

Digital Fertiliser Product Passport:

From Regional Waste Streams to
EU-Compliant Fertilisers in the V4

Katarzyna Chojnacka



Wrocław University
of Science and Technology

SOURCE ➤ ROUTE ➤ EVIDENCE ➤ PRODUCT

The problem is not a lack of data. It is the loss of its history.

ILLUSTRATION



A REAL TANGO 5 CASE

Micronutrient-enriched rapeseed fertiliser

EUROPEAN ROUTE PURSUED.
REGISTRATION IN PROGRESS.

SOURCE

EKOPLON feed intermediate
+ Cu, Fe, Mn, Zn

Spray impregnation | nutrient enrichment

INTENDED USE

Organic farming



ILLUSTRATION

EKOPLON: TO MARKET
PRODUCTION: SUBCONTRACTED

WHY NOW

Why digital product information matters now

Three EU developments are moving in parallel, on different legal tracks.

1

FPR TODAY

Fertiliser rules already define the product case

product category + eligible ingredients + evidence

Conformity assessment + CE marking

2

FROM 1 MAY 2027

Optional FPR digital labelling

Selected information can move online

3

PRODUCT PASSPORTS

BATTERIES • 18 FEBRUARY 2027
EV, LMT and industrial >2 kWh
Separate Batteries Regulation

ESPR PRIORITY PRODUCTS

Textiles and apparel
Tyres • Furniture • Mattresses
Iron and steel • Aluminium

Product-specific rules will set DPP requirements.

MATERIAL

Natural materials vary. Each new source lot needs a new evidence check.

Natural feedstocks vary. Industrial products need controlled specifications.



SLUDGE

source + treatment

DIGESTATE

feedstock + process

AGRI-FOOD

season + moisture

ASH

fuel + combustion

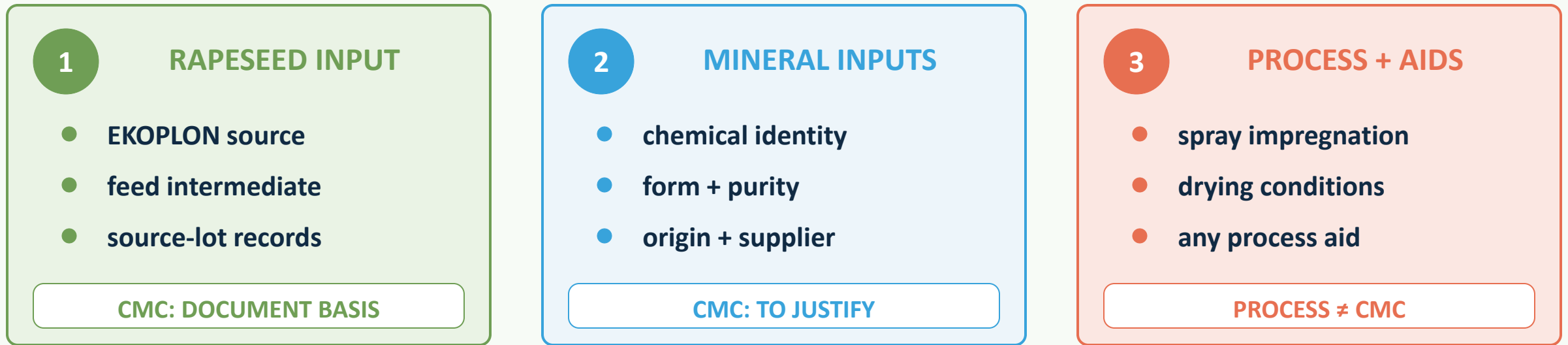
NEW SOURCE LOT = NEW EVIDENCE CHECK

MATERIAL

CMC = Component Material Category

PFC = Product Function Category

First classify every input. Then classify the finished product.



FIRST: WHICH INPUTS MAY ENTER?

