Marginal lands for Growing Industrial Crops

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Type			Dissemination Level		
R	Document, report	☒	**PU**	Public	☒
DEM	Demonstrator, pilot, prototype	☐	**CO**	Confidential, only for members of the consortium (including the Commission Services)	☐
DEC	Websites, patent fillings, videos, etc.	☐			
OTHER		☐			

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Abbreviations

COGECA: General Confederation of Agricultural Cooperatives
COPA: Committee of Professional Agricultural Organisations
EIP-AGRI: European Innovation Partnership for Agricultural productivity and Sustainability
DBH: Diameter at Breast Height
DSS: Decision Support System
EC: European Commission
ET: Evapotranspiration
EU: European Union
GCV: Gross Calorific Value
GHG: Greenhouse Gas
JRC: Joint Research Centre
MAGIC: Marginal lands for Growing Industrial Crops
P: Precipitation
PA: Practice Abstract
REA: Research Executive Agency
SRC: Short Rotation Coppices

Partners short names

CIEMAT: Centro de Investigaciones Energéticas, Medioambientales y Tecnológicas
CRES: Centre for Renewable Energy Sources and Saving
IBCSB NAASU: Institute of Bioenergy Crops and Sugar Beet National Academy of Agrarian Sciences of Ukraine
Imperial: Imperial College of Science Technology and Medicine
LSFRI SILAVA: Latvijas Valsts Mezinatnes Instituts Silava
nova: nova-Institut für Politische und Ökologische Innovation GmbH
Spanish Co-ops: Cooperativas Agro-alimentarias de España
UHOH: Universität Hohenheim
UNICT: Università Degli Studi di Catania
WR: Stichting Wageningen Research
3B: BioWarmia Bioenergy and Bioresources Michal Krzyzaniak

1 Executive summary

One of the MAGIC Project targets is “to maximise stakeholder’ mobilization and enhance the impact of the project activities and outcomes for promoting the cultivation of industrial crops on marginal land”. In this line, practice abstracts (PA’s) are short summaries that describe main information that can serve end users in their daily practice. Following the guidelines of the EIP-AGRI and their common format, MAGIC will produce as many PA’s as required for dissemination over the entire duration of the project. PA’s will feed the newsletter and webpage of EIP-AGRI with easily understandable practical knowledge that is expected to reach a broader public.

This document presents twenty practice abstracts that introduce the potential or expected results at the end of the project. This report is a living document which will be updated as project progresses and results are available.

2 Introduction

The European Innovation Partnership for Agricultural productivity and Sustainability (EIP-AGRI) was launched by the European Commission in 2012. This initiative aimed to help all EU countries to provide their citizens with a more competitive economy, better jobs and life standards, fostering a competitive and sustainable agriculture and forestry sector that "achieves more from less".

The EIP-Agri adheres to the "interactive innovation model" which brings together specific actors (e.g., farmers, advisors, researchers, businesses, etc.) to work together in multi-actor projects to find a solution for a specific issue or developing a concrete opportunity. In this sense, communicating about projects activities and results is much easier through the use of a common format (see *Figure 2*). Such common format facilitates the knowledge flow and enables contacting farmers, researchers and all the other actors involved in innovation projects. The EIP common format consists of a set of basic elements characterising the project, including practice abstracts (PA's). The format is developed with the aim of enable the contact with partners, incentivise efficient knowledge exchange and to disseminate the results of the project in a concise and easy understandable way to practitioners.

All the PA's generated during the period of the MAGIC project are uploaded to the EIP-AGRI website (see *Figure 1*), where the information is shared at EU level, via the EIP- AGRI project database, a unique repository which supports the dissemination of results of all interactive innovation projects. In addition, these PA's will be a useful dissemination tool to share the updates and outcomes of MAGIC both with the EIP-AGRI subgroup of innovation and the COPA-COGECA Sectoral Boards of European farmers.

This document presents twenty PA's that have been developed based on the deliverables submitted so far and the outcomes provided by the long-term field trials. Even though not so many results are available at this time, the following PA's intended to present preliminary and potential results and provide an overview of the expected benefits for practitioners. As the project progresses, more PA's will be released based on other public deliverables, long-term field trials or any other useful outcomes.

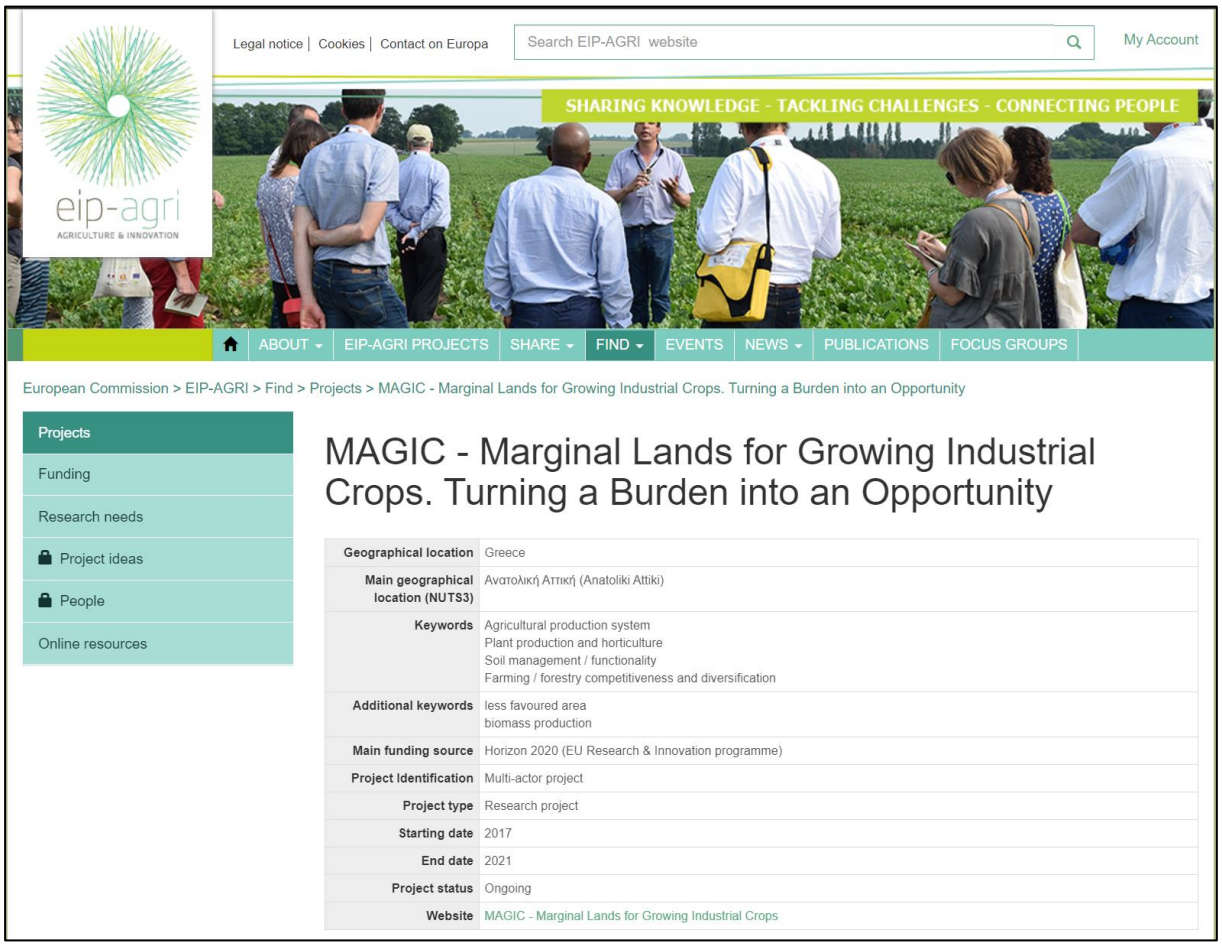


Figure 1. MAGIC at EIP-Agri website. Source: EIP-Agri

3 Methodology

Practice abstracts (PA's) are short summaries of around 1000 - 1500 characters (word count – no spaces) which describe main information/recommendations and serve end users in their daily practice. All PA's have been prepared following the guidance and Common Format of EIP-AGRI (see *Figure 2*) in the shape of an excel template. The information shown in this template (see Annex B) is accumulative and will be updated when new practice abstracts are available. Every PA must be accompanied by a short title of no more than 150 characters.

Summaries (see *Figure 3*) are expected to contain the following information:

- Main results/outcomes of the activity (expected or final).
- Main practical recommendations such as the main added value/benefit/opportunities to the end user.
- How the generated knowledge is implemented and how the practitioner can make use of the project results.

Both the summary and the title may be also provided in the native language of the coordinator or one of the partners. However, an English version of PA's must always be available. In addition to the PA's, the excel template contains some general information about the project, including keywords, list of partners and contacts, website and audio-visual material (see Annex B).

Finally, the PA is delivered to agri-eip-practice-abstracts@ec.europa.eu with copy to the Project Officer (REA) and Policy Officer (DG AGRI).

EUROPEAN COMMISSION
DIRECTORATE-GENERAL FOR AGRICULTURE AND RURAL DEVELOPMENT

Directorate H. Sustainability and Quality of Agriculture and Rural Development
H.5. Research and Innovation

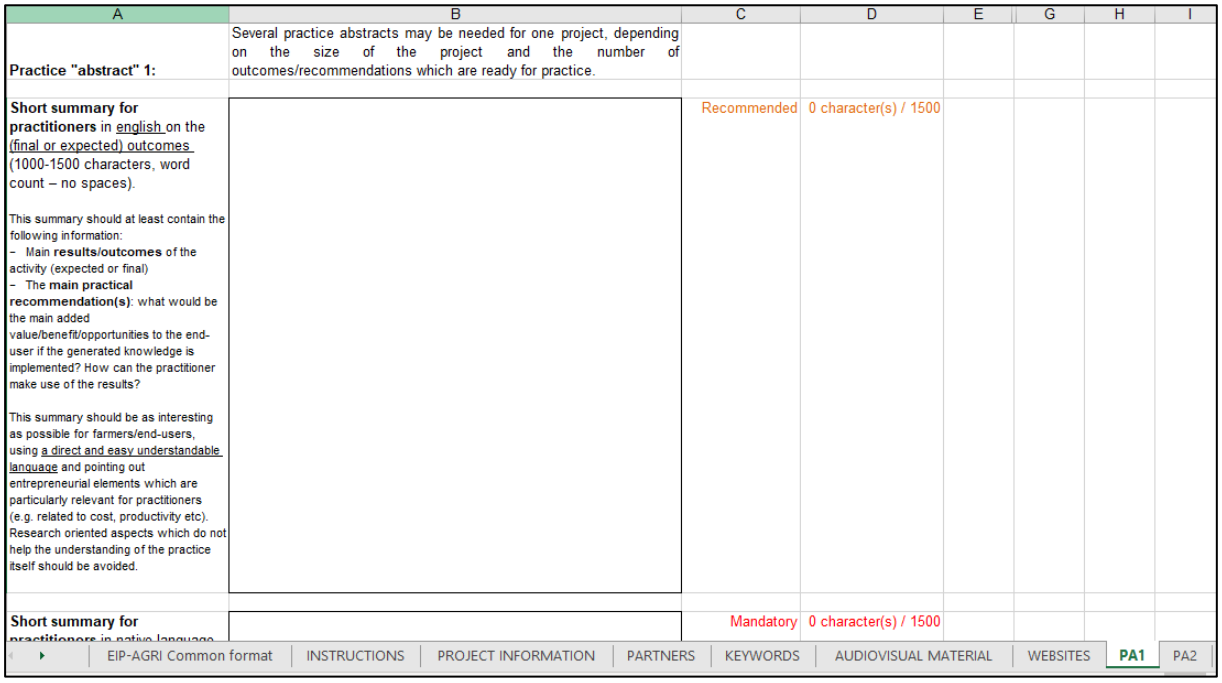
EIP-AGRI Common format for interactive innovation projects

The interactive innovation approach under the European Innovation Partnership Agricultural Productivity and Sustainability (EIP-AGRI)[1] fosters the development of demand-driven innovation, turning creative new ideas into practical applications thanks to interactions between partners, the sharing of knowledge and effective intermediation and dissemination.

The EIP **common format** consists of a set of basic elements characterising the project and **includes one (or more) "practice abstract"(s)**. The format was developed with two main objectives:
(1) to enable contacting partners and incentivise efficient knowledge exchange, and
(2) to disseminate the results of the project in a concise and easy understandable way to practitioners.
The common format allows providing information all along the life-cycle of the project. The **content of the common format can be updated at any moment** when useful, for instance in an intermediate phase of the project. Project information should at least be available at the beginning (describing the situation at the start of the project, including project title and objectives) and at the end of the project (describing the results/recommendations resulting from the project, including a final project report and one or more practice abstracts).

EIP-AGRI Common format | INSTRUCTIONS | PROJECT INFORMATION | PARTNERS | KEYWORDS | AUD

Figure 2. EIP-AGRI Common format. Source: EIP-Agri.



A	B	C	D	E	G	H	I
Practice "abstract" 1:	Several practice abstracts may be needed for one project, depending on the size of the project and the number of outcomes/recommendations which are ready for practice.						
Short summary for practitioners in english on the (final or expected) outcomes (1000-1500 characters, word count – no spaces). This summary should at least contain the following information: – Main **results/outcomes** of the activity (expected or final) – The **main practical recommendation(s)**: what would be the main added value/benefit/opportunities to the end-user if the generated knowledge is implemented? How can the practitioner make use of the results? This summary should be as interesting as possible for farmers/end-users, using a direct and easy understandable language and pointing out entrepreneurial elements which are particularly relevant for practitioners (e.g. related to cost, productivity etc). Research oriented aspects which do not help the understanding of the practice itself should be avoided.		Recommended	0 character(s) / 1500				
Short summary for practitioners in native language		Mandatory	0 character(s) / 1500				

EIP-AGRI Common format | INSTRUCTIONS | PROJECT INFORMATION | PARTNERS | KEYWORDS | AUDIOVISUAL MATERIAL | WEBSITES | PA1 | PA2

Figure 3. EIP-AGRI template for PA. Source: EIP-Agri.

4 Practice abstracts

4.1 PA1: About MAGIC Project

Author: nova

Title (English): Marginal lands for growing industrial crops

Summary (English): Marginal lands for Growing Industrial Crops (MAGIC) is a 4-year project and gets funding by the European Commission. The project aims to promote the sustainable development of resource-efficient and economically profitable industrial crops grown on marginal lands.

Industrial crops can provide abundant renewable biomass feedstocks for the production of high added-value bio-based commodities (such as bio-plastics, bio-lubricants, bio-chemicals, pharmaceuticals, bio-composites, etc.) and bioenergy. Most of these crops are multi-purpose and offer the opportunity to follow a cascade biorefinery concept to produce a number of high-quality bio-products and bioenergy, to strengthen the bio-based economy.

To achieve the project objectives, an up-to-date database of existing resource-efficient industrial crops will be developed with information on their agronomic characteristics, input requirements, yield performance and quality traits for end use applications. In parallel, current and future marginal lands in Europe facing natural constraints will be mapped, characterised and analysed to provide a spatially explicit classification that will serve as a basis for developing sustainable best-practice options for industrial crops. A Decision Support System (DSS) based on both MAGIC-CROPS and MAGIC-MAPS will be developed and validated with the active involvement of farmers and end users in order to choose the most promising industrial crop at any geo-location in Europe.

In the long term, this strategy will foster the sustainable development of the EU bio-based economy and will contribute to achieving EU energy and climate targets.

4.2 PA2: About definition and classification of marginal lands

Author: Spanish Co-ops (based on D2.1, prepared by WR)

Title (English): Definition and classification of marginal lands suitable for industrial crops in Europe

Summary (English): Industrial crops will provide feedstocks for bio-based applications, thereby, will foster the bioeconomy and provide diversification opportunities to farmers. MAGIC project has identified and mapped those marginal lands across Europe where industrial crops (oil, lignocellulosic, carbohydrate and specialty crops) could be grown in a sustainable way.

This mapping was based on a previous classification of marginal lands according to features such as:

-Biophysical constraints, considering adverse climate due to low temperature, dryness, or excessive wetness; analysing soil problems such as adverse chemical composition, low fertility, or limitations in rooting; and paying attention to adverse terrain due to steep slope.

-Socio-economic constraints regarding limited access to markets, difficult accessibility and bad infrastructure.

-Sustainability, since the impact of growing industrial crops depend very much on whether other land uses are replaced by the industrial crops (leading to potential competition with food production); on whether biodiversity and other ecosystem services will be affected; and on what industrial crops and what management systems are to be used.

Moreover, to determine whether a land is suitable for growing industrial crops or not, four key main features of the terrains classified as marginal lands must be pointed out: land can be marginal for agricultural use, but not for forestry use; marginality refers to the mentioned biophysical and socio-economic constraints; there are synonymous uses of “marginal lands” (abandoned farmland, low productivity, etc.); and that “marginality” is a dynamic feature which can change in time.

4.3 PA3: About spatially explicit map database of MAGIC

Author: Spanish Co-ops (based on D2.6, prepared by WR)

Title (English): Mapping marginal lands for growing industrial crops

Summary (English): The purpose of the MAGIC mapping is to characterize and analyse projections for current and future marginal lands in Europe facing natural constraints.

Identified MAGIC marginal lands are defined as: “Lands having limitations which in aggregate are severe for sustained application of a given use and/or are sensitive to land degradation, as a result of inappropriate human use, and/or have lost already part or all of their productive capacity as a result of inappropriate human use”. The elements that were considered in building the classification include biophysical limitations clustered in six main groups. In addition, the resulting marginal land map was further classified according to, land use management, socio-economic limitations, ecosystem services and drives and pressures influencing the ecosystem functions.

As a result, in total 29% of the agricultural land (i.e. land classified as agricultural by Corine Land Cover since 1992) in the European Union are classified as marginal. The most common limitations are rooting limitations, with 12% of the agricultural area. This is followed by adverse climate and excessive soil moisture occurring in respectively 11% and 8% of the agricultural land.

The spatial explicit classification created by MAGIC will serve as a basis for developing sustainable best-practice options for industrial crops in Europe. In addition, the spatially explicit map database is accessible via the project website and will be maintained and further improved during the project’s lifetime and at least five years beyond the project completion. Visitors to the public website can access the map to inform themselves about the marginal land status in their region but can also help to evaluate the quality of the map.

4.4 PA4: About MAGIC long-term field trials

Author: UHOH

Title (English): Long-term field trials with industrial crops on marginal land

Summary (English): One of the expected results of the MAGIC Project will be a comprehensive overview of the long-term performance potential of industrial crop cultivation on marginal land in Europe. For this purpose, the results of several long-term field trials with important industrial plants such as Miscanthus, Giant Reed, Reed Canary Grass, Camelina, Hemp and Poplar, which are carried out Europe-wide under the most important marginal growth conditions such as adverse rooting conditions, adverse climatic conditions and unfavourable terrain, will be compiled and evaluated. Many of these field trials are still on-going. In particular, the best low-input agricultural cultivation strategies for the crop categories ‘tillage’, ‘nitrogen fertilization’, ‘weed control’ and ‘irrigation’ will be identified.

Practitioners should benefit from the results by implementing low-input agricultural practices for industrial crop cultivation, which are adapted to both the marginality conditions of their locations and to the market requirements in their region. It is assumed that this will increase both the overall income of the farms and the net profit due to higher biomass yields (and qualities) and higher production efficiencies. In addition, to these direct benefits, it is expected to bring indirect benefits through improved legal frameworks resulting from the policy recommendations.

4.5 PA5: About Miscanthus long-term field trial in Germany

Author: UHOH

Title (English): Miscanthus cultivation on marginal land in southwest Germany

Summary (English): In 2012 and 2014, several field trials with Miscanthus (a perennial C4 grass for combustion and other conversion routes) were carried out at various marginal sites in southwest Germany. The most severe marginality conditions at one of these sites ('OLI') are a combination of adverse root conditions (shallow soil (10 - 20 cm) and stoniness (50%)) and low temperatures (frost and short vegetation period). At OLI, six genotypes of Miscanthus were established in 2014 (~1 plantlet/m²). Weeding was performed by hand in 2014 and 2015. The harvest was carried out each year in spring starting from 2016. No fertilization was applied. The previous crop was grassland. The estimated accumulated dry matter yields of the first three growing seasons (2015, 2016 and 2017) range between 12.4 t/ha (GNT 4) and 30.9 t/ha (*Miscanthus* × *giganteus*). These preliminary results suggest that low-input cultivation of Miscanthus on shallow stony soil under low temperature conditions may be a success depending on the genotype. *Miscanthus* × *giganteus* is expected to provide high dry matter yields (in relation to the given marginal growing conditions) also in the following seasons.

