PARTIAL LIST OF ABSTRACTS OF PAPERS PRESENTED AT THE XI ANNUAL MEETING OF OTAN AT CHARLESTON, SOUTH CAROLINA, JUNE 10-14, 1979

LISTA PARCIAL DE LOS RESUMENES DE TRABAJOS PRESENTADOS EN LA XI REUNION ANUAL DE ONTA EN CHARLESTON, CAROLINA DEL SUR, 10-14 DE JUNIO, 1979

STIMULATORY EFFECT OF PHENAMIPHOS ON YIELD OF CABBAGE GROWN IN NONINFESTED AND *HETERODERA SCHACHTII*-INFESTED SOILS [EFECTO ESTIMULANTE DE PHENAMIPHOS SOBRE COLES EN SUELOS LIBRES E INFESTADOS CON *HETERODERA SCHACHTII*]. G. S. Abawi and W. F. Mai, Department of Plant Pathology, NYS Agricultural Experiment Station, Geneva, NY 14456, and Department of Plant Pathology, Cornell University, Ithaca, NY 14853 - - - The relationship between initial population (Pi) density of *Heterodera schachtii* and yields of cabbage was determined in nontreated and phenamiphos (Nemacur)-treated field soils placed in unglazed clay tiles (25-cm diam. and 30-cm long) under field conditions during 1977. At planting time, phenamiphos was applied as a broadcast treatment and incorporated into the top 8-12 cm of soil at a rate of 45 kg 15 G/ha. Three cabbage seeds (cv. Round up) was planted/tile which were later thinnned to one plant/tile. All treatments were replicated 10 times in a randomized block design. Insect and disease control applications were made according to commercial recommendations. In nontreated soils, total yield of cabbage averaged 7.3, 7.2, 6.8, 6.7, and 5.8 kg/plot and marketable yield averaged 4.3, 4.1, 3.8, 3.7, and 3.0 kg/plot at Pi densities of 0.7, 1.5, 3.0, 6.0, and 12.0 eggs and larvae/g soil, respectively. Cabbage yield was lowered significantly (P = 0.05) only at the highest Pi density tested. In contrast, soil treatment with phenamiphos significantly increased total yields by 19, 19, 24, 33, and 54%, and marketable yields also were significantly increased by 23, 23, 33, 45, and 77% at Pi densities of 0.7, 1.5, 3.0, 6.0, and 12.0 eggs and larvae of *H. schachtii*/g soil, respectively. Nematode buildup was inversely related to Pi density and generally there were no significant differences in the final populations (Pf) of *H. schachtii* in nontreated and phenamiphos-treated soils at any Pi density tested. Data obtained to date suggest that the damage threshold density of *H. schachtii* to cabbage is approx. 6-12 eggs and larvae/g soil. Accordingly, the significant increase in cabbage yield obtained in the phenamiphos-treated soils at the lowest 3 Pi densities was probably due to a factor(s) other than the control of *H. schachtii*. The Pf/Pi ratios of treated soils was 165, 28, 20, 11, and 3 at Pi densities of 0.7, 1.5, 3.0, 6.0, and 12.0 eggs and larvae/g, respectively. In 1978, yields of cabbage were determined in 4 soils with and without the addition of phenamiphos. The 4 soils were 1) nontreated *H. schachtii*-infested soil (7 eggs and larvae *H. schachtii*/g soil); 2) *H. schachtii*-infested soil previously fumigated with 410 L Telone CR/ha; 3) nontreated *H. schachtii*-free soil; and 4) steam-sterilized *H. schachtii*-free soil. Marketable yield of cabbage grown in soils 1, 2, 3, and 4 with phenamiphos was 26, 8, 27, and 4% higher, respectively, than that obtained in the same soils without the application of phenamiphos. The Pf density of *H. schachtii* in soil 1 with and without the phenamiphos application was 196 and 206 eggs and larvae/g soil, respectively. However, the Pf density of *H. schachtii* in the other treatments was essentially nil. Results of the 1978 study suggest that the higher yields of cabbage obtained by treating soil with phenamiphos is due to the control of biological agent(s) other than plant parasitic nematodes. The organism(s) involved is also controlled by Telone CR and steam sterilization.

SUSCEPTIBILITY OF SOYBEAN CULTIVARS TO *PRATYLENCHUS SCRIBNERI* AND *MELOIDOGYNE INCOGNITA*. [SUSCEPTIBILIDAD DE CULTIVARES DE SOYA A *PRATYLENCHUS SCRIBNERI* Y *MELOIDOGYNE INOCOGNITA*]. N. Acosta, Department of Crop Protection, University of Puerto Rico, Mayagüez, Puerto Rico 00708 - - - Soybean cultivars representing maturity groups I-X were compared for their susceptibility to *Pratylenchus scribneri* under greenhouse conditions. A preliminary screening of 51 cultivars indicated a relatively wide range of susceptibility. Reevaluation of 12 of the cultivars confirmed that Clark 63, Woodworth and Williams are highly susceptible. Amsoy 71, Bonus, Corsoy, Jupiter and Wayne supported only limited reproduction. Custer, Dyer and Forrest, resistant to other nematodes, also appeared to be resistant to *P. scribneri,* while PI 88788 was intermediate in susceptibility. In comparison to other cultivars, Corsoy was the most intolerant of infection because growth was poorest and the density of nematodes in the roots was high. Susceptibility of soybean cultivars: Jupiter, Hardee late selection, Bragg, Forrest, Bedford and Hutton to *Meloidogyne incognita* was studied in the greenhouse. Roots of Hutton, Bedford and Forrest showed the lowest gall index and nematode population reproduction when compared to Jupiter, Hardee late selection and Bragg.

EVALUATIONS OF DIFFERENT INOCULUM DENSITIES FOR SCREENING TOMATO *(LYCOPERSICON ESCULENTUM* AND *L. PERUVIANUM)* FOR RESISTANCE TO ROOT-KNOT NEMATODES [EVALUACION DE DIFERENTES DENSIDADES DE INOCULO EN PRUEBAS DE RESISTENCIA EN TOMATE *(LYCOPERSICON ESCULENTUM & L. PERUVIANUM)* CON EL NEMATODO NODULAR DE LA RAIZ]. M. T. Araujo, D. W. Dickson, and J.J. Augustine, Department of Vegetable Crops (UEPAE -Brasilia, EMBRAPA, Brasilia, Brazil), Department of Entomology & Nematology, IFAS, University of Florida, Gainesville, Florida 32611, and Agricultural Research & Education Center, Bradenton, Florida 33508 - - - Different inoculum densities were used to screen tomatoes for resistance to root-knot nematodes *(Meloidogyne incognita* and *M. javanica)* at 25 and 32.5 C. Three *Lycopersicon esculentum* cultivars, Floradade (mimi), Nematex (MiMi), and Patriot (MiMi), and one *L. peruvianum* PI- 129149 were transplanted in plastic pots measuring 21 cm (diam) x 16.5 cm. The pots were placed in water-bath temperature tanks equipped with a heating-cooling system and a circulating pump. Each pot had an individual plastic tube for drainage. Twelve days after transplanting, five seedlings were removed leaving five uniform plants per pot. At this time, the soil was inoculated by pipetting an egg suspension of either 20, 100, 200, 1,000 or 2,000 eggs per plant into holes of 0.5 cm diam x 2.0 cm deep around each plant. Each inoculum level was replicated two times. After 28 days the plants were removed, the roots separated, washed and evaluated for resistance by determining the number of egg masses produced per plant. The number of egg masses on the susceptible cultivar, Floradade, was very similar for both species of *Meloidogyne* at both temperatures. The average number of egg masses from ten Floradade plants ranged from 12 to 100 at inoculum levels of 20 to 1,000 eggs/plant, respectively. Very low numbers of egg masses were found on the three resistant cultivars, Nematex, Patriot and PI-129149 grown at 25 C, however there were slightly more egg masses produced by *M. javanica*- than *M. incognita*. There was a breakdown in resistance of these three cultivars when grown at 32.5 C. In most cases more egg masses were found for *M. incognita* than *M. javanica* at the higher temperature. The inoculum density of 200 eggs/plant appeared best for screening tomatoes at 32.5 C. At this level, individual egg masses were observed and quantitative differences in resistance to both species of nematodes could be assessed.

