

BIOLOGY AND CONTROL OF BLACK NIGHTSHADE (SOLANUM NIGRUM)
IN COTTON (GOSSYPIUM HIRSUTUM)

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OBJECTIVES: To determine why control of nightshade with prometryn declined with time in a field study conducted in 1985, 1987, 1988, and 1989.

PROCEDURES: Both seed and soil samples were collected from field plots previously untreated and treated with prometryn. Treated plots were those where rates of prometryn from 1.5 to 2.0 lbs ai/A originally controlled black nightshade in 1985 and 1987 but failed to control nightshade in 1988 and 1989. Untreated plots were the weedy-check plots of the 1985 to 1989 study that had never been treated with a herbicide. Soil samples from the field in early 1990 were treated with 2.00 ppm prometryn and bioassayed in the greenhouse with black nightshade at weekly intervals for 7 weeks. Seed from field plots, which had been collected earlier, was planted into soil freshly treated with 0.25, 0.50, 1.00, and 2.00 ppm prometryn.

In addition to the experiments described above, a final field study was initiated on April 18, 1990 to determine if nightshade had developed some resistance to prometryn or if previously treated soil was now degrading prometryn at some accelerated rate. Plots, 19 m long by 4 m wide, which were treated during 1985 to 1989, were treated in a perpendicular direction with a 4 m band of 2.0 lbs/A of prometryn. The soil was left flat after treating and the herbicide was incorporated into the soil with a mulcher operated at 10 cm deep. The area was sprinkle irrigated at 3 to 5 day intervals for the following 36 days. Total sprinkling time was 35 hours, and total amount of water applied was 9 cm. Black nightshade seedlings were counted in treated and untreated strips of all plots 4 weeks after treatment, and visual weed control ratings were recorded at 4 and 6 weeks after treatment.

RESULTS: Degradation of prometryn in the greenhouse appeared to occur at approximately equal rates in soil collected from field plots previously treated or untreated with prometryn. Residues from applications of 2 ppm of prometryn killed all nightshade seedlings for 3 weeks. When some plants began surviving at 5 and 7 weeks after treatment, dry matter production of nightshade was similar in soils previously treated and untreated with prometryn. Nightshade seedlings from seed collected from plots treated with prometryn responded similarly to increasing rates of prometryn under greenhouse conditions as seed collected from untreated plots. Herbicidal activity was sufficiently great from applications of as little as 0.25 to 0.50 ppm to kill most seedlings, and very little growth occurred at 1.0 ppm of prometryn.

When prometryn was applied in perpendicular strips 4 m wide across plots previously untreated and treated with prometryn, no black nightshade seedlings survived for 4 weeks (Table 2). Even at 6 weeks after treatment, visual control ratings of weed seedlings were still 99 to 100%. The fact that control in 1990 was complete for 6 weeks indicates that nightshades have not developed appreciable amounts of resistance to prometryn and degradation of prometryn probably occurred at normal rates. Furthermore, the excellent control obtained indicates that the herbicide was not readily leached from the upper 2.5 cm of soil where the majority of the weed seeds germinate. Since efforts failed to provide evidence for the movement of the herbicide with water, the development of weed resistance to prometryn, or accelerated degradation of this herbicide in

soil, increasing weed populations were suspected of contributing greatly to the declining nightshade control from prometryn. It is suspected that, if numbers of seedlings estimated ha^{-1} in Table 2 represents only 10% or less of the soil seed reservoir, weed seed populations have increased from 85 million in 1985 to as much as 800 million in 1990.

FUTURE PLANS: A manuscript reporting the results of this study has been written and was submitted for consideration for publication in Weed Technology Journal.

Table 1. Emergence of black nightshade seedlings in field plots in 1990 when blocks of treatments from previous years were strip-treated in 1990 with 2.0 lbs/A of prometryn.^a

Number of black nightshade counted 4 weeks			
Treatments in ^b	after treatment		Estimated ^c
	previous years		
lbs/A	Treated strip	Untreated strip	
	no. 930 cm ⁻²		no. ha ⁻¹
Prometryn (1.5 PPI-1)	0	554 ab	60 x 10 ⁶
Prometryn (1.5 PPI-2)	0	545 ab	59 x 10 ⁶
Prometryn (2.0 PPI-1)	0	687 a	74 x 10 ⁶
Prometryn (2.0 PPI-2)	0	84 c	9 x 10 ⁶
Hoe x 1	0	309 bc	33 x 10 ⁶
Weedy control	0	750 a	81 x 10 ⁶
Weed-free	0	85 c	9 x 10 ⁶

^aThe actual count area for the treated strip in each plot was 4 m long by 4 m wide. Numbers of seedlings in untreated strips are averages of two counts/plot. Visual control ratings of black nightshades were still 99 to 100% 6 weeks after strip-treating plots in 1990.

^bPPI-1 = Preplant incorporated into planting beds just prior to the preplant irrigation in middle of March. PPI-2 = Preplant incorporated into planting beds the day before cotton planting in early April.

^cThe factor used to convert the number of seedlings in the counted strip (930 cm²) to the estimated number ha⁻¹ was 107,593.