The expected main recommendation of these results is that farmers should consider the possibility of growing *Miscanthus* × *giganteus* on marginal areas similar to those of OLI (shallow stony soil + low temperature). In addition to economic benefits such as high biomass yields, low external inputs (fertilizers, pesticides) and low labour intensities (except for the

establishment procedure), there are a number of eco-systemic advantages of *Miscanthus* × *giganteus* over annual cultivation systems such as improved soil fertility, habitat networking and reduced soil erosion.

Title (German): Miscanthusanbau auf Marginalstandorten in Süddeutschland

Summary (German): In den Jahren 2012 und 2014 wurden an verschiedenen Marginalstandorten im Südwesten Deutschlands mehrere Feldversuche mit Miscanthus (einem mehrjährigen C4-Gras für die Verbrennung, Biogasproduktion und andere Konversionsarten) durchgeführt. Die stärksten Marginalitätsbedingungen an einem dieser Standorte ("OLI") sind eine Kombination aus ungünstigen Bodeneigenschaften (Flachgründigkeit (10 - 20 cm) und ein hoher Steinanteil im Oberboden (50%)) und niedrigen Temperaturen (Frost und kurze Vegetationszeit). Am OLI wurden 2014 sechs Genotypen von Miscanthus etabliert (~1 Planze/m²). In den Jahren 2014 und 2015 wurde das Unkraut mechanisch entfernt. Geerntet wurde ab 2016 jedes Jahr im Frühjahr. Auf eine Düngung wurde verzichtet. Die vorherige Kultur war Grünland. Die geschätzten kumulierten Trockenmasseerträge der ersten drei Vegetationsperioden (2015, 2016 und 2017) liegen zwischen 12,4 t/ha und 30,9 t/ha. Diese vorläufigen Ergebnisse deuten darauf hin, dass ein extensiver Anbau von Miscanthus auf flachem steinigem Boden in Kombination mit niedrigen Temperaturbedingungen ein Erfolg sein kann. Es wird erwartet, dass *Miscanthus* × *giganteus* auch in den folgenden Jahren hohe Trockenmasseerträge liefert.

Die erwartete Hauptempfehlung ist, dass die Landwirte die Möglichkeit in Betracht ziehen sollten, *Miscanthus* × *giganteus* auf Marginalstandorten anzubauen, die denen vom OLI ähneln. Neben wirtschaftlichen Vorteilen wie hohen Biomasseerträgen, geringem Einsatz von Arbeitsmitteln und niedrigen Arbeitsintensitäten gibt es bei Miscanthus gegenüber einjährigen Anbausystemen eine Reihe von ökosystemischen Vorteilen wie verbesserte Bodenfruchtbarkeit, Habitatvernetzung und geringere Bodenerosion.

4.6 PA6: About Energy Willow long-term field trial in Ukraine

Author: IBCSB NAASU

Title (English): Growing energy willow on marginal lands in Ukraine

Summary (English): In Ukraine, optimal conditions for willow growth exist in regions with an annual rainfall of at least 650 mm and groundwater in July at a depth of 0.6-2.0 m. Such places include floodplains, gullies, and ravines, where the following soil marginality types occur: hard clay soil, flood land, acid soil, saline soil, and peatland.

Growing willow on acid soils (pH < 5.0) is associated with the risk of release of mobile aluminum and manganese, which is manifested in the inhibition of root development, metabolic disorder, and, consequently, growth retardation. Therefore, such soils should be amended with lime ameliorants before planting in doses necessary for deoxidation of the root layer of the soil. Gypsum should be applied on saline soils (chestnut and light chestnut soils).

To control weeds effectively in the first years of growing one can mulch the soil with straw or sawdust, cover the soil with agrotextile, or mechanically destruct weeds using mulchers of plant residues.

On hard clay soils (clay content ≥ 50%) when planting, it is necessary to carry out ripping with ripper-cultivators to a depth of 45-50 cm at an interval of 140 cm. When soil crust occurs, it is necessary to carry out interrow loosening.

Treatment of willow cuttings before planting with humic products along with foliar fertilization in the first year can improve the survival and adaptation of plants to adverse growing conditions.

Title (Ukrainian): Вирощування енергетичної верби на маргінальних землях в Україні

Summary (Ukrainian): В Україні оптимальні умови для росту верби існують у регіонах з річною кількістю опадів не менше 650 мм і заляганням ґрунтових вод у липні на глибині 0,6–2,0 м. До таких місць відносяться заплави річок, балки і яри, де зустрічаються такі види маргінальності ґрунтів: ґрунти з високим вмістом глини, запливаючі, кислі, торфовища, рідше – солончаки.

Вирощування верби на кислих ґрунтах (pH < 5,0) пов'язане з ризиком вивільнення рухомих форм алюмінію й марганцю, що виявляється у пригніченні розвитку кореневої системи, порушенні обміну речовин і, як наслідок, сповільненні росту. Тому, такі ґрунти, перед закладанням плантації, необхідно розкислювати шляхом внесення вапняних меліорантів у дозах, необхідних для розкислення кореневмісного шару ґрунту. На солонцюватих ґрунтах (каштанові і світло каштанові) слід вносити гіпс.

Для ефективної боротьби з бур'янами в перші роки експлуатації плантації слід застосовувати мульчування ґрунту соломою або тирсою, агроволокно, або ж механічне знищення з використанням мульчувачів рослинних решток.

На важких глинистих ґрунтах (вміст глини ≥ 50%) при закладанні плантацій потрібно проводити щілювання культиваторами-щілювачами на глибину 45−50 см з інтервалом 140 см. При утворенні ґрунтової кірки необхідно проводити міжрядні розпушування.

Обробка живців верби перед садінням добривами на основі гуматів і позакореневе підживлення ними в перший рік вегетації дозволяють покращити приживання й адаптацію рослин до несприятливих умов вирощування.

4.7 PA7: About Miscanthus long-term field trial in Ukraine

Author: IBCSB NAASU

Title (English): Growing miscanthus on marginal lands in Ukraine

Summary (English): Miscanthus can grow on soils with the following types of marginality: acidic, saline, chemically contaminated, poor in organic matter, unfavourable soil structure, and steep slopes.

On soils with a low content of organic matter, the productivity of miscanthus significantly depends on the type and amount of fertilizer applied. Therefore, fertilization should be carried out taking into account the actual removal of nutrients with the harvest. Growing miscanthus on poor soils for seven years allows increasing the content of organic matter in the arable soil layer by 0.37%. There is also a positive effect of counteracting water erosion of the soil when grown on steep slopes.

On acidic and saline soils, it is necessary to amend the soil with lime or gypsum ameliorants before planting in doses necessary for deoxidation of the root layer of the soil.

Variation of planting depth within 8−16 cm does not affect the growth, development, and productivity of plants. Therefore, in regions with cold and snowless winters, it is recommended to plant the rhizomes deeper. Planting rhizomes in the ridges is not recommended due to the freezing of the soil.

High-quality biomass can be obtained with the aid of foliar feeding with a complex of microelements. This minimizes the accumulation of heavy metals in biomass on chemically contaminated soils.

Treatment of miscanthus plants in the first and second years with humic products can improve plant adaptation to adverse growing conditions.

On soils with unstable soil moisture, at planting, it is recommended to apply moisture-retaining hydrogel in the root-containing layer of the soil or in the planting hole at the rate of 150-300 kg/ha.

Title (Ukrainian): Вирощування міскантусу на маргінальних землях в Україні

Summary (Ukrainian): Міскантус можна вирощувати на ґрунтах з такими видами маргінальності: кислі, засолені, хімічно забруднені, бідні на органічні речовини, кам’янисті, з несприятливою структурою, розташовані на крутих схилах.

На ґрунтах із низьким вмістом органічних речовин продуктивність міскантусу значно залежить від виду й кількості внесених добрив. Тому удобрення потрібно проводити з урахуванням фактичного виносу поживних речовин із урожаєм. Вирощування міскантусу на бідних ґрунтах протягом семи років дозволяє збільшити вміст органічних речовин в орному шарі ґрунту на 0,37 %. Також спостерігається позитивний ефект протидії водній ерозії ґрунту за вирощування на крутих схилах.

На кислих і солонцюватих ґрунтах перед закладанням плантації варто вносити, відповідно, вапняні або гіпсові меліоранти в дозах, необхідних для розкислення кореневмісного шару ґрунту.

Варіювання глибини садіння ризом міскантусу в межах 8−16 см не впливає на ріст, розвиток і продуктивністю рослин. Тому, в регіонах з холодними й малосніжними зимами рекомендовано садити ризоми глибше. Висаджування рослин у гребені не бажане через промерзання ґрунту.

Біомасу високої якості можна отримати, якщо проводити позакореневе підживлення комплексом мікроелементів. Це дозволяє мінімізувати накопичення в біомасі важких металів на хімічно забруднених ґрунтах.

Обробка рослин міскантусу в перший і другий роки вегетації гуматами дозволяє покращити адаптацію рослин до несприятливих умов вирощування.

На ґрунтах з нестійким вологозабезпеченням при закладанні плантації рекомендується вносити в кореневмісний шар ґрунту або в лунку вологоутримувач-гідрогель з розрахунку 150−300 кг/га.

4.8 PA8: About Wild Sugar Cane long-term field trial in Italy

Author: UNICT

Title (English): Wild Sugar Cane on marginal lands affected by drought in southern Italy

Summary (English): Mediterranean climates are characterized by long periods of drought during summer and short dry periods from autumn to spring, what limits plant CO_2 assimilation and biomass production to a great extent. More limiting scenarios are forecasted due to climate change in the coming years in the Mediterranean basin. Under these circumstances, plants with excellent adaptation are needed. Perennial crops, and grasses in particular, have proved to be more efficient than annual crops for biomass production for several environmental and economic reasons. The Joint Research Centre (JRC) has set thresholds to define marginal lands in terms of biophysical constraints. In this case, climate limitation given by the ratio between precipitations and potential evapotranspiration (P/ET) was focused. Areas with P/ET ≤0.60 are classified as affected by dryness. The study follows up a long-term plantation of the C4 perennial grass wild sugarcane (*Saccharum spontaneum* ssp. *aegypticum*) under different water regimes in a semi-arid environment. The species were established at the experimental farm of the University of Catania in 2005 by using rhizome cuttings. Biomass dry matter yield was significantly affected by irrigation treatment and meteorological conditions of the growing season (mainly precipitation amount and distribution) with yield values ranging between 29.9 and 37.1 t/ha in full-irrigation, between 24.5 and 32.0 t/ha in half-irrigation and between 19.1 and 27.4 t/ha in rainfed conditions. Wild Sugar Cane is well adapted to environments dominated by dryness, and even after 10 years the biomass yield remain quite stable and at very high levels. However, agronomic, energetic, environmental and economic issues need further research.

Title (Italian): La canna d'Egitto in terreni marginali siccitosi

Summary (Italian): I climi mediterranei sono caratterizzati da lunghi periodi di siccità durante l'estate e brevi periodi di siccità dall'autunno alla primavera, il che limita in larga misura l'assimilazione della CO_2 e la produzione di biomassa. Scenari più limitanti sono previsti a causa del cambiamento climatico. In queste circostanze, sono necessarie specie in grado di ottimizzare le risorse naturali. Le colture perenni e in particolare le graminacee hanno dimostrato di essere più efficienti delle colture annuali per la produzione di biomassa per diverse ragioni agronomiche ed ambientali. Il JRC ha stabilito una serie di soglie per definire

le terre marginali in termini di vincoli biofisici. Il nostro studio focalizza sulla limitazione climatica data dal rapporto tra precipitazioni ed evapotraspirazione potenziale (P/ET ≤0,60). Il presente studio riporta una piantagione di lungo termine della canna d'Egitto (*Saccharum spontaneum ssp. aegypticum*) in diversi regimi idrici in un ambiente mediterraneo semi-arido. La resa della biomassa è stata significativamente influenzata dal trattamento di irrigazione e dalle condizioni meteorologiche della stagione di crescita (principalmente dalla quantità e distribuzione delle precipitazioni) con valori di resa compresi tra 29,9 e 37,1 t/ha in irrigazione completa, tra 24,5 e 32,0 t/ha in irrigazione ridotta e tra 19,1 e 27,4 t/ha condizioni idriche naturali. La specie si adatta bene agli ambienti dominati dall'aridità, e anche dopo 10 anni dalla piantagione la resa della biomassa rimane abbastanza stabile. Tuttavia, ulteriori ricerche conseguite per altre graminacee perenni (ad esempio, *A. donax, Miscanthus spp. P. virgatum, P. arundicnacea*, ecc.), devono essere affrontate.

4.9 PA9: About Arundo and Miscanthus long-term field trials in Italy

Author: UNICT

Title (English): Arundo and Miscanthus on marginal land affected by dryness in fertilized and unfertilized conditions in southern Italy

Summary (English): Perennial, non-food grasses have been proposed as the most efficient species for biomass production due to their agronomic, environmental and social benefits. Species characterized by high water use efficiency and low nitrogen requirement, well adapted to use natural resources of a specific environment, can be recommended as ideal crops. Along with irrigation and water savings, nitrogen requirement is a significant issue in intensive agriculture and has a great effect over the energetic balance of crops. Therefore, low input cropping systems could directly mitigate greenhouse gas emissions. In this case long-term plantations of two perennial grasses (*Arundo donax* and *Miscanthus x giganteus*), grown in rainfed conditions under two nitrogen regimes, were compared in an environment affected by dryness (according to the thresholds set by the Joint Research Centre (JRC) in terms of ratio between precipitations and potential evapotranspiration (P/ET ≤0.60)). *Miscanthus x giganteus* and *Arundo donax* were transplanted in summer 1993 and in spring 1997, respectively. In 2015 (22-year for Miscanthus and 18-year for Arundo), Arundo and Miscanthus (fertilized with 80 kg N ha^{-1}) showed similar yields (11.9 and 10.4 t/ha), while Arundo unfertilized (N0) produced 10 t/ha against 5.3 t/ha of Miscanthus N0. In 2016 (23-year for Miscanthus and 19-year for Arundo) Arundo and Miscanthus N0 produced 10.6 and 6.2 t/ha, while Arundo and Miscanthus N80 attained 15.3 and 8.7 t/ha. In 2017 (24-year for Miscanthus and 20-year for Arundo) a similar trend was observed, Arundo N80 showed the highest yield (14.9 t/ha) followed by Miscanthus N80 (9.7 t/ha), Arundo N0 (8.4 t/ha) and Miscanthus N0 (5.9 t/ha).

Title (Italian): Arundo e Miscanthus in terreni marginali siccitosi in condizioni concimate e non-concimate

Summary (Italian): Le graminacee perenni, non alimentari, sono state proposte come le specie più efficienti per la produzione di biomassa grazie all'elevata efficienza dell'uso delle risorse naturali. Le specie caratterizzate da un'elevata efficienza d'uso dell'acqua e un basso

fabbisogno di azoto, possono essere raccomandate come colture ideali. Accanto al risparmio di acqua, il fabbisogno di azoto è un problema significativo nell'agricoltura intensiva e influisce notevolmente sull'equilibrio energetico delle colture. Nel presente studio sono state confrontate coltivazioni a lungo termine di due graminacee perenni (*Arundo donax e Miscanthus x giganteus*) coltivate in condizioni di idriche naturali in due regimi di concimazione azota in un ambiente affetto da siccità (secondo le soglie stabilite dal JRC in termini di rapporto tra precipitazioni ed evapotraspirazione potenziale (P/ET ≤0,60)). Miscanthus e Arundo sono stati trapiantati nell'estate del 1993 e nella primavera del 1997, rispettivamente. Nel 2015 (22 anni per Miscanthus e 18 anni per Arundo), Arundo e Miscanthus (concimati con 80 kg/ha di N) hanno mostrato rese simili (11,9 e 10,4 t/ha), mentre Arundo non concimato (N0) ha prodotto 10 t/ha contro 5,3 t/ha di Miscanthus N0. Nel 2016, Arundo e Miscanthus N0 hanno prodotto 10,6 e 6,2 t/ha, mentre Arundo e Miscanthus N80 hanno ottenuto 15,3 e 8,7 t/ha. Nel 2017 è stata osservata una tendenza simile, Arundo N80 ha mostrato la resa più elevata (14,9 t/ha) seguito da Miscanthus N80 (9,7 t/ha), Arundo N0 (8,4 t/ha) e Miscanthus N0 (5,9 t/ha).

4.10 PA10: About Siberian Elm long-term field trial in Spain

Author: CIEMAT

Title (English): Siberian Elm long-term field trial in Spain

Summary (English): Siberian Elm (*Ulmus pumila* L.) is a hardy and fast-growing tree that features greater resistance to Dutch Elm disease than other species in genus *Ulmus*. Drought tolerance, adaptation to different environments and sprouting capacity suggest that this plant species could be grown as a short rotation energy/industrial crop.

Siberian Elm was planted in 2 plots in 2009 and 2010 in marginal land in Soria province (North-Central Spain). The marginality factors were climate (low temperature) and soil (texture, stoniness, organic matter). In 2009, two plant densities (3,333 and 6,666 plants/ha) under two irrigation regimes (2,000 and 4,000 m^3/ha) were implemented and one plant density was established in rainfed conditions in 2010. Furthermore, 2 crops cycles were studied in each plot.

The results for a nine year period confirmed that Siberian Elm is a fast-growing woody species, adapted to the harsh climate of Soria: cold winters, frosts, and wind. It is also resistant to pests and diseases since no pesticide treatment has been carried out.

Siberian Elm prefers well-drained soils, although it also tolerates a wide variety of adverse conditions, such as soils with low organic matter content and flooding situations.

Yield was strongly influenced by the amount of irrigation water applied, planting densities and crop cycle. Maximum yields were obtained with planting densities of 6,666 and 3,333 trees/ha cropped every 3 and 4 years, respectively. The yield ranged between 4 - 7.5 t/ha.

The composition of the biomass was: ash content 3.0%, 48.0% C, 6.0% H, 0.5% N and Gross Calorific Value (GCV) of 19.2 MJ/kg.

Title (Spanish): Ensayo de campo a largo plazo con olmo siberiano en España

Summary (Spanish): El olmo de Siberia (*Ulmus pumila L.*) es una especie de rápido crecimiento, con mayor resistencia a plagas y enfermedades que otras especies del género Ulmus. Es tolerante a la sequía, se adapta a diferentes condiciones ambientales y tiene alta capacidad de rebrote, pudiendo utilizarse como cultivo energético o industrial en corta rotación.

Se establecieron dos parcelas de olmo de Siberia en tierras marginales de la Provincia de Soria en distintas fechas: noviembre de 2009 y abril de 2010. Los factores de marginalidad en ambas parcelas son debidos a las bajas temperaturas y las condiciones del suelo (textura, pedregosidad, materia orgánica). En la parcela establecida en 2009 se estudiaron dos densidades (3.333 y 6.666 plantas/ha) y dos regímenes hídricos (2000 y 4000 m^3/ha), mientras que en la parcela establecida en 2010 se ensayó una densidad de 3.333 plantas/ha en secano. Además, en cada parcela se estudiaron dos turnos de corta, cada 3 y 4 años.

Los resultados obtenidos en los 9 años de crecimiento muestran que el olmo es una especie de rápido crecimiento, adaptado al clima duro de Soria: inviernos fríos, heladas y viento. Es una especie resistente a plagas y enfermedades ya que no ha sido necesario aplicar tratamientos fitosanitarios. Aunque prefiere suelos bien drenados, tolera situaciones de encharcamiento puntuales o baja materia orgánica.

Los rendimientos de biomasa dependieron de la cantidad de riego aplicada, la densidad de plantación y el ciclo de cultivo, obteniéndose las mayores producciones con densidades de 6.666 plantas/ha en ciclos de 3 años y 3.333 plantas/ha en ciclo de 4 años. El rendimiento de biomasa varió entre 4-7,5 t/ha.

La composición de la biomasa fue: cenizas 3,0 %; C 48,0 %; H 6,0 %; N 0,5 %; PCS 19.2 MJ/kg.

