



VFARM

Vertical Farming Sostenibile

D6.3 Inventario LCI in ILCD



Acronimo:	VFARM
Titolo completo:	Vertical Farming sostenibile
Codice progetto:	2020ELWM82
Finanziamento	PRIN
Coordinatore:	Università di Bologna
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1. Introduzione

Il progetto VFarm – Vertical Farming sostenibile (CUP: J33C20002350001) è un progetto PRIN (progetti di ricerca di rilevante interesse nazionale) finanziato nell'ambito della call 2020. Il progetto mira all'identificazione di strategie innovative per il *vertical farming*, implementando un approccio interdisciplinare che integra orticoltura e fisiologia vegetale con applicazioni negli ambiti dell'ingegneria e delle scienze economiche ed ambientali. Il progetto mira a definire le caratteristiche ottimali di sistemi di coltivazione e controllo climatico, adattando le tecnologie alle diverse specie coltivate e consentendo di progettare unità di coltivazione modulari ed adattabili a diversi contesti in città italiane. Inoltre, promuove collaborazioni tra le università partner e aziende operanti nel settore per consentire un rapido trasferimento delle conoscenze generate, permettendo infine l'identificazione e la validazione delle soluzioni tecnologiche ottimali per l'implementazione del *vertical farming* in Italia. VFarm è coordinato dall'Università di Bologna Alma Mater Studiorum, e ha come partner l'Università di Napoli Federico II, l'Università degli Studi di Torino e l'Università degli Studi di Padova.

1.1 Obiettivi del progetto

Gli obiettivi specifici del progetto sono:

- Studiare l'adattabilità di 7 tipologie di prodotti al *vertical farming* (WP2)
- Progettare soluzioni tecnologiche ottimali in termini di sistemi di coltivazione, gestione della luce e controllo del clima (WP3)
- Valutare la sostenibilità, sociale, ambientale ed economica delle *vertical farm* (VF) tramite analisi del ciclo di vita (LCA, eLCC e S-LCA) e con riferimento all'uso delle risorse (energia, acqua e nutrienti) (WP4)
- Definire le tecnologie ottimali, integrandole sia a VF di piccola scala realizzate all'interno di container sia a quelle a grande scala realizzate all'interno di magazzini industriali (WP5).

2. Trasferimento degli inventari a ILCD



La possibilità di trasferimento di life cycle inventories al database è stata purtroppo interrotta nel 2019 (come si può leggere anche qui: <https://eplca.jrc.ec.europa.eu/LCDN/contactListLCD.html>). Durante la scrittura del progetto non era chiara l'impossibilità di caricare i dati.

Sono state esplorate altre opzioni di database simili, senza trovare nulla di convincente che sia allo stesso tempo open source e rilevante per la diffusione di database ambientali.

La strategia scelta per rispondere all'obiettivo della deliverable (rendere gli inventari open e accessibili) è di prevedere di diffondere gli inventari come Supplementary Materials in una prossima pubblicazione OA. Inoltre, gli inventari verranno diffusi come file CSV correlato di un readme in Word in AMS ACTA.

Nei capitoli successivi sono riportati gli inventari con riferimenti al database proprietario ecoinvent 3.10 pronti da essere riutilizzati e adattati.



3. UNIBO

Gli inventari per la struttura pilota di UNIBO (SALUS) sono stati costruiti per un anno di coltivazione, con una produzione totale di **725.76kg di lattuga**. Come riportato nel D4.2, la prova è stata condotta su mezzo container, perciò tutti gli input sono calcolati su un anno di produzione con mezzo container occupato. Gli input relativi ai consumabili sono relativi a un anno, mentre quelli relativi alla struttura sono stati considerati come rapporto tra la durata della valutazione (1 anno) e la durata di vita dei vari elementi (variabile, da 6 a 15 anni).

Process	Flow	Source	Amount	Unit	Provider	Description
Consumables - Fertilizers	ammonium nitrate	ecoinvent 3.10	0.38	kg	market for ammonium nitrate ammonium nitrate Cutoff, U – RER	
Consumables - Fertilizers	boric oxide	ecoinvent 3.10	0.005*0.7467	kg	market for boric oxide boric oxide Cutoff, U - GLO	component of Mikrom https://www.cifo.it/prodotto/agricoltura-professionale/prodotti-ap/meso-e-microelementi/concime-mikrom/
Consumables - Fertilizers	calcium nitrate	ecoinvent 3.10	3.724	kg	market for calcium nitrate calcium nitrate Cutoff, U - RER	

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Process	Flow	Source	Amount	Unit	Provider	Description
Consumables - Fertilizers	copper sulfate	ecoinvent 3.10	0.01*0.7467	kg	market for copper sulfate copper sulfate Cutoff, U - GLO	component of Mikrom https://www.cifo.it/prodotto/a gricoltura- professionale/prodotti- ap/meso-e- microelementi/concime- mikrom/ included both copper sulfate and chelate copper
Consumables - Fertilizers	inorganic nitrogen fertiliser, as N	ecoinvent 3.10	3.05*0.108	kg	market for inorganic nitrogen fertiliser, as N inorganic nitrogen fertiliser, as N Cutoff, U - IT	from magnesium nitrate (10,8% N)
Consumables - Fertilizers	inorganic phosphorus fertiliser, as P2O5	ecoinvent 3.10	0.52*0.6365	kg	market for inorganic phosphorus fertiliser, as P2O5 inorganic phosphorus fertiliser, as P2O5 Cutoff, U - IT	inserted phosphorus content of monopotassic phosphate NPK (0-52-34)
Consumables - Fertilizers	inorganic potassium fertiliser, as K2O	ecoinvent 3.10	0.34*0.6365	kg	market for inorganic potassium fertiliser, as K2O inorganic potassium fertiliser, as K2O Cutoff, U - IT	inserted potassium content of monopotassic phosphate NPK (0-52-34)

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Process	Flow	Source	Amount	Unit	Provider	Description
Consumables - Fertilizers	iron sulfate	ecoinvent 3.10	0.08*0.7467	kg	market for iron sulfate iron sulfate Cutoff, U - RER	component of Mikrom https://www.cifo.it/prodotto/agricoltura-professionale/prodotti-ap/meso-e-microelementi/concime-mikrom/ included both iron sulfate and chelate iron
Consumables - Fertilizers	magnesium oxide	ecoinvent 3.10	0.03*0.7467	kg	magnesium oxide production magnesium oxide Cutoff, U - RER	component of Mikrom https://www.cifo.it/prodotto/agricoltura-professionale/prodotti-ap/meso-e-microelementi/concime-mikrom/
Consumables - Fertilizers	magnesium oxide	ecoinvent 3.10	3.05*0.154	kg	market for magnesium oxide magnesium oxide Cutoff, U - GLO	from magnesium nitrate (15,4% MgO)
Consumables - Fertilizers	manganese sulfate	ecoinvent 3.10	0.08*0.7467	kg	market for manganese sulfate manganese sulfate Cutoff, U - GLO	component of Mikrom https://www.cifo.it/prodotto/agricoltura-professionale/prodotti-ap/meso-e-microelementi/concime-mikrom/ included both

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Process	Flow	Source	Amount	Unit	Provider	Description
						manganese sulfate and chelate manganese
Consumables - Fertilizers	molybdenum	ecoinvent 3.10	0.002*0.7467	kg	molybdenum production molybdenum Cutoff, U - RER	component of Mikrom https://www.cifo.it/prodotto/agricoltura-professionale/prodotti-ap/meso-e-microelementi/concime-mikrom/
Consumables - Fertilizers	monoammonium phosphate	ecoinvent 3.10	0.5225	kg	market for monoammonium phosphate monoammonium phosphate Cutoff, U - RER	
Consumables - Fertilizers	potassium nitrate	ecoinvent 3.10	3.6385	kg	market for potassium nitrate potassium nitrate Cutoff, U - RER	
Consumables - Fertilizers	potassium sulfate	ecoinvent 3.10	1.254	kg	market for potassium sulfate potassium sulfate Cutoff, U - RER	
Consumables - Fertilizers	sulfur dioxide, liquid	ecoinvent 3.10	0.06*0.7467	kg	market for sulfur dioxide, liquid sulfur dioxide, liquid Cutoff, U - RER	component of Mikrom https://www.cifo.it/prodotto/agricoltura-professionale/prodotti-ap/meso-e-microelementi/concime-mikrom/

