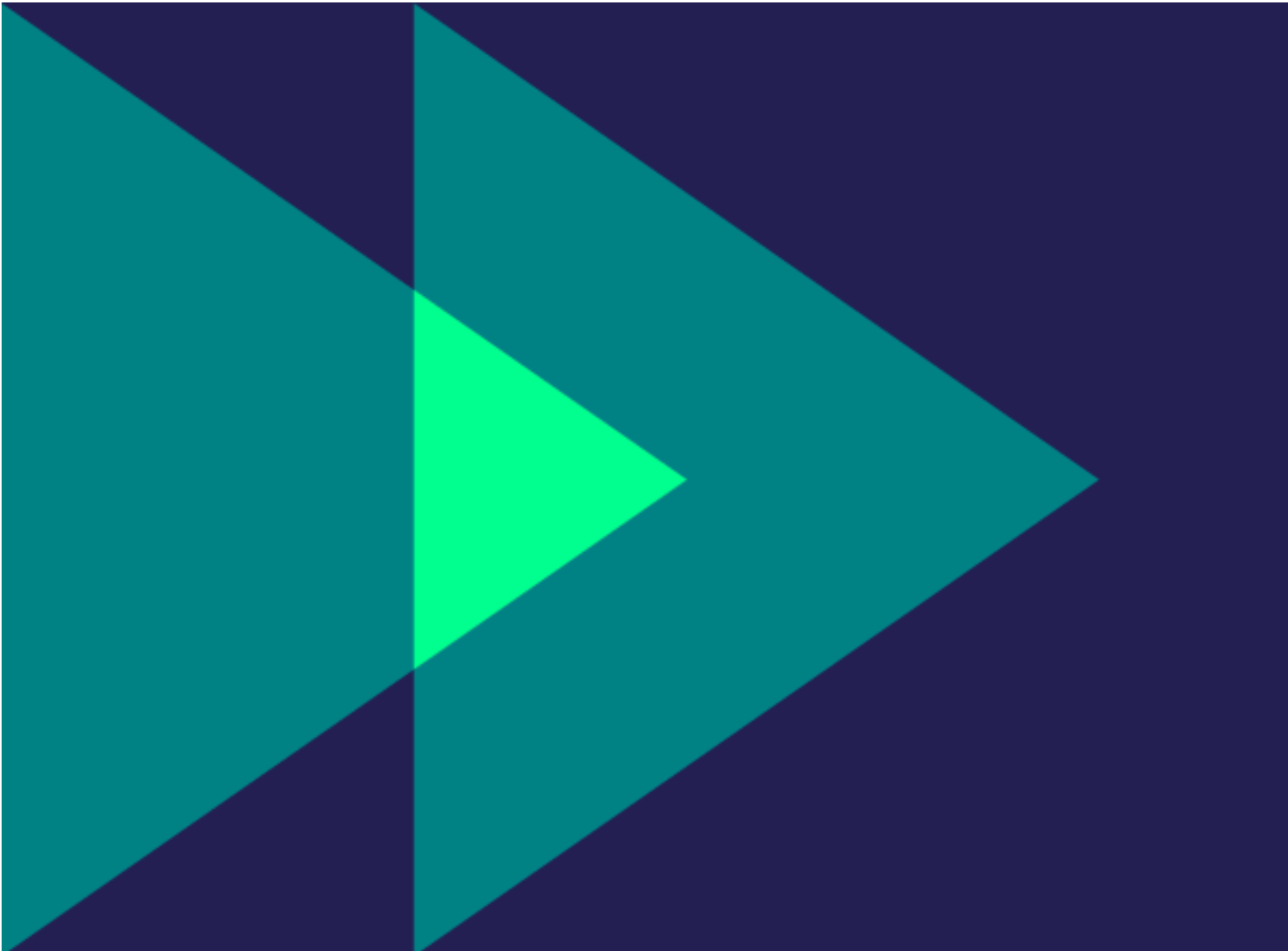


VALIDATION REPORT

Sapropel Organics
2022 - 960



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Details of the validation process

	Validation request	First review	Feedback call	Hand-in revisions	Final review	Wrap-up call
Date	16/01/23	03/02/23	09/02/23	03/03/23	03/03/23	16/03/23
Result	PLAUSIBLE, UNCLEAR AND SIGNIFICANT			VALID, POSITIVE AND SIGNIFICANT		

Colofon

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Project name: Sapropel Organics LLC
Project CIF lead: Igor Marushko
Validation ID #960
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More information: [impact-forecast.com](https://www.impact-forecast.com)

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Introduction and definitions

This Validation report documents the Validation of a Climate Impact Forecast:

Validation is a review process performed by an impartial impact expert to determine if a CIF is Valid, Positive and Significant.

