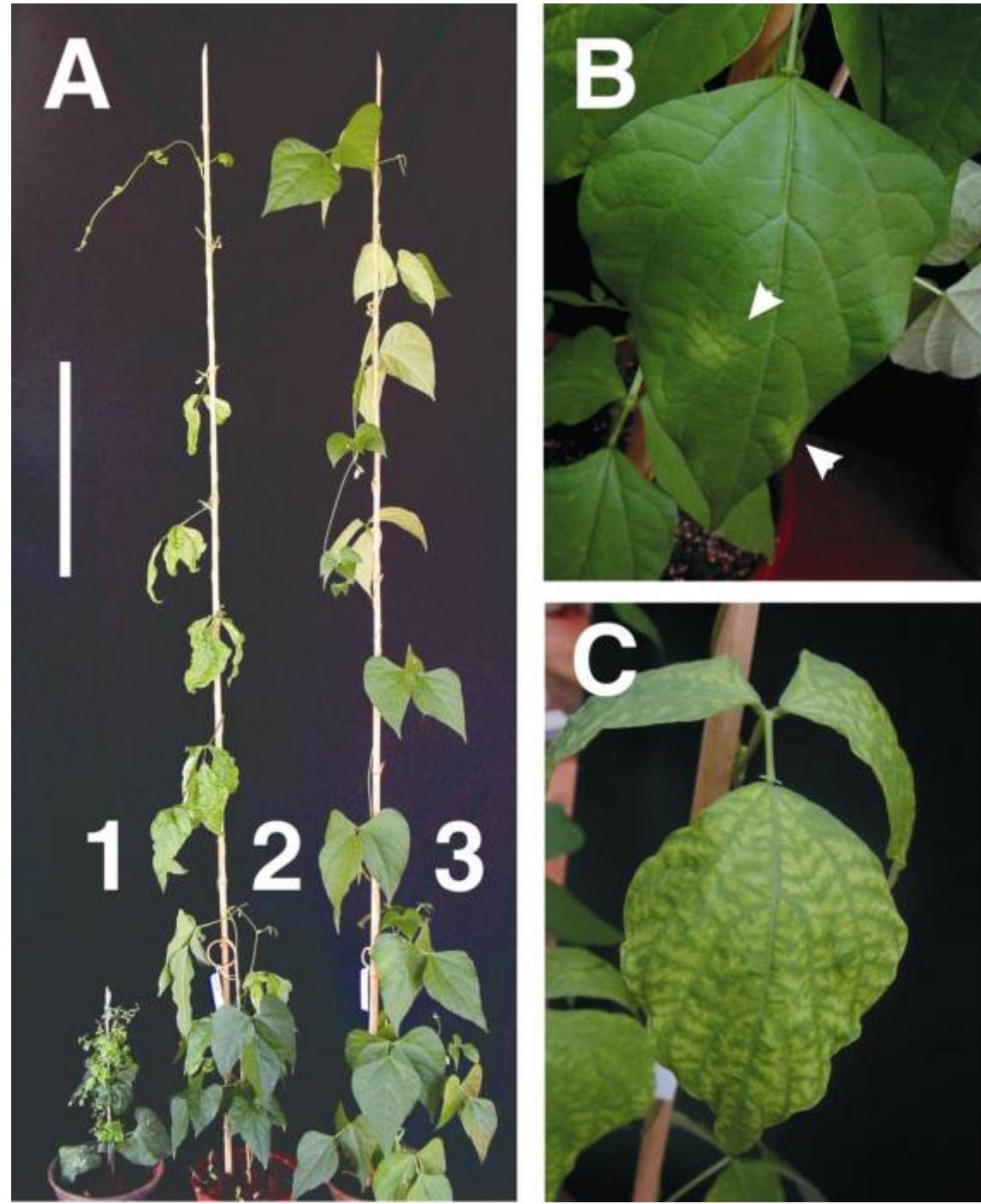


Arabidopsis thaliana AHAS

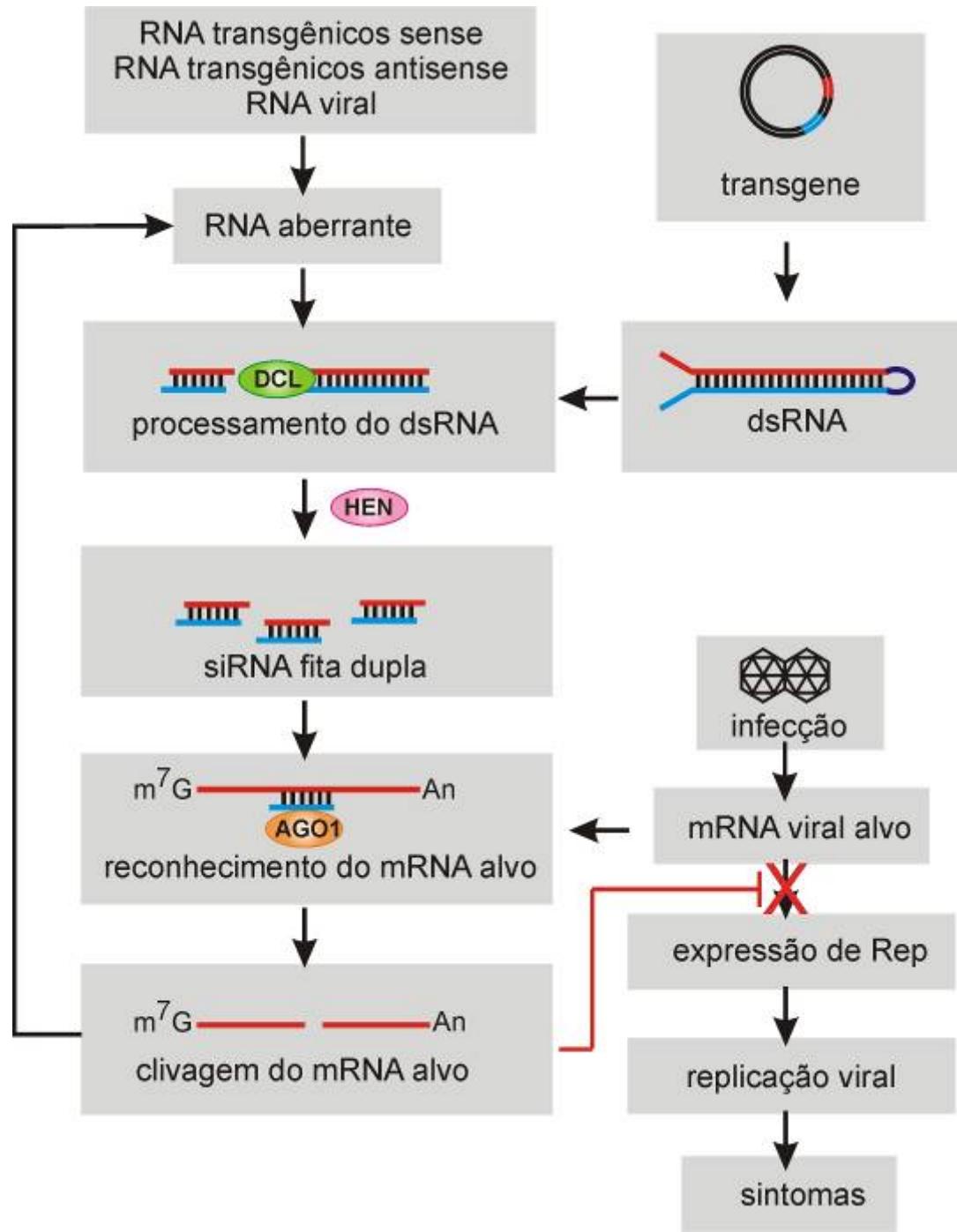


**Várias construções
Linhagens GM 5.1 e 3.2**

Bonfim et al. 2007



