土壤微生物量氮含量、矿化特性及其供氮作用

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摘要:论述了土壤中微生物体氮的含量及其影响因素,土壤微生物量氮的矿化特性及其与土壤矿化氮间的关系,土壤微生物量氮含量与土壤供氮指标间的关系等。提出研究不同生态系统中土壤微生物量氮的含量及其变化规律,不同耕作栽培措施对土壤微生物量氮含量的影响;土壤微生物量氮在土壤氮素保持和释放中的作用;土壤微生物量氮的转化率与其供氮量间的关系;土壤微生物量氮与作物氮素吸收间的关系等,是土壤微生物量氮方面应重点研究的问题。

关键词:土壤微生物量氮;氮素矿化;供氮意义

Contents of soil microbial biomass nitrogen and its mineralized characteristics and relationships with nitrogen supplying ability of soils

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Abstract: As soil microorganisms decompose the organic matter, they also assimilate a portion of the nutrient in soils to build their body. The nutrients in soil microbial biomass are mineralized from the dead microorganisms. Therefore, soil microbial biomass is considered as a source and sink for nutrients, and is an active pool of organic matter in soils. Because of its important role in various ecological systems, nitrogen contained in soil microbial biomass (i. e., SMBN) has got much attention in recent years. This article intends to briefly review the advances in studying the content of SMBN in soils, its mineralization characteristics and the relationships with nitrogen supplying ability of soils. Areas, which need further research, are stressed.

The content of SMBN in soils in the different ecosystems depends on climate, vegetation, soil types and cultivation practices. Contributions of organic matter to soil from manure, plant residues or root secretion usually increase the levels of SMBN. The rate of increase depends on the amounts of organic matter added and its properties. Soils with fine texture were found to have high contents of SMBN, perhaps due to the ability to better protect soil microbial biomass from decomposition. The effects of inorganic N fertilizers on SMBN were not consistent. The effects of various management practices on the changes of SMBN were perhaps related to their different influences and contributions to the organic matter pool in soils.

Compared to the other pools of organic-N in soils, N in microbial biomass, fractionated by the acid hydrolysis method, is lower in unhydrolysable N and higher in amino acid and acid hydrolysably unidentified forms. This indicates the easy decompositions of SMBN. The turnover of SMBN varies with soils, however, it was faster than other pools of organic N in soil. Therefore, SMBN can be considered as a source of easily mineralizable organic-N in soils.

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Significant correlation between SMBN and the mineralizable N in soils was found in several studied. As for the contribution of SMBN to mineralized N in soils, there were some controversial reports. Some researchers showed that the SMBN were the main source of easily mineralizable organic-N in soils. Others concluded that SMBN contributed only a part of the easily mineralizable organic-N. Although its content is low, the short-term turnover of SMBN makes it an important source for the mineralizable N in soils.

SMBN can be extracted chemically. Mild extractants, such as 0.01 mol/L $CaCI_2$, or 0.01 mol/L $NaHCO_3$ solutions, were found to be preferential for extracting the SMBN. Due to the active role of SMBN in N transformation in soils, chemical methods used to extract the available N from soils, and which are sensitive to SMBN, are also important for evaluation of N availability in soils. Such methods could also be used to assess the N supplying ability of soils.

Researchers have recognized the important role of SMBN in adjusting N transformations in soils, and used the SMBN as an index to evaluate the effects of fertilization and tillage on soil properties. To understand the exact role of SMBN in N dynamics in soil-plant systems there are still many issues to be resolved. Among these are:

A. Quantifying the changes in the SMBN in soils of various ecosystems and under different management practices. This could help understand the role of SMBN in affecting the mineralization and immobilization of N in soil-plant systems, and to explain the fate of N-fertilizer applied to soils.

B. Evaluating the relationship between the content and turnover rate of SMBN and N supplying ability of soils in different ecosystems. This includes the mineralization characteristics of SMBN under aerobic and anaerobic conditions, and the relationship between the SMBN and other N availability indices of soils.

C. Assessing the contribution of SMBN to N uptake by the plant in various ecosystems, including its role at different growth stages of plants.

In summary, the core of the needed research is to understand the relationships of SMBN with other pools of N in soils. That would be helpful for adjusting N supplying ability in soils, and reducing N losses from the ecosystems, and increasing the efficiency of N-fertilizers.