REPRODUCTION OF THREE *MELOIDOGYNE* SPP. ON SUSCEPTIBLE 'MCNAIR 944' TOBACCO [REPRODUCCION DE TRES ESPECIES DEL GENERO *MELOIDOGYNE* EN UN CULTIVAR SUSCEPTIBLE DE TABACO 'MCNAIR 944']. M. L. Arens, J. R. Rich and D. W. Dickson, Department of Entomology and Nematology, University of Florida, Agricultural Research Center, Live Oak, Florida 32060, and University of Florida, Gainesville, Florida 32611 ---Sixty-seven-day old tobacco seedlings were inoculated with *Meloidogyne arenaria, M. incognita,* and *M. javanica* at inoculum levels of 0, 4, 16, 47, and 64 nematode eggs/100 cm^3 soil. Gall development and number of nematodes in the roots were observed at 20, 40 and 60 days after inoculation. Each treatment was replicated 5 times/date. The roots from all inoculum levels except those inoculated with 47 eggs/100 cm^3 soil were washed and the galled roots collected. Galls were labeled separately, measured, dissected, and the number of nematode/gall was determined. Twenty days after inoculation, *M. javanica* numbers in the plant roots were greater (P=0.05) than those of the other two nematode species, whereas, the number of *M. arenaria* recovered were found to be significantly greater than those of *M. incognita.* Forty and sixty days after inoculation, numbers of *M. javanica* were significantly greater than the two remaining species, but there were no differences between number of *M. incognita* and *M. arenaria.* Correlation coefficients between total numbers of nematodes/gall and gall volume were highly positive for each one of the species as well as across all three species. Gall volume produced by *M. javanica* was greater than that produced by the other two species. The number of nematodes and root weights were determined for each pot inoculated with 47 nematodes/100 cm^3 of soil. Twenty and sixty days after inoculation, nematode numbers were not significantly different among the three species. Forty days after inoculation, numbers of *M. javanica* per g root were significantly greater than *M. arenaria,* whereas, the numbers of *M. arenaria* were significantly greater than *M. incognita.* Roots inoculated with *M. javanica* exhibited significantly lower weights followed by *M. incognita* and then by *M. arenaria.*

NEMATODOS FITOPARASITOS ASOCIADOS AL CULTIVO DEL CAFETO *(Coffea arabica* L.) EN NICARAGUA [PHYTOPARASITIC NEMATODES ASSOCIATED WITH COFFEE *(Coffea arabica* L.) CULTURE IN NICARAGUA]. Frank Sequeira Bustamante, Heinrich Schuppener, Jorge Cuarezma y Porfirio Zepeda Arana, Instituto Nicaragüense de Tecnología Agropecuaria, Nicaragua ---A pesar de no contar con estudios que lo hubieran demostrado, en Nicaragua se ha mencionado frecuentemente que los nematodos fitoparásitos afectan los cafetales en el Pacífico Central pero que no existen en el Interior Central y Norte. Para aclarar estas observaciones, se realizó un muestreo en las principales zonas productoras, con el fin de determinar la presencia, la distribución y la densidad poblacional de los nematodos fitoparásitos asociados al cafeto. De julio a diciembre de 1978 se muestrearon 214 fincas ubicadas en cinco departamentos en el Pacífico Central, Interior Norte e Interior Central, y se tomaron 268 muestras de suelo y raíces que fueron procesadas por las técnicas de macerado, tamizado y colado combinadas con el embudo de Baerman. Se encontró que los géneros *Meloidogyne, Pratylenchus, Helicotylenchus, Aphelenchus, Aphelenchoides, Tylenchus, Paratylenchus, Rotylenchulus, Tylenchulus* y *Xiphinema* estaban asociados al cultivo. En el Pacífico Central *Meloidogyne* fue el género más ampliamente distribuido y de mayor densidad poblacional, al estar presente en el 75% de los sitios muestreados y representar el 95% de la población total recuperada. En el Interior Central y Norte sólo se encontraron nematodos fitoparásitos en el 5% de los sitios muestreados; en este caso *Pratylenchus* fue el de mayor distribución y densidad poblacional; en estas áreas no se logró recuperar *Meloido-*

gyne, lo que podría ser la razón de la creencia popular de que no hay nematodos en el Norte, ya que no se observan los nódulos radicales característicos.

EL NEMATODO *HELICOTYLENCHUS MULTICINCTUS* (Cobb, 1893) Golden, 1956 EN BANANO EN ARGENTINA [THE NEMATODE *HELICOTYLENCHUS MULTICINCTUS* (Cobb, 1893) Golden, 1956 ON BANANA IN ARGENTINA]. Miguel A. Costilla, Susana González de Ojeda y Teresa H. de Gómez, Sección Entomología de la Estación Experimental A.I.O.C. de Tucumán, Tucumán, Argentina - - - Por no existir referencias en cuanto a los nematodos asociados a las plantas de banano en Argentina, y para conocer también las posibles causas del daño en plantas con síntomas de franco declinamiento, se realizó un estudio analítico de suelo y raíces de banano. De 6 a 8 kg de suelo y 1 kg de raíces/ha fueron tomados en diferentes puntos del área cultivada en el departamento Orán, provincia de Salta. El suelo fue procesado por el método de decantación, mientras que las raíces lo fueron por el método con renovación contínua de agua; las muestras fueron examinadas 24 y 48 horas después, y en todos los casos se detectó la presencia de *Helicotylenchus multicinctus.* Su distribución fue general en el área de cutivo, y se encontró una severa infección en los tejidos radicales donde esta especie actúa como endoparásito, encontrándose tanto en raíces aparentemente sanas como en enfermas; en estas últimas se observó necrosis de los tejidos y descortezamiento de las mismas; las densidades poblacionales en estas raíces fueron altas. Las plantas afectadas son fácilmente volcadas por el viento. En raíces con nódulos, *H. multicinctus* convive con *Meloidogyne incognita.*

POPULATION DYNAMICS AND CONTROL OF *PRATYLENCHUS PENETRANS* ASSOCIATED WITH NAVY BEANS *(PHASEOLUS VULGARIS* L.) AND SOYBEANS *(GLYCINE MAX)* [DINAMICA DE POBLACION Y CONTROL DE *PRATYLENCHUS PENETRANS* ASOCIADO CON EL FRIJOL *(PHASEOLUS VULGARIS)* Y LA SOYA *(GLYCINE MAX)*]. A. P. Elliott and G.W. Bird, Michigan State University, East Lansing, Michigan 48824 U.S.A. - - - Population dynamics and control of *Pratylenchus penetrans* in navy bean and soybean *(Glycine max)* production were evaluated with the use of aldicarb (Temik 15G). Population dynamics of *P. penetrans* differed with navy beans and soybeans. Peaks in population levels on navy beans corresponded to decreases in population levels on soybeans. Although population levels associated with navy beans were highest at DD10 = 1349 (Degree day accumulation at base 10 C = [10 C-(max. temp) + (min. temp/2)]. The highest population peak associated with soybeans was at DD10 = 1877. Aldicarb at 0.75 lb a.i. per acre was effective in reducing population levels associated with navy beans, while aldicarb at 2.0 lb a.i. per acre reduced population levels of *P. penetrans* associated with soybeans. Significant increases in yield were obtained with the use of aldicarb on both navy beans and soybeans.

