

# ECOSOL – IPM approaches for the control of early blight



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**EcoSol** *Eco-friendly solutions for the integrated management  
of late and early blight of potatoes*



# ECOSOL

“Eco-friendly solutions for the integrated management of late and early blight of potatoes”

## Scientific partners



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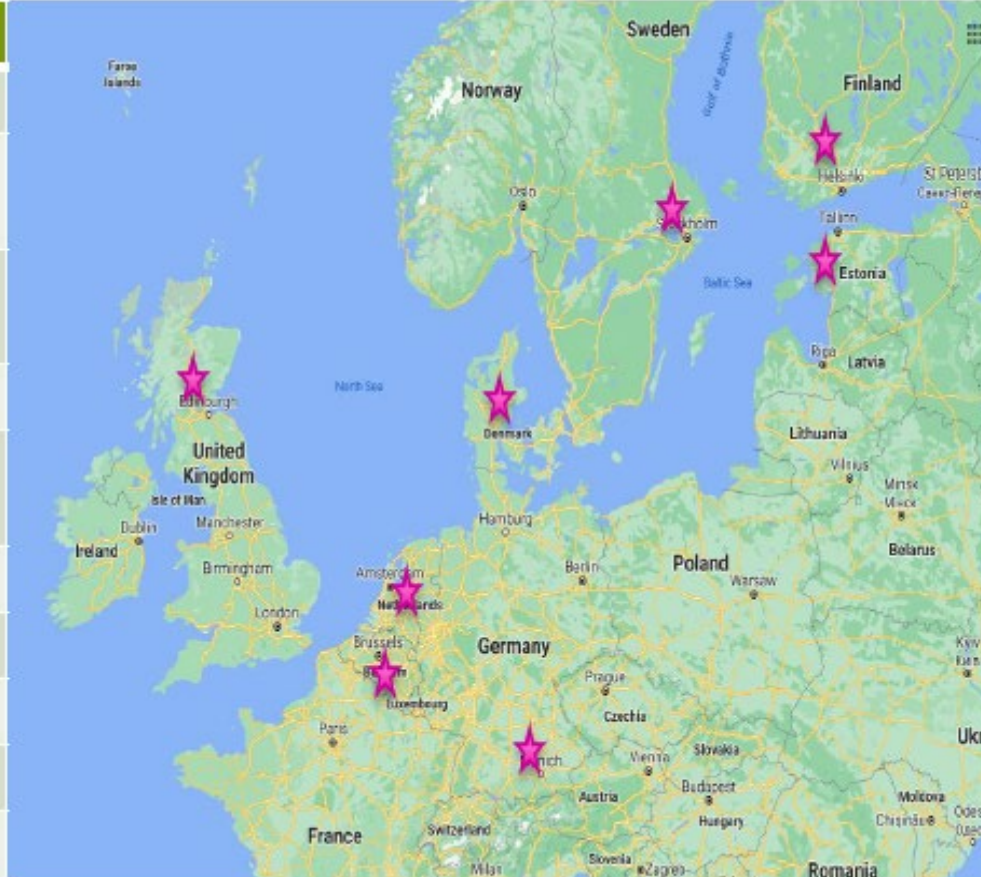
Nicole Bellé

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# Associated Partners

| Associate Partner                           | Country | Area            |
|---|---------|-----------------|
| Chr. Hansen A/S                             | DK      | Biologicals     |
| Wageningen University & Research            | NL      | LB/EB Research  |
| Solynta                                     | NL      | Host Resistance |
| Finnamyl                                    | FI      | IPM             |
| Swedish University of Agricultural Sciences | SE      | LB/EB Research  |
| SEGES                                       | DK      | Agronomy        |
| AKV Langholt AmbA                           | DK      | Agronomy        |
| BJ Agro                                     | DK      | Biologicals     |
| Sudstarke GmbH                              | DE      | Starch/IPM      |
| Fytofend                                    | BE      | Biologicals     |



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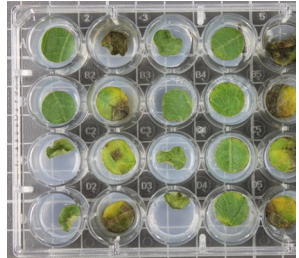


# Aim

- Select candidate BCA and PRI and assess their disease control efficacy in laboratory and glasshouse tests
- Understand factors affecting disease control efficacy (cultivar resistance, timing and method of application).
- Select candidates for inclusion in IPM strategies for early and late blight control (WP5).