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Process	Flow	Source	Amount	Unit	Provider	Description
						microelementi/concime-mikrom/
Consumables - Fertilizers	transport, freight, lorry 3.5-7.5 metric ton, EURO4	ecoinvent 3.10	14/1000*6.2	t*km	transport, freight, lorry 3.5-7.5 metric ton, EURO4 transport, freight, lorry 3.5-7.5 metric ton, EURO4 Cutoff, U - RER	Shipping from Meraville (Bologna, BO) to Salus Space, Bologna (BO).
Consumables - Fertilizers	zinc sulfide	ecoinvent 3.10	0.02*0.7467	kg	zinc sulfide production zinc sulfide Cutoff, U - RER	component of Mikrom https://www.cifo.it/prodotto/agricoltura-professionale/prodotti-ap/meso-e-microelementi/concime-mikrom/
Consumables - Electricity	electricity, medium voltage	ecoinvent 3.10	7147.44	kWh	electricity voltage transformation from high to medium voltage electricity, medium voltage Cutoff, U - IT	
Consumables - Other consumables	packaging, for fertilisers or pesticides	ecoinvent 3.10	14.586*36	kg	market for packaging, for fertilisers or pesticides packaging, for fertilisers or pesticides Cutoff, U - GLO	packaging for peat

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Process	Flow	Source	Amount	Unit	Provider	Description
		ecoinvent 3.10				36 (liters of peat for 1m2/year) * 14.586 (m2 of total cultivation surface) * 6.5 (weight peat https://www.leroymerlin.it/prodotti/giardino-e-terrazzo/coltivazione-e-cura-delle-piante/terricci/torba-geolia-per-tutte-piante-70-l-85372755.html) market
Consumables - Other consumables	peat		14.586*36	kg	market for peat peat Cutoff, U - RER	process for transportation from production zone to Bioflor
Consumables - Other consumables	Seeds	ecoinvent 3.10	8328	Item(s)	SALUS_seed	left for reference, seeds were not modelled
Consumables - Other consumables	tap water	ecoinvent 3.10	9500	kg	market for tap water tap water Cutoff, U - Europe without Switzerland	
Consumables - Other consumables	transport, freight, lorry 3.5-7.5 metric ton, EURO4	ecoinvent 3.10	14.586*36/100*184	t*km	market for transport, freight, lorry 3.5-7.5 metric ton, EURO4 transport, freight, lorry 3.5-7.5 metric ton, EURO4 Cutoff, U - RER	Transport for 184km from Bioflor (San Biagio di Callalta) to SALUS Space
Structure - Fertirrigation system (1/15*1/2)	electronics, for control units	ecoinvent 3.10	0.67	kg	electronics production, for control units electronics,	0.67 kg water control station https://www.amazon.it/

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Process	Flow	Source	Amount	Unit	Provider	Description
					for control units Cutoff, U - RER	Kazeila-Digitale-Irrigazione-Programmabile-Automatica/dp/B0CNX3TB1J/ref=asc_df_B09MLQHFSV/?tag=googshopit-21&linkCode=df0&hvadid=700970681663&hvpos=&hvnetw=g&hvrnd=15497137456651263870&hvpone=&hvptwo=&hvmqmt=&hvdev=c&hvdvcmdl=&hvlocint=&hvlocphy=1008141&hvtargid=pla-1646185588017&mcid=eb4f56f78a8c333ab16705804968c826&gad_source=1&th=1
Structure - Fertirrigation system (1/15*1/2)	extrusion of plastic sheets and thermoforming, inline	ecoinvent 3.10	21.2*4	kg	extrusion of plastic sheets and thermoforming, inline extrusion of plastic sheets and thermoforming, inline Cutoff, U - FR	21.2 kgs for tanks https://www.obal-centrum.com/pe-sud-500-l-garden-green-880-x-720-x-1080-mm-including-plastics-screen
Structure - Fertirrigation system (1/15*1/2)	extrusion, plastic pipes	ecoinvent 3.10	4.98	kg	extrusion, plastic pipes extrusion, plastic pipes Cutoff, U - RER	Extrusion for plastic pipes Parameters Lenght vertical pipes: 2m Number of vert.pipes: 2*8 Lenght of

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Process	Flow	Source	Amount	Unit	Provider	Description
						horizontal pipes: 10m Number of horiz. pipes: 2*4 Density PVC for pipes: 950kg/m3 Diameter (internal): 14mm External volume pipe: 22512072 mm3 Internal volume pipe: 17266045 mm3 Total PVC volume: 5246027mm3 Weight: volume*density=4.98kgs
Structure - Fertirrigation system (1/15*1/2)	polyvinylchloride, emulsion polymerised	ecoinvent 3.10	1*(1/0.94)*4.98	kg	polyvinylchloride production, emulsion polymerisation polyvinylchloride, emulsion polymerised Cutoff, U - RER	1kg of pellet = 0.94 kg of plastic sheet for pipes
Structure - Fertirrigation system (1/15*1/2)	polyvinylchloride, emulsion polymerised	ecoinvent 3.10	1*(1/0.94)*21.2*4	kg	polyvinylchloride production, emulsion polymerisation polyvinylchloride, emulsion polymerised Cutoff, U - RER	1kg of pellet = 0.94 kg of plastic sheet fo tanks
Structure - Fertirrigation system (1/15*1/2)	pump, 40W	ecoinvent 3.10	900/40	Item(s)	pump production, 40W pump, 40W Cutoff, U - RoW	Upscaled for higher powerful pump (900w) https://www.agrieuro.com/gar

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Process	Flow	Source	Amount	Unit	Provider	Description
						dena-5600-silent-pompa-elettrica-per-irrigazione-da-giardino-900-p-43034.html?gad_source=1&gclid=Cj0KCQjwkdO0BhDxARIsANkNcrd6mO68xkadNPs4pjY4Mb1lfhtNVYFXP7xPxcx450VzA59cJB2fO0aAjxqEALw_wcB
Structure - Fertirrigation system (1/15*1/2)	transport, freight, lorry 3.5-7.5 metric ton, EURO4	ecoinvent 3.10	21.2*4/1000*6.2	t*km	transport, freight, lorry 3.5-7.5 metric ton, EURO4 transport, freight, lorry 3.5-7.5 metric ton, EURO4 Cutoff, U - RER	Tanks: Shipping of tanks from Meraville (Bologna, BO) to Salus Space, Bologna (BO). https://www.leroymerlin.it/prodotti/giardino-e-terrazzo/irrigazione/pompe-per-acqua/serbatoi-recupero-acqua-piovana/serbatoio-esterno-valigia-blu-500-l-82431280.html
Structure - Fertirrigation system (1/15*1/2)	transport, freight, lorry 3.5-7.5 metric ton, EURO4	ecoinvent 3.10	0.67/1000*6.2	t*km	transport, freight, lorry 3.5-7.5 metric ton, EURO4 transport, freight, lorry 3.5-7.5 metric ton, EURO4 Cutoff, U - RER	Electronics: Shipping from Meraville (Bologna, BO) to Salus Space, Bologna (BO).

