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Uncertainty in simulating N uptake and N use efficiency in the crop rotation systems across Europe

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Fig. 1. Locations of the five experimental study sites in Europe.

ROTATION/SINGLE (Kollas et al., 2015)

Objectives

- To evaluate the model performance in simulating crop N uptake in crop rotation systems across Europe within different calibration levels;
- To assess the model ensemble effects in predicting N uptake;
- To investigate different management effects on N uptake and N use efficiency.

Observation data

- Grain N for all the treatments in BR, FO, MU & TH
- Crop N for all the treatments in BR, FO, MU & TH
- N leaching in FO for 0-100cm depth, in TH for 0-110cm depth
- Soil N in BR for 0-30cm depth, in MU for 0-90cm depth, in TH for 0-110cm depth

Model applications (13/9)

Model	Abbreviation	Version	Rotation/Single	CN model	Notes
APSIM	AP	7.5	YES/NO	CN	HL
CROPSYST	CS	3.02	YES/YES	N	HL
DAISY	DA	5.16	YES/YES	CN	HL
DSSAT1	DS	4.6	NO/YES	CN	L
DSSAT2	DT	4.5	NO/YES	CN	HL
FASSET	FA	2.2.3	YES/YES	CN	HL
HERMES	HE	4.26	YES/YES	N	HL
LINTUL2	LI	Svn3257	YES/YES	N	HL
MONICA	MO		YES/YES	CN	L
SPACSYS	SP	5.0	NO/YES	CN	L
STICS	ST	8.3.1	YES/YES	N	HL
SWIM	SW		YES/NO	N	HL
WOFOST	WO	7.1.5	NO/YES		L

