FREQUENCY OF INSECTICIDE SPRAY APPLICATION FOR CONTROL OF FALL ARMYWORM (LEPIDOPTERA: NOCTUIDAE) ON SORGHUM

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RESUMEN

Existe desconocimiento del efecto de frecuencias de aplicación de los insecticidas sobre el comportamiento de las poblaciones del gusano cogollero (*Spodoptera frugiperda*) y la repercusión de estas en los rendimientos del sorgo granifero (*Sorghum bicolor* L. Moench). El estudio se realizó en la Estación Experimental dos del Centro Nacional de Tecnología Agropecuaria y Forestal (CENTA), ubicado en San Andrés, departamento de La Libertad, El Salvador, durante los meses de septiembre del año 2001 y enero de 2002. El objetivo de la investigación fue determinar el efecto del numero de aplicaciones de clorpirifos sobre las poblaciones de larvas de gusano cogollero en el cultivo del sorgo. Para este ensayo se estableció un diseño de bloques al azar con cinco tratamientos y cuatro repeticiones. Se realizaron aplicaciones de Chlorpyrifos en el cultivo del sorgo, en dosis de 1.4 l ha^{-1}, en 285 l de agua durante cuatro fechas (4 estados de desarrollo de la planta), específicamente a los 15, 25, 35 y 45 días después de la siembra. Las parcelas con tratamientos recibieron 1, 2, 3 y 4 aplicaciones de insecticidas y fueron comparadas con una parcela sin aplicación. Cada tratamiento insecticida inicialmente tuvo reducciones significativas en las poblaciones de cogollero, comparados con la parcela sin aplicación. Tratamientos con cada aplicación adicional tuvo reducciones significativas en las poblaciones de larvas vivas, comparados con tratamientos que tuvieron menor numero de aplicaciones. El cogollero, tuvo reinfestaciones, en las parcelas que recibieron ya sea una, dos o tres aplicaciones de insecticidas, durante el periodo de observación después de cada uno de los tres tratamientos. Estos resultados muestran las reinfecciones de las poblaciones de cogollero después de las aplicaciones de insecticidas, y la carencia de efecto residual de los mismos. A pesar de que no se determinaron diferencias significativas en el rendimiento de grano, las diferencias numéricas oscilaron desde 555 a 1 674 kg ha^{-1} mas allá del rendimiento observado en el tratamiento sin aplicación, lo cual sugiere que el manejo efectivo del daño ocasionado por el cogollero en el cultivo de sorgo, puede resultar en mejora de los rendimientos.

ABSTRACT

The effectiveness of four insecticide spray programs for control of fall armyworm, *Spodoptera frugiperda* (J.E. Smith), larvae on sorghum was evaluated in small plots at San Andres, El Salvador in 2001. Chlorpyrifos at 1.4 l/ha was applied in 285 l of water/ha to sorghum on four dates (4 stages of plant development), specifically at 15, 25, 35 and 45 days after planting. Treatment plots received 1, 2, 3 or 4 insecticide spray applications and were compared with the untreated control. Each insecticide treatment initially had significantly lower fall armyworm survival than the untreated. Treatments with each additional spray application had significantly lower larval survival compared with treatments having fewer spray applications. Fall armyworm reinfested each of the treatment plots receiving either 1, 2 or 3 insecticide applications during the observation period after each of the three treatments. These results reflect the resurgence of fall armyworm infestations and lack of residual effect of the insecticide. Although no significant yield differences were determined from grain measurements at harvest, the numerical differences that ranged from 555 go 1,674 kg/ha greater than the untreated suggests that effective management of damaging fall armyworm infestations on sorghum should result in improvements in yield.

The fall armyworm, *Spodoptera frugiperda* (J.E. Smith), is a significant pest of sorghum in Latin America (King and Saunders, 1984; Paul, 1990) and could be a limiting factor in sorghum production (ICRISAT, 1983). Insecticides have been the first line of defense against this pest with best results generally obtained when used against early stages of larval development (ICRISAT, 1983). These toxic chemicals are usually applied as spray applications and with a knapsack sprayer by small and medium scale farmers (King and Saunders, 1984).

The behavior of fall armyworm adults in establishing infestations of larvae on sorghum plantings is a determining factor in the frequency that insecticide applications are made to control the pest to limit crop damage. Insecticide applications may be made when not needed. Knowledge of the number of insecticide applications needed to control damaging infestations of fall armyworm larvae on sorghum is essential in the pest management decision making process. Thus, the objective of this study was to elucidate the efficacy of several insecticide spray programs to limit fall armyworm infestations on sorghum and associated crop damage.

METHODS AND MATERIALS

The study was conducted in an established sorghum, [RCV variety (M-35584 x CS 3541 Crosses 31) BK-5-2-2-3-1-1-1-BK] field at the National Center for Agricultural and Forestry Technologies Experiment Station Number 2 located in the San Andres Valley, Department of La Libertad in El Salvador, Central America. Test plots were established in a randomized complete block with 5 treatments and 4 replications.