4.11 PA11: About Tall Wheatgrass long-term field trial in Spain

Author: CIEMAT

Title (English): Tall Wheatgrass long-term field trial in Spain

Summary (English): Perennial grasses have been envisaged by the scientific community as an interesting group of plant species for the sustainable production of biomass in marginal land in terms of crop diversification, improved control of soil erosion and recovery of soil organic matter content. Compared with annual grain crops, perennial biomass crops require fewer inputs, produce more energy and reduce Greenhouse Gas (GHG) emissions than annual cropping systems.

In 2010 and 2013, field trials with Tall Wheatgrass were carried out in two marginal lands in Soria province (North-Central Spain). The marginality factors were climate (low temperature) and soil (texture, stoniness, organic matter). In 2010 *Elytrigia elongata* Alkar was studied as single crop and mixed with other annual and perennial species. In 2013 three *Elytrigia elongata* cultivars: Alkar, Szarvasi-1 and Bamar were established on a parcel.

The results obtained in an eight year period showed that Tall Wheatgrass is a species well adapted to the hard climate conditions of Soria with a high tolerance to drought. Moreover, it is a crop resistant to pests and diseases since no pesticide treatment has been carried out.

Tall Wheatgrass prefers well-drained soils, although it tolerates a wide variety of adverse conditions, such as soils with low organic matter content and moderate salinity. However, flooding situations should be avoided.

Yields were between 2 and 5 t/ha. *Elytrigia elongata* Alkar produced the most yield when planted as single crop. *Elytrigia elongata* Szarvasi-1 produced the most yield.

The composition of the biomass was: ash content 5.2%, 46.0% C, 6.1% H, 0.6% N and Gross Calorific Value (GCV) of 18.5 MJ/kg.

Title (Spanish): Ensayo de campo a largo plazo con agropiro en España

Summary (Spanish): Las gramíneas perennes representan un grupo de interés para la producción sostenible de biomasa en tierras marginales, tanto en términos de diversificación de cultivos como para el control de la erosión y la mejora del contenido de materia orgánica del suelo. En comparación con los cultivos anuales, los cultivos perennes requieren menos insumos, gastan menos energía y reducen las emisiones de gases de efecto invernadero.

Se establecieron dos parcelas de agropiro en tierras marginales de la Provincia de Soria en años distintos: 2010 y 2013. Los factores de marginalidad en ambas parcelas son debidos a las bajas temperaturas y las condiciones del suelo (textura, pedregosidad, materia orgánica). En la parcela establecida en 2010 se estudió Agropiro (*Elytrigia elongata* Alkar) como cultivo solo y mezclado con otras especies anuales y perennes. En la parcela establecida en 2013, se ensayaron 3 cultivares de *Elytrigia elongata*: Alkar, Szarvasi-1 y Bamar.

Los resultados obtenidos en los 8 años de crecimiento muestran que el agropiro es una especie bien adaptada a las duras condiciones climáticas de Soria, con alta tolerancia a la sequía. Además, el cultivo es resistente a plagas y enfermedades, ya que no ha sido necesario llevar a cabo tratamientos fitosanitarios.

Tolera situaciones de baja materia orgánica y moderada salinidad, debiendo evitarse el encharcamiento del suelo.

Los rendimientos de la biomasa estuvieron entre 2-5 t/ha. *Elytrigia elongata* Alkar produjo el mayor rendimiento cuando se sembró sin mezclar en 2010. En el estudio comparativo sembrado en 2013, *Elytrigia elongata* Szarvsi-1 produjo el mayor rendimiento.

La composición de biomasa fue: cenizas 5,2 %; C 46,0 %; H 6,1 %; N 0,6 %; PCS 18,5 MJ/kg.

4.12 PA12: About Switchgrass long-term field trial in Spain

Author: CIEMAT

Title (English): Switchgrass long-term field trial in Spain

Summary (English): As Tall Wheatgrass, Switchgrass is a perennial grass that offers similar advantages.

Switchgrass (*Panicum virgatum* L.) is a warm season C4 grass propagated by seeds. Since the early 1990's the crop has been developed as an herbaceous energy crop for ethanol and electricity production.

In 2013 trials were carried out in Badajoz Province (South-Western Spain) under irrigation conditions. Cultivar used was Alamo. The aim of this work was to investigate the optimal dose of seeds. Two treatments were tested: 12 and 20 kg/ha, and minimum tillage conditions. The volume of water applied was 3,700 m^3/ha.

The results showed that it is a species adapted to sandy-loam soil and acidic pH of 6.6. In Spain, irrigation was necessary in order to ensure the good establishment and high biomass yields as well.

In this case, higher doses of seeds resulted in higher productions, showing yields between 10 and 17 t/ha.

The composition of the biomass was: ash content 5.1%, 46.2% C, 5.9% H, 0.53% N and Gross Calorific Value (GCV) of 18.6 MJ/kg.

Title (Spanish): Ensayo de campo a largo plazo con switchgrass en España

Summary (Spanish): El switchgrass (*Panicum virgatum L.*) en una gramínea perenne con ventajas similares a las del agropiro.

Se trata de una especie C4 de clima cálido propagada por semillas. Desde principios de 1990 ha sido estudiada como cultivo energético herbáceo para producción de electricidad y para etanol.

Los ensayos empezaron en 2013 bajo condiciones de riego en la provincia de Badajoz (Sureste de España). El cultivar ensayado fue Alamo. El objetivo del ensayo fue investigar la dosis óptima de siembra. Para ello, se ensayaron dos dosis: 12 y 20 kg/ha, en condiciones de mínimo laboreo. El volumen medio de agua aplicada durante los años de ensayo fue de 3.700 m^3/ha.

Los resultados muestran que es una especie adaptada a suelo franco-arenoso y pH acido de 6,6. En las condiciones de España, debe garantizarse el regadío tanto para asegurar un buen establecimiento del cultivo como para lograr altos rendimientos de biomasa.

Los resultados muestran que las producciones de biomasa están relacionadas con la dosis de siembra, implicando mayores dosis un incremento de las producciones. Los rendimientos de biomasa estuvieron entre 10-17 t/ha.

La composición de la biomasa fue: contenido de cenizas 5,1 %; carbono 46,2 %; hidrógeno 5,9 %; nitrógeno 0,53 %; poder calorífico superior 18,6 MJ/kg.

4.13 PA13: About Switchgrass long-term field trial in Greece

Author: CRES

Title (English): Switchgrass cultivation on marginal land in central Greece

Summary (English): Two Switchgrass field trials were established by seeds in 1998 on marginal land located in central Greece and are still on-going. The aim was to identify the appropriate cultural practices of Switchgrass when grown on marginal land. Tested factors were: 10 varieties in the first and 5 in three nitrogen rates (0, 75 and 150 kg N/ha) in the second. Varieties were: Caddo, Alamo, Blackwell, Cathage, Cave-in-rock, Forestburg, Kanlow, Pangburn, SL 93-2, SL 93-3, SL 94-1, SU 94-1 and Summer.

Biomass yields were maximized in the second growing period and come up to 20 t/ha (oven-dried), almost double to yields recorded at first year. In the 3rd year a yield reduction was measured from 5% to 20%. Yields reduction continued in year 4 and for more than a decade the dry matter yields varied from 12 to 14 t/ha. Further reduction was recorded from 18th till 20th year of the plantation and the mean dry yields varied from 8 to 10 t/ha during this period. During two decades lowlands varieties gave always higher yields but the superiority of lowland over upland was quite profound till the 6th growing period. Lowland varieties were higher with stronger stems and thus had higher lodging resistance than upland ones. Lodging problems were recorded for the upland varieties at the mid-point of the tested years and at the end of summer, after strong rainfall with high winds. In the first years, no significant effect of nitrogen fertilization on growth and yields was recorded. From year 6 to 20 dry yields for switchgrass varieties were always higher in the plots that received 150 kg N/ha as top fertilization. From 18th growing season the plantation began to look quite old and the tiller density had been greatly reduced. The average mean yields of switchgrass (oven-dried) fields was 12 t/ha.

Title (Greek): Καλλιέργεια σε περιθωριακή γη της κεντρικής Ελλάδας

Summary (Greek): Το 1998 πραγματοποιήθηκαν δύο δοκιμές στον τομέα του switchgrass από σπόρους σε οριακές εκτάσεις που βρίσκονται στην κεντρική Ελλάδα και βρίσκονται ακόμη σε εξέλιξη. Ο στόχος ήταν να εντοπιστούν οι κατάλληλες πολιτιστικές πρακτικές του switchgrass όταν καλλιεργούνται σε περιθωριακή γη. Οι παράγοντες που ελέγχθηκαν ήταν: 10 ποικιλίες το πρώτο και 5 σε τρεις ρυθμούς αζώτου (0, 75 και 150 kg N/ha) στη δεύτερη. Οι ποικιλίες ήταν: Caddo, Alamo, Blackwell, Cathage, Cave-in-rock, Forestburg, Kanlow, Pangburn, SL 93-2, SL 93-3, SL 94-1, SU 94-1 και Summer.

Οι αποδόσεις της βιομάζας μεγιστοποιήθηκαν κατά τη δεύτερη περίοδο καλλιέργειας και ανέρχονται σε 20 τόνους/εκτάριο (φυγή), σχεδόν διπλάσιες από τις αποδόσεις που καταγράφηκαν κατά το πρώτο έτος. Κατά το 3ο έτος μετρήθηκε μείωση της απόδοσης από 5 % σε 20 %. Η μείωση των αποδόσεων συνεχίστηκε κατά το έτος 4 και για περισσότερο από μια δεκαετία οι αποδόσεις ξηρής ύλης κυμαίνονταν από 12 έως 14 τόνους/εκτάριο. Περαιτέρω μείωση σημειώθηκε από το 18ο έως το 20ο έτος της φυτείας και οι μέσες ξηρές αποδόσεις κυμαίνονταν από 8 έως 10 τόνους/εκτάριο κατά την περίοδο αυτή. Κατά τη διάρκεια δύο δεκαετιών πεδινών ποικιλιών έδιναν πάντα υψηλότερες αποδόσεις, αλλά η ανωτερότητα των πεδινών στα ορεινά εδάφη ήταν αρκετά βαθιά μέχρι την 6η περίοδο ανάπτυξης. Οι πεδινές ποικιλίες ήταν υψηλότερες με ισχυρότερους μίσχους και έτσι είχαν μεγαλύτερη αντοχή στο κατάλυμα από ό, τι τα ορεινά. Καταγράφηκαν προβλήματα στέγασης για τις ορεινές ποικιλίες στα μέσα των δοκιμασμένων ετών και στο τέλος του καλοκαιριού, μετά από έντονες βροχοπτώσεις με δυνατούς ανέμους. Κατά τα πρώτα έτη, δεν καταγράφηκε καμία σημαντική επίδραση της γονιμοποίησης του αζώτου στην ανάπτυξη και τις αποδόσεις. Από το 6 έως το

20 οι ξηρές αποδόσεις για τις ποικιλίες switchgrass ήταν πάντα υψηλότερες στις εκτάσεις που έλαβαν 150 kg N/ha ως κορυφαία γονιμοποίηση. Από την 18η καλλιεργητική περίοδο η φυτεία άρχισε να φαίνεται αρκετά παλιά και η πυκνότητα των γεωργών είχε μειωθεί σημαντικά. Η μέση μέση απόδοση των πεδίων switchgrass (με ξήρανση) ήταν 12 t/ha.

4.14 PA14: About Short Rotation Coppices long-term field trial in Poland

Author: 3B

Title (English): Short Rotation Coppices cultivation on sandy soil with different soil enrichment method in Poland

Summary (English): Poplar, Willow and Black locust are Short Rotation Coppices (SRC) species. Their plantations are established mainly on poor quality marginal or contaminated soils. The aim of this research, located in North-Eastern Poland, was to determine the impact of soil enrichment method on survivability, productivity and energy value of a yield of three plant species cultivated in four-year harvest cycle on sandy soil. This sandy soil was characterized by unfavourable air and water conditions. Such conditions caused in periods of no precipitation permanent water shortage for plants. The highest average yield of dry biomass, in four-year rotation, was found for Willow, 33.36 t/ha. Poplar yielded 0.5 t/ha lower and Black Locust almost three times lower. The highest yield in the whole experiment was obtained for Poplar fertilized with lignin and mineral fertilizers (41.96 t/ha). A similar yield was obtained for Willow fertilized with lignin, mycorrhiza and mineral fertilizers (41.20 t/ha) and fertilized with lignin and mineral fertilizers (39.32 t/ha). The use of lignin in combination with mineral fertilizers resulted in an increase in the yield by 8-14% compared to mineral fertilizers alone for Willow and Poplar and in a nearly twofold increase for Black Locust. The energy value of the yield ranged from 28.6 to 176.7 GJ/ha, respectively, for Black Locust grown on the control plot and for Poplar grown on the plot with mineral fertilization and lignin used in combination. Thus, real possibilities of increasing the biomass and energy yield of SRC on sandy soils have been found, including marginal ones, by appropriate selection of woody species and soil enrichment. These results should be verified in subsequent harvesting cycles.

Title (Polish): Zaganiki uprawiane w krótkich rotacjach na glebie lekkiej wraz z różnymi metodami wzbogacenia gleby w Polsce

Summary (Polish): Topola, wierzba i robinia akacjowa to gatunki uprawiane w krótkich rotacjach (SRC). Ich plantacje prowadzone są głównie na glebach marginalnych lub skażonych i niskiej jakości. Celem tych badań, zlokalizowanych w północno-wschodniej Polsce, było określenie wpływu metod wzbogacania gleby na przeżywalność, produkcyjność i wartość energetyczną plonu trzech gatunków roślin uprawianych w czteroletnim cyklu zbiorów na glebie piaszczystej. Gleba ta charakteryzowała się niekorzystnymi warunkami powietrzno-wodnymi. Takie warunki powodowały w okresach braku opadów stały niedobór wody dla roślin. Najwyższy plon suchej biomasy, w czteroletniej rotacji, stwierdzono dla wierzby (33,36 t/ha). Topola dała 0,5 t/ha mniejszy, a robinia prawie trzy razy mniejszy plon. Najwyższy plon uzyskano dla topoli nawożonej ligniną i nawozami mineralnymi (41,96 t/ha). Podobny plon uzyskano dla wierzby nawożonej ligniną, mikoryzą i nawozami mineralnymi (41,20 t/ha) i

nawożonej ligniną i nawozami mineralnymi (39,32 t/ha). Zastosowanie ligniny w połączeniu z nawozami mineralnymi spowodowało wzrost plonu wierzby i topoli o 8-14% w porównaniu do samego stosowania nawozów mineralnych oraz prawie dwukrotny wzrost dla robinii. Wartość energetyczna plonu wahała się od 28,6 do 176,7 GJ/ha, odpowiednio dla robinii uprawianej w kotroli i topoli uprawianej na poletku z łącznym nawożeniem mineralnym i ligniną. Wyniki te pokazują realne możliwości zwiększenia plonu biomasy i wydajności energetycznej SRC na glebach piaszczystych, w tym na marginalnych, poprzez odpowiedni dobór gatunków i metod wzbogacanie gleby. Wyniki te należy zweryfikować w kolejnych cyklach zbiorów.

4.15 PA15: About Willow long-term field trial in Poland

Author: 3B

Title (English): Biomass yield from Willow cultivated in 4-year harvest cycle on marginal land in Poland

Summary (English): In this study, the biomass yield and morphological traits of plants were reported from a field trial with six genotypes of Willow, cultivated in northern Poland. Willow was planted using a pole cutting system, which is called Eco-Salix. Two planting densities were selected: 5,200 and 7,400 plants/ha at two marginal sites. The first site had heavy textured clay soil and the second site was located on peaty muck soil. The aim of this study was to determine the morphological traits of plants and the biomass yield of six Willow genotypes (clones and varieties) under low-input agriculture on two marginal soils with a quadrennial harvest cycle. In the field trial, the average Willow biomass yield of dry matter was 7.87 t/ha. The new variety Ekotur had higher yield and more favourable morphological traits compared to other registered Polish varieties. The Willow biomass yield obtained on peat muck soil was significantly higher than from Willow grown on heavy textured clay soil. Eco-Salix system could be effective if used: (i) in regions of low forest coverage to increase biodiversity; (ii) on lands permanently or periodically too wet; (iii) and on land where heavy machinery cannot be used for soil preparation. The Eco-Salix system has the potential to produce high yields of Willow biomass under conditions of low-input agriculture (no or reduced tillage, and a limited number of other management practices) using poles on marginal soils. Furthermore, Ekotur (*Salix viminalis*) and cv. Doutur (*S. alba*) can be recommended for cultivation due to high biomass yield on peat-muck soil. When converting land to bioenergy production, the Eco-Salix system can be used on marginal lands and can provide additional environmental and financial benefits.

Title (Polish): Plon biomasy wierzby uprawianej w 4-letniej rotacji zbioru na gruntach marginalnych w Polsce

Summary (Polish): W doświadczeniu tym określono plon biomasy i cechy morfologiczne sześciu genotypów wierzby, uprawianych w północnej Polsce. Doświadczenie założono za pomocą żywokołów (nieukorzenionych pędów o długości 2.4 m) tak zwanym systemem Eko-Salix. Zastosowano dwie gęstości sadzenia: 5 200 i 7 400 roślin na hektar na dwóch gruntach marginalnych. Pierwsze stanowisko położone było na ciężkiej glebie ilastej, a drugie znajdowało się na glebie torfowo-murszowej. Celem badań było określenie cech morfologicznych roślin i produkcyjności sześciu genotypów wierzby (klonów i odmian) bez

uprzedniej uprawy na dwóch glebach marginalnych w czteroletnim cyklu zbioru. Średni plon suchej biomasy wierzby z doświadczenia wynosił 7,87 t/ha. Nowa odmiana Ekotur dała wyższy plon i miała korzystniejsze cechy morfologiczne w porównaniu do wcześniej zarejestrowanych polskich odmian. Plon biomasy wierzby uzyskany na glebie torfowo-murszowej był znacznie wyższy niż z wierzby uprawianej na ciężkiej glebie ilastej. Można wnioskować, że system Eko-Salix może być skuteczny, jeżeli jest stosowany: (i) w regionach o niskiej lesistości, w celu zwiększenia różnorodności biologicznej; (ii) na gruntach trwale lub okresowo zbyt mokrych (gleby ciężkie gliniaste i ilaste, gleby torfowe); (iii) oraz na gruntach, gdzie maszyny rolnicze są zbyt ciężkie i nie mogą być użyte do przygotowania gleby. System Eko-Salix może dać wysokie plony biomasy wierzby w warunkach rolnictwa niskonakładowego (brak lub ograniczona uprawa i niska liczba innych zabiegów agrotechnicznych) przy użyciu żywokołów na glebach marginalnych. Ponadto, odmiana Ekotur (*Salix viminalis*) i cv. Doutur (*S. alba*) mogą być zalecane do uprawy na glebie torfowo-murszowej.

4.16 PA16: About Scots Pine long-term field trials in Latvia

Author: LSFRI SILAVA

Title (English): Scots Pine long-term field trials in Latvia

Summary (English): In Northern Europe Scots Pine (*Pinus sylvestris*) is one of the most often planted tree species in plantations. When planted in abandoned agricultural land and intensively tended, Pine successfully takes root in open areas. 15-year-old plantations in 7 sites were evaluated. Overall, the growth of plantation Pine is evaluated as average or good, yet it grows best in naturally dry podzolic sandy, sod-podzolic sandy loam and gravelly loam soils. When plantation is established on marginal or abandoned agricultural land, Scots Pine shows slow development in the first 5 years (on average 0.10 to 0.15 m/year). Diameter at Breast Height (DBH, 1.3 m) is reached at 6 - 8 years, and the growth of Pines increase at this age. 15-year plantation Pine on agricultural land shows the same DBH parameters that are found on forest land at 25 - 28 years and average height at 16 -18 years. The stock volume of well-growing plantation Pine may by the age of 15 be as high as 80 to 155 m^3/ha, and by 22 years reach even 243 m^3/ha. Pine plantations produce the highest stock volume in podzolic, cultivated, and sod-podzolic soils, where the stock volume for 15 to 16-year Pine is 112 to 155 m^3/ha, with the current volume growth 5 to 8 m^3/ha. Above ground biomass analysis show that in plantations 12 - 15-year-old tree has total biomass of 137 - 190 kg consisting of stem biomass 70 - 149 kg (51 - 78%) and crown biomass 67 - 42 kg (49 - 22%). Agricultural land can be too fertile for Scots Pine, leading to rapid growth, but also to development of thick lateral branches, which decreases wood quality and even stock volume. Therefore, it is important to prune the trees and carry out thinning no later than at 14 - 15 years of age.

