



AgEcon SEARCH
RESEARCH IN AGRICULTURAL & APPLIED ECONOMICS

The World's Largest Open Access Agricultural & Applied Economics Digital Library

This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.

Help ensure our sustainability.

Give to AgEcon Search

AgEcon Search

<http://ageconsearch.umn.edu>

aesearch@umn.edu

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

*Joint symposium on maize and peanut. Held in Suriname
on behalf of the 75th Anniversary of
The Agricultural Experiment Station of Paramaribo.*

November 13 – 18, 1978



Proceedings of the Caribbean Food Crops
Society. Vol. XV, 1978

EFFECT OF POST-EMERGENCE APPLIED ATRAZINE/DALAPON/OIL MIXTURE ON WEED GROWTH AND CORN PRODUCTIVITY

C.A.L. Phillips
Textrin Research Laboratory, Texaco Trinidad, Inc.,
Pointe-a-Pierre, Trinidad.

and

David Martin
Chaguaramas Agricultural Development Project,
Macqueripe, Chaguaramas, Trinidad.

SUMMARY

Atrazine and dalapon are used as post-emergence herbicides in corn. Dalapon is also recommended as a pre-plant soil treatment for soybean. However, the high rates of atrazine used with pre-emergence applications in corn result in the build-up of residues which adversely affect the ensuing crops of the rotation. The application of low rates of atrazine in such grain/legume rotation is desirable. The use of spray oils as an adjuvant in atrazine/dalapon mixtures would therefore be advantageous since the oil increases the post-emergence activities of atrazine. The current trial was conducted to determine the optimum levels of atrazine and dalapon, in an oil/water emulsion, consistent with proper weed control and good corn production under Chaguaramas conditions.

A simple randomised block design trial was conducted on weeds in corn (var. X-304B) grown at Tucker Valley, Chaguaramas. There were 14 treatments, replicated three times in three blocks and included four rates of atrazine (0 to 2.24 kg. a.i. per hectare); in factorial combination with three rates of dalapon (0 to 1.12 kg. a.i. per hectare); giving 12 treatments, and two controls; an unweeded and a weed-free achieved by paraquat applications. The atrazine and/or dalapon were carried in oil/water emulsions, and applied post-emergence to the weeds and corn seedlings.

Increments of atrazine and dalapon up to 1.12 kg. a.i. per hectare suppressed weed growth; the spray oil/herbicide mixture with atrazine and dalapon at 1.12 kg. a.i. per hectare respectively was the most effective suppressor of weed growth. The blanket spray application of the herbicide/oil emulsion did not affect adversely plant stand and seedling growth. In fact, grain yield increased with increments of atrazine at the middle and high levels of dalapon. The mixture of atrazine and dalapon at 1.12 kg. a.i. and 0.56 kg. a.i. per hectare respectively in the oil/water emulsion seems to be the most suitable formulation.

INTRODUCTION

Weeds are of great economic importance in agricultural cropping programmes. In the absence of weed control measures, yield reduction as high as 70 percent has been reported for corn and soybean. Indeed total crop losses may be experienced when mechanical harvesting is

made impossible due to choking of the combine harvester by ranked weed growth. Such occurrences have been reported in corn crops grown in Trinidad and Guyana, respectively. Atrazine and/or atrazine/dalapon in oil/water emulsions have proven quite successful as early post-emergence herbicide treatments in corn (Escaff, 1971; Hammerton, 1973; Kesasian, 1971). The oil/water emulsion carrier permits using lower chemical rates than for aqueous carrier, thus reducing the potential for atrazine residue which could adversely affect subsequent crops (soya, black-eye, oats, etc.) of the rotation. In an unreplicated trial at Tucker Valley, Chaguaramas in Trinidad, Gesaprim (atrazine at 2 kg./hectare) carried in Spraytex-CT/water emulsion gave the most effective weed control in field corn. The corn yields, however, were not ascertained. A further trial was therefore conducted at Chaguaramas to determine a suitable post-emergence herbicide formulation, using mixtures of atrazine and dalapon carried in Spraytex-CT/water emulsions, consistent with proper weed control and high corn yields. This paper describes the trial, and presents the results on weed-growth, crop-growth and grain yield.

