

**CRUISER®/ADAGE™ PERFORMANCE  
FEATURES OF THIAMETHOXAM  
AS A SEED TREATMENT  
IN WORLDWIDE COTTON  
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**Introduction**

Thiamethoxam (CGA 293'343) is a novel broad spectrum insecticide currently under worldwide development by Novartis Crop Protection AG. The molecule belongs to a new chemical class - the neonicotinoids. Neonicotinoids have a new mode of action interfering with the nicotinic acetylcholine receptor of the nervous system of insects. This insecticidal target is different from all known mode of actions. Therefore it provides also control of OP, carbamate and pyrethroid resistant insects.

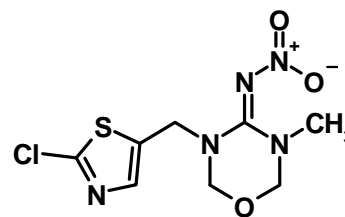
Thiamethoxam (CGA 293'343) will be introduced into the seed treatment market of the US under the trademark **ADAGE™**, in the rest of the world under the trademark **CRUISER®**.

In Cotton **CRUISER® / ADAGE™** applied as seed treatment shows excellent control of all important early season sucking pests including thrips, aphids, leafhoppers, well as soil-dwelling pests like Eutinobothrus sp. and wireworms. Good activity was also observed against leaf feeding weevils and some Lepidoptera. Depending on the dose rates of 35 to 210 g a.i./100 kg seeds a long lasting effect from 14 to 50 days can be achieved. The product shows excellent performance under different environmental conditions. Especially under dry soil conditions Cruiser performs clearly better than Gaucho. Virus transmission by aphids, like the blue disease in Brazil, is very well controlled by the highest rate of 210 g a.i./100 kg seeds with a lasting effect of 35 to 45 days. After the initial protection by seed treatment it is recommended to apply one additional foliar spray of Thiamethoxam.

**Chemical and Physical Properties**

Code Number:CGA 293'343  
Chemical Class:Neonicotinoid  
Subclass:Thianicotinyl  
Common Name:Thiamethoxam (ISO draft)  
Water Solubility 25° C:4,100 mg/l

**Structural Formula**



**Chemical Name**

3-(2-Chloro-thiazol-5-ylmethyl)-5-methyl-[1,3,5]oxadiazinan-4-ylidene-N-nitroamine

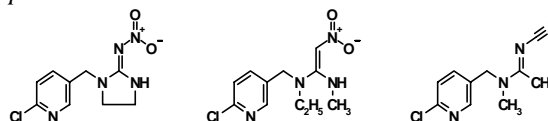
CGA 293'343 belongs to a new class of compounds - the neonicotinoids (I. Yamamoto, 1996). Its chemical structure differs remarkably from the 3 neonicotinoids already introduced to the market:

- CGA 293'343 is the first neonicotinoid possessing a chlorothiazole heterocycle
- the nitroguanidine group is incorporated in an oxadiazinane ring

These structural features make CGA 293'343 a quite unique compound.

**Neonicotinoids on the Market**

<b>Imidacloprid</b>	<b>Nitenpyram</b>
<b>Acetamiprid</b>	
<i>Bayer</i>	<i>Takeda</i>
<i>Nippon Soda</i>	



**Crop Tolerance**

Based on a large database, CGA 293'343 is very safe for the germinating seed and young seedling at the recommended use rates and even at 1.5 x use rates for registration requirements. The behavior of CGA 293'343 regarding crop tolerance can be summarized as follows:

- no delay in germination of the treated seed
- uniform emergence
- strong vigor of the seedling and young plant

**User Safety**

Seed treatment applications are typically performed under the controlled environment of seed production plants. In

addition to an overall favorable toxicological profile, CGA 293'343 has

- no skin irritation potential
- no sensitization potential

### **Environmental Safety**

CGA 293'343 has very favorable eco-toxicological characteristics. With the targeted use as seed treatment the exposure level to the environment is even more reduced.

