



# Insect Resistance Management in the Cotton Belt with Syngenta VipCot™ Cotton

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LATMC

February 2010

The VipCot and Agrisure Viptera traits are not currently approved for sale or use in the U.S. and are not being offered or promoted for sale. These products will not be available for sale until all necessary regulatory approvals and authorizations have been granted.

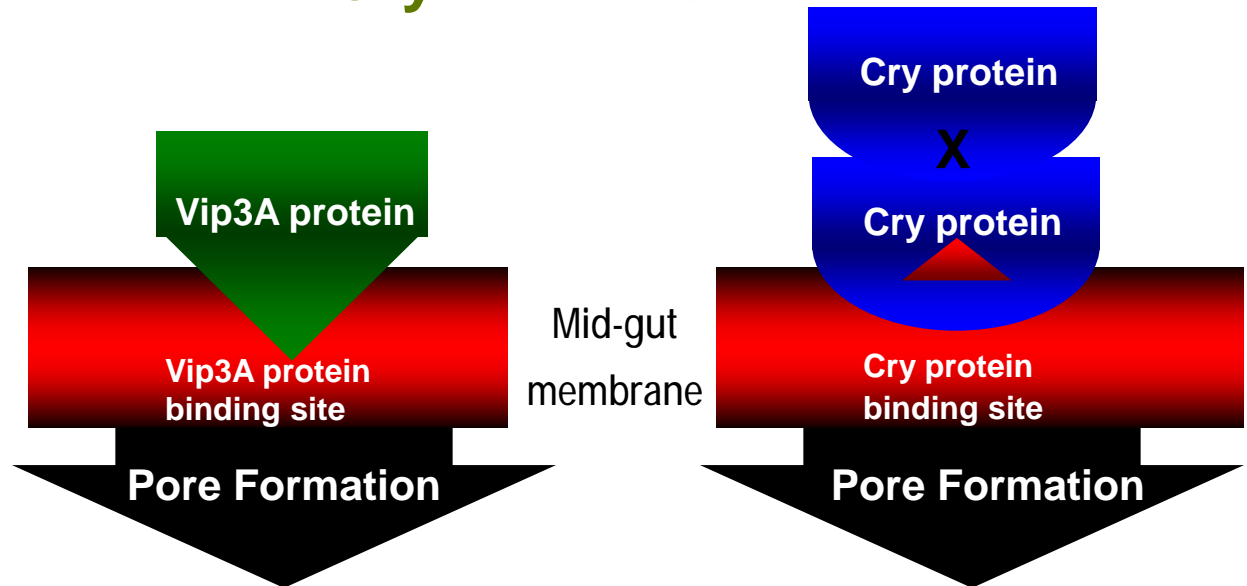
# VipCot™ Cotton and Agrisure Viptera™ Corn Traits & Stacks

- New choice for transgenic control of Lepidopterans in cotton and corn
- Product offerings from Syngenta will combine the novel **Vip3A** protein with the proven efficacy and performance of **Cry1Ab**
- EPA approved in 2008; awaiting UDSA approval for event COT67B and MIR162
- Both VipCot™ cotton and COT102 cotton traits have been licensed to Dow AgroSciences
- The Vip3A event, COT102, will also be part of Monsanto's Bollgard III™ cotton
- Agrisure Viptera trait will be sold in Syngenta corn germplasm as well as being a licensed trait

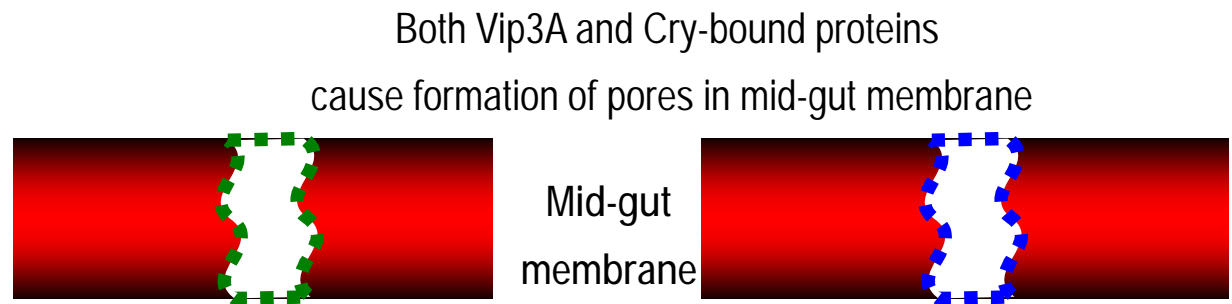


# How is Vip3A Different From Cry Proteins?

- Vip3A binds to a *different* receptor protein on the lining of insect mid-gut than Cry