# Identification of biological candidates



Screening of candidates in the lab (25)



Studies in the Greenhouse (15)



**Field**



BCA alone (5)

Solo application of BCA



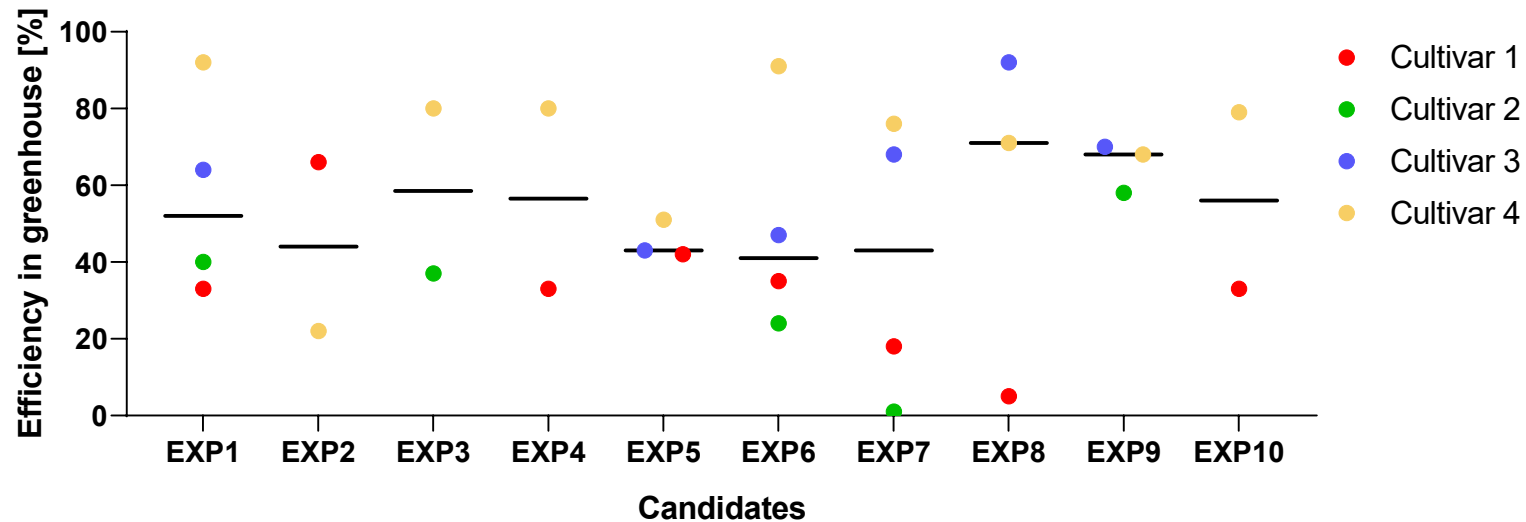
Strategy

DSS, combination with fungicides



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# EB Results – whole plant assays in greenhouse trials



