

## LTE “BSG” (Biologische Stickstoff-Gewinnung/Biological Nitrogen Fixation)

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### Site description

The long-term experiment “Biological Nitrogen Fixation” (BNF) is an ongoing trial, which was established in 1982 in the experimental station “Weilburger Grenze” Giessen (50° 36’ 12“ N, 8° 39’ 16“ E, 158 m a.s.l.) at the Justus Liebig University Giessen. The total area of the experiment covers 7200 m<sup>2</sup> including the paths and edges.

The **soil** is classified as Eutric Fluvisol Gleyic Cambisol (IUSS Working Group WRB 2015) which is characterized (0-30 cm) by silty clay texture (39-49% clay, 40-58% silt, 4-12% sand). The usable field capacity (0-100 cm) of the soil is about of 123 mm. In the topsoil (0-30 cm) the SOC varies from 0.7 to 1.6%; with a soil density of 1.2-1.3 g cm<sup>-3</sup> and a pH value of 6.0-6.4. The K, P and Mg from 2015 to 2018, can be characterized as following: potassium (KCAL) level of 4-15 (mg/100 g soil), phosphorous (PCAL) level of 4-18 (mg/100 g soil) and magnesium level of 9-28 (mg/100 g soil).

The **climate** (within the period 1982-2020) is characterized by a mean air temperature of 9.8 °C and a mean precipitation sum of 672 mm per year.

### BSG - experimental design and treatments

The field experiment includes two main factors (A) pre-crop/land use and (B) mineral fertilization (N, P, K) arranged as a randomized block design with four field replications. The four years rotational crop sequence is as follows: first year: five different pre-crops/land uses arranged parallel to each other in the same field including crimson clover (CC) (*Trifolium incarnatum* used as green mulch, field bean (FB) (*Vicia faba*), summer oat (O) (*Avena sativa*), maize (M) (*Zea mays*) and fallow (F).

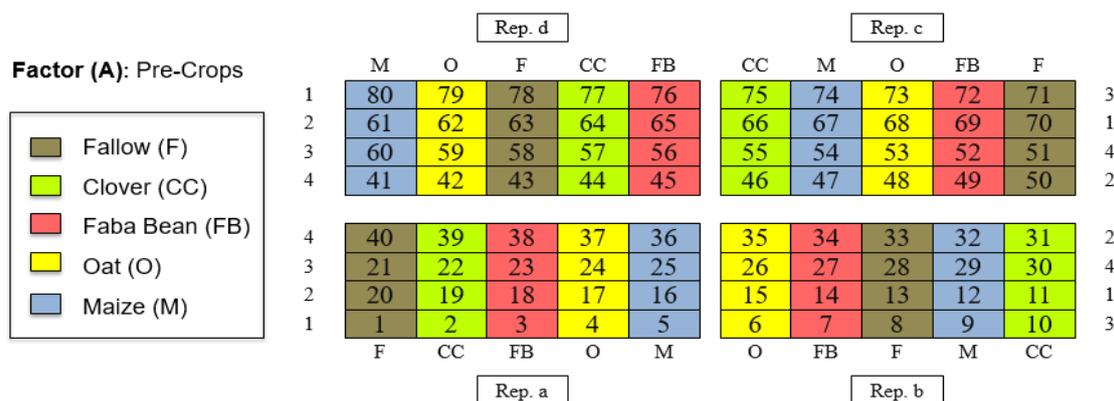
Crop rotation: First year: Crimson clover as green mulch and straw residues of fava bean, oat and maize were incorporated into the soil three weeks after harvesting. Second year: cultivation of winter wheat as the first subsequent crop after all pre-crops, Third year: cultivation of winter rye as the second subsequent crop. Fourth year: cultivation of summer barley as the third and last subsequent crop within the rotational crop sequence.

**Table:** Cultivation systems in the LTE “BNF” in Giessen since 1982, tenth rotational crop sequence in 2018-2021.

Cropping system	CS. 1	CS. 2	CS. 3	CS. 4	CS. 5
Cereals	75%	75%	75%	100%	75%

Legumes	0%	25%	25%	0%	0%
Fallow	25%	0%	0%	0%	0%
Maize	0%	0%	0%	0%	25%
Rotational crop sequence					
1 <sup>st</sup> year	Fallow	Green mulch	Fava bean	Oat	Maize
2 <sup>nd</sup> year	Wheat	Wheat	Wheat	Wheat	Wheat
3 <sup>rd</sup> year	Rye	Rye	Rye	Rye	Rye
4 <sup>th</sup> year	Barley	Barley	Barley	Barley	Barley

Mineral fertilization to winter wheat, winter rye and summer barley includes four sub-treatments: (1) zero NPK, (2) only PK 50%, (3) PK 100%+N 50% dosage (90, 60 and 60 kg N/ha for wheat, rye and barley, respectively) and (4) PK+N 100% dosage (180, 120 and 90 kg N/ha for wheat, rye and barley, respectively). The plots cover a gross size at sowing of 80 m<sup>2</sup> and at harvesting a net plot size of 42 m<sup>2</sup>. The LTE includes 20 treatments (5 pre-crops x 4 NPK fertilisations) and 80 plots.



**Factor (B): Mineral Fertilization**

- |  |                            |
|--|----------------------------|
| 1. Without NPK                                   | First year: Pre-crop       |
| 2. P 50% 45 kg/ha K 50% 60 kg/ha                 | Second year: Winter wheat  |
| 3. P 90 kg/ha K 120 kg/ha +N 50% 40+30+20 kg/ha  | Third year: Winter rye     |
| 4. P 90 kg/ha K 120 kg/ha +N 100% 80+60+40 kg/ha | Fourth year: Summer barley |

**Figure:** Experimental design and treatments distribution of biological nitrogen fixation trial (1982) "BNF" – experimental station "Weilburger Grenze" University Giessen.

**References**

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