

TEACHING PLAN

Course name: Special Topics in Soil and Water - Beneficial plant-bacteria interactions for grain yield improvement in Cerrado

Coordinator: Enderson Petrônio de Brito Ferreira

Hours: 32 hours

Theoretical: 32 hours

Practical: 0 hour

Credits: 2

Frequency: Annual

Offering Semester: 1st Semester

Prerequisites/Co-requirements/Equivalences: None

- **Summary**

General concepts about plant-growth promoting microorganisms. Economic importance of microorganisms that promote plant growth. Characteristics of the main genera of plant-growth promoting microorganisms. Obtaining, characterizing and using plant growth-promoting microorganisms.

- **Objective**

To make academics able to apply basic knowledge about plant growth-promoting microorganisms, especially in aspects of the different growth promotion mechanisms and their interactions. To provide knowledge for the correct application of biological inputs in grain-producing crops, as well as methods of evaluating and monitoring the effect of these microorganisms.

- **Teaching Process**

- ✓ Expositive and debated theoretical classes;
- ✓ Practical classes (Not applicable for online classes/web conferences));
- ✓ Problem and Questionnaires Solving;
- ✓ Dynamics and Seminars;
- ✓ Articles Discussion;
- ✓ Preparation and Writing of Scientific Articles through Scientific Experiments (Not applicable for online classes/web conferences).

- **Teaching Resources**

- ✓ **Classroom-based Classes**
 - Blackboard and chalk;
 - Multimedia projector and notebook;

- Laboratory of Agricultural Microbiology of the Embrapa Arroz e Feijão
- Greenhouse (Controlled conditions experiments)
- Experimental Area (Rainfed and Irrigated) – Field experiments

✓ **Online Classes**

- Web Conferencing Platform - WebConf - RNP;
- Moodle Platform;
- SIGAA Platform;
- G Suite for Education with the following apps:
 - Gmail
 - Google Meet
 - Google Drive
 - Google Forms
 - Google Classroom
 - Google Jamboard

For more information, click the link: <https://ufgemcasa.ufg.br/p/33095-ferramentas-e-tutoriais>

• **Evaluation procedures**

✓ **For face-to-face practical classes**

$$MF = (ATP*0,40) + (AC*0,30) + (NQ*0,10) + (NS*0,20)$$

Where:

NQ - Individual questionnaires, printed (for classroom-based classes) or online (for web conference classes);

NS – Seminars note;

ATP - Theoretical-practical evaluations;

AC - Scientific article preparation from the practical studies, **when possible**, carried out under greenhouse conditions.

✓ **For online classes**

$$MF = (ATP*0,50) + (NQ*0,20) + (NS*0,30)$$

Onde:

NQ - Individual questionnaires, printed (for classroom-based classes) or online (for web conference classes);

NS – Seminars note;

ATP - Theoretical-practical evaluations

- **Important information**

- Attendance will be required at a minimum of 85%; as regulated by the CEPEC Resolution 1461,
- Grades and their respective considered intervals:
 - A: 9,0 – 10,0;
 - B: 7,5 – 8,9;
 - C: 6,0 – 7,4;
 - D: 5,9 – 0,0 (Failed);

- **Course program**

Week	Program content	Nº of hours
1	Welcoming and course presentation	2
2	Beneficial interactions between plants and microorganisms	2
3	Importance of plant growth-promoting microorganisms	2
4	Groups of plant growth-promoting microorganisms	2
5	Mechanisms related to plant growth promotion	2
6	Isolation and morphophysiological characterization of endophytic growth-promoting microorganisms	2
7	Continuation (Isolation and morphophysiological characterization of endophytic growth-promoting microorganisms)	2
8	Isolation and morphophysiological characterization of N-fixing microorganisms	2
9	Evaluation (Seminar-S1)	2
10	Genotypic characterization of growth-promoting microorganisms	2
11	Continuation (Genotypic characterization of growth-promoting microorganisms)	2
12	Agronomic evaluation and registration for commercial use of plant growth-promoting microorganisms	2
13	Strategies for the efficient use of plant growth-promoting microorganisms	2
14	Current and future scenario for the use of growth-promoting microorganisms	2
15	Evaluation (Seminar-S2)	2
16	Final Evaluation	2

- **Recommended Bibliography**

Brazilian Journal of Microbiology – Revista oficial da Sociedade Brasileira de Microbiologia. São Paulo, SP.

Pesquisa Agropecuária Brasileira – Revista oficial da Empresa Brasileira de Pesquisa Agropecuária. Brasília – DF.

Revista Brasileira de Ciência do Solo – Revista oficial da Sociedade Brasileira de Ciência do Solo. Viçosa, MG.

European Journal of Soil Biology – Revista oficial da Sociedade Européia de Biologia do Solo. Londres, UK.

Soil Science Society of America Journal - Revista oficial da Sociedade Americana de Ciência do Solo, USA.

- **Complementary Bibliography**

Chueire, L.M.; Bangel, E.V.; Mostasso, F.L.; Campo, R.J.; Pedrosa, F.O.; Hungria, M.

Taxonomic classification of rhizobial strains recommended for soybean and common bean crops in Brazil based on the sequencing of the 16s rRNA gene. Revista Brasileira de Ciência do Solo. v. 27, p. 833-840, 2013.

Hungria, M. & Silva, K. 2011. Manual de curadores de germoplasma – microorganismos: rizóbios e bactérias promotoras do crescimento vegetal. Embrapa: Embrapa Recursos Genéticos e Biotecnologia. 21p.

Hungria, M. & Araújo, R. 1994. Manual de métodos empregados em estudos de microbiologia agrícola. Embrapa, Brasília, 890p.

Martins, L.M.V.; Xavier, G.R.; Neves, M.C.P. & Rumjanek, N.G. 1997. Características relativas ao crescimento em meio de cultura e a morfologia de colônias de “Rizóbio”. Comunicado Técnico, Embrapa p.1-14.

Melo, I.S. & Azevedo, J. L. 1998. Ecologia Microbiana. Embrapa-CNPMA, Jaguariúna - SP. 488p.

Moreira, L.P.; Oliveira, A.P.S.; Ferreira, E.P.B. Nodulation, contribution of biological N₂ fixation, and productivity of the common bean (*Phaseolus vulgaris* L.) inoculated with rhizobia isolates. Australian Journal of Crop Science. v. 11, p. 644-651, 2017.

Souza, J.E.B.; Ferreira, E.P.B. Improving sustainability of common bean production

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systems by co-inoculating rhizobia and azospirilla. *Agriculture, Ecosystems & Environment*. v. 237, p. 250-257, 2017.