



**BioAtlantis**

Nature Working Naturally®

***“Use of natural bioactive compounds to mitigate oxidative stress and increase fruit set in avocados”***

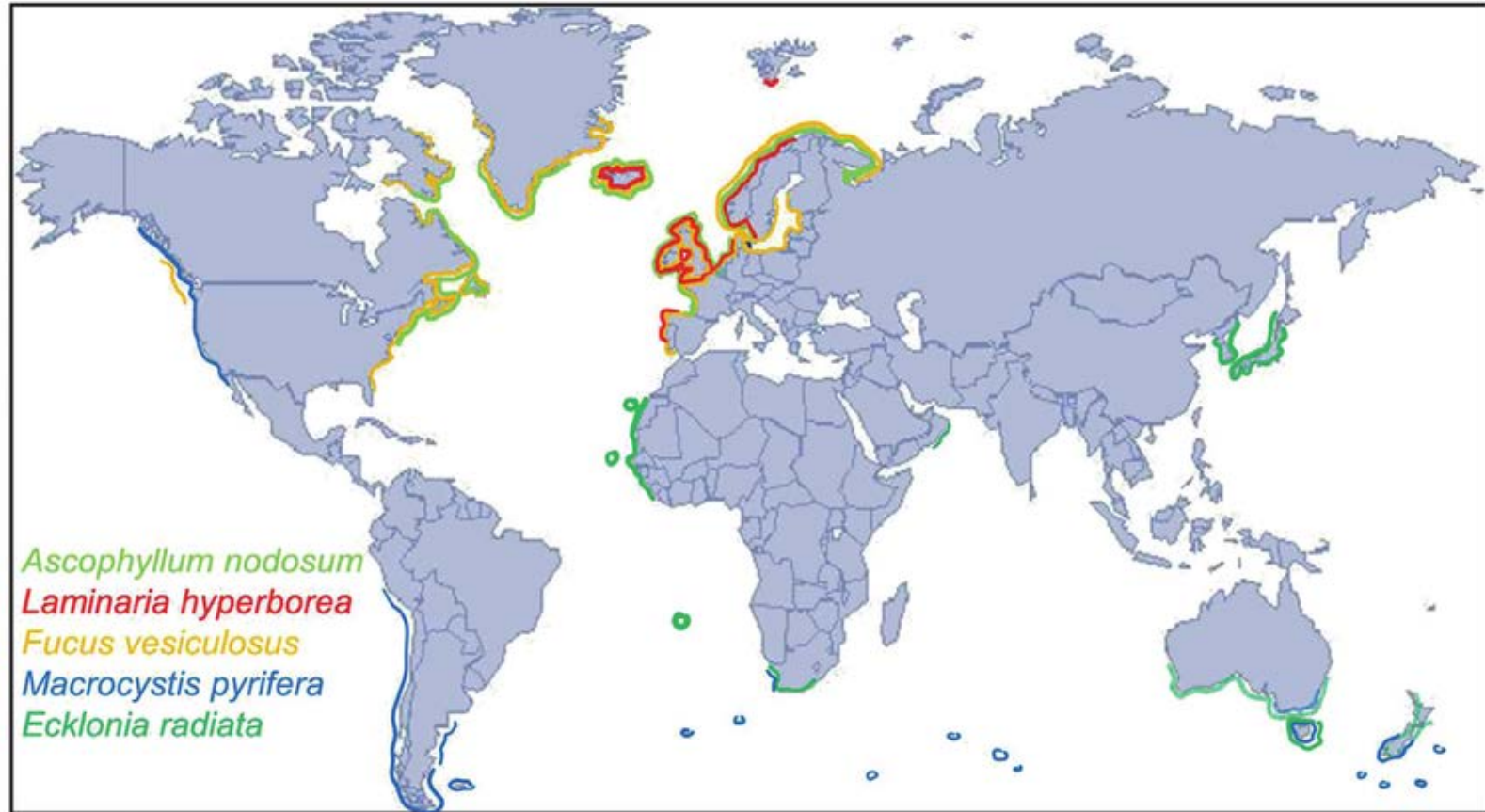
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Name	Fucoidan	Phlorotannin	Laminarin
<b>Definition</b>	Polysaccharide Fucose main constituent.	Polyphenol compound. Type of Tannin	Polysaccharide of glucose
<b>Human Health Benefits</b>	Anticancer, Cholesterol and blood pressure reduction, Anti-virus action	Antioxidant, Anti inflammatory, Anticancer and Antidiabetic.	Antioxidant, Antimicrobial, Antifungal, Intestinal microflora promoter.
<b>Main sources of origin</b>	Brown seaweed	Brown and red seaweed	Brown seaweed



