Characteristics of Inorganic Compounds in Waste Nutrient Solution Used and Leaves According to Fruiting Node on Hydroponic Cultivation of Cherry Tomato

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OBJECTIVES

The recycling operated system of waste nutrient solution (WNS) in view of closed hydroponic cultivation is important to reduce the cost of purchasing fertilizer and to preserve the natural environment by eliminating the unauthozied discharge of organic and inorganic nutrients. We therefore investigated the changes of inorganic compounds in WNS and tomato plant leaves, and the diversity of microorganisms in WNS to determine whether it is possible or not to recycle the WNS drained in hydroponic cultivation of tomatoes during spring cultivation.

MATERIAL and METHODS

Experiment material : 'Minichal' cherry tomato (seedlings for 40 days)

Transplanting distance : 160 × 20 cm (Perlite medium)

Cultivation Period : March 10 to June 30, 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 ℃ night

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

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

RESULTS

The change of EC in WNS was increased by 4.5 dS.m^{-1} when tomato plants were grown until the 9th fruiting node than the initial rate of 2.0 dS.m^{-1} at the 2nd ones. However, the pH of WNS was lowered to pH 5.9-6.1 at the 9th and the 10th fruiting node compare to pH 6.4-6.7 at the 2nd and the 3rd ones, respectively (Fig. 1). The concentrations of nitrogen (NO_3-N), phosphorus (PO_4), potassium (K), calcium (Ca), magnesium (Mg) and boron (B) were similar in both WNS and initial nutrient solution (INS) during the 2nd and the 3rd fruiting stage, while their concentrations in WNS were higher than that of INS at the middle and late fruiting of tomato. The Fe content was also higher in INS than that of WNS from the beginning to the end of tomato growth (Fig. 2). The content of total NO_3-N in the leaves was 4.01% level at the 2nd fruiting node, but it was reduced by 2.75% at the 10th ones. The phosphorus (PO_4) concentration in the analysis of the leaves was not difference from 2nd fruiting node to 10th ones, however the concentration of K and Ca were increased slightly during tomato growth. The content of Mg is 0.67 to 0.92% of the total (Fig. 3). The results of these experiments showed that the reuse of WNS could be possible because of the high concentration of inorganic compounds and non-pathogenic microoganisms in the WNS (Table 1).

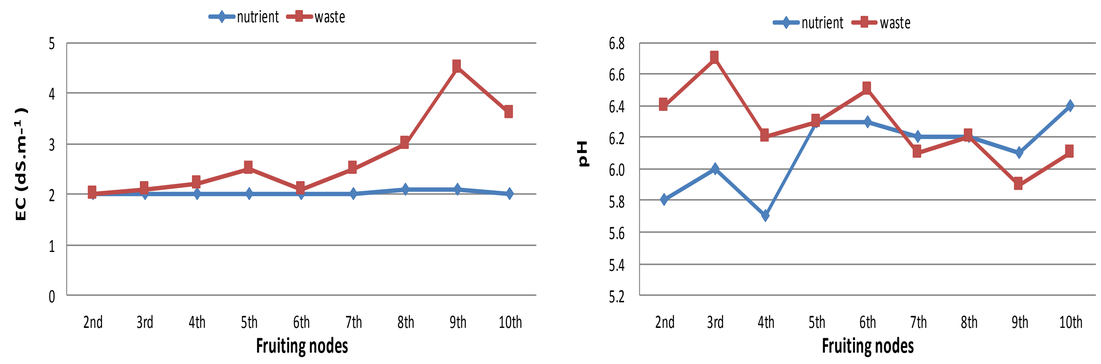

Fig. 1. Changes in EC and pH of INS and WNS collected in each fruiting node during the cultivation of 'Minichal' cherry tomato.

