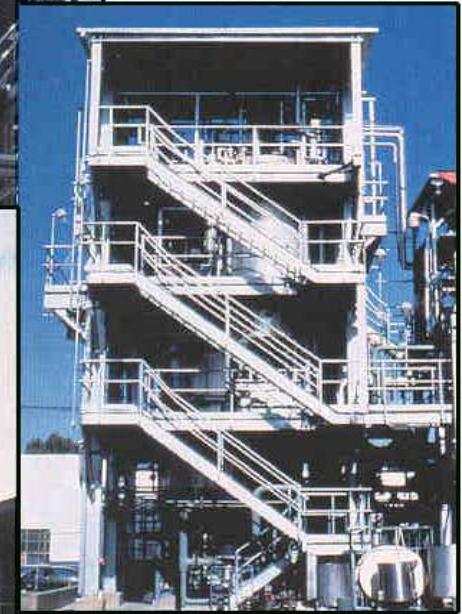




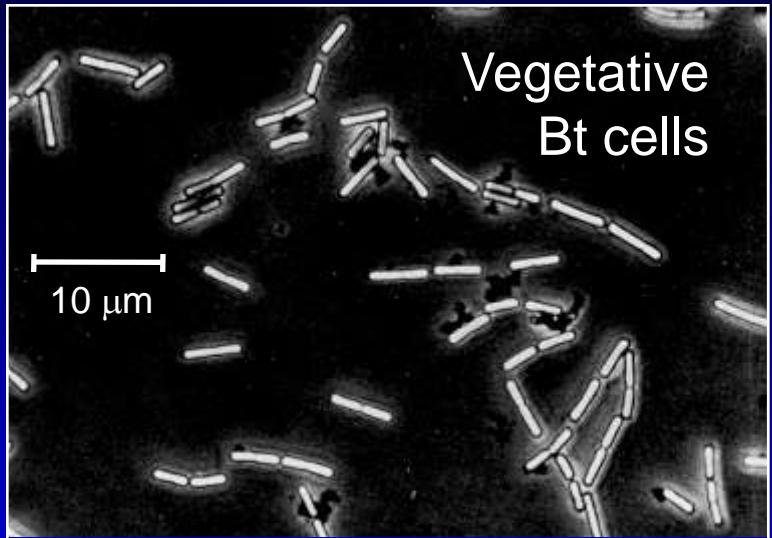
Bt 101

The only US Bt company that manufactures its own products



**Fermentation Plant
Wasco, California**

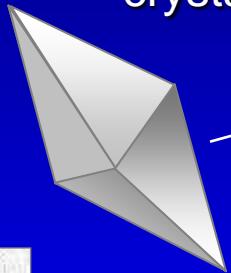
Bacillus thuringiensis Life Cycle: Production of Spores and Crystals