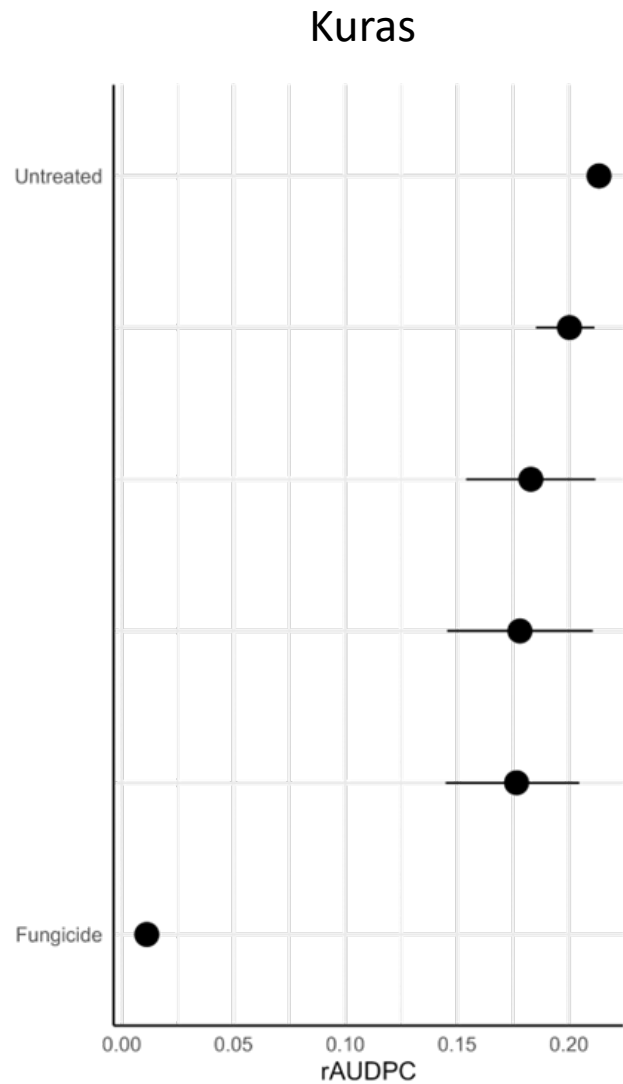
➤ Efficiency between 50 and 70%

➤ Cultivar seems to play a role

# Alternaria Field trials 2022

## Solo-applications of BCAs

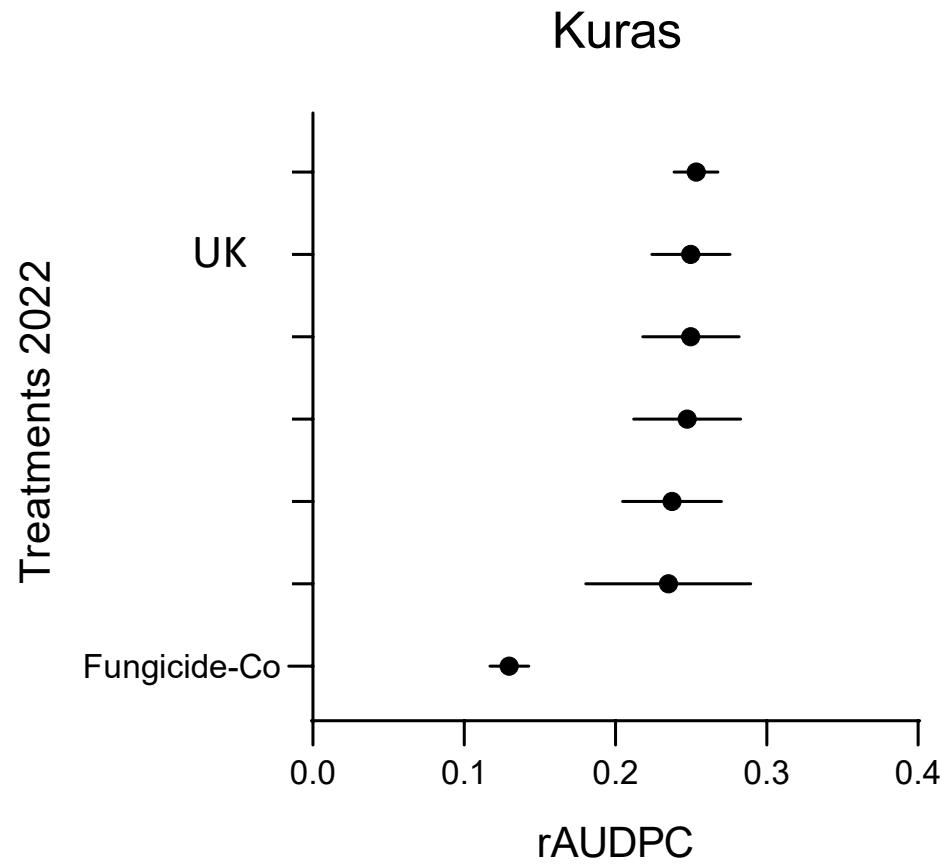
# Results WP2 Solo trial Denmark



- Fungicide with highest effect



# Results WP2 Solo trial Germany



- Fungicide with highest effect

# Summary

There is the need to combine effective BCA and fungicides:

