**一、论坛主题报告**

**1.范利超教授**

**报告题目：**湿地甲烷厌氧氧化过程：机理及效应

**个人简介：**博士生导师，教授，2022年入选西北农林科技大学“高层次人才发展支持计划”。主持基金项目5项，在研经费179万元。于2020年9月在德国哥廷根大学获得博士学位，2020年10月至2022年5月在德国哥廷根大学从事博士后研究，2021年11月至2021年12月访问美国密歇根州立大学。主要围绕土壤温室气体排放、土壤健康等方面开展研究工作，以第一作者或通讯作者身份在Global Change Biology、Soil Biology and Biochemistry等国内外学术期刊发表论文20余篇。多次参加EGU、AGU等国际会议，为Soil Ecology Letter、Journal of Integrative Agriculture、《土壤通报》、《土壤》等期刊的青年编委。

**2.周健副教授**

**报告题目：**典型新型全氟化合物在汾渭平原土壤中的污染特征及其在植物中的富集迁移和转化行为

**个人简介：**周健，男，中共党员，汉族，1992年5月生，山东莱芜人，西北农林科技大学环境科学专业工学博士，硕士生导师，副教授。近三年主持了国家自然科学基金青年项目、国家重点研发计划子课题、中国博士后基金面上资助。主要从事典型新型全氟化合物在环境中的赋存特征和源汇机制及其在土壤-植物系统中的富集迁移和转化行为。以第一作者或通讯作者发表SCI论文12篇，其中7篇发表在环境领域国际权威期刊 Environmental Science & Technology 、Environment International和Journal of Hazardous Materials。

**二、论坛研究生报告**

1**.王梦雨博士**

**报告题目：**森林砍伐和再生对中国林业部门碳封存潜力的影响

**个人简介：**2022级土地资源与空间信息技术专业博士研究生，师从岳超研究员，主要从事陆地森林碳循环相关研究。研究方向为不同森林管理政策对中国林业部门碳汇潜力的影响。先后发表SCI论文两篇（Forest Ecosystems 1篇，Remote Sensing and Environment 1篇），目前有一篇SCI论文在投（Forest Ecology and Management）。

**中文摘要：**

随着中国森林进入老龄化阶段，碳饱和问题受到越来越多的关注。木材砍伐后的森林再生长可以重新启动与年龄相关的碳汇，同时使碳保留在采伐木材产品（HWP）中。在本研究中，我们重新审视了中国现行的禁伐森林管理政策，探讨了森林砍伐后再生长是否能提高整个林业部门 2021-2060 年的碳汇。我们的研究结果表明，与不发生砍伐相比，木材砍伐对碳封存的净影响主要取决于 HWP使用时间，其次取决于砍伐强度。与 2020 年相比，到 2060 年，"无砍伐 "情景将使森林活生物质中的碳储存量增加 10.05 Pg。在中国目前的木制林产品平均半衰期（12.5 年）下，轻度砍伐将提高森林部门的碳封存能力，高强度的砍伐将降低碳封存能力。然而，如果将 HWP 的半衰期延长一倍（25 年）甚至四倍（50 年），那么无论砍伐强度如何，整个林业部门的固碳能力都将提高，甚至可提高 50%以上，最高可达 16.76 Pg C。我们的研究结果凸显了木材砍伐在提高中国林业固碳能力方面的潜在积极作用，并为国家森林管理政策的制定提供了有益的视角。

**英文摘要：**

The issue of carbon saturation is becoming increasingly important for China’s forests as they move into an old-growth stage. Wood harvest followed by forest regrowth can reinitiate an age-dependent carbon sink while allowing carbon retention in harvested wood products (HWP). In this study, we re-visit the current harvest-prohibitive forest management policies in China through exploring whether wood harvest followed by forest regrowth can enhance carbon sequestration of the whole forest sector for 2021-2060. Our results show that the net effect of wood harvest on carbon sequestration, compared to that without any harvest, is crucially dependent on the HWP service lifetime and secondarily dependent on harvest intensity. The ‘no-harvest’ scenario will allow 10.05 Pg more carbon to be stored in the forest live biomass by 2060 relative to 2020. Under the current half-life of HWP in China (12.5 years), wood harvest will enhance the forest sector’s capability to sequester carbon with a light harvest intensity and diminish it with an intensive harvest intensity. However, if the HWP half-life could be doubled (25 years) or even quadrupled (50 years), the carbon sequestration capacity of the whole forest sector would increase irrespective of harvest intensity, by up to more than 50%, reaching a value as high as 16.76 Pg C for the maximum. Our findings highlight the potential positive role of wood harvest in increasing the carbon sequestration capacity of the forest sector in China and provide useful perspectives for the formation of national forest management policies.

**2.丁维婷**

**报告题目：**旱作农田土壤质量和作物产量对长期保护性耕作的响应

**个人简介：**丁维婷，女，1995年生，籍贯甘肃天水。2021级土壤学专业博士研究生，师从何海龙教授。主要研究方向为农田土壤碳转化机理及调控。近年主要研究农田增施有机肥、有机无机肥合理配施的有机替代技术及其减氮增效机理和保护性耕作土壤增碳培肥。综合运用野外长期定位观测、荟萃分析和实验模型融合等多种方法，探究管理措施和气候变化对土壤碳动态变化的影响。先后以第一作者发表学术论文3篇（Journal of Hydrology，Agronomy，Information）。

**中文摘要：**

为缓解我国北方地区干旱、水土流失及气候变化等问题，保护性耕作于20世纪90年代被引入中国。然而，免耕作为保护性耕作的基本组成部分，通常会降低作物产量。虽然增施氮肥可以缓解这种减产效应，但长期施用氮肥能否通过改善土壤质量来提高保护性耕作的产量，甚至超过传统耕作的产能潜力，目前仍不清楚。本研究基于山西寿阳旱作春玉米长期定位试验（20年），明确了长期保护性耕作下影响产量的主控因子，进一步评估了耕作和氮肥交互作用对产量及土壤质量的协同效应。

**英文摘要：**

In order to alleviate drought, soil erosion and climate change in northern China, conservation farming was introduced into China in the 1990s. However, no-tillage is an essential component of conservation tillage and usually reduces crop yields. Although increased application of nitrogen fertilizer can mitigate this reduction effect, it is still unclear whether long-term application of nitrogen fertilizer can improve the yield of conservation tillage by improving soil quality, even beyond the productivity potential of conventional tillage. In this study, based on the long-term positioning experiment (20 years) in Shouyang, Shanxi Province, the main controlling factors affecting the yield of spring maize under long-term conservation tillage were identified, and the synergistic effects of tillage and nitrogen fertilizer interaction on yield and soil quality were further evaluated.

