EFFECT OF *ROTYLENCHULUS RENIFORMIS* ON YIELD AND OIL QUALITY OF SUNFLOWERS

C. M. Heald and E. Stein

Respectively, USDA, ARS, Plant Health and Stress Physiology, and Subtropical Crop Insects Research, P. O. Box 267, Weslaco, Texas 78596, U.S.A.

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ABSTRACT

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The effect of the reniform nematode, *Rotylenchulus reniformis*, on growth, yield, and/or quality of sunflower was compared in fumigated and unfumigated plots in the Lower Rio Grande Valley of Texas. In 1975, 1976, and 1981 plots were established in a sandy loam field naturally infested with the reniform nematode. Treatments included 1,3-dichloropropene applied at 47, 56, or 75 L/ha by chisel injection 25 cm deep and an untreated chiseled control. The soil fumigant significantly reduced the nematode populations in all years when compared to untreated plots. Yields of fumigated plots were significantly increased in 1975, 1976, and 1981. In 1975 seeds from fumigated and unfumigated plots were analyzed for palmitic, stearic, oleic, and linoleic acid. Oleic acid was significantly higher in seed from fumigated plots.

Additional key words: reniform nematode, Helianthus annuus, soil fumigant.

RESUMEN

Heald, C. M., y E. Stein. 1987. Efecto de *Rotylenchulus reniformis* en rendimiento y calidad del aceite del girasol. Nematropica 17:1-5.

El efecto del nematodo, *Rotylenchulus reniformis*, en el crecimiento, rendimiento y calidad del girasol fue comparado en parcelas fumigadas y sin fumigar en el Valle Bajo del Rio Grande de Texas. En 1975, 1976, y 1981 se establecieron parcelas en un campo de franco-arena e infestado naturalmente con el nematodo reniforme. Los tratamientos incluyeron 1,3-dicloropropeno aplicados a 47, 56, 75 L/ha inyectados a 25 cm de hondo y un testigo inyectado sin tratamiento. El fumigante de suelo redujo significativamente la población de nematodos en todos los años al comparase con las parcelas sin tratamiento. El rendimiento de las parcelas fumigadas aumentó significativamente en 1975, 1976 y 1981. En 1975 semillas de las parcelas fumigadas y sin fumigar fueron analizadas para los acidos palmitico, estearico, oleico y linoleico. El acido oleico fue significativamente más alto en las semillas de las parcelas fumigadas.

Palabras claves adicionales: nematodo reniforme, Helianthus annuus, fumigante del suelo.

INTRODUCTION

In recent years there has been an increased interest in commercial sunflower (*Helianthus annuus* L.) production in the Southern United

States. Rich and Green (6) reported that sunflower yields in Florida were significantly increased by control of *Meloidogyne javanica* (Treub) Chitwood with phenamiphos. Other non-fumigant nematicides significantly increased head size of sunflower. Other studies by Rich and Dunn (5) suggest that sunflower may be tolerant to additional species of nematodes. In Tennessee, Keyserling and Bernard (3) found *M. javanica* and *M. incognita* (Kofoid and White) Chitwood populations did not differ among sunflower cultivars, but *Helicotylenchus dihystera* (Cobb) Sher increased greatly on most sunflower cultivars tested. Heilman *et al.* (1) showed that sunflower is an excellent host of the reniform nematode, *Rotylenchulus reniformis* Linford & Oliveira. The histopathology of *R. reniformis* on sunflower was investigated by Robinson and Orr (8), and they concluded that the nematode caused extensive injury to cortical and vascular tissue of roots. In cultivated fields there is evidence that this nematode causes injury to the crop; however the economic importance of this parasite has not been determined. Our objective was to determine the effect of the reniform nematode on yield and oil quality of sunflower.

MATERIALS AND METHODS

Studies were conducted in 1975, 1976, and 1981 on a Hidalgo sandy loam soil (75% sand, 14% clay, 11% silt) naturally infested with *R. reniformis*. Plots were 4 rows, 15 m long and 100 cm wide, replicated 4 times in a randomized complete block. Row application of 1,3-dichloropropene (1,3-D) was made by a tractor-drawn chisel applicator 2 wk before planting using two shanks placed 25 cm deep, 13 cm on either side of the row middle. In 1975, 1,3-D (56 L/ha) was compared with untreated plots, and two sunflower varieties (Sunbred 212 and Sun Hi 380) were planted. In 1976, 1,3-D was applied at rates of 56 and 75 L/ha and plots planted to 'Sun Hi 380'. In 1981, 1,3-D was applied at 56 L/ha and plots planted to 'Triumph 894'.

Soil samples for nematode analysis were collected before treatment, and twice after treatment as specified for each year (Table 1). Soil samples were a composite of 6 subsamples per replication taken with a nursery spade at a depth of 18-25 cm. One hundred g of the mixed composite was placed on a Baermann funnel and after 48 hr the nematodes in 20 ml of water were extracted and counted with the aid of a stereo-dissecting microscope.

