

**FOSTERING SUSTAINABLE FEEDSTOCK
PRODUCTION FOR ADVANCED BIOFUELS
ON UNDERUTILISED LAND IN EUROPE**

**REPORT ON TRAINING EVENTS IN THE
TARGET COUNTRIES (ITALY, UKRAINE,
GERMANY)**

24.08.2018

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	NAME	ORGANIZATION
AUTHOR(S)	Cosette Khawaja, Rainer Janssen, Dominik Rutz	WIP
	Giuseppe Pulighe, Guido Bonati	CREA
	Oleksandra Tryboj, Tetiana Zheliezna	SECB
	Rainer Schlepphorst, Dirk Knoche, Raul Köhler	FIB



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1. Objectives

The main objective of the capacity building events is to give stakeholders who have already assisted to the info days and also other interested stakeholders the chance to get more in-depth information and knowledge on biomass feedstock production on underutilised land. The training will inform about agronomic, techno-economic and sustainability requirements and overcoming policy barriers based on the results of agronomic and techno-economic feasibility studies which were developed in the core of the project. The training event is a one-day event and conducted in national languages. Six training events are implemented in the target countries (2 in Italy, 2 in Ukraine and 2 in Germany).

2. Capacity building events in Italy

2.1. First training event

2.1.1. Introduction

The first capacity-building event, organized by CREA in Italian language, was titled: Progetto FORBIO – Promuovere la produzione sostenibile di materie prime per biocarburanti avanzati in terreni sotto utilizzati in Europa, Seminario di Approfondimento.

The event took place on 7 June 2018 in the “Aula Magna” of the “Duca degli Abruzzi” Agricultural Secondary School located in Elmas (Cagliari, Sardinia). The school is a great place for organising the event as it often hosts events, conferences and seminars and is easily accessible by the participants due to its location on the outskirts of the city of Cagliari, near the airport, and from the main communication routes.

The main aims of the capacity building event were to: 1) examine the opportunities and perspectives of bioenergy supply chains in underused areas; 2) provide detailed information on the agronomic, techno-economic and sustainability potential for the cultivation of dedicated energy crops in Sardinia; 3) propose recommendations and feasible solutions to encourage farmers, investors and local actors toward sustainable local supply chains for the production of bioenergy and biofuels.

The capacity-building event included a number of advanced topics regarding the development of bioenergy crops and their main challenges with respect to their feasibility in marginal lands. The event has been designed to be practical with field trial results, examples and new opportunities to provide skills, encourage participation and exchange information.

The presentations were given by 6 speakers from CREA, FAO, Department of Agriculture – University of Sassari, AGRIS research agency of Sardinia Region, and was attended by 30 participants representative of farmers, agronomists and agriculture professional organization, researchers, local investors and students from the host school.

2.1.2. Invitation

The following invitation flyer was sent to all participants at the info day organised in Carbonia on 12-14 October 2016 with an invitation e-mail as follow-up initiative to save the date. Furthermore, invitation flyer was sent to professional associations and agronomists, regional officers, reclamation and irrigation consortia, environmental protection agency.

L'uso delle **biomasse** a fini energetici è una parte importante del mix energetico da fonti rinnovabili nell'Unione Europea (UE), e si prevede che nei prossimi anni possa crescere in maniera significativa sospinto dalla revisione della Direttiva sulle **energie rinnovabili** (RED II). In questo senso, i terreni sottoutilizzati (marginali, contaminati o abbandonati) nelle regioni mediterranee hanno un grande potenziale per raggiungere gli obiettivi dell'UE con una produzione di materie prime sostenibili, ma anche per dare nuove opportunità di lavoro e crescita economica. Il progetto H2020 **FORBIO** (www.forbio-project.eu) ha applicato una serie di approcci innovativi al fine di sviluppare piani di azione per la rimozione degli ostacoli economici e non economici alla diffusione di **bioenergie sostenibili** e per promuovere e facilitare la formazione di partenariati tra agricoltori, produttori di bioenergia e istituzioni locali. Lo scopo dell'incontro è quello di sensibilizzare e promuovere i principali risultati del progetto al fine di costituire le basi per la creazione e il rafforzamento di una catena di valore bioenergetica locale competitiva e che soddisfi i più elevati criteri di sostenibilità, contribuendo alla diffusione sul mercato delle bioenergie sostenibili nell'Unione Europea, nelle regioni mediterranee e in Sardegna.

Gli obiettivi specifici dell'incontro di **capacity building** sono:

- Esaminare le opportunità e prospettive di filiere bioenergetiche in aree sottoutilizzate (contaminate, abbandonate, marginali);
- Fornire informazioni sulle potenzialità agronomiche, tecnico-economiche e di sostenibilità per la coltivazione di colture dedicate per la produzione di bioenergie;
- Proporre raccomandazioni e soluzioni fattibili e trasferibili per incoraggiare gli agricoltori, investitori e attori locali verso filiere locali sostenibili e integrate nel territorio.

SEMINARIO DI APPROFONDIMENTO

Istituto Agrario Duca degli Abruzzi – Elmas (Ca)
7 Giugno 2018

PROGRAMMA

09.00 - 09.30	Registrazione dei partecipanti
09.30 - 09.35	Saluti e apertura lavori Roberto Zurrù - Direttore Generale AGRIS
09.35 - 10.00	Il progetto FORBIO Guido Bonati, Giuseppe Pulighe - CREA
10.00 - 10.30	Progetto AGROENER - Energia dall'agricoltura: innovazioni sostenibili per la bioeconomia Paolo Menesatti - CREA
10.30 - 11.00	Indicatori di sostenibilità per le filiere bioenergetiche Marco Colangeli - FAO
11.00 - 11.30	Arundo donax per la produzione di biomasse in Sardegna Giacomo Patteri - UNISS
11.30 - 12.00	Progetto CANOPAES. Canapa: opportunità ambientali ed economiche in Sardegna Ermino Spanu - AGRIS
12.00 - 13.00	Dibattito e chiusura lavori

FILIERA

Fornitura sostenibile di biomassa per biocarburanti avanzati



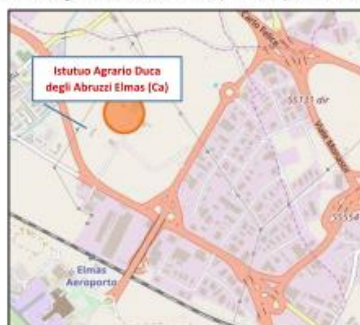
Questo progetto ha ricevuto fondi dal programma di ricerca ed innovazione dell'Unione Europea Orizzonte 2020 (Contratto N° 691846).

SEGRETERIA ORGANIZZATIVA

CREA - Consiglio per la ricerca in agricoltura e l'analisi dell'economia agraria
Centro di ricerca Politiche e Bioeconomia - Via Po, 14 00198 Roma
Guido Bonati - Giuseppe Pulighe
Telefono: 06 47856280
e-mail: guido.bonati@crea.gov.it - giuseppe.pulighe@crea.gov.it

COME RAGGIUNGERE LA SEDE DEL SEMINARIO:

Istituto Agrario Duca degli Abruzzi – Elmas (Ca)
Via Acquedotto Romano, Zona Industriale Est, 09030 Elmas (Ca)
- Dalla S.S. 131 (E25), in direzione Cagliari, ingresso Cagliari Aeroporto
- Dalla S.S. 130, in direzione Cagliari, Ingresso Aeroporto
- In uscita da Cagliari, dall'Asse mediano (SS 131 dir), uscita Aeroporto



CON IL PATROCINIO DI:

Ordine dei Dottori Agronomi e Dottori Forestali della Provincia di Cagliari



Collegio Prov.le dei Periti Agrari e dei Periti Agrari Laureati di Cagliari e Oristano



PROGETTO AGROENER
agroener.crea.gov.it



CREDITI FORMATIVI:

La partecipazione al seminario consente l'attribuzione di CFP come da regolamento sulla formazione professionale continua.



Questo progetto ha ricevuto fondi dal programma di ricerca ed innovazione dell'Unione Europea Orizzonte 2020 (Contratto N° 691846).

2.1.3. Agenda

Agenda of the event:

- 09.00 - 09.30 Registration of participants
- 09.30 - 09.35 Opening and Welcome Speech. Roberto Zurru - Director of AGRIS agency
- 09.35 - 10.00 The FORBIO project. Guido Bonati, Giuseppe Pulighe - CREA
- 10.00 - 10.30 The AGROENER project - Energy from agriculture: sustainable innovations for the bioeconomy. Paolo Menesatti - CREA
- 10.30 - 11.00 Sustainability indicators for bioenergy supply chains. Marco Colangeli - FAO
- 11.00 - 11.30 Arundo donax for biomass production in Sardinia. Giacomo Patteri - UNISS
- 11.30 - 12.00 The CANOPAES project. Hemp: environmental and economic opportunities in Sardinia. Ermino Spanu - AGRIS
- 12.00 - 13.00 Open debate and closure of event

2.1.4. Summary of presentations

Guido Bonati and **Giuseppe Pulighe** from CREA presented the rationale and main aims of the FORBIO project, the Consortium and partners involved, the study areas in Europe, and specifically the results obtained in the study area in Sardinia (Sulcis) with the agronomic and tecno-economic feasibility studies. More in detail, were presented the most promising bioenergy crops suitable for the study area, potential yields, costs of planning, landowner fee, irrigation, harvesting, machinery, and finally theoretical cost of biomass delivered to the plant gate and collected in a radius of 40 km.

Paolo Menesatti from CREA (Research Centre for Engineering and Agro-food Processing) presented an overview of the activities of its research center, and in particular the activities carried out within the AGROENER project (www.agroener.crea.gov.it), which aims to make new sustainable innovations in the agro-energy supply chain.

Marco Colangeli from FAO presented the results of the calculation of some sustainability indicators for the FORBIO project for bioenergy supply chain in the study area in Sardinia (developed within the GBEP platform), and calculated using the new user-friendly tool STEN (Sustainability Tool for Europe and Neighbouring countries).



Guido Bonati, CREA



Paolo Menesatti, CREA

Giacomo Patteri from the University of Sassari, Department of Agriculture, presented the results of the field trials (carried out in collaboration with the FORBIO project partner Biochemtex spa) regarding the cultivation of *Arundo donax* L. (giant reed) in Sardinia, with particular emphasis on the agronomic inputs (e.g. fertilization, water requirements) and the main results on the above-ground biomass yields obtained at the cultivation sites.

Erminio Spanu from AGRIS (Sardinia research agency in agriculture) presented the results of the CANOPAES project regarding the environmental and economic opportunities for the cultivation of hemp (*Cannabis sativa* L.) in marginal and polluted areas in Sardinia.



Open discussion with a farmer

2.1.5. Conclusions

The open debate, following the presentations on the agenda, was opened by Prof. Roggero from the Department of Agriculture, University of Sassari. In her introduction, Prof. Roggero pointed out that the bioenergy market has been historically negatively influenced by inadequate support policies such as monetary incentives and feed-in tariffs. These incentives have altered the farming systems with market distortions for some years, (e.g. oleaginous crops planted in the past in Sardinia) encouraging farmers to grow only for the incentive system. In general, bioenergy policies are influenced by industries at European level, but local farming systems are poorly engaged or equipped to address such systems. Looking at the recent initiatives of industries such as ENI and MATRICA (www.matrica.it) in North Sardinia, more perspectives in the future could come from integrated biorefineries that produces a spectrum of marketable products (biomaterials, biochemicals, bioplastics and biofuels). Furthermore, Prof. Roggero argued that in the future the sustainable cultivation of bioenergy crops should be implemented considering context-specific landscape design, considering possible conflicting land uses with sheep farming, farmers' willingness and acceptance, as well as biodiversity threats (e.g. insects). In summary, annual and perennial dedicated lignocellulosic crops (as those identified in the agronomic feasibility study) have good potential, but their use in Sardinia must be implemented with specific landscape planning processes including integrated rotations.

Following the first statements, one entrepreneur on renewable energies pointed out the lack of support for programming and policies on bioenergy (and more generally for agriculture) from the Sardinia Region. In the same vein, the participant told that the equilibrium with livestock farming (i.e. sheep) for forage production and pasture management should be guaranteed.

One agronomist commented that in the past in Sardinia were promoted Eucalyptus plantations (*Eucalyptus spp.*) with different species and radiata pine plantations (*Pinus radiata D.Don*) which are biomass crops not suitable for the local climate, and more generally for Sardinia. In this sense, it must be paid attention with regard to new bioenergy crops, especially for the competition with food production, as well as conflicting land uses in marginal lands.

Commenting the previous statements of the agronomist, one local farmer said that he has been growing eucalyptus for years successfully and is able to gain interesting net income from this tree crop. For him it is very important where it is planted and grown. Moreover, this farmer proposed the utilisation of Eucalyptus biomass for the production of wood pellet fuel considering the high local consumption (imported by other Countries). In addition, this farmer called for more programming actions by Regional authorities in order to have a greater range of opportunities and possibilities in the bioenergy sector.

Talking about the issue of the dimension of the new bioenergy projects, a researcher from AGRIS said that these projects should be smaller in size with respect to the model of large biorefineries, for example with small plants on a local scale to produce bioenergy using local supply chains with different kinds of biomass, as dedicated perennial crops, by-products and crop residues. This researcher alluded to the possibility that the failure of big investors can have serious consequences on small farmers involved in the value chain.

2.2. Second training event

2.2.1. Introduction

The second capacity-building event, organized by CREA and conducted in Italian language, was titled: "Seminario di Approfondimento progetto FORBIO – Promuovere la produzione sostenibile di materie prime per biocarburanti avanzati in terreni sotto utilizzati in Europa". The event took place on September 19, 2018 within RemTech Expo (September 19-21, 2018 www.remtechexpo.com), an international event dedicated to reclamation of contaminated sites, environmental and natural hazards, safety, maintenance and upgrading of the territory.