**3.何浩然博士**

**报告题目：**干旱区土壤深剖面微生物群落分布格局与驱动因素

**个人简介：**2020级土壤学博士研究生，导师方临川教授。自2017年起开始开展干旱区河流、土壤微生物生态学的研究，探索干旱区高含沙河流水体和沉积物微生物群落特征，阐明干旱梯度下土壤剖面尺度微生物资源限制模式、群落组成、功能及多样性的形成与维持机制，揭示深剖面土壤微生物的空间格局及驱动因素。获批2021年年度研究生优秀学术成果，参与完成发明专利2项，先后于Global Change Biology，Catena，Ecological Indicators发表SCI论文3篇，发表中文核心论文1篇（生命科学研究），会议论文1篇。

**中文摘要：**

众所周知，生活在深层土壤中的微生物与表土不同，但它们的结构、功能如何，多样性是如何形成的，仍在进一步研究中。深层土壤(>1 m)的微生物群相对稳定，且不易受气候条件的影响。然而，对这些微生物群落如何沿着气候梯度变化知之甚少。研究采用扩增子测序研究了中国黄土高原半干旱森林生态系统中15个18 m深度(以20-50 cm为间隔)剖面上的细菌、古菌和真菌。结果表明，表层土壤细菌和真菌的α多样性以及细菌和古菌的群落相似性显著下降，深层土壤细菌和真菌α多样性保持相对稳定。尽管如此，深层土壤微生物群仍展现出氮循环、植物源有机碳降解、资源交换和水分协调等功能潜力。深层土壤微生物群落比表层土壤微生物具有更紧密的跨界共现网络关系和细菌-真菌关联，受扩散限制的影响更大。地理距离对深层土壤细菌和古菌的影响大于表层。进一步的结果发现，干旱与深层土壤古菌和真菌丰富度、古菌群落相似性、植物腐生菌相对丰度和细菌-真菌关联数呈负相关，但增加了深层土壤好氧氨氧化、锰氧化和丛枝菌根真菌的相对丰度。根系深度和复杂性、土壤体积水分和粘土含量在介导干旱对深层土壤微生物的间接影响方面起关键作用。总之，即使是深层土壤中的微生物群落和地球化学循环也容易受到干旱引起的水分可用性变化的影响，这对理解旱地生态系统可持续性和全土壤剖面对干旱化的响应有重要意义。此外，在未来气候变化情景下，忽略土壤深度可能会低估土壤水分在旱地生态系统中的作用。

**英文摘要：**

Microbes inhabiting deep soil layers are known to be different from their counter-part in topsoil yet remain under investigation in terms of their structure, function, and how their diversity is shaped. The microbiome of deep soils (>1 m) is expected to be relatively stable and highly independent from climatic conditions. Much less is known, however, on how these microbial communities vary along climate gradients. Here, we used amplicon sequencing to investigate bacteria, archaea, and fungi along fifteen 18-m depth profiles at 20–50-cm intervals across contrasting aridity conditions in semi-arid forest ecosystems of China's Loess Plateau. Our results showed that bacterial and fungal α diversity and bacterial and archaeal community similarity declined dramatically in topsoil and remained relatively stable in deep soil. Nevertheless, deep soil microbiome still showed the functional potential of N cycling, plant-derived organic matter degradation, resource exchange, and water coordination. The deep soil microbiome had closer taxa–taxa and bacteria–fungi associations and more influence of dispersal limitation than topsoil microbiome. Geographic distance was more influential in deep soil bacteria and archaea than in topsoil. We further showed that aridity was negatively correlated with deep-soil archaeal and fungal richness, archaeal community similarity, relative abundance of plant saprotroph, and bacteria–fungi associations, but increased the relative abundance of aerobic ammonia oxidation, manganese oxidation, and arbuscular mycorrhizal in the deep soils. Root depth, complexity, soil volumetric moisture, and clay play bridging roles in the indirect effects of aridity on microbes in deep soils. Our work indicates that, even microbial communities and nutrient cycling in deep soil are susceptible to changes in water availability, with consequences for understanding the sustainability of dryland ecosystems and the whole-soil in response to aridification. Moreover, we propose that neglecting soil depth may underestimate the role of soil moisture in dryland ecosystems under future climate scenarios.

**4.邱天逸硕士**

**报告题目：**秸秆还田维持全球土壤生态化学计量平衡

**个人简介：**2021级土壤学专业硕士研究生，师从方临川研究员，研究方向为全球变化与土壤生态。目前主要关注森林和农业生态系统元素循环和生物多样性-生态系统功能关系，系统揭示了根际过程驱动退化生态系统恢复的坡位调节机制，阐明了农业管理措施对土壤碳氮循环和作物生产等关键服务的积极后果与改良潜力。曾荣获西北农林科技大学“优秀大学生”称号及2023–2024学年研究生国家奖学金。已发表SCI论文7篇，其中以第一作者在土壤学主流期刊Catena发表论文1篇，成果先后于“第七届水土保持研究所研究生学术论坛”和“2023年中国土壤学会土壤化学专业委员会学术研讨会”获研究生优秀报告奖。

**中文摘要：**

虽然土壤生态化学计量在自然生态系统中受到限制，但其对人为扰动的响应在很大程度上是未知的。无机肥料和秸秆还田是关键的农田人为管理，具有改变土壤生态化学计量的潜力。我们对682个野外观测数据进行了全球综合，以量化土壤碳（C）、氮（N）和磷（P）以及粮食产量对秸秆还田加无机肥料组合投入（与仅施用无机肥料相比）的响应。总体上，秸秆还田增加了土壤C（10.5–12%）、N（7.63–9.2%）和P（2.62–5.13%）的含量，增加了C:N（2.51–3.42%）和C:P（7.27–8.00%）的比率，以及粮食产量（6.12–8.64%），表明秸秆还田减轻了单独无机肥料投入引起的土壤C限制，并能够维持平衡的生态化学计量。此外，秸秆还田后13～16年，土壤C和C:N的增加达到饱和，而粮食产量的增加趋势停止。此外，我们发现增加的C、N、P含量和C:N受初始pH值和C含量的调节，粮食产量的增加不仅与土壤性质有关，而且在更大程度上与无机N肥投入量呈负相关。鉴于秸秆还田效果因土壤性质和氮输入水平而异，我们提出了一个预测模型来初步评估其改良潜力。特别是，我们建议将全球预算的一部分用于补贴作物秸秆管理，以实现农业生产、生态保护和减缓气候变化的双赢。

**英文摘要：**

Although soil ecological stoichiometry is constrained in natural ecosystems, its responses to anthropogenic perturbations are largely unknown. Inputs of inorganic fertilizer and crop residue are key cropland anthropogenic managements, with potential to alter their soil ecological stoichiometry. We conducted a global synthesis of 682 field observations to quantify the responses of soil carbon (C), nitrogen (N), and phosphorus (P) and grain yields to combined inputs of crop residue plus inorganic fertilizer compared with only inorganic fertilizer application. Crop residue inputs enhance soil C (10.5–12%), N (7.63–9.2%), and P (2.62–5.13%) contents, with an increase in C:N (2.51–3.42%) and C:P (7.27–8.00%) ratios, and grain yields (6.12–8.64%), indicating that crop residue alleviated soil C limitation caused by inorganic fertilizer inputs alone and was able to sustain balanced stoichiometry. Moreover, the increase in soil C and C:N(P) ratio reached saturation in ~13–16 years after crop residue return, while grain yield increase trend discontinued. Furthermore, we identified that the increased C, N, and P contents and C:N(P) ratios were regulated by the initial pH and C content, and the increase in grain yield was not only related to soil properties, but also negatively related to the amount of inorganic N fertilizer input to a greater extent. Given that crop residual improvement varies with soil properties and N input levels, we propose a predictive model to preliminary evaluate the potential for crop residual improvement. Particularly, we suggest that part of the global budget should be used to subsidize crop residue input management strategies, achieving to a win-win situation for agricultural production, ecological protection, and climate change mitigation.