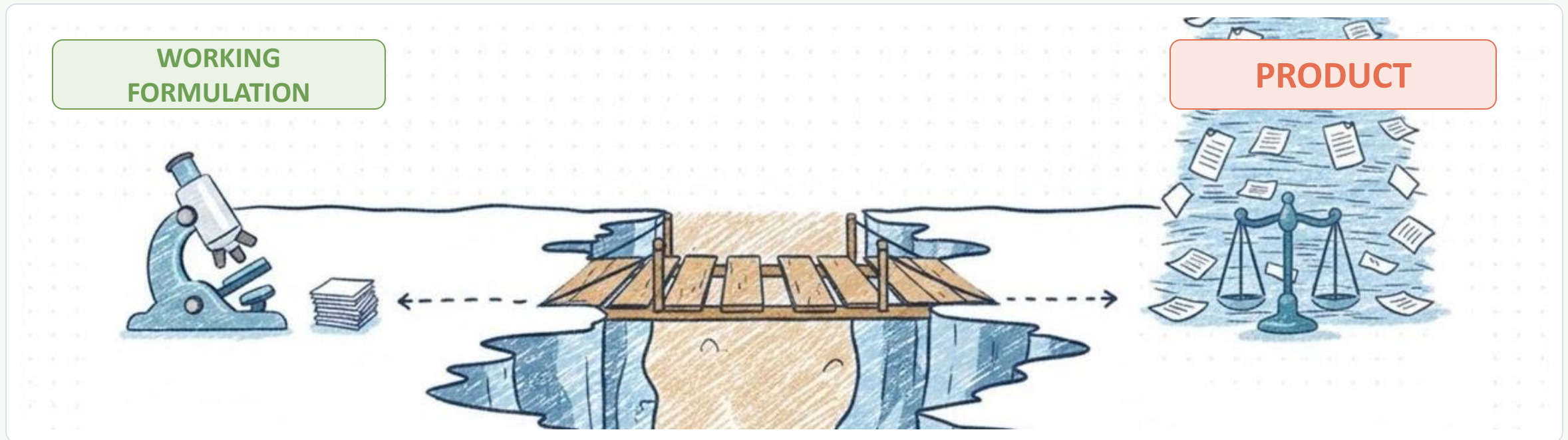


THEN: WHICH PRODUCT CATEGORY?

PRODUCT ROUTE

**Technology makes the material.
A manufacturer makes it a product.**

No microscope can sign an EU declaration of conformity.



Scientific evidence exists. The product case remains open.

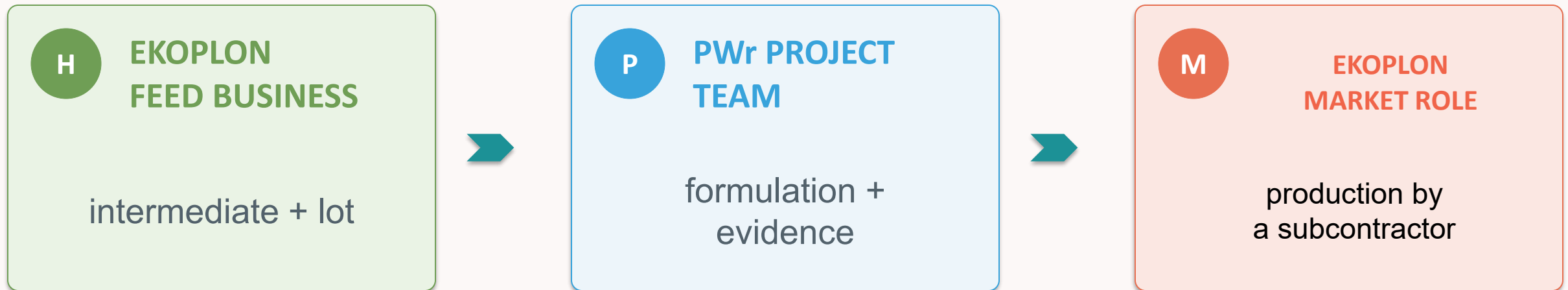
THE BRIDGE IS THE EVIDENCE CHAIN

RESPONSIBILITY

Data can be shared.

Legal responsibility must be assigned.

EKOPLON will market the product and subcontract its manufacture.

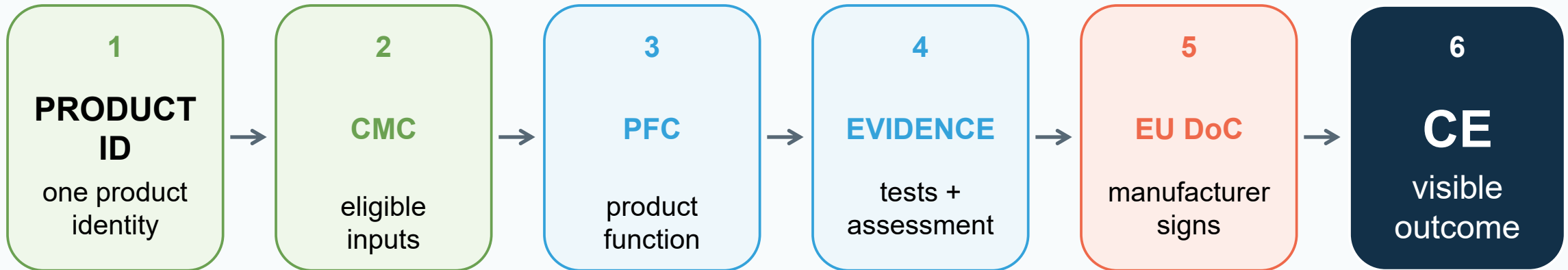


THE PLATFORM CONNECTS. IT DOES NOT SIGN.