- Mixture
- Alternation

# IPM-strategies for early blight control

| IPM-Strategy 1 | Low-medium risk: 100% BCA | Interval: 7 days  |
|----------------|---------------------------|-------------------|
|                | High risk: 75% Fungicide  | Interval: 14 days |
|                |                           |                   |

# IPM-strategies for early blight control

| IPM-Strategy 1 | Low-medium risk: | 100% BCA<br>Interval: 7 days  |
|----------------|------------------|---|
|                | High risk:       | 75% Fungicide<br>Interval: 14 days  |
| IPM-Strategy 2 | Low-medium risk: | 100% BCA<br>Interval: 7 days  |
|                | High risk:       | 75% Fungicide + 100% BCA<br>Interval for fungicide: 14 days<br>Interval for BCA: 7 days |

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|                | High risk:       | 75% Fungicide + 100% BCA<br>Interval for fungicide: 14 days<br>Interval for BCA: 7 days |

Example:

| Strategy          | Week 1         | Week 2              | Week 3         | Week 4              | Week 5         | Week 6 |
|-------------------|----------------|---------------------|----------------|---------------------|----------------|--------|
| Fungicide control | 100% Fungicide | /                   | 100% Fungicide | /                   | 100% Fungicide | /      |
| 1                 | BCA            | 75% Fungicide       | /              | 75% Fungicide       | BCA            | BCA    |
| 2                 | BCA            | 75% Fungicide + BCA | BCA            | 75% Fungicide + BCA | BCA            | BCA    |

