

## **FLONICAMID: A NOVEL, HIGHLY SELECTIVE APHICIDE FOR USE ON COTTON**

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### **Abstract**

Flonicamid is a highly selective, fast acting aphicide belonging to a new class of insecticides: the pyridinecarboxamides. Flonicamid was discovered by Ishihara Sangyo Kaisha (ISK) and was selected for development based on its insecticidal activity and superb environmental profile. ISK and FMC Corporation entered into a co-development and commercialization agreement for the Americas. Flonicamid has been tested under the ISK code number IKI-220 and the FMC code number F1785. The crop use (cotton, leafy vegetables, fruiting vegetables, pome fruit, stone fruit, potato, and cucurbits) registration packet was submitted to EPA in 2003. EPA classified flonicamid as an OP replacement and U.S. crop registrations are expected for 2005 season. It has already been approved for use on greenhouse ornamentals.

Flonicamid presents the grower with a highly targeted insecticide: active on aphids and safe to all tested beneficial arthropods and other non-target species – birds, fish and aquatic invertebrates. As such, it will be a superb component of future IPM programs. Its use rate from 0.05 to 0.10 lb a.i./acre and the short soil half life of flonicamid and its metabolites lead to there being no risk of groundwater contamination from flonicamid. Crop residues are also low.

The exact target site remains undefined but laboratory assays have demonstrated that flonicamid is not a neonicotinoid. In fact, these laboratory trials have demonstrated that the target site is different from all known insecticidal mode of actions. Binding/inhibition studies have ruled out specific target sites: mitochondrial respiration (diafenthiuron, hydramethylnon, chlorfenapyr), GABA-receptor (cyclodienes, fipronil, bifenazate, avermectins), Sodium channel (pyrethroids, DDT, indoxacarb), Acetylcholinesterase (OP's, carbamates, carbamoyl triazoles), Nicotinic acetylcholine receptor (neonicotinoids, spinosad), Octopamine receptor, Nitric oxide synthase, and Nitrous oxide receptor. Rapid onset of flonicamid activity rules out additional modes of action including: chitin synthesis inhibition, juvenile hormone and ecdysone agonist activity. Flonicamid induced behavioral symptoms in treated aphids that differ substantially from those induced by imidacloprid. Studies have proven that flonicamid is not cross-resistant with OP's, carbamates, pyrethroids or imidacloprid.

Flonicamid's action on aphids is rapid. Within one hour of exposure via contact or ingestion, adult and immature aphids cease feeding. This same short exposure results in eventual mortality. Mortality typically takes 2-5 days and is a result of dehydration. Mortality is more rapid under warmer conditions, but otherwise flonicamid performance is not affected by temperature.

No beneficial species has been discovered which is significantly impacted by flonicamid. GLP lab studies in which flonicamid was dosed at 80-85 grams ai/ha, revealed the following effects: 1) predatory carabid ground beetle (*Poecilus cupreus*) no effects on survival or food consumption (IOBC: low/harmless), 2) predatory phytoseid mite (*Typhlodromus pyri*) 19% reduction in beneficial capacity (IOBC: low/harmless), 3) parasitic braconid wasp (*Aphidius rhopalosiphii*) 14% reduction in beneficial capacity (IOBC: low/harmless), 4) green lacewing larvae (*Chrysoperla carnea*) 3.7% reduction in beneficial capacity (IOBC: low/harmless). Additional lab studies revealed that flonicamid is safe toward the lady beetles *Harmonia axyridis*, *Hippodamia convergens*, *Cybocephalus binotatus*, and *Cryptolaemus montrouzieri*, the praying mantis *Tenodera aridifolia sinensis*, the predatory mites *Amblyseius cucumeris* and *Phytoseiulus persimillis*, minute pirate bugs *Orius spp.*, the big-eyed bug *Geocoris pallens*, the parasitic wasps *Encarcia formosa*, *Diglyphus isaea*, and *Trichogramma spp.*, and the whitefly parasite *Eretmocerus californicus*. Thus, flonicamid can be expected to preserve beneficial populations, which will aid in overall pest control and prevent a return of aphid populations to above threshold.