

# Leafminer Resistance Breeding and Application of Fish-derived Protein Hydrolysates in Lettuce

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# Breeding for Leafminer Resistance in Lettuce



- $F_2 - F_6$  plants from crosses and backcrosses between resistant genotypes and different lettuce types were selected in the field for leafminer and multiple resistance.
- Eighteen  $F_7$  to  $F_{11}$  breeding lines of green leaf, red leaf, and romaine lettuce were planted in a trial at the Spence Farm in Salinas in June 2018.

# 2018 Lettuce Leafminer Resistance Trial

## Green Leaf

<u>Genotype</u>	<u>Stings/cm<sup>2</sup></u>	<u>Plant Wt. (g)</u>	<u>Core length (cm)</u>	<u>Downy mildew</u>
Waldmann's Green	2.9 A	458.7 B	7.6 A	3.0 B
Grand Rapids	2.2 B	290.7 C	4.9 E	1.5 D
Two Star	2.1 B	598.5 A	6.4 BC	4.0 A
Shining Star	1.7 C	490.5 B	6.9 B	4.0 A
MU17-337 ( <i>cor</i> )	0.4 D	506.7 B	5.4 DE	1.8 D
MU17-340 ( <i>cor</i> )	0.4 D	635.7 A	6.5 B	1.5 D
MU17-348 ( <i>cor</i> )	0.2 D	611.3 A	6.2 BC	2.0 CD
MU17-352 ( <i>cor</i> )	0.2 D	610.8 A	5.7 CD	2.5 BC

# 2018 Lettuce Leafminer Resistance Trial

## Red Leaf

<u>Genotype</u>	<u>Stings/cm<sup>2</sup></u>	Plant <u>Wt. (g)</u>	Core <u>length (cm)</u>	<u>Tipburn</u>
Big Red	4.5 A	466.5 AB	8.8 AB	0.6 A
Prizehead	3.5 B	492.7 AB	6.2 CD	0.0 A
Red Fox	3.3 B	528.8 A	7.9 ABC	0.0 A
Lolla Rossa	2.0 C	200.0 C	5.1 D	0.0 A
Red Hot	1.9 C	188.2 C	5.4 D	0.0 A
Merlot	1.9 C	231.5 C	6.1 CD	0.0 A
MU17-344	0.7 D	498.0 AB	9.3 A	0.0 A
MU17-351	0.7 D	425.0 B	6.9 BCD	0.0 A

# 2018 Lettuce Leafminer Resistance Trial

## Romaine

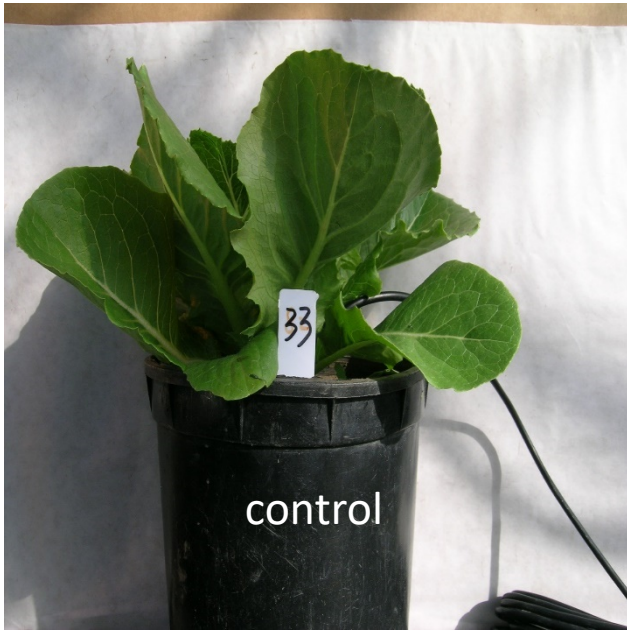
<u>Genotype</u>	<u>Stings/cm<sup>2</sup></u>	<u>Plant Wt. (g)</u>	Core	
			<u>length (cm)</u>	<u>Tipburn</u>
Green Forest	4.6 A	969.9 B	9.7 A	0.0 B
Valmaine	4.2 AB	890.0 B	7.8 C	0.3 AB
Heart's Delight	3.8 AB	1,031.5 AB	9.5 A	0.4 AB
Parris Island Cos	3.8 AB	877.0 B	7.6 CD	0.1 B
Clemente	3.2 B	1,190.9 A	9.3 AB	0.6 AB
MU17-362 ( <i>cor</i> )	0.4 C	857.2 B	7.3 CDE	0.0 B
MU17-534 ( <i>cor</i> )	0.2 C	890.3 B	6.2 E	0.6 AB
MU17-536 ( <i>cor</i> )	0.2 C	873.8 B	6.6 DE	0.0 B
MU17-361 ( <i>cor</i> )	0.2 C	861.8 B	8.2 BC	0.9 A
MU17-355	0.2 C	1,008.0 B	7.7 CD	0.0 B

