FARMING INDIGENOUS FIBREPLANTS

RESEARCH PAPER

Partikal

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This paper consists out of Six chapters

Personal Introduction

Written by: Rik Makes,
Founder & Developer of CompostBoard / Partikal

As you travel through the Netherlands, moving from city to city, you drive continuously through agricultural land. It is the birthplace of our food and the landscape that defines our country.
As a designer, I wanted to reconnect with this essential landscape. But what I uncovered upon diving deeper was confronting: the beauty that initially captivated me began to fade as my knowledge grew.

I witnessed how chemical crop protection degrades entire ecosystems. I saw how butterflies, beetles, and birds are disappearing at an alarming rate, and how human impact on the Earth's surface is unprecedented.

Everything appears to be managed for maximum efficiency and profit, causing other life forms and natural systems to weaken both economically and ecologically.
At the same time, in the Netherlands alone, we burn millions of tons of material every year, while our artificially enriched soils continue to degrade on organic matter. Desertification is rising from Southern Europe.

Driven by that frustration—but above all by a determination to do things differently. I began developing biobased board materials in 2018.
My mission unites two core ideologies: first, creating high-quality material from agricultural residual streams that would otherwise be incinerated; second, developing a fully rain-compostable material with a nutrient-rich binder that can return to the soil after its lifecycle, as an interior panel or building board, enriching the soil once again.

We hold the holy grail of sustainability in our hands: a panel that scores 700% better on CO_2 emissions than conventional drywall (gypsum board), and whose Environmental Cost Indicator (ECI / MKI) is less than half that of particle-board. Yet something continued to gnaw at me.

Many biobased pioneers—myself included opt for fiber crops such as Miscanthus (Elephant Grass), Mammoth Grass, and Industrial Hemp.
While this is a massive leap forward—since these crops require no pesticide or fertilizer plus allow the soil extended periods of rest they do virtually nothing for above ground biodiversity.

They do not actively contribute to the life expectancy of butterflies, bees, or birds.
That realization led me to ask myself a fundamental question: How can I ensure that even the fiber content within my panel actively contributes to life on this planet during its cultivation?

This sparked an intensive search into the cultivation of native, flower-rich, and woody plants.

This document is the result of that journey. It combines my conversations with ecologists, seed growers, farmers, and nature managers, forming the blueprint for a material that does not merely extract from the Earth, but blesses her with care, nourishment, and fertility.

Rik

Fibre Cultivation for Biodiversity

Challenges and Experts

1. Challenges in the Field: Insights from Experts
Developing a new, nature-inclusive fiber crop is not something you do from behind a desk. To truly understand why farmers operate the way they do and how we can break existing patterns, I headed out into the field. Conversations with various stakeholders brought crucial barriers—and solutions—to light.

1.1 *The Nature Manager: Forestry Commission / Staatsbosbeheer Rick*

In discussions with Rick, Ranger in the Peel region near our workshop on behalf of Staatsbosbeheer (SBB / Dutch Forestry Commission), we explored opportunities for cultivating crops on their land, as well as the conditions that must be met and the underlying reasons behind them. Naturally, SBB holds a positive stance toward biodiversity; however, in practice, it proved to be a closed-off organization that does not view agricultural innovation as a core operational task. Nevertheless, we held several very positive conversations in which we exchanged knowledge and addressed key questions for a biodiversity-focused cultivation plan.

The Soil Problem of an Arable Field:
There is immense weed pressure on fields, caused by factors such as high pH levels and a nutrient imbalance in the soil. Rick indicated that a natural plant community in a permaculture system easily takes five to seven years to restore the soil to a healthy, balanced condition.

The Harvest Dilemma:
When leasing land from Staatsbosbeheer, you are often permitted to harvest only 40% of the crop due to nature conservation rules. Furthermore, harvesting must take place in September/October, and harvesting after early March is strictly prohibited

due to the bird nesting season. This creates an ecological paradox: we want to dedicate everything to protecting meadow birds, but insects rely on overwintering inside hollow stems throughout the winter, only emerging by late March. Are we protecting birds at the expense of the very insects that serve as their essential food source?

1.2 The Seed Grower and Ecologist: Cruydt-Hoeck, Thijs

Thijs, an ecologist specializing in wild bees, works at Cruydt-Hoeck, an organization that cultivates native plants for seeds across 35 hectares in Friesland.

Hyper-Locality:

They work with absolute purity of principle: every seven years, they collect fresh seeds from nature in small quantities (in collaboration with SBB) to prevent plants from becoming overly “domesticated” and losing their ecological value.

The Weed Problem:

Seed mixes are more expensive, and sowing on nutrient-rich agricultural soil frequently fails: out of 25 sown species, sometimes only 2 or 3 manage to emerge due to intense competition from unsown weeds.

The Solution - Plugs & Ridges:

Thijs advised switching to plugs (seedlings/cuttings) instead of seeds. They rototill the soil into elevated ridges and plant the plugs on top. This gives the plants a head start and allows—if strictly necessary—for mechanical hoeing (or temporary targeted spraying) in the furrows between ridges without touching the plants.