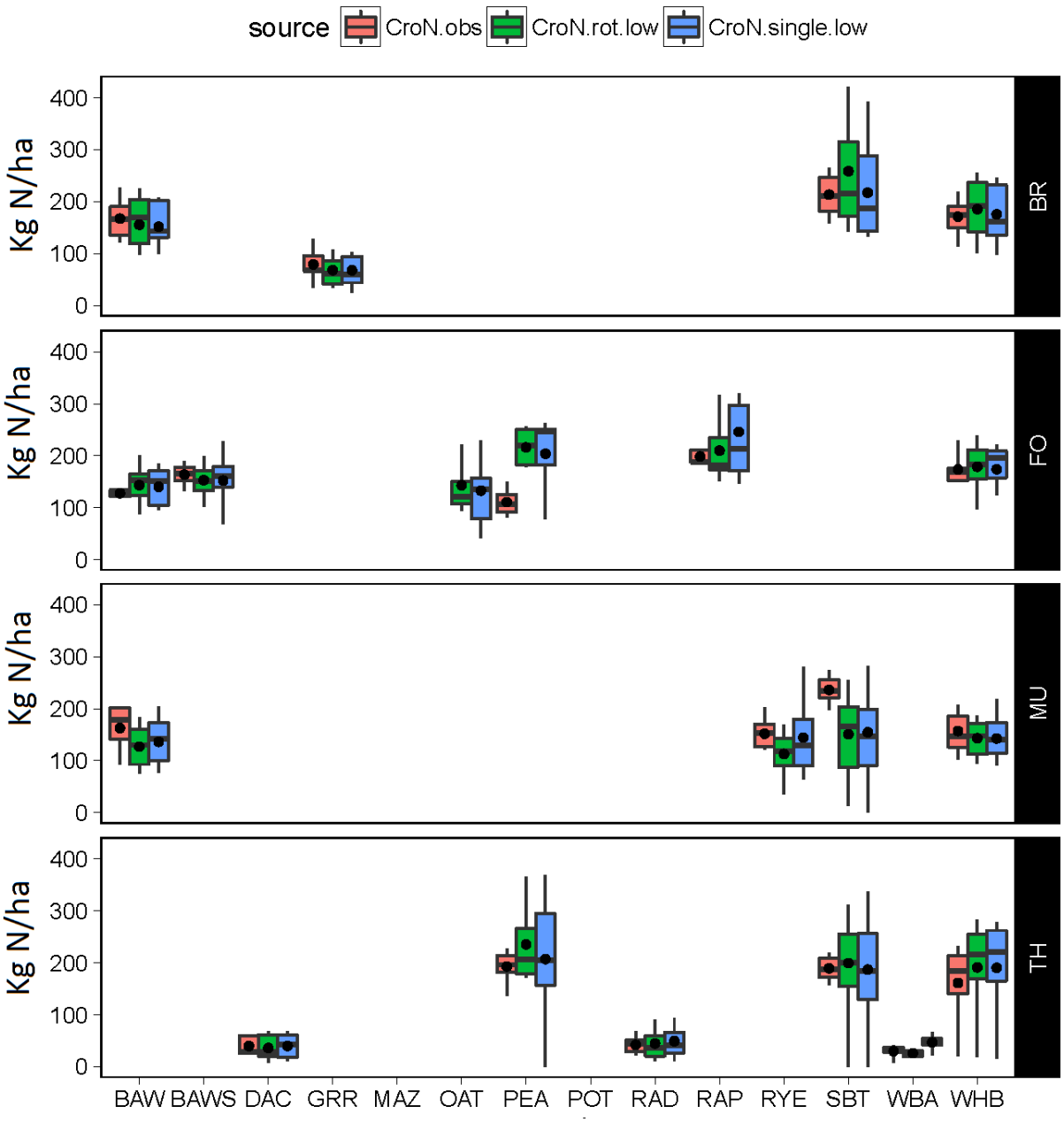
Notes: L means step2a, H means step 2b

Section 1: Model performance in simulating N uptake under both minimum and full calibration

models included in this section

- **BR:** FA, HE, MO, ST, SW
- **FO:** FA, HE, ST, SW
