Managing Nitrogen for Greenhouses Gases Mitigation in Tropical Agricultural

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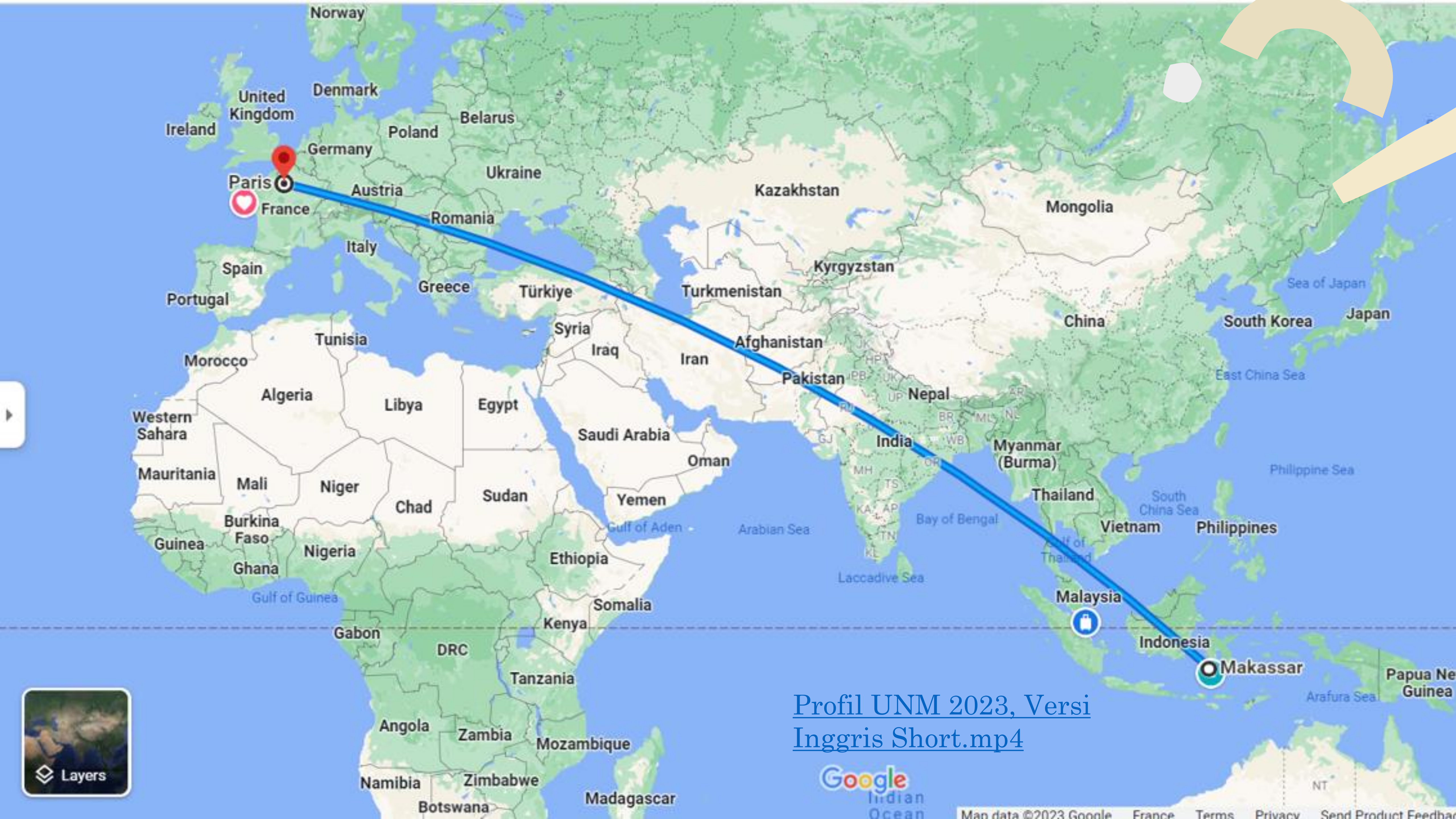
Acknowledgments

This work was supported;

Directorate General of Higher Education Indonesia

Mobility scheme 2023: ***NUSANTARA est le Partenariat Hubert Curien franco-indonésien. Il est mis en œuvre en France par le Ministère de l’Europe et des Affaires étrangères (MEAE) et le Ministère de l'Enseignement Supérieur et de la Recherche (MESR), et dans le pays partenaire par le Ministère de l’Education, de la Culture, de la Recherche et de la Technologie (KEMDIKBUDRISTEK).***



[Profil UNM 2023, Versi Inggris Short.mp4]

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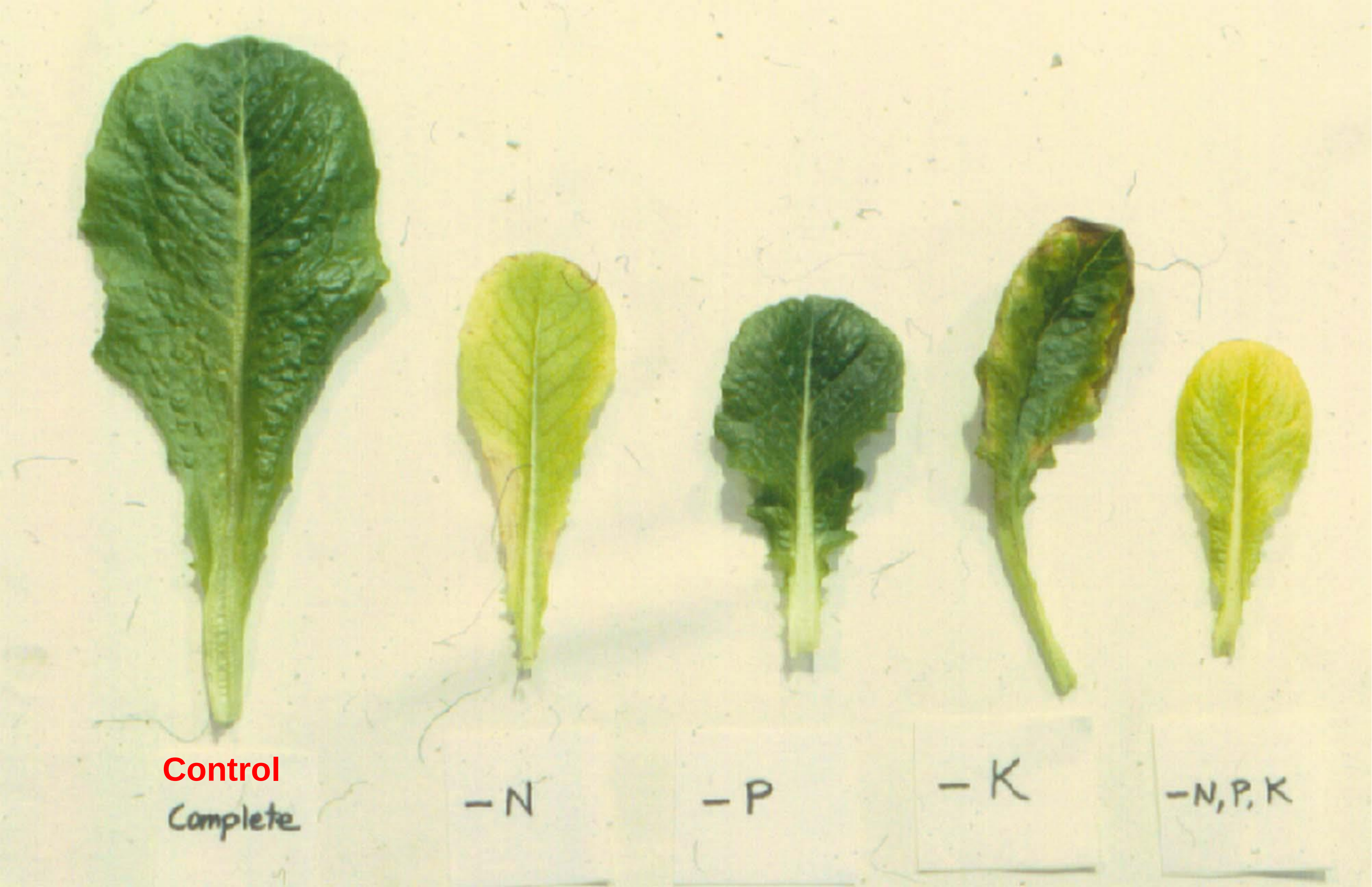
[Sokolia Field.mp4]

Why nitrogen fertilizer should be managed,

- Without fertilizers, the soil would be depleted and therefore plants would be particularly difficult to grow.

Fig.: Fertilizer adds nutritional value: To the right, tomato plant with nitrogen deficiency, to the left, tomato plant with optimum nutritional balance.

