



# SolACE

Solutions for improving Agroecosystem and  
Crop Efficiency for water and nutrient use


# Proceedings of the Third SolACE Stakeholder Event

Dundee, Scotland

October 9, 2019



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## The Third SolACE Stakeholder Event

The third Stakeholder Event of SolACE - *Solutions for improving Agroecosystem and Crop Efficiency for water and nutrient use*<sup>1</sup> - took place on October 9, 2019, in Dundee, Scotland.<sup>2</sup> The event was held together with SolACE sister project TomRes – *A novel and integrated approach to increase multiple and combined stress tolerance in plants using tomato as a model*<sup>3</sup> – and was hosted by the James Hutton Institute (JHI). The event took place as part of the SolACE and TomRes annual project meetings, providing an opportunity for exchange between the two projects.

During the Stakeholder Event, SolACE and TomRes project partners presented innovations that are being tested in the projects with the aim to receive feedback and comments. The “Dragon’s Den” approach, which was successful at the second Stakeholder event in Foggia (Italy), was used: SolACE and TomRes partners presented their innovations for the stakeholders (the “dragons”), who, in turn, asked critical questions. The stakeholders that were present were very interested in the innovations and had a lot of questions for the presenters.

The following innovations were presented and discussed:

- › Adapted tillage practices and wheat genotypes to reduce external inputs into agriculture
- › Water and nutrient stress stress-resilient tomato genotypes
- › Humble Potato Hidden Treasure Unlocked
- › Biostimulants in tomato under stress
- › Field application of microbial inoculants using DCM’s MINIGRAN® technology
- › A powerful and cheap molecular tool to obtain the varietal composition of durum (or any species) mixtures (and some other applications)

For these proceedings, we have included the presentations as well as the questions and answers from stakeholders and presenters, respectively.

## Programme

- › Welcome and introduction to the event and the 'Dragon's Den' approach  
*Niki Rust, Newcastle University, UnK (SolACE)*
- › Adapted tillage practices and wheat genotypes to reduce external inputs into agriculture  
*Sarah Symanczik, Research Institute of Organic Agriculture, Switzerland (SolACE)*
- › Water and nutrient stress-resilient tomato genotypes  
*Giorgia Batelli, National Research Council, Italy (TomRes)*
- › Humble Potato Hidden Treasure Unlocked  
*Michiel De Vries, Solynta, the Netherlands (SolACE)*

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<sup>1</sup> More information about SolACE is available on [www.solace-eu.net](http://www.solace-eu.net).

<sup>2</sup> Information on the SolACE stakeholder events is available from <https://www.solace-eu.net/service/stakeholder-events.html>

<sup>3</sup> The TomRes project is funded under Horizon 2020, Grant agreement ID: 727929. More information is available at <https://cordis.europa.eu/project/id/727929> and [www.tomres.eu](http://www.tomres.eu).



- Biostimulants in tomato under stress  
*Eleonora Deva, Strigolab, Italy (TomRes)*
- Field application of microbial inoculants using DCM's MINIGRAN® technology  
*Hervé Dupré de Boulois, DCM, Belgium (SolACE)*
- A powerful and cheap molecular tool to obtain the varietal composition of durum (or any species) mixtures (and some other applications)  
*Jacques David, Inra-Montpellier SupAgro, France (SolACE)*
- Closing remarks  
*Niki Rust, Newcastle University, UK (SolACE)*



# Adapted tillage practices and wheat genotypes to reduce external inputs into agriculture

SARAH SYMANCZIK<sup>4</sup>

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**SolACE**  
Solutions for Improving Agroecosystems and  
Crop Efficiency for water and nutrient use


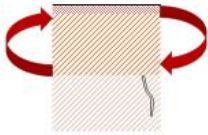


**Adapted tillage practices and wheat genotypes to reduce external inputs into agriculture**

Sarah Symanczik, Maïke Krauss, Paul Mäder, Research Institute of Organic Agriculture  
Miguel Soares, Gottlieb Basch, University of Evora  
Miguel Quemada, Technical University of Madrid