OWN-NAME MARKETING MAKES EKOPLON THE FPR MANUFACTURER

CE marking comes at the end of an evidence chain

CE is the visible end of an invisible product story.



THE SYMBOL IS SIMPLE. THE CHAIN BEHIND IT IS NOT.

Design the product case while the research is still running.

What does each system actually do?

One product. Three audiences. Three different information needs.

REGULATOR

FPR

**WHAT MUST BE
TRUE?**

PFC + CMC
composition + safety
conformity assessment

FARMER

DIGITAL LABEL

**WHAT DOES THE
USER NEED?**

identity + operator
declared nutrients
use + precautions

QUALITY ASSURANCE TEAM

DFPP

**WHERE DID THE
ANSWER COME FROM?**

evidence origin
current version
decisions + changes

LAW DEFINES | THE LABEL COMMUNICATES | DFPP TRACES THE EVIDENCE

CHOOSING A ROUTE

Three routes to compare when building the product case

The evidence requirements differ between routes.

DOOR 1

PFC 1(B)(I)

SOLID ORGANO-MINERAL

EU ROUTE TO ASSESS

solid organo-mineral fertiliser
confirm PFC 1(B)(I) conditions

DOOR 2

PFC 1(C)(II)(b)

COMPOUND INORGANIC MICRONUTRIENT

UNLIKELY FIT

Solid category: $\geq 5\%$ declared
micronutrients by mass.
Laboratory totals alone do not qualify.

DOOR 3

POLISH NATIONAL ROUTE

NON-HARMONISED FERTILISER

NATIONAL ALTERNATIVE

MRiRW permit route
if the harmonised route does not fit

DECISION: PURSUE A EUROPEAN ROUTE | INTENDED USE: ORGANIC FARMING

EUROPEAN ROUTE

The selected direction: a European route

Documented feed-production origin supports the input eligibility assessment.

SOURCE

EKOPLON

FEED-PRODUCTION INTERMEDIATE

DOCUMENT ORIGIN

lot + process history
+ input eligibility

STATUS

EUROPEAN ROUTE

REGISTRATION IN PROGRESS

COMPLETE THE DOSSIER

final product category
+ supporting evidence
+ conformity assessment

INTENDED USE

ORGANIC FARMING

USE ELIGIBILITY

DISTINCT REQUIREMENTS

intended use does not
mean approval is complete

PROCEDURE ONGOING: CONFORMITY AND ORGANIC-USE ELIGIBILITY TO CONFIRM

Example: what a fertiliser digital label may look like

From 1 May 2027: optional digital labelling; key information stays on physical labels.



1

WHAT THE USER SEES

Identity | operator | nutrients | ingredients
use | precautions

2

HOW ACCESS WORKS

Free | no app or login
10 years from placing on the market

3

WHAT STAYS OUTSIDE

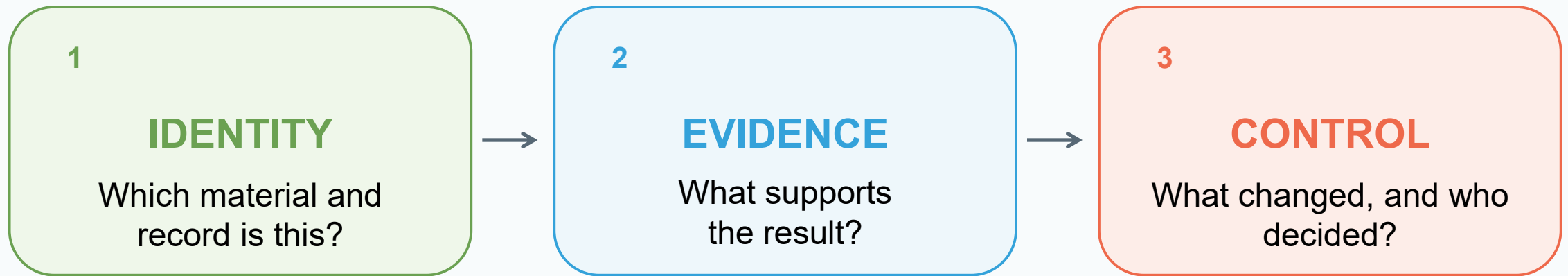
Batch history | lab reasoning | change decisions

DIGITAL LABEL: REGULATED VIEW | DFPP: EVIDENCE TRACE

Why build an evidence record before an EU fertiliser passport exists?

Voluntary project evidence record; no mandatory EU fertiliser DPP currently applies.