Macronutrients N, P, K Deficiencies
Leaf Lettuce



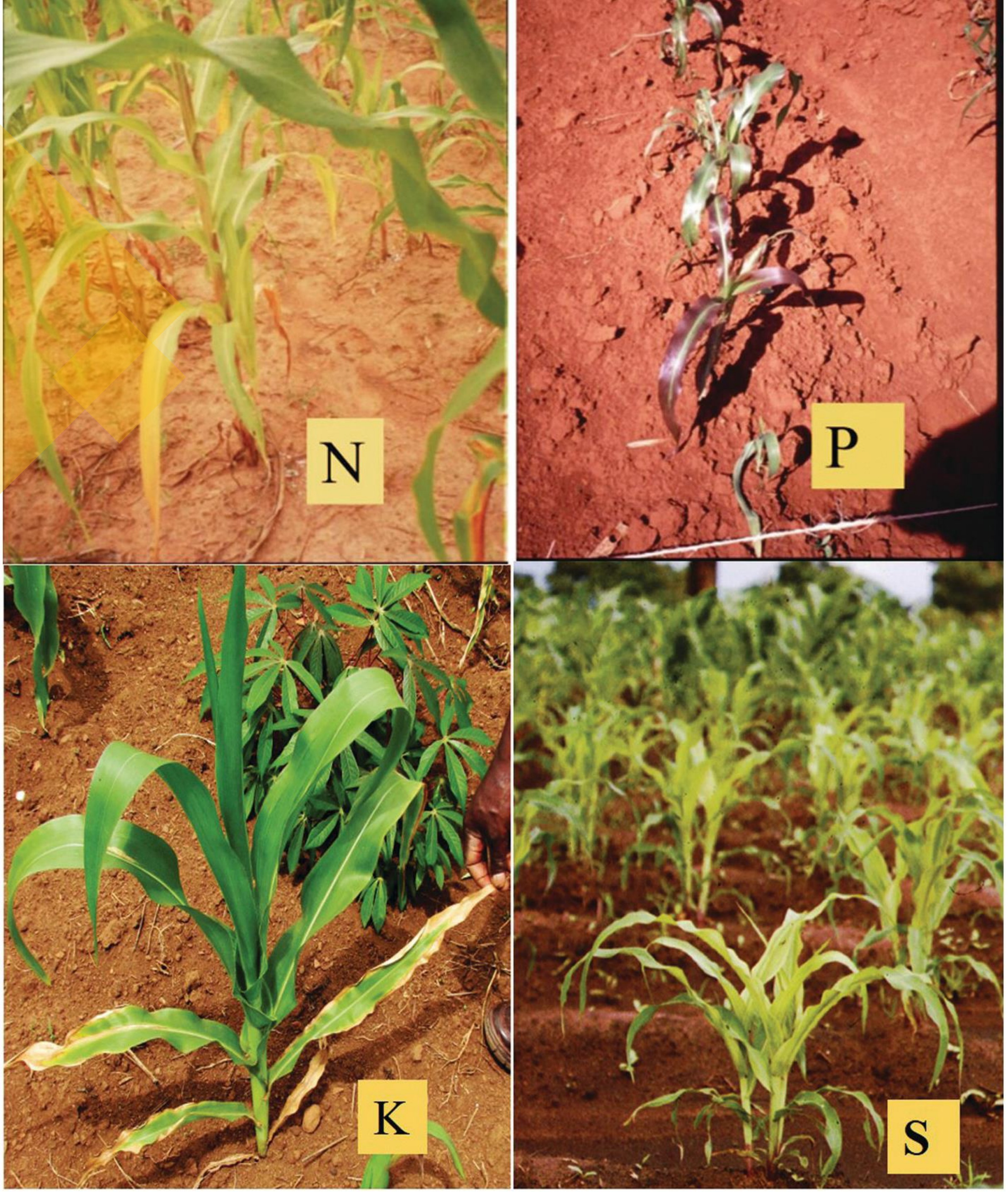


Fig.: Maize deficiency symptoms of the four main limiting macronutrients in the tropics. Nitrogen (N) phosphorus (P) potassium (K) sulfur (S) deficiency.

(Sanchez, P. A. (2019). Properties and Management of Soils in the Tropics. Cambridge University Press)

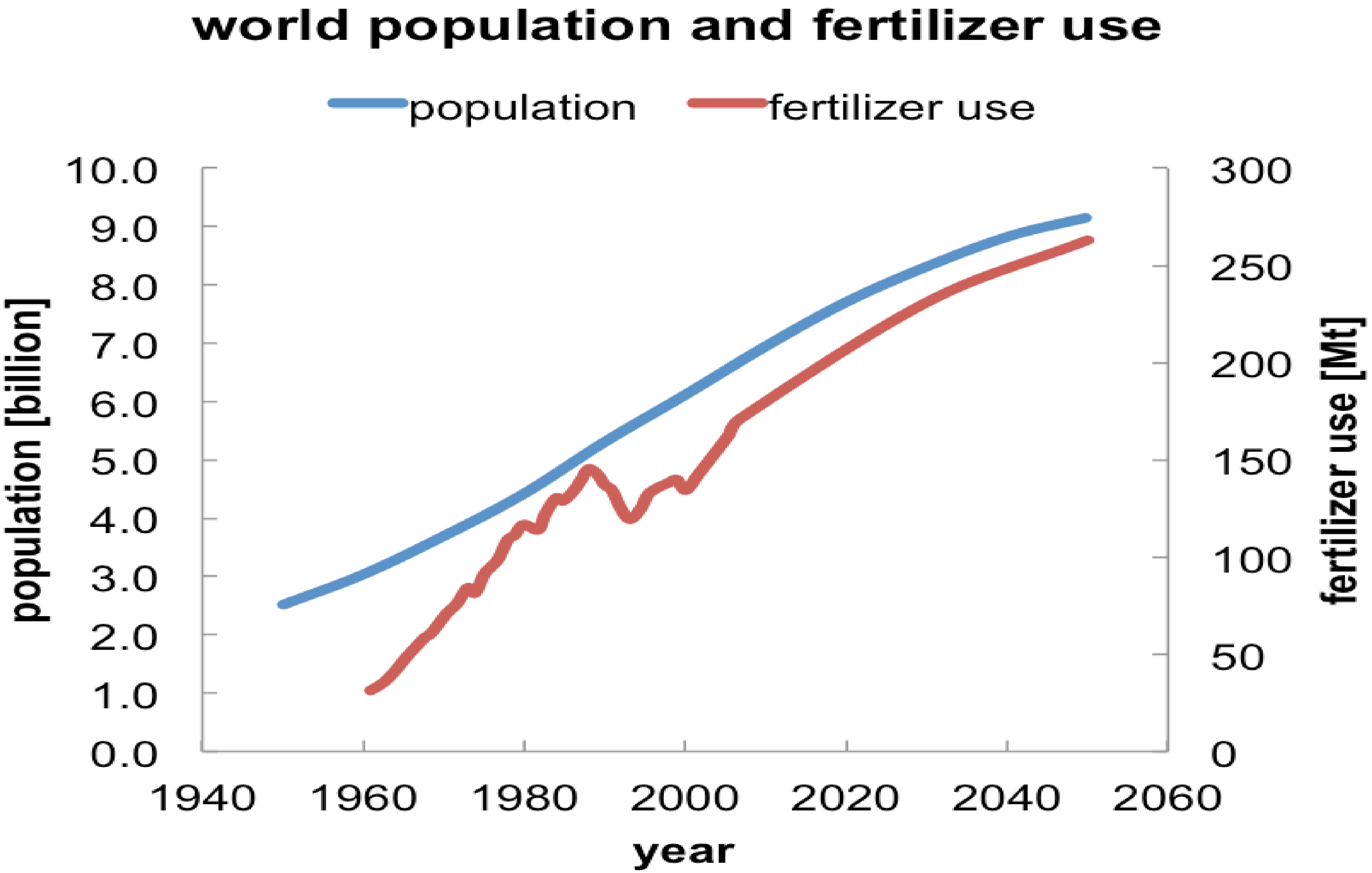


Fig.: World population and fertilizer consumption, with projections to 2050

(Alexandratos, N. and J. Bruinsma. 2012. World agriculture towards 2030/2050: the 2012 revision. ESA Working paper No. 12-03. Rome, FAO.)