# Application of Fish-derived Protein Hydrolysates in Lettuce

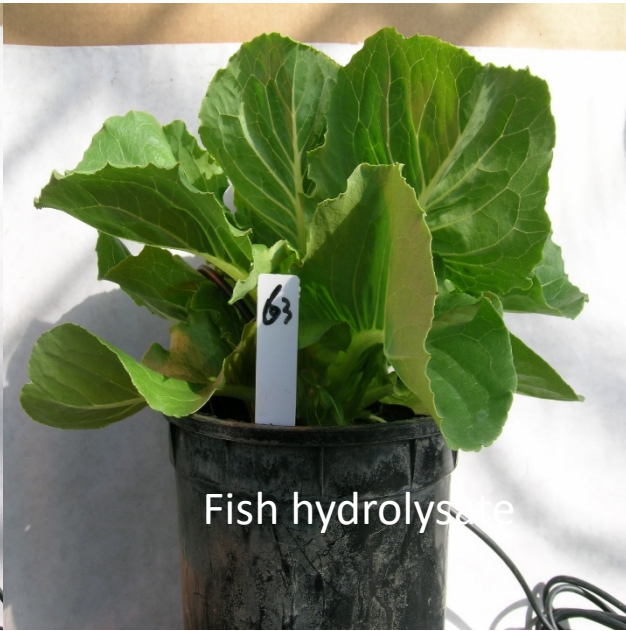
- Protein hydrolysates (PHs) consist of oligo and polypeptides and free amino acids obtained through chemical and enzymatic hydrolysis of plant or animal sources.
- PHs are biostimulants - substances enhancing plant growth and development when applied in small quantity.
- Effects of PHs on lettuce grown in soil have not been tested yet.

# Materials and Methods

- Two weeks after sowing, romaine lettuce (cv. Heart's Delight) seedlings were transplanted into 2.5 L plastic pots filled with 3 kg field soil in growth chambers.
- Plants were irrigated with water (control) or fish-derived PHs (3 mL/L) at 0, 14 and 24 days after transplanting.
- A complete randomized design was used with eight replicates for each treatment.



control

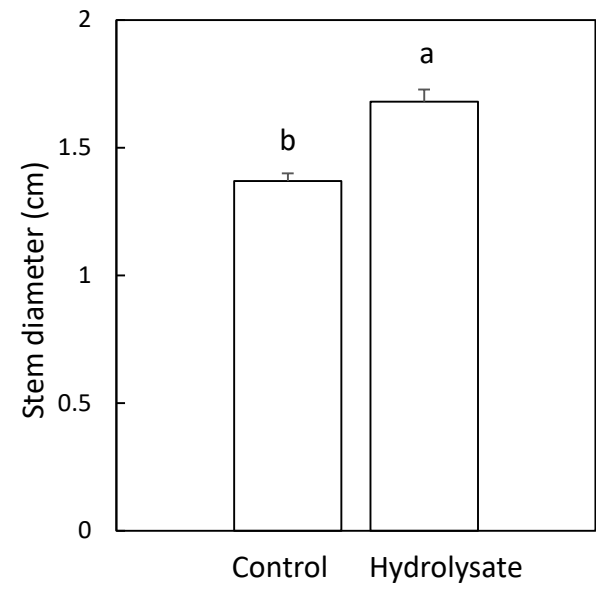
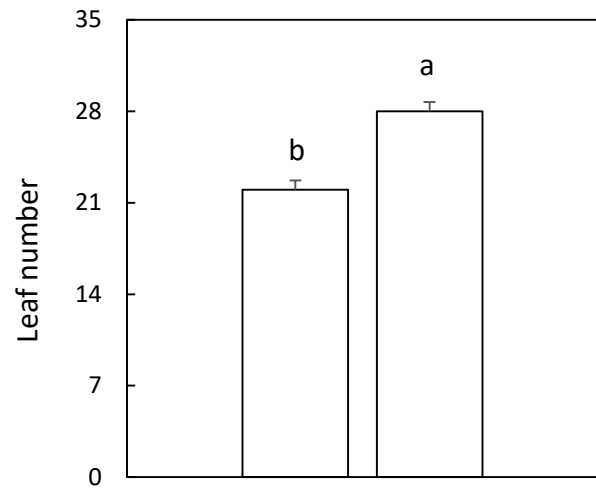