**5.Yaseen Khan（亚新）**

**报告题目:** Revolutionizing Agriculture: Achieving Sustainable Wheat Crop Growth and Yield with Genetically Modified Abiotic Stress-Resistant Varieties.

**个人简介：**I am Yaseen Khan (亚新), 29-year-old, a Pakistani national, currently in the final year of my Ph.D. program at NWAFU's College of Nature Resources & Environments, where I specialize in Plant Nutrition Molecular Biology. My academic journey began with a bachelor's degree from Bacha Khan University in Pakistan, and I pursued my master's degree at Northeast Normal University in China. During my master's program, I delved into the realm of cereal crops, focusing on their physiology and biochemical responses to nitrogen (N) and AMF application in the context of false wheat. In my ongoing Ph.D., I've shifted my attention to wheat and have been investigating the GRAS gene family's involvement in nitrogen uptake, AM symbiosis, and their capacity to mitigate abiotic stresses, particularly salt and drought stress. We've recently uncovered a groundbreaking discovery that suggests GRAS genes could be a game-changer in combatting drought stress. This finding has the potential to revolutionize agriculture in arid and dryland regions that’s heavily reliant on rainfall and artificial water systems. I'm passionate and excited to share my research findings, as they could serve as a source of inspiration and innovation for fellow researchers, both now and in the future, aiming to enhance crop growth, yield, and productivity.

**英文摘要：**

The global population is on the rise, leading to a conversion of agricultural land into residential areas. Rapid climate change, characterized by increasing temperatures, poses a significant challenge and a major concern for the world. Also, the increased demand for food results in the use of higher nitrogen fertilizers, which disrupts soil structure, damages the microbial community, and bring negative variation to the ecosystem. Under these circumstances, it is advisable to implement several measures, including enhancing the agricultural system, utilizing arid land, developing and utilizing high-yield varieties, and use dryland areas specifically tailored for high abiotic stress-tolerant varieties of wheat, as wheat is most important crop for staple foods for human’s kind. The GRAS transcription factors play a crucial role in potentially inducing positive transformations for the development of high-tolerance wheat varieties in response to abiotic stress. This presentation delves into the involvement of GRAS transcription factors in responding to abiotic stresses, specifically focusing on drought and salt stress in arid regions. Additionally, we explore the biochemical and molecular mechanisms and diverse facets of GRAS TFs role and its function. Additionally, we offer both current and future solutions, paving the way for innovative ideas that contribute to the development of genetically modified crops with enhanced resistance to abiotic stress in arid regions.

**6.井海梦博士**

**报告题目：**人工藻结皮可以提高旱区农田土壤养分含量，促进作物生长

**个人简介：**2023级土壤学博士，师从赵允格研究员。自2020年起开始对生物结皮发育过程及生态功能进行研究，主要研究对象为农田生物结皮及人工藻结皮。近年来先后对生物结皮的入渗、蒸发过程及藻结皮人工培育技术进行了研究。探讨了人工藻结皮及农田生物结皮对农田土壤水循环的影响。发表期刊论文一篇（农业环境科学学报）。

**中文摘要：**

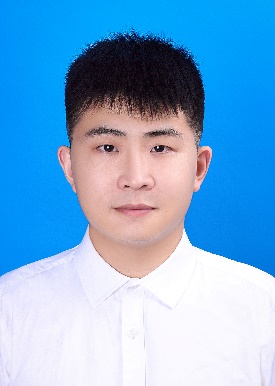
利用人工藻结皮技术防治土壤风蚀已在荒漠化地区得到广泛应用，其在农田土壤风蚀防治方面也有着良好的应用前景。然而人工藻结皮对农田土壤水分、养分及作物生长的影响尚不明确，这不利于综合评估利用人工藻结皮技术防治农田土壤风蚀的可行性。为此，本文以小白菜为指示作物，以不施肥（CK）为对照，在黄土高原风蚀水蚀交错区农田分别研究了接种人工藻结皮（BSC）及施用常规化肥（CF）对农田土壤水分、养分及作物生长的影响。结果表明，BSC能有效改善农田土壤养分状况，与CK相比，在作物生长的第50天，BSC显著提高了0-2cm土层土壤SOC, NN，TN含量，分别提高了26.4%、106.5%和28.2%，BSC显著提高0~2cm土层土壤蔗糖酶、碱性磷酸酶、脲酶及过氧化氢酶活性，分别提高了29.8%、29.4%、53.8%、21.4%；2-5 cm土层土壤碱性磷酸酶活性显著提高了62.8%。BSC显著提高了作物产量及养分含量，与CK相比，BSC植株鲜重显著提高了242.9%，植株P、K及叶绿素含量分别提高了47.6%、43.4%及65.5%。BSC对农田土壤水分入渗及蒸发过程无影响。可见，在农田接种人工藻结皮可以改善土壤养分状况，提高作物产量及其养分含量。从作物产量及土壤养分、水分方面来看，通过接种人工藻结皮进行黄土高原农田土壤风蚀防控是可行的。此外，人工藻结皮的增产效应也为黄土高原农田化肥减量，农业高效可持续发展提供了新思路。

**英文摘要：**

Artificial cyanobacteria crust was a promising technology for soil wind erosion control in drylands. However, the effects of artificial cyanobacteria crusts on soil moisture, nutrients and crop growth are not fully discussed. To this end, this study examined the effect of inoculation of cyanobacteria crust (BSC) on soil moisture, nutrients and plant growth in cropland through field experiments by comparing no fertilizer (CK) and application of chemical fertilizer (CF) using Pak choi as an indicator plant. The results showed that BSC could effectively improve the nutrient status of cropland soil. Compared with CK, on the 50th day of plant growth, BSC significantly increased the soil SOC, NN, and TN contents in the 0-2 cm soil layer by 26.4%, 106.5%, and 28.2%, respectively, and BSC significantly increased the activities of sucrase, alkaline phosphatase, urease and catalase in the 0-2 cm soil layer by 29.8%, 29.4%, 53.8% and 21.4%, respectively, and the activities of alkaline phosphatase in the 2-5 cm soil layer by 62.8%. BSC significantly increased plant biomass and nutrient content. Compared with CK, the fresh weight of BSC plants was significantly increased by 242.9%, and the P, K and chlorophyll contents of plants were increased by 47.6%, 43.4% and 65.5%, respectively. BSC has no effect on the infiltration and evaporation of cropland soil moisture. The inoculation of artificial cyanobacteria crusts in agricultural fields not only has no negative effect on soil nutrients and plant biomass, but also improves soil nutrient status, plant biomass and its nutrient content. From the viewpoint of plant biomass and soil nutrients, it is feasible to prevent and control wind erosion in cropland on the Loess Plateau by inoculating artificial cyanobacteria crusts. In addition, the biomass-enhancing effect of artificial cyanobacteria crusts also provides a new idea for the reduction of chemical fertilizers and the efficient and sustainable development of agriculture in the arid and semi-arid areas cropland.

