

Improving Fertigation Applications in a Flood-Irrigated Pecan Orchard

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Abstract

New Mexico is the largest producer of pecan in the USA with 43.8 million kilograms of in-shell nuts produced in 2019. The objective of this study is to investigate the soil nitrogen (N) distribution and root N uptake in a flood-irrigated pecan orchard located at the New Mexico State University Plant Science Research Center (PSRC). To measure soil N, loose soil samples were collected 5 times in three different distances (under canopy, dripline, and outside of dripline) from a tree trunk in six different depths. To determine the amount N in the pecan tree, plant samples including branch, leaf, stem, and nuts were collected 5 times. Results showed that considerable amounts of N were leached below rooting zone (approximately 60 cm) for all different distances in all months. As more root N uptake happens within rooting zone, N below the rooting zone can leach and contaminate the groundwater resources. No specific patterns were observed among soil N concentrations in different distances from the tree trunk for each month. Also, findings showed the NO₃ uptake increased sharply in the early growing season and declined gradually to the end of the growing season. The maximum NO₃ uptake occurred in May which was around 144 PPM. The results showed there was no increase in root NO₃ uptake after the peak root NO₃ uptake while two more fertigation applications were applied. Thus, findings showed that N fertilizer applications should be managed properly and should be applied any time before May.

Keywords: Nitrogen application; Nitrogen leaching; Root nitrogen uptake; Soil nitrogen

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Introduction

Methods & Objectives

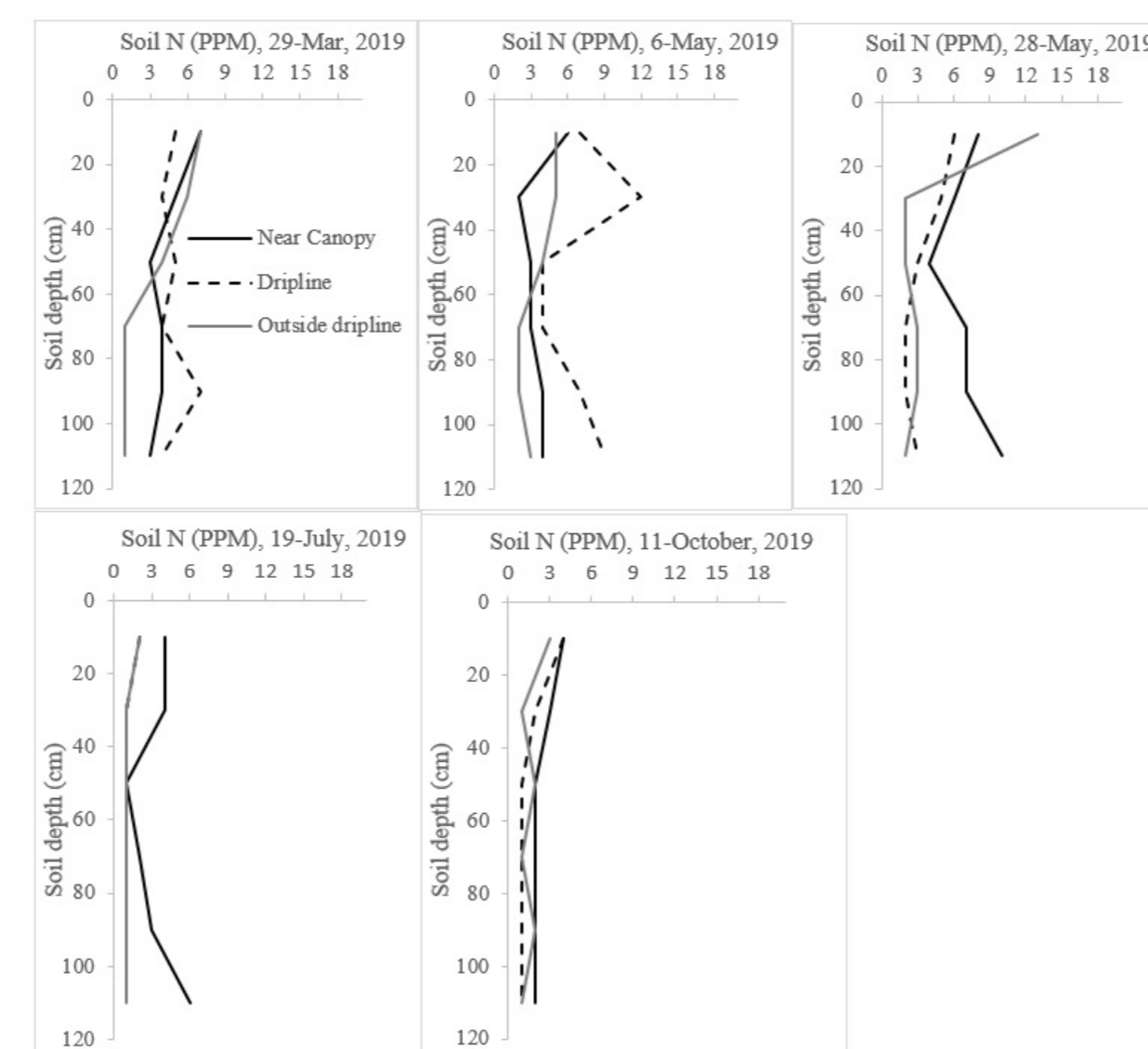
- New Mexico is currently the leading pecan producer in the United States with 43.8 million kilograms of in-shell nuts produced (USDA-NASS, 2020)
- Surface water availability for irrigation is getting scarce because of low precipitation, high evaporation rates.
- Pecan needs nitrogen (N) fertilizer, an essential element for plant growth, during the nut enlargement and nut filling stages.
- N application rates are usually much higher than their recommended rates, about 200 kg/ha (Byford, 2005).
- Excess N fertilization in irrigated pecan orchards can increase N leaching and contaminate groundwater.

