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# The sustainability of agriculture

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# Agriculture, forestry and rural development in Portugal

The background and current work of Luís Capoulas Santos, Minister of Agriculture, Forestry and Rural Development is placed under the spotlight by Open Access Government

**L**uís Capoulas Santos, Minister of Agriculture, Forestry and Rural Development in Portugal has been in office since November 2015. Before we look at his current role, it's worth providing his background prior to attaining that position. He was born in Montemor-o-Novo, in 1951 and many years later, he graduated in Sociology from the Universidade de Évora.

He also worked in the Ministry of Agriculture for many years, from 1977 to 1991. After that, he was a member of the Assembly of Republic by Évora district between 1991 and 1995, then again from 2002 to 2004, plus he was re-elected in 2015.

Between 1995 to 1998, he served as Secretary of State of Agriculture and Rural Development and from 1998 to 2002, he was Minister of Agriculture, Rural Development and Fisheries. In addition, he was a member of the European Parliament between 2004 and 2014 and spokesman for the Agriculture Affairs of Socialist and European Democrats Group.

Other impressive positions he has held include his time as vice-president of Euro-Latin-America Parliamentary Assembly and as rapporteur of European Parliament for the reforms of Common Agricultural Policy between 2008 and 2013.

## Supporting farmers in Portugal

In late March this year, The Ministry of Agriculture, Forestry and Rural Development in Portugal paid a total amount of €37.3 million to Portuguese farmers through Institute for Financing Agriculture and Fisheries (IFAP). This payment includes €13.5 million that constituted the final payment to the farmers affected by the deadly fires that swept Portugal

(and Northern Spain) during October 2017, after the control actions were carried out.

A few days after this, Minister Santos says that on the recent full payment of support to 23746 farmers affected by the fires: "Some 30 million are in payment against the presentation of their supporting documents", he adds, noting that 25 are from community funds (Rural Development Program 2020) and €5.5 million to support the recovery of vines.

In other recent news, Minister Santos announced that the government will constitute the Public Enterprise for Forest Development and Management. He said that the key objective would be "to demonstrate how it is possible to profitably manage the forest, particularly in the minifundium areas".

The company "aims to demonstrate how the forest can be professionally managed, how it can yield and how to prevent fires", the Minister says, adding that the company will also seek to identify the rustic buildings. The Minister also points out that the contracts involving municipalities and other organisations in the forestry sector allowed for the creation of 26 reception and storage areas for burnt wood were signed during March.

The Minister for Home Affairs was also present at the debate on the report of the independent technical commission on the fires of October 2017 and announced [the reinforcement of the means of fighting the fires](#).

## Rural development in Portugal

Through the above examples, we can see that Luís Capoulas Santos, Minister of Agriculture, Forestry



*Luís Capoulas Santos, Minister of Agriculture, Forestry and Rural Development*

and Rural Development strongly supports those working in the rural sector in the country. This is also evidenced by the government’s clear support for the tornado-hit farms in Esposende, Portugal. The ordinance signed by the Minister himself and recognises that the tornado that reached the coastal zone of the municipality of Esposende on 14th March this year was an “adverse climatic phenomenon”.

This measure is part of the Rural Development Program PDR 2020, providing support totalling €3 million and is intended for the holders of agricultural holdings located in the parishes of Belinho and Mar, where the damage of more than 30% has occurred. The support is for equipment and rural buildings, the replenishment of animals, multi-annual plantations to support agricultural activity in the country. The support is for 100% for losses up to €5,000; of 85% for losses between €5,000 and €50,000; and 50% for damages between €50,000 and €800,000. The minimum support limit is €100 and added to that, the thresholds are cumulative.

