Ultrasol®ine K Plus, potassium nitrate with Iodine, for better root development and faster plant growth in lettuce

Application of Ultrasol®ine K Plus resulted in better root development and faster plant growth, enabling an earlier harvest in a number of trials in lettuce grown in water-culture (nutrient film technique, NFT).

Iodine (I) should be considered as a plant nutrient. That is the main conclusion of Kiferle et al., 2021. In that paper, the presence and identity of naturally occurring iodinated proteins in higher plants, which had never been described before, was published. Eighty-two iodinated proteins have been identified that take part in important biological processes in higher plants. Similar to deficiency in any other plant nutrient, a deficiency in iodine is predicted to cause yield losses.

In fertigated and protected horticultural crops, grown in a commercial production setting, iodine deficiency can occur when the presence of iodine in the nutrient solution is below a sufficiency target value. In intensive, fertigated cropping systems under cover, the nutrient solution and irrigation water are the main sources of iodine. This deficiency will be visible as sub-optimal root or leaf development, later flowering, lower fruit growth and lower resilience to stress, resulting in lower yields compared to a crop which has been supplied with sufficient iodine in the nutrient solution.

To demonstrate the effect of improving iodine supply in an iodine-deficient crop, **Ultrasol®ine K Plus** (potassium nitrate containing a fixed amount of iodine) was applied as source of K and N - and iodine - in the nutrient solution of four cultivars of ‘Crispa’ type head lettuce, ‘Vanda’, ‘Milena’, ‘Brida’ and ‘Bruna’, and coriander in NFT

hydroponics, with four different growers. The size of the treated sectors varied between the growers. On average it contained 4-6 NFT tables of 1.5-2 m wide, constructed of galvanized steel tubes. Between the separately fertigated sectors sectors, the crop cultivar, planting date, plant density and overall crop management were the same. The composition of the nutrient solution was determined by the grower's standard practice. Two treatments were compared: in the control sector the grower's standard nutrient solution was prepared using potassium nitrate without iodine as the main K-source, whereas in the other, **Ultrasol®ine K Plus** was applied in the same amounts and frequency.

In each of the 4 separate production locations, samples of 10-15 heads or plants per sector were taken shortly before harvest, at the same time after transplant in both sectors, and weighed. In one location with two cultivars of lettuce on NFT, additionally the root length was determined in an early stage of the crop cycle (13 days after transplant, DAT) and for coriander the total plant length was measured at 20 DAT.

In all locations a beneficial effect of **Ultrasol®ine K Plus** application on root growth was observed by the growers, already early in the crop cycle (Figure 1). A consistent improvement of head weight of lettuce and plant weight and length of coriander, was observed in the NFT tables where **Ultrasol®ine K Plus** was applied compared to the control (Table 1, figures 2 and 3). This could be interpreted as a delay in growth in the control treatment, which lacks a sufficient supply of iodine from the recycling nutrient solution.

Particularly in crops grown on water-culture, the only supply of iodine in these plants

derives from the irrigation water. This means that a severe deficiency in iodine was predicted to occur in these locations, based on the low concentrations of iodine measured in the irrigation water.

Iodine is present in proteins like the enzymes that control of redox-balance in oxygen supply of the roots, important for root development and for proteins managing the flow of electrons during photosynthesis; these processes are the important drivers for plant growth. For both lettuce and coriander, a faster development of the biomass translates into shorter cultivation cycles for the benefit of the grower. The produce can be brought to the market on average 2-4 days faster (figure 4), making it possible to include more crop cycles in a growing season.

Table 1. Average plant weight and root growth of lettuce and weight and *plant length of coriander grown on a nutrient film technique (NFT) hydroponic system. Use of potassium nitrate without iodine in the control sectors (Control) was compared with application of iodine containing potassium nitrate (**Ultrasol®ine K Plus**). DAT=days after transplant.

Cultivar and crop	DAT	Plant weight (g plant^{-1})		Root or plant* length (cm plant^{-1})	
		Control	Ultrasol®ine	Control	Ultrasol®ine
lettuce 'Vanda'	20	320	390		
lettuce 'Milena'	31	289	326		
lettuce 'Bruna'	23	319	384	36.4	43.6
lettuce 'Brida'	13	24	64	18.4	27.2
coriander	20	42	47	19.1*	21.7*