# Treatment schedule EB Strategy trial Germany

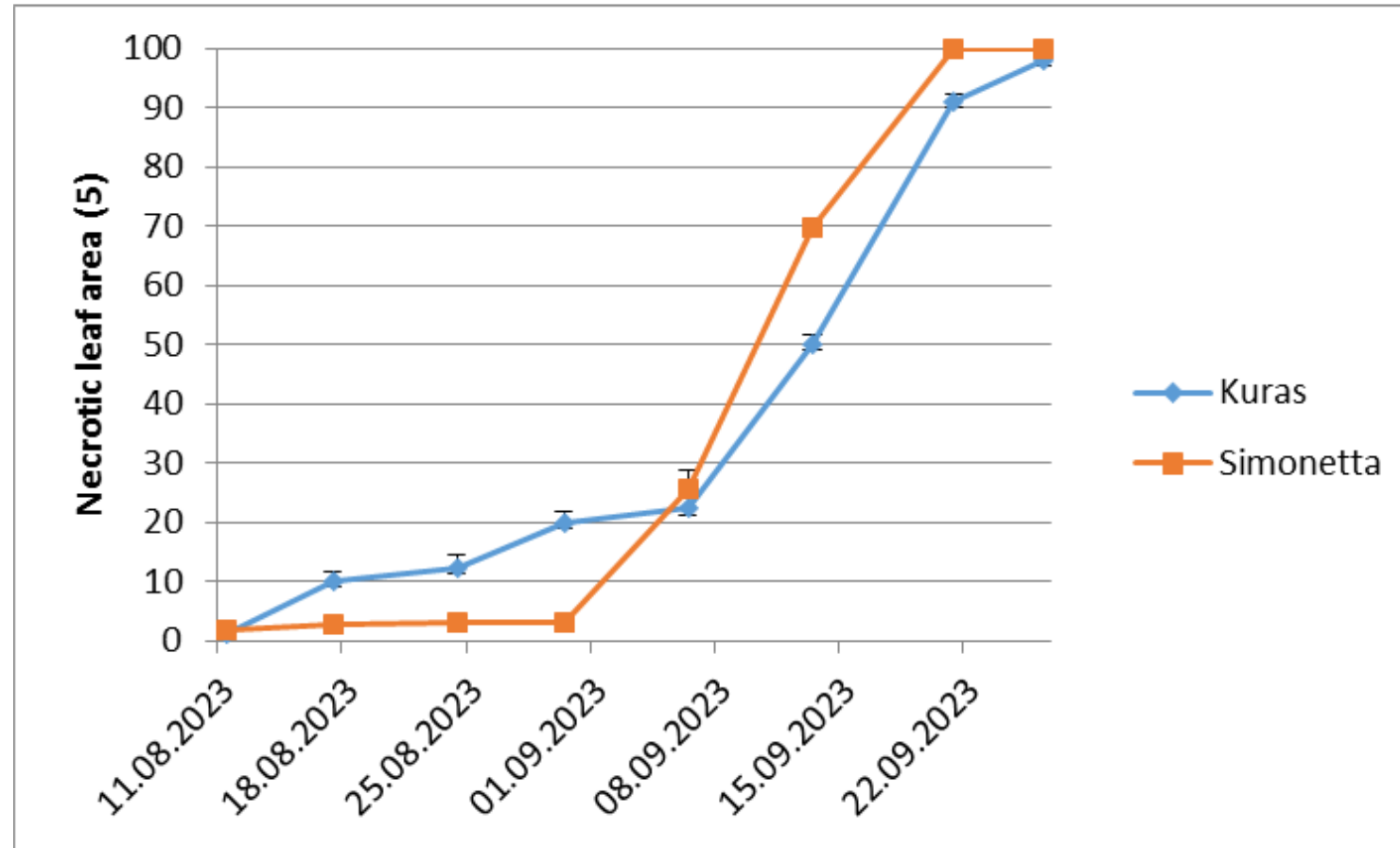
| Treatments        | T1 low  | T2 high            | T3 low   | T4 high          | T5 low             | T6 high            | T7 low   | T8 high          | T9 low  | T10 high         | T11 low |
|-------------------|---------|--------------------|----------|------------------|--------------------|--------------------|----------|------------------|---------|------------------|---------|
|                   | 10. Jul | 17. Jul            | 24. Jul  | 31. Jul          | 07. Aug            | 14. Aug            | 21.08.   | 28. Aug          | 04. Sep | 11. Sep          | 18.09.  |
| Untreated         |         |                    |          |                  |                    |                    |          |                  |         |                  |         |
| Fungicide (100%)  | Narita  | /                  | Propulse | /                | Narita             | /                  | Propulse | /                | Narita  | /                | Narita  |
| Fungicide (75%)   |         | Propulse           |          | Narita           |                    | Propulse           |          | Narita           |         | Narita           |         |
| Fungicide-Ref-DSS |         |                    |          |                  | Propulse           |                    |          | Narita           |         |                  |         |
| BCA1              | BCA1    | BCA1               | BCA1     | BCA1             | BCA1               | BCA1               | BCA1     | BCA1             | BCA1    | BCA1             | BCA1    |
| BCA2              | BCA2    | BCA2               | BCA2     | BCA2             | BCA2               | BCA2               | BCA2     | BCA2             | BCA2    | BCA2             | BCA2    |
| IPM 1 + BCA1      | BCA1    | Propulse           | BCA1     | Narita           | BCA1               | Propulse           | BCA1     | Narita           | BCA1    | Narita           | BCA1    |
| IPM 2 + BCA1      | BCA1    | Propulse +<br>BCA1 | BCA1     | Narita +<br>BCA1 | BCA1               | Propulse +<br>BCA1 | BCA1     | Narita +<br>BCA1 | BCA1    | Narita +<br>BCA1 | BCA1    |
| IPM 1 + BCA2      | BCA2    | Propulse           | BCA2     | Narita           | BCA2               | Propulse           | BCA2     | Narita           | BCA2    | Narita           | BCA2    |
| IPM 2 + BCA2      | BCA2    | Propulse +<br>BCA2 | BCA2     | Narita<br>BCA2   | BCA2               | Propulse +<br>BCA2 | BCA2     | Narita<br>BCA2   | BCA2    | Narita<br>BCA2   | BCA2    |
| DSS -IPM1 BCA-1   | BCA1    | BCA1               | BCA1     | BCA1             | Propulse           | BCA1               | BCA1     | Narita           | BCA1    | BCA1             | BCA1    |
| DSS -IPM2-BCA-1   | BCA1    | BCA1               | BCA1     | BCA1             | Propulse +<br>BCA1 | BCA1               | BCA1     | Narita +<br>BCA1 | BCA1    | BCA1             | BCA1    |