Strong points that make this event an interesting site for hosting the capacity building is that it involves a qualified and large community, composed of private companies, public entities, universities, research centers, associations, and professionals and it is characterised by a specialised exhibition area, high level technical, technological, scientific congressional sessions, and an intense networking activity, round tables, training courses for operators, authorities and decision makers. The event was held in a dedicated room at the Ferrara Expo center, Via della Fiera 11, 44124 Ferrara.

The main aims of the capacity building event were to: 1) examine the opportunities and perspectives of bioenergy supply chains in underused areas, with a focus on detailed information on the agronomic, techno-economic and sustainability indicators for the cultivation of dedicated energy crops in Sardinia; 3) provide information on potentials of biomass production in the framework of green chemistry and bioeconomy; 4) give an overview on national and EU strategies and legislation for the agroenergy sector.

The training event has been designed to be practical, covering the main results obtained in the study area and in the project, and providing examples, good practices (and some limitations and barriers), as well as new business opportunities, to provide skills, encourage participation and exchange information. The presentations were given by 5 speakers from CREA, FAO, Legambiente, Chimica Verde Bionet, and 14 participants attended the event. These were representative of farmers, agronomists and agriculture professional organization, researchers, and environmental engineers.

2.2.1. Invitation

The following invitation flyer was sent to professional associations and agronomists, regional officers, reclamation and irrigation consortia, environmental protection agency. Furthermore, CREA issued a press release of the event that was sent to the main Italian press agencies and is available at the following link: <https://www.crea.gov.it/it/comunicati-stampa/CREA--Progetto-FORBIO--fino-al-70--in-meno-di-CO2--con-le-bioenergie>. The invitation flyer was visible to all participants of the expo and available in the website of RemTech Expo at the following link:

http://www.remtechexpo.com/images/2018/programmi/FORBIO_agenda_19.09.2018.pdf

L'uso delle **biomasse** a fini energetici è una parte importante del mix energetico da fonti rinnovabili nell'Unione Europea (UE), e si prevede che nei prossimi anni possa crescere in maniera significativa sospinto dalla revisione della Direttiva sulle **energie rinnovabili** (RED II). In questo senso, i terreni sottoutilizzati (marginali, contaminati o abbandonati) nelle regioni mediterranee hanno un grande potenziale per raggiungere gli obiettivi dell'UE con una produzione di materie prime sostenibili, ma anche per dare nuove opportunità di lavoro e crescita economica. Il progetto H2020 **FORBIO** (www.forbio-project.eu) ha applicato una serie di approcci innovativi al fine di sviluppare piani di azione per la rimozione degli ostacoli economici e non economici alla diffusione di **bioenergie sostenibili** e per promuovere e facilitare la formazione di partenariati tra agricoltori, produttori di bioenergia e istituzioni locali. Lo scopo dell'incontro è quello di sensibilizzare e promuovere i principali risultati del progetto al fine di costituire le basi per la creazione e il rafforzamento di filiere bioenergetiche locali competitive e che soddisfino i più elevati criteri di sostenibilità, contribuendo alla diffusione sul mercato delle bioenergie sostenibili nell'Unione Europea.

Gli obiettivi specifici dell'incontro di **capacity building** sono:

- Esaminare le opportunità e prospettive di filiere bioenergetiche in aree sottoutilizzate (siti inquinati, aree marginali);
- Fornire informazioni sulle potenzialità agronomiche, tecnico-economiche e di sostenibilità per la coltivazione di colture dedicate per la produzione di bioenergie;
- Proporre raccomandazioni e soluzioni fattibili e trasferibili per incoraggiare gli agricoltori, investitori e attori locali verso filiere locali sostenibili e integrate nel territorio.

SEMINARIO DI APPROFONDIMENTO RemTech Expo, Ferrara Fiere Congressi Ferrara 19 Settembre 2018

PROGRAMMA

- 09.30 - 10.00** Registrazione dei partecipanti
- 10.00 - 10.30** **Il progetto FORBIO**
Guido Bonati, Giuseppe Pulighe - CREA
- 10.30 - 11.00** **Strategie nazionali e comunitarie per le agroenergie**
Stefano Fabiani - CREA - Attilio Tonolo - MiPAAF
- 11.00 - 11.30** **Indicatori di sostenibilità per le filiere bioenergetiche**
Marco Colangeli - FAO
- 11.30 - 12.00** **Biomasse, chimica verde e sostenibilità**
Sofia Mannelli - Chimica verde
- 12.00 - 12.30** **Il progetto SEEMLA**
Federica Barbera - Legambiente
- 12.30 - 13.00** **Dibattito e chiusura lavori**

FILIERA

Fornitura sostenibile di biomassa per biocarburanti avanzati



Questo progetto ha ricevuto fondi dal programma di ricerca ed innovazione dell'Unione Europea Orizzonte 2020 (Contratto N° 691846).

SEGRETERIA ORGANIZZATIVA

CREA - Consiglio per la ricerca in agricoltura e l'analisi dell'economia agraria
Centro di ricerca Politiche e Bioeconomia - Via Po, 14 00198 Roma
Guido Bonati - Giuseppe Pulighe - Telefono: 06 47856280
e-mail: guido.bonati@crea.gov.it - giuseppe.pulighe@crea.gov.it

COME RAGGIUNGERE LA SEDE DEL SEMINARIO:

REMTECH EXPO - Ferrara Fiere Congressi - Via della Fiera 11, 44124 Ferrara
I visitatori che effettuano la pre-registrazione online entrano gratis.
Link registrazione: www.webland2000.com/RemTechExpo/

In aereo. L'aeroporto Guglielmo Marconi di Bologna dista 45 Km dal quartiere fieristico di Ferrara. Servizio di bus-navetta "Ferrara Bus&Fly" da e verso aeroporto. Per maggiori informazioni: www.ferrarabusandfly.it.

In treno. La stazione dista solo 5 Km dal quartiere fieristico. Navetta gratuita "RemTech" all'uscita della stazione ferroviaria.

In auto. Autostrada A13 uscita "Ferrara Sud". Prendere la 1ª uscita a destra in direzione Ferrara Fiere (4 minuti di percorrenza).



CON IL PATROCINIO DELL'ORDINE DOTTORI AGRONOMI E DOTTORI FORESTALI DELLA PROVINCIA DI FERRARA.

Presso Conaf e Federazione Regionale dei Dottori Agronomi e Forestali dell'Emilia Romagna sarà accreditato il convegno (0,125 Credito/Ora = 1CFP/8 ore).



Questo progetto ha ricevuto fondi dal programma di ricerca ed innovazione dell'Unione Europea Orizzonte 2020 (Contratto N°

2.2.2. Agenda

Agenda of the training event:

- 09.30 - 10.00 Registration of participants
- 10.00 - 10.30 Opening and Welcome Speech, Main Objectives of the project. Guido Bonati - CREA
- 10.30 - 11.00 The FORBIO project. Giuseppe Pulighe – CREA
- 11.00 - 11.15 Coffe break
- 11.15 - 11.45 National and EU strategies for agroenergy. Sofia Mannelli – Chimica Verde
- 11.45 - 12.15 Sustainability indicators for bioenergy supply chains. Marco Colangeli - FAO
- 12.15 - 12.40 Biomass, green chemistry and sustainability. Sofia Mannelli – Chimica Verde
- 12.40 - 12.55 The SEEMLS project. Federica Barbera - Legambiente
- 12.55 - 13.00 Closure of the event

2.2.3. Summary of presentations

The event was opened by Dr. **Guido Bonati** from CREA by welcoming all participants and introducing the rationale and main objectives of the FORBIO project, the Consortium and partners involved, and the study area in Italy and other countries.

Giuseppe Pulighe from CREA presented in details the results obtained in the study area in Sardinia (Sulcis) with the agronomic and techno-economic feasibility studies. More specifically, were presented the most promising bioenergy crops suitable for the study area, potential yields, costs of planning, landowner fee, irrigation, harvesting, machinery, and finally the theoretical cost of biomass delivered to the plant gate and collected in a radius of 40 km.

Due to an inconvenience the speakers S. Fabiani from CREA and A. Tonolo from Italian Ministry of Agriculture could not attend the event scheduled in the official agenda. Their intervention was reframed and carried out by **Sofia Mannelli**, president of the association Chimica Verde Bionet (<http://www.chimicaverde.it>), that is an expert in bioenergy sector and green chemistry.

In the first presentation, **Sofia Mannelli** explained the framework of Italian and EU legislation, and national action plan regarding bioenergy sector, with particular focus on the update of the Renewable Energy Directive (RED II) and targets for 2030.

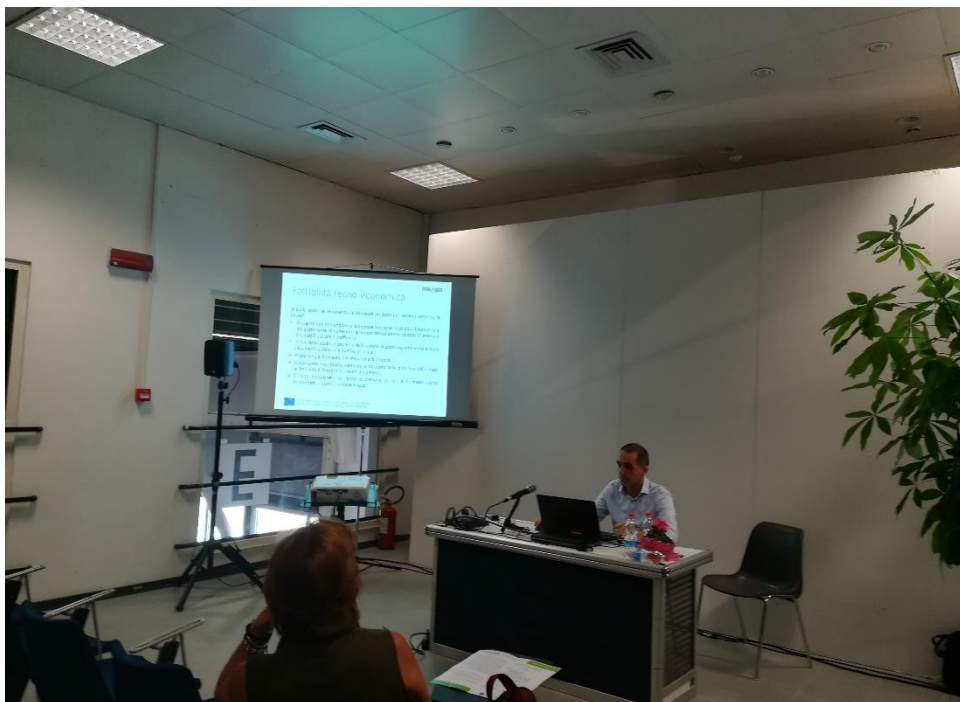
Marco Colangeli from FAO, speaking online through Skype connection, presented the results of the calculation of some sustainability indicators for the FORBIO project for a bioenergy supply chain in the study area in Sardinia (developed within the GBEP platform), and calculated using the new user-friendly tool FAST.

In her second presentation **Sofia Mannelli** presented an inspiring and compelling vision regarding the sustainable use of biomass products, the conversion of raw material and byproducts in the framework of green chemistry, as well as outlook issues for sustainability and the bioeconomy.

Finally, **Federica Barbera** from Legambiente presented the main objectives and topic results of the SEEMLA project (www.seemla.eu.it), an Horizon 2020 project for the establishment of suitable innovative land-use strategies for a sustainable production of plant-based energy on marginal lands while improving general ecosystem services. In addition, she reports that in Europe 220 Mha of marginal lands are available, but only 63 Mha are potentially available for cultivation. This project has interesting links with FORBIO project.



Guido Bonati, CREA



Giuseppe Pulighe, CREA



Sofia Mannelli, Chimica Verde Bionet



Federica Barbera, Legambiente

2.2.4. Conclusions

During the presentations were raised and discussed some issues, especially regarding the sustainability aspects like the sustainable use of water and the facts that the results of sustainability assessment vary or are different from one region to another. It was also pointed out that, today the production costs of biomass for bioenergy are higher than for traditional crops.

2.3. Study tour

2.3.1. Introduction

The study tour in Italy was implemented on 14 October 2016 in Carbonia alongside with the project meeting and information day. It was a one-day study tour organised by CREA for the local stakeholders. Different FORBIO dissemination materials were available at the event. In total 30 participants attended.

FIELD TRIP GUIDE - OCTOBER 14, 2016

FIELD TRIP ROUTE MAP IN THE STUDY AREA IN ITALY

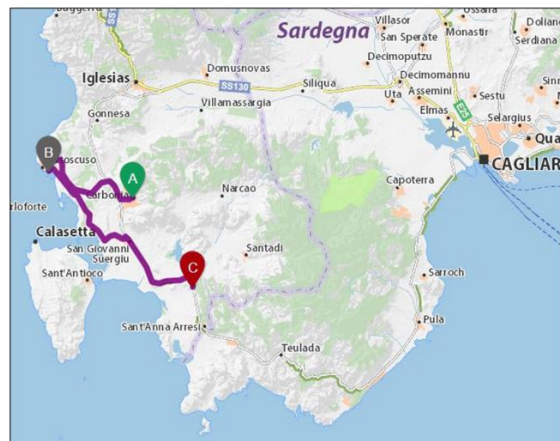


 **Carbonia → Portovesme** *distance 18 km*

 **Portovesme → Masainas** *distance 33 km*

 **Masainas → Cagliari Airport** *distance 94 km*

 **Carbonia**  **Portovesme**  **Masainas**



Overview of the field trip in the study area

2.3.2. Foreword

The main goal of this Field trip is to show, in a short time, the main environmental traits of the Sulcis study area and to frame the complexity of the environmental management problems of this marginal region.

To set up the frame, during the excursion there will be two dedicated stops (see box), the first on the most contaminated area in the industrial complex of Portovesme, the second on the experimental fields of bioenergy crops.