- **MU:** DA, FA, HE, MO, ST, SW
- **TH:** FA, HE, ST

Predicted crop N under minimum calibration



(5 models)

(4 models)

(6 models)

(3 models)

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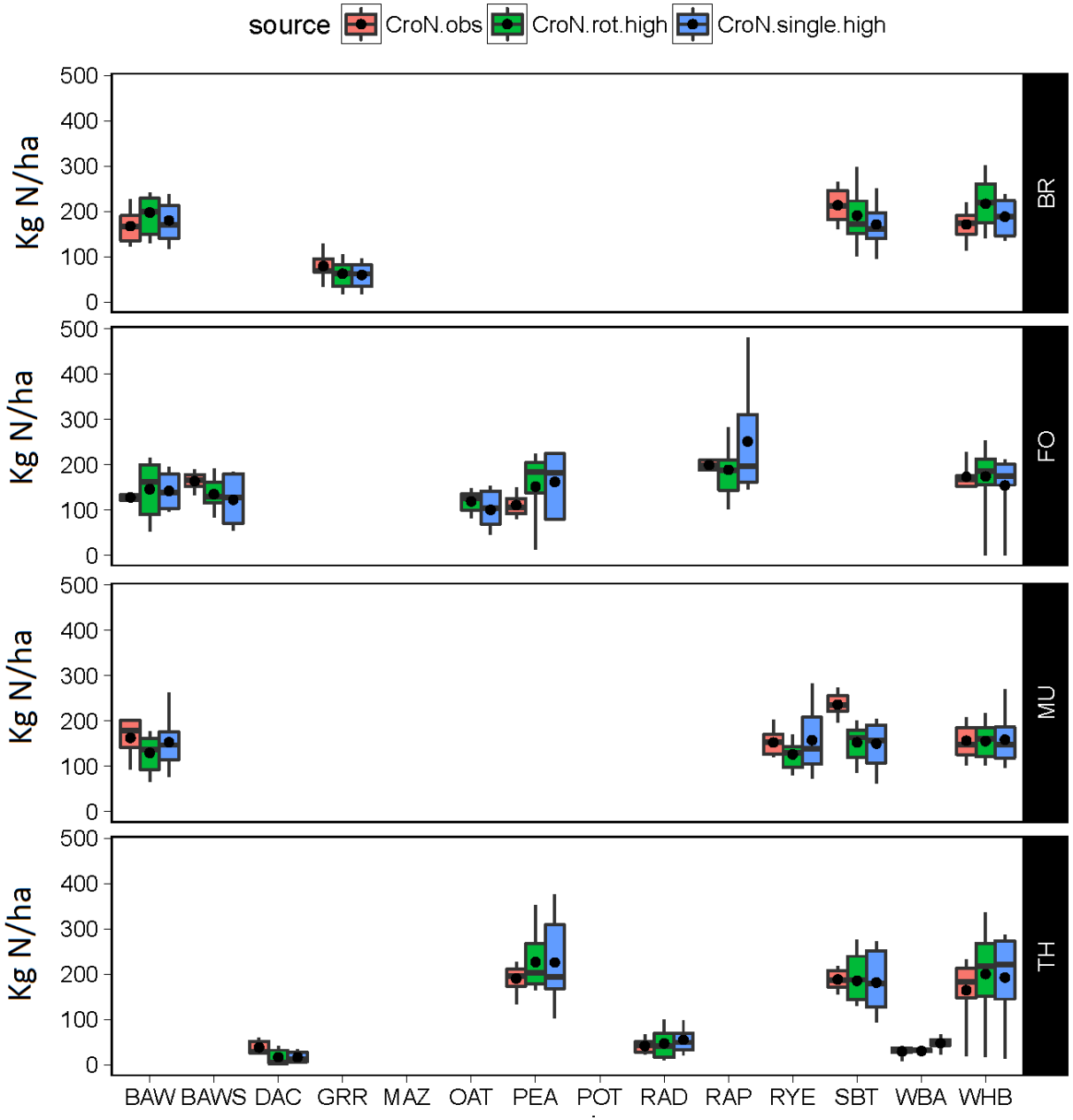
Predicted crop N under full calibration



