Miscanthus

Miscanthus-based bio-sourced materials

aGRICULTURES & TERRITOIRES
CHAMBRE D'AGRICULTURE PYRÉNÉES-ATLANTIQUES

Avec le soutien de :
Région Nouvelle-Aquitaine
Ministère de l'Agriculture et de l'Alimentation
Agence de l'eau Adour-Garonne
Union européenne

The plant

- Miscanthus Giganteus
  - Non-invasive sterile hybrid originating in Asia.
  - Fast-growing C4 plant.
  - Multiplication by rhizome
  - **Perennial** plant 15 to 20 years
  - Adapts to all types of soil
  - Simple crop **0 fertiliser - 0 pesticides**
  - One harvest a year at the end of winter **12 to 15T/ha** using a bulk maize forage harvester
  - Low density:**120 to 140kg/m3 => 115m$^{3/ha}$**
  - 2 years before the first harvest
  - Not sensitive to rodents

Miscanthus


Plantation


15 days after planting


June year 1


September year 1


September year 3

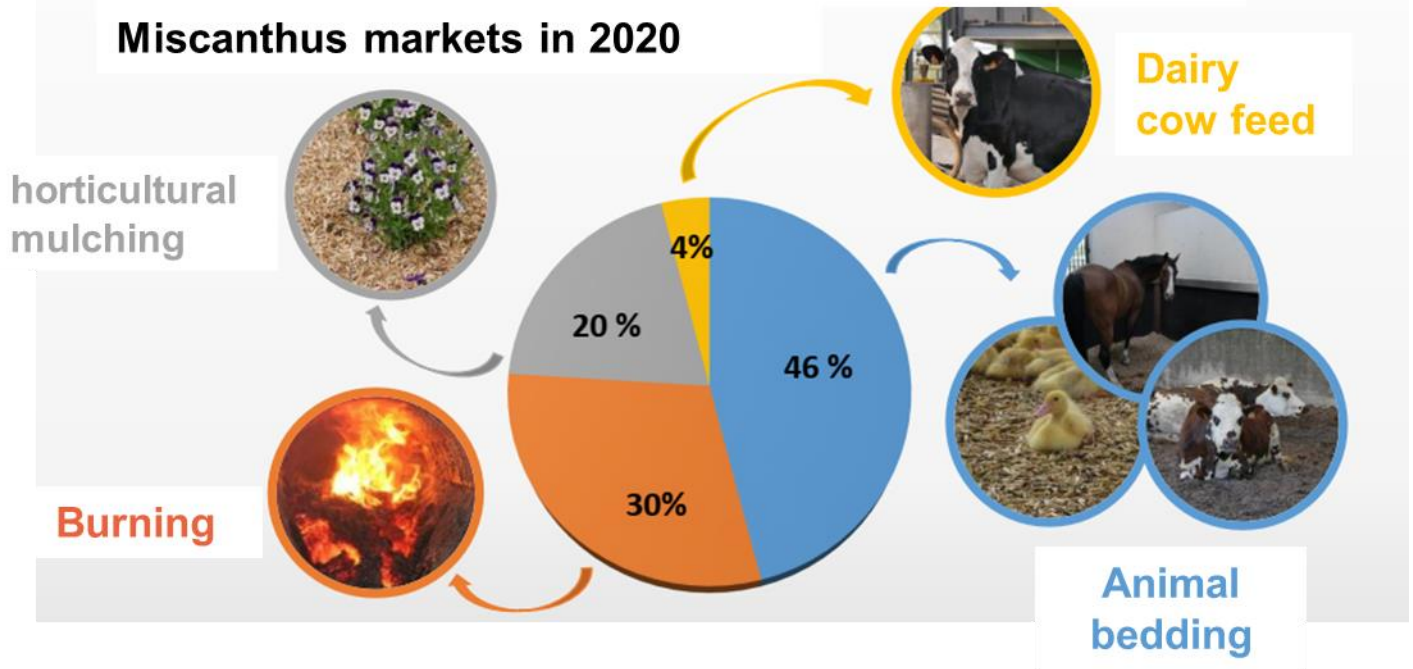

Harvesting maize forage harvesters

Applications

A non-food crop that does not compete with food, as it is eligible to :

- water catchment protection areas
- areas of ecological interest
- no-treatment zones

Miscanthus markets in 2020



Type of miscanthus-based materials

Miscanthus concrete

ADEME fact sheet 2011

MISCANTHUS: A NEW BUILDING MATERIAL

TECHNICAL CHARACTERISTICS OF MISCANTHUS CONCRETE :

- Density: 440kg/m^3
- Surface thermal resistance: R = 3.03 m^2.K/W UF1
- Thermal conductivity: 0.0915 W/m.K
- 1 FU (Functional Unit) = 1 m^2 of wall lined with 20cm of miscanthus concrete