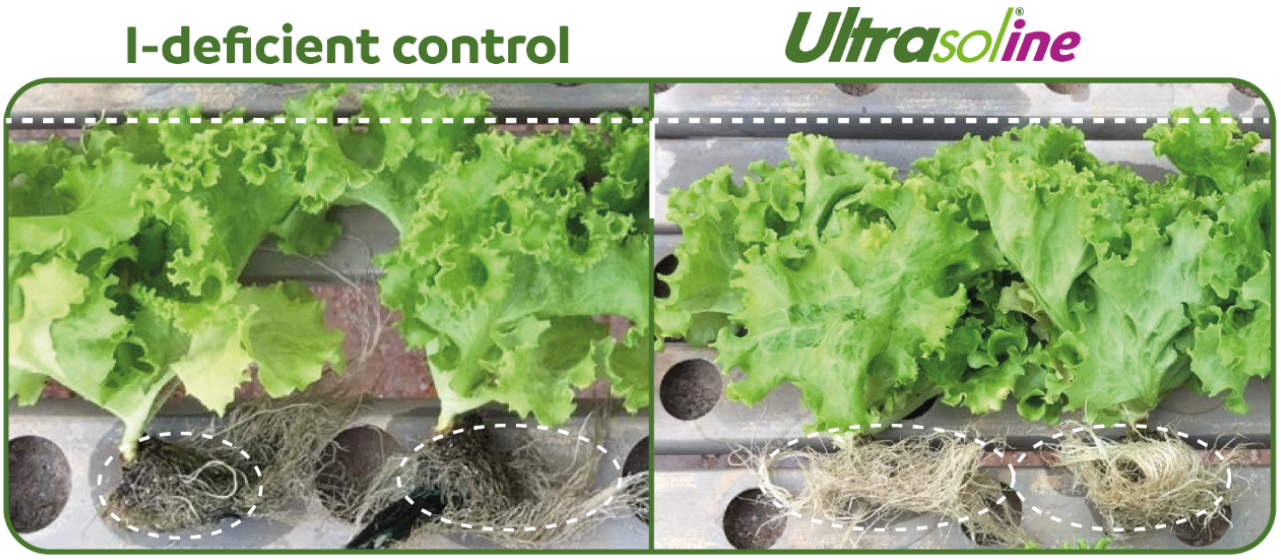

Figure 1. Lettuce ‘Brida’ plantlets show faster innitial growth 13 days after transplant due to better root development with **Ultrasol®ine K Plus**.

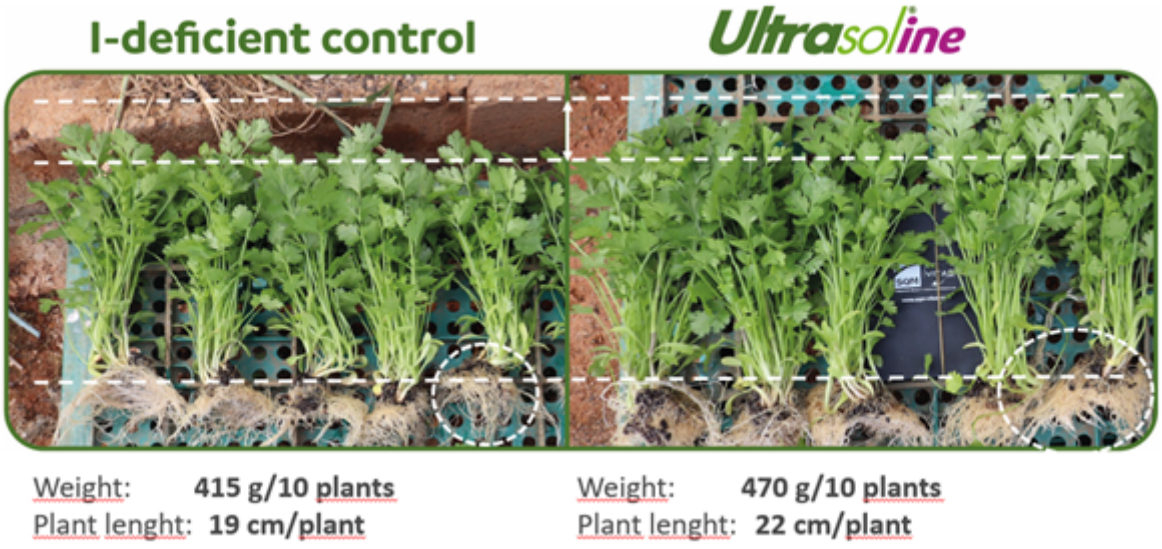

Figure 2. Rapid plant growth for earlier harvest in coriander, with **Ultrasol®ine K Plus**

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Figure 3. Samples of plants for assessment of plant weight and root growth of Crispa lettuce.

Figure 4. At 23 days after transplant in a summer cultivation, the plants grown with **Ultrasol®ine K Plus** in the nutrient solution are ready for harvest. The control plants will need 2-4 more days of growth before they fill the market boxes.

The original publication is available at https://doi.org/10.17660/ActaHortic.2021.1321.27

Kiferle et al., 2021, https://doi.org/10.3389/fpls.2021.616868

Hora and Holwerda 2021, https://doi.org/10.17660/ActaHortic.2021.1321.27