

QUALITY IMPROVEMENT

- Longer Shelf Life Products:

- ✓ tomato, melon, flowers

- Dry Matter Improvement:

- ✓ low calorie chips, low cost processing

- Low or non-calorie Sweeteners:

- ✓Thaumantin & monellin expression

- Better Food Quality Products

- ✓Altered Fatty Acid content in oil seeds (γ -linolenic acid)

- ✓Altered Amino-acid & Protein Content

- ▀cereals (low lysine), legumes (low methionine)

- ▀Lysine content in animal feeds

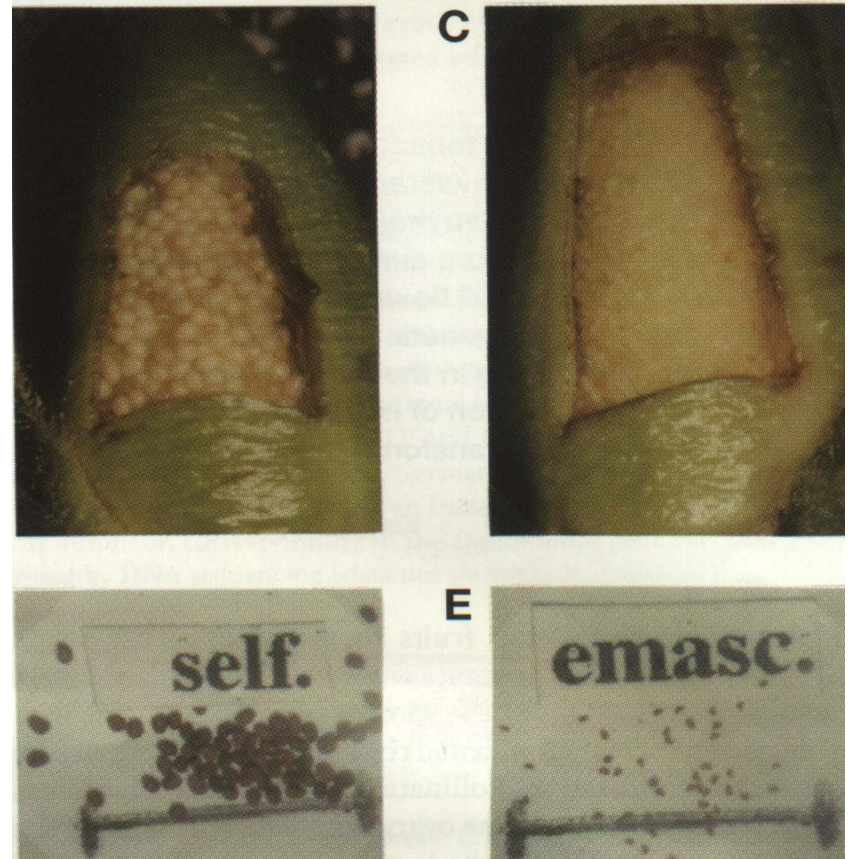
- ▀New gluten subunits in wheat (bread making quality)

QUALITY IMPROVEMENT

PARTHENOCARPIC FRUITS (NO SEEDS)