INCREASED RESISTANCE OF ANHYDROBIOTIC *APHELENCHUS AVENAE* TO METHYL BROMIDE [AUMENTO DE RESISTENCIA AL BROMURO DE METILO POR FORMAS ANHIDROBIOTICAS DE *APHELENCHUS AVENAE*]. D. W. Freckman[1], Y. Demeure[2], D. E. Munnecke[3], and S. D. Van Gundy[1]. 1) Department of Nematology, University of California, Riverside, California 92521; 2) Laboratoire de Nematologie, ORSTOM, Dakar, BP 1386, Republique de Senegal; 3) Department of Plant Pathology, University of California, Riverside, California 92521. - - - The effect of methyl bromide (MB) was tested on active and anhydrobiotic *Aphelenchus avenae* Bastian, 1865. *A. avenae* was induced into anhy-

drobiosis by three methods: I) Crowe and Madin's (1975) slow desiccation of masses of nematodes (0.1 g w/w) in a constant relative humidity chamber; II) Demeure *et. al.*'s (1978) pressure plate method which induces nematodes into anhydrobiosis in soil; and III) Simon's wet chamber technique in which individual nematodes are induced into anhydrobiosis on a Millipore filter in a relative humidity chamber. Anhydrobiotic nematodes prepared by Methods I and II were each mixed into 100-ml portions of dry (1.5% w/w) sandy loam soil (72.8% sand, 21.2% silt and 6.0% clay) in 250-ml Erlenmeyer flasks. Prior to fumigation with MB, soil in one-half of the flasks was moistened (9% w/w) to allow nematodes to become active. The other half of the flasks contained anhydrobiotic nematodes in dry soil. Millipore filters containing either normally moist, active, or anhydrobiotic nematodes were suspended on steel rods in the flasks containing moist soil or dry soil, respectively. All flasks were attached to the manifold of a MB fumigation apparatus with a continuous flow of gas (20 ml/min) at a concentration of 3000 ul MB/liter air for 14 time periods from 0-24 h. Controls were identical to MB treatments except only air (moist or dry) was passed through the soil. Nematodes in soil were extracted by the anhydrobiotic nematode technique and percent coiled nematodes determined. Extracted nematodes and Millipore filter nematodes were then bubbled in tap water for 24 h to determine percent activity (motility). Anhydrobiotic *A. avenae* were more resistant to MB than active *A. avenae*. The LD50 for anhydrobiotic nematodes from Methods I, II and III was 57 h, 54 h and 121 h (CT = 171,000, 162,000 and 363,000 ul/liter/h), respectively. None of the normally moist, active nematodes survived a 22 h (CT = 66,000) treatment.

NEMATODOS ASOCIADOS CON EL CULTIVO DE ARROZ EN MEXICO [NEMATODES ASSOCIATED WITH THE RICE CROP IN MEXICO]. M. García-López y E. Zavaleta-Mejía, Rama de Fitopatología, Colegio de Postgraduados, Chapingo, México - - - En México la investigación realizada en relación con el cultivo del arroz se ha enfocado principalmente hacia mejoramiento genético para obtener los máximos rendimientos y muy poco se ha realizado para conocer el efecto de las enfermedades sobre la producción. Por este motivo, se decidió llevar a cabo la presente investigación en que se identificaron los nematodos fitoparásitos asociados al cultivo del arroz en la localidad de "El Progreso" Morales, México, y además se trató de conocer el efecto que éstos tienen sobre el desarrollo del mismo. Los géneros que se identificaron fueron: *Hirschmanniella, Helicotylenchus, Psilenchus, Tylenchus, Paratrophurus, Tylenchorhynchus, Hoplolaimus, Rotylenchus* y *Paratylenchus,* además 2 criconematidos no identificados hasta género; de los géneros mencionados los primeros 5 fueron los más ampliamente distribuídos. Para conocer el efecto de los nematodos fitoparásitos encontrados en la exploración nematológica, se estableció que los nematodos por si solos no causaron un decremento tan significativo en el peso fresco de las plantas de arroz, como cuando hubo asociación con los hongos fitopatógenos del suelo; en este caso el decremento fue hasta del 55%.

IDENTIFICATION AND RELATIONSHIP OF THE RYE GRASS AND OAT CYST NEMATODES [IDENTIFICACION Y RELACION DE LOS NEMATODOS ENQUISTADORES DEL BALLICO Y LA AVENA]. A. M. Golden, USDA, Nematology Laboratory, Plant Protection Institute, BARC-West, Beltsville, Maryland 20705 - - - The rye cyst nematode *(Heterodera mani)*, known previously in five European countries and primarily on rye grass, is extremely close to the oast cyst nematode *(H. avenae)*, a major worldwide pest of cereals, occurring also in Oregon, USA. Some workers consider the two to be essentially the same. In order to make a final identification of a cyst nematode on a grass in California, several populations of

H. mani and *H. avenae* from various sources were studied morphologically in detail. Of many structures examined, the length of the cyst vulval slit and shape of larval stylet knobs were the most useful and reliable in separating the two forms. In *H. mani* the vulval slit averaged 6.2 um and stylet knobs were extremely anchor-shaped; in *H. avenae* the vulval slit averaged 9.8 um and stylet knobs showed only a slight, blunt projection anteriorly. These characters indicate that *H. mani* is a valid species and were used to identify the cyst nematode from California as *H. mani,* its first known occurrence in the Western Hemisphere.

PROBLEMS AND PROGRESS WITH NEMATICIDAL CONTROL OF NEMATODES IN BANANAS [PROBLEMAS Y AVANCES EN EL COMBATE DE NEMATODOS EN BANANO]. S. R. Gowen, INIAP, Aptdo. 7069, Guayaquil, Ecuador. On secondment as part of British Government Technical Assistance - - -Since the fumigant DBCP is less readily available than in the past, current developmental work is concentrated on non-fumigants used as granular formulations or more recently as liquids applied in irrigation systems. Granular nematicides are sprinkled around banana plants to a distance of 30-40 cm from the pseudostem. These give protection to the primary roots close to the corm, which is essential if uprooting is to be prevented. Experimental evidence indicates that the commercial nematicides phenamiphos, ethoprop, carbofuran and aldicarb are effective at dosages of 2-4g a.i. per plant when applied at 4 monthly intervals. Economics may dictate that lesser dosages and wider frequencies of application are more worthwhile in the long term. Some differences in efficacy may occur between products when used at the lower dosages. Nematode control will not be effective if there is insufficient rainfall or irrigation to carry the nematicide into the soil. Granular nematicides perform best when they are applied regularly from the time of planting rather than in established bananas with high initial root infestations of endoparasitic nematodes. Liquid formulations of non-fumigant nematicides may provide better control in those zones which are dependent on irrigation. However, when overall treatments are applied through an irrigation system dosages may have to be increased and the effect on non-target organisms may be unacceptable.

