Effect of lupin Sap and Chicken Manure Extract on Plant Growth and Root Zone Activities of Tomato

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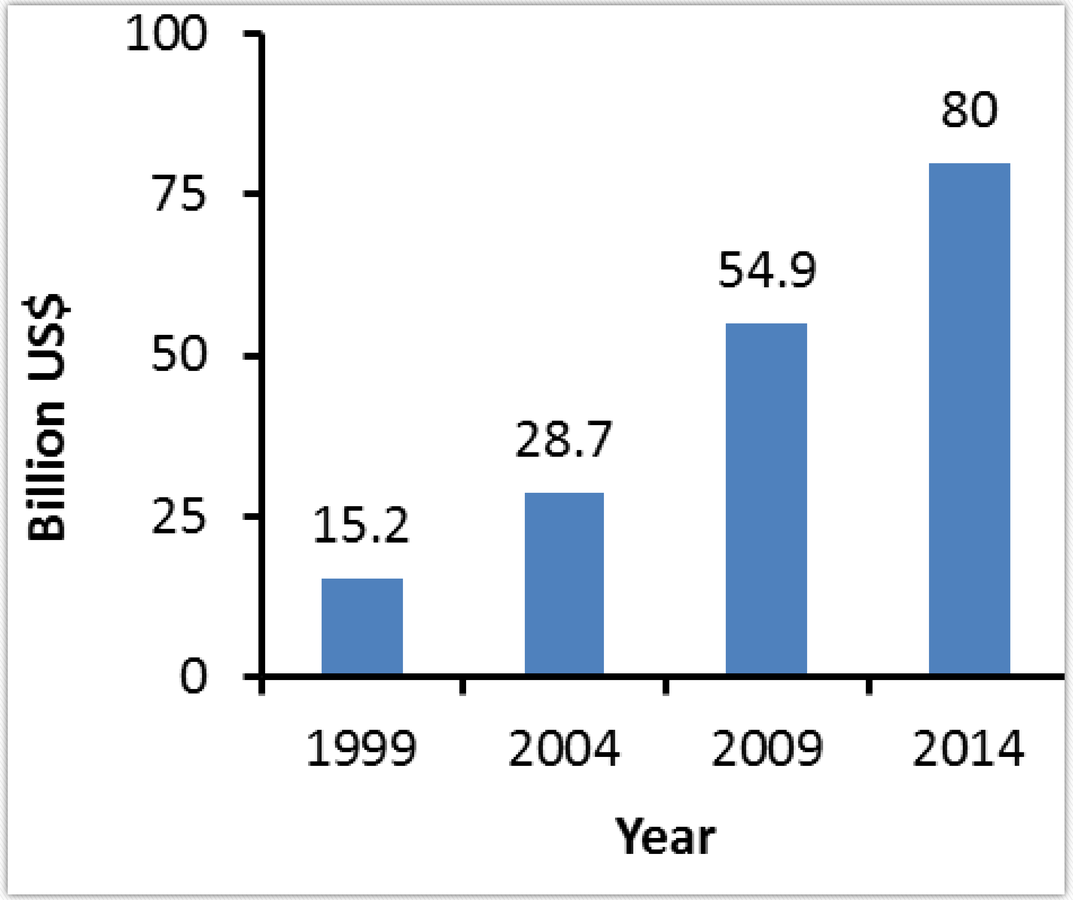
ISHS
BioGreenhouse
cost EUROPEAN COOPERATION IN SCIENCE AND TECHNOLOGY

3rd INTERNATIONAL SYMPOSIUM ON
ORGANIC GREENHOUSE HORTICULTURE
11 - 14 APRIL 2016 / IZMIR, TURKEY

World revenue of organic foods



Data source: FiBL and IFOAM - Organics International:
The World of Organic Agriculture 2016

MARKET SHARE OF ORGANIC FOOD

3.5% was the global market share of organic food in 2013

xx% was the European market share of organic food in yy

7.6% was the Danish organic market share in 2014

42% of the global organic food market shares by Europe

162 euro per capita is spent by Danish consumers, after Switzerland (221 euro) and Luxemburg (164 euro), on organic food (world avr 9.8 euro)

DANISH ORGANIC SECTOR

6.6% **farmland is organically managed in Denmark in 2014**

100% **increase in the organically cultivated area by 2020 from the 2007 level (Organic action plan for Denmark)**

13% **of the Danish tomato production is organic**

Data source: FiBL and IFOAM - Organics International: The World of Organic Agriculture 2016