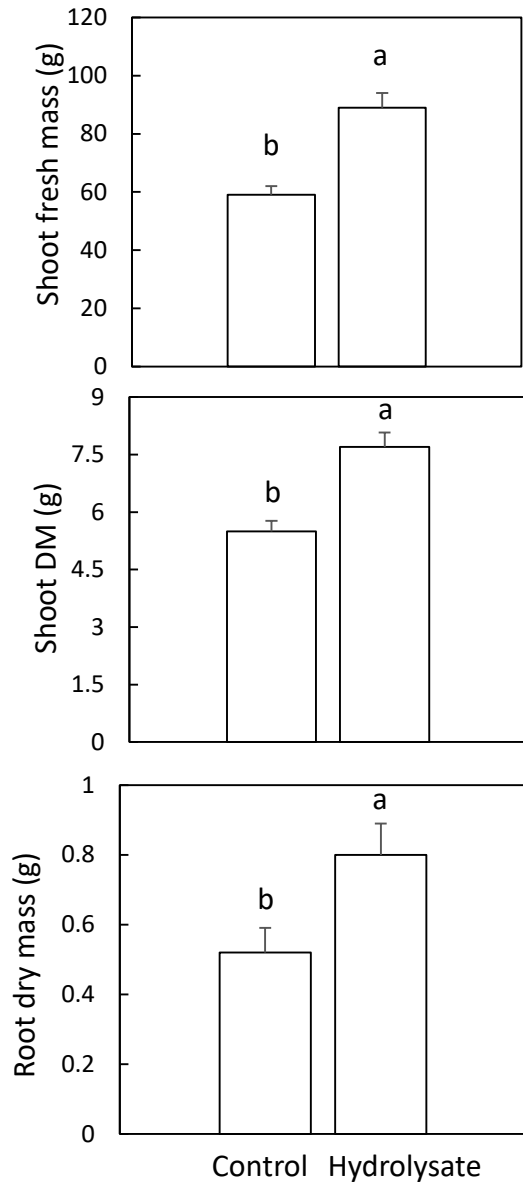
Fish hydrolysate

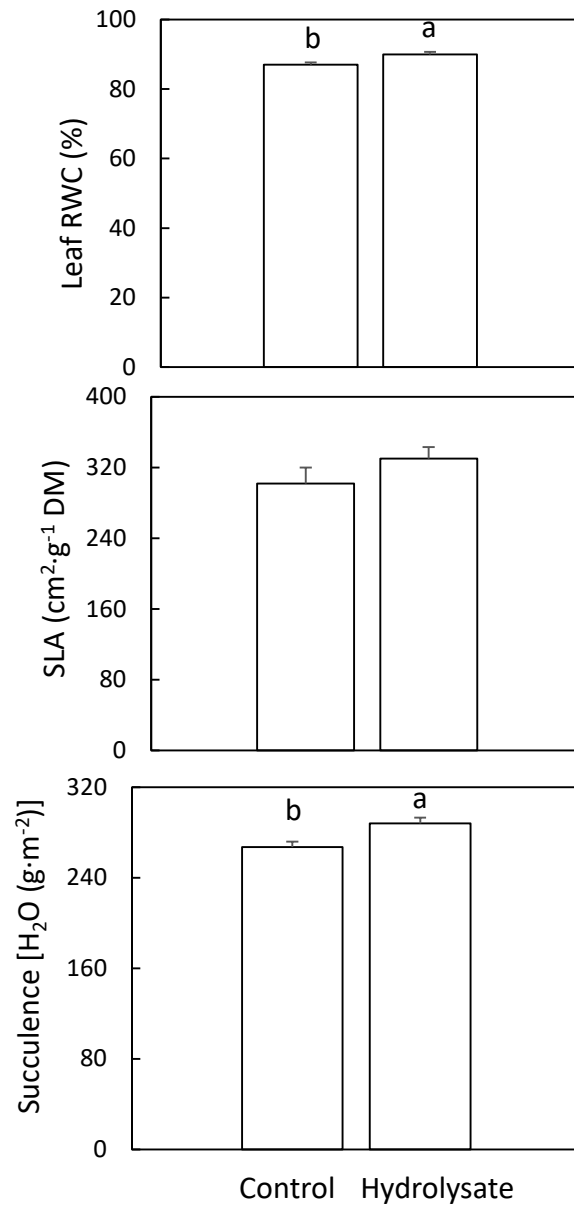


