ENVIRONMENTAL PRODUCT DECLARATION

IN ACCORDANCE WITH ISO 14025 FOR:

SEED POTATO (G2 class)

from

TEKFEN TARIMSAL ARAŞTIRMA ÜRETİM VE PAZARLAMA A.Ş.

Programme:	The International EPD® System, www.environdec.com EPD Turkey, a fully aligned regional programme, www.epdturkey.org
Programme operator:	EPD International AB & EPD Turkey
EPD registration number:	S-P-02237
Publication date:	2022-01-24
Valid until:	2027-01-23

TEKFEN AGRI

EPD®

THE INTERNATIONAL EPD® SYSTEM

TURKEY EPD®

ENVIRONMENTAL PRODUCT DECLARATIONS

Programme information

Programme:	The International EPD® System EPD International AB Box 210 60 SE-100 31 Stockholm Sweden www.environdec.com info@environdec.com EPD Turkey, a fully aligned regional programme www.epdturkey.org
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Product category rules (PCR): PCR 2020:07 Arable and Vegetable Crops, ver. 1.0 Product Category Classification: UN CPC 011, 012, 014, 017, 0191 (PCR 2020:07 Version 1.0), The International EPD® System
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Independent third-party verification of the declaration and data, according to ISO 14025:2006: ☐ EPD process certification ☒ EPD verification
Third party verifier: *Hüdai Kara, PhD, Metsims Sustainability Consulting*      Approved by: The International EPD® System
Procedure for follow-up of data during EPD validity involves third party verifier: ☐ Yes ☒ No

The EPD owner has the sole ownership, liability, and responsibility for the EPD. EPDs within the same product category but from different programmes may not be comparable.

Company information

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Description of the organisation:
Established in 1956, Tekfen Group of Companies operates in three core business areas: Contracting, Agricultural-Industry (Agri-Industry) and Investment and Services. Tekfen Holding is the umbrella company for all of the firms and subsidiaries in the Tekfen Group.

Tekfen Tarımsal Araştırma, Üretim ve Pazarlama A.Ş. (Tekfen Agricultural Research, Production and Marketing, Inc.) is the umbrella company of the Tekfen Agricultural Production Group and was established in 2017 with the aim to bring a corporate perspective to agricultural production, which plays a vital role in securing a sustainable future. This move allows the Group to put its know-how gained during almost four decades in the field of agricultural inputs as well as its science-based approach and strong financial structure in the service of agricultural production.

With 76 agricultural engineers on its payroll who bring agriculture together with science and the most up-to-date technologies, Tekfen Agri exports fresh fruits to 80 different customers in 22 countries under the Alanar Fruit brand name, which Tekfen entirely acquired in May 2019. The company also uses its own seeds and saplings to grow bread wheat seeds, high-grade edible and seed potatoes, cherries, Bursa black figs, apricots, pomegranates, Japanese plums, nectarines, and bananas. Tekfen Agri is one of the few agricultural production companies in the world to produce such a diverse range of species. Tekfen Agri also contributes to raising productivity and quality in agricultural production by offering high-quality seeds, seedlings and saplings to farmers. As Turkey's first and one of the few technological centres of agriculture, the Agripark complex located in Adana has been producing disease-free seeds and seedlings since 2004 through the tissue culture method and carries out crop seed breeding practices. The facility, which was registered as an R&D Centre in 2018, carries out studies that primarily focus on the improvement of Turkish agriculture benefiting from Anatolia's rich endemic biodiversity.

Tekfen Agri has been at the fore of its sector by allocating 8.5% of its revenues to research and product development in 2020. The Company ranked 3rd in the agriculture category of the "Turkish Companies with the Highest R&D Expenditure in 2019" list prepared by the Turkishtime journal.

In 2020, 4 varieties of bread wheat (Tekfen 1039, Tekfen 2001, Tekfen 2077 and Tekfen 2095) and 1 variety of sesame suitable for machine harvesting (Equi2017010) have been registered by Republic of Turkey Ministry of Agriculture and Forestry Variety Registration and Seed Certification Centre.