Key words: soil microbial biomass nitrogen; mineralizable N; N supplying ability
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土壤微生物在参与土壤有机物分解与合成的同时,还同化土壤有机质和土壤中的一些矿质养分构成其躯体。微生物固持的这些养分在其死亡后可发生再矿化,成为矿质养分[1,2]。关于这一方面的研究在近二、三十年以来才引起人们的重视[3]。由于氮素在生态系统中的重要作用,特别是其与农业生产和环境保护的密切关系,土壤微生物体所含的氮素(Soil microbial biomass nitrogen, SMBN,简称土壤微生物量氮)与土壤氮素转化的关系是人们研究的一个热点问题[4~7]。本文拟对土壤微生物量氮的含量及其影响因素,土壤微生物量氮的矿化特性及有效性等问题作一简要论述。

1 土壤微生物量氮的含量及其影响因素

土壤微生物量氮的含量与气候、植被、土壤类型和耕作栽培措施等有关。表 1 汇总了国外不同地区不同植被下土壤微生物量氮的含量的测定结果,从中可以看出,农田土壤微生物量氮含量在 40～385kgN/hm^2,平均 195kgN/hm^2;林地在 130～216kgN/hm^2,平均 170kgN/hm^2;草地在 40～496kgN/hm^2,平均 225kgN/hm^2。

土壤微生物量氮占土壤全氮的比例不同研究者的结果有别。Anderson 等[2]对 26 个农业土壤的研究发现,土壤微生物量氮占土壤全氮的比例在 0.5%～15.3%,平均约 5%;Azam 等[20]发现,微生物体氮占土壤全氮的比例为 2.6%～14.8%,平均约 6.4%。根据对黄土高原区土壤的研究[21],微生物体氮量为土壤全氮的 0.20%～5.65%,平均 3.36%。结果低于国外的报道,这可能与供试土壤肥力普遍较低有关。

土壤微生物量氮的含量是土壤微生物对氮素矿化与固持作用的综合反映。因此,凡能影响土壤氮素矿化与固持过程的因素都会影响土壤微生物量氮的含量。

土壤微生物量氮含量与加入土壤的有机碳源的种类和数量有关。Aoyana 等[22]发现,加入鸡粪、三叶草、厩肥、树皮堆腐物及水稻秸秆后,土壤微生物量氮的含量均有所增加,但增长量因有机物料的种类而异。厩肥、三叶草及水稻秸秆处理的增加幅度高于鸡粪和树皮堆腐物处理。Patra 等[23]发现,施用小麦和豇豆秸秆,土壤微生物量氮增加,且前者高于后者;随着培养时间延长,豇豆秸秆处理土壤微生物量氮含量下降,而加入小麦秸秆,土壤微生物量氮含量基本保持不变。沈其荣等[24,25]通过盆栽试验比较了不同施肥处理对黄棕壤中土壤微生物量氮的影响,结果表明,施用稻草土壤微生物量氮最高,其次为施用猪粪的处理,再次为氮肥与有机肥配合处理,单施化学氮肥的最低,与不施肥对照相近,认为有机肥的不同是影响土壤微生物量氮水平的主要因子。有研究者比较了土壤加入蔗糖和麦秆后氮素的固持情况,结果表明[26],加入麦秆培养的前 20d 内,随着培养时间的延续,氮素固持几乎呈直线增加,到 20d 左右达到最高峰;加入蔗糖后氮的固持高峰出现于培养后的第 2 天。一般认为,加入有机物的含氮量小于 1.2%～1.3%(相应的 C/N 比约为 30),在培养的 1 个月左右一直进行氮素固持;加入有机物的含氮量超过 1.8%～2.0%(相应的 C/N 比约为 20),培养 1 周左右即发生氮素矿化作用[27]。氮素的固持无疑会增加土壤微生物量氮含量,而矿化作用将使土壤微生物量氮含量降低。不同有机物料对土壤微生物量氮含量的影响,是其对土壤氮素矿化和固持作用影响的综合反应。

表 1　不同地区土壤微生物量氮的含量

Table 1　Contents of soil microbial biomass nitrogen in the soils at different regions

