Characteristics and Changes of Waste Nutrient Solution Used in Semi-forcing Hydroponic Cultivation of Tomato cv. Bonus

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OBJECTIVES

The It is important to develop the recycling system of waste nutrient solution (WNS) in view of closed hydroponic cultivation of tomatoes because many farmers have grown tomatoes with hydroponics but released a lot of WNS once used to the surrounding natural environment without permission.

- Tomato total cultivation area in Korea 6,076 ha, Hydroponic cultivation area 602 ha

So we investigated the changes of inorganic compounds in WNS to examine the possibility of recycling of WNS.

MATERIAL AND METHODS

Experiment material : 'Bonus' tomato (seedlings for 40 days)

Transplanting distance : 160 × 20 cm (Perlite medium)

Cultivation Period : March 10 to June 28, 2016.

Nutrient solution : Yamazaki for tomato

- NO_3-N 7, PO_4-P 2, K 4, Ca 3, Mg 2 meq · L^{-1} , Fe 2, B 0.,2 Mn 0.14, Zn 0.02 mg · L^{-1}

Temperature : up 13 ℃ at night

Nitrogen analysis : Kjeldahl method (1030 analyzer, Kjeltec Auto, Korea)

Macroelement analysis : ICP (Integra XM2, GBC Scientific Equipment, Australia)

RESULTS

The EC of WNS were increased by from 2.0 to 3.0 dS.m-1 when tomatoes were grown. The pH of WNS was low as 5.5-5.8 level until mid-April, and maintained pH 6.1-6.4 level after the end of April (Fig. 1).

The content of total NO_3-N in the leaves was 4.9% level on 5th April, but it was reduced by 2.97% on 24th May. And that of K was low by 0.24 -0.43 % mid-April, however the concentration of PO_4-P and Mg have been few changes during tomato growth (Fig. 2).

The concentration of NO_3-N, PO_4 and K were similar in both WNS and initial nutrient solution (INS) during the early growth stage, while it were higher than the initial concentration at the middle and late growth of tomato. The concentration of Ca and Mg were no significant difference between INS and WNS until mid-April. but concentration of Ca and Mg in WNS were increased by 1.3-1.5 times than in INS after the end of April. The Boron content was higher in INS by the end of March, but it was increased by 1.5 times in WNS than INS. The Fe content was also higher in INS than in WNS from the beginning to the end of growth (Fig. 3).

In general, inorganic compound concentration in INS and WNS were no difference at the seedling period when absorption of nutrients is low. But that in WNS was higher than INS because evaporation loss of big plant increased. Although these results provided a lot of information about the changes of inorganic compounds in initial and waste nutrient solution as one of a recycling nutrient solution for hydroponic cultivation of tomato, further studies for the availability of waste nutrients in plant vegetative and reproductive growth are required in the near future.

Table 1. Growth characteristics of 'Bonus' tomato during the semi-forcing hydroponic cultivation .

Days after explanting	Plant height (cm)	Stem dia. (mm)	No. of leaves	Leaf area (㎠/plant)	Dry weight (g/plant)
1	16.6	5.4	6.3	112	1.59
30	69.0	7.6	14.9	2,248	23.3
60	125.0	9.3	23.0	9,892	92.7

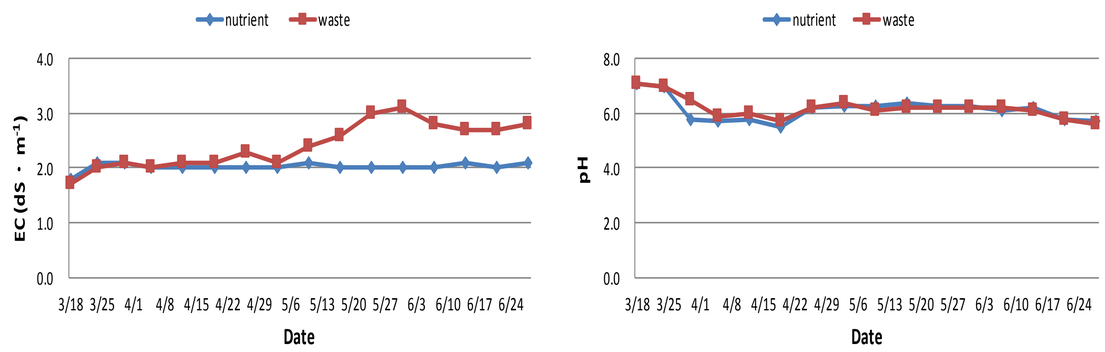

Fig. 1. Changes in EC and pH of INS and WNS during semi-forcing hydroponic cultivation of 'Bonus' tomato.

