

**ISO FAR /MOAN
Symposium 2010**

Book of Abstracts

**Soil Fertility and Crop Nutrition
Management in Mediterranean Organic
Agriculture**

March 23 - 25, 2010 Sousse, Tunisia

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**ISO FAR /MOAN Symposium
March 23- 25, 2010 in Sousse (Tunisia)**

*'Soil Fertility and Crop Nutrition Management in Mediterranean
Organic Agriculture*

Book of Abstracts

edited by

Mohamed Ben Kheder, Jenna Ewert & Daniel Neuhoff

Conference hosted by

Technical Center of Organic Agriculture (CTAB)
International Society of Organic Agricultural Research (ISO FAR)
Mediterranean Organic Agriculture Network (MOAN)

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Conference programme

Venue: Hotel Tej Marhaba, Sousse

Monday, 22 March 2010

4.00 pm - 6.00 pm: Registration

Tuesday, 23 March 2010

8.00 am - 9.00 am: Registration

9:00 am - 9:45 am: Opening Ceremony

Prof. Dr. M. Ben Kheder, Chairman

Prof. Dr. U. Köpke, President ISOFAR

Dr. L. Al Bitar, MOAN

S. Znazen, CRDA de Sousse

9:45 am - 11:00 am: Plenary session

1 - Organic Agriculture in the Mediterranean Area:
current situation and expected development (L. Al Bitar,
Italy)

2 - Direct seeding in temperate (and Mediterranean?)
climate: ways to overcome restrictions in OF, U. Köpke,
Germany

3 - Scientific challenges to maintain soil fertility in
organic farming, G. Rahmann, Germany

11:00 am - 11:20 am: Coffee break

11:20 am - 1:00 pm: Soil fertility I

4 - Long-term experiments can advise us of soil organic
matter management, crop yield development and carbon
sequestration, J. Raupp, Germany

5 - Evaluation of pre-crops and fertilization strategies on soil chemical properties in Mediterranean organic rotations: case of South of Italy, L. Al Bitar, Italy

6 - Effect of crop rotation on root-knot nematode control, H. Védie, France

7 - Irrigation impact on soil salinization and on groundwater dynamics in the irrigated district of kalaat el andalous, H. Daghari, Tunisia

1:00 pm - 2:00 pm: Lunch break

2:00 pm - 4:00 pm: Fertilisation strategies for Vegetables I

8 - Organic feeding of vegetable crops grown under arid conditions in South of Morocco, K. Lahcen, Morocco

9 - Effect of composts on growth, production and fruit quality of tomato crop, R. Ben Jenana, Tunisia

10 - Effects of pig wastes and sludge compost on tomato plants grown outdoors in high salinity soil, A. Stamatakis, Greece

11 - Effect of different organic fertilizers combinations on the yield and quality of two field tomato cultivars grown organically in Tunisia, A. Riahi, Tunisia

12 - Nitrate Accumulation in Organic Leaf Vegetable, S.M. Sohn, Republic of Korea

13 - The effect of different types of compost extracts on vegetative growth, fruit quality and soil fertility of organic tomato crop under greenhouse, H. Nabli, Tunisia

4:00 pm - 4:20 pm: Coffee break

4:20 pm - 6:00 pm:

*Fertilisation strategies for
Vegetables II*

14 - Fertilizing and nematicidal effect of argan, castor and neem cake on organic cucurbits (cucumber and melon) grown under greenhouse in sous region (Southwest of Morocco), K. Azim, Morocco

15 - Effect of Compost and Compost tea on Potato and Zucchini crops, F. Ayed, Tunisia

16 - Effect of animal manure compost extracts on mineral nutrition and production of organic pepper, A. Kerkeni, Tunisia

17 - Effect of organic matter on soil biological activity, growth and quality of organic potato crop, F. Ayed, Tunisia

18 - Evaluation of pre-crops and fertilization on soil properties and crop growth and productivity, M. Mechri, Tunisia

19 - Agronomic quality of composted organic wastes used as substrates for tomato seedling and culture: Effects on plant growth and soils fertility, F. Sellami, Tunisia

6:30 pm - 8:00 pm:

ISO FAR Board-Meeting

Wednesday, 24 March 2010

9:00 - 11:00 am: *Olive trees*

20 - Olive oil quality as affected by different irrigation regimes of olive mill wastewaters, B. Mechri, Tunisia

21 - Mineral nutrition and the abundance of arbuscular mycorrhizal fungi as affected by irrigation with Olive Mill Wastewaters, B. Mechri, Tunisia

22 - Essay of valorisation of Olive Mill Wastewaters as a Biological Fertilizer, L. Ghezal, Tunisia

23 - Effect of the compost on the organic olive-tree productivity and the soil organic matter and biological activity, Y. Amor, Tunisia

24 - Composting of Posidonia, solid fraction of Olive Mill Wastewater and Chicken Manure, R. K. Ben Jenana, Tunisia

25 - Spatial distribution of soil organic matter content and organic matter mineralization in an olive orchard, K. Gargouri, Tunisia

11:00 am - 11:20 am: *Coffee break*

11:20 am - 1:00 pm: *Crop fertilization strategies I*

26 - Increasing Phosphorus Availability from Rock Phosphate Using Organic Matter in Rice (*Oryza sativa* L.), P. Azizi, Iran

27 - Sorghum Production Using Organic and Inorganic Fertilizers in Semi-arid Environment, U. L. Arunah, Nigeria

28 - Effect of different doses of compost based on date palm on alfalfa cultivated in oasis conditions, M. Haddad, Tunisia

29 - Effect of the biological fertilization on the growth of the green bean *Phaseolus vulgaris*, B. Dridi, Tunisia

30 - Research on soil fertility, fertilization and plant nutrition in organic production systems in Spain: A review of the last 20 years, V. González, Spain

31 - Current approaches for future scenarios: agroecological management of soil fertility in arable cereal agro-ecosystems in Mediterranean conditions, J. Labrador, Spain

1:00 pm - 2:00 pm: *Lunch break*

2:00 pm - 4:00 pm: *Poster session*

32 - Effect of Chicken Manure, Soil Type and Salinity on Growth and Yield of Spearmint (*Mentha spicata* L.) Grown in Sudan, A. Siribel, Sudan

33 - Assessing the Status of GO and NGO Efforts in Introducing Organic Farming in Bangladesh, N. Hoque, Germany

34 - Olive mill waste water valorisation in agriculture: Effects on the soil properties and barley yield, R. Dakhli, Tunisia

35 - Future of Education - Organic.Edunet Web Portal for Organic Agriculture and Agroecology, L. Radics, Hungary

36 - Effects of irrigation with saline waters on soil and salt tolerance of barley varieties in arid area, C. Fdhil, Tunisia

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- 37 - Physiological and nutritional indicators of tolerance to salinity in *Nitraria retusa* and *Atriplex halimus* plants growing under increasing salinity, M. Denden, Tunisia
- 38 - Quality comparison of conventionally and organically grown oranges in Spain. D. Neuhoff, Germany
- 39 - Humus balancing for sustainable soil organic matter management, C. Brock, Germany
- 40 - Co-Composting of Agro-food Industries and Vineyard wood Residues: Extractable Lipids as an Indicator of Maturity, M.K. Islam, Italy
- 41 - Evaluation of pre-crops and fertilization on organic tomato production under Mediterranean conditions: Case of Tunisia, H. Guenichi, Tunisia
- 42 - Status of the phospho-potassic fertility of soils under in-season potato in the North-East of Tunisia, H. Ben Hassine, Tunisia
- 43 - Effect of a range of composts on palm dates in vitro plant survival during acclimatization phase, S. Hachicha, Tunisia
- 44 - Effect of N-source and soil amendments (organic matter) on wheat yield and N-uptake under Gezira conditions in Sudan, S. E. Elimam, Sudan
- 45 - Valuation of the Extracts of Vegetable Compost in Fertigation of the Tomato Seedlings, I. Saad, Tunisia
- 46 - Better use of sheep compost extract in the fertigation of tomato and pepper, R. Jelali, Tunisia
- 47 - Attempt to optimize the extraction process Co-composting for better preparation of extracts, W. Hamdi, Tunisia

48 - Agronomic interest of the Residues of Rural Biomethanisation Applied to the Bovine Biomass
Y. M'Sadak, Tunisia

49 - Soil fertility management in organic lettuce (*Lactuca sativa* L.): use of aerobic and anaerobic stabilized amendments, F. Tittarelli F., Italy

50 - Influence of crop rotation and amendments application on lettuce yield and quality, O. Lopodota, Italy

51 - Use of impoverished rabbit's compost for the production of tomato plants grown in garden nurseries, M'Hamdi Naceur, Tunisia

52 - Effects of salt stress on the growth dynamic and the mineral nutrition of two silage maize (*Zea mays* L.) varieties, Hichem Hajlaoui, Tunisia

53 - Assessment of Tunisian agricultural wastes composts properties: application as components in reconstituted anthropic soils and their effects on tomato yield and quality, M. K. Rigane, Tunisia

54 - Properties of Tunisian wastes composts and their assessment for use as soilless substrate, M. K. Rigane, Tunisia

4:00 pm - 4:30 pm: Coffee break

4:30 pm - 5:30 pm: Closing ceremony

Acknowledgments (NN)

Concluding remarks (Prof. Dr. M. Ben Kheder)

Outlook (Prof. Dr. U. Köpke)

7:30 pm: Gala Dinner

Thursday, 25 March 2010

One-day excursion

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|-----------|---|
| 8: 00 am | Departure from Hotel (Sousse) to Kairouan |
| 9: 00 am | Visit to "Ascheri Herbs": Production and packaging of aromatic plants |
| 10: 30 am | Visit of Historical Islamic Monuments |
| 12: 30 pm | Lunch |
| 2: 00 pm | Departure to "Chorbane" |
| 3: 00 pm | Visit of an Organic farm (Olives, almonds, honey ...) |
| 4: 00 pm | Departure to "Eljem" |
| 5: 00 pm | Visit of "Roman coliseum" |
| 6: 00 pm | Return to Sousse |
| 7: 00 pm | Arrival at Hotel |

Dear Reader,

Organizers of scientific symposia feel rewarded, if the timing of the event generates an additional value with respect to societal relevance. For the present symposium 'Soil fertility and crop nutrition management in Mediterranean Organic Agriculture' in Sousse, Tunisia, the frame conditions are certainly more than optimal. The Tunisian Government has recently decided to actively foster the development of Organic Agriculture (OA) by a set of measures including also the establishment of an adequate research infrastructure in the near future. Given that context a scientific symposium on OA is certainly more than topical.

Nutrient management plays a key role for the successful management of organic farms. Both crop nutrient supply and long - term soil fertility are two pillars of equal importance for OA. Hence, some 30 oral presentations and another 25 posters will be dedicated to the various issues of nutrient management with a strong focus on organic fertilizers. Some contributions will also focus on indirect effects of soil organic matter management such as the maintenance or increase of the soil carbon level. Attentive reader will realise that many papers, although embedded in the regulatory system of OA, follow classical approaches with respect to methodology and objectives of research. The present book of abstracts is considered to be a modest source of information that may help to exchange ideas and to contact partners for future research activities.

The Symposium has been organized by the Technical Center of Organic Agriculture (CTAB), the International Society of Organic Agriculture research (ISO FAR) and the Mediterranean Organic Agriculture Network (MOAN).

The organising institutions sincerely hope that the Symposium will not only be a beneficial and worthwhile source of information for you, but will also favour capacity building for the successful development of Organic Agriculture in Tunisia.

On behalf of the Editors

Prof. Dr. Mohamed Ben Kheder

Dr. Daniel Neuhoff

Organic Agriculture in the Mediterranean Area: current situation and expected development

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Abstract

Organic agriculture was introduced in the Mediterranean area more than 30 years ago by some foreign private companies looking for new investment opportunities in Morocco, Egypt, Turkey and Tunisia (Al Bitar, 2002).

Nevertheless, the expansion of this activity to the whole region was quite slow until the year 2000. Thereafter, a rapid growth has occurred (Al Bitar, 2004). Today, the concept of organic agriculture has gained much attention in almost all the Mediterranean countries that have been stimulated by two factors: (i) the progressive interest of the European stakeholders that have moved more and more to the South to meet the growing demand of the North-European consumers and (ii) the interest for new commercial opportunities identified by local producers.

Over the last few years organic farming in the Mediterranean has been very vital, as shown by the strong growing trend of surface areas, originated undoubtedly by market phenomena but also by the evolution of the local agricultural policies, increasingly sensitive to environmental sustainability and production upgrading (Al Bitar, 2005). Recently, organic agriculture has been included into national and international research, training and cooperation programmes for development.

However, one of the major weaknesses of the Mediterranean organic agriculture is the lack of statistics. In fact, it is not easy to find reliable data on the present state and spread of organic agriculture in the Mediterranean basin. The diversity in data collection methodologies, the unreliability and the inconstant supply of organic statistics are well-known problems to those operating in this field. However, significant progress has been made in the last years and data collection methods and systems are undergoing a constant improvement and becoming more reliable and regular in most of the region's countries. Yet, it is useful to specify that in some cases data are not so far available each year and rather depend much on the source (Al Bitar et al, 2010).

In order to respond to the growing information needs on organic agriculture in the Mediterranean area and to start monitoring the growth trend of this sector, the Italian offshoot of the International Centre for Advanced Mediterranean Agronomic Studies (CIHEAM-IAMB) started up in 1999 a Mediterranean Network on Organic Agriculture (MOAN). A preliminary objective of MOAN was to gather detailed data on organic agriculture and much attention has been given to the Mediterranean countries where statistics monitoring the growth trend of this sector are lacking and where a real need of information on the situation of organic agriculture really exists.

Since 2006, MOAN has become an institutional network gathering the Ministries of Agriculture of 21 (out of 24 potential) Euro-Mediterranean countries.

MOAN is a tool for decision makers to exchange information and good practices related to organic agriculture, to share common strategies for its further development in the Mediterranean area and to valorise its potential and identity in the global debate.

