



INTRODUCTION

The use of beneficial microorganisms can provide beneficial effects on plant growth. Additionally, the cultivation of cover crops in the agricultural area provides benefits for the chemical, physical and biological attributes of the soil, contributing to the increase cash crop grain yield.

Thus, the objective of this work was to determine the effect of cover crops with beneficial microorganisms in soybean and upland rice development under greenhouse and field conditions.

MATERIAL AND METHODS

Greenhouse conditions

The experiment was conducted in a greenhouse in a completely randomized design with four replications. The 26 treatments consisted of the rhizobacteria *Bacillus* sp. (BRM 32109, BRM 32110 and 1301), *Azospirillum* sp. (1381), *Azospirillum brasilense* (Ab-V5), *Pseudomonas* sp. (BRM 32111), *Pseudomonas fluorescens* (BRM 32112), *Burkholderia pyrrocinia* (BRM 32113), *Serratia* sp. (BRM 32114), and a fungal genus formed by a pool of *Trichoderma asperellum* (T-06, T-09, T-12, and T-52), alone or in mix, plus a control treatment without microorganism application.

Field conditions

The experimental design was a randomized block in the 6 × 2 factorial scheme, with six combinations of soil coverings (1. Millet (*Penisetum glaucum*) + Crotalarías (*Crotalaria juncea*, *C. spectabilis* and *C. ochroleuca*), 2. Millet + pigeon pea (*Cajanus cajan*), 3. millet + *Urochloa ruziziensis*, 4. millet + *U. ruziziensis* + pigeon pea, 5. millet + buckwheat (*Fagopyrum esculentum*) and 6. fallow), with or without the application of beneficial microorganisms (*Trichoderma asperellum* pool) in the soybean crop or mixture isolate 1301 (*Bacillus* sp.) + *Azospirillum brasiliensis* isolate AbV5 in upland rice crop.

CONCLUSION

Beneficial microorganisms provided positive effect on yield of soybean and upland rice under greenhouse conditions;

Cover crops as affected upland rice and soybean yield under field conditions.

Beneficial microorganisms did not provide increases in upland rice and soybean grain yield.

RESULTS AND DISCUSSION

Table 1. Cover crops and beneficial microorganism as affecting soybean and upland rice grain yield.

Factors	Soybean yield (kg/ha)	Upland rice yield kg/ha)
Cover crops		
Fallow	1980 ^{bc}	4105 ^{bc}
Millet + Crotalarías	1784 ^c	4648 ^a
Millet + Pigeon pea	1988 ^{bc}	4184 ^{abc}
Millet + <i>Urochloa ruziziensis</i>	2265 ^a	3941 ^c
Millet + <i>U. ruziziensis</i> + Pigeon pea	2440 ^a	4231 ^{abc}
Millet + <i>Fagopyrum esculentum</i>	2014 ^b	4439 ^{ab}
Beneficial microorganism		
With	2071 ^a	4370 ^a
Without	2058 ^a	4116 ^a

*Means followed by the same letter, do not differ by the Tukey test.