地点 Location	土类或质地 Soil texture or type	植被 Vegetation	土壤有机碳 Soil organic C(g/kg)	土壤微生物量氮 SMBN (kg/hm^2)	参考文献 Reference
澳大利亚	砂壤土	牧草	7.0	40	[8]
澳大利亚	粘　土	牧草	13.0	100	[8]
新西兰	粉壤土	草地	32.0	273	[9]
新西兰	粉砂土	牧草	68.0	309	[10]
加拿大	粉壤土	草地	67.0	116	[11]
美　国	淋溶土	草地	26.0	85	[12]
美　国	—	牧草	19.0	110	[13]
爱尔兰	棕　壤	草地	56.0	485	[14]
新西兰	粘壤土	牧草	56.0	496	[9]
美　国	淋溶土	林地	40.0	130	[12]
尼日利亚	—	林地	19.0	216	[15]
加拿大	壤　土	小麦	23.0	108	[16]
加拿大	粉壤土	小麦	15.0	157	[16]
加拿大	黑钙土	小麦	6.5	360	[17]
加拿大	粘壤土	小麦	46.0	385	[16]
苏格兰	—	大麦	56.0	260	[18]
巴　西	灰　土	甘蔗	26.0	84	[17]
爱尔兰	潜育土	谷类	39.0	146	[14]
英格兰	淋溶土	小麦	—	80	[4]
瑞　典	粘壤土	谷类	—	240	[19]

植物根际由于根系的分泌作用及根细胞的脱落等,累计了大量有机物质。就根系分泌作用来看,植物一般将其光合同化产物的 5%～25%运至根系,这些光合产物除约 25%～70%通过根系呼吸作用转化为 CO_2 外,其余的主要以有机物形式释放于土壤[28]。据估计,作物根系释放的总碳素每年约为 900～3000kg/hm^2[29]。根际存在的大量有机物为微生物活动提供了能源,因此根际土壤微生物数量远远高于土体。据 Jensen 等[30]研究,自大麦播种 6d 开始,根际土壤微生物量氮含量显著高于土体,平均高出 33%～97%。

耕作栽培措施也会影响土壤微生物量氮含量。据 Carter 研究[11],免耕土壤 0～5cm 土层微生物体碳和氮含量比浅耕的高 10%～23%. Follett 等[31]研究发现,长期耕作使土壤微生物生长所需的碳源减少,降低了土壤微生物固持土壤矿质氮的能力。在加拿大淋溶土上进行的试验表明,小麦→休闲与小麦→燕麦→大麦→饲草轮作方式相比,50a 后,后一轮作方式土壤微生物体量和微生物体氮含量明显高于前者[32]。据 Franzluebbers 等研究[33],免耕条件下复种指数增加,可提高土壤微生物量氮含量。

植物、气候不同也影响土壤微生物量氮的含量。Singh 等[34]对高度风化及淋溶、养分缺乏的热带干旱地区林地及草原土壤微生物量氮变化的研究发现,在干旱炎热的夏季,土壤微生物量氮含量最高,原因是干旱缺水限制了作物正常生长,而微生物仍可利用土壤水分,土壤养分被微生物固持;雨季矿化作用强,植物生长旺盛,土壤养分被植物吸收,微生物体氮含量最低。认为在养分缺乏的生态系统中,土壤微生物量既是养分的源,又是养分的库。美国堪萨斯州的草原土壤早春的微生物体氮的含量最高,随着植物的生长,其

含量逐渐下降;夏末秋初后,微生物体氮含量又开始上升[13]。而Franzluebbers等[35]对农田土壤研究却发现,作物生长前期土壤微生物体量含量最低,5～11月份土壤微生物量氮含量逐渐增加,以后开始下降。Holmes等[36]对北美落叶林地区土壤研究发现,一年中微生物量氮含量相对稳定。不同生态系统下土壤微生物量氮含量变化规律差异的原因尚待进一步研究。

土壤微生物量氮的含量还与土壤性质有关。据Ladd等[37]研究,加入标记的植物残体4a后,粘粒含量高的土壤微生物体中^{14}C和^{15}N残留量比例高。质地细的土壤微生物体C、N占土壤全C、N的比例高于粗质地土壤,且单位微生物体中C、N的矿化作用前者小于后者,认为这与前者对微生物体氮的保护作用有关[38,39]。一些学者还发现,土壤微生物量氮含量与土壤粘粒含量间呈密切的正相关关系,土壤中未被保护的微生物量的矿化率显著高于被保护的微生物量的矿化率[40,41]。因此,有学者提出了土壤微生物体量承载容量(Carrying capacity)的概念[3],认为土壤微生物体量的承载容量为土壤的一个特性,是土壤可稳定保护土壤微生物体量的能力,其大小与土壤碳素输入、粘粒含量、团聚体的结构等因素有关。