Sources : BBRI (2010), RVéchohabitat

EXAMPLE FOR A MISCANTHUS WALL 20 CM THICK AND A SURFACE AREA OF AROUND 40M2 :

- 40 litres of air lime
- 200 litres of miscanthus (approximately 1cm thick)
- 20 litres of plaster- 20 litres of pumice stone (0.4 mm diameter)
- cost (material + labour): 60-70 €/m^2 (+ 20-30 €/m^2 for finishing)

Made by RVécohabitat

On an industrial scale

Alkern / Concrete block announced in 2017 - Plant 2024

- Construction of manufacturing plant at Andelys (Eure) Start-up 1er half-year 2024
- Block with 30% miscanthus replacing mineral aggregates
- 40% reduction in the carbon footprint of blocks
- Envisaged annual savings of 2000 to 3000T of CO_2
- Production 25km around the plant, estimated at 100ha

On an industrial scale

Muance / Prefabricated modular building - Plant 2022

- For local authorities
- Technical accreditation of modules
- 14 housing by March 2024
- Seeking to manufacture miscanthus-based insulation (<50km) for its modules
- Plant at Vatry in the Marne department

On a pre-industrial scale

Kellig Emren

KELLIG EMREN
BIOSOURCÉ - MATÉRIAUX ET CONSTRUCTION

Production et process de matériaux de construction avec des matières premières végétales

21 500 € de chiffre d'affaires

2 collaborateurs

ZA de Kermestre, 56150 Baud

Partenaires : Akta BVP, Akterre, Sable Vert, Centre Morbihan Communauté, Institut de Recherche Dupuy de Lôme, BPI France, Région Bretagne

HUB DES PRESCRIPTEURS BAS CARBONE

ifpeb

carbone 4

Panneau en béton végétal (miscanthus, terre crue, chaux)

Familles	Isolant Cloison
Application	*Tertiaire* *Logement collectif* *Logement individuel*
Points mis en avant par le porteur d'innovation	Sobriété et économie de moyens et d'énergie sur toute la chaîne des acteurs Vertueux en fin de vie : production de nouveaux isolants, compostable et valorisable en amendement

MATURITÉ

Développement	Validation
Réglementation	Pass innovation 2021 : ATEx de type B
Données env.	FDES en cours de réalisation

RESSOURCE

Origine	Rayon de 15 km autour de l'entreprise
Capacité de production	Miscanthus : 8 000 Ha Production de 8000 m² d'isolant par an

PERFORMANCES

Epaisseur	7,5 cm
Performance thermique	λ = 0,077 W/(m.K), soit R=0,97 m².K/W
Réaction au feu	B-s1, d0
Résistance flexion	0,20 MPa

COÛT

Fourniture et pose	ITE : 89€/m² ITI : 174€/m² ~ 800 € (prix de revient ttc au m² SDP)

CARBONE

Taux de biosourcé *(en masse)*	59 % Donnée indiquée par le porteur
Stockage biogénique	Non connu
Impact carbone	Non connu

MISE EN OEUVRE

Spécificité	Diagnostic de gestion d'humidité

Avis du hub

Ressources très locales, produit offrant une réponse à plusieurs fonctions par ses caractéristiques.
L'absence de FDES ne permet pas de se prononcer sur le rapport coût-carbone.

Type of miscanthus-based materials

Naturconcept ecoconstruction Luxembourg

Benefits

- 100% natural product
- Easy to use and quick to prepare
- Suitable for mixing and spraying machines
- Thermal and acoustic insulation
- Humidity and temperature regulation
- Fire protection and resistance
- Health and environmental qualities

Dosing

Lime: 40 kg (Air 45% / Hydraulic 55%)
Miscanthus (2-25 mm fibres): 200 L
Water: 50 L

Physical characteristics

- Miscanthus thermal conductivity λ :0.09 W/mK
- Thermal resistance 4.16m².K/W
- Miscanthus density ρ : 500 kg/m³
- Miscanthus heat capacity c : 580 [J/(kgK)
- Vapour diffusion resistance coefficient μ : 8
- Phase shift: 9 a.m.

Search in progress

Standardisation of plant aggregates: NG2B

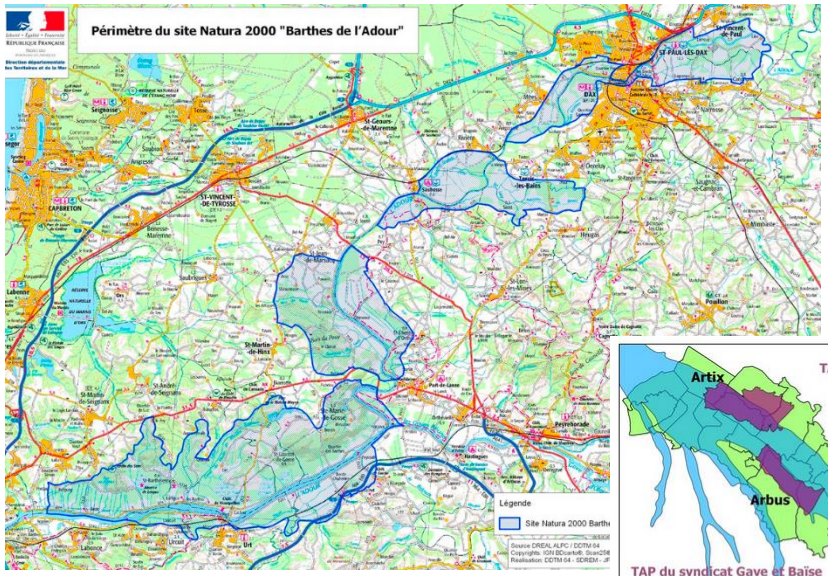
Despite a great deal of work => the problem of moving from research to an easily usable and insurable product.