LINK EACH RESULT TO ITS SOURCE



USEFUL NOW FOR TRANSFER | STRUCTURED FOR FUTURE DIGITAL SYSTEMS

VOLUNTARY PROJECT RECORD | NOT AN EU REGULATORY PASSPORT

New source lot: what can we reuse?

The method may transfer. The old result does not.



1

NEW IDENTITY**DOES NOT TRANSFER**

create a new record

2

METHOD**MAY TRANSFER**

reuse only if still valid

3

OLD RESULT**DOES NOT TRANSFER**

verify under the sampling plan

DOCUMENTATION: REUSE THE METHOD | VERIFY THE NEW LOT | REVISE THE RECORD

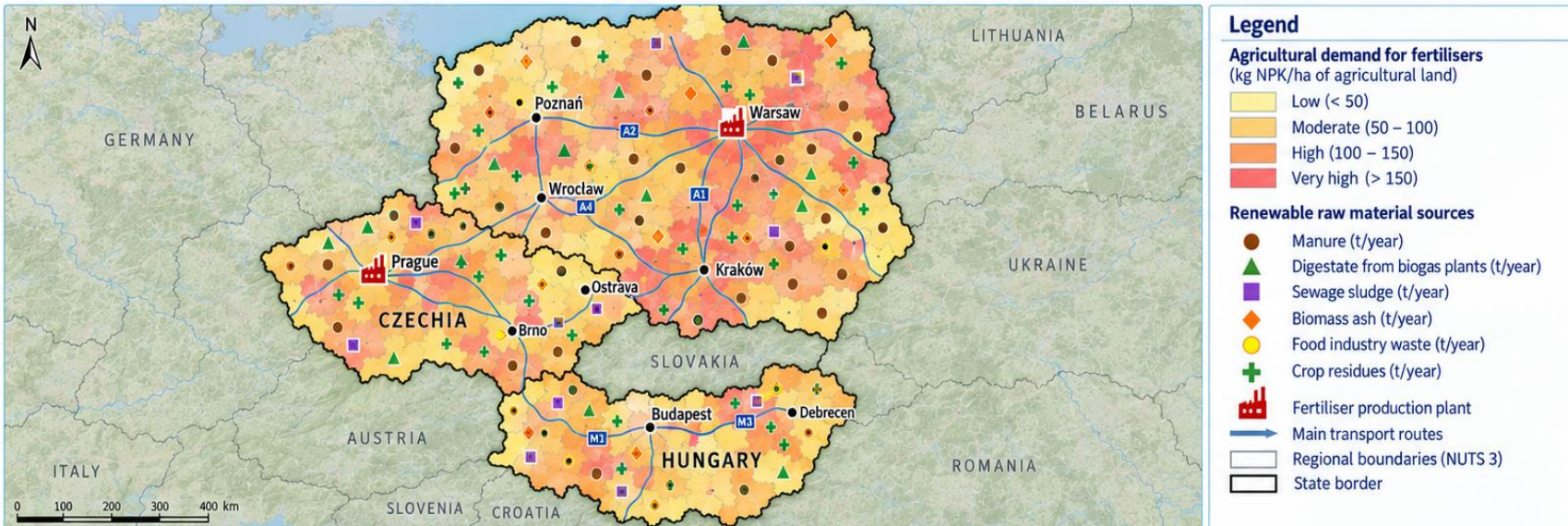
A GIS map finds the stream. Sampling tests it.

Illustrative V4 example: selected renewable feedstock streams in Poland, Czechia and Hungary.

GIS - Renewable Raw Materials for Organo-Mineral Fertiliser Production

Illustrative V4 example for Poland, Czechia and Hungary: availability, composition and logistics

SUSTAINABLE NUTRIENTS
STRONGER AGRICULTURE
CLEANER TOMORROW



WHAT GIS CAN SHOW

- feedstock locations
- stream types and quantities
- cross-border distribution
- users and transport routes

VERIFY

- material representativeness
- composition and variability
- safety and eligibility
- testing + source/process records