Smart Harvesting:

Thijs noted that harvesting in autumn while leaving the lower 10 to 15 cm of the stem intact preserves a massive quantity of insect eggs.

1.3 Agricultural Practice:

Nieuw Zwanenburg (Ad Raaijmakers)

Ad Raaijmakers, a former agricultural contractor now growing organic grain, outlined the harsh economic reality of introducing new crops like nettles.
Cost Structure: Leasing a hectare costs €2,000, and sowing/planting incurs an additional €2,000 per hectare.

Weed Control:

Because crop protection chemicals (pesticides) cannot be used in native plant cultivation, alternatives are required. Ad highlighted manual labor (seasonal workers at €25 per hour), precision farming robots (still under development), or covering the soil with low-cost fibers to block sunlight from weed seeds.

Harvest Technique:

Fortunately, processing can be done with existing machinery. A forage harvester chops the plants into 12-millimeter pieces (ideal for our board material) with a dry matter content of 32% (our manufacturing process can handle up to 50%). It is then pressed into round bales and wrapped in plastic, giving it a shelf life of up to a year.

Perennial Crops:

Stinging nettle is a perennial plant, making it less attractive for a farmer to attempt as a short-term trial, as it requires a multi-year commitment rather than a single season.

1.4 Ecology and Landscape:

Mascha, Landscape Ecologist at Waardenburg:

Pointed to RIVM research regarding the hidden healthcare costs of our current unsustainable environmental policies. Monoculture agriculture serves lowest-price trading, but society ultimately pays the bill through public healthcare expenses and drought damages. She emphasized that virtually any native crop contributes far more to biodiversity than another field of forage

maize—primarily by reducing drought impact and eliminating pesticide use.

1.6 Other Stakeholders

Waterschap de Dommel *Watermunicipality*:
Highlighted strict regulatory frameworks: mowing (harvesting) is allowed only from June to September/ October.

1.7 Color in the Fiber Lucilla Kenny:

I looked into plants containing natural color pigments, hoping to manufacture pre-colored panels directly from the field. Lucilla, an expert in natural dyes, tempered these expectations: natural pigments in bark or stems are volatile and fade under sunlight. However, she recommended Sorrel (Rumex) for introducing intriguing natural color variations within the fiber, or exploring the extensive process of boiling colors out of fibers and re-infusing them for panel production.

7 Selected Crops

Quality and Benefits

Based on expert consultations and trial evaluations, we narrowed down 30 plant species to a core selection of 7 powerful native plants. These were selected because they form woody structures, deliver strong and resilient fibers (neither hollow nor flimsy), grow tall, and are indispensable to local biodiversity. Furthermore, trials with seed growers revealed that certain native fibers are hairier and longer than standard biobased crops, providing superior strength and structural integrity in the final board product.

Foxglove (Digitalis purpurea)

Above-ground benefit:
The ultimate host plant for the Foxglove Pug moth. Its deep corollas act as a magnet for long-tongued bumblebees. In autumn, birds such as Goldfinches and Linnets pick small seeds from the seed capsules.
Material value:
Yields a tough, long fiber.

Mullein Species: Great Mullein, Dark Mullein & Hoary Mullein (Verbascum species)

Above-ground benefit:
Crucial for the survival of the rare Mullein moth. The Woolcarder bee uses the felt-like hairs of the leaves for nest construction. The tall, woody stems (reaching up to 2 meters) remain standing through winter, acting as a five-star winter hotel for solitary bees, ladybugs, and lacewings. Tits pick insects out of the stems during winter months.
Material value:
Provides high biomass yield.

Tansy (Tanacetum vulgare)

Above-ground benefit:

Attracts specialized bee species (such as the Tansy Cellophane Bee). Due to its late flowering season, it is an essential late-autumn pollen source. Its strong scent attracts hoverflies that naturally suppress aphid populations.

Material value:

Delivers a remarkably strong, rigid stem that is ideal for the structural integrity of our board materials.

St. John's Wort (Hypericum perforatum)

Above-ground benefit:

A haven for hoverflies. Its bushy structure offers excellent shelter for spiders and predatory bugs.

Material value:

Yields a finely branched fiber structure.

Sorrel / Dock (Rumex species)

Above-ground benefit:

The exclusive host plant for the Small Copper butterfly. Without sorrel, this butterfly species cannot reproduce. In winter, the reddish-brown seed clusters provide prime food for overwintering songbirds (Tree Sparrows, Reed Buntings).

Material value:

Cultivation and Business Case

How to make it Reality

Regardless of how compelling the ecological narrative is, cultivation must be economically viable for arable farmers. Farmers operate on tight margins. Currently, biodiversity, water retention, and soil health are not monetized, making the business case for native crop cultivation challenging.
Consequently, we adapted our cultivation methodology.

3.1 The Failed Sowing Experiment and Plan B.

Initially, we sowed seeds directly onto rich agricultural soil in spring. The outcome was disappointing: only grass and aggressive weeds emerged, completely smothering the native seeds.

Plan B is based on professional practice from experts like Thijs from Cruydt-Hoeck: we transitioned to pre-grown seedlings and plugs (planted around May/June). This gives the plants a physical advantage over weeds. Although the initial purchase cost per plug is higher 10-20 cents than seed mixes, it prevents total crop failure.