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Process	Flow	Source	Amount	Unit	Provider	Description
Structure - Fertirrigation system (1/15*1/2)	transport, freight, lorry 3.5-7.5 metric ton, EURO4	ecoinvent 3.10	13.2/1000*6.2	t*km	transport, freight, lorry 3.5-7.5 metric ton, EURO4 transport, freight, lorry 3.5-7.5 metric ton, EURO4 Cutoff, U - RER	Pump: Shipping of water pump from Meraville (Bologna, BO) to Salus Space, Bologna (BO).
Structure - Fertirrigation system (1/15*1/2)	transport, freight, lorry 3.5-7.5 metric ton, EURO4	ecoinvent 3.10	4.98/1000*6.2	t*km	transport, freight, lorry 3.5-7.5 metric ton, EURO4 transport, freight, lorry 3.5-7.5 metric ton, EURO4 Cutoff, U - RER	Pipes: Shipping of pipes from Meraville (Bologna, BO) to Salus Space, Bologna (BO).
Structure - Lighting (1/6*1/2)	electronics, for control units	ecoinvent 3.10	0.2	kg	electronics production, for control units electronics, for control units Cutoff, U - RER	0.2 kg LEDs control station https://www.adsenergy.ru/en/products/light-emitting-diode-luminare-control-unit-lcu-d-01-plc/
Structure - Lighting (1/6*1/2)	light emitting diode	ecoinvent 3.10	0.35/1000*60*44	kg	light emitting diode production light emitting diode Cutoff, U - GLO	0.35 g per led * 60 leds per tray*44 trays
Structure - Lighting (1/6*1/2)	printed wiring board, for through-hole mounting, Pb containing surface	ecoinvent 3.10	1.25*0.79*44	m2	printed wiring board production, for through-hole mounting, Pb containing surface printed wiring board, for through-hole mounting, Pb	surface of 1 wiring board = (surface of 1 tray)

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Process	Flow	Source	Amount	Unit	Provider	Description
					containing surface Cutoff, U - GLO	
Stucture - Lighting (1/6*1/2)	transport, freight, lorry 3.5-7.5 metric ton, EURO4	ecoinvent 3.10	1.25*0.79*3.2 6*44/1000*24 4	t*km	transport, freight, lorry 3.5-7.5 metric ton, EURO4 transport, freight, lorry 3.5-7.5 metric ton, EURO4 Cutoff, U - RER	Shipping from Flytech (Belluno, BL) to Salus Space, Bologna (BO). https://www.flytech.it/scategoria_3_101_0_0_Accessori-Fly-Tech.html
Stucture - Lighting (1/6*1/2)	transport, freight, lorry 3.5-7.5 metric ton, EURO4	ecoinvent 3.10	0.2/1000*244	t*km	transport, freight, lorry 3.5-7.5 metric ton, EURO4 transport, freight, lorry 3.5-7.5 metric ton, EURO4 Cutoff, U - RER	Shipping from Flytech (Belluno, BL) to Salus Space, Bologna (BO). https://www.flytech.it/scategoria_3_101_0_0_Accessori-Fly-Tech.html
Stucture - Lighting (1/6*1/2)	transport, freight, lorry 3.5-7.5 metric ton, EURO4	ecoinvent 3.10	0.35/1000*60 *44/1000*244	t*km	transport, freight, lorry 3.5-7.5 metric ton, EURO4 transport, freight, lorry 3.5-7.5 metric ton, EURO4 Cutoff, U - RER	Shipping from Flytech (Belluno, BL) to Salus Space, Bologna (BO). https://www.flytech.it/scategoria_3_101_0_0_Accessori-Fly-Tech.html
Structure - Scaffolding (1/15*1/2)	electronics, for control units	ecoinvent 3.10		0.2 kg	electronics production, for control units electronics, for control units Cutoff, U - RER	0.2 kg LEDs control station https://www.adsenergy.ru/en/products/light-emitting-diode-luminare-control-unit-lcu-d-01-plc/

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Process	Flow	Source	Amount	Unit	Provider	Description
Structure - Scaffolding (1/15*1/2)	light emitting diode	ecoinvent 3.10	0.35/1000*60 *44	kg	light emitting diode production light emitting diode Cutoff, U - GLO	0.35 g per led * 60 leds per tray*44 trays
Structure - Scaffolding (1/15*1/2)	printed wiring board, for through-hole mounting, Pb containing surface	ecoinvent 3.10	1.25*0.79*44	m2	printed wiring board production, for through- hole mounting, Pb containing surface printed wiring board, for through-hole mounting, Pb containing surface Cutoff, U - GLO	surface of 1 wiring board = (surface of 1 tray)
Structure - Scaffolding (1/15*1/2)	transport, freight, lorry 3.5-7.5 metric ton, EURO4	ecoinvent 3.10	1.25*0.79*3.2 6*44/1000*24 4	t*km	transport, freight, lorry 3.5-7.5 metric ton, EURO4 transport, freight, lorry 3.5-7.5 metric ton, EURO4 Cutoff, U - RER	Shipping from Flytech (Belluno, BL) to Salus Space, Bologna (BO). https://www.fly- tech.it/scategoria_3_101_0_0_ Accessori-Fly-Tech.html
Structure - Scaffolding (1/15*1/2)	transport, freight, lorry 3.5-7.5 metric ton, EURO4	ecoinvent 3.10	0.2/1000*244	t*km	transport, freight, lorry 3.5-7.5 metric ton, EURO4 transport, freight, lorry 3.5-7.5 metric ton, EURO4 Cutoff, U - RER	Shipping from Flytech (Belluno, BL) to Salus Space, Bologna (BO). https://www.fly- tech.it/scategoria_3_101_0_0_ Accessori-Fly-Tech.html
Structure - Scaffolding (1/15*1/2)	transport, freight, lorry 3.5-7.5 metric ton, EURO4	ecoinvent 3.10	0.35/1000*60 *44/1000*244	t*km	transport, freight, lorry 3.5-7.5 metric ton, EURO4 transport, freight, lorry	Shipping from Flytech (Belluno, BL) to Salus Space, Bologna (BO). https://www.fly- tech.it/scategoria_3_101_0_0_ Accessori-Fly-Tech.html

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Process	Flow	Source	Amount	Unit	Provider	Description
					3.5-7.5 metric ton, EURO4 Cutoff, U - RER	tech.it/scategoria_3_101_0_0_ Accessori-Fly-Tech.html
Structure - Shipping container (1/30*1/2)	intermodal shipping container, 40-foot	ecoinvent 3.10		Item(1 s)	intermodal shipping container production, 40- foot intermodal shipping container, 40-foot Cutoff, U - GLO	
Structure - Shipping container (1/30*1/2)	transport, freight, lorry 3.5-7.5 metric ton, EURO4	ecoinvent 3.10	4*34	t*km	transport, freight, lorry 3.5-7.5 metric ton, EURO4 transport, freight, lorry 3.5-7.5 metric ton, EURO4 Cutoff, U - RER	Container transported from Bazzano (BO) to Salus Space, Bologna (BO) for 34 km

4. UNINA

Gli inventari per la struttura pilota di UNINA sono stati costruiti per un anno di coltivazione, con una produzione totale di **14.4kg di canapa**. Come riportato nel D4.2, gli input relativi ai consumabili sono relativi a un anno, mentre quelli relativi alla struttura sono stati considerati come rapporto tra la durata della valutazione (1 anno) e la durata di vita dei vari elementi (variabile, da 6 a 15 anni).