A point worth considering is the government’s National Irrigation Program, presented in March

2018. The National Irrigation Program is an initiative that will create more than 90,000 hectares of irrigated land by 2022, with a public investment of €534 million. The National Irrigation Program is financed through the Rural Development Program (PDR 2020), the European Investment Bank (EIB) and the Council of Europe Development Bank (CEB). The future of Portugal’s rural sector looks bright, despite the fires of October last year. ▣

For more details, please visit <https://www.portugal.gov.pt/en/gc21/ministries/agriculture-forestry-and-rural-development>

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# The sustainable intensification of agriculture In Europe

Cristina Cruz, Professor Auxiliar at Faculdade de Ciências da Universidade de Lisboa (FCUL) shares her thoughts on the sustainable intensification of agriculture (SIA) in Europe

The sustainable intensification of agriculture (SIA) is intended to strengthen food production with minimum negative environmental impacts and zero increase in land degradation. According to the European Commission (COM-2017/713), this is its latest objective for European agriculture.

However, sound supporting evidence of its advantages and tools for its implementation are not currently reaching the farmers, which may explain farmers' low engagement with the concept. It is, therefore, essential to understand the interactions of above- and below-ground biodiversity with various farm management systems and their relationship with the ecosystem services provided. A relevant question is to understand whether soils that have been subject to intensive agriculture will increase and improve below-ground biodiversity, which would represent a key justification for the promotion of SIA as a management tool to support ecosystem function.

In Europe, where agriculture is already very intensive, SIA can only be achieved through the development of new techniques targeted at increasing the efficiency of use of the available resources in order to produce healthy food outputs with minimal disturbance to agro-ecosystems' components. For this, we need to bring research and innovation out of the labs and into the fields and markets, to better link what we know with what we grow.

Soil, the pillar of food sustainability, is a biological system. The support and sustenance of soil's functionality and provision of ecosystem services, related to natural, societal and productive capital, is its biological community, which, in highly managed systems, is the first to be destroyed by high levels of fertilizer, pesticides and herbicides and



soil mobilisation. The recovery of a functional soil biota may represent an opportunity to increase sustainable productivity and mitigate the environmental impacts of conventional (intensive) farm systems (even though in certain EU locations this would imply a de-intensification).

Agriculture is the principal factor responsible for the 33% increase in EU ecological footprint over the last 40 years. However, at the same time, EU farmers are the guardians of environmental sustainability since they care for the natural resources (soil, water, air and biodiversity) of 48% of the EU's land, on which all of us depend. High opportunities for SIA are found on 34% of the arable area in the EU. All the results obtained in our research indicate that biodiversity is a key to sustainability of agrosystems and that it is possible to convert intensively managed farms into sustainable ones by increasing below- and above-ground biodiversity.

However, the actors of this change must be farmers and to achieve this, they require access to this evidence in order to implement the necessary strategies to promote biodiversity and consequently

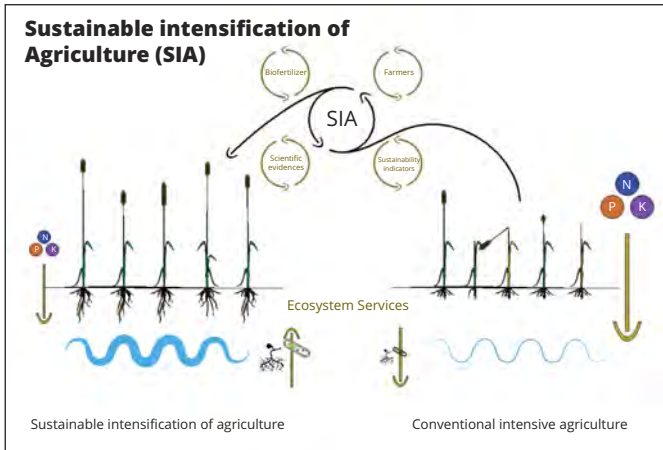


Figure 1: The relation between management and biodiversity and ecosystem services in the transition from intensive to sustainable intensification of agriculture (SIA). Design: Florian Ulm.

farm sustainability; they need tools to convert intensive farms into more sustainable ones and indicators of that change; and they need knowledge of changing farm management, since it also involves socio-economic issues (Fig. 1). Thus, implementing the sustainable intensification of agriculture has social, scientific and technical dimensions.

