Not at all times – timing and mode of application of biologicals in potato cultivation

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Biologicals

Biostimulants

- Growth improvers, general resilience
- E.g. N-fixers

Biocontrol agents (BCAs)

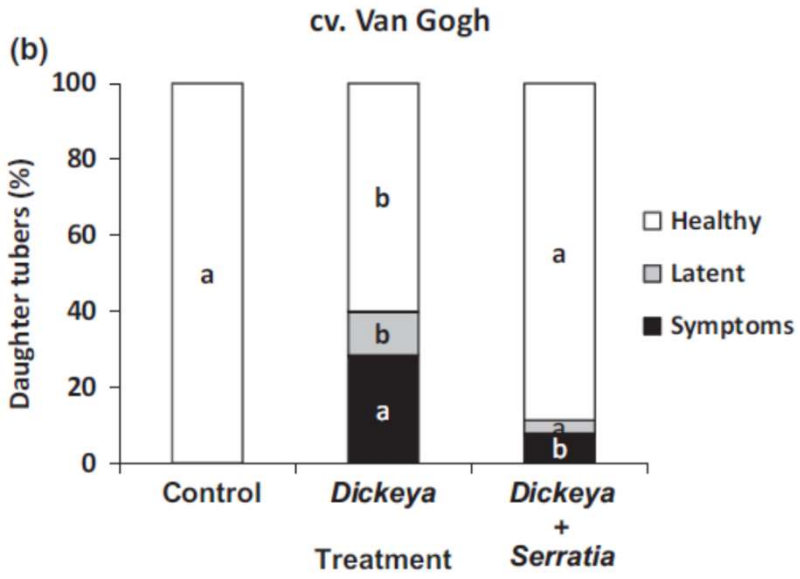
- Biological control of diseases
- E.g. *Trichoderma, Bacillus*

Efficacy is variable

Examples of successful BCAs- *Serratia* A30

Treatment with *Serratia plymuthica* A30 before tendering

Protection against *Dickeya* in the field



Hadizadeh et al. 2018

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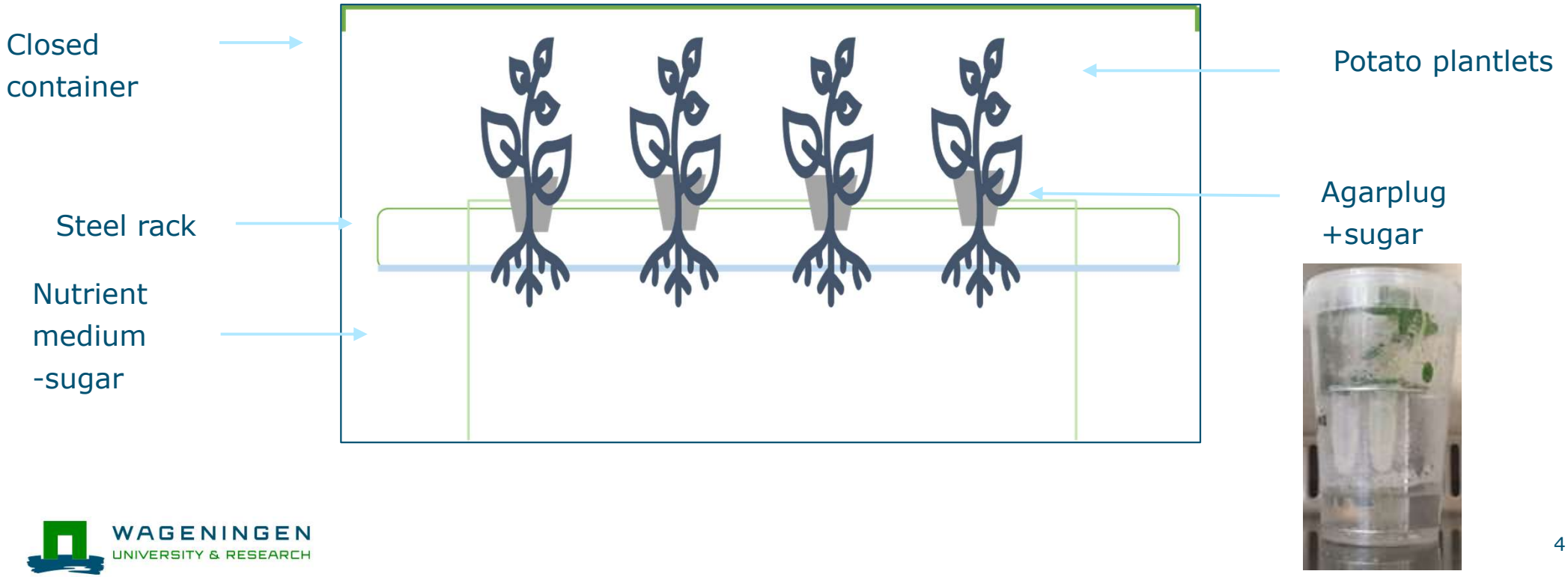
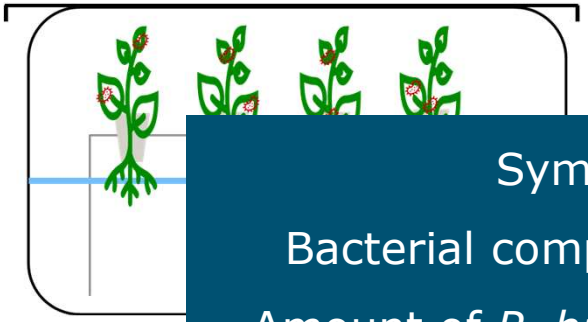
Recent endofyte research @WUR

