GRASSES AS HOSTS OF MELOIDOGYNE NAASI FRANKLIN: II. STUDY OF NEMATODE POPULATIONS AND THEIR EFFECTS ON YIELD OF THREE VARIETIES

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The yields of Italian and hybrid ryegrass cvs Promenade and Inca respectively and of tall fescue cv. Pastelle were decreased by M. naasi for the three first months of their growth. The second stage juvenile populations within the roots during establishment were responsible in 1984 for losses of seedlings of Inca and Promenade. Negative correlations were statistically significant between these root populations and the height of both varieties, but dry and fresh plant weight was diminished only in cv. Promenade. The initial population in the soil (Pi) was significantly negatively correlated with dry weights of the plants of all three cultivars after three months growth. At the time of the second yield assessment cvs Inca and Pastelle were tolerant to M. naasi, by contrast with cv. Promenade.

The study of the relationships relating to Pi and the root populations of the nematode revealed that J2 invaded the roots of grasses independently of the Pi, but three months after sowing, the number invading was proportional to the Pi. The increase of J2 populations in the roots may have been the consequence of invasion throughout the experiment only at the highest levels of infestation. The development of J2 into females in cvs Inca and Pastelle was negatively related with infestation level, but was independent of Pi in cv. Promenade.

Keywords: Lolium spp., Festuca arundinacea, root knot nematode, yield components, tolerance.

In France, M. naasi is one of the earliest recognized parasitic nematodes on grasses: the damage caused by it to ryegrasses was estimated by Caubel et al. in 1971. However, only a few studies have been made of host parasite relations of M. naasi and grasses. Cook et al. (1977, 1979 & 1980) have shown the effect of this nematode on the establishment of varieties of Italian or perennial ryegrass. But in their experiments, they compared the yield obtained on naturally infested plots only at three levels of infestation: 1, 30 and 100 juveniles per g of soil and controls treated with the nematicide aldicarb.

In the present investigation, biological and economic aspects of the disease were considered. Firstly, the yield components of two ryegrasses and a tall fescue in relation to high nematode populations were studied. Secondly, the interactions between the initial population of the soil (Pi) and the root populations of M. naasi were investigated.

MATERIAL AND METHODS

Infested soils were collected late in March from Le Rheu (Ille et Vilaine) just before the tests. In 1983, they were from 10 areas within a pasture sown in
1978 with Italian ryegrass cv. Sabalan. Each sampling area corresponded to a different amount of damage to the crop. The levels of infestation averaged from 0.4 to 222 juveniles (J2) per g of soil. For the trials in 1984, soil was taken from 21 microplots (1.5 x 6 m) grown for two years with different cultivars of perennial or Italian ryegrass. The initial nematode population was low and averaged from 3 to 41 J2/g soil.

Three varieties belonging to different grass species were studied; their host status, described by Person-Dedryver & Fischer (1986), differed. Pastelle (tall fescue: Festuca arundinacea Schreb.) was a poor host of the nematode; the hybrid ryegrass (Lolium x hybridum Hauss) cv. Inca and the Italian rye-grass (Lolium multiflorum Lam.) cv. Promenade were good hosts for the development of M. naasi. Of the three, Promenade was the best host.

The infested soil from each sampling area was kept outside in pots (14 cm diam.) containing 1 l soil. Before the experiment, nematodes in 100 g of soil from each pot were counted to determine the initial infestation (Pi).

The juveniles (J2) were extracted from the soil by centrifugation and flotation with a sugar solution density of 1.18 (Coolen & D’Herde, 1972). Pots were grouped by similar levels of infestation and identical origins from each sampling area. Generally, two pots, exceptionally 3 were obtained from the same sampling area and with similar nematode numbers.

Seeds of grasses were sown in each pot with seedling densities similar to those found in field conditions = 16, 19, 23 seeds per pot corresponding to a seed rate of 35, 20 and 25 kg/ha for Promenade, Inca and Pastelle, respectively.

The pots were laid out in blocks of each variety. All pots were covered with a thin layer of a sand/soil mixture and watered every day outside rainy periods. The plants were provided with a solution of major nutrient elements (N, P2, O5, K2O) once a month.

The times of sowing and assessment are summarised in Fig. 1.

During the experiments, observations were made on growth parameters (number of plants per pot after emergence, tillers per plant, fresh and dry shoot weight, and height of plants).

During the experiment or at its termination, the roots of all the plants in a pot were washed and cut into 2 cm pieces and the nematodes released from the roots in a Waring blender, then extracted by the centrifugation flotation method used for the soil. Nematode numbers were expressed per g of fresh root and, exceptionally, per plant.

Linear correlation and regression analyses were computed between nematode populations and different yield components and between initial and root populations of the nematode. For the nematode data a naperian logarithm transformation (In (x)) was used.

The computations were made with all data of each analysis but only the results of the correlation coefficients are tabulated.