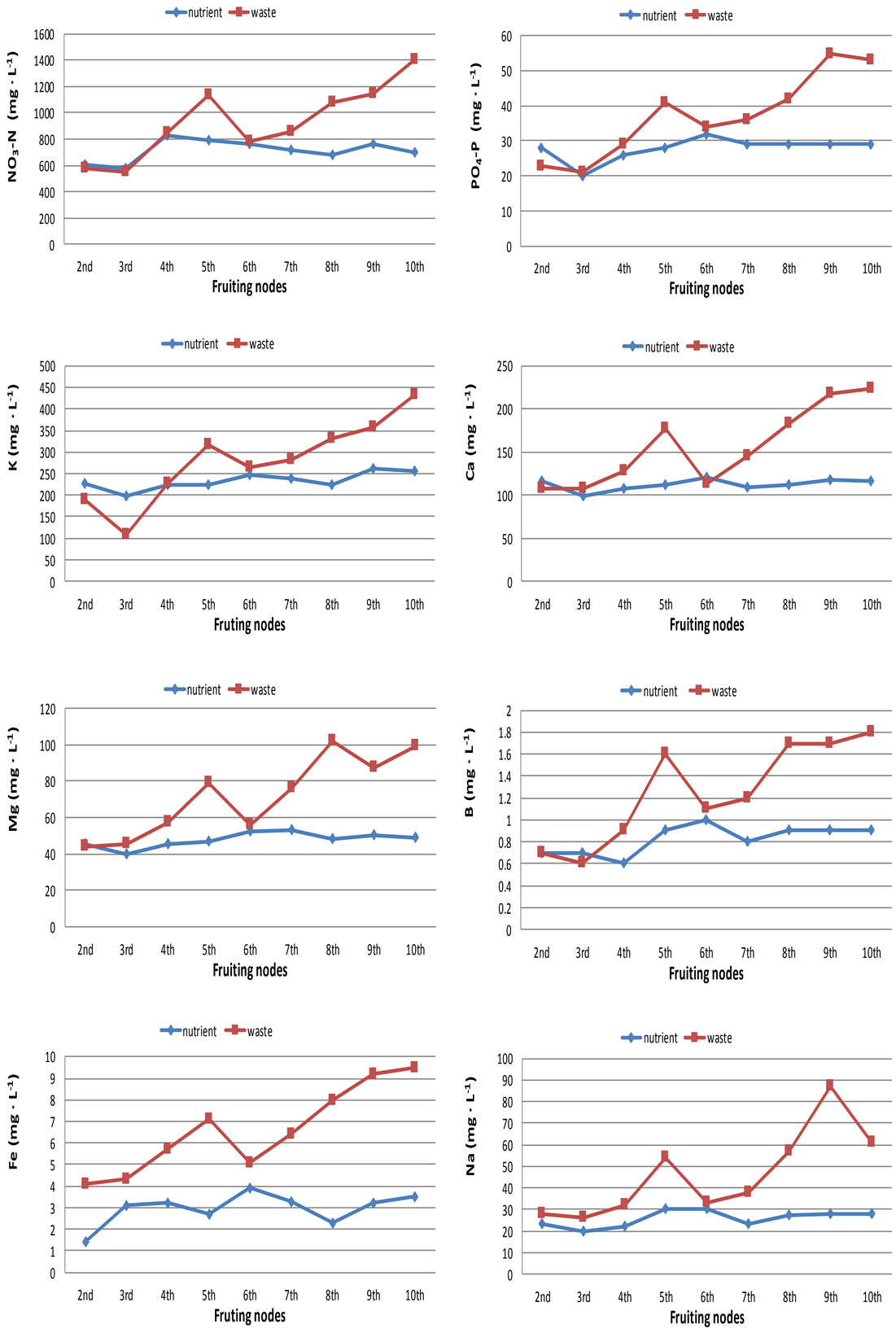

Fig. 2. Change of inorganic nutrientsof INS and WNS collected in according to fruiting node of Minichal' cherry tomato.

Table 1. Microorganism identification of initial and waste nutrient solution during 'Minichal' cherry tomato cultivation.

Month	Nutrient solution	Total microorganism (cnu/ml)	No. of Microorganisms	Microorganism	Pathogenicity
March	Initial	8.5×10^6	2	*Trichoderma* sp.	Non
	Waste	9.4×10^6	3	*Penicillium* sp.	Weak
May	Initial	6.7×10^6	3	*Pseudomonas* sp.	Weak
	Waste	3.5×10^6	3	*Trichoderma* sp. *Pseudomonas* sp.	Weak
June	Initial	9.4×10^6	3	*Penicillium* sp. *Pseudomonas* sp.	Weak
	Waste	4.3×10^6	3	*Penicillium* sp. *Pseudomonas* sp.	Weak
July	Initial	2.3×10^6	3	*Penicillium* sp. *Pseudomonas* sp.	Weak
	Waste	5.2×10^6	2	*Pseudomonas* sp.	Weak

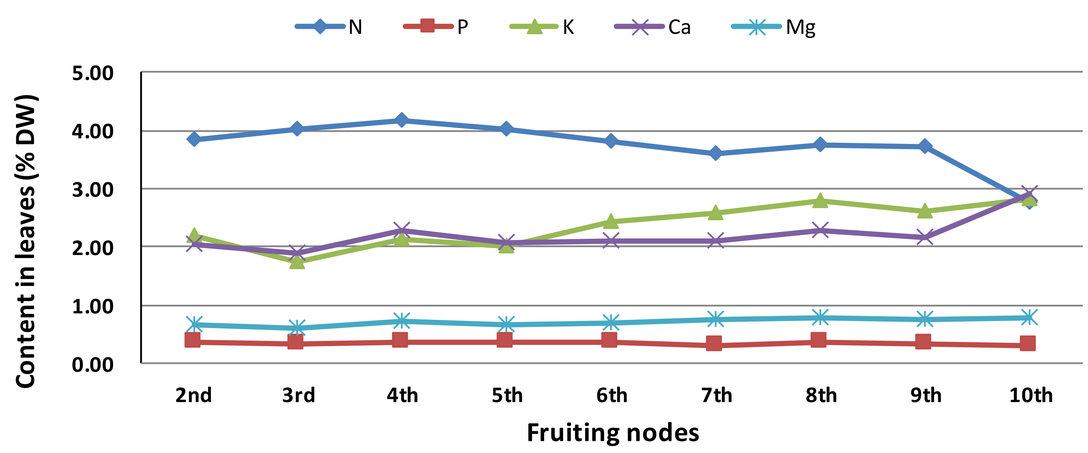

Fig. 3. Change of macro-nutrient contents based on dry weight of leaves collected in each fruiting node of 'Minichal' cherry tomato.