The **Validation process** usually takes two weeks and includes a first review, a first feedback call between the team and validator, time for revisions if needed, a final review and a final results call. For a detailed description see www.impact-forecast.com/cif-validations

The **review** comprises a structured check using our CIF Validation tool, a sensitivity analysis and the writing of an Impact story. CIF trainers with LCA expertise are trained to perform this process in a uniform and objective way.

CIF Validations are made on the request of the project team, and possibly commissioned by an impact organisation. The results are used by teams and organisations to compare and communicate the climate impact of projects.

A **Climate Impact Forecast** or CIF is an LCA based calculation of the GHG reduction or climate adaptation potential of a project. Using our CIF tool, the project team found the net climate impact of the key differences between business as usual and their innovative solution.

The **Impact data** in this report, and in CIF in general, is calculated with information from the project team and from the CIF tool.

Technical details, amounts and assumptions in the calculation are provided by the project team. Impact factors (LCI data), impact equivalents and the calculation itself are provided by the CIF tool.

The **CIF tool** is used by teams to improve their impact and support design and business decisions with impact data.

CIF results are the project's potential or actual avoided emissions in tCO₂eq.

Every CIF Validation result consists of three independent outcomes:

Valid

A CIF is valid if it is representative of the project, using appropriate data and well justified assumptions. Therefore, the CIF and its results are representative of the potential for the project to mitigate, enable or adapt to climate change.

Detailed requirements for validity are specified on www.impact-forecast.com/cif-validations. A CIF can be Valid, Plausible, Improbable and Invalid.

Positive

A CIF is positive when it shows that the project has a lower climate impact than business as usual, or improved climate resilience in the case of adaptation. A positive mitigation or enabler CIF shows the avoided GHG emissions in -tCO₂eq.

This outcome depends on a sensitivity assessment. CIF results can be Positive, Positive within limits, Unclear, Sensitive and Negative.

Significant

A CIF is significant when the project has a climate impact (positive or negative) greater than 5 tonnes of CO₂eq per year. This is roughly the global average annual CO₂ emissions per person, and the mass of a male African Elephant.

The threshold for significant impact can be set to a higher amount for a particular organisation or occasion. The result can be Significant or Marginal.

Impact story

An impact story is a summary of how a project makes a positive climate impact. It is written by the validating impact expert and contains the key impact data from the Climate Impact Forecast.

WHEN NPK IS NOT ENOUGH

Sapropel Organics produces “HUMUSON Complex”: a natural origin additive with capacity to increase mineral fertilisers assimilation instead of the use of excessive synthetic fertilisers.

How does Sapropel Organics make a positive climate impact? Compared to which baseline?

HUMUSON is a supplement for traditional mineral NPK (Nitrogen [N], Phosphorous [P], Potassium [K]) fertilisers, which have been shown to be an unsustainable option for the future of agriculture. While helping to feed the world, the use and overuse of synthetic mineral fertilisers has been linked to many environmental and health issues to humans, animals and soil alike.

Moreover, the limit of effectiveness of mineral fertilisers has been reached decades ago. Further increase of mineral fertilisers dosage don't ensure necessary increase of crops. This aspect is crucial corresponding to the increase of the global human population. HUMUSON increases efficiency of traditional mineral fertilisers that may help to overcome hunger. Fertiliser production is responsible for 1.4% of global emissions, and with a growing world population, the use of synthetic fertilisers isn't disappearing, unless competitive agricultural methods and fertiliser technologies come to market.

HUMUSON is based on the use of biomimetic principles to create products with active ingredients that are highly polarised, which enables a faster, more efficient, and more efficacious mechanism of action than products that lack this high degree of polarisation.

Sapropel Organics developed unique methods of cavitation and ionization that allow it to produce highly polarized molecules of natural

origin without creating temperatures higher than 39 Celcius, which enables it to preserve the activity of the host of beneficial enzymes and proteins inherent in the source material.

How does HUMUSON work?