Each plot consisted of 8 rows, 15 meters long, with 0.7 meters between rows. Treatments and replications were separated by 1.5 meters. Treatments included chlorpyrifos insecticide (1.4 l/ha) in 143 l of water/ha applied initially when fall armyworm infestations and leaf damage were observed at levels indicating the presence of sufficient numbers of larvae to conduct a study. The four different insecticide treatment programs included: T1. Insecticide applied 15 days after planting, T2. As T1 plus a second application in 10 days, T3. As T1 plus 2 applications at 10 day intervals, T4. As T1 plus 3 applications at 10 day intervals, and T5. untreated control. Insecticide sprays were made in the morning when there was little wind, thus avoiding drift of the insecticide and by the same person on each date to maintain uniformity of treatment application. Immediately before insecticide application and 20 hours after insecticide was applied in designated plots, 100 plants from the border rows and center rows, respectively, within each plot were examined for presence of fall armyworm larvae. Observations consisted of whole plant destructive sampling of whorl stage plants and counting the number of live and dead larvae to calculate percent survival after insecticide application.

Yield was determined at harvest from 14 meters of the two center rows in each treatment plot. The data were analyzed using Analysis of Variance, F test and means were compared using Tukey's test at P=0.01 significance level.

RESULTS AND DISCUSSION

Each of treatments T1 through T4 receiving one application of chlorpyrifos insecticide on day 15 after planting had a significantly lower percent larval survival (3.8 to 7.3%) than the untreated (T5) at 95.8% 20 hours (day 16) after this application (Table 1). Treatments T2 through T4, receiving two applications of insecticide by day 25 after planting, had significantly lower percent larval survival (3.5 to 10.0%) than T1 (35.0%) and T5 (93.5%) 20 hours (day 26) after the second application (Table 1). Treatment plots (T1), with only one spray application, had an increase in larval number at this time, reflecting the resurgence of fall armyworm infestation and lack of residual effects of the insecticide. Treatments T3 and T4, receiving three applications of insecticide by day 35, had significantly lower percent larval survival (8.0%) than T2 (72.5%), T1 (92.0%) and T5 (94.0%) 20 hours after the third application (Table 1). Treatment plots T1 and T2 had increased larval infestations at this time, once again reflecting resurgence of fall armyworm infestations in plots receiving only one or two insecticide applications. Treatment T4, receiving four applications of insecticide by day 45, had significantly lower percent larval survival (6.8%) than the other treatments (T3 with 65.3%, T2 with 88.3%, T1 with 89.5%, and T5 with 95.3%) (Table 1). Fall armyworm reinfested each of the treatment plots receiving either 1, 2 or 3 insecticide spray applications during the observation periods after each of the three treatments.

As the sorghum plants developed through vegetative and reproductive stages in each of the insecticide treatment plots, the extent of leaf feeding damage was apparent, but the difference in defoliation among treatments did not appear to be a major limiting factor in production under the conditions of this study. When grain yield was measured at harvest, no significant differences were determined among insecticide treatments (Table 2). The variability in yield data for treatments precluded the significant separation of treatment effects. Nevertheless, numerical yield differences ranging from 555 to 1,674 kg/ha greater for insecticide treatments compared with the untreated suggest that limiting fall armyworm damage to sorghum should result in improvements in yield.

Table 1. Effectiveness of insecticide spray programs for control of fall armyworm on sorghum. San Andres, El Salvador, C.A. 2001.

Treatment (T)[1/]		Percent survival 20 hours after insecticide spray program on days after planting			
Number	No. insecticide applications	15	25	35	45
T1	1	5.3 a[2]	35.0 b	92.0 c	89.5 bc
T2	2	7.3 a	10.0 a	72.5 b	88.3 bc
T3	3	3.8 a	3.5 a	8.0 a	65.3 b
T4	4	6.8 a	9.3 a	8.0 a	6.8 a
T5[3/]	0	95.8 b	93.5 c	94.0 c	95.3 c

[1/] Insecticide programs included 1, 2, 3 or 4 spray applications.
[2/] Treatment means with the same letter are not significantly different (Tukey's test, P=0.01).
[3/] Untreated (no insecticide).

Table 2. Sorghum yield from plots treated with chlorpyrifos insecticide programs. San Andres, El Salvador, C.A. 2001.

Treatment (T)[1/]		
Number	No. insecticide applications	Yield (kg/ha)
T1	1	6,245 a[2/]
T2	2	5,702 a
T3	3	6,145 a
T4	4	5,126 a
T5[3/]	0	4,571 a

[1/] Insecticide programs included 1, 2, 3 or 4 spray applications.
[2/] Treatment means with the same letter are not significantly different (Tukey's test, P=0.01).
[3/] Untreated (no insecticide).

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