Process	Flow	Source	Amount	Unit	Provider	Description
Consumables - Fertilizers	ammonium nitrate	ecoinvent 3.10	0.38	kg	market for ammonium nitrate ammonium nitrate Cutoff, U - RER	
Consumables - Fertilizers	calcium nitrate	ecoinvent 3.10	3.724	kg	market for calcium nitrate calcium nitrate Cutoff, U - RER	
Consumables - Fertilizers	inorganic nitrogen fertiliser, as N	ecoinvent 3.10	3.05*0.108	kg	market for inorganic nitrogen fertiliser, as N inorganic nitrogen fertiliser, as N Cutoff, U - IT	from magnesium nitrate (10,8% N)
Consumables - Fertilizers	inorganic phosphorus fertiliser, as P2O5	ecoinvent 3.10	0.52*0.6365	kg	market for inorganic phosphorus fertiliser, as P2O5 inorganic phosphorus fertiliser, as P2O5 Cutoff, U - IT	inserted phosphorus content of monopotassic phosphate NPK (0-52-34)
Consumables - Fertilizers	inorganic potassium fertiliser, as K2O	ecoinvent 3.10	0.34*0.6365	kg	market for inorganic potassium fertiliser, as K2O inorganic potassium fertiliser, as K2O Cutoff, U - IT	inserted potassium content of monopotassic phosphate NPK (0-52-34)

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Process	Flow	Source	Amount	Unit	Provider	Description
Consumables - Fertilizers	magnesium oxide	ecoinvent 3.10	3.05*0.154	kg	market for magnesium oxide magnesium oxide Cutoff, U - GLO	from magnesium nitrate (15,4% MgO)
Consumables - Fertilizers	monoammonium phosphate	ecoinvent 3.10	0.5225	kg	market for monoammonium phosphate monoammonium phosphate Cutoff, U - RER	
Consumables - Fertilizers	potassium nitrate	ecoinvent 3.10	3.6385	kg	market for potassium nitrate potassium nitrate Cutoff, U - RER	
Consumables - Fertilizers	potassium sulfate	ecoinvent 3.10	1.254	kg	market for potassium sulfate potassium sulfate Cutoff, U - RER	
Consumables - Fertilizers	transport, freight, lorry 3.5-7.5 metric ton, EURO4	ecoinvent 3.10	13.25330/100 0*16.6	t*km	transport, freight, lorry 3.5-7.5 metric ton, EURO4 transport, freight, lorry 3.5-7.5 metric ton, EURO4 Cutoff, U - RER	Shipping from Leroy Merlin Afragola (NA) to Portici (NA)
Consumables - Electricity	electricity, medium voltage	ecoinvent 3.10	87360	kWh	electricity voltage transformation from high to medium voltage	Electricity for climate control

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Process	Flow	Source	Amount	Unit	Provider	Description
					electricity, medium voltage Cutoff, U - IT	
Consumables - Other consumables	packaging, for fertilisers or pesticides	ecoinvent 3.10	33*16/8	kg	market for packaging, for fertilisers or pesticides packaging, for fertilisers or pesticides Cutoff, U - GLO	packaging for perlite
Consumables - Other consumables	perlite	ecoinvent 3.10	33*16/8	kg		33 liters of perlite, for 16m2, weighting 1kg for 8 liters https://www.geosism.com/terr Ricci-substrati-inerti/171-perlite--agriperlite-2-6-mm--1-kg---c-ca-8--lt--detail#:~:text=L'agriperlite%20%C3%A8%20un%20prodotto, stabile%2C%20chimicamente%20inerte%2C%20sterilizzata
Consumables - Other consumables	tap water	ecoinvent 3.10	4200	kg		
Consumables - Other consumables	transport, freight, lorry 3.5-7.5 metric ton, EURO4	ecoinvent 3.10	33*16/8/1000 *16.6	t*km	transport, freight, lorry 3.5-7.5 metric ton, EURO4 transport, freight, lorry 3.5-7.5 metric ton, EURO4 Cutoff, U - RER	Shipping of perlite from Leroy Merlin Afragola (NA) to Portici (NA)

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Process	Flow	Source	Amount	Unit	Provider	Description
Consumables - Other consumables	Seeds	Modelled	40.02*16	Item(s)	UNINA_seeds	no data, left for reference
Consumables - Other consumables	Carbon dioxide, in air	ecoinvent	60	kg		Proxy for artificially added CO2 in the system
Structure - Fertirrigation system (1/15)	electronics, for control units	ecoinvent	0.67	kg	electronics production, for control units electronics, for control units Cutoff, U - RER	0.67 kg water control station https://www.amazon.it/Kazeila-Digitale-Irrigazione-Programmabile-Automatica/dp/B0CNX3TB1J/ref=asc_df_B09MLQHFSV/?tag=googshopit-21&linkCode=df0&hvadid=700970681663&hvpos=&hvnetw=g&hvrnd=15497137456651263870&hvpone=&hvptwo=&hvqmt=&hvdev=c&hvdvcmdl=&hvlocint=&hvlocphy=1008141&hvtargid=pla-1646185588017&mcid=eb4f56f78a8c333ab16705804968c826&gad_source=1&th=1
Structure - Fertirrigation system (1/15)	extrusion of plastic sheets and thermoforming, inline	ecoinvent	8.5	kg	extrusion of plastic sheets and thermoforming, inline extrusion of plastic sheets and	8.5 kgs for tanks https://www.obal-centrum.com/pe-sud-220-l-

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Process	Flow	Source	Amount	Unit	Provider	Description
					thermoforming, inline Cutoff, U - FR	garden-green-580-x-1000-mm-including-plastic-screen-6-5kg
Structure - Fertirrigation system (1/15)	extrusion, plastic pipes	ecoinvent 3.10	0.734	kg	extrusion, plastic pipes extrusion, plastic pipes Cutoff, U - RER	Extrusion for plastic pipes Parameters Lenght vertical pipes: 0.9 m Number of vert.pipes: 4 Lenght of horizontal pipes: 3.2m Number of horiz. pipes: 4 Density PVC for pipes: 950kg/m3 Diameter (internal): 14mm Volume (chatgpt)= 0.0007728 m3 Weight: volume*density=0,734 kgs
Structure - Fertirrigation system (1/15)	polyvinylchloride, emulsion polymerised	ecoinvent 3.10	$1 \cdot (1/0.94) \cdot 8.5$	kg	polyvinylchloride production, emulsion polymerisation polyvinylchloride, emulsion polymerised Cutoff, U - RER	1kg of pellet = 0.94 kg of plastic sheet fo tanks
Structure - Fertirrigation system (1/15)	polyvinylchloride, emulsion polymerised	ecoinvent 3.10	$1 \cdot (1/0.94) \cdot 0.7$ 34	kg	polyvinylchloride production, emulsion polymerisation polyvinylchloride, emulsion polymerised Cutoff, U - RER	1kg of pellet = 0.94 kg of plastic sheet for pipes

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Process	Flow	Source	Amount	Unit	Provider	Description
Structure - Fertirrigation system (1/15)	pump, 40W	ecoinvent 3.10	900/40	Item(s)	pump production, 40W pump, 40W Cutoff, U - RoW	Upscaled for higher powerful pump (900w) https://www.agrieuro.com/gar dena-5600-silent-pompa-elettrica-per-irrigazione-da-giardino-900-p-43034.html?gad_source=1&gclid=Cj0KCQjwkdO0BhDxARIsANkNcrd6mO68xkadNPs4pjY4Mb1lfhtNVYFXP7xPxp450VzA59cJB2fO0aAjxqEALw_wcB
Structure - Fertirrigation system (1/15)	transport, freight, lorry 3.5-7.5 metric ton, EURO4	ecoinvent 3.10	8.5/1000*16.4	t*km	transport, freight, lorry 3.5-7.5 metric ton, EURO4 transport, freight, lorry 3.5-7.5 metric ton, EURO4 Cutoff, U - RER	Tank: Shipping from Leroy Merlin Afragola (NA) to Portici (NA) https://www.leroymerlin.it/prodotti/giardino-e-terrazzo/irrigazione/pompe-per-acqua/serbatoi-recupero-acqua-piovana/serbatoio-esterno-valigia-blu-500-l-82431280.html
Structure - Fertirrigation system (1/15)	transport, freight, lorry 3.5-7.5 metric ton, EURO4	ecoinvent 3.10	0.73/1000*16.4	t*km	transport, freight, lorry 3.5-7.5 metric ton, EURO4 transport, freight, lorry	Pipes: Shipping from Leroy Merlin Afragola (NA) to Portici (NA)