3.2 Chemical-Free Mechanical Management & Soil Mulching

While mechanical hoeing with a tractor is possible, it introduces oxygen into the soil, stimulating weed growth and requiring frequent field passes.
Our innovative solution closes our production loop:

- We cover the soil surrounding the young plants with plant residual material/fiber waste from our own board manufacturing process.
- This completely blocks sunlight, preventing weed seeds from germinating.
- It retains soil moisture significantly better and for longer periods (mitigating drought impact).
- It increases the organic matter content of the soil.
- Consequently, the farmer eliminates both chemical spraying and mechanical hoeing.

3.3 Dual Purpose: Seed and Fiber Harvesting

Economic feasibility for the farmer increases substantially through dual-purpose farming:

- We reached agreements with natural seed breeders to supply the plant material, after which they also repurchase and process the harvested seeds.
- The farmer first harvests the seed crop, which is dried and threshed for resale to municipalities and private buyers.
- The remaining dried stems (the “waste stream” for the seed grower) are shredded and processed by us to form the structural fiber for our board materials.

As long as government subsidies for agricultural biodiversity remain insufficient, market realization remains complex. Combined crop revenues contribute directly to a profitable business case. Because we process these fibers into aesthetically refined design panels (where native flower textures remain visible), we are not producing an anonymous bulk board, but a premium design product. This creates the financial margin needed to compensate farmers fairly for their native fiber cultivation.

Spatial Integration

A Gradient Around Nature Reserves

Conservation professionals frequently maintain a strict division between natural habitats and agricultural land, creating barriers to collaboration. However, buffer zones between nature reserves—the agricultural lands directly adjacent to nature—hold the greatest potential for ecological impact.

We propose a landscape model featuring a gradual transition (gradient) from protected nature to intensive agriculture, preventing direct pesticide exposure alongside vulnerable ecosystems:

Zone Nearest to Nature Reserve:

Cultivation of selected native species (Sorrel, Foxglove, Mullein). These require zero fertilizers or chemical protection, serving as an ecological buffer zone that attracts pollinators and provides overwintering habitat.

Middle Buffer Zone:

Cultivation of semi-intensive biobased crops (such as Miscanthus or hemp), requiring light management while contributing to soil rest and carbon sequestration.

Zone Further from Nature:

Conventional, intensive agriculture for food production.

If local government funding were made available to financially support farmers working around nature reserves to cultivate fiber crop gradients, the benefits would be multi-faceted: farmers secure stable income, conservation organizations achieve biodiversity targets, and green industry receives clean, uncontaminated raw materials for sustainable building products.

Insects and Harvest

Two Scenario's on Timing

To maximize biodiversity impact, not only crop selection but also harvesting time and cutting height are critical. Insects lay their eggs in specific zones across the plant:

Stem Base & Root Crown (0–15 cm):
Permanent overwintering habitat for bugs, leafhoppers, beetles, and moths.

Pith & Hollow Stems:
Shelter for stem-boring insects and wood-nesting solitary bees.

Leaves & Seed Capsules: Nurseries for summer insect generations (such as the Small Copper on Sorrel) and food for seed-eating birds.

Scenario 1: Harvesting in September (Autumn)
Biomass is chopped at the end of the growing season using a basic corn harvester.

Impact on insects:
Summer eggs have already pupated or emerged. By maintaining a stubble height of 10 to 15 cm, insect populations in the stem base and root crown remain 100% protected. Eggs positioned higher up the stem are processed with the harvested material.

Advantages:
No conflict with the bird nesting season, excellent soil load-bearing capacity for heavy machinery, and immediately dry raw materials ready for processing.
Disadvantage:
The field loses its high vertical winter structure.

Scenario 2: Harvesting in March (Early Spring)
Standing dead stems remain in the field throughout autumn and winter and are harvested in early March.

Impact on insects:
The woody, hollow stems act as a “winter hotel”. Because many insects emerge in late March, a portion of the dormant population higher up the stem is preserved. Eggs in the bottom 10–15 cm survive via the remaining stubble.

Advantages:
Maximum shelter and winter seed availability for songbirds like Goldfinches and Linnets.

Disadvantage: Tight operational windows due to the start of bird nesting season and harvesting challenges on wet spring soil.

Conclusion

By Rik Makes

Cultivating native crops presents clear challenges; after all, the added value for biodiversity, water management, and soil health is not easily expressed directly in a customer's initial price point.

Nevertheless, our material testing, CO_2 performance calculations, and ecological data prove that this research lays the foundation for a revolution in both materials and agriculture. By implementing ridge planting with pre-grown plugs, mulching soil with our own fiber residuals, and combining seed and fiber harvests, we make the cultivation of native "weeds" economically viable for high-end design panels.

We transform agricultural landscapes from monoculture manufacturing grounds back into living ecosystems. The panels pressed from these crops bring that natural richness straight into building interiors until, years later, they return safely and nutritiously back to the Earth.

That is true building with respect for all life.

my Gratitude

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