IN-SEASON PLANT NUTRIENT UPTAKE IN ROOTS, SHOOTS, AND FLOWERS OF HYBRID CARROTS GROWN FOR SEED

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Introduction

Evaluation of in-season plant nutrient uptake patterns under local field conditions is important for understanding how much of a nutrient is needed by the plant and when the plant has the greatest need for each nutrient. Information on plant nutrient uptake in minor crops, such as carrot seed, is often limited. In-season nutrient uptake was evaluated in Madras, OR, from 2000 to 2002 on hybrid Nantes type 49-1 (Butler et al., 2002; Hart and Butler, 2003). The information generated from these studies established baseline numbers for nutrient uptake that are currently used by carrot seed growers in central Oregon. As these studies were conducted almost 20 years ago, there was interest in better understanding nutrient uptake patterns under current field management practices and for other hybrid Nantes types. There was also interest in understanding how nutrients move through the plant over the course of a growing season, which has not been previously evaluated for all agronomic nutrients in carrot plants produced for seed.

The objective of this study was to evaluate the uptake of nitrogen (N), phosphorus (P), potassium (K), and other nutrients in the roots, shoots, and flowers of hybrid Nantes type 969 carrot plants grown for seed.

Materials and Methods

This study was conducted on two commercial carrot seed production fields near Madras, OR. Both fields were planted to the hybrid carrot variety Nantes 969, with Field #1 planted on August 9, 2017 and Field #2 planted on August 7, 2017. The soil type of both fields was a Madras loam, with similar chemical properties at the 0- to 6-inch soil depth (pH 5.9–6.2; organic matter 1.9–2.0%; NO_3-N 114–187 ppm; Olsen P 30–55 ppm; Olsen K 228–239 ppm). Field #1 was under furrow irrigation following *Poa trivialis* (rough bluegrass). Field #2 was under drip irrigation following summer fallow. Clean seed yield was 154 lb/acre for Field #1 and 177 lb/acre for Field #2.

Sixteen plots were established in a randomized complete block design for each field, with four replicated plots within each field selected randomly for evaluating in-season nutrient uptake patterns. Field #1 had two female sets per plot (one set had four rows with a 30-inch row width), with plot length ranging from 1,157 to 1,248 feet. Field #2 had three female sets per plot, with plot length ranging from 1,290 to 1,595 feet. Plot length differences in Field #2 were caused by the triangular shape of the field.

Plants from female rows were sampled by plot on a monthly basis from October 2017 to August 2018, excluding the months of January and February, when plant growth was minimal. Entire plants (including the roots) were removed from three separate 3-foot-long transects per plot at each sampling event. Soil was removed from roots, and plants were separated into roots, tops, and flowers. Separated samples were weighed, dried at 60°C for 3 days, weighed, and ground to pass a 2 mm sieve. Tissue samples were analyzed for total N, P, and K, plus magnesium (Mg), calcium (Ca), sulfur (S), zinc (Zn), manganese (Mn), iron (Fe), and boron (B). Results from the N, P, and K analyses will be discussed here.

Results and Discussion

Data collected from these two fields have been averaged together for discussion. Mean total biomass over the two fields was 7,645 lb/acre on a dry weight basis (Figure 1a). Approximately 7, 65, and 28% of the biomass accumulated in the roots, tops, and flowers, respectively. Mean total N uptake was 178 lb N/acre on a dry weight basis (Figure 1b). Similar to biomass, approximately 6, 65, and 29% of the N accumulated in the roots, tops, and flowers, respectively. Mean total P uptake was 45 lb P_2O_5/acre on a dry weight basis (Figure 1c). Approximately 6, 54, and 40% of the P accumulated in the roots, tops, and flowers, respectively. Mean total K uptake was 303 lb K_2O/acre on a dry weight basis (Figure 1d). Approximately 5, 76, and 19% of the K accumulated in the roots, tops, and flowers, respectively.

Findings from this research will be compiled with data previously reported by Hart and Butler (2003) and Butler et al. (2002) to inform growers, agronomists, and researchers on the amount of nutrients used by hybrid carrot plants grown for seed production, the time of the season when the plant will use the nutrients, and where in the plant the nutrients are accumulated at various plant growth stages.