**7.李凯博士**

**报告题目：**有机酸在马基诺矿（FeS）诱导污染物自然衰减过程中未被识别的作用：碳中心自由基的重要性

**个人简介：**2022级土壤学专业博士研究生，师从贾汉忠教授。本科、硕士、博士都是农业资源与环境专业的。热爱农业、农村、农民，立志为乡村振兴，绿色发展服务。硕士工作聚焦于基于过一硫酸盐的高级氧化技术，针对金属碳复合材料对过一硫酸盐活化和环境新污染物去除开展过系统研究工作。博士工作主要聚焦于土壤环境界面过程。目前已以第一或共同第一作者在环境领域知名1区期刊（Environmental Science & Technology 1作，Chemical Engineering Journal 1作，Journal of Hazardous Materials 1作，Journal of Colloid and Interface Science，共一）发表SCI论文4篇。曾获“河南省优秀硕士毕业论文”、“国家奖学金”等荣誉。

**中文摘要：**

在生物地球化学循环背景下，有机酸在地下环境中的普遍存在，使得其在氧化还原活性矿物降解污染物过程中扮演了重要角色。以往关于有机酸在活性氧（ROS）生成中的作用的研究主要集中在电子穿梭或配体效应上，本研究深入探讨了有机酸分解与马基诺矿（FeS）氧化对黑暗有氧环境中有机污染物转化的影响。使用双酚A（BPA）作为模型污染物，研究发现草酸（OA）在增强BPA去除方面的显著优势，使BPA去除速率常数达到了0.69 h-1。质谱表征结合厌氧处理证实了分子氧活化是实现污染物转化的关键。机理的研究结果表明，由羟基自由基（•OH）攻击诱导产生的碳中心自由基是实现污染物氧化转化的关键媒介，其至少贡献了体系中93.6%的•OH产生。有机酸的分解和碳中心自由基的同时形成驱动的动力学过程，确保了体系中用于ROS生成的稳定电子供应。研究工作强调了OA分解在污染物自然衰减过程中的重要性，并为FeS与有机酸耦合的净化策略提供了创新思路。

**英文摘要：**

Organic acid is prevalent in underground environments and, against the backdrop of biogeochemical cycles on Earth, holds significant importance in the degradation of contaminants by redox-active minerals. While earlier studies on role of organic acid in generation of reactive oxygen species (ROS) primarily concentrated on electron shuttle or ligand effects, this study delves into the combined impacts of organic acid decomposition and Mackinawite (FeS) oxidation in contaminant transformation under dark aerobic conditions. Using bisphenol A (BPA) as a model, our findings showed that oxalic acid (OA) notably outperforms other acids in enhancing BPA removal, attaining a rate constant of 0.69 h-1. Mass spectrometry characterizations, coupled with anaerobic treatments, advocate for molecule-O2 activation as principal mechanism behind pollutant transformation. Comprehensive results unveiled that carbon center radicals, initiated by hydroxyl radical (•OH) attack, serve as the primary agents in pollutant oxidation, accounting for at least 93.6% of the total •OH generation. This dynamic, driven by the decomposition of organic acids and the concurrent formation of carbon-centered radicals, ensures a steady supply of electrons for ROS generation. The obtained information highlights the importance of OA decomposition in the natural attenuation of pollutants and offers innovative strategies for FeS and organic acid-coupled decontamination.

**8.杨惠强博士**

**报告题目：**豆科植物促进硝基多环芳烃衍生物积累的新认识

**个人简介：**杨惠强，男，中共党员，现为西北农林科技大学资源环境学院2020级在读博士研究生。主要研究方向为：生物炭上环境持久性自由基的生物毒性；持久性有机污染物的植物吸收、富集和转运机制。目前已在Environmental Science & Technology、ACS Sustainable Chemistry & Engineering、Environmental Chemistry Letters等期刊上发表3篇SCI论文。

**中文摘要：**

多环芳烃衍生物（SPAHs）因其高毒性和广泛分布而受到越来越多的关注。然而，SPAHs在作物根部的积累行为仍不清楚。本研究通过水培实验从利用、吸收和排出的角度系统地揭示了SPAHs在作物根部中的积累机制。研究结果表明了一个有趣的现象；尽管在五种SPAHs中，硝基取代的多环芳烃（包括9-硝基蒽和1-硝基芘）在豆科植物的根部积累潜力最强，但它们并不具有最强的疏水性。氮缺乏实验、抑制剂实验和转录组分析共同揭示了硝基取代的多环芳烃可以被豆科植物利用为氮源，进而通过H+-ATPase驱动氨基酸转运蛋白去主动吸收。分子对接模拟进一步证明了氨基酸转运蛋白主要通过氢键作用与SPAHs的硝基相互作用。此外，排出实验表明，硝基取代的多环芳烃可能进入根细胞，进一步减慢其排出速率，这增强了其在豆科植物根部的积累潜力。我们的研究揭示了一种以前未被重视的SPAHs在根部的积累机制，这可能会影响它们在土壤中的生物地球化学过程。

**英文摘要：**

Substituted polycyclic aromatic hydrocarbons (SPAHs) are receiving increased attention due to their high toxicity and ubiquitous presence. However, the accumulation behaviors of SPAHs in crop roots remain unclear. In this study, the accumulation mechanism of SPAHs in crop roots was systematically disclose by hydroponic experiments from the perspectives of utilization, uptake, and elimination. The obtained results showed an interesting phenomenon that despite not having strongest hydrophobicity among the five SPAHs, nitro-PAHs (including 9-nitroanthracene and 1-nitropyrene) displayed the strongest accumulation potential in the roots of legume plants, including mung bean and soybean. The nitrogen-deficient experiments, inhibitor experiments, and transcriptomics analysis reveal that nitro-PAHs could be utilized by legumes as nitrogen source, thus being significantly absorbed by active transport which relies on amino acid transporters driven by H+-ATPase. Molecular docking simulation further demonstrates that the nitro group is significant determinant of interaction with amino acid transporter. Moreover, the depuration experiments indicate that the nitro-PAHs may enter the root cells, further slowing down their elimination rates and enhancing the accumulation potential in legume roots. Our results shed light on a previously unappreciated mechanism for roots accumulation of SPAHs, which may affect their biogeochemical processes in soils.

**9.姜文鋆博士**

**报告题目：**光老化含硫微塑料上的硫持久自由基和活性物质:形成机制和氧化还原电位

**个人简介：**2022级环境科学专业博士研究生，师从贾汉忠教授。主要研究方向为微塑料光老化过程中环境自由基的形成及其潜在毒性，探索研究了含杂原子微塑料的光老化过程和光老化条件下微塑料与持久性有机污染物的相互作用，阐明了硫持久性自由基，含硫活性物质形成以及微塑料与持久性污染物的相互作用机制。获得2022-2023年年度国家奖学金，目前已在Environmental science & technology上发表论文一篇。

**中文摘要：**

元素组成可能影响微塑料光老化过程中持久性自由基(PFRs)和活性物质的形成，但相关研究尚缺乏。本研究系统研究了模拟阳光下含硫微塑料(S-MPs)的PFRs和RS的形成，以及氧化电位(OP)评价。结果表明，利用电子顺磁共振技术(EPR)在光老化聚苯硫醚(PPS)和聚砜(PSF)表面检测到硫氧自由基、氧中心自由基和硫中心自由基。结合密度泛函理论计算，PSF上以硫为中心的自由基为4-羟基苯基磺酰基自由基，PPS和PSF上的硫氧自由基分别为4-巯基苯基硫醇自由基和4-羟基苯磺酸自由基。热解-气相色谱/质谱分析表明，S-MPs光老化诱导苯磺酸的形成，而苯磺酸是S中心自由基的重要前体。有趣的是，光老化S-MPs表面除了存在活性氧外，还存在活性硫(SO3•−)，主要来源于•OH和磺酰基自由基的反应。此外，光老化PPS具有较高的氧化潜能(33.725 mmol/g)，这是由于其含有丰富的含硫自由基。这些结果对评估大气S-MPs的潜在风险具有重要意义。