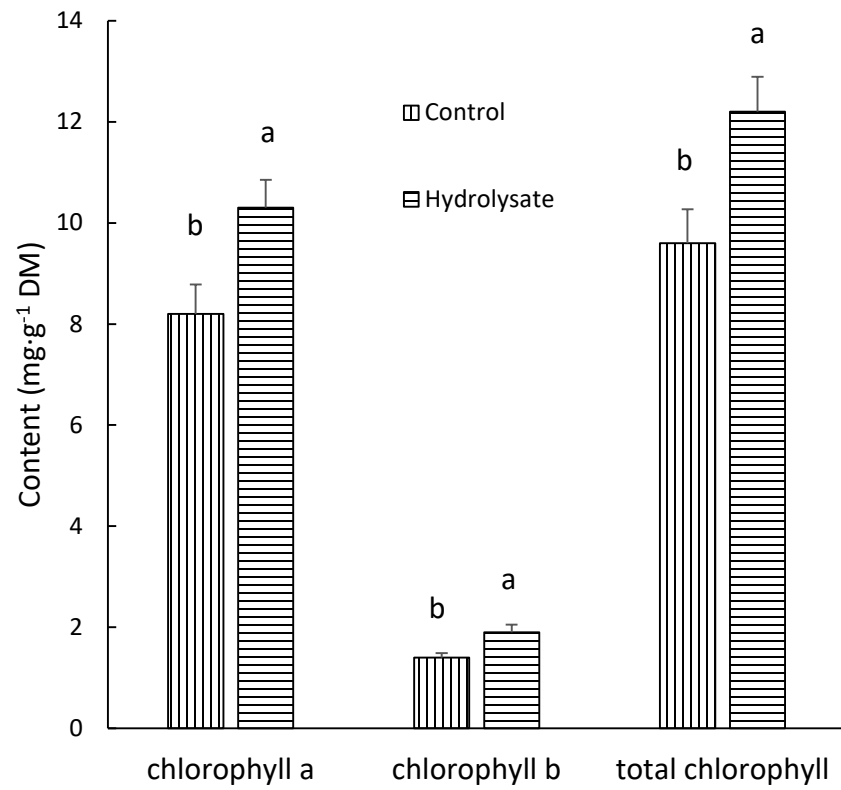
Physical and  
Chemical  
Properties of  
Soil from each  
Treatment after  
Harvesting.

