Peanut and Nematode Response to Rotation Sequence, Cultivar, and Chemicals applied at Planting

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Introduction

- Plant parasitic nematodes can have negative impacts on the yield of peanuts in North Carolina by affecting root growth and peg development (1).
- Crop rotation, crop cultivar selection, and chemical treatments can be viable components of effective Integrated Pest Management programs for plant parasitic nematodes control (2).
- Short and long-term rotations to peanuts can impact yield, disease prevalence, and nematode populations (1).
- Common rotations sequences involve cotton, soybean, and corn.
- Chemical treatments, such as nematicides or fumigants, can be used to reduce their populations in the soil (3).
- Cultivar selection as a tool for nematode control is limited in peanuts.

Objective

To quantify the impact that crop rotation, cultivar selection, and chemical treatment on nematode populations and peanut production in eastern North Carolina.

Bailey II Imidacloprid	TIFNV High O/L Imidacloprid	Bailey II Imidacloprid Fluopyram	TIFNV High O/L Imidacloprid Fluopyram	Bailey II Imidacloprid Metam Sodium	TIFNV High O/L Imidacloprid Metam Sodium

Figure 1. Treatment layout in the field for the 2021 season.

Reference

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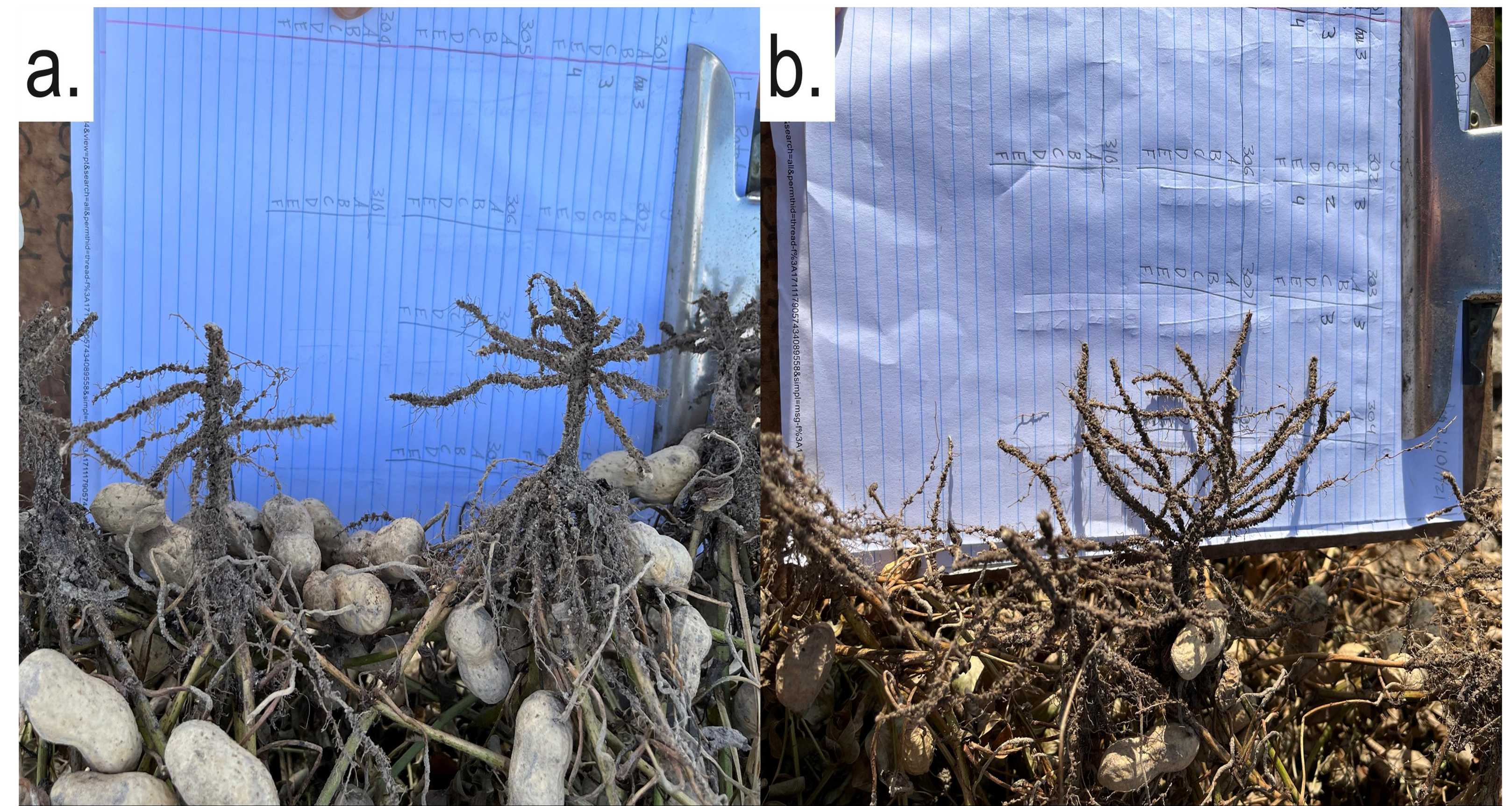

