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Linqiao Xi
Tarim University, China

Juan Qi
Gansu Agricultural University, China

Degang Zhang
Gansu Agricultural University, China

Tuo Yao
Gansu Agricultural University, China

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Using ^{15}N isotopic dilution method to quantify the associative nitrogen fixing bacteria from grassland in eastern qilian mountains

Linqiao Xi^{1,2}, Juan Qi², Degang Zhang², Tuo Yao²

¹ College of Animal Science and Technology, Tarim University, Alar, China, 843300, E-mail: gsexlq666@163.com.

² Grassland College, Gansu Agricultural University, Lanzhou, Gansu, 730070

Key words: associative nitrogen-fixing bacteria, phosphate-solubilizing, auxins

Introduction N_2 -fixation carried out by associative and free-living microorganisms in the rhizosphere of oat has been recognized as an important factor in nitrogen nutrition of the plant. NFB can produce plant growth regulators (PGRs).

Materials and methods The associative nitrogen fixation strains were isolated from the Rhizosphere of wheat and oat in Gansu (Table1). The ^{15}N analyzer with optical principle was used to determine stable isotopes (NOI7). ^{15}N isotopic dilution method was chosen to determine quantification of association nitrogen fixation bacteria in soil.

Table 1 The ability of different strains as nitrogen fixers, IAA producers and phosphate solubilizers.

strains	nitrogenase activity (C_2H_4 nmol/ml·h)	IAA	organic (D/r)	phosphorus inorganic phosphorus(D/r)	P dissolution (ug/ml)
<i>Azospirillum lipoferum</i> O6	351.6	19.2	ND	1.67	82
<i>Azotobacter sp</i> O5	359.4	16.2	1.4	ND	ND
<i>Azotobacter sp</i> W5	512.7	12.2	2.27	ND	ND
<i>Zoogloea sp</i> C6	256.9	15.1	ND	1.25	76
<i>Pseudomonas sp</i> N4	940.5	22.3	1.6	ND	ND
<i>Zoogloea sp</i> W6	312.1	6.33	2	1.07	58
<i>Pseudomonas sp</i> O3	453.9	17.6	1.41	ND	ND

Results N concentration and ^{15}N atom% excess of above ground dry matter of different strains (Table 2).

Table 2 N concentration and ^{15}N atom% excess of above ground dry matter of different strains of Oats.

strains	Above dry weight(kg/ha ²)	N concentration (%)	% Ndfa Fixation N	^{15}N atom% excess	Total N fixation kg/ha ²
<i>Azospirillum lipoferum</i> O6	5615.0	0.67	18.23	1.131	6.8582 ^{bb}
<i>Azotobacter sp</i> O5	6302.5	0.65	14.11	1.187	5.7803 ^{bb}
<i>Azotobacter sp</i> W5	8557.5	0.49	11.14	1.228	4.6712 ^{bb}
<i>Zoogloea sp</i> C6	5702.5	0.58	9.91	1.245	3.2777 ^{cc}
CK	4700.0	0.48	/	1.381	ND
<i>Pseudomonas sp</i> O3	7215.0	0.63	4.78	1.316	2.1727 ^{cc}
<i>Pseudomonas sp</i> N4	8565.0	0.58	21.35	1.087	10.6060 ^{aa}
<i>Zoogloea sp</i> W6	7510.0	0.53	13.10	1.201	5.2142 ^{bb}

note: CK 148kg/ha urea a.e. 2.24% ^{15}N urea atom% excess is 2.24%, dosage is 149 kg/ha. ND not detector.

The amount of biological nitrogen fixation was determined to be $\text{N}_4 > \text{O}_6 > \text{O}_5 > \text{W}_6 > \text{W}_5 > \text{C}_6 > \text{O}_3$; ^{15}N atom% ranged from 1.0871% to 1.3164%. The range of biological nitrogen fixation was 2.17~10.61 kg/ha; ^{15}N atom% content of above ground dry matter varied for different strains of Oats.

Conclusion N_2 -fixing bacterial inoculation increased growth and development of oats, particularly by increasing above ground dry-weight.

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