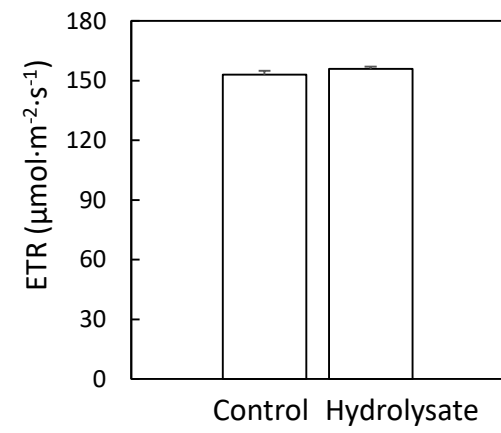
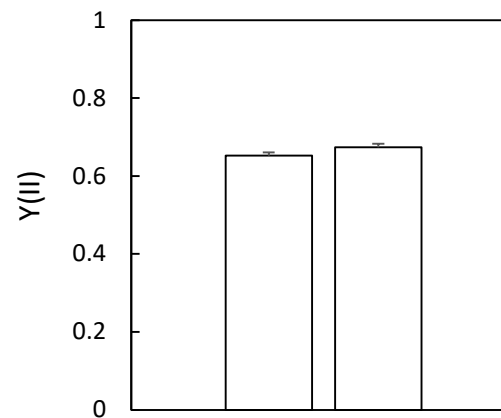
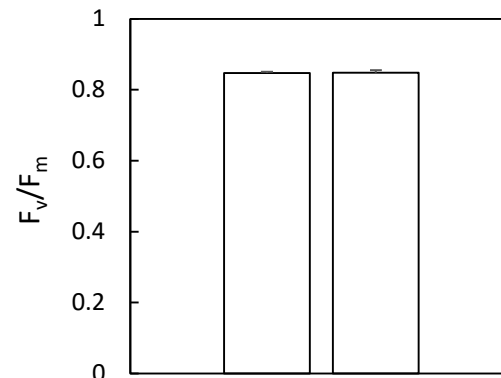
Properties	Control	PHs
NH <sub>4</sub> -N (mg/kg)	2.9	4
NO <sub>3</sub> -N (mg/kg)	23	12
P (mg/kg)	82	54
K (mg/kg)	140	250
Ca (g/kg)	1.6	2.0
Mg (mg/kg)	240	150
SO <sub>4</sub> (mg/kg)	175	32
Cu (mg/kg)	0.63	0.38
Zn (mg/kg)	3.4	3.3
Fe (mg/kg)	14	50
Mn (mg/kg)	7.4	4.5
B (mg/kg)	0.54	0.10
Na (mg/kg)	150	40
Cl (mg/kg)	105	100
pH	6.8	5.4
EC (dS/m)	2.2	1.3
Organic matter (%)	2.6	2.6
Organic carbon (%)	1.5	1.5
CEC (meq/100 g)	11.0	7.8

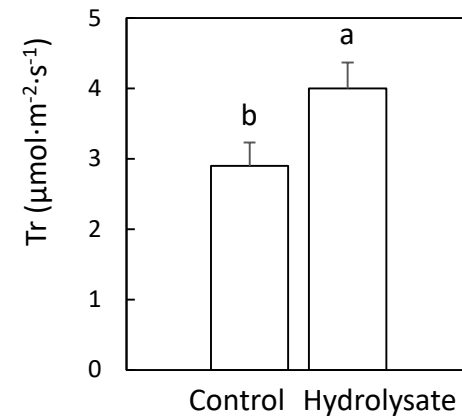
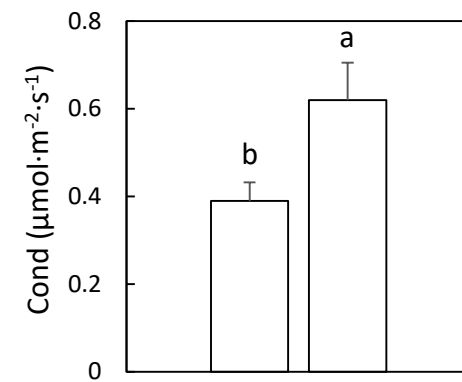
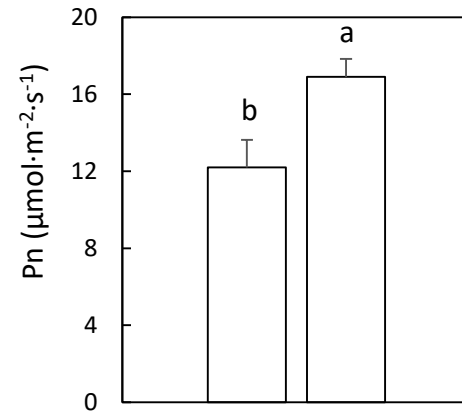












Control Hydrolysate

# Summary

- Eighteen F7 to F11 breeding lines of green leaf, red leaf, and romaine lettuce had high levels of resistance to leafminers, tipburn, corky root, downy mildew, and/or acceptable horticultural traits in field trials.
- Fish-derived protein hydrolysates (PHs), as biostimulant, significantly increased the leaf number, stem diameter, shoot FW and DW, root DW, leaf RWC, and succulence, enhanced leaf chlorophyll content, photosynthesis, and gas exchange, and have potential to be used for sustainable production of lettuce.
- The growth enhancement by PHs might result from increased uptake, assimilation and metabolism of nutrients, improvement of microbial activity, micronutrient mobility and solubility, increases in root length and density, and activities of enzymes involved in nutrient metabolism.





Questions?