

CRUISER®/ADAGE™ UPTAKE DYNAMIC AND BIOLOGICAL PERFORMANCE UNDER DIFFERENT ENVIRONMENTAL CONDITIONS

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Abstract

Thiamethoxam (CGA 293'343) is a novel broad spectrum insecticide currently under worldwide development and market introduction 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.

Introduction

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®**. Registrations up to date have been granted in Brazil, Argentina, Chile, Paraguay, Uruguay, South Africa and New Zealand.

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 Lepitoptera.

Depending on the dose rates of 70 to 300 g a.i./100 kg seeds a long lasting effect from 14 to 45 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 rate of 210 g a.i./100 kg seeds with a lasting effect up to 35 to 45 days. After the initial protection by seed treatment it is recommended to apply one or two additional foliar spray of Thiamethoxam.

Uptake and Distribution

CGA 293'343 has a low molecular weight and an excellent 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 the formation of a treatment halo around the seed, CGA 293'343 is providing an efficient protection shield for the germinating seed against soil dwelling insects.

Under many different environmental conditions **CRUISER®** performs best compared to competitive neonicotinoids.

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 also at 1.5 x use rates for registration requirements. No negative effect on germination on seeds carried over for at least one year have been observed. 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
- earlier boll formation

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® / ADAGE™** 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®** 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® / ADAGE™** (see Figure 1).

A chemodynamic study on tomato plants visualizes the lasting effect of **CRUISER®** after drench application compared to Gaucho (see Picture 1). Tomato plants drenched with **CRUISER®** take the product up fast and after three days it is distributed in the whole plants and after 14 days there is still enough product around to protect the new growth against pests. In the treatment with Gaucho the same behavior was found after 3 days but after 14 days there was not enough product available to protect the new growth and the pests are able to build new colonies again.

Water Solubility

Due to the very favorable water solubility CRUISER[®] / ADAGE[™] (Figure 2) performs well under different environmental conditions. Especially in dry soil, the activity is clearly superior to the competition. A field study (Figure 3) shows the control of thrips under two different water regimes. One field plot was irrigated and the other was kept dry. CRUISER[®] / ADAGE[™] shows similar control as Gaucho under normal moisture soil but is clearly superior under dry conditions.

Field trials in Brazil confirmed this finding. In one trial it was so dry that even Aldicarb (Temik) performed clearly inferior to CRUISER[®] against thrips.

Due to the higher water solubility of Thiamethoxam compare to Imidacloprid we could speculate that under high moisture condition the product is not long enough available to the plant and therefore gives a shorter protection than its competitor.

To evaluate the behavior of the products under high moisture conditions two trials were initiated in cotton against thrips in Egypt. One part of the field was irrigated by flooding, three and 21 days after planting and the other part was irrigated with a sprinkling system to give the soil just enough moisture that the cotton was growing well.

Under the sprinkling irrigation both CRUISER[®] at 210 g/ai per 100 kg of seeds and Gaucho at 490 g/ai showed excellent control of thrips over 32 DAP. Under flood irrigation both compound lost activity after the second flooding of the field 22 DAP (Figure 4). More trials need to be done to confirm the results and to establish a recommendation for region with high volume flood irrigation.

CRUISER[®] with its 8 times higher water solubility over Gaucho has a clear advantage under dry conditions, this trials shows that the higher water solubility is no disadvantage under high water irrigation systems compare to its competition.

A chemodynamic study with radio labeled a.i. showed that under normal soil moisture condition only CRUISER[®] is well distributed throughout the cotyledons and therefore gives best protection against pests. Imidacloprid showed under this very favorable moisture condition an inferior distribution in the leaves (Picture 2).

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
Aphids (<i>Aphis gossypii</i>)	70 - 210	21 - 50 days
Cotton Leaf-worm (<i>Alabama argillacea</i>)	210	10 - 14 days
Jassids (<i>Empoasca devastans</i>)	210	45 - 50 days
Thrips (<i>Caliothrips brasiliensis</i> , <i>Frankliniella fusca</i> , <i>F. schulzei</i> , <i>F. occidentalis</i> , <i>Thrips tabaci</i>)	140 - 300	15 - 21 days
Eutinobothrus brasiliensis	210	30 days
Wireworm (<i>Agrotis sp.</i>)	210	40 days
Conotrachelus denieri	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.