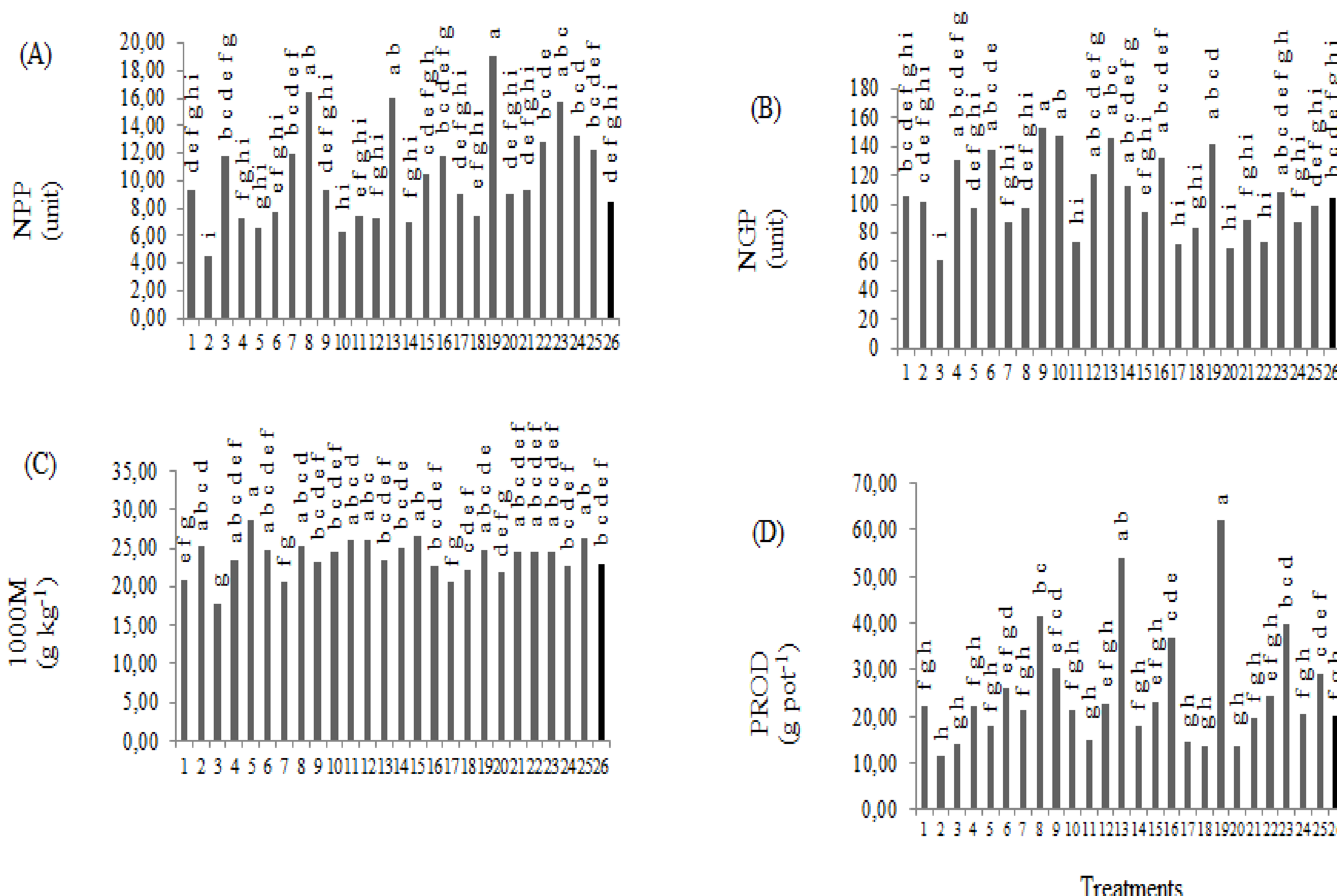


Figure 1. Number of panicles per pot (NPP, A), number of grains per panicle (NGP, B), mass of 1000 grains (1000M, C) and grain yield (PROD, D) in upland rice plants, cultivar BRS A501 CL, treated with multifunctional microorganisms, isolated or mixed. (Numbers 1 to 26). * Means followed by the same letter do not differ by the LSD test ($p < 0.05$). The black column refers to the control treatment (without application of the microorganism). *Burkholderia pyrrocinia* isolates (BRM 32113) (1); *Pseudomonas fluorescens* (BRM 32111) (2); *Pseudomonas* sp. (BRM 32112) (3); *Serratia* sp. (BRM 32114) (4); *Bacillus* sp. (BRM 32110) (5); *Bacillus* sp. (BRM 32109) (6); Pool of *T. asperellum* (7); *Azospirillum brasilense* (Ab-V5) (8); *Azospirillum* sp. (1381) (9); *Bacillus* spp. (1301) (10); Mix treatments BRM 32114 + BRM 32110 (11); BRM 32114 + Ab-V5 (12); BRM 32114 + Pool de *T. asperellum* (13); BRM 32110 + Ab-V5 (14); BRM 32110 + *T. asperellum* pool (15); Ab-V5 + *T. asperellum* pool (16); 1381 + 1301 (17); 1381 + Ab-V5 (18); 1301 + Ab-V5 (19); 1381 + BRM 32114 (20); 1301 + BRM 32114 (21); 1381 + BRM 32110 (22); 1301 + BRM 32110 (23); 1381 + Pool *T. asperellum* (24); 1301 + Pool of *T. asperellum* (25) and the control treatment (without microorganism) (26).