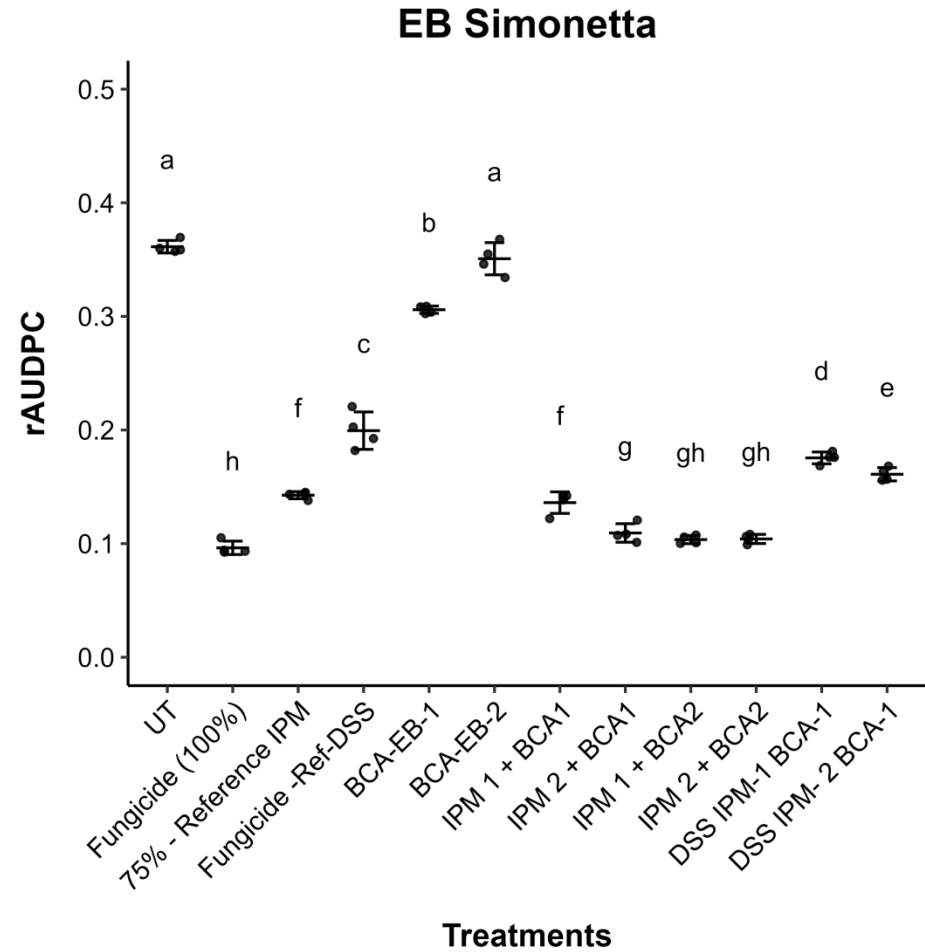
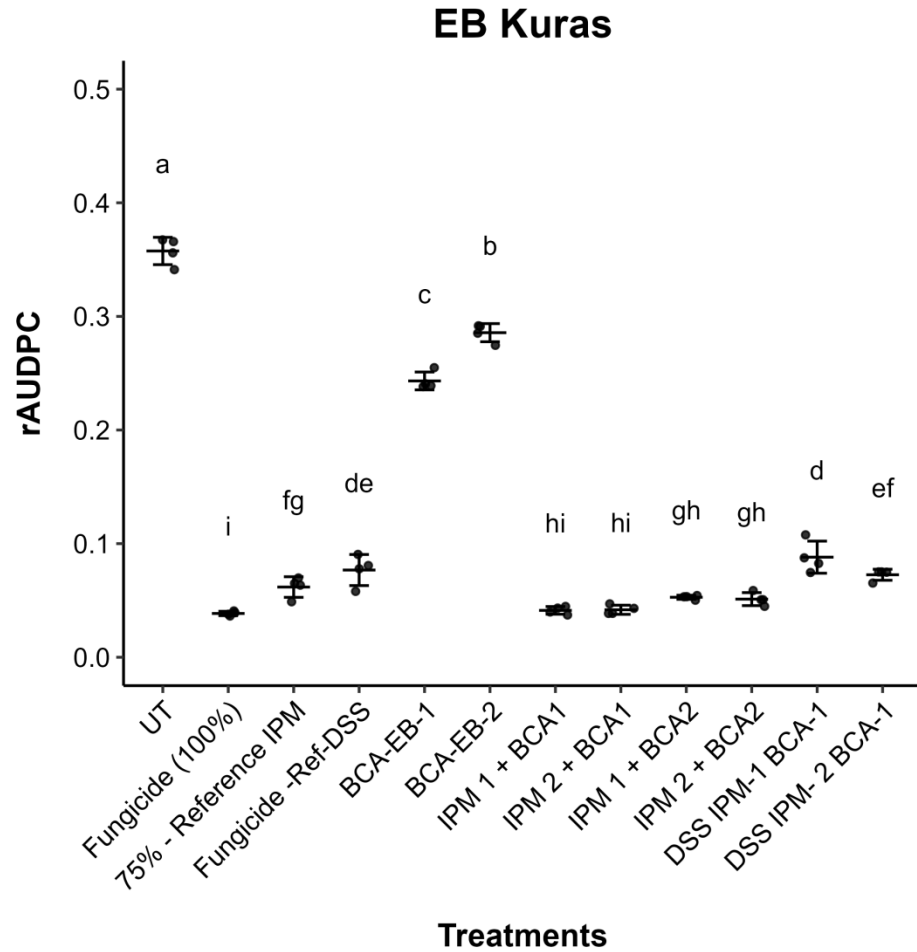
# Treatment schedule EB Strategy trial Germany