# Bioactive comparisson



Product Name	Specie	Physic-Chemical Composition			Bioactive composition			
		SG (density) (g/cc)	pH	Dry Matter (g/L)	Fucoidan (g/L)	Phlorotanins (g/L)	Laminarin (g/L)	Mannitol (g/L)
<b>Super Fifty® Prime</b>	<i>Ascophyllun nodosum</i>	1.23	5-6	500	<b>73</b>	<b>35</b>	<b>8</b>	<b>12</b>
Commercial Brand 1	<i>Ascophyllun nodosum</i>	1.11	8	220	22	13	3	11
Commercial Brand 2	<i>Ascophyllun nodosum</i>	1.13	5.6	308	N/D	0.9	N/D	2
Commercial Brand 3	<i>Ascophyllun nodosum</i>	1.2	7.7	398	N/D	3.1	N/D	6.6
Commercial Brand 4	<i>Ascophyllun nodosum</i>	1.26	7.4	466	5.1	16	N/D	N/D
Commercial Brand 5	<i>Ascophyllun nodosum</i>	1.14	N/A	250	17.8	10.5	2.5	N/D
Commercial Brand 6	<i>Ecklonia maxima</i>	1.02	5-Apr	23	1.25	0.2	1.03	2.5
Commercial Brand 7	<i>Ecklonia maxima</i>	1.01	5-Apr	25	N/D	0.18	0.65	N/D
Commercial Brand 8	<i>Macrocystis</i>	0.99	N/A	56	0	0.5	N/D	0
Commercial Brand 9	<i>Druvillea a.</i>	1.12	4.5	294	N/D	1.8	N/D	6.3

Source: Internal QC analysis



## ◆ Bioactive compounds with multiple metabolic functions.

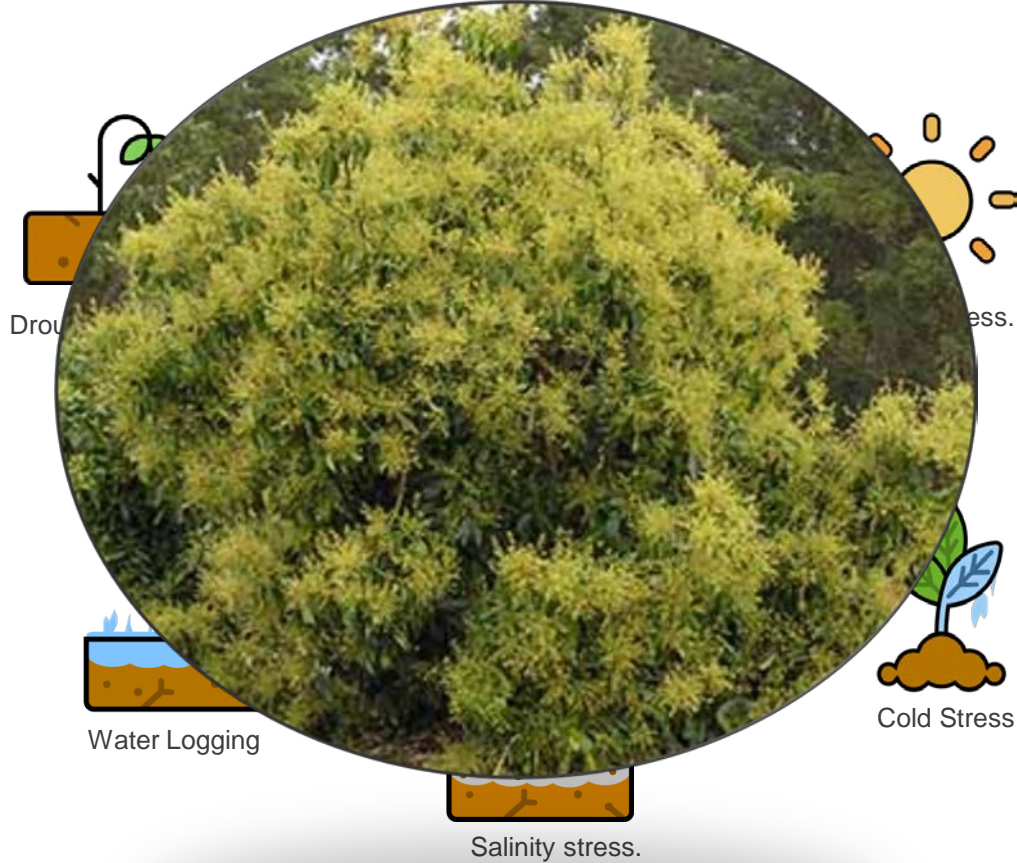
- |                        |                           |
|------------------------|---------------------------|
| ◆ <i>Phlorotannins</i> | ◆ <i>Antioxidants</i>     |
| ◆ <i>Fucoidan</i>      | ◆ <i>Plant priming</i>    |
| ◆ <i>Laminarin</i>     | ◆ <i>Plant defense</i>    |
| ◆ <i>Mannitol</i>      | ◆ <i>Osmoprotection</i>   |
| ◆ <i>Alginate</i>      | ◆ <i>Stress reduction</i> |