In 2008, organic agriculture provided work for more than 143 thousand operators in the Mediterranean and covered an area of about 5 million ha of which around 1.3 million ha of wild collection and forests mainly concentrated in the Eastern Adriatic (EA) and some South East Mediterranean (SEM) countries (Al Bitar et al, 2010). These figures have almost doubled between 2001 and 2007 (Al-Bitar and Pugliese, 2008) and continue to increase in terms of organic agricultural land. However, in 2008 a slight reduction of the total Mediterranean organic land area was registered. This reduction is mainly due to the absence of an official communication from the certification bodies to the competent authorities that re-confirm the certification of the wide wild collection areas reported in previous years and the end of many foreign funded projects and investments in the organic sector, mainly in SEM and EA countries. It is also noteworthy to underline that data categorization is undergoing a sort of standardisation with the EU Eurostat requirements for most of the candidate countries, which explains in some cases considerable variations of the values of the total organic area and the organic agricultural area.

In EA countries, Croatia leads the way in terms of organically certified agricultural area with almost 10.000 ha followed by Serbia with 4.500 ha. Tunisia and Turkey lead the SEM countries, the others are far below.

However, if we look at values including wild collection, Montenegro lead EA countries and Morocco the SEM countries.

In EU Med countries, Italy has been the leader in the Mediterranean and in Europe till 2007 both in terms of land area (over 1 million ha) and number of operators. In 2008, Spain has taken the lead in terms of land area (with around 1.3 million ha). Italy still have the highest number of organic operators (almost 50 thousand). The organic sector in France had a period of stagnancy between 2003 and 2007. However, a slight increase in terms of organic agricultural area has been registered in 2008.

The weight of the organic sector is much more modest in the other EU Med countries (15,87%) even if it is in constant growth. Non EU Med countries, with an increasing trend, account for 10,24% where Tunisia is the leader with 4,75%, followed by Turkey (2,98%), and the other SEM (2,02%); EA countries represent only 0,49% despite the increase in terms of organic agricultural land area (without considering wild collection and forests).

Italy has the highest share of organic land (7,22%) followed by Slovenia (5,97%) and Spain (4,6%). The other countries are far behind. Most (seven) of the top ten countries with highest share of organic area are EU Med, only Tunisia and Egypt, ranking respectively 6th and 8th, are from SEM countries and Croatia ranking 9th is the only EA country in this top ten list.

Organic farming in the Mediterranean countries is not only a production method but rather an actual development model that integrates environmental, socio-economic and ethical aspects.

Despite its progressive development and the rising interest of the major international markets, the evolution of the sector in the region is still constrained by some critical points.

However, there is a common trend in the whole area towards the reconversion of the present agricultural productive systems into a more comprehensive sustainable one, aiming at the growth and overall recovery of the rural space and tackling the aspects bearing a reference to environmental protection, animal welfare, consumers' behaviour, market development, quality of food products, regulations, certification and labelling.

Within this scenario, some strategic lines should be set up. The primary task is to locally develop a culture of organic farming relating not only to the production but also to the market, social and land-related issues.

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Direct seeding in temperate (and Mediterranean?) climate: ways to overcome restrictions in OF

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Abstract

The aim of reducing tillage intensity is to prevent soil compaction and erosion, to improve top soil trafficability and to save labour and energy costs. It is often suggested that tillage procedures in Organic Agriculture (OA) should avoid disturbance and mixing of the different soil layers. However, the use of loose soil husbandry (LSH), which is mostly performed with the mouldboard plough (MP) and combined with secondary tillage, is still common practice. A few organic farmers in Central Europe are using permanent firm soil mulch husbandry (FSMH), especially the extreme option of direct seeding (DS), mainly due to two reasons: i. under temperate climate conditions omitting deep loosening and thorough inversion of the topsoil results in cooler and wetter soils in early spring and hence reduced mineralization and nitrification of soil-borne nitrogen and its transformation into crop yield of non-leguminous crops. ii. tillage, and in particular ploughing, is one of the most effective tools to directly control annual and perennial weeds. In contrast to non-legumes, grain legumes do not depend on soil-borne nitrogen due to their ability to fix nitrogen symbiotically. Competitiveness against weeds is high for faba bean (FAB) which can satisfy their high demand for water to germinate in wetter no-till soil. Mulch layers of precrops may suppress weeds. In high residue reduced tillage systems at least 4-6 t ha⁻¹ homogeneously distributed crop residues are considered as necessary for efficient weed suppression. Additionally, allelopathic action of some oats genotypes has been assumed. For the conditions of the European temperate climate, competitiveness of yellow oats (*Avena sativa* L.) is considered as relatively high when compared with other cereals, black oats (*Avena strigosa* Schreb) included. The latter has been used for decades successfully in Brazil under subtropical conditions. Our field experiments carried out at several experimental sites in North-Rhine Westphalia Germany during the last 4 years showed that occasionally DS of FAB is possible in OA when weed pressure of perennials is low. Density of annual weeds of DS treatments declined in most cases, a function of the increased amount of crop residues (0, 4, 6 t ha⁻¹) left on the soil surface, and was lower when compared with MP. Lower costs of labour and fuel were determined for DS compared with MP. Estimated DS gross margins exceeded MP gross margins although grain yields were in most cases (not significantly) lower compared with MP yields. Based on these results and the advantages FSMH has demonstrated in the tropics and subtropics, DS or other mulch-seeding systems are suggested to be investigated under Mediterranean conditions in detail. Obstacles might be found in limited amount of crop residues, i. e. less than four tons per hectare and when perennials may play a more important role compared with Central Europe. Plant extracts displaying herbicidal effects ('bioherbicides') that are officially certified in other regions of this globe (e.g. pine wood extract, citronella extract) are currently not considered adequate to be used in Europe's OA, but need further research input to have these tools available at least for exceptional rules. More research efforts should be made to clarify the interaction of soil conditions and crop development to elaborate specific rotation systems (e.g. for vegetable cropping or stockless organic systems) and to study climate change issues.

Scientific challenges to maintain soil fertility in organic farming

G. Rahmann¹, H.-M. Paulsen¹ and B. Eichler-Lobermann²

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Abstract

Organic farming has developed enormously in the past, not only in Germany, but all over the world. In many countries it has emerged from its niche and it is considered as a model for sustainable agriculture. Despite the worldwide success, organic farming has no reason to sit back and stop developing. The "maintenance of long term soil fertility" (IFOAM principle from 1980) is still one of the main targets and challenges of organic farming (EU regulation 834/07 article 5 a).

If good organic farming practice is not fulfilled soil fertility decreases. Increasing cereal cropping in organic crop rotations and the reduction of grain legumes (Gruber & Tietze 2008) is critical with regard to humus production, above all in pure crop farms. The nutrient cycles are broken with the export of the products (not closed nutrient cycles). Thus, after a while, the soil fertility decreases through a loss of nutrients such as potassium, phosphorous (P) and trace elements (Watson et al. 2002, Stolze et al. 2001, Newmann 1997). The use of sludge and household compost (Adam et al. 2008, Pinnekamp et al. 2008) is, however, not permitted in organic farming, since it could be contaminated with undesirable substances (Kratz & Schnug 2006). Non-closed nutrient cycles between production and consumption are evident. An increasing portion of nutrients comes from nonrenewable sources (i.e., crude phosphates, peat) or from risky conventional sources (i.e., feather meal with medicinal residues). Their availability is either limited and/or not sustainable (Schnug et al. 2003, Déry & Anderson 2002).

Challenges for research and development of soil fertility in organic farming:

Better availability of nutrients through improved cultivation measures (e.g., mixed cropping, catch crops, agro-silvo-pastoral systems).

Avoiding nutrient losses with improved manure, slurry and compost storage and application.

Development of local nutrient cycles between farms (organic local resource management)

Design of concepts to include consumers into the nutrient cycle with non-contaminated sludge and city composts

Stop of the decrease of legume cropping (limitation of non organic nitrogen imports)

Improvement of phosphate availability to plants (e.g., mineralization of rock phosphate)

Development of light weight machines to reduce soil compaction.

Concepts for the reduction of mechanical land use management (minimum tillage systems).

Introduction of biogas facilities to make nutrient cycle in stockless organic farm possible.

The following two examples shall show that it is possible to reduce the need for external P input and may help to save the limited P resources in the world:

Recent studies on mixed cropping of cereals and grain legumes with oil crops in Organic Farming revealed an increase in site productivity by this cropping system (Paulsen & Schochow 2007, Paulsen 2007). E. g., in mixtures of *Pisum sativum* with the oil-crop *Camelina sativa* or in mixtures of *Lupinus angustifolius* with *Carthamus tinctorius* higher absolute biomass yields of the mixtures compared to the mono-cropped plants in general led to higher nutrient uptake of the above-ground biomass. Nutrient contents in the different plants at harvest were unexpectedly not affected by the cropping system. This hints that mono-cropped legume fields acquire nutrients less effectively. Only low increases in total kernel yields but substantial increases in straw yields in mixed cropping were determined. Nutrient acquisition from the soil and backflow with harvest residues therefore increased with mixed cropping systems (e.g., 1-7 kg ha⁻¹ additional P). This might be intrinsic in crop rotations under the aspect of high mobilization and recycling of unused soil P resources.

Catch crops have a positive influence on soil fertility and can help to reduce nutrient losses from soil (Dinnes et al. 2002, Nziguheba & Bünemann 2005). Furthermore, plants used as green fertilizers can improve the P availability in soil, either during their growth by modification of soil properties and mobilization of P, or after decomposition, when the organic P bound in the catch crops may provide an easily accessible form of P to the following crops. In different experiments *phacelia* and *serradella* were found to be suitable in this respect (Eichler-Löbermann et al. 2007). They substantially increased the phosphate content in the soil and soil solution and resulted in higher P uptake of the following main crops. On P poor, sandy soils buckwheat was found to have a high phosphate uptake and a high potential to release P during decomposition (Eichler & Schnug 2006).

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Long-term experiments can advise us of soil organic matter management, crop yield development and carbon sequestration.

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Abstract

Long-term field experiments at different sites give important information on soil fertility management and crop performance under organic farming conditions. Eleven experiments started before 1995 in Europe and North America comprise in total more than 230 experimental years. Most of these experiments (65%) deal with fertilization and cropping systems. In this paper, the key results of the experiments are summarized to show the effects of organic cultivation and of different organic fertilizers on soil fertility and crop yield.

Soil organic matter (SOM)

Higher SOM contents were achieved in organic compared to conventional cropping systems and by organic compared to mineral fertilization. In some experiments in Germany and Switzerland, SOM was better maintained in biodynamic than in other organic treatments. In most trials farmyard manure was more effective in SOM maintenance than other organic fertilizers. Only one experiment, the Farming Systems Trial (USA), showed that organic treatments were able to accumulate SOM over decades. In all other trials the SOM contents were kept constant over years in the best treatments, but did not increase. These findings indicate that SOM maintenance by organic cultivation is more likely than additional carbon sequestration in the soil. However, investigations were made mainly in topsoils, results from subsoils are very scarce.

Soil life

Microbial biomass was higher and metabolic quotient was lower in organic cropping systems and with organic fertilization compared to conventional cultivation or mineral fertilization, respectively. In organic treatments a higher dehydrogenase activity and a higher root colonization of different crops with arbuscular mycorrhiza fungi were found. This indicates that crops in organic farming are better accommodated against limited growth conditions.

Crop yield

Depending on crop, long-term yield averages were about the same or lower in organic compared to conventional or mineral treatments. However, under drought conditions organic treatments yielded significantly higher with maize (Farming Systems Trial) and wheat (IBDF trial). The architecture of the root system was possibly changed by organic treatments.

Conclusions and further research tasks

Long-term experiments provide basic information for farmers and researchers as well as for politicians. In the future, soil investigation should also study subsoil conditions. Non-destructive methods need to be developed for this purpose. More research

efforts should be made to clarify the interaction of soil conditions and crop development to elaborate specific rotation systems (e.g. for vegetable cropping or stockless organic systems) and to study climate change issues.

More information on organic long-term experiments

Please visit <http://www.isofar.org/sections/wg-long-term-experiments.html>

Evaluation of pre-crops and fertilization strategies on soil chemical properties in Mediterranean organic rotations: case of South of Italy

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Abstract

Organic farming systems rely on the long-term soil fertility management to enhance the soil chemical properties for the optimization of crop production. Crop rotation, including a mixture of leguminous fertility building (fertility-building legumes) as pre-crops and cash crops, is the main mechanism for nutrient supply within organic systems (Watson et al., 2002). Nitrogen supply is often a limiting factor of organic vegetable production. Organic farms specializing in vegetable production have problems with N supply, as their crop rotations include much fewer legumes (Thorup-Kristensen, 2008).

Several research works studied the effect of different types of pre-crops on the following main crop, but information and data are still lacking, especially in the Mediterranean area characterized by water scarcity and low soil fertility.

For this purpose, a four-year rotation programme was launched by the Mediterranean Agronomic Institute of Bari to oversee the application of a common research programme to be carried out in four countries: Italy, Morocco, Tunisia and Turkey. It aims at identifying the most suitable rotation programme in organic farming for Mediterranean countries under the prevailing conditions. The same experimental protocol and methodology were established in each country using legume and non-legume species as pre-crops, followed by a main crop chosen among those preferred by farmers and more adapted to the site pedo-climatic conditions.

The present study was conducted in southern Italy. It consists of evaluating the effects of pre-crops (faba bean, vetch and broccoli) in comparison to a fallow test of two different fertilization strategies (commercial organic fertilizer and compost tea) on the subsequent crops (tomato and lettuce, respectively) and on the main soil

chemical properties in two consecutive years (2007-2009). A split plot design was used with four replicates and two factors with pre-crop as main factor and fertilizers as sub-factor.