Embrapa







a



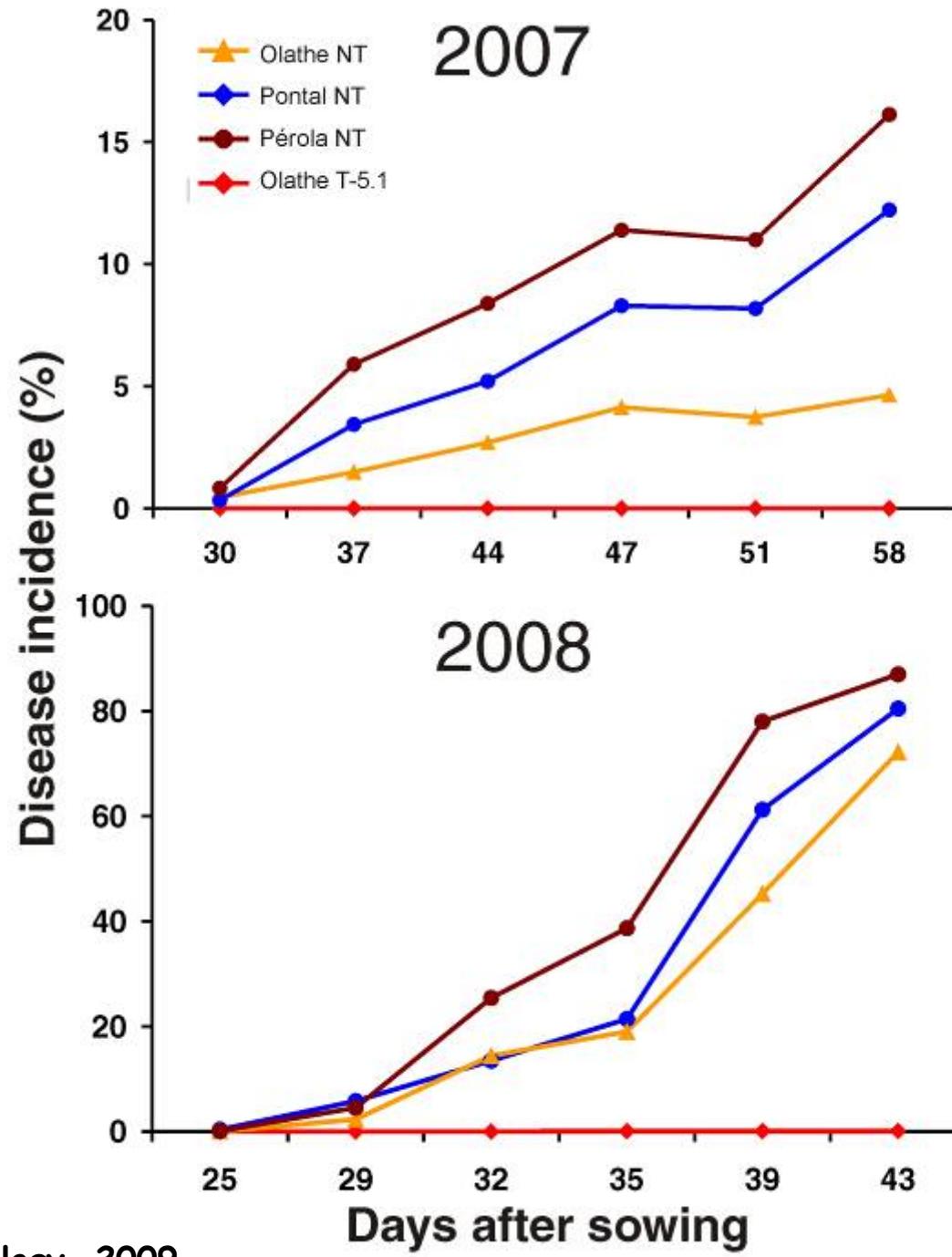
b



c



d



Homozigose (100 % de resistência)

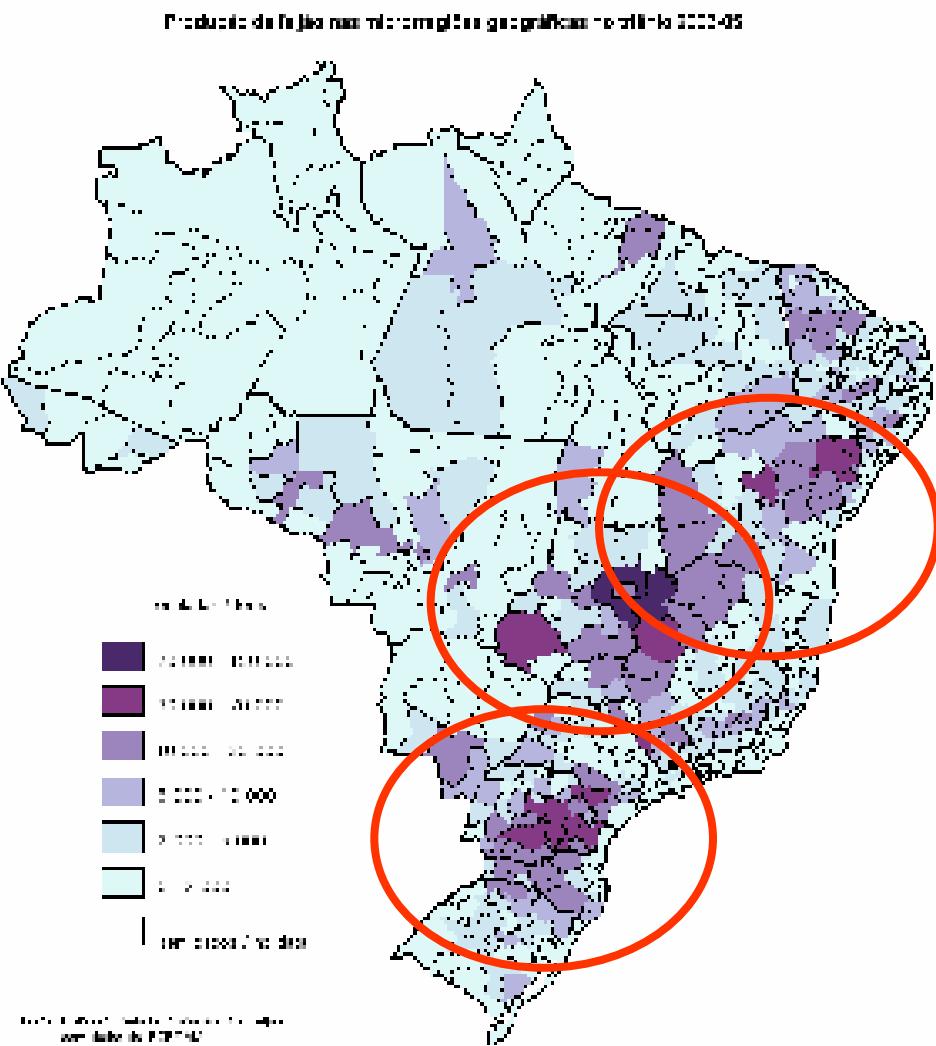
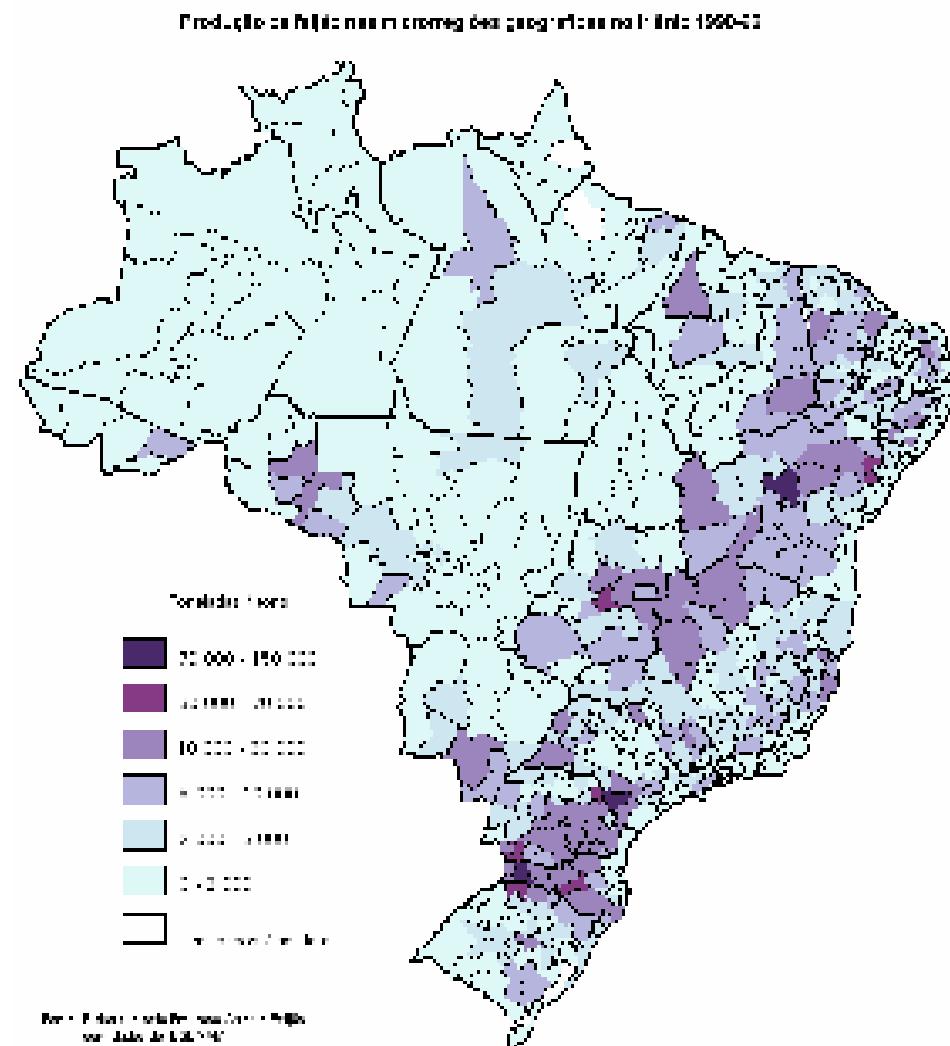
X