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Process	Flow	Source	Amount	Unit	Provider	Description
					3.5-7.5 metric ton, EURO4 Cutoff, U - RER	
Structure - Fertirrigation system (1/15)	transport, freight, lorry 3.5-7.5 metric ton, EURO4	ecoinvent 3.10	0.67/1000*16. 4	t*km	transport, freight, lorry 3.5-7.5 metric ton, EURO4 transport, freight, lorry 3.5-7.5 metric ton, EURO4 Cutoff, U - RER	Electronics: Shipping from Leroy Merlin Afragola (NA) to Portici (NA)
Structure - Fertirrigation system (1/15)	transport, freight, lorry 3.5-7.5 metric ton, EURO4	ecoinvent 3.10	13.2/1000*16. 4	t*km	transport, freight, lorry 3.5-7.5 metric ton, EURO4 transport, freight, lorry 3.5-7.5 metric ton, EURO4 Cutoff, U - RER	Pump: Shipping of water pump from Meraville (Bologna, BO) to Salus Space, Bologna (BO).
Structure - Growtable (1/15)	extrusion of plastic sheets and thermoforming, inline	ecoinvent 3.10	48*1400*((0.12+0.15)*0.20/2*0.001)*4+(0.12*0.12*0.001)	kg	extrusion of plastic sheets and thermoforming, inline extrusion of plastic sheets and thermoforming, inline Cutoff, U - FR	Density (d) PVC: https://www.chimica-online.it/download/peso-specifico-pvc.htm weight 1 vase: d*volume 1400*[(0.12+0.15)*0.20/2*0.001]*4+[(0.12*0.12*0.001)]*4 8 trays
Structure - Growtable (1/15)	polyvinylchloride, emulsion polymerised	ecoinvent 3.10	48*1400*((0.12+0.15)*0.20/2*0.001)*4+(0	kg	polyvinylchloride production, emulsion polymerisation polyvinylchloride,	1kg of pellet = 0.94 kg of plastic sheet

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Process	Flow	Source	Amount	Unit	Provider	Description
			.12*0.12*0.00 1)/0.94		emulsion polymerised Cutoff, U - RER	
Structure - Growtable (1/15)	steel, low-alloyed	ecoinvent 3.10	((0.09*0.09*0.9*4)- (0.085*0.085*0.9*4))*8000+ (3.2*1.2*0.005*8000)*2	kg	steel production, electric, low-alloyed steel, low- alloyed Cutoff, U - Europe without Switzerland and Austria	Weight of a standard steel growtable https://www.greenhousemega store.com/products/fixed- steel-greenhouse- bench?variant=427011967879 11 weight legs=[(0.09*0.09*0.9*4)- (0.085*0.085*0.9*4)]*8000=2 2.8 weight table top=3.2*1.2*0.05*8000=307. 2 total weight: 307.2+22.8=330
Structure - Growtable (1/15)	transport, freight, lorry 3.5-7.5 metric ton, EURO4	ecoinvent 3.10	48*1400*((0.1 2+0.15)*0.20/ 2*0.001)*4+(0 .12*0.12*0.00 1)/1000*16.6	t*km	transport, freight, lorry 3.5-7.5 metric ton, EURO4 transport, freight, lorry 3.5-7.5 metric ton, EURO4 Cutoff, U - RER	Shipping from Leroy Merlin Afragola (NA) to Portici (NA)
Structure - Growtable (1/15)	transport, freight, lorry 3.5-7.5 metric ton, EURO4	ecoinvent 3.10	330*16.6	t*km	transport, freight, lorry 3.5-7.5 metric ton, EURO4 transport, freight, lorry 3.5-7.5 metric ton, EURO4 Cutoff, U - RER	Shipping from Leroy Merlin Afragola (NA) to Portici (NA)

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Process	Flow	Source	Amount	Unit	Provider	Description
Stucture - Lighting (1/6)	electronics, for control units	ecoinvent 3.10	0.2	kg	electronics production, for control units electronics, for control units Cutoff, U - RER	0.2 kg LEDs control station https://www.adsenergy.ru/en/products/light-emitting-diode-luminare-control-unit-lcu-d-01-plc/
Stucture - Lighting (1/6)	light emitting diode	ecoinvent 3.10	0.35/1000*20 *60	kg	light emitting diode production light emitting diode Cutoff, U - GLO	0.00035 kg per led (0.35g/1000) * 20 led per line* 60 lines
Stucture - Lighting (1/6)	printed wiring board, for through-hole mounting, Pb containing surface	ecoinvent 3.10	3.6*2	m2	printed wiring board production, for through-hole mounting, Pb containing surface printed wiring board, for through-hole mounting, Pb containing surface Cutoff, U - GLO	surface of 1 wiring board = surface of 1 bench of the growtable
Stucture - Lighting (1/6)	transport, freight, lorry 3.5-7.5 metric ton, EURO4	ecoinvent 3.10	0.2/1000*807	t*km	transport, freight, lorry 3.5-7.5 metric ton, EURO4 transport, freight, lorry 3.5-7.5 metric ton, EURO4 Cutoff, U - RER	Shipping from Flytech (Belluno, BL) to Portici (NA). https://www.flytech.it/scategoria_3_101_0_0_Accessori-Fly-Tech.html
Stucture - Lighting (1/6)	transport, freight, lorry 3.5-7.5 metric ton, EURO4	ecoinvent 3.10	0.35/1000*20 *60/1000*807	t*km	transport, freight, lorry 3.5-7.5 metric ton, EURO4 transport, freight, lorry	Shipping from Flytech (Belluno, BL) to Portici (NA). https://www.fly-

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Process	Flow	Source	Amount	Unit	Provider	Description
					3.5-7.5 metric ton, EURO4 Cutoff, U - RER	tech.it/scategoria_3_101_0_0_Accessori-Fly-Tech.html
Stucture - Lighting (1/6)	transport, freight, lorry 3.5-7.5 metric ton, EURO4	ecoinvent 3.10	3.6*2*3.26/10 00*807	t*km	transport, freight, lorry 3.5-7.5 metric ton, EURO4 transport, freight, lorry 3.5-7.5 metric ton, EURO4 Cutoff, U - RER	Shipping from Flytech (Belluno, BL) to Portici (NA). https://www.fly-tech.it/scategoria_3_101_0_0_Accessori-Fly-Tech.html

5. UNIPD

Gli inventari per la struttura pilota di UNIPD sono stati costruiti per un anno di coltivazione, con una produzione totale di **129.6 kg di lattuga**. Come riportato nel D4.2, gli input relativi ai consumabili sono relativi a un anno, mentre quelli relativi alla struttura sono stati considerati come rapporto tra la durata della valutazione (1 anno) e la durata di vita dei vari elementi (variabile, da 6 a 15 anni). L'occupazione della serra è stata stimata a 8m2 di impronta al suolo.

Process	Flow	Source	Amount	Unit	Provider	Description
Consumables - Fertilizers	calcium nitrate	ecoinvent 3.10	0.798	kg	market for calcium nitrate calcium nitrate Cutoff, U - RER	
Consumables - Fertilizers	iron sulfate	ecoinvent 3.10	0.966643	kg		

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Process	Flow	Source	Amount	Unit	Provider	Description
Consumables - Fertilizers	magnesium sulfate	ecoinvent 3.10	0.966643	kg		
Consumables - Fertilizers	potassium sulfate	ecoinvent 3.10	0.268714	kg	market for potassium sulfate potassium sulfate Cutoff, U - RER	
Consumables - Fertilizers	transport, freight, lorry 3.5-7.5 metric ton, EURO4	ecoinvent 3.10	3/1000*14	t*km	transport, freight, lorry 3.5-7.5 metric ton, EURO4 transport, freight, lorry 3.5-7.5 metric ton, EURO4 Cutoff, U - RER	Shipping from Eurobrico Padova (PD) to Legnaro (PD)
Consumables - Electricity	electricity, medium voltage	ecoinvent 3.10	907	kWh	electricity voltage transformation from high to medium voltage electricity, medium voltage Cutoff, U - IT	Electricity for water refreshment
Consumables - Electricity	electricity, medium voltage	ecoinvent 3.10	718	kWh	electricity voltage transformation from high to medium voltage electricity, medium voltage Cutoff, U - IT	Electricity for pumps
Consumables - Other consumables	tap water	ecoinvent 3.10	3200	kg	market for tap water tap water Cutoff, U - Europe without Switzerland	

