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Comparison of Development, Reproduction, and Aggressiveness of *Meloidogyne incognita* Races 3 and 4 on Cotton

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Meloidogyne incognita (Kofoid and White) Chitwood has been separated into four races (R1–R4) based on the ability of different populations to parasitize 'NC95' tobacco and 'Deltapine 16' cotton (7). Since the designation of races within this species, several workers have attempted to characterize them on the basis of reproduction on a common host. Araujo et al. (1) compared the reproduction of R1 and R4 on susceptible and resistant tomatoes at 32.5 C. No difference between the races was observed on susceptible tomatoes, but R4 produced significantly more egg masses than did R1 on five of seven resistant tomato cultivars. Swanson and Van Gundy (6) reported that R1, R3, and R4 had significantly greater reproduction on 'Pickett' soybean than did R2. On 'Centennial' soybean, however, R2 had a greater reproductive potential then did R1 or R4.

Of the four described races of *M. incognita*, only R3 and R4 are known to parasitize cotton (*Gossypium hirustum* L.). Both of these races are present in the Southern High Plains cotton production region of Texas. Kirkpatrick and Sasser (3) reported that in a comparison of six populations of R3 and two populations of R4 on susceptible and resistant cotton cultivars, R3 generally had significantly greater reproduction than did R4. In this paper we compare the development, reproduction, and aggressiveness of R3 and R4 on cotton. We define aggressiveness, after Vanderplank (8), as a quantitative measure of the pathogen's ability to cause host damage.

The populations of R3 and R4 used throughout these studies were isolated from cotton and tobacco, respectively, and were maintained separately on 'Rutgers' tomato. Development of R3 and R4 was compared on susceptible 'Deltapine 16' and 'Rowden' cotton using a rag-doll synchronous inoculation procedure (2). Cotton seedlings were inoculated with 100 freshly hatched second-stage juveniles (J2) of either R3 or R4. Twenty-four hours after inoculation, the seedlings were removed

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TABLE 1. Reproductive factors (RF) and races 3 and 4 of *Meloidogyne incognita* on 'Tamcot SP37' cotton in microplot tests.

	1983		1984	
Pi*	Race 3	Race 4	Race 3	Race 4
0.3			4,792 ± 2,507	1,917 ± 1,113
1.7			319 ± 133	419 ± 116
3	477 ± 223	168 ± 55	266 ± 70	218 ± 49
17	23 ± 13	34 ± 11	51 ± 22	36 ± 12
33	10 ± 5	17 ± 9	22 ± 6	22 ± 8
167	6 ± 2	3 ± 1		

There were no significant differences in the reproductive factors between R3 and R4 at any Pi level in either 1983 or 1984.
* Pi = initial population density of eggs and second-stage juveniles per 100 cm^3 soil.

TABLE 2. Regression analysis of the relationship between the log(x + 1) transformation of initial nematode populations and seed cotton yields of Tamcot SP37 in microplots infested with race 3 or 4 of *Meloidogyne incognita*.

	1983		1984	
Race	*r*	Slope	*r*	Slope
3	−0.88*	−9.8	−0.98**	−18.6
4	−0.95*	−10.0	−0.92**	−17.8

* Significant at $P = 0.05$.
** Significant at $P = 0.01$.

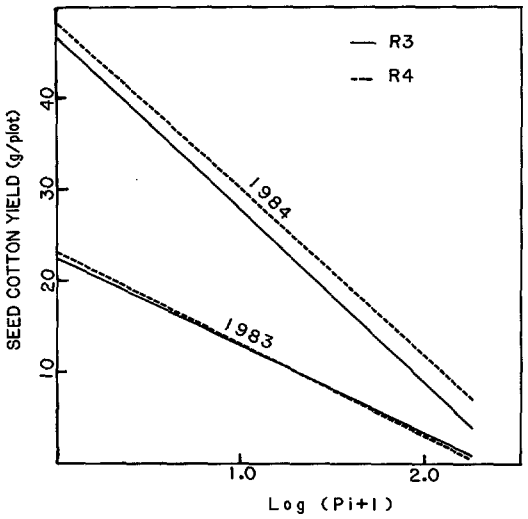

FIG. 1. The relationship between the log(x + 1) transformation of initial nematode populations (Pi) and seed cotton yields in microplots infested with race 3 or 4 of *Meloidogyne incognita*.

from the rag-dolls, the roots washed gently in tap water, and the seedlings transplanted into plastic cups containing 500 cm³ of a sand-peat-vermiculite mix (2:1:1). Seedlings were maintained in a growth chamber at 28 C with 14-hour days. At 2, 5, 16, 19, 23, and 26 days after inoculation, 5–9 plants for each race–cultivar combination were harvested. The roots were washed gently to remove adhering soil, stained with acid fuchsin in lactophenol, and examined microscopically to determine the developmental stages of the nematodes present. A minimum of 36 individual nematodes were examined per treatment on each sample date.

The reproductive factor (RF) (4) and aggressiveness of R3 and R4 were compared in microplot tests on 'Tamcot SP37' cotton. Microplots were plastic cylinders (45 cm d × 55 cm long) buried in the ground and filled with loamy sand soil (85% sand, 7% silt, 8% clay, pH 7.5). The microplots were fumigated with methyl bromide (1 kg/10 m²) before infesting with nematodes. Inoculum for the plots was infested soil containing galled root fragments from greenhouse cultures of the nematodes. Sufficient infested soil was incorporated into the upper 25 cm of soil in each plot to establish a range of initial nematode population densities (Pi). Ten cotton seeds were planted in each plot immediately after infesting with the nematodes, and seedlings were thinned to five per plot 14 days later. Plots were fertilized according to soil test recommendations and irrigated as needed. In 1983 five Pi levels (0, 3, 17, 33, and 167 eggs and J2/100 cm³ soil) were each replicated five times. In 1984 six Pi levels (0, 0.3, 1.7, 3, 17, and 33 eggs and J2/100 cm³) were each replicated six times.

To estimate nematode population densities, composite soil samples (eight cores each 2.5 cm d × 25–30 cm deep) were removed from each plot 8 weeks after planting and at crop harvest (24 weeks after planting). Eggs and J2 were extracted from the soil samples by elutriation as previously described (5), and RF values were calculated. Each plot was hand harvested to determine seed cotton yields.

Development of R3 and R4 nematodes was similar on Deltapine and Rowden. Adult females were first observed 16 days after inoculation and eggs 23 days after inoculation. Using 10 C as the threshold value, ca. 10,000 centigrade-hours were required for nematodes of each race to complete their life cycles.

Reproduction of R3 and R4 was similar on Tamcot SP37 in 1983 and 1984. No significant difference in the RF of R3 and R4 was detected at any Pi tested (Table 1). As Pi increased, the RF decreased in all instances. Furthermore, both races suppressed seed cotton yields similarly. In 1983 and 1984 there was a significant negative correlation between the log(x + 1) transformation of Pi and seed cotton yields (Table 2). Slopes of the regression lines for R3 and R4 were similar for both years (Fig. 1).

Although other workers (1,3,6) have reported that reproduction of *M. incognita* races differ on common hosts, we were un-

able to detect any difference between R3 and R4 in terms of development, reproduction, or aggressiveness on cotton. Therefore, in the development of management strategies for *M. incognita* R3 and R4 on cotton, these races should be treated similarly.

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