SOLAR HEATING OF THE SOIL FOR CONTROL OF *VERTICILLIUM DAHLIAE - PRATLENCHUS THORNEI* COMPLEX DISEASE IN POTATOES [CALEFACCION SOLAR DEL SUELO PARA COMBATIR EL COMPLEJO *VERTICILLIUM DAHLIAE - PRATYLENCHUS THORNEI* EN PAPA]. A. Grinstein[1], D. Orion[2], and J. Katan[1], [1]Department of Plant Pathology & Microbiology, Faculty of Agriculture, The Hebrew University, Rehovot, Israel and [2]Division of Nematology, Agricultural Research Organization, Volcani Center, Bet-Dagan, Israel - - - Mulching infested soil for 31 days with polyethylene sheeting in Israel caused solar heating and resulted in an 80 to 100% reduction in numbers of *Pratylenchus thornei,* weeds were completely controlled and disease was reduced by 66%. A mixture of EDB and chloropicrin increased yield by 30% but only slightly affected *V. dahliae,* the 55% disease reduction being due to a 90% reduction in the population of *P. thornei.*

EFFECT OF *PARATRICHODORUS CHRISTIEI* ON THOMPSON SEEDLESS GRAPE [EFECTO DE *PARATRICHODORUS CHRISTIEI* SOBRE UVAS THOMPSON SIN SEMILLAS]. S. L. Hafez, D. J. Raski, and B.F. Lownsbery, Division of Nematology, University of California, Davis, California 95616 - - - *Paratrichodorus christiei* (Allen, 1957) appears to be the most widely distributed stubby root nematode in the United States (Allen, 1957). It has been found in soil around the roots of grapevines throughout California (Raski, 1973). Thompson

Seedless rooted grape cuttings growing in 20-cm diameter clay pots were inoculated with 100, 1,000 and 10,000 *P. christiei* per pot in four holes around the root system. There were nine replicates of each treatment. Nematode populations and plant growth were measured 20 months after inoculation. Shoot and root growth were inversely related to the initial nematode population level. One hundred *P. christiei* did not suppress growth, but did cause some necrosis, browning and stubby root symptoms. Chimera symptoms also were found, mostly at the higher nematode inoculum levels, suggesting the possibility that Chimera appearance may be related to the stress resulting from nematode infection.

APPARENT PARTHENOGENESIS IN TWO RACES OF *RADOPHOLUS SIMILIS* FROM FLORIDA [PARTENOGENESIS APARENTE DE DOS RAZAS DE *RADOPHOLUS SIMILIS* DE LA FLORIDA]. R. Norton Huettel and D. W. Dickson, University of Florida, Gainesville, Florida 32611 - - - The role of parthenogenesis in the reproduction of the citrus and banana races of *Radopholus similis* from Florida was investigated. Inoculations of single L2 and L3 larvae onto okra seedling produced all-female populations after 90 days and male/female populations after 180 days. The females in the 90 days study produced viable eggs and no spermatozoa were observed in the spermatheca. Males were found after 180 days. The proportion of males was as expected in an amphimictic population (ca. 30-40%). At least 95% of the females in the 180 day old populations were found to be inseminated. No intersexes were observed. Apparently the all-female populations were produced from unfertilized eggs through automictic (meiotic) facultative parthenogenesis. However, under unkown environmental conditions it appears the noninseminated females gave rise to both male and female progeny through deuterotokous parthenogenesis. The mechanisms of this phenotypic sex determination are not known.

RESPONSE OF SOYBEAN LINES AND CULTIVARS IN BRAZIL TO ROOT-KNOT NEMATODES, *MELOIDOGYNE INCOGNITA* AND *MELOIDOGYNE JAVANICA* [COMPORTAMIENTO DE DIFERENTES LINEAGES Y CULTIVARES DE SOYA AL ATAQUE DEL NEMATODO NODULADOR *MELOIDOGYNE INCOGNITA* Y *M. JAVANICA* EN BRASIL]. P.S. Lehman, J.E.S. Gomes and J.P. Gutterres, Bureau of Nematology, Division of Plant Industry, Gainesville, Florida 32602 and Agronomic Research Institute (IPAGRO) Goncalves Dias 570, Porto Alegre 90.000, RS, Brazil - - - In three field experiments, 107 lines and 25 cultivars of soybean were evaluated for their response to root-knot nematodes, *Meloidogyne javanica* and *Meloidogyne incognita.* Between flowering and pod fill, 30 plants of each cultivar or line were rated for severity of root galling. Of the cultivars evaluated for their response to *M. incognita,* 60% were rated as very resistant, 25% as resistant, 8% and 7% were considered susceptible and very susceptible, respectively. The response to *M. javanica* differed from that of *M. incognita.* No cultivar was classified as very resistant, 27% were classified as resistant, 8% as susceptible, and 65% as very susceptible to *M. javanica.* In general, the percentage of lines with resistance to *M. incognita* or *M. javanica* was less than the percentage observed for the 25 cultivars tested. The following cultivars were classified as very resistant to *M. incognita*: Bienville, Bragg, Coker's 4505, Hale-7, Hampton, Hardee, Hill, IAS-1, IAS-2, IAS-3, IAS-4, IAS-5, Jackson, Louisiana, and Parana. Of these however, all were found to be very susceptible to *M. javanica* except for the cultivars Bragg and IAS-1, which are resistant. In addition to these two cultivars, two of the 107 lines tested, JC 5086 and JC 5087 had resistance to both *M. javanica* and *M. incognita.* Davis, Hood, Prata, and Perola cultivars were found to be resistant to *M. incognita,* but very susceptible to *M.*

javanica. Pampeira, Planalto, Vicoja, and Bossier cultivars are susceptible to both species of root-knot nematodes. Industrial and Santa Rosa cultivars were found to be resistant to *M. javanica* but susceptible and very susceptible, respectively, to *M. incognita.* Many of the cultivars grown in Brazil are resistant to *M. incognita* whereas few are resistant to *M. javanica.* This could explain the greater incidence of *M. javanica* associated with severe root-knot nematode damage in soybean fields.

NEMATODE COMMUNITIES ASSOCIATED WITH ROOTSTOCKS OF TAHITI LIME [COMUNIDADES DE NEMATODES ASOCIADOS CON PATRONES DE LIMON TAHITI]. R. McSorley, University of Florida, Agricultural Research and Education Center, Homestead, Florida, 33031 - - - Soil samples were collected in October, 1978, from about the roots of eight rootstock of Tahiti lime *(Citrus* x 'Tahiti') planted in July, 1967, in order to examine the nematode communities which had developed. The eight rootstocks (Alemow, Cleopatra mandarin, Ichang lemon, Kalpi, Nansho daidai, Rough lemon, Sampson tangelo, and Shekwasha) were arranged in a randomized complete block design with 4 replicates. The study site was located on a Rockdale fine sandy loam soil with pH 7.5. *Rotylenchulus reniformis* was the most abundant nematode found, comprising 22% of all nematodes in the 32 samples. Although mean levels of *R. reniformis* in the soil ranged from 25/100 cm^3 on Shekwasha to 124/100 cm^3 on Sampson tangelo, the differences between rootstocks were not significant (P = .05). The 32 samples contained 28% plant parasites, 4% mycophages, 24% microbivores, 19% predators, and 24% nematodes of unknown trophic groups. The four samples from Rough lemon, the most widely grown rootstock of limes in Florida, were compared with four samples each from papaya *(Carica papaya),* snap bean *(Phaseolus vulgaris),* and tomato *(Lycopersicum esculentum),* all within a km of the lime grove. The communities associated with Rough lemon contained significantly (P = 0.5) more individuals than those from either the bean field or the field which was being prepared for tomato planting. While Rough lemon and papaya communities had similar numbers of individuals, the Rough lemon samples contained more genera than did the papaya samples, which averaged 49% *R. reniformis.*

PLANT NEMATODE PROBLEMS IN VENEZUELA: A TEN YEAR ASSESSMENT[UNA EVALUACION DE LOS PROBLEMAS CAUSADOS POR NEMATODOS FITOPARASITOS EN VENEZUELA DURANTE LA ULTIMA DECADA]. Julia A. Meredith, Universidad Central de Venezuela, Instituto de Zoología Agrícola, Sección de Nematología, Apartado 4579, Maracay, Aragua, Venezuela - --Principal nematode problems in Venezuela as shown by Yépez and Meredith in 1969 were *Meloidogyne* spp. especially in tomato, coffee, and tobacco; *Rhadinaphelenchus cocophilus* in coconut and oil palm; *Tylenchulus semipenetrans* in citrus; *Ditylenchus dipsaci* in garlic; and *Hirschmanniella spinicaudata* and *H. oryzae* in rice. Ten years later, *H. spinicaudata* and *H. oryzae* no longer constitute a problem in rice, and *D. dipsaci* is found only in the Andean region of the country. Incidence of red ring disease has also been lowered. Root-knot nematodes are still prevalent on a large scale throughout the country and attack many economically important plant species. The situation of *T. semipenetrans* has not been reevalutated. New agricultural problems in the decade are *Globodera rostochiensis,* now disseminated throughout the entire Andean potato-growing region; *Radopholus similis* in plantain south of Lake Maracaibo; and *Pratylenchus* sp. in banana in the country's central region. During the past decade increased attention was given to determining nematode problems in vegetable and fruit crops, and as important, different authors have cited *Pratylenchus* and

Meloidogyne in black bean, cowpea, and soybean; *Meloidogyne* and *Rotylenchulus* in tomato and lettuce; *Pratylenchus, Meloidogyne,* and *Paratylenchus* in pineapple; *Helicotylenchus, Meloidogyne,* and *Criconemoides* in peach; and *Xiphinema index, T. semipenetrans,* and *Meloidogyne* in grape. Other crops surveyed in that period include cacao, sesame, avocado, mango, and sugar cane.