- very favorable to birds
- to fish, Daphnia and molluscs, practically non-toxic
- algae earthworms are insensitive

### **Formulations**

CGA 293'343 is formulated in different formulations according to specific market needs. There are mainly three different formulation categories under development:

- Straight CGA 293'343 formulations as Wettable Slurry (WS)  
WS 70 containing 700 g a.i./ kg product either colored red or colorless
- Straight CGA 293'343 formulations as flowables
  - FS 350 containing 350 g a.i./1 product colored red
  - FS 600 containing 600 g a.i./ 1 product colorless

### **Uptake and Distribution**

CGA 293'343 has a low molecular weight and relatively high water solubility, all of which favor rapid and efficient uptake and xylem transport. When applied to the seed, CGA 293'343 is rapidly taken up by the roots and translocated into the cotyledons and leaves. In combination with the retention of the compound in the drilling zone and formation of treatment halo around the seed, CGA 293'343 is providing an efficient protection shield for the germinating seed against soil dwelling insects.

### **Use Rates**

In cotton depending on the use rate and the target insect, Thiamethoxam offers the possibility to control early season insects up to 50 days after crop emergence (Table 1). For most targeted pests, applied at around 50 % of the registered use rates of the current available compounds from the same chemical class Thiamethoxam provides an equal or even superior activity.

## **Results**

### **Lasting Effect**

The lasting effect of CRUISER<sup>®</sup> / ADAGE<sup>™</sup> can be adjusted to the need by varying the dose rate. Field trials over two years against aphids in Paraguay show a clear dose rate response. The high dose rate of 210 g a.i. of CRUISER<sup>®</sup> gave excellent control over 50 days whereas the low dose rate of 52.5 g a.i. gave good control over 18 days. Imidacloprid at 210 g a.i. performed similar to the low rate of CRUISER<sup>®</sup> / ADAGE<sup>™</sup> (see Figure 3).

### **Water Solubility**

Due to the very favorable water solubility CRUISER<sup>®</sup> / ADAGE<sup>™</sup> performs well under different environmental conditions. Especially in dry soil, the activity is clearly superior to the competition. A lab study (Figure 2) shows the control of aphids under two different water regimes. CRUISER<sup>®</sup> / ADAGE<sup>™</sup> shows similar control as Gaucho under normal moisture soil but is clearly superior under dry conditions.

### **Control of Aphids and Blue Disease, a Cotton Virus in Brazil**

Several trials initiated between 1996 and 1998 showed, that CRUISER<sup>®</sup> / ADAGE<sup>™</sup> is very effective against aphids (*Aphis gossypii*). At 210 g a.i./100 kg seeds it performs equal to the standard granule application of Furadan at 1500 g a.i./ha and clearly superior to Gaucho at 210 g a.i. over 41 days after emergence (DAE) (Figure 3). To prevent the transmission of the blue disease by aphids, the highest rate of 210 g a.i./100 kg seeds is required. After the initial protection by seed treatment it is recommended to apply one additional foliar spray of Thiamethoxam.

### **Efficacy on *Eutinobothrus Brasiliensis* in Brazil**

*Eutinobothrus* is an increasing pest problem in all cotton growing areas of Brazil. CRUISER<sup>®</sup> / ADAGE<sup>™</sup> at 210 g a.i./100kg sufficiently controls *Eutinobothrus* over 40 DAE, is clearly superior to Gaucho at 210 g a.i. and equal to the standard Furadan at 1500 g a.i.(Figure 4). At the lower rate of 140 g a.i. the efficacy is still very good but the residual effect last only until about 40 DAE..

### **Early Season Control of *Alabama Argillacea***

During the first 11 to 14 days after emergence, 140 to 210 g a.i./100kg seeds of CRUISER<sup>®</sup> / ADAGE<sup>™</sup> results in excellent protection of the cotton against *Alabama argillacea*. The efficacy is equal to Furadan at 1500 g/ha and clearly superior to Gaucho at 210g a.i. (Figure 5).