Eggplant



Tobacco

KALİTE İYİLEŞTİRME

Methionine



S-Adenosyl methionine

ACS



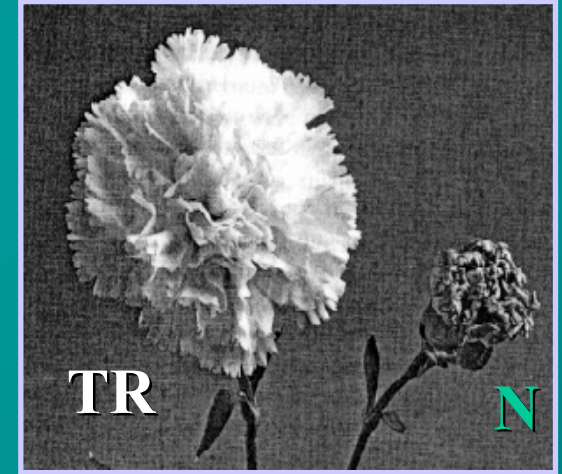
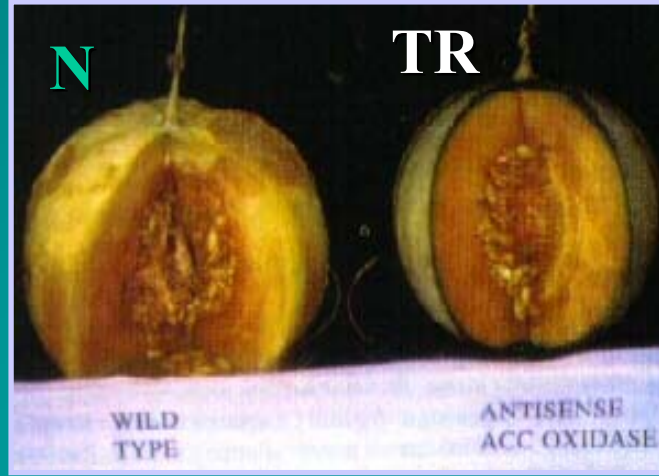
1-Aminocyclopropane-1-carboxylic acid (ACC)

ACO



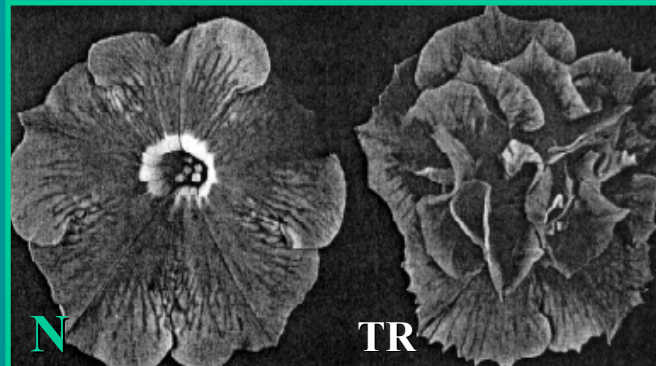
ETHYLENE

Transgenik bitkilerde "Antisense" teknolojisi ile AAC oksidaz enzimi inhibe edilerek olgunlaşmanın kontrol altına alınması.



Normal ve transgenik kavunlar polinasyondan 38 gün sonra hasat edilip 25 derecede 10 gün bekletilmişler

Normal ve transgenik karanfillerin kesildikten 8 gün sonraki görünüşleri.