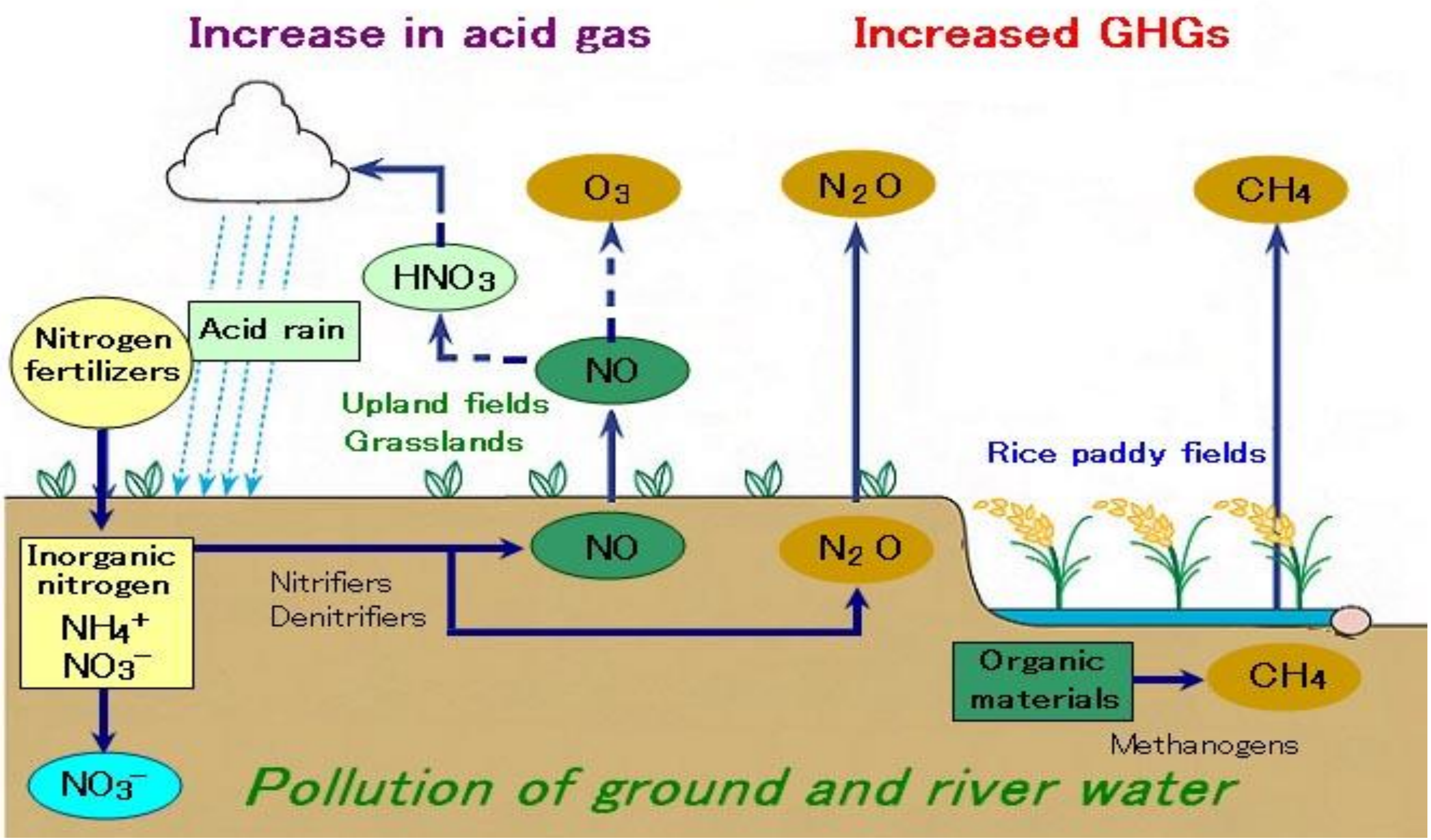
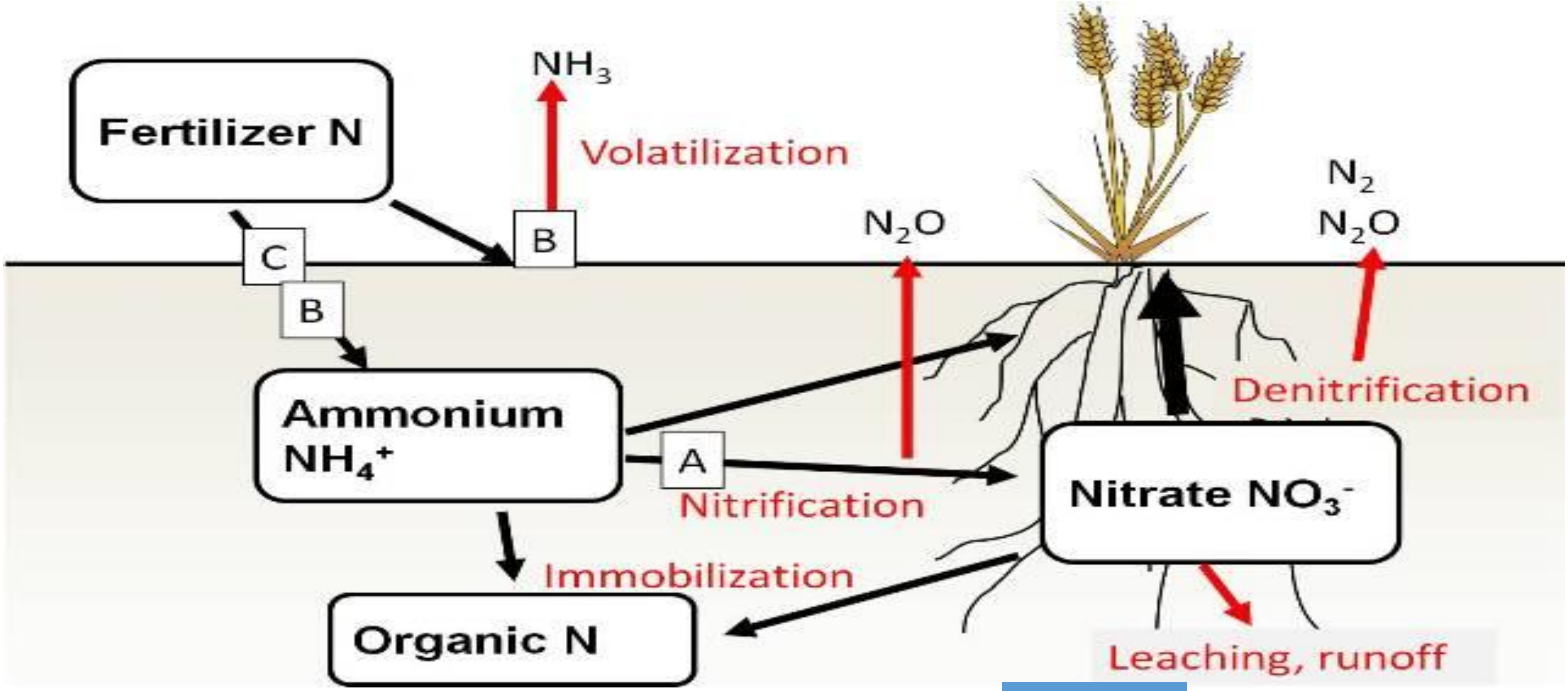


Fig. Greenhouse gases production from agriculture system.

(*Research Project for Mitigation of Greenhouse Gas Emissions, National Institute for Agro-Environmental Sciences Japan*).



/Archeae

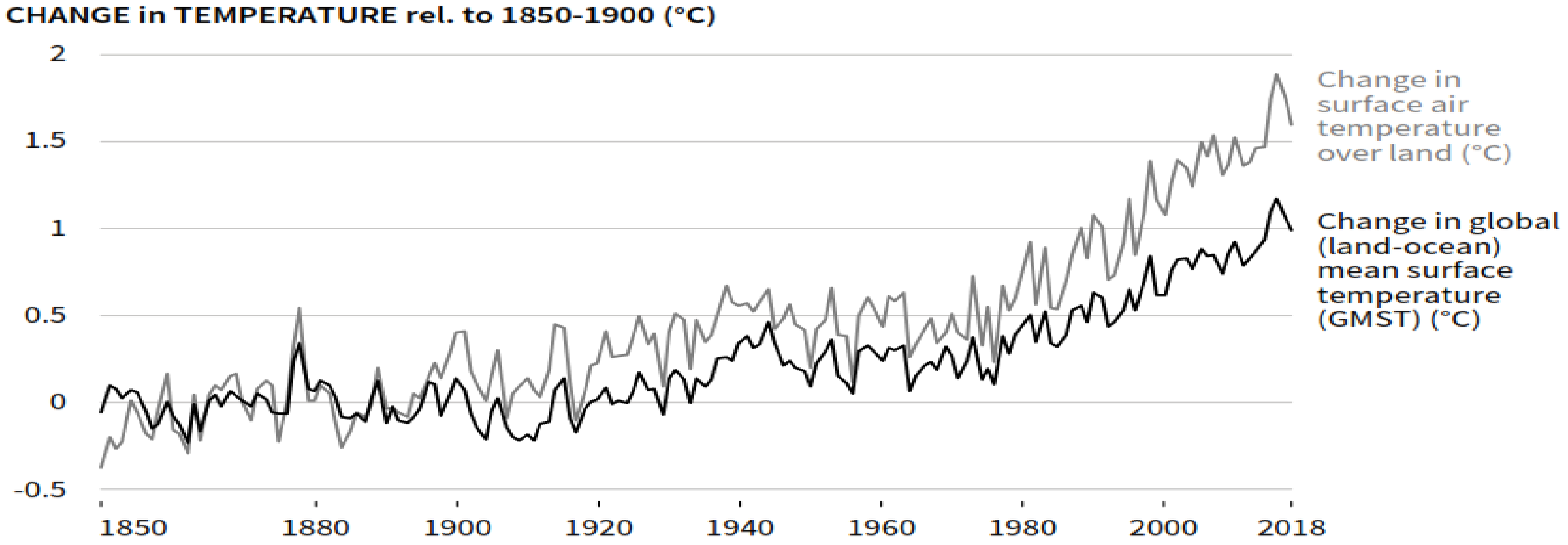
Figure. Main sources of Nitrous Oxide (N_2O) Gas Production

Nitrogen Buffering Mechanisms

1. Increased Applied N results in increased = plant N loss (NH_3)
2. Higher rates of applied N - increased = volatilization losses
3. Higher rates of applied N - increased = denitrification
4. Higher rates of applied N - increased organic C, = increased organic N
5. Increased applied N - increased = grain protein
6. Increased applied N - increased = forage N
7. Increased applied N - increased = straw N