MATERIALS AND METHODS

The trial was conducted on field corn (Variety X-304B) planted on River Estate sandy loam at Tucker Valley, Chaguaramas. A simple randomised block design was used with 14 treatments replicated three times in three separate blocks. The treatments included four rates of atrazine (0, 0.56, 1.12 and 2.24 kg. a.i. per hectare) in factorial combination with three rates of dalapon (0, 0.56 and 1.12 kg. a.i. per hectare) thus giving rise to 12 treatments in addition to a weed-free and an unweeded control. The weed-free condition was achieved by applying paraquat at the rate of 1.43 litres per hectare at weekly intervals in accordance with prevailing weed conditions. The atrazine and/or dalapon were carried in Spraytex-CT/water emulsions applied at the rate of 370.6 litres per hectare. The oil was 11 percent (40.8 litres per hectare) of the spray volume and the emulsifier (Sponto AC 60) 1 percent (0.8 litres per hectare) of the spray oil. The herbicide mixtures were applied broadcast, using a manually operated knapsack sprayer. The corn seedlings were about 18 cm tall and the weed about 3-5 cm tall at the time of spraying. The weeds infesting the corn field were *Cyperus rotundus*, *Rottboellia exaltata* and species of *Digitaria*, *Eleusine*, and *Amaranthus*.

RESULTS

Weed growth and corn growth were assessed four weeks after applying the herbicide treatments. The treatment effect on weed growth was highly significant (table 1), but that on corn seedling survival, phytotoxicity and growth respectively was not significant, basis the variance (F) ratio (tables 2, 3 and 4). Increased rates of atrazine and dalapon up to 1.12 kg. a.i. per hectare significantly suppressed weed growth. The mixture of atrazine and dalapon, each at 1.12 kg. a.i. per hectare give the best weed control, but was not significantly better than those of atrazine at 1.12 kg. and 2.24 kg. a.i. plus dalapon at 0.56 kg. a.i. per hectare, respectively. Atrazine at 1.12 kg. a.i. plus dalapon at 0.56 kg. a.i. per hectare carried in the Spraytex-CT/water emulsion would therefore be the preferred formulation.

Effect of post – emergence applied atrazine/dalapon/oil mixture on weed growth and corn-productivity

Table 1. Chaguaramas herbicide trial in field corn: mean treatment effect on weed growth

Atrazine (kg/ha.)	Dalapon (kg/ha.)		
	0	0.56 (Weed Score*)	1.12
0	8.4 e	1.6 ab	3.9 bcd
0.56	6.1 cde	6.2 cde	2.1 abc
12	3.0 abc	0.9 ab	0.1 a
2.24	3.0 abc	0.5 ab	2.8 abc
	No Weeding = 7.9 ed	Weed Free = 0.1 a	

Figures followed by the same letters are not significantly different (5% level)

* – Weed Score: 0 = No weed
 1 = 1 to 10% weed 6 = 51 to 60% weed
 2 = 11 to 20% weed 7 = 61 to 70% weed
 3 = 21 to 30% weed 8 = 71 to 80% weed
 4 = 31 to 40% weed 9 = 81 to 90% weed
 5 = 41 to 50% weed 10 = 91 to 100% weed

Table 2. Chaguaramas herbicide trial in field corn: mean treatment effect on plant survival

Atrazine (kg/ha.)	Dalapon (kg/ha.)		
	0	0.56	1.12
	[No. of Plants/ha. ('000)]		
0	27.0 abc	24.8 abc	24.1 abc
0.56	27.5 abc	31.3 ab	21.8 bc
1.12	27.2 abc	25.4 abc	25.3 abc
2.24	32.5 a	18.9 c	32.6 a
	No weeding = 18.5 c	Weed free = 27.9 abc	