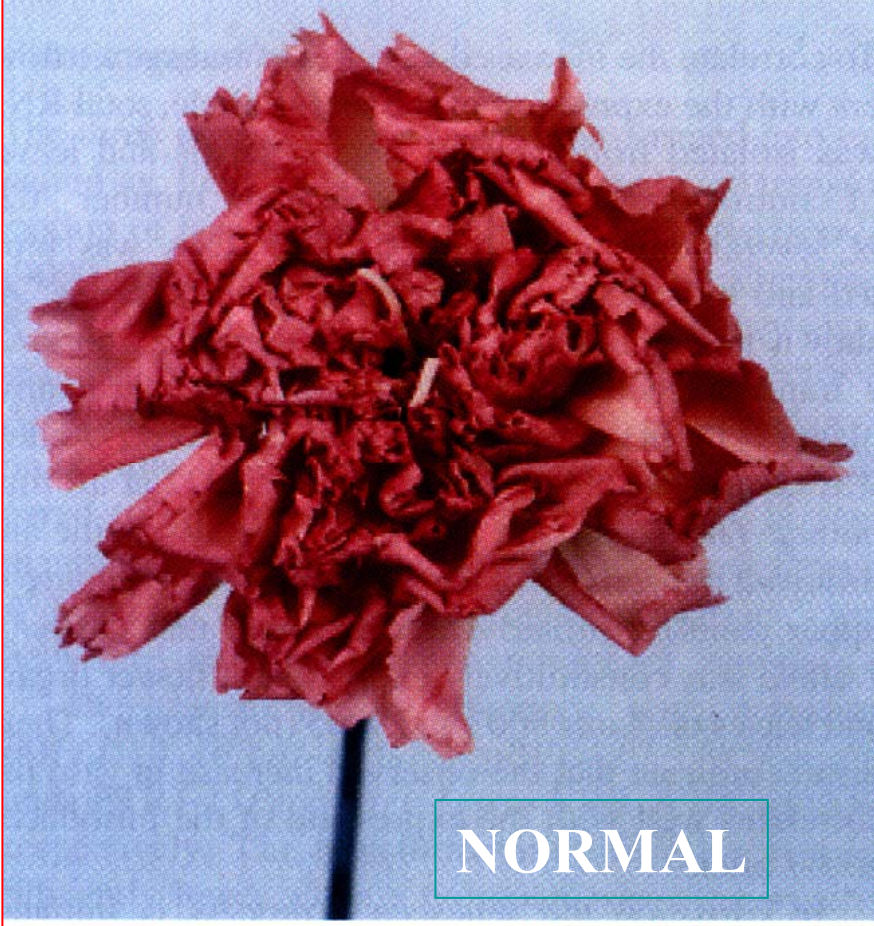


Genetik manipölasyonlar ile çiçek şeklinin değiştirilmesi

UZUN RAF ÖMRÜ

KESİMDEN 8 GÜN SONRA

KESİMDEN 24 GÜN SONRA



0

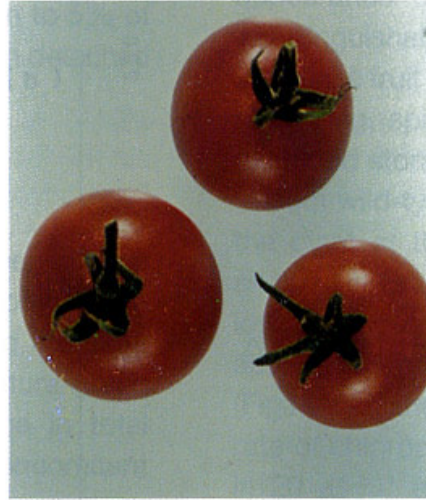
4 hafta

8 hafta

N



TR



UZUN RAF ÖMRÜ

ALTIN PİRİNÇ

Dünya genelinde 150 milyon çocuk vitamin A eklikliği çekmekte.

Güneydoğu Asyada her yıl vitamin A eksikliğine bağlı:

- 5 milyon çocuk görme özürlü olmakta**
- 2 milyon çocuk ölmekte**

Ana besinleri PİRİNÇ

Çözüm: Gen transferi yöntemiyle pirinçte Vitamin A oranının arttırılması

110-180 kg pirinç tüketimiyle sorun çözümlenebilecek

GOLDEN RICE



- **Worldwide 150 million children suffer from Vitamin-A deficiency**
- **South East Asia: 5 million children become blinded and 2 million die.**
- **Main food is rice.**
- **Engineer Vit-A precursor beta-caroten biosynthetic pathways in rice.**
- **110-180 kg/year consumption would solve Vit-A deficiency problem.**

TR PLANTS AS “LIVING BIOREACTORS

- Industrial Enzymes :

- ✓ α -Amylase (liquefaction, bread baking),
- ✓ phytase (animal feeds, replace inorganic P addition)

- Pharmaceutical Proteins:

- ✓ Antibodies
- ✓ Enkephalins
- ✓ Interferons
- ✓ Glucocerebrosidase (Gaucher's disease therapy)

- Polymers:

- ✓ Polyhydroxybutyrate (biodegradable polymer)

- Oral Vaccines

- ✓ Animal Use (Mink enteritis virus, DK, UK, NL, 1997)
- ✓ Human Use (Cholera toxin subunits, USA, 1998)

