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WELCOME MESSAGE

Welcome to Aquaculture Europe 2022 on the Italian Adriatic coast in Rimini.

The theme of the conference "Innovative Solutions in a Changing World" reflects the need for addressing the many challenges facing the sector in the coming decades. Most in land, coastal and marine water bodies will undoubtedly be impacted directly or indirectly by climate change and urbanisation, from sea acidification and warming, sea-level rise, coastal erosion, flooding, eutrophication and pollution. These will represent important sustainability challenges for current and future European aquaculture. AE2022 will provide a great opportunity for discussing new and innovative ideas to address these challenges but also identify strategies for implementing and up scaling already proven concepts and solutions.

Since moving recently from academia to industry, I can testify on the importance of capturing and translating new research into industry protocols and solutions for the benefit of the sector. What makes EAS annual events unique is bringing together scientists, industry leaders and entrepreneurs, governmental bodies and regulators from all over Europe and sharing the same passion for aquaculture. AE2022 will include a wide range of scientific sessions (32 over 3 days) and a trade show with close to 180 booths. In addition, several workshops and special events will take place; including the AE2022 Industry Forum and the AE2022 Innovation Forum - organised by The European Aquaculture Technology and Innovation Platform, the European Commission and EAS.

This year we are expecting more than 2000 attendees with more than 600 scientific abstracts received and these have been reviewed by the session chairs and integrated into an impressive programme by Maria Letizia Fioravanti and Daniel Żarski as Program co-chairs. Thank you for your hard work! I'd like also to thank our Steering and Local Organising Committees who gave their time and efforts to make AE2022 possible as for my colleagues on the Board of the EAS with several newly appointed directors. A big thanks also to our Gold Sponsors Biomar, Silver Sponsors U.S. Soybean Export Council, Session Sponsor Lallemand and Conference Support from the Italian National and Regional Governments.

This is the end of my two-year term as President. It has been a challenging period for all, but I am delighted to see the great resilience of EAS thanks to our collective efforts and welcome to our new president, Bente Torstensen. I hope you enjoy the event, the people and the science.

Herve Migaud
EAS President 2020-2022

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ABSTRACTS

A COMPARISON BETWEEN HYDROPONIC AND AQUAPONIC GROWN SALANOVA LETTUCE INFECTED BY *Pythium* sp.

L. Bruni*[a], F. Gartmann[b], R. Junge[b], G. Parisi[a], Z. Schmautz[b]

[a]Department of Agriculture, Food, Environment and Forestry, University of Florence, Firenze, Italy
[b]School of Life Sciences and Facility Management, Zurich University of Applied Sciences, Wädenswil, Switzerland
E-mail: leonardo.bruni@unifi.it

Introduction

Soil-independent, closed environment agriculture (CEA) has potential to meet challenges in food production, such as climate change and soil deterioration by assuring yield, improving water and fertiliser efficiency, decreasing the incidence of pathogens and pests, among others. The use of recovered or recycled fertilisers instead of chemically pure mineral fertilizers would further contribute towards increasing the sustainability of vegetable production. By combining hydroponics (HP) with aquaculture, nutrient-rich aquaculture effluent is recirculated, thereby diminishing or removing the need for inorganic fertilisers. As additional benefit, cultivation in aquaponics seems to provide competitive presence of beneficial microorganisms that contribute towards mitigation of root rot infections1–3. However, detailed studies of this are rare. Pythium spp. are root pathogens that often cause root rot in soil-less grown vegetables. To test the hypothesis that aquaculture effluent contributes toward fighting against Pythium spp. infection, lettuce (Lactuca sativa, variety Salanova) was cultivated in either conventional HP or in the effluent of a commercial aquaculture farm before being inoculated with the pathogen.

Materials and Methods

Twenty-four lettuces were grown in rafts in a climate chamber (23-15 °C day/night, 65% relative humidity, 16-8h day/night, 0.12% CO_2) and underwent two treatments in duplicate boxes of 6 plants each: *(i)* HP solution of demineralised water with added nutrients and NaCl to mimic the composition of the aquaculture effluent; *(ii)* aquaculture effluent from a commercial RAS rearing pike perch at 37 kg/m^3 (AP). AP contained 782 mg/L Na^+ and 830 mg/L Cl^- (4.2 mS/cm) as the farm used NaCl to prevent disease in fish. K and Fe were added in AP as KOH and Fe EDTA, respectively, to meet lettuce requirements. pH at the end of the trial was 7.95 and 7.88 in HP and AP, respectively. On day 29 after seeding, 0.25 g *Pythium* sp.-infected millet was inoculated onto each rockwool cube of one replicate. After 60 days from seeding, chlorophyll, flavonoid, and nitrogen levels were estimated with Dualex® (ForceA, France)[4]. On day 61, the lettuces were harvested, shoots and roots were weighed separately and thereafter dried at 60 °C before determining dry matter. The elemental composition was analysed by XRF spectrometry (SPECTRO analytical instruments GmbH, Germany). R software[5] was used to perform a two-way ANOVA with factors system (S; levels: HP, AP) and infection (I; levels: no, yes), followed by a Tukey's test.

