Nitrogen fertilizer

Title	**Effects of nitrogen fertilization rate on tocopherols, tocotrienols and γ-oryzanol contents and enzymatic antioxidant activities in rice grains**
Author Name	Yu-Hsiang Tung & Lean-Teik Ng
Journal Name	Physiol Mol Biol Plants
Year	2019
Volume and Issue	25, 1
Pages	Pages 189 - 195
Abstracts	Tocopherols (Toc), tocotrienols (T3) and c-oryzanol (GO), major bioactive compounds of rice, are known to possess potent antioxidant activity. In this study, the objective was to determine the effects of nitrogen fertilization rate on contents of Toc, T3 and GO, and activities of enzymatic antioxidants in rice grains. Experiments were conducted on five different levels of nitrogen fertilization. Among the different treatments, grains of 2 N (two-fold of the recommended amount of nitrogen fertilizer) treatment showed the highest total Toc, total T3, a-T3, b-Toc, c-Toc and c-T3 levels, whereas 0 N (no treatment) group had the highest GO content. Increasing nitrogen fertilization significantly reduced the rice grain catalase and ascorbate peroxidase, but not the superoxide dismutase activities. Under 0 N and 0.5 N (low N fertilization) treatments, malondialdehyde and H_2O_2 contents in rice grains were significantly higher than that of other treatments. These results suggest that a two-fold increase in nitrogen fertilization favor the accumulation of Toc and T3 but not GO in rice grains.
Keywords	Oryza sativa; Nitrogen nutrient; Bioactive components; Enzymatic antioxidants

Title	**Comparative Metabolite Profiling Of Two Wheat Genotypes As Affected By Nitrogen Stress at Seedling Stage**
Author Name	F. U. Khan, D. Fuentes, R. Threthowan , F. Mohammad & M. Ahmad
Journal Name	The Journal of Animal & Plant Sciences
Year	2019
Volume and Issue	29, 1
Pages	Pages 260-268
Abstracts	Increasing demands for wheat productivity together with environmental concerns about the use of nitrogen-based fertilizers dictate the importance of improving nitrogen use efficiency (NUE). Identifying biological processes responsible for efficient fertilizer use will provide tools for crop improvement under reduced nutrient inputs. Metabolic response under nitrogen (N) stress was investigated at Centre for Carbon, Water and Food (CCWF), The University of Sydney, Australia. GC-MS and LC-MS techniques were used for metabolite and amino acid profiling in N-stress tolerant (Krichauff) and sensitive (Berkut) varieties under with (normal) and without nitrogen (stress) conditions in 28 days old seedlings. Twenty-six metabolites including organic acids, sugars, and amino acids were characterized in both genotypes under stress and normal conditions. Organic acids (citric acid and oxalic acid) and sugars (glucose, sucrose, fructose and mannose) were significantly increased in both varieties under stress conditions, whereas, malic and oxalic acids were increased in tolerant (Krichauff), while decreased in susceptible (Berkut) genotype. Sugar alcohol (pentaerythitol, xylitol and myo-inositol) remained similar in both genotypes under stress and normal conditions. Seven out of twenty amino acids (glycine, cysteine, valine, methionine, isoleucine, leucine and tryptophan) were not detected in both genotypes under both stress and normal conditions. Most of the remaining amino acids were detected under normal condition only, exhibiting the relationship of amino acid with nitrogen applications. Amino acids viz. serine, aspargine, alanine, threonine, glutamine and proline were specifically decreased under stress condition in Krichauff, whereas glutamic acid increases in both genotypes under stress than normal conditions. Compared with Berkut, Krichauff experienced greater increase in both sugars and organic acids, and more pronounced decrease in most of the amino acids under stress condition. L-ascorbic acid, allo-insitol, lysine and tyrosine were unique metabolites found only in tolerant (Krichauff) genotype. Metabolic responses of wheat to nitrogen stress were dynamic and involve many metabolites. Greater Ntolerance and different metabolic expression in Krichauff necessitate further studies to examine various pathways and adaptive reactions at critical stress conditions. Current findings of metabolite profiling might help in unveiling the genetic targets for the improvement of nitrogen use efficiency in wheat.
Keywords	Metabolites; genotypes; nitrogen stress; adaptive reactions