SolACE stakeholder event  
Dundee, 9. October 2019

### What is conservation tillage?


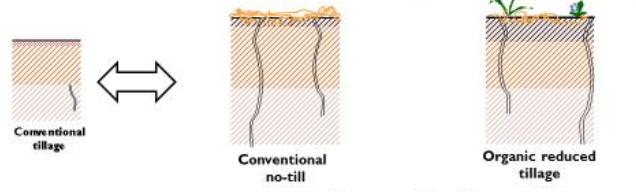



**Conventional tillage**

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4. Februar 2020 2

### What is conservation tillage?

**Conventional tillage**      **Conventional no-till**      **Organic reduced tillage**

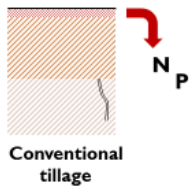
**Conservation tillage**

**FiBL** www.fibl.org

4. Februar 2020 3

### Why do we apply conservation tillage?

- Loss of SOC
- Erosion, Degradation
- Nutrient run off + leaching

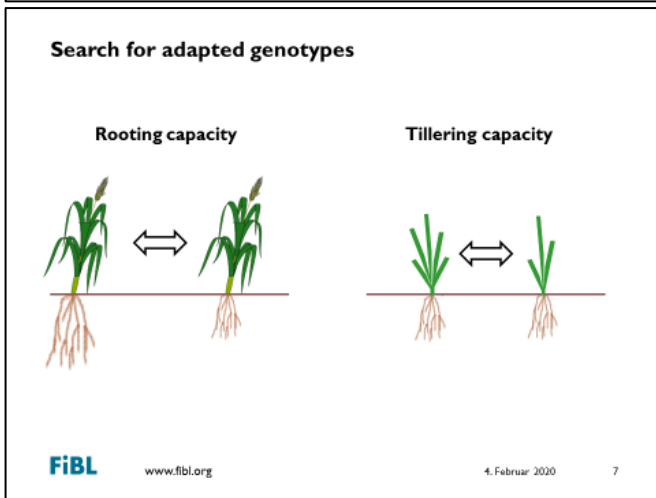
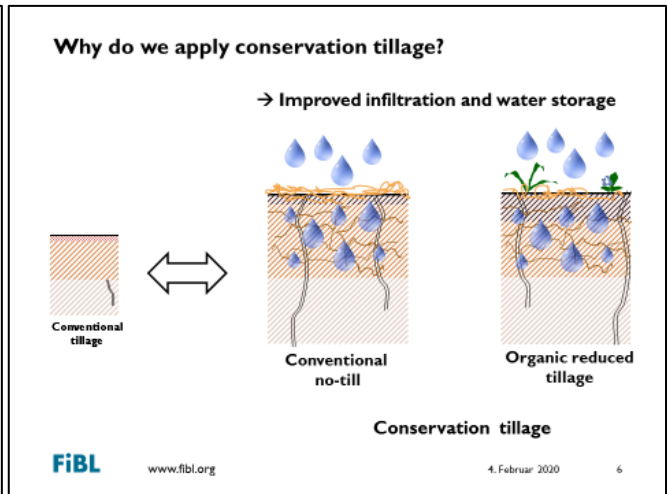
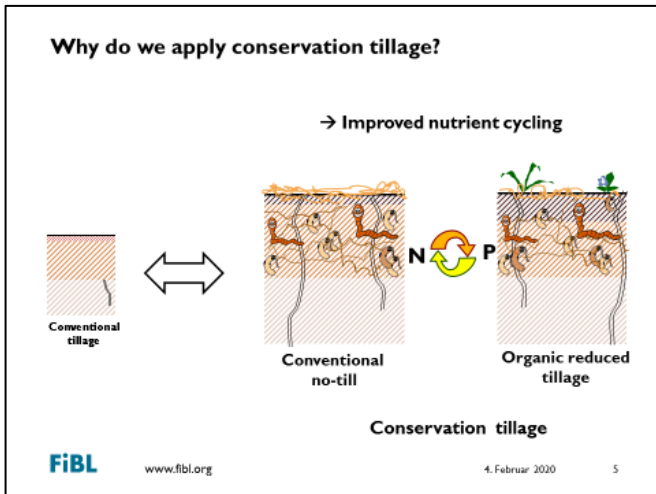


**Conventional tillage**

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<sup>4</sup> Sarah Symanczik, Research Institute of Organic Agriculture (FiBL), Switzerland, SolACE



**Many thanks for your attention**

**Questions?**

FiBL      www.fibl.org      4. Februar 2020      8

## Discussion

**Question: You mentioned tillering capacity. Why is that?**

Answer: It is an interesting wheat trait when dealing with competition with weeds. Some genotypes produce tillers faster in the early stages. This is especially important for reduced tillage in organic agriculture because we don't apply herbicides. So if soil is covered with more tillers at early stages, it is better for competition against the weeds.

**Q: Do you find yield differences?**

A: In Portugal, after the first year of trials, we didn't find any difference between the two tillage systems – conventional and no-till.

In our trials in Switzerland, where we do reduced tillage in organic agriculture, there are differences between varieties. There was at least one variety that even performed slightly better under reduced tillage than under conventional. So it is up to us to find genotypes that are more adapted to lower soil disturbance than others.



We also want to reduce the inputs we use in agriculture. In the Swiss trials, the conventional system needs a lot of nutrients in order to perform well in terms of yield. In reduced tillage, although the yield is sometimes slightly lower, it is not as dependent on inputs. In some systems, it performed just as well with half of the nutrient inputs.