施用无机氮肥对土壤微生物量氮含量的影响,不同研究者的结果不尽一致。在加拿大进行的试验发现,连续50a施肥,NPKS处理土壤微生物量氮含量与不施肥处理相比无显著差异[32]。在英国洛桑进行的肥料定位试验也发现,长期施用无机氮肥并未增加土壤微生物体碳、氮的含量[42]。也有研究发现,施用氮肥增加了土壤微生物量氮含量[43]。不同研究者结果差异的原因可能与试验地区土壤碳素供应状况有关。

总之,土壤微生物量氮是土壤有机态氮中最活跃的组分,是土壤中有机-无机态氮转化关键的环节之一。了解不同生态系统下土壤中微生物量氮的含量变化,对于揭示土壤中的碳氮转化规律,查明氮肥在土壤中的去向等,具有十分重要的作用。

2 土壤微生物量氮的矿化特性

土壤微生物体固持的养分在其死亡后可矿化为无机养分。因此,习惯上都将微生物体所含的养分归为土壤有效养分。但土壤微生物量氮的矿化分解速率怎样?其矿化量大小如何?与土壤矿化氮有何关系?是人们更关心的问题。

从微生物体的养分组成看,因其C/N比一般小于10(表2),所以是容易矿化的。

表2 一些植物、微生物及农家肥的养分含量(干基%)[27]

Table 2 The C/N ratios of some plants, microbial biomass, and farmyard manure

种类 Variety	C	N	P	S	C/N
细 菌	50	15	3.2	1.1	3.33
放线菌	50	11	1.5	0.4	4.55
酵母菌	47	6.2	0.7	0.3	7.58
真 菌	44	3.4	0.6	0.4	12.9
蚯 蚓	46	10	0.9	0.8	4.6
玉米秸秆	44	1.4	0.20	0.17	31.4
农家肥	37	2.8	0.54	0.70	13.2

有机态氮的分解特性还与其所含氮素的形态有关。与土壤有机态氮相比,微生物体氮中酸不溶态氮的比例较低,仅占有机氮总量的2%～4%,而一般土壤酸不溶态氮要占土壤有机氮的20%～35%[44]。从氮素组分看,微生物体氮中氨基酸态氮、酸解未鉴定态氮比例较高(表3)。培养2周后,这两种组分的含量迅速降低。即使相对难分解的细胞壁也是如此。因此,Marumoto等[45]指出,微生物细胞,特别是其细胞壁是土壤可矿化有机物的重要组分之一。由此可见,土壤微生物量氮应属土壤可矿化氮的范畴。

Lethbridge等[47]用^{15}N在培养基上标记微生物体,然后将^{15}N标记的微生物体施入土壤,研究了微生物体氮的有效性。结果发现,微生物体氮对小麦的有效性与无机氮肥($Ca(NO_3)_2$)相近,施用8周后约有51%～58%的微生物体氮被小麦吸收。Marumoto等[45]将^{14}C和^{15}N标记的微生物体施入土壤培养发现,28d后平均有48.6%的^{14}C和33%的^{15}N发生矿化作用。可见土壤微生物量氮的矿化率远远高于土壤氮的平均矿化率。Zagal等[48]将易矿化碳源-葡萄糖与无机氮肥($Ca(NO_3)_2$)加入土壤,1～3d内加入的$^{15}NO_3$-N即完全被微生物固持,3d后微生物固持的^{15}N随即发生矿化作用。以上结果均说明,微生物固持的氮素会很快发生矿化作用而释放出来,具有较高的有效性。

有机质的半衰期($t_{1/2}$)反映了其周转率的大小。据Paul等[17]的研究,土壤微生物量氮的$t_{1/2}$为0.5a,明显低于土壤中其他组份氮的半衰期。Okano等[49]得到的草原土壤微生物量氮的$t_{1/2}$约为60d。韩晓日等[50]

表 3　土壤及微生物体中有机态氮组分的比较(占有机氮%)

Table 3　Comparisons of the forms of organic-N in microbial cells and soils (% of organic-N)