- This study was carried out in Leyendecker Plant Science Research Center (PSRC).
- To measure soil N, loose soil samples were collected 5 times in three different distances (under canopy, dripline, and outside of dripline) from a tree trunk in six different depths including 0-20, 20-40, 40-60, 60-80, 80-100, 100-120 cm.
- To determine the amount N in the pecan tree, plant samples including branch, leaf, stem, and nuts were collected 5 times.
- Leaching of N below the rootzone were determined based on measured data.
- The objective of this study is to investigate the soil N distribution and root N uptake in a flood-irrigated pecan orchard located at PSRC.

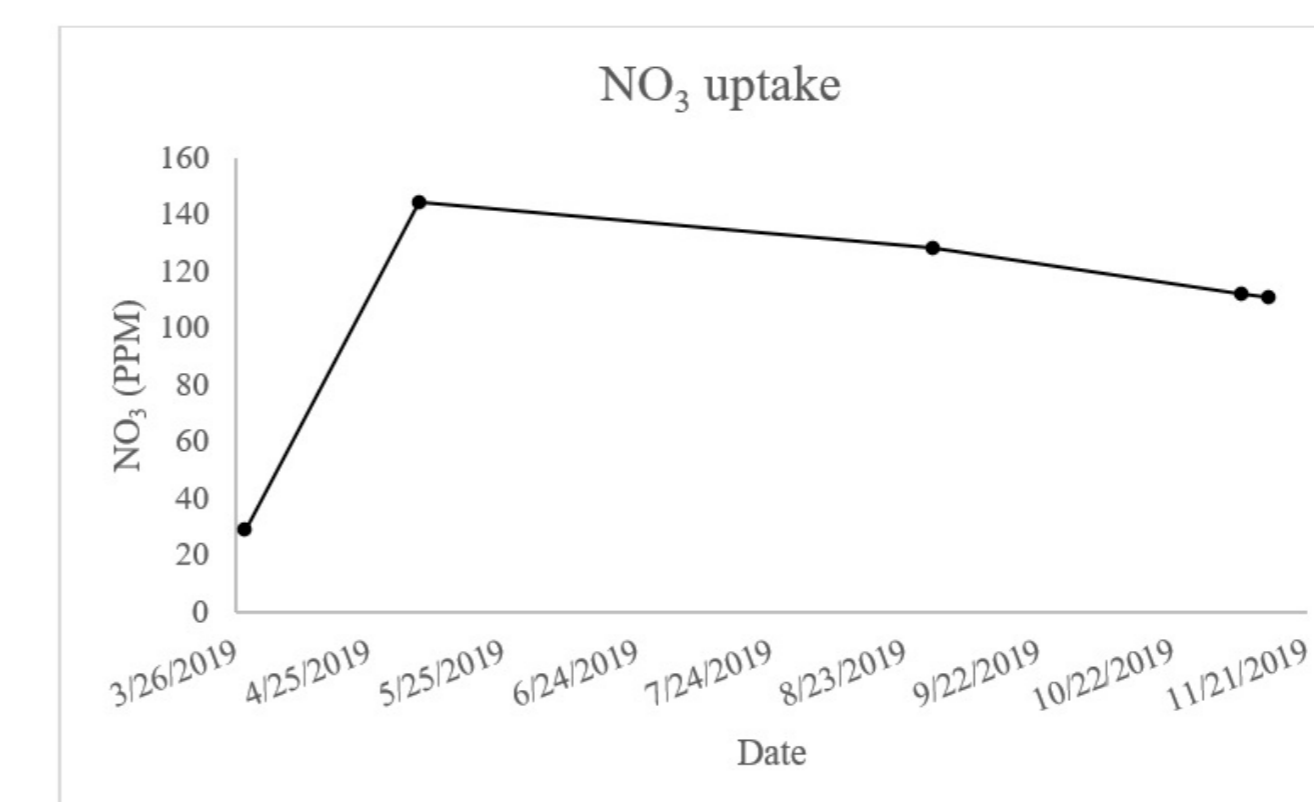


Results

Click graphs to enlarge



Measured N concentration profiles for the day of soil sample collection Near canopy, dripline, and outside dripline in six different depths during 2019.