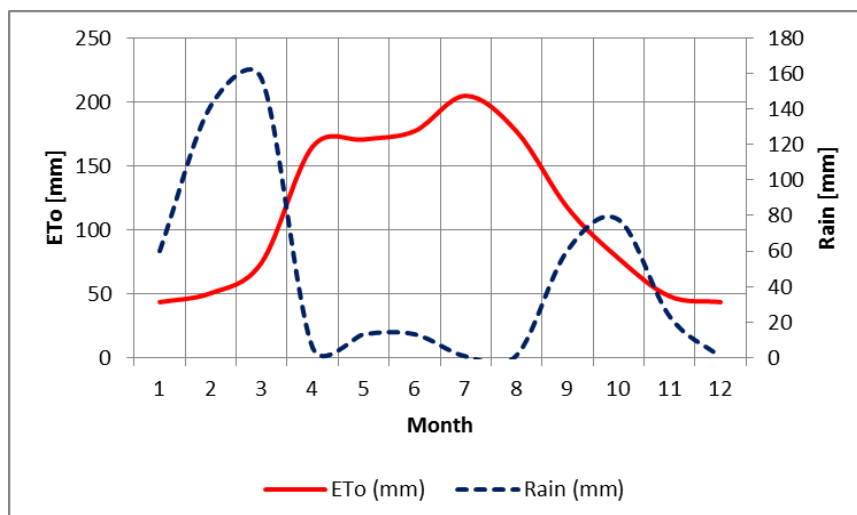
2.3.3. The study area

The area under investigation is in the southwestern part of Sardinia. It is characterized by flat and undulating topography which extends from the coastline to inland rugged areas, with elevation ranging from 1 to 450 m a.s.l. In the Iglesias-Sulcis area the geology is largely dominated by Paleozoic lithotypes, of sedimentary and igneous origin.

The climate of the area is between semi-arid and dry sub-humid, with the typical bimodal pattern of precipitation distribution (i.e. peaks in autumn and spring). **Average annual rainfall is about 550-600 mm** and annual mean temperature reaches 16° C

The soil types of the agricultural land are mainly Xerofluvents (Petric Calcisols; Haplic Nitosols; Calcic Luvisols), Chromoxererts (Vertic ed Eutric Cambisols) and Xerochrepts (Eutric, Calcaric e Mollic Fluvisols). The area is mainly covered by arable land over flat terrain (mainly cereal production), to a lesser extent vineyards, Mediterranean grasslands and eucalyptus plantations over slightly sloping and marginal land. The coastal area is a sensitive and ecologically protected region and hosts endangered aquatic and terrestrial species.

Example of climatic characteristics of the study area (UTA station year 2015). Source: SCIA database.



2.3.4. Quick look to the stop sites

Site 1: Portovesme district

Coordinates: 39°12'22" N; 8°24'24" E

Altitude: 10 m a.s.l.

Slope: flat

Site description

The metallurgical Portovesme industrial plants occupies an area of about 700 ha, operating from the 1960s until a few years ago, they are no longer active after an economic crisis since the end of the last century. The district included a lead–zinc smelter producing Pb, Zn, Cd, and Hg; a coal-fired power plant; alumina production from bauxite and primary aluminium production by electrolytic reduction of alumina. Currently is operating only an oil-fired power plant.

The Italian Government declared the Sulcis-Iglesiente district as **Site of National Interest (SIN)** with high risk of environmental crisis and a possible threat for the inhabitants' health due to heavy metals from industrial flumes derived from coal power generation, bauxite and aluminum production, as well as by the centuries-old previous mining activities. In the past, considerable emissions into the atmosphere were estimated annually up to 65000 Mg of Sulphur oxides, 4000 Mg of dust, 10 Mg of Pb and 100 Mg of Fe.

In the **municipality of Portoscuso**, contaminated by dust fallout of the surrounding industrial area, the topsoil (0-10 cm) and groundwater values of pollutants in the monitoring network exceed the legal limit values, therefore cultivation and commercialization of agricultural goods and milk production is forbidden due to the potential threat to human health.



Overview of the industrial site of Portovesme

Site 2: Masainas

Coordinates: 39°02'05" N; 8°37'16" E

Altitude: 34 m a.s.l.

Slope: flat, slightly wavy relief

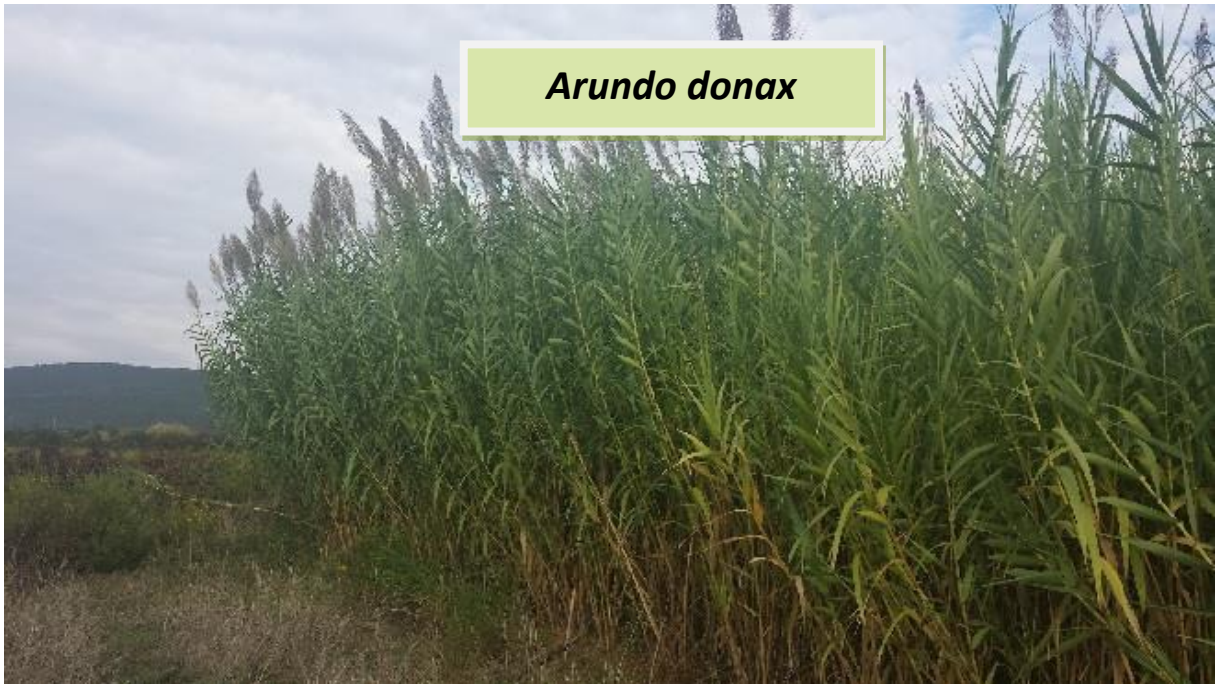
Site description

The experimental field is located in the **municipality of Masainas**, approx. 20 Km from Portovesme. The area has interesting agricultural activities, as well as land with marginal production. Surrounding the trial site, farmers cultivate artichokes, grapes, olives, melons, cereals; there is also fallow land, grassland and areas occasionally used as pastures.

This specific location has been chosen to evaluate the agronomic performances of **Arundo donax** in comparison with other productions, and to study the potential integration of energy crops into existing farming models with minimal risk of food production displacement.

- The field area is 0,5 ha. The soil type is a sandy loam.
- The experimental design is composed of 18 blocks 6 m x 36,6 m.
- Three propagation methods were used: micropropagation, rhizomes, stem cuttings, evenly distributed in the experimental blocks.

Plant density of 2,2 plant/m² (H - High density) and 1,2 plant/m² (L - Low density). Time of plantation were also recorded: blocks 1 to 6 were planted in autumn 2013, the remaining (6 to 18) in spring 2014.



Experimental field of *Arundo donax*



Aerial view of an experimental field of *Arundo donax*

3. Capacity building events in Ukraine

3.1. First training event

3.1.1. Introduction

FORBIO Capacity building event "Energy crops from cultivation to utilisation. Foreign and domestic experience" was held on February 21, 2018 in Kyiv in frames of exhibitions "Grain Tech Expo", "Agro Animal Show" and "Fruit. Vegetables. Logistics" for the Target region of Kyiv oblast (includes Ivankiv region). Venue of the event was an International exhibition center, Pavilion №2, entrance 2A, 2nd floor, conf. hall 9.

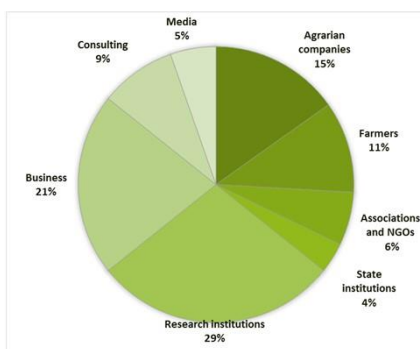
Main goal of the Capacity-building event was to demonstrate the domestic and foreign experience of energy crops growing and the economic efficiency of using biomass from energy plantations for sustainable energy production in Ukraine.

Invited Target audience included representatives of agrarian companies, farmers, representatives of research institutes of agrarian and technical direction, as well as representatives of business, consulting and the media that attended the Capacity building event (see Fig.1).

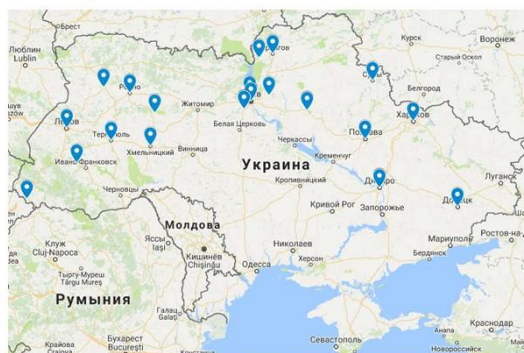
The number of participants amounted to 100 persons, although all the 122 persons that registered received the Capacity building materials afterwards. The materials were also published on the websites of SEC "Biomass", Bioenergy Association of Ukraine, GrainExpo and FORBIO project

Capacity building in Kyiv on 21.02.2018

>100 participants

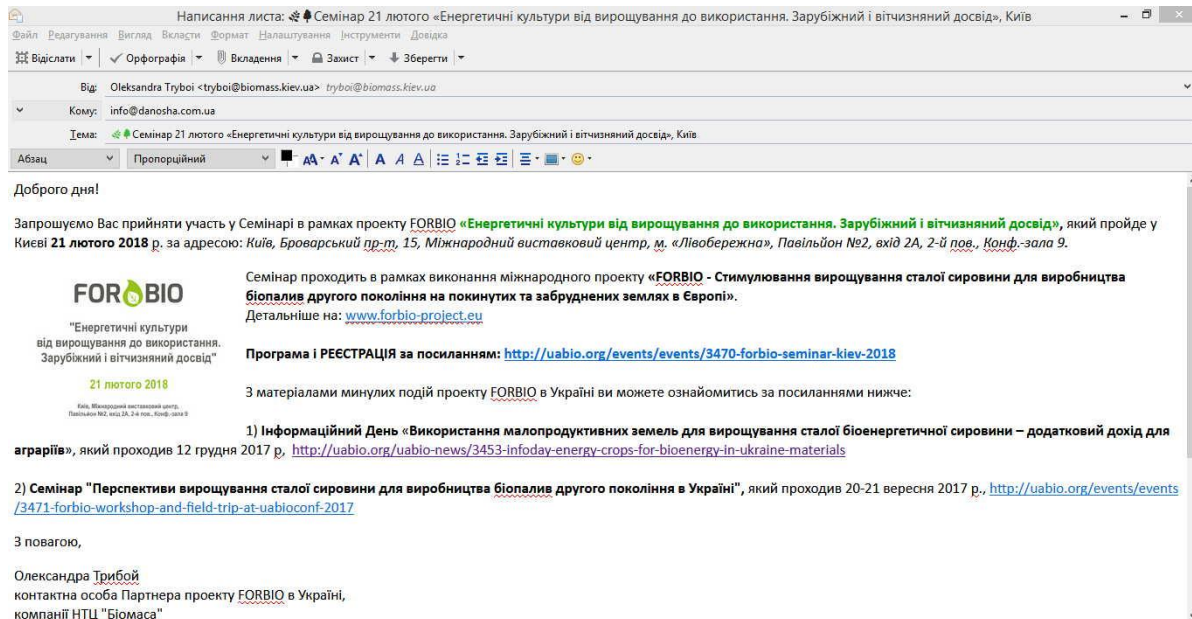


Geography of participants



Number and geography of participant of the Capacity building Event in Kyiv on February 21, 2018.