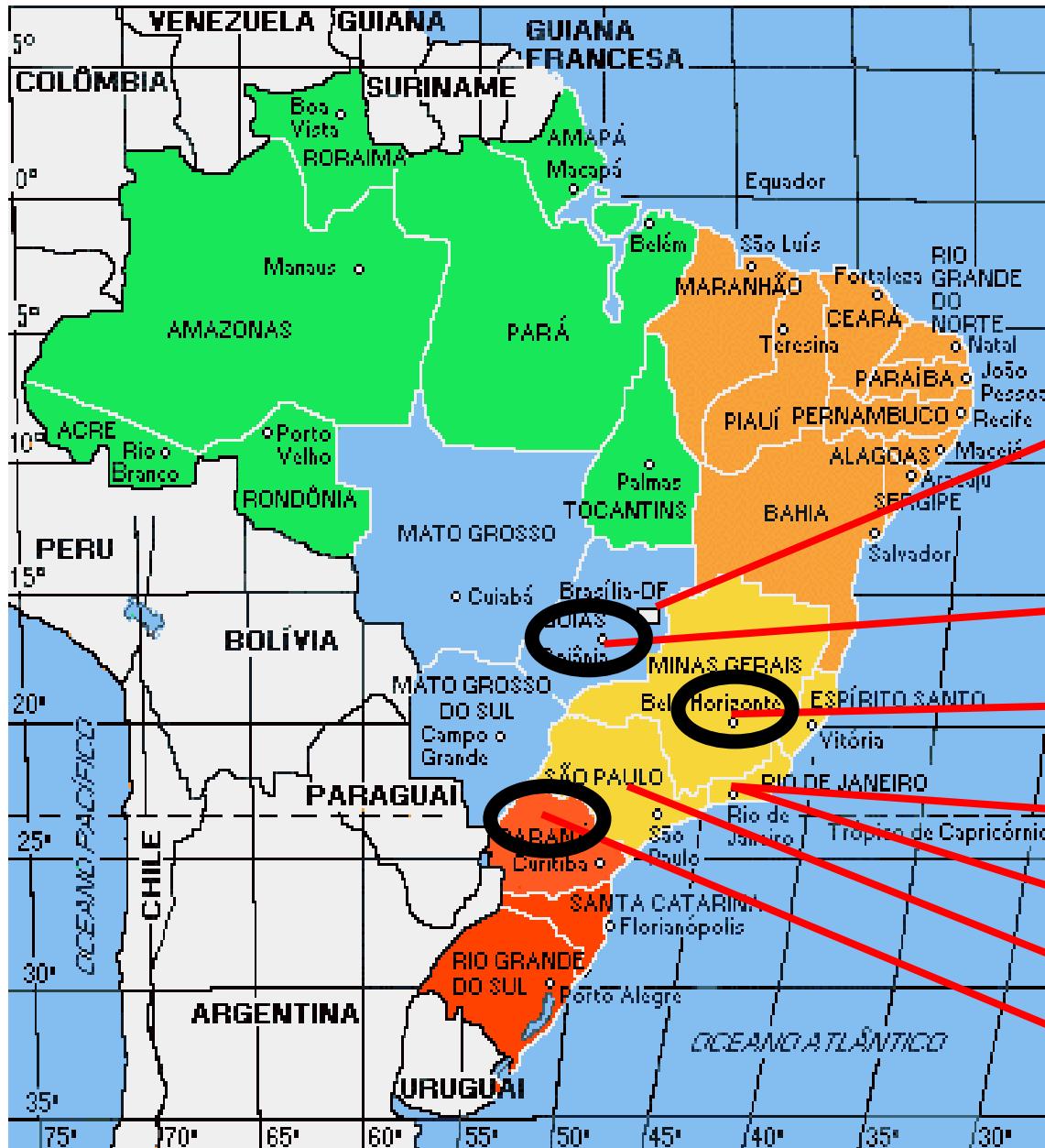
Hemizigose (= ou até > 30% sintomas)

Resolução Normativa N° 5, de 12 de março de 2008

Dispõe sobre normas para liberação comercial de Organismos Geneticamente Modificados e seus derivados

- informações relativas ao OGM
- avaliação de risco à saúde humana e animal
- avaliação de risco ao meio ambiente
- plano de monitoramento