In line with the SIA concept, farms rely on their natural resource capital that includes a self-sustaining and hence resource-efficient, nutrient acquisition strategy, which depends on the close interaction of plant roots with their microbiome. The plant microbiome is known to supply plants with nutrients such as nitrogen and phosphorus and increase plant tolerance to biotic and abiotic stresses. SIA may compensate for some of the reduced inputs, through enhanced soil microorganism-mediated nutrient mobilisation. This advantage would justify SIA promotion at the EU level as an attractive farmland management alternative.

However, in highly managed conventional agrosystems, the soil biological community is the first to be destroyed. Of the techniques for recovery of those soils, not many are economically viable in the farming context. Due to the influence of plants on soil microbial composition, the best way to restore soil ecology is by increasing plant diversity. It has been proven that crop rotation or crop cover are practices that stimulate crop productivity through soil enrichment.

The use of old crop varieties or the introduction of new varieties with stronger interactions with the soil

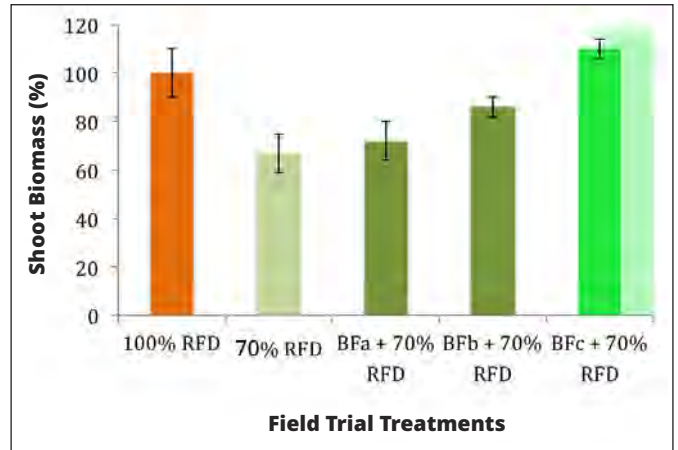


Figure 2: Results of the field trial using 3 biofertilizers (BFa, BFb and BFc) prototypes and 70% of the recommended fertilizer dose (RFD). Field trials were performed in Alentejo, Portugal, using maize (Sincero variety). Vertical bars represent standard deviation (n=3).

biota may also contribute to the stimulation of soil vitality. However, there are situations where a stronger intervention is needed, where bio-fertilisers may be an important tool to recover soil biota, nutrient use efficiency and plant health.

Many small and big companies are intensively working to produce the best possible biofertilizer. Bioclub, a project financially supported by FCT (PTDC/AGR-PRO/1852/2014), has a multi-actor team involving international (Israel, India, The Netherlands and national (from Universidade de Lisboa) scientists, as well as companies (Soilvitae, Trichodex, Fertiprado), to develop a biofertilizer able to reduce mineral fertilizer application in 30% without affecting productivity. The first three biofertilizer prototypes were designed and produced and are being tested in field trials, which have had promising results (Fig. 2). At the moment we can say that at least one biofertilizer prototype (BFc) allowed the reduction of the recommended dose of fertilizer (RFD) by 30% without decreasing maize productivity.

More field trials are being performed with various crops (wheat, tomato, peas) in close collaboration with farmers, adjusting the experimental design to answer their questions. This challenge has been very rewarding from the scientific and social point of view. We are convinced that by the end of the project (in two years) we will have solid evidence that the combined use of bio- and mineral fertilizers may provide the fine tuning necessary to increase the resource use efficiency of EU agricultural systems where intensification is already very high. ■



# ...And in the Mediterranean Region

In the Mediterranean Region (MR) the agro-food sector is a key player in the conservation of the agricultural landscape and in providing livelihoods and employment. But, at the same time, the sector consumes significant resources and constitutes one of the main drivers of environmental degradation through processes such as desertification of marginal lands and fertilizer, pesticides and herbicides run-off.