Title	Enhanced efficiency nitrogen fertilizers maintain yields and mitigate global warming potential in an intensified spring wheat system
Author Name	Xiaodong Lyu, Ting Wang, Zhongming Ma, Chuanyan Zhao, Kadambot H.M. Siddique & Xiaotang Ju
Journal Name	Field Crops Research
Year	2019
Volume and Issue	244
Pages	--
Abstracts	Enhanced efficiency nitrogen fertilizers (EENFs), including nitrification inhibitors (NIs) and slow-release fertilizers (SRFs), are considered a feasible pathway for improving grain yield and mitigating greenhouse gas (GHG) emissions. However, the usage of EENFs in an intensified spring wheat system has not been well documented. The combined application of EENFs with water and fertilizer management (EENFs-WFM) was investigated in an irrigated spring wheat cropping system over two years. Measurements of soil nitrous oxide (N2O), methane (CH4) and carbon dioxide (CO2) fluxes were taken across five treatments: no N fertilizer as a control (CK), conventional N fertilization and irrigation (Con), optimum N fertilization and irrigation (Opt), optimum N fertilization and irrigation plus nitrification inhibitor (Opt + NI), and optimum N fertilization as slow-release fertilizer and irrigation (Opt-SRF). The cumulative N2O emissions in both growing seasons were significantly ($P < 0.05$) higher than the fallow seasons and accounted for 56–83% of total emissions. The Opt, Opt-SRF, and Opt + NI treatments significantly reduced the cumulative N2O emissions by 25%, 34%, and 45%, respectively, relative to the Con treatment, while the fertilizer N input decreased by 36%. The soil acted as a tiny sink for atmospheric CH4, with no significant effect in any treatment. Moreover, global warming potential (GWP) and greenhouse gas intensity (GHGI) declined by ∼45% and ∼33%, respectively, in the Opt + NI treatment and ∼46% and ∼34%, respectively, in the Opt-SRF treatment, relative to the Con treatment, with almost no effect on grain yield. Our results highlight that EENFs-WFM is a promising management system for maintaining yield while minimizing GWP and GHGI.
Keywords	GHG emissions; Nitrification inhibitor; Slow-release fertilizer; GWP; GHGI

Title	**Effect of high-nitrogen fertilizer on gliadin and glutenin subproteomes during kernel development in *wheat (Triticum aestivum L.)***
Author Name	Shoumin Zhen, Xiong Deng, Xuexin Xu, Nannan Liu, Dong Zhu, Zhimin Wang & Yueming Yan
Journal Name	The Crop Journal
Year	2019
Volume and Issue	---
Pages	---
Abstracts	Nitrogen (N), a macronutrient essential for plant growth and development, is needed for biosynthesis of protein and starch, which affect grain yield and quality. Application of high-N fertilizer increases plant growth, grain yield, and flour quality. In this study, we performed the first comparative analysis of gliadin and glutenin subproteomes during kernel development in the elite Chinese wheat cultivar Zhongmai 175 under high-N conditions by reversed-phase ultra-performance liquid chromatography and two-dimensional difference gel electrophoresis (2D-DIGE). Application of high-N fertilizer led to significant increases in gluten macropolymer content, total gliadin and glutenin content, and the accumulation of individual storage protein components. Of 126 differentially accumulated proteins (DAPs) induced by high-N conditions, 24 gliadins, 12 high-molecular-weight glutenins, and 27 low-molecular-weight glutenins were significantly upregulated. DAPs during five kernel developmental stages displayed multiple patterns of accumulation. In particular, gliadins and glutenins showed respectively five and six accumulation patterns. The accumulation of storage proteins under high-N conditions may lead to improved dough properties and bread quality.
Keywords	Bread wheat; High nitrogen; Gliadins, Glutenins; RP-UPLC; 2D-DIGE