Tekfen Agri undertakes its seedling operations through Hishtil-Toros Fidecilik (HTF) (which is a subsidiary of Tekfen Agri). Conducting its operations in high-tech greenhouses at two locations, with 50 decares in Antalya and 26 decares in Adana, HTF grows high-quality, healthy seedlings that are in compliance with recognized Good Seeds and Plants Practices (GSPP) standards.

Tekfen Agri's Corporate Farming Karaman plantations and Antalya Çandır pilot banana greenhouses have been awarded the GAP (Good Agricultural Practices) certificate in 2020.

In order to minimize the restrictive and negative effects of the pandemic, Tekfen Agri has taken the necessary precautions against COVID-19 since the first day, prioritizing the health of its employees, business partners and customers. In that regard, by carrying out the Infection Prevention and Control

Procedures specified by the Turkish Standards Institution (TSE), Tekfen Agri's Nevşehir Underground Storage (Warehouse) and Agripark facility and Alanar Fruit's İznik and Alaşehir facilities have been awarded the TSE COVID-19 Safe Production Certificate.

Having established its waste management infrastructure with a system where waste is effectively separated at source, a Zero Waste Certificate (Basic Level) has been obtained for Tekfen Agri's Nevşehir Warehouse and Adana Agripark facility and Alanar Fruit's Alaşehir facility.

Name and location of production site:
Agripark tissue culture laboratory, greenhouse and cold storage are located in Adana, Turkey
Seed potato fields are located in Karaman, Turkey
Nevşehir Warehouse is located in Nevşehir, Turkey

Product information

Product name: Seed Potato (G2 class)

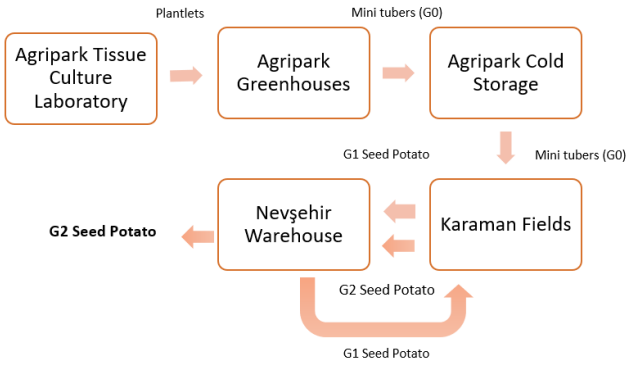
Cultivation and Production Process:
Potato mini tuber production started in the Agripark tissue culture laboratory in 2017, was completed in 2019. After 2 years of multiplication, it came to the sales stage in 2021. In addition to tissue culture laboratory and greenhouse production, it is a production model that spreads over a wide area under field conditions.

Seed potatoes obtained in 3 storage seasons, 2018-2019 (Agripark Cold Storage), 2019-2020 (Nevşehir Warehouse) and 2020-2021 (Nevşehir Warehouse), were stored. Production process takes a total of 5 years including the storage periods.

Seed potatoes (G2 class) that came to the Nevşehir Warehouse in September 2020, were stored until May 2021. And then they were sold to growers.

The following figure shows production diagram:

Production diagram:



Product description:
Name of the species: Solanum tuberosum (high class seed potato).
Name of the varieties: Agria, Marabel, Madeleine, Melody, Provento and Lady Olympia.
Seed potato size: 30-45 mm and 45-65 mm.

UN CPC code: 0126-Vegetable seeds, except beet seeds

Geographical scope: Turkey
The geographical scope of this EPD is Turkey.

LCA information

Functional unit / declared unit: The declared unit is 1 kg of G2 seed potatoes (with about moisture content 80%).

Reference service life: Not applicable for this product category.