**Recursos Genéticos
e Biotecnologia**

Arroz e Feijão

Milho e Sorgo

Agrobiologia

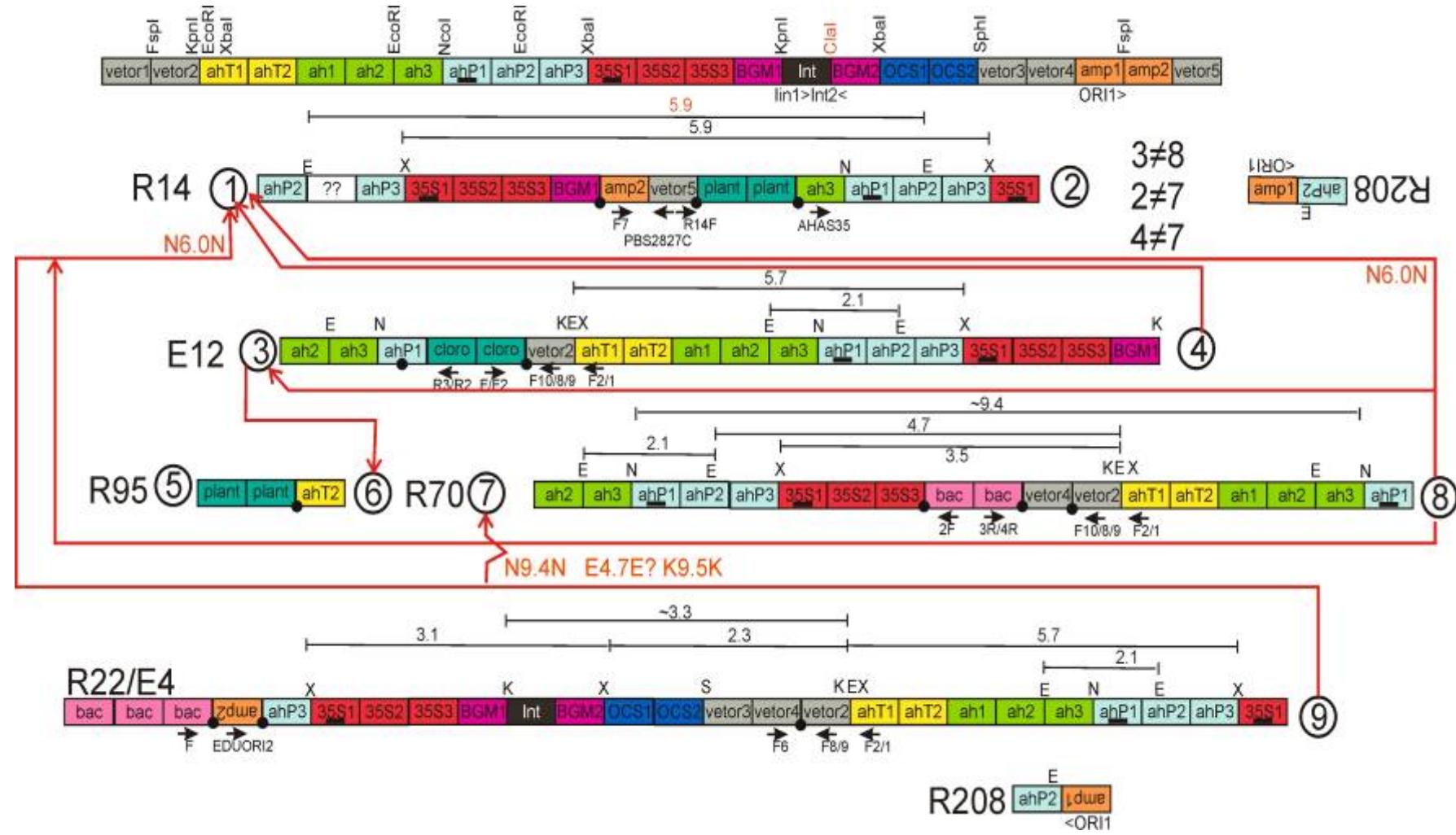
**Agroindustria
de alimentos**

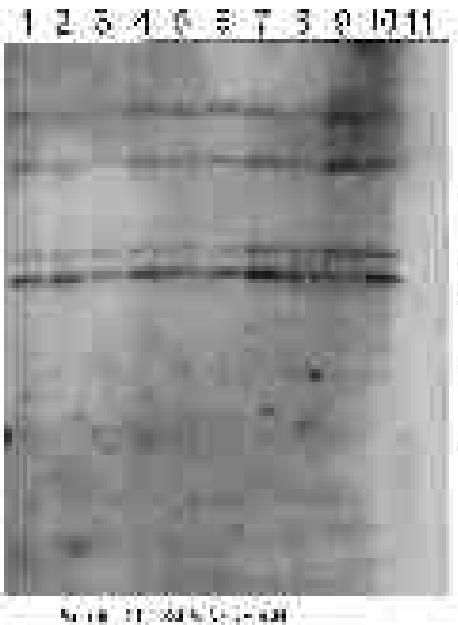
UNESP-Botucatu

Soja

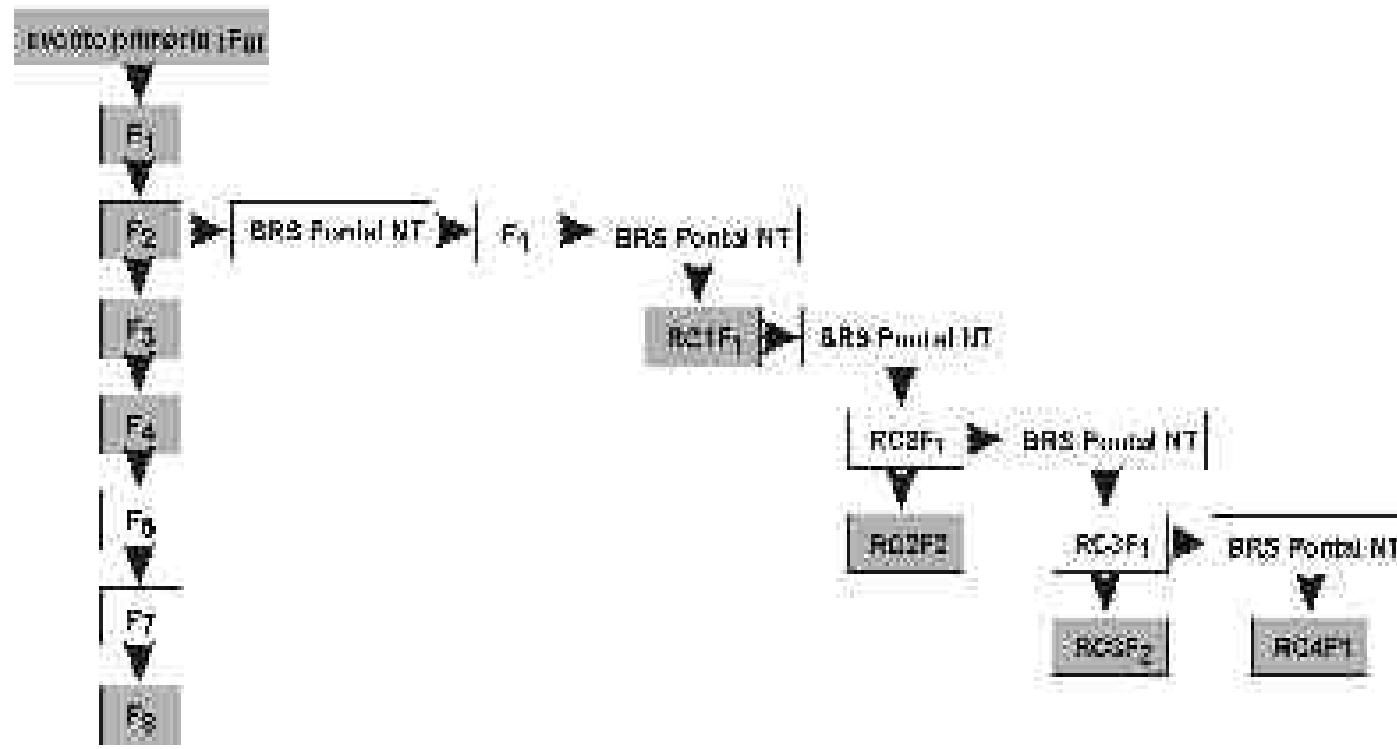
Caracterização Molecular

- Número de insertos, estabilidade
- Número de cópias dos elementos genéticos
- Integridade dos cassetes de expressão
- Presença de DNA adicional (backbone)
- Seqüência flanqueadoras no DNA genômico
- Seqüência dos elementos inseridos
- Marcadores de DNA (eventos específicos)

