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The effects of sugarcane ripeners drift in non-target crops

Abstract

The use of ripeners is one of the steps of managing sugarcane in Brazil. Sugarcane ripeners are mostly applied by airplanes and besides the target crop, these products can reach neighboring areas close to the sugarcane crops, causing a variety of effects. One of the crops that can be affected by this phenomenon is lettuce. Lettuce, as sugarcane, has its importance at local markets in Brazil. In literature, some researches are mentioning the effects caused by drift in many crops, but for lettuce the information is scarce. Researches that identifies the main consequences of ripeners drift are extremely necessary and it is a useful source for growers to identify the first possible symptoms when it occurs.

Keywords: Lactuca sativa, phytosanitary products, application technology, off-target, management

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Introduction

In Brazil, the state of Sao Paulo has one of the most representative areas regarding the cultivation of sugarcane, with a planted area of 5,686,134 ha, which corresponds to 55% of the total national area.[1] Linked to the cultivation of sugarcane, the state also has a strong representation in the vegetable market. According to Camargo and Camargo,[1] the planted area in the state corresponds to approximately 11,704 ha, with an average productivity of 40.60 t ha-1. Thus, considering the large areas in the state exploring the cultivation of sugarcane and its intense use of phytosanitary products, crops in nearby areas would be susceptible if any management was performed in the wrong way. Thus, the question arises of the potential damage that the lettuce crop could suffer, because of the need for phytosanitary treatments that it is necessary to carry out during the cultivation of sugarcane. One of these possible damages is a phenomenon known as drift and this could affect lettuce plantations in nearby areas.

In the sugarcane cultivation, as a way to better plan and optimize the supply of material for the sugar-energy sector, the use of ripeners is one of the important stages of cultivation. The maturation process of sugarcane consists of reducing vegetative growth without affecting the photosynthetic process of the plant, so that the balance of photosynthesized products and transformed into sugars is greater.[2] According to Leite et al.[3] for sugarcane ripeningin Brazil are used, for example, ethephon, trinexapac-ethyl, sulfometuron-methyl and glyphosate.

As the application of ripeners occurs by air in the cultivation of sugar cane, the risk of drift of these products increases.[4] Drift is defined as the movement of drops of phytosanitary products beyond the target area, which may occur at the time of application or immediately after.[5] The droplets from the moment of the application of phytosanitary products can, in addition to reaching the desired target, also be dragged by winds or air currents thus reaching adjacent areas. Thus, in addition to the losses, the drops resulting from the drift reach undesirable locations and favor the contamination of nearby areas and cultures.[6]

According to Ozkan and Zhu,[7] drift can occur either by particles and vapor drifts. Particle size drift is formed right after the spraying and is influenced mainly by droplet sizes. Smaller droplet sizes are more likely to reach outside the desired target area when compared to the larger droplets. Errors in the choice of the spray nozzle, applications in inadequate environmental conditions, among others, are factors that intensify this phenomenon. On the other hand, vapor drifts are formed from the volatilization of the active ingredient, and to exemplify, 2,4-D is well known for the negative effects resulting from its application when reaching non-target crops. The effect of ripeners on non-target plants resulting from drift is directly linked to the amount of active ingredient that reaches them, ranging from the so-called full dose to sub-doses, with sub-doses causing the most recurrent effects.

In many crops, recent researches have already demonstrated the negative effects of ripeners drift, for example, glyphosate and sulfometuron-methyl in *Citharexylum myrianthum*,[8] which affected the development of the plants; glyphosate in sunflower altered growth patterns of the plants,[9] in coffee, resulted in leaf necrosis;[10] chlorosis and necrosis in cotton, resulting in plant death;[11] eucalyptus leaf injury,[12] injuries to yellow passion fruit, reducing plant growth and development[13] and sulfometuron-methyl in corn, which morphological and production components were affected.[14] Pires et al.[15] tested the simulated drift of ripeners over *Eucalyptus urograndis* and found that for sulfometuron methyl, the effect of hormesis (stimulated plant growth) was observed, also trinexapac ethyl resulted in greater increases in leaf mass and area and no differences were observed for ethephon.

However, few are the works that relates to the effects of the drift ripeners on lettuce. Here worth mentioning the research conducted by Rodrigues et al.[16] (submitted for publication) who aimed to evaluate the physiological effects of sugarcane ripeners drift in two different lettuce cultivars. Glyphosate, sulfometuron methyl and trinexapac ethyl were tested in 'Vanda' and 'Lucy Brown' cultivars at subdoses corresponding to 3%, 6%, 9% and 12% of the recommended dose as

a sugarcane ripener. Chlorophyl content, Fv/Fm was also altered and oxidative stress was observed across different times of observation. These changes reflected on the fresh mass of Lucy Brown and dry mass for Vanda, which were reduced due to the contact with the products. According to these results, even subdoses of ripeners can affect lettuce physiology, reducing final plant biomass.

In the State of São Paulo, according to data from CEAGESP,[17] lettuce is the 18th most commercialized product, with an equivalent of 54,272 tons. In the national market, on the other hand, trade moved the amount of R $ 8 billion in retail, for a production of more than 1.5 million tons per year.[18] In Brazil, there are four cultivation systems used, namely: organic and conventional systems in the open field and also protected cultivation from the hydroponic system and in the soil.[19] Lettuce grown in the conventional system it is the most representative in terms of area and production[20] being more susceptible to drift in these conditions. In practical terms, information regarding visual symptoms, possible losses, plant establishment, and development are necessary to help growers identify the first symptoms, which explains the need for research in this area.

Conclusion

Despite of the problems caused in a variety of crops, ripeners drift is still little explored. The effects on non-target crops, whether visual, morphological, or physiological vary across species or even cultivars. It is necessary to identify the effects of drift as a way to understand how plant normal growth and development can be affected, serving as a guide when the first possible signals appear in the field. Also, this information is crucial for sugarcane management and its importance of spraying these products following the correct practices, avoiding to reach undesirable areas.

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Conflicts of interest

Authors declare no conflict of interest exists.

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