Toxicity of Jimson Weed Seed and Cocoa Shell Meal to Broilers[1]

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ABSTRACT Jimson weed seed meal, which contains alkaloids toxic to animals, and cocoa shell meal, which contains theobromine, also toxic to animals, were used in two experiments with broilers to determine relative toxicity. Pure theobromine was added to diets to furnish the same levels as furnished by 1, 2, 4, and 6% dietary cocoa shell meal, which contained, by analysis, 1.3% theobromine.

Approximately 1% jimson meal is the upper dietary limit that can be safely incorporated into the diet of young broilers. Dietary levels of 3 and 6% from 1 to 21 days of age drastically depressed performance. Cocoa shell meal that contained 1.3% theobromine was somewhat less toxic to chicks than jimson meal. However, performance tended to be depressed with dietary levels above 1%. Pure theobromine was a little more toxic than that furnished by cocoa shell meal.

(*Key words:* toxicity, jimson weed seed, cocoa shell meal)

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INTRODUCTION

Jimson weed *(Datura stramonium)* is a summer, annual plant 2 to 5' tall (.609 to 1.52 m) producing large white flowers and large egg shaped seeds. Both the seeds and plants are known to be toxic to cattle and swine. The toxicity is thought to be due principally to three alkaloids: atripine, hyoscyamine, and scopolamine. The plant is indigenous to the midwestern corn belt area. It grows in feedlots, wastelands, and cultivated fields.

Jimson weed is not native to Mississippi, Alabama, and Louisiana, but large quantities of grain screenings, which may contain jimson seed, are available from terminal elevators through which grain is exported. Cocoa shell meal is used as a mulch by the mushroom industry. Confectioners and certain other manufacturers have this byproduct for sale on a regular basis. Its nutritive content would seem to make it a good ingredient for usage in low energy type feeds.

Our tests were conducted to determine the toxicity of these two products to broilers.

MATERIALS AND METHODS

Jimson weed seed obtained from F and J Seed Service, Box 82, Woodstock, IL was incorporated into a basal broiler diet at the expense of corn at five different levels from 0 to 6% (Table 1).

Cocoa shell meal, which contained by analysis, 17.6% protein, 5.6% fat, 1.3% fiber, .48% sodium, .65% lysine, and .43% methionine plus cystine and calculated to contain 2783 kcal/kg of metabolizable energy (ME), was incorporated into broiler starter diets with the aid of an electronic computer at dietary levels

TABLE 1. *Composition of basal diets, Experiment 1*

Ingredients	
	(%)
Yellow corn	64.28
Soybean meal, 49%	25.67
Fish meal, 60%	5.00
Dicalcium phosphate	1.16
Limestone	.79
Salt	.29
Micronutrient premix[1]	.25
Methionine hydroxy analogue-Ca, 93%	.22
Animal fat	2.34
Total	100.00

[1]Furnished the following per kilogram of diet: vitamin A, 5500 IU; vitamin D_3, 1650 ICU: vitamin E, 1.1 IU; riboflavin, 5.5 mg; niacin, 33 mg; d-pantothenate, 8.8 mg; folic acid, 137.5 μg; vitamin B_{12}, 11 μg; choline chloride, 495 mg; ethoxyquin, 55 mg; menadione sodium bisulfide, 1.39 mg; manganese, 66.25 mg; zinc, 44 mg; iodine, 1.25 mg; iron, 20 mg; copper, 2 mg.