**Q: You didn't mention some of the problems associated with no-till and leaving residues, like certain diseases. Can you tell us more about that?**

A: There are actually some diseases that might increase under no-till, and if you retain residues, which can be the cause of some fungal diseases. However, if you introduce a well-selected crop rotation, you can also overcome these problems. In addition, some diseases might even decrease, as beneficial soil microbes such as arbuscular mycorrhizal fungi and other plant growth-promoting bacteria and fungi can better proliferate due to the lower disturbance of the soil.

**Q: It's important to emphasise that if we encourage farmers to use reduced tillage, it is absolutely essential to have a breeding programme that provides genotypes that thrive in those systems. It's really obvious that there are differences between the soil conditions in reduced tillage and conventional systems and traits – particularly below-ground traits – will be quite different. So I think that breeding programs for this are absolutely essential.**

A: Yes, that's true. When searching for the varieties we are testing, we wanted to get varieties with contrasting traits so that we can identify the impact of the different traits.

**Q: Some systems can take 7-9 years to transition. There are too many experiments on conservation agriculture going on in systems that have not yet transitioned and are essentially conventional systems. We need to set up platforms, especially for experiments of this nature.**

A: I completely agree. For every system, you have a residual effect from your previous system. You need time to adapt in order to see the real picture. It is really important to have long-term trials to get a realistic picture.

**Q: One of the functions of conventional tillage is to control weed populations. How do you use reduced tillage or conservation agriculture in organic farming, if you can't use herbicides?**

A: Crop rotation is a very important feature for that. For example, alternating winter crops and summer crops can help to reduce weeds quite a lot.

**Q: Did you do economic comparisons as well? Or full cost accounting? Maybe reduced emissions, inputs, etc., can offset lower yield.**

A: Yes, we do life cycle assessments to measure these aspects, but this will only be done after the second year once the field trials have been completed.





## Water and nutrient stress resilient tomato genotypes

GIORGIA BATELLI<sup>5</sup>

### DUNDEE MEETING

### TOMRES-SolACE Stakeholder Event

### Water and nutrient stress resilient tomato genotypes

### Giorgia Batelli (CNR)

TOMRES

The project is funded by the  
European Union under  
Horizon2020



**The problem**

Tomatoes, like every plant, are **sessile** organisms, fixed in one place

They cannot go around looking for **food** (nutrients) and **water**

To meet the plants needs for nutrients and water in agriculture, farmers use a lot of resources (inputs).

To reduce the inputs in agriculture, we can:

1. Improve Management Practices.
2. Look for genotypes which can survive and produce with less inputs: **STRESS RESILIENT genotype**


<sup>5</sup> Giorgia Batelli, National Research Council, Italy, TomRes



## The gold mine

There's thousands of tomato genotypes



TOMRES



Produced by  
breeders/scientists



Selected by farmers  
for local environments



## Which genotypes can work with less inputs?

TOMRES

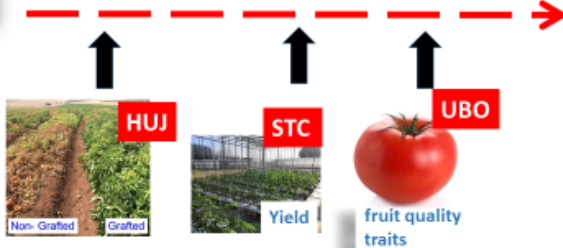
Genotype	Year	Origin	Parent(s)
1	1980	Italy	...
2	1985	Spain	...
3	1990	France	...
4	1995	USA	...
5	2000	Japan	...
6	2005	China	...
7	2010	India	...
8	2015	Mexico	...
9	2018	Peru	...
10	2020	Egypt	...
11	2022	Kenya	...
12	2023	South Africa	...
13	2024	USA	...
14	2025	Italy	...
15	2026	Spain	...
16	2027	France	...
17	2028	Germany	...
18	2029	UK	...
19	2030	Canada	...
20	2031	Australia	...
21	2032	India	...
22	2033	China	...
23	2034	Japan	...
24	2035	South Korea	...
25	2036	USA	...
26	2037	Mexico	...
27	2038	Peru	...
28	2039	Egypt	...
29	2040	Kenya	...
30	2041	South Africa	...
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44	2055	Mexico	...
45	2056	Peru	...
46	2057	Egypt	...
47	2058	Kenya	...
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59	2070	Japan	...
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84	2095	South Africa	...
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87	2098	Spain	...
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92	2103	Australia	...
93	2104	India	...
94	2105	China	...
95	2106	Japan	...
96	2107	South Korea	...
97	2108	USA	...
98	2109	Mexico	...
99	2110	Peru	...
100	2111	Egypt	...
101	2112	Kenya	...
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191	2202	Kenya	...
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295	2306	USA	...
296	2307	Mexico	...
297	2308	Peru	...
298	2309	Egypt	...
299	2310	Kenya	...
300	2311	South Africa	...