### **Control of Jassids in Asia**

Jassids are a severe pest in Asian cotton and the damage in form of hopper burn can destroy the whole crop. CRUISER<sup>®</sup> / ADAGE<sup>™</sup> is highly active on Jassids. In trials in Thailand, 140 g a.i./100 kg seeds is clearly superior to Gaucho at 210 g a.i. (Figure 6).

## Activity on Thrips

Thrips attack the cotton during the first 21 to 28 days after emergence. In trials from Paraguay (Figure 7) CRUISER® / ADAGE™ at 210 g a.i./100 kg of seeds shows very good control of thrips after 14 as well as 28 DAE. In contrast Gaucho at 210 g a.i. and Marshall at 625g a.i. performed inferior, with a clearly shorter residual activity.

Table 1: World wide Use Recommendation  
Seed Treatment with Cruiser 70 WS / 350 FS / 600 FS

Pest Species	Rate of Active Ingredient per 100kg of seeds	Expected Lasting effect
<b>Aphids</b> ( <i>Aphis gossypii</i> )	70 - 210	21 - 50 days
<b>Cotton Leaf-worm</b> ( <i>Alabama argillacea</i> )	210	10 - 14 days
<b>Jassids</b> ( <i>Empoasca devastans</i> )	210	45 - 50 days
<b>Thrips</b> ( <i>Caliothrips brasiliensis</i> , <i>Frankliniella fusca</i> , <i>F. schulzei</i> , <i>F. occidentalis</i> , <i>Thrips tabaci</i> )	140 - 210	15 - 21 days
<b>Eutinobothrus brasiliensis</b>	210	30 days
<b>Wireworm</b> ( <i>Agrotis sp.</i> )	210	40 days
<b>Conotrachelus denieri</b>	105 - 210	15 - 21 days

## Conclusions

CGA 293'343 is the first representative of the 2nd generation neonicotinoid compounds with clear advantages, such as lower use rates, higher residual activity and a much broader spectrum. Furthermore, in comparison to other currently marketed neonicotinoid products, Thiamethoxam performs superior under different environmental conditions. It can be used in most agricultural crops and controls a wide range of sucking and chewing insects, including some *Lepidopteran* pests. Thiamethoxam is the ideal replacement of older chemistry in this market.

## Acknowledgment

The authors like to thank all of their colleagues in Basel and many countries who have contributed to research and development. Without their dedicated assistance this paper would not be possible.

## References

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Yamamoto I (1996). Neonicotinoids - mode of action and selectivity. *Agrochem. Jpn* 68: 14-1

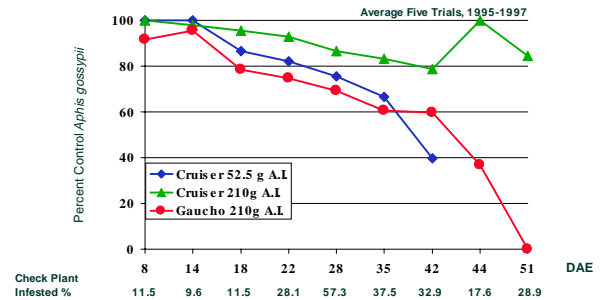


Figure 1: Field trials in Cotton in Paraguay against *Aphis gossypii*.

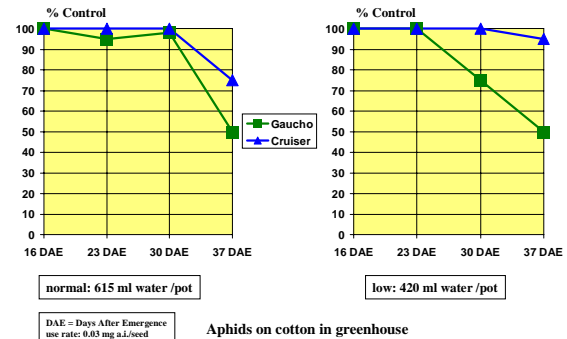


Figure 2: Greenhouse trial in Cotton against *Aphis gossypii* under different water regimes.