Title	Effect of bag-controlled release fertilizer on nitrogen loss, greenhouse gas emissions, and nitrogen applied amount in peach production
Author Name	Yuansong Xiao, Futian Peng, Yafei Zhang, Jian Wang, Yuping Zhuge, Shoushi Zhang, Huaifeng Gaoa
Journal Name	Journal of Cleaner Production
Year	2019
Volume and Issue	234
Pages	---
Abstracts	In common nutrient management in peach orchards in China, a large amount of nitrogen fertilizer is used. However, low nitrogen absorption and utilization rate results in nitrogen loss and greenhouse gas emissions, which is not favorable for cleaner production in peach orchards. In this experiment, nitrogen leaching, ammonia volatilization, greenhouse gas emissions under bag-controlled release fertilizer (BCRF) were evaluated. In addition, the impact of BCRF on soil nutrient status in peach orchards, peach root system growth, nitrogen absorption and utilization rate, fruit quality, and the potential for using BCRF in major peach-producing areas in China to reduce the amount of nitrogen fertilizer application were also investigated. Results showed that BCRF maintained a stable supply of nutrients to soil, decreased nitrogen leaching, ammonia volatilization and greenhouse gas emissions while nitrogen loss was significantly reduced from peach orchard soil. Also, BCRF reduced the combined global warming potential at 20-, 100-, and 500-years. A 5-year study revealed that application of BCRF promoted the formation of a dense root system in peach trees by the development of fine roots and a more concentrated root distribution. This extended the lifespan of the root system and improved fruit quality. 15N tracer experiments showed that BCRF significantly increased the absorption and utilization rate of nitrogen by peach trees. BCRF reduced the amount of nitrogen fertilizers applied by 65–82% compared to common fertilizer application methods without decreasing peach yield, so it has huge potential for reducing the amount of nitrogen fertilizer used as well as fertilizer input costs in peach production. The results showed that BCRF has huge application potential as a new, environmentally friendly, low-cost, and efficient fertilizer for cleaner production in peach orchards.
Keywords	Bag-controlled release fertilizer; Nitrogen leaching; Ammonia volatilization; Greenhouse gases emissions; Nitrogen applied amount; Peach orchards

Title	**Chronic nitrogen addition induces a cascade of plant community responses with both seasonal and progressive dynamics**
Author Name	XiaobingZhou, Matthew A.Bowker, YeTao, LinWu&Yuanming Zhang
Journal Name	Science of The Total Environment
Year	2018
Volume and Issue	626
Pages	Pages 99-108
Abstracts	Short-lived herbaceous plants provide a useful model to rapidly reveal how multiple generations of plants in natural plant communities of sensitive desert ecosystems will be affected by N deposition. We monitored dynamic responses of community structure, richness, evenness, density and biomass of herbaceous plants to experimental N addition (2:1 NH_4^+:NO_3^- added at 0, 0.5, 1, 3, 6 and 24 g N m^{-2} a^{-1}) in three seasons in each of three years in the Gurbantunggut desert, a typical temperate desert of central Asia. We found clear rate-dependent and season-dependent effects of N deposition on each of these variables, in most cases becoming more obvious through time. N addition reduced plant richness, leading to a loss of about half of the species after three generations in the highest N application level. Evenness and density were relatively insensitive to all but the greatest levels of N addition for two generations, but negative effects emerged in the third generation. Biomass, both above and below ground, was non-linearly affected by N deposition. Low and intermediate levels of N deposition often increased biomass, whereas the highest level suppressed biomass. Stimulatory effects of intermediate N addition disappeared in the third generation. All of these responses are strongly interrelated in a cascade of changes. Notably, changes in biomass due to N deposition were mediated by declines in richness and evenness, and other changes in community structure, rather than solely being the direct outcome of release from limitation. The interrelationships between N deposition and the different plant community attributes change not only seasonally, but also progressively change through time. These temporal changes appear to be largely independent of interannual or seasonal climatic conditions.
Keywords	Arid; Biodiversity-productivity relationship; Ephemeral plant; Evenness; Global change; Species richness