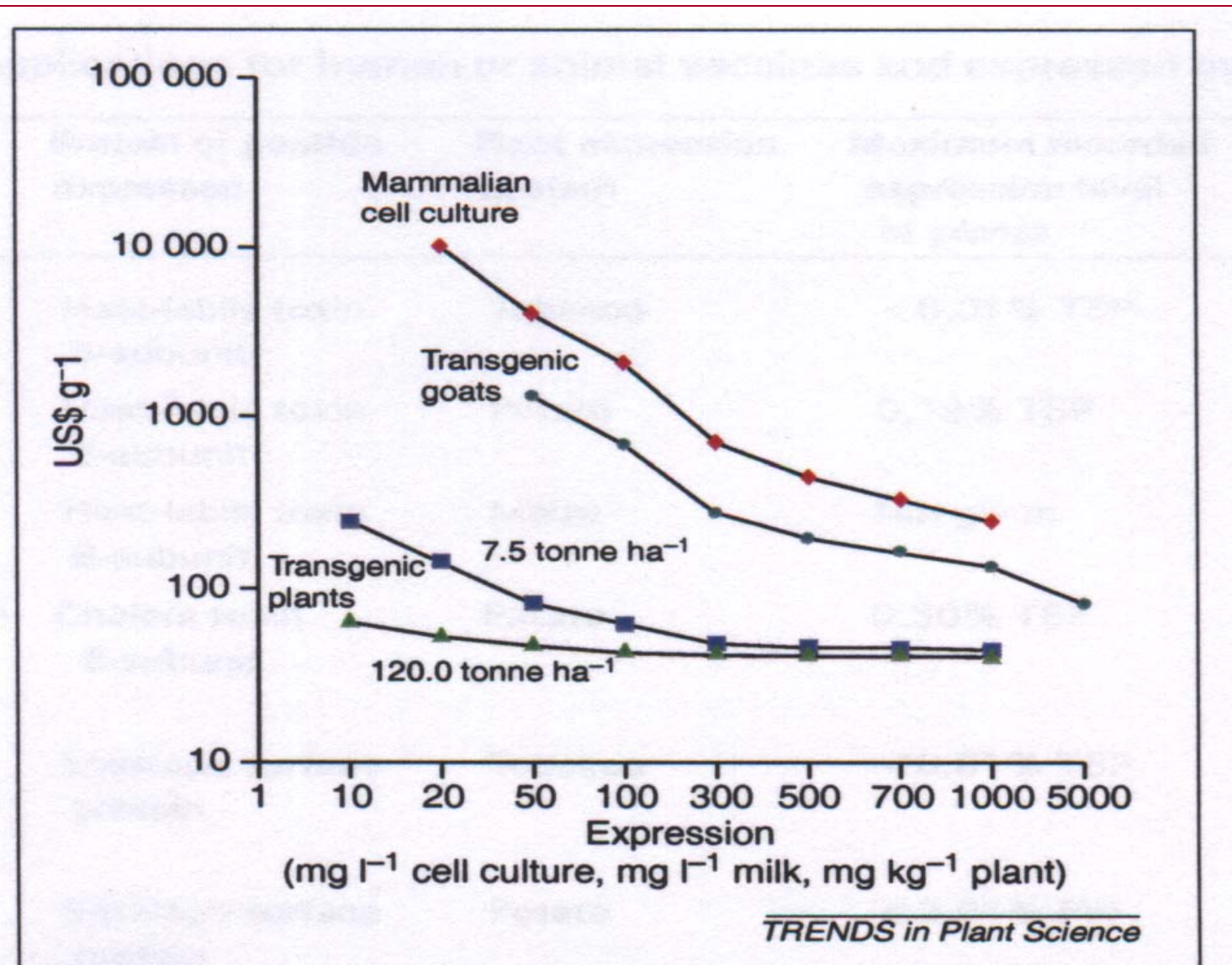
“AN APPLE A DAY KEEPS THE DOCTOR AWAY”