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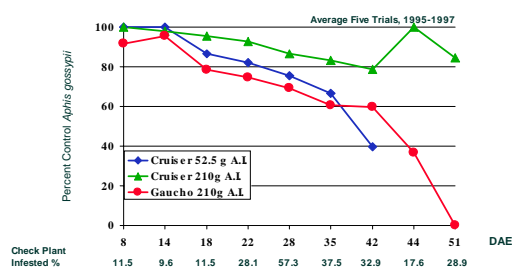
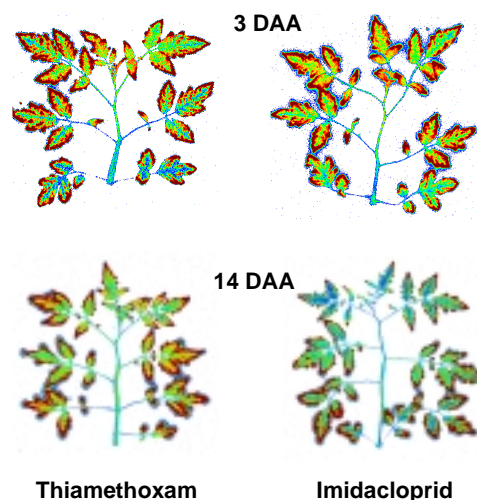


Figure 1. Field trials in Cotton in Paraguay against *Aphis gossypii*.



Picture 1. Uptake in tomatoes after drench application of Thiamethoxam and Imidacloprid. At 3 DAA both products are well distributed. At 14 DAA Thiamethoxam shows a higher uptake into the new growth of the plants than Imidacloprid.

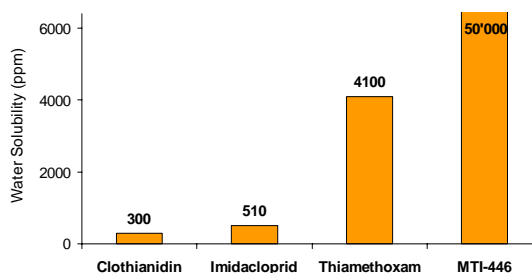


Figure 2. Water solubility in ppm of four different neonicotinoids

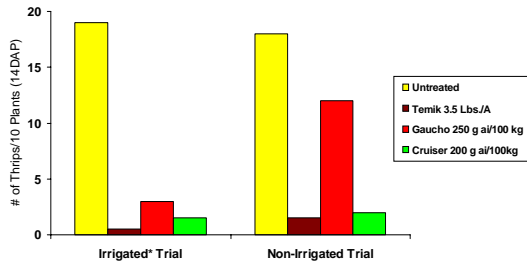


Figure 3. Thrips trial in cotton in USA under irrigated and dry soil conditions

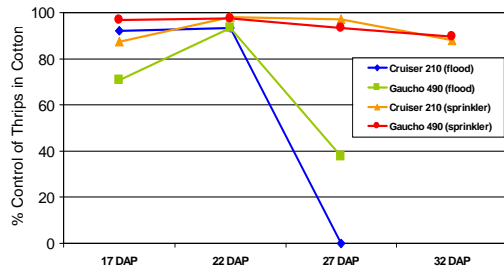
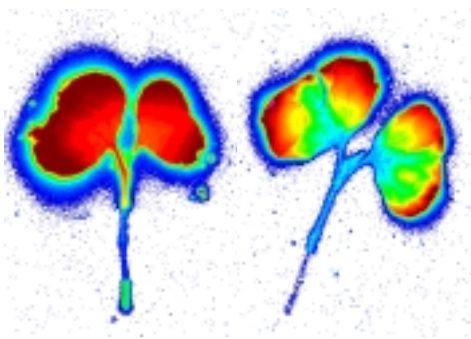


Figure 4. Field trials in Cotton in Egypt against Thrips under sprinkler and flood irrigation.



Thiamethoxam

Imidacloprid

Picture 2. Uptake study of thiamethoxam and imidacloprid in cotton under normal moisture conditions. As darker the color (red) as more product is taken up. Thiamethoxam is distributed throughout the whole leaf where as Imidacloprid shows more unprotected areas.