Beneath our feet, out of sight and often out of mind, soil is probably the least appreciated source of human welfare and security. More than a simple prerequisite for farming and food production, it is a profoundly complex web of interactions that enables many of the Earth's life support systems to function. This is not simply reflected in the fact that plants grow out of the ground. It is a highly complex sub-system where dynamic relationships between the atmosphere and life are sustained. It is of vital importance and yet it is no more than a thin fragile skin, between rock and air.

Our team, working in BioClub and other projects, identifies soil degradation, although in varying degrees, as the main problem mining the sustainability of the MR agro-ecosystems. Our main aim is to create a toolbox able to deliver tailored solutions to increase farming soil organic matter, which is in alignment with the Mediterranean Strategy for Sustainable Development (MSSD).

We think that soil is the foundation the natural world depends on, and that dead soils with low organic content and low water retain capacity is one of the main causes of the Mediterranean vulnerability to increased human pressure and climate changes. Disturbance of the soil system has potential to alter ecosystem services such as efficient and conservative nutrient cycling, soil formation, and/or water holding capacity that are provided by structurally heterogeneous soils with a thriving biota.



Cristina Cruz,  
Professor Auxiliar

Ploughing not only exposes soil to the air, but it breaks down soil structure, making the disaggregated soil particles highly vulnerable to erosion. The loss of topsoil is the most serious symptom of soil degradation and is regarded as a major problem in the Mediterranean regions. Soils generally take a long time to form ( $\pm 1$  mm/year). In certain parts of the Mediterranean, soil is being lost ten times faster than it is being replenished. All available evidences show that the best way to increase soil quality is to increase its biodiversity. Which can only be achieved through a holistic approach, integrating farmers, the real soil stewards, with tools to promote the ability of soil to hold water, which will also help sustaining food production, especially in times of low rainfall. With climate change causing more extreme weather, including droughts, the capacity of soils to store water will be an increasingly important factor for crop productivity in terms of yield and quality, and indeed food security as a whole.

BioControl will contribute to establish a relationship between biodiversity, farm management, income generation and ecosystem functions by providing information to optimize the match between type of agro-system, respective management and soil recovery tailored strategy.

Our strategy to exploit new taxa of microorganisms (mycorrhiza-like) to produce efficient bio-fertilizers adapted to Mediterranean conditions that can be

produced in massive quantities at reasonable prices, will provide a way to improve soil organic matter, carbon sequestration, reduce the agricultural ecological foot print while increasing productivity. The aim is to produce bio-fertilizer based on microorganisms not yet used and suitable to be used in seed coatings and that will allow to reduce the recommended mineral fertilizer dose by 30% and the fungicide by 50% while increasing productivity and water use efficiency by 15%. The success of this task is failsafe because the team has experts in each of the productive chain links working in synergy. As traditional crops are more responsive to microbial symbioses than those used in conventional farming, the use of bio-fertilizer may promote the productivity of old varieties transforming them in economically viable options at the farm level (wheat conservation varieties).

The strategy of using endophytic fungi (enodmycorrhiza-like) integrated in biofertilizers will combat desertification by showing that soil carbon sequestration can increase by 4% a year in Mediterranean countries, through the application of agricultural practices adapted to local situations economically, environmentally and socially (SDGs target 15). Due to the high costs and technical exigencies of producing arbuscular mycorrhiza fungi, BioClub envisage the production of mycorrhiza-like fungi (*Piriformospora williamsii* and *Serendipita indica*); that, although having similar effects on soil and plant growth, are suitable for fermentative growth under industrial conditions.

The bio-fertilizer produced by BioClub is based on microbial consortia made of strains isolated from a very wide collection where individual strains and species have been already thoroughly characterized for those parameters that are mostly relevant for an



effective bio-fertilizer action (e.g., tolerance to desiccation, soil aggregation; improved soil carbon storage, plant growth promotion under stress conditions). It aims to increase soil quality, reducing the recommended dose of fertilizer by 30% and the use of fungicides by 50%. Moreover, these microbial consortia and holistic management will be tested in real farms monitored for its effectiveness and compared with the usual farm management programs. Although the tests will be made locally, its overall impact will be analysed and disseminated at regional level. This impact is being tested with different varieties of wheat, including old ones. ▣



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