IMPROVING THE LOGISTIC OF ENERGY CROPS

JatroMed Third International Workshop on Bio-based economy and renewable energy resources as key mechanisms for achieving sustainable development
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Luigi Pari
Unità di Ricerca per l'Ingegneria Agraria
Via delle Pascolare, 16 - 00016 Monterotondo (Roma)
Tel. +39 06 90675249 Fax. +39 06 90675250

Our working model

Research demand from stakeholders

Funding bodies

PRIVATE

MINISTERO DELLE POLITICHE AGRICOLE ALIMENTARI E FORESTALI

Transfer

Research activities
Knowledge and
Prototypes
development

Dissemination

experimental demo center on agroenergies

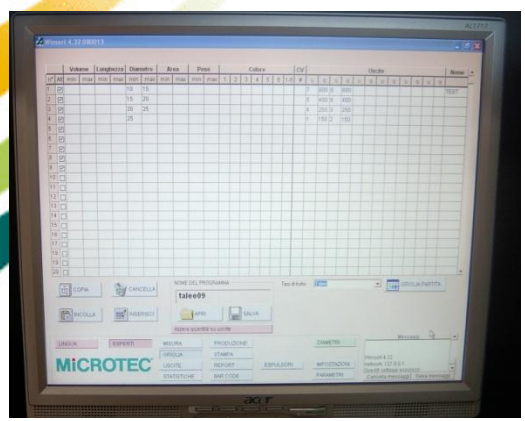
Stakeholders
Public and private bodies
Scientific community

Research activities to improve the logistic of energy crops

Stage of bioenergy chain	Studied species
Propagation mat in nursery	Poplar, arundo, miscanthus
Transplanting	Poplar, Arundo, miscanthus
Harvesting	Poplar, Eucalipto, Melia, Ash, Oilseed rape, Ethiopian mustard, Arundo, Cardoon, Fiber sorghum, Sweet sorghum
Storage	Poplar, Arundo, Sweet sorghum
Logistic	Energy crops and residues
Biomass characterization	Poplar, Arundo, Cardoon
Transformation	Woody and herbaceous crops

Optical selection of Poplar cuttings for SRF

The machine developed at prototype level allows to classify the poplar cutting for SRF according to their diameter. The classification will allow to speed up the packaging process and solving the problem of the **automatic feeding system in transplanters**



Mechanization of *Arundo* rhizome extraction in nurseries

A mechanized system capable of reducing rhizome production cost has been developed. The solution proposed involves the use of a modified stump grinder capable to section and dig up rhizomes directly *in situ*. This operation would make the subsequent harvesting and packaging much easier.

MECHANIZATION OF RHIZOME EXTRACTION IN GIANT REED (*ARUNDO DONAX* L.) NURSERIES

A. Assirelli, E. Santangelo, R. Spinelli, A. Acampora, S. Croce, V. Civitarese, L. Pari

Applied Engineering in Agriculture, 2013, vol 29(4): 489-494

Reduced tillage for a good establishment of poplar planting

CRA-ING has developed a new system for reduced tillage in order to carry out in one pass both the deep cracking of the soil and the superficial thinning of the area where the cuttings will be grown.

In such way, there is reduction of the number of field operations, creating, at the same time, the better conditions for poplar rooting without meaningful effects on yield.

Mechanical transplanting

Poplar

Cuttings

Arundo

Rhizome

Poles

Stem cuttings

Harvesting system for Short and Medium Rotation Coppice

An innovative harvesting approach for two-years (SRC) and five-years old poplar (MRC) has been designed: a semi-trailed cut-windrower and a self-propelled chipper equipped with a pick-up head.

Five-years old (Medium Rotation Coppice MRC)

Two-years old (Short Rotation Coppice SRC)

Harvesting of different SRF crops

The experimentation started the last spring. It aims at evaluating the suitability of the self-propelled Claas Jaguar combined with the GBE-1 header for the harvesting of different species cultivated as SRF crops. The species are the following:

- European Poplar
- American Poplar
- Eucalyptus
- Melia
- Fraxinus

Forage harvester chipping systems

Presently, the rotor mounted foragers harvesters has been designed for the harvesting of grass crops, when they are used. The reduced size of SRF final product can negatively affect the wood chip storability.

A new drum chipper to apply on self propelled forage harvester has been designed in order to shift the particles size distribution towards the larger dimensional classes.

Arundo harvesting

First tests were carried out adapting common self-propelled forage harvesters. A new prototype is under study in order to improve the particle size distribution of chips.

Claas Jaguar

Prototype CRA-ING/Spapperi

Harvesting of cardoon (*Cynara cardunculus*)

Diversification and specialization seem to be the most suitable ways to add value to cardoon. A selective harvest would allow to use the lignocellulosic biomass for energy or/and paper pulp, the seeds for oil and the pappi for chemicals.