Amount of NO₃ (PPM) removed by root uptake during the time periods Mar.28 to Nov.12 in 2019.

Conclusions

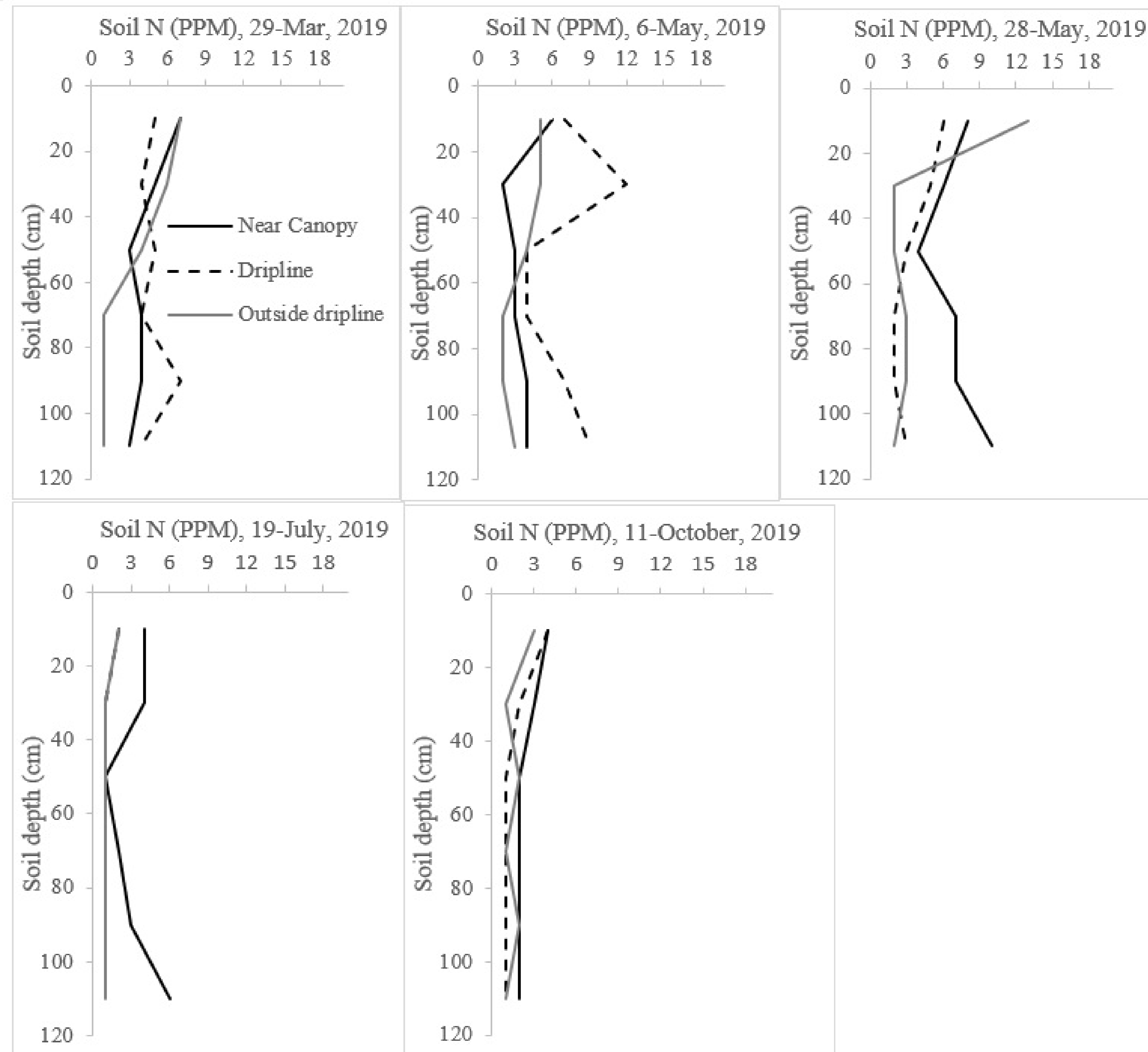
- Considerable amounts of N were leached below rooting zone (approximately 60 cm) for all different distances in all months.
- No specific patterns were observed among soil N concentrations in different distances from the tree trunk for each month.
- NO₃ uptake increased sharply in the early growing season and declined gradually to the end of the growing season.
- The maximum NO₃ uptake occurred in May which was around 144 PPM.
- Findings showed that N fertilizer applications should be managed properly and should be applied any time before May.