Figures followed by the same letters are not significantly different (5% level)

Maize – Pests, diseases and weeds

Table 3. Chaguaramas herbicide trial in field corn: mean treatment effect on crop phytotoxicity

Atrazine (kg/ha.)	Dalapon (kg/ha.)		
	0	0.56	1.12
	(Phytotoxicity score)*		
0	0.7	0.3	0
0.56	0	0	1.0
1.12	0	1.0	1.3
2.24	0	1.0	0
	No weeding = 0.3		Weed free = 0.7

* – Phytotoxicity score: 0 = No damage
 1 = Slight
 2 = Moderate
 3 = Severe

Table 4. Chaguaramas herbicide trial in field corn: mean treatment effect on crop growth

Atrazine (kg./ha.)	Dalapon (kg/ha.)		
	0	0.56	1.12
	(Crop growth score)*		
0	2.3 ab	3.0 a	2.7 ab
0.56	2.7 ab	2.7 ab	2.7 ab
1.12	2.0 b	2.0 b	2.3 ab
2.24	3.0 a	2.3 ab	3.0 a
	No weeding = 2.0 b		Weed free = 2.3 ab

* – Crop growth Assessment: 1 = Poor growth
 2 = Moderate growth
 3 = Good growth

Figures followed by the same letters are not significantly different (5% level)

Effect of post – emergence applied atrazine/dalapon/oil mixture on weed growth and corn-productivity

The corn cobs were harvested mid-October. The cob weight and grain weight respectively were determined, and the grain moisture content was 20 percent. Of the production parameters measured, only the grain yield was significantly affected by the herbicide treatments, basis the variance (F) ratio. At 0.56 kg. and 1.12 kg. a.i. dalapon per hectare, grain yields increased with increments of atrazine in the herbicide mixtures up to the third and fourth levels respectively

Table 5. Chaguaramas herbicide trial in field corn: mean treatment effect on corn yield

Atrazine (kg./ha.)	Dalapon (kg/ha.)		
	0	0.56	1.12
	(Grain yield tons/ha.)		
0	2.06 bcd	2.58 abc	1.76 cd
0.56	1.99 cd	2.78 abc	2.51 abc
1.12	1.62 cd	3.48 a	2.79 abc
2.24	2.70 abc	1.73 cd	3.31 ab
	No weeding = 0.93 d	Weed free = 1.68 cd	

Figures followed by the same letters are not significantly different (5% level)

Table 6. Chaguaramas herbicide trial in field corn: mean treatment effect on cob production

Atrazine (kg./ha.)	Dalapon (kg/ha.)		
	0	0.56	1.12
	[No. of Cobs/ha. ('000)]		
0	20.2 bc	20.8 bc	16.8 bc
0.56	21.3 abc	23.3 ab	20.1 bc
1.12	16.9 bc	24.5 ab	20.1 bc
2.24	24.1 ab	13.4 c	30.5 a
	No weeding = 13.5 c	Weed free = 17.4 bc	

Figures followed by the same letters are not significantly different (5% level)

Maize – Pests, diseases and weeds

(table 5). Also, the number of cobs harvested at 0.56 kg. a.i. dalapon per hectare and the cob weight at 1.12 kg. a.i. dalapon per hectare increased with increments of atrazine in the mixture up to the third level (tables 6 and 7 respectively). Conversely, the grain yields at all, except the highest levels of atrazine and cob weight at the second and third atrazine levels increased with dalapon addition to the mixture up to 0.56 kg. a.i. per hectare.