Title (Latvian): Parastās priedes ilgtermiņa izmēģinajuma pētījumiLatvijā

Summary (Latvian): Ziemeļeiropā, parastā priede (*Pinus sylvestris*) ir viena no biežāk stādītajām koku sugām mežā, bet ne lauksaimniecības zemju apmežojumos. Stādot pamestās lauksaimniecības zemēs un intensīvi kopjot, priede ir ieaudzējama atklātās platībās. 15 gadīgos stādījumos 7 vietās, dažādos apstākļos vērtētas apmežošanas sekmes. Priežu

plantāciju mežu augšana vērtējama kā vidēja vai laba, tomēr tā vislabāk jūtas dabiski sausās podzola, velēnu podzolētās mālsmilts un oļainās mālsmilts augsnēs ar nepaaugstinātu grunts ūdens līmeni). Kad plantāciju izveido uz marginālas zemes, parastā priede uzrāda lēnu attīstību pirmajos 5 gados (vidēji 0,10 līdz 0,15 m gadā–1). Diametrs krūšu augstumā (DBH, 1,3 m) tiek sasniegts 6 - 8 gados, paātrinās priežu augšana.

15 gadu vecumā plantāciju mežā augušiem kokiem DBH parametri atbilst mežos 25 - 28 gadus augušiem kokiem. Vidējais priežu augstums plantāciju mežā 15 gados ir līdzīgs 16 -18 gadus veciem mežā augušiem kokiem. Priežu stādījuma krāja 15 gadu vecumā variē no 80 līdz 155 m^3/ha, bet 22 gadu laikā sasniedz pat 243 m^3/ha. Priežu stādījumos vislielāko krājas apjomu iegūst podzolaugsnēs, kultūraugsnēs un velēnu podzolētas augsnes, kur 15 līdz 16 gadu parastās priedes krājas apjoms ir 112 līdz 155 m^3/ha, un ikgadējais krājas pieaugums ir 5 līdz 8 m^3/ha. Virszemes biomasa 12 –15 gadus vecu koku stādījumos variē no 137 līdz 190 kg, (stumbrs 70 –149 kg (51 –78%) un vainagi 67 –42 kg (49 –22%)). Lauksaimniecības zeme var būt pārāk auglīga, pārlieku strauja parastās priedes augšana saistīta ar kupla vainaga un daudzu sānzaru veidošanos, tas samazina stumbra – baļķa koksnes kvalitāti un pat to koksnes krājas apjomu. Tāpēc ir svarīgi atzarot mērķkokus un veikt kokaudzes retināšanu jau 14 – 15 gadu vecumā.

4.17 PA17: About MAGIC good practices

Author: Spanish Co-ops (based on D7.1., prepared by Imperial)

Title (English): Good practices in MAGIC

Summary (English): Marginal lands are in large part attributed to agricultural fields which have been abandoned. This is a major problem in terms of environmental, socioeconomic and landscape implications, as it can cause several impacts, such as higher risk of fires, loss of biodiversity, water scarcity, etc., essential for the sustainable development of rural communities. The aim of identifying ‘Good Practices’ is to understand the context of using marginal land for cropping, the state and prospects for industrial crops, the conditions framing their cultivation and the supply chains as well as their operational capacities across time and development stages. The process of identifying the ‘Good Practice’ involves gathering information on successes and failures of growing industrial crops on marginal lands in different contexts and lessons learned from them followed up with analysis of what works, what does not work and why. The ‘Good Practice’ can be assessed based on a combination of technical, environmental, economic and socio-economic criteria and indicators.

It will follow practices which rehabilitate the biophysical constraints related to the soil and water conditions of the land while improving environmental, economic and societal establishments and operational aspects of the value chain. These practices will lead a path to policy success in integrating industrial crops cultivated in marginal lands in bio-based value chains. The ‘Good Practice’ when assessed will score highest on these indicators compared to other practices in the region.

4.18 PA18: About low-input agricultural practices

Author: Spanish Co-ops (based on D4.1., prepared by UHOH)

Title (English): Low-input agricultural practices for industrial crops on marginal land

Summary (English): The identification of the most suitable industrial crops that can be cultivated in the European "prevalent marginal agro-ecological zones" (MAEZ), as well as of the "marginal agricultural land low-input systems" (MALLIS) for growing these crops were among the main issues addressed by MAGIC.

In addition to the economic and environmental aspects, the research was also based on the current knowledge on best low-input agricultural practices for food crop production on good soils. It sought to optimize the use of on-farm resources and minimize off-farm inputs, which translates into having a more ‘closed’ production cycle and requires more advanced agronomic skills.

As a conclusion, the selection of suitable industrial crops was found to be the most important component in the development of MALLIS, because all other measures (tillage, fertilization, weeding, irrigation, etc.) very much depend on the site-specific performance of the crop. The expected overall performance of the crops was analysed by means of a multi-criteria analysis.

Some examples of the conclusions are:

-in Mediterranean climate conditions and soils with unfavourable texture and stoniness tall wheatgrass can be cultivated using practices of minimum/no tillage. Also, Siberian elm could be cultivated in rainfed;

-in Atlantic climate conditions and soils contaminated by wastewater the lignocellulosic crops such as miscanthus can be cultivated with minimum/no tillage and bio-fertilisation;

-in Continental climate conditions and soils with hard clay and limited soil drainage there can be cultivated crops such as tall wheatgrass, willow, hemp, poplar or reed canary grass with minimum/no tillage, reduced fertilization and weed control practices.

4.19 PA19: About factsheets of the existing resource-efficient industrial crops

Author: Spanish Co-ops (based on D1.5, prepared by CRES)

Title (English): Handbook with factsheets of the existing resource-efficient industrial crops

Summary (English): MAGIC consortium has gained an extensive knowledge on industrial crops by coordinating and participating in several relevant national & EU projects. This experience has allowed to create a handbook with fact sheets of the existing resource-efficient industrial crops. In them, useful agronomic information is presented in a synthetic way.

Although not all aspects were available for each crop, most factsheets present information on crop features such as varieties, soil and climate preferences, soil preparation and sowing, water and fertilization needs, yields, uses, qualitative traits, harvesting, handling, storing, environmental impacts and risks associated with cultivation (diseases, insects and weed control).

All this information was supported by a thoroughly research work on literature, position papers, project reports, etc. In total, twenty factsheets are available for the following crops:

- Amaranth
- Calendula
- Camelina
- Caper spurge
- Castor bean
- Crambe
- Ethiopian mustard
- Flax
- Industrial hemp
- Kenaf
- Nettle
- Pennycress
- Poplar
- Safflower
- Sorghum
- Spartium
- Sunflower
- Sunn hemp
- Switchgrass
- Wild tobacco

All the factsheets can be found at MAGIC website over the Reports&Deliverables tab (D1.5 – Handbook with fact sheets of the existing resources-efficient). In addition, MAGIC has created MAGIC-CROPS, a database that provides a description of 37 industrial crops suitable for growing on marginal land in Europe where more information can be found. You can also access MAGIC-CROPS through the main page of MAGIC website.

4.20 PA20: About factsheets of the inventory on available harvesting technology

Author: Spanish Co-ops (based on D5.1, prepared by CREA)

Title (English): Inventory on available harvesting technology for industrial crops on marginal lands

Summary (English): The apparent lack of appropriate machinery significantly affects farmers' perception of the possibility to cultivate industrial crops. Thus, the development of a comprehensive inventory on currently available harvesting systems of industrial crops on marginal land has been considered as a need in the MAGIC project. This inventory gathers information obtained from direct data collection in previous projects, scientific literature review and market analysis on the current existing technologies used to harvest non-food crops in marginal lands and included in the MAGIC CROPS database.

The inventory document is organized in fact-sheets representing an “easy-to-find” and “easy-to-use” instrument for final users, providing a rapid identification of the principal mechanized harvesting solutions for a specific crop, according to the final use of the biomass. For each crop a traffic light is included to provide indications about the status of knowledge on harvest technologies. In total, twenty factsheets are available for the following crops:

- *Sorghum bicolor L.*
- *Camelina sativa L.*
- *Crambe abyssinica L.*
- *Ricinus communis L.*
- *Panicum virgatum L.*
- *Miscanthus x giganteus*
- *Arundo donax L.*
- *Agropyron elongatum (Host)*
- *Brassica carinata L.*
- *Cannabis sativa L.*
- *Phalaris arundinaceae L.*
- *Carthamus dictorius L.*
- *Cynara cardunculus L.*
- *Thlaspi arvense L.*
- *Salix spp*
- *Populus spp*
- *Robinia pseudoacacia L.*
- *Ulmus pumila L.*
- *Saccharum spontaneum L.*
- *Lupinus mutabilis Sweet*

Factsheets can be found at MAGIC website over the Reports&Deliverables tab (D5.1 – Inventory on available harvesting technology for industrial crops on marginal lands).

5 Up-coming practice abstracts

17 PA's were planned at the beginning of the project from a selection of public deliverables of the MAGIC project (see *Table 1*). The selection of the respective deliverables was made by the consortium according to the expected results and findings from the tasks that could be of interest to practitioners and farmers. All those deliverables from the below list that were released before Month 36 (June 2020) already have PA's available in Section 4. However, since most of them will be released at the end of the project, their PA's will be included at "D8.6 - Final list with the practice abstracts following the EIP AGRI common format". In addition, partners involved in long-term field trials will also summarize and update their main outcomes during the lifetime of the MAGIC project. Finally, any other useful results obtained will be added in the PA format.

Table 1. List of selected deliverables for PA elaboration. Source: MAGIC Project.

Deliverable	Title
D1.5	Handbook with fact sheets of the existing resorce-efficient industrial crops
D1.10	Final version of the MAGIC-DS available on the website
D2.1	Definition and classification of marginal land suitable for industrial crops in Europe
D2.5	Final MAP-DB
D2.6	Methodological approaches to identify and map marginal land suitable for industrial crops in Europe
D3.4	New lines of industrial crops with improved quality adapted to marginal land
D4.2	Farmers' guidelines on "How to cultivate profitable industrial crops on marginal land"
D5.1	Inventory on available harvesting technologies for industrial crops on marginal land
D5.2	High-resolution maps of potential biomass supply from marginal land around a biorefinery
D5.4	Release of the Bio2Match tool user interface and documentation
D5.6	Report on Demand-driven supply and logistics plan for industrial crops from marginal lands for existing operational biorefineries
D6.7	Report on integrated sustainability assessment
D7.1	Report with profiles of Best Practice Cases
D7.2	Report with analysis of Best Practices
D7.3	Report on key findings and transferability
D7.4	Best-Practice Guidelines
D7.5	Policy recommendations

6 Conclusions

This document gathers the twenty practice abstracts that have been produced in the first thirty-six months of the MAGIC Project. While PA1 provides an overview of the general purpose of the MAGIC Project, PA2 present some of the factors and approaches used by WR to define and identify MAGIC marginal lands (Task 2.1). In addition, in PA3 the expectations for the spatially explicit map database (Task 2.4) that will be created from it, are presented.

PA4 and PA18 present some of the expected outcomes from Task 4.2 and Task 7.1, respectively. PA19 and PA20 describe the structure of the factsheets for the existing resource-efficient industrial crops and for the available harvesting technology. The other PA's summarize preliminary outcomes that have been obtained to this point from several long-term field trials (from PA5 to PA15).

Although not so many results are currently available, the present PA's are intended to introduce preliminary and potential results and provide an overview of the expected benefits for practitioners. As the project progresses, more practices abstracts will be released based on other public deliverables, long-term field trials or any other useful outcomes.

This deliverable is linked with Tasks 8.3 (EIP and Operational Groups interaction) and 8.4 (Multi-Actor networking) from WP8.

In line with Task 8.3, MAGIC will take advantage of the seat on the EIP-AGRI subgroup of innovation (through Spanish Cooperatives-COGECA) and foster the interaction with it. Contacts with the EIP-Service point staff have been held to arrange collaboration as closest as possible, including feeding the newsletter and webpage of EIP-AGRI with easily understandable practical knowledge for broad dissemination in the common EIP format, such us the practice abstracts presented in this document. In this sense, all PA's included in "D8.10 - List with the practice abstracts following the EIP common format (version 1)" were sent in the Common Format template (see Annex B) to the EIP-AGRI staff at the beginning of 2019, being uploaded to their website just after it (see *Figure 1*). Same procedure will take place after the submission of this deliverable.

Regarding Task 8.4, MAGIC will periodically report its findings to COPA-COGECA, through their Sectorial Boards of European farmers (Oilseeds & Protein Crops WG, Cereals WG, Environment WG, BioEnergy WG, and Rural Development WG). In this sense, several presentations to the COPA-COGECA Innovation, Cereals and Oilseeds & Proteins Working Parties have already been performed by Spanish Co-ops at the end of 2019 in Brussels. PA's will be used as supporting material to report on the advances of the project and collect their comments, suggestions and doubts, if any.

7 References

CENTRE FOR RENEWABLE ENERGY SOURCES AND SAVING – CRES, 2019. *PA13: About Switchgrass long-term field trial in Greece.*

CENTRE FOR RENEWABLE ENERGY SOURCES AND SAVING – CRES, 2020. *PA19: About factsheets of the existing resource-efficient industrial crops.*

CENTRO DE INVESTIGACIONES ENERGÉTICAS, MEDIOAMBIENTALES Y TECNOLÓGICAS – CIEMAT, 2018. *PA10: About Siberian Elm long-term field trial in Spain.*

CENTRO DE INVESTIGACIONES ENERGÉTICAS, MEDIOAMBIENTALES Y TECNOLÓGICAS – CIEMAT, 2018. *PA11: About Tall Wheatgrass long-term field trial in Spain.*

CENTRO DE INVESTIGACIONES ENERGÉTICAS, MEDIOAMBIENTALES Y TECNOLÓGICAS – CIEMAT, 2018. *PA12: About Switchgrass long-term field trial in Spain.*

CONSIGLIO PER LA RICERCA IN AGRICOLTURA E L'ANALISI DELL'ECONOMIA AGRARIA – CREA, 2020. *PA20: About factsheets of the inventory on available harvesting technology.*

EIP-AGRI Agricultural and Innovation. EIP-AGRI common format

https://ec.europa.eu/eip/agriculture/en/eip-agri-common-format

EIP-AGRI Agricultural and Innovation. EIP-AGRI MAGIC specific website

https://ec.europa.eu/eip/agriculture/en/find-connect/projects/magic-marginal-lands-growing-industrial-crops

IMPERIAL COLLEGE OF SCIENCE TECHNOLOGY AND MEDICINE – IMPERIAL, 2018. *PA17: About MAGIC good practices.*

INSTITUTE OF BIOENERGY CROPS AND SUGAR BEET NATIONAL ACADEMY OF AGRARIAN SCIENCES OF UKRAINE - IBCSB NAASU, 2020. *PA6: About Energy Willow long-term field trial in Ukraine.*

INSTITUTE OF BIOENERGY CROPS AND SUGAR BEET NATIONAL ACADEMY OF AGRARIAN SCIENCES OF UKRAINE - IBCSB NAASU, 2020. *PA7: About Miscanthus long-term field trial in Ukraine.*

BIOWARMIA BIOENERGY AND BIORESOURCES MICHAL KRZYZANIAK – 3B, 2019. *PA14: About Short Rotation Coppices long-term field trial in Poland.*

BIOWARMIA BIOENERGY AND BIORESOURCES MICHAL KRZYZANIAK – 3B, 2019. *PA15: About Willow long-term field trial in Poland.*

LATVIJAS VALSTS MEZZINATNES INSTITUTS SILAVA – LSFRI SILAVA, 2019. *PA16: About Scots Pine long-term field trials in Latvia.*

MAGIC Project, 2017. *Definition and classification of marginal land suitable for industrial crops in Europe.* Deliverable 2.1.

MAGIC Project, 2017. *Dissemination plan.* Deliverable 8.1.

MAGIC Project, 2017. *MAP-DB (version 1).* Deliverable 2.2.

MAGIC Project, 2017. *Methodological approaches to identify and map marginal land suitable for industrial crops in Europe.* Deliverable 2.6.

MAGIC Project, 2017. *Low-input agricultural practices for industrial crops on marginal land.* Deliverable 4.1.

MAGIC Project, 2018. *Report with profiles of Best Practice Cases.* Deliverable 7.1.

MAGIC Project, 2018. *Handbook with factsheets of the existing resource-efficient industrial crops.* Deliverable 1.5.

MAGIC Project, 2019. *Inventory on available harvesting technologies for industrial crops on marginal land.* Deliverable 5.1.

MAGIC Project, 2019. *List with the practice abstracts following the EIP common format (version 1).* Deliverable 8.10.

NOVA-INSITITUT FUR POLITISCHE UND OKOLOGISCHE INNOVATION GMBH – nova, 2019. *PA1: About MAGIC Project.*

STICHTING WAGENINGEN RESEARCH – WR, 2020. *PA2: About definition and classification of marginal lands*.

STICHTING WAGENINGEN RESEARCH – WR, 2018. *PA3: About spatially explicit map database of MAGIC*.

UNIVERSITA DEGLI STUDI DI CATANIA – UNICT, 2018. *PA8: About wild sugar cane long-term field trial in Italy*.

UNIVERSITA DEGLI STUDI DI CATANIA – UNICT, 2018. *PA9: About arundo and miscanthus long-term field trials in Italy.*

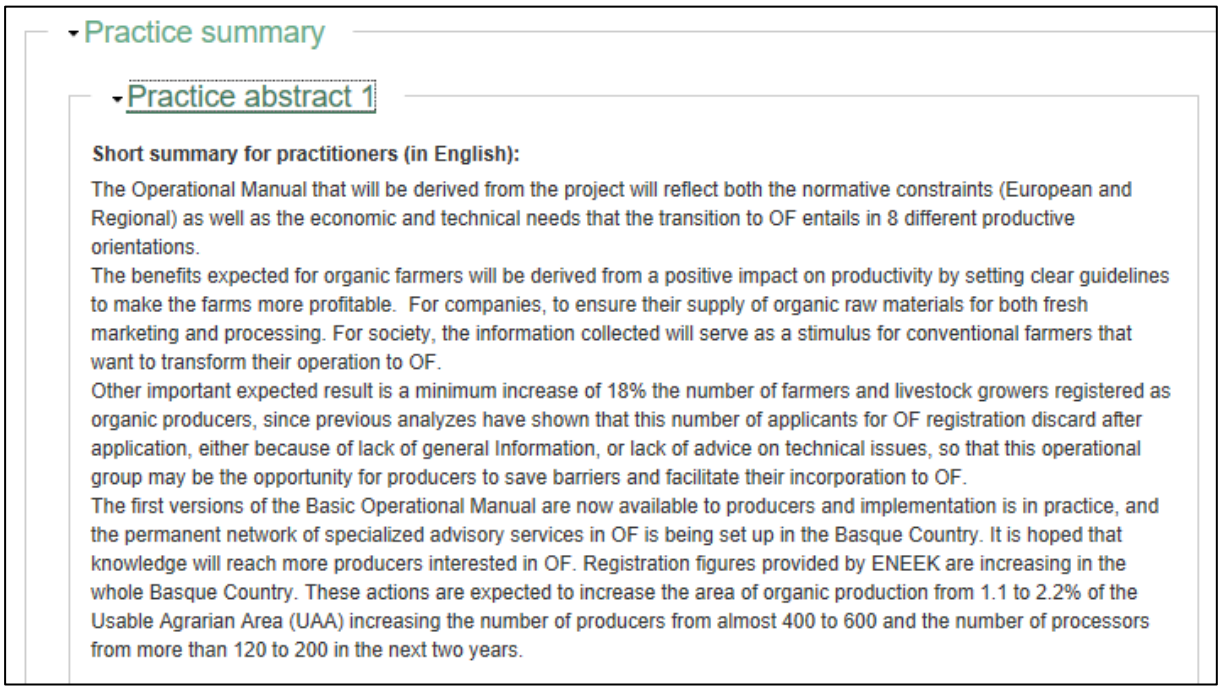
UNIVERSITAET HOHENHEIM – UHOH, 2018. *PA4: About MAGIC long-term field trials*.

UNIVERSITAET HOHENHEIM – UHOH, 2018. *PA5: About miscanthus long-term field trial in Germany.*

UNIVERSITAET HOHENHEIM – UHOH, 2020. *PA18: About low-input agricultural practices.*

8 Annexes

Annex A: An example of a practice abstract published at the EIP-AGRI website



Practice summary

Practice abstract 1

Short summary for practitioners (in English):

The Operational Manual that will be derived from the project will reflect both the normative constraints (European and Regional) as well as the economic and technical needs that the transition to OF entails in 8 different productive orientations.