The effect of pre-crops and fertilization on tomato qualitative and quantitative parameters was not significant in the first year, whereas in the second year both factors induced significant effects on lettuce yield and quality. Marketable fresh weight/ha of lettuce obtained after pre-crops was always higher compared to fallow treatment: vetch (27%), broccoli (23%) and faba bean (18%). In broccoli-lettuce treatment, nitrates content was found to be 80% lower and ascorbic acid content 16% higher, compared to fallow-lettuce treatment. On the other hand, there was no significant effect of fertilizers on lettuce yield and quality.

Results showed that vetch was able to satisfy the N requirements of the main crop without any additional fertilizer application.

The main soil chemical parameters (organic carbon, total nitrogen, available phosphorus and exchangeable potassium) were improved over the two-year experiment. The trend was quite consistent; all parameters displayed a significant increase in all treatments, while no significant difference was obtained between treatments.

Findings indicate that all rotation programs used in this experiment resulted in an important increase in soil organic matter and larger pools of stored nutrients, which are critical for long-term fertility maintenance under the Mediterranean conditions.

Effect of crop rotation on root-knot nematode control

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Abstract

In intensive cropping systems under greenhouses, where several crops follow one another throughout the year, the main reasons for yield losses are soil-borne pests and diseases. Among them, root-knot nematodes (*Meloidogyne* spp.) are an increasing problem for mediterranean production of organic vegetables. Rotations widely used in the South-East of France imply susceptible species (salads in winter followed by a cucurbitaceous or a solanaceous plants in spring). All the more, the effects of "alternative" methods (soil solarisation, nematicidal amendments or green manures...) are too limited in heavy infestation conditions. A higher crop diversification is necessary to prevent and control nematodes, and thus to preserve soil fertility.

We first present the results of a 12-year trial in organic vegetable production, comparing 1) an "intensive" crop rotation, salad in winter and cucurbitaceous (melon or cucumber) in spring, to 2) an "ethic" rotation, with a 3 year-rotation (6 different vegetables/3 years). Each cropping system was present in one 400 m² unheated plastic greenhouse. To assess meloidogyne infestation, we used a root gall index (scale from 0 to 10) based on a visual estimation of the number of galls and of the percentage of infested roots. These notations were realised at the end of each spring crop. In the intensive crop rotation 1, *Meloidogyne* infestation appeared after 7 years, in 2000, and rapidly increased to reach an average root gall index of 4 in 2003. In the "ethic" rotation, no galls were observed on the roots. These results show that crop rotation is highly effective to prevent soil-borne pests. The observations on this trial also showed that nematode diversity was higher in the "ethic" crop rotation, with more free nematodes, and that some other soil-borne pests, such as *Sclerotinia minor* on lettuce and corky-root on melon, were reduced.

The aim of the second study is to evaluate, in high infestation conditions, the efficiency of inserting poor host plants in rotation to limit the nematodes reproduction. We first identified the lowest susceptible species by surveying organic farmers, and we then verified the host status in the field of the 13 identified species. The comparison of the 13 vegetable species' susceptibility during summer 2009 allowed us to show that all these species are less susceptible than a salad control. Moreover, we determined 5 poor hosts of meloidogyne which could be cultivated to reduce the infestation level : onion, fenel, leek, lamb's lettuce and rocket salad. At the same time, we started a 4 year trial in 2008, to evaluate the effectiveness of a 1) poor-host rotation in comparison with a 2) classic farming system consisting in salad crop in autumn and zucchini crop in spring. Each cropping system is present in two 200 m² unheated plastic greenhouse. The root gall index is measured before harvest of each crop. First results are encouraging, showing fewer attacks on the "low susceptible" rotation. We will continue this study in the next 2 years, to see if the break in the biological cycle of *Meloidogyne* with poor host crops during 3 years

allows a significant reduction of the infestation level on a same susceptible crop in the two cropping systems.

These studies highlight the importance of cropping system to prevent or suppress soil-borne pathogen problems in organic farming, and thus to maintain soil fertility. Specialised systems are not compatible with sustainable vegetable crop production because they are too susceptible to soil-borne pathogens.

Irrigation impact on soil salinization and on groundwater dynamics in the irrigated district of kalaat el andalous

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The achieved study took place in the irrigated area of Kalâat El Andalous localized in the low part of the Medjerda wady during the period may 2008-may 2009 under four vegetables crops (tomato, melon, marrow, pepper), under wheat and under fallow. Localized and sprinkler irrigation are used in this irrigated area. Also, these fields were provided with subsurface network drains buried at a depth of 1,5 m and spaced at intervals of 40 m.

Measurements of different water budget components, salts fluxes, diverted irrigation water, drainage water, water table level and salinity were done for all the irrigated area.

During the irrigation season water amount delivered to the crop was extremely high when compared to crop water requirement. The water delivered was about 1 030 mm for tomato, 637 mm for pepper, 503 mm for melon and 300 mm for marrow. In the case of tomato, water requirement is about 449 mm.

The salts imported to the soil with the irrigated water were 22 tons/ha for tomato and the drainage amount was 53 mm. Drainage quantity increased as applied water increased.

During the summer irrigation, the groundwater level rose remarkably (1,2 m) and the electric conductivity of the groundwater decrease indicating the dilution induced by excess irrigation water.

The monitoring of the soil salinity during the period may 2008-may 2009 shows a decrease of the electric conductivity which indicated a desalinization of the soil profile. Although during the irrigation season, the soil salinity showed a remarkably increase in the upper layer (0-30 cm) where roots are localized.

A called CIRFLE conceptual model was used. Two scenarios were studied. The first showed that a reduction of irrigation water contribution of more than 32% imply an accumulation of salt in soil profile. As an example of 40% reduction resulted in 4557,5 tons of salt. The second scenario treated the rainy regime on the volume and the concentration of salt of drainage water. A concordance between measured and computed volumes were observed only and for dry and wet years. For the drainage water salinity the concordance was observed for only averaged year.

Organic feeding of vegetable crops grown under arid conditions in South of Morocco

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Abstract

The mild winter climate that prevails in arid regions makes the production of off-seasons vegetables an attractive business for organic vegetable growers in South of Morocco. Good prices and high demand for organic fresh commodities have pushed farmers to target the November-May window to take advantages of these incentives. Using modern technology (plastic house, drip irrigation, fertigation) and organic farming concept vegetable growers have been trying to develop cropping systems based on rotation, crop mixing and organic feeding programs using compost and organic fertilizers. While climatic conditions seems to be suitable for growing highly sensitive crops such as tomatoes, melon, cucumber and eggplant, the management of the organic feeding program is posing a serious challenge for farmers given the low fertility of arid soils, the high demand of these crops and the slow release of nutrients organic fertilizers are known for. Technical guidelines on how to manage organic feeding under arid conditions are still lacking and farmers have been testing a variety of recipes and practices with variable successes. Three major questions are usually asked by farmers when using organic fertilizers: how to assess the crop's need in term of inputs, how to apply the fertilizers and when the best time for applying fertilizers is. In an attempt to address some of these questions, the Hassan II Institute in Morocco has been running experiments in different locations to test the effect of different commercial fertilizers on growth and yield of selected vegetable crops (Tomato, eggplant, cucumber and melon). The effect of doses, time of application and nature of the fertilizers were tested on soil physical and chemical parameters, biomass, crop yield and fruit quality. The results have shown that compost in general give a much better results that commercial organic fertilizers in terms of yield and fruit quality. As in conventional cropping system, the yield is often correlated to the amount of nutrients applied under an organic form, but the main problem of using commercial products is the cost. Fruit quality, particularly firmness; tend to deteriorate by the end of the cropping cycles as soil exchangeable potassium decreased significantly with all kind of fertilizers. Other positive effects and constraint of organic nutrition will be discussed.

Effect of composts on growth, production and fruit quality of tomato crop

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Abstract

Composts act as an effective mulch, increase concentration of soil organic matter, improve tilth and water-holding capacity, suppress weeds and provide a long-term supply of nutrients with decomposition of their organic material (Evanylo and Daniels, 1999). Several composts from vegetal material were assessed by many authors for horticultural purposes. And more than one compost from animal material were also studied. Production and use of composts not only reduce the volume of wastes but also offer a high potential substrate and reduce usage of peat in the market of growth media (Zoes et al. 2001). In this study, we tested the efficiency of three composts, made from Posidonia (*Posidonia oceanica*, Delile), Chicken Manure and solid olive mill wastes on growth, production and fruit quality of tomato crop. Composts used in this study were produced after 300 days of composting in the Technical Center of Organic Agriculture in Chott Meriem-Sousse (Tunisia). Three composts (C1, C2 and C3) were tested, with the following combinations: i) C1: 50% Solid Fraction of Olive Mill Wastewater, 20% Posidonia, 30% Chicken Manure. ii) C2: 35% Solid Fraction of Olive Mill Wastewater, 35% Posidonia, 30% Chicken Manure. iii) C3: 20% Solid Fraction of Olive Mill Wastewater, 50% Posidonia, 30% Chicken Manure. These percentages are proportions in weight. Three rates: 5%, 10% and 15% (v/v) of each compost were added to crop soil in 10l-containers and in control containers composts were substituted by organic fertilizer at the same rates. Corresponding compost extracts were added to irrigation water. During six months, the following parameters were measured on tomato plants: shoot length, leaf number, flower number, fruit number and fruit weight. The following analyses were also done on tomato fruits: firmness, total sugar rate, pH, titrable acidity and vitamin C. The analysis of the results was performed by using the general linear model procedure of SPSS (SPSS 16.0). Results show that even with 10% of compost plant growth was significant. Fruit production was also significantly improved by compost fertilization. Composts reduced the fruit firmness which allows premature harvest. Citric acid content was comparables with those in control and vitamin C content was near than literature values. As a conclusion, the use of composts based on Posidonia, Chicken Manure and Olive Mill Residues as fertilizers is very promising.

Effects of pig wastes and sludge compost on tomato plants grown outdoors in high salinity soil

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Abstract

Pig waste and organic sludge (under registration) compost was evaluated as fertilizer and as soil ameliorative in an open-field tomato crop experiment during a single growing season (Jun-Dec 2008). Chemical properties of the soil were registered prior to the experiment: electrical conductivity (E.C) 3.39 mS/cm, pH 8.48 organic matter (OM) 1.9%, CaCO₃ 10.5% and sodium 160 mg/Kg. The effectiveness of compost was evaluated in a completely randomized block design experiment consisting of five replications for each of the following four treatments: inorganic fertilizer (IF) consisting of equal units of nitrogen and potassium as ammonium nitrate and potassium nitrate, pearl compost (PC), powder compost (DC), blank control (C). Inorganic fertilizer and composts were incorporated into the soil (30 cm in depth) at the exact positions of establishing the plants two days prior to tomato planting. The average fresh weight per plant and treatment was documented over the eighteen harvests, while fruit quality characteristics (Brix, pH, E.C.) were analysed in the middle of the experiment. Compost and soil were analysed before the beginning of the experiment. Furthermore, complete soil and leaf analysis were carried out in the middle and at the end of the experiment. Weights of harvested fruits per plant were not found to be different between treatments PC (14.7) and IF (14.8), but were significantly higher than treatments DC (13.7) and C (12.9). Fruit quality characteristics were significantly different between the treatments: Brix (PC: 4.88, DC: 4.90, IF: 4.7, C: 4.6), Electrical Conductivity (PC: 5.6 mS/cm, DC: 5.72 mS/cm, IF: 5.42 mS/cm, C: 5.08 mS/cm). Soil analyses at the end of the experiment exhibited significant differences between the treatments concerning Organic Matter (PC: 3.66%, DC: 2.94%, IF: 2.34%, C: 1.87%), Phosphorus concentration (PC: 2.24 ppm, DC: 2.102 ppm, IF: 0.5212 ppm, C: 0.4114 ppm), Calcium (PC: 6754 ppm, DC: 5996 ppm, IF: 6754 ppm, C: 6698 ppm), Magnesium (PC: 440 ppm, DC: 343 ppm, IF: 173.4 ppm, C: 183.4 ppm) and Zinc (PC: 16.234 ppm, DC: 16.858 ppm, IF: 1.914 ppm, C: 2.176 ppm). Interestingly, the concentration of nitrates in the soil at the end of the experiment were found higher in PC (PC: 27.486 ppm, DC: 20.924 ppm, IF: 12.372 ppm, C: 15.172 ppm), while soil pH at both compost treatments was lower (PC: 7.69, DC: 7.76, IF: 8.06, C: 8.05). These results indicate that incorporation of pearl pig manure compost into high salinity soil can improve soil and tomato fruit quality characteristics.

Effect of different organic fertilizers combinations on the yield and quality of two field tomato cultivars grown organically in Tunisia

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Abstract

In Tunisia, tomato is the main 'vegetable' grown and consumed and is therefore of strategic importance. Organic field tomato cultivation is a relatively recent introduction, but it has shown promise and can contribute to the promotion of agriculture. Although information on conventional tomato cultivation, particularly fertilization, is widely available, little is known about organic cultivation practices. Organic nutrient sources could be combined and used in order to achieve a balanced nutrient supply and an improved organic tomato yield and quality. In this study the influence of different organic fertilizer treatments on fruit yield and physicochemical properties of two field tomato cultivars (Rio Grande and Firenze) grown organically in Tunisia was determined. The three treatments were: T: codahumus 20; C: 40 t ha⁻¹ of mixed compost (500 g kg⁻¹ olive husk + 300 g kg⁻¹ horse manure + 200 g kg⁻¹ poultry manure) + mixed compost extract + codahumus 20; and CM: 20 t ha⁻¹ sheep manure + 20 t ha⁻¹ mixed compost + mixed compost extract + codahumus 20. Total and marketable yields of the two tomato cultivars were greater for C and CM treatments compared to the T treatment. However, tomato physicochemical (fresh weight, soluble solids, pH, titratable acidity and firmness) and nutritional (lycopene and total phenolics) properties were not affected by the different organic fertilizer treatments. Correlations among fruit variables measured will also be presented and discussed. This study confirmed that satisfactory tomato yield and quality, comparable to those usually found for conventionally grown tomato in Tunisia, could be obtained in organic production systems using adequate combinations and rates of organic nutrient sources.