INTRODUCTION

But

Up to 35% lower productivity in the production of organic tomatoes in Denmark

Nutrient management in organic greenhouse production is difficult due to limited availability of suitable liquid organically certified fertilizers

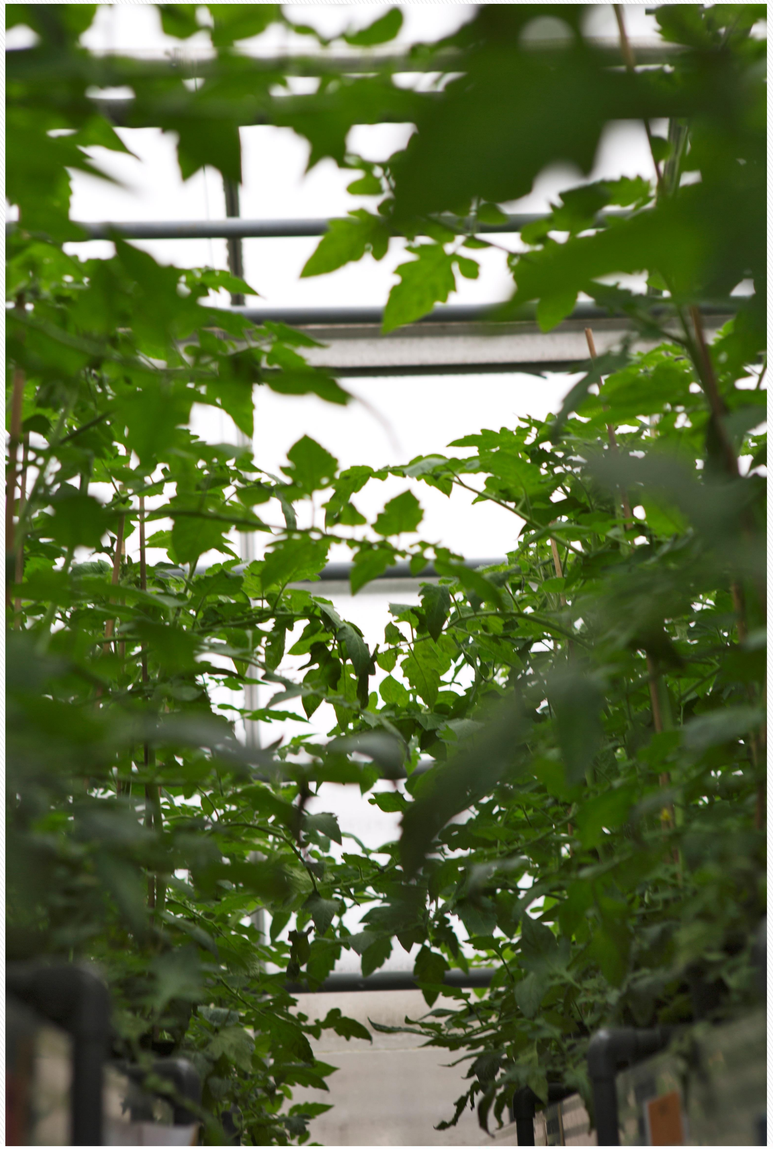
And

Applied organic fertilizers greatly affect the biological, chemical and physical properties of growing media

AIMS

To determine the effects of different organic fertilizer strategies on

- **Nutrient availability, pH and EC in the root zone**
- **Biomass yield and plant growth parameters**



MATERIAL AND METHODS

Growing medium: Limed peat + 20 kg m^{-3} composted chicken manure (2-1-2 NPK)