## ◆ Highly effective on gene modulation of plant metabolism

- |  |                                   |
|--|-----------------------------------|
| ◆ Reduction of ROS (oxidative stress)        | ◆ Antioxidants induction          |
| ◆ Cell wall strengthening.                   | ◆ Photosynthesis activation       |
| ◆ Water channel regulation (drought stress). | ◆ Improve shoot meristem activity |
| ◆ Stomatal adjustments (drought stress).     | ◆ Plant hormonal response         |



Reproductive Stress



Drou

ess.

Water Logging

Cold Stress

Salinity stress.





“Is a complex chemical and physiological phenomenon that accompanies virtually all biotic and abiotic stresses in higher plants and develops as a result of overproduction and accumulation of reactive oxygen species (ROS)”

**ROS**  
(Super oxide ( $O_2^-$ ), Hydroxyl ( $OH^*$ ), Hydrogen peroxide ( $H_2O_2$ ))  
**concentration gradient**

(ROS balance is required in plants)



**In non-stressed crops, low levels of ROS act as signalling molecule for plant development**

- ◆ Pollen tube development.
- ◆ Seed germination & root hair growth.

(Ref: Sing et al, 2016, Frontiers in plant science)



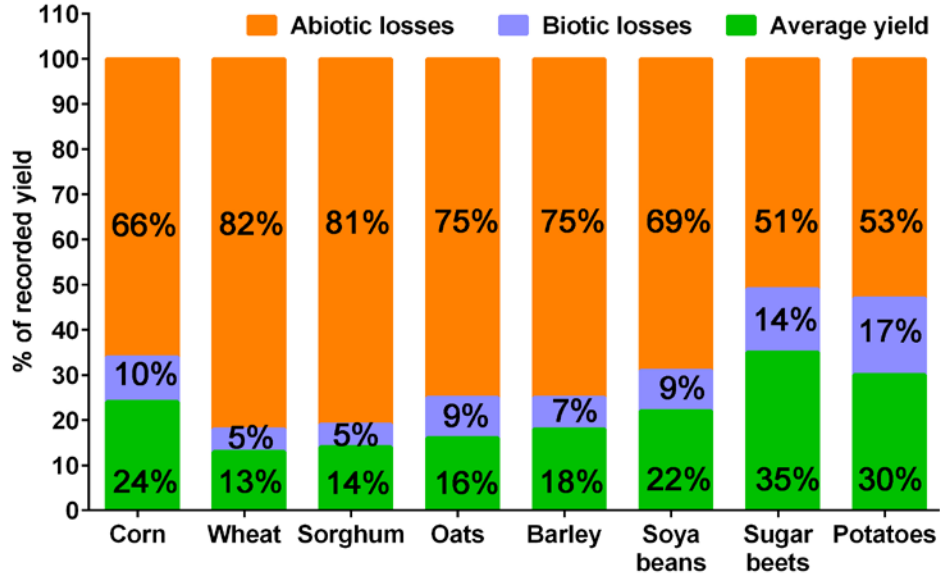
**In stressed crops, higher ROS accumulation is toxic, induces oxidative reactions in plants**

- ◆ Impaired growth & development.
- ◆ Increased cell death and crop losses.