Nitrate Accumulation in Leaf Vegetable and Organic Farming

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Abstract

This study was carried out to determine how to reduce the nitrate accumulation of vegetable by fertilization and how to reduce the nitrate content of vegetables during storage, preparation, drying and cooking.

The nitrate accumulation of vegetables as affected by the application rate of organic fertilizer was examined in fertile and infertile soils. Soil analyses were also included in the experimental programme.

The chlorophyll content in Chinese cabbage leaf blades, cabbage and lettuce showed a close relationship with nitrate content. Results showed that the darker the leaf blade color, the higher the nitrate content in the vegetables and the elder the leaf age, the higher the nitrate content in the vegetables.

The relation between the nitrogen dynamics in rooted soil profiles and nitrate content in vegetables and relationship between activity of nitrate reductase (NiR) and nitrate accumulation in different parts of vegetables were also investigated. Furthermore changes of nitrate content by light in storage, temperature in cooking processes, drying, boiling and cooking methods were also discussed.

We also calculated the daily intake of nitrate for Koreans and it was found that Koreans intake 1.8~3.4 times more nitrate than the Acceptable Daily Intake(ADI), 218mg/day/60kg b.w., provided by FAO/WHO. More than 90% of daily nitrate was taken in through vegetable consumption. The nitrate concentration in saliva water peaked at 200ppm after 2 hours and stayed 4 hours after eating.

We recommend to introduce the nitrate limit valued for vegetables not only to reduce the daily nitrate intake but also to decrease drinking water pollution and forcing the implementation of optimized fertilization.

The Effect of different types of compost extracts on vegetative growth, fruit quality and soil fertility of organic greenhouse tomatoes

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Abstract

In organic farming, plant nutrition depends largely on farm manure. The aim of this work is to study in a greenhouse the effect of different types of compost extracts (compost tea) on vegetative growth, yield, fruit quality and resistance of tomato crop to late blight and on the soil fertility. The experiment was carried out at the Technical Center of Organic Agriculture in Chatt Meriem.

Nine treatments were used in this experiment:

- Six types of compost teas (T1, T2, T3, T4, T5 and T6) extracted from different combinations of composts (organic matter from cow manure, sheep manure, poultry manure, horse manure, crushed wheat straw and natural phosphate), and
- Three types of commercial fertilizers (T7: Algadul , T8: Codahumus and T9: Molex).

The treatment T3 (50 % Cow manure + 20 % Sheep manure + 20 % Poultry manure + 10 % crushed wheat straw) and T4 (30 % Cow manure + 30 % Sheep manure + 30 % Poultry manure + 10 % crushed wheat straw) showed the highest tomato yield in relation to the control. The amendments also led to increase in nitrogen contents and a variability in macronutrients of leaves, stems and roots according to the composition of the different types of compost. The treatment T3 allowed the increase of nitrogen content in the leaves by 3.43 % .

However concerning yield, the treatment T4 was more efficient than the other compost tea treatments by 27.5 % compared to the control treatment. Moreover, there was not a significant difference between yields obtained from compost tea fertilization and organic commercial fertilizers.

Concerning the quality of fruits, the treatments T3 showed fruits with high dry matter. The pH of fruits decreases slightly, whereas the rate of sugar appeared indifferent to amendments. Results also showed an increase of nitrogen and a reduction of contents in macronutrients and micronutrients.

Concerning the effects of spray of the compost tea on the late blight control, the treatments T2 (60 % Cow manure + 30 % Sheep manure + 10 % crushed wheat straw), T3 and T5 (25 % Cow manure + 25 % Sheep manure + 25 % Poultry manure + 15 % Horse manure + 10 % crushed wheat straw) showed more efficient disease control. However, these treatments were less efficient compared to copper treatments.

Regarding soil fertility, the organic fertilization by compost tea allowed to improve the level of the organic matter and nitrogen. In fact, the compost tea tends to reduce soil pH. The treatment T3 and T4 allowed an increase in soil organic matter and carbon content, which can be explained by the high content of organic matter in these compost teas (35.5 and 25.9 %).

Fertilizing and nematicidal effect of argan, castor and neem cake on organic cucurbits (cucumber and melon) grown under greenhouse in sous region (southwestern of Morocco)

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Key words: Organic agriculture, soil fertility, cucurbits, *Meloidogyne spp.*, argan cake, castor, neem.

Abstract

Plant products are receiving greater attention as prophylactics against several species of plant-parasitic nematodes (Akhtar, 2000). Plants with nematicidal properties can effectively reduce soil populations of nematodes and improve crop yields (Elbadri, 2009). The aim of these two experiments was to evaluate the impact of oil plant cake amendments (argan; neem; castor cake and ground castor leaves) on soil fertility; agronomic parameters and on the control of root-knot nematodes (*Meloidogyne spp.*) –especially free larvae of second stage J2- affecting cucumber and melon under greenhouse in south-western Morocco. In the cucumber greenhouse trial, oilcake amendments were applied before transplanting with a dose of 5t ha⁻¹. Experimental results showed a reduction of gall formation, soil nematode density, root rot infestation and improvement of plant height and yield as compared to the control. In general, amending with oil cake improved the soil fertility, and increased the soil organic matter content and some major elements. Compared to the control, argan and neem cake respectively improved the soil organic matter (+23.33% and +31.11%); total nitrogen (+105.55% and +27.77%) and exchangeable potassium (+24.73% and +80.64%). The tested oil cakes significantly reduced the population of *Meloidogyne spp.* in the soil during the first two months. Argan cake, tested for the first time, showed very significant performance in controlling free larvae J2 three months after inclusion (96.85% reduction as compared to the Control), while neem; castor cake and ground castor leaves had respectively reduced free J2 by 90.55; 88.98 and 89.76% as compared to the control. Galling Index (GI) performed on cucumber roots has shown that argan; neem and castor cake were statistically a homogeneous group (4.17; 5.00 and 4.58) and had the lowest GI in comparison to ground castor leaves and the control (6.00 and 7.00). Argan cake produced statistically the highest yield 29.3 t⁻¹ ha⁻¹ (112% more than the control), whereas neem and castor cake improved equally the yield by 89.31% and 80.6%. Ground castor leaves resulted in the lowest yield (+27.66%). A trial on melons grown in pots has received a quantity of 200 grams per plant of oilcakes amendment. Results showed maximum suppression (100%) of root knots and soil larvae population with argan, castor cake and ground argan shoot while neem cake was less effective (Root Knot Index=1 and the average of free J2 = 1.75). Argan cake resulted in 24% increase in fresh weight compared to the infested control, while ground argan shoot enormously decreased both height and weight as a result of phytotoxicity. These

results raise up some relevant points on which further investigations should be done in order to get deep inside, making the collected data and results beneficial and useful for the organic farming. It would be worthwhile: (i) To make further in vitro tests, to find out if argan cake and ground argan shoot have a nematotoxic or a nematostatic effect (ii) To perform the phenolic analysis to facilitate the identification of the active substance (s) or molecule (s) responsible for the nematotoxic or the nematostatic effect on *Meloidogyne spp* (iii) To investigate the fertilizing effect on the oil cakes in a nematode free soil, in order to have a clear idea of the effect on soil fertility and plant growth and yield.

Effect of compost and compost tea on Potato and Zucchini crops

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Key words: potato, zucchini, compost, compost tea

Abstract

The principle of the fertilization in organic farming is based on the maintenance or the improvement of the soil fertility. The use of the compost is considered the principal remedy in the fertilization of organic crops. The commercial bio-fertilizers are imported and usually expensive. In addition, animal manure is rare and expensive, and in general, there is a high supply of olive by-products, such as, solid olive mill waste which is not expensive and olive mill waste water that may cause environmental pollution. In this context, the present work focussed on the effect of the use of new combinations of organic matter sources as compost and compost tea on potato and zucchini crops.

Two field experiments were conducted at the Technical Center of Organic Agriculture in Sousse, Tunisia, to study the effects of ten (10) combinations of organic matter to compare composts and then compost teas, on growth, development, yield, nutrition and soil fertility of potato (cv. Spunta) and Zucchini (cv. Jedida) crops. These combinations were composed of cow manure, sheep manure, poultry manure, horse manure, solid olive mill waste and with or without olive mill waste water. The proportion of each component were chosen on the basis of the availability of the raw materials in the different Tunisian regions.

For both potato and zucchini crops, there was a greater agronomic effectiveness of applying composts and compost teas made from a combination of manures and olive mill wastes, with or without olive mill waste water, mainly on plant stand, vegetative growth and yields.

However, some composts, such as, those composed of cow, cheep, poultry and horse manure in equal amounts (20% each) and solid olive mill waste (20%) with or without olive mill waste water, were used as soil amendment, together with their compost teas, applied for fertilization purposes. They were better than the other treatments, both for potato and zucchini. The quality of products was also improved through mineral nutrition.

Concerning economics, compost used in combination with compost tea did not reduce the production cost, however, they acted slightly similarly as the commercial bio-fertilizer in terms of benefits. So the use of compost and compost teas in substitution to commercial bio-fertilizers will be suggested.

Effect of animal manure compost extracts on mineral nutrition and production of organic pepper

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Abstract

Green house essay was conducted on pepper plants (*Capsicum annuum* L. cv. 'Rouge Long') to assess the nutritional value of four different kind of compost extracts (C1, C2, C3 and C4) obtained from various composted animal manure mixtures. Plants were cultivated on perlite and irrigated once a week by diluted compost extracts (1/5) at the rate of 250 ml/ irrigation. They were compared to plants irrigated by a commercial nutritional solution Nitrophoska. Results showed that, after six months of growth, irrigation by compost extracts had no significant effect on stem length of plants in comparison to the control. On the contrary, stem dry matter of pepper plants increased in comparison to those irrigated by the commercial product. Leaf dry matter increased only from the extract C3 (40% cattle manure + 40% sheep manure + 20% vegetable wastes). Production of pepper, irrigated by compost extracts, was higher than the control. Improvement of production reached 72,5% C4 extract. Concerning mineral nutrition, results showed that compost extracts had positive effects on plant mineral nutrition. These effects were higher or similar to plants irrigated with a commercial solution. In fact, compost extract application had increased N, Ca and Mg contents of pepper shoots (leaves and stems) and decreased on the other hand, the content of Na and heavy metals like Cu, Mn and Zn on pepper fruits in comparison to the control. Compost extracts could constitute an alternative to commercial nutritional solution for production of pepper plants.

Effect of organic matter on soil biological activity, growth and quality of organic potato crop

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Abstract

Organic matter management constitutes an important factor in the fertilization process in organic agriculture. The effect of five types of organic matter (fresh manure, green manure, compost mix, compost containing solid olive mill waste with and without margine) on a potato crop was studied.

Several agronomic parameters of potato crop and chemical and biological observations of the soil were made in this study.

The incorporation of organic matter in the soil significantly affected the plant growth, the chemical characteristics of the soil and numbers of thermophilic bacteria in comparison with the control treatment.

The fresh organic matter was characterized by the highest number of thermophilic bacteria and fungi, and led to the most important increase in the crop cover, the fresh matters of the various plant parts and the yield. High contents of organic matter, carbon, potassium and zinc, as well as a high early yield were obtained with the fresh manure in comparison with green manure.

The composts were characterized by slightly higher contents of mineral elements (Iron, Calcium and Magnesium) in leaves and stems than the fresh organic matter.

The use of compost containing solid olive mill waste led to a reduction in the vegetative growth, yield and number of the tubers compared to compost mix. The compost with margine gave similar results to those of the compost without margine for all studied agronomical, chemical and biological parameters. The addition of margine did not affect any of the studied parameters.

Roots, stolons and tubers of treatments based on fresh organic matter (FF and EV) were characterized by relatively high values for the majority of the mineral elements.

The microbial biomass differed between treatments. The number increased in the soil amended by the organic matter compared to the control treatment. Supplying organic matter to the soil (a source of food to micro-organisms) with different amendments stimulates the microbial populations.

The results showed that the number of thermophilic microorganisms is distinctly less than those of mesophilic ones.

The microbiological analysis of various soils highlighted the abundance and diversity of total soil microorganisms and the presence of a rather important number of microorganisms (fungi and bacteria) antagonistic being able to be useful in biological control. There are benefits from natural antagonists which can be used in the control of pathogens.

Results indicated that the right choice of organic matter makes it possible to improve the beneficial effects on soil chemical conditions, soil microbial activity and the crop viability.

Evaluation of pre-crops and fertilization on soil properties and crop growth and productivity

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Abstract

Soil fertility is a critical issue in organic farming which attempts to close the nutrient cycle and enhance beneficial biological interactions and processes. Soil building crops and organic fertilizers usually contribute to improved soil properties and crop productivity. A four year research programme undertaken by Mediterranean Organic Agriculture Network and carried out in Italy, Morocco, Tunisia and Turkey aims to identify the best combinations between pre-crops and the following crops associated with specific fertilizers.

The present experiments are conducted in the East Centre coastal area of Tunisia and consist of studying the effects of pre-crops (fennel, pea, Faba bean) compared to fallow as a control on different following main crops (potato and zucchini) fertigated with commercial fertilizer and compost tea during two seasons (2006/2007 and 2007/2008).

The main aspects can be summarized as follows:

Regarding potato as main crop, results showed that both thermophilic and mesophilic bacteria are significantly affected by the interaction between soil building crops, depth and fertilization. The highest number of colonies was obtained with Faba bean plots fertigated with compost tea at both 15 and 30 cm in depth. However, the lowest was obtained with the control plots and commercial fertilizers at both 15 and 30 cm in depth. Higher soil cover was recorded in plots fertigated by compost than the ones by commercial fertilizers. Plant growth parameters did not differ significantly between treatments. Similar results were obtained with chemical analysis of plants parts. Concerning yield, there were not significant differences between soil building crops or fertilizers. Striking effects of compost teas on potato tuber number were recorded.