The benefits expected for organic farmers will be derived from a positive impact on productivity by setting clear guidelines to make the farms more profitable. For companies, to ensure their supply of organic raw materials for both fresh marketing and processing. For society, the information collected will serve as a stimulus for conventional farmers that want to transform their operation to OF.

Other important expected result is a minimum increase of 18% the number of farmers and livestock growers registered as organic producers, since previous analyzes have shown that this number of applicants for OF registration discard after application, either because of lack of general Information, or lack of advice on technical issues, so that this operational group may be the opportunity for producers to save barriers and facilitate their incorporation to OF.

The first versions of the Basic Operational Manual are now available to producers and implementation is in practice, and the permanent network of specialized advisory services in OF is being set up in the Basque Country. It is hoped that knowledge will reach more producers interested in OF. Registration figures provided by ENEEK are increasing in the whole Basque Country. These actions are expected to increase the area of organic production from 1.1 to 2.2% of the Usable Agrarian Area (UAA) increasing the number of producers from almost 400 to 600 and the number of processors from more than 120 to 200 in the next two years.

Annex B: Second version of the H2020 EIP excel template to be submitted to EIP-AGRI for MAGIC Project

Project Information

Project identifier (see INSTRUCTIONS)	2017H2020_727698_MAGIC
Title of the project in native language (*can be the language of the coordinator / one of the partners - otherwise repeat the title in English*)	MAGIC - Marginal Lands for Growing Industrial Crops. Turning a Burden into an Opportunity
Title of the project in English (*provide the project ACRONYM + short title within the characters limit*)	MAGIC - Marginal Lands for Growing Industrial Crops. Turning a Burden into an Opportunity

Geographical location

Country (*of the coordinator*)	Greece
Main geographical location (NUTS3) (of coordinator - *for geolocalisation on map*)	EL305 - Eastern Attica

Editor of the text: person/organisation responsible for delivering the text	Efthymia Alexopoulou - CRES

Project coordinator (lead-partner) according to the cooperation/consortium agreement:

Name	Center for Renewable Energy Sources and Saving - CRES
Address	Biomass Department of CRES Center for Renewable Energy Sources and Saving 19th Km Marathonos Avenue 19009 Pikermi Attikis
E-mail	ealex@cres.gr
Telephone	+30 210 6603300

Project period:

start year (YYYY)	2017
end year (YYYY)	2021

Project status: ongoing (after selection of the project) or completed (after final payment)	Ongoing
Main **funding source** (Rural development programme, H2020, or other EU, national/regional or private funds)	H2020
Total budget of the project (total costs - in euros)	5,999,987.00

Objective of the project in English: what problems/opportunities does the project address that are relevant for the practitioner/end-user, and how will they be solved? - (300-600 characters, word count – no spaces)	Due to changing climatic conditions in Europe, the areas that are less favourable for conventional agriculture are expanding. This land has been either abandoned because of its productivity, or it is used as grassland. Moreover, contaminated soils cannot be used for food or feed production for sanitary reasons and thus provide great potential for the production of biomass for material or energy use. Cultivating industrial crops on marginal land unsuitable for food production is consistently proposed as a viable alternative to minimize land-use competition for food production, and its adverse effects (direct or indirect) on food security, land-based greenhouse gas emissions and biodiversity loss.
Description of project activities in English: (max 600 characters, word count – no spaces): short summary highlighting main project activities.	MAGIC is an up-to-date database that combines two different data sets (MAGIC CROPS and MAGIC MAPS) into a Decision Support System (DSS). MAGIC CROPS categorize resource-efficient industrial crops according to their agronomic characteristics: input requirements, yield performance and quality traits for end-user applications. MAGIC MAPS chart and analyse marginal land in Europe that are exposed to natural constraints. These classifications serve as a basis for the development of best-practice options for industrial crops. Moreover, the DSS gives farmers a quick and easy overview of the most productive industrial crops that meets the geological requirements of their soils.
Additional comments (in English): free text field which can be used by the editor e.g. for listing facilitating elements or obstacles for the implementation of the produced results, for suggestions for future actions/research, for messages to end-users etc.	Industrial crops can be broadly categorised as: -Oil, -Lignocellulosic, -Carbonhydrate, - Speciality Crops

Project partners (mandatory information) - *N.B. : "Name" can be that of an organisation - "Address" should include the country*					
	Name	**Address**	**E-mail**	**Telephone**	**Type of partner**
project coordinator (lead partner) *from PROJECT INFORMATION*	Center for Renewable Energy Sources and Saving - CRES				Research institute
project partner	UNIBO				Research institute
project partner	WR				Research institute
project partner	WU				Research institute
project partner	UNHO				Research institute
project partner	INRA				Research institute
project partner	IFEU				Research institute
project partner	Imperial College				Research institute
project partner	Nova-Institut GmbH				SME
project partner	UNICT				Research institute
project partner	FCT/UNL				Research institute
project partner	ARKEMA				Other
project partner	CIEMAT				Research institute
project partner	Spanish Co-ops				SME
project partner	3B				SME
project partner	CREA				Research institute
project partner	IWNiRZ				Research institute
project partner	AUA				Research institute
project partner	IBCSB NAASU				Research institute
project partner	LSFRI SILAVA				Research institute
project partner	IIASA				Research institute
project partner	SAS Novabiom				SME
project partner	VDS				SME
project partner	BIOS				SME
project partner	BTG				SME

Keyword - category

Keyword - category 1	Agricultural production system
Keyword - category 2	Plant production and horticulture
Keyword - category 3	Soil management / functionality
Keyword - category 4	Farming/forestry competitiveness and diversification
Keyword - category 5	
Keyword - category 6	
Keyword - category 7	
Keyword - category 8	
Keyword - category 9	
Keyword - category 10	

Audiovisual material which is useful and attractive for practitioners (e.g. YouTube link, videos, other dissemination material)

Title/description (in English)	**URL**
MAGIC Project Website	http://magic-h2020.eu/
Leaflet & poster	http://magic-h2020.eu/press-publications/
Documents & reports	http://magic-h2020.eu/documents-reports/
First press release	http://magic-h2020.eu/press/

Official website of the project

Title/description	**URL**
MAGIC - Marginal Lands for Growing Industrial Crops	http://magic-h2020.eu

Links to other website(s) hosting information on the project (results) that are available after the project has ended, by preference using the existing local/regional/national communication channels that practitioners most often use.

Title/description	**URL**
	http://

Practice "abstract" 1:

Several practice abstracts may be needed for one project, depending on the size of the project and the number of outcomes/recommendations which are ready for practice.

Short title in English

Marginal lands for growing industrial crops

Short summary for practitioners in english on the (final or expected) outcomes (1000-1500 characters, word count – no spaces). *Do not complete if the summary below is completed in English*

This summary should at least contain the following information:
- Main **results/outcomes** of the activity (expected or final)
- The **main practical recommendation(s)**: what would be the main added value/benefit/opportunities to the end-user if the generated knowledge is implemented? How can the practitioner make use of the results?

This summary should be as interesting as possible for farmers/end-users, using a direct and easy understandable language and pointing out entrepreneurial elements which are particularly relevant for practitioners (e.g. related to cost, productivity etc). Research oriented aspects which do not help the understanding of the practice itself should be avoided.

Marginal lands for Growing Industrial Crops (MAGIC) is a 4-year project and gets funding by the European Commission. The project aims to promote the sustainable development of resource-efficient and economically profitable industrial crops grown on marginal lands.
Industrial crops can provide abundant renewable biomass feedstocks for the production of high added-value bio-based commodities (such as bio-plastics, bio-lubricants, bio-chemicals, pharmaceuticals, bio-composites, etc.) and bioenergy. Most of these crops are multi-purpose and offer the opportunity to follow a cascade biorefinery concept to produce a number of high-quality bio-products and bioenergy, to strengthen the bio-based economy. To achieve the project objectives, an up-to-date database of existing resource-efficient industrial crops will be developed with information on their agronomic characteristics, input requirements, yield performance and quality traits for end use applications. In parallel, current and future marginal lands in Europe facing natural constraints will be mapped, characterised and analysed to provide a spatially explicit classification that will serve as a basis for developing sustainable best-practice options for industrial crops. A Decision Support System (DSS) based on both MAGIC-CROPS and MAGIC-MAPS will be developed and validated with the active involvement of farmers and end users in order to choose the most promising industrial crop at any geo-location in Europe.
In the long term, this strategy will foster the sustainable development of the EU bio-based economy and will contribute to achieving EU energy and climate targets.

Several practice abstracts may be needed for one project, depending on the size of the project and the number of outcomes/recommendations which are ready for practice.

Practice "abstract" 2:

Short title in native language	Definition and classification of marginal lands suitable for industrial crops in Europe
Short summary for practitioners in native language (*can be the language of the coordinator / one of the partners - otherwise in English*) (1000-1500 characters, word count – no spaces). This summary should at least contain the following information: − Main **results/outcomes** of the activity (expected or final) − The **main practical recommendation(s)**: what would be the main added value/benefit/opportunities to the end-user if the generated knowledge is implemented? How can the practitioner make use of the results? This summary should be as interesting as possible for farmers/end-users, using a direct and easy understandable language and pointing out entrepreneurial elements which are particularly relevant for practitioners (e.g. related to cost, productivity etc). Research oriented aspects which do not help the understanding of the practice itself should be avoided.	Industrial crops will provide feedstocks for bio-based applications, thereby, will foster the bioeconomy and provide diversification opportunities to farmers. MAGIC project has identified and mapped those marginal lands across Europe where industrial crops (oil, lignocellulosic, carbohydrate and specialty crops) could be grown in a sustainable way. This mapping was based on a previous classification of marginal lands according to features such as: -Biophysical constraints, considering adverse climate due to low temperature, dryness, or excessive wetness; analysing soil problems such as adverse chemical composition, low fertility, or limitations in rooting; and paying attention to adverse terrain due to steep slope. -Socio-economic constraints regarding limited access to markets, difficult accessibility and bad infrastructure. -Sustainability, since the impact of growing industrial crops depend very much on whether other land uses are replaced by the industrial crops (leading to potential competition with food production); on whether biodiversity and other ecosystem services will be affected; and on what industrial crops and what management systems are to be used. Moreover, to determine whether a land is suitable for growing industrial crops or not, four key main features of the terrains classified as marginal lands must be pointed out: land can be marginal for agricultural use, but not for forestry use; marginality refers to the mentioned biophysical and socio-economic constraints; there are synonymous uses of “marginal lands” (abandoned farmland, low productivity, etc.); and that “marginality” is a dynamic feature which can change in time.

Several practice abstracts may be needed for one project, depending on the size of the project and the number of outcomes/recommendations which are ready for practice.

Practice "abstract" 3:

Short title in native language	Mapping marginal lands for growing industrial crops
Short summary for practitioners in native language (*can be the language of the coordinator / one of the partners - otherwise in English*) (1000-1500 characters, word count – no spaces). This summary should at least contain the following information: − Main **results/outcomes** of the activity (expected or final) − The **main practical recommendation(s)**: what would be the main added value/benefit/opportunities to the end-user if the generated knowledge is implemented? How can the practitioner make use of the results? This summary should be as interesting as possible for farmers/end-users, using a direct and easy understandable language and pointing out entrepreneurial elements which are particularly relevant for practitioners (e.g. related to cost, productivity etc). Research oriented aspects which do not help the understanding of the practice itself should be avoided.	The purpose of the MAGIC mapping is to characterize and analyse projections for current and future marginal lands in Europe facing natural constraints. Identified MAGIC marginal lands are defined as: “Lands having limitations which in aggregate are severe for sustained application of a given use and/or are sensitive to land degradation, as a result of inappropriate human use, and/or have lost already part or all of their productive capacity as a result of inappropriate human use”. The elements that were considered in building the classification include biophysical limitations clustered in six main groups. In addition, the resulting marginal land map was further classified according to, land use management, socio-economic limitations, ecosystem services and drives and pressures influencing the ecosystem functions. As a result, in total 29% of the agricultural land (i.e. land classified as agricultural by Corine Land Cover since 1992) in the European Union are classified as marginal. The most common limitations are rooting limitations, with 12% of the agricultural area. This is followed by adverse climate and excessive soil moisture occurring in respectively 11% and 8% of the agricultural land. The spatial explicit classification created by MAGIC will serve as a basis for developing sustainable best-practice options for industrial crops in Europe. In addition, the spatially explicit map database is accessible via the project website and will be maintained and further improved during the project’s lifetime and at least five years beyond the project completion. Visitors to the public website can access the map to inform themselves about the marginal land status in their region but can also help to evaluate the quality of the map.

Several practice abstracts may be needed for one project, depending on the size of the project and the number of outcomes/recommendations which are ready for practice.

Practice "abstract" 4:

Short title in native language	Long-term field trials with industrial crops on marginal land
Short summary for practitioners in native language (*can be the language of the coordinator / one of the partners - otherwise in English*) (1000-1500 characters, word count – no spaces). This summary should at least contain the following information: − Main **results/outcomes** of the activity (expected or final) − The **main practical recommendation(s)**: what would be the main added value/benefit/opportunities to the end-user if the generated knowledge is implemented? How can the practitioner make use of the results? This summary should be as interesting as possible for farmers/end-users, using a direct and easy understandable language and pointing out entrepreneurial elements which are particularly relevant for practitioners (e.g. related to cost, productivity etc). Research oriented aspects which do not help the understanding of the practice itself should be avoided.	One of the expected results of the MAGIC Project will be a comprehensive overview of the long-term performance potential of industrial crop cultivation on marginal land in Europe. For this purpose, the results of several long-term field trials with important industrial plants such as Miscanthus, Giant Reed, Reed Canary Grass, Camelina, Hemp and Poplar, which are carried out Europe-wide under the most important marginal growth conditions such as adverse rooting conditions, adverse climatic conditions and unfavourable terrain, will be compiled and evaluated. Many of these field trials are still on-going. In particular, the best low-input agricultural cultivation strategies for the crop categories ‘tillage’, ‘nitrogen fertilization’, ‘weed control’ and ‘irrigation’ will be identified. Practitioners should benefit from the results by implementing low-input agricultural practices for industrial crop cultivation, which are adapted to both the marginality conditions of their locations and to the market requirements in their region. It is assumed that this will increase both the overall income of the farms and the net profit due to higher biomass yields (and qualities) and higher production efficiencies. In addition, to these direct benefits, it is expected to bring indirect benefits through improved legal frameworks resulting from the policy recommendations.

Several practice abstracts may be needed for one project, depending on the size of the project and the number of outcomes/recommendations which are ready for practice.

Practice "abstract" 5:

Short title in English	Miscanthus cultivation on marginal land in southwest Germany
Short summary for practitioners in english on the (final or expected) outcomes (1000-1500 characters, word count – no spaces). *Do not complete if the summary below is completed in English* This summary should at least contain the following information: − Main **results/outcomes** of the activity (expected or final) − The **main practical recommendation(s)**: what would be the main added value/benefit/opportunities to the end-user if the generated knowledge is implemented? How can the practitioner make use of the results? This summary should be as interesting as possible for farmers/end-users, using a direct and easy understandable language and pointing out entrepreneurial elements which are particularly relevant for practitioners (e.g. related to cost, productivity etc). Research oriented aspects which do not help the understanding of the practice itself should be avoided.	In 2012 and 2014, several field trials with Miscanthus (a perennial C4 grass for combustion and other conversion routes) were carried out at various marginal sites in southwest Germany. The most severe marginality conditions at one of these sites ('OLI') are a combination of adverse root conditions (shallow soil (10 - 20 cm) and stoniness (50%)) and low temperatures (frost and short vegetation period). At OLI, six genotypes of Miscanthus were established in 2014 (~1 plantlet/m²). Weeding was performed by hand in 2014 and 2015. The harvest was carried out each year in spring starting from 2016. No fertilization was applied. The previous crop was grassland. The estimated accumulated dry matter yields of the first three growing seasons (2015, 2016 and 2017) range between 12.4 t/ha (GNT 4) and 30.9 t/ha (Miscanthus × giganteus). These preliminary results suggest that low-input cultivation of Miscanthus on shallow stony soil under low temperature conditions may be a success depending on the genotype. Miscanthus × giganteus is expected to provide high dry matter yields (in relation to the given marginal growing conditions) also in the following seasons. The expected main recommendation of these results is that farmers should consider the possibility of growing Miscanthus × giganteus on marginal areas similar to those of OLI (shallow stony soil + low temperature). In addition to economic benefits such as high biomass yields, low external inputs (fertilizers, pesticides) and low labour intensities (except for the establishment procedure), there are a number of eco-systemic advantages of Miscanthus × giganteus over annual cultivation systems such as improved soil fertility, habitat networking and reduced soil erosion.

Short title in native language	Miscanthusanbau auf Marginalstandorten in Süddeutschland
Short summary for practitioners in native language (*can be the language of the coordinator / one of the partners - otherwise in English*) (1000-1500 characters, word count – no spaces). This summary should at least contain the following information: − Main **results/outcomes** of the activity (expected or final) − The **main practical recommendation(s)**: what would be the main added value/benefit/opportunities to the end-user if the generated knowledge is implemented? How can the practitioner make use of the results? This summary should be as interesting as possible for farmers/end-users, using a direct and easy understandable language and pointing out entrepreneurial elements which are particularly relevant for practitioners (e.g. related to cost, productivity etc). Research oriented aspects which do not help the understanding of the practice itself should be avoided.	In den Jahren 2012 und 2014 wurden an verschiedenen Marginalstandorten im Südwesten Deutschlands mehrere Feldversuche mit Miscanthus (einem mehrjährigen C4-Gras für die Verbrennung, Biogasproduktion und andere Konversionsarten) durchgeführt. Die stärksten Marginalitätsbedingungen an einem dieser Standorte ("OLI") sind eine Kombination aus ungünstigen Bodeneigenschaften (Flachgründigkeit (10 - 20 cm) und ein hoher Steinanteil im Oberboden (50%)) und niedrigen Temperaturen (Frost und kurze Vegetationszeit). Am OLI wurden 2014 sechs Genotypen von Miscanthus etabliert (~1 Planze/m²). In den Jahren 2014 und 2015 wurde das Unkraut mechanisch entfernt. Geerntet wurde ab 2016 jedes Jahr im Frühjahr. Auf eine Düngung wurde verzichtet. Die vorherige Kultur war Grünland. Die geschätzten kumulierten Trockenmasseerträge der ersten drei Vegetationsperioden (2015, 2016 und 2017) liegen zwischen 12,4 t/ha und 30,9 t/ha. Diese vorläufigen Ergebnisse deuten darauf hin, dass ein extensiver Anbau von Miscanthus auf flachem steinigem Boden in Kombination mit niedrigen Temperaturbedingungen ein Erfolg sein kann. Es wird erwartet, dass Miscanthus × giganteus auch in den folgenden Jahren hohe Trockenmasseerträge liefert. Die erwartete Hauptempfehlung ist, dass die Landwirte die Möglichkeit in Betracht ziehen sollten, Miscanthus × giganteus auf Marginalstandorten anzubauen, die denen vom OLI ähneln. Neben wirtschaftlichen Vorteilen wie hohen Biomasseerträgen, geringem Einsatz von Arbeitsmitteln und niedrigen Arbeitsintensitäten gibt es bei Miscanthus gegenüber einjährigen Anbausystemen eine Reihe von ökosystemischen Vorteilen wie verbesserte Bodenfruchtbarkeit, Habitatvernetzung und geringere Bodenerosion.

Several practice abstracts may be needed for one project, depending on the size of the project and the number of outcomes/recommendations which are ready for practice.

Practice "abstract" 6:

Short title in English

Growing energy willow on marginal lands in Ukraine

Short summary for practitioners in english on the (final or expected) outcomes (1000-1500 characters, word count – no spaces). *Do not complete if the summary below is completed in English*

This summary should at least contain the following information:
- Main **results/outcomes** of the activity (expected or final)
- The **main practical recommendation(s)**: what would be the main added value/benefit/opportunities to the end-user if the generated knowledge is implemented? How can the practitioner make use of the results?

This summary should be as interesting as possible for farmers/end-users, using a direct and easy understandable language and pointing out entrepreneurial elements which are particularly relevant for practitioners (e.g. related to cost, productivity etc). Research oriented aspects which do not help the understanding of the practice itself should be avoided.