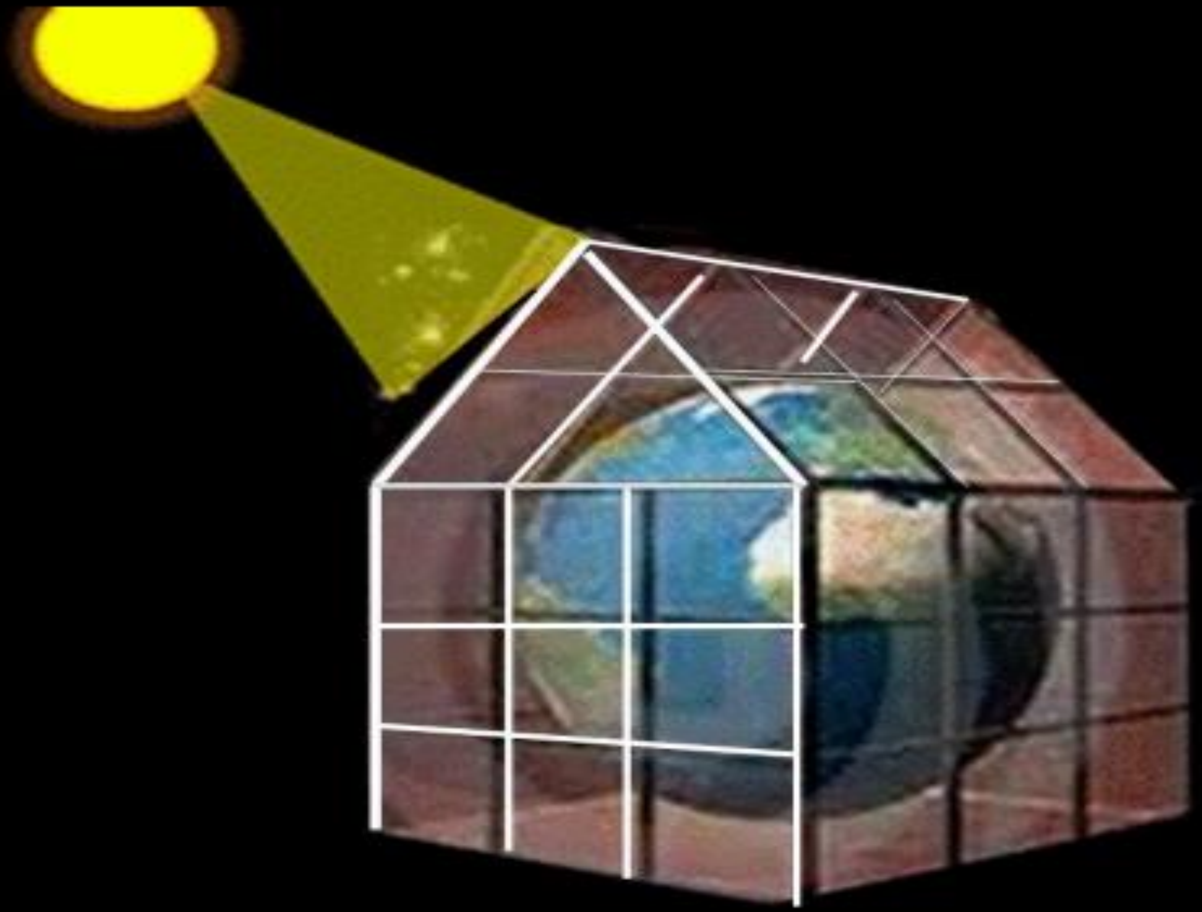
Trends of greenhouse gases emission and global warming

Observed temperature change relative to 1850-1900



IPCC, 2019: Summary for Policymakers. In: Climate Change and Land: an IPCC special report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems [P.R. Shukla, J. Skea, E. Calvo Buendia, V. Masson-Delmotte, H.- O. Pörtner, D. C. Roberts, P. Zhai, R. Slade, S. Connors, R. van Diemen, M. Ferrat, E. Haughey, S. Luz, S. Neogi, M. Pathak, J. Petzold, J. Portugal Pereira, P. Vyas, E. Huntley, K. Kissick, M. Belkacemi, J. Malley, (eds.)].

Greenhouse gases GHGs) in the atmosphere have a heat trapping effect, like the glass of a greenhouse traps heat from the sun, heating up the greenhouse. Light energy passes easily through glass into the greenhouse but the heat energy cannot pass through the glass well.



Whilst the Glasgow Climate Pact agreed at the UN Climate Change Conference of the Parties (COP26) firms up the global commitment to accelerate action on climate this decade, it left many wondering if this deal is enough to limit global warming to 1.5°C over pre-industrial levels.

The possible option of mitigation strategies for N_2O and CH_4

- Fertilizer managements

  - Slow Release, ***Nitrification Inhibitor (Neem or DCD***, Switching Fertilizer (synthetic to organic)

- Drainage Managements

  - Intermitted Drainage

  - Midseason Drainage

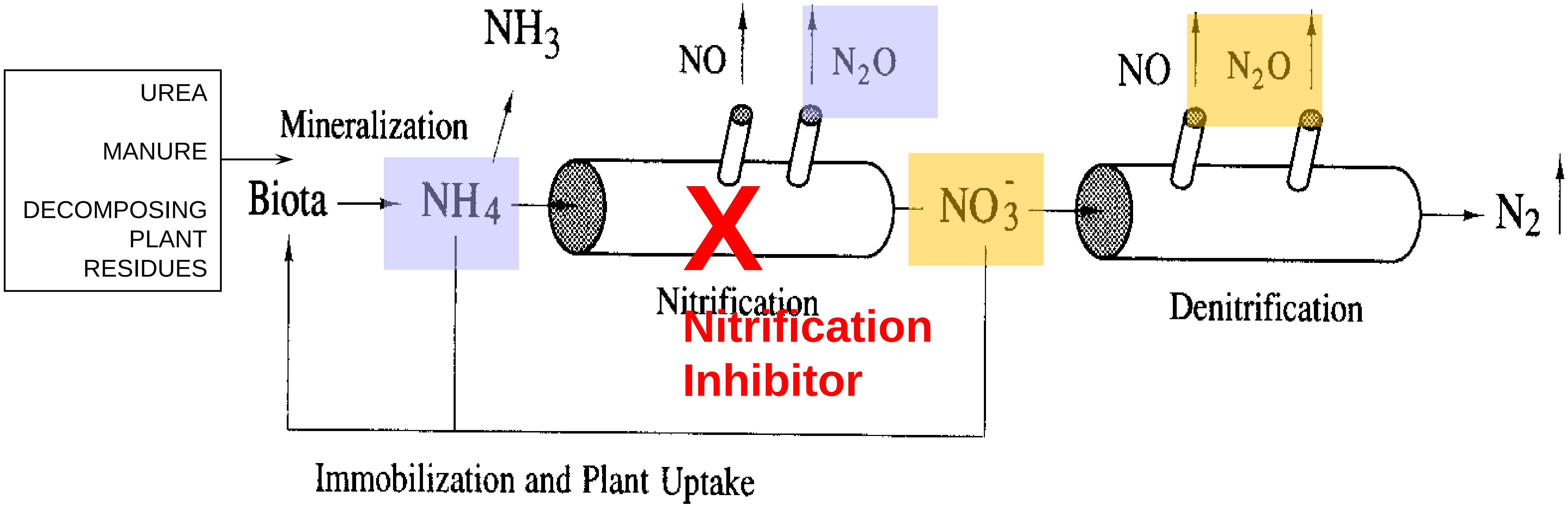
- *Crop management (short duration varieties, aerial Parenchyma)*

Mitigation Options: Nitrification Inhibitor

Nitrification

Conversion of Nitrogen Containing Materials to a Plant Useable Form

"Leaky pipe" analogy for N_2O production



(Firestone and Davidson et al. 2000)

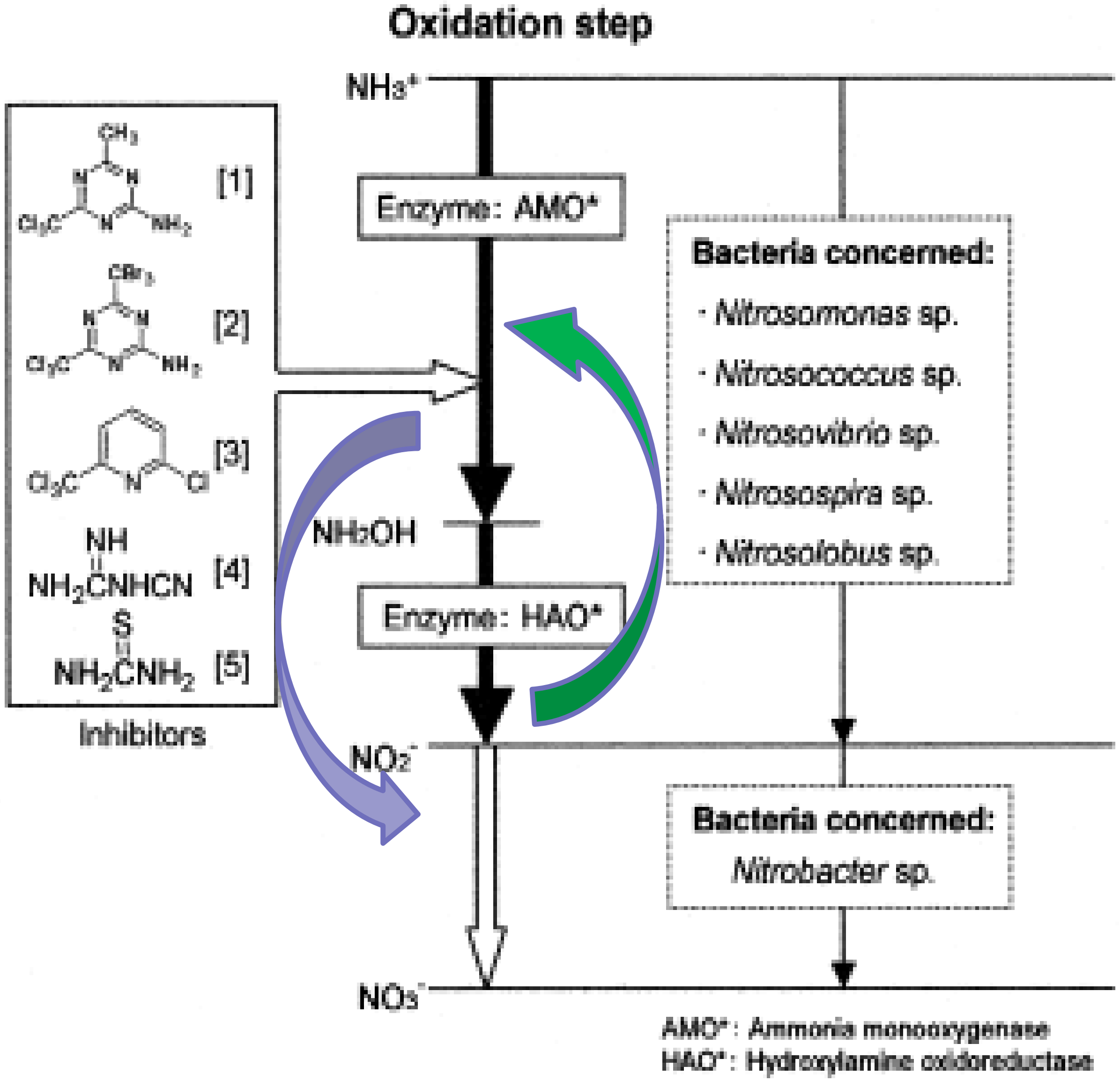


Fig. 2. Effect of inhibitors on nitrification of ammonia.