类　别 Items	酸不溶态氮 Unhydrolysable	水解态氮 Acid hydrolysable				资料来源 Reference
		氨态氮 Ammonium	氨基糖氮 Amino sugar	氨基酸氮 Amino acid	水解未鉴定氮 Unidentified	
微生物体						
B. subtilis 细胞	2.0	11.8	5.3	51.3	29.5	Marumoto 等 (1982)[45]
B. subtilis 细胞壁	4.0	17.2	13.0	45.9	19.9	
S. cerevisiae 细胞壁	3.1	9.2	7.6	39.9	40.2	
土壤						
耕地(德国)	16.2	32.1	4.2	22.1	25.4	Stevenson (1982)[46]
耕地(美国)	20.2	16.7	14.4	35.0	13.9	
耕地(美国)	24.0	24.7	5.4	23.4	22.5	
耕地(加拿大)	21.1	15.1	10.4	30.9	22.6	

根据不同时间内土壤微生物量氮的含量变化推算的东北棕壤中土壤微生物量氮的周转率在 0.25～0.52a 之间,并发现有机肥与化肥配施,土壤微生物量氮的周转率最快。姚槐应等[51]对我国南方 3 种不同肥力水平红壤的研究发现,低肥力红砂土微生物量氮周转率最快(63 d),高肥力的黄筋泥最慢(251d)。可见土壤微生物量氮的周转率与土壤性质关系密切。虽然不同研究者得到的土壤微生物量氮的周转率不同,但其均明显高于其他组份有机氮的周转率,这一点是显而易见的。查明影响微生物量氮周转率的因素,及在一定条件下土壤微生物量氮的周转率,可以揭示微生物量氮在土壤氮素转化中的作用。

3　土壤微生物量氮与土壤可矿化氮间的关系

土壤微生物量氮属土壤可矿化氮。多数研究也都发现,土壤微生物量氮与土壤可矿化氮间有十分密切的正相关[52],相关系数多在 0.900 以上。但二者关系密切,并不能说明它们在数量上存在等量关系。因而应进一步了解土壤微生物量氮在土壤矿化氮中占的比例。一些研究者从不同角度对这一问题进行了探讨。

干土效应,即风干处理对土壤氮素矿化的促进作用已为人们熟知。一般认为,干土效应产生的原因有三:即风干死亡微生物体的矿化,保护的土壤有机氮的释放,以及一些原生动物的死亡促进了微生物的活性,增加了氮素的释放。其中死亡微生物体的矿化在干土效应中占有重要地位。Marumoto 等[45]发现,风干或烘干处理,土壤释放的氮素中源于死亡微生物体矿化的氮分别占总矿化量的 55%和 77%. Sakamoto 等[53]分别采用氯仿熏蒸及不同温度处理土壤的方法,研究了土壤氮素的释放情况,结果表明,50℃和 100℃下处理 24h 矿化的氮量与熏蒸处理矿化的氮量相同,认为风干土壤释放的氮素来自土壤微生物量氮的矿化作用。Ando 等[54]比较了干、湿水稻土培养时的矿化作用,发现湿土氮素的矿化量可用单指数方程描述,干土需用双指数方程反映;干、湿土矿化氮量间的差值在培养开始后的 5 周内不同,之后保持一致。由此推断,干土矿化氮有两个来源,其一来自易矿化氮,其二来自较难矿化氮。Bonde 等[55]发现,土壤微生物量氮的矿化常数(0.36～0.61 周$^{-1}$)与土壤易矿化氮的矿化常数(0.45～0.56 周$^{-1}$)相近,据此推断,土壤微生物体是土壤易矿化氮的主体。

对加拿大 Saskatchewen 省 100 余个中等质地土壤的研究发现[17],其氮素矿化势 N_0 在 50～300μg/g 之间,相当于这些土壤经氯仿熏蒸培养后释放的氮(F_N)的 3.3 倍。若微生物体氮的矿化系数 K_N 为 0.3,则这些土壤微生物量氮含量与土壤氮素矿化势 N_0 的大小相当。但也有学者认为,对土壤微生物量氮对土壤可矿化氮的贡献不应估计过高[56]。理由主要是其含量仅占土壤全氮的百分之几,且它在分解时只能矿化出一部分氮素。Paul 等[57]的研究发现,土壤微生物量氮对土壤氮素总矿化量的贡献不足 30%. 作者的研究发现[58],就含量比较,黄土地区几种土壤微生物量氮的含量占土壤氮的矿化势 N_0 的比例在 0.16～0.44 之间,平均 0.28,似乎也支持了这一观点。应该看到,土壤中的微生物体不停地进行作新陈代谢,其含量在不断变化。土壤微生物量氮的比例虽低,但其具有较快的周转率,因此在土壤可矿化氮中可能占有重要的作用。