Time representativeness: Time period of production processes takes a total of 5 years including the storage periods (The process, which started with mini tuber production in 2017, ended in 2021 when G2 seed potatoes were stored in the Nevşehir warehouse and ready for sale).

Database(s) and LCA software used: The background data used as secondary data in the life cycle model were taken from Ecoinvent (v3.6), World Food LCA Database WFLDB (v3.5) and Agribalyse (v3.0) databases within SimaPro LCA software (version 9.1.0.11).

Description of system boundaries: "Cradle-to-gate"
The system boundary covers all phases from extraction of raw materials to finished packaged seed potato (G2 class). This study has adopted an LCA calculations procedure which is separated into two different lifecycle stages: Upstream and Core processes. Within this LCA work, downstream stage is not declared.

The upstream stage includes the following processes:
• Production of fertilizers, pesticides used,
• Production of materials used for greenhouse (such as peat, perlite, sand),
• Production of other inputs used in the tissue culture laboratory,
• Manufacturing of packaging material used for final product

The core stage includes the following processes:
• Fields preparation, planting, potato plant care, harvest, post-harvest processes,
• Water used for fertilization, spraying, irrigation and preparation of plant nutrient media,
• Emissions due to fertilizers and pesticides use,
• Impacts due to the generation of electricity and fuels used in the core module,
• Direct emissions of fuel consumptions,
• Wastes related to the agricultural phase and post-harvest operations,
• Transport of raw materials to the production and storage sites,
• Transport of seed potatoes harvested from Karaman fields to Nevşehir warehouse,
• Transport of seed potatoes stored from Nevşehir warehouse to fields in Karaman,
• Transport of potato mini tubers from Agripark facility to fields in Karaman,
• Internal transport

Excluded lifecycle stages:
In this study, production of capital goods, infrastructure, production of manufacturing equipment in core stage and personnel-related activities, energy utilization for office lighting and heating were not included.

More information:
Cut-off rules: There are no excluded raw materials (such as fertilizers, pesticides used and water consumption) in this study. All of them were considered in the study.

Allocation rules: No allocation procedures were applied in LCA modelling within the software.

Data quality: Throughout this study, ISO 14040/44 guidelines were followed. The primary data used in this study were collected through a questionnaire filled out by the company and through e-mail, telephone communications. Secondary data comes from the databases within LCA software. The analysis is carried out using the SimaPro LCA software (version 9.1.0.11) and the rules indicated by the PCR 2020:07 Arable and Vegetable Crops (Version 1.0) were applied for the evaluation of data quality. Air and water emissions caused by the use of fertilizers utilized for the cultivating were calculated in accordance with the PCR document.

Content declaration

Product

Materials / chemical substances	Value	Unit
Seed Potato	100	%

Packaging

The composition of the product as supplied is as follows (% values in kg):
99.8% Seed Potato Product
0.2% Packaging Material (Big bag) - Packaging for the transportation and distribution

Environmental performance

The following tables show the impact estimate results which are relative expressions and do not predict impacts on category endpoints or the transgression of thresholds, safety margins or risks.

Environmental performance is represented per 1 kg of G2 seed potatoes (The weight of the packaging of final product is not included in this 1 kg).