Matsuba et al, 2002

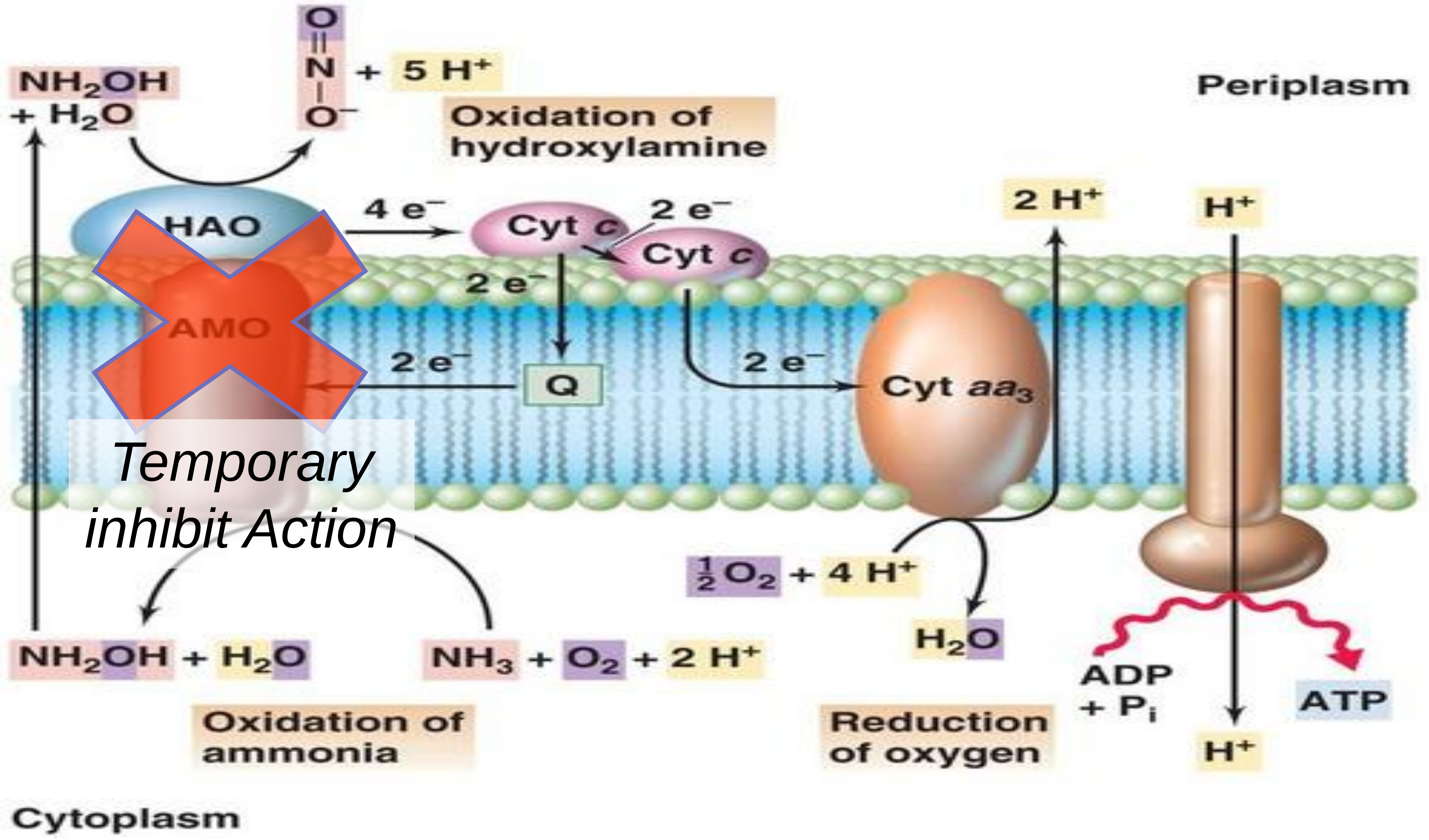


Fig. Hypothesis inhibition two enzymes, ammonia monooxygenase (AMO) and hydroxylamine oxidoreductase (HAO) are involved in the oxidation of ammonia to nitrite.

Several chemical/synthetics nitrification inhibitors (NIs);

1. AM (2-amino 4-chloro 6-methyl pyrimidine)
2. ST (2-sulfanilamide thiazone), DCS (N-2,5-dichlorophenyl succsinamic acid)
3. ASU (1-amino 2-thiourea),
4. DCD (dicyandiamide),
5. Nitrapiryn
6. CCC (wax-coated calcium carbide)
7. DMPP (3,4-dimethylpyrazol-phosphate).

(Mosier. 1996; Zerulla et al. 2001; Weiske et al. 2001; Liu et al. 2013).

The synthetics NIs are mostly expensive and limited available in market particularly in Indonesia.
In addition, several studies showed that NI like dicyandiamide (DCD) has dissatisfactory impact to environment due to the coumpund of DCD belong to the group of organic chlorine.

(Zerulla et al. 2001).

The Alternative:

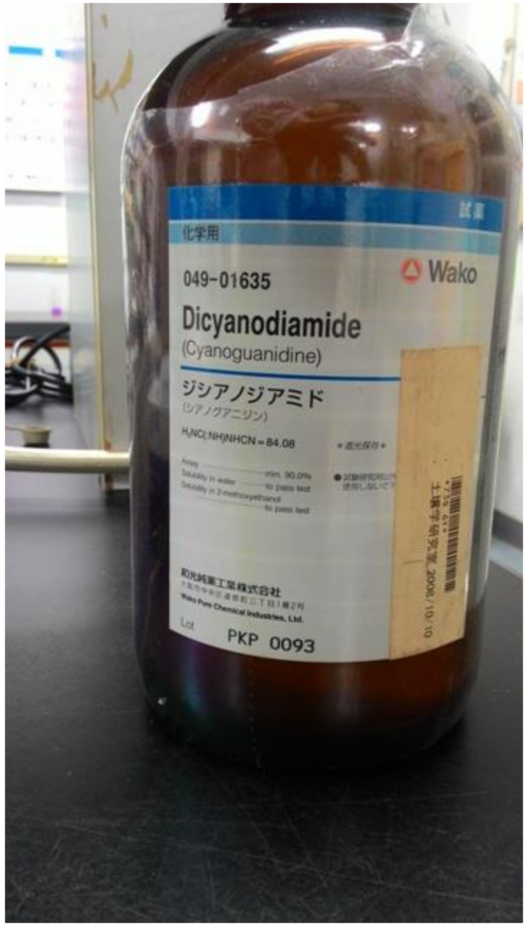
Several plant materials/extracts can also inhibit the nitrification with the potency to compete with the synthetic NI (Subbarao et al., 2012).

Some of these plant products are easily available, less expensive and easily degradable in soil than the synthetic NI.

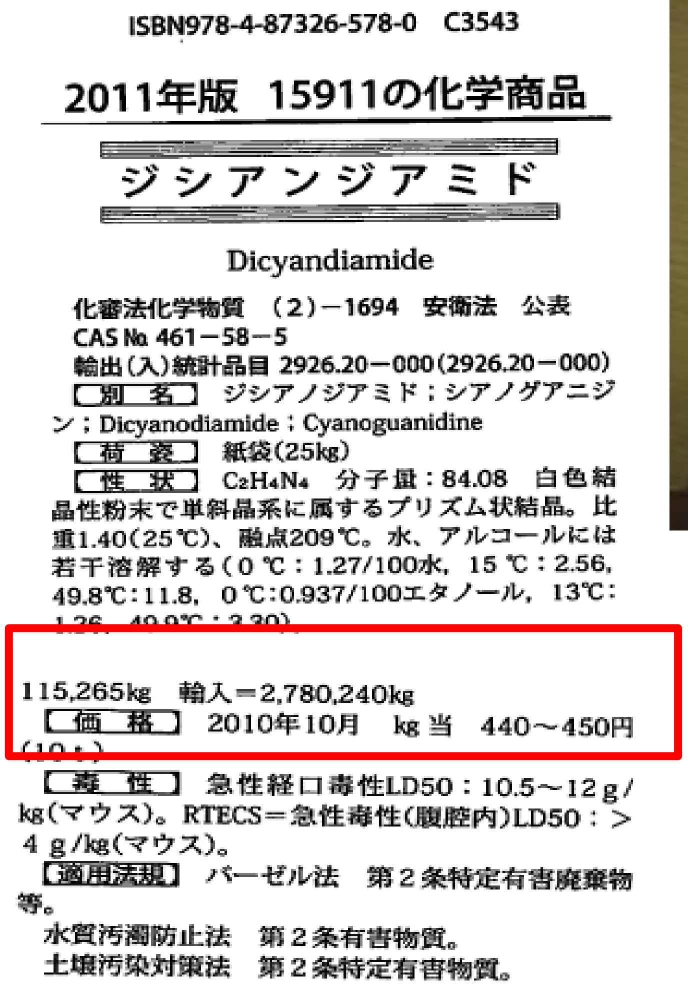
Organic nitrification inhibition;

1. Karanja (*Pongamia glabra*)(Singh, 1966), and
2. Neem (*Azadiracta indica*) and Nimin (plant extract of A. indica) possess wide spectrum antimicrobial action and the properties to be a potent NI) (Sharma and Prasad 1995); (Biswas et al. 2002); (Kumar et al. 2007); (Abbasi et al. 2011): (Jumadi et al. 2019:2020).