Figure 2a-2b. Peanut roots at the time of rating

Material and Methods

- For the past 25 years, ten different rotation sequences have been in place in the same field at the Peanut Belt Research Station in Lewiston-Woodville, North Carolina. These rotations include corn, cotton, peanut, and soybean with varying times between peanut plantings. While variation in rotations occurred over the 25 years, the rotation from 2013 through 2021 is presented in Table 2. In this poster we discuss results from 2021 only.
- During the 2021 season, all the rotation sequences in the field were planted to two cultivars of peanut, a Virginia market type variety (Bailey II) and a runner market type variety (TiNV High O/L) received three chemical treatments. Chemical treatments included: 1) imidacloprid in the seed furrow at planting (12 oz product/acre), 2) imidacloprid plus fluopyram in the furrow at planting (18 oz product/acre), and 3) metam sodium injected in the soil (12 gallons product/acre) two weeks prior to planting followed by imidacloprid in the seed furrow at planting. This gives six different treatments within the ten rotation sequences for a total of 60 treatments, replicated 4 times (Figure 1).
- In the third week of September twelve soil cores from each plot were collected at a 2 to 6 inch depth and homogenized for a single sample for analysis by the NCDA&CS Agronomic Services Division to determine nematode composition and population in the soil.
- Peanut pods were dug and vines inverted based on pod mesocarp color. Final mass was converted to 8% moisture.
- Prior to peanut harvest, a qualitative root rating was taken on a scale from 1-10, with 1 corresponding to most root growth and branching and 10 corresponding to the least amount of root growth and branching (Figure 2).
- The experimental design was a split plot with rotation serving as whole plot unit and combinations of cultivar and chemical treatment serving as split plot units.

Table 1. Pod yield, root knot nematode (RKN) density in soil, and plant root condition following various rotation sequences at Lewiston-Woodville

Year	1	2	3	4	5	6	7	8	9	10
2013	Peanut	Peanut	Peanut	Peanut	Peanut	Peanut	Peanut	Peanut	Peanut	Peanut
2014	Corn	Cotton	Cotton	Cotton	Soybean	Soybean	Corn	Corn	Cotton	Peanut
2015	Peanut	Peanut	Corn	Cotton	Corn	Cotton	Corn	Corn	Cotton	Peanut
2016	Corn	Cotton	Peanut	Peanut	Peanut	Peanut	Corn	Peanut	Cotton	Peanut
2017	Peanut	Peanut	Cotton	Cotton	Soybean	Soybean	Corn	Corn	Cotton	Peanut
2018	Corn	Cotton	Corn	Cotton	Corn	Cotton	Corn	Corn	Cotton	Peanut
2019	Peanut	Peanut	Peanut	Peanut	Peanut	Peanut	Peanut	Peanut	Peanut	Peanut
2020	Cotton	Cotton	Cotton	Cotton	Cotton	Cotton	Cotton	Cotton	Cotton	Cotton
2021	Peanut	Peanut	Peanut	Peanut	Peanut	Peanut	Peanut	Peanut	Peanut	Peanut
Peanut yield (lbs/A)	**3833_{d}**	**4468_{ab}**	**4328_{abcd}**	**4389_{abc}**	**4152_{bcd}**	**38888_{cd}**	**4389_{abc}**	**3943_{bcd}**	**4807_{a}**	**3212_{e}**
RKN (No./500 cm³)	**292_{ab}**	**873_{a}**	**70_{b}**	**10_{b}**	**210_{b}**	**585_{ab}**	**39_{b}**	**56_{b}**	**16_{b}**	**212_{b}**
Plant condition (0-5)	**3.98_{ab}**	**4.11_{a}**	**4.03_{ab}**	**4.09_{ab}**	**4.09_{ab}**	**4.03_{ab}**	**4.11_{a}**	**3.89_{ab}**	**4.22_{a}**	**3.83_{b}**

Means in a row followed by the same letter are not significantly different at $p < 0.05$.
Data are pooled over levels of chemical and variety treatments.
Plant condition assessed on foliar rating on a scale from 0-5, with 5 having the best quality.