要准确了解土壤微生物量氮对土壤矿化氮的贡献是十分困难的。需同时测定土壤微生物量氮的含量及周转率，只有借助于^{15}N示踪技术才可能解决这一问题。Myrold[59]在这一方面进行了有益的探索，通过给土壤中加入$^{15}NH_4Cl$培养法标记土壤微生物量氮，研究了淹水培养法矿化氮与土壤微生物量氮间的关系，结果表明，氯仿熏蒸土壤培养后产生的铵态氮（反映了土壤微生物量氮水平）与淹水培养矿化氮间有显著的正相关，且两种方法得到氮的^{15}N丰度相近。这一结果初步说明淹水培养矿化氮主要来自土壤微生物量氮的矿化。通气培养下土壤微生物量氮在土壤矿化氮量中所占的比例尚少见报道。

4 土壤微生物量氮的化学提取性

由于土壤微生物体量与土壤可矿化氮容量有关，因此，一些研究者认为，评价土壤有效氮较好的化学方法应是能选择提取土壤活体微生物体所含氮素的方法[60]。Kelley 培养试验[61]发现，温和提取剂（热水，0.01mol/L 热 $CaCl_2$，0.05 mol/L 热 $NaHCO_3$，0.01 mol/L $NaHCO_3$）比强烈提取剂（甲醛，酸性 $KMnO_4$）对土壤微生物量氮的选择性强，更适合提取土壤有效氮。前者的提取比率（（提取液中^{15}N/提取液中全 N）/（土壤中^{15}N/土壤全 N））在 2.3～3.0 之间，后者在 1.0～1.4 之间。Lin 等[62]的研究也发现，氯仿熏蒸后提取的土壤有机氮与 0.01mol/L $CaCl_2$ 105℃提取的有机氮含量相近，认为 0.01mol/L 热 $CaCl_2$ 提取了部分土壤微生物量氮。Seeling 等[63]对溶液提取的磷素成分进行了研究发现，该浸提液的有机磷主要来源于土壤微生物体所含的磷。这一研究结果说明，0.01mol/L $CaCl_2$ 浸提液可提取土壤微生物体所含的养分。但也有学者认为，0.01mol/L $CaCl_2$ 溶液提取的有机氮与氯仿熏蒸后提取的有机氮不同，提取的主要为与粘土结合较松的有机氮[64]。

大田试验发现，土壤微生物量氮与反映土壤氮素有效性的其他指标间存在显著的正相关关系[65]。Inubushi 等[66]发现，氯仿熏蒸土壤淹水培养前后矿质氮之差（简称为 MinNacf-N）与水稻吸氮量间有很高的相关性，这一差值的^{15}N丰度也与植物吸收氮的^{15}N丰度接近。由此推断，土壤铵态氮被作物吸收完后，MinNacf-N 是作物吸收氮的直接来源，称其为“有效氮”，其含量高低是评价土壤有机态氮有效性的指标。Patra 等[23]指出，土壤原有的矿质氮和氯仿熏蒸后矿质氮的增量之和是评价土壤氮素有效性的适宜指标。由此可见，土壤微生物量氮作为土壤有机氮组分中最活跃的一部分，与土壤供氮状况有密切关系。若能提高一种化学方法对土壤微生物量氮的选择提取性，无疑将会改善此测定结果与植物吸氮量间的关系。

5 结 语

近十余年来的一些研究使人们开始认识到，土壤微生物量作为土壤有机质中最活跃的一部分，是土壤养分转化过程中的一个重要的源和库，在调节土壤养分供应方面具有不可忽视的作用。因此，土壤微生物体量和土壤微生物量氮含量已被越来越多的研究者用于评价耕作栽培、施肥等措施对土壤性质影响的有效指标之一。但关于土壤微生物量氮在土壤氮素供应中的作用尚有许多问题需进一步研究，包括不同生态系统中土壤微生物量氮的含量及其变化规律，不同耕作栽培措施对土壤微生物量氮含量的影响；土壤微生物量氮在土壤氮素保持和释放中的作用；土壤微生物量氮的转化率与其供氮量间的关系；土壤微生物量氮与作物氮素吸收间的关系等。研究这些问题的核心是查明土壤微生物量氮与土壤其他氮素组分及作物吸氮间的关系，以便采取有效的措施，调控土壤氮素的供应状况，减少氮素损失，提高氮肥利用率。

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