Title	Effects of glyphosate application and nitrogen fertilization on the soil and the consequences on aboveground and belowground interactions
Author Name	ElodieNivelle, JulienVerzeaux, AmélieChabot, DavidRoger, QuentinChesnais, ArnaudAmeline, JérômeLacoux, Jose-EdmundoNava-Saucedo, ThierryTétu&ManuellaCatteroua
Journal Name	Geoderma
Year	2018
Volume and Issue	311
Pages	45 - 57
Abstracts	The application of nitrogen (N) and herbicides are commonly used to fertilize crops and protect them against weed development, but are also considered as soil and environment pollutants. Even so, the individual and combined non-target effects of N fertilizers and herbicides on multitrophic interactions within agrosystems are not well known. From soil samples collected in the field, we examined the effects of the direct application of glyphosate and/or N fertilization on microbial activities and soil nutrient status. In addition, we investigated the increase in biomass and, nutrient acquisition of the bean (Phaseolus vulgaris) and the consequences of the applications of N and glyphosate on the performance of the herbivore aphid (Aphis fabae). From soils that did (N +) or did not receive (N0) synthetic N fertilization over a 6-year period, we assessed the effects of glyphosate (CK, without glyphosate; FR, field rate of glyphosate) and N fertilization (N +, with N fertilization; N0, without N fertilization) applications in a mesocosm experiment for 75-days. Following the 75 day treatment, the biological and physiological consequences, both belowground and aboveground were determined. The growth of arbuscularmycorrhizal fungi (AMF) and dehydrogenase activity, were negatively affected following N + fertilization and the application of the FR of glyphosate, while in the absence of glyphosate, alkaline phosphatase (AlP) activity was reduced. Functional microbial responses were unaffected by both N and glyphosate, even when applied in combination. Conversely, the N fertilization significantly increased the nitrate content ($NO3-$) in the CK soils and the total N in the FR soils, compared to CK/N0 and FR/N0 soils. The combined effects of glyphosate and nitrogen fertilization (FR/N +) significantly decreased the soil C:N ratio, but significantly increased nitrification compared to CK/N0 and FR/N0 soils. The FR/N + treatments positively affected plant performance, improving the total chlorophyll, sucrose, ammonium, amino acid content, and pod biomass, compared to the CK/N0 and FR/N0 soils. Unlike glyphosate, which did not appear to exert an effect when applied alone or in combination, N fertilization significantly increased aphid nymph survival. The non-metric multidimensional scale allowed us to establish belowground and aboveground interactions with glyphosate and N fertilization. We conclude that glyphosate and N fertilization have negative effects on soil microflora and potential pests, but do not necessarily affect belowground and aboveground interactions, and may offer equal or superior benefits to crop productivity.
Keywords	Nitrogen fertilization; Glyphosate herbicide; Soil functional activities; Soil nutrients; Plant performance; Aphid nymph survival

Title	**The effects of organic and mineral fertilizers on carbon sequestration, soil properties, and crop yields from a long-term field experiment under a Swiss conventional farming system**
Author Name	Alexandra Maltas, HediKebli, Hans Rudolf Oberholzer, Peter Weisskopf&SokratSinaj
Journal Name	Land Degradation & Development
Year	2018
Abstracts	The effects of mineral fertilizers and organic amendments on soil properties, carbon (C) sequestration, and crop yields are studied in a 37-year field experiment, Phosphorus–Potassium-balanced design, in Switzerland.Treatments included a control (mineral fertilization) without nitrogen (N) fertilizers (Min-N0) and with optimal N (Min-Nopt) and 5 organic amendments (green manure [Gm], cereal straw [Str], fresh cattle manure in 2 doses 35 and 70 t ha−1 [Ma35 and Ma70] and cattle slurry [Slu]) all receiving the same optimal N fertilization as Min-Nopt. All mineral and organic treatments received optimum P–K fertilization.Nitrogen fertilization (Min-Nopt vs. Min-N0) increased soil organic C, microbial activity, and microporosity but decreased pH, magnesium, and macroporosity. All organic treatments with optimal mineral N resulted in higher soil organic C content compared with Min-Nopt, however, these effects were significant only for the highest dose of manure. The organic amendments supplied 25% to 80% additional C input to the soil compared with Min-Nopt, and their amendment-C retention coefficients ranged from 1.6% (Gm) to 13.6% (Ma70). Chemical, physical, and biological soil properties were not or slightly significantly different among organic treatments. Nevertheless, soils fertilized with farmyard manure produced generally higher grain yield (up to 7.3%) compared with Min-Nopt whereas the opposite effect was noted for Gm (−2.2%) and Str (−5.2%) treatments due to their negative effect on N availability. In conclusion, Gm and Str treatments were as effectives as Ma35 and Slu treatments to prevent soil degradation but required higher chemical fertilizer to maintain crop yield.
Keywords	crop yields; farmyard manure; green manure; mineral fertilizers; soil organic carbon; soil properties