CONTROL OF *MELOIDOGYNE ARENARIA* NEMATODES AND *SCLEROTIUM ROLFSII* IN PEANUTS WITH NEMATICIDES AND A FUNGICIDE [CONTROL DE NEMATODOS Y *SCLEROTIUM ROLFSII* EN MANI MEDIANTE EL USO DE UN FUNGICIDA Y VARIOS NEMATICIDAS]. N. A. Minton and D. K. Bell, Agricultural Research, Science and Education Administration, U.S. Department of Agriculture, and the University of Georgia, Coastal Plain Station, Tifton, Georgia 31794 - - - Nematicides and nematicide-PCNB combinations were evaluated in 1977 and 1978 for control of *Meloidogyne arenaria* and *Sclerotium rolfsii* in field tests. Preplant or at-plant applications of nematicides were followed by postplant applications of individual chemicals or combinations of chemicals in subplots. Whole plot treatments were: non-treated check, DBCP, ethoprop, and phenamiphos applied ca. 2 wk before planting in 1977 and at-planting in 1978. Subplot treatments were: non-treated check, ethoprop, phenamiphos, PCNB, ethoprop + PCNB, and phenamiphos + PCNB applied ca. 50 days after planting both years. DBCP was injected and all other chemicals were incorporated. Two-year average peanut yields ranged from 4143 kg/ha for the check plots to 5609 kg/ha for plots treated preplant or at-plant with phenamiphos + ethoprop-PCNB postplant. Only phenamiphos increased yields when applied preplant or at-plant, but all chemicals and combination of chemicals except PCNB applied postplant increased yields. Yields of plots treated preplant and at-plant with DBCP and phenamiphos were not improved by addition of any postplant treatment. However, all postplant treatments, except ethoprop, increased yields of plots treated preplant and at-plant with ethoprop. *Sclerotium rolfsii* disease loci per 30.5 meters of row ranged from 28 for check plots to 6 for plots treated preplant and at-plant with phenamiphos + ethoprop-PCNB postplant. Root-knot indices, (1 = no galling, 2 = 0-25%, 3 = 26-50%, 4 = 51-75%, 5 = 76-100% of roots, pegs, and pods galled) ranged from 3.1 for check plots to 1.6 for plots treated preplant and at-plant with phenamiphos + ethoprop postplant. Yields were negatively correlated with *S. rolfsii* disease loci [(r = -0.47 (P = 0.01)] and root-knot index [r = -0.47 (P = 0.01)].

CORRELATION OF *PRATYLENCHUS PENETRANS* WITH LOSS OF QUALITY AND YIELD OF TOMATOES [CORRELACION DE *PRATYLENCHUS PENETRANS* CON LAS PERDIDAS DE CALIDAD Y RENDIMIENTO DE TOMATES]. R. F. Myers, Rhizosphere Research Group, Agricultural Experiment Station, Rutgers University, New Brunswick, New Jersey, 08903, U.S.A. - - - A field study designed to determine optimal fertilizer requirements for fresh market tomatoes (Campbell's 1327) was conducted in soil infested with *Pratylenchus penetrans.* The design was a randomized 4 x 2 x 3 x 2 factorial in four blocks: four rates of N (0, 44.8, 89.7, and 134.5 kg N/ha), two of P (0 and 112.1 kg P2O5/ha), and three of K (0, 168.1, and 336.2 kg K2O/ha) applied before planting over two pH levels (pH 5.5 and 6.0) to Sassafras sandy loam soil. Plots were 4.88 m wide x 5.49 m long and contained four rows 1.22 m apart with 0.61 m between plants. Lesion nematodes were extracted from soil samples taken after plants had been killed by frost and started to decay. Ca, N, Mg, K, and P levels were determined in soil and leaf samples. Results were subjected to multiple regression, analyses of variance, correlation and other analyses. Final

numbers of *P. penetrans* ranged from 75 to 6140 with a mean number of 1276 nematodes/250 cc of soil. Losses of No. 1 tomatoes, or those exceeding 6.3 cm diameter and without visual defects, ranged from 1.7 T/ha to 15.5 T/ha with a mean loss of 2.9 T/ha due to nematodes. Number 2 tomato yields were generally unchanged. Nematode effect on yield increased throughout the season until a mean loss of 30% of the No. 1 tomatoes occurred by the 4th picking. In general, low fertility treatments resulted in higher nematode numbers. Nematode numbers were affected negatively by increased N fertilization and leaf P but related positively to higher pH, soil and leaf Mg. Highest yield (58.1 T/ha) of No. 1 tomatoes was obtained with 44.8, 112.1, 336.2 (NPK) at pH 6.0 and the additional loss due to nematodes was calculated as 7.8 T/ha. Processing tomatoes have about 17% of the value per acre of those sold as fresh market tomatoes and potential loss determines the amount that can be spent on controlling lesion nematodes. Yield relationship reduced to its simplest form was: yield loss = $\sqrt{b \text{ nematode numbers}}$, where b is the slope of a line. Considerably higher numbers of lesion nematodes may therefore be tolerated in fields containing processing tomatoes than in those picked for fresh market. The data indicate that yield, mineral nutrition, and nematodes have many interesting and complex interactions.

POSSIBLE *RADOPHOLUS SIMILIS* BIOTYPES REPRODUCING AND MIGRATING ON RESISTANT CITRUS ROOTSTOCKS [POSIBILIDAD DE BIOTIPOS DE *RADOPHOLUS SIMILIS* REPRODUCIENDOSE Y TRANSMUDANDOSE EN RAICES DE CITRUS RESISTENTE]. J. H. O'Bannon and H. W. Ford, U. S. Department of Agriculture, Science and Education Administration, Agricultural Research, Prosser, Washington 99350 and Agricultural Research and Education Center, IFAS, Lake Alfred, Florida 33850, U.S.A. --- *Radopholus similis* populations were found infecting Milam limon *(Citrus* sp.), a *R. similis* resistant rootstock in two groves in central Florida. One, the Conway population, was found to infect and reproduce on Milam limon, Ridge Pineapple and Algerian Navel orange *(C. aurantium)*, and Carrizo Citrange *(C. sinensis* x *P. trifoliata)* seedlings considered to be resistant to highly resistant to *R. similis,* in significantly greater numbers than the *R. similis* population that causes the disease "spreading decline" of citrus. The second, Ward's population, was found to readily infect Milam seedlings. Both populations migrated from infected to uninfected Milam seedlings in greenhouse soil tanks. In two years, the Ward population migrated further than the Conway population and appears to be more infective to Milam.

