Dynamic Soil, Dynamic Plant

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Scope and target readership: *Dynamic Soil, Dynamic Plant* publishes research papers, reviews, short communications and techniques papers on a wide range of applications of soil science, applying scientific principles to understand and solve important soil problems as they affect plant growth, development, flowering and other processes linking the plant to the soil environment. *Dynamic Soil, Dynamic Plant* also covers all aspects of soil biology which deal with floral ecology or the plant-microbe ecology and activity in soils, at different levels of organization: individuals, populations, communities, ecosystems using a range of approaches: molecular biology, genetics, ecophysiology, biogeography, ecology, soil processes, organic matter, nutrient dynamics and landscape ecology.

Papers covering the following themes are acceptable:

1) Biological transformations of plant nutrients in soil;
2) Community ecology and functioning processes: interactions between plants and mineral or organic compounds; involvement of such interactions in soil pathogenicity; transformation of mineral and organic compounds, cycling of elements; soil structure;
3) Modelling of plant processes and population dynamics;
4) Nitrogen fixation and denitrification;
5) Pathogenesis: soil-borne phases of plant parasites, the ecological control of soil-borne pathogens;
6) Pesticides and their influence on soil organisms;
7) Physical, chemical and biological parameters of the soil environment brought about by biotic and abiotic influences;
8) Population biology and molecular ecology: methodological development and contribution to study microbial and plant populations; diversity and population dynamics; genetic transfers, influence of environmental factors;
9) Soil biology, physics and chemistry: occurrence of physicochemical parameters and surface properties on plant processes and population behaviour;
10) Soil pollution: the biochemistry of pesticide and pollution decomposition in soil, microbial aspects of soil pollution;
11) Soil tillage: characterization or modelling of tillage and field traffic effects on the soil environment; tillage systems (including reduced cultivation and direct drilling) suitable for specific conditions of soil, climate, topography, irrigation and drainage with the objective of improving crops, crop rotations, intensities for fertilization, degree of mechanization, and crop production for sustainable agriculture with minimum environmental impacts; tillage in weed, pest and disease control.

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Cover photo: Top left: Lupinoid nodule surrounding the lupin root; top right: Transversal sections obtained with light microscopy of dark field and polarized light showing the air-filled pathways in the cortex and the infected zone; bottom left: Light micrograph of a nodule section (stained with toluidine blue) showing the infected zone and the cortex zones (1, 2 and 3) where the oxygen diffusion barrier is localized; bottom right: Transmission electron microscopy micrograph showing the immuno-gold localization of leghemoglobin in the cytoplasm of the infected cells. More details in Fernández-Pascual *et al.*, pp 1-16.

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Mercedes Fernández-Pascual, José J. Pueyo, María R. de Felipe, M. Pilar Golvano, M. Mercedes Lucas (Spain) Singular Features of the *Bradyrhizobium-Lupinus* Symbiosis (pp 1-16)

ABSTRACT

Special Feature: *Lupinus* is a legume with great agronomic potential due to the high protein content of its seeds and its positive effect on soil fertility. It is able to fix atmospheric nitrogen through the establishment of a symbiosis with soil bacteria of the genus *Bradyrhizobium*. The process is carried out in a special subclass of indeterminate nodules known as lupinoid nodules. The *Bradyrhizobium-Lupinus* symbiosis has particular characteristics, which makes it different from other *Rhizobium*-legume symbioses. The entry of the bacteria into the plant root occurs at the junction between the root hair base and the adjacent epidermic cell and only sporadic "infection threads" have been observed. The involvement of mitogen-activated protein kinases (MAPKs) and aldehyde oxidase in infection and nodule morphogenesis have been reported for the first time in this symbiosis. The presence of nitric oxide synthase activity in plants has been detected for the first time, in roots and nodules of *Lupinus albus*. The unique lupin nodule cortical structure has contributed to the visualization and elucidation of the operational mechanisms of the oxygen diffusion barrier. Nodule senescence takes place in a similar way to that of determinate nodules, starting in the central area of the nodule. This symbiosis is especially resistant to abiotic stresses such as herbicides, nitrate, salinity and heavy metals. This unusual tolerance has permitted the use of inoculated lupin plants for the re-vegetation of degraded areas and as a pioneer plant to fight soil erosion and to reclaim eroded soils. The capability to accumulate Cd, Zn and others heavy metals in the nodulated roots has resulted in the consideration of this symbiosis as a potential phytoremediator.

William L. Berndt, Joseph M. Vargas, Jr. (USA) A Review of the Nature and Control of Black Layer (pp 17-23)

ABSTRACT

Invited Mini-Review: Black layer is a condition where a darkened stratum exists in the root-zone of golf putting greens. It was the number one malady of greens in the 1980s because its nature was unknown and severe turf injury was associated with it. Researchers at Michigan State University (MSU) hypothesized that black layer was an accumulation of metal sulfides (MeS) linked to release of hydrogen sulfide (H_2S) by sulfur-reducing bacteria (SRBs) in response to low redox potential. Turf injury likely resulted from H_2S toxicity. Elemental sulfur (S^0) was thought to contribute to black layer, and nitrate (NO_3^-) could be a control. Researchers at MSU sought to test this hypothesis. The presence of MeS was verified in *in situ* black layers from putting greens at 26 golf courses by spot testing with a solution of sodium azide (NaN_3^-) and iodine (I_2). Black layer and H_2S were linked when $H_2{}^{35}S$ and $Me^{35}S$ were produced after ${}^{35}SO_4^{2-}$ was injected into intact soil cores from an *in situ* black layer. Adding molybdate (MoO_4^{2-}) with the label demonstrated involvement of SRBs. MeS-based black layers resulted and redox potential as p*e* + pH was lowered when S^0 was applied to waterlogged sand. Nitrate (NO_3^-) poised redox high enough to avert release of H_2S. Black layer was MeS. Applying S^0 contributed to black layer because it reduced redox and stimulated H_2S. The release of H_2S by SRBs was controlled by poising redox with NO_3^- and limiting S^0. Fertilizing with NO_3^- and limiting S^0 were effective controls for black layer.