- Different binding sites enhance resistance management

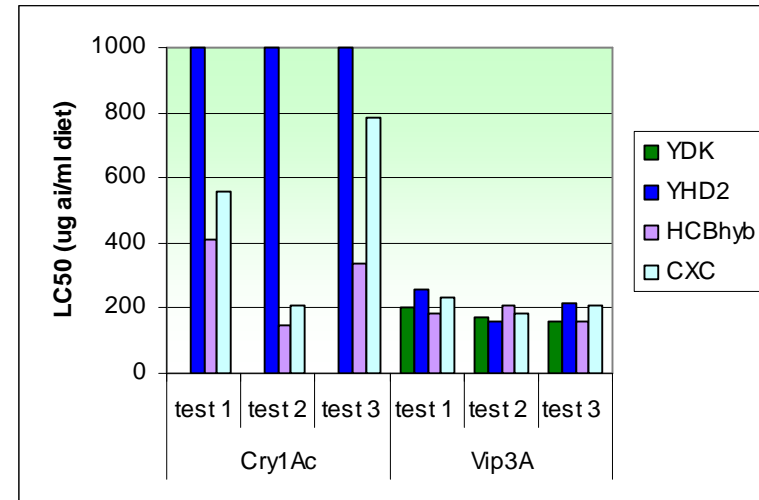


Pore formation results in insect death

# Cross resistance bioassays

- *H. virescens* strains: Jackson et al. 2007

- YDK: susceptible strain
- YHD2: resistant to Cry1Ac, Cry1F & Cry2Ab
- HCBhyb: resistant to Cry1Ac
- CXC: resistant to Cry1Ac



Jackson et al. 2007

- *H. zea* strain: Konasale et al. 2008

Strain	G <sup>a</sup>	Compound	Total no. of insects tested <sup>b</sup>	LC <sub>50</sub> (95% FL) <sup>c</sup>	Slope (mean ± SE)	RR <sup>d</sup>
AR	19 (93)	Cry1Ab	200	— <sup>h</sup>		ND <sup>e</sup>
SC <sup>f</sup>			200	133.33 (98.42–261.41)	1.82 ± 0.55	
AR	15 (>100)	Vip3A	512	22.29 (15.18–31.07)	2.59 ± 0.49	0.94
SC			512	23.73 (16.82–33.80)	2.24 ± 0.35	
AR	16 (>100)	Cry2Aa2	672	101.83 (72.60–167.39)	2.83 ± 0.51	1.55
SC			672	65.70 (46.27–109.34)	1.89 ± 0.27	
AR	16 (>100)	Cypermethrin	288	1.70 (1.11–2.61) <sup>g</sup>	2.08 ± 0.40	1.85
SC			288	0.92 (0.61–1.33) <sup>g</sup>	2.55 ± 0.52	

No cross-resistance between Vip3A and Cry proteins

# High Dose Methods

- Methods for claiming high dose established by US EPA SAP 1998 & 2000

ü Lyophilized tissue bioassays (Method #1)

ü Artificial field infestations (Method #4)

ü Older instar bioassay (Method #5)

## EPA review of dose data for VipCot cotton stack

- “COT67B expresses a probable high-dose against TBW (methods 1 and 4) and CBW (methods 1 and 5).”
- “COT102 does not appear to express a high-dose against any of three target pests when tested with method 1, but has a probable high dose against TBW and CBW with method 5.”
- "VipCot expresses a probable high-dose against TBW (using method 1; method 4 was considered inconclusive) and CBW (methods 1 and 5)."

VipCot EPA Biopesticide Registration Action Document

## Currently approved refuge options for VipCot™ stack

- Standard options for all previous insect-resistant cottons
- Options include
  - 20% sprayed non-Bt cotton
  - 5% unsprayed non-Bt cotton
  - 5% embedded non- Bt cotton
- With other dual-gene insect-resistant cottons, there has been a shift to the natural refuge option



## VipCot™ stack: Natural refuge option

- Massive data set developed identifying the contribution of non-cotton hosts to the overall TBW and CBW population.
- Data show that the contribution insects from non-cotton hosts vastly outweighs the contribution from the structured cotton refuge.
- Monsanto and Dow successfully argued that these non-cotton hosts should be sufficient to delay resistance to Genuity™ Bollgard® II and WideStrike®
- Syngenta used the same data set to show that the contribution of non-cotton host will also be sufficient to delay resistance to VipCot™ cotton.
- Natural refuge option for VipCot cotton requested from EPA in 2009.



## Summary

- Data have been submitted to EPA in support of a natural refuge option for delaying resistance in Heliothines for VipCot cotton stack.
- Previous modeling results have shown that adding Vip3A to the cropping system reduced the risk of resistance to Cry proteins.
- Adding Vip3A to the cropping system should still reduce the risk of resistance to Cry proteins using a natural refuge option.

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