- Objectives: common reference system for all players in the sector, based on relevant and consolidated technical and environmental data, enabling materials to be specified and recommendations to be made.
- Eventually: specific standards framework for plant-based aggregates intended for bio-sourced mortars and concretes, with a view to standardisation at European level.

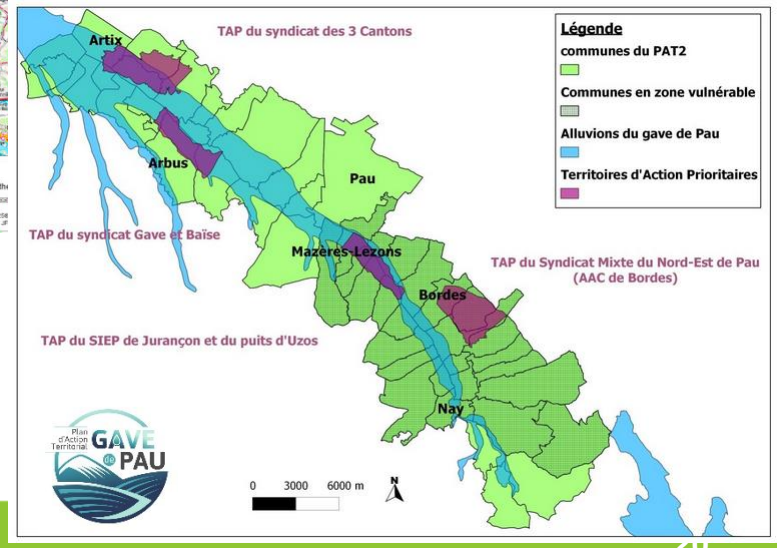
Our work

- **In the Pyrénées-Atlantiques and Landes regions**
  - Interest in production in areas where water is an issue

PAT **Gave de Pau** and **Barthes de l'Adour** area



=> 8500ha of farmland



16 856 ha of farmland <= 650ha of which in close catchment = drinking water

Our work

Developing a network of stakeholders

- From the farming community
- Teaching and research
- Prescribers
- Very small businesses
- (Users)

- => To structure local development

- => In a coherent production network
- => Improving farmers' incomes
- => Preserving our resources

Our work

- **First trial 2022: Exploratory study of plant fibres for lightweight soil - Nobatek/IFEP4**
  - Miscanthus target compared with chenevotte and wheat straw

RESULTS	Hemp shives	Miscanthus	Straw
Pictures			
Handling	Excellent Good wrap Non-elastic material Fibre length < 1cm Easy to mould	Medium Medium wrap Non-elastic material Fibre length 1 to 3 cm Medium moulding	Low Difficult to wrap (silica) Very elastic material Fibre length 3 to 10 cm Difficult moulding (size of fibres, elasticity)
Fibre density	150 kg/m3	190 kg/m3	135 kg/m3
Dry consistency	Excellent Very clean material	Average Dust seems to affect cohesion	Good The adhesion that seems wet, is resolved on drying.
Compression	Compressible materials. There is no breaking strength; the material becomes denser as a function of the force applied. Straw is also highly elastic.		
Thermal conductivity	= 0,090 W/m².K λ	= 0,067 W/m².K λ	= 0,061 W/m².K
Ways to improve	Already optimised	Dust removal Finer grinding? Sorting? Defibration?	Shorter calibrated cut? Press drying

Our work

2024: 5-6 month co-supervised internship

- the Pyrénées-Atlantiques Chamber of Agriculture in Pau,
- the Materials and Durability of Constructions Laboratory (LMDC) and Agromat in Tarbes
- NOBATEK/INEF4 in Anglet,

Assessing the potential of plant-based aggregates from miscanthus stems for use in construction materials

Our work

2024: 5-6 month work placement

Main objectives:

- Characterise miscanthus aggregate, particularly from an environmental point of view,
- Study the influence of the harvesting and pre-processing process on its properties as a plant aggregate
- Evaluating the performance of formulated composites from the material scale to the wall scale

Additional objectives:

- Links between agriculture and the construction industry
- Clarifying languages
- Identify the development positioning