Sporangium

Sporulation

“Bipyramidal”
crystal

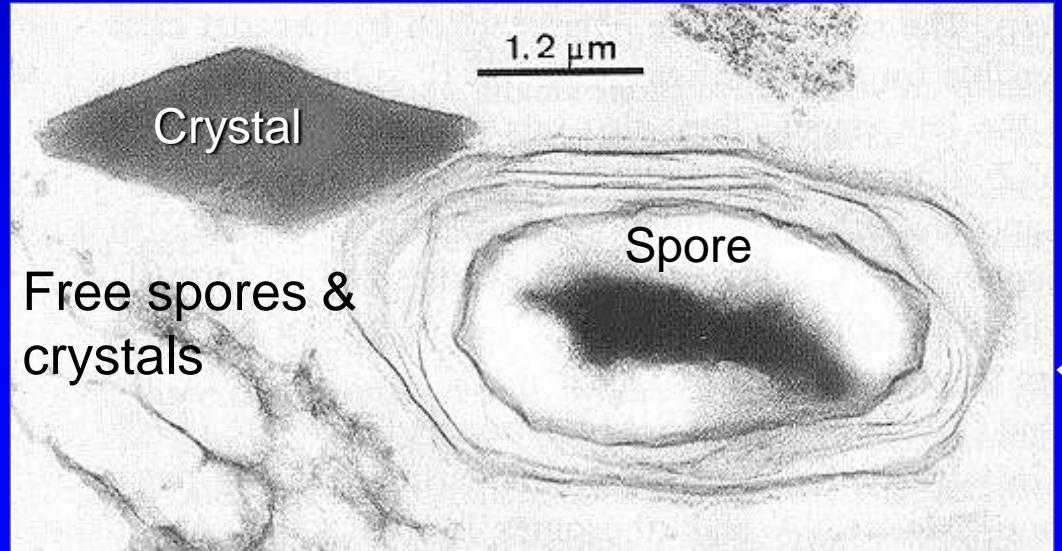


Crystal

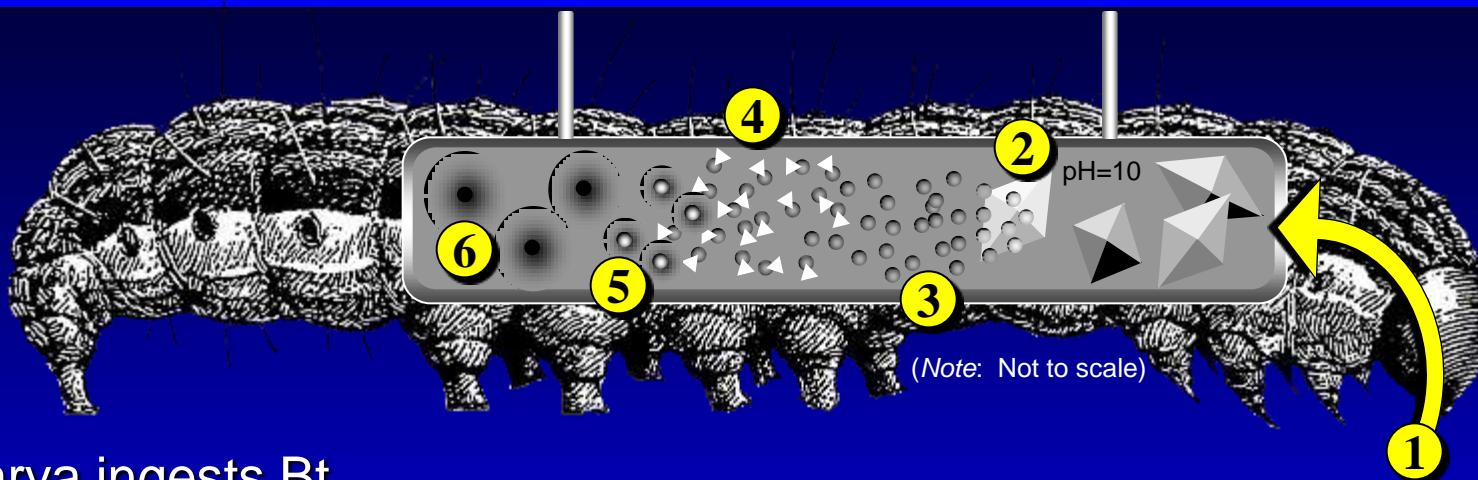
Spore

(Typical of Btk; other
Bt's may have
different crystal
types.)