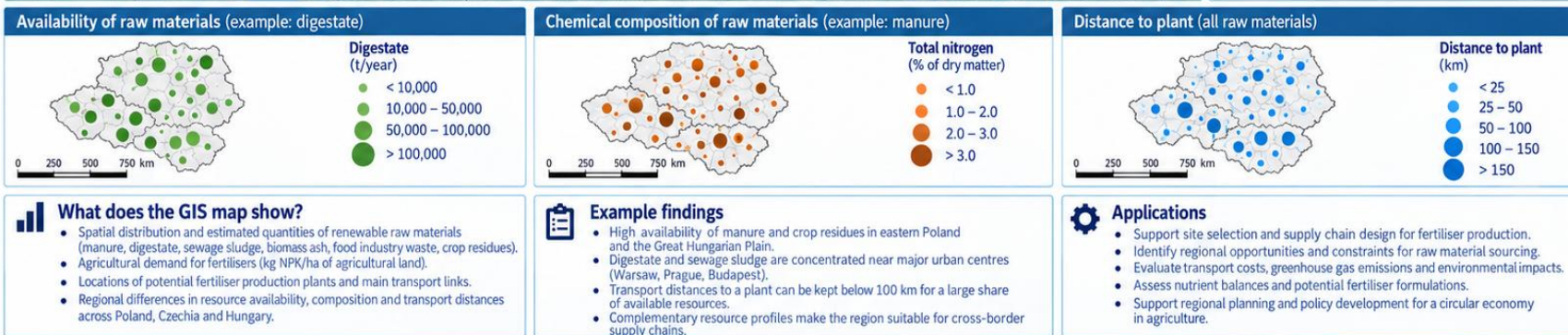
EXAMPLE STREAMS

Digestate

Manure

Food-processing residues

Biomass ash



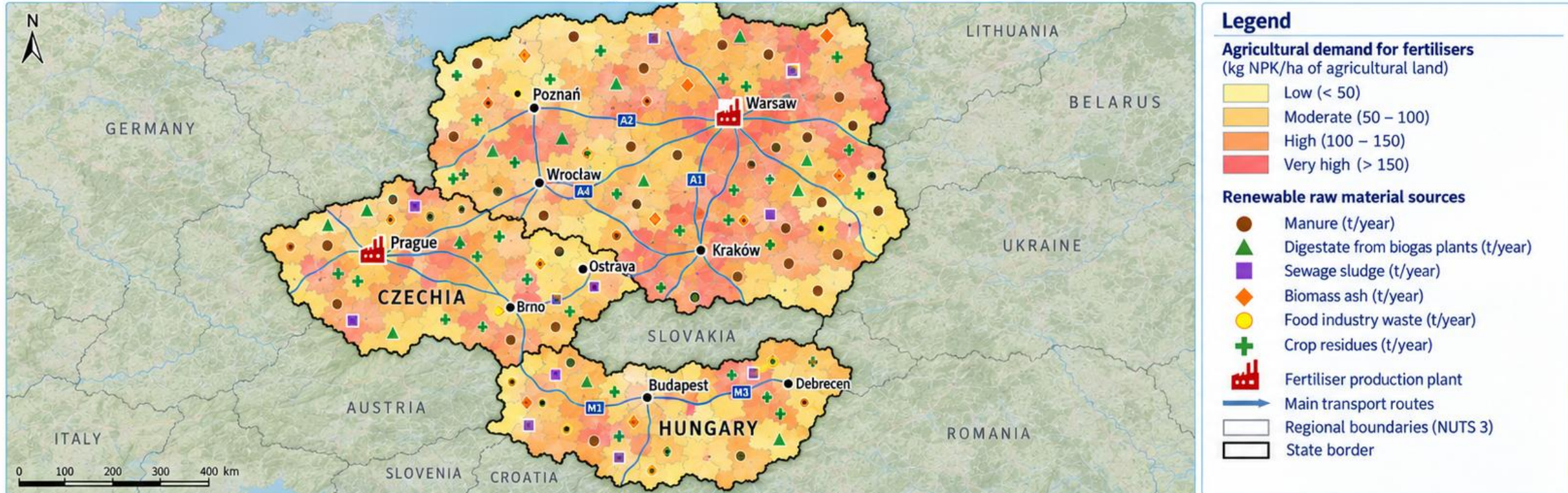
Source: Illustrative example. Basemap: OpenStreetMap style.

GIS locates the stream. Testing and source records establish what the material can support.

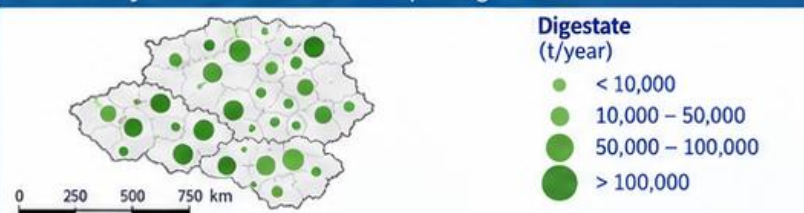
GIS - Renewable Raw Materials for Organo-Mineral Fertiliser Production

Illustrative V4 example for Poland, Czechia and Hungary: availability, composition and logistics