3.1.2. Invitation



3.1.3. Agenda

Time	Title of presentation	Speaker
9:30 - 10:00	Registration. Morning coffee	
10:00 – 10:20	Welcome. Development of bioenergy in Ukraine	Georgii Geletukha, SEC «Biomass», UABio
10:20 – 10:40	Presentation of the FORBIO: purpose and objectives of the project	Rainer Jansen, WIP, FORBIO project coordinator
International experience in energy crops cultivation		
10:40 – 11:00	Italian experience in energy crops cultivation on low-yielding lands. FORBIO project	Guido Bonati, CREA
11:00 – 11:20	German experience in energy crops cultivation on contaminated lands. FORBIO project	Rainer Janssen, WIP
11:20 – 11:40	Polish experience in energy crops cultivation	Magdalena Rogulska, POLBIOM
11:40 – 12:00	Criteria for sustainable development for growing energy crops	Marco Colangeli, FAO

12:00 – 12:20	Coffee break	
Domestic experience in energy crops cultivation		
12:20 – 12:40	Agronomic requirements for the energy crops growing	Oleksandra Tryboi, SEC "Biomass"
12:40 – 13:00	Results of the feasibility analysis of energy willow cultivation for the FORBIO project area in Ukraine	Oleksandra Tryboi, SEC "Biomass"
13:00 – 13:20	Results of energy willow growing in Ukraine. Company experience	Sevastyan Trushevsky, LLC "Ukragroenergo"
13:20 – 13:40	Results of growing Miscanthus in Ukraine. Farmer's experience	Valery Katelevsky, farmer
Usage of energy crops in Ukraine		
13:40 – 14:00	Prospects for the use of biomass for energy production in Ukraine	Tetiana Zheliezna, SEC «Biomass»
14:00 – 14:20	Synergy of using energy crops in agriculture	Olena Kotsar, Unilos-U
14:20 – 15:00	Coffee break	
15:00	Closure of the Capacity building event	

PARTNERS INFORMATION:

agrochart.com	ecolog-ua.com	agro-smart.com.ua	agrarnik.com	agroprofi.com.ua	energefficiency.in.ua	biowatt.com.ua

Screenshot of press-release in Media	Link to Media resource
	http://www.biowatt.com.ua/sobytiya/seminar-energetichni-kulturi-vid-viroshhuvannya-do-vikoristannya-zarubizhnij-i-vitchiznyanij-dosvid/

	<p>http://energefficiency.in.ua/full-news/57-seminar-energetichni-kulturi-vid-viroshchuvannya-do-vikoristannya-zarubizhnij-i-vitchiznyanij-dosvid</p>
	<p>http://agroprofi.com.ua/component/jevents/eventdetail/7/-/enerhetychni-kultury-vid-vyroshchuvannya-do-vykorystannya-zarubizhnyy-i-vitchyznyanyy-dosvid?Itemid=1</p> <p>http://agroprofi.com.ua/statti/1580-seminar-enerhetychni-kultury-vid-vyroshchuvannya-do-vykorystannya-zarubizhnyy-i-vitchyznyanyy-dosvid</p>
	<p>https://agrarnik.com/index.php?option=com_rseventspiro&layout=show&id=255:energetichni-kulturi-vid-viroshchuvannya-do-vikoristannya-zarubizhnij-i-vitchiznyanij-dosvid&Itemid=229</p>
	<p>https://agro-smart.com.ua/ua/event/energeticheskie-kultury-ot-vyraschivaniya-do-ispolzovaniya--zarubezhnyy-i-otechestvennyy-opyt</p>

3.1.4. Summary of presentations

The seminar was opened by the Chairman of the Board of the Bioenergy Association of Ukraine **Georgii Geletukha** who spoke about the current state and prospects of bioenergy development in Ukraine and coordinator of the FORBIO project of Horizon2020 research and innovation programme **Rainer Janssen** from WIP -

Renewable Energies (Germany), who presented the FORBIO project: the goal and objectives of the project.

At the workshop participants learned about the results of the FORBIO project and the experience of growing energy crops in Germany, Italy, Poland and Ukraine from the project participants: WIP, FIB (Germany), CREA (Italy), POLBIOM (Poland) and SEC "Biomass" (Ukraine).

Guido Bonati from CREA explained Italian experience of growing no-food crops on about 22,000 ha of lands polluted by industrial flumes derived from coal power generation, bauxite and aluminum production, and previous mining activities. GIS-based evaluation of marginal and contaminated lands of the Italian study followed by results of field trials defined the most suitable bioenergy crops for large deployment, which are Giant reed (*Arundo donax* L.), Milk thistle (*Silybum marianum* L. Gaertn.) and potentially Smilo grass (*Piptatherum miliaceum* L.) Cocksfoot (*Dactylis glomerata* L.).

Rainer Janssen from WIP gave an overview of German experience of growing such bioenergy crops as *Sorghum bicolor/sudanense*, *Miscanthus x giganteus*, *Silphium perfoliatum*, *Populus x spec.* on a disused sewage irrigation fields and low-yielding agricultural soils. Recommendations for growing on such lands included advice to apply basic amelioration and choose undemanding and heavy metal tolerant species, to use tillage and additional mineral fertilisers, establish low-input management systems, and grow self-regenerating perennial feedstock crops, e.g. *Miscanthus*.

Magdalena Rogulska from POLBIOM shared the Polish experience with growing agroenergy crops, which in 2016 covered an area of about 15,978 hectares including Willow (7728 ha), Poplar (6600 ha), *Miscanthus* (992 ha). According to her recommendations agroenergy crops production must be assessed not only by economic criteria, but also by social and environmental ones (water balances, GHGs balance, energy balance, biodiversity, landscape, etc.).

Marco Colangeli from FAO gave an insight on sustainability indicators for biofuels. Mr. Colangeli presented the environmental, social and economic sets of indicators selected in the context of FORBIO and announced the barriers to the market uptake of bioenergy in the case study sites in Germany, Italy and Ukraine. The most critical barriers that exist in Ukraine are Land tenure, Financial Security, Profitability, and lack of Incentives for growing bioenergy crops.

Oleksandra Tryboi from SEC "Biomass" explained to the audience the agronomic requirements for growing of energy crops including requirements to the field for plantation, perspective bioenergy crops for cultivation based of FORBIO Agronomic feasibility for Ukraine, which are *Salix Viminalis* L., *Miscanthus x giganteus*, *Panicum virgatum* L., Columbian grass, *Silphium perfoliatum*, *Populus* sp. L.

In another presentation, Ms. Tryboi showed the results of the techno-economic feasibility analysis of energy willow cultivation for the FORBIO project area in Ukraine.

According to the results for the payback of 10 years the cost of willow chips at plant gate amounts 28.7 EUR/Mg DM a year (including transportation at a distance of 50 km).

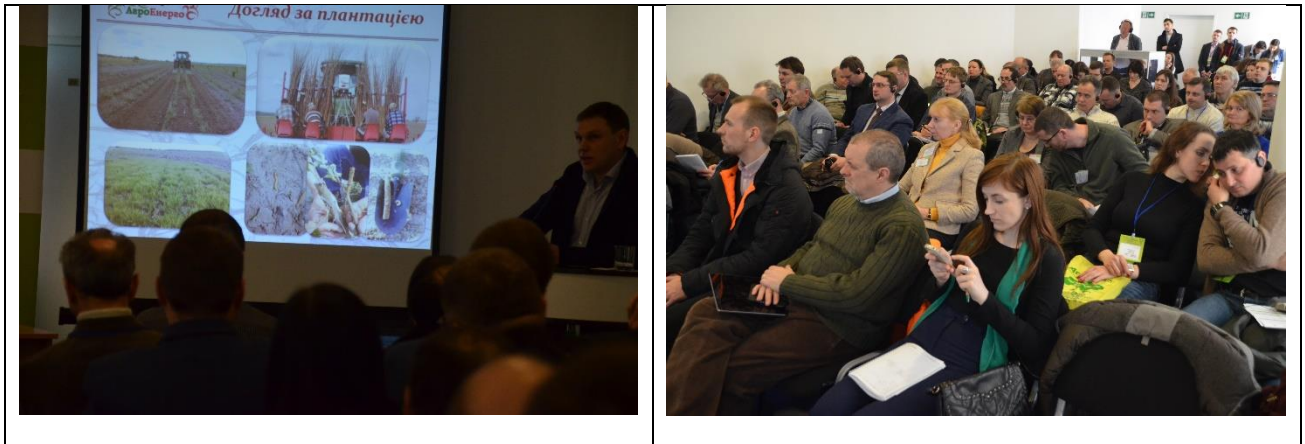
Representative of the company "Ukragroenergo" LLC that is the owner of the FORBIO case study site of willow plantation **Sevastyan Trushevsky** told about their experience of growing *Salix Viminalis* L. in Kyiv oblast. According to Mr. Trushevsky industrial plantations of the company amounted 74 ha in 2017 and additional 200 ha are planned for 2018. Company offers consultancy in setting a plantation and is ready to buy the harvest of willow chips.

Farmer from Kharkiv oblast **Valery Katelevsky** shared experience of growing *Miscanthus* in the steppe zone of Ukraine. According to Mr. Katelevsky return of investments for *Miscanthus* plantation of 30 ha amounts about 3 years for mother-industrial plantation and 6 years for the industrial plantation.

Tetiana Zheliezna from SEC "Biomass" told about the prospects for the use of biomass for energy production in Ukraine. According to statistics, wood biomass from the forests is mainly used in Ukraine now, although the main shares of biomass potential belong to agro residues and energy crops. In Ukraine annually there are about 3-5 million ha of unused agricultural land that can serve for potential plantations of bioenergy crops. The most economically feasible utilization of biomass today is heat production in boilers and combined electricity and heat production in CHP with 3.1 and 4.1 years of simple payback respectively for the typical projects. However, production of second generation biofuels will be stimulated till 2015 according to the National Energy Strategy of Ukraine till 2035.

Olena Kotsar from UNILOS-Ukraine presented opportunities for synergy of using energy crops in agriculture for treatment of sewage water. She told about their technology of "Synergetic Bioplato", where such bioenergy crops, like SRC willow, poplar, paulownia and perennial grasses like reed, *Miscanthus* are used for filtration of sewage water and renewal of biological full value of return waters.





3.1.5. Conclusions

Capacity building event in Kyiv attracted more than 100 participants from Western, North and Eastern parts of Ukraine (20 locations), including 17 agrarian companies and 12 farmers. From Italian experience of growing bioenergy crops on polluted lands participants learnt that most suitable for large deployment in such conditions are Giant reed (*Arundo donax* L.), Milk thistle (*Silybum marianum* L. Gaertn.) and potentially Smilo grass (*Piptatherum miliaceum* L.) Cocksfoot (*Dactylis glomerata* L.). German experience of growing *Sorghum bicolor/sudanense*, *Miscanthus x giganteus*, *Silphium perfoliatum*, *Populus x spec.* on a disused sewage irrigation fields and low-yielding agricultural soils included advice on overcoming obvious barriers for energy cropping. Sustainability indicators selected in the context of FORBIO for case study sites were presented. The most critical barriers for Ukraine, such as Land tenure, Financial Security, Profitability, and lack of Incentives for growing bioenergy crops, were once again discussed with the audience.

Significant part of the event was devoted to practical issues of growing bioenergy crops in Ukrainian conditions, including agronomic requirements, necessary machinery and perspective crops for cultivation in Ukraine. Presented results of the techno-economic feasibility study of energy willow cultivation for the FORBIO site in Ukraine showed competitiveness of willow chips with other solid biofuels at the market for transportation distance of 50 km.

Practitioners, which grow willow (company "UkrAgroEnergо") and *Miscanthus* (farmer Katelevsky) in Ukraine, confirmed that energy cropping is feasible in case of large plantations and available own agro machinery.

3.2. Second training event

3.2.1. Introduction

FORBIO Capacity building Event "**Energy crops from cultivation to utilization**" was held on **May 17, 2018 in Cherkasy** as another region for dissemination of the project results. Venue of the event was Conference Hall, located at the International agro-industrial expo-fest AGROSHOW Ukraine 2018 (<http://agroshow.com.ua>) on Smilyanska Street, 168, Cherkasy held on 16-19 of May, 2018.

Main goal of the Capacity-building event was to inform the audience about the issue of growing energy crops on marginal lands, including agronomic, techno-economic, sustainability requirements and policy issues.

Invited **Target audience** included agrarian companies, farmers, municipalities, business companies, but also research institutes, consulting companies.

The number of participants amounted 23 persons, including representatives from 6 agrarian companies and farmers, who received all the materials of the Capacity Building Event by e-mail afterwards. The materials were also published on the websites of [SEC "Biomass"](#), [Bioenergy Association of Ukraine](#) and FORBIO project.

3.2.2. Invitation



AGRO SHOW МІЖНАРОДНИЙ АГРОПРОМИСЛОВИЙ ЕКСПО-ФЕСТ, 16-19 ТРАВНЯ, ЧЕРКАСИ

Тренінг проекту FORBIO

**«Енергетичні культури:
від вирощування до використання»**

17 травня 2018 р.

м. Черкаси, вул. Смілянська 168, Конференц зал

Організатор:  НТЦ «Біомаса»

3.2.3. Agenda

Time	Title of presentation	Speaker
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11:30 - 12:00	Registration. Morning coffee	
12:00 – 12:30	How to choose a biomass crop for cultivation	Oleksandra Tryboi, SEC “Biomass”
12:30 – 13:00	Agronomic requirements for growing biomass crops	Oleksandra Tryboi, SEC “Biomass”
13:00 – 13:30	Financing opportunities for biomass projects in Ukraine	Tetiana Zheliezna, SEC “Biomass”
13:30 – 14:30	Lunch	
14:30 – 15:00	How to harvest and store biomass of energy crops	Semen Dragniev, SEC “Biomass”
15:00 – 15:30	Bioenergy utilisation pathways for biomass of energy crops	Tetiana Zheliezna, SEC “Biomass”
15:30 – 16:00	Networking and coffee	
16:00	Closure of the Capacity Building Event	

3.2.4. Summary of presentations

The Capacity Building Event in Cherkasy followed the InfoDay and was devoted to practical issues of cultivation of energy crops and their further utilization pathways.

Oleksandra Tryboi from SEC “Biomass” informed the audience about requirements when choosing biomass crop for cultivation and gave an overview of energy crops suitable for growing under Ukrainian climatic conditions, as well as named organizations that provide planting material (e.g. Institute of Bioenergy Crops and Sugar Beet of the National Academy of Agrarian Sciences, „Salix Energy” LLC, „EnergoAgrar” LLC etc.).

In the next presentation, **Oleksandra Tryboi** told the audience about the agronomic requirements for growing energy crops, including necessary field operations, needed machinery, requirements for fertilizing and application of pesticides.