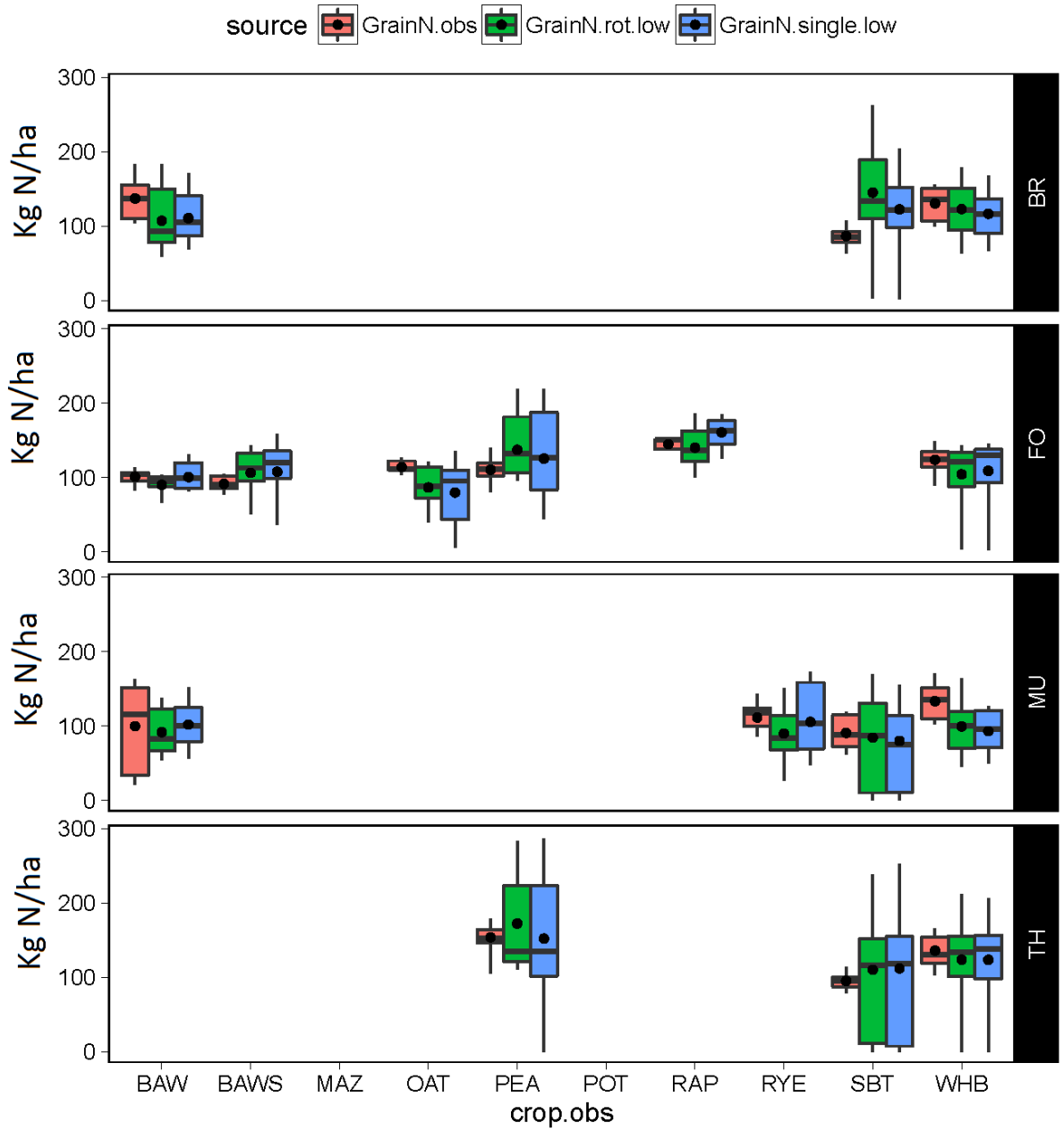
(5 models)