**英文摘要：**

The elemental composition may affect the persistent free radicals (PFRs) and reactive species formation associated with photoaging microplastics, however, relevant study is still lacking. In this study, PFRs and RS formation, as well as the oxidation potential (OP) evaluations of sulfur-containing microplastics (S-MPs) were systematically investigated under simulated sunlight. The results suggested that various free organic radicals, including thio-oxygen, oxygen-centered and sulfur-centered radicals, were detected on photoaging polyphenylene sulfide (PPS) and polysulfone (PSF) by electron paramagnetic resonance (EPR) technique. By combining the density functional theory calculation, the sulfur-centered radical on PSF was 4-hydroxyphenylsulfonyl radical and the thio-oxygen radical on PPS and PSF were identified as 4-mercaptophenyl thiol radical and 4-hydroxybenzenesulfonic acid radical, respectively. Pyrolysis−gas chromatography/mass spectrometry showed that photoaging of S-MPs induced the formation of benzenesulfonic acid, which was an important precursor of S-centered free radicals. Interestingly, reactive sulfur specie (SO3•−) was also observed on the photo-aged S-MPs in addition to reactive oxygen species, which was mainly derived from the reaction of •OH and sulfonyl radicals. Besides, the higher oxidation potential was detected on photoaging PPS (33.725 mmol/g) attributing to abundant sulfur-containing radicals. These results have implication for assessing the potential risks of atmospheric S-MPs.

**10.霍盼博士**

**报告题目：**关中平原地下水溶解性温室气体变化特征及其灌溉排放潜力

**个人简介**：2023级环境工程专业博士研究生，师从高鹏程副教授。自2021年起对地下水溶解性温室气体（N2O、CO2、CH4）的来源和环境影响展开研究。目前主要对关中平原中西部地区地下水溶解性温室气体的季节性变化和垂直分布特征进行了研究，并估算了地下水灌溉过饱和温室气体的脱气潜力。先后在《Environmental Pollution》、《Science of the Total Environment》、《Chemosphere》发表SCI论文3篇。

**中文摘要：**

地下水作为全球关键的灌溉水源，农业灌溉碳预算通常忽略了地下水溶解性温室气体（N2O，CO2，CH4）的直接排放，量化这部分排放潜力并探索减排策略对农业绿色发展具有重要意义。本研究分析了关中平原中西部地区地下水溶解性温室气体的季节性和垂直分布特征及其来源，估算了不同灌溉模式下地下水温室气体的直接排放量，并探索出利于减排的灌溉模式。结果表明：近96%的地下水未检测到溶解性CH4，地下水溶解性N2O和CO2的平均浓度分别为9.71 ± 9.03 μg L-1和11300 ± 5788 ppm，并呈现丰水期高于枯水期和浅井高于深井的变化特征。关中平原地下水灌溉温室气体排放量介于1.38万t ~ 5.22万t CO2-eq yr-1之间，不同灌溉模式下排放量呈现地上滴灌 > 地面滴灌 > 地下滴灌 > 漫灌的趋势。从温室气体减排和节水角度分析，地下滴灌是利于温室气体减排的最佳灌溉模式。评估灌溉实践中过饱和溶解温室气体的直接排放对地下水和灌溉农业碳预算十分重要，本研究为未来农业温室气体碳减排提供了新的见解。

**英文摘要：**

Groundwater, serving as a key global source for irrigation, is often neglected in agricultural carbon budgets, particularly concerning the direct emissions of dissolved greenhouse gases (N2O, CO2 and CH4) in groundwater. Quantifying the potential of these emissions and exploring reduction strategies is crucial for the green development of agriculture. This study analyzed the seasonal and vertical distribution characteristics of dissolved greenhouse gases in groundwater and their sources in the central and western areas of the Guanzhong Basin, estimated the direct emissions of greenhouse gases under different irrigation methods, and explored the beneficial irrigation methods for emission reduction. The results showed that dissolved CH4 was not detected in nearly 96 % of the groundwater, and the average concentrations of dissolved N2O and CO2 in the groundwater were 9.71 ± 9.03 μg L-1 and 11,300 ± 5,788 ppm and both exhibited higher concentrations during the wet season and shallow wells compared to the dry season and deep wells. The degassing potential of groundwater irrigation is 13,819-52,163 t CO2-eq year-1 in Guanzhong Basin and exhibited a trend of over-surface drip irrigation (ODI) > surface drip irrigation (DI) > subsurface drip irrigation (SDI) > flood irrigation (FI) under the same irrigation amount. SDI is a promising irrigation method that considers water conservation and the reduction of greenhouse gases. The assessment of the degassing potential of supersaturated dissolved greenhouse gases in irrigation practices is important for optimizing the carbon budget for groundwater and irrigated agriculture and provides new insights for reducing agricultural greenhouse gas emissions in the future.

**11.何壮博士**

**报告题目：**磺胺类抗生素的催化降解及其界面催化机制研究

**个人简介：**2022级环境科学专业博士研究生，师从祝凌燕教授。2019年-2022年期间主要研究基于高级氧化技术去除水中抗生素类有机污染物的研究，揭示过硫酸盐活化作用下典型抗生素催化降解规律，分别探索催化体系中产生不同活性物种及其相互作用关系，阐明基于高级氧化技术对抗生素类有机污染物去除的界面催化潜在机制。获批2021-2022年年度国家奖学金，获批省级创新资助项目1项(已结题)，先后发表SCI论文4篇（Applied Catalysis B: Environmental 1篇，Journal of Colloid and Interface Science 1篇，Journal of Water Process Engineering 1篇，Chemosphere 1篇）。

**中文摘要：**

该研究报告了将镍物质引入LaCoO3钙钛矿的B位金属中心，通过活化过单硫酸盐（PMS），对溶液中的磺胺异恶唑（SIZ）表现出高催化活性。采用共沉淀-煅烧策略设计了一种新型双金属镧基钙钛矿（LaCo0.5Ni0.5O3），通过激活PMS，可以在20分钟内有效降解近100%的SIZ。密度泛函理论（DFT）计算表明，LaCo0.5Ni0.5O3的界面结构具有更高的PMS吸附能力和更快的电子转移效率。此外，引入Ni物质后，B位金属的界面结构更有可能促进PMS活化。同时，Fukui指数表明了活性物种攻击SIZ分子的反应位点，合理地提供了SIZ可能的降解路径。该工作为后续探索基于PMS活化的多相催化剂界面结构降解有机污染物的催化机理提供了重要参考。

**英文摘要：**

This study reports the introduction of nickel species into the B-site metal center of LaCoO3 perovskite, which shows high catalytic activity for sulfafurazole (SIZ) in solution by activating peroxymonosulfate (PMS). A novel bimetallic lanthanum-based perovskite (LaCo0.5Ni0.5O3) was designed by coprecipitation-calcination strategy, which can effectively degrade nearly 100% SIZ in 20 min by activating PMS. Density functional theory (DFT) calculations show that the interface structure of LaCo0.5Ni0.5O3 has higher PMS adsorption capacity and faster electron transfer efficiency. Additionally, the interface structure of the B-site metal is more likely to promote PMS activation after the introduction of Ni species. Meanwhile, the Fukui index indicates the reaction sites of the active species attacking SIZ molecules and reasonably provides the possible degradation path of SIZ. This work provides an essential reference for the subsequent exploration of the catalytic mechanism of interfacial structure of heterogeneous catalysts based on PMS activation to degrade organic pollutants.