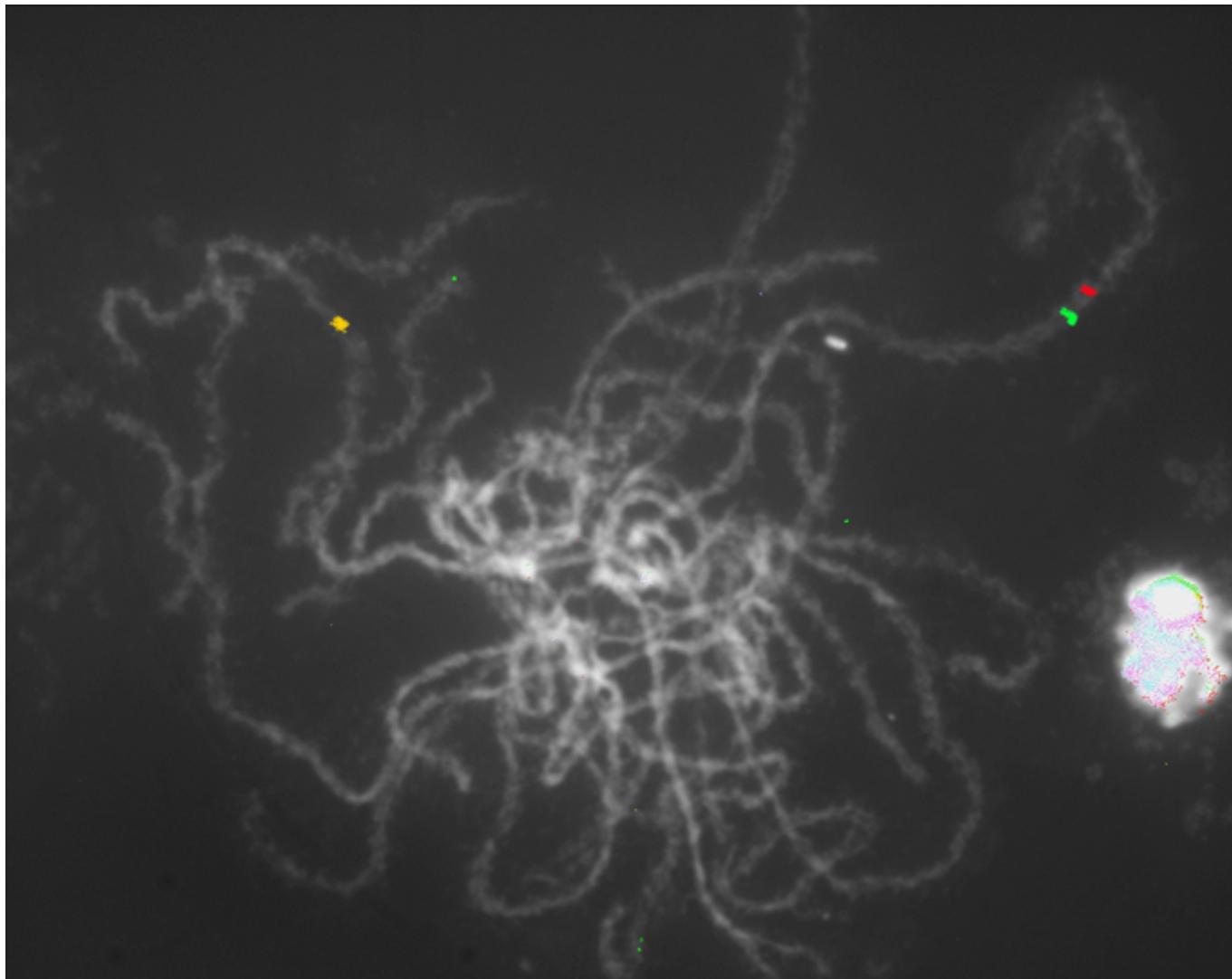




Stabilidade
Gerações x após cruzamentos



Presença dos transgenes, sem genes de res. a antibióticos

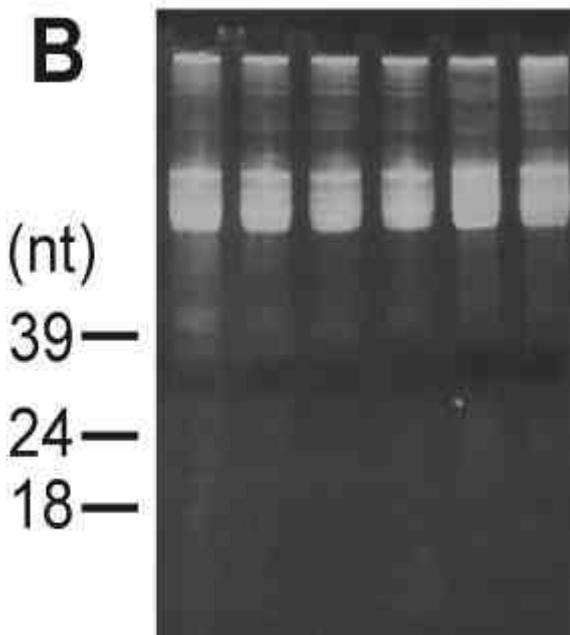
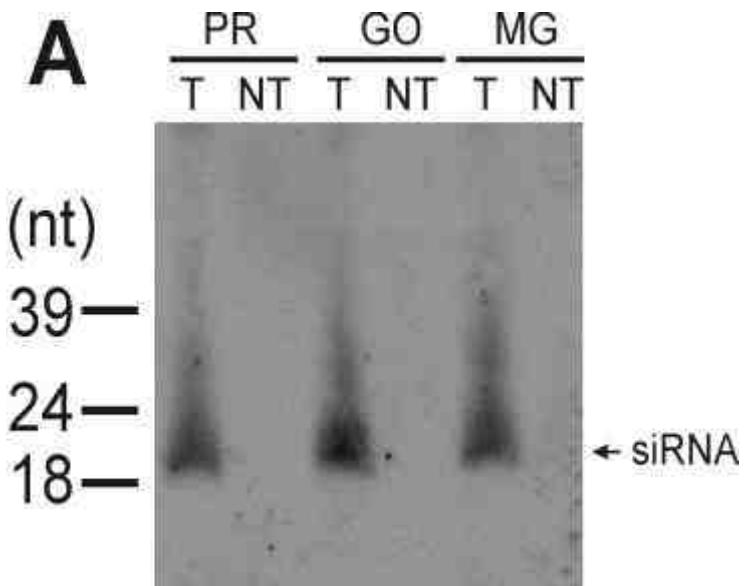
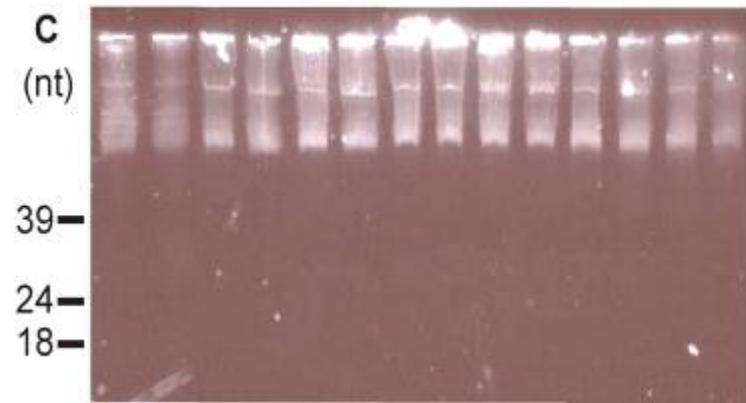
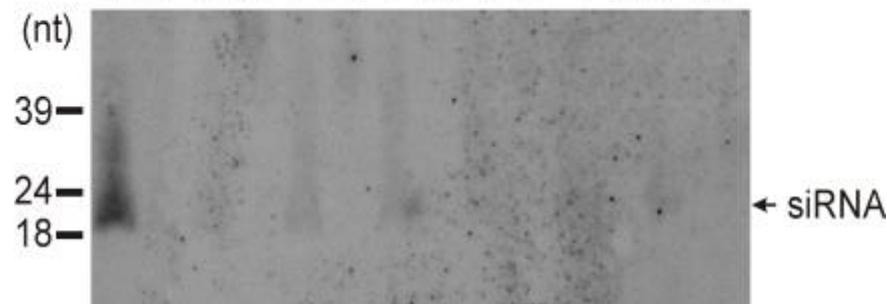