Comparative price of NIs
Synthetics Vs Organic



500 g = **23€**(Wako ltd.)



ISBN978-4-87326-578-0 C3543

2011年版 15911の化学商品

ジシアンジアミド

Dicyandiamide

化審法化学物質 (2)−1694 安衛法 公表
CAS No. 461−58−5
輸出(入)統計品目 2926.20−000(2926.20−000)
【別 名】 ジシアノジアミド；シアノグアニジン；Dicyanodiamide；Cyanoguanidine
【荷 姿】 紙袋(25kg)
【性 状】 $C_2H_4N_4$ 分子量：84.08 白色結晶性粉末で単斜晶系に属するプリズム状結晶。比重1.40(25℃)、融点209℃。水、アルコールには若干溶解する(0℃：1.27/100水, 15℃：2.56, 49.8℃：11.8, 0℃：0.937/100エタノール, 13℃：1.26, 49.9℃：3.30)

115,265kg 輸入＝2,780,240kg
【価 格】 2010年10月 kg当 440〜450円 (10t)
【毒 性】 急性経口毒性LD50：10.5〜12g/kg(マウス)。RTECS＝急性毒性(腹腔内)LD50：> 4g/kg(マウス)。
【適用法規】 バーゼル法 第2条特定有害廃棄物等。
水質汚濁防止法 第2条有害物質。
土壌汚染対策法 第2条特定有害物質。

Neem Cake (Waste product)	Neem Oil (pure extract)
0.19€	4.4€

TRENDS IN SCIENCES 2023; 20(1): 6395 RESEARCH ARTICLE
https://doi.org/10.48048/tis.2023.6395

Efficiency of Nitrification Inhibitor on Designing Nitrogen Fertilizer by Neem Compounds Based on Molecular Docking

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Received: 5 September 2021, Revised: 28 October 2021, Accepted: 5 December 2021, Published: 24 November 2022

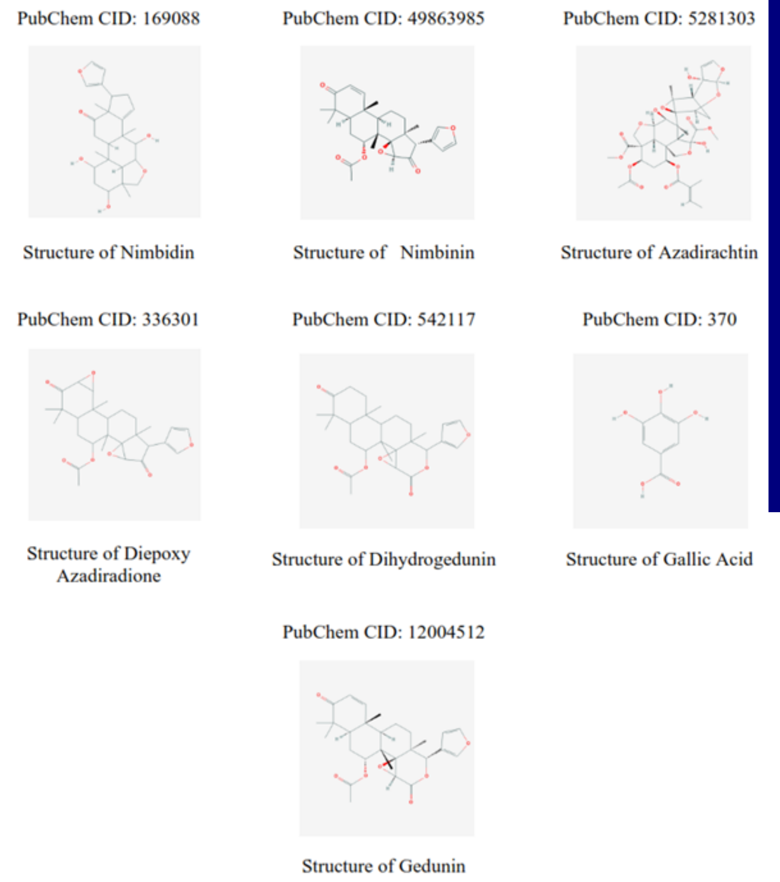


Figure 1 Ten chemicals structure of Neem compounds with highest energy binding score.
Source: https://pubchem.ncbi.nlm.nih.gov/.https://pubchem.ncbi.nlm.nih.gov/.

https://www.youtube.com/watch?v=b_RJUdi4tD8

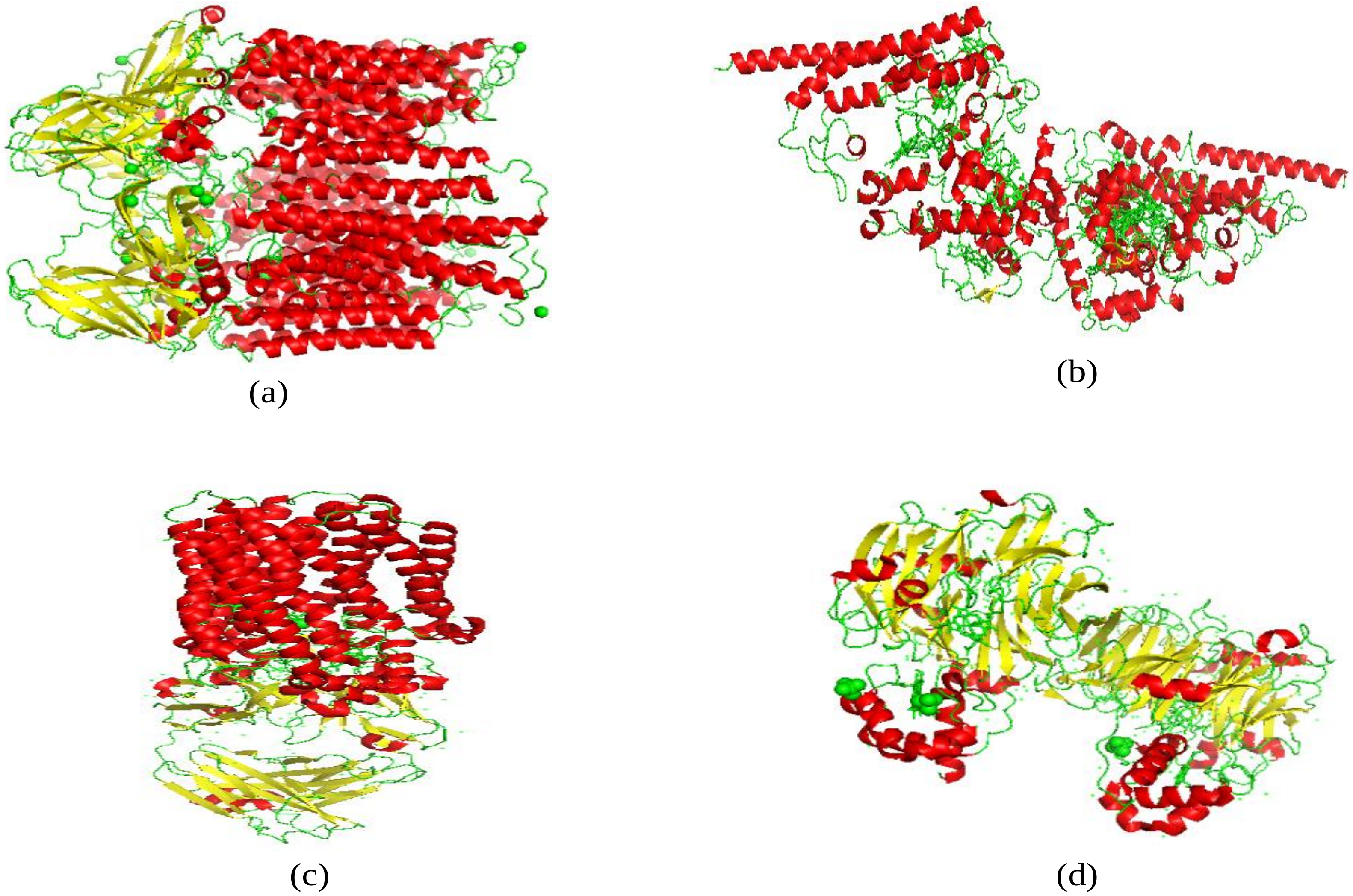
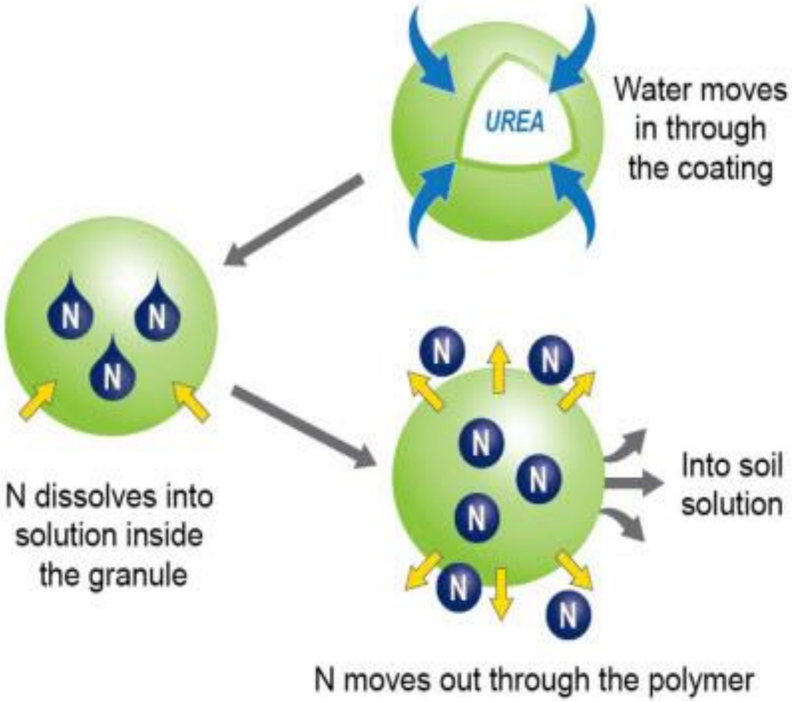


Figure 2 The tertiary structure of enzymes (a) Methane Monooxygenase, (b) Hydroxylamine Oxidoreductase, (c) Nitric Oxide Reductase and (d) Nitrite Reductase. The structures of alpha-helix and beta-sheet are presented by red and green colors in cartoon models, respectively.

