

Research Note

HERBICIDE DRIFT CONTROL IN PLANTAINS AND TANIERS¹

Herbicide drift that injures adjacent planting is often reported, especially when the herbicide is applied by air.^{2,3} Tractor-applied sprays have also caused injury with paraquat,⁴ an important herbicide used in plantains and taniers in Puerto Rico. Paraquat has been reported to cause leaf scorch and minor injury in banana plants.⁵ In Puerto Rico, paraquat drift injury to plantain plants is frequently claimed by farmers, whereas injury caused by oxyfluorfen drift has only sporadically been encountered, with little detrimental effect. Consequently, two field experiments using drift control agents and drift control nozzle tips to apply a paraquat-oxyfluorfen mixture in plantains were initiated to find whether herbicide injury with knapsack application could be reduced.

The use of adjuvants for reducing herbicide drift was first reported by Butler et al.⁷ They found that three adjuvants (Ves-

tik, Norbak and Dacagin) reduced the danger of drift considerably in a ground sprayer. Shappel et al.⁸ reported that adjuvants reduced drift of herbicide to affected plants in brush control. Bouse et al.⁹ found that spray drift within 36 m downwind was significantly less for reduced pressure fan nozzles and reduced pressure hollow cone nozzles than for conventional ones. Previously, Bouse and Leerskov¹⁰ had found that the air inducting nozzle reduced herbicide drift compared to that of conventional fan nozzles, but this air inducting nozzle apparently was not successful enough to be commercially developed. The present study was conducted in an attempt to determine the effect of selected adjuvants and nozzle tips on drift of a paraquat-oxyfluorfen spray applied on plantains, with sensitive taniers planted in adjacent rows.

Two field experiments were carried out at the UPR Corozal Substation in 1987. The

¹Manuscript submitted to Editorial Board 15 March 1990.

²Wheatley, G. A., 1973. Pesticides in the atmosphere p. 376-78, *In* C. A. Edward Environmental Pollution by Pesticides, Plenum Press London and New York.

³Anonymous, 1981. Environmental Trend, p. 92, Council on Environmental Quality, Executive Office of the President, U. S. Government Printing Office, Washington, D.C.

⁴Byass, J. B. and J. R. Lake, 1977. Spray drift from a tractor-powered field sprayer. *Pestic. Sci.* 8 (12): 117-26.

⁵Lassoudiere, A. and A. Pinon, 1971. Preliminary results of trials with herbicides in banana. *Fruits Outre Mer.* 26: 333-48.

⁶Liu, L. C., 1986. Plantain injury resulting from paraquat and oxyfluorfen drift. Annual Progress Report of H-173 project of Agric. Exp. Stn., Univ. P.R.

⁷Butler, B. J., N. B. Akesson and W. E. Yates, 1969. The use of spray adjuvants to reduce drift. *Trans. ASAE* 12: 182-86.

⁸Shappel, W.E., C. L. Foy, E. S. Hagwood, Jr., R. C. Lambe and R. J. Stipes, 1986. Report of Technical Committee SRIEG on advances in Pesticide Application Technology. *Va. Agric. Exp. Stn. VPU.*

⁹Brouse, L. F., J. B. Carlton and M. G. Merkle, 1976. Spray recovery from nozzles to reduce drift. *Weed Sci.* 24: 361-65.

¹⁰_____ and R. E. Leerskov, 1973. Drift comparison of low expansion foam and conventional sprays, *Weed Sci.* 21: 405-09.

TABLE 1.—Weed control and crop response to spraying 14.2 liters of mixture with 56 ml of Gramoxone Super and 56 ml of Goal 1.6 E' per plot plus added amount of drift control agents listed below

Drift control agents	Weed control at end of ²			Plantain injury at end of ³			Tanier injury at end of ⁴		
	1st week	3rd week	6th week	1st week	3rd week	6th week	1st week	3rd week	6th week
1. Bivert 14.2 ml ^{**6}	82 a ⁶	80 a	57 a	16 b	10 b	0 a	9 c	5 a	0 a
2. Orthotrol 7-8 ml ^{***7}	78 a	68 ab	38 ab	17 b	11 b	1 a	8 c	7 a	0 a
3. Poly Control 7-8 ml ^{***}	73 a	55 b	28 b	17 b	9 b	0 a	9 c	6 a	0 a
4. X-77 7-8 ml ^{***}	85 a	80 a	52 a	17 b	12 b	2 a	11 ab	7 a	0 a
5. No drift control agent	75 a	59 ab	34 ab	23 a	17 a	3 a	12 a	6 a	0 a

¹Equivalent to 4.7 L/ha rate for each.

²Weed control rating is based on a scale of 0-100, where 0 = no control, 100 = perfect control.

³⁴Represent the number of plants showing herbicide injury symptoms from each plot.

⁶Equivalent to 1.2 L/ha rate.

⁶Means within a column followed by the same letter do not differ at the 5% level, Duncan's Multiple Range Test.

⁷Equivalent to 0.6 L/ha rate for each. Because of viscosity, more exact measurement of volume was difficult.

TABLE 2.—Weed control and crop response to spraying 14.2 liters of mixture with 56 ml of Gramoxone Super and 56 ml of Goal 1.6 E¹ & 7-8 ml of X-77² per plot in combination with different nozzle tips or a spray shield

Nozzle tips or spray shield	Weed control at end of ³			Plantain injury at end of ⁴			Tanier injury at end of ⁴		
	1st week	3rd week	6th week	1st week	3rd week	6th week	1st week	3rd week	6th week
1. LFR NY 2 80 nozzle	95 a ⁵	90 a	43 a	28 a	16 a	3 a	4 ab	3 a	0 a
2. Raindrop SS 1.0	88 a	83 ab	35 a	18 c	10 b	0 b	3 b	2 a	0 a
3. 2-8002 LP SS nozzle	88 a	82 ab	35 a	23 b	10 b	0 b	3 b	2 a	0 a
4. 2-8002 SS nozzle	90 a	82 ab	31 a	24 b	12 b	0 b	5 a	2 a	0 a
5. 2-8002 SS nozzle + plastic spray shield	88 a	81 b	36 a	22 b	10 b	0 b	3 b	2 a	0 a

¹Equivalent to 4.7 L/ha rate for each.