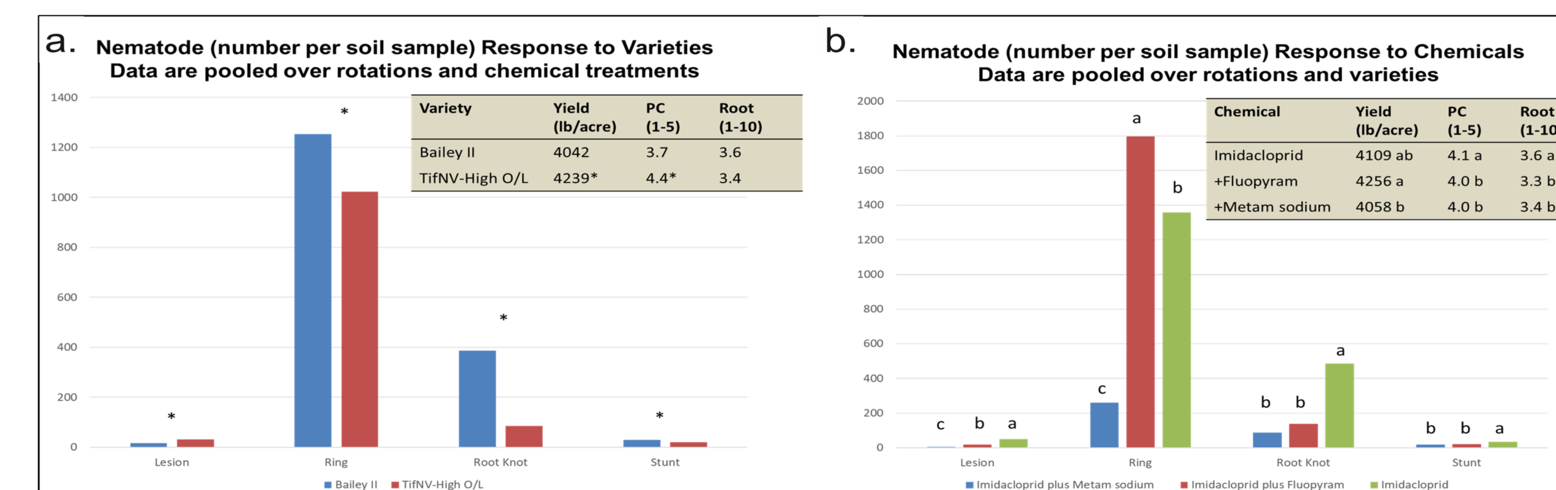

Figure 3. 3a) Graph showing nematode population response for each variety, pooled over rotation and chemical treatment. 3b) Graph showing nematode response to each chemical treatment applied, pooled over rotation and varieties.

Results and Discussion

- Main effects of rotation, cultivar, and chemical treatment were significant for peanut yield and populations of lesion, root knot, and stunt nematodes.
- The interaction of rotation by cultivar by chemical treatment was not significant for peanut yield or nematode population while the interaction of cultivar and chemical treatment was significant for lesion and stunt nematodes.
- Fewer nematodes were observed when the sequence between peanut plantings was increased or when soybean was not included in the rotation (Table 1).
- Pooled over rotation sequence, lesion, root knot, and stunt nematode populations were lower for TifNV High O/L than Bailey II (Figure 3a).
- Pod yield was greater for TifNV High O/L than Bailey II.
- Metam sodium was generally more effective in reducing populations of nematodes than fluopyram (Figure 3b).
- Fluopyram reduced nematodes in some cases.
- These results demonstrate the relative effectiveness of cultural practices including rotation and cultivar for suppressing nematodes relative to chemical controls applied at planting.