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Process	Flow	Source	Amount	Unit	Provider	Description
Consumables - Other consumables	Seedlings	Modelled	432	Item(s)	UNIPD_seedlings	
Structure - Electronics (1/6)	electronics, for control units	ecoinvent 3.10	3	kg	electronics production, for control units electronics, for control units Cutoff, U - RER	different electronics from TECO TK 1000H (cooler) (considered 3Kg on 19.7Kg for the total weight of the product)
Structure - Electronics (1/6)	pump, 40W	ecoinvent 3.10	58/40	Item(s)	pump production, 40W pump, 40W Cutoff, U - RoW	Upscaled for higher powerful pump (58w) https://www.newa.it/prodotto/newa-jet-4500-6000-8000/
Structure - Electronics (1/6)	pump, 40W	ecoinvent 3.10	38/40	Item(s)	pump production, 40W pump, 40W Cutoff, U - RoW	Upscaled for higher powerful pump (38w) https://www.newa.it/prodotto/newa-jet-4500-6000-8000/
Structure - Electronics (1/6)	transport, freight, lorry 3.5-7.5 metric ton, EURO4	ecoinvent 3.10	2*3/1000*602	t*km	transport, freight, lorry 3.5-7.5 metric ton, EURO4 transport, freight, lorry 3.5-7.5 metric ton, EURO4 Cutoff, U - RER	Shipping of 2 pumps from Agricoltura2punto0 (Cassino, FR) to Legnaro (PD). https://www.agricoltura2punto0.it/contatti-impattozero-acquaponica/
Structure - Electronics (1/6)	transport, freight, lorry 3.5-7.5 metric ton, EURO4	ecoinvent 3.10	3/1000*602	t*km	transport, freight, lorry 3.5-7.5 metric ton, EURO4 transport, freight, lorry	Shipping of electronics from Agricoltura2punto0 (Cassino, FR) to Legnaro (PD). https://www.agricoltura2punto0.it/contatti-impattozero-acquaponica/

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Process	Flow	Source	Amount	Unit	Provider	Description
					3.5-7.5 metric ton, EURO4 Cutoff, U - RER	0.it/contatti-impattozero-acquaponica/
Structure - Pipes (1/15)	extrusion, plastic pipes	ecoinvent 3.10	3.25	kg	extrusion, plastic pipes extrusion, plastic pipes Cutoff, U - RER	Extrusion for plastic pipes Parameters Lenght pipes: 3m Number of vert.pipes: 1 Density PVC for pipes: 950kg/m3 Diameter (internal): 125mm External volume pipe: 0.0368 m3 Internal volume pipe: 0.03339 m3 Total PVC volume: 0.00342 m3 Weight: volume*density=3.25 kg
Structure - Pipes (1/15)	extrusion, plastic pipes	ecoinvent 3.10	0.51	kg	extrusion, plastic pipes extrusion, plastic pipes Cutoff, U - RER	Extrusion for irrigation plastic pipes Parameters Weight = 0.51 kg
Structure - Pipes (1/15)	polyvinylchloride, emulsion polymerised	ecoinvent 3.10	1*(1/0.94)*3.2 5	kg	polyvinylchloride production, emulsion polymerisation polyvinylchloride, emulsion polymerised Cutoff, U - RER	1kg of pellet = 0.94 kg of plastic sheet for pipes

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Process	Flow	Source	Amount	Unit	Provider	Description
Structure - Pipes (1/15)	polyvinylchloride, emulsion polymerised	ecoinvent 3.10	$1 \cdot (1/0.94) \cdot 0.5$ 1	kg	polyvinylchloride production, emulsion polymerisation polyvinylchloride, emulsion polymerised Cutoff, U - RER	1kg of pellet = 0.94 kg of plastic sheet for pipes
Structure - Pipes (1/15)	transport, freight, lorry 3.5-7.5 metric ton, EURO4	ecoinvent 3.10	$3.25/1000 \cdot 60$ 2	t*km	transport, freight, lorry 3.5-7.5 metric ton, EURO4 transport, freight, lorry 3.5-7.5 metric ton, EURO4 Cutoff, U - RER	Shipping of tank from Agricoltura2punto0 (Cassino, FR) to Legnaro (PD). https://www.agricoltura2punto0.it/contatti-impattozero-acquaponica/
Structure - Pipes (1/15)	transport, freight, lorry 3.5-7.5 metric ton, EURO4	ecoinvent 3.10	$0.51/1000 \cdot 60$ 2	t*km	transport, freight, lorry 3.5-7.5 metric ton, EURO4 transport, freight, lorry 3.5-7.5 metric ton, EURO4 Cutoff, U - RER	Shipping of tank from Agricoltura2punto0 (Cassino, FR) to Legnaro (PD). https://www.agricoltura2punto0.it/contatti-impattozero-acquaponica/
Structure - Steel structure (1/15)	steel, low-alloyed	ecoinvent 3.10	$15.6 \cdot 0.418$	kg	steel production, electric, low-alloyed steel, low-alloyed Cutoff, U - Europe without Switzerland and Austria	Steel structure: https://www.leroymerlin.it/prodotti/ferramenta/profilati-lamiere-e-griglie-di-aerazione/profilati-e-accessori/profilo-standers-in-acciaio-galvanizzato-grigio-

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Process	Flow	Source	Amount	Unit	Provider	Description
						opaco-l1m-l23-5xsp1-2xh23-5-mm-36504783.html total lenght: 15.6m weight: 0.418 kg/m
Structure - Steel structure (1/15)	transport, freight, lorry 3.5-7.5 metric ton, EURO4	ecoinvent 3.10	15.6*0.418/100*602	t*km	transport, freight, lorry 3.5-7.5 metric ton, EURO4 transport, freight, lorry 3.5-7.5 metric ton, EURO4 Cutoff, U - RER	Shipping of tank from Agricoltura2punto0 (Cassino, FR) to Legnaro (PD). https://www.agricoltura2punto0.it/contatti-impattozero-acquaponica/
Structure - Tanks (1/15)	extrusion of plastic sheets and thermoforming, inline	ecoinvent 3.10	21.2	kg	extrusion of plastic sheets and thermoforming, inline extrusion of plastic sheets and thermoforming, inline Cutoff, U - FR	21.2 kgs for tanks https://www.obal-centrum.com/pe-sud-500-l-garden-green-880-x-720-x-1080-mm-including-plastics-screen
Structure - Tanks (1/15)	extrusion of plastic sheets and thermoforming, inline	ecoinvent 3.10	8.5	kg	extrusion of plastic sheets and thermoforming, inline extrusion of plastic sheets and thermoforming, inline Cutoff, U - FR	8,5 kgs for tanks https://www.obal-centrum.com/pe-sud-220-l-garden-green-580-x-1000-mm-including-plastic-screen-6-5kg Pipes are considered in the general structure

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Process	Flow	Source	Amount	Unit	Provider	Description
Structure - Tanks (1/15)	extrusion of plastic sheets and thermoforming, inline	ecoinvent 3.10	3.1	kg	extrusion of plastic sheets and thermoforming, inline extrusion of plastic sheets and thermoforming, inline Cutoff, U - FR	3.1 kgs for tanks https://www.obal-centrum.com/hdpe-plastic-sud-120l-green-screw-viko-3-1-kg
Structure - Tanks (1/15)	polyvinylchloride, emulsion polymerised	ecoinvent 3.10	$1 \cdot (1/0.94) \cdot 21.2$	kg	polyvinylchloride production, emulsion polymerisation polyvinylchloride, emulsion polymerised Cutoff, U - RER	1kg of pellet = 0.94 kg of plastic sheet fo tanks
Structure - Tanks (1/15)	polyvinylchloride, emulsion polymerised	ecoinvent 3.10	$1 \cdot (1/0.94) \cdot 8.5$	kg	polyvinylchloride production, emulsion polymerisation polyvinylchloride, emulsion polymerised Cutoff, U - RER	1kg of pellet = 0.94 kg of plastic sheet fo tanks
Structure - Tanks (1/15)	polyvinylchloride, emulsion polymerised	ecoinvent 3.10	$1 \cdot (1/0.94) \cdot 3.1$	kg	polyvinylchloride production, emulsion polymerisation polyvinylchloride, emulsion polymerised Cutoff, U - RER	1kg of pellet = 0.94 kg of plastic sheet fo tanks