References

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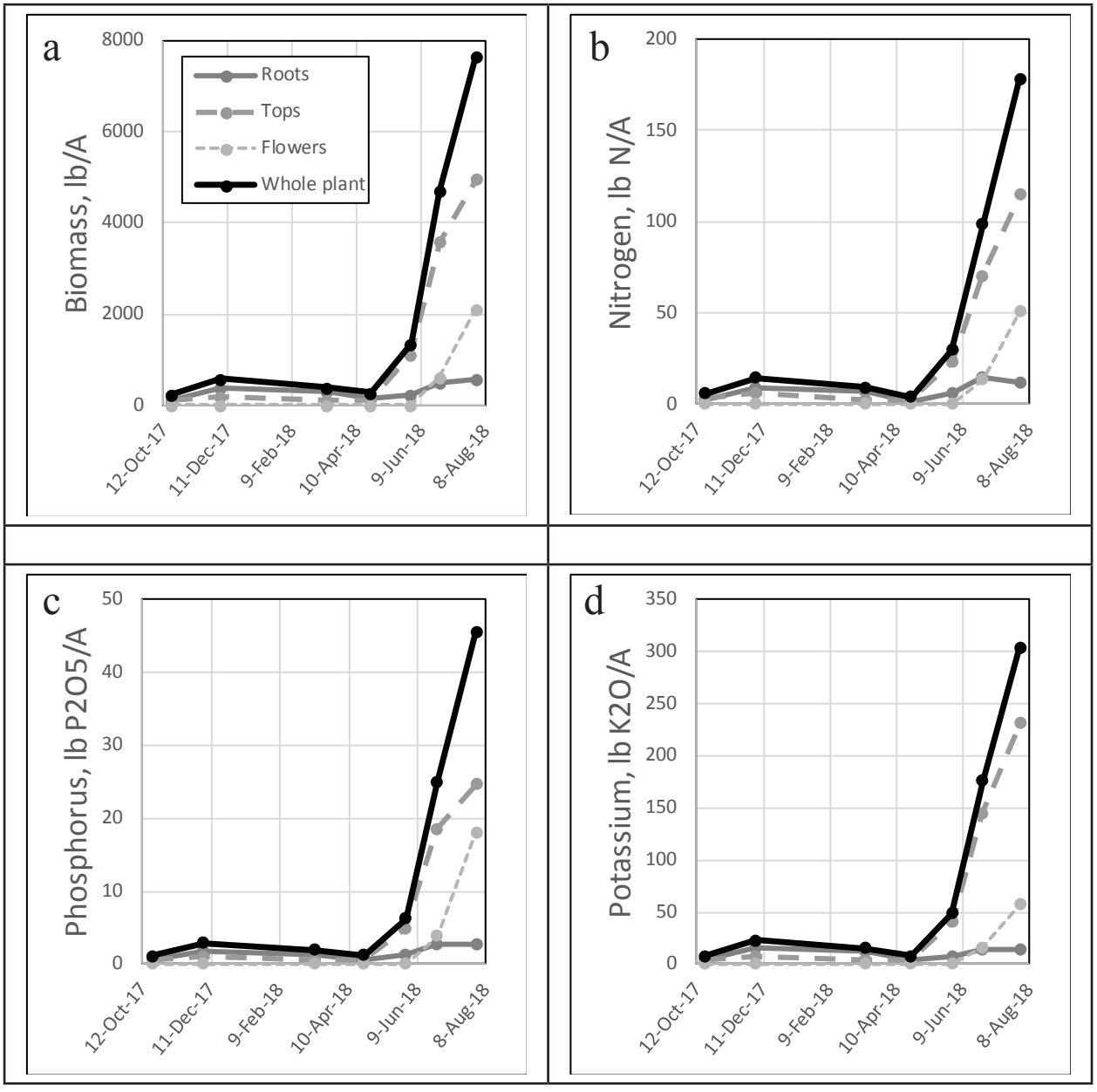

Figure 1. Mean in-season biomass and nutrient accumulations for two hybrid Nantes 969 carrot seed production fields in Madras, OR, from October 2017 to August 2018. Soil type is Madras loam.