Adele Muscolo, Maria Sidari (Italy) Coniferous Mediterranean Forest Soil Dynamics (pp 24-37)

ABSTRACT

Invited Review: Soil organic matter accumulated in the litter of a forest ecosystem is considered the single most important indicator of soil quality because it contributes to plant growth and development through its effect on the chemical, biological, and physical properties of soils. The decomposition of organic matter is an important process responsible for the release of nutrients in soils, which affect the productivity of forest ecosystems, particularly of coniferous forests and other nutrient-poor types. Nutrient release from fresh plant litter occurs via the enzymatic activities of the microbial communities. The varying predominance of the individual enzymes can be related to the amount of soil microorganisms. Thus, fluctuation in the size and turnover of the soil microbial biomass is very important in controlling the turnover of carbon and associated nutrients. Conifers are under strong exploitation pressure in Mediterranean forests; thus, knowledge of litter decomposition process and soil ecological functions is necessary for their adequate conservation. This review summarizes the progress made in recent years in understanding the mechanisms implicated in the dynamics of litter and nutrients release in coniferous forest soils, putting in

evidence that the litter decomposition rate for Conifers appears to be limited by low water availability, affected by the initial chemical composition of the litter types, and strongly influenced by biomass, particularly by the proportion of microfungi in the microbial community, which mediate the decomposition of organic matter, influencing nutrient turnover and soil productivity. There is a close relationship between content of microbial biomass, soil organic matter and enzyme activities.

R.W. McDowell (New Zealand) Dissolved Organic Phosphorus: A Mini-Review of Composition, Transformations and Loss (pp 38-42)

ABSTRACT

Invited Mini-Review: Despite comprising of 10-80% of total phosphorus (P) in soil solution, little is known of the composition, transformations and loss of dissolved organic P (DOP). Once dissolved in solution, organic P can either be mineralized into phosphate or lost in flowing waters. However, the potential for mineralization and loss depends on the chemical form of DOP. For instance, orthophosphate diesters such as RNA are known to be much more labile than compounds such as phosphonates or inositol phosphates (a subset of orthophosphate monoesters). This review highlights recent developments in characterising DOP, the mineralization and utilization of DOP by microbes and plants (largely via exocellular enzymes or organic acids), and the potential for loss in overland or subsurface flow under different landuses.

J. W. Waceke, J. W. Kimenju (Kenya) Intensive Subsistence Agriculture - Impacts, Challenges and Possible Interventions (pp 43-53)

ABSTRACT

Invited Review: Subsistence farming is a form of production in which nearly all crops or livestock are raised to sustain the farm family, and rarely producing surpluses to sell for cash or store for later use. There are two major types of subsistence agriculture: primitive and intensive. Primitive subsistence farming, which includes shifting cultivation, slash and burn, and pastoral nomadic farming is mainly practiced in marginal areas. In contrast, intensive subsistence agriculture, which is the subject of this paper, is practiced in high potential arable land where land is scarce and the farmers have to maximize food production on relatively small fields. This type of farming exhibits a high degree of diversification (mixed crop-livestock systems), inter-cropping and limited use of modern technologies and purchased agricultural inputs. Intensive subsistence agriculture is widespread in many less developed countries where over 80% of their rural population is engaged in this type of farming. Intensive subsistence agriculture contributes substantially to economies of these countries and in alleviating food insecurity. It has high potential for increased growth if given the necessarily support. Despite this high dependence on subsistence agriculture, the farmers are faced with several challenges which unless addressed will continue to drag behind the economic development of these countries. This paper not only reviews the characteristics and impacts of intensive subsistence agriculture but also the challenges and possible interventions to these challenges.

Shu Wang, Feng zhi Wu, Shou wei Liu (China) Optimization of Polymerase Chain Reaction Conditions of Denaturing Gradient Gel Electrophoresis for North Black Soil Microbes (pp 54-57)

ABSTRACT

Techniques Paper: This paper studies the effects of concentrations of Mg^{2+} and dNTP, the annealing temperature, extension and cycling times in PCR of north black soil microbes using an orthogonal experiment. Results showed that the feasible PCR reaction system for soil microbes should be carried in a volume of 50 μl, composed of 50 ng soil microbial DNA template, 15 pm primer, 5 u Pfu enzyme, 0.2 $mmol.L^{-1}$ Mg_2SO_4, and 0.3 $mmol.L^{-1}$ dNTPs. The PCR reaction procedures were set up under two conditions. At first, the soil microbial DNA was denatured at 94°C for 5 min followed by 20 cycles of each 94°C for 1 min, 65-55°C for 1 min (descending at 0.5°C per cycle), and finally 72°C for 1 min. The second reaction conditions also included 20 cycles, each of 94°C for 1 min, 56°C for 1 min, and 72°C for 1 min, and a final extension temperature of 72°C for 7 min. The work was repeated several times on the same model using the same primers and PCR conditions to acquire clear and pure bands.