PHYTOTOXICITY ON COTTON SEEDS BY USING THE INSECTICIDE IMIDACLOPRID

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RESUMO

Inseticidas pertencentes aos neonicotinoides são sistêmicos, podendo alterar parâmetros da fisiologia das plantas de forma negativa provocando fitotoxicidade. Diante disto, o presente trabalho procurou identificar o potencial efeito fitotóxico em sementes do genótipo BRS Aroeira. O trabalho foi conduzido em casa de vegetação no campus universitário de Santa Helena de Goiás, da Universidade Estadual de Goiás – UEG. Registrou-se o potencial fitotóxico do ingrediente ativo Imidacloprid quando no tratamento de sementes sem diluição. Quando o produto foi utilizado sem diluição, o inseticida Imidacloprid afetou negativamente a sobrevivência, o acúmulo de matéria seca, taxa de crescimento diário e o período de germinação. Portanto, os resultados deste trabalho revelaram que o Imidacloprid, quando sem diluição, é altamente nocivo para parâmetros da qualidade fisiológica de sementes de algodoeiro.
Palavras-chave: Toxicidade; Qualidade fisiológica; Neonicotinóide.

ABSTRACT

Insecticides belonging to neonicotinoids are systemic and can change parameters of plant physiology negatively causing phytotoxicity. Given this, the present study sought to identify the potential phytotoxic effect on seed genotype BRS Aroeira. The work was conducted in a greenhouse on the campus of Santa Helena de Goiás, Goiás State University – UEG (Universidade Estadul de Goiás). Was Recorded the phytotoxic potential of the active ingredient Imidacloprid seed treatment when undiluted. When the product was used without dilution, the insecticide Imidacloprid negatively affected the survival, dry matter accumulation, daily growth rate and the germination period. Therefore, the results of this study revealed that Imidacloprid, when undiluted, is highly detrimental to physiological parameters of quality of cotton seeds.
Keywords: Toxicity; Physiological quality; Neonicotinoid.

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1. INTRODUCTION

The cotton industry is of paramount importance to the textile industry in the Brazilian. That culture has changed substantially, the marketing of fiber in Brazil. While with the commercial release of GM crops expressing Bt toxins, the occurrence of insect pests in cotton agroecosystems, has hindered the achievement of successful exploitation of this culture (MALAQUIAS *et al.,* 2012). Both conventional varieties as the GM may be directly or indirectly affected by the attack of sucking arthropods (FERNANDES *et al.,* 2012). Therefore, it is important to adopt measures to control these organisms (RAMALHO *et al.,* 1994).

The use of insecticides as seed treatment is a way to reduce losses arising from actions of many insect pests that damage the underground parts of young plants, since its germination (PEREIRA *et al.,* 2011). In cotton production systems, seed treatment, especially through the use of insecticides, is a tactic that has been employed in the preventive control of sucking arthropods, is of great importance because of the aggressiveness of attack of various pests such as aphids *Aphis gossypii* Glover (Hemiptera: Aphididae) and *Myzus persicae* (Sulzer) (Hemiptera: Aphididae), weevils *Eutinobothrus brasiliensis* (Hambleton) (Coleoptera: Curculionidae) and *Conotrachellus denieri* Hustache (Coleoptera: Curculionidae), thrips *Frankliniella* spp. (Thysanoptera: Thripidae) and *Bemisia tabaci* (Gennadius) (Hemiptera: Aleyrodidae) (SARAN & SANTOS, 2007). However, studies focusing on the impact of insecticides on seed quality are considered incipient.

The seed quality is evaluated through germination and vigor. The germination test and the official procedure to evaluate the ability of seeds to produce normal seedlings under ideal conditions (CARVALHO & NAKAGAWA, 2000), but these often differ from results obtained in the field. Therefore, there is growing interest in the use of force tests, as these complement the information obtained in the germination test, with reliable results in relatively short period of time (TORRES & MARCOS FILHO, 2005). These tests are essential components of programs of quality control, in order to avoid handling and marketing of seeds of inadequate quality (MENDONÇA *et al.,* 2003).

Insecticides belonging to neonicotinoids such as Imidacloprid, are systemic and may change parameters of plant physiology receptors negatively causing phytotoxicity, mainly because in many cases the insecticides used for seed treatment are applied with little or no dilution which has contributed to altered physiological status of the receiving plant.

However, until now this information are incipient thus are relevant studies that show such effects. Against this backdrop the present study sought to identify the potential phytotoxic effect of active ingredient when used undiluted on BRS Aroeira.

2. MATERIAL AND METHODS

The work was conducted in a greenhouse on the campus of Santa Helena de Goiás, Goiás State University – UEG (Universidade Estadual de Goiás – UEG). The insecticide and seeds were purchased from the Fundação de Apoio à Pesquisa e Desenvolvimento de Goiás (Fundação Goiás), Santa Helena de Goiás, GO.

Bioassay: In this assay was considered the exposure route contact through the direct application of the insecticide Imidacloprid in seeds. For this, the seeds were exposed to insecticide into one plastic container with a capacity of 250 ml with seeds using a suspension of 20 ml, for each group of 36 seeds. After soaking in the product, the seeds were removed from the container and filter paper retained for disposal of excess products for 2 minutes. Then the treated seeds were kept in tubes containing substrate Plant Max®, to evaluate the percentage of germination. Was determined susceptibility genotype BRS Aroeira through the active ingredient Imidacloprid without dilution. For this we considered the treatments: control and Imidacloprid (undiluted).