In vitro potato system

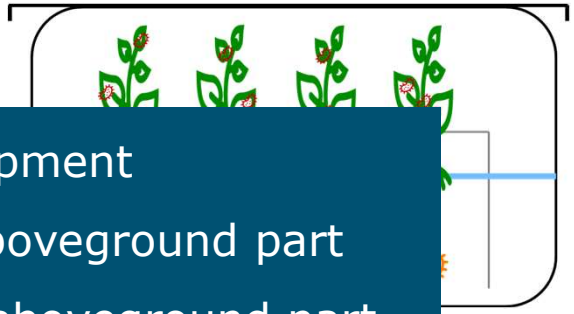


Experimental design

1) Control (mock)



2) Endophyte mix

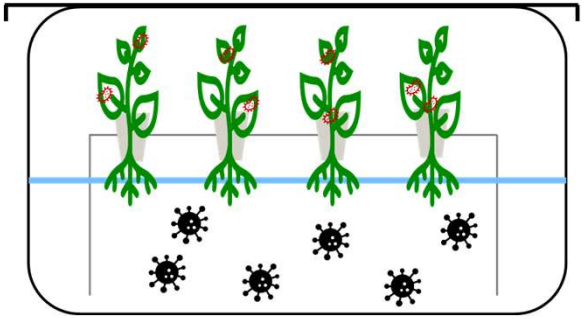


Symptom development

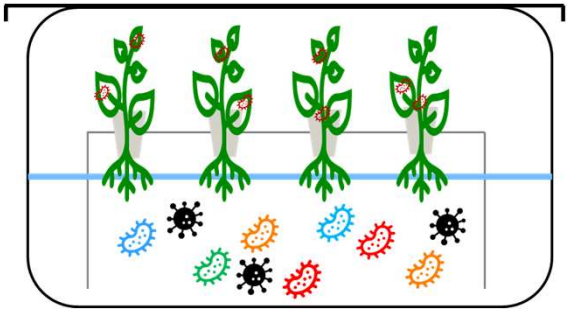
Bacterial composition in aboveground part