Regarding Zucchini crop, the results showed no significant effects of soil building crops for the main soil parameters except for electrical conductivity and total nitrogen. No significant differences between treatments were recorded for the agronomic parameters. Fennel plots and commercial fertilizer ones tend to give higher values. Soil building crops showed significant differences for fruit chemical analysis mainly pH, EC, N, Mg, Fe and Mn. However, no significant differences were found between compost tea and commercial fertilizers for all fruit chemical characteristics. Similar results to potato were found for microorganisms colonies.

Some common results emphasised the importance of soil building crops (pre-crops) and the possible substitution of commercial fertilizer by compost tea.

Olive oil quality as affected by different irrigation regimes of olive mill wastewaters

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Olive oil mill wastewater (OMW) constitutes a major environmental problem especially for Mediterranean countries, where most of the world olive oil production takes place. The environmental implications from the uncontrolled disposal of OMW are mainly connected to their high organic load and their antimicrobial and phytotoxic properties. OMW have been the subject of many waste treatment studies but no satisfactory solution was yet been found for its safe disposal. Many researchers have established that these wastes have a high fertilizer value when applied to the soil.

This work reports the results of a study carried out in an orchard of *Olea europaea* L. cv. Chemlali, to investigate the effect of different irrigation regimes of OMW on quality of olive oil. The treatment details are as follows (T0: control, T1:30m³/ha, T2:60m³/ha, T3:100m³/ha and T4: 150m³/ha of OMW). Irrigation regimes did not affect the fatty acid composition of the olive oil, K270 were significantly different between the T0 and T4. An increase of free acidity was found in olive oil after agronomic application of OMW. Significant increase was observed in total phenol content of oils (ranging from 18 mg/kg eq as Gallic acid in control to 87 mg/kg as Gallic acid in T4). Beta-sitosterol was not significantly different between treatments, while the levels of Erythrodiol + uvaol after agronomic application of OMW increased more in treatment than in control (ranging from 0.94 % in control to 1.48 % in T4).

The present data are important in providing information about the compounds of olive oil as effected by different irrigation regimes of olive mill wastewaters, since few facts in the literature are available to explain the effect of agronomic application of OMW on olive and olive oil quality.

Mineral nutrition and the abundance of arbuscular mycorrhizal fungi as affected by irrigation with Olive Mill Wastewaters

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Olive mill wastewater (OMW) management is a serious environmental issue for the Mediterranean area where there is the most production of olive oil. Olive mill wastewater contains a high organic load, substantial amounts of plant nutrients but also several compounds with recognized toxicity towards living organisms. Moreover, OMW may represent a low cost source of water. Thus, The recycling of the OMW and their use as water for irrigation in the agriculture, provided that its impact on soil and plant is established, and is an attractive perspective for the Mediterranean countries in which water resources have been severely decreased in the last years. Olive tree mineral nutrition and the abundance of OMW were studied in an olive tree orchard, which has been irrigated with four doses of OMW (amounts applied: 30, 60, 100 and 150 m³ h⁻¹). The soil FAME 16:1W5 was used to quantify biomass and amount of energy reserves of AM fungi and the root FAME 16:1W5 analysis was used as index for the development of colonization in the olive tree root. Agronomic application of OMW decreased significantly the abundance of the soil FAME 16:1W5 and the root FAME 16:1W5 from 1.47 % and 14.29 % in the control soil to 0.82 % and 9.11 % in the soil amended with 150 m³ ha⁻¹ OMW respectively. Decreased soil FAME 16:1W5 and root FAME 16:1W5 due to OMW amendment significantly reduced olive tree mineral status. The highest application of OMW to the soil reduced the uptake of P, K, Na, Mg, Fe, Cu, Mn and Zn in OMW treated olive tree as compared to the control. These findings suggest that the altering functioning of arbuscular mycorrhizas should be considered as potential factors mediating olive tree responses to agronomic application of OMW.

Essay of valorisation of Olive Mill Wastewaters as a Biological Fertilizer

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Because of its high content of minerals substances, mainly potassium, phosphorus and magnesium, the olive mill wastewaters (OMW) can be used as organic fertilizers by the direct spreading of these effluents on soils.

In this context, an experimental essay was carried out in the High School of Agriculture of Mogran (ESA Mogran) located in Zaghouan area, in which three different amounts of OMW (50, 100 et 200 m³/ha) were applied , in only one spreading, on small parcels of 4 m² of surface each one.

In order to study the effect of spreading OMW according to three various amounts on the floristic composition of an clay-sandy soil, an identification test of the natural vegetation was made on the experimental plots.

It was observed that the abundance of the spontaneous vegetation in the experimental plots decreases while increasing the dose of OMW. Indeed, for the dose 200 m³/ha, there are practically only some species which resist such as *Malva sylvestris*, *Carduus*, *Polygonum aviculare*, *Phalaris paradoxa*, *Emex spinosa* and *Turgenia latifolia*. This could be explained by the inhibiting effect that caused the OMW on vegetation development, which appears for the high doses. In the other hand, it was found that the majority of the species were developed on plots which were treated by the amounts 50 and 100 m³/ha. This result indicates the fertilizing effect of the OMW for the low and the average amounts.

It is concluded that the direct application of OMW on the soil according the doses 50 and 100 m³/ha could contribute to a biological fertilization and the development of spontaneous vegetation on soil.

Effect of compost on organic olive-tree productivity, soil organic matter and biological activity

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Abstract

Olive crop is very important in Tunisia; it is grown on nearly 1700000 hectares and produces annually an average of 150000 tons of oil. Olive crop, is also the main crop grown in organic agriculture and accounts for 66% of all organic land.

The soil is a live natural body, a living entity, an ecosystem containing a wide variety of different flora and fauna. The biological activity of the soil depends on the availability of nutrients and energy supplied by soil organic matter, crops and livestock residues. The principle of the fertilization in organic farming is based on the maintenance or the improvement of the soil fertility. The use of the compost is considered the principal remedy in the fertilization of organic crops.

In this context, our research focused on the use of compost containing: olive residue (solid olive mill waste: 66%); cow manure (17%) and sheep manure (17%) for olive crop fertilization. This fertilization was applied in organic rain-fed olive orchards located in North (Tebourba) and South (Hageb) areas of the country.

This work aims to evaluate the effects of compost on the olive-tree productivity, the soil organic matter, nitrogen contents and the biological activity.

The experimental field received two compost spreadings, 5 tonnes/ha each during two consecutive years. Soil organic matter was determined according to the method of Walkley & Black. The method of determination of soil nitrogen contents was according to Kjeldhal. The bacterial isolates were identified on the basis of biochemical tests. The results showed that the incorporation of the compost in organic farming improved the soil organic matter and total nitrogen contents at depths of 20 and 40cm in North (Tebourba) and South (Hageb) areas. The olive tree's productivity was also improved by 6 - 14% in the south area compared to the control. Concerning the biological activity, the incorporation of the compost was accompanied by an increase in total flora population and diversity. Indeed, new bacterial strains were isolated from the treated soil.

The full number of the micro-organisms in the soil was increased by 30% and 67% in North (Tebourba) and South (Hageb) areas respectively.

The olive farms in the North gave better results than in the South because of the better climatic conditions.

Moreover, we recorded, in the treated soil, the presence of the bacteria "*Bacillus*", which has an important role in the soil protection because it is characterized by an antagonism effect of the pathogenic micro-organisms.

Composting of Posidonia, solid fraction of Olive Mill Wastewater and Chicken Manure

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Abstract

Posidonia (*Posidonia oceanica*) is a Mediterranean marine phanerogam. Its leaves accumulated in litter cover more than two million ha of the Mediterranean coasts and rejected in enormous quantities on the Tunisian beaches. Chicken manure accumulation is accompanied by serious environmental problems. For instance, the underground water is affected by nitrates and phosphates; air is affected by the ammonia emission and soil by accumulated heavy metals and phosphorus (Walker and Bernal 2007). The solid fraction of olive mill wastewater is accumulated each year in the Tunisian oil mills and is very rich with organic matter. Despite its various uses, the available quantities are still huge (Fourati et al. 2001). The objective of this study is to contribute to resolve these environmental problems by the valorization of the mentioned organic waste through composting. Three mixtures of these wastes were composted in about 300 days in the Technical Center of Organic Agriculture. At the end of the composting process, three composts were obtained: i) C₁: 50% Solid Fraction of Olive Mill Wastewater, 20% Posidonia, 30% Chicken Manure. ii) C₂: 35% Solid Fraction of Olive Mill Wastewater, 35% Posidonia, 30% Chicken Manure. iii) C₃: 20% Solid Fraction of Olive Mill Wastewater, 50% Posidonia, 30% Chicken Manure. These percentages are proportions by weight. Each compost pile weight was 20 tons. During the composting process, we measured the following parameters: physical parameters (temperature, pH and salinity), chemical parameters (OM, TOC, TN, CaO, MgO, K₂O, P₂O₅, Fe, Cu, C/N, Al, Cd, Co, Pb, Ni, Cr, Zn and Hg) and biological parameters (detection of salmonella). For compost analysis, sampling was made by mixing three sub-samples taken from three different points in the pile. Each sub-sample was a mixture of three samples taken from the top to the bottom of the pile in each sampling pile. The analysis of the results was performed by using the general linear model procedure of SPSS (SPSS 16.0). Results show that at the end of the composting process salinity, C/N ratio, MgO, K₂O and P₂O₅ decreased; nitrogen contents however, increased during composting. The results confirm also that posidonia, solid fraction of olive mill wastewater and chicken manure might be considered as valuable ingredients of compost mixtures. We conclude that composting of posidonia mixed with chicken manure and olive mill residues shows some interesting outcomes and the physical, chemical and biological characteristics of the final product may allow their use in crop media.

Spatial distribution of soil organic matter content and organic matter mineralization in an olive orchard

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Abstract

Soil fertility has to be preserved in order to assure high yields and therefore better income. Thus, crop production sustainability is highly related to soil fertility preservation. A living soil with active flora should be highly fertile. This situation is achieved when sufficient organic matter and moisture are present in the concerned soil layer. Consequently, one of the best indicators of soil fertility is organic matter content. In rain-fed olive orchards of central Tunisia, spontaneous plants are systemically avoided in order to limit competition for water. This, with the lack of manure application, induce soil fertility degradation. Organic farmers apply organic fertilizer in order to balance orchard exportation. However, they consider that soil organic matter content is spatially uniform and obviously that organic matter mineralization is the same everywhere. For this reason organic fertilization may be far to meet soil fertility sustainability requirements for the whole orchard. The aims of this work is 1- to draw soil organic matter content spatial variability, 2- to assess spatial variability of soil organic matter mineralization and 3- to propose organic fertilization plan based on previous findings. The olive orchard (134 ha) used for this study is located on a toposequence in central Tunisia (Sfax region - 34.37 N 10.16 E). The trees of the cv Chemlali, 80 yrs old, with very low plantation density (24x24 m apart =17 trees/ha), are conducted under rainfed conditions. The soil is sandy. First of all, we had drawn the shape of the orchard that has been georeferenced. Then, for soil analysis a 200x200m grid pattern was established; each intersection point (node) represented a sampling point. A total of 27 sampling points were identified. Soil samples were taken, from every sampling point, at 1 m depth. Organic matter content was determined by dichromate oxidation using Walkley and Black method. Soil OM content distribution pointed out the presence of four zones having a concentration higher than 0.43%. These zones were located in the western boundary (northern and southern extremities), in mid-eastern limit and in the mid-southern spot. They covered an area representing 23.2% of the total parcel. In addition, a very limited area (0.55% of the whole surface) presented OM values greater than 0.54%. However, the most part of the toposequence (65.1% of the total surface) had extremely low organic matter content, i.e. less than 0.43%. This area was located in the centre of the orchard. Additionally, 11.7% of the toposequence had less than 0.32% of organic matter content. Organic matter exportation and mineralization showed an important spatial variation. Thus fertilization has to be more important in poorest areas and where exportation is high. On the other hand organic fertilization frequency should be more important in the zones with highest mineralization rates.

Effect of different doses of compost based on date palm on alfalfa cultivated in oasis conditions

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Abstract

The Tunisian coastal oasis suffers from salinity, soil degradation and lack of fertility. In these oases the accumulation of date palm's wastes induces their pollution.

Two experiments relating to: (i) Comparing two types of amendments (compost and manure) after two years (ii) and the effect of different doses of compost on the growth, yield and quality of alfalfa, were carried out. Results shows that:

After two years (i) the number of plants per m² and yields have not been affected by the two types of amendments but yields (resulting from ten cuts), expressed in dry matter are stable both for the two treatments .

The effect of different doses of compost (ii) noted that:

* Vegetative activity in winter is almost the same for all doses studied

* Growth of alfalfa in height is faster with the treatment 4 Kg of compost / m². This growth is faster during the summer than during the winter period

* Leaf area and seeds production are influenced by the doses of compost applied,

the dose 3 Kg / m² production's has generated the highest yield expressed on fresh and dry matter. The treatment 4 Kg / m² seems to correspond to a luxury consumption dose.

For these two experiments, fodder production has got a good nutrition quality. It is rich in dry matter and well endowed with potassium, sodium, phosphorus and nitrogen.

Effect of the biological fertilization on the growth of the green bean *Phaseolus vulgaris*

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Abstract

The use of green bean as a crop in a program of rotation allows on one hand to develop this culture because the national production for this specie covers only 2/5 of the consumption needs and on the other hand to exploit the plant capacity to fix the atmospheric nitrogen. In fact, the fixation of the atmospheric nitrogen by legumes presents a considerable agronomic interest because it seems as a very important economic means to increase the nitrogen stock in the ground and to improve the yield of the crop. This favorable effect can be obtained only in the presence of a

highly efficient rhizobium strain. However, Dahmane et al, (1995) and Sifi et al.(1997) showed that in Tunisia the bean nodulation is low, even completely absent with a symbiotic insufficient fixation of the nitrogen and low yields. In this case, the solution is to introduce a rhizobium strain into the soil (Gobat et al., 1994).