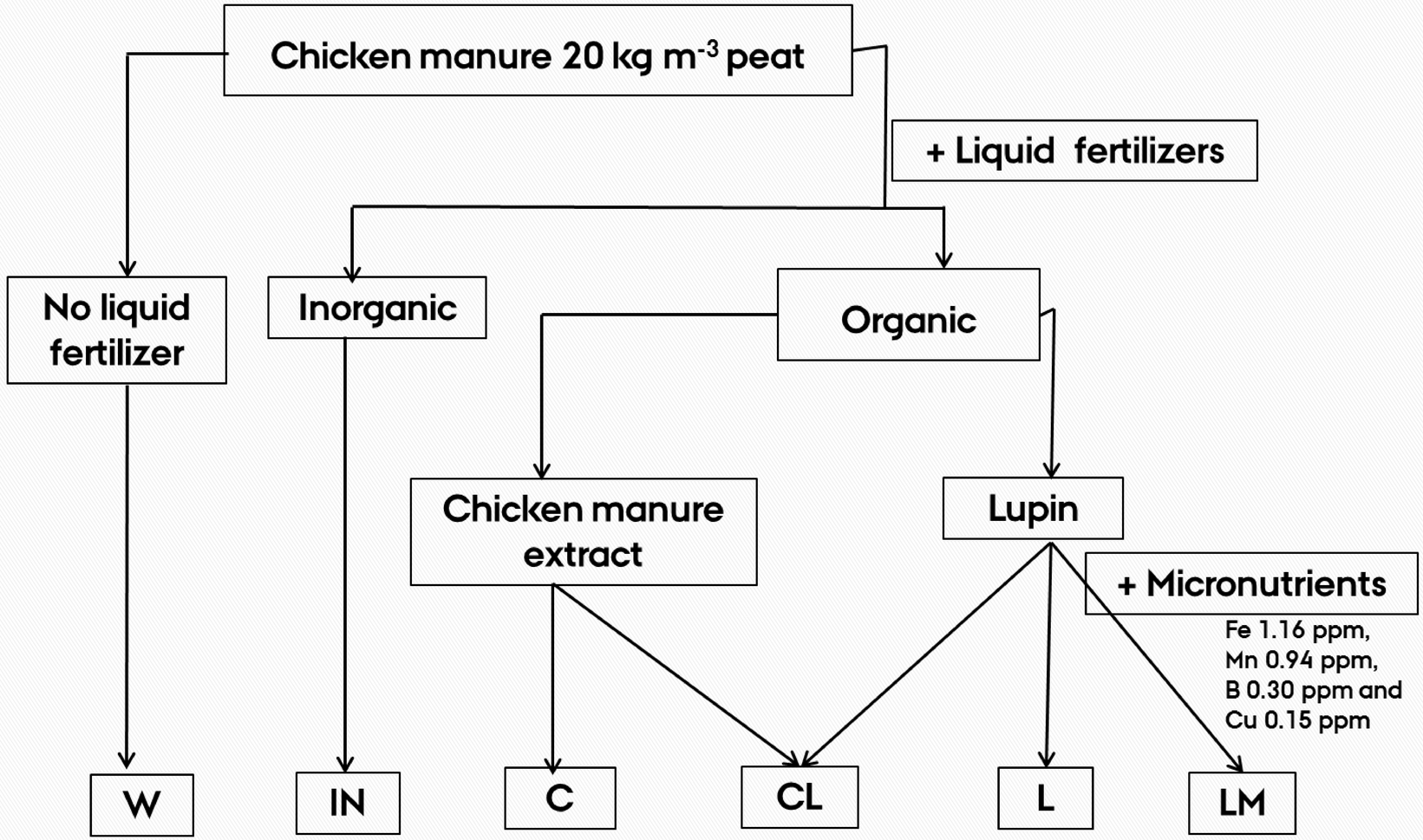
Temperature: Set point 18 + 3 °C before venting, natural day length

Plant material: Cuttings of *S. lycopersicum* L. 'Diamantino'

Fertigation started just after transplanting into 15 cm pots, ebb/flood irrigation and re-use of drainage water. Fertigation solutions were changed every week.