The principle of the effect of the product is based on the multiplication effect due to the involvement of all the main chains of biological bonds the expansion of the nutrition elements in the upper soil layer activation of the action of positive soil microorganisms and PGB bacteria improvement of the plant's transport system and bioavailability of nutrients.

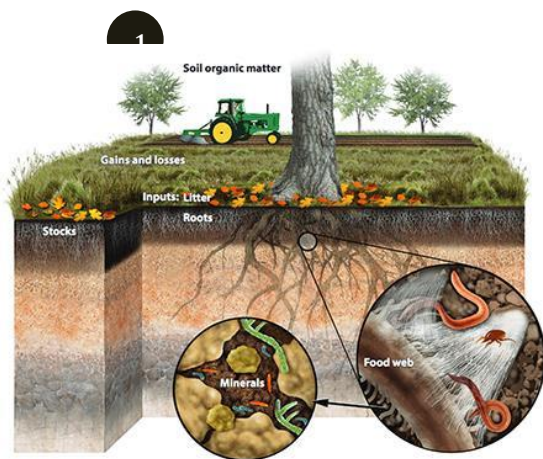


Principle of action on macro level:

1. Returns water-soluble and humified organic carbon back in to the soil;
2. Decreases the salinity of the soil by converting mineral nutrient deposits to bioavailable form by supplying enzymes;

- Increases microbial factory activity in the soil by supplying enzymes, proteins, sugar, and organic matter;
- Increases the decomposition of organic residuals by activating microbial factory activity;

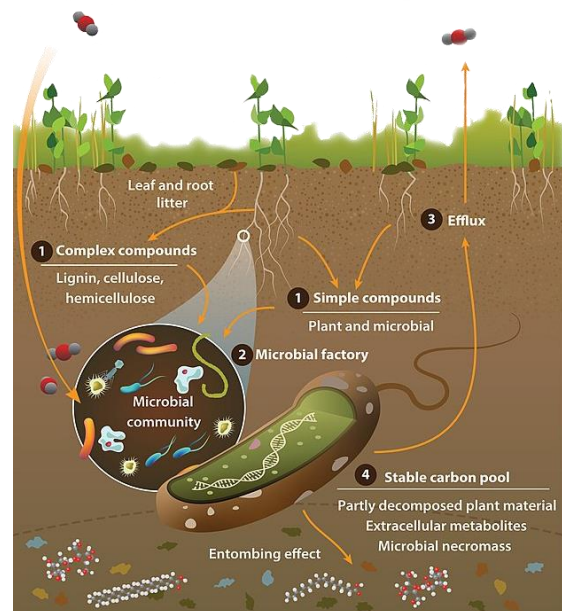
As a result, it restores the natural carbon cycle and the soil fertility self-restoration process.



Principle of action on micro level:

- Increases the diversity of complex and simple compounds by their direct supply and by the supply of enzymes that split mineral and organic complexes and create new compounds;
- Increases the activity of microbial factories by normalizing pH level, and supplying organic carbon, sugar, enzymes, and proteins¹;
- Increases the number of complex compounds that extend the lifespan of organic nitrogen and water in the soil;
- Stabilizes the carbon pool, ensuring a diversity of nutritional and building elements in the soil structure. It guarantees the proper working of the soil's fertility self-restoration system and the effectiveness of plant nutrient assimilation;

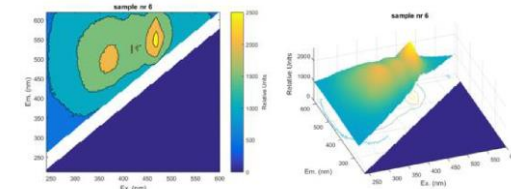
¹ "Microbiological activity and qualitative evaluation of products with probiotic properties", University named after Alexander Stulginsky



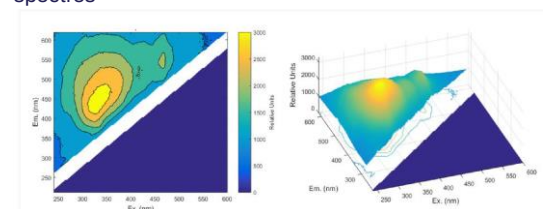
Source of picture: Naylor D, et al. 2020. *Annu. Rev. Environ. Resour.* 45:29-59

From nature to nature

The molecular structure² of HUMUSON Complex's organic elements is similar to the molecular structure of natural soil humus.