In the present work, we studied the effect of the rhizobium inoculation associated or not to the biological fertilization with compost tea on the growth and production parameters, the nodulation and the nitrogen fixation of a green bean organic crop. The essay is settled in the biological certified experimental plot of the Agronomic Higher Institute of Chott-Mariem. The cultivated variety is the dwarfish variety of green bean "Contender ". Four treatments are settled in the plot according to a randomized complete bloc design: green bean (control), green bean inoculated with the rhizobium stump CIAT 899, green bean fertilized with a compost tea prepared with 50 % of bovine manure, 20 % of ovine manure, 20 % of poultry manure and 10 % of crushed straw, and finally green bean both inoculated and fertilized with compost tea.

The results allowed the following:

* The inoculation could be advantageous only when the ground does not already contain a native strain or if it contains it, it presents a low infectivity. Indeed, according to this study the strain did not present a good infectivity expressed by a decline of the nodulation. However, we noticed an increase in the fresh and the dry biomass, the leaf area, the flowers' number and the nitrogen content of the vegetative part of the bean plant. This informs about the good effectiveness of the introduced rhizobium strain;

* The fertilization with the compost tea did not present a remarkable effect on the estimated parameters only for the plant height where we registered an important improvement compared to the other treatments;

* When we combined the inoculation with the fertilization the results were weaker than those obtained with the other treatments.

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Research on soil fertility, fertilization and plant nutrition in organic production systems in Spain: A review of the last 20 years

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Abstract

Soil fertility, organic crop fertilization, plant nutrition and soil organic matter management is the most relevant topic for organic research as soil are a key element for these organic farmers. But in Spain, organic research was more relevant in the topic of plant protection, if we search references from the last 20 years. Only less than 12 % of total papers presented in the different scientific conferences, congresses and symposium organised by the Spanish Society for Organic Farming (SEAE), the most important forum in organic farming research, were dedicated to nutrient management.

The types of thematic of the research works reviewed were distributed in five categories: a) organic and mineral fertilisation; b) general evaluation of soil fertility under organic management; c) compost making and compost types; d) soil conservation and fertilisation; e) crop fertilisation and food quality

We found that more than 20 % of the total published research are related to general aspects of crop fertilisation in 16 types of vegetables, 14 arable crops and pastures and 8 types perennial crops (almonds, citrics, vineyards, olive trees, and banana) have been presented. Most studies were done on vegetables and very few on nutrient balance have been published. There are some interesting studies on cover crops. The soil fertility impact of organic farming compared with conventional is focussed in nearly 30 % of all the scientific papers presented. Compost from different crop residues and the effects on soil and on different crops, including waste sludge (normally not appropriated for organic farming) have been studied. There are also some studies on how to use the residues of the olive oil mills or residues of vineyards as organic fertiliser. Some of the recent studies are focussed on how compost can control pest and diseases in crop cultivation. Another type of study has analysed the soil disinfection potential of manure with high exposition to the sun (high temperature) to be used in greenhouses. Few studies are concentrated in the application of mycorrhizae to enhance the capacity of the plants to absorber nutrients from soil. We found some few studies on biofertilisers, but there are many different inputs being offered to organic farmers as natural fertiliser. Soil conservation and organic fertilisation studies are scarce and not sufficiently detailed. Finally we found a five category of very few studies on the relation between fertilisation of different crops and the final quality of the crops and fresh foods.

This paper present the main results of organic farming fertilisation in several crops conducted in Spain which can be useful for other Mediterranean countries with similar soil characteristics

Current approaches for future scenarios: agroecological management of soil fertility in arable agro-ecosystems under Mediterranean conditions

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Abstract

Spain is the EU country with the greatest diversity in arable farming systems with cereals. This difference, rather than an advantage in the context of the Common Agricultural Policy is currently a characteristic giving a high degree of uncertainty to farmers. It is expected that the changes will push to a radical shift in the production sector, and also in the institutions and in national policies, to support clearly the conversion to sustainable production models. Currently, it is a fact that these types of agrosystems are not economically viable, and the farmers are surviving because the CAP aids. On the other hand it is also a fact that there are serious contamination process in water and degradation in soil, if we use the conventional arable production systems in this environment. Currently there are several experts' opinions explaining that only one agroecological management can offer the key solution for recovering the consistency in converting the handicaps factors in signs of cultural identity, ecological stability and quality of life in rural areas. The new scenarios/challenges to be taken into account - low profitability, climate change, alarming loss of genetic diversity, soil degradation and biotechnology threat - force to rethink urgently fundaments of the agroecological management.

Agroecological management strategies for the sustainability of dry land agrosystems under Mediterranean conditions

| Aims | Strategies |
|--|--|
| <ul style="list-style-type: none"> 1. High energy efficiency and lower production costs. ▪ Optimal levels of organic matter. Increased efficiency in the dynamics of nitrogen and phosphorus availability. Efficient use of water, - visible and invisible- and improving soil conservation farming overing biodiversity at the farm level and in a big scale ▪ Diversification of revenue sources according to the multifunctionality of agriculture | <ul style="list-style-type: none"> ▪ Low inputs, of alternative energy soruces use, conservation tillage, recovery of agricultural and livestock systems, increased photosynthetic efficiency ▪ Increase of organic matter, improving aggregation and structural stability, increased diversity specific soil-fixing bacteria Nitrógen free-living and symbiotic mycorrhizae ▪ Increase of organic matter improves aggregation, diversification of soil biomass, cover crop management and cover crops and animal stocking control ▪ Introduction of stable elements in the agrosystems -traditional varieties, fragments of natural vegetation and pastures, recovery indigenous breeds and agro-ecological management of the territory- ▪ Management oriented to diversify the incomes sources for the quality of production, market diversification and compensation of environmental services provided by farmers |

POSTER CONTRIBUTIONS

Olive mill waste water valorisation in agriculture: Effects on the soil proprieties and barley yield

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Abstract

Olive oil extraction produces large amounts of waste water, known as olive mill waste water (OMWW) "margins". This sludge has a high chemical oxygen demand and contains high levels of phenolic compounds and is therefore a cause of environmental pollution. The exploitation of this waste without preliminary treatment is very limited considering its toxicity for soils and plants. In Tunisia, 700,000 tons of margins produced annually are generating many types of pollution (Taamallah, 2007). They are dried in special basins and then put in heaps to be used as compost, while an important fraction of the product is poured directly in the natural channel (wadi) beds.

It is within this framework that this work has been carried out, aimed at finding new technologies or processes for the treatment and the valorisation of this effluent. The spreading of margins on sandy soil in southern Tunisia represents an interesting alternative for this sewage. The major aim of this study was to investigate the use of margins as a fertilizer for Barley cultivation. In fact, the application of 50 (T1), 100 (T2) and 200 (T3) m³/ha of this wastewater resulted in a significant improvement of the soil fertility. Indeed, the ratio of carbon/nitrogen increased from 9 for the control to more than 22 for the T3 treatment. The potassium content also showed a considerable improvement (From 300 mg/kg for the control to more than 1988 mg/kg for the treatment T3). Because of its binding and hydrophobic effects, the application of margins resulted in a more stable soil and created mulch reducing the losses of water evaporation.

Regarding the production, compared to the control and after the spreading operation, a decreased seed yield has been recorded. In fact, compared to the control (1262.2 Kg/ha), the seed yield recorded a clear decrease for the treatment 100 m³/ha (762.9 Kg/ha) and 200 m³/ha 362.2 Kg/ha). However, treatments of 50 m³/ha recorded a light increase (1362, 2Kg/ha) without being statistically different from the control. It was concluded that the margins applied with high doses (100 m³/ha and 200 m³/ha) reduce the production whereas the low doses (under 50 m³/ha) improve the soil characteristics. Then, it is recommended that the margins can be applied with amounts less than 50 m³/ha for Barley cultivation.

Future of Education - Organic.Edunet Web Portal for Organic Agriculture and Agroecology

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Abstract

Organic.Edunet (ECP-2006-EDU-410012 Organic.Edunet) aims to facilitate access, usage and exploitation of digital educational content related to Organic Agriculture (OA) and Agroecology. It will deploy a multilingual online federation of learning repositories, populated with quality content from various content producers. In addition, it will deploy a multilingual online environment (the Organic.Edunet Web portal) that will facilitate end-users' search, retrieval, access and use of the content in the learning repositories. The project will study educational scenarios that introduce the use of the Organic.Edunet portal and content to support teaching of topics related to Organic Agriculture and Agroecology in two cases of formal educational systems, i.e., high-schools and agricultural universities. Furthermore, it will evaluate project results in the context of pilot demonstrators in pilot educational institutions, as well as through open validation events where external interested stakeholders will be invited.

Organic.Edunet focuses on achieving interoperability between the digital collections of Organic Agriculture and Agroecology content that producers in various EU countries have developed, as well as facilitating publication, access, and use of this content in multilingual learning contexts through a single European reference point. In this way, digital content that can be used to educate European Youth about the benefits of Organic Agriculture and Agroecology, will become easily accessible, usable and exploitable.

Until the end of the Organic.Edunet Project, more than 10.000 learning objects (presentations, text documents, pictures, scenario descriptions, quizzes, etc.) dealing with different aspects of Organic Agriculture and Agroecology, as well as Soil Fertility and Crop Nutrition will be uploaded onto the network by fourteen member organizations, mainly Agricultural Universities and Organic Organizations of the European Union. Detailed metadata annotation of learning objects will make searching in the database easier. The metadata of over 1.000 learning objects will be available in six languages until the end of the project.

Project partners have created educational scenarios in order to support the integration of action learning and novel educational techniques into the present system. The description of these scenarios as well as the learning material belonging to the agenda has been uploaded into the educational portal. Universities held test courses in order to highlight the strengths and weaknesses of the methodology and collected feedbacks will be evaluated and incorporated into future strategy.

Launching of the portal is on 10 March 2010, the portal is publicly and freely available for everyone interested.

Effects of irrigation with saline waters on soil and salt tolerance of barley varieties in arid area

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Abstract

In arid areas such as south Tunisia, the use of saline water in irrigation is one of the recent alternatives to meet crop water requirements, but one of the problems of using this water for irrigation is soil salinisation. The understanding of the current and expected impact of saline irrigation on soil and plants make the management of our soil and water resources possible. This study aims to evaluate effects of saline irrigation on crop yields and soil salinity. First we tested the salt tolerance of 7 barley accessions, provided by ICBA and compared them with a land race barely variety "Arthaoui" originally from Medenin, under field conditions (southeast of Tunisia). Second we monitored the soil salinity under saline irrigation. Twenty-four plots as 3 replicates for each variety or accessions were irrigated with saline water (EC = 9.73 dS m⁻¹ and TDS = 7400 mg/l). According to our field experiment, the variety Arthaoui and the accession 82/2A showed a larger grain and straw yield and the highest water use efficiency values. The stomatal conductance values showed that some of the 7 tested accessions were more sensitive than others to water stress caused by salinity. The fewer ears per plant of the 7 tested accessions compared to the Arthaoui variety explained the decrease in crop productivity and water use efficiency. The barley accession 82/2A was the most salt tolerant in our field conditions. Under saline irrigation, the salinity increase significantly in the upper soil profiles of all plots (from 2.01 to 7.83 dS/m in P1). The sodium and chloride concentrations increased with soil electric conductivities. The slight leaching due to the rainfall (142.4 mm) was insufficient to transport salt deeper in the soil profile. The salt accumulation was aggravated by the intense evapotranspiration.

Physiological and nutritional indicators of tolerance to salinity in *Nitraria retusa* and *Atriplex halimus* plants growing under increasing salinity

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Abstract

Nitraria retusa and *Atriplex halimus* (xero-halophytes) plants were grown in 0-800 mM NaCl. Plants were harvested after 120 days of salt-treatment. The present study was designed to study the effect of salinity on plant growth, nutrition behaviour, ion distribution and plant water relations. The leaf area (LA) was measured by using a leaf area meter. The osmotic potential (ψ_s) was measured using a vapour pressure osmometer. Na^+ and K^+ contents were determined with a flame photometer (Model 410, Corning, Halstead, UK). Ca^{2+} and Mg^{2+} concentrations were measured with an atomic absorption spectrophotometer. Chloride concentration was performed using a digital chloridometer. Phosphorus was determined colorimetrically at 436 nm. Nitrogen content was determined by the Kjeldhal method adapted to the colorimetric method at 660 nm. Both xero-halophytic species showed positive plant growth for low levels of salinity. For example, shoots dry mass at 100 mM NaCl was about 15.5% to 29.7% higher in *N. retusa* and *A. halimus* plants, respectively. Increasing concentrations of salinity from 400-800 mM NaCl caused high salinity stress. At 800 mM NaCl level, shoot dry mass decreased by 51.5% and 69% in *N. retusa* and *A. halimus*, respectively (in relation to control). On the other hand, NaCl induced decrease in leaf expansion growth only at higher salinities levels in these species. The results show that the presence of salt leads to high accumulation of Na^+ and Cl^- in plant organs and particularly in the aerial parts. At 800 mM NaCl salt stress treatment, Na^+ content of shoots was 10.6 and 5.4 times than that in the control in *N. retusa* and *A. halimus*, respectively. This accumulation of ions is accompanied by improved leaf hydration in 100-400 mM NaCl in *N. retusa* and at 100-200 mM NaCl in *A. halimus*. It seems that these two species are able to sequester salt into leaf cells and used them for osmotic adjustment. Osmotic potential of the plants increased with increasing salinity in both species. On the other hand, the presence of salt leads to a restriction of the potassium, calcium, and magnesium alimentations and to a lesser extent nitrogen nutrition. This decrease is due to reduction of the absorption system performance of these cations and varies depending on the dose of salt and species. In addition, we observed significant increases in shoots and roots Na^+/K^+ , $\text{Na}^+/\text{Ca}^{2+}$ and $\text{Na}^+/\text{Mg}^{2+}$ ratio. The presence of salt in the irrigation solution did not affect the inorganic phosphorus content in plant organs. The values of sensitivity index of potassium nutrition are higher than those of calcium or magnesium and nitrogen nutrition in *A. halimus*, suggesting that salt reduces the absorption of K^+ than other elements. In *N. retusa* this sensitivity affects calcium and potassium nutrition. Moreover, this study shows for salinities above 400 mM NaCl, the content of Na^+ and Cl^- remained constant in *A. halimus* and even decreases significantly in *N. retusa*. It appears that salt excretion was involved in the strategies for salt tolerance in both xero-halophytic species, especially in *N. retusa*. From these results, it appears that the best growth of *N. retusa* is linked to greater succulence, better ability to control the absorption and transport of ions, and the nutrition preference with potassium, calcium, nitrogen and magnesium.