Amount of *P. brasiliense* in aboveground part

3) *Pectobacterium brasiliense*



4) Endophyte mix+ *P. brasiliense*



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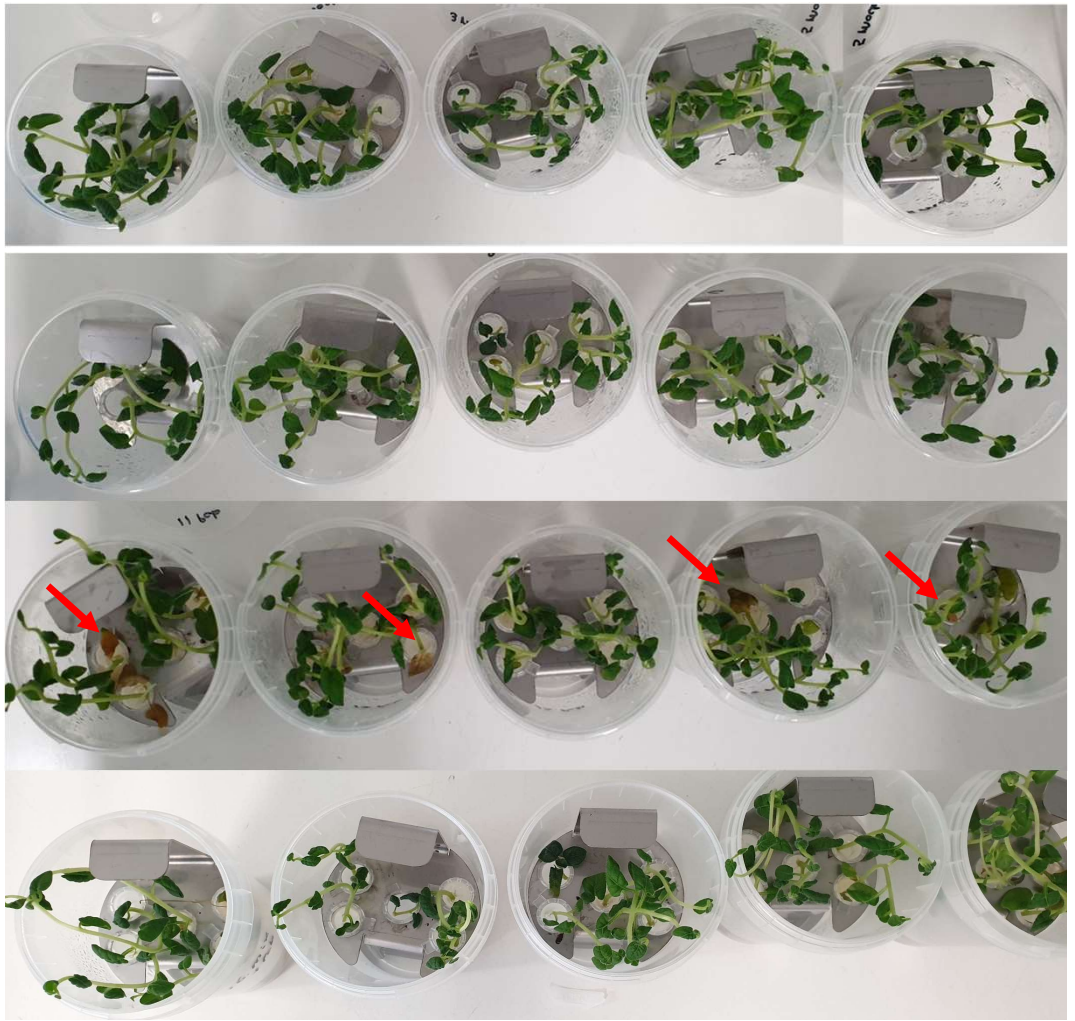
Symptom development

1) Control (mock)

2) Endophyte mix

3) *Pectobacterium brasiliense*

4) Endophyte mix+ *P. brasiliense*



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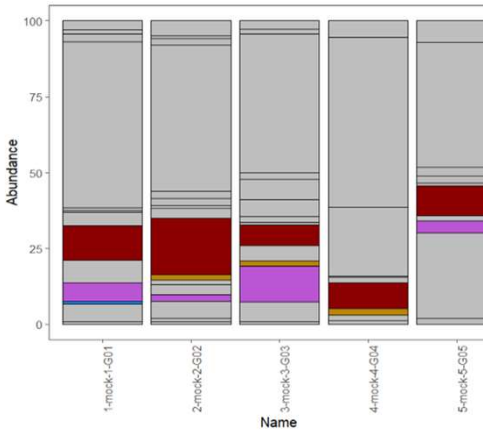
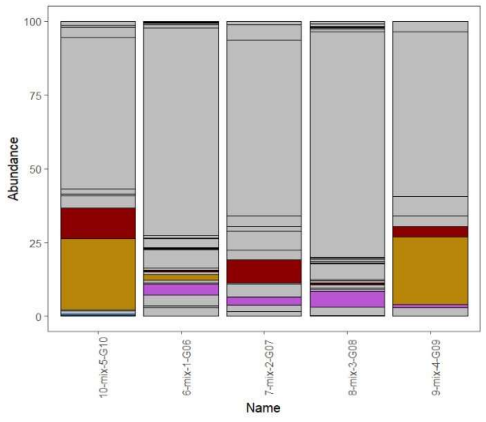
Bacterial composition in aboveground part