Title	**Nitrogen effects on plant species richness in herbaceous communities are more widespread and stronger than those of phosphorus**
Author Name	Merel B. Soons, Mariet M. Hefting, EduDorland, Leon P.M.Lamers, CarmenVersteeg & RolandBobbink
Journal Name	Biological Conservation
Year	2017
Volume and Issue	212
Pages	390-397
Abstracts	Both nitrogen (N) and phosphorus (P) enrichment are known to impact plant diversity globally. Recent studies suggest that P enrichment may be as important, or even more important, as a driver of terrestrial plant species loss as N enrichment. However, the generality and relative contribution of these critical nutrients to species losses remains unclear. Here, we quantitatively compared effects of N, P and combined NP enrichment on species richness of natural and semi-natural herbaceous ecosystems across the world in a meta-analysis of 189 long-term nutrient addition experiments in the field. Our experiment-based approach shows that, across terrestrial and wetland ecosystems, N and NP enrichment had widespread and strong negative effects on plant species richness. N reduced plant species richness across experiments by on average 16% ($p < 0.001$), while P did not (on average 3%, NS). Combined NP enrichment also reduced species richness, by on average 16% ($p = 0.009$), with the dominant effect statistically attributed to N. N enrichment effects were greater in China than in Europe and America, which may be explained by background atmospheric N deposition rates and earlier species losses in Europe and America. P enrichment reduced species numbers only in the most species-rich communities and even increased species numbers at high latitudes. All nutrient enrichment combinations (N, P, NP) stimulated aboveground biomass production, and biomass-mediated mechanisms are likely to have contributed to reported species losses. Our findings demonstrate that for the protection of the world's herbaceous plant diversity, it is of the highest priority that N loads be drastically reduced.
Keywords	Biodiversity; Eutrophication; Meta-analysis; Nitrogen deposition; Nutrient enrichment; Phosphorus release

Title	**Increased plant uptake of native soil nitrogen following fertilizer addition – not a priming effect?**
Author Name	María Teresa Muñoz-Quezada, Boris Lucero, Verónica Iglesias, Karen Levy, MaríaPía Muñoz, Eduardo Achú, Carlos Concha, Ana MaríaBrito and Marcos Villalobos
Journal Name	Applied Soil Ecology
Year	2017
Volume and Issue	114
Abstracts	Fertilizer inputs affect plant uptake of native soil nitrogen (N), yet the underlying mechanisms remain elusive. To increase mechanistic insight into this phenomenon, we evaluated the effect of fertilizer addition on mineralization (in the absence of plants) and plant uptake of native soil N. We synthesized 43 isotope tracer (15N) studies and estimated the effects of fertilizer addition using meta-analysis. We found that organic fertilizer tended to reduce native soil N mineralization (−99 kg ha−1 year−1; $p = 0.09$) while inorganic fertilizer tended to increase N priming (58 kg ha−1 year−1; $p = 0.17$). In contrast, both organic and inorganic fertilizers significantly increased plant uptake of native soil N (179 and 107 kg ha−1 year−1). Organic fertilizer had greater effect on plant uptake than on mineralization of native soil N ($p < 0.001$), but inorganic fertilizer had similar effects. Fertilizer effects on mineralization and plant uptake of native soil N were not influenced by study location (laboratory or field) and duration, soil texture, carbon and N content, and pH. Fertilizer addition variably affected native soil N mineralization but consistently increased plant uptake of native soil N. The positive effect of organic fertilizer on plant uptake of native soil N can not be explained by its negative effect on native soil N mineralization, suggesting that increased plant uptake of native soil N was caused mostly by plant-mediated mechanisms (e.g., increased root growth, rhizosphere N priming) rather than by soil microbe-mediated mechanisms.
Keywords	^{15}N isotope tracer; Added nitrogen interaction; Mineralization and immobilization; 15N labeled fertilizer; Plant-soil interaction; Rhizosphere priming