Quality comparison of conventionally and organically grown oranges in Spain

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Abstract

High product and process quality are key criteria for the successful marketing of organic products such as oranges. We compared the fruit quality of organically and conventionally grown Spanish oranges (cv. Navelina) as affected by date of harvest (either November or December 2008) and storage time (0, 1 or 2 months). Samples were taken from both a certified organic (ORG) and a conventional (CON) orchard (700 m distance) in the La Safor Valley, Gandia, close to Valencia, Spain. The vicinity to the Mediterranean Sea (ca. 5 km) resulting in little frost danger and the fertile calcareous soils favour the cultivation of oranges. In total 640 oranges (320 ORG and 320 CON) were analysed one by one following a systematic sampling procedure over 4 blocks (4 fruits per tree * 4 trees = 1 block).

A wide range of fruit physical and chemical parameters including weight and size, proportion of juice, Brix value, ascorbic acid and mineral content were measured. Data were submitted to ANOVA using a statistical model with repeated measurements, a procedure, which considers the results gained from individual fruits.

Conventionally compared to organically grown oranges had a significantly higher weight (224 vs. 204 g) and a larger height and diameter. The relative skin proportion was significantly lower in ORG (24,3%) compared to CON (26,7%), while the juice and pulp proportion of both growing systems were equal.

The L-ascorbic acid content was significantly higher in ORG compared to CON fruits (65,2 vs. 58,4 mg per 100g juice). The soluble dry matter and the citric acid content of the juice were not affected by the growing system. The potassium and magnesium (significant) content of orange juice tended to be higher in ORG, while the phosphorous (significant) and calcium content were higher in CON. Interestingly, colour skin, an important quality trait for consumers, was not affected by the growing system.

The experimental factors harvesting date and storage duration only had a slight effect on fruit quality (less than expected). However, as expected, a clear increase of the sugar / acid ratio was noted in later compared to earlier harvested fruits independent of the growing system.

All in all our data suggest that differences in the amount of beneficial compounds are not a key criteria for quality distinction of different growing systems, probably because they mainly depend on the variable fertilisation regimes.

Other important quality traits such as the amount of harmful compounds were not assessed in our experiment, but it is clear and evident that in general the amount of pesticide residues is much lower in organic as compared to conventional oranges.

Moreover, there is some evidence that the process quality, which includes environmental impacts such as groundwater contamination, is considerably higher under organic management.

Humus balancing for sustainable soil organic matter management

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Abstract

The maintenance and promotion of soil organic matter (SOM, humus) quantity and quality is of crucial interest in farming systems. Soil organic matter properties such as storage and transformation of nutrients, contribution to pest regulation, improvement of soil structure and a beneficial impact on the soil water household, are valuable ecosystem services and are of particular relevance under conditions of organic farming.

Against this background, humus balance methods have been developed as tools for the assessment of farming systems with regard to their impact on SOM dynamics. However, since coefficients for humus balances usually have been derived from long-term field experiments, methodical applicability is only given for locations with site conditions that are largely comparable to those at coefficient generation. A model-based approach offering the opportunity of bypassing this problem has been provided with the HUMOD method (Brock et al. 2009 and Brock et al., in prep.). Here, soil organic matter demand of crops is estimated relating to nitrogen in plant biomass, and humus supply is calculated based on organic matter inputs with plant material and fertilizers.

SOM demand is defined as the minimal amount of nitrogen in plant biomass that has necessarily been supplied by SOM mineralization, if the contribution of other inputs has been taken into account. Partial utilization of N from different input pools by plants is recognized applying site and management specific utilization rates.

SOM supply by organic matter inputs (harvest residues, roots, root exudates, straw, green manure, but also animal manure) is calculated recognizing organic matter losses during turnover with substrate specific humification rates.

Site specific calibration of the algorithm is possible especially by adapting utilization rates for nitrogen and/or humification rates. This can preliminarily be done based on literature data. Of course, the availability of particular (field) experiments would be especially valuable.

Under different environmental conditions in mid-Europe, the HUMOD approach performed sufficiently well, even though a need for further calibration was obvious. Up to now, the method has not been tested under arid or semiarid conditions, but basically the algorithm offers the opportunity of application under any site conditions, if data for calibration are available.

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Co-Composting of Agro-food Industries and Vineyard wood Residues: Extractable Lipids as an Indicator of Maturity

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Abstract

Organic agriculture relies greatly on building soil organic matter with compost, typically replacing inorganic fertilizers. Co-composting of poultry and milk derived processing industries and vineyard wood residues can be a potential source of compost in organic farming systems in the Mediterranean region. Before field application of such compost, determination of maturity is of utmost necessity in order to avoid adverse effects on plant growth due to reduced oxygen or nitrogen availability or the presence of phytotoxic compounds. Some of the methods that are used to measure compost maturity include temperature, color, odor, structure, specific gravity, C/N ratio, changes in nitrogen content, organic carbon content, humification parameters, respirometric indexes, germination index, microbial population changes, enzyme activity etc. However, there is no universal method for measuring compost maturity (Goyal *et al.*, 2005). Current approaches for estimation of compost stability and maturity are related to the concentration of different lipid fractions.

Two static piles of compost were prepared at the Mediterranean Agronomic Institute of Bari, Italy, on November 2009 by mixing manually i) poultry industry residue with vineyard wood and ii) milk deriving materials with the same wooden materials. The initial C/N ratio of the mixture was brought to 28 for both piles by using appropriate proportion of the starting materials on the basis of their carbon, nitrogen and moisture content. During 120 days of composting, pile turning or water adding were performed to maintain temperature below 70 °C and humidity between 55 and 65%. The experiment was designed to collect samples on 0, 7, 15, 45, 60, 90 and 120 days of composting to monitor changes in physico-chemical characteristics such as pH, organic carbon, total N, inorganic nitrogen, ash content together with microbiological characteristics such as static respiration index and microbial biomass. Besides, sequential extraction of lipids were performed firstly by diethyl ether (DEE) followed by chloroform (ClCH₃) in order to evaluate the changes in extractable lipids content during the process.

Organic carbon was observed to decrease within composting time together with the initial C/N ratio while total nitrogen was observed to increase due to a concentration effect. The content of ammonium nitrogen was found high at the beginning of the composting process and decreased with composting time while the nitrate nitrogen content increased at the end of the process. A ten day incubation period showed a reduction of carbon biomass and CO₂ evolution rate for both the piles indicating a decrease of microbial activity. Nitrogen biomass was found to differ accordingly with composting materials and composting time. The diethyl ether extractable lipids tend

to decrease during the composting process whereas the chloroform extractable ones remain rather constant, as reported elsewhere (Dinel *et al.*, 1996). Therefore, a number of selected indexes also related to the respiration activities of microbial biomass have been used in order to evaluate compost maturity with a quite simple and reliable procedure.

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Evaluation of pre-crops and fertilization on organic tomato production under Mediterranean conditions: Case of Tunisia

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Abstract

A crop rotation, including a mixture of leguminous fertility building as pre-crops and cash crops, is the main mechanism for nutrient supply within organic systems. Additionally, the use of adequate organic fertilization was necessary to promote organic crop production. The study evaluated the effect of pre-crops (fennel, peas, faba bean and control) and organic fertilizer (compost tea and commercial organic fertilizer) on soil properties and on qualitative-quantitative tomato fruit production. After pre-crop incorporation, soil organic matter (SOM), organic carbon (OC) and nitrogen (N) content increased. Moreover, plots grown by peas expressed the highest SOM, OC and Ex K content. Tomato plants grown after green manure and fertilized by commercial fertilizer showed the highest plant height. The highest tomato cumulative yield was noted for plots fertilized by compost tea, and the highest marketable yield was recorded for plots grown after fennel. The highest K and P content on tomato shoots were recorded for plots grown after green manure and fertilized by commercial fertilizer. Tomato shoot's Ca content was higher in plots fertilized by compost tea. The economic study showed that the highest gross margin was recorded for pea-tomato rotation fertilized by commercial fertilizer. The lowest one was recorded for faba bean-tomato rotation fertilized by compost tea and for fennel-tomato fertilized by compost tea.

Status of the phospho-potassic fertility of soils under in-season potato in the North-East of Tunisia

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Abstract

Potato is a crop which needs a lot of mineral and organic fertilizers. In order to assess the impact of the current practices of phospho-potassic fertilization on two types of soils differing in geomorphological localization, particle-size distribution and limestone content, a monthly monitoring of the soils by sampling was carried out during the growing season, which extends from February to June 2009. The first observation is that farmers apply rather high rates of phosphate-enriched fertilizers and that mineral potassic fertilization is not practiced.

Analysis of the soil samples showed high accumulations of phosphatic and potassic reserves in the two types of soils, which are probably the result of fertilizer excesses accumulated over many seasons of cultivation ; these reserves remain high even at the end of the growing cycle of the crop. In the sandy soil, a trend to in-depth migration of phosphorus and potassium was observed. Analysis of the exports by the tubers showed that these did not take the totality of the applied phosphorus and did not exhaust the soils in potassium. The rates of phosphate-enriched fertilizers are even too high that farmers will have to reduce them so as to bring down production costs and avoid the negative repercussions of phosphorus on the environment. The high residual potassium reserves at the end of the growing season in the two soils mean that the annual rates of organic fertilizers enable both to provide greatly for the needs of the crop as well as to maintain and improve the soil fertility.

There is no salinization in the soil of the low valley of Mejerda because of a high rainfall received by this area and the mode of management of the soil, which resulted in a leaching of salts outside the root zone.

Effect of N-source and soil amendments (organic matter) on wheat yield and N-uptake under Gezira conditions in Sudan

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Abstract

The central clay plains in Sudan where all large schemes are established are low in nitrogen and organic carbon. This can be corrected and improved through the application of organic and inorganic fertilizers for commercial and sustainable wheat production. Addition of animal manure to agricultural lands normally improves physical soil conditions and enhances organic matter content, as well as soil fertility. Generally nitrogen from organic matter will not satisfy plant's requirements, hence application of chemical fertilizer is of great importance. Thus combination of both chemical and organic fertilization may be important compliments to each other.

A field experiment was executed at the Gezira Research Station Farm for two consecutive seasons (1999, 2000) in order to assess the effects of farm yard manure (FYM), nitrogen (N) source fertilization on wheat growth and productivity NUE and N-uptake under Gezira conditions, Wad Medani, Sudan. The treatments consisted of three levels of FYM (0, 2.5 and 5 tons ha⁻¹), two source of nitrogenous fertilizer ,urea and ammonium nitrate (0 and 86 kg N ha⁻¹), were laid out in split plot design replicated three times. The FYM were assigned to the main plots whereas the N was plotted to the subplots. For the second season the land preparation was done manually so as not to disturb the treatments which were fixed in the same plots from the first season. Results of the study revealed that both FYM and N significantly influenced the yield and studied yield components of wheat in the two seasons except in the 1000-seed weight. The treatment consisting of 5 tons FYMha⁻¹ + 86 kgNH₄NO₃ha⁻¹ gave the highest wheat grain yield in the first and the second (3206, 3812 kg ha⁻¹, respectively). But the differences in wheat grain yield between the above mentioned nitrogenous fertilizers treatment were not statistically significant. Also N uptake and NUE increased significantly with increasing organic manure doses, but there were no significant differences between N-sources.

AS a conclusion there is no significant difference between N sources, but grain yield of wheat was positively associated with N uptake

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Valuation of the Extracts of Vegetable Compost in Fertigation of the Tomato Seedlings

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Abstract

The process of compost extraction is a mode of valorization which leads particularly to obtaining a fertilizing extract.

Accordingly, the present study proposes the valuation of the fertilizing power of two extracts (by calling upon a simple infusion) of compost (one resulting from a crush of *Acacia cyanophylla* and the other one resulting from a vegetable crush), while specifying the reports of suitable extraction and dilution for the production of the tomato seedlings. With this intention three tests, A, B and C, were set up.

Test A aimed to test the effect of the report of extraction (1: 4 and 1: 5) and of the frequency of contribution (One, two or three applications) of extract named ECCMVC (Extracted from Co-Compost Multi-Plants Sifted) with the same report of dilution (1/150) after 21 days of extraction on the growth of the tomato seedlings except ground. It shows that the variation of the report of extraction did not affect great the growth in height of the tomato seedlings, however the maximum value from growth is recorded for the ECCMVC (1:4) It also showed that the fertigation of the tomato seedlings according to two successive applications proves to be sufficient.

Test B had the objective of testing the incidence of the type of extract and reporting dilution on the growth in height of the tomato seedlings except ground. It proves that the variation of the type of extract did not have a great effect on the growth in height of the tomato seedlings, however the maximum value of growth is recorded for the extract named ECSC (Extracted from Sifted silvicultural Compost). It also proved that a dilution of 200 times of the concentrated extract is beneficial for the growth of these seedlings.

Test C aimed to test the effect of the time of extraction and the report of dilution on the growth in height of the tomato seedlings except ground. The results show that the variation of the time of extraction did not greatly affect the growth in height of the tomato seedlings, however the maximum value from growth is recorded for the ECSC at the 14th day and that the report of dilution influences slightly the growth of the tomato seedlings. However, for the ECSC at the 14th day like for the ECCMVC at the 21st day, the median value of the most considerable growth is that of the seedlings sprinkled by this extract with a report of dilution of (1/100).

The Importance of the vegetable biomass (waste of the green areas, waste forestry, waste oasiens, ...) strongly abundant in Tunisia encourages the research of the new possibilities of its valorization, the object of this preliminary work. This should be continued for a better optimization of the parameters of extraction and dilution of the extracts of compost.