In Ukraine, optimal conditions for willow growth exist in regions with an annual rainfall of at least 650 mm and groundwater in July at a depth of 0.6-2.0 m. Such places include floodplains, gullies, and ravines, where the following soil marginality types occur: hard clay soil, flood land, acid soil, saline soil, and peatland.
Growing willow on acid soils (pH < 5.0) is associated with the risk of release of mobile aluminum and manganese, which is manifested in the inhibition of root development, metabolic disorder, and, consequently, growth retardation. Therefore, such soils should be amended with lime ameliorants before planting in doses necessary for deoxidation of the root layer of the soil. Gypsum should be applied on saline soils (chestnut and light chestnut soils).
To control weeds effectively in the first years of growing one can mulch the soil with straw or sawdust, cover the soil with agrotextile, or mechanically destruct weeds using mulchers of plant residues.
On hard clay soils (clay content ≥ 50%) when planting, it is necessary to carry out ripping with ripper-cultivators to a depth of 45-50 cm at an interval of 140 cm. When soil crust occurs, it is necessary to carry out interrow loosening.
Treatment of willow cuttings before planting with humic products along with foliar fertilization in the first year can improve the survival and adaptation of plants to adverse growing conditions.

Short title in native language	Вирощування енергетичної верби на маргінальних землях в Україні
Short summary for practitioners in native language (*can be the language of the coordinator / one of the partners - otherwise in English*) (1000-1500 characters, word count – no spaces). This summary should at least contain the following information: − Main **results/outcomes** of the activity (expected or final) − The **main practical recommendation(s)**: what would be the main added value/benefit/opportunities to the end-user if the generated knowledge is implemented? How can the practitioner make use of the results? This summary should be as interesting as possible for farmers/end-users, using a direct and easy understandable language and pointing out entrepreneurial elements which are particularly relevant for practitioners (e.g. related to cost, productivity etc). Research oriented aspects which do not help the understanding of the practice itself should be avoided.	В Україні оптимальні умови для росту верби існують у регіонах з річною кількістю опадів не менше 650 мм і заляганням ґрунтових вод у липні на глибині 0,6–2,0 м. До таких місць відносяться заплави річок, балки і яри, де зустрічаються такі види маргінальності ґрунтів: ґрунти з високим вмістом глини, запливаючі, кислі, торфовища, рідше – солончаки. Вирощування верби на кислих ґрунтах (pH < 5,0) пов'язане з ризиком вивільнення рухомих форм алюмінію й марганцю, що виявляється у пригніченні розвитку кореневої системи, порушенні обміну речовин і, як наслідок, сповільненні росту. Тому, такі ґрунти, перед закладанням плантації, необхідно розкислювати шляхом внесення вапняних меліорантів у дозах, необхідних для розкислення кореневмісного шару ґрунту. На солонцюватих ґрунтах (каштанові і світло каштанові) слід вносити гіпс. Для ефективної боротьби з бур'янами в перші роки експлуатації плантації слід застосовувати мульчування ґрунту соломою або тирсою, агроволокно, або ж механічне знищення з використанням мульчувачів рослинних решток. На важких глинистих ґрунтах (вміст глини ≥ 50%) при закладанні плантацій потрібно проводити щілювання культиваторами-щілювачами на глибину 45−50 см з інтервалом 140 см. При утворенні ґрунтової кірки необхідно проводити міжрядні розпушування. Обробка живців верби перед садінням добривами на основі гуматів і позакореневе підживлення ними в перший рік вегетації дозволяють покращити приживання й адаптацію рослин до несприятливих умов вирощування.

Several practice abstracts may be needed for one project, depending on the size of the project and the number of outcomes/recommendations which are ready for practice.

Practice "abstract" 7:

Short title in English	Growing miscanthus on marginal lands in Ukraine
Short summary for practitioners in english on the (final or expected) outcomes (1000-1500 characters, word count – no spaces). *Do not complete if the summary below is completed in English* This summary should at least contain the following information: − Main **results/outcomes** of the activity (expected or final) − The **main practical recommendation(s)**: what would be the main added value/benefit/opportunities to the end-user if the generated knowledge is implemented? How can the practitioner make use of the results? This summary should be as interesting as possible for farmers/end-users, using a direct and easy understandable language and pointing out entrepreneurial elements which are particularly relevant for practitioners (e.g. related to cost, productivity etc). Research oriented aspects which do not help the understanding of the practice itself should be avoided.	Miscanthus can grow on soils with the following types of marginality: acidic, saline, chemically contaminated, poor in organic matter, unfavourable soil structure, and steep slopes. On soils with a low content of organic matter, the productivity of miscanthus significantly depends on the type and amount of fertilizer applied. Therefore, fertilization should be carried out taking into account the actual removal of nutrients with the harvest. Growing miscanthus on poor soils for seven years allows increasing the content of organic matter in the arable soil layer by 0.37%. There is also a positive effect of counteracting water erosion of the soil when grown on steep slopes. On acidic and saline soils, it is necessary to amend the soil with lime or gypsum ameliorants before planting in doses necessary for deoxidation of the root layer of the soil. Variation of planting depth within 8−16 cm does not affect the growth, development, and productivity of plants. Therefore, in regions with cold and snowless winters, it is recommended to plant the rhizomes deeper. Planting rhizomes in the ridges is not recommended due to the freezing of the soil. High-quality biomass can be obtained with the aid of foliar feeding with a complex of microelements. This minimizes the accumulation of heavy metals in biomass on chemically contaminated soils. Treatment of miscanthus plants in the first and second years with humic products can improve plant adaptation to adverse growing conditions. On soils with unstable soil moisture, at planting, it is recommended to apply moisture-retaining hydrogel in the root-containing layer of the soil or in the planting hole at the rate of 150-300 kg/ha.

Short title in native language	Вирощування міскантусу на маргінальних землях в Україні
Short summary for practitioners in native language (*can be the language of the coordinator / one of the partners - otherwise in English*) (1000-1500 characters, word count – no spaces). This summary should at least contain the following information: − Main **results/outcomes** of the activity (expected or final) − The **main practical recommendation(s)**: what would be the main added value/benefit/opportunities to the end-user if the generated knowledge is implemented? How can the practitioner make use of the results? This summary should be as interesting as possible for farmers/end-users, using a direct and easy understandable language and pointing out entrepreneurial elements which are particularly relevant for practitioners (e.g. related to cost, productivity etc). Research oriented aspects which do not help the understanding of the practice itself should be avoided.	Міскантус можна вирощувати на ґрунтах з такими видами маргінальності: кислі, засолені, хімічно забруднені, бідні на органічні речовини, кам'янисті, з несприятливою структурою, розташовані на крутих схилах. На ґрунтах із низьким вмістом органічних речовин продуктивність міскантусу значно залежить від виду й кількості внесених добрив. Тому удобрення потрібно проводити з урахуванням фактичного виносу поживних речовин із урожаєм. Вирощування міскантусу на бідних ґрунтах протягом семи років дозволяє збільшити вміст органічних речовин в орному шарі ґрунту на 0,37 %. Також спостерігається позитивний ефект протидії водній ерозії ґрунту за вирощування на крутих схилах. На кислих і солонцюватих ґрунтах перед закладанням плантації варто вносити, відповідно, вапняні або гіпсові меліоранти в дозах, необхідних для розкислення кореневмісного шару ґрунту. Варіювання глибини садіння ризом міскантусу в межах 8−16 см не впливає на ріст, розвиток і продуктивністю рослин. Тому, в регіонах з холодними й малосніжними зимами рекомендовано садити ризоми глибше. Висаджування рослин у гребені не бажане через промерзання ґрунту. Біомасу високої якості можна отримати, якщо проводити позакореневе підживлення комплексом мікроелементів. Це дозволяє мінімізувати накопичення в біомасі важких металів на хімічно забруднених ґрунтах. Обробка рослин міскантусу в перший і другий роки вегетації гуматами дозволяє покращити адаптацію рослин до несприятливих умов вирощування. На ґрунтах з нестійким вологозабезпеченням при закладанні плантації рекомендується вносити в кореневмісний шар ґрунту або в лунку вологоутримувач-гідрогель з розрахунку 150−300 кг/га.

Several practice abstracts may be needed for one project, depending on the size of the project and the number of outcomes/recommendations which are ready for practice.

Practice "abstract" 8:

Short title in English

Wild Sugar Cane on marginal lands affected by drought in southern Italy

Short summary for practitioners in english on the (final or expected) outcomes (1000-1500 characters, word count – no spaces). *Do not complete if the summary below is completed in English*

This summary should at least contain the following information:
- Main **results/outcomes** of the activity (expected or final)
- The **main practical recommendation(s)**: what would be the main added value/benefit/opportunities to the end-user if the generated knowledge is implemented? How can the practitioner make use of the results?

This summary should be as interesting as possible for farmers/end-users, using a direct and easy understandable language and pointing out entrepreneurial elements which are particularly relevant for practitioners (e.g. related to cost, productivity etc). Research oriented aspects which do not help the understanding of the practice itself should be avoided.

Mediterranean climates are characterized by long periods of drought during summer and short dry periods from autumn to spring, what limits plant CO2 assimilation and biomass production to a great extent. More limiting scenarios are forecasted due to climate change in the coming years in the Mediterranean basin. Under these circumstances, plants with excellent adaptation are needed. Perennial crops, and grasses in particular, have proved to be more efficient than annual crops for biomass production for several environmental and economic reasons. The Joint Research Centre (JRC) has set thresholds to define marginal lands in terms of biophysical constraints. In this case, climate limitation given by the ratio between precipitations and potential evapotranspiration (P/ET) was focused. Areas with P/ET ≤0.60 are classified as affected by dryness. The study follows up a long-term plantation of the C4 perennial grass wild sugarcane (Saccharum spontaneum ssp. aegypticum) under different water regimes in a semi-arid environment. The species were established at the experimental farm of the University of Catania in 2005 by using rhizome cuttings. Biomass dry matter yield was significantly affected by irrigation treatment and meteorological conditions of the growing season (mainly precipitation amount and distribution) with yield values ranging between 29.9 and 37.1 t/ha in full-irrigation, between 24.5 and 32.0 t/ha in half-irrigation and between 19.1 and 27.4 t/ha in rainfed conditions. Wild Sugar Cane is well adapted to environments dominated by dryness, and even after 10 years the biomass yield remain quite stable and at very high levels. However, agronomic, energetic, environmental and economic issues need further research.

Short title in native language	La canna d'Egitto in terreni marginali siccitosi
Short summary for practitioners in native language (*can be the language of the coordinator / one of the partners - otherwise in English*) (1000-1500 characters, word count – no spaces). This summary should at least contain the following information: − Main **results/outcomes** of the activity (expected or final) − The **main practical recommendation(s)**: what would be the main added value/benefit/opportunities to the end-user if the generated knowledge is implemented? How can the practitioner make use of the results? This summary should be as interesting as possible for farmers/end-users, using a direct and easy understandable language and pointing out entrepreneurial elements which are particularly relevant for practitioners (e.g. related to cost, productivity etc). Research oriented aspects which do not help the understanding of the practice itself should be avoided.	I climi mediterranei sono caratterizzati da lunghi periodi di siccità durante l'estate e brevi periodi di siccità dall'autunno alla primavera, il che limita in larga misura l'assimilazione della CO2 e la produzione di biomassa. Scenari più limitanti sono previsti a causa del cambiamento climatico. In queste circostanze, sono necessarie specie in grado di ottimizzare le risorse naturali. Le colture perenni e in particolare le graminacee hanno dimostrato di essere più efficienti delle colture annuali per la produzione di biomassa per diverse ragioni agronomiche ed ambientali. Il JRC ha stabilito una serie di soglie per definire le terre marginali in termini di vincoli biofisici. Il nostro studio focalizza sulla limitazione climatica data dal rapporto tra precipitazioni ed evapotraspirazione potenziale (P/ET ≤0,60). Il presente studio riporta una piantagione di lungo termine della canna d'Egitto (Saccharum spontaneum ssp. aegypticum) in diversi regimi idrici in un ambiente mediterraneo semi-arido. La resa della biomassa è stata significativamente influenzata dal trattamento di irrigazione e dalle condizioni meteorologiche della stagione di crescita (principalmente dalla quantità e distribuzione delle precipitazioni) con valori di resa compresi tra 29,9 e 37,1 t/ha in irrigazione completa, tra 24,5 e 32,0 t/ha in irrigazione ridotta e tra 19,1 e 27,4 t/ha condizioni idriche naturali. La specie si adatta bene agli ambienti dominati dall'aridità, e anche dopo 10 anni dalla piantagione la resa della biomassa rimane abbastanza stabile. Tuttavia, ulteriori ricerche conseguite per altre graminacee perenni (ad esempio, A. donax, Miscanthus spp. P. virgatum, P. arundicnacea, ecc.), devono essere affrontate.

Several practice abstracts may be needed for one project, depending on the size of the project and the number of outcomes/recommendations which are ready for practice.

Practice "abstract" 9:

Short title in English

Arundo and Miscanthus on marginal land affected by dryness in fertilized and unfertilized conditions in southern Italy

Short summary for practitioners in english on the (final or expected) outcomes (1000-1500 characters, word count – no spaces). *Do not complete if the summary below is completed in English*

This summary should at least contain the following information:
- Main **results/outcomes** of the activity (expected or final)
- The **main practical recommendation(s)**: what would be the main added value/benefit/opportunities to the end-user if the generated knowledge is implemented? How can the practitioner make use of the results?

This summary should be as interesting as possible for farmers/end-users, using a direct and easy understandable language and pointing out entrepreneurial elements which are particularly relevant for practitioners (e.g. related to cost, productivity etc). Research oriented aspects which do not help the understanding of the practice itself should be avoided.

Perennial, non-food grasses have been proposed as the most efficient species for biomass production due to their agronomic, environmental and social benefits. Species characterized by high water use efficiency and low nitrogen requirement, well adapted to use natural resources of a specific environment, can be recommended as ideal crops. Along with irrigation and water savings, nitrogen requirement is a significant issue in intensive agriculture and has a great effect over the energetic balance of crops. Therefore, low input cropping systems could directly mitigate greenhouse gas emissions. In this case long-term plantations of two perennial grasses (Arundo donax and Miscanthus x giganteus), grown in rainfed conditions under two nitrogen regimes, were compared in an environment affected by dryness (according to the thresholds set by the Joint Research Centre (JRC) in terms of ratio between precipitations and potential evapotranspiration (P/ET ≤0.60)). Miscanthus x giganteus and Arundo donax were transplanted in summer 1993 and in spring 1997, respectively. In 2015 (22-year for Miscanthus and 18-year for Arundo), Arundo and Miscanthus (fertilized with 80 kg N ha-1) showed similar yields (11.9 and 10.4 t/ha), while Arundo unfertilized (N0) produced 10 t/ha against 5.3 t/ha of Miscanthus N0. In 2016 (23-year for Miscanthus and 19-year for Arundo) Arundo and Miscanthus N0 produced 10.6 and 6.2 t/ha, while Arundo and Miscanthus N80 attained 15.3 and 8.7 t/ha. In 2017 (24-year for Miscanthus and 20-year for Arundo) a similar trend was observed, Arundo N80 showed the highest yield (14.9 t/ha) followed by Miscanthus N80 (9.7 t/ha), Arundo N0 (8.4 t/ha) and Miscanthus N0 (5.9 t/ha).

Short title in native language	Arundo e Miscanthus in terreni marginali siccitosi in condizioni concimate e non-concimate
Short summary for practitioners in native language (*can be the language of the coordinator / one of the partners - otherwise in English*) (1000-1500 characters, word count – no spaces). This summary should at least contain the following information: − Main **results/outcomes** of the activity (expected or final) − The **main practical recommendation(s)**: what would be the main added value/benefit/opportunities to the end-user if the generated knowledge is implemented? How can the practitioner make use of the results? This summary should be as interesting as possible for farmers/end-users, using a direct and easy understandable language and pointing out entrepreneurial elements which are particularly relevant for practitioners (e.g. related to cost, productivity etc). Research oriented aspects which do not help the understanding of the practice itself should be avoided.	Le graminacee perenni, non alimentari, sono state proposte come le specie più efficienti per la produzione di biomassa grazie all'elevata efficienza dell'uso delle risorse naturali. Le specie caratterizzate da un'elevata efficienza d'uso dell'acqua e un basso fabbisogno di azoto, possono essere raccomandate come colture ideali. Accanto al risparmio di acqua, il fabbisogno di azoto è un problema significativo nell'agricoltura intensiva e influisce notevolmente sull'equilibrio energetico delle colture. Nel presente studio sono state confrontate coltivazioni a lungo termine di due graminacee perenni (Arundo donax e Miscanthus x giganteus) coltivate in condizioni di idriche naturali in due regimi di concimazione azota in un ambiente affetto da siccità (secondo le soglie stabilite dal JRC in termini di rapporto tra precipitazioni ed evapotraspirazione potenziale (P/ET ≤0,60)). Miscanthus e Arundo sono stati trapiantati nell'estate del 1993 e nella primavera del 1997, rispettivamente. Nel 2015 (22 anni per Miscanthus e 18 anni per Arundo), Arundo e Miscanthus (concimati con 80 kg/ha di N) hanno mostrato rese simili (11,9 e 10,4 t/ha), mentre Arundo non concimato (N0) ha prodotto 10 t/ha contro 5,3 t/ha di Miscanthus N0. Nel 2016, Arundo e Miscanthus N0 hanno prodotto 10,6 e 6,2 t/ha, mentre Arundo e Miscanthus N80 hanno ottenuto 15,3 e 8,7 t/ha. Nel 2017 è stata osservata una tendenza simile, Arundo N80 ha mostrato la resa più elevata (14,9 t/ha) seguito da Miscanthus N80 (9,7 t/ha), Arundo N0 (8,4 t/ha) e Miscanthus N0 (5,9 t/ha).

Several practice abstracts may be needed for one project, depending on the size of the project and the number of outcomes/recommendations which are ready for practice.

Practice "abstract" 10:

Short title in English	Siberian Elm long-term field trial in Spain
Short summary for practitioners in english on the (final or expected) outcomes (1000-1500 characters, word count – no spaces). *Do not complete if the summary below is completed in English* This summary should at least contain the following information: − Main **results/outcomes** of the activity (expected or final) − The **main practical recommendation(s)**: what would be the main added value/benefit/opportunities to the end-user if the generated knowledge is implemented? How can the practitioner make use of the results? This summary should be as interesting as possible for farmers/end-users, using a direct and easy understandable language and pointing out entrepreneurial elements which are particularly relevant for practitioners (e.g. related to cost, productivity etc). Research oriented aspects which do not help the understanding of the practice itself should be avoided.	Siberian Elm (Ulmus pumila L.) is a hardy and fast-growing tree that features greater resistance to Dutch Elm disease than other species in genus Ulmus. Drought tolerance, adaptation to different environments and sprouting capacity suggest that this plant species could be grown as a short rotation energy/industrial crop. Siberian Elm was planted in 2 plots in 2009 and 2010 in marginal land in Soria province (North-Central Spain). The marginality factors were climate (low temperature) and soil (texture, stoniness, organic matter). In 2009, two plant densities (3,333 and 6,666 plants/ha) under two irrigation regimes (2,000 and 4,000 m3/ha) were implemented and one plant density was established in rainfed conditions in 2010. Furthermore, 2 crops cycles were studied in each plot. The results for a nine year period confirmed that Siberian Elm is a fast-growing woody species, adapted to the harsh climate of Soria: cold winters, frosts, and wind. It is also resistant to pests and diseases since no pesticide treatment has been carried out. Siberian Elm prefers well-drained soils, although it also tolerates a wide variety of adverse conditions, such as soils with low organic matter content and flooding situations. Yield was strongly influenced by the amount of irrigation water applied, planting densities and crop cycle. Maximum yields were obtained with planting densities of 6,666 and 3,333 trees/ha cropped every 3 and 4 years, respectively. The yield ranged between 4 - 7.5 t/ha. The composition of the biomass was: ash content 3.0%, 48.0% C, 6.0% H, 0.5% N and Gross Calorific Value (GCV) of 19.2 MJ/kg.