Genoma aplóide



B

folha	sementes					
	1	2	3	4	seca	emb.
T	NT	T	NT	T	NT	T
T	NT	T	NT	T	NT	T



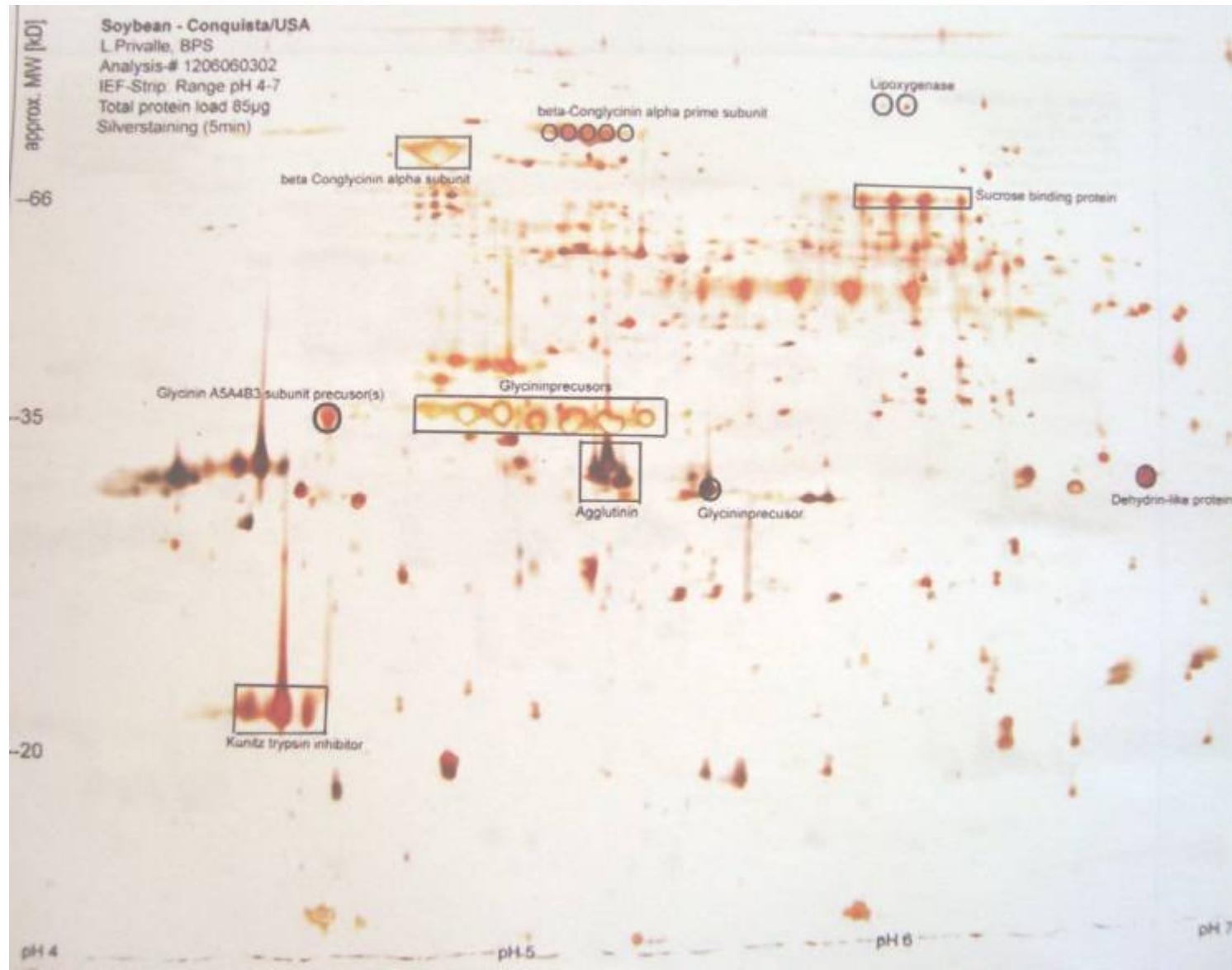
Caracterização da Proteína, Alimento / segurança para alimentação

- Caracterização da proteína e equivalente
- Concentração da proteína dos tecidos da planta
- Caracterização da proteína purificada como alimento
- Alergenicidade?
- Toxicidade?

Soja tolerante a imidazolinona - Embrapa/BASF



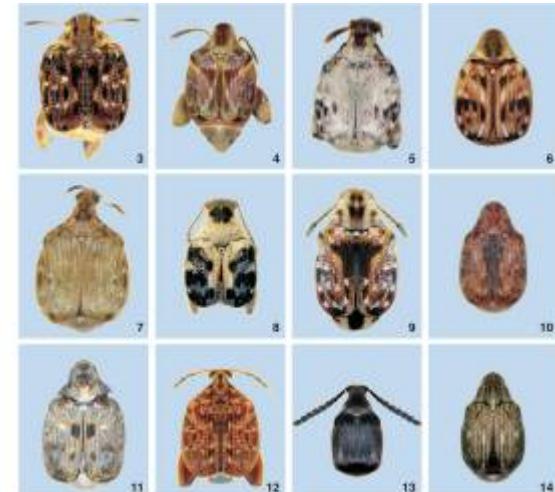
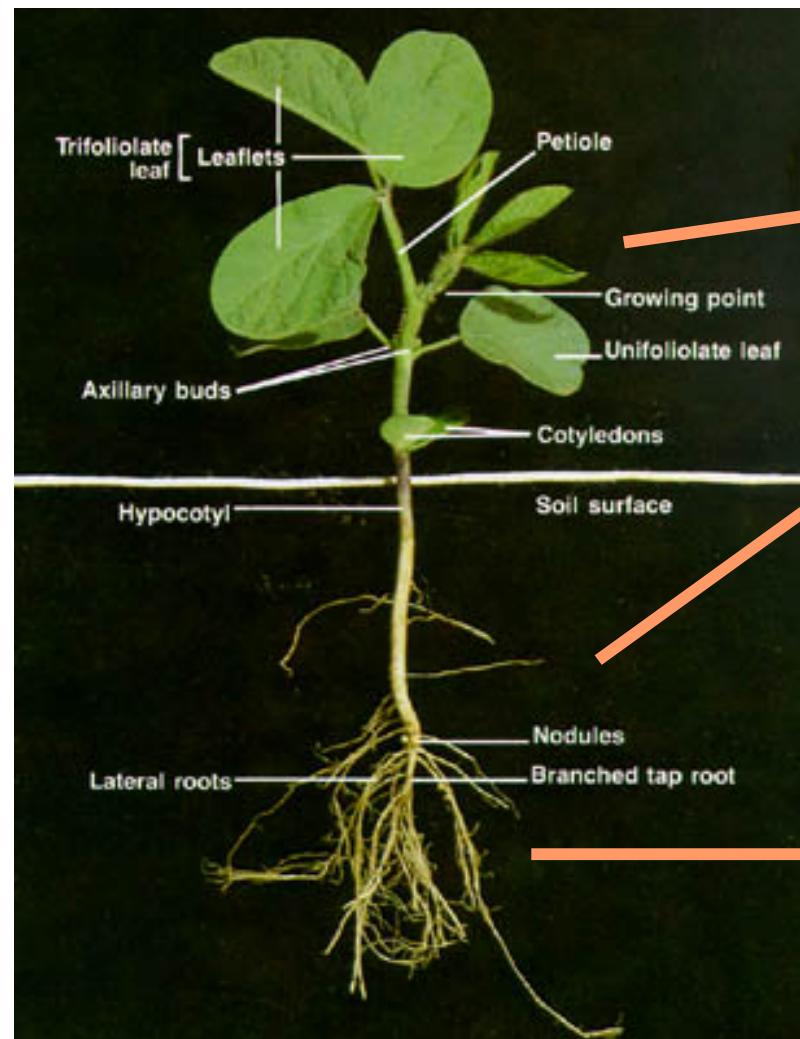