MOLECULAR FARMING

Production of pharmaceutically important and commercially valuable proteins in plants

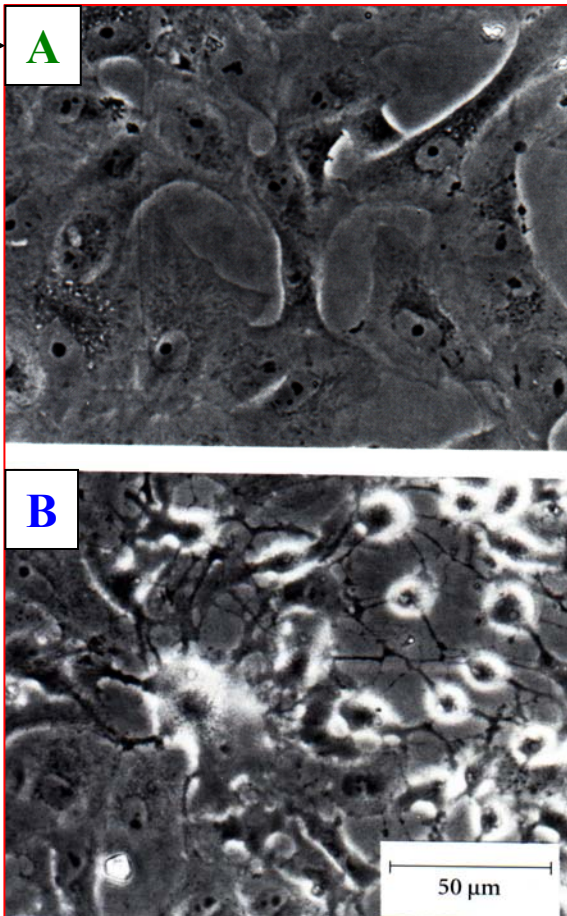
3 Main area

- **Antibodies (plantibodies)**
 - i. **Therapeutic**
 - ii. **Diagnostic**
- **Oral vaccines (edible vaccines)- Human, animal**
- **Biopharmaceutiacs for human health**



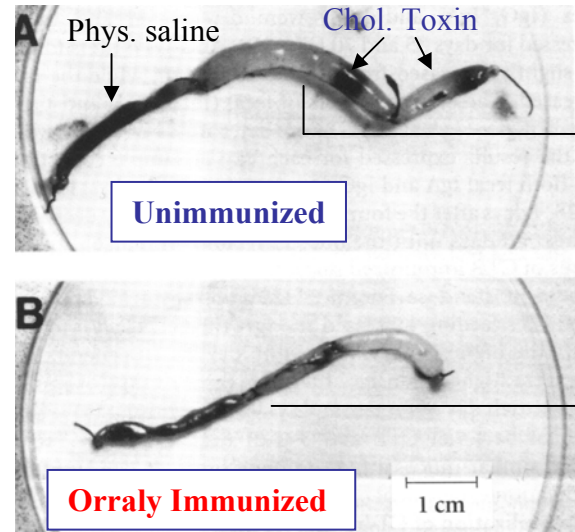
PLANT BASED ORAL VACCINES: Cholera Toxin B Subunit

Cells are protected by the antiserum



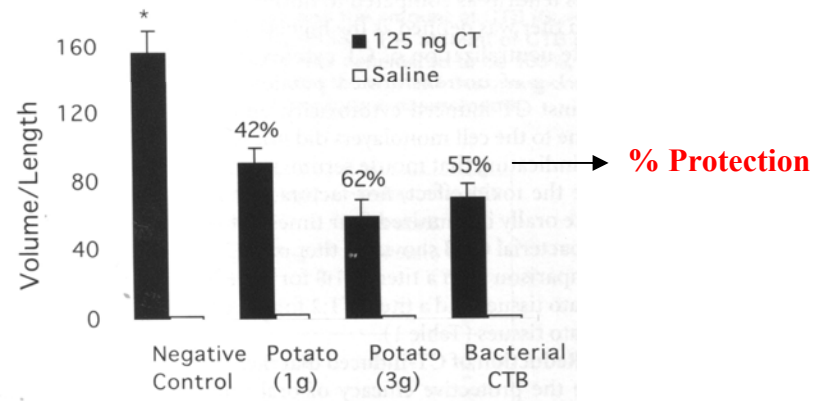
A: Normal vero cell morphology protected by antiserum from orally immunized mice.