CRA-ING has conceived and refined over the years a combine head able to collect separately the different biomass fractions.

Fiber sorghum harvesting

One of the main constraints hindering the cultivation of fiber sorghum is the lack of an efficient harvesting method.

Over the years, CRA-ING has introduced various technical improvements (starting from the first prototype) that greatly improved the field drying of fiber sorghum.

2007

2010

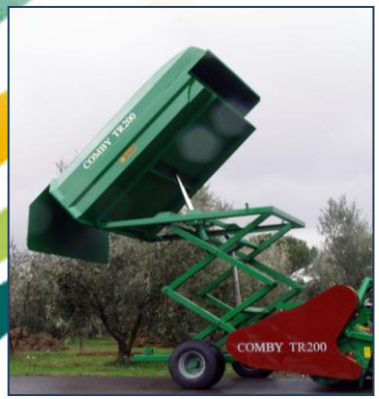
AN INNOVATIVE SYSTEM FOR CONDITIONING BIOMASS SORGHUM [*SORGHUM BICOLOR* (L.) MOENCH.]

A. Assirelli, S. Croce, A. Acampora, V. Civitarese, A. Suardi, E. Santangelo, L. Pari

Transactions of the ASABE, 2013, vol 56(3): 829-837

Harvesting residues

Prunings



Performance evaluation of commercial machines Development of a prototype

Stump residues

Analysis of working times and fuel quality

Riparial *Arundo*

Assessment of the operating capacity and the potential yield

Harvesting residues

BIOSYSTEMS ENGINEERING 110 (2011) 443–449

Available online at www.sciencedirect.com

SciVerse ScienceDirect

journal homepage: www.elsevier.com/locate/issn/15375110

Research Paper

Assessing the cost of stump-site debarking in eucalypt plantations

Natascia Magagnotti [a], *Carla Nati* [b], *Luigi Pari* [c], *Raffaele Spinelli* [b,*], *Rien Visser* [d]

[a] CNR, Timber and Tree Institute, Via Biasi 75, I-38010 San Michele all'Adige (TN), Italy
[b] CNR, Timber and Tree Institute, Via Madonna del Piano, Pal. F, I-50019 Sesto Fiorentino (FI), Italy
[c] CRA ING, Via della Pascolare 16, Monterotondo Scalo (Roma), Italy
[d] Forest Engineering, Canterbury University, Private Bag 4800, Christchurch, New Zealand

Bioresource Technology 128 (2013) 697–702

Contents lists available at SciVerse ScienceDirect

Bioresource Technology

journal homepage: www.elsevier.com/locate/biortech

Technology alternatives for tapping the pruning residue resource

Natascia Magagnotti [a], Luigi Pari [b], Gianni Picchi [a], Raffaele Spinelli [a,*]

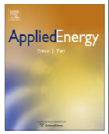
[a] CNR IVALSA, Via Madonna del Piano 10, I-50019 Sesto Fiorentino, Italy
[b] CRA ING, Via della Pascolare 16, Monterotondo Scalo (Roma), Italy

Applied Energy 89 (2012) 374–379

Contents lists available at SciVerse ScienceDirect

Applied Energy

journal homepage: www.elsevier.com/locate/apenergy



Production and quality of biomass fuels from mechanized collection and processing of vineyard pruning residues

Raffaele Spinelli [a,*], Carla Nati [a], Luigi Pari [b], Enzo Mescalchin [c], Natascia Magagnotti [d]

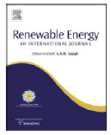
[a] CNR IVALSA, Via Madonna del Piano 10, Sesto Fiorentino (FI), Italy
[b] CRA ING, Via della Pascolare 16, Monterotondo Scalo (Roma), Italy
[c] Edmund Mach Foundation, Via E. Mach, San Michele all'Adige (TN), Italy
[d] CNR IVALSA, Via Biasi 75, San Michele all'Adige (TN), Italy