DP product (soil originates) 2D (left) and 3D (right) EEM spectres



CP product (saproel originates) 2D (left) and 3D (right) EEM spectres

HUMUSON molecule's structure similarity with soil humus allows the product to be involved in microbial activity and in biochemical reactions immediately, without additional biochemical transformations.

² "Multiproxy analytical comparison of industrially produced humic production", Karina Upska¹, Maris Klavins², Arturs Viksna¹, Faculty of Chemistry, University of Latvia, Riga,

How much impact, and what does it depend on?

The source of most of Sapropel Organics' climate impact is the avoided production of NPK fertilisers through the adoption of HUMUSON by farmers. HUMUSON can decrease the use of traditional fertilisers by 25%³⁴⁵⁶⁷.

Social meaning of this impact is crucial for Countries with agricultural social structure. The decrease of dosage of traditional fertilisers increases economical efficiency of agricultural practices, and leads to the increase of farmer's incomes. It helps to return the population back to rural territory [reference: Sapropel].

About life cycle:

The manufacturing process of HUMUSON don't produce any harmful, or non-recycling waste. HUMUSON are delivered in eco-friendly packaging. HUMUSON complex molecules are very similar with natural soil's organic molecule's structure. This reason for HUMUSON products are 100% biodegradable and uptaken by a local ecosystem.

Validity

The Sapropel Organics Impact Forecast assessment was validated as "VALID, POSITIVE AND SIGNIFICANT".

Sapropel Organics provides HUMUSON Complex a natural origin additive with capacity to increase mineral fertilizers assimilation

instead of the use of excessive synthetic fertilizers (NPK - 10:20:20, or 20:16:20). The difference in impact is calculated per year and the total impact of Sapropel Organics per year is calculated for 3,750 hectares. The final impact of Sapropel is -108t per 3,750 hectares.

Co-benefits

The extraction of raw material used in HUMUSON production restores natural freshwater resources by restoring lake ecosystems in the Baltic region⁸. The removal of sapropel restores the natural ways of water resource renewal in the lake, enriches it with oxygen and prevents drying. This leads to the restoration of fish populations, beetle colonies and other important participants in the lake's ecosystem. Moreover, the restoration of the lake's ecosystem leads to the increase of carbon dioxide uptake from the environment.

The application on the soil of HUMUSON reduces soil salinity because of helping transform mineral fertilizers deposited in the soil into a bioavailable form. It leaves a beneficial impact on soil fertility and helps to prevent soil degradation processes.

The product helps to restore local beneficial soil biota and increases their activity. It also has beneficial impacts on soil fertility and forces soil restoration.

³ Tobacco research board, Kutsaga, Zimbabwe.

⁴ Integrated fertiliser trial: Report for Organic Complex, Zimbabwe.

⁵ Integrated practice efficiency on Cashew Nuts, Ivory Coast.

⁶ Organic strawberry farmer trials, Lithuania

⁷ Integrated methods of raps growing, Latvia

⁸ Stankevica, 2014, Environmental and economic aspects of small freshwater lake sustainable use: Lake pilvelis example

Climate Impact Forecast and Validation result

Sapropel Organics provides HUMUSON Complex a natural origin additive with capacity to increase mineral fertilizers assimilation instead of the use of excessive synthetic fertilizers (NPK - 10:20:20, or 20:16:20). The difference in impact is calculated per year and the total impact of Sapropel Organics per year is calculated for 3750 times Ha.