The evaluations were performed according to the Rules for Seed Analysis (BRAZIL, 2009) and the results expressed as percentage of normal seedlings and dead. Phytotoxicity evaluations were considered at 21 days after emergence (DAE), according to the methodology used by DAN *et al.,* (2012), in which data collection was made for the height of the Aerial part. Also collected was the shoot dry weight at 30 days after seedling emergence. The dry matter was obtained in a greenhouse with controlled temperature at 65 ºC for 72 hours.

Data analysis: The effects of lethal and sublethal insecticide Imidacloprid. We used a model to estimate the daily growth rate as adaptations of the formula adopted by Mal et al., (2010).

where:

$$\mathbf{r(C)= 1{,}0/C_a^{\{|\sum \ln(di)|n\}}}$$

Ca = Length of shoot.

di = days required for germination.

n = number of plants in the sample universe.

The mortality, dry matter accumulation and the parameters: shoot (cm), radicle (cm), germination (days) and daily growth rate were subjected to analysis of variance and compared by t-test (SAS Institute , 2002).

3. RESULTS AND DISCUSSION

The insecticide Imidacloprid affected negatively the survival and dry matter accumulation of cotton plants, so this active ingredient when used without dilution is harmful to the development of cotton seedlings, because increases mortality (20.02%) and reduces the accumulation dry matter (204.50 mg) to the twentieth day seedling germination (**Figure 1A and 1B**).

In parameters: length of Aerial part (9.38 cm) and radicle (7.45 cm) and daily growth rate (1.19) were found lower values (Table 1), and a prolonged period of germination (6.26 days) when the seeds were treated with Imidacloprid.

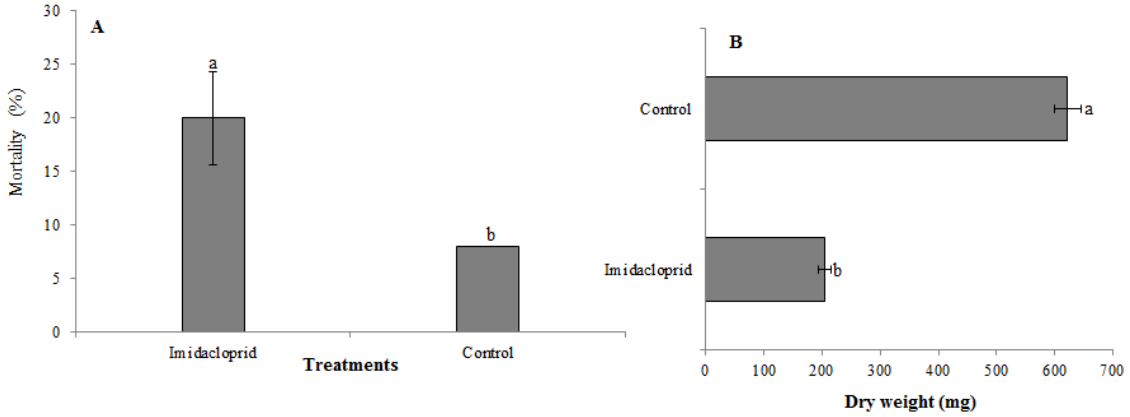

Figure 1. Inhibition of survival (**A**) and dry matter accumulation (**B**) by the insecticide Imidacloprid.

Table 1 - Effects of Imidacloprid in Parameters (Mean±SE) of Seed Quality of Cotton[1].

Treatment	Aerial part (cm)	Radicle (cm)	Germination (days)	Daily growth rate
Imidacloprid	9.38±0.20 a	7.45±0.20 a	6.26±0.12 a	1.19±0.16 b
Control	10.24±0.23 a	9.94±0.24 a	3.80±0.08 b	2.61±0.14 a

[1]Means followed by the same letter (within the column) do not differ by t test (P = 0.05).

There was no significant difference (P> 0.05) for the length of the shoot and radicle.

The daily growth rate in the group treated with insecticide, as well as the germination period were 1.19 and 6.26 days, respectively, differed significantly (P< 0.05) in the control group. Therefore, seeds treated with the product when undiluted, produced seedlings with lower daily growth rate. This factor is extremely important when considering the maintenance of plants in the field, because

the growth rate uniformity and assist in weed control with faster canopy closure.

The occurrence of abiotic stress in natural populations is common, leading to adaptive evolution and, therefore, the genotypes more skilled in dealing with stress, should be more successful. However, if an organism exposed to a toxic agent expend energy in the process of detoxification to keep yourself alive, you can reduce the energy used for other physiological processes of great importance (FORBES, 2000).

When smaller doses in other studies have shown no effect phytotoxicity this molecule. In a study by Kubo *et al.,* (2012), was found no influence of the active ingredient Imidacloprid, when used in combination with products Thiodicarb and / or Clothianidin, the parameters plant height, fresh weight from root and dry weight aerial of cultivars Fibermax 966 and IAC 25. Padua & Vieira (2001) reported that lots of cotton seeds undergoing treatment with Imidacloprid + Tolylfluanid + Pencycuron showed higher vigor those untreated.

This study confirms that the insecticide Imidacloprid affects negatively the survival and dry matter accumulation of cotton plants, showing that the active ingredient, when used without dilution is harmful to the development of cotton seedlings, which are also found in lower growth rates daily. Therefore, applications of this molecule, without proper technical recommendations should be used judiciously on cotton.

4. CONCLUSIONS

The insecticide Imidacloprid when used without dilution affects negatively the survival and dry matter accumulation of cotton plants, so the active ingredient when used without dilution is harmful to the development of cotton seedlings, which are also found in lower rates daily growth.

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