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TABLE 2. *Composition of the experimental diets, Experiment 2*

Ingredients	1	2	3	4	5
Yellow corn	61.46	60.38	59.52	57.56	55.63
Soybean meal, 48%	29.19	29.05	28.91	28.64	28.36
Fish meal, 60%	2.50	2.50	2.50	2.50	2.50
Limestone	.76	.76	.76	.76	.75
Dicalcium phosphate	1.54	1.54	1.55	1.56	1.58
Salt	.40	.39	.38	.36	.33
Micronutrient premix[1]	.25	.25	.25	.25	.25
Methionine hydroxy analogue Ca, 93%	.21	.21	.21	.22	.22
Animal fat	3.69	3.92	3.92	4.15	4.38
Cocoa shell meal	. . .	1.00	2.00	4.00	6.00
Total	100.00	100.00	100.00	100.00	100.00

[1] Furnished the following per kilogram of diet: vitamin A, 5500 IU; vitamin D_3, 1650 ICU: vitamin E, 1.1 IU; riboflavin, 5.5 mg; niacin, 33 mg; d-pantothenate, 8.8 mg; folic acid, 137.5 μg; vitamin B_{12}, 11 μg; choline chloride, 495 mg; ethoxyquin, 55 mg; menadione sodium bisulfide, 1.39 mg; manganese, 66.25; zinc, 44 mg; iodine, 1.25 mg; iron, 20 mg; copper, 2 mg.

ranging from 0 to 6% (Table 2). By analysis, cocoa shell meal contained 1.3% theobromine. Theobromine was added to four diets to supply identical levels supplied in the four diets containing cocoa shell meal at the expense of corn. Each of the experimental diets, in both experiments, was fed to triplicate groups (10 per group) of Arbor Acre male birds from 1 to 21 days of age. Body weight and feed conversion data were collected at 21 days of age.

Data were analyzed statistically by the analysis of variance procedure and means were compared by a multiple range test (Steel and Torrie, 1960).

TABLE 3. *Effect of varying dietary levels of jimson meal on broiler performance*

Dietary level of jimson meal	Results, 3 weeks	
	Mean body weight	Feed/ gain
(%)	(g)	
0	476[a]	1.49[a]
1	451[a]	1.45[a]
3	320[b]	1.80[ab]
6	293[b]	1.98[b]

[a,b]Means within a column and without a common superscript letter are significantly different (P<.05).

RESULTS AND DISCUSSION

Feeding jimson weed seed at 3 and 6% of the diet significantly depressed body weight at 3 weeks, but feed conversion was significantly depressed only at the 6% level (Table 3).

Feeding cocoa shell meal at up to 6% of the diet did not significantly affect 3-week body

TABLE 4. *Effect of cocoa shell meal and theobromine on broiler performance*

Added cocoa shell meal	Theobromine	Results, 3 weeks[1]	
		Mean weight	Feed/ gain
(%)	(%)	(g)	
. . .	0	528[a]	1.37[a]
1.0	.013[1]	528[a]	1.43[abc]
2.0	.026[1]	504[a]	1.47[abc]
4.0	.052[1]	475[ab]	1.45[abc]
6.0	.078[1]	455[ab]	1.53[c]
. . .	.013[2]	513[a]	1.42[abc]
. . .	.026[2]	518[a]	1.40[ab]
. . .	.052[2]	429[b]	1.50[bc]
. . .	.078[2]	350[c]	1.44[abc]

[a,b,c]Means within a column and without a common superscript letter are significantly different (P<.05).

[1] Based on analysis, which showed theobromine content of cocoa shell to be 1.3%.

[2] Based on addition of pure theobromine, 3,7-dimethylxonthine.

weights, but feed conversion at 3 weeks was significantly affected by feeding 6% cocoa shell meal (Table 4). More replicates should have been employed in these experiments to improve precision.

The addition of theobromine to four additional diets to furnish levels identical to that furnished by 1, 2, 4, and 6% cocoa shell meal depressed performance somewhat more than did cocoa shell meal. This greater depression in performance was statistically significant for growth rate at the two highest levels of theobromine, .052 and .078%. These results suggest that either the chemical analysis for theobromine was not correct or that the pure substance was more available than that in cocoa shell meal.

REFERENCES

Steel, R.G.D., and J. H. Torrie, 1960. Principles and Procedures of Statistics. McGraw-Hill Book Co., Inc. New York, NY.