INFLUENCE OF SOIL TYPE AND TEMPERATURE ON THE MIGRATION OF *MELOIDOGYNE INCOGNITA* JUVENILES TOWARD TOMATO ROOTS [INFLUENCIA DEL TIPO DE SUELO Y DE LA TEMPERATURA SOBRE LA MIGRACION DE FORMAS JUVENILES DE *MELOIDOGYNE INCOGNITA* HACIA RAICES DE TOMATE]. J. C. Prot and S. D. Van Gundy, Department of Nematology, University of California, Riverside, California 92521, U.S.A. --- The effects of soil type and temperature on the migration of *M. incognita* juveniles towards tomato roots were tested in 20-cm PVC columns attached to styrofoam cups containing the plants and separated from the root system by a 85-um screen. Juveniles that had migrated 20 cm and penetrated the roots were counted after staining the roots in 0.05% cotton blue. Approximately 300 juveniles not more than 24 h old were introduced into the soil at the bottom of the column. At a constant temperature of 26° C the percent penetration in 10 days in soils containing: a) 8.8% clay (C) + 5.2% silt (S); b) 10.2% C + 11.9% S; c) 9.2% C + 16% S; d) 13.2% C + 19.5% S; and e) 18.5% C + 23.5% S was 32, 13, 10, 0 and 0, respectively. Migration in soil of composition a) was also

studied as a function of time at 14, 16, 18, 20 and 22° C. The percent juveniles found in the roots after 5, 10, 15 and 20 days was, respectively: 0, 1, 1, 2 at 14° C; 0, 3, 3, 2 at 16° C; 0, 7, 6, 8 at 18° C; 1, 33, 34, 33 at 20° C; and 5, 35, 43, 40 at 22° C. These data indicate that increasing the fine soil particles has a limiting influence on the migration of *M. incognita* juveniles, and that very few juveniles are able to migrate and penetrate roots when the temperature is less than 18° C. Also, it would appear that some juveniles have the ability to migrate 20 cm whereas others do not, because penetration was not significantly different between 10 and 20 days at 18, 20, or 22° C.

FEEDING PLUG FORMATION AND ULTRASTRUCTURE CHANGES IN COTTON ROOTS FOLLOWING RENIFORM NEMATODE PARASITISM [FORMACION DE UN TAPON ALIMENTICIO Y CAMBIOS DE ULTRAESTRUCTURA EN RAICES DE ALGODON PARASITADAS POR EL NEMATODO RENIFORME]. R.V. Rebois, USDA, Nematology Laboratory, Plant Protectin Institute, BARC-West, Beltsville, Maryland 20705.--- Susceptible *Gossypium hirsutum* 'Auburn 56' and moderately resistant *G. arboreum* 'Nanking' (C.B. 1402) seedlings were planted in vermiculite which was inoculated 3 days later with reniform nematodes, *Rotylenchulus reniformis*. At 3, 11, and 24 day intervals following inoculation, roots were washed free of vermiculite. Roots were cut into 1 mm pieces and processed for examination by transmission electron microscopy. Within the first three days, the infective female passed intracellularly through the cortex, usually perpendicular to the root axis, and came to rest with its lips in contact with an endodermal cell. The female inserted approximately half of the conical part of the stylet (3 um) into an endodermal or less frequently a pericycle cell (PC) to initiate feeding. This cell then became a prosyncyte, inital syncytial, or feeding cell (ISC). If the head or body of the nematode penetrated and ruptured the wall of a PC, feeding did not appear to be initiated. The portion of the stylet inserted in the ISC became surrounded with a cell-wall-like deposit or feeding plug (FP). The FP was thinner on the ventral or aperture side of the stylet and thicker on the opposite side. A feeding tube (FT) like structure was seen in the ISC and often extended into the adjacent PC. The FT appears to be formed from materials secreted through the stylet aperture which is located about 1 um fom the stylet tip. Portions of the FT near the stylet aperture were surrounded by smooth endoplasmic reticulum and electron dense spherical inclusions. The FT appeared in juxtaposition to the plasmalema, covering the FP, immediately surrounding the stylet aperture. Sections of the FT were found in the ICS and the adjacent PC at 3, 11, and 24 day following inoculation. On days 3 to 11 the syncytia consisted mainly of PC's. Eleven to 24 days after inoculation, the infection was observed deep in the stelar area between xylem elements in both hosts.

PATHOGENICITY AND CONTROL OF TWO SPECIES OF *MELOIDOGYNE* ON LATE SEASON SUNFLOWER [PATOGENICIDAD Y CONTROL DE DOS ESPECIES DE *MELOIDOGYNE* EN GIRASOLES]. J. R. Rich, Department of Nematology, University of Florida, Agricultural Research Center, P.O. Box 657, Live Oak, Florida, 32060 - - - Two field studies were initiated on August 11, 1978, to determine the influence of *Meloidogyne incognita* and *M. javanica* on sunflower (*Helianthus annuus* L.). In test A, the soil was previously cropped to corn and was a sand moderately infested with 204 *M. incognita,* 47 *Pratylenchus* sp., and 20 *Trichodorus christiei* per 250 cm^3 soil. Five nematicide treatments, each replicated 6 times, included: a control, aldicarb (Temik 15G), and carbofuran (Furadan 10G) and two phenamiphos (Nemacur 15G) treatments. Three nematicide treatments were applied at 2.98 kg a.i./ha in a 20 cm band over the seed row at-planting, and an additional

phenamiphos treatment was placed in the seed furrow. Soil in the test B was a sandy loam heavily infested with *M. javanica* (916/250 cm^3 soil). A single phenamiphos treatment (2.98 kg a.i./ha) was overlaid in paired plots on a previous tobacco nematicide test containing a control, a 1,3-dichloropropene - 1,2-dichloropropane (DD) treatment at 100.9 kg a.i./ha, and two ethoprop (Mocap 10G) treatments at 26.9 and 9 kg a.i./ha. The phenamiphos was applied at planting over the seed row in a 20 cm band. In test A, application of carbofuran significantly (P=0.05) increased plant vigor 25 days after planting while sunflowers treated with phenamiphos in-furrow exhibited the poorest stand and significantly poorer plant vigor than any of the other treatments. Only the aldicarb treatment produced a significantly higher seed yield than the control plots, and the in-furrow phenamiphos treatment produced the lowest sunflower yield. After 66 days, root-knot larval numbers were significantly lower in the aldicarb and phenamiphos treatments than in the control plots. Root-knot numbers found in sunflowers treated with carbofuran were not different from any of the treatments. In the *M. javanica* test (B), only a slight residual effect of nematicides previously used on tobacco was found with the DD treatment yielding significantly better (P=0.10) than the untreated controls. The phenamiphos application significantly (P=0.05) increased sunflower seed yield, and plant vigor (25 days) and significantly reduced the number of *M. javanica* recovered 64 days after planting. Plant emergence, however, was significanly reduced by the phenamiphos treatment.

INVASION AND DEVELOPMENT OF *GLOBODERA* IN FOUR NON-HOST *SOLANUM* SPECIES [INVASION Y DESARROLLO DE *GLOBODERA* EN CUATRO ESPECIES DE *SOLANUM* NO HOSPEDANTES]. P. A. Roberts and A. R. Stone, Department of Nematology, University of California, Riverside, California 92521, and Nematology Department, Rothamsted Experiment Station, Harpenden, Herts., England - - - One population each of *Globodera rostochiensis* European pathotype Rol and *G. tabacum* were compared on four *Solanum* subgenus *Leptostemonum* species. Previous host range tests showed that nematode multiplication did not occur (cyst Pf:Pi ratio <1) in any of the eight test combinations. Observations were made to determine the extent of nematode development in non-host roots. Plants were grown in 9-cm-diam plastic pots containing sand:loam (4:1) in the greenhouse at approximately 20° C, and were inoculated each with 4000 newly hatched second-stage juveniles. Two pots of each combination were harvested at 1, 2, 3, 4, 6, 8, 10 and 12 weeks after inoculation, the root systems were washed, surface dried and weighed, fixed in formal-acetic-alcohol, stained with cotton blue in lactophenol, macerated, and the numbers of all nematode stages were counted. Adult males were extracted from the pot soil using a Baermann tray technique. Root systems in all the test combinations were invaded. *G. tabacum* invaded the roots of all test plants in greater numbers than *G. rostochiensis.* Nematodes developed at similar rates in all tests, but the numbers that developed beyond the second-stage were variable. The greatest numbers (per gram of fresh root) of *G. rostochiensis* third-stage juveniles recorded at one sampling date on *Solanum torvum, S. viarum, S. sisymbriifolium,* and *S. quitoense* were 2, 1, 12 and 8, respectively, and of fourth-stage juveniles were 0, 0, 0 and 2 (all males), respectively. No adults were found. The corresponding numbers of *G. tabacum* third-stage juveniles were 18, 4, 508 and 365, respectively, and of fourth-stage juveniles were 0, 0, 78 (75 males, 3 females) and 353 (all males), respectively. The numbers of adults were 0, 0, 21 (all males) and 6 (5 males, 1 female), respectively. The results indicate that after penetration of the roots by the second-stage juveniles, either significant development does not occur, or development of males only occurs. The interaction is determined by the nematode and plant combination, and can vary for