The TOMRES tools to answer this question:

Different environments, setups, tools to verify tolerance

NDVI Thermography *In vivo* leaf gas exchange, including iWUE

*Genotypes are characterized for different traits, and environments. Selected lines outperform others in several experiments*



Non-Grafted Grafted

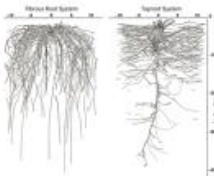
Yield

fruit quality traits

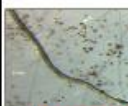


## Which traits promote resilience?

TOMRES



Root system architecture traits.



Lines where improved W/NUE when associated with AMF-root colonization

UNITO

Gene variations; Hormone Responses etc



Many partners

*Resilience promoting traits identified*



SolACE

Proceedings of the Third SolACE Stakeholder Event  
October 9, 2018, Dundee, Scotland

## Discussion

**Question: You didn't mention quality. How important is quality for the production of drought and nutrient deficient varieties?**

Answer: One of the partners is assessing quality under stress conditions. In some of the genotypes, quality is virtually unchanged in the tolerant genotypes. What can change is the yield. We are looking into that.

**Q: Are you looking for drought stress-resilient genotypes for field cultivation or also for greenhouse cultivation?**

A: We have different types of tomatoes. We have tomatoes in the open field, but we also have cherry tomatoes grown in greenhouses.

**Q: In the greenhouse, you also need to have stress tolerance?**

A: Well, you can always reduce the inputs. We are most interested in the combined stress of drought – water deficit and nutrient stress. But really, the aim is to reduce inputs, even in the greenhouse.

**Q: Do you have first results about root traits? Can you say something about what kind of root has been better for plant stress?**

A: We don't have final results. What we have observed is that some of the adapted varieties have longer root systems, but this is not yet finalised.

**Q: For the traits, are they assessed in artificial conditions, platforms or real conditions?**

A: They are not tested in real soil, but we have different systems. For example, in Naples, we are using sand. In Nottingham, we are using a field soil-sand mix.



# Humble Potato Hidden Treasure Unlocked

MICHEL DE VRIES<sup>6</sup>

**Humble Potato Hidden Treasure Unlocked**  
*Highly recommended food security crop triples yield and halves pesticides use  
More with less*






**Potato potential unleashed through tiny true seeds**

**25 grams** to plant a hectare **2500 kilo**



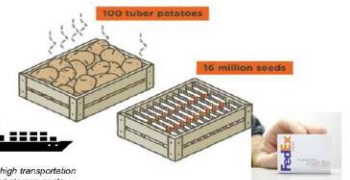
<sup>6</sup> Michiel De Vries, Solynta, the Netherlands, SolACE

25 grams to plant a hectare 2500 kilo

diseased contaminated healthy, pristine


## So, seed instead of tubers, is this important, ....



102 tuber potatoes 16 million seeds



10 copies



25,000,000 copies

Very high transportation and storage costs






experimental trials yield / ha

local average

Trial	Yield (t/ha)
Local Average	~4
Trial 1	~8
Trial 2	~10
Trial 3	~10
Trial 4	~16
Trial 5	~18
Trial 6	~19
Trial 7	~19
Trial 8	~23
Trial 9	~28
Trial 10	~28





*Highly recommended food security crop triples yield and halves pesticides use*

*more with less*



Solynta 6

## Humble Potato Hidden Treasure Unlocked

*Highly recommended food security crop triples yield and halves pesticides use  
More with less*



Potato potential unleashed through tiny true seeds

### Discussion

**Question: Seeds are not automatically free of diseases. I understand your point because you compare it to a tuber, but they are not automatically free of disease.**

Answer: Within the European Union, there are no diseases known for potato seed. This doesn't mean that they do not exist. But outside the EU, there are three viroids that are seed transmittable.

**Question: When you provide the seed to the farmer, I guess he needs to produce the seedlings before planting them in the field. Or can you plant the seed directly in the field?**

A: That is an option, but there are quite a lot of crops, where the farmer is supplied with seedlings by nurseries, rather than just receiving the seeds.

**Q: In your business model, are you going to sell to the farmer directly or to the nurseries or to both?**

A: Both. It depends on the local economic conditions. It can be too expensive to do that whereas in other cases it can be a very good option.



SolACE

Proceedings of the Third SolACE Stakeholder Event  
October 9, 2018, Dundee, Scotland

**Q: Is there any change in the crop cycles when you sow it from the seed?**

A: If you have the same genotype in true seed and in the seed tuber, the cropping cycle is longer in a true seed than a tuber by about two to four weeks.