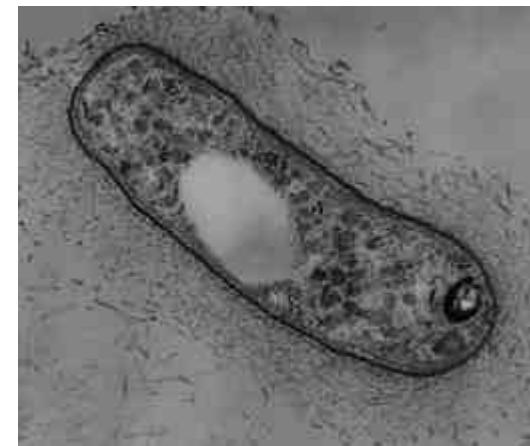


Equivalencia agronômica, Segurança ambiental

- Caracterização agronômica / variações fenotípicas?
- Adaptabilidade
- Segurança ambiental
- Cadeia no meio ambiente

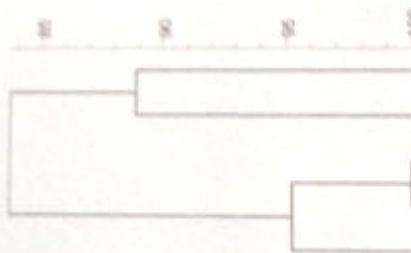


Figures 3-14. Vista dorsal: (1) *Corydalis brasiliensis*; (4) *C. godmani*; (5) *C. reticulata*; (6) *C. pseudociliata*; (7) *C. intercephala*; (8) *Demodex colleti*; (9) *C. ciliatissima*; (10) *Glyptoscelis minutus*; (11) *G. acacia*; (12) *G. speciosus*; (13) *Melormenis conspicua*; (14) *M. maculata*.



Jaccard (Opt:1.00%) (Tol:5.0%-5.0%) (H>0.0% S>0.0%) [0.0%-100.0%]
DGGE

DGGE



CTTP 26Renan/Adri.	100				
CTTP 27Renan/Adri.	88.9	100			
CTTP 28Renan/Adri.	80.0	90.0	100		
CTTP 29Renan/Adri.	80.0	90.0	100	100	
CTTP 30Renan/Adri.	76.2	85.7	95.2	95.2	10

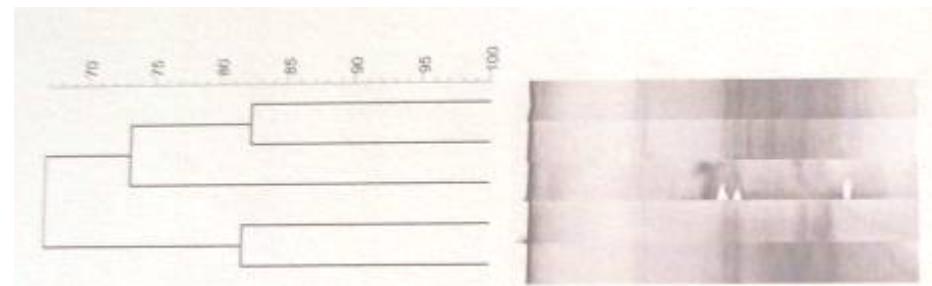
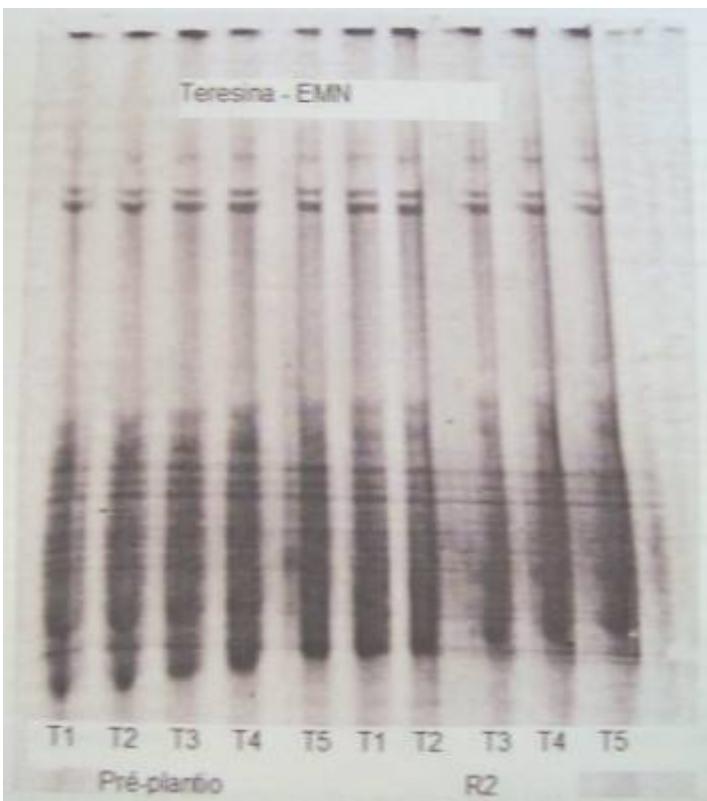


Table 1 Agronomic traits in bean transgenic line 5.1 cultivated in the field during low-disease-incidence season in three regions of Brazil

Trait	Goiás ^a		Minas Gerais ^a		Parana ^a	
	Control	Transgenic	Control	Transgenic	Control	Transgenic
Yield (kg/ha)	770.8	628.1	2,450	2,476	2,268	2,344
Seed germination (%)	85.9	91.4	87.9	89.4	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	5.9	5.4	5.5	5.7

^aStatistical analyses revealed no significant differences ($P < 0.05$; Tukey studentized range test, $n = 3$) between transgenic and control lines (AU). ^a not found in table; ^b not explained in legend. Does the ^a refer to the ^b instead? If the P value applies to all data in the table, it is not necessary to include a superscript in all columns — just state it once.

Equivalência de Composição, Equivalência Nutricional

- Amostras de multi-locais, multi-anos, com réplicas de campos
- Metabólicos secundários
- Processamento em escala piloto, análises de nutrientes/ antinutrientes (métodos validados)
- Confirmação da segurança como alimento
- Estudos de alimentação em animais

Acúcares: Sacarose, Rafinose, Estaquiose

Vitaminas: Vitamina B1, Vitamina B2

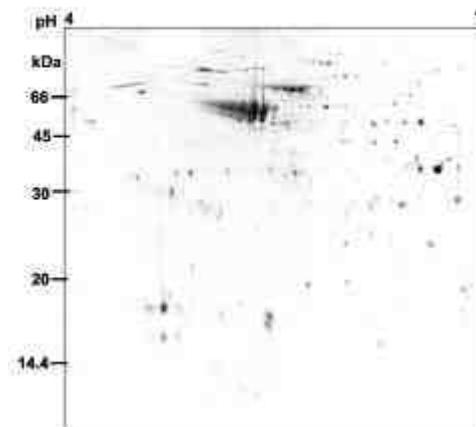
Aminoácidos: Triptófano, Cisteína, Metionina, Ácido aspártico, Serina, Ácido glutâmico, Glicina, Histidina, Arginina, Treonina, Alanina, Prolina, Tirosina, Valina, Lisina, Isoleucina, Leucina, Fenilalanina

Análises físico-químicas- Umidade, Cinzas, Proteína, Extrato Etéreo, Ácido Fítico, Inibidor de Tripsina