the same *Globodera* species on different solanums and for different *Globodera* species on the same solanum.

CONTROL OF ROOT-KNOT NEMATODES ON PEANUT WITH PLANTING TIME AND POSTEMERGENCE APPLICATIONS OF ETHYLENE DIBROMIDE AND AN ETHYLENE DIBROMIDE-CHLOROPICRIN MIXTURE [COMBATE DEL NEMATODO NODULADOR EN EL MANI CON APLICACIONES EN LA SIEMBRA Y LA POSTSIEMBRA DE BIBROMURO DE ETILENO Y DE UNA MEZCLA DE BIBROMURO DE ETILENO CON CLOROPICRINA]. R. Rodríguez-Kábana, P. S. King, H. W. Penick, and H. Ivey, Department of Botany and Microbiology, Agriculture Experiment Station, Auburn University, Auburn, Alabama 36830, U.S.A. - - - Field studies were conducted during 1977 and 1978 to determine the feasibility of using ethylene dibromide (Soilbrom 90 EC®) or an ethylene dibromide-chloropicrin mixture (Terr-O-Cide® 72-27) as substitutes for DBCP (1,2-dibromo-3-chloropropane) for control of root-knot nematodes on the Florunner cultivar of peanut *(Arachis hypogaea* L.). Results from a field heavily infested with root-knot nematodes indicated that planting time applications of Soilbrom 90 EC at 9.35 L/ha were as effective as applications of DBCP at the same rate but that higher rates of Terr-O-Cide 72-27 were needed to obtain the same degree of nematode control. Maximal yield responses and best control of root-knot nematode were obtained with rates of 18.70 L/ha with either of the two ethylene dibromide formulations; rates higher than 18.70 L/ha did not produce additional benefits. When Soilbrom 90 EC was applied postemergence at rates of 9.35-37.41 L/ha at the mid-bloom stage of growth, no phytotoxicity was detected. Planting time applications of either Soilbrom 90 EC or Terr-O-Cide 72-27 resulted in better control of root-knot nematodes and higher yields than postemergence applications; planting time applications alone were as effective as treatments that combined planting time followed by mid-bloom application.

CONTROL OF NEMATODES ON SOYBEAN WITH PLANTING-TIME APPLICATIONS OF ETHYLENE DIBROMIDE [COMBATE DE NEMATODOS EN LA SOYA CON APLICACIONES EN LA SIEMBRA DE BIBROMURO DE ETILENO]. R. Rodríguez-Kábana, H. W. Penick, and P. S. King, Department of Botany and Microbiology; F. A. Gray, Auburn University Cooperative Extension Service; E. L. Carden, N. R. McDaniel, and F. B. Selman, Gulf Coast Substation at Fairhope; and H. W. Ivey, Wiregrass Substation at Headland; Auburn University, Agricultural Experiment Station, Auburn, Alabama 36830, U.S.A. - - - Planting-time applications of ethylene dibromide (Soilbrom® 90 EC) and a mixture of ethylene dibromide (EDB) containing 27% (w/w) chloropicrin (Terr-O-Cide® 72-27) were compared with DBCP (1,2-dibromo-3-chloropropane) for effectiveness against *Meloidogyne arenaria* (Neal) Chitwood, *M. hapla* Chitwood, and race 3 of *Heterodera glycines* Ichinohe on soybeans *(Glycine max* (L.) Merr.). Field tests conducted at three different locations in Alabama demonstrated that the two formulations of EDB were as effective as DBCP in controlling the parasites and in incrementing yields of Bragg or Ransom soybeans. No phytotoxicity was detected from planting applications of EDB-containing fumigants at rates of 37.41 L/ha or below.

EFECTO DE LA DOSIS Y FRECUENCIA DE APLICACION DE NEMATICIDAS EN LA PRODUCCION DE PLATANOS [EFFECT OF RATE AND FREQUENCY OF APPLICATION OF NEMATICIDES IN PLANTAIN PRODUCTION]. J. Román, D. Oramas y J. Green, Agricultural Experiment Station,

University of Puerto Rico, Río Piedras, Puerto Rico --- Para determinar si la dosis y la frecuencia de aplicación de nematicidas recomendados por la Estación Experimental Agrícola del Recinto de Mayagüez de la Universidad de Puerto Rico se podrían variar para beneficio económico del agricultor, se estableció un experimento en la Subestación de Corozal. En este experimento se utilizaron los nematicidas-insecticidas fensulfothion 15G (2.1 y 4.2g i.a. por planta) y carbofuran 10G (1.4 y 2.8 i.a. por planta) aplicados al sembrar y cada cuatro meses. Estas dosis e intervalos de aplicación se compararon con las que han demostrado eficacia significativa en los experimentos de campo (5.6 y 8.4g i.a. por planta aplicados al sembrar y luego cada seis meses). Además, se evaluó el chlordecone 5D (0.7 y 1.4g i.a. por planta), el cual es solamente insecticida, aplicado al mismo intervalo de aplicatión que los otros productos. Los resultados demostraron que todos los tratamientos químicos aumentaron significativamente el número y peso de frutas por planta. Se encontró, además, que el número de plantas tumbadas por el viento fue más alto en las parcelas testigo y en las tratadas con chlordecone que en las tratadas con fensulfothion y carbofuran. Debido a que los tratamientos de diferentes dosis e intervalos de aplicación de fensulfothion y carbofuran no fueron significativamente diferentes entre sí, se decidió efectuar un análisis económico para determinar si las dosis de 2.1 y 1.4g i.a. por planta aplicada cada cuatro meses es económicamente ventajosa para el agricultor, ya que, aunque el número de aplicaciones por planta es mayor, la cantidad total de nematicida aplicada es menor. El análisis demostró que, tras tomar en consideración el precio del nematicida en Puerto Rico y el costo de aplicarlo, el agricultor puede ahorrarse $216 durante el cultivo de la plantilla si utiliza un nematicida del costo del fensulfothion y $100.40 si utiliza uno con el costo del carbofurán. Queda por determinar si estas cifras cambian durante los retoños.