(4 models)

(6 models)

(3 models)

Predicted Grain N under minimum calibration



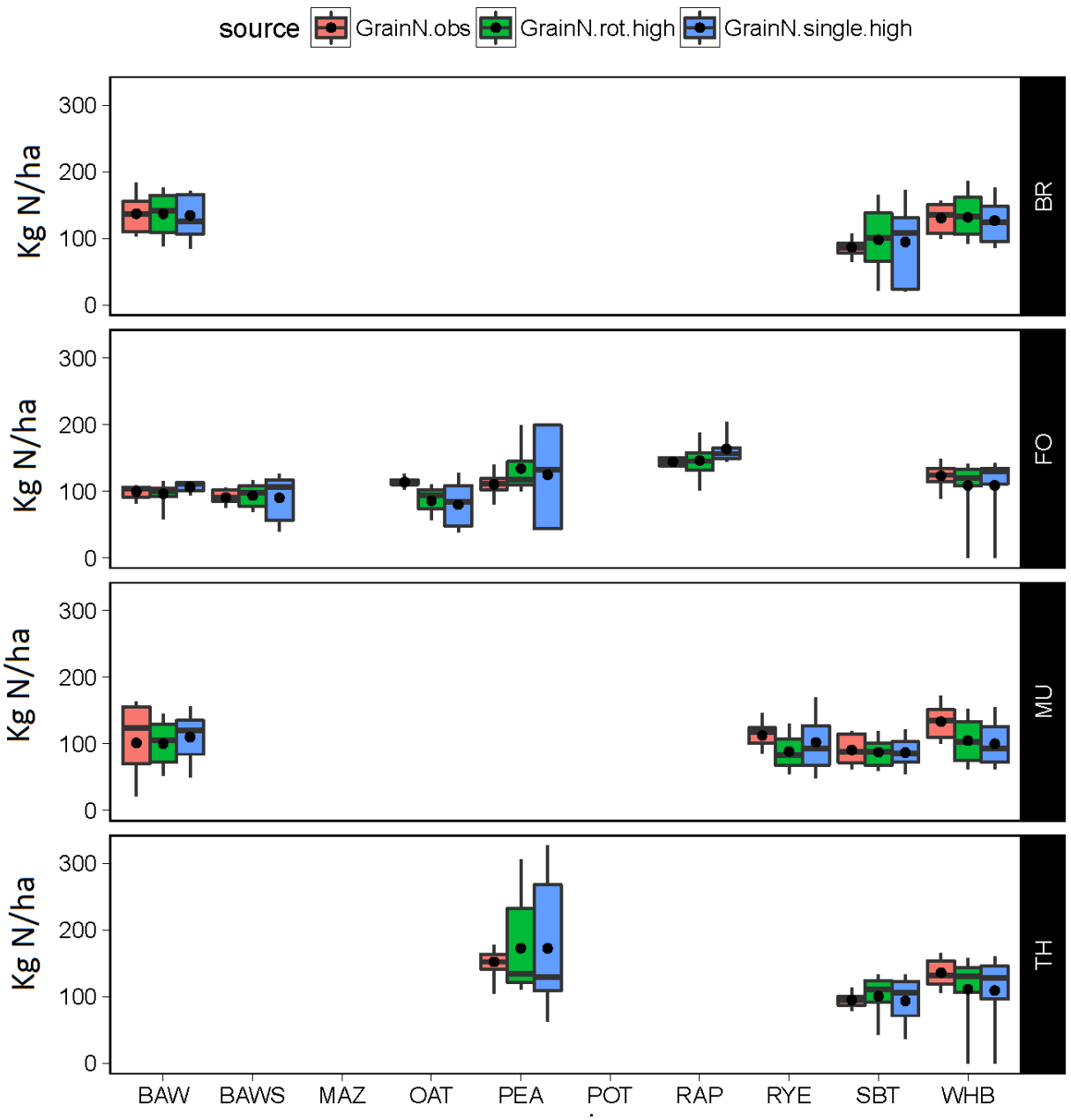
(5 models)