²Equivalent to 0.75 L/ha rate.

³Weed control rating is based on a scale of 0-100, where 0 = no control, 100 = perfect control.

⁴Represents the number of plants showing herbicide injury symptoms from each plot.

⁵Means within a column followed by the same letter do not differ at the 5% level, DMR test.

soil is Coroza clay with pH 4.7 and organic matter 2.4%. The first experiment was planted with corms of Maricongo cultivar 7 July 1987 to determine the effect of three adjuvants and X-77 on paraquat-oxyfluorfen drift to plantains and taniers. A randomized complete block design with three replications was used. Plot size was 12.8 × 13.7 m, each with 42 plantain plants and 40 tanier plants. Plantains were planted 1.8 m apart in 6 rows of 7 plants each, and tanier 0.9 m apart in two rows of 20 plants each. The first tanier row was separated by 1.8 m from the downwind side of adjacent plantain plots. A buffer row of plantains was maintained between plots. The actual area treated with herbicide was 11.0 × 11.0 m (0.012 ha), including 36 plants in 6 × 6 rows. The area planted to taniers was not treated with herbicides and was maintained weed free by manual weeding. The basic treatment consisted of 56 ml each of Gramoxone Super and Goal 1.6 E in 14.2 L of water per plot. The treatment variables were three adjuvants (Bivert, Orthotrol and Poly Control), X-77 and none. The chemical identity of these compounds is as follows: Bivert (amine salts of organic acid), Orthotrol (polyvinyl polymer), Poly Control (polyacrylamide copolymer) and X-77 (alkyl aryl polyoxyethylene glycols).

The number of plantain and tanier plants showing injury symptoms was recorded at the end of the first, third and sixth weeks after herbicide application to assess the drift effect. Weed control data were also taken at respective periods to determine whether any adjuvants reduced herbicide efficacy. All weed control data were transformed into degree arc sine and analyzed statistically.

The second experiment was conducted on the same soil at the Coroza Substation to determine the effect of different nozzle tips and a spray shield combination on herbicide drift.

The same plantain and tanier cultivars as in the first experiment were planted 13 August 1987. The experimental design, size of plot, planting distance and herbicide application method were identical to those of the first experiment. The basic treatment

consisted of 56 ml Gramo-Super and Goal 1.6 E each plus 9 ml of X-77 in 14.2 L of water per plot. The treatment variables were four nozzle tips: LFR NY 2 80 (DALAVAN), Raindrop SS 1,0 (DALAVAN), 2-8002 LP SS (SPRAY SYSTEM), 2-8002 SS (SPRAY SYSTEM) and a plastic spray shield combination with 2-8002 SS. All spray applications were made 30 September 1987, when plantain plants were 6-weeks old. The wind speed and direction at the time of application were mentioned by Singmaster and Liu. The same drift injury evaluation and weed control rating used in the first experiment were followed here.

In the first experiment with drift control agents, all agents and X-77 caused significantly less injury to plantain plants than the use of no drift control agent at the end of the first and third weeks (table 1). The X-77 apparently functioned here as a drift control agent reducing the transient injury in plantains, similar to the other three agents, although the X-77 label makes no claim of its being a drift control agent. However, by the end of the sixth week, all differences disappeared. Three agents also caused slightly fewer injuries to tanier plants at the end of the week (table 1), but differences were no longer noticeable from the third week on. The drift effect was encountered mostly on the lower leaves of the plantain plants. The injury symptom of burned patches was rapidly outgrown. No death of plantain plants was registered throughout the course of this study. On the other hand, the injury symptoms on the tanier plants were found mostly on the upper part of the leaves as small scattered brown specks. Again, the observed injury on tanier plants seldom caused the death of the plant. Weed control was not significantly reduced by addition of adjuvants to the herbicide mixture, except with Poly Control, where slightly reduced efficacy was noted from the third week on (table 1). In the second experiment with drift control nozzle tips, Raindrop SS 1.0 nozzle tip registered the lowest number of injured plantain plants at the end of the first week (table 2), whereas with LFR NY 2 80 there was the highest number of injured plants in the same time period. Application

with the LFR NY 2 80 nozzle tip continued to show more injured plantain plants than other nozzle tips the third and sixth weeks (table 2). Both 2-8002 SS and LFR NY 2 80 nozzle tips had caused more injury to taniel plants than the other nozzle tips by the end of the first week (table 2). This difference disappeared from the third week on. All nozzle tips including their spray shield combinations gave good to excellent weed control up to the third week with few differences among them (table 2).

Results from both field experiments indicate that certain drift control agents and drift control nozzle tips used in our study provided only slight improvements in reducing herbicide drift injury from a duration of one to 3 weeks after the initial herbicide application. The advantage of using either

drift control agents or nozzle tips was no longer noticeable by the end of the sixth week. Thus, the low pressure knapsack application of the paraquat-oxyfluorfen mixture in plantain would not cause any drift hazard provided certain precautions based on conditions present in the experiments are followed. The conditions are essentially direct downward spraying with nozzle held no higher than 0.6 m above the ground and spraying only when winds do not exceed 8 km/h average.

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