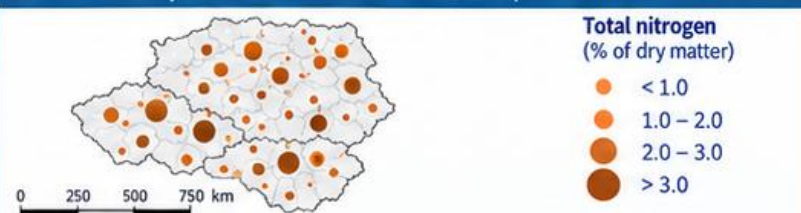
CONCEPTUAL GIS
NOT PROJECT DATA



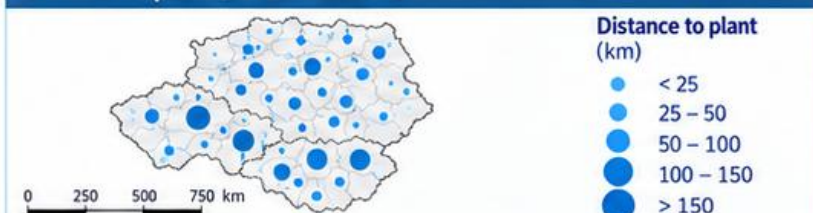
Availability of raw materials (example: digestate)



Chemical composition of raw materials (example: manure)



Distance to plant (all raw materials)



What does the GIS map show?

- Spatial distribution and estimated quantities of renewable raw materials (manure, digestate, sewage sludge, biomass ash, food industry waste, crop residues).
- Agricultural demand for fertilisers (kg NPK/ha of agricultural land).
- Locations of potential fertiliser production plants and main transport links.
- Regional differences in resource availability, composition and transport distances across Poland, Czechia and Hungary.

Example findings

- High availability of manure and crop residues in eastern Poland and the Great Hungarian Plain.
- Digestate and sewage sludge are concentrated near major urban centres (Warsaw, Prague, Budapest).
- Transport distances to a plant can be kept below 100 km for a large share of available resources.
- Complementary resource profiles make the region suitable for cross-border supply chains.

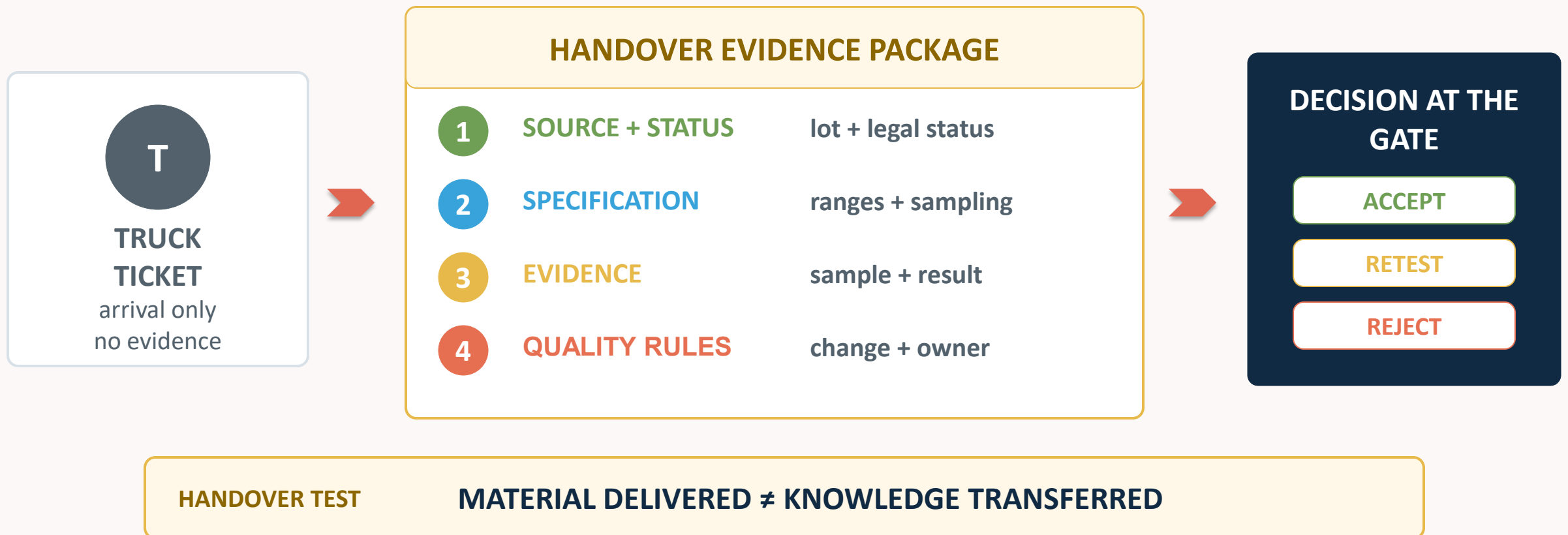
Applications

- Support site selection and supply chain design for fertiliser production.
- Identify regional opportunities and constraints for raw material sourcing.
- Evaluate transport costs, greenhouse gas emissions and environmental impacts.
- Assess nutrient balances and potential fertiliser formulations.
- Support regional planning and policy development for a circular economy in agriculture.