Lysis

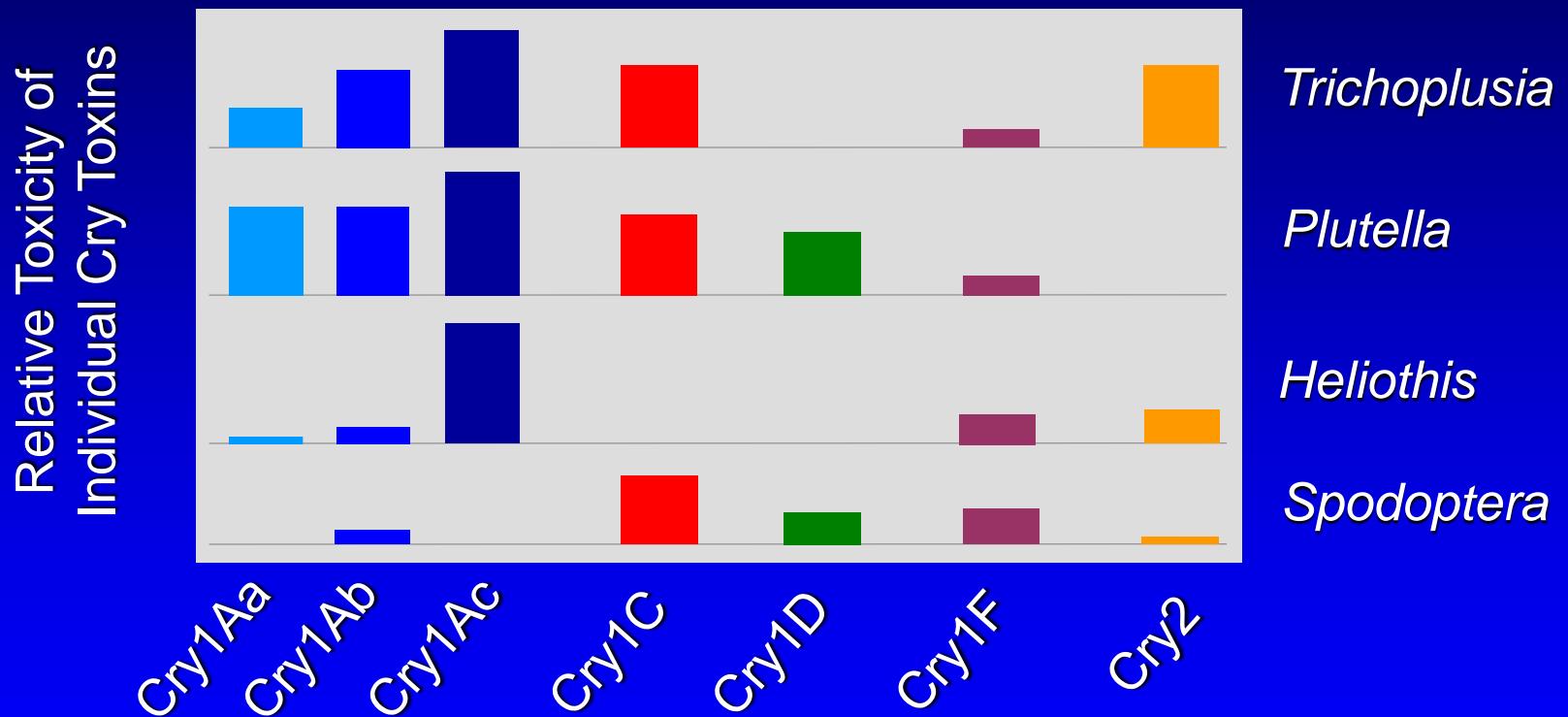


Mode of Action of *Bacillus thuringiensis* subsp. *kurstaki*

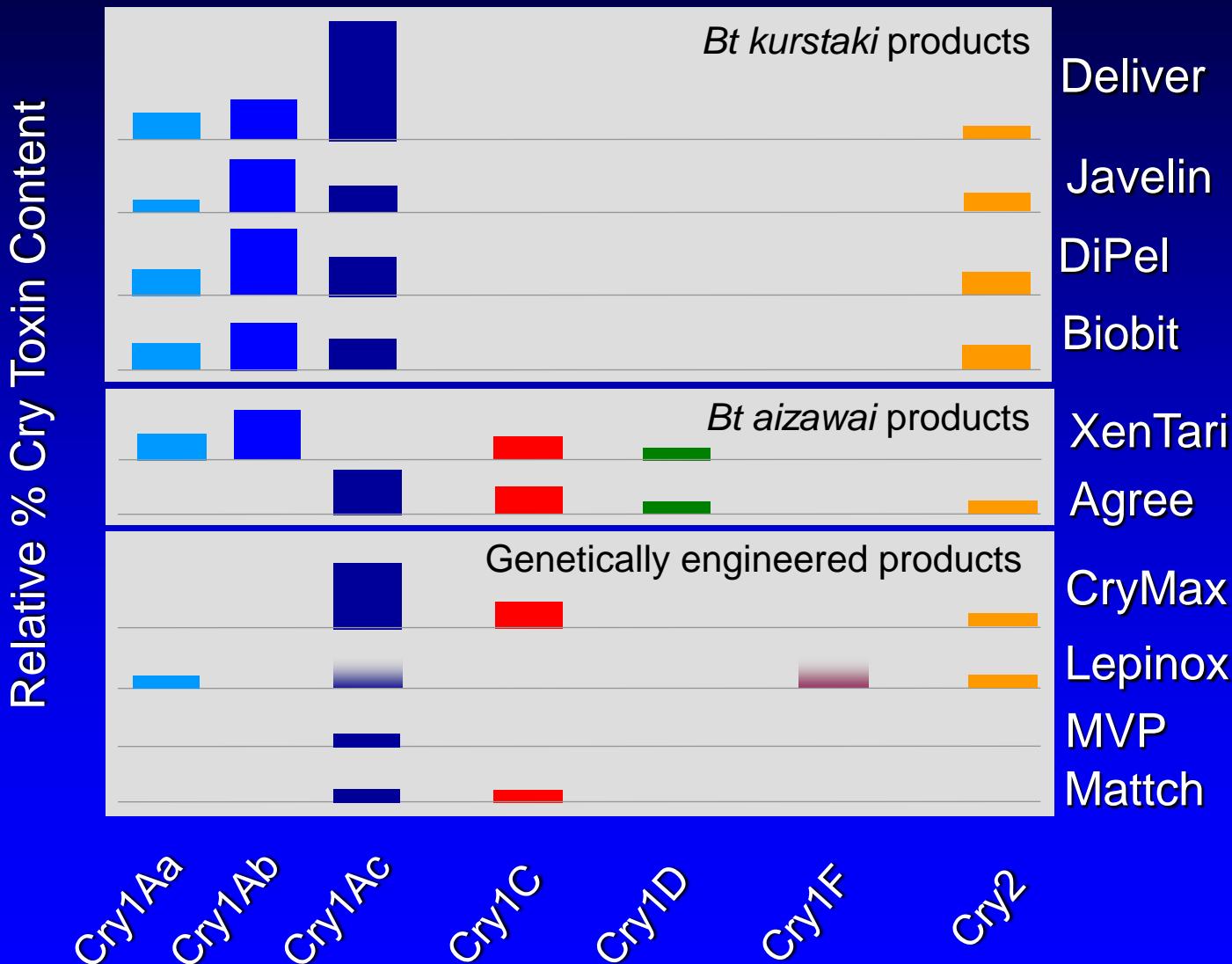


1. Larva ingests Bt.
2. Toxin crystals dissociate in alkaline midgut.
3. Protoxin molecules are released from dissociated crystal.
4. Protoxin molecules “activated” by the insect’s digestive enzymes.
5. Activated δ -endotoxin molecules bind to receptors on midgut cells.
6. Toxin destroys the cellular lining of the midgut.
7. Gut is paralyzed, insect stops feeding.
8. Death from osmotic shock, septicemia (spores germinate), or starvation.