**12.李瑞丰博士**

**报告题目：**水分亏缺限制了黄土覆盖区老年苹果园土壤有机碳固定

**个人简介：**2021级环境科学专业博士研究生，师从李志教授。本科及硕士分别就读于西华师范大学和西南石油大学。硕士期间主要从事重金属及石油污染土壤修复的工作，探究海绵负载对磁性纳米材料在修复土壤过程中对污染物、土壤性质、及微生物的影响。博士期间从事旱区水循环的研究，探究深层土壤水碳耦合关系及其对陆面过程的响应机制。曾获得西南石油大学优秀硕士学位论文，博士期间发表SCI论文一篇，Agriculture Ecosystems and Environment (IF = 6.6)。

**中文摘要：**

在陆地生态系统中，非饱和带储存的水和有机碳至关重要。然而，深层土壤水与有机碳的耦合效应研究仍然很少。为探讨植被种植对深剖面土壤水碳耦合关系的影响，本研究测定了中国黄土覆盖区耕地和不同树龄(5、10、15、20、24年)果园土壤20 m深处的水分和有机碳含量。采用条件过程模型探讨了植被因子和土壤因子对水碳耦合关系的影响。与农田相比，幼龄苹果园(0 - 10年)水分亏缺较低，但老龄苹果园(15 - 24年)土壤储水量减少21 - 32%。不同树龄苹果树的有机碳含量差异不显著。水碳耦合关系随植被生长阶段的不同而不同。具体而言，幼龄苹果园水储量与有机碳密度呈显著正相关(p < 0.05)，而老龄苹果园的水分亏缺与有机碳固存呈显著负相关(p < 0.01)。条件过程模型表明，由于根系生物量较低，幼龄苹果园水碳耦合关系主要受粘粒含量控制，而老龄苹果园根系发达，水碳耦合关系同时受砂粒含量和粗根影响。该研究为在深根植被和非饱和带地区的农业和植被的可持续管理提供了新的见解。

**英文摘要：**

The water and organic carbon stored within unsaturated zones are crucial in terrestrial ecosystems; however, the coupling effects of deep soil water and organic carbon are still poorly documented. To explore the water-carbon coupling effects within soils under tree plantations, we investigated the water and organic carbon content to 20 m deep under cultivated farmland and orchards with apple trees of varying ages (5, 10, 15, 20, and 24 years) in the loess-covered region of China. A conditional process model was used to explore the impacts of vegetation and edaphic factors on the water-carbon coupling processes. Compared with farmland, young apple orchards (0-10 years) showed lower water deficit, but the soil water storage reduced by 21-32% under old apple orchards (15-24 years). The organic carbon content exhibited negligible variation among apple trees of different ages. However, the water-carbon coupling effects varied with apple tree ages. A positive correlation existed between water storage and organic carbon density under young apple orchards (p < 0.05), but a negative correlation was found between water deficit and organic carbon sequestration under old apple orchards (p < 0.01). The conditional process model suggested that the water-carbon coupling relationship under young apple orchards was primarily controlled by clay content due to lower root biomass, while that under old apple orchards was concurrently shaped by silt content and coarse roots because of the developed root system of apple trees. This study offers novel insights into the sustainable management of agriculture and tree plantations in regions with deep-rooted vegetation and thick unsaturated zones.

**13.王延杰 博士**

**个人简介：**西北农林科技大学资源环境学院2023级环境工程专业博士研究生，师从王铁成教授。研究方向为抗生素抗性基因传播机制与风险控制。

**报告题目：**废弃口罩是抗生素抗性基因（ARGs）的新“港湾”：大气污染物促进ARGs接合转移的机制

**摘要：**新冠大流行期间，一次性外科口罩（DSMs）的使用量呈爆发式增长。DSMs优良的过滤性能不仅可以有效阻断病毒的传播，还能够吸附各种大气污染物；且在使用过程中，口罩表面温和且湿润的环境为微生物增殖提供了便利。本研究以DSMs为基底，调查了口罩上的大气污染物对富集在其表面的抗生素抗性细菌（ARB）及其携带的抗性基因(ARGs)水平转移的影响。在环境相关浓度下，大气水溶性无机离子(WSIIs，包括NO3-、SO42-、NH4+和Ca2+)使接合转移频率(CTF)提高了1.18 ~ 1.58倍，多环芳烃(PAHs，包括菲Phe和奈Nap)使CTF增加1.41 ~ 1.51倍，总悬浮颗粒物(TSP)与WSIIs或PAHs联合作用进一步提高了CTF。分子动力学模拟表明，WSIIs和PAHs与磷脂双分子的相互作用，降低了膜脂流动性，增大了膜通透性；在WSIIs和PAHs暴露下，与氧化应激反应、细胞间接触、细胞膜通透性和接合转移能量驱动力相关的基因表达水平上调。此外，呼吸模拟表明，RP4的接合转移主要取决于佩戴时间而不是呼吸量。利用数学模型预测表明，长期暴露于WSIIs和PAHs会加速ARGs的传播，并维持遗传稳定性。

**关键词**：抗生素抗性基因，一次性外科口罩，大气污染物，接合转移，分子动力学模拟

**Title：**Discarded masks as a new hotspot of antibiotic resistance genes: Highlighting mechanisms of atmospheric pollutants promoting conjugative transfer of ARGs

**Abstract:** The use of disposable surgical masks (DSMs) has exploded during the COVID-19 pandemic. The excellent filtration performance of DSMs can not only effectively block the spread of viruses, but also adsorb various atmospheric pollutants. During use, the mild and moist environment on the mask surface facilitates the proliferation of microorganisms. Based on DSMs, this study investigated the effect of air pollutants on the horizontal transfer of antibiotic-resistant bacteria (ARB) and their resistance genes (ARGs). At ambient concentrations, the conjugation-transfer frequency (CTF) was increased by 1.18-1.58 times by atmospheric water-soluble inorganic ions (WSIIs, including NO3-, SO42-, NH4+, and Ca2+), and the CTF was increased by 1.41-1.51 times by polycyclic aromatic hydrocarbons (PAHs, including Phe and Nap). The combined action of total suspended particulate matter (TSP) with WSIIs or PAHs further enhances the CTF. Molecular dynamics simulation showed that the interaction of WSIIs and PAHs with phospholipid bimolecules decreased the fluidity of membrane lipids and increased the permeability of membrane. Under WSIIs and PAHs exposure, gene expression levels associated with oxidative stress response, intercellular contact, cell membrane permeability, and conjugation transfer energy drive were upregulated. Furthermore, respiratory simulations showed that the conjugation transfer of RP4 depended primarily on wear time rather than breathing volume. Mathematical models predict that long-term exposure to WSIIs and PAHs accelerates the spread of ARGs and maintains genetic stability.

