EVALUATION OF COTTON AGROCHEMICALS IN SITUATIONS WHERE SPRAY APPLICATION IS DELAYED P.M. Eure D.L. Jordan J.S. Bacheler A.C. York L.R. Fisher R. Seagroves J. Hinton North Carolina State University Raleigh, NC

<u>Abstract</u>

Weather events, equipment failure, and other unforeseen circumstances can prevent timely application of spray solutions. Although agrochemicals are often left in the spray tank for numerous days, there is little information available to growers concerning the effects of delayed applications on efficacy. Experiments were conducted in 2009 and 2010 to determine the influence of delayed spray applications on commonly applied cotton insecticides, plant growth regulators, and defoliants. Each agrochemical was mixed individually on the day of application and 3, 6, and 9 days prior to application using the same water source. When comparing 14 formulated products, over all pests, efficacy of ethephon, indoxacarb, methomyl, and thidiazuron was influenced by delayed applications of spray solution. While these agrochemicals have sporadic changes in efficacy, changes are small and would likely be difficult to notice at the farm level. These experiments were conducted using a single water source with pH 6.7; response with other water sources may be dramatically different.

Introduction

Unforeseen events such as wind, rain, and equipment failure can prevent timely application of spray solutions. Although pesticides may be left in the spray tank for numerous days, there is little research available concerning the influence of delayed applications of spray solutions. Growers today may have sprayers with tanks that can contain enough spray solution to treat up to 100 acres. This amount of spray solution constitutes a significant economic interest to growers. When agrochemical applications are delayed there is the possibility that agrochemical efficacy could be influenced when they remain in the tank for an extended period of time. Research was conducted to determine the influence of delayed applications on efficacy of 45 agrochemicals labeled for use in peanut, tobacco, and/or cotton. The objective of this paper is to discuss our finding associated with 14 commonly applied cotton insecticides, plant growth regulators, and defoliants when left in solution for extended periods of time.

Materials and Methods

General Methodology

Insecticides, plant growth regulators, and defoliants were mixed individually the day of application and 3, 6, and 9 days prior to application. Spray solutions were mixed in 3L plastic spray bottles, sealed for storage in the dark at room temperature and were agitated every third day. The same water source with a pH of 6.7 and water hardness of 31 ppm was used in all experiments. On the day of application, agrochemicals were agitated thoroughly to ensure they returned to solution. All experiments were conducted using a randomized complete block design with 4 replications. Data were subjected to analysis of variance and means separated using Fisher's Protected LSD at $p \le 0.05$.

Thrips (Frankliniella spp.) Control Experiment

In 2010, thrips control using acephate (280 g ai/ha) was evaluated at 4 locations. Cotton was planted without the use of in-furrow insecticides or insecticidal seed treatment to enhance thrips pressure. Visual estimates of thrips damage were recorded 10 and 20 DAT using a 0-5 ordinal scale; (0) no damage, (1) noticeable feeding but no stunting, (2) noticeable feeding and 25% stunting, (3) feeding with blackened terminals and 50% stunting, (4) severe feeding and 75% stunting, and (5) severe feeding and 90% stunting. To determine thrips populations, leaves from 5 cotton plants per plot were collected 5 and 10 DAT and placed in jars with soapy water, and then rinsed thoroughly to determine the number nymphs and adults.

Bollworm (Heliothis zea) Control Experiment

Bollworm control was evaluated during 2009 and 2010 at a single location using a non-*Bt* cotton cultivar. Indoxacarb (1100 g ai/ha), lambda-cyhalothrin (30 g ai/ha), lambda-cyhalothrin plus thiamethoxam (40 g ai/ha), methomyl (490 g ai/ha), spinosad (70 g ai/ha), and thiodicarb (840 g ai/ha) were applied when cotton bollworm eggs or small larvae were easily found on fruiting structures. 5 DAT, 25 bolls and squares were collected from each plot and examined for damage and for the number live bollworms present.

Plant Growth Regulator Experiment

Mepiquat chloride (30 g ai/ha) and mepiquat pentaborate (1100 g ai/ha) were evaluated during 2009 at a single location and during 2010 at 2 locations to determine the influence of delayed applications of spray solution on these products. Applications were made to actively growing cotton with a height of 50-60 cm and an internode length greater than 6 cm. Plant heights and number of nodes were collected from 5 plants per plot 10 and 20 DAT and used to calculate the height/node ratio of each plant.

Defoliant Experiment

Defoliation using carfentrazone (20 g ai/ha), diuron plus thidiazuron (150 g ai/ha), ethephon (1680 g ai/ha), ethephon plus cyclanalide (1460 g ai/ha), and thidiazuron (1700 g ai/ha) was compared in one experiment in both 2009 and 2010. Applications were made at 50-60% cracked bolls. Visual estimates of percent defoliation were recorded 10 DAT.

Results

Greater thrips damage and higher populations were found in non-treated controls compared with cotton treated with acephate. Delayed applications of acephate did not influence thrips damage at 10 and 20 DAT and thrips populations at 5 and 10 DAT. Damaged bolls and squares and live bollworms on or in bolls and squares were dramatically greater in the non-treated control when compared to treated cotton. At 1 of 2 locations, treatments using the 9 day mix of indoxacarb had an average of 1 live bollworm per 25 squares as compared to 0.1 live bollworms per 25 squares in treatments using the 0 day mix. Plots treated with the 3 day mix of methomyl had 1.4 live bollworms per 25 squares as compared to plots treated with 0, 6, and 9 day mixes of methomyl having 0.3, 0.4, and 0.4 live bollworms per 25 squares, respectively. Delayed applications of the plant growth regulators mepiquat chloride and mepiquat pentaborate did not influence plant height, number of nodes, or height/node ratio. In defoliation experiments, thidiazuron and ethephon efficacy were sporadically influenced by delayed applications of spray solution. When considering thidiazuron for defoliation, treatments using 0, 6, and 9 day mixes had greater defoliation then the 3 day mix at 1 of 2 locations. Treatments using the 3-day mix of ethephon had 10% more defoliation than the mixture made on the day of application at 1 of 2 locations.

Summary

When comparing 14 formulated products over all pests, performance was compromised in the case of three products and improved in the case of one. While ethephon, indoxacarb, methomyl, and thidiazuron did have sporadic changes in efficacy, changes are small and would likely be difficult to notice at the farm level. In the case of ethephon, spray solutions mixed 3 days prior to application performed better than ethephon mixed on the day of application. These results do not suggest that mixing ethephon in advance is advisable but reassures growers that the efficacy of ethephon is not compromised when left in the spray tank for up to 9 days. These experiments were conducted using a single water source at pH 6.7 with relatively low water hardness. Leaving agrochemicals in spray tanks in water with other characteristics might lead to a dramatically different response in performance.