Short title in native language	Ensayo de campo a largo plazo con olmo siberiano en España
Short summary for practitioners in native language (*can be the language of the coordinator / one of the partners - otherwise in English*) (1000-1500 characters, word count – no spaces). This summary should at least contain the following information: − Main **results/outcomes** of the activity (expected or final) − The **main practical recommendation(s)**: what would be the main added value/benefit/opportunities to the end-user if the generated knowledge is implemented? How can the practitioner make use of the results? This summary should be as interesting as possible for farmers/end-users, using a direct and easy understandable language and pointing out entrepreneurial elements which are particularly relevant for practitioners (e.g. related to cost, productivity etc). Research oriented aspects which do not help the understanding of the practice itself should be avoided.	El olmo de Siberia (Ulmus pumila L.) es una especie de rápido crecimiento, con mayor resistencia a plagas y enfermedades que otras especies del género Ulmus. Es tolerante a la sequía, se adapta a diferentes condiciones ambientales y tiene alta capacidad de rebrote, pudiendo utilizarse como cultivo energético o industrial en corta rotación. Se establecieron dos parcelas de olmo de Siberia en tierras marginales de la Provincia de Soria en distintas fechas: noviembre de 2009 y abril de 2010. Los factores de marginalidad en ambas parcelas son debidos a las bajas temperaturas y las condiciones del suelo (textura, pedregosidad, materia orgánica). En la parcela establecida en 2009 se estudiaron dos densidades (3.333 y 6.666 plantas/ha) y dos regímenes hídricos (2000 y 4000 m3/ha), mientras que en la parcela establecida en 2010 se ensayó una densidad de 3.333 plantas/ha en secano. Además, en cada parcela se estudiaron dos turnos de corta, cada 3 y 4 años. Los resultados obtenidos en los 9 años de crecimiento muestran que el olmo es una especie de rápido crecimiento, adaptado al clima duro de Soria: inviernos fríos, heladas y viento. Es una especie resistente a plagas y enfermedades ya que no ha sido necesario aplicar tratamientos fitosanitarios. Aunque prefiere suelos bien drenados, tolera situaciones de encharcamiento puntuales o baja materia orgánica. Los rendimientos de biomasa dependieron de la cantidad de riego aplicada, la densidad de plantación y el ciclo de cultivo, obteniéndose las mayores producciones con densidades de 6.666 plantas/ha en ciclos de 3 años y 3.333 plantas/ha en ciclo de 4 años. El rendimiento de biomasa varió entre 4-7,5 t/ha. La composición de la biomasa fue: cenizas 3,0 %; C 48,0 %; H 6,0 %; N 0,5 %; PCS 19.2 MJ/kg.

Several practice abstracts may be needed for one project, depending on the size of the project and the number of outcomes/recommendations which are ready for practice.

Practice "abstract" 11:

Short title in English

Tall Wheatgrass long-term field trial in Spain

Short summary for practitioners in english on the (final or expected) outcomes (1000-1500 characters, word count – no spaces). *Do not complete if the summary below is completed in English*

This summary should at least contain the following information:
- Main **results/outcomes** of the activity (expected or final)
- The **main practical recommendation(s)**: what would be the main added value/benefit/opportunities to the end-user if the generated knowledge is implemented? How can the practitioner make use of the results?

This summary should be as interesting as possible for farmers/end-users, using a direct and easy understandable language and pointing out entrepreneurial elements which are particularly relevant for practitioners (e.g. related to cost, productivity etc). Research oriented aspects which do not help the understanding of the practice itself should be avoided.

Perennial grasses have been envisaged by the scientific community as an interesting group of plant species for the sustainable production of biomass in marginal land in terms of crop diversification, improved control of soil erosion and recovery of soil organic matter content. Compared with annual grain crops, perennial biomass crops require fewer inputs, produce more energy and reduce Greenhouse Gas (GHG) emissions than annual cropping systems.
In 2010 and 2013, field trials with Tall Wheatgrass were carried out in two marginal lands in Soria province (North-Central Spain). The marginality factors were climate (low temperature) and soil (texture, stoniness, organic matter). In 2010 Elytrigia elongata Alkar was studied as single crop and mixed with other annual and perennial species. In 2013 three Elytrigia elongata cultivars: Alkar, Szarvasi-1 and Bamar were established on a parcel.
The results obtained in an eight year period showed that Tall Wheatgrass is a species well adapted to the hard climate conditions of Soria with a high tolerance to drought. Moreover, it is a crop resistant to pests and diseases since no pesticide treatment has been carried out.
Tall Wheatgrass prefers well-drained soils, although it tolerates a wide variety of adverse conditions, such as soils with low organic matter content and moderate salinity. However, flooding situations should be avoided.
Yields were between 2 and 5 t/ha. Elytrigia elongata Alkar produced the most yield when planted as single crop. Elytrigia elongata Szarvasi-1 produced the most yield.
The composition of the biomass was: ash content 5.2%, 46.0% C, 6.1% H, 0.6% N and Gross Calorific Value (GCV) of 18.5 MJ/kg.

Short title in native language	Ensayo de campo a largo plazo con agropiro en España
Short summary for practitioners in native language (*can be the language of the coordinator / one of the partners - otherwise in English*) (1000-1500 characters, word count – no spaces). This summary should at least contain the following information: − Main **results/outcomes** of the activity (expected or final) − The **main practical recommendation(s)**: what would be the main added value/benefit/opportunities to the end-user if the generated knowledge is implemented? How can the practitioner make use of the results? This summary should be as interesting as possible for farmers/end-users, using a direct and easy understandable language and pointing out entrepreneurial elements which are particularly relevant for practitioners (e.g. related to cost, productivity etc). Research oriented aspects which do not help the understanding of the practice itself should be avoided.	Las gramíneas perennes representan un grupo de interés para la producción sostenible de biomasa en tierras marginales, tanto en términos de diversificación de cultivos como para el control de la erosión y la mejora del contenido de materia orgánica del suelo. En comparación con los cultivos anuales, los cultivos perennes requieren menos insumos, gastan menos energía y reducen las emisiones de gases de efecto invernadero. Se establecieron dos parcelas de agropiro en tierras marginales de la Provincia de Soria en años distintos: 2010 y 2013. Los factores de marginalidad en ambas parcelas son debidos a las bajas temperaturas y las condiciones del suelo (textura, pedregosidad, materia orgánica). En la parcela establecida en 2010 se estudió Agropiro (Elytrigia elongata Alkar) como cultivo solo y mezclado con otras especies anuales y perennes. En la parcela establecida en 2013, se ensayaron 3 cultivares de Elytrigia elongata: Alkar, Szarvasi-1 y Bamar. Los resultados obtenidos en los 8 años de crecimiento muestran que el agropiro es una especie bien adaptada a las duras condiciones climáticas de Soria, con alta tolerancia a la sequía. Además, el cultivo es resistente a plagas y enfermedades, ya que no ha sido necesario llevar a cabo tratamientos fitosanitarios. Tolera situaciones de baja materia orgánica y moderada salinidad, debiendo evitarse el encharcamiento del suelo. Los rendimientos de la biomasa estuvieron entre 2-5 t/ha. Elytrigia elongata Alkar produjo el mayor rendimiento cuando se sembró sin mezclar en 2010. En el estudio comparativo sembrado en 2013, Elytrigia elongata Szarvsi-1 produjo el mayor rendimiento. La composición de biomasa fue: cenizas 5,2 %; C 46,0 %; H 6,1 %; N 0,6 %; PCS 18,5 MJ/kg.

Several practice abstracts may be needed for one project, depending on the size of the project and the number of outcomes/recommendations which are ready for practice.

Practice "abstract" 12:

Short title in English	Switchgrass long-term field trial in Spain
Short summary for practitioners in english on the (final or expected) outcomes (1000-1500 characters, word count – no spaces). *Do not complete if the summary below is completed in English* This summary should at least contain the following information: − Main **results/outcomes** of the activity (expected or final) − The **main practical recommendation(s)**: what would be the main added value/benefit/opportunities to the end-user if the generated knowledge is implemented? How can the practitioner make use of the results? This summary should be as interesting as possible for farmers/end-users, using a direct and easy understandable language and pointing out entrepreneurial elements which are particularly relevant for practitioners (e.g. related to cost, productivity etc). Research oriented aspects which do not help the understanding of the practice itself should be avoided.	As Tall Wheatgrass, Switchgrass is a perennial grass that offers similar advantages. Switchgrass (Panicum virgatum L.) is a warm season C4 grass propagated by seeds. Since the early 1990's the crop has been developed as an herbaceous energy crop for ethanol and electricity production. In 2013 trials were carried out in Badajoz Province (South-Western Spain) under irrigation conditions. Cultivar used was Alamo. The aim of this work was to investigate the optimal dose of seeds. Two treatments were tested: 12 and 20 kg/ha, and minimum tillage conditions. The volume of water applied was 3,700 m3/ha. The results showed that it is a species adapted to sandy-loam soil and acidic pH of 6.6. In Spain, irrigation was necessary in order to ensure the good establishment and high biomass yields as well. In this case, higher doses of seeds resulted in higher productions, showing yields between 10 and 17 t/ha. The composition of the biomass was: ash content 5.1%, 46.2% C, 5.9% H, 0.53% N and Gross Calorific Value (GCV) of 18.6 MJ/kg.

Short title in native language	Ensayo de campo a largo plazo con switchgrass en España
Short summary for practitioners in native language (*can be the language of the coordinator / one of the partners - otherwise in English*) (1000-1500 characters, word count – no spaces). This summary should at least contain the following information: − Main **results/outcomes** of the activity (expected or final) − The **main practical recommendation(s)**: what would be the main added value/benefit/opportunities to the end-user if the generated knowledge is implemented? How can the practitioner make use of the results? This summary should be as interesting as possible for farmers/end-users, using a direct and easy understandable language and pointing out entrepreneurial elements which are particularly relevant for practitioners (e.g. related to cost, productivity etc). Research oriented aspects which do not help the understanding of the practice itself should be avoided.	El switchgrass (Panicum virgatum L.) en una gramínea perenne con ventajas similares a las del agropiro. Se trata de una especie C4 de clima cálido propagada por semillas. Desde principios de 1990 ha sido estudiada como cultivo energético herbáceo para producción de electricidad y para etanol. Los ensayos empezaron en 2013 bajo condiciones de riego en la provincia de Badajoz (Sureste de España). El cultivar ensayado fue Alamo. El objetivo del ensayo fue investigar la dosis óptima de siembra. Para ello, se ensayaron dos dosis: 12 y 20 kg/ha, en condiciones de mínimo laboreo. El volumen medio de agua aplicada durante los años de ensayo fue de 3.700 m3/ha. Los resultados muestran que es una especie adaptada a suelo franco-arenoso y pH acido de 6,6. En las condiciones de España, debe garantizarse el regadío tanto para asegurar un buen establecimiento del cultivo como para lograr altos rendimientos de biomasa. Los resultados muestran que las producciones de biomasa están relacionadas con la dosis de siembra, implicando mayores dosis un incremento de las producciones. Los rendimientos de biomasa estuvieron entre 10-17 t/ha. La composición de la biomasa fue: contenido de cenizas 5,1 %; carbono 46,2 %; hidrógeno 5,9 %; nitrógeno 0,53 %; poder calorífico superior 18,6 MJ/kg.

Several practice abstracts may be needed for one project, depending on the size of the project and the number of outcomes/recommendations which are ready for practice.

Practice "abstract" 13:

Short title in English	Switchgrass cultivation on marginal land in central Greece
Short summary for practitioners in english on the (final or expected) outcomes (1000-1500 characters, word count – no spaces). *Do not complete if the summary below is completed in English* This summary should at least contain the following information: − Main **results/outcomes** of the activity (expected or final) − The **main practical recommendation(s)**: what would be the main added value/benefit/opportunities to the end-user if the generated knowledge is implemented? How can the practitioner make use of the results? This summary should be as interesting as possible for farmers/end-users, using a direct and easy understandable language and pointing out entrepreneurial elements which are particularly relevant for practitioners (e.g. related to cost, productivity etc). Research oriented aspects which do not help the understanding of the practice itself should be avoided.	Two Switchgrass field trials were established by seeds in 1998 on marginal land located in central Greece and are still on-going. The aim was to identify the appropriate cultural practices of Switchgrass when grown on marginal land. Tested factors were: 10 varieties in the first and 5 in three nitrogen rates (0, 75 and 150 kg N/ha) in the second. Varieties were: Caddo, Alamo, Blackwell, Cathage, Cave-in-rock, Forestburg, Kanlow, Pangburn, SL 93-2, SL 93-3, SL 94-1, SU 94-1 and Summer. Biomass yields were maximized in the second growing period and come up to 20 t/ha (oven-dried), almost double to yields recorded at first year. In the 3rd year a yield reduction was measured from 5% to 20%. Yields reduction continued in year 4 and for more than a decade the dry matter yields varied from 12 to 14 t/ha. Further reduction was recorded from 18th till 20th year of the plantation and the mean dry yields varied from 8 to 10 t/ha during this period. During two decades lowlands varieties gave always higher yields but the superiority of lowland over upland was quite profound till the 6th growing period. Lowland varieties were higher with stronger stems and thus had higher lodging resistance than upland ones. Lodging problems were recorded for the upland varieties at the mid-point of the tested years and at the end of summer, after strong rainfall with high winds. In the first years, no significant effect of nitrogen fertilization on growth and yields was recorded. From year 6 to 20 dry yields for switchgrass varieties were always higher in the plots that received 150 kg N/ha as top fertilization. From 18th growing season the plantation began to look quite old and the tiller density had been greatly reduced. The average mean yields of switchgrass (oven-dried) fields was 12 t/ha.

Short title in native language	Καλλιέργεια σε περιθωριακή γη της κεντρικής Ελλάδας
Short summary for practitioners in native language (*can be the language of the coordinator / one of the partners - otherwise in English*) (1000-1500 characters, word count – no spaces). This summary should at least contain the following information: − Main **results/outcomes** of the activity (expected or final) − The **main practical recommendation(s)**: what would be the main added value/benefit/opportunities to the end-user if the generated knowledge is implemented? How can the practitioner make use of the results? This summary should be as interesting as possible for farmers/end-users, using a direct and easy understandable language and pointing out entrepreneurial elements which are particularly relevant for practitioners (e.g. related to cost, productivity etc). Research oriented aspects which do not help the understanding of the practice itself should be avoided.	Το 1998 πραγματοποιήθηκαν δύο δοκιμές στον τομέα του switchgrass από σπόρους σε οριακές εκτάσεις που βρίσκονται στην κεντρική Ελλάδα και βρίσκονται ακόμη σε εξέλιξη. Ο στόχος ήταν να εντοπιστούν οι κατάλληλες πολιτιστικές πρακτικές του switchgrass όταν καλλιεργούνται σε περιθωριακή γη. Οι παράγοντες που ελέγχθηκαν ήταν: 10 ποικιλίες το πρώτο και 5 σε τρεις ρυθμούς αζώτου (0, 75 και 150 kg N/ha) στη δεύτερη. Οι ποικιλίες ήταν: Caddo, Alamo, Blackwell, Cathage, Cave-in-rock, Forestburg, Kanlow, Pangburn, SL 93-2, SL 93-3, SL 94-1, SU 94-1 και Summer. Οι αποδόσεις της βιομάζας μεγιστοποιήθηκαν κατά τη δεύτερη περίοδο καλλιέργειας και ανέρχονται σε 20 τόνους/εκτάριο (φυγή), σχεδόν διπλάσιες από τις αποδόσεις που καταγράφηκαν κατά το πρώτο έτος. Κατά το 3ο έτος μετρήθηκε μείωση της απόδοσης από 5 % σε 20 %. Η μείωση των αποδόσεων συνεχίστηκε κατά το έτος 4 και για περισσότερο από μια δεκαετία οι αποδόσεις ξηρής ύλης κυμαίνονταν από 12 έως 14 τόνους/εκτάριο. Περαιτέρω μείωση σημειώθηκε από το 18ο έως το 20ο έτος της φυτείας και οι μέσες ξηρές αποδόσεις κυμαίνονταν από 8 έως 10 τόνους/εκτάριο κατά την περίοδο αυτή. Κατά τη διάρκεια δύο δεκαετιών πεδινών ποικιλιών έδιναν πάντα υψηλότερες αποδόσεις, αλλά η ανωτερότητα των πεδινών στα ορεινά εδάφη ήταν αρκετά βαθιά μέχρι την 6η περίοδο ανάπτυξης. Οι πεδινές ποικιλίες ήταν υψηλότερες με ισχυρότερους μίσχους και έτσι είχαν μεγαλύτερη αντοχή στο κατάλυμα από ό, τι τα ορεινά. Καταγράφηκαν προβλήματα στέγασης για τις ορεινές ποικιλίες στα μέσα των δοκιμασμένων ετών και στο τέλος του καλοκαιριού, μετά από έντονες βροχοπτώσεις με δυνατούς ανέμους. Κατά τα πρώτα έτη, δεν καταγράφηκε καμία σημαντική επίδραση της γονιμοποίησης του αζώτου στην ανάπτυξη και τις αποδόσεις. Από το 6 έως το 20 οι ξηρές αποδόσεις για τις ποικιλίες switchgrass ήταν πάντα υψηλότερες στις εκτάσεις που έλαβαν 150 kg N/ha ως κορυφαία γονιμοποίηση. Από την 18η καλλιεργητική περίοδο η φυτεία άρχισε να φαίνεται αρκετά παλιά και η πυκνότητα των γεωργών είχε μειωθεί σημαντικά. Η μέση μέση απόδοση των πεδίων switchgrass (με ξήρανση) ήταν 12 t/ha.

Several practice abstracts may be needed for one project, depending on the size of the project and the number of outcomes/recommendations which are ready for practice.

Practice "abstract" 14:

Short title in English

Short Rotation Coppices cultivation on sandy soil with different soil enrichment method in Poland

Short summary for practitioners in english on the (final or expected) outcomes (1000-1500 characters, word count – no spaces). *Do not complete if the summary below is completed in English*

This summary should at least contain the following information:
- Main **results/outcomes** of the activity (expected or final)
- The **main practical recommendation(s)**: what would be the main added value/benefit/opportunities to the end-user if the generated knowledge is implemented? How can the practitioner make use of the results?

This summary should be as interesting as possible for farmers/end-users, using a direct and easy understandable language and pointing out entrepreneurial elements which are particularly relevant for practitioners (e.g. related to cost, productivity etc). Research oriented aspects which do not help the understanding of the practice itself should be avoided.

Poplar, Willow and Black locust are Short Rotation Coppices (SRC) species. Their plantations are established mainly on poor quality marginal or contaminated soils. The aim of this research, located in North-Eastern Poland, was to determine the impact of soil enrichment method on survivability, productivity and energy value of a yield of three plant species cultivated in four-year harvest cycle on sandy soil. This sandy soil was characterized by unfavourable air and water conditions. Such conditions caused in periods of no precipitation permanent water shortage for plants. The highest average yield of dry biomass, in four-year rotation, was found for Willow, 33.36 t/ha. Poplar yielded 0.5 t/ha lower and Black Locust almost three times lower. The highest yield in the whole experiment was obtained for Poplar fertilized with lignin and mineral fertilizers (41.96 t/ha). A similar yield was obtained for Willow fertilized with lignin, mycorrhiza and mineral fertilizers (41.20 t/ha) and fertilized with lignin and mineral fertilizers (39.32 t/ha). The use of lignin in combination with mineral fertilizers resulted in an increase in the yield by 8-14% compared to mineral fertilizers alone for Willow and Poplar and in a nearly twofold increase for Black Locust. The energy value of the yield ranged from 28.6 to 176.7 GJ/ha, respectively, for Black Locust grown on the control plot and for Poplar grown on the plot with mineral fertilization and lignin used in combination. Thus, real possibilities of increasing the biomass and energy yield of SRC on sandy soils have been found, including marginal ones, by appropriate selection of woody species and soil enrichment. These results should be verified in subsequent harvesting cycles.