(4 models)

(6 models)

(3 models)

Predicted Grain N under full calibration



(5 models)

(4 models)

(6 models)

(3 models)

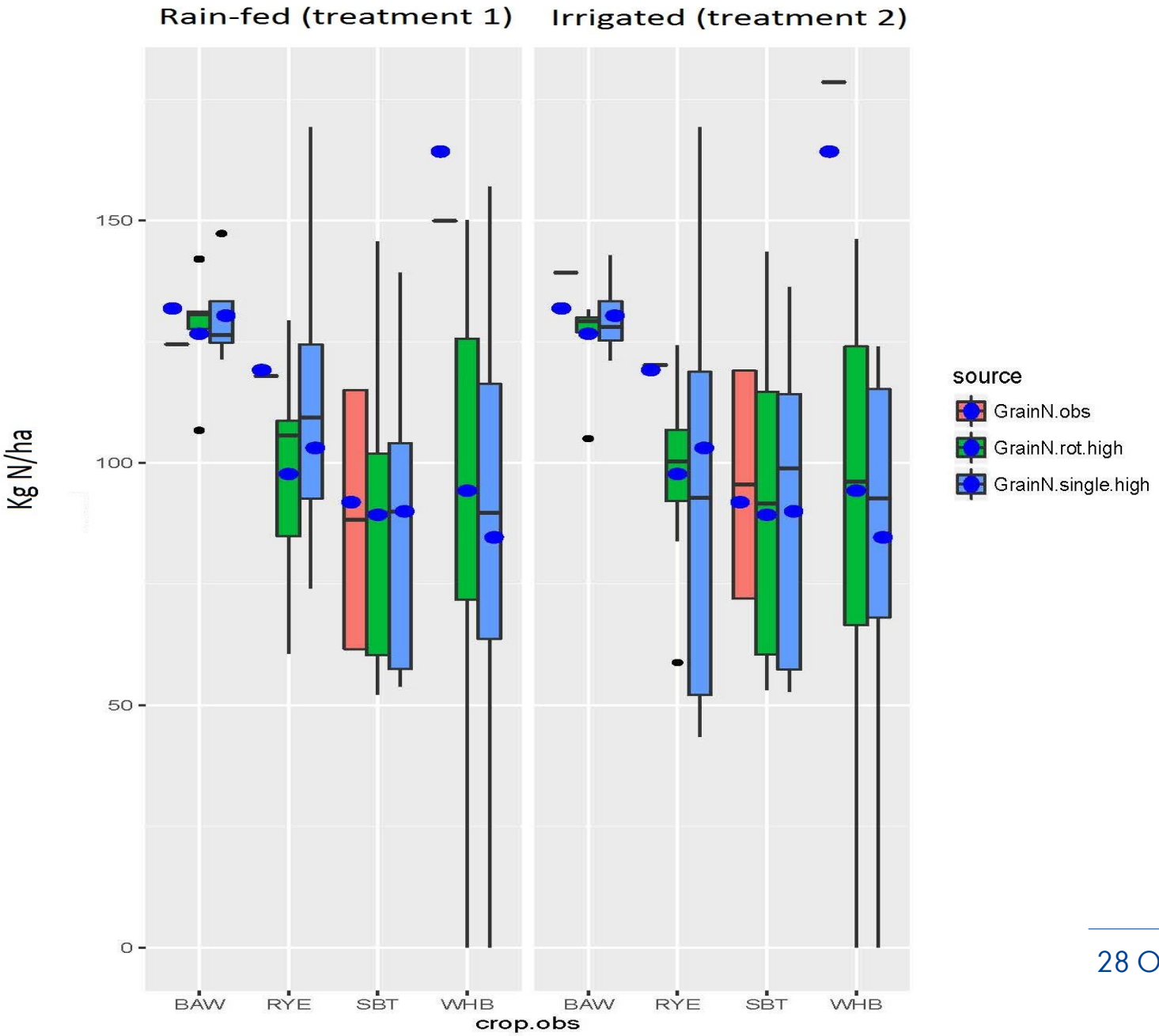
Conclusions

- ✓Both ROTATION and SINGLE models performed better under full calibration than minimum calibration in simulating both grain N and crop N
- ✓More models performed better in predicting N uptake than less models
- ✓ROTATION simulation resulted slightly higher quality compared to the SINGLE simulation

Section2: How do models respond to different managements in predicting N uptake (based on outputs from step 2b)

- **BR:** 1. Low CO2 low N; 2. Low CO2 high N; 3. High CO2 low N; 4. High CO2 high N
- **FO:** 3. Plough without residue; 4. No tillage without residue; 5. Plough with residue; 6. No tillage with residue
- **MU:** 1. rain-fed; 2. irrigated
- **TH:** 1. High N without CC; 2, Low N without CC; 3. High N with CC; 4. Low N with CC

Irrigation effects on grain N (Muncheberg)



Section 3 what we plan to do next

➢To assess multi-model ensembles in simulating N uptake

- Multi-model ensembles in simulating grain N/crop N under both minimum calibration and full calibration
- To consider both ROTATION and SINGLE simulation for each main crop (WHB, BAW, SBT, PEA)

➢To investigate CO_2 concentrations and catch crop effects on N use efficiency and N harvest index (BR & TH)

- The agronomic efficiency of applied N (AE_N)
- The apparent recovery efficiency of applied N (RE_N)
- The physiological efficiency of applied N (PE_N)
- N harvest index (HI_N)

Manuscript2:

How accuracy of models in simulating N cycling in the crop rotation systems across Europe

(based on outputs from step 2b)

- N uptake (solved)
- N leaching (from April to April)
- Soil N (each crop season)
- N emissions (each crop growing season)
- N balance (whole rotation)

Time arrangement

- **- 20.Dec.2015**, to finish all the calculations for N uptake simulations
- **1.Jan. 2016 – 15. March. 2016**, to finalize the first manuscript "Uncertainty in simulating N uptake and N use efficiency in the crop rotation systems across Europe"
- **1.Jan. 2016 – 30. Mar. 2016**, to finish calculations for N balance and draft
- **1. Apr. 2016 – 31. May. 2016**, to finalize the second manuscript regarding N balance

Thank you for your attention!