B: Effect of cholera toxin on vero cells.



Fluid accumulation in the intestine means toxin is effective.

No or little fluid accumulation in immunized mice. Means toxin is ineffective



Effect of oral immunization with bacterial or plant cholera toxin B subunit.

AĞIZDAN ALINABİLECEK AŞILAR

- Plant-derived vaccine protects target animals against a viral disease
Dalsgaard et al., Nature Biotechnology, **1997**
- Efficacy of a food plant-based oral cholera toxin B subunit vaccine
Arakawa et al., Nature Biotechnology, **1998**
- A plant-derived edible vaccine against hepatitis B virus
Kapusta et al., FASEB J., **1999**
- Transgenic plants for production of edible vaccines and antibodies for immunotherapy Sharma et al., Current Science., **1999**
- Plants for delivery of edible vaccines. Walmsley, Curr.Opp. Plant Sci., **2000**
- Development of oral vaccines for human use.
. Fooks., Curr.Opp. Mol. Therap., **2000**

YENİLEBİLİR İNSAN ve HAYVAN AŞILARI

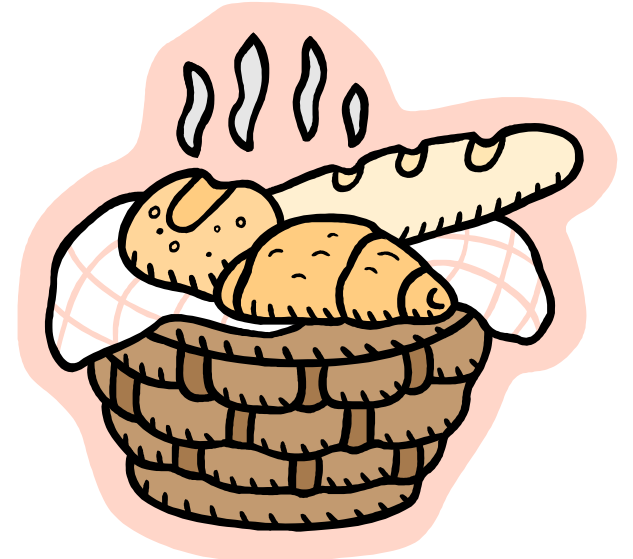


HEPATİT

KOLERA

ŞAP (feet and mouth disease)