HANDOVER

Never ship material without its evidence package

What must travel with the material so another company can decide?



The micro-pilot tests whether the evidence can travel

Would the package work without its original authors?

THREE TRANSFER TESTS

1 REPRODUCE

Can another laboratory reproduce the method?

2 INTERPRET

Can another partner interpret the result?

3 DECIDE

Can another organisation make a documented decision?

IF ANY ANSWER IS NO, THE HANDOVER IS NOT READY.

SMALL-SCALE TEST | INDUSTRIAL DISCIPLINE

Readiness map: what is the next useful study?

Which evidence gap should we fund next?

1 WHAT WE KNOW

EKOPLON feed origin |
composition | initial field
evidence

2 CURRENT PRIORITY

Registration dossier | source
records | batch controls

3 WHAT DEPENDS ON IT

Defined product | safety
evidence | market readiness

NEXT STEP

COMPLETE THE DOSSIER AND BATCH-CONTROL PLAN

Batch traceability works as a chain

Link each result to its material, analytical step and the decision that used it.

T5-RC-2026-04

ILLUSTRATIVE RECORD ID

1

SOURCE LOT

received feedstock

2

PROCESS BATCH

one manufacturing run

3

SAMPLE

material from that batch

4

METHOD

test method

5

RESULT

measured result

6

DECISION

release, retest or hold

7

VERSION

change history

ONE HISTORY: EACH RESULT STAYS LINKED TO ITS MATERIAL

Cucumber field trial: Cu concentration in fruit

Cucumis sativus L. • Reference treatment compared with TANGO 5, dose 1

CONCEPTUAL CROP VISUAL



Reported Cu in fruit (mg/kg d.m.)

Reference: 13.4 ± 2.0

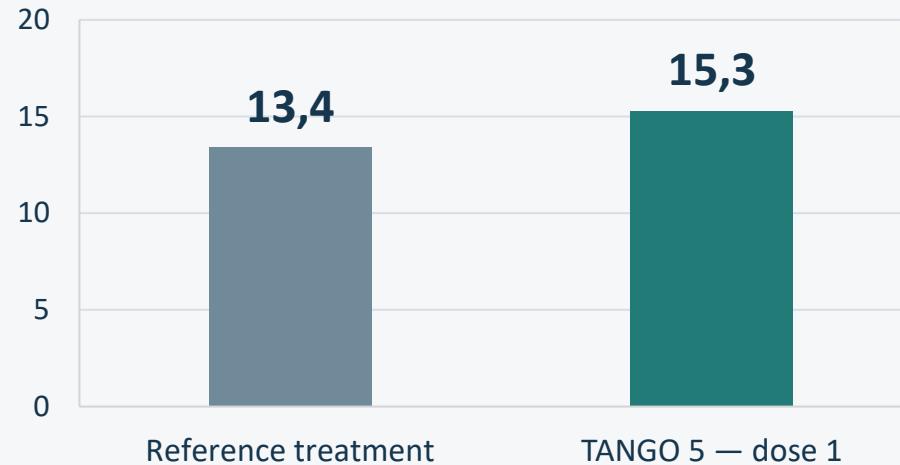
TANGO 5, dose 1: 15.3 ± 2.3

MATERIAL → PROCESS → RESULT

Rapeseed feed intermediate → spray impregnation
→ Cu concentration in cucumber fruit

Batch linkage, replication and the meaning of $\pm$ require confirmation in the full study record.

mg Cu/kg dry matter



+14.2%

descriptive
difference

The 14.2% difference is a signal for the next study.
It does not establish significance or agronomic benefit.

KEEP THE EVIDENCE CONNECTED

Link the source lot and process batch to the trial
protocol, application rate, raw data and statistics.

What should researchers report in the paper?

Three reporting upgrades make published results easier to reuse in a future product file.

COMMON IN A PAPER

MATERIAL

rapeseed feedstock



REPORT SO IT CAN BE REUSED LATER

named source + source lot + moisture basis

ANALYSIS

Cu: 1.244 g/kg d.m.



sample ID + method + unit + uncertainty

BIOASSAY

fruit Cu concentration



dose + comparator + statistics + exact tested batch

FOUR HABITS: identify the sample • document the method • report the statistics • control the batch

Preserve: raw dataset | version | DOI | named contact

Writing example: from results to reusable evidence

Rapeseed-feedstock example: reporting instructions, not complete project records

RESULT-ONLY EXAMPLE

MATERIAL

EKOPLON's rapeseed feedstock was enriched with Cu, Fe, Mn and Zn by spray impregnation.