Extraction	<p>The solution uses less NPK compared with the baseline. Based on world bank data (https://data.worldbank.org/indicator/AG.CON.FERT.ZS?end=2020&start=1961), the average farm consumes 146.4 kg/Ha per season. Our solution allows farmers to use 25% less NPK, which is equal to 36.5 kg/Ha. During the year, Sapropel Organics produces at least 150 M3 of HUMUSON Complex per year. One average farmer consumes 40 L of HUMUSON Complex per season. 1m3 of HUMUSON Complex can treat 25 Ha. It means that, during the year, approximately 3750 Ha are treated by HUMUSON Complex (taking as the assumption that the farmer has only one growing season). The main effect of HUMUSON Complex application is more effective mineral fertilizer assimilation by plants. Plants 25%, more effectively assimilate mineral fertilizers, which leads to the reduction of mineral fertilizer consumption by 25%. Taking as the assumption that the most popular mineral fertilizers blend is NPK 10:20:20 means that per one-hectare farmer can reduce consumption of Nitrogen by 3.65 kg, Phosphorus by 7.3 kg, and Potassium by 7.3 kg. HUMUSON Complex developed on science basic. The product went through a lot of laboratory and field trials. On product development was working hard team of scientists and industry experts. List of some of them: Scientific studies: 1. "Multiproxy analytical comparison of industrially produced humic production", Karina Upska1, Maris Klavins2, Arturs Viksna1, Faculty of Chemistry, University of Latvia, Riga. 2. "Report for the tests of plant growth-affecting activity with two liquid products", Prof., Dr. habil. biol. Gederts Levinsh, Department of Plant Physiology, Faculty of Biology, University of Latvia, Riga. 3. "Microbiological activity and qualitative evaluation of products with probiotic properties", University named after Alexander Stulginsky Field trials of authorized companies: 1. Innovaciones Agrícolas GOES S.L.L. Poligono Industrial San Roque C/Villa de Blanca nº6 Puerta 6 30540 Blanca (Murcia). 2. Tobacco research board, Kutsaga, Zimbabwe. Countries from which Sapropel Organics received customers' test reports and testimonials, based on which statements of this validation have been made: Germany, Ireland, UK, Lithuania, Latvia, Spain, Saudi Arabia, UAE, Nigeria, Ivory coast, Zimbabwe, Benin. Company entire studies and field trials: 1. Integrated fertilizer trial: Report for ORGANIC Complex, Zimbabwe. 2. Integrated practice efficiency on Cashew Nuts, Ivory Coast. 3. Organic strawberry farmer trials, Lithuania As a main element of HUMUSON is used Sapropel for freshwater lakes in Latvia. The extraction of the raw material used in HUMUSON production restores natural freshwater resources by restoring the lake's ecosystem. The removal of sapropel restores the natural ways of water resource renewal in the lake, enriches it with oxygen, and prevents drying. This leads to the restoration of fish populations, beetle colonies, and other important participants in the lake's ecosystem. Moreover, the restoration of the lake's ecosystem leads to an increase in carbon dioxide uptake from the environment. The extraction of the sapropel happens by pumping it out from 1-4 m under the Lakes bottom level, without destroying the lake's bottom sediment and without significant impact on the lake's bottom biotope. Specifically constructed pumps extract the sapropel and deliver it through the tubes in 500 m3 tanks. Extraction happens once a year. The delivery of raw materials to the production place is carried by truck. The average number of kilometers covered by trucks during the production year is less than 1000 km. Transportation's impact on climate change isn't significant if it is compared with the impact of transportation of mineral fertilizer. But if we compare the impact on transportation from point of view of reducing the volume of transported mineral fertilizers – the impact will be positive rather than negative. Energy consumption for the extraction process is calculated into total production energy consumption per 1m3 of HUMUSON.</p>
Production	<p>Sapropel Organics technology is based on the use of biomimetic principles to create products with active ingredients that are highly polarized, which enables a faster, more efficient, and more efficacious mechanism of action than products that lack this high degree of polarization. Our production process features stages like homogenization, cavitation, chemical extraction, non-chemical extraction, and ionization. All of these processes allow us to maintain the consistency and high-quality standards that have come to define our product. We have developed unique methods of cavitation and ionization that allows us to produce highly polarized molecules of natural origin without creating temperatures higher than 39 Celcius, which enables us to preserve the activity of the host of beneficial enzymes and proteins inherent in the source material. The process of extracting Sapropel not only helps to create HUMUSON Complex but restores the biotope of the freshwater lakes from which it's sourced, preventing them from drying out. To produce 1m3 of HUMUSON Complex production consumes 202 kWh. The manufacturing process of HUMUSON doesn't produce any harmful, or non-recycling waste. HUMUSON is delivered in eco-friendly packaging. HUMUSON complex molecules are very similar to natural soil's organic molecule structure. This reason for HUMUSON products are 100% biodegradable and uptaken by a local ecosystem. During the season, the farmer uses an average of 40L of product per hectare. That is, one ton can process 25 hectares. That means that 8.08 kWh of electricity is used to produce 40L of HUMUSON Complex needed for one-hectare treatment during the season. HUMUSON is possible to deliver by a drip system or spraying, depending on traditional agricultural practices. HUMUSON is a concentrated product. It should be diluted with water before application. It helps to reduce logistic costs and product impact on carbon footprint. HUMUSON can be applied in combination with traditional chemical products of plant treatment. It means that no need for additional machinery rides, or additional energy consumption. The application on the soil of HUMUSON reduces soil salinity because of helping transform mineral fertilizers deposited in the soil into a bioavailable form. It leaves a beneficial impact on soil fertility and helps to prevent soil degradation processes.</p>