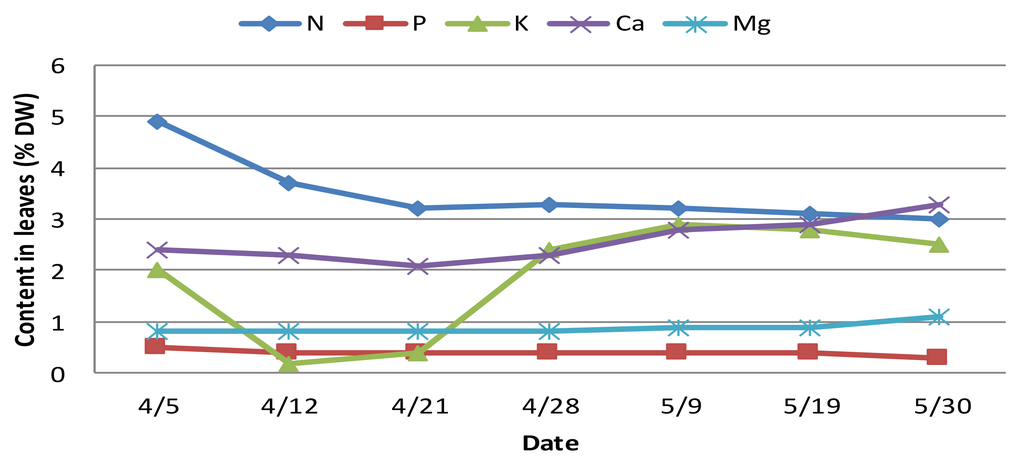

Fig. 2. Change in macro-nutrient contents based on dry weight of leaves during semi-forcing hydroponic cultivation of 'Bonus' tomato.

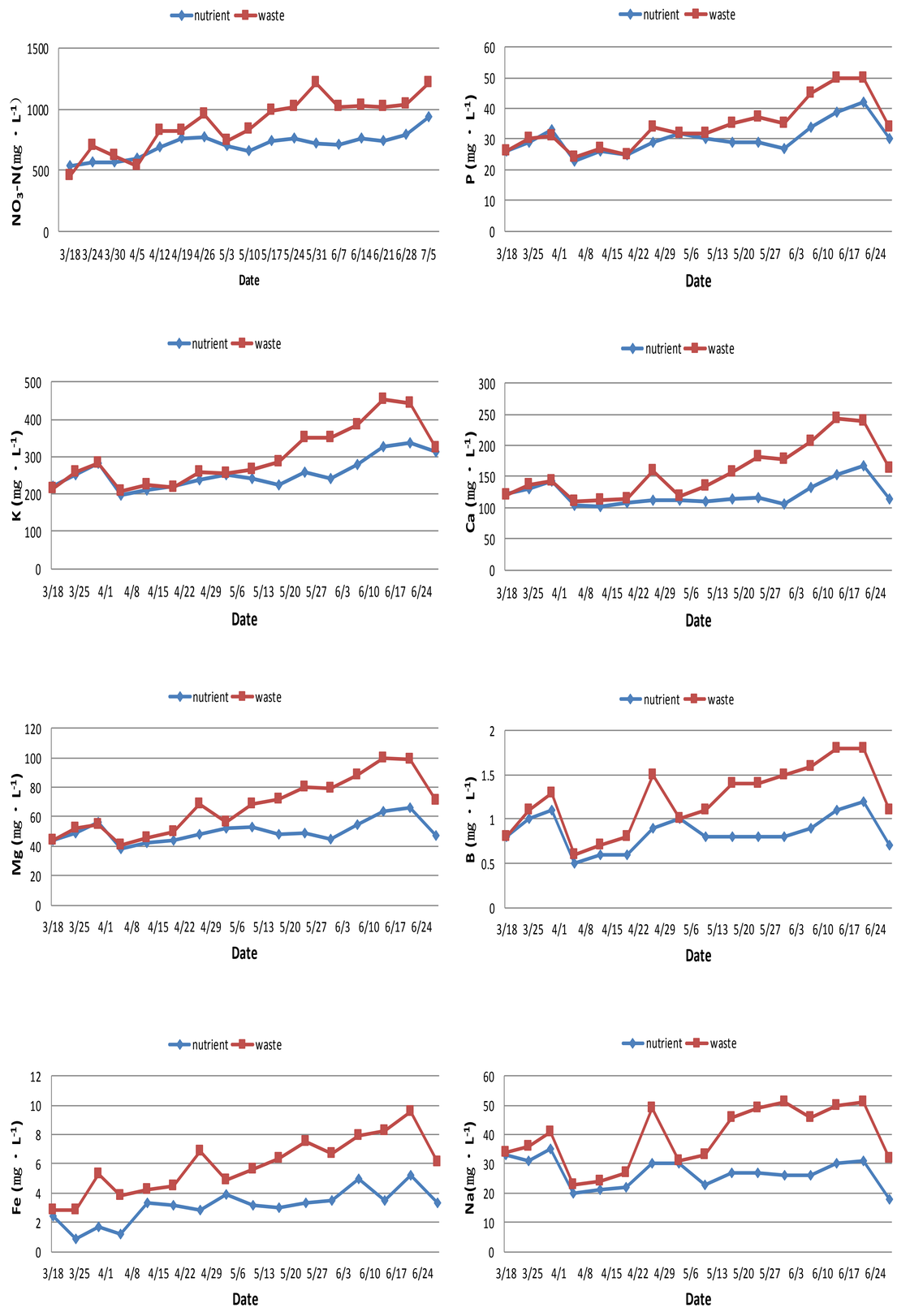

Fig. 3. Change in inorganic nutrients of INS and WNS collected during semi-forcing hydroponic cultivation of 'Bonus' tomato.