AİDS



Foot-and-Mouth Disease Vaccine Production in Transgenic Plants

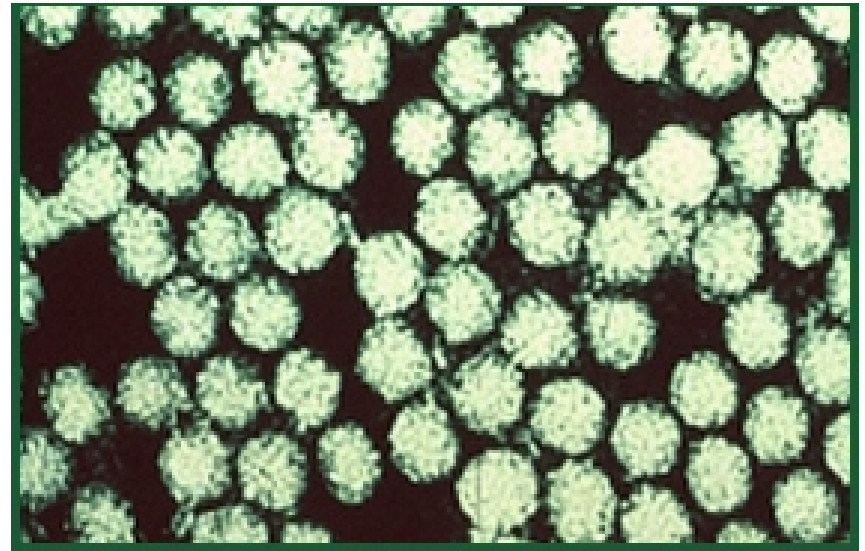
Foot-and-Mouth Disease

- One of the most contagious animal diseases
- Permanent impairment of milk production, abortion, high mortality of young cattle and piglets, permanent loss of weight, myocarditis in cattle, pig
- Important economic losses; e.g. 10 billion £ in UK in endemic 2001



Foot-and-Mouth Disease Virus

- FMDV, an Aphthovirus;
Picornaviridae
- Nonenveloped,
icosohedral capsid
- SS(+)RNA
- Serotypes A, O, C,
Asia1



FMD Virus Photomicrograph USDA

Usage of TR plants

- **Expression of antigens in TR plants increasingly used for production of immunogens**
- **TR plants can be parenterally administered or used as edible vaccines**
- **Low concentration of the expressed protein to induce significant immune response**
- **Increasing translational efficiency**
- **Utilization of plant-optimized synthetic genes via inclusion of specific promoters, enhancers or signal sequences**
 -increased levels of expression of rec genes**

FMDV vaccine in TR plants

- First peptide-based vaccine production in TR plants for FDMV
- Structural protein VP1, carrying critical epitopes responsible for induction of protective neutralizing antibodies, expressed in alfalfa



CaMV 35S used as promoter

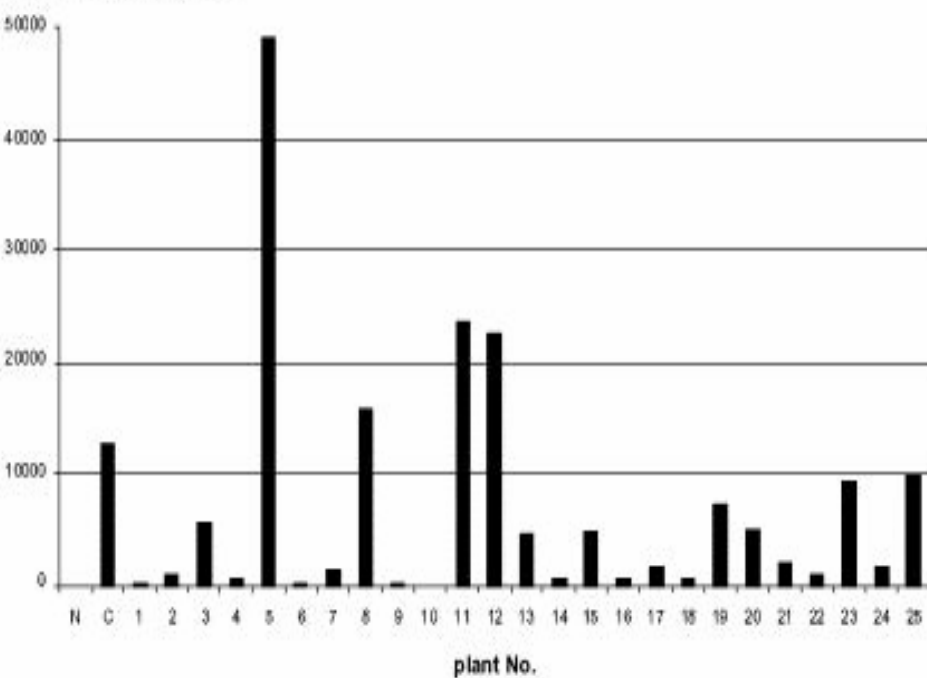
Obtained vector code for rec product VP-betaGUS, fusion protein containing FMDV VP1 followed by *gus* A gene