Sunflowers were harvested at 110±5 days depending on the year. Sunflower heads were harvested from 14 m of row, dried in the greenhouse for one wk, and seed yields were determined by collecting threshed seeds per plot. In 1975, oil content and quality were analyzed. The seeds from treated and untreated cultivars were washed with a 1%

sodium hypoclorite solution, rinsed with distilled water, and dried in a 60C forced draft oven. Moisture and oil (7) and nitrogen content (4) of the seed were determined. Protein was calculated by multiplying the Kjeldahl N by the factor 6.10. The fatty acid composition of the oils was determined by transesterification of glycerides in the oil using a methanolic-base reagent from Supelco Inc. (6). Analysis of the fatty acid mixture was made with a Perkin-Elmer® Model 900 gas chromatograph equipped with a flame ionization detector. A sample was injected into a 3-m long x 0.3-cm O. D. stainless steel column filled with 12% ethylene glycol succinate on 80-100 mesh chromosorb W. Quantitation of each fatty acid ester on the chromatogram was made by determining the area under each peak using a Gelman® planimeter.

RESULTS AND DISCUSSION

Fumigation with 1,3-D significantly reduced the reniform nematode populations in all experiments resulting in a seed yield increase in the three experiments (Table 1). In 1975, the fumigated 'Sun Hi 380' plots yielded 18% higher than the unfumigated plots, but yields were not different with 'Sunbred 212'. Nematode populations were significantly reduced 30 days after treatment but not after 75 days (Table 1). In 1976, the yields of the 'Sun Gro 380' were significantly increased at the high application rate of 1,3-D (75 L/ha) but not at the lower rate (47 L/ha). Nematode counts at both rates were significantly reduced 5 wk after treatment (Table 1). In 1981, 'Triumph 894' gave an 18% increase in seed yield in fumigated plots compared to unfumigated plots. Nematode numbers in the fumigated plots were significantly lower than those in unfumigated plots after 30 days but not after 75 days.

Seed analysis for fatty acids, N, and protein were made to determine if stress to sunflowers caused by *R. reniformis* had an effect on quality of the seed contents. No significant differences in oil or protein content between cultivars grown in fumigated on nonfumigated soil could be established. Heilman *et al.* (2) found a difference in N and protein content between infected and non-infected plants of the cultivars they tested. No significant variation in the content of palmitic and stearic acid between treated and untreated cultivars was observed. Oil from 'Sunbred 212' seed showed a slight increase in oleic acid content between check and treated cultivars. The protein and fatty acid composition and percent oil of the control 'Sunbred 212' agree with results of other studies conducted in this area (2).

The reniform nematode caused economic losses to sunflower as determined in these studies. This supports findings by Robinson and Orr (8) wherein they showed the pathogenicity of *R. reniformis* to sunflower in histopathological studies.

Table 1. Effect of soil fumigation on *Rotylenchulus reniformis* and yield of sunflowers.

Variety	Treatment (Rate of 1,3-D)	Nematodes/100g soil[z] Pretreatment	Posttreatment 30 days	Posttreatment 75 days	Yield (kg/6m)
1975 Test					
Sun Hi 380	56 L/ha	234	40	1400	609
Sun Hi 380	check	268	290	1434	499
Sunbred 212	56 L/ha	290	57	940	786
Sunbred 212	check	322	447	1280	721
LSD (P=0.05)		162	253	1383	98
1976 Test					
Sun Gro 380	47 L/ha	290	22	410	1078
Sun Gro 380	75 L/ha	265	8	378	1282
Sun Gro 380	check	195	253	700	977
LSD (P=0.05)		452	100	623	109
1981 Test					
Triumph 894	56 L/ha	27	10	504	605
Triumph 894	check	18	185	498	499
LSD (P=0.05)		13	94	120	75

[z] Data are means of 4 replications.

LITERATURE CITED

1. HEILMAN, M. D., C. M. HEALD, J. R. COPPEDGE, and J. A. ROBERTSON. 1975. Fall production of oil type sunflower in the Lower Rio Grande Valley of South Texas. J. Rio Grande Valley Hort. Soc. 29:99-108.
2. HEILMAN, M.D., E. STEIN, and R.V. CANTU. 1977. Yield, growth characteristics, and oil composition of four hydrid sunflower cultivars. J. Rio Grande Valley Hort. Soc. 31:147-151.
3. KEYSERLING, M.L., and E.C. BERNARD. 1980. Suitability of sunflower for reproduction of selected plant-parasitic nematodes. J. Nematol. 12:228.
4. MEHLENBACHER, V.C., T.H. HOPPER, E.M. SALLEE, and W.E. LINK. 1974. Official and tentative methods of the American Oil Chemistry Society. Am. Oil Chem. Soc. 1 (Sec. Ba 4-38):1-2.

5. RICH, J.R., and R.A. DUNN. 1982. Pathogenicity and control of nematodes affecting sunflower in north-central Florida. Plant Disease 66:297-298.
6. RICH, J.R., and V.E. GREEN, JR. 1981. Influence of *Meloidogyne javanica* on growth and yield of oilseed sunflower. Nematropica 11:11-16.
7. ROBERTSON, J.A. 1974. Collaborative study of the determination of total oil in sunflower seed. J. Am. Oil Chem. Soc. 51:223a-225a.
8. ROBINSON, A.F., and C.C. ORR. 1980. Histopathology of *Rotylenchulus reniformis* on sunflower. J. Nematol. 12:84-85.
9. SUPELCO, INC. 1975. Esterification Bulletin 721B. Supelco Inc., Bellafonte, Pennsylvania. Pp 3-4.

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