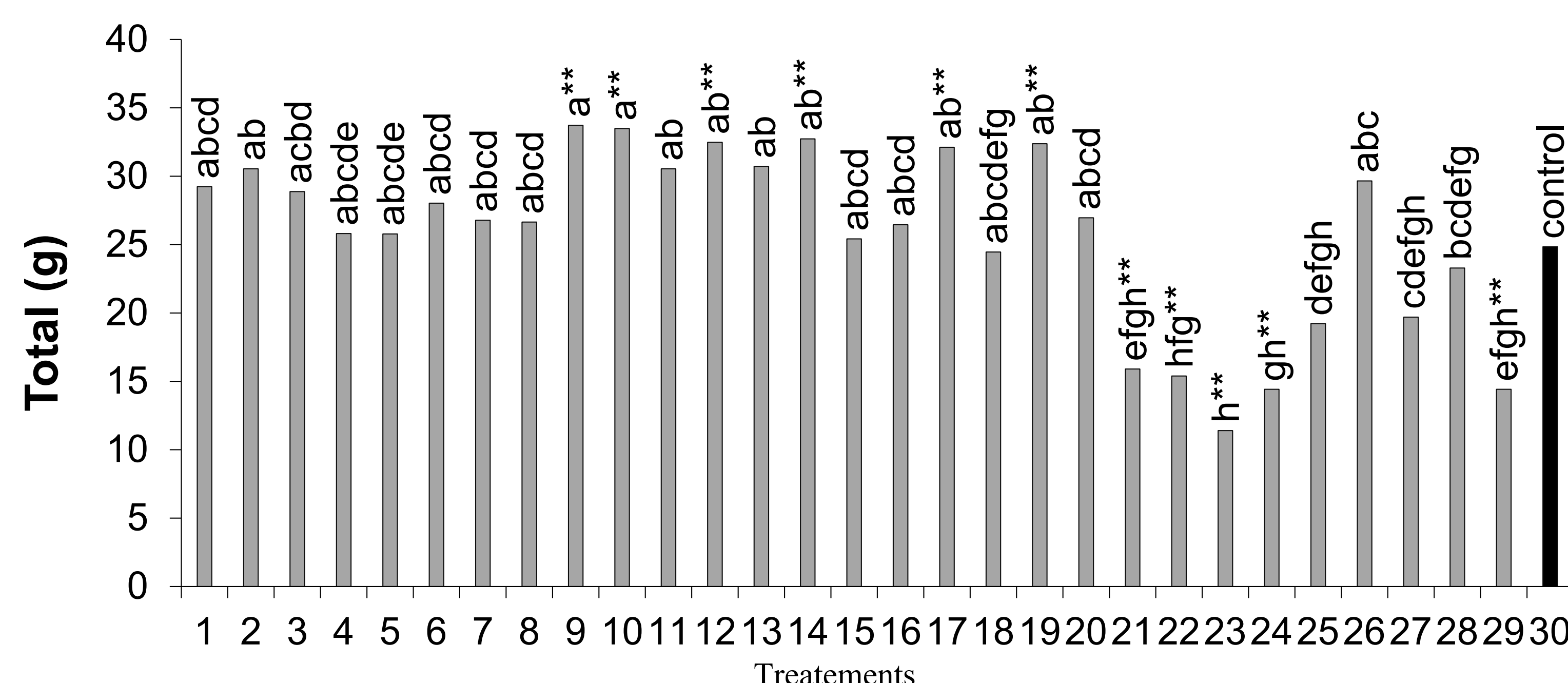


Figure 2. Total of soybean plants treated with beneficial microorganisms, use alone or in a mixture. *Means followed by the same letter in columns do not differ from each other by the LSD test. Comparisons between treatments and control, significant by the Dunnett test, at significance level 0.05, are indicated by **. Treatments: (1) BRM 32109; (2) BRM 32110; (3) BRM 32111; (4) BRM 32112; (5) BRM 32113; (6) BRM 32114; (7) 1301; (8) 1381; (9) *T. asperellum* pool (*T. pool*); (10) Ab-V5; (11) 32110 + 32114; (12) 1301 + 32110; (13) 1381 + 32110; (14) 1301 + 32114; (15) 1381 + 32114; (16) 1301 + 1381; (17) 32110 + Ab-V5; (18) 32114 + Ab-V5; (19) 1301 + Ab-V5; (20) 1381 + Ab-V5; (21) Ab-V5 + *T. pool*; (22) 32110 + *T. pool*; (23) 32114 + *T. pool*; (24) 1301 + *T. pool*; (25) 1381 + *T. pool*; (26) 32110 + 32114 + Ab-V5; (27) 32110 + Ab-V5 + *T. pool*; (28) 32110 + 32114 + Ab-V5 + *T. pool*; (29) 32110 + 32114 + Ab-V5 + *T. pool* + 1301 + 1381 and (30) control (no microorganism).

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