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Process	Flow	Source	Amount	Unit	Provider	Description
Structure - Tanks (1/15)	transport, freight, lorry 3.5-7.5 metric ton, EURO4	ecoinvent 3.10	21.2/1000*60 2	t*km	transport, freight, lorry 3.5-7.5 metric ton, EURO4 transport, freight, lorry 3.5-7.5 metric ton, EURO4 Cutoff, U - RER	Tank: Shipping of tank from Agricoltura2punto0 (Cassino, FR) to Legnaro (PD). https://www.agricoltura2punto0.it/contatti-impattozero-acquaponica/
Structure - Tanks (1/15)	transport, freight, lorry 3.5-7.5 metric ton, EURO4	ecoinvent 3.10	8.5/1000*602	t*km	transport, freight, lorry 3.5-7.5 metric ton, EURO4 transport, freight, lorry 3.5-7.5 metric ton, EURO4 Cutoff, U - RER	Tank: Shipping of tank from Agricoltura2punto0 (Cassino, FR) to Legnaro (PD). https://www.agricoltura2punto0.it/contatti-impattozero-acquaponica/
Structure - Tanks (1/15)	transport, freight, lorry 3.5-7.5 metric ton, EURO4	ecoinvent 3.10	3.1/1000*602	t*km	transport, freight, lorry 3.5-7.5 metric ton, EURO4 transport, freight, lorry 3.5-7.5 metric ton, EURO4 Cutoff, U - RER	Tank: Shipping of tank from Agricoltura2punto0 (Cassino, FR) to Legnaro (PD). https://www.agricoltura2punto0.it/contatti-impattozero-acquaponica/
Structure - Towers (1/15)	extrusion, plastic pipes	ecoinvent 3.10	7.75	kg	extrusion, plastic pipes extrusion, plastic pipes Cutoff, U - RER	Extrusion for aquaponic towers Parameters: Length vertical pipes: 1.6m Number of vert.pipes: 9 Density PVC for pipes: 950kg/m3 Diameter (internal): 0.444 m External volume pipe: 0.256 m3

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Process	Flow	Source	Amount	Unit	Provider	Description
						Internal volume pipe: 0.24784 m3 Total PVC volume: 0.00816 m3 Weight: volume*density=7.75 kg
Structure - Towers (1/15)	polyvinylchloride, emulsion polymerised	ecoinvent 3.10	1*(1/0.94)*7.75 5	kg	polyvinylchloride production, emulsion polymerisation polyvinylchloride, emulsion polymerised Cutoff, U - RER	1kg of pellet = 0.94 kg of plastic sheet for tanks
Structure - Towers (1/15)	transport, freight, lorry 3.5-7.5 metric ton, EURO4	ecoinvent 3.10	7.75/1000*60 2	t*km	transport, freight, lorry 3.5-7.5 metric ton, EURO4 transport, freight, lorry 3.5-7.5 metric ton, EURO4 Cutoff, U - RER	aquaponic towers : Shipping of aquaponic towers from Agricoltura2punto0 (Cassino, FR) to Legnaro (PD). https://www.agricoltura2punto0.it/contatti-impattozero-acquaponica/

6. UNITO

Gli inventari per la struttura pilota di UNITO sono stati costruiti per un anno di coltivazione, con una produzione totale di **44.78kg di basilico**. Come riportato nel D4.2, gli input relativi ai consumabili sono relativi a un anno, mentre quelli relativi alla struttura sono stati considerati come rapporto tra la durata della valutazione (1 anno) e la durata di vita dei vari elementi (variabile, da 6 a 15 anni).



Process	Flow	Source	Amount	Unit	Provider	Description
Consumables - Fertilizers	ammonium nitrate	ecoinvent 3.10	0.38	kg	market for ammonium nitrate ammonium nitrate Cutoff, U - RER	
Consumables - Fertilizers	calcium nitrate	ecoinvent 3.10	3.724	kg	market for calcium nitrate calcium nitrate Cutoff, U - RER	
Consumables - Fertilizers	inorganic nitrogen fertiliser, as N	ecoinvent 3.10	3.05*0.108	kg	market for inorganic nitrogen fertiliser, as N inorganic nitrogen fertiliser, as N Cutoff, U - IT	from magnesium nitrate (10,8% N)
Consumables - Fertilizers	inorganic phosphorus fertiliser, as P2O5	ecoinvent 3.10	0.52*0.6365	kg	market for inorganic phosphorus fertiliser, as P2O5 inorganic phosphorus fertiliser, as P2O5 Cutoff, U - IT	inserted phosphorus content of monopotassium phosphate NPK (0-52-34)
Consumables - Fertilizers	inorganic potassium fertiliser, as K2O	ecoinvent 3.10	0.34*0.6365	kg	market for inorganic potassium fertiliser, as K2O inorganic potassium fertiliser, as K2O Cutoff, U - IT	inserted potassium content of monopotassium phosphate NPK (0-52-34)

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Process	Flow	Source	Amount	Unit	Provider	Description
Consumables - Fertilizers	magnesium oxide	ecoinvent 3.10	3.05*0.154	kg	market for magnesium oxide magnesium oxide Cutoff, U - GLO	from magnesium nitrate (15,4% MgO)
Consumables - Fertilizers	monoammonium phosphate	ecoinvent 3.10	0.5225	kg	market for monoammonium phosphate monoammonium phosphate Cutoff, U - RER	
Consumables - Fertilizers	potassium nitrate	ecoinvent 3.10	3.6385	kg	market for potassium nitrate potassium nitrate Cutoff, U - RER	
Consumables - Fertilizers	potassium sulfate	ecoinvent 3.10	1.254	kg	market for potassium sulfate potassium sulfate Cutoff, U - RER	
Consumables - Fertilizers	transport, freight, lorry 3.5-7.5 metric ton, EURO4	ecoinvent 3.10	13.25330/100 0*7.4	t*km	transport, freight, lorry 3.5-7.5 metric ton, EURO4 transport, freight, lorry 3.5-7.5 metric ton, EURO4 Cutoff, U - RER	Shipping from Leroy Merlin Collegno (TO) to Grugliasco (TO)
Consumables - Electricity	electricity, medium voltage	ecoinvent 3.10	2336	kWh	electricity voltage transformation from high to medium voltage	Electricity for lighting

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Process	Flow	Source	Amount	Unit	Provider	Description
					electricity, medium voltage Cutoff, U - IT	
Consumables - Electricity	electricity, medium voltage	ecoinvent 3.10	163.52	kWh	electricity voltage transformation from high to medium voltage electricity, medium voltage Cutoff, U - IT	Electricity for humidifier
Consumables - Electricity	electricity, medium voltage	ecoinvent 3.10	5694	kWh	electricity voltage transformation from high to medium voltage electricity, medium voltage Cutoff, U - IT	Electricity for climate control
Consumables - Electricity	electricity, medium voltage	ecoinvent 3.10	420.48	kWh	electricity voltage transformation from high to medium voltage electricity, medium voltage Cutoff, U - IT	Electricity for fertirrigator
Consumables - Electricity	electricity, medium voltage	ecoinvent 3.10	481.8	kWh	electricity voltage transformation from high to medium voltage electricity, medium voltage Cutoff, U - IT	Electricity for pump