**Q: Compared to the classical tubers, do you think another variety would be faster?**

Yes

**Q: How do you register your variety?**

A: We are in the registration process in several countries. It depends on the regulations of the different countries, whether they have to adapt the registration protocol or whether they can take an existing one. In the EU, we are working with several companies that are working on this type of starting material to have a European registration protocol.

**Q: Has anyone tried direct drilling?**

A: Yes, we did it to show that it didn't work, but we were surprised. Sometimes you get 20-30 tons if you direct sow. I can foresee in the distant future that we may direct drill potato in some cases.

**Q: Why doesn't it work now?**

A: Early growth is slow, so you miss an important part of the season. Breeding frost tolerance would be something that is needed to make that happen.

**Q: In Africa, one of the obstacles to adoption of tubers by farmers is the lack of mechanisation. Do you see an improvement through seeds rather than tubers?**

A: Yes, it is easier for dissemination and adoption. In Africa, storage of seed tubers is a very big issue.

**Q: Why didn't these farmers adopt tubers in the past?**

A: They are using tubers, but they are affected by diseases. That is one of the main reasons why their yields are so low.

**Q: Cost of seed compared to tubers?**

A: It depends on the added value. If we can supply a variety that saves 500 euros per hectare in spraying costs, we can find ways to split the added value.

**Q: But how much does it cost? I guess it should be more complicated to produce the seeds.**





A: Not necessarily. But today there is a potato market, so we should be competitive on price and quality in today's market. Also, seed tubers have a wide range in terms of price. So I cannot give a general answer.

**Q: Does the longer cycle exclude that you have alternative cycles? Is it just for a normal cycle?**

A: We see a big variation in cycle length. Not only in the time that the crop is amassing, but also in the time that the crop tends to tuberise. So with these two traits, you can play and breed one that fits the cropping cycle of the farmer. In the Mediterranean areas, we still need to optimise the crop cycle and hybrid to each other.

# Biostimulants in tomato under stress

ELEONORA DEVA<sup>7</sup>

<p>TOMRES – SolACE Joint Stakeholders Event</p> <p style="text-align: right;">TOMRES</p> <h2 style="text-align: center;">Biostimulants in tomato under stress</h2>  <p> StrigoLab Innovative Plant Materials</p> <p>Eleonora Deva</p> <p style="text-align: right;">1</p>	<p>TOMRES – SolACE Joint Stakeholders Event</p> <p style="text-align: right;">TOMRES</p> <h2 style="text-align: center;">Biostimulants - Definition</h2> <p>“Substance(s) and/or microorganisms whose function when applied to plants or the rhizosphere is to stimulate natural processes to enhance/benefit nutrient uptake, nutrient efficiency, tolerance to abiotic stress and crop quality.” (The European Biostimulant Industry Consortium)</p>  <p style="font-size: small;">Induction of lateral root formation on Brachypodium seedlings by volatile compounds emitted by the co-cultivated PRRF <i>Bacillus pumilus</i>C26 (Delaplace et al., 2015).</p> <p style="text-align: right;">2</p>
<p>TOMRES – SolACE Joint Stakeholders Event</p> <p style="text-align: right;">TOMRES</p> <h2 style="text-align: center;">Biostimulant - Classification</h2> <ul style="list-style-type: none"> <li>➤ Organic and inorganic substances             <ul style="list-style-type: none"> <li>▪ Humic and Fulvic acids</li> <li>▪ Protein hydrolysates</li> <li>▪ Seaweed extracts</li> <li>▪ Inorganic compounds</li> </ul> </li> <li>➤ Microorganisms             <ul style="list-style-type: none"> <li>▪ Beneficial fungi</li> <li>▪ Beneficial bacteria</li> </ul> </li> </ul> <div style="text-align: center; border: 1px solid black; border-radius: 50%; width: 100px; height: 100px; display: flex; align-items: center; justify-content: center; margin: 20px auto;"> <p>Possible combinations to increase the benefits</p> </div> <p style="text-align: right;">3</p>	<p>TOMRES – SolACE Joint Stakeholders Event</p> <p style="text-align: right;">TOMRES</p> <h2 style="text-align: center;">Biostimulants – Market and Regulation</h2>  <ul style="list-style-type: none"> <li>➤ <u>\$2.0 billion</u>: today’s biostimulant global market, <u>\$3.0 billion</u>: expected by 2021.</li> <li>➤ Absence of any specific and harmonized framework in either EU or USA.</li> </ul> <p style="text-align: right;">4</p>

<sup>7</sup> Eleonora Deva, StrigoLab, Italy, TomRes





TOMRES – SolACE Joint Stakeholders Event **TOMRES**

## Effects of biostimulants in tomato plants under stress



Climate change: increase of abiotic stress

↓

REDUCTION OF CROP YIELDS

↓

Biostimulants application on tomato plants promote several physiological and molecular responses, which help the plant to cope better with stress conditions.