Toxicity of δ -endotoxins of *Bacillus thuringiensis* to Important Lepidoptera pests

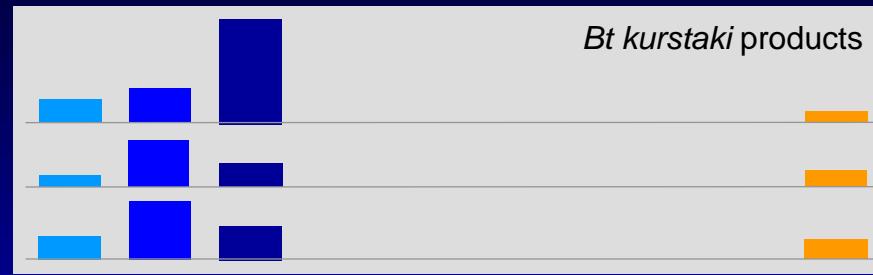


Endotoxin Profiles of Bt spray products for control of Lepidoptera



The Cry Toxin “Spectrum”

Product profiles



Deliver

Javelin

Dipel

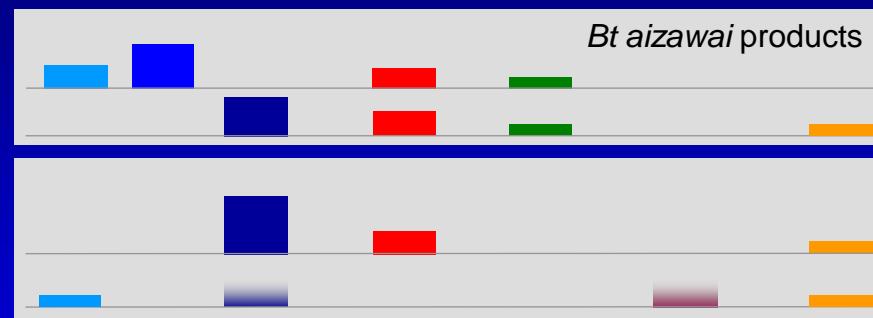
Xentari

Agree

Crymax

Lepinox

Pest Activity



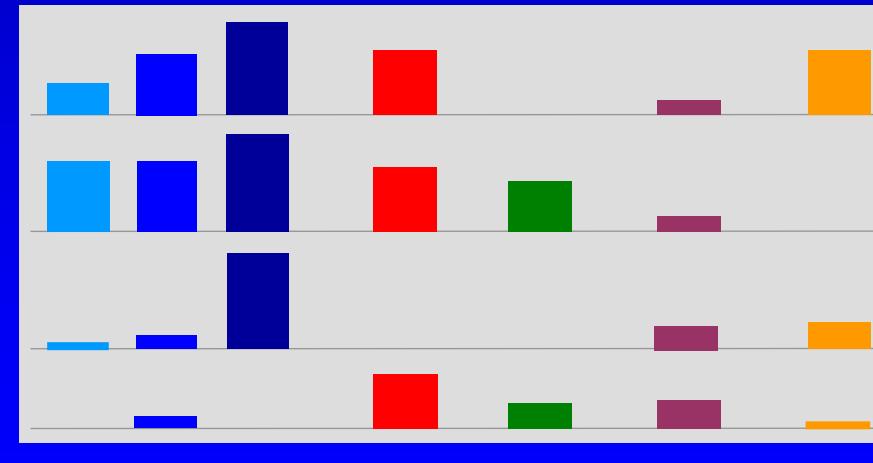
Cabbage Looper

Diamond Back Moth

Corn Earworm

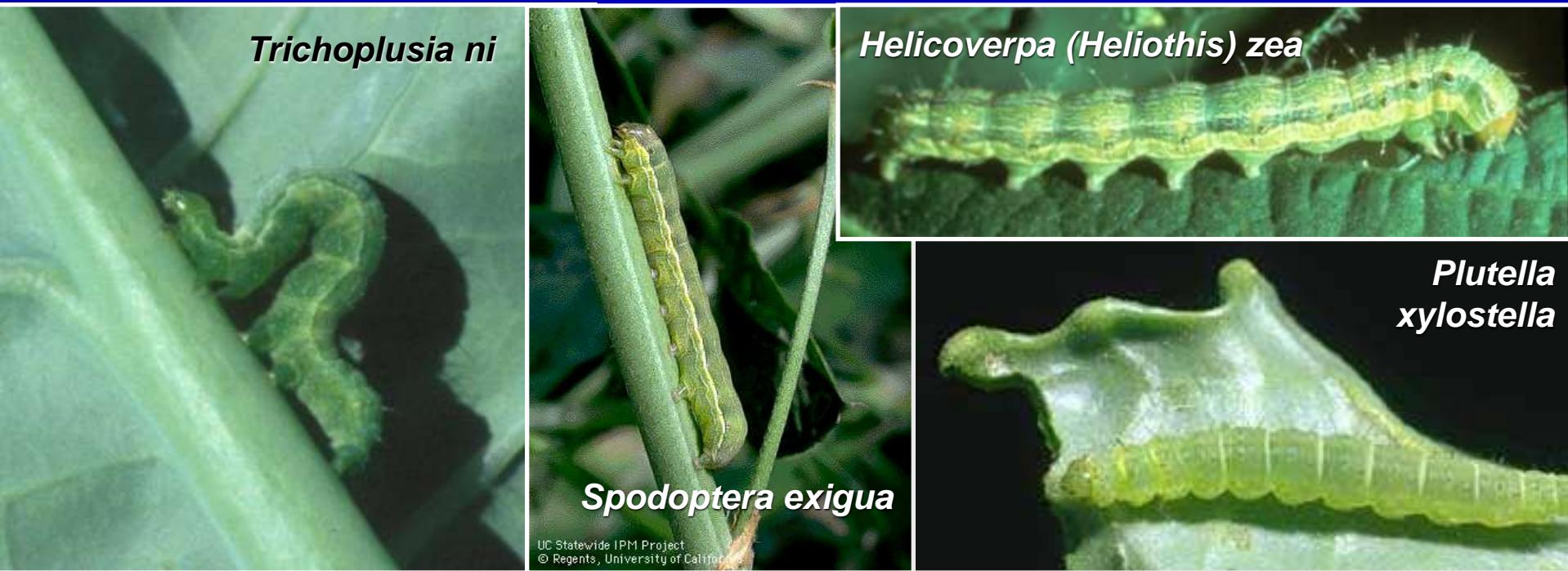
Fall & Beet Armyworm