Results and Discussion

All parameters, except shoot dry weight, root dry weight, and nitrogen balance index, differed between HP and AP systems ($p<0.05$ or smaller; Table 1). Plant growth in the AP system was lower than in the HP system, as found elsewhere[6]making it difficult to accurately determine deficient nutrients limiting crop yield and quality across the systems. To avoid interference with background nutrients, we used reverse osmosis water in this study. The objectives were to identify critical nutrients that affect the yield and quality of cherry tomato-, basil-, and lettuce by characterizing nutrient composition and concentration in aquaponic systems in comparison to hydroponic systems. Daily release rate (mg L–1. There were no visible signs of infection on lettuces from either system. AP plants undergoing *Pythium* infection did not show differences from the non-infected ones, while the percentage of shoot dry weight on fresh weight in infected HP-grown lettuce was significantly higher. Infecting the plants also led to a not significant increase in the levels of flavonoids (stress response) and chlorophyll (possibly related to nitrogen status[7]), irrespective of the system. However, the nitrogen balance index was not significantly different, indicating that the nitrogen status of leaves was not sharply affected.

Na, Ca, Mg, P, Cl, Mn, Cu and Zn contents were significantly higher in shoots of HP-grown plants, while there were no differences in K, Al, and Si; Fe and Ni were higher in the shoots of AP-grown plants (Table 2). The levels of Fe in shoot biomass seemed to be lower in the infected plants. The lack of replicates did not allow to detect statistical differences between the different treatments in the element concentrations in root samples.

Conclusions

The study showed that HP and AP nutrient solutions containing similar values of pH, nutrients and salinity could both sustain Salanova lettuce growth. Infection with *Pythium* sp. did not compromise the lettuce growth; however, the beneficial effect could not be confirmed. As there were no visible signs of infection on lettuces from either system, *inocula* containing more active spores should be tested to delve into the capacity of AP system to provide beneficial bacteria against pathogens.

(Continued on next page)

Table 1. Lettuce growth (means from 3 pools of 2 lettuce per treatment), and estimates of leaf chlorophyll, flavonoid and nitrogen balance index at harvest measured by Dualex® (ForceA, France) (means from 4 leaves of 3 lettuce per treatment).

System (S)	HP		AP		ANOVA results	SEM
Infection (I)	No	Yes	No	Yes		
Shoot fw [g]	179.8^{a}	168.0^{a}	97.5^{b}	137.0^{ab}	S: **	5.9
Shoot dw [g]	8.5	10.9	9.0	11.5	I: *	0.3
Root fw [g]	49.5^{a}	41.6^{a}	15.2^{b}	19.3^{b}	S: ***; S×I: *	2.3
Root dw [g]	3.0^{a}	2.5^{a}	0.9^{b}	1.2^{b}	S: ***	0.1
Chlorophyll	22.99^{b}	24.38^{ab}	27.58^{ab}	30.96^{a}	S: **	0.996
Flavonoid	0.075	0.159	0.222	0.292	S: *	0.019
Nitrogen balance index	217.0	282.6	214. 0	127.0	ns	27.5

*SEM: standard error of the mean. fw: fresh weight; dw: dry weight. Different superscripts indicate: *: p<0.05; **: p<0.01; ***: p<0.001. ns: no statistically significant difference.*

Table 2. Average lettuce element concentrations (on dry weight) in the shoots at harvest; values are means from 3 pools of 2 lettuce per treatment.

System (S)	HP		AP		ANOVA results	SEM
Infection (I)	No	Yes	No	Yes		
Na [mg/g]	51.92^{a}	42.59^{b}	32.85^{c}	33.85^{c}	S: ***; I: **; S×I: **	1.18
Ca [mg/g]	14.06^{a}	9.94^{b}	7.06^{c}	7.10^{c}	S: ***; I: ***; S×I: ***	0.44
Mg [mg/g]	5.43^{a}	4.26^{b}	2.86^{c}	2.72^{c}	S: ***; I: **; S×I: **	0.17
P [mg/g]	9.77^{a}	7.35^{b}	5.39^{c}	5.26^{c}	S: ***; I: **; S×I: *	0.29
Cl [mg/g]	32.79^{a}	27.79^{b}	19.15^{c}	19.64^{c}	S: ***; I: *; S×I: *	0.88
Fe [µg/g]	80.8	69.2	113.6	96.1	S: *	3.4

*SEM: standard error of the mean. Different superscripts indicate significant differences for the system factor: *: p<0.05; **: p<0.01; ***: p<0.001. ns: no statistically significant difference.*

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