Better use of sheep compost extract in the fertigation of tomato and pepper

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Abstract

The objective of this experiment is to prove the fertilising power of the sheep compost extract, stating precisely the best rapports of extraction and suitable dilution for the cultivation of tomato and pepper as summer strategic cultivation.

Two trials were done. The objective of the first one was the optimisation of sheep compost extraction rapport with 1/ 150 as dilution rapport. For this, rapports 1:6 (AF1), 1:5 (AF2) and 1:4 (AF3) were tested with a control (SF, without fertilisation). In the second trial, the goal was to determine the suitable dilution rapport between three rapports tested: 1/ 200 (AF'1), 1/150 (AF'2) and 1/100 (AF'3) (the rapport of extraction was 1: 5) with comparison to control (SF').

In the first experiment, in the case of tomato culture, from the measure 3 tacked after fertilization, the extraction with a rapport 1: 6 has given the best plant growth. In measures 4 and 5, the rapport 1: 4 was the more efficacious (respectively $15, 20 \pm 0,26\text{cm}$ and $18, 81 \pm 0,45\text{cm}$). Analysing the results obtained with 1: 5, shows that it can be considered as a suitable extraction rapport of sheep compost for the fertilization of tomato with a dilution of 1/150.

In the case of pepper culture, according to measures 3 and 5, the extraction rapport 1: 5 was the most efficacious (respectively $2, 55 \pm 0,29\text{cm}$ and $6, 96 \pm 0,41\text{cm}$). In measure 4, the best growth was obtained with a rapport of 1: 4. So that, the best extraction rapport of sheep compost for production of pepper plants is 1: 5 (dilution 1/ 150), that is why it was chosen for the next experiment.

In the second experiment concerning tomato plants, it was observed that according to the three last measures, the dilution 1/ 200 of concentrated compost extract (rapport of extraction 1: 5) has given the best plant growth (respectively $14,31 \pm 0,74\text{cm}$; $17,61 \pm 0,89\text{cm}$ and $20,72 \pm 1,08\text{cm}$) compared with the control.

In the case pepper plants, differences between treatments were not statistically significant ($P > 0,05$). The fertilization with its different dilution rapports has no effect on plant growth of pepper. It was observed that pepper plants fertilized with extract have a growth inferior to control. So, the sheep compost extract (1: 5 as extraction rapport), with its different rapports of dilution (1/ 200, 1/ 150 and 1/ 100) is not suitable for the fertilization of pepper plants in the case of the experimental conditions of our study.

This preliminary study has demonstrated the importance of the sheep compost extract in the plant fertilization, especially for tomato plants. In fact, this extract applied with an extraction rapport of 1: 5 and a dilution of 1/ 200 is a good stimulant for plant growth. But, such result was not obtained with pepper culture. Since pepper is also a strategic culture, the development of a biological fertilizing product is also important.

Attempt to optimize the extraction process Co-composting for better preparation of extracts

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Abstract

Demand for production plants, more and more intense soil and peat imported nationally, respectively, could create an imbalance in the ecosystem and a drain of foreign exchange by import. From this, a transformation technique such waste especially organic waste could be a solution capable of meeting the one hand, the reduction of pollution levels increasing, and secondly, the unlimited increase of production of organic matter in agriculture. The co-composting of animal origin and / or vegetable products according to conventional standards, have often unexpected properties beneficial for crop production (in ground or aboveground). In this perspective, realized that this work aims to enhance and optimize the process of extraction and dilution of extracts from co-compost (plant or animal) to better use aboveground. To this end, we conducted a simple extraction and double infusion of Co-compost (from biomass forestry and sheep) to determine the best physico-chemical and environmental extracts produced.

The main results show that:

- The method of extraction of Co-compost by double infusion did not improve significantly the balance of Abatement (inadequate reduction of pollution load), which encourages to continue the current practice of extraction with a simple infusion.

- The physico-chemical (MES, pH, EC, N, P and K) extracts of Co-compost helped to identify the optimal time needed for extraction (depending on the content of suspended during the 30 days of extraction considered) and the nutrient content according to the report and the extraction time. Basically shows that:

* Whatever the extraction ratio (1 / 4, 1 / 5 or 1 / 6), the extraction time of 14 days is sufficient time to ensure optimal extraction process.

* The extraction according to the report 1 / 5 or 1 / 6 should be chosen, based on the results observed TSS, while the extraction according to the report 1 / 4 showed a better fertilizer value previews. Based on these findings, it should opt to compromise, advising extraction according to the report 1/5, to reduce the polluting power of the extract while improving the nutrient content.

- Monitoring of environmental parameters (TSS, BOD5, COD, Ib) extracts of Co-compost showed mainly the following lessons:

* Suspended solids TSS are very high and far exceed the acceptable standards for discharge into the entrance to the STEP (TSS = 400mg / l) and discharge standards at the exit (SS = 30mg / l).

* The values of biological oxygen demand BOD5 far exceed the values tolerated by the discharge standards at the exit for the STEP (BOD5 = 30mg / l).

* The values of chemical oxygen demand COD does not exceed the values tolerated by the discharge standards at the entrance to the STEP (COD = 1000 mg / l).

* All index values of biodegradability Ib are less than 3, therefore, all substrates have become biodegradable.

Agronomic interest of the Residues of Rural Biomethanisation Applied to the Bovine Biomass

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Abstract

Vis-a-vis the programmed exhaustion of the fossil energy resource and with climate warming, renewable energies arouse a growing interest (BÉLINE and GAC, 2007). Among these renewable energies, the biomethanisation of the agricultural effluents presents some energetics and ecological interests.

So the valorization of organic waste and mainly animal manure for the production of biogas could be regarded as an economic, decentralized and ecological solution (TOU and al., 2001).

Concerning agronomic valorization, it constitutes an ideal way of action of management of waste in the world. The object of the majority of the pursued policies is to, at the same time, support this biological management of waste and to control the environmental and medical impacts which are potentially associated there.

Animal manure is particularly interesting to use when it is produced in significant and regular amounts (TOU and al., 2001) and especially when it is treated biologically (by biomethanisation and/or composting) before use. Thus there appears to be an interest growing for the composts and the residues of methanisation (FUCHS, 2008).

The conditioning of the digestat, a secondary by-product of the biomethanisation, generally allows obtaining a solid digestat, called methacompost and of a liquid digestat, called juice of process.

The recourse to the solid digestat or the compost like substitute integral or partial of the peat or the compost in the clothes industry of the substrates of growth could constitute an interesting alternative to limit the peat imports as well (and consequently the hemorrhage of the currencies) as the degradation of the arable and forest lands (following the excessive use of the composts agricultural and forest). In the same way, the liquid digestat could be spread directly on the arable lands, as it could be used as fertilizing solution of the cultures of full field and/or except ground.

This work consists of studying the possibilities of agronomic valorization except ground of the residues of the rural biomethanisation applied to the bovine dejections: the bovine methacompost as a substitute integral or partial of the peat and/or the compost and juice of bovine process like fertilizer of the market-gardening seedlings.

The significant preliminary results rising from this work are the following:

- The produced methacompost cannot be regarded as good substrate in a pure state, because of its relatively insufficient porosity of ventilation, which justifies its mixture according to adequate proportions, with the peat which has a higher porosity of ventilation. Besides the correction of the physical balance of the substrates of growth, the tests carried out during this study confirmed that the use of the peat mixed with methacompost (60% peat and 40% methacompost) as substrate of culture proves to be encouraging and powerful with respect to the speed of germination as well as growth in height of the pepper seedlings.

- The juices of process (concentrated or diluted at a rate of 25 to water 75%) showed very interesting fertilizing powers.

However, the results obtained are only preliminary and they deserve to be considered with prudence before the progress of checks.

Ultimately, the current trend towards the agrobiologic practices encourages the agronomic use of these digestats, because of the important depollution generated by the biomethanisation applied.

Soil fertility management in organic lettuce (*Lactuca sativa* L.): use of aerobic and anaerobic stabilized amendments

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Abstract

A three-year field experiment was carried out in the Metaponto plain (Southern Italy) on organically managed lettuce in order to evaluate the quality and quantity of the vegetable yield and the potential environmental risks of organic amendments application. The soil in the experimental site was silty-clay of alluvial origin, classified by Soil Taxonomy-USDA as Fine, Mesic, Typic Chromoxerert. Four-week-old lettuce (*Lactuca sativa* var. *longifolia* Lam., cv "Bacio") plants were transplanted manually in the autumn-winter of each year. The length of the cropping cycle ranged between 124 and 161 days. The following treatments supplying 140 kg N ha⁻¹ were compared: stabilized anaerobic digestate coming from wine distillery waste water (WWD); not stabilized organic material coming from wine distillery waste water (NWWD); olive waste compost (OWC); mineral N fertilizer (MIN); commercial organic fertilizer (FORG). These treatments were compared, in a randomized complete block experimental design with three replications, with an unfertilized control (CONTR).

The anaerobic digestate (WWD) significantly increased (37%) marketable yield compared to the unfertilized control, maintaining a comparable production with respect to the mineral treatment. In terms of quality of the marketable products, even if with low absolute values for all the investigated treatments, organic amendments showed lower level of nitrates in the leaves (ranging from 178 and 276 mg kg⁻¹) with respect to the mineral treatment (492 mg kg⁻¹). Moreover, organic treatments determined lower values of soil mineral N (ranging from 5 to 16 mg kg⁻¹) compared to the mineral fertilizer treatments (26 mg kg⁻¹). The NWWD and the OWC treatments had significantly lower biomasses and marketable yields (19% and 18%, respectively) than MIN.

Moreover, at the end of the three-year field experiment, no significant increase of soil heavy metal concentration was observed in any of the organic amendments treatments with respect to the control.

Our results demonstrated that, for short cycle vegetables, the typology of amendments applied plays a crucial role in crop performances and quality. In particular, in our research, the WWD treatment was able to ensure high yield and low risk of environmental impact.

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Influence of crop rotation and amendments application on lettuce yield and quality

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Abstract:

Two-years (2006 and 2007) of field research was carried out at Metaponto (MT) in Southern Italy, to evaluate the influence of crop rotation on lettuce performance. The effects of different organic amendments were also evaluated. In a strip-plot experimental design with three replications the following two-year crop rotations were evaluated: eggplant-lettuce and melon-lettuce. In each crop the following treatments were compared: mineral fertilizer, commercial stable manure, anaerobic digestate based on wine distillery wastewater, composted municipal solid organic wastes coming from the separate collection. In this note the lettuce yield and quality were presented.

Results showed that in both years lettuce yield was significantly influenced by the crop rotation. In particular, the previous cultivation of melon positively influenced all lettuce analyzed parameters compared with eggplant crop. The LAI values, green leaves number, height of tuft and SPAD readings did not show significant difference among organic treatments. The marketable yield, average weight of cleaned tuft and of heart showed lower values in organic treatments than in mineral one. However, the sustainability of low-input agronomical interventions, i.e. application of anaerobic digestate by wine distillery and compost by municipal solid waste, could have a great practical importance in organic farming and, at the same time, for the waste (agro-industrial and municipal solid) recycling and disposal, but it is necessary to improve the application methods to increase the productions.

Assessment of Tunisian agricultural wastes composts properties: application as components in reconstituted anthropic soils and their effects on tomato yield and quality

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(PM)) and mixtures of compost-manure CM. The amendments characterization showed that i) nitrogen contents were Organic amendments are mainly used for their potential of preventing soil losses. This work investigated the physico-chemical properties of six different organic amendments and their effects on the properties and productivities of reconstituted anthropic soils during a short-term application compared to farm manure. Treatments were obtained from Tunisian agricultural wastes composts (almond shell (AS), sesame bark (SB), olive cake (OC), olive mill wastewater sludge (OMWS) and poultry manure greater in olive wastes and PM based composts; ii) Carbon/Nitrogen ratio (C/N) and the organic matter (OM) contents ranged from 14.1-29.7 to 19.3-64.5 %, respectively; iii) the electrical conductivity (EC) was higher in manure (M) and compost-manure mixture (4.8-10.4 mS/cm) and iv) pH values were alkaline (8.2-8.8). Treatments were applied as compounds to a reconstituted soil at the ratio of 14 kg/m². The mixtures of soil/treatment (600 L/28 kg) were placed in metallic basins in order to form the reconstituted anthropic soil. Pilot areas were of 2 m² for each treatment and 2 × 2 m² for control. The assessment of the geochemical properties of soils during the cultivation period showed variations in soil organic matter SOM contents as well as pH and EC values. Soils productivity was determined by comparing quantitative and qualitative tomato fruits obtained from each plot amended with manure treated soil.

Properties of Tunisian wastes composts and their assessment for use as soilless substrate

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Abstract

The co-composting of waste is a new management priority in Tunisia. In this study, four composts, CI, CII, CIII and CIV were evaluated by comparing the changes in measured physic-hydric, physico-chemical properties and phytotoxicity. The organic wastes used were almond shell (AS), sesame bark (SB), olive husk (OH), and green and wood wastes (GW and WW, respectively). CI and CII were composed respectively of AS/SB and OH/SB at a ratio of 75/25 (wet weight basis). CIII was the compost of OH, SB and CAS (coarsely-ground almond shell used as a bulking agent) at a ratio of 55/25/20. Finally, CIV was composed of 25%SB+7%CAS+18%GW+48%WW. The composts studied were characterised by basic pH and an EC value ranging from 1.6 to 2.4 mS/cm. The organic matter (OM) contents and C/N ratios of composts ranged from 20 to 46 % and from 10 to 21, respectively. Physical and hydric analyses revealed that CI, CIII and CIV containing AS presented an interesting porosity and water contents (10-26% and 10-20%, respectively). The phytotoxicity of composts was studied by determining the cress seed germination. Studies revealed that the differences in properties are related to the nature of the waste and some of these properties are compatible with the use of composts as constituents in growing media for horticultural soilless culture.