Potential environmental impacts per kg of seed potatoes

PARAMETER		UNIT	Upstream	Core	Downstream	TOTAL (Upstream+ Core)
Global warming potential (GWP)	Fossil	kg CO_2 eq.	9.94E-02	2.61E-01	MND	**3.61E-01**
	Biogenic	kg CO_2 eq.	9.05E-05	7.48E-04	MND	**8.39E-04**
	Land use and land transformation	kg CO_2 eq.	1.96E-04	1.74E-03	MND	**1.93E-03**
	TOTAL	kg CO_2 eq.	9.97E-02	2.64E-01	MND	**3.64E-01**
Depletion potential of the stratospheric ozone layer (ODP)		kg CFC 11 eq.	5.96E-09	1.89E-08	MND	**2.49E-08**
Acidification (fate not incl.)		kg SO2 eq	4.01E-04	2.41E-03	MND	**2.81E-03**
Eutrophication potential (EP)		kg PO_4^{3-} eq.	8.94E-05	1.59E-03	MND	**1.68E-03**
Formation potential of tropospheric ozone (POCP)		kg NMVOC	1.78E-04	1.36E-03	MND	**1.53E-03**
Abiotic depletion potential – Elements		kg Sb eq.	1.54E-06	1.52E-06	MND	**3.06E-06**
Abiotic depletion potential – Fossil resources		MJ, net calorific value	1.10E+00	3.14E+00	MND	**4.25E+00**
Water scarcity potential		m^3 eq.	4.27E-02	1.35E+01	MND	**1.36E+01**
Freshwater Ecotoxicity		[PAF.m3.day]	4.76E+01	6.64E+01	MND	**1.14E+02**
Marine Water Eutrophication		kg N eq	6.14E-06	1.68E-04	MND	**1.74E-04**
Land use		m2a crop eq	3.08E-03	1.78E-01	MND	**1.81E-01**

MND: Module Not Declared

Use of resources per kg of seed potatoes

PARAMETER		UNIT	Upstream	Core	Downstream	TOTAL (Upstream+ Core)
Primary energy resources – Renewable	Use as energy carrier	MJ, net calorific value	4.70E-02	5.16E-01	MND	**5.63E-01**
	Used as raw materials	MJ, net calorific value	0	0	MND	**0**
	TOTAL	MJ, net calorific value	4.70E-02	5.16E-01	MND	**5.63E-01**
Primary energy resources – Non-renewable	Use as energy carrier	MJ, net calorific value	1.47E+00	3.21E+00	MND	**4.68E+00**
	Used as raw materials	MJ, net calorific value	9.31E-02	0	MND	**9.31E-02**
	TOTAL	MJ, net calorific value	1.57E+00	3.21E+00	MND	**4.78E+00**
Secondary material		kg	0	0	MND	**0**
Renewable secondary fuels		MJ, net calorific value	0	0	MND	**0**
Non-renewable secondary fuels		MJ, net calorific value	0	0	MND	**0**
Net use of fresh water		m^3	3.64E-04	3.13E-01	MND	**3.13E-01**

MND: Module Not Declared

Waste production and output flows

Waste production per kg of seed potatoes

PARAMETER	UNIT	Upstream	Core	Downstream	TOTAL (Upstream+ Core)
Hazardous waste disposed	kg	1.44E-06	3.51E-06	MND	**4.94E-06**
Non-hazardous waste disposed	kg	1.17E-02	8.68E-02	MND	**9.85E-02**
Radioactive waste disposed	kg	1.36E-06	9.27E-06	MND	**1.06E-05**

MND: Module Not Declared

Note: It should be mentioned that according to the information taken from Tekfen Agri's Tekno Tarım Operation, there are no direct radioactive wastes during the production processes. Within the core stage, the amount of radioactive waste generation mostly is in relation with the background processes of road transport.

Output flows per kg of seed potatoes

PARAMETER	UNIT	Upstream	Core	Downstream	TOTAL (Upstream+ Core)
Components for reuse	kg	0	0	MND	**0**
Material for recycling	kg	0	0	MND	**0**
Materials for energy recovery	kg	0	0	MND	**0**
Exported energy, electricity	MJ	0	0	MND	**0**
Exported energy, thermal	MJ	0	0	MND	**0**