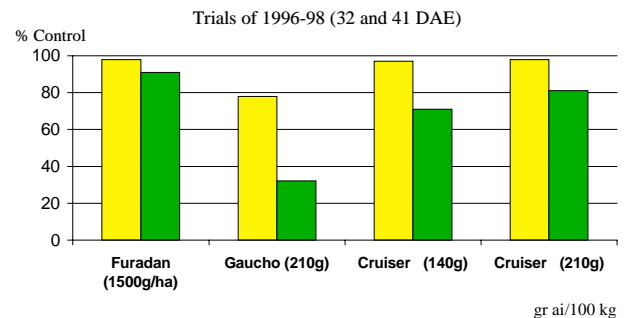


Figure 3: Field trials in Cotton in Brazil against *Aphis gossypii*.

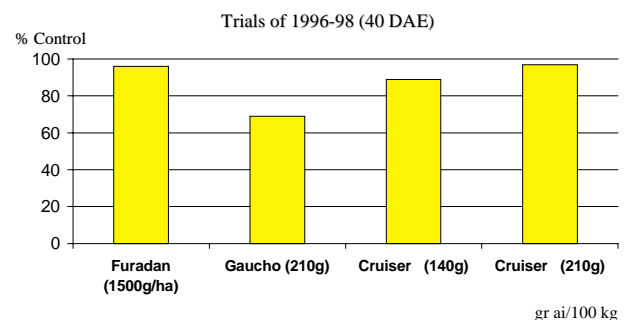


Figure 4: Field trials in Cotton in Brazil against *Eutinobothrus brasiliensis*.

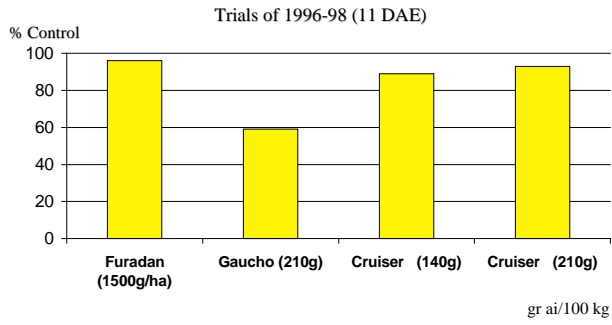


Figure 5: Field trials in Cotton in Brazil against *Alabama argillacea*.

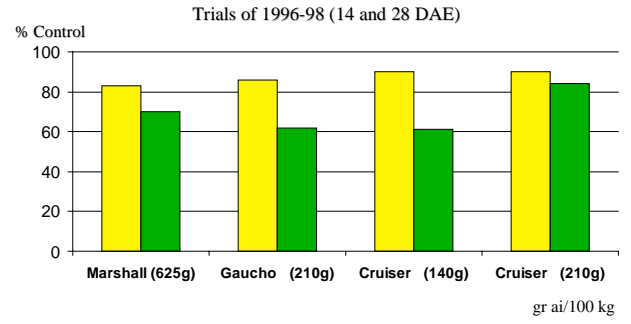


Figure 7: Field trials in Cotton in Paraguay against Thrips.

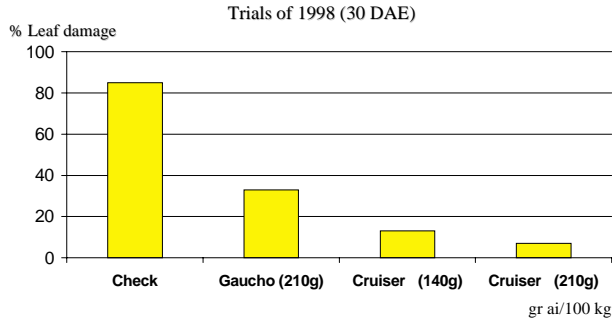


Figure 6: Field trials in Cotton in Thailand against *Amrasca biguttula*.