References & Acknowledgements

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- Byford, R. 2005. Pecan Orchard Fertilization. Guide H-602. NMSU. P: 4.
- U.S. Department of Agriculture–NASS, 2020. Pecan Production, Crops and Crop Products category.

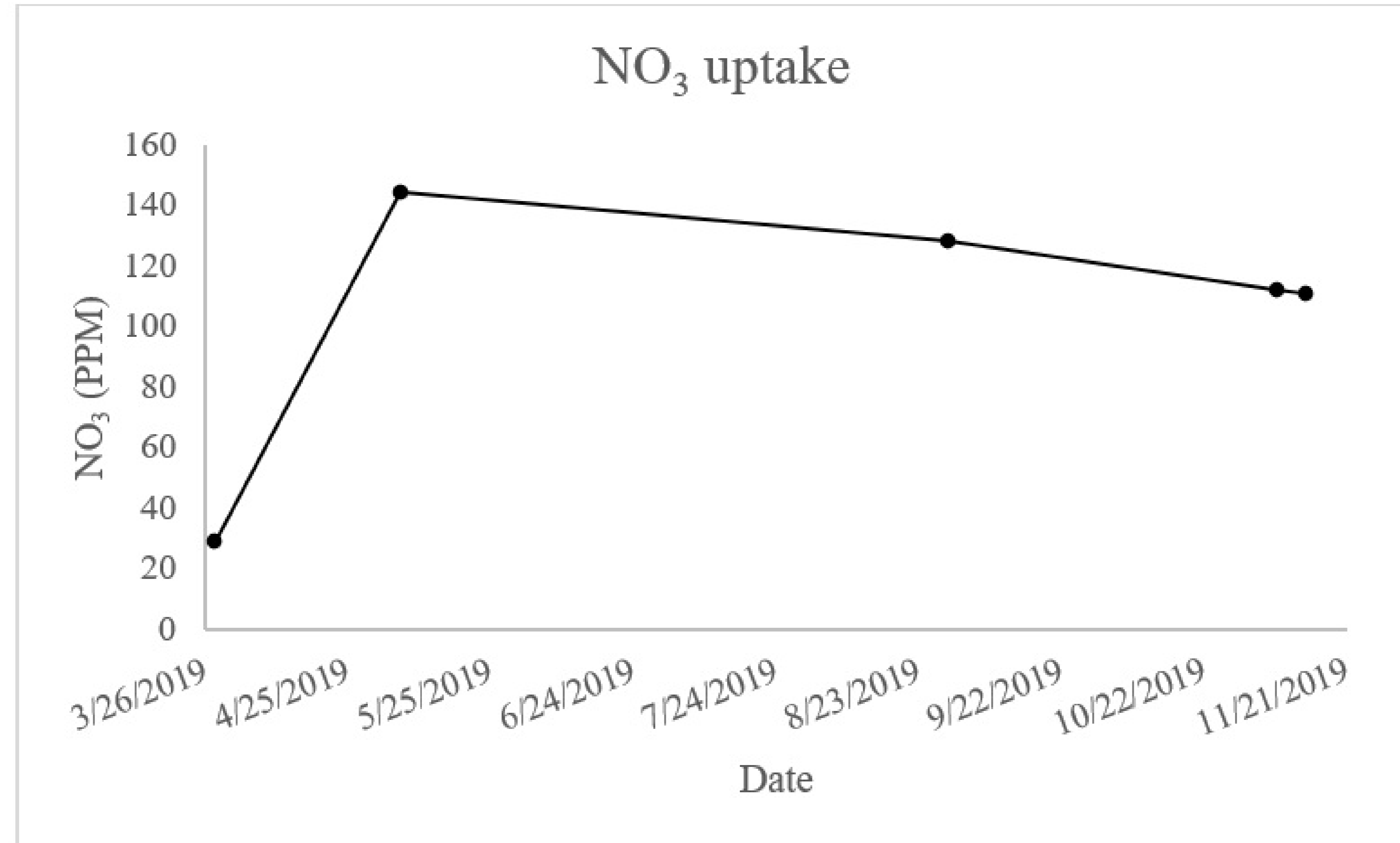
Graphs 2



Measured N concentration profiles for the day of soil sample collection Near canopy, dripline, and outside dripline in six different depths during 2019.



Graphs 3



Amount of NO₃ (PPM) removed by root uptake during the time periods Mar.28 to Nov.12 in 2019.