**Keywords:** Antibiotic resistance genes; Disposable surgical masks; Atmospheric pollutants; Conjugative transfer; Molecular dynamics simulation

**14.张国栋博士**

**报告题目：**污水处理厂排放的生物气溶胶衍生的溶解性有机物质的微生物转化的分子机制

**个人简介：**2020级环境科学博士，师从祝凌燕教授。自2016年起开始对抗生素抗性基因转移和气载内毒素污染控制进行研究，主要研究对象为不同水、土壤和大气介质。近年来先后对内毒素的环境行为和污染控制、内毒素对抗生素抗性基因转移的影响进行了研究。探讨了放电等离子体技术对水和气溶胶内毒素的去除机制、内毒素对抗性基因转移的影响机制。先后中发表论文五篇《water research》、《environmental international》、《environmental pollution》、《chemosphere》和《water》。

**中文摘要：**

污水处理厂(WWTP)是气溶胶衍生的溶解有机物(ADOM)的重要来源，它可能通过呼吸系统威胁人类的健康。本研究以典型污水处理厂的气溶胶为样本，探讨了气溶胶中ADOM的化学分子多样性、分子生态网络和潜在毒性。高荧光指数(> 1.9)和生物指数(0.66 ~ 1.17)表明ADOM在污水处理厂具有较强的自生微生物源特征。在污水处理过程中，由于强烈的搅拌和鼓泡作用，废水中的DOM和微生物被雾化，分别贡献了气溶胶中ADOM和微生物的74%和75%。ADOM主要由CHO和CHOS组成，分别占总分子数的35%和25%，其中木质素(69%)为主要成分。49%的ADOM转化受热力学限制，群内转化比群间转化更容易。参与ADOM转化的气溶胶中的细菌表现出合作和分化行为，并倾向于将碳水化合物样和氨基糖/蛋白质样转化为顽固性木质素样。大气温度和湿度通过调节ADOM的性质间接影响微生物组成。新生成的ADOM一般不会被大气中的微生物进一步转化。ADOM中的单宁、木质素和不饱和碳氢化合物样分子是主要的毒性贡献者，分别促进炎症因子IL-β (2.2-5.4倍)、TNF-α (3.5-7.0倍)和IL-6 (3.5-11.2倍)的表达。

**英文摘要：**

Wastewater treatment plants (WWTP) are important sources of aerosol-derived dissolved organic matter (ADOM) which may threaten human health via the respiratory system. In this study, aerosols were sampled from a typical WWTP to explore the chemical molecular diversity, molecular ecological network, and potential toxicities of the ADOM in the aerosols. The high fluorescence index (> 1.9) and biological index (0.66-1.17) indicated the strong autogenous microbial source characteristics of the ADOM in the WWTP. DOM and microbes in the wastewater were aerosolized due to strong agitation and bubbling in the treatment processes, and contributed to 74% and 75%, respectively, of the ADOM and microbes in the aerosols. The ADOM was mainly composed of CHO and CHOS accounting for 35% and 29% of the total number of molecules, respectively, with lignin (69%) as the major constituent. 49% of the ADOM transformations were thermodynamically limited, and intragroup transformations were easier than intergroup transformations. Bacteria in the aerosols involved in ADOM transformations exhibited both cooperative and divergent behaviors and tended to transform carbohydrate-like and amino sugar/protein-like into recalcitrant lignin-like. The microbial compositions were affected by atmosphere temperature and humidity indirectly by modulating the properties of ADOM. The newly generated ADOM was generally not further transformed by the microbes in the atmosphere. Tannin-, lignin-, and unsaturated hydrocarbon-like molecules in the ADOM were primary toxicity contributors, facilitating the expression of inflammatory factors IL-β (2.2-5.4 folds), TNF-α (3.5-7.0 folds), and IL-6 (3.5-11.2 folds), respectively.

**15.王齐博士**

**报告题目：**污泥胞外聚合物诱导抗生素抗性基因结合转移的机制:分子多样性和电子转移

**个人简介：**2021级环境工程专业博士研究生，师从王铁成教授。自2022年起开展污泥胞外聚合物介导的抗生素耐药基因水平转移的研究，从分子层面剖析了三种污泥胞外聚合物的成分差异，结合其电化学性能，探明了三种污泥胞外聚合物促进抗性基因水平转移的主要机制，为更好的控制污水处理过程中抗生素耐药性的传播提供了理论基础。

**中文摘要：**

抗生素耐药基因(ARGs)的传播已成为对公共卫生的严重威胁。活性污泥富含胞外聚合物质(EPS)，是ARGs的重要资源库。本研究从EPS的分子多样性和电子转移性质等方面探讨了三种EPS诱导ARGs接合转移的机制，包括紧密结合EPS (TBEPS)、可溶性EPS (SEPS)和松散结合EPS (LBEPS)。与对照组相比，接合转移频率分别提高了9.98倍(SEPS)、4.21倍(LBEPS)和15.75倍(TBEPS)。在接合转移过程中，涉及氧化应激(9个基因)、膜通透性(18个基因)、细胞间接触(17个基因)和能量代谢途径(13个基因)的核心基因均上调，尤其是在TBEPS存在时。SEPS和LBEPS中的碳水化合物和脂肪类物质是ARG水平转移的主要贡献者，SEPS通过影响活性氧(ROS)的形成促进ARG的转移，LBEPS通过影响活性氧(ROS)的形成和三磷酸腺苷(ATP)的产生促进ARG的转移。TBEPS具有最高的氧化还原电位和不稳定性，通过促进细胞间的电子转移和呼吸交替，从而通过产生ATP促进ARG转移。总的来说，EPS的化学分子特性和氧化还原特性主要通过影响脂质过氧化和ATP的合成来促进ARG的转移。

**英文摘要：**

Dissemination of antibiotic resistance genes (ARGs) has become a critical threat to public health. Activated sludge, rich in extracellular polymeric substances (EPS), is an important pool of ARGs. In this study, mechanisms of conjugation transfer of ARGs induced by EPS, including tightly bound EPS (TBEPS), soluble EPS (SEPS), and loosely bound EPS (LBEPS), were explored in terms of molecular diversities and electron transfer properties of EPS. Conjugation transfer frequency was increased by 9.98-folds (SEPS), 4.21-folds (LBEPS), and 15.75-folds (TBEPS) versus the control, respectively. Conjugation-related core genes involving SOS responses (9 genes), membrane permeability (18 genes), intercellular contact (17 genes), and energy metabolism pathways (13 genes) were all upregulated, especially in the presence of TBEPS. Carbohydrates and aliphatic substances in SEPS and LBEPS were contributors to ARG transfer, via influencing reactive oxygen species (ROS) formation (SEPS) and ROS and adenosine triphosphate (ATP) production (LBEPS). TBEPS had the highest redox potential and greatest lability and facilitated electron transfer and alternated respiration between cells, thus promoting ARG transfer by producing ATP. Generally, the chemical molecular characteristics and redox properties of EPS facilitated ARG transfer mainly by influencing lipid peroxidation and ATP, respectively.