MND: Module Not Declared

REFERENCES

The International EPD System	The International EPD® System is a programme for type III environmental declarations, maintaining a system to verify and register EPD®s as well as keeping a library of EPD®s and PCRs in accordance with ISO 14025. www.environdec.com
International EPD® System; General Programme Instructions (EPD)	International EPD® System; General Programme Instructions (EPD); Ver 3.0.1 del 2019/09/18 www.environdec.com
PCR: Arable And Vegetable Crops	PCR 2020:07 Arable And Vegetable Crops (Version1.0) 2020/07, www.environdec.com
ISO 14040/44	Environmental management – Life cycle assessment principles and framework (ISO 14040:2006) and Requirements and guidelines (ISO 14044:2006)
ISO 14025:2006	Environmental labels and declarations – Type III Environmental declarations – Principles and procedures
Ecoinvent (v3.6)	Ecoinvent Centre, www.ecoinvent.org
SimaPro (version 9.1.0.11)	SimaPro LCA Package, Pré Consultants, the Netherlands, www.pre-sustainability.com; www.simapro.com
Agribalyse (v3.0)	This database has been produced as part of AGRIBALYSE program lead by ADEME and INRAE since 2009. It contains agricultural and food products produced and/or consumed in France. It follows CIQUAL nomenclature, the French nutritional database. www.agribalyse.fr
WFLDB (v3.5)	World Food LCA Database; www.quantis-intl.com/metrics/databases/wfldb-food

GLOSSARY

Carbon Footprint: A product carbon footprint is the total amount of greenhouse gases produced along the entire life cycle. It is expressed in equivalent mass of carbon dioxide (CO2 -eq). It is also known as Global Warming Potential (GWP). The carbon footprint shall include emissions and removals of greenhouse gases arising from fossil sources, biogenic sources, and direct land use change. The reporting shall be done in separate sub-indicators for the different sources, unless other guidance is provided in the reference PCR.

Acidification Potential (AP): It is a phenomenon for which precipitation is unusually acidic, meaning that it has substandard levels of pH. It can have harmful effects on plants, aquatic animals and infrastructure. Acid rain is caused by emissions of SO2. NOx and NH3. The acidification potential is measured in mass of sulphur dioxide equivalent (SO2-eq).

Eutrophication Potential (EP): It is an abnormal proliferation of vegetation in the aquatic ecosystems caused by the addition of nutrients into rivers, lakes or ocean, which determinates a lack of oxygen. The eutrophication potential is mainly influenced by emission into water of phosphates and nitrates. It is expressed in mass of PO_4^{3-} equivalent.

Photochemical Oxidant Formation Potential (POFP): Chemical reaction brought about by the light energy of the sun. The reaction of nitrogen oxides with hydrocarbons in the presence of sunlight forms the ozone in the troposphere. The indicator is mainly influenced by VOCs (Volatile organic compounds) is usually expressed in mass of non-metallic organic compounds (NMVOC).

Land Use: This indicator is measured mass of C deficit. and represents the impact related to the use of soil.

Marine Water Eutrophication: This indicator is measured in g N eq. and represents the impact related to eutrophication due to nitrogen and phosphorus emissions in water.

Aquatic Ecotoxicity: This indicator is measured in Comparative Toxic Unit (CTU) and refers to the impact of toxic substances (chemical and physical agents) on aquatic ecosystems.

Water Scarcity Potential: The water scarcity potential provides additional information related to the availability of water in different geographical locations. This indicator is measured in volume of water and it relates water use to local scarcity of water. This enables differentiation between situations where water extraction causes different levels of impact.

Abiotic Depletion Potential Element (ADP-e): Impact from depletion of resources excluding fossil fuel resources (such as oil or natural gas) expressed in equivalent antimony so to take into account scarcity of resources.

Non-Renewable Primary Energy: Non-renewable energy resources required to manufacture the product. Sources of non-renewable energy are fossil fuels and uranium.

Renewable Primary Energy: Renewable energy resources required to manufacture the product. Sources of renewable energy are biomass, wind, solar or hydraulic sources for example.

Net Fresh Water: The net use of fresh water does not constitute a “water footprint” as potential environmental impacts due to the water use in different geographical locations is not captured. Net freshwater use is included as an indicator in the section of resource use, calculated from the life cycle inventory (Input of net fresh water consumed in the life cycle stages).

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