Tetiana Zheliezna from SEC “Biomass” informed participants about financing opportunities for bioenergy projects in Ukraine. These opportunities include stimulating state regulation, financing by international financing organizations and commercial banks. Stimulating regulation includes “green” tariff for electricity production from biomass and introduction of Electricity market, in which electricity producers from renewables will have state support, namely, a guaranteed buyer that will be obliged to purchase by “green’ tariff all amount of produced electricity, if this electricity has not been sold at the market. A special tariff for heat produced from

biomass that is 10% less compared to heat from natural gas and boosts the consumers switch from natural gas to biomass, while creating attractive investment environment for implementation of bioenergy projects and reducing their payback period.

Semen Drahnev from SEC "Biomass" shared with audience how to harvest and store energy crops. He told that there are two alternatives for harvest of biomass of energy crops with chipping. For big areas of plantations it is more efficient to use forage harvesters, like John Deere and Claas with special SRC chipping Head, which allows to cut plants of 6-8 cm diameter (3 year rotation) and can harvest about 5 ha a day. For small plantations it is more feasible to use Mower-chippers (like Kuhn, Kemper etc.) that can be combined with tractor, but have productivity of about 2-3 ha a day and cut plants of 3-4 cm diameter (2 year rotation).

Tetiana Zheliezna (SEC "Biomass") explained the issue of biomass use after harvest of energy crops. Harvested biomass can be used either directly in form of chips or can be further converted into briquettes or pellets. Obtained solid biofuel (chips, pellets, briquettes) can be further combusted in boilers for heat production or in CHP for further combined production of electricity and heat. The average simple payback of such bioenergy value chains can be from 3 years for small boiler-houses to 7-8 years in case of CHP.



3.2.5. Conclusions

Capacity building Event in Cherkasy was held in frames of International agro-industrial expo-fest AGROSHOW Ukraine 2018 and attracted more than 20 participants. The audience learnt about practical issues of all stages of a bioenergy value chain from growing energy crops to their utilisation for energy. Among questions raised by the participants were the following: availability of state support for growing energy crops and specific expenses for development of 1 ha of plantation. Participants were interested in the topic, but some of them mentioned that the issue of growing energy crops needed further examples, pilots and state support.

3.3. Study tour

3.3.1. Summary

Study tour to the FORBIO case study site in Ukraine took place on September 21, 2017, in frames of the FORBIO 2-day workshop "Prospects of sustainable feedstock production for advanced biofuels in Ukraine", which attracted 38 participants. Case study site plantation is operated by UkrAgroEnerg LLC, subsidiary of Ukrteplo group of companies, which implements energy efficiency projects on fossil fuels substitution with biomass. Ukrteplo has replaced more than 50 million cubic meters of natural gas in 16 regions of Ukraine, and reequiped approximately 100 boiler-houses to combust solid biofuels.



The mother plantations of willow are located at the area of 50 ha in Ivankiv region and were set in 2016 on the lands, which were abandoned for 15 years ago, because of unsatisfying soil conditions (sandy, sandy loam soils) and bad economic conditions in the region (Fig. 2).

Mother plantation of *Salix viminalis* L. near village Kukhari, Ivankiv region, Kyiv oblast

Swedish *Salix viminalis* L. varieties "Tora", "Tordis", "Inger" are grown on the plantation.

The main climate characteristics of the study area are summarized in the table below:

Climate	moderately continental
Average temperature in January	- 6 °C
Average temperature in July	+19.5 °C
Average annual temperature	6.9 °C
Average altitude	131 m
The annual radiation balance	45 kcal/cm ²
Moisturizing factor (the ratio of precipitation to evaporation)	1.0-1.2
Annual precipitation	550-650 mm
Relief	flat
Annual air humidity	80%
Wind direction	north-west

Soil analysis shows low indexes of chemical fertility of the following elements: nitrogen (N), potassium (K), calcium (Ca), magnesium (Mg), sulfur (S), zinc (Z), Cu (copper), boron (B).

Chemical elements												
N	P	K	Ca	Mg	S	Fe	Mn	Zn	Cu	Mo	B	Na
26*	169	43*	725*	75*	11*	610	90	2.9*	1.3*	0,05	0.3*	10
<i>Low level</i>												

Level of pH_{KCl} is 5.20 (acid soil), the level of electroconductivity of soil (EC mS/cm=0.39) is low for growing common food agriculture crops.

In 2015, an abnormally dry and hot summer negatively affected the plantings of willow. However, in 2016 the weather conditions were more favourable and the mother plantation has grown. The company have planted 30 ha of industrial plantations in 2017 and plans to plant additional 150 ha in 2018. Potential of unused agricultural lands within a radius of 50 km from Ivankov is 21.35 thousand ha.



4. Capacity building events in Germany

4.1. First training event

4.1.1. Introduction

The first training event for stakeholders in Germany was implemented on 7 April 2018 in Goßmar at the Klementinenhof (County Elbe-Elster / Southern Brandenburg). It was a one-day workshop with expert lectures on cultivation, handling, application and utilisation of Miscanthus. The event was organised by FIB in cooperation with Klaus & Roberto Töpfer GbR for local stakeholders.

The title of the event was "Miscanthus-Feldtag 2018". Its aim was to demonstrate different basic aspects of Miscanthus at regular managed and underutilised land: from agronomical issues like planting and planting material, fertilisation, harvest and recultivation to its utilisation in small heat plants, for insulation materials, as bedding material for animals or mulch in gardens and green houses or the application of its organic elements in chemical processes.

Miscanthus is a genus in the grass family (Poaceae). Hybrids of Miscanthus can produce high annual amounts of biomass, especially *M. X giganteus*. The harvest is commonly carried out in early spring, when the stalks are nearly dry. Undemanding Miscanthus can be a promising option for the cultivation of disused sewage irrigation fields but also agricultural lignite mining reclamation sites.

Our event took place on the property of Klaus and Roberto Töpfer, because their stand of Miscanthus is located directly beside it. Moreover, they also own a heating plant on site. Miscanthus is used on both facilities for heating.

The event was conducted in the national language. Translation into English was provided by project contributors, e.g. for our guests from the Czech Republic. Different FORBIO dissemination materials (handout, flyer, roll ups) were available at the event. In total 48 participants attended the event.

4.1.2. Invitation

EINE EFFIZIENTE VERWERTUNGSKETTE



Erläuterung: (1) die beiden Anbauflächen, Alter 4 bzw. 6 Jahre, Flächengröße insgesamt 9,35 ha, (2) Zwischenlager, Kapazität: 400 m³ / etwa 40 to, (3) Gebäude mit Heizanlage, beheizte Grundfläche 78 m², (4) Wohngebäude, beheizte Grundfläche 360 m²

Kurzinformationen zur Heizanlage: 'ETA Hack 50' mit einer Nennleistung von 49,5 kW, Errichtungsjahr 2014, Pufferspeichersystem ca. 2.000 Liter. Ausgehend von 8-12 % Restfeuchte und 10 bis 18 mm Schnittlänge lassen sich ab dem 3. Jahr pro Hektar 4.500-6.000 Liter leichtes Heizöl ersetzen. Schon im ersten Standjahr wurden etwa 3.000 kWh Strom bei der Warmwasserbereitung eingespart.

WEITERE INFORMATIONEN ZUM MISCANTHUS-ANBAU

- www.miscanthus.de- Aktuelle Informationen aus der Miscanthus-Forschung von Prof. Dr. Ralf Fude
- www.miscanthusverein.de- Miscanthus-Förderverein Nordbayern
- Berichte aus dem TFZ Bayern, Hefte 18 und 19
- KTBL-Datensammlung Energiepflanzen

ORGANISATORISCHES

Unser Veranstaltungsort ist der Klementinhof bei Gölmar (Landkreis Elbe-Elster) Friedensstraße 22, 03249 Gölmar.

Eine Anreise mit öffentlichen Verkehrsmitteln ist leider nicht möglich. Bitte nutzen Sie die beschilderten Parkmöglichkeiten auf dem Klementinhof.

Für einen kleinen Mittagimbiss wird gesorgt, und es fallen keine Veranstaltungsgebühren an.



IMPRESSUM & KONTAKT

Forschungsinstitut für Bergbaufolgelandschaften e.V. (FiB)
Brauhausweg 2
D-03238 Finsterwalde

Dr. Dirk Knoche & Rainer Schleppehorst
d.knoche@fib-ev.de, r.schleppehorst@fib-ev.de
Tel.: 03531 7907-11, www.fib-finsterwalde.de

Miscanthus GbR Klaus & Roberto Töpfer
Friedensstraße 22, OT Gölmar
03249 Sonnenwalde

Tel.: +49 (0) 172 9142 419, service@tischlerei-toepler.de
www.facebook.com/MiscanthusGbRToepler



Nachhaltige Biomasseerzeugung auf Sonderstandorten für neue Wertschöpfungsketten

EINLADUNG

ZUM MISCANTHUS-FELDTAG 2018
AM SAMSTAG, DEN 7. APRIL 2018



WWW.FORBIO-PROJECT.EU

FORBIO wird durch die Europäische Kommission im EU-Faherensprogramm für Forschung und Innovation Horizon 2020 finanziert (Projekt Nr. 691846)

HERZLICH WILLKOMMEN!

Sehr geehrte Damen und Herren,
liebe Freunde,

zum *Miscanthus-Feldtag 2018* auf dem Klementinhof bei Gölmar (Landkreis Elbe-Elster) laden wir Sie herzlich ein:

Termin:
Samstag, der 7. April 2018, von 10:00 bis 14:00 Uhr

Ort:
Klementinhof bei Gölmar
Friedensstraße 22
03249 Gölmar

Über Ihre Teilnahme freuen wir uns.

MISCANTHUS- NACHWACHSENDER ROHSTOFF DER ZUKUNFT

Miscanthus ist ein zunehmend gesuchter Biomasserohstoff mit guten Marktchancen. Dabei verbindet die anspruchsvolle Dauerkultur ihre hohe Ertragsleistung mit standort- und landschaftsökologischen Vorteilen. Hinzu kommen vielseitige Verwertungsmöglichkeiten - von der hoieigenen Nutzung als Brennstoff bis hin zur anspruchsvollen Verwendung in Gewerbe und Industrie.

Demgegenüber stehen aber die Vorbehalte vieler landwirtschaftlicher Großbetriebe, die vor allem mit der langen Kapitalbindung und einer fehlenden Erfahrung zusammenhängen. Während die Anbauswerpunkte in Südwestdeutschland liegen, beträgt die bestockte Fläche in Brandenburg derzeit weniger als 50 Hektar. Insgesamt wird der Miscanthus-Anbau nur von wenigen, dafür aber umso begeisterungsfähigen Pionieren des Landbaus getragen.

DER KLEMENTINHOF ALS GUTES BEISPIEL

Dabei mangelt es auch hierzulande nicht an wirtschaftlich überzeugenden Praxisbeispielen: Wie Klaus und Roberto Töpfer vom Klementinhof im Landkreis Elbe-Elster zeigen, sind bereits bei mittlerer Standortgüte durchschnittliche jährliche Hektarerträge von über 10 Tonnen (Trockensubstanz) möglich. Für einen 20-jährigen Investitionszeitraum errechnen sich daraus jährliche Überschüsse zwischen 250 und 300 Euro pro Hektar - ohne Berücksichtigung von Prämienzahlungen.



UNSER PROGRAMM

09:30 - 10:00	Ankunft und Registrierung der Teilnehmer auf dem Klementinhof
10:00 - 10:10	Begrüßung - Klaus und Roberto Töpfer, Dirk Knoche (FiB e.V.)
10:10 - 10:35	Beitrag zu Verwertung - Uwe Kühn
10:35 - 11:00	Beitrag zu Anbau und Pflanzgut - Anton Sieverdingbeck
11:00 - 11:45	Vorführung Erntekette Miscanthus - Klaus und Roberto Töpfer, Rainer Schleppehorst (FiB e.V.)
11:45 - 12:30	Besichtigung Miscanthus-Heizung - Klaus und Roberto Töpfer, Handelsagentur Reichrich
12:30 - 14:00	Mittagsimbiss (Selbstzahler) & Erfahrungsaustausch mit Anwendern und Experten

An diesem Tag präsentieren sich auf dem Klementinhof:

- **Anton Sieverdingbeck**, 46342 Velen-Ramsdorf www.sieverdingbeck-agrar.de/miscanthus/, Anbieter für Pflanzgut
- **Bauunternehmen Marko Kaule GmbH**, 04936 Lebusa Erntetechnik
- **Dr. Margit Hettler, In-vitro-tec GmbH Berlin und strohlos Produktentwicklung GmbH Waren (Müritze)**, Kooperationspartner im Forschungsvorhaben „Optimierung einer Dampflatte aus Miscanthus“, gefördert durch das Bundesministerium für Ernährung und Landwirtschaft (BMEL)
- **Uwe Kühn** stellv. Vorsitzender Internationale Vereinigung für Miscanthus und mehrjährige Energiegräser (MEG) e.V., 02633 Göda www.miscanthus-buscheritz.de Anbieter für diverse Miscanthus-Erzeugnisse
- **Handelsagentur Reichrich** (ETA Heizungssysteme), 15370 Vogelödorf info@hv-reichrich.de mobile Ausstellung miscanthusfähiger Heizkessel
- **Bauernhof Frank Böhme**, 04916 Herzberg Miscanthus-Häcksel als Einstreu im Hühnerstall, Verkaufstand vor Ort
- **Pferdepension Tierärztin Josephine Alma Maria Gampe und Katharina Treilmann**, 03238 Finsterwalde, Erfahrungsaustausch zu Miscanthus als Einstreu im Offenstall


Miscanthus GbR
Klaus und Roberto Töpfer
(Veranstalter)

Dr. Michael Haubold-Rosar
(FiB, Direktor)




FORBIO





MISCANTHUS-FELDTAG 2018
7. APRIL 2018, 10:00 BIS 14:00 UHR










Veranstalter:
Miscanthus GbR Klaus & Roberto Töpfer und
Forschungsinstitut für Bergbaufolgelandschaften e.V.