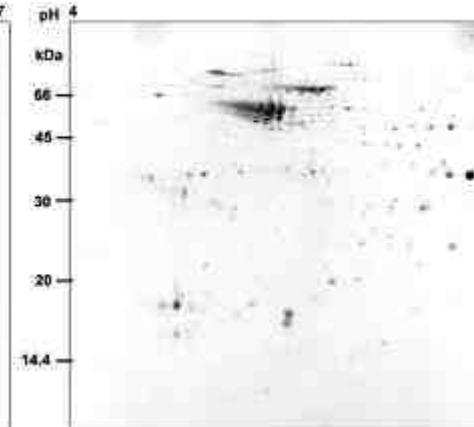
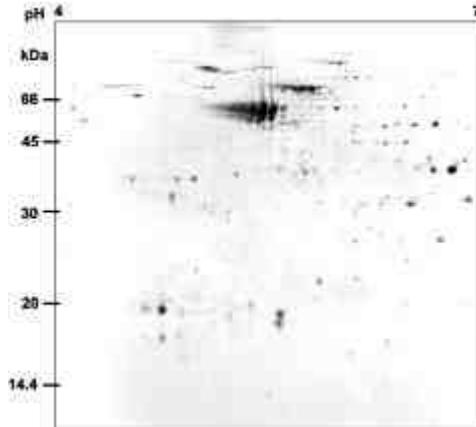
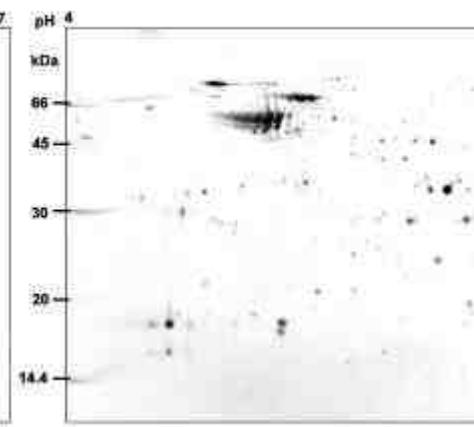
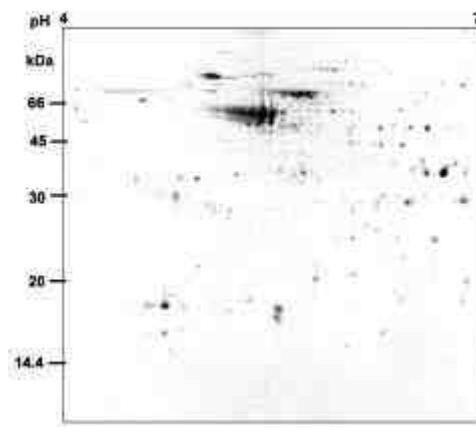
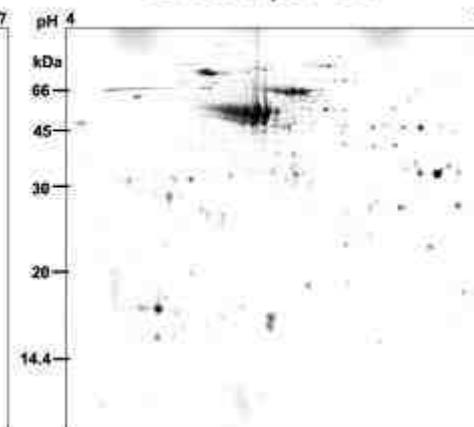
Minerais - Alumínio, Cálcio, Chumbo, Cobalto, Cobre, Cromo, Ferro, Fósforo, Magnésio, Manganês, Molibdênio, Potássio, Selênio, Sódio, Zinco

Análises sensoriais

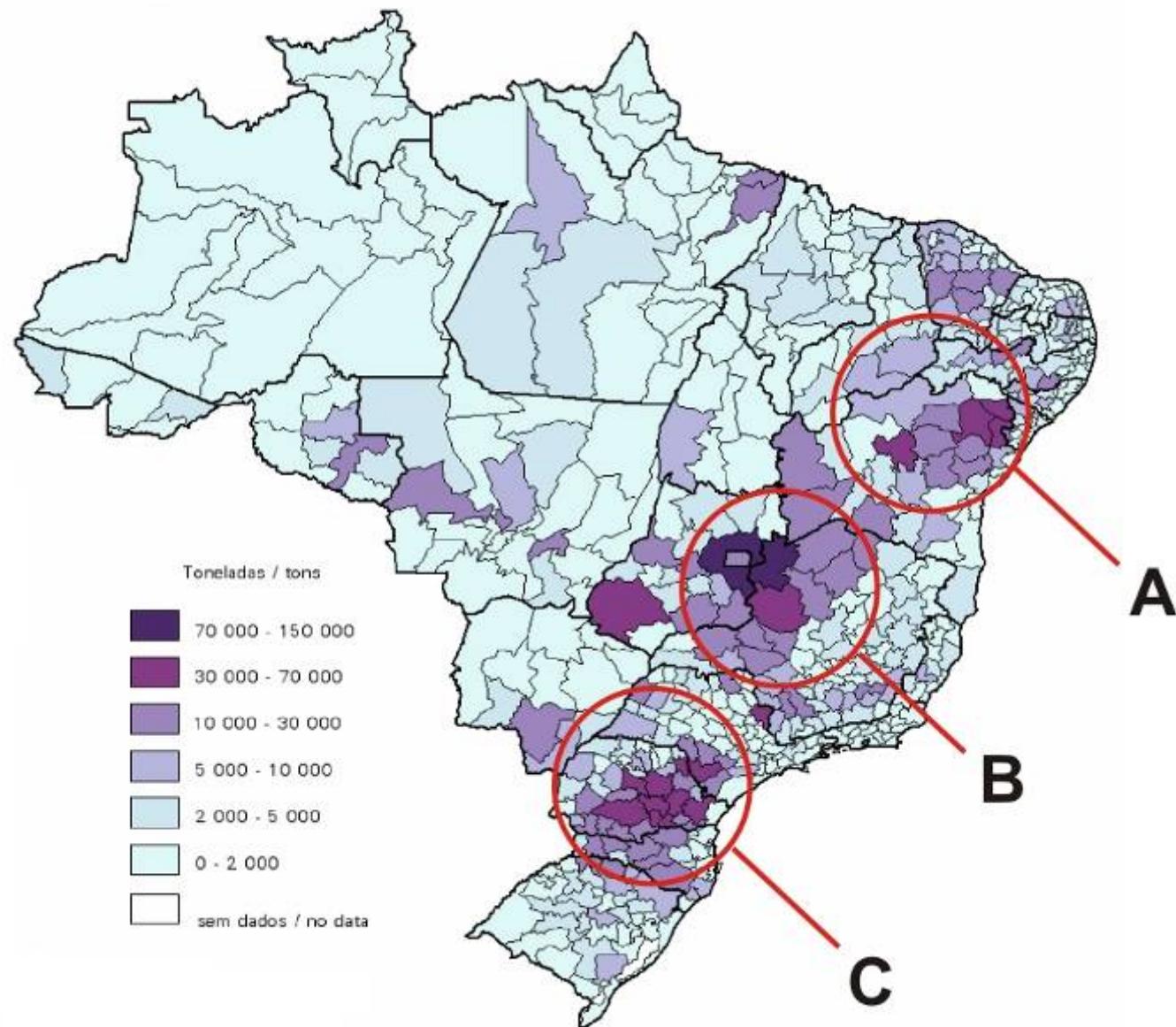
Olathe convencional



Embrapa 5.1



Monitoramento pós-comercial



**Segundo evento GM comercial
desenvolvido pela Embrapa e no Brasil**

**Primeiro evento GM 100% desenvolvidos
pela Embrapa**

**Primeira tecnologia comercial baseada em
RNAi**

Primeiro feijão GM



Embrapa Agrobiologia, Embrapa Agroindustria de Alimentos,
Embrapa Arroz e Feijão, Embrapa Rec. Genéticos e Biotecnologia,
UNESP-Botucatu, Embrapa Milho e Sorgo, Embrapa Soja



Obrigado !