(Ref: Petrov et al, 2015, Frontiers in plant science).



### Yield losses due to abiotic & biotic stresses



### Potential yield loss:

- 70% due to Abiotic Stress.
- 10% due to Biotic Stress.

### Average production:

- ~20% of genetic potential.

### References:

(1) FAO stats 2013, (2) Bray *et al* 2002, (3) Buchanan *et al* 2000.





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## Scientific Validation





## Sponsors & Participants

- Potsdam University (Germany), Crop Strengthen project, EU funded, 2020
- <https://www.uni-potsdam.de/en/cropstrengthen/overview>
- BioAtlantis Ltd. (Ireland) and Enza Zaden R&D B.V.,(Netherlands.)



## Project Goals

- Develop novel methods for increasing crop strength and resistance to stress by alternative genetic and genomic, non-GMO, technologies.
- Assess Super Fifty® pre-treatment on drought tolerance for 10 days in Tomatoes (cv. Heinz 1706)

## Materials & Methods

- Transcriptomics & Bioinformatics
- RNA-seq using Next Generation Sequencing (NGS).
- Differential gene expression analysis (DGE).



Treatments

T0: UTC

T1: Stress

T2: SF+ Stress

Drought conditions

No drought, normal water

10 days of 100% drought

10 days 100% drought + SF

Visual and physical results



Differential in Gene Expression

Total Genes: 3038 (↑ 1370 ↓ 1668)

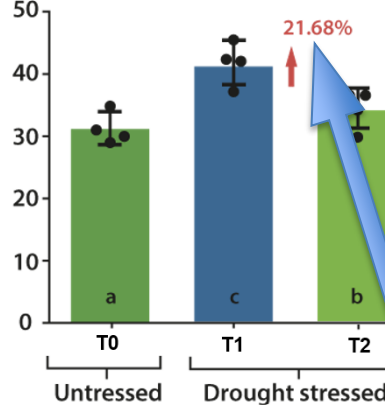
Total Genes: 164 (↑ 135 ↓ 29)

Type of response

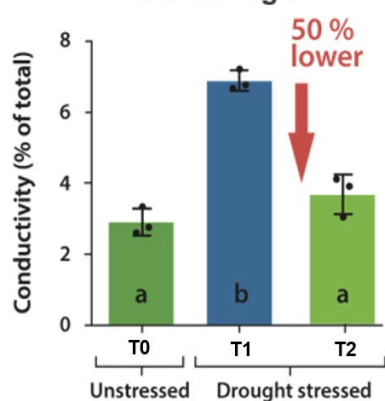
Drought Stress

Drought Tolerance

H<sub>2</sub>O<sub>2</sub> accumulation in leaves



Ion leakage



UP regulate d-Genes Function

PsaW, PsaF, PsaH Photosynthesis

PYL8 RCAR3 Stomatal movement









XTH1,2, PME12 Cell wall strength

APX ROS Detoxification

TIP2.1, XIP 1.1,1, SFP5 Regulation of water channels

# Scientific Validation | Oxidative/herbicide stress tolerance in Arabidopsis



Treatments	T0	T1	T2	T3
Foliar spray	H2O+H2O	H2O + PQ (10µM)	SF + PQ (10µM)	SF + H2O
Visual Results				
Trypan blue staining - dead cells (dark blue)				
Parameter	Total Gene Expression (TTM values)			
Photosynthesis	19172	8971	21234	22464
Carbohydrates M.	105	72	184	186
ROS Detoxific.	1335	854	1911	1837
Autophagy	150	277	83	80
Conclusion	Super Fifty® pre-treated plants reduce damage on the leaves and ion leakage by 98%			

Source: International Journal of Molecular Science, Neerakkal, *et al*, 2020



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## Field Validation in Avocados





**TRIAL INFORMATION**

**Goal** Evaluate foliar application during Bloom-fruit set and overall yield

**Grower/ Location** Agrícola Lomas de Pochay, La Cruz, Chile

**Orchard info**

- 110 ha orchard.
- Hass/Dusa
- Planted 2017 (2 Ha)
- Spacing 6x3 m
- 555 plants/ha
- Irrigation system: Netafim sprinkler 35 L/Hr.