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FORBIO wird durch die Europäische Kommission im EU-Rahmenprogramm für Forschung und Innovation Horizon 2020 finanziert (Projekt Nr. 691846). Die alleinige Verantwortung für den Inhalt dieses Roll-ups liegt bei den Autoritäten. Sie gibt nicht unbedingt die Meinung der Europäischen Union wieder. Weder die Europäische Kommission noch H2A übernehmen Verantwortung für jegliche Verwendung der darin enthaltenen Informationen.

FORBIO

MISCANTHUS IN BRANDENBURG
EIN ANBAUSTECKBRIEF

Miscanthus x giganteus (J.M. Greef & Deuter) und *Miscanthus sinensis* (Andersson)

Name	Miscanthus, Chinaschilf, Chinesisches Silbergras, Chinagrass
Typisierung	dauerhaftes Großgras (Familie der Süßgräser), anspruchslose C4-Pflanze trockener Standorte mit guter Wasser- und Nährstoffausnutzung
Herkunft	Zentral-Japan, Korea, China, auf Ruderalflächen und Grenztragsböden in der klimatischen Maisanbauzone Anbaufläche in Deutschland: rund 3.000 Hektar Anbau im Land Brandenburg: seit 1990, heute etwa 50 ha
Verwertung	energetisch: Fermentation, Koferment, Verbrennung, Brikkett, Pyrolyse, Biotreibstoffe stofflich: unter anderem für Baustoffe, Fasern und Biokunststoffe
Ertrag	im südlichen Brandenburg zwischen 5 und 20 Tonnen Trockenmasse pro Hektar & Jahr, je nach Standortqualität, Genotyp, Aufwuchsalter und Bestockungsdichte
Ansprüche	toleriert geringe Jahresniederschläge von 500 bis 600 mm, die durchschnittliche Jahrestemperatur soll mindestens 8 °C betragen, warme Sommer sind vorteilhaft, aber nur bei bedarfsgerechter Wasserversorgung hat eine weite Standortamplitude und gedeiht selbst auf humusarmen Rohböden, bevorzugt aber lehmige, gut durchlüftete Böden mittlerer Ackerzahl, reagiert auf Bodenschadverdichtungen und Wasserstau
Risiken	Gefahr durch Bodenfrost, vor allem bei Stickstoff-Überdüngung, bis zum zweiten Standjahr recht empfindlich gegenüber verdämmenden Unkräutern und Großgräsern, Sommerdürre führt zu Ertragsausfällen und früherer Abreife
Pflanzenbau	Dauerkultur, sogenannte <i>Low-input</i> -Pflanze bezüglich Düngung, Pflanzenschutz und Bodenbearbeitung, mit einer Standzeit von etwa 20 Jahren, das örtliche mögliche Ertragsniveau wird ab dem vierten Jahr erreicht Pflanzung der Rhizomknollen mit Kartoffellegemaschine (10.000 Stk./ha), besonders leistungsfähiges und winterhartes Vermehrungsgut ist am Markt verfügbar Pflanzung von vorgezogenen Jungpflanzen ist ebenfalls möglich, aber Gefahr des Auswintems im ersten Jahr
Ernte	voll mechanisierte Ernte mit Mähhäckslern, entweder Ganzpflanzen-Ernte im Herbst (Trockensubstanz (TS)-Gehalt: 35 bis 45 %), insbesondere für die Biogaserzeugung, oder Häckseln der abgereiften Stängel im kommenden Vorfrühling (TS-Gehalt: 10 bis 20 %), das Erntegut lässt sich ohne Nachtrocknung lagern, direkt verbrennen oder weiter verarbeiten

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4.1.3. Agenda

10:00 Welcome and opening, Klaus Töpfer (Klaus & Roberto Töpfer GbR), Michael Haubold-Rosar (FIB), Dirk Knoche (FIB)

10:10 Presentation: Miscanthus in practice – use and cultivation, Anton Sieverdingbeck (Sieverdingbeck Agrar)

10:35 Presentation: Miscanthus (*x giganteus*) – 10 years of experience in Miscanthus cultivation, Uwe Kühn

11:00 Presentation: Possible material use of Miscanthus, Prof. Dr. Ralf Pude (INRES-Nachwachsende Rohstoffe, Rheinische Friedrich-Wilhelms-Universität Bonn)

11:25 Multistakeholder discussion

12:00 Lunch break

12:30 Harvest demonstration

13:00 Inspection of Mr. Klaus Töpfer`s heating system

14:00 Open end and friendly get-together

4.1.4. Summary of presentations

The event was opened by Mr. Klaus Töpfer (Klaus & Roberto Töpfer GbR) , Michael Haubold-Rosar (FIB) and Dirk Knoche (FIB) by welcoming all participants. Klaus Töpfer and his son Roberto Töpfer own several hectares of agricultural land. They cultivate approximately 10 ha of Miscanthus (*Miscanthus x giganteus*) beside their home and use it as solid fuel in their own heating plant. Moreover, they sell Miscanthus chips as bedding material for horse farmers and want to extend the cropping area, especially on underutilized land in the region.

Starting our event **Klaus Töpfer** shortly explicated his reasons to switch from oil to Miscanthus as raw material for heat generation and clearly depicted the history of his experiences with that perennial crop.



Klaus Töpfer welcomes the participants of FORBIO trainings event and gives a brief overview about his practical experiences with Miscanthus

Presentation: Miscanthus in practice - Use and cultivation (Miscanthus in der Praxis – Nutzung und Anbau von Miscanthus (Chinaschilf))

Anton Sieverdingbeck, Sieverdingbeck Agrar

Mr. Sieverdingbeck is the owner of a farm in the federal state North-Rhine Westfalia (<http://www.sieverdingbeck-agrar.de/>). Over there he produces common agricultural products but also cultivates Miscanthus since 2002, delivers Miscanthus rhizomes and is a full service provider for planting and harvesting. In his presentation Mr. Sieverdingbeck in particular explained lots of agronomical issues and details of Miscanthus which result from his practical experiences with this crop.



Anton Sieverdingbeck presents his encouraging experiences with Miscanthus cultivation and utilization

Presentation: Miscanthus (x giganteus) – 10 years of experience in Miscanthus cultivation (Erfahrungen aus 10 Jahren Miscanthus-Anbau)

Uwe Kühn, Farmer

Mr. Kühn also cultivates Miscanthus and operates a small heating plant with Miscanthus chips on a farm in Saxony (<http://www.miscanthus-buscheritz.de/>). He delivers several Miscanthus products, like bedding material for animals, clay construction boards or mulching chips for the garden. The presentation focused on different interesting options for the practical material utilization of Miscanthus.



Uwe Kühn reports about options of Miscanthus utilisation

Presentation: Possible material uses of Miscanthus (Stoffliche Nutzungsmöglichkeiten von Miscanthus)

Prof. Dr. Ralf Pude, INRES-Nachwachsende Rohstoffe, Rheinische Friedrich-Wilhelms-Universität Bonn

Mr. Ralf Pude leads the research area 'Renewable raw materials' at the University Bonn in North-Rhine Westfalia. He deals with current and forward-looking questions of the cultivation of renewable raw materials in research projects and applied research works. His work particularly focuses on different aspects of Miscanthus. Furthermore, Mr. Pude is the chairman of the "*International Society for Miscanthus and perennial Energy Grasses (MEG) e.V.*"

In his inspiring presentation he showed lots of forward-looking issues concerning Miscanthus from a scientific view. He pleaded strongly for the trendsetting use of the raw material in cascades. Heat generation should be the last link in such a value chain, ideally.



Prof. Dr. Ralf Pude (University of Bonn) informing about actual research projects on an advanced Miscanthus utilization in cascades

Multistakeholder discussion

Several stakeholder questions were discussed after the presentations. Especially, agronomical issues were of interest for farmers in the audience.





Impressions from the vivid multistakeholder dialog, here Dirk Knoche & Anton Sieverdingbeck (to the right) under discussion

Demonstration of a harvest chain

Miscanthus can be harvested in several ways. Generally, it does not require special technologies, which is an advantage. A common method is to directly chip the stalks with a self-propelled forage-harvester with a corn-header. Such a setup is easily available in most European regions where farmers grow maize. A tractor with a trailer drives parallel to the harvester to take up the finely chopped Miscanthus chips. This material has a water content of 15 % to 18 % and can be stored lossless without additional drying effort.

In Goßmar a self-propelled forage harvester from New Holland with a row-independent header from Kemper was used to demonstrate this technology on a part of the Miscanthus stand. The relative old machine works properly and produced chips with a length of approx. 1 to 8 cm. The chips of one trailer were dumped beside the storage hall of Mr. Klaus Töpfer.





Demonstration of a Miscanthus harvest with a self-propelled forage harvester

4.2. Second training event

4.2.1. Introduction

The second training event for stakeholders in Germany was implemented under the Task 5.3 "Capacity building for stakeholders in target region" on 12 June 2018 in Neupetershain at the Gut Geisendorf (county Oberspreewald-Lausitz / Southern Brandenburg). It was a one-day workshop with expert lectures on cultivation, handling, marketing and utilisation of black locust organised by FIB and LEAG for local stakeholders (government authorities, forest management, reclamation department, scientific community, land owners, nature conservation stakeholders). Afterwards, the cultivation trials on underutilized land were visited.

Robinia can be a promising option for the cultivation on lignite mining reclamation sites. One aim of the event was to demonstrate the yield and economic potential of black locust on underutilized land. Furthermore, the advantages of the species in terms of site requirements and soil improvement, future climate development (keyword drought stress) and management (e.g. rejuvenation) were addressed. The challenges in terms of quality and possible cultivation barriers (e.g. frost, invasiveness) were discussed as well.

The event was conducted in the national language (German). Different FORBIO dissemination materials - handout - flyer - roll ups - were available at the event.

4.2.2. Invitation

DER ANBAU- UND SORTENVERSUCH WELZOW SÜD

Seit dem Jahr 2014 führt das FIB e.V. gemeinsam mit seinen Projektpartnern *Thünen Institut für Forstgenetik, Landeskompetenzzentrum Forst Eberswalde* und der LEAG ertragskundliche und ökophysiologische Messungen durch.

Es werden 12 qualitativ hochwertige Zuchtklone und 3 vielversprechende Bestandesbaaen aus Brandenburg untereinander verglichen. Das betrifft neben ihrer Biomassebildung die Qualitätsentwicklung und Resistenz gegenüber Krankheiten und abiotischen Schäden.

Als besondere aussagekräftiger Indikator der Stress-Bewältigung erweist sich die photosynthetische Vitalität (P_{max}). Durch eine direkte Messung der physiologischen Leistungsfähigkeit im Blatt lassen sich Sortenunterschiede erkennen und Anbauempfehlungen ableiten.

EINE ANBAUEMPFEHLUNG

Dabei überzeugen die Robinien-Klone *FRAPORT (FRA) 3* sowie die brandenburgischen Genotypen *Roger, Romy* und *Röwenia (ROM)*. Sie verfügen über eine hohe Vitalität und trotz den extremen Standort- und Witterungsverhältnissen der Rekrutierungsfläche.

Zwar kommt es im trockenen Spätsommer 2016 zu einem vorzeitigen Laubwurf und spärlichen Ertragsentwürfen. Aber die Baumsart erholt sich schnell. Schon im Folgejahr erreicht ihr mittlerer Biomassezuwachs 9 Tonnen_{DM} pro Hektar. Die Pflanzenausfälle betragen bis heute nur 5 % der ursprünglichen Stammzahlen.

WEITERFÜHRENDE LITERATUR

- Knoche, D., Engel, J., Lange, C., 2014: Hinweise zur Bewirtschaftung von Robinien-Beständen in Brandenburg. Informationen für Waldbesitzer, 1-12.
- Knoche, D., Lange, C., Engel, J., 2015: Entwicklung von innovativen Bewirtschaftungsverfahren für Robinienbestände (*Robinia pseudoacacia* L.). in: Liesebach, M. (Hrsg.): FastWOOD II: Züchtung schnellwachsender Baumarten für die Produktion nachwachsender Rohstoffe im Kurzumtrieb: Erkenntnisse aus 6 Jahren FastWOOD. Thünen Report 26, 71-84.
- Schneek, V., 2010: Robinie: Züchtungsansätze und Begründungsverfahren. In: Deutschland / Bundesministerium für Ernährung Landwirtschaft und Verbraucherschutz (Hrsg.): Beiträge: Agrarholz 2010: Symposium vom 18. bis 19. Mai 2010 in Berlin, Bonn, 1-8, <http://www.irs-ver.de>.
- Schüler, S., Weißbacher, L., Sieberer, K., 2006: Robinie für Energie- oder Wertholz: die Sorte macht's! Forstzeitung 117, 8, 8-9.
- Veite, M., Kriebitzsch, W.-J., 2013: Einfluss von Trockenstress auf Photosynthese, Transpiration und Wachstum junger Robinien (*Robinia pseudoacacia* L.). Forstarchiv 84, 35-42.



ORGANISATORISCHES

Unser Veranstaltungsort ist das Gut Geisendorf - Kulturforum der Lausitzer Braunkohle.

Der Robinien-Anbau- und Sortenversuch befindet sich im Tagebau Welzow Süd der Lausitz Energie Bergbau AG (LEAG).

Vom Gut Geisendorf geht es nach dem Mittagsimbis in Fahr gemeinschaften und über die gut ausgebauten Wirtschaftswege zur Versuchfläche. Eine Anreise mit öffentlichen Verkehrsmitteln ist leider nicht möglich.

Für einen kleinen Mittagsimbis ist gesorgt. Es fallen keine Veranstaltungsgbühren an.