5

TOMRES – SolACE Joint Stakeholders Event **TOMRES**

## Effects of biostimulants in tomato plants under stress

- Facilitate nutrient uptake and nutrient utilisation efficiency
- Increase crops quality and yield
- Protective role against abiotic stress, such as:
  - Drought
  - Soil salinization
  - Sub-optimal temperatures

Future perspective: biostimulants as a tool to a more **efficient** and **sustainable** agriculture for a growing population.



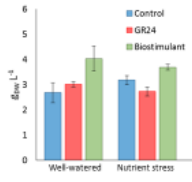


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TOMRES – SolACE Joint Stakeholders Event **TOMRES**

## Effects of Strigolab biostimulant on WUE and NUE under drought and phosphate stress

Tomato plants treated with strigolactone-enriched Strigolab biostimulant:

- ✓ Show a better root water use efficiency (WUE) under well-watered and nutrient-stress conditions.
- ✓ Enhanced root-specific P utilization efficiency of nutrient-stressed tomato plants.
- ✓ Secondary effects: earlier flowering and fruits production.

7

TOMRES – SolACE Joint Stakeholders Event **TOMRES**





8

## Discussion

**Question: If you have a plant hormone that you apply, it doesn't fall under the biostimulant registration. It should fall under the plant protection regulation**

Answer: We are not applying a plant hormone. Our biostimulant is derived from the root of tomato. So we did some chemical research on the composition, and we found out that it is naturally enriched. So we didn't apply a synthetic hormone.

**Q: Do you know what the mode of action is? Obviously, it makes bigger root systems, but what is it changing?**

A: Until now, we just saw that the dry weight per litre of water was higher. We don't know the physiological response yet.

# Field application of microbial inoculants using DCM's MINIGRAN<sup>®</sup> technology

HERVÉ DUPRÉ DE BOULOIS<sup>8</sup>



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<sup>8</sup> Hervé Dupré de Boulois, DCM, Belgium, SolACE



If beneficial microbes are naturally present in soils, why should I add more?



**Low natural population** due to:

- Agricultural practices (pesticides, fertilizers, tillage, rotations with non-host, fallow, etc.)
- Low colonisation potential, competition with other for same niches
- Feeders, grazers, paratistes: insects, nematodes, mycoparasites, bacteriophages, etc.
- Unfavorable climatic conditions
- etc.

**Variable agronomic performance**

**Loose localisation, not on target**

**Have the right microbial**



But this is not enough!



Is it allowed to use them ?

Can they be mass-produced ?

Minimum shelf-life?

How to deliver them to the plant ?

Can they be used with current cultural practices ?

Cost ?

Etc.



Design single inoculum units to bring consortia of beneficial microorganisms to the field

**Microbials ingredients consisted of:**

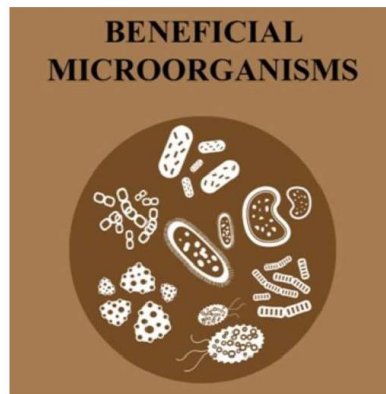
- Mycorrhiza root fragments
- Wettable powders for
  - Bacteria
  - Trichoderma

**Possible formulations:**

Pellets

**Granules**

Capsules using entrapment technologies  
???

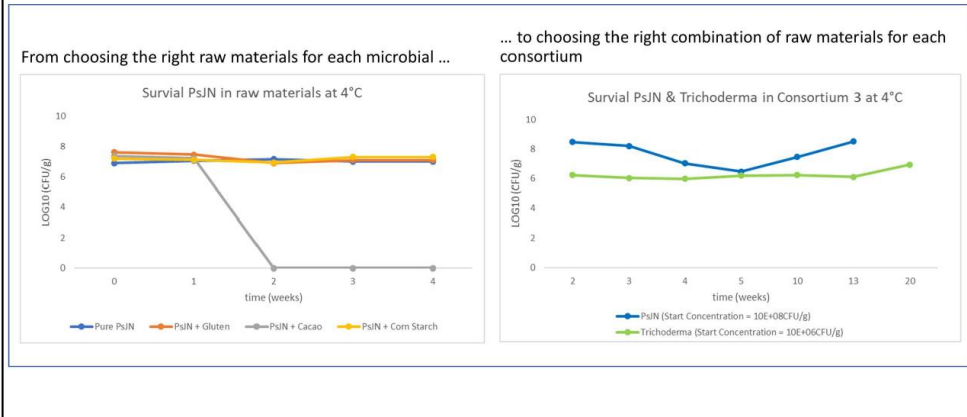


**Minigran®**

- Organic ingredients blend into granules
- Flexible composition, size and density
- Compatible with machinery
- Suitable for organic farming