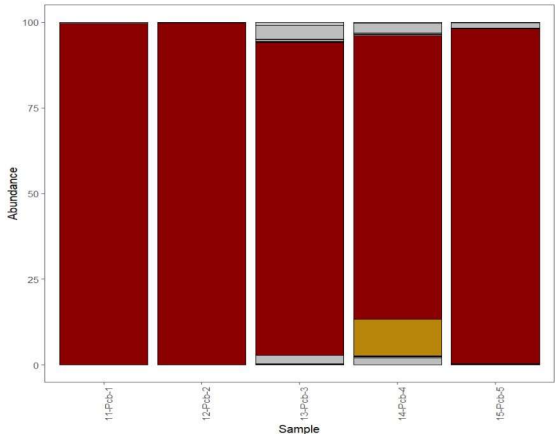
1) Control



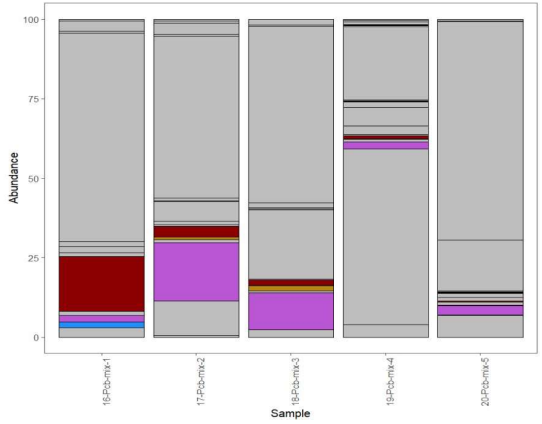
2) Endophyte mix

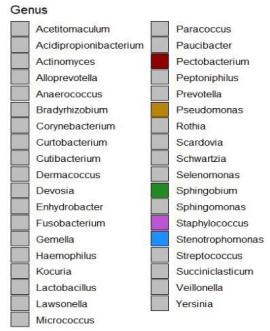


3) *P. brasiliense*



4) Endophyte+ *P. brasiliense*





- In the *Pectobacterium* treatment high numbers of Pcbr, but not after colonisation with endophytes
- 4 endophytes detected in aboveground part -> colonisation

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Amount of *P. brasiliense* in aboveground part

Lower densities of *P. brasiliense* after inoculation with endophytes

inoculated with	CT replicate 1	CT replicate 2
Pcb	24.83	24.85
Pcb	23.54	23.49
Pcb	31.00	30.91
		.64
		.21
		.58
Pcb + endophytes	40.00	40.00
Pcb + endophytes	40.00	40.00
Pcb + endophytes	34.58	36.98
Pcb + endophytes	40.00	37.51

Conclusions:

- Effective *in-vitro* assay for *P. brasiliense*
- Reduction of *P. brasiliense* colonisation by endophytes
- Can be used for selection of endophytes

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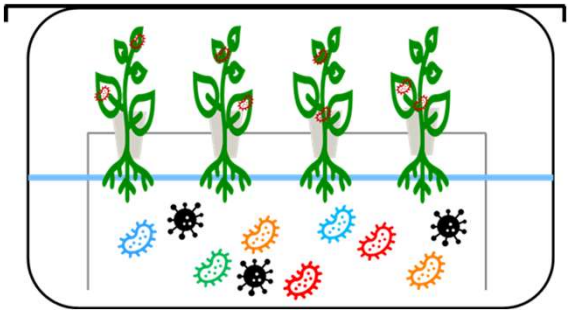
Recent research bacterial soft rot

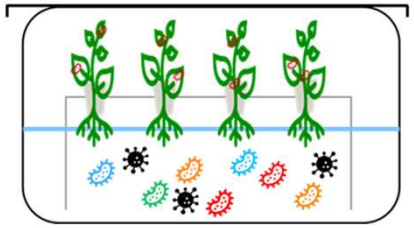
Protection by BCAs



Infection

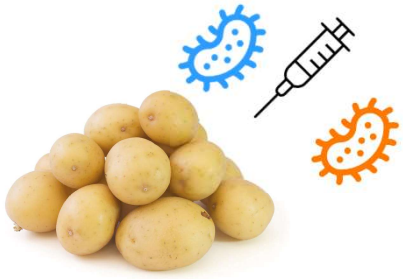
Missing knowledge

Colonisation by BCAs

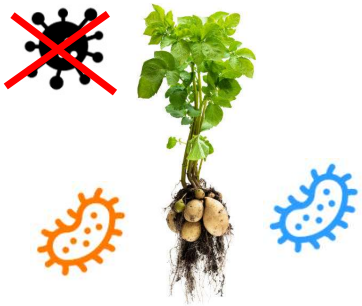


Infection

Inoculation methods

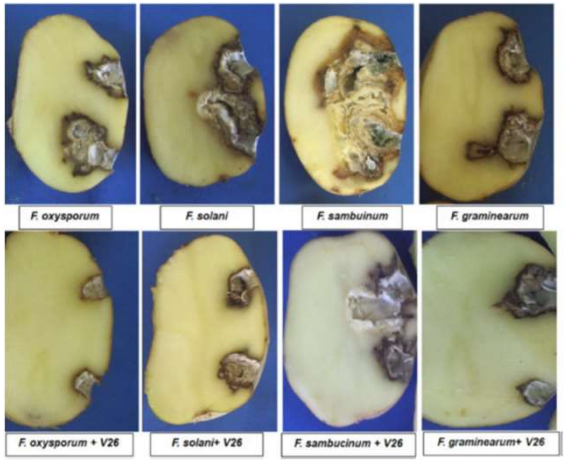


Protection against infection



Fusarium dry rot

- Dry rot reduction by number of BCAs



- Efficacy dependent on age of the tuber
    - Younger tubers more sensitive to both *Fusarium* and colonisation by BCAs