IMPRESSUM & KONTAKT

Forschungsinstitut für Bergbaufolgelandschaften e.V. (FIB)
 Brauhausweg 2
 D-03238 Finsterwalde
 Dr. Dirk Knoche & Dr. Christian Lange
 d.knoche@fib-ev.de, c.lange@fib-ev.de
 Tel.: 03531 7907-11, www.fib-finsterwalde.de

Lausitz Energie Bergbau AG (LEAG)
 Vom-Stein-Straße 39
 D-03050 Cottbus
 Franziska Uhlig-May
 franziska.uhlig-may@leag.de
 Tel.: 0355 28873198, www.leag.de



WWW.FORBIO-PROJECT.EU



Nachhaltige Biomasseerzeugung auf Sonderstandorten für neue Wertschöpfungsketten

EINLADUNG

ZUM ROBINIEN-FELDTAG 2018
 DIE SORTE MACHT DEN UNTERSCHIED
 AM DIENSTAG, DEN 12. JUNI 2018



©LEAG wird durch die Europäische Kommission im Rahmen des Programms für Forschung und Innovation Horizon 2020 finanziert (Projekt Nr. 641366).

Invitation flyer 4-pages Part I

HERZLICH WILLKOMMEN!

Sehr geehrte Damen und Herren,
liebe Freunde,

zum Robinien-Feldtag 2018 laden wir Sie herzlich ein.

Termin:
Dienstag, der 12. Juni 2018, von 09:30 bis 15:00 Uhr

Treffpunkt:
Gut Geisendorf - Das Kulturforum der Lausitzer Braunkohle
Jahrstraße 7A, 03103 Neupetershain
Lausitz Energie Bergbau AG (LEAG)

Über Ihre Teilnahme freuen wir uns.

F. Uhlir

M. Rosar

Franziska Uhlir-May
(LEAG, Leiterin
Rekultivierung und
Naturschutz)

Dr. Michael Heikoald-Rosar
(FIB, Direktor)



DIE ROBINIE - VIELSEITIG & LEISTUNGSSTARK

Schon seit über dreihundert Jahren genießt die nordamerikanische Robinie (*Robinia pseudoacacia* L.) in Brandenburg, ihrem mitteleuropäischen Anbauswerpunkt. Nach anfänglichen Fehlschlägen ist sie heute eine bedeutsame Wirtschaftsbaumart mit vielseitigen Verwendungsmöglichkeiten und besonders hochwertigem Holz.

Die schnellwachsende Robinie gilt aufgrund der regen Wurzeltrübungs- und ihres Stockausschlages als besonders regenerationsfreudig. Hinzu kommt eine außerordentliche Hitze- und Trockenheitstoleranz. Von Konkurrenzvorteil ist die symbiotische Bindung von Luftstickstoff in Wurzelknäulen. Damit erprobt sich die Robinie gerade für den Anbau auf humusarmen Sonderstandorten und landwirtschaftlichen Holzplantagen.



PFLANZENZÜCHTUNG

Das Zuchtziel sind Plusbäume mit überdurchschnittlichen Eigenschaften. Bisher betrachtet die Robinienzüchtung vor allem den Phänotyp, also die äußeren Leistungsmerkmale des Baumes. Es geht um eine Verbesserung der Biomasseleistung, Holzqualität und Wuchstom.

Im Gegensatz zu den Hochleistungspapieren des Agrarholzmanbaus steckt die Hochzucht der Robinie hierzulande noch in den Anfängen. Nicht selten versagen die als leistungsstark beworbenen Superklone im praktischen Anbau, manchmal erst nach Jahren.

Auch fehlt es an geprüften Vermehrungsgut heimischer Erntebestände und Samenplantagen. Hier besteht also Nachholbedarf, was aber kaum verwundert, unterliegt doch die Robinie erst seit 2002 den Bestimmungen des Forstvermehrungsgutgesetzes.

UNSER PROGRAMM

09:30 - 09:50	Ankunft und Registrierung der Teilnehmer	Gut Geisendorf
09:50 - 10:00	Begrüßung	Dirk Knoche, FIB, Franziska Uhlir-May, LEAG
10:00 - 10:20	Die Bedeutung der Robinie als Rekultivierungsbaumart im Lausitzer Revier	Michael Röster, LEAG
10:20 - 10:40	Das Teakholz Brandenburg - innovative Bewirtschaftungsverfahren für Robinienbestände in Brandenburg	Jan Engst, LFB
10:40 - 11:00	Selektion von geeignetem Vermehrungsgut für die Pflanzung von Robinie	Volker Schneck, TI
11:00 - 11:20	Kaffeepause	
11:20 - 11:40	Auf den Stock - Das Ertragspotenzial von Robinien-Verjüngungsbeständen	Dirk Knoche
11:40 - 12:00	Stresstoleranz von Robinien und Sortenempfehlungen	Christian Lange, FIB
12:00 - 13:30	Mittagsimbis & auf dem Weg zum Exkursionspunkt	
13:30 - 14:30	Vorstellung Anbau- und Sortenversuch Welzow Süd & Flächenbegehung	Christian Lange Volker Schneck
14:30 - 15:00	Abschließende Diskussion & Verabschiedung	

LEAG - Lausitz Energie Bergbau AG, FIB - Forschungsinstitut für Bergbaufolgelandschaften e.V., LFB - Landesbetrieb Forst Brandenburg, Landeskompetenzzentrum Forst Eberswalde, TI - Thünen Institut für Forstgenetik, Außenstelle Malsbeversdorf



Fotos: Anbau- und Sortenversuch, Welzow Süd, rechts im Bild, im April 2018



Invitation flyer 4-pages Part II

ROBINIEN-FELDTAG 2018 12. JUNI 2018, 09:30 BIS 15:00 UHR



Veranstalter:
Lausitz Energie Bergbau AG
Forschungsinstitut für Bergbaufolgelandschaften e.V.

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Die alleinige Verantwortung für den Inhalt dieses Roll Ups liegt bei den Autoren. Sie gibt nicht unbedingt die Meinung der Europäischen Union wieder. Weder die Europäische Kommission noch IFA übernehmen Verantwortung für jegliche Verwendung der darin enthaltenen Informationen.

DIE ROBINIE IN BRANDENBURG EIN ANBAUSTECKBRIEF FÜR DEN KURZUMTRIEB

Robinia pseudoacacia L.

Name	Gewöhnliche Robinie, Weiße Robinie, Scheinakazie, Falsche Akazie, Black Locust
Typisierung	sommergrüner Laubb Baum, zählt zu den Schmetterlingsblütenartigen (<i>Fabales</i>), Familie der Hülsenfrüchtler (<i>Fabaceae</i>), regenerationsfreudig durch Stockausschlag und Wurzelschösslinge (<i>Wurzelbrüt</i>), eine der am häufigsten kultivierten Wirtschaftsbaumarten weltweit
Herkunft	östliches Nordamerika, insbesondere Appalachen, seit 340 Jahren in Mitteleuropa kultiviert, inventarisierte Anbaufläche in Deutschland rund 15.000 Hektar, davon entfallen auf Brandenburgs Wälder 8.100 ha, allerdings sind die Daten veraltet, Schätzungen gehen von insgesamt rund 34.000 Hektar aus
Verwertung	stofflich: hochwertiges und besonders dauerhaftes Stammholz mit überlegenen physikalischen Eigenschaften, für vielseitige Verwendungszwecke, unter anderem im Möbel- und Wasserbau, Nutzung der hochwertigen Inhaltsstoffe für pharmazeutische Zwecke, Biotreibstoffherstellung, Bedeutung für die Imkerei: Akazienhonig energetisch: Festbrennstoff (Brennholz, Hackschnittel), der Heizwert des trockenen Stammholzes und Astmaterials entspricht in etwa dem von Braunkohlenbriketts
Ertrag	in jungen Stockausschlagbeständen zwischen 3 und 10 Tonnen (Trockenmasse) pro Hektar & Jahr, je nach Standortgüte, Genotyp, Aufwuchsalter und Bestockungsdichte
Ansprüche	ausgesprochen hitze- und trockenheitsresistente Zukunftsbaumart im Klimawandel, toleriert geringe Jahresniederschlag von unter 400 mm, und gedeiht selbst in der semiariden Klimazone auf nicht mehr pappelfähigen Standorten, wärmeliebend, sie benötigt mindestens 140 bis 220 frostfreie Tage (Weinbauklima) anspruchlos und anbausicher, vorwüchsig auf humusarmen Neulandböden - die symbiotische Luftstickstoffbindung in Wurzelknöllchen sichert Konkurrenzvorteile, die Baumart bevorzugt sandig-lehmige, gut durchlüftete Böden mittlerer Ertragsfähigkeit
Risiken	Gefahr durch Spätfrost, bis zum zweiten Standjahr recht empfindlich gegenüber verdämmenden Unkräutern und Großgräsern, während der Anwuchsphase können pilzliche Schwächeparasiten (<i>Nectria</i> , <i>Phomopsis</i>) zu hohen Pflanzenausfällen führen
Pflanzenbau	im Agrarholzanbau eine Low-input-Pflanze bezüglich Düngung, Pflanzenschutz und Bodenbearbeitung, mit einer Standzeit von etwa 30 Jahren, Kurzumtrieb (3-4-jährig) oder Midi-Rotation (10-15-jährig), das örtliche Zuwachspotenzial wird ab dem vierten Jahr und in der zweiten Rotation erreicht Bestandesbegründung durch Pflanzung, danach fortlaufende vegetative Verjüngung im Stockausschlagbetrieb, zwar ist leistungsfähiges Vermehrungsgut am Markt verfügbar, es fehlt aber eine Sortenempfehlung für den Energiepflanzenanbau
Ernte	voll mechanisierte Ernte mit umgerüsteten Maishäckslern oder bei längeren Nutzungszeiträumen mit leichten Harvestern, im Winterhalbjahr - die Hackschnittel müssen nachgetrocknet werden

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Die alleinige Verantwortung für den Inhalt dieses Roll Ups liegt bei den Autoren. Sie gibt nicht unbedingt die Meinung der Europäischen Union wieder. Weder die Europäische Kommission noch IFA übernehmen Verantwortung für jegliche Verwendung der darin enthaltenen Informationen.

Rollups with information on the capacity building event (left) and cultivation profile of black locust on underutilized land in Central Europe

4.2.3. Agenda

The invitation flyer contains the agenda in national language.

- 09:50 Welcome and opening by Dirk Knoche (FIB) and Michael Rösler (LEAG)
- 10:00 The role of Black locust as a tree species for recultivation in the Lusatian lignite mining district, Michael Rösler (LEAG)
- 10:20 Brandenburg's teak wood – Innovative management methods for robinia stands in Brandenburg, Lan Engel (LFE)
- 10:40 Selection of suitable reproductive material for planting of black locust, Volker Schneck (TI)
- 11:00 coffee break
- 11:20 The yield potential of robinia rejuvenation stands, Dirk Knoche (FIB)
- 11:40 Stress tolerance of black locust and recommendation of varieties, Christian Lange (FIB)
- 12:00 Lunch break
- 13:30 Presentation and site inspection of cultivation and variety trial on reclamation areas in Welzow-Süd
- 14:30 Final discussions and farewell

Abbreviations of speakers' institutions:

- LEAG Lausitz Energie Bergbau AG
- LFE Landeskompetenzzentrum Forst Eberswalde
- TI Thünen Institut, Institut für Forstgenetik
- FIB Forschungsinstitut für Bergbaufolgelandschaften e.V.

4.2.4. Summary of presentations

The event was opened by Dirk Knoche and Michael Rösler, a representative of the reclamation department of the mining company (LEAG).

In the first presentation, **Michael Rösler** explained the relevance of black locust / robinia in the context of forest reclamation in the Lusatian lignite mining district. He described the area proportion and preferred site conditions for the cultivation of black locust. Furthermore, he presented positive aspects of the tree species, e.g. soil improvement of raw soils, emission and erosion control, bee pasture, etc. However, LEAG is aware of the high competitive power of the species. Therefore, no plantations are realised close to worth protecting open landscapes.

In the second presentation, **Jan Engel** from the "Eberswalde forestry state centre of excellence" (research institution of the state forestry enterprise in Brandenburg) gave an overview about different types of management. He presented several options of feedstock usage, e.g. for bioenergy/biofuels from short rotation coppices, which were analysed in long term research projects.

Volker Schneck, Institute of Forest Genetics from Thünen Institute, works in the field of activity "Provenance and Breeding Research". He discussed the importance of the selection of suitable reproductive material for successful cultivation of black locust. Volker Schneck stated also that there is a strong need for site-adapted planting material, mainly for short rotation coppices.

In his presentation, **Dirk Knoche** (FIB) focussed primarily on economic aspects of Black locust management, both biomass yields and monetary aspects. He was mainly looking on questions of marketing, management and profitability in short production lines with the highest interest payment.

The lecture part of the capacity building event was concluded with a detailed presentation given by **Christian Lange** (FIB) about the sensitivity and tolerance of robinia to selected abiotic stress factors (frost, drought). He gave recommendations for the cultivation of different clones and provenances on underutilized and marginal land such as lignite reclamation sites in the German case study region.



Presentation about the economic potential of black locust on lignite reclamation sites by Dirk Knoche (FIB)



Agile networking during coffee break



Registration at the second German FORBIO capacity building event



Visit of cultivation and varieties trials in Welzow-Süd

4.2.5. Conclusions

Main Questions

- How is the feedstock used/marketed? Are there any marketing problems?
- How invasive is robinia on reclamation sites?
- What is the experience with stem quality?
- How does the nutrient balance (with exception of nitrogen) develop during intensive use, especially on new raw soils?
- How intensive is the cultivation maintenance?
- Which biotic factors affect the cultivation?

Main outcomes

- Currently there are no experience with pathogens on robinia in reclamation sites. From this point of view, the cultivation of black locust seems to be without increased risk.
- Multipurpose robinia is able to react very quickly to various stress factors. This provides advantages in terms of climate change and for a diverse biomass utilization, including biofuels.
- In the event of increasing drought and water shortage in the future, black locust enables the forest preservation and raw material supply at underutilized land.