Design: Completely randomized design, 6 treatments with 3 replicates

FERTILIZER TREATMENTS



MEASUREMENTS AND ANALYSES

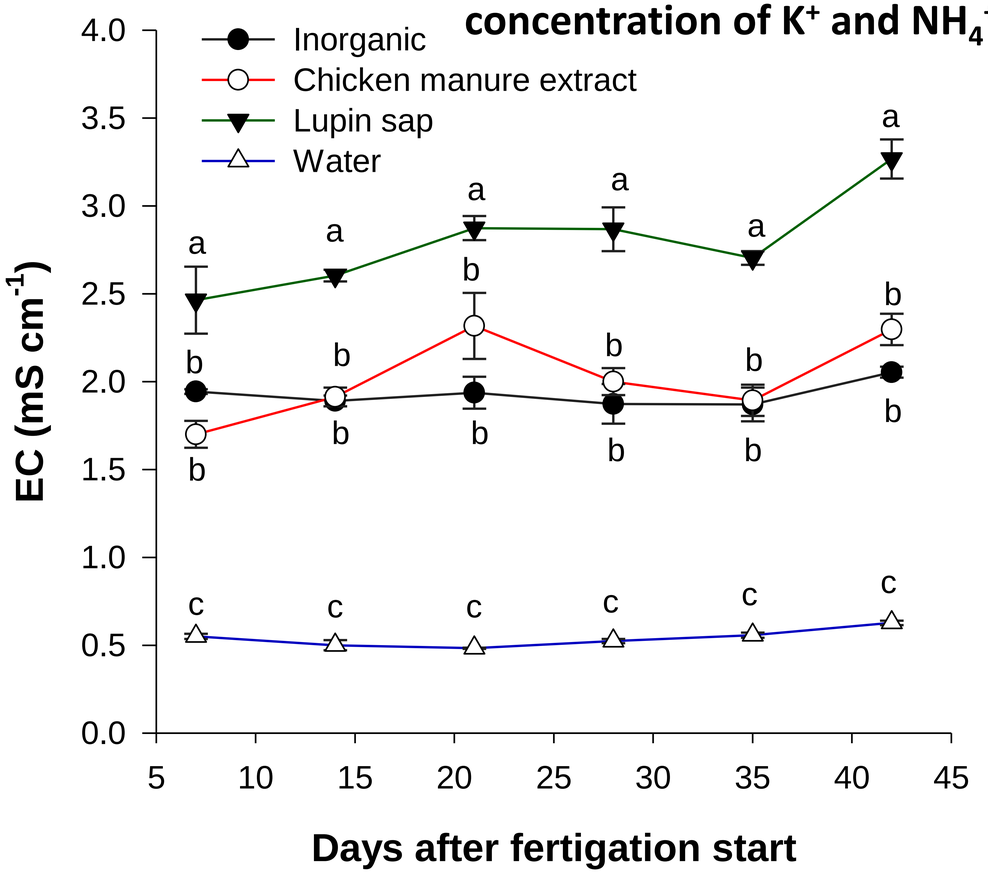
- pH, EC and nutrient content of growing medium solutions
- Biomass yield parameters
- *Final harvest:* 42 days after fertigation start (DAF)

