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Split Daily Applications of Ammonium Can Not Ameliorate Ammonium Toxicity in Tomato Plants

MOHAMMAD KAZEM SOURI¹, SAFAR RASTGAR², GHASEM TOHIDLOO³

¹*Tarbiat Modarres University, Department of Horticulture, Iran*

²*Ministry of Agriculture, Iran*

³*Islamic Azad University of Karaj, Iran*

Abstract

Ammonium is the safer and more reliable source of nitrogen fertiliser for agricultural applications in terms of use efficiency and environmental impacts. However, many plants show severe toxicity symptoms with ammonium nutrition in hydroponics systems. Finding some techniques to overcome this problem is in crucial importance. Tomato is a typical ammonium sensitive plant in solution culture, showing severe toxicity symptoms. In this study, we hypothesised that by gradually adding 2 mM N-NH₄ (as final concentration) during four days period of nutrient solution change, plants would have enough time to assimilate ammonium, and consequently results in less toxicity symptoms. So, different treatments were applied as follows: nitrate as Ca(NO₃)₂, ammonium as control (once application), three split applications and six split applications of ammonium as (NH₄)₂ SO₄. When plants were treated with ammonium, in both control and split applications, they had severe toxicity symptoms. No significant difference was found in growth parameters when plants received 3 or 6 split applications (660 and 330 μM, respectively) of a final volume of 2 mM N-NH₄ in a four days nutrient solution change compared to control plants. Independent of application method, ammonium resulted in shorter roots and shoots, less root and shoot dry weight, less chlorophyll in leaves as well as fewer lateral shoots and lower transpiration, compared to nitrate grown plants. These results indicated that even a low daily μM (330 μM) concentration of ammonium in nutrient solution can result in severe toxicity on tomato plants, and despite the importance of other factors, this toxicity seems to be mainly due to low pH of root medium.

Keywords: Ammonium toxicity, nitrate, nutrient solution, split application, tomato