4.3. Study tour

4.3.1. Introduction

The study tour in Germany was implemented on 7 September 2017 in Finsterwalde alongside with the project meeting and information day. It was a one-day study tour organised by FIB for the local stakeholders. Different FORBIO dissemination materials were available at the event. In total 30 participants attended the information day.

4.3.2. Agenda

EXKURSION, 7. SEPTEMBER 2017

09.00 - 09.30	Treffpunkt: Marktplatz / Rathaus Finsterwalde
09.30 - 10.30	Busfahrt zum Braunkohlentagebau Welzow-Süd
10.30 - 11.00	Aussichtspunkt Tagebau Welzow-Süd - <i>das geologische Fenster, zur Historie des Bergbaus & Tagebauführung, Bergbautechnologie, Kippsubstrate</i> Franziska Uhlig-May, Lausitz Energie Bergbau AG
11.30 - 12.15	Robinien-Schnellwuchsplantage, Klonprüfung - <i>Biomasseertrag im Kurzumtrieb, Stresstoleranz, ökologische Bedeutung auf Kippenstandorten mit Anbauempfehlungen</i> Christian Lange, FIB
12.15 - 13.45	Durch die Bergbaufolgelandschaft zur Mittagspause auf den Wolkenberg - <i>Landschaftsgestaltung: Land- und Forstwirtschaftliche Rekultivierung, Renaturierung, Sondernutzungen</i> Franziska Uhlig-May & Thomas Lückfeldt, Lausitz Energie Bergbau AG
13.45 - 14.30	Sorghum-Hirse, Anbau- und Sortenversuch - <i>Energiemais versus Sorghum, Einordnung in die Rekultivierungsfruchtfolge, Anbauverfahren</i> Stefan Lukas, FIB
14.30 - 15.00	Diskussion zum Anbau nachwachsender Rohstoffe auf Rekultivierungsflächen
15.00 - 16.00	Rückkehr nach Finsterwalde & Verabschiedung

4.3.3. Summary of the study tour

Excursion point 1: Brown-coal opencast mine Welzow-Süd

Deposit & Geology

The deposit Welzow-Süd is located in the Southeast of the federal country Brandenburg West of the river Spree and is situated between the communities Welzow, Drebkau and Spremberg. The landscape zone can be assigned to the glacial stamped north-east German lowlands with flat relief.

In the large open-pit mine of the Lausitz Energie Bergbau AG (LEAG) the second lusatian seam is mined since 1966. It is between 10 and 16 m thick and has a predominantly horizontal alignment. The overlying rock has a thickness of between 90 and 130 m and consists mainly of Saalian (II) ice age deposits (loam, sand) and tertiary loose sediments (predominantly Miocene sands). The formation of coal began around 15 million years ago in a brackish-marine coastal belt - very similar to today's conditions of the Amazon Basin.

Lignite mining & Exploitation

The annual production volume of the open-pit mine is about 20 million tons of raw brown-coal which is about one third of the total lignite mining in the region. The raw brown-coal is transported by train to the nearby power plant Schwarze Pumpe and converted to electricity. High quality lignite briquettes are also produced to a lesser extent. On average, the ratio between overburden material and coal is about 6 to 1 m³/t. Additionally, the bucket wheel excavator SRs 6300 obtains about 14,000 m³ of quaternary overburden material to cover the sulphuric dumps with a substrate more suitable for plant cultivation and growth. The output of the AFB F60 is about 18,000 m³/h.

Landscape dynamic

Until today, 17 villages and about 10,000 hectares of native cultural landscape had to make way for the opencast mine Welzow-Süd. On the other side, diverse, ecological valuable and astonishing productive post mining landscapes are developing. According to the mining law, an area of around 5,000 hectares have been recultivated on schedule for subsequent use. About two third of this area are used for sylvicultural exploitation. Species-rich mixed woodland is developing predominantly with a high proportion of sessile oak which is a valuable contribution to the ecological forest conversion in the region.

The returned areas used for agriculture are fundamental to secure the long-term existence of local agricultural farms. They are involved in the recultivation process from day one. Thereby, the main focus is on restoring soil fertility by crop rotations adapted for recultivation and soil conserving management. Additionally, renewable resources are of growing importance.



Participants of the study tour next to the brown-coal opencast mine Welzow-Süd

Excursion point 2

Testing different Black locust origins for identification productive and stress tolerant clones (joint project FastWOOD III)

Intention

Within the framework of FastWOOD III project (collaboration of Thünen Institut, Landeskompetenzzentrum Forst Eberswalde and FIB e.V.) investigations on growth and biomass production as well as plant physiological status identifying individual photosynthetic efficiency and drought stress tolerance of black locust clones are conducted. Even in March 2014, test plants originating from 12 black locust clones and from 3 European forest seed stocks have been planted.

Test design

The test design of the different Black locust clones and origins comprises 15 test variants in total, as shown in the table below.

Test variant	Name	Breeding ID	Origin
1	Bendida	NW 12-466 D	Hann. Münden (GER)
2	Tangra		Hann. Münden (GER)
3	Fraport 1	NW 8-1491 L	Frankfurt/Main (GER)
4	Fraport 2	NW 8-653 B	Frankfurt/Main (GER)
5	Fraport 3	NW 8-819 Z	Frankfurt/Main (GER)
6	Habichtborn	NW 11-660 K	Hann. Münden (GER)
7	Langen	NW 11-461 X	Frankfurt/Main (GER)
8	Robert		Waldsieversdorf (GER)
9	Roger		Waldsieversdorf (GER)
10	Romy		Waldsieversdorf (GER)
11	Rowena		Waldsieversdorf (GER)
12	Roy		Waldsieversdorf (GER)
15	Kiskunsagi	NW13-0448X	Hungary (reference)
22	Schöneiche	ROB1-09	Brandenburg (GER)
23	Cuci	ROB5-10	Romania

Site conditions

The test area is situated in the northern part of lignite mining pit Welzow-Süd and is being rehabilitated since 2012. Investigations on local dump soil substrate revealed two different dumped materials:

- **Loamy sand with few gravels**
- **Loamy sand with few gravels and lignitic material**

Both dump substrates units are characterized by low pH value, low nutrition level and low water holding capacity.

Biomass growth

Individual biomass growth of the Black locust clones is varying. Black locust clones like *FRAPORT3*, as well as Brandenburgian genotypes *Roger*, *Romy* und *Rowena* are characterized by an outstanding total growth performance and therefore highly recommendable.

Across all 15 test plots of Black locust clones and origins currently average biomass growth (dGZ_B) is about 3 tons (atro) per hectare per year.



Visiting the Black locust test plantation



Discussion with stakeholders at the Black locust test plantation

Excursion point 3

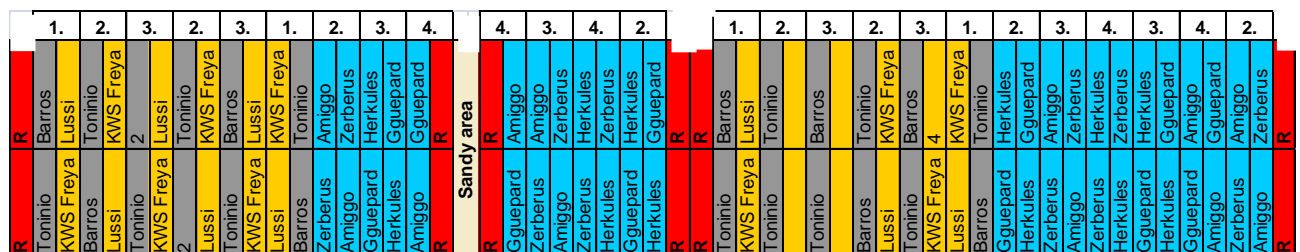
Field trial to optimize biomass and biogas yield of Sorghum on a reclamation site using different species and harvest dates

Intention

The aim of the project is to evaluate the best combination of high biogas and dry matter biomass yield at the same time by testing different *Sorghum* species at different harvest dates.

Experimental layout

For that, we compare early maturing *Sudan grass* hybrids (*Lussi*, *Freya*), medium-early ripening forage sorghum (*Zerberus*, *Amiggo*) and medium-late ripening forage sorghum (*Gguepard*, *Herkules*). To estimate the optimal harvest date, each species and maturity group is harvested at three dates (figure 2). In addition to the *Sorghum* species, medium-early (*Toninio*) and medium-late (*Barros*) silage maize is grown and harvested.



Randomized strip-plot design of the species and harvest-date trial 2017

Experimental site

The experimental site is located in the opencast mine *Welzow-Süd* and is under recultivation since 2008. The dumped substrate is a nutrient poor **gravel-carrying calcareous loam-sand** and is classified as a slightly to medium loamy sand with low organic carbon content and low water holding capacity as shown in the table below.

Chemical and physical soil parameters of the experimental site

	pH _(CaCl2)	CaCO ₃	C _t	C _{org}	N _t	C/N	N _{min}	K _{DL}	P _{DL}
			[%]				[kg/ha]	[mg/kg]	[mg/kg]
0-30 cm	7.4	1.8	0.7	0.5	0.04	13	5.7	29.5	39.7
	Soil type	R _t	PV	FK	nFK	LK	PWP	ka-Value	
		[g/cm ³]			[%]			[μm ²]	
0-30 cm	SI2	1.81	31.6	17.2	9.0	14.4	8.2	7.4	

K_{DL}/P_{DL} : plant available potassium and phosphorus, R_t : dry bulk density, PV : pore volume, FK : field capacity, nFK : plant available water capacity, LK : air capacity, PWP : permanent wilting point, k_a -Value: air conductivity



Sorghum trial fields

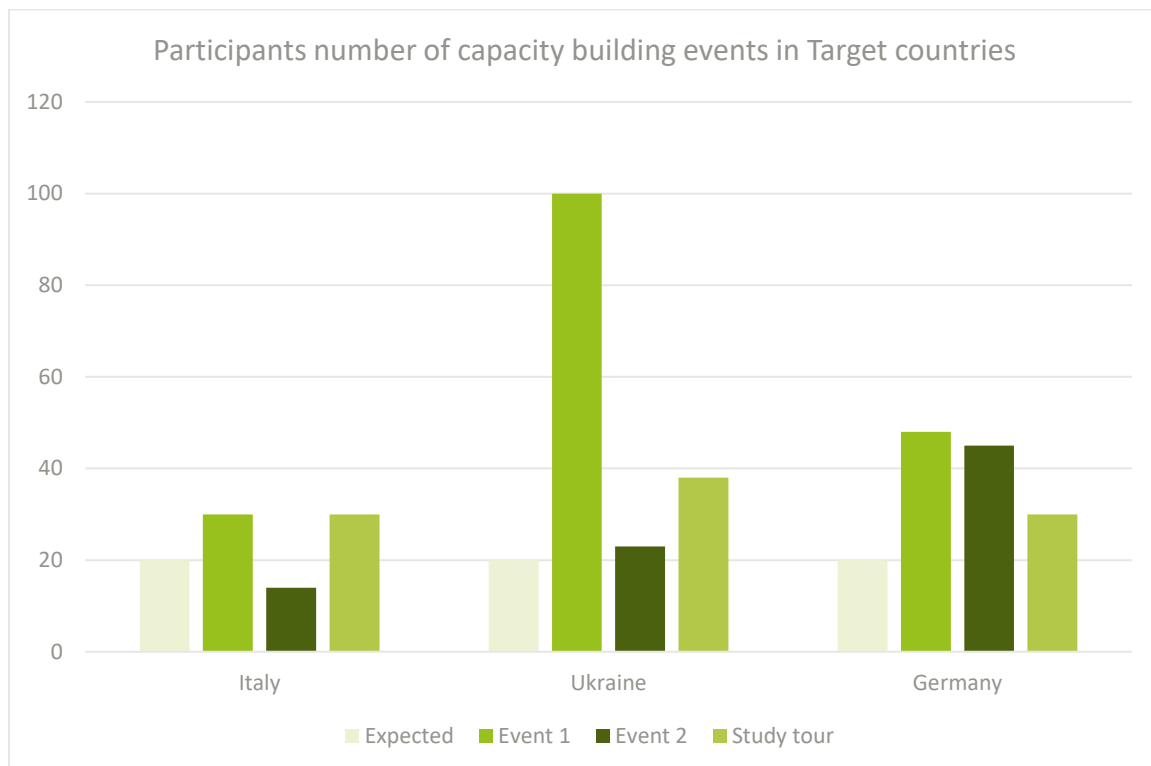


Discussion with stakeholders at the *Sorghum* trial fields

5. Overall impacts of the capacity building events

The capacity building events and the study tours in the three target regions were very successful. They were attended by 260 and 98 stakeholders respectively from different categories (farmers, agronomists and agriculture professional organization, local investors, students, environmental engineers, representatives of agrarian companies, representatives of research institutes of agrarian and technical direction, media, municipalities, business companies, consulting companies, government authorities, forest management, reclamation department, scientific community, land owners, nature conservation. The communication impact which was foreseen for the workshops in the target regions and which is 20 participants per workshop was reached in almost all countries as it is shown in the table below and in Ukraine it exceeded by the expectations.

Furthermore, the dissemination of the results of the capacity building events went to beyond the participants as the summaries of the events were sent not only to the ones who attended the info days but also to all invited stakeholders including a big list of farmers, agrarian associations, governmental bodies etc. In addition, the presentations were also uploaded on the website of the FORBIO project.



The objectives of the capacity building events were fulfilled as it gave interested stakeholders the chance to get more in-depth information and knowledge on biomass feedstock production on underutilised land. The events informed about agronomic,

techno-economic and sustainability requirements and overcoming policy barriers based on the results of agronomic and techno-economic feasibility studies which were developed in the core of the project.