| Treatments        | T1 low  | T2 high            | T3 low   | T4 high          | T5 low             | T6 high            | T7 low   | T8 high          | T9 low  | T10 high         | T11 low | Nr of fungicide treatments | treatment index |
|-------------------|---------|--------------------|----------|------------------|--------------------|--------------------|----------|------------------|---------|------------------|---------|----------------------------|-----------------|
|                   | 10. Jul | 17. Jul            | 24. Jul  | 31. Jul          | 07. Aug            | 14. Aug            | 21.08.   | 28. Aug          | 04. Sep | 11. Sep          | 18.09.  |                            |                 |
| Untreated         |         |                    |          |                  |                    |                    |          |                  |         |                  |         |                            |                 |
| Fungicide (100%)  | Narita  | /                  | Propulse | /                | Narita             | /                  | Propulse | /                | Narita  | /                | Narita  | 6                          | 6               |
| Fungicide (75%)   |         | Propulse           |          | Narita           |                    | Propulse           |          | Narita           |         | Narita           |         | 5                          | 3,75            |
| Fungicide-Ref-DSS |         |                    |          |                  | Propulse           |                    |          | Narita           |         |                  |         | 2                          | 1,5             |
| BCA 1             | BCA1    | BCA1               | BCA1     | BCA1             | BCA1               | BCA1               | BCA1     | BCA1             | BCA1    | BCA1             | BCA1    |                            |                 |
| BCA 2             | BCA2    | BCA2               | BCA2     | BCA2             | BCA2               | BCA2               | BCA2     | BCA2             | BCA2    | BCA2             | BCA2    |                            |                 |
| IPM 1 + BCA1      | BCA1    | Propulse           | BCA1     | Narita           | BCA1               | Propulse           | BCA1     | Narita           | BCA1    | Narita           | BCA1    |                            |                 |
| IPM 2 + BCA1      | BCA1    | Propulse +<br>BCA1 | BCA1     | Narita +<br>BCA1 | BCA1               | Propulse +<br>BCA1 | BCA1     | Narita +<br>BCA1 | BCA1    | Narita +<br>BCA1 | BCA1    |                            |                 |
| IPM 1 + BCA2      | BCA2    | Propulse           | BCA2     | Narita           | BCA2               | Propulse           | BCA2     | Narita           | BCA2    | Narita           | BCA2    |                            |                 |
| IPM 2 + BCA2      | BCA2    | Propulse +<br>BCA2 | BCA2     | Narita<br>BCA2   | BCA2               | Propulse +<br>BCA2 | BCA2     | Narita<br>BCA2   | BCA2    | Narita<br>BCA2   | BCA2    |                            |                 |
| DSS -IPM1 BCA-1   | BCA1    | BCA1               | BCA1     | BCA1             | Propulse           | BCA1               | BCA1     | Narita           | BCA1    | BCA1             | BCA1    | 2                          | 1,5             |
| DSS -IPM2-BCA-1   | BCA1    | BCA1               | BCA1     | BCA1             | Propulse +<br>BCA1 | BCA1               | BCA1     | Narita +<br>BCA1 | BCA1    | BCA1             | BCA1    | 2                          | 1,5             |