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Process	Flow	Source	Amount	Unit	Provider	Description
Consumables - Other consumables	stone wool, packed	ecoinvent 3.10	0.38*7	kg	stone wool production, packed stone wool, packed Cutoff, U - CH	0.38kg (1 package) * 7 packages https://www.growland.it/Vas-soio-Grodan-con-cubetti-da-2-x-2-cm-150-cubetti?gad_source=1&gclid=CjwKCAjw9cCyBhBzEiwAJT UWNbjBDyqj9ixjGJsOATG7d 5iGpPBbVHqHnQe_6LFm6ZJ Da1xWoXo44xoC89gQAvD_BwE
Consumables - Other consumables	tap water	ecoinvent 3.10	220*11	kg	market for tap water tap water Cutoff, U - CH	220 liters * 11 cycles
Consumables - Other consumables	transport, freight, lorry 3.5-7.5 metric ton, EURO4	ecoinvent 3.10	2.44/1000*12 39	t*km	transport, freight, lorry 3.5-7.5 metric ton, EURO4 transport, freight, lorry 3.5-7.5 metric ton, EURO4 Cutoff, U - RER	Shipping stone wool from Hamburg (Germany) to Grugliasco (TO)
Consumables - Other consumables	Seeds	Modelled	3840*11	Item(s)	UNITO_seeds	3840 seeds * 11 cycles
Structure - Lighting (1/6)	electronics, for control units	ecoinvent 3.10	0.5	kg	electronics production, for control units electronics, for control units Cutoff, U - RER	different electronics from NidoPro: 0.2 kg smart plug+0.2 kg nido camera+0.1 sensor for humidity and temperature

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Process	Flow	Source	Amount	Unit	Provider	Description
						https://www.nidopro.com/it/prodotto/smart-plug-nido/ https://www.nidopro.com/it/prodotto/nido-camera/
Stucture - Lighting (1/6)	electronics, for control units	ecoinvent 3.10	0.2	kg	electronics production, for control units electronics, for control units Cutoff, U - RER	0.2 kg LEDs control station https://www.adsenergy.ru/en/products/light-emitting-diode-luminare-control-unit-lcu-d-01-plc/
Stucture - Lighting (1/6)	light emitting diode	ecoinvent 3.10	0.35/1000*8*10*4	kg	light emitting diode production light emitting diode Cutoff, U - GLO	0.35 g per led * 10 leds per tube*8 tubes*4 trays
Stucture - Lighting (1/6)	printed wiring board, for through-hole mounting, Pb containing surface	ecoinvent 3.10	1.2*0.9*4	m2	printed wiring board production, for through-hole mounting, Pb containing surface printed wiring board, for through-hole mounting, Pb containing surface Cutoff, U - GLO	surface of 1 wiring board = surface of 1 tray total surface=surface 1 tray *n trays (4)
Stucture - Lighting (1/6)	transport, freight, lorry 3.5-7.5 metric ton, EURO4	ecoinvent 3.10	0.5/1000*145	t*km	transport, freight, lorry 3.5-7.5 metric ton, EURO4 transport, freight, lorry	Shipping from NidoPro (Gallarate, VA) to Grugliasco (TO). https://www.nidopro.com/it

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Process	Flow	Source	Amount	Unit	Provider	Description
					3.5-7.5 metric ton, EURO4 Cutoff, U - RER	
Stucture - Lighting (1/6)	transport, freight, lorry 3.5-7.5 metric ton, EURO4	ecoinvent 3.10	0.2/1000*149 2	t*km	transport, freight, lorry 3.5-7.5 metric ton, EURO4 transport, freight, lorry 3.5-7.5 metric ton, EURO4 Cutoff, U - RER	Shipping from Flytech (Belluno, BL) to Grugliasco (TO). https://www.fly-tech.it/scategoria_3_101_0_0_Accessori-Fly-Tech.html
Stucture - Lighting (1/6)	transport, freight, lorry 3.5-7.5 metric ton, EURO4	ecoinvent 3.10	0.35/1000*8* 10/1000*1492	t*km	transport, freight, lorry 3.5-7.5 metric ton, EURO4 transport, freight, lorry 3.5-7.5 metric ton, EURO4 Cutoff, U - RER	Shipping from Flytech (Belluno, BL) to Grugliasco (TO) https://www.fly-tech.it/scategoria_3_101_0_0_Accessori-Fly-Tech.html
Stucture - Lighting (1/6)	transport, freight, lorry 3.5-7.5 metric ton, EURO4	ecoinvent 3.10	1.2*0.9*4/100 0*1492	t*km	transport, freight, lorry 3.5-7.5 metric ton, EURO4 transport, freight, lorry 3.5-7.5 metric ton, EURO4 Cutoff, U - RER	Shipping from Flytech (Belluno, BL) to Grugliasco (TO). https://www.fly-tech.it/scategoria_3_101_0_0_Accessori-Fly-Tech.html
Structure - Fertirrigation system (1/15)	extrusion of plastic sheets and thermoforming, inline	ecoinvent 3.10	8.5	kg	extrusion of plastic sheets and thermoforming, inline extrusion of plastic sheets and thermoforming, inline Cutoff, U - FR	8,5 kgs for tanks https://www.obal-centrum.com/pe-sud-220-l-garden-green-580-x-1000-mm-including-plastic-screen-6-5kg Pipes are considered in the general structure

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Process	Flow	Source	Amount	Unit	Provider	Description
Structure - Fertirrigation system (1/15)	polyvinylchloride, emulsion polymerised	ecoinvent 3.10	1*(1/0.94)*8.5	kg	polyvinylchloride production, emulsion polymerisation polyvinylchloride, emulsion polymerised Cutoff, U - RER	1kg of pellet = 0.94 kg of plastic sheet fo tanks
Structure - Fertirrigation system (1/15)	pump, 40W	ecoinvent 3.10	40/30	Item(s)	pump production, 40W pump, 40W Cutoff, U - RoW	Primary data: https://www.nidopro.com/it/prodotto/nido/ Upscaled for higher powerful pump (900w), considered on maximum power of 30W
Structure - Fertirrigation system (1/15)	transport, freight, lorry 3.5-7.5 metric ton, EURO4	ecoinvent 3.10	5/1000*145	t*km	transport, freight, lorry 3.5-7.5 metric ton, EURO4 transport, freight, lorry 3.5-7.5 metric ton, EURO4 Cutoff, U - RER	Pump: Shipping of water pump from NidoPro (Gallarate, VA) to Grugliasco (TO) Weight: https://www.nidopro.com/it/prodotto/nido/
Structure - Fertirrigation system (1/15)	transport, freight, lorry 3.5-7.5 metric ton, EURO4	ecoinvent 3.10	8.5/1000*145	t*km	transport, freight, lorry 3.5-7.5 metric ton, EURO4 transport, freight, lorry 3.5-7.5 metric ton, EURO4 Cutoff, U - RER	tank: Shipping of tanks from Collegno (TO) to Grugliasco (TO)

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Process	Flow	Source	Amount	Unit	Provider	Description
Structure - Radix (1/15)	extrusion of plastic sheets and thermoforming, inline	ecoinvent 3.10	13.5	kg	extrusion of plastic sheets and thermoforming, inline extrusion of plastic sheets and thermoforming, inline Cutoff, U - FR	PVC structure https://virextech.com/product/radix-module/?lang=en
Structure - Radix (1/15)	polyvinylchloride, emulsion polymerised	ecoinvent 3.10	$(1/0.94) * 13.5$	kg	polyvinylchloride production, emulsion polymerisation polyvinylchloride, emulsion polymerised Cutoff, U - RER	1kg of pellet = 0.94 kg of plastic sheet
Structure - Radix (1/15)	transport, freight, lorry 3.5-7.5 metric ton, EURO4	ecoinvent 3.10	$13.5/1000 * 14$ 94	t*km	transport, freight, lorry 3.5-7.5 metric ton, EURO4 transport, freight, lorry 3.5-7.5 metric ton, EURO4 Cutoff, U - RER	Shipping from Lorca (Murcia, ES) to Grugliasco (TO). https://virextech.com/contact/?lang=en

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