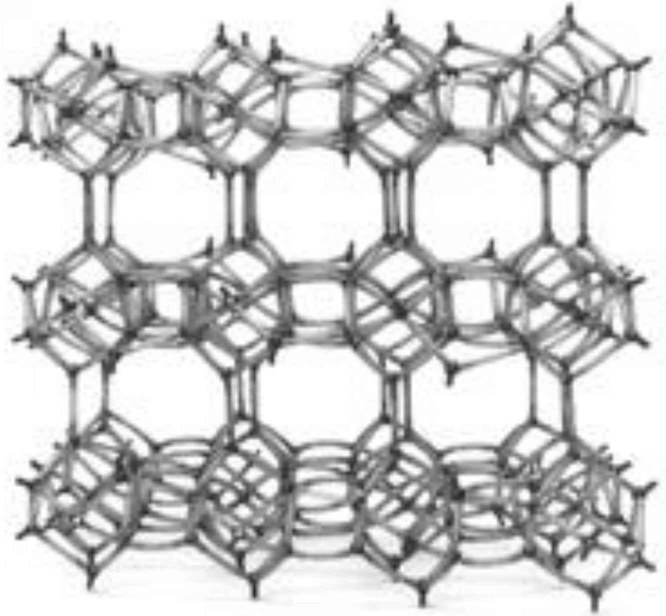
Table 6. The binding energy of ligands in complex with Nitric Oxide Reductase enzyme obtained by molecular docking.

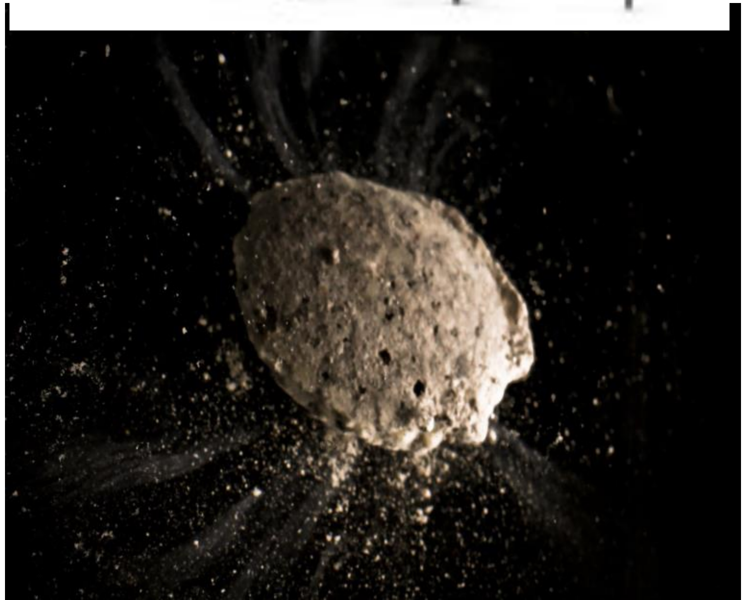
No.	Compound	Binding energy (Kcal/mol)
1	Nimbin	-7.5
2	Nimbidin	-8.4
3	Nimbic Acid	-7.8
4	Nimbidinin	-8.3
5	Nimbinin	-7.8
6	Azadirachitin	-7.4
7	Diepoxy Azadiradione	-8.7
8	Dyhidrogedunin	-8.1
9	Gallic	-6.3
10	Gedunin	-8.2

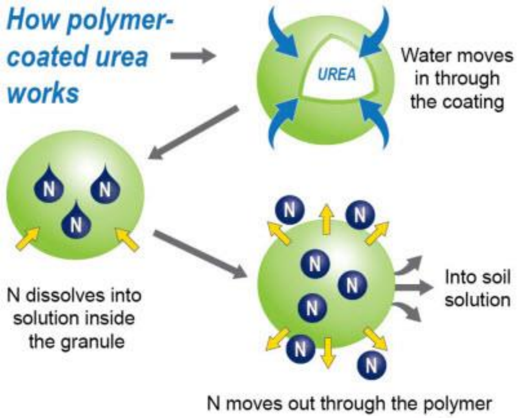
While zeolite act as slow release -
releases nutrients gradually into the soil (nitrogen or phosphor)

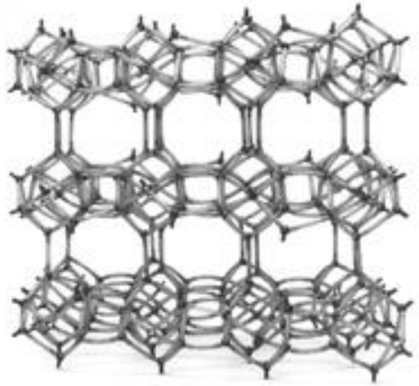


(Adapted polymer Analogy)









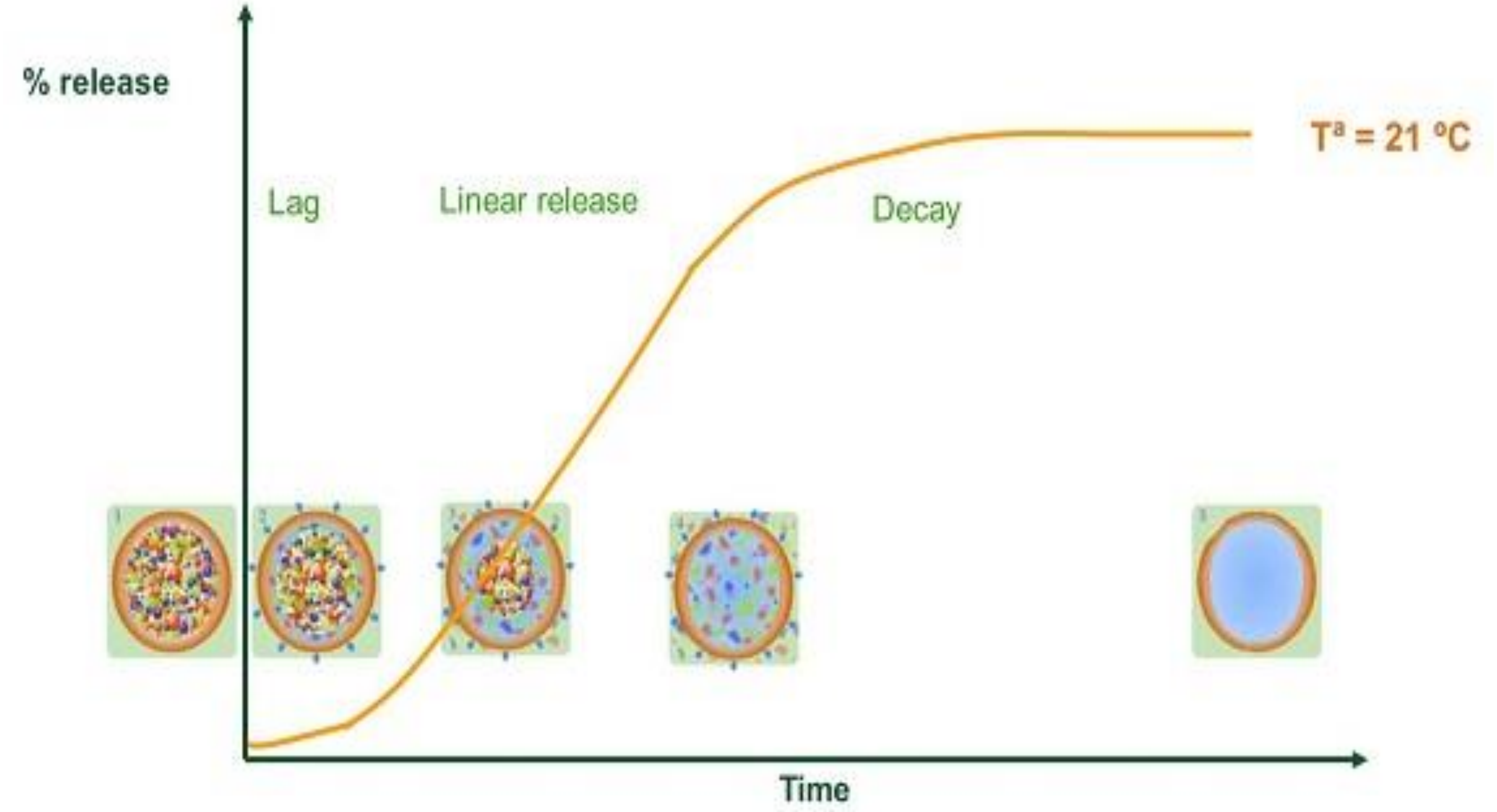
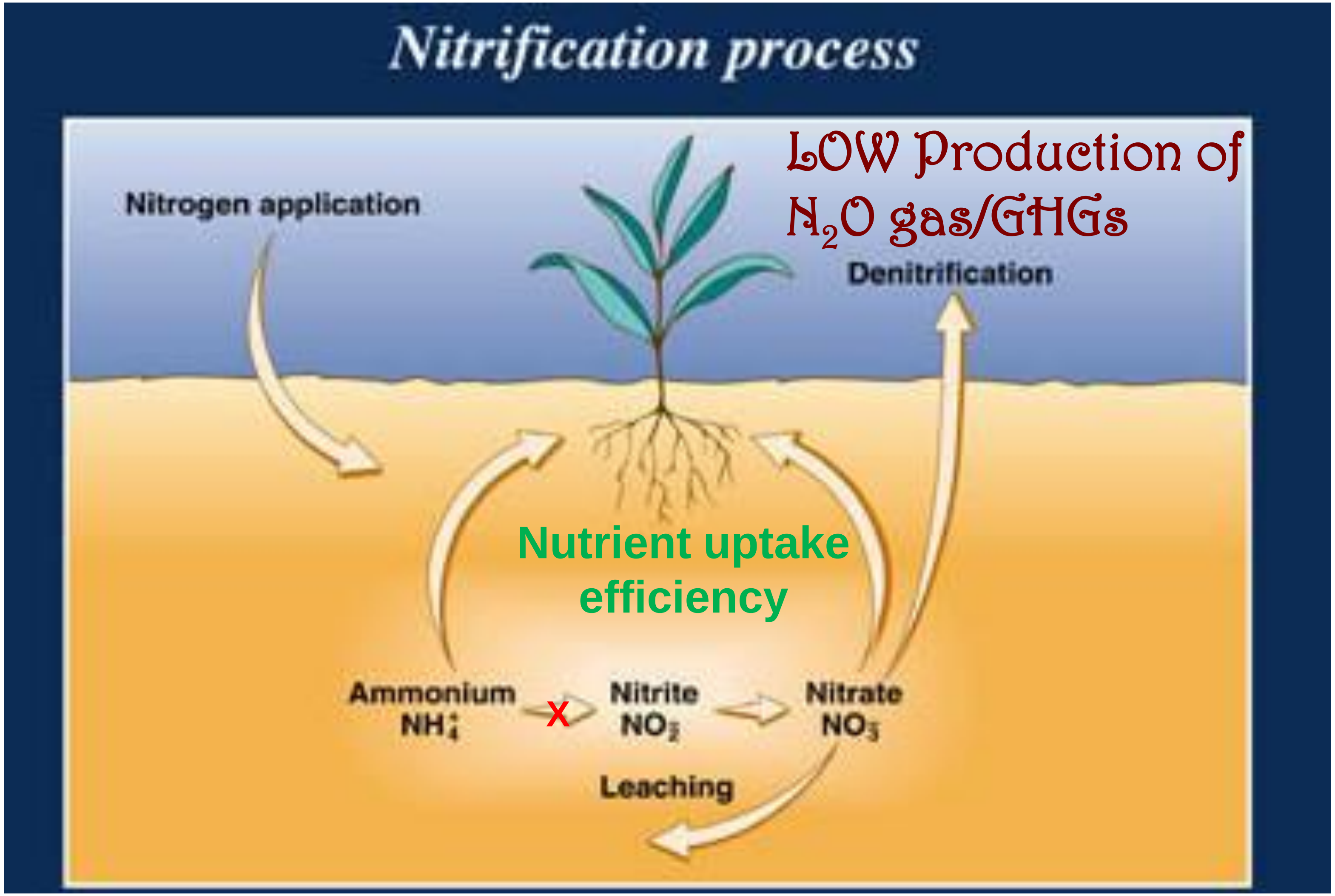