Short title in native language	Zaganiki uprawiane w krótkich rotacjach na glebie lekkiej wraz z różnymi metodami wzbogacenia gleby w Polsce
Short summary for practitioners in native language (*can be the language of the coordinator / one of the partners - otherwise in English*) (1000-1500 characters, word count – no spaces). This summary should at least contain the following information: − Main **results/outcomes** of the activity (expected or final) − The **main practical recommendation(s)**: what would be the main added value/benefit/opportunities to the end-user if the generated knowledge is implemented? How can the practitioner make use of the results? This summary should be as interesting as possible for farmers/end-users, using a direct and easy understandable language and pointing out entrepreneurial elements which are particularly relevant for practitioners (e.g. related to cost, productivity etc). Research oriented aspects which do not help the understanding of the practice itself should be avoided.	Topola, wierzba i robinia akacjowa to gatunki uprawiane w krótkich rotacjach (SRC). Ich plantacje prowadzone są głównie na glebach marginalnych lub skażonych i niskiej jakości. Celem tych badań, zlokalizowanych w północno-wschodniej Polsce, było określenie wpływu metod wzbogacania gleby na przeżywalność, produkcyjność i wartość energetyczną plonu trzech gatunków roślin uprawianych w czteroletnim cyklu zbiorów na glebie piaszczystej. Gleba ta charakteryzowała się niekorzystnymi warunkami powietrzno-wodnymi. Takie warunki powodowały w okresach braku opadów stały niedobór wody dla roślin. Najwyższy plon suchej biomasy, w czteroletniej rotacji, stwierdzono dla wierzby (33,36 t/ha). Topola dała 0,5 t/ha mniejszy, a robinia prawie trzy razy mniejszy plon. Najwyższy plon uzyskano dla topoli nawożonej ligniną i nawozami mineralnymi (41,96 t/ha). Podobny plon uzyskano dla wierzby nawożonej ligniną, mikoryzą i nawozami mineralnymi (41,20 t/ha) i nawożonej ligniną i nawozami mineralnymi (39,32 t/ha). Zastosowanie ligniny w połączeniu z nawozami mineralnymi spowodowało wzrost plonu wierzby i topoli o 8-14% w porównaniu do samego stosowania nawozów mineralnych oraz prawie dwukrotny wzrost dla robinii. Wartość energetyczna plonu wahała się od 28,6 do 176,7 GJ/ha, odpowiednio dla robinii uprawianej w kotroli i topoli uprawianej na poletku z łącznym nawożeniem mineralnym i ligniną. Wyniki te pokazują realne możliwości zwiększenia plonu biomasy i wydajności energetycznej SRC na glebach piaszczystych, w tym na marginalnych, poprzez odpowiedni dobór gatunków i metod wzbogacanie gleby. Wyniki te należy zweryfikować w kolejnych cyklach zbiorów.

Several practice abstracts may be needed for one project, depending on the size of the project and the number of outcomes/recommendations which are ready for practice.

Practice "abstract" 15:

Short title in English

Biomass yield from Willow cultivated in 4-year harvest cycle on marginal land in Poland

Short summary for practitioners in english on the (final or expected) outcomes (1000-1500 characters, word count – no spaces). *Do not complete if the summary below is completed in English*

This summary should at least contain the following information:
- Main **results/outcomes** of the activity (expected or final)
- The **main practical recommendation(s)**: what would be the main added value/benefit/opportunities to the end-user if the generated knowledge is implemented? How can the practitioner make use of the results?

This summary should be as interesting as possible for farmers/end-users, using a direct and easy understandable language and pointing out entrepreneurial elements which are particularly relevant for practitioners (e.g. related to cost, productivity etc). Research oriented aspects which do not help the understanding of the practice itself should be avoided.

In this study, the biomass yield and morphological traits of plants were reported from a field trial with six genotypes of Willow, cultivated in northern Poland. Willow was planted using a pole cutting system, which is called Eco-Salix. Two planting densities were selected: 5,200 and 7,400 plants/ha at two marginal sites. The first site had heavy textured clay soil and the second site was located on peaty muck soil. The aim of this study was to determine the morphological traits of plants and the biomass yield of six Willow genotypes (clones and varieties) under low-input agriculture on two marginal soils with a quadrennial harvest cycle. In the field trial, the average Willow biomass yield of dry matter was 7.87 t/ha. The new variety Ekotur had higher yield and more favourable morphological traits compared to other registered Polish varieties. The Willow biomass yield obtained on peat muck soil was significantly higher than from Willow grown on heavy textured clay soil. Eco-Salix system could be effective if used: (i) in regions of low forest coverage to increase biodiversity; (ii) on lands permanently or periodically too wet; (iii) and on land where heavy machinery cannot be used for soil preparation. The Eco-Salix system has the potential to produce high yields of Willow biomass under conditions of low-input agriculture (no or reduced tillage, and a limited number of other management practices) using poles on marginal soils. Furthermore, Ekotur (Salix viminalis) and cv. Doutur (S. alba) can be recommended for cultivation due to high biomass yield on peat-muck soil. When converting land to bioenergy production, the Eco-Salix system can be used on marginal lands and can provide additional environmental and financial benefits.

Short title in native language	Plon biomasy wierzby uprawianej w 4-letniej rotacji zbioru na gruntach marginalnych w Polsce
Short summary for practitioners in native language (*can be the language of the coordinator / one of the partners - otherwise in English*) (1000-1500 characters, word count – no spaces). This summary should at least contain the following information: − Main **results/outcomes** of the activity (expected or final) − The **main practical recommendation(s)**: what would be the main added value/benefit/opportunities to the end-user if the generated knowledge is implemented? How can the practitioner make use of the results? This summary should be as interesting as possible for farmers/end-users, using a direct and easy understandable language and pointing out entrepreneurial elements which are particularly relevant for practitioners (e.g. related to cost, productivity etc). Research oriented aspects which do not help the understanding of the practice itself should be avoided.	W doświadczeniu tym określono plon biomasy i cechy morfologiczne sześciu genotypów wierzby, uprawianych w północnej Polsce. Doświadczenie założono za pomocą żywokołów (nieukorzenionych pędów o długości 2.4 m) tak zwanym systemem Eko-Salix. Zastosowano dwie gęstości sadzenia: 5 200 i 7 400 roślin na hektar na dwóch gruntach marginalnych. Pierwsze stanowisko położone było na ciężkiej glebie ilastej, a drugie znajdowało się na glebie torfowo-murszowej. Celem badań było określenie cech morfologicznych roślin i produkcyjności sześciu genotypów wierzby (klonów i odmian) bez uprzedniej uprawy na dwóch glebach marginalnych w czteroletnim cyklu zbioru. Średni plon suchej biomasy wierzby z doświadczenia wynosił 7,87 t/ha. Nowa odmiana Ekotur dała wyższy plon i miała korzystniejsze cechy morfologiczne w porównaniu do wcześniej zarejestrowanych polskich odmian. Plon biomasy wierzby uzyskany na glebie torfowo-murszowej był znacznie wyższy niż z wierzby uprawianej na ciężkiej glebie ilastej. Można wnioskować, że system Eko-Salix może być skuteczny, jeżeli jest stosowany: (i) w regionach o niskiej lesistości, w celu zwiększenia różnorodności biologicznej; (ii) na gruntach trwale lub okresowo zbyt mokrych (gleby ciężkie gliniaste i ilaste, gleby torfowe); (iii) oraz na gruntach, gdzie maszyny rolnicze są zbyt ciężkie i nie mogą być użyte do przygotowania gleby. System Eko-Salix może dać wysokie plony biomasy wierzby w warunkach rolnictwa niskonakładowego (brak lub ograniczona uprawa i niska liczba innych zabiegów agrotechnicznych) przy użyciu żywokołów na glebach marginalnych. Ponadto, odmiana Ekotur (Salix viminalis) i cv. Doutur (S. alba) mogą być zalecane do uprawy na glebie torfowo-murszowej.

Several practice abstracts may be needed for one project, depending on the size of the project and the number of outcomes/recommendations which are ready for practice.

Practice "abstract" 16:

Short title in English

Scots Pine long-term field trials in Latvia

Short summary for practitioners in english on the (final or expected) outcomes (1000-1500 characters, word count – no spaces). *Do not complete if the summary below is completed in English*

This summary should at least contain the following information:
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This summary should be as interesting as possible for farmers/end-users, using a direct and easy understandable language and pointing out entrepreneurial elements which are particularly relevant for practitioners (e.g. related to cost, productivity etc). Research oriented aspects which do not help the understanding of the practice itself should be avoided.

In Northern Europe Scots Pine (Pinus sylvestris) is one of the most often planted tree species in plantations. When planted in abandoned agricultural land and intensively tended, Pine successfully takes root in open areas. 15-year-old plantations in 7 sites were evaluated. Overall, the growth of plantation Pine is evaluated as average or good, yet it grows best in naturally dry podzolic sandy, sod-podzolic sandy loam and gravelly loam soils. When plantation is established on marginal or abandoned agricultural land, Scots Pine shows slow development in the first 5 years (on average 0.10 to 0.15 m/year). Diameter at Breast Height (DBH, 1.3 m) is reached at 6 - 8 years, and the growth of Pines increase at this age. 15-year plantation Pine on agricultural land shows the same DBH parameters that are found on forest land at 25 - 28 years and average height at 16 -18 years. The stock volume of well-growing plantation Pine may by the age of 15 be as high as 80 to 155 m3/ha, and by 22 years reach even 243 m3/ha. Pine plantations produce the highest stock volume in podzolic, cultivated, and sod-podzolic soils, where the stock volume for 15 to 16-year Pine is 112 to 155 m3/ha, with the current volume growth 5 to 8 m3/ha. Above ground biomass analysis show that in plantations 12 - 15-year-old tree has total biomass of 137 - 190 kg consisting of stem biomass 70 - 149 kg (51 - 78%) and crown biomass 67 - 42 kg (49 - 22%). Agricultural land can be too fertile for Scots Pine, leading to rapid growth, but also to development of thick lateral branches, which decreases wood quality and even stock volume. Therefore, it is important to prune the trees and carry out thinning no later than at 14 - 15 years of age.

Short title in native language	Parastās priedes ilgtermiņa izmēģinajuma pētījumiLatvijā
Short summary for practitioners in native language (*can be the language of the coordinator / one of the partners - otherwise in English*) (1000-1500 characters, word count – no spaces). This summary should at least contain the following information: − Main **results/outcomes** of the activity (expected or final) − The **main practical recommendation(s)**: what would be the main added value/benefit/opportunities to the end-user if the generated knowledge is implemented? How can the practitioner make use of the results? This summary should be as interesting as possible for farmers/end-users, using a direct and easy understandable language and pointing out entrepreneurial elements which are particularly relevant for practitioners (e.g. related to cost, productivity etc). Research oriented aspects which do not help the understanding of the practice itself should be avoided.	Ziemeļeiropā, parastā priede (Pinus sylvestris) ir viena no biežāk stādītajām koku sugām mežā, bet ne lauksaimniecības zemju apmežojumos. Stādot pamestās lauksaimniecības zemēs un intensīvi kopjot, priede ir ieaudzējama atklātās platībās. 15 gadīgos stādījumos 7 vietās, dažādos apstākļos vērtētas apmežošanas sekmes. Priežu plantāciju mežu augšana vērtējama kā vidēja vai laba, tomēr tā vislabāk jūtas dabiski sausās podzola, velēnu podzolētās mālsmilts un oļainās mālsmilts augsnēs ar nepaaugstinātu grunts ūdens līmeni). Kad plantāciju izveido uz marginālas zemes, parastā priede uzrāda lēnu attīstību pirmajos 5 gados (vidēji 0,10 līdz 0,15 m gadā–1). Diametrs krūšu augstumā (DBH, 1,3 m) tiek sasniegts 6 - 8 gados, paātrinās priežu augšana. 15 gadu vecumā plantāciju mežā augušiem kokiem DBH parametri atbilst mežos 25 - 28 gadus augušiem kokiem. Vidējais priežu augstums plantāciju mežā 15 gados ir līdzīgs 16 -18 gadus veciem mežā augušiem kokiem. Priežu stādījuma krāja 15 gadu vecumā variē no 80 līdz 155 m3/ha, bet 22 gadu laikā sasniedz pat 243 m3/ha. Priežu stādījumos vislielāko krājas apjomu iegūst podzolaugsnēs, kultūraugsnēs un velēnu podzolētas augsnes, kur 15 līdz 16 gadu parastās priedes krājas apjoms ir 112 līdz 155 m3/ha, un ikgadējais krājas pieaugums ir 5 līdz 8 m3/ha. Virszemes biomasa 12 –15 gadus vecu koku stādījumos variē no 137 līdz 190 kg, (stumbrs 70 –149 kg (51 –78%) un vainagi 67 –42 kg (49 –22%)). Lauksaimniecības zeme var būt pārāk auglīga, pārlieku strauja parastās priedes augšana saistīta ar kupla vainaga un daudzu sānzaru veidošanos, tas samazina stumbra – baļķa koksnes kvalitāti un pat to koksnes krājas apjomu. Tāpēc ir svarīgi atzarot mērķkokus un veikt kokaudzes retināšanu jau 14 – 15 gadu vecumā.

Several practice abstracts may be needed for one project, depending on the size of the project and the number of outcomes/recommendations which are ready for practice.

Practice "abstract" 17:

Short title in native language	Good practices in MAGIC
Short summary for practitioners in native language (*can be the language of the coordinator / one of the partners - otherwise in English*) (1000-1500 characters, word count – no spaces). This summary should at least contain the following information: − Main **results/outcomes** of the activity (expected or final) − The **main practical recommendation(s)**: what would be the main added value/benefit/opportunities to the end-user if the generated knowledge is implemented? How can the practitioner make use of the results? This summary should be as interesting as possible for farmers/end-users, using a direct and easy understandable language and pointing out entrepreneurial elements which are particularly relevant for practitioners (e.g. related to cost, productivity etc). Research oriented aspects which do not help the understanding of the practice itself should be avoided.	Marginal lands are in large part attributed to agricultural fields which have been abandoned. This is a major problem in terms of environmental, socioeconomic and landscape implications, as it can cause several impacts, such as higher risk of fires, loss of biodiversity, water scarcity, etc., essential for the sustainable development of rural communities. The aim of identifying 'Good Practices' is to understand the context of using marginal land for cropping, the state and prospects for industrial crops, the conditions framing their cultivation and the supply chains as well as their operational capacities across time and development stages. The process of identifying the 'Good Practice' involves gathering information on successes and failures of growing industrial crops on marginal lands in different contexts and lessons learned from them followed up with analysis of what works, what does not work and why. The 'Good Practice' can be assessed based on a combination of technical, environmental, economic and socio-economic criteria and indicators. It will follow practices which rehabilitate the biophysical constraints related to the soil and water conditions of the land while improving environmental, economic and societal establishments and operational aspects of the value chain. These practices will lead a path to policy success in integrating industrial crops cultivated in marginal lands in bio-based value chains. The 'Good Practice' when assessed will score highest on these indicators compared to other practices in the region.

Several practice abstracts may be needed for one project, depending on the size of the project and the number of outcomes/recommendations which are ready for practice.

Practice "abstract" 18:

Short title in native language	Low-input agricultural practices for industrial crops on marginal land
Short summary for practitioners in native language (*can be the language of the coordinator / one of the partners - otherwise in English*) (1000-1500 characters, word count – no spaces). This summary should at least contain the following information: − Main **results/outcomes** of the activity (expected or final) − The **main practical recommendation(s)**: what would be the main added value/benefit/opportunities to the end-user if the generated knowledge is implemented? How can the practitioner make use of the results? This summary should be as interesting as possible for farmers/end-users, using a direct and easy understandable language and pointing out entrepreneurial elements which are particularly relevant for practitioners (e.g. related to cost, productivity etc). Research oriented aspects which do not help the understanding of the practice itself should be avoided.	The identification of the most suitable industrial crops that can be cultivated in the European "prevalent marginal agro-ecological zones" (MAEZ), as well as of the "marginal agricultural land low-input systems" (MALLIS) for growing these crops were among the main issues addressed by MAGIC. In addition to the economic and environmental aspects, the research was also based on the current knowledge on best low-input agricultural practices for food crop production on good soils. It sought to optimize the use of on-farm resources and minimize off-farm inputs, which translates into having a more 'closed' production cycle and requires more advanced agronomic skills. As a conclusion, the selection of suitable industrial crops was found to be the most important component in the development of MALLIS, because all other measures (tillage, fertilization, weeding, irrigation, etc.) very much depend on the site-specific performance of the crop. The expected overall performance of the crops was analysed by means of a multi-criteria analysis. Some examples of the conclusions are: -in Mediterranean climate conditions and soils with unfavourable texture and stoniness tall wheatgrass can be cultivated using practices of minimum/no tillage. Also, Siberian elm could be cultivated in rainfed; -in Atlantic climate conditions and soils contaminated by wastewater the lignocellulosic crops such as miscanthus can be cultivated with minimum/no tillage and bio-fertilisation; -in Continental climate conditions and soils with hard clay and limited soil drainage there can be cultivated crops such as tall wheatgrass, willow, hemp, poplar or reed canary grass with minimum/no tillage, reduced fertilization and weed control practices.

Several practice abstracts may be needed for one project, depending on the size of the project and the number of outcomes/recommendations which are ready for practice.

Practice "abstract" 19:

Short title in native language	Handbook with factsheets of the existing resource-efficient industrial crops
Short summary for practitioners in native language (*can be the language of the coordinator / one of the partners - otherwise in English*) (1000-1500 characters, word count – no spaces). This summary should at least contain the following information: − Main **results/outcomes** of the activity (expected or final) − The **main practical recommendation(s)**: what would be the main added value/benefit/opportunities to the end-user if the generated knowledge is implemented? How can the practitioner make use of the results? This summary should be as interesting as possible for farmers/end-users, using a direct and easy understandable language and pointing out entrepreneurial elements which are particularly relevant for practitioners (e.g. related to cost, productivity etc). Research oriented aspects which do not help the understanding of the practice itself should be avoided.	MAGIC consortium has gained an extensive knowledge on industrial crops by coordinating and participating in several relevant national & EU projects. This experience has allowed to create a handbook with fact sheets of the existing resource-efficient industrial crops. In them, useful agronomic information is presented in a synthetic way. Although not all aspects were available for each crop, most factsheets present information on crop features such as varieties, soil and climate preferences, soil preparation and sowing, water and fertilization needs, yields, uses, qualitative traits, harvesting, handling, storing, environmental impacts and risks associated with cultivation (diseases, insects and weed control). All this information was supported by a thoroughly research work on literature, position papers, project reports, etc. In total, twenty factsheets are available for the following crops: • Amaranth • Calendula • Camelina • Caper spurge • Castor bean • Crambe • Ethiopian mustard • Flax • Industrial hemp • Kenaf • Nettle • Pennycress • Poplar • Safflower • Sorghum • Spartium • Sunflower • Sunn hemp • Switchgrass • Wild tobacco All the factsheets can be found at MAGIC website over the Reports&Deliverables tab (D1.5 – Handbook with fact sheets of the existing resources-efficient). In addition, MAGIC has created MAGIC-CROPS, a database that provides a description of 37 industrial crops suitable for growing on marginal land in Europe where more information can be found. You can also access MAGIC-CROPS through the main page of MAGIC website.

Several practice abstracts may be needed for one project, depending on the size of the project and the number of outcomes/recommendations which are ready for practice.

Practice "abstract" 20:

Short title in native language	Inventory on available harvesting technology for industrial crops on marginal lands
Short summary for practitioners in native language (*can be the language of the coordinator / one of the partners - otherwise in English*) (1000-1500 characters, word count – no spaces). This summary should at least contain the following information: − Main **results/outcomes** of the activity (expected or final) − The **main practical recommendation(s)**: what would be the main added value/benefit/opportunities to the end-user if the generated knowledge is implemented? How can the practitioner make use of the results? This summary should be as interesting as possible for farmers/end-users, using a direct and easy understandable language and pointing out entrepreneurial elements which are particularly relevant for practitioners (e.g. related to cost, productivity etc). Research oriented aspects which do not help the understanding of the practice itself should be avoided.	The apparent lack of appropriate machinery significantly affects farmers' perception of the possibility to cultivate industrial crops. Thus, the development of a comprehensive inventory on currently available harvesting systems of industrial crops on marginal land has been considered as a need in the MAGIC project. This inventory gathers information obtained from direct data collection in previous projects, scientific literature review and market analysis on the current existing technologies used to harvest non-food crops in marginal lands and included in the MAGIC CROPS database. The inventory document is organized in fact-sheets representing an “easy-to-find” and “easy-to-use” instrument for final users, providing a rapid identification of the principal mechanized harvesting solutions for a specific crop, according to the final use of the biomass. For each crop a traffic light is included to provide indications about the status of knowledge on harvest technologies. In total, twenty factsheets are available for the following crops: • Sorghum bicolor L. • Camelina sativa L. • Crambe abyssinica L. • Ricinus communis L. • Panicum virgatum L. • Miscanthus x giganteus • Arundo donax L. • Agropyron elongatum (Host) • Brassica carinata L. • Cannabis sativa L. • Phalaris arundinaceae L. • Carthamus dictorius L. • Cynara cardunculus L. • Thlaspi arvense L. • Salix spp • Populus spp • Robinia pseudoacacia L. • Ulmus pumila L. • Saccharum spontaneum L. • Lupinus mutabilis Sweet Factsheets can be found at MAGIC website over the Reports&Deliverables tab (D5.1 – Inventory on available harvesting technology for industrial crops on marginal lands).