Relative Toxicity of Individual Cry Toxins

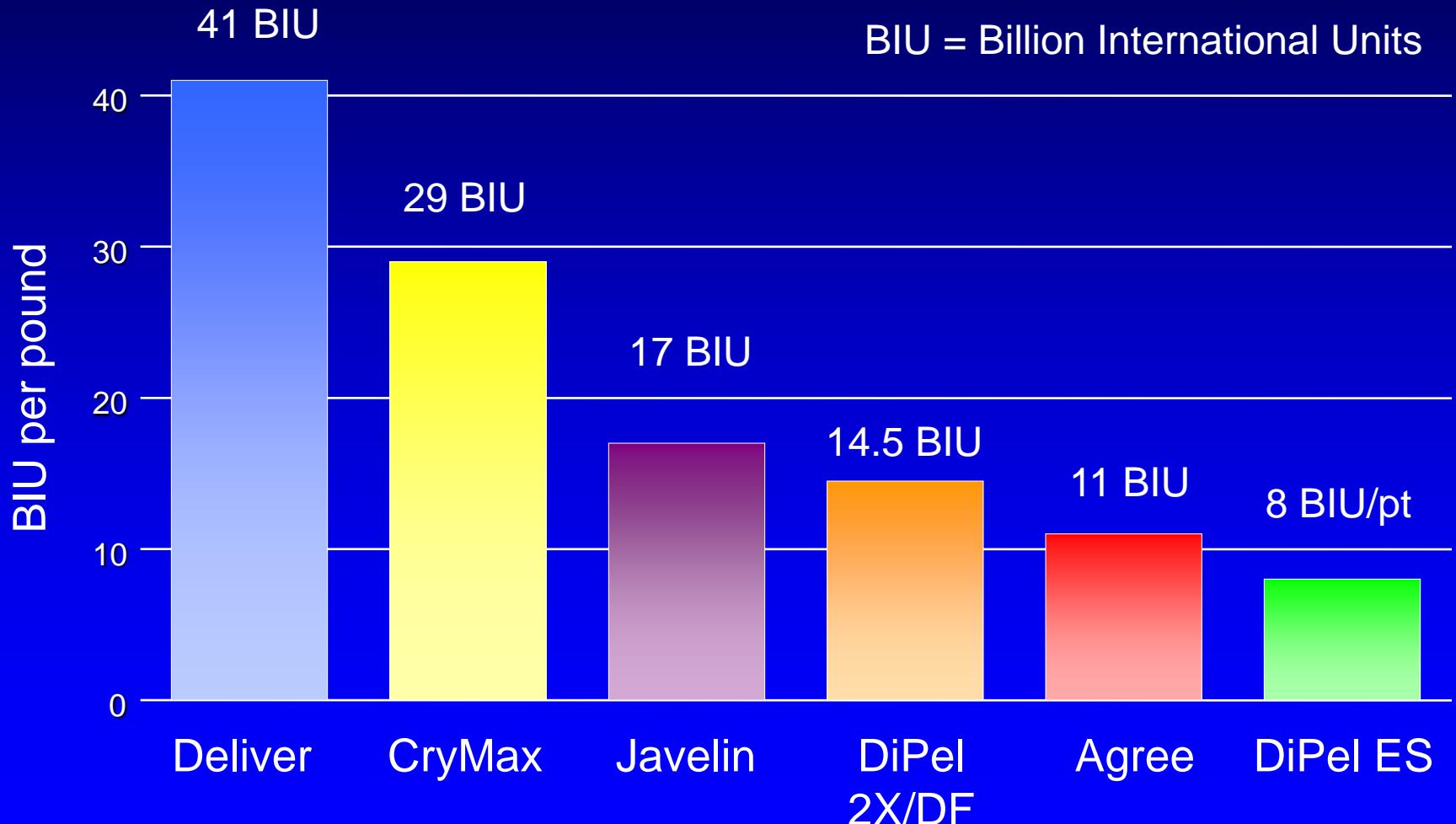


Important Cry Toxins for Control of Lepidoptera in Agriculture

- Broadest spectrum of high activity **Cry1Ac**
- Best *Spodoptera* activity **Cry1C**
- DBM resistance management **Cry1C, Cry1D**