Figure: Release of N from polymer-coated urea. (*Adapted from Blaylock, 2010*).

Mitigation Options: Nitrification Inhibitor and Slow-Release Fertilizer

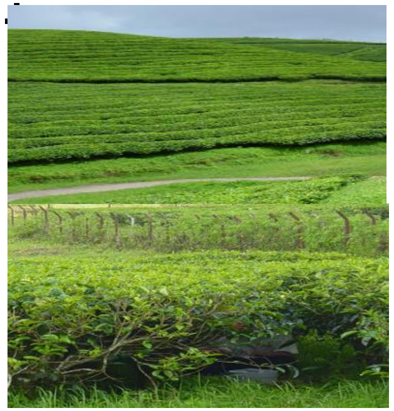


Sites and soil samples :

1.Pine forest soil

2.Potato field soil

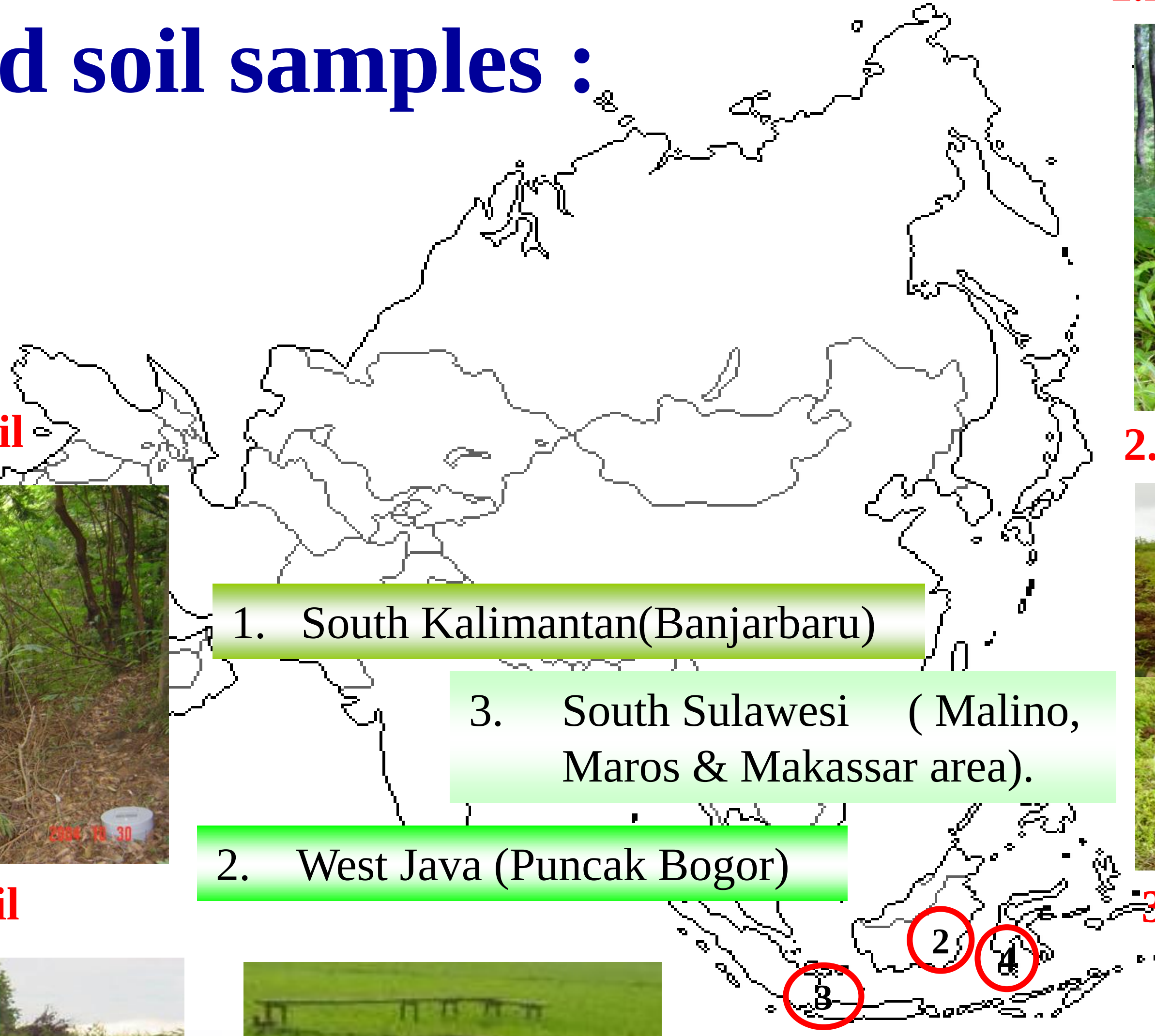
3.Tea garden soil



5. Agroforest soil

6. Corn field soil

7. Paddy field soil



1. South Kalimantan(Banjarbaru)
2. West Java (Puncak Bogor)
3. South Sulawesi (Malino, Maros & Makassar area).

Paddy and Water Environment (2019) 17:715–724
https://doi.org/10.1007/s10333-019-00724-3

ARTICLE

Environmental Science and Pollution Research
https://doi.org/10.1007/s11356-019-06776-6

RESEARCH ARTICLE

Abstract EGU23-7372

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EGU23-7372, updated on 21 Apr 2023
https://doi.org/10.5194/egusphere-egu23-7372
EGU General Assembly 2023

ELSEVIER

Brown algae (Sa
microbe ferment

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[d] Department of Biology, Faculty of M
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TRUESOIL Project: Understanding Trade-offs and Dynamic Interactions between SOC Stocks and GHG Emissions for Climate Smart Agrisoil Management

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Published online: 26 November 2019

Springer

Field preparations

Rice field experiments

Nitrogen Fertilizer application (130 kg-N ha^{-1}) split time (60 and 70 kg-N ha^{-1})

- Urea Granule
- Urea Granule Zeolit
- Urea Granule Zeolit and Neem
- Urea Granule Zeolit and Dicyandinamide

Water Managements