Introduced into *A. tumefaciens* by electroporation, alfalfa co-cultivated

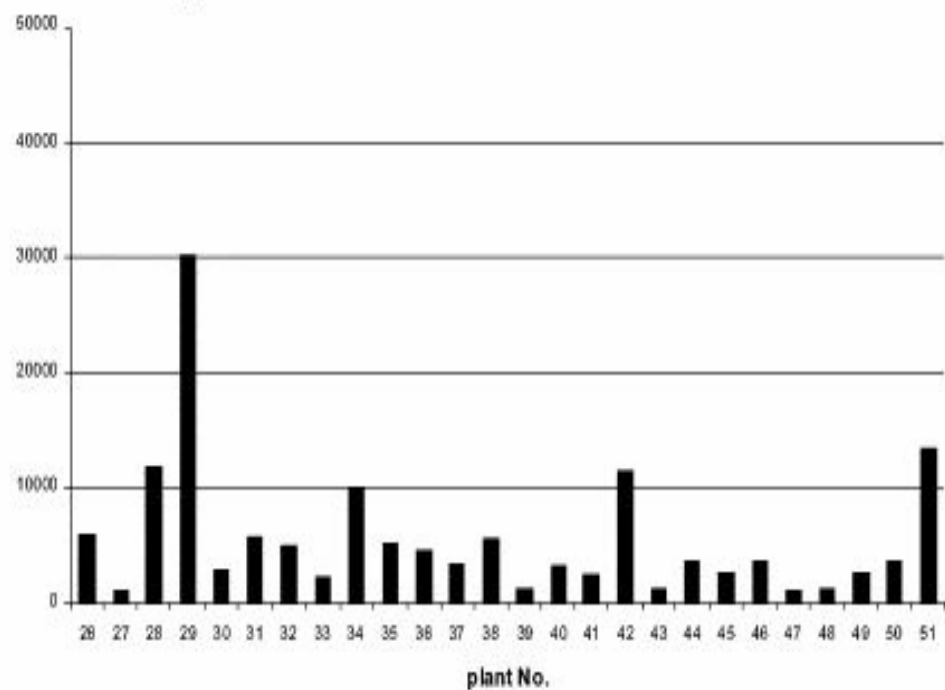
Results

- 5% of tested individuals presented high beta-GUS activity
- Also showed highest VP1 peptide accumulation
- Rec VP-betaGUS reached concentrations of 0.5-1 mg/g of total

nmol MU/min/mg prot.

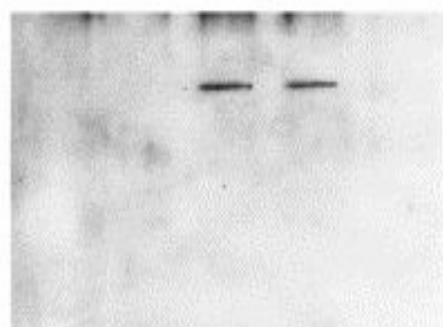


nmol MU/min/mg prot.



plant No.

11 12 5 29 N



— 79 KDa

Results

- Intraperitoneally immunized mice present specific antibody response against both synthetic peptide VP1 and purified FMDV particles
- VP-betaGUS immunized mice challenged with infectious FMDV, 100% protection were observed

In brief

- Idea of production of vaccines with TR plants cost-friendly and safe
- Promising results obtained to date, methodology to be perfected by using more sophisticated vector systems, appropriate plant
- Extensive trials to prove effect of FMDV vaccine in meat-producing animals

•Kanser terapisinde kullanılabilecek antikörlerin üretimi

Transient expression of a tumor specific single chain fragment and a chimeric antibody in tobacco leaves Vaquero et al., PNAS 1999.

•Otoimmün hastalıkların tedavisi

Supression of autoimmune diabetes by a plant-delivered cholera toxin B subunit-human glutamate decarboxylase fusion protein. Arakawa et al. Transgenics, 1999