Table 7. Chaguaramas herbicide trial in field corn: mean treatment effect on cob weight

Atrazine (kg./ha.)	Dalapon (kg/ha.)		
	0	0.56	1.12
	[Cob Weight (gm)]		
0	106 abcd	138 ab	104 abcd
0.56	92 cd	119 abc	123 abc
1.12	100 abcd	144 a	140 a
2.24	116 abcd	121 abc	108 abcd
	No weeding = 79 d	Weed free = 94 bcd	

Figures followed by the same letters are not significantly different (5% level)

DISCUSSION

The trial results are similar to those of trials conducted by other workers with atrazine and/or atrazine/dalapon formulations on weeds in corn (Almodovar-Vega & Ilnicki 1970; Escaff, 1971; Hammerton, 1973). *Rotboellia exaltata* is the most serious weed at Onaguaramas, but its growth was adequately controlled by some of the herbicide formulations tested. In fact, increased rates of both atrazine and dalapon in the oil/water emulsion formulation increased the suppression of weed growth. The post-emergence activity of atrazine in particular is known to be increased by emulsifying the suspension with non-phytotoxic vegetable or mineral spray oils. Mixtures of the mineral and vegetable oils in herbicide formulations have given good control of grass weeds (Almodovar-Vega & Ilnicki, 1970). However, paraffinic oils of medium to high viscosity, and which are similar to the Spraytex-CT employed in the trial, are preferred (Kasasian, 1971) The oil content of the formulations used in the trial was 11 percent of the spray volume, but quantities as low as five percent have given satisfactory results. The oil's function in the formulation is to solubilize the waxy cuticle of the weed leaf thus facilitating the entry of the chemical into the plant's tissue (Peacock, 1970). The presence of the non-phytotoxic oils,

Effect of post – emergence applied atrazine/dalapon/oil mixture on weed growth and corn-productivity

therefore, results in a synergistic action causing lower rates of the chemical to produce similar effectiveness as higher ones in aqueous formulations. The chance of residue build-up and damage to subsequent sensitive crops of the rotation is therefore minimized when low rates of atrazine are carried in oil/water emulsions. The corn seedlings and plant stand were not adversely affected by the blanket spray applications. Directional spraying of the atrazine/dalapon in oil/water emulsion formulation is therefore unnecessary. Aircraft application of such herbicide formulations with appropriate reduction in the carrier volume is therefore a distinct possibility for large-scale operations.

The seed for follow-up trials of this nature at Chaguaramas and elsewhere is quite evident. However, on the basis of the current results, atrazine at 1.12 kg a.i. plus dalapon at 0.56 kg a.i. per hectare carried in an oil/water emulsion are recommended for use until enlightened by future experience.

ACKNOWLEDGEMENT

The authors are indebted to (1) the Authorities of the Chaguaramas Agricultural Development Project for providing the facilities for conducting the trial and for permitting the publication of the results, and (2) to Texaco Trinidad, Inc., for providing the spray oil.

REFERENCES

- Almodovar-Vega, L. and Illnicki, R.D., 1970. Enhancing atrazine activity with the additions of mineral and vegetable oils. Northeastern weed control Conf. Proc. 24, 31 and 32.
- Escaff, G.M. 1971. Trop. Abstr. 26, u853.
- Fink, R.J. 1970. Crops Soils 22(4); 18-19 in PANS 17:74.
- Hammerton, J.L. 1973. Weed control work in progress at the University of the West Indies, Part 3, PANS 18:383.
- Kasasian, L. 1971. Weed control in the tropics, Leonard Hill, London.
- Peacock, J.F. 1970. Enhancement of foliar penetration and herbicide activity by oils. Ph.D. Thesis, South Dakota State University, Brookings.

Maize – Pests diseases and weeds

NAME OF PAPER: Effect of Post-Emergence applied Atrazine/Dalapon/Oil Mixture on Weed Growth and Corn Productivity. (C.A.L. Phillips)

Question by: Bruce Lauckner
Country: Barbados

QUESTION: What is the reason for the poor performance (high weed growth, poor plant survival, poor yield etc.) for the corn treated with 2.24 kg/ha Atrazine and 0.56 (kg/ha) Dalapon?

ANSWER: Distribution of weed species in the trial area was very variable. The relatively high incidence of weed in plots receiving high levels of Atrazine and Dalapon was due to that of *Cyperus rotundus* which the chemicals did not control on those plots. Poor plant survival and poor yields may have been due to inherent soil plot variation and not a treatment effect.