Renewable Energy 53 (2013) 350–353

Contents lists available at SciVerse ScienceDirect

Renewable Energy

journal homepage: www.elsevier.com/locate/renene



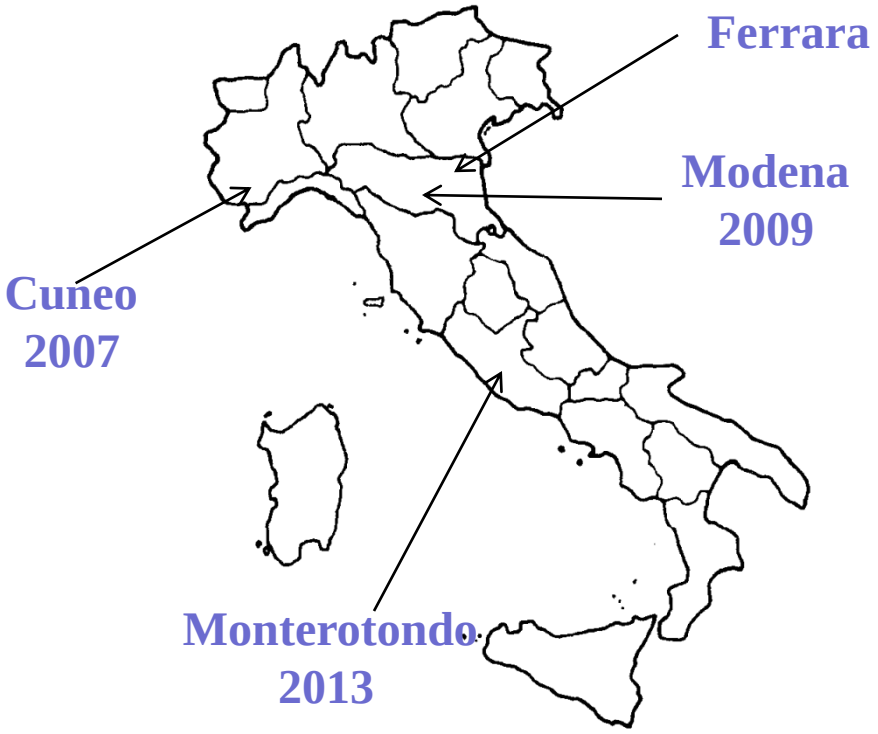
Product contamination and harvesting losses from mechanized recovery of olive tree pruning residues for energy use

Andrea Acampora [a], Sara Croce [a], Alberto Assirelli [a], Angelo Del Giudice [a], Raffaele Spinelli [b,*], Alessandro Suardi [a], Luigi Pari [a]

Storage (1)

Several storage trials has been carried out during time in order to identify the best methodologies for preserving the qualitative traits of fuel.

- Natural drying
- Covered pile
- Compacted pile
- Ventilated heap
- Stem wood chips
- Branch wood chips



Storage (2)

Storage (3) - Windrows

Time-course study of the moisture content and the dry matter losses occurred during the storage of whole poplar trees (SRF) arranged in windrows aimed at identifying the most suitable harvesting period for poplar SRF for high-grade fuel quality.

Storage (4) – References (poplar)

energies
ISSN 1996-1073
www.mdpi.com/journal/energies

Article

Characterization of Woodchips for Energy from Forestry and Agroforestry Production

Rodolfo Picchio [1,*], Raffaello Spina [1], Alessandro Sirna [1], Angela Lo Monaco [1], Vincenzo Civitarese [2], Angelo Del Giudice [2], Alessandro Suardi [2] and Luigi Pari [2]

BIOMASS AND BIOENERGY 51 (2013) 169–176
Available online at www.sciencedirect.com
SciVerse ScienceDirect
http://www.elsevier.com/locate/biombioe

Influence of chipping device and storage method on the quality of SRC poplar biomass

Luigi Pari [a], Vincenzo Civitarese [a,*], Angelo del Giudice [a], Alberto Assirelli [a], Raffaele Spinelli [b], Enrico Santangelo [a]

BIOMASS AND BIOENERGY 54 (2013) 77–82
Available online at www.sciencedirect.com
SciVerse ScienceDirect
http://www.elsevier.com/locate/biombioe

Effect of piece size and tree part on chipper performance

Alberto Assirelli [a], Vincenzo Civitarese [a], Roberto Fanigliulo [a], Luigi Pari [a], Daniele Pochi [a], Enrico Santangelo [a], Raffaele Spinelli [b,*]

BIOMASS AND BIOENERGY 62 (2014) 17–25
Available online at www.sciencedirect.com
ScienceDirect
http://www.elsevier.com/locate/biombioe

Storage dynamics and fuel quality of poplar chips

Maurizio Barontini [a,*], Antonio Scarfone [a], Raffaele Spinelli [b], Francesco Gallucci [a], Enrico Santangelo [a], Andrea Acampora [a], Raida Jirjis [c], Vincenzo Civitarese [a], Luigi Pari [a]

Journal of Cleaner Production xxx (2012) 1–10
Contents lists available at SciVerse ScienceDirect
Journal of Cleaner Production
journal homepage: www.elsevier.com/locate/jclepro

Modelling lignocellulosic bioethanol from poplar: estimation of the level of process integration, yield and potential for co-products

Giacomo Filippo Porzio [a], Matteo Prussi [b], David Chiaramonti [c,*], Luigi Pari [d]

International Biodeterioration & Biodegradation 90 (2014) 17–22
Contents lists available at ScienceDirect
International Biodeterioration & Biodegradation
journal homepage: www.elsevier.com/locate/ibiod