INTERACTION OF *GLOMUS ENTUNICATUS,* A VESICULAR-ARBUSCULAR MYCORRHIZAL FUNGUS, AND *MELOIDOGYNE INCOGNITA* ON COTTON [INTERACCION DE *GLOMUS ENTUNICATUS,* HONGO FORMADOR DE MICORRIZAS VESICULO-ARBUSCULARES, Y *MELOIDOGYNE INCOGNITA* EN ALGODON]. R. W. Roncadori and R. S. Hussey, Department of Plant Pathology and Plant Genetics, University of Georgia, Athens, Georgia 30602 ---Separate and co-inoculations were made with *Glomus entunicatus* (GE) and *Meloidogyne incognita* (MI) to determine the effects on development of greenhouse-grown cotton *(Gossypium hirsutum)* and reproduction by the microorganisms. The additional interactions of plant cultivars, McNair 511 (MI-resistant) and Stoneville 213 (MI-susceptible), as well as fertility (low = 1.77 g 10-10-10 NPK/pot and high = 3.54 g 10-10-10 NPK/pot) were evaluated in a fumigated Marlboro loamy-sand soil. Ten weeks after inoculation, square set and root and shoot weights of mycorrhizal plants were increased over nonmycorrhizal plants by 65 to 200%, 45 to 366%, and 59 to 330%, respectively. Maximum stimulation of growth and square production occurred with Stoneville 213 at low fertility. MI retarded square production and root and shoot growth by 46 to 94% with the most marked suppression in McNair 511 at low fertility. Vegetative growth and reproduction of plants co-inoculated were 21 to 37% less than that of mycorrhizal only plants. Reproduction of both microorganisms was influenced in concomitant culture. GE chlamydospore production was suppressed on McNair 511 but increased on Stoneville 213 when plants were co-inoculated with MI. Total MI egg production per plant was not significantly increased by GE even though the root systems of mycorrhizal plants were considerably larger than those of the MI only inoculated plants. This resulted in the egg number per g of root being significantly lower on mycorrhizal plants at low fertility (McNair 511, 91% and Stoneville 213, 74%) suggesting physiological or physical antagonism toward MI.

STANDAK PERFORMANCE ON TOBACCO, TOMATOES AND PEANUTS [USO DE STANDAK EN TABACO, TOMATE Y MANI]. Paul Schroeder, Union Carbide Corporation, P. O. Box 17610, Jacksonville, Florida 32216 - - - Standak aldoxycarb pesticide was applied in tobacco transplant water in 1974 to 1978 in plots in North Carolina, South Carolina, and Georgia at the rate of 2.2 kg ai/ha. The Standak plots yielded an average of 317 kg/ha more than untreated plots and 82 kg/ha more than standard ethoprop (Mocap) plots. Standak was banded and incorporated in California tomato plots at the rate of 1.7 kg ai/ha and 3.4 kg ai/ha. Plots treated at 1.7 kg ai Standak/ha yielded 8.3 tons tomatoes/ha more than untreated checks. Plots treated at 3.4 kg ai/ha yielded 12.2 tons/ha more than untreated checks. Peanut plots treated at the rate of 1.7 kg ai Standak/ha banded and incorporated were included in eight tests. The average yield was 30% higher than yields from untreated checks. In 14 tests the average peanut yields from plots treated with Standak at 3.4 kg ai/ha were 24% more than peanut yields from untreated check plots. Nematodes were the primary pests in tests with all three crops. Insect control affected yields in some tests.

THE ORIGIN AND PHYLOGENY OF THE NEMATODE ORDER TYLENCHIDA [ORIGEN Y FILOGENIA DE LOS NEMATODOS DEL ORDEN TYLENCHIDA]. M. R. Siddiqi, Commonwealth Institute of Helminthology, St. Albans, Hertfordshire, England - - - The nematode order Tylenchida Thorne, 1949, is not a monophyletic group. The two suborders of the Tylenchida appear to have originated and evolved separately. This is evident from the ecological-morphological analysis of the members of the Tylenchina and Aphelenchina and a study of their relationships with the contemporary free-living and animal-parasitic Secernentea. A comparison of the oesophagi of *Tylopharynx* and *Paraphelenchus* shows that they are homologous structures appearing to have a common ancestry. Such an oesophagus is not seen in the Tylenchina. Similarly the male papillate tail and ribbed bursa of the Aphelenchina have no parallel in the Tylenchina. Other key character states distinguishing the two suborders and pointing to separate origin and development are analyzed. It is concluded that the Aphelenchina are closely related to the Diplogastroidea and that their origin is clearly in the ancient Diplogastrina which were predatory in habit. The closest contemporary relatives of the Tylenchina are the Oxyuroidea, especially those parasitizing insects and other invertebrates. The origin of the Tylenchina is still obscure.

HISTOPATHOLOGY OF *MELOIDOGYNE INCOGNITA* ON PEPPER AND TOMATO [HISTOPATOLOGIA DE *MELOIDIGYNE INCOGNITA* EN PIMIENTO Y TOMATE]. Jorge Toro and Alejandro Ayala, Research Assistant and Nematologist, respectively. Department of Crop Protection, College of Agricultural Sciences, Mayagüez Campus, Mayagüez, Puerto Rico, 00708 - - - Pepper *(Capsicum anuum)* cv. California Wonder and tomato *(Lycopersicon esculentum)* cv. Rutgers seedlings were inoculated with 10,000 eggs of each of 14 different root-knot *(Meloidogyne incognita)* populations from different ecological zones of Puerto Rico. After 45 days plants were harvested and a portion of their roots stained with acid fuschin and lactophenol for the determination of root-knot nematode gall index; another portion of the roots was fixed in FAA and following the usual procedures, histological sections of 9 um were prepared and stained to determine the effect of each population on the plant roots. In pepper roots, gall index varied from 3.6 to 5.0 but nodules were always small. In tomato all roots had a 5.0 index, and nodules were large. Giant cell formation was profuse in both crops but cell wall thickness varied from 1.95 um in pepper to 9.7 um in tomato. In some instances hyperplasia was pronounced, with a great number of

disorganized tiny cells grouped around the giant cells. Giant cells formed in the pericycle and cortical tissue were usually spherical, whereas those formed in vascular tissue were elongated. Mechanical damage was caused by developing females and egg masses, which was expressed as a semicircle of compressed small cells around the posterior part of the mature females. When pepper was inoculated with eggs from a root-knot nematode population previously attacking *Urena lobata,* giant cells were completely full of nuclei (usually over 40 per cell).

RESEARCH PAPERS — TRABAJOS DE INVESTIGACION

THE NON-TARGET EFFECTS OF PENTACHLORONITROBENZENE ON PLANT PARASITIC AND FREE-LIVING NEMATODES [EFECTOS ALEATORIOS DE PENTACLORONITROBENCENO SOBRE NEMATODOS FITOPARASITOS Y DE VIDA LIBRE]

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ABSTRACT

The effects of pentachloronitrobenzene (PCNB) on plant parasitic and free-living nematodes were studied *in vitro* and under greenhouse and field conditions. PCNB exerts a direct toxic effect on larvae of *M. incognita* (Kofoid and White) Chitwood, *Helicotylenchus dihystera* (Cobb) Sher, *Hoplolaimus galeatus* (Cobb) Sher, *Rotylenchulus reniformis* Linford and Oliveira, mononchoid and dorylaimoid nematodes and the microbivorous nematode *Pelodera chitwoodi* (Bassen) Dougherty. Toxic effects were most pronounced on mononchoid and dorylaimoid nematodes and on *P. chitwoodi.* Greenhouse studies indicated that PCNB can cause an increase or decrease in nematode numbers depending on the nematode species involved and the concentration of PCNB used. The nematode species most likely to increase in numbers when PCNB is applied are *Pratylenchus scribeneri* Steiner, *P. brachyurus* (Godfrey) Filip. and Schuur, Stek., *H. dihystera,* and *H. galeatus.* The effect on *M. incognita,* dorylaimoid, mononchoid and saprophagous nematodes was usually a decrease in numbers. In some instances nematode numbers increased at field application levels and decreased at higher levels of PCNB. Results from field studies generally coincided with those from greenhouse experiments.
Key Words: Soil fungicides, nematode control, cotton, Gossypium hirsutum, chloronitrobenzenes, quintozene, Terraclor®.

INTRODUCTION

Pentachloronitrobenzene (PCNB) is a selective soil fungicide principally manufactured by the Olin Corporation and marketed under the trade name Terraclor®. It is