**16.李华勇博士**

**个人简介：**2019级资源环境生物学专业博士研究生，师从和文祥教授。自2019年起开始开展不同碳源添加条件下砷胁迫对土壤微生物养分需求的影响及其作用机制研究，揭示砷胁迫下土壤微生物养分代谢调控机制，最终为明确土壤酶活性和砷污染间的关系理论依据。先后在Science of the Total Environment上发表了2篇SCI研究论文。

**报告题目：**不同碳源添加条件下砷胁迫对土壤微生物养分需求的影响及作用机制

**摘要：**为了解砷污染对土壤微生物养分代谢的影响，开展了为期120天的微观培养实验，重点研究了砷污染下的碳循环生化过程。培养期间，测定了土壤基础呼吸、碳氮磷循环相关酶活性、微生物生物量和微生物群落结构。结果表明：与未污染土壤相比，砷胁迫下β-1,4-N-乙酰葡糖胺酶（NAG）活性提高了1.21-2.81倍，而磷酸酶活性（ACP+ALP）降低了9.86%-45.20%。土壤酶化学计量显示砷胁迫下微生物C和P的需求减轻。虽然碳源的添加减轻了微生物对碳的需求，但它放大了磷的需求。网络分析表明，砷胁迫刺激土壤微生物抗性基因的表达并修饰微生物养分需求。结果，在500 mg kg-1砷胁迫下，微生物碳利用效率（CUE）和土壤基础呼吸分别增加了1.17-1.59和1.18-3.56倍。碳源添加通过增加微生物之间的凝聚力来增强微生物对砷的抵抗力。结果对于理解砷污染区域微生物营养素的可用性和局限性以及建立基于酶的土壤砷污染毒性评估系统具有重要意义。

**关键词**：砷污染；土壤酶；生态化学计量学；微生物碳利用率

**Title：**Effect mechanism of arsenic on soil microbial nutrient requirements under different carbon source addition

**Abstract:** To understand the effects of arsenic contamination on soil microbial nutrient metabolism, a 120-day microcosm incubation experiment focused on carbon cycling biochemical processes under arsenic contamination was conducted. Soil basal respiration, enzyme activities, microbial biomass, and microbial community structure were determined. Results showed that, compared to the uncontaminated soil, β-1,4-N-acetylglucosaminidase (NAG) activities were increased by 1.21-2.81 times under arsenic stress, while the phosphatase activities (ACP+ALP) were decreased by 9.86%-45.20%. The soil enzymatic stoichiometry showed an alleviation of microbial C and P requirements under arsenic stress. Though the addition of C-sources alleviates the microbial C requirement, it amplifies the P requirement. Network analysis revealed that arsenic stress stimulates the expression of soil microbial resistance genes and modifies microbial nutrient requirements. As a result, microbial carbon use efficiency (CUE) and soil basal respiration increased by 1.17-1.59 and 1.18-3.56 times respectively under 500 mg kg-1 arsenic stress. The application of C-sources enhanced microbial resistance to arsenic by increasing the cohesion among microorganisms. The results are important for understanding the availability and limitations of microbial nutrients in arsenic-contaminated areas, and for the establishment of enzyme-based toxicity assessment systems for soil arsenic contamination.

**Keywords:** Arsenic contamination; Soil enzyme; Ecological stoichiometry; Microbial carbon use efficiency.

**17.南运有博士**

**个人简介：**2019级植物营养学专业博士研究生，师从高亚军教授。自2019年起开始开展甘蓝型油菜氮吸收利用相关调控基因的挖掘及功能研究，通过分子生物学与生理生化等方法研究关键候选基因参与油菜氮素吸收利用调控的生物学功能，为通过生物技术培育氮营养高效利用或者耐低氮的油菜新品种提供理论依据，对氮肥减施、农业可持续发展及生态环境保护具有重要意义。以第一作者身份先后发表SCI论文3篇（*International Journal of Molecular Sciences* 1篇，*Plant Stress* 1篇， *International Journal of Biological Macromolecules* 1篇）。

**报告题目：**结合BSA-seq与RNA-seq技术鉴定甘蓝型油菜氮效率相关调控基因

**摘要：**油菜(*Brassica napus* L.)是世界上重要的油料作物之一，对氮素的需求量较高，挖掘油菜自身营养遗传潜力对于提高其氮素利用效率(NUtE)至关重要。甘蓝型油菜是一种异源四倍体作物，基因组较大且较为复杂，目前对其NUtE相关调控基因的鉴定和功能研究较少。本研究采用混合分组分析(Bulked Segregant Analysis sequencing, BSA-seq)和RNA测序分析(RNA-seq)相结合的方式，对氮高效油菜“浙油18”和氮低效油菜“Sollux”进行研究，以确定其氮效率遗传调控机制。筛选出了高亲和力硝酸盐转运蛋白基因*NRT2.1* (BnaC08g43370D)以及脱落酸(abscisic acid, ABA)信号转导相关基因(BnaC02g14540D、BnaA03g20760D、BnaA05g01330D)等候选基因。其中，BnaA05g01330D被注释为受ABA诱导的bHLH类转录因子(AIB/bHLH17)，在根系中大量表达。结果表明：在低氮条件下，*ataib*突变体的主根长度显著长于野生型（Ler）。过表达*BnaA5.AIB*可以降低低氮条件下拟南芥(*Arabidopsis*)的NUtE。研究表明*BnaA5.AIB*是油菜NUtE的负调控因子，并且可能参与了ABA与氮信号通路互作的调控。本研究鉴定到了参与油菜NUtE调控的候选基因，并揭示了*AIB*基因在协调氮素吸收和利用方面的新功能，为通过生物技术培育氮高效油菜品种提供了理论依据。

**关键词**：油菜；氮利用效率，BSA-seq; RNA-seq; AIB

**Title：**Integrated BSA-seq and RNA-seq analysis to identify candidate genes associated with nitrogen utilization efficiency (NUtE) in rapeseed (*Brassica napus* L.)

**Abstract:** Rapeseed (*Brassica napus* L.) is one of the most important oil crops worldwide, which has a higher demand for nitrogen (N). It is very important to tap the genetic potential of rapeseed to improve N utilization efficiency (NUtE). Rapeseed is a heterotetraploid crop with a large and complex genome. There are few studies on the identification and function study of genes related to NUtE regulation in rapeseed. In this study, a combination of Bulked Segregant Analysis sequencing (BSA-seq) and RNA sequencing analysis (RNA-seq) is employed to analyze N-efficient rapeseed "Zheyou18" and N-inefficient rapeseed "Sollux" for exploring the genetic regulation mechanism. Candidate genes such as high-affinity nitrate transporter gene *NRT2.1* (BnaC08g43370D) and abscisic acid (ABA) signal transduction genes (BnaC02g14540D, BnaA03g20760D, BnaA05g01330D) were screened. Among them, BnaA05g01330D is annotated as an ABA-induced bHLH-type transcription factor (AIB/bHLH17), which is highly expressed in the root system. The results showed that the primary root length of *ataib* mutant was significantly longer than that of the wild type (Ler) under low N conditions. Overexpression of *BnaA5.AIB* can reduce the NUtE of *Arabidopsis* under low N conditions. The results indicate that *BnaA5.AIB* is a negative regulator of NUtE in rapeseed and may be involved in regulating the interaction between ABA and N signaling pathways. In this study, candidate genes involved in NUtE regulation in rapeseed were identified, and new functions of the *AIB* gene in coordinating N uptake and utilization were revealed, which provided a theoretical basis for cultivating N-efficient rapeseed varieties through biotechnology.

**Keywords:** Rapeseed; nitrogen utilization efficiency; BSA-seq; RNA-seq; AIB