Label potencies of some *Btk* products



Performance Characteristics of Sprayable Bt Products

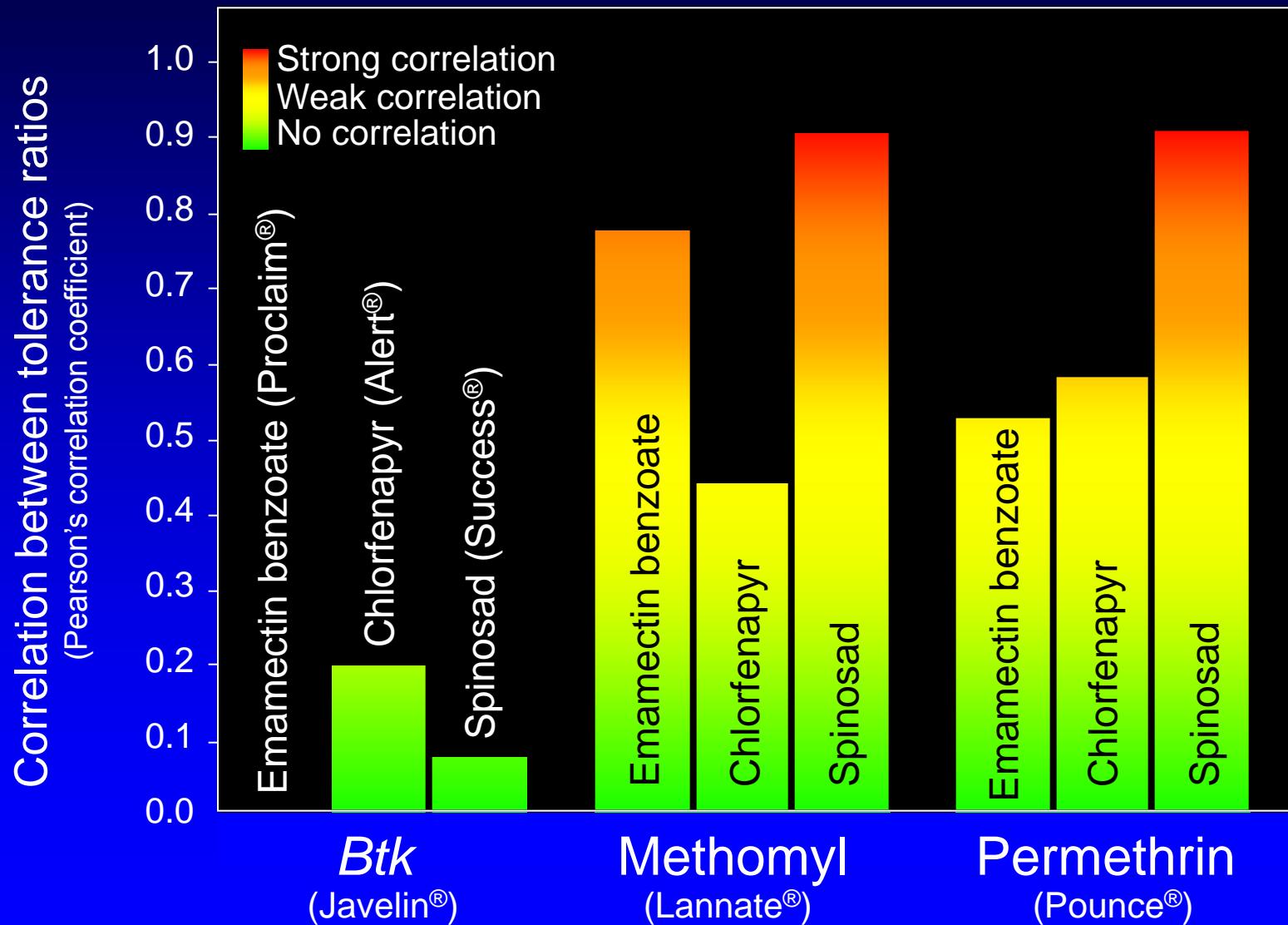
- Cry toxin complement and concentration
- Presence/absence of other potency factors
 - Synergists (spores, zwittermycin, VIP's)
 - Centrifugation vs. spray drying
- Formulation quality
 - Suspensibility
 - Particle size
 - "Inert" ingredients (UV screens, surfactants)

Physical Characteristics of Some Commercial *Bacillus thuringiensis* Formulations

Manufacturers & Products	Suspensibility (%)	Median particle diameter (μm)
Certis USA		
Javelin® WG	87.4	5.1
Deliver® WG	86.5	5.9
Agree® WG	80.4	30.1
Valent BioSciences		
DiPel® 2X WP	79.1	37.7
XenTari® WG	75.7	45.9
Ecogen		
Lepinox® WDG	74.4	83.5
CryMax® WDG	53.7	86.4

Potential for Cross-Resistance of Diamondback Moth (*Plutella xylostella*) to Different Insecticides

Shelton et al., J. Econ. Entomol. 93:931-936 (2000).



Shelton et al., J. Econ. Entomol. 93:931-936 (2000).

CONCLUSIONS:

Some “new” insecticides may not appear so new to the insect pest!

Threat of cross-resistance may already be limiting the life of new insecticides.



**The foundation of
Resistance Management
programs!**

Little or no risk of nontarget effects
No risk of cross-resistance