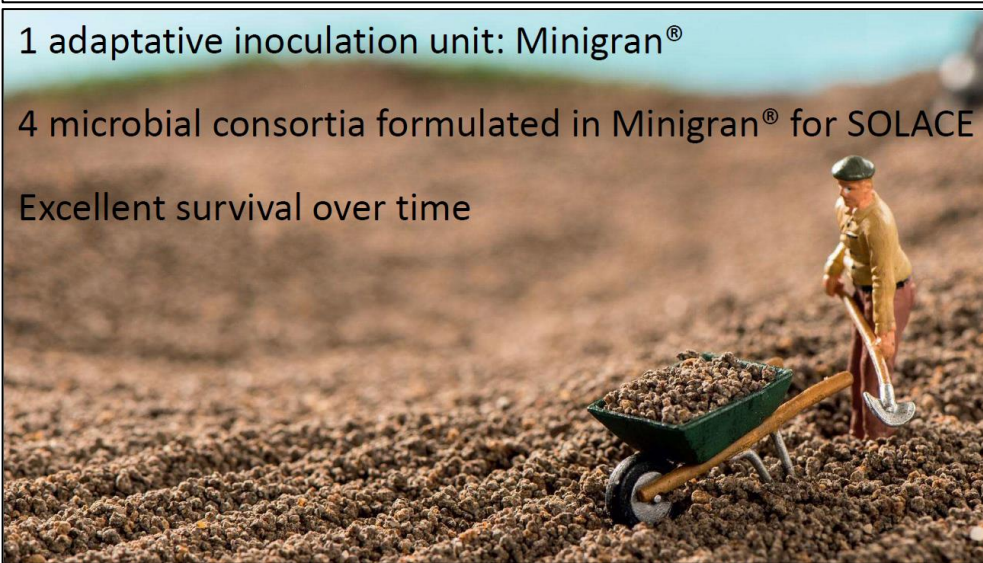
## Designing Minigran® as microbial carrier



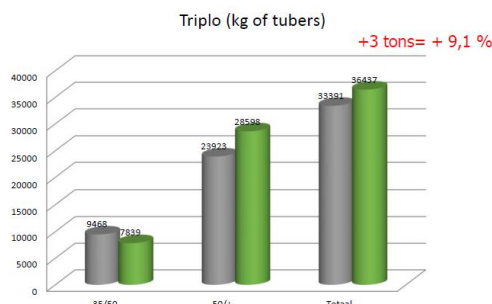
1 adaptative inoculation unit: Minigran®

4 microbial consortia formulated in Minigran® for SOLACE

Excellent survival over time



Minigran®  
as a microbial carrier



Precise application of 30 kg Minigran® with *Bacillus* sp.



## Discussion

**Question: I'm interested in the cost. Do you have numbers to compare one unit of nitrogen or phosphorus? How much more expensive is it?**

Answer: This is an example of a commercial product that we have had on the market now for a few years. The price per hectare is 40 euros. If you have three extra tons of potatoes, you are probably profiting. The objective of biostimulants such as those developed with the minigran<sup>®</sup> technology is not to replace nitrogen or phosphorus fertilisers, but to use them better.

**Q: AMF survives quite well in a dry product. Do you think your bacteria in your product could be compromised in a dry state? So you might be losing some viability.**

A: It depends on what type of bacteria you have to start with. If you have a spore-forming bacteria, no problem. If you are working with gram-negative bacteria, most of the time, their stability in either a liquid or dry formulation will be complicated. The preliminary results that I showed on gram-negative bacteria were with granules kept at four degrees, for instance. At other temperatures, viability could drop faster. The results we obtained are, however, very encouraging.

**Q: There haven't been a lot of studies on the effect of these inoculants on the soil microbial community at all. We assume it's ok, but we've not checked.**

A: Anything you do on your field will impact the natural soil microbial community. This is true whether it's a plant, a chemical or a microbial inoculant that you add to your system. So whether you use a strain from Japan, India or Europe, there will be a perturbation of the natural soil microbial community. What may be relevant is the persistence of an introduced microorganism and its spreading to natural ecosystems. In this respect, it might be better to work with local strains than exotic ones.


**Q: Is the product capable of carrying trophic assemblages that might work together?**

A: Yes, but the more you add things, the more the costs will rise. This can make costs unviable for farmers.