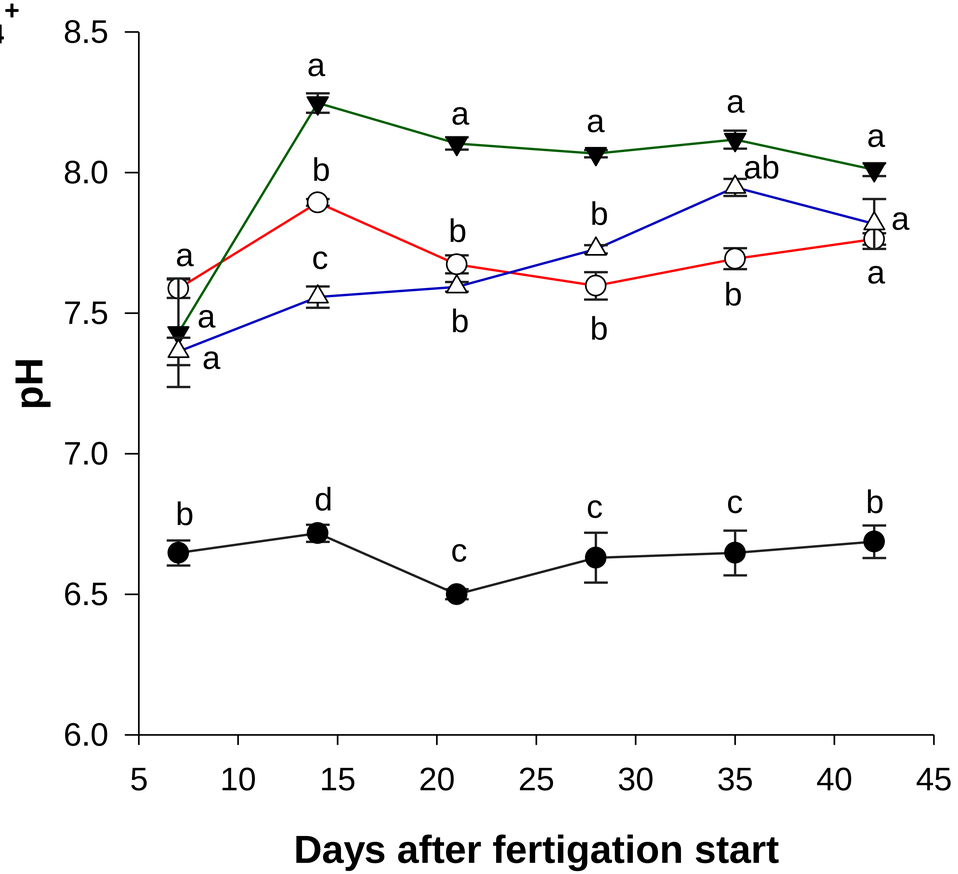
APPLIED NUTRIENT SOLUTIONS

Nutrients, pH and EC	IN	C	CL	L	LM	W
pH	6.3	6.8	6.8	7.8	7.8	7.7
EC	2.1	2.8	2.7	3.1	3	0.6
NO_3^--N	155	1	1	1	1	1
NH_4^+-N	19	73	77	126	117	1
P	28	51	11	1	1	0.1
K	227	395	390	429	427	2
Ca	139	131	89	99	98	99
Mg	27	29	26	35	34	8
S	53	57	42	24	24	28
Na	17	67	46	30	32	16
Cl	37	170	158	138	133	35
Fe	1.4	3.3	2.5	0.8	2.3	0.1
Zn	0.35	0.54	0.28	0.21	0.28	0.08
Cu	0.14	0.05	<0.02	<0.02	0.08	<0.02
B	0.2.0	0.09	0.03	<0.01	0.25	<0.01
Mn	1.11	0.52	0.2	0.06	1.28	0.03
Mo	<0.01	0.02	0.02	<0.01	<0.01	<0.01

EC AND PH IN DRAINAGE SOLUTION

Could be due to higher concentration of K^+ and NH_4^+





Due to high pH given fertigation solutions

NUTRIENTS IN DRAINAGE SOLUTION

Nutrients	IN	C	CL	L	LM	W
NO_3^--N	137^{a}	1^{b}	1^{b}	1^{b}	1^{b}	1^{b}
NH_4^+-N	4^{cd}	31^{ab}	22^{bc}	43^{a}	37^{ab}	1^{d}
P	27^{a}	28^{a}	11^{b}	2^{c}	2^{c}	2^{c}
K	205^{d}	374^{c}	473^{b}	589^{a}	513^{ab}	6^{d}
Ca	144^{a}	58^{c}	70^{bc}	56^{c}	65^{bc}	79^{b}
Mg	29^{a}	16^{c}	24^{b}	30^{a}	32^{a}	10^{d}
S	90^{a}	51^{b}	27^{c}	20^{c}	18^{c}	30^{c}
Cl	42^{b}	158^{a}	151^{a}	153^{a}	153^{a}	43^{b}
Na	23^{d}	71^{a}	54^{b}	41^{c}	42^{c}	19^{e}
Fe	0.95^{b}	1.34^{a}	0.45^{cd}	0.22^{de}	0.60^{c}	0.12^{e}
Zn	0.98^{a}	0.63^{b}	0.26^{c}	0.11^{c}	0.17^{c}	0.23^{c}
Mn	0.71^{a}	0.14^{b}	0.08^{b}	0.05^{b}	0.17^{b}	0.02^{b}
Cu	0.10^{a}	0.08^{a}	0.03^{b}	0.01^{b}	0.01^{b}	0.01^{b}
B	0.28^{a}	0.01^{c}	0.005^{c}	0.005^{c}	0.09^{b}	0.005^{c}
Mo	0.005^{a}	0.005^{a}	0.005^{a}	0.005^{a}	0.005^{a}	0.005^{a}

YIELD PARAMETERS

Treatment	Fresh weight (g plant^{-1})	Dry weight (g plant^{-1})	Leaf area (cm^2 plant^{-1})	Leaf number	Plant height (cm)
IN	265^{a}	28^{a}	4490^{a}	14.2^{a}	124^{a}
C	224^{b}	24^{b}	3994^{b}	13.3^{ab}	116^{ab}
CL	197^{c}	21^{bc}	3598^{bc}	13.2^{ab}	112^{b}
L	178^{c}	20^{c}	3159^{c}	12.8^{b}	112^{b}
LM	194^{c}	21^{bc}	3522^{c}	13.5^{ab}	113^{b}
W	147^{d}	16^{c}	2436^{d}	11.5^{c}	102^{c}

CONCLUSIONS

Organic treatments → high pH in the root zone

Fertigation with lupin sap resulted in high EC mainly due to a high K concentration

Nutrient concentrations in the applied solution and in the root zone are not always positively correlated due to high pH effects on nutrient solubility

Inorganic fertigation gave higher biomass yield than organic and extract of composted chicken manure was better than lupin sap

Many factors may have caused a lower biomass yield: higher pH, higher EC, high NH_4/NO_3, cation imbalance and nutrient deficiency


Thank You!