NOVALURON – A NEW IGR FOR STORED PRODUCT INSECT PEST CONTROL

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Negative medical, ecological and socio-economic consequences of wide use of conventional fumigants and protectants have lead to the search for safe and environmentally friendly alternatives. One of them is Insect Grows Regulators (IGRs). These compounds disturb the development of insects and cause the larval mortality but they are not effective against adult stage. IGRs have very low toxicity to mammals and other non-target organisms and usually are rapidly degraded in the environment.

It is well known, that some of the harmful stored product pests, such as *Sitophilus sp.*, develop all stages inside the grain. Another, *Rhizopertha dominica*, develops only the first instar larva outside of the kernel, but all other stages are inside the grain. It means that larval stage of these species does not have direct contact with active compound. This is the main reason of low activity of IGR's from juvenoids and ecdysteroids groups on internal feeders. The most effective IGR's against these stored product pests belong to the group of Chitin Synthesis Inhibitors (CSI's).

Novaluron is a new CSI from benzoyl phenyl urea's group, developed in Israel by Makhteshim–Agan Company. It has a broad-spectrum activity on various insects and very low toxicity to mammals. The objective of our studies was to evaluate the efficacy of Novaluron on the main stored product insect pests as a possible alternative to standard pesticides for stored pest control.

Total mortality of external *Tribolium castaneum* and *Trogoderma granarium* in third-instar larvae and prevention of the adult emergence of *Plodia interpunctella* in laboratory conditions, at a concentration of 1.0 ppm, was recorded. At this concentration the numbers of F_1 internal feeders *S. oryzae* and *R. dominica* were reduced by 95% compared with the control. The insect, that survived completely died out after 3–4 months and the total decrease of insect populations was observed. The activity of Novaluron against *S. oryzae* was maintained for at least 1 year. At the concentration of 0.3 ppm the numbers of *S. oryzae and R. dominica* F_1 were also significantly reduced compared to the control (85% and 84% respectively). The population of *R. dominica* survived, whereas *S. oryzae* was unable to establish a stable vital population.

The influence of Novaluron on the egg stage was studied on *T. castaneum*, the world wide important external stored product insect pest. Novaluron did not affect the number of eggs laid by *T. castaneum* adults, which were exposed to treated wheat flour, and did not affect directly the egg hatch, but it totally inhibited their hatching after three days of adult exposure to Novaluron at a

concentration of 1 ppm. The main way of Novaluron penetration into insect is by contact with it. Also the rehabilitation of egg hatching after break of the contact of parental adults with Novaluron was shown.

Some experiments performed with *T. castaneum*, when only adults were exposed to the treated culture, showed, that this model may be used for explanation of effects of CSI's on internal feeders, especially *S. oryzae.*

The distribution of Novaluron is the most critical factor for treatment efficacy. When Novaluron was used by dropping at a concentration of 2 ppm, with good grain mixing, the reduction of F_1 of *S. oryzae* and *R. dominica* was 5 times higher compared to unmixed treatment.

Two methods of application: dropping and spraying were tested in large scale laboratory studies. There were used different concentrations and dilutions of Novaluron (Rimon 10% E.C.). By dropping, at concentrations of 2-4 ppm the population of *S. oryzae* adults was decreased by 88-95% compared with control two months after treatment and grain infestation. At 2 and 4 ppm, and with application rate of 1 l/t, the activity was at the same level. At 2 ppm there were no significant differences also between treatments without dilution and with the rate of 1 l/t. However, at 2 ppm, but undiluted, the effect was significantly lower than at 4 ppm with the rate of 1 l/t.

By spraying, the effect of Novaluron at 2 ppm with rate of 2 l/t reached 98% against *S. oryzae* and was significantly higher compared with the same concentration but at rate of 1 l/t (90%) and was similar to effect of 4 ppm with the rate of 1 l/t (97%). Dropping and spraying at tested concentrations and application rates, showed similar effects. *S. oryzae* and *R. dominica* were unable to establish stable vital populations.

In field studies, the efficacy of Novaluron at 2 ppm against both *S. oryzae* and *R. dominica* was high enough during at least 9 months: 82-90% F_1 reduction.

Key words: *Benzoyl phenyl ureas; Chitin synthesis inhibitors; Novaluron; Stored product insect pest; Stored product protectants*