ANALYSIS

Fertiliser Cu: 1.244 g/kg d.m.; ICP-OES reported.

BIOASSAY

Fruit Cu: 15.3 vs 13.4 mg/kg d.m. Reported central values.

REPORTING TEMPLATE

MATERIAL

Document EKOPLON's feed-production origin, source lot, moisture basis, process batch and spray-impregnation procedure.

ANALYSIS

Report sample ID, sampling plan, method, unit, QA/QC, uncertainty and raw-data reference.

BIOASSAY

Report dose, comparator, endpoint, experimental unit, replication and statistics. State any missing batch link.

MAKE EACH CLAIM TRACEABLE: material • batch • sample • method • uncertainty • trial • limits

What should stay outside the manuscript?

Some evidence does not belong in the paper, but it must remain accessible for future product documentation.

IN THE PAPER

material description • method summary • results • statistics • interpretation



PRESERVE OUTSIDE THE MANUSCRIPT

CONTROLLED RECORDS

- SOP version history
- instrument + calibration logs
- deviations from protocol
- sample chain-of-custody

RAW EVIDENCE

- raw ICP-OES files/spectra
- original laboratory worksheets
- field sheets + photographs
- raw statistical outputs

CHANGE HISTORY

- source/formulation changes
- process deviations
- who approved + why
- retesting decision

OWNERSHIP & ARCHIVING

- data owner
- storage location
- retention period
- named responsible contact

DESIGN TRACEABILITY INTO THE STUDY. DO NOT RECONSTRUCT IT AFTER PUBLICATION.

THE EVIDENCE MUST SURVIVE THE PAPER.

SOURCE

METHOD

LIMITS

IDENTITY

CAN SOMEONE REUSE THE RESULT FIVE YEARS LATER?

Acknowledgements

The project tests whether evidence can cross borders without losing its meaning.

-
- Visegrad Fund
-
-

V4-BIOWASTELINK

From regional feedstock to regionally used,
EU-compliant fertilisers

Project ID 22530372 | 01/04/2026-30/09/2027



Wrocław University
of Science and Technology

VSB TECHNICAL
UNIVERSITY
OF OSTRAVA



MISKOLCI
EGYETEM
UNIVERSITY OF MISKOLC

Funded by the International Visegrad Fund

DECISION

Four things must be ready before EKOPLON can sell the product

PW_r supplies evidence. A subcontractor makes the batches. EKOPLON decides when to market.

1

DOCUMENT THE LEGAL ROUTE
What kind of fertiliser is it?

2

SHOW IT IS SAFE AND CONSISTENT
Composition, contaminants and performance

3

CONTROL OUTSOURCED PRODUCTION
Specifications, sampling and acceptance rules

4

COMPLETE THE MARKET FILE
Label, declarations and required documents

PW_r: BUILDS EVIDENCE | SUBCONTRACTOR: MAKES EACH BATCH

EKOPLON: OWN-NAME MARKETING CARRIES MANUFACTURER RESPONSIBILITY

50
YEARS

50. INTERNATIONAL SCIENTIFIC AND TECHNICAL SEMINAR

CHEMISTRY FOR AGRICULTURE & HUMAN HEALTH

JUBILEE EDITION

22-25 November 2026 | Karpacz, Sandra SPA | chemistryforagriculture.pl

CONTACT

Dr Grzegorz Izydorczyk

E-mail: chemforagro@gmail.com

promocja.chemforagro@gmail.com

Tel.: +48 533 567 987

Facebook:

Chemistry For Agriculture

Organiser:

Agrophos Sp. z o. o.



SPECIAL OPENING SESSION

Living legacy - Prof. Henryk Górecki's ideas in science and practice



Science - research results continuing the ideas of the Wrocław school of fertiliser technology



Industry - implementations and technology transfer inspired by Prof. Górecki's legacy



Legacy - the history of half a century of chemistry for agriculture and human health

IN THE PROGRAMME

- Plenary lectures
- Sessions for Young Researchers
- Poster session
- Science-industry matchmaking
- Consortium meetings

4 JUBILEE DEBATES

- **Henryk Górecki:** ideas that changed the fertiliser industry.
- **Science and industry:** what do we expect from each other?
- **Fertiliser digital Label:** is the European industry ready?
- **Critical raw materials in the fertiliser industry:** dependence or strategy?



During registration, responses from companies and researchers will be collected for an anonymous science-industry report, which will serve as the basis for Debate 2.