Airborne fungi in biofuel wood chip storage sites

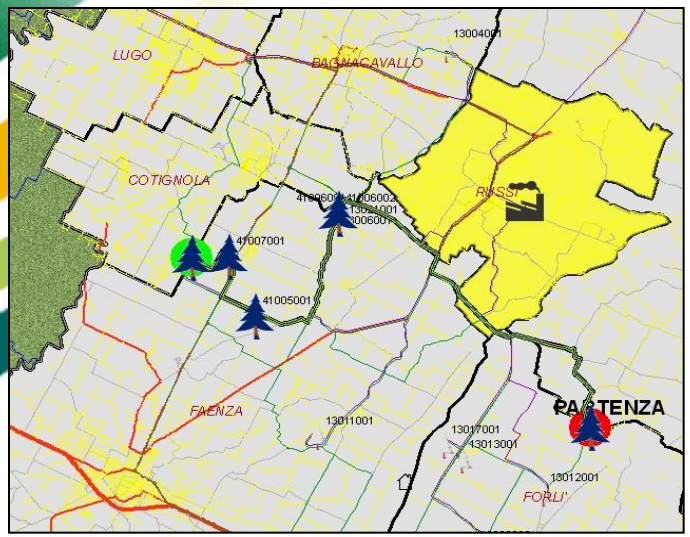
Maurizio Barontini [a,1], Silvia Crognale [b,*,1], Antonio Scarfone [a], Pietro Gallo [a], Francesco Gallucci [a], Maurizio Petruccioli [b], Lorena Pesciaroli [b], Luigi Pari [a]

Storage (5) – *Arundo* and sweet sorghum

Ventilated and not ventilated stoage tests for chopped *Arundo*

Dry matter and sugar content losses evaluation in sweet sorghum in relation to the length of stems portion and storage period.

GIS and GPS tools for logistic



GIS and GPS tools has been developed to schedule the daily harvesting operation in biomass plantations and to organize the logistic for feedstock handling and transport in function of the machine type and the pedoclimatic conditions.

Biomass characterization – Facilities and studies

Availability of lab instruments for the determination of ash content, heating value, ash melting point, elementary analysis.

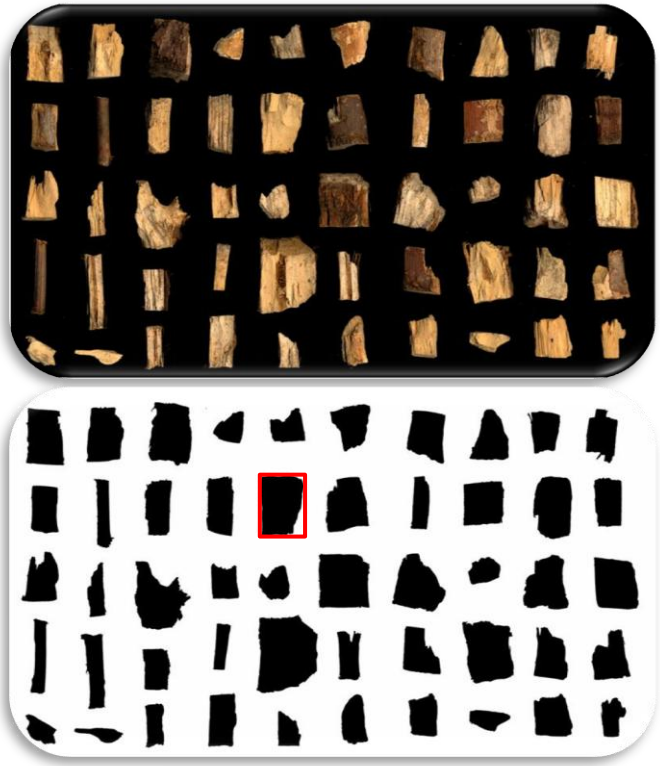
Chemical-physical analysis of the biomass

Chemical-analitycal assessment of emissions

CHN analyser

ICP/MS

GC/MS



Set up of new methods based on the image analysis for the classification of wood particles, depending on both size and shape.

Our Dissemination model

Visits to Agroenergy Centre

Internet

Dissemination

Scientific articles

Workshops - Seminars – Demonstration days – Fairs

Experimental demo agroenergies center

The results of the scientific research activities are transfered also trought the Experimental demo center on agroenergies., The objective is to transfer the technological innovation to the final users, working as linkage between the different stakeholders involved in the agroenergy chain (industries, mechanical enterprices, agricoltural investors, etc.)

Downloadable from http://ing.entecra.it/biomasse/

Thank you for your attention

Versione completa
Indice e introduzione
Colture legnose
Colture erbacee annuali
Colture erbacee poliennali
Biomasse residuali

All the data obtained from the research activities carried out are freely downloadable from the Site: http://ing.entecra.it/biomasse/

English version in

www.gruppo-panacea.it