## TRIAL INFORMATION

- Treatments**
- T0:** Control
  - T1:** PGR, Uniconzol, 1%, 1 application early bloom
  - T2:** BioA, SuperFifty, 1.5 L/ha, 3 application from early bloom to early fruit set

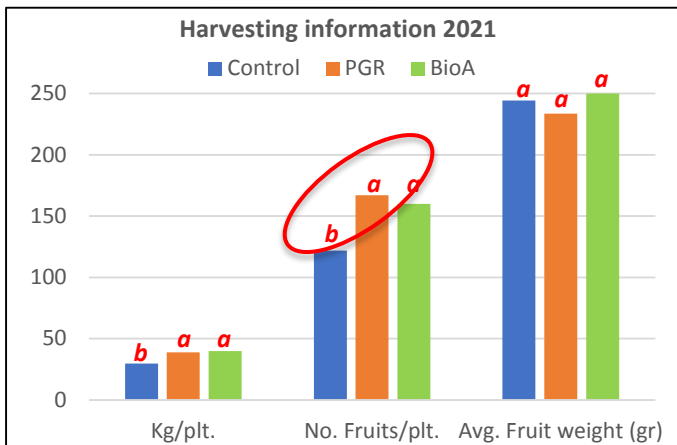
- Application**
- Foliar application, 250 L/ha to the flower panicles

- Comment**
- Harvest date: Sept. 2021 and Oct. 2022
  - 8 Rep./treatment
  - Statistics: Tukey & Scott-Knott ( $p < 0.05$ )

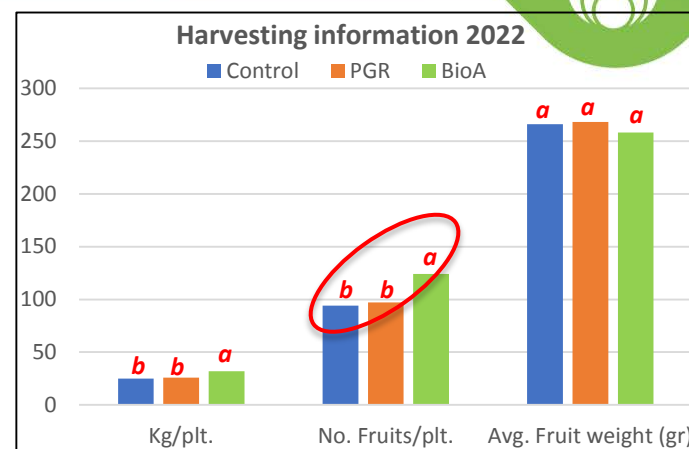
**Source** BioAtlantis – Summit Agro Chile, 2022

## CONCLUSIONS

- Increased accumulative yield by 31% vs Control and 11% vs PGR.
- Accumulative ROI vs Control: 85:1**
- Accumulative ROI vs PGR: 39:1**



RESULTS	2021		
	Control	PGR	BioA
Kg/plant	30	39	40
No. Fruits/plant	122	167	160
Avg. Fruit weight (gr)	246	234	250
Yield (Kg/ha)	16,650	21,645	22,200
U\$/KG	1.5	1.5	1.5
Total Income U\$/Ha	24,975	32,468	33,300
Application Cost (U\$/Ha)	0	420	81
Net Income U\$/Ha	24,975	32,048	33,219
ROI vs T0		16	101
ROI T2 vs T1			13



RESULTS	2022		
	Control	PGR	BioA
Kg/plant	25	26	32
No. Fruits/plant	95	97	124
Avg. Fruit weight (gr)	263	268	258
Yield (Kg/ha)	13,875	14,430	17,760
U\$/KG	1.5	1.5	1.5
Total Income U\$/Ha	20,813	21,645	26,640
Application Cost (U\$/Ha)	0	420	81
Net Income U\$/Ha	20,813	21,225	26,559
ROI vs T0		0	70
ROI T2 vs T1			65



- ◆ Irish science-based company founded in 2004, located in Tralee, County Kerry.
- ◆ Our Mission is to develop technologies based on beneficial compounds extracted from natural resources.



- ◆ Strong focus in R&D and scientific validation
- ◆ Largest extraction facilities in the British isles
- ◆ Global presence in more than 35 countries



**Nga mihi nui !!!**

**Thanks a lot !!!**

**Muchas gracias !!!**