# Disease progression EB Strategy Germany 2023



# rAUDPC EB Strategy Kuras, Simonetta Germany



# EB Strategy Kuras, Simonetta, Germany

| Treatments        | Nr of fungicide treatments | treatment index | efficacy |           |  |
|-------------------|----------------------------|-----------------|----------|-----------|--|
|                   |                            |                 | Kuras    | Simonetta |  |
| Untreated         |                            |                 |          |           |  |
| Fungicide (100%)  | 6                          | 6               | 89       | 73        |  |
| Fungicide (75%)   | 5                          | 3,75            | 83       | 61        |  |
| Fungicide-Ref-DSS | 2                          | 1,5             | 79       | 45        |  |
| BCA1              |                            |                 | 32       | 15        |  |
| BCA2              |                            |                 | 20       | 3         |  |
| IPM 1 + BCA1      |                            |                 | 88       | 62        |  |
| IPM 2 + BCA1      |                            |                 | 88       | 70        |  |
| IPM 1 + BCA2      |                            |                 | 85       | 71        |  |
| IPM 2 + BCA2      |                            |                 | 86       | 71        |  |
| DSS -IPM1 BCA-1   | 2                          | 1,5             | 75       | 51        |  |
| DSS -IPM2-BCA-1   | 2                          | 1,5             | 80       | 55        |  |

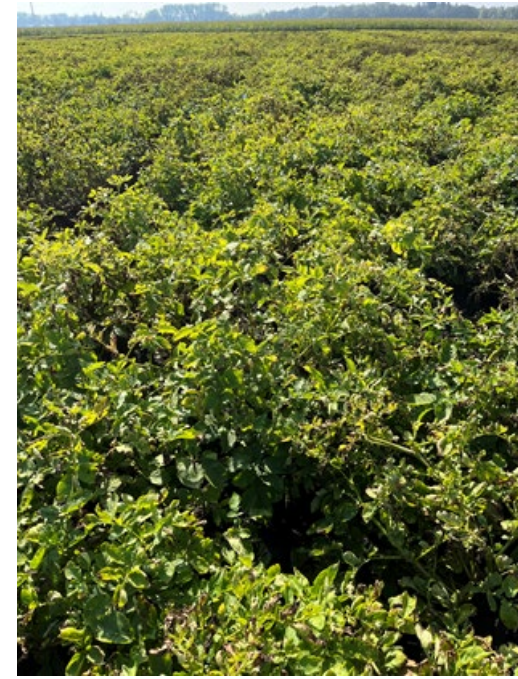
# Impression EB Strategy Simonetta, Germany



Untreated (100%)



IPM-Fungicide -75% (76%)



IPM-1-BCA-2 (58%)

# EB Strategy Denmark

| Treatment                     | No. of Fungicide application | Treatment frequency index | AUDPC |
|-------------------------------|------------------------------|---------------------------|-------|
| Untreated                     |                              |                           | 976   |
| Standard                      | 4                            | 4                         | 0,81  |
| Standard 0,75 (IPM reference) | 3                            | 2,25                      | 2,6   |
| BCA-1                         | 0                            | 0                         | 825   |
| BCA-2                         | 0                            | 0                         | 673   |
| IPM 1 + BCA1                  | 3                            | 2,25                      | 2,2   |
| IPM 2 + BCA1                  | 3                            | 2,25                      | 1,1   |
| IPM 1 + BCA2                  | 3                            | 2,25                      | 1,1   |
| IPM 2 + BCA2                  | 3                            | 2,25                      | 1,2   |



# Summary

- BCAs are very promising in greenhouse trials
  - Standalone application of BCAs in the field consistently proves less effective than fungicide treatments
  - All IPM strategies are significantly better compared to UT and BCA treatments alone
  - In same locations: Benefits of integrating BCA into a fungicide strategy (75%)
- Very promising approach

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