# A powerful and cheap molecular tool to obtain the varietal composition of durum (or any species) mixtures (and some other applications)

JACQUES DAVID<sup>9</sup>

A powerful and cheap molecular tool to obtain the varietal composition of durum (or any species) mixtures (and some others applications !)

Johanna Girodolle, Sylvain Santoni, Jacques David

Solace meeting, Dundee, Stakeholder's meeting  
Dundee Meeting, Stakeholder's event

## Game change in wheat production

### Cropping variety mixtures is rocketing



Farmers may grow up to 10 varieties in the same field

So, end users, i.e.,

- collectors
- traders
- food processing industry

have to adapt.

- What varieties are in this lot ?
- In which proportions ?
- Is the average and variance of grain quality predictable ?

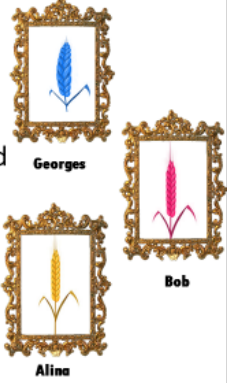




Dundee Meeting, Stakeholder's event

## Use the Who'swho Principle

Each variety has a record in the Who'swho european catalog of varieties

A molecular picture can be obtained from 4000 points in their genome

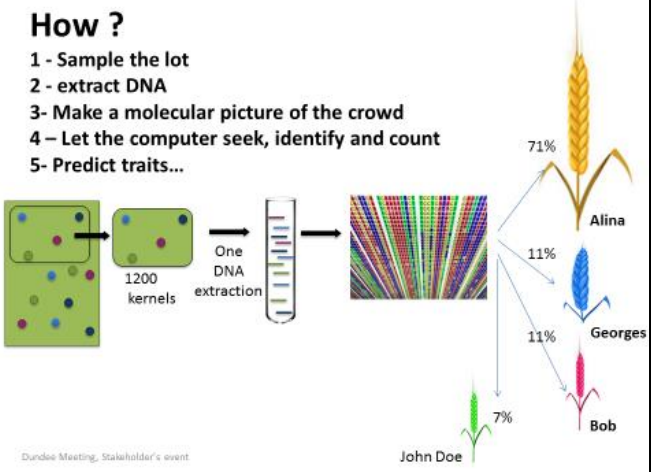



Targeted zones (red) across the durum wheat genome

Dundee Meeting, Stakeholder's event

## How ?

- 1 - Sample the lot
- 2 - extract DNA
- 3- Make a molecular picture of the crowd
- 4 - Let the computer seek, identify and count
- 5- Predict traits...



Dundee Meeting, Stakeholder's event

<sup>9</sup> Jacques David, Inra-SupAgro, France, SolACE




## Possible extensions

- Describe heterogeneous varieties for registration : get ready for new EU regulation in 2021
- Diagnosis of presence of pathogens, weeds and pests in seed lots
- Environmental DNA ....




Dundee Meeting, Stakeholder's event  
Dundee Meeting, Stakeholder's event

## Discussion

### **Question: What is the degree of confidence?**

Answer: Very good. In SolACE, we will have a number of tests, and we will use that in a routine way on our populations. We have a much higher number of pixels than what is needed to identify the few components of a simple mix. If you only have recorded varieties, the error level is very low because we have so much information.

### **Q: What is the cost of one analysis?**

A: The lab costs, without salary, are about 30 euros.

### **Q: Will you calibrate the seed samples?**

A: Yes, this still needs to be done. We have to verify how much DNA one additional seed could provide. At the moment we consider it equal. But we don't know yet, where the DNA is in the sequence.

### **Q: Is it possible to apply this to below-ground?**

A: Yes. If you want to do this below ground, you can. You take a sample of something and then you can identify who is who. Very simple.

### **Q: Do you think if there are more mixtures, the notion of variety will become less important?**

A: When we first discussed this with bread makers or pasta makers, they were horrified that it would be blended. After a while, they found that the mixtures also had nice properties for them sometimes, for example, good textures. So the debate is currently open. Most of the French farmers that I know use mixtures for their cattle. And for the part that goes to the market, it is unclear. However, some French bakeries started to design mixtures by themselves in order to be the first to promote the mixture to the farmers and control the quality.

### **Q: What are the main drivers that make farmers want to cultivate mixtures?**

A: Facility. There is a trend of saying to farmers that they have to diversify. But if you want to have diversity and sell products that aren't in mixtures, then it's very difficult to have more than two or three varieties. It is also



difficult for them to get seeds and then split them according to variety. So it is much easier to mix. There are also a lot of other possible benefits.

**Q: I would like to know more about the method. What do you sequence?**

A: We use a capture method to sequence only targeted zones in the genome. Because the wheat genome is huge, we can't sequence everything. From that, we get sequence reads, and with those, we can use the software to estimate the frequency of each component.

