N Mineralization in Soil from 5-and 9-Year Lucerne Stands on the Loess Plateau

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Key words : leaching ,N fertilizer ,companion plants ,mineralization

Introduction The legume component plays an important role in a dry farming system on the Loess Plateau by increasing soil N . Lucerne (*Medicago sativa*) is the common legume which can be used . The objective of this study is to determine influences of initial N level , added N fertilizer and planted ryegrass on N mineralization in soil under lucerne .

Materials and methods A pot (15×20 cm , contained 2 kg soil) incubation experiment was carried out for 12 weeks . Loess soils (70% silt and 23% clay) were taken from the upper 30cm layers of 5-and 9-year lucerne stands (35°40′N , 107°51′E , 1298 m a . s l) . There were six treatments : control (CK) , leaching initial inorganic N (L) , N fertilizer application (N) , planted ryegrass (Rye) , leached soil plus ryegrass planting (L+Rye) and N fertilizer application plus ryegrass (*Lolium perene*) planting (N+Rye) . The six treatments were randomly allocated in 4 blocks . Data were analysed using One-way ANOVA model by SPSS (version 13 .0) .

Results Initial leaching of inorganic nitrogen and addition of N fertilizer significant ($P<0.001$) affected N mineralization rate of soil from 5-year lucerne stands , but only slightly affected the soil from 9-year lucerne stands . Planted ryegrass significantly ($P<0.001$) increased both in soils from 5-and 9-year lucerne stands . Net N mineralization rate was highest in the N+Rye treatment and higher in 9-year lucerne stands than 5-year . N uptake by ryegrass was unaffected by leaching , and was highest when N fertilizer was added in both 5-and 9-year lucerne soils .

Discussion Leaching stimulated N mineralization , suggesting a low initial inorganic nitrogen level increased N availability of soil after lucerne in dry farming system . Crops after lucerne should increase nitrogen availability , because plant N uptaking by ryegrass removed existing mineralized nitrogen benefiting N mineralization process . N fertilizer plus reygrass growth increased soil N mineralization that confirmed the suggesting results for winter wheat following 4-year lucerne having a positive response to the N supply in the region (Zou *et al* . , 2005) . Soil in 9-year lucerne stands had higher mineralization availability than 5-year stand suggesting more organic substances accumulated after lucerne growth .

Table *Net N mineralization rate (N_{min} rate) and nitrogen uptake by ryegrass (N uptake) during 12 weeks incubation in 5-and 9-year lucerne soils .*

Treatments	N_{min} rate (mg kg^{-1} day^{-1})		$N_u$ptake (mg pot^{-1})	
	5-year	9-year	5-year	9-year
CK	0 .02	0 .16	—	—
L	0 .07	0 .23	—	—
N	0 .06	0 .06	—	—
Rye	0 .26	0 .37	42 .19	62 .51
L+Rye	0 .32	0 .35	43 .37	50 .22
N+Rye	0 .57	0 .59	161 .54	166 .56
$LSD_{(0.05)}$	0 .03	0 .08	6 .20	17 .52

Net N mineralization rate (N_{min} rate) was determined using the equation : N_{min} rate = ($N_{inorg\ after}$-$N_{inorga\ pre}$ + N_{uptake}-$N_{fertilizer}$) / (DW_{soil} × 85days) , where $N_{inorg\ after}$ indicates inorganic N after harvesting , and $N_{inorg\ pre}$ represents initial inorganic N . Inorganic N is calculated as the sum of NO_3^--N and NH_4^+-N . N_{uptake} and $N_{fertilizer}$ were zero then there were no ryegrass or fertilizer added in the treatment . DW_{soil} is the dry weight of pot soil .

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