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Growth, Nutrition, and Photosynthetic Response of Black Walnut to Varying Nitrogen Sources and Rates

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ABSTRACT

Black walnut (*Juglans nigra* L.) half-sib 1+0 seedlings were exponentially fertilized with ammonium (NH_4^+) as ammonium sulfate [$(NH_4)_2SO_4$], nitrate (NO_3^-) as sodium nitrate ($NaNO_3$), or a mixed nitrogen (N) source as ammonium nitrate (NH_4NO_3) at the rate of 0, 800, or 1600 mg N plant^{-1} and grown for three months. One month following the final fertilization, N concentration, growth, and photosynthetic characteristics were assessed. Compared with unfertilized seedlings, N addition increased plant component N content, chlorophyll content, and photosynthetic gas exchange. Net photosynthesis ranged from 2.45 to 4.84 μmol m^{-2} s^{-1} for lower leaves but varied from 5.95 to 9.06 μmol m^{-2} s^{-1} for upper leaves. Plants responded more favorably to NH_4NO_3 than sole NH_4^+ or NO_3^- fertilizers. These results suggest that N fertilization can be used to promote net photosynthesis as well as increase N storage in black walnut seedlings. The NH_4NO_3 appears to be the preferred N source to promote black walnut growth and physiology.

Keywords: photosynthesis, chlorophyll, nitrate, ammonium, nitrogen, *Juglans nigra*

INTRODUCTION

Black walnut (*Juglans nigra* L.) is one of the most valuable species of the Central Hardwood Forest Region of the United States. The species is used for high quality lumber and veneer (Cassens, 2004) and has additional value for

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