Validation	By: Santeri Lehtonen, Started: Fri Mar 03 2023 17:08:34 GMT+0100 (Central European Standard Time), Completed: Fri Mar 03 2023 17:34:49 GMT+0100 (Central European Standard Time)
Strong points	Simple and well-built assessment, with good assumption and references, supported by experimental data from the field. HUMUSON product and its lifecycle explained well in the feedback call.
Weak points	Fuel use of pumps, albeit marginal, should be included in future assessments.
Sensitivity	The results are sensitive to the exact amount of NPK fertiliser replaced by users. However, the impact is not in danger of becoming negative.

Extraction

Fertilizer-N	4.307 per kg	3.65 kg	-16.72
Fertilizer-P	1.229 per kg	7.3 kg	-8.968
Fertilizers-K	0.7882 per kg	7.3 kg	-5.754

Production

Latvia, electricity consumption	0.05368 per MJ	9.08 kWh	1.755
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Sapropele Organics's total impact per year

eco-costs of human health euro	-983.6	Carbon footprint CO ₂ -eq.
eco-costs of eco-toxicity euro	-2628	
eco-costs of resource depletion euro	-1244	
eco-costs of carbon footprint euro	-13279	
Impact per Ha		-28.69 kg
Impact of 3750 times Ha		-108t

Impact validation: **VALID, POSITIVE AND SIGNIFICANT**

16 approved, 2 questions

Equivalent to



4890 trees

13 times driving a car around the world

109 passengers flying London-New York

209 barrels of oil burnt

22 Average humans

45 EU households annual electricity

22 elephants mass (5t) of CO₂

19 hot air balloons (2800 m³) of CO₂

Validation quality mark can be checked on: www.impact-forecast.com

validated in March 2023
validation id:

SL960

Verifyable at
www.impact-forecast.com

SAPROPEL ORGANICS SIA

Mitigates climate change with an impact reduction potential of:

-108

tCO₂eq / year

Validity of forecast

■ Valid

Impact compared to baseline

■ Positive

Magnitude of impact

■ Significant

References

Scientific studies:

1. "Multiproxy analytical comparison of industrially produced humic production", Karina Upska¹, Maris Klavins², Arturs Viksna¹, Faculty of Chemistry, University of Latvia, Riga.
2. "Report for the tests of plant growth-affecting activity with two liquid products", Prof., Dr. habil. biol. Gederts Ievinsh, Department of Plant Physiology, Faculty of Biology, University of Latvia, Rīga.
3. "Microbiological activity and qualitative evaluation of products with probiotic properties", University named after Alexander Stulginsky
4. "Environmental and economic aspects of small freshwater lake sustainable use: Lake pilvelis example" Dr. Karina Stankevica, Dr. Juris Burlakovs, Dr. habil. chem. Maris Klavins, Dr. Zane V.-Gaile, University of Latvia, 2014

Field trials of authorised companies:

1. Innovaciones Agrícolas GOES S.L.L. Polígono Industrial San Roque C/Villa de Blanca nº6 Puerta 6 30540 Blanca (Murcia).
2. Tobacco research board, Kutsaga, Zimbabwe.

Countries from which Sapropel Organics received customers test reports and testimonials, based on which statements of this validation have been made: Germany, Ireland, UK, Lithuania, Latvia, Spain, Saudi Arabia, UAE, Nigeria, Ivory coast, Zimbabwe, Benin.

Company entire studies and field trials:

1. Integrated fertiliser trial: Report for ORGANIC Complex, Zimbabwe.
2. Integrated practice efficiency on Cashew Nuts, Ivory Coast.
3. Organic strawberry farmer trials, Lithuania
4. Integrated methods of raps growing, Latvia

More information

We help companies to know, show and grow their climate impact. More information about the validation process you can find on our website: www.impact-forecast.com