Khedler et al. 2021

Research question

Hypothesis: mode and timing of inoculation determines if beneficials can colonise the plant and suppress disease

Aim: finding the most effective inoculation method(s) for beneficials that can increase resilience against pathogens

- Model 1: *P. brasiliense*, Model 2: *Fusarium* dry rot
- Beneficials/BCAs: already registered and WUR strains
- Selection with *in vitro* system

Work plan

WP1: Selection of BCAs
- From registered products and WUR strains
- Optimalisation *in vitro* system

WP2: Detection methods
- Quantitative + molecular (TaqMan)
- Fluorescence label

WP3: Population dynamics glasshouse
- Follow colonisation/survival
- Interaction pathogen

WP4: Field experiments
- Different inoculation methods
- Follow population dynamics BCAs and pathogen

WP5: Mode of action
- Genome sequences (WGS)
- Planthormones en secundairy metabolites

Go/no Go

Inoculation methods

Timing of inoculation





Mini tuber

Plant 1st gen

Daughter tuber 1st gen harvest

Daughter tuber 1st gen before planting

Timing of inoculation

→ Colonised tuber as starting material

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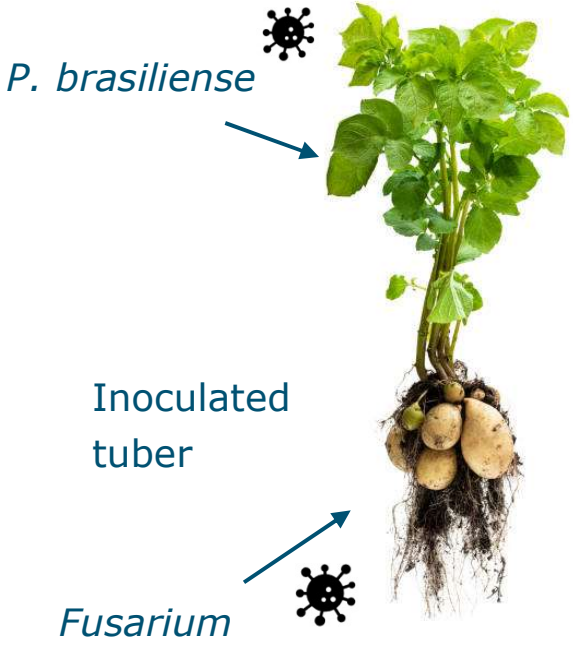
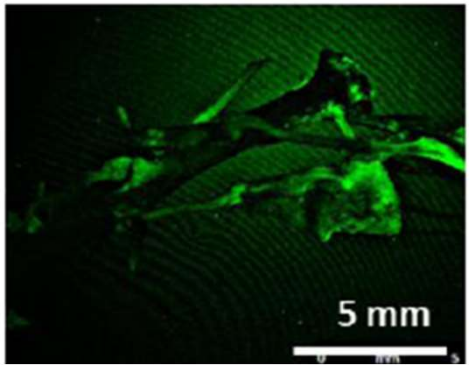
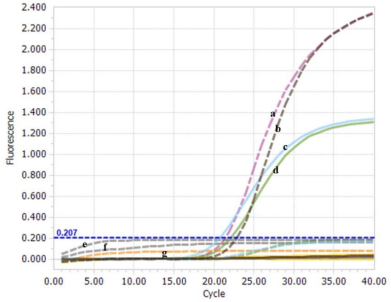
Glasshouse and field experiments



Glasshouse



Field



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Deliverables

- Optimised selection methods for effective antagonists
- Inoculation method(s) for the effective application of beneficials for increased plant resilience

Indicative budget

	2025	2026	2027	2028	**Total**
Contribution private (in cash)	42.5	30	100	40	325
Contribution private (in kind)	42.5	30	50	40	162.5
Requested contribution public (in cash)	85	60	50	80	162.5
Total	170	120	200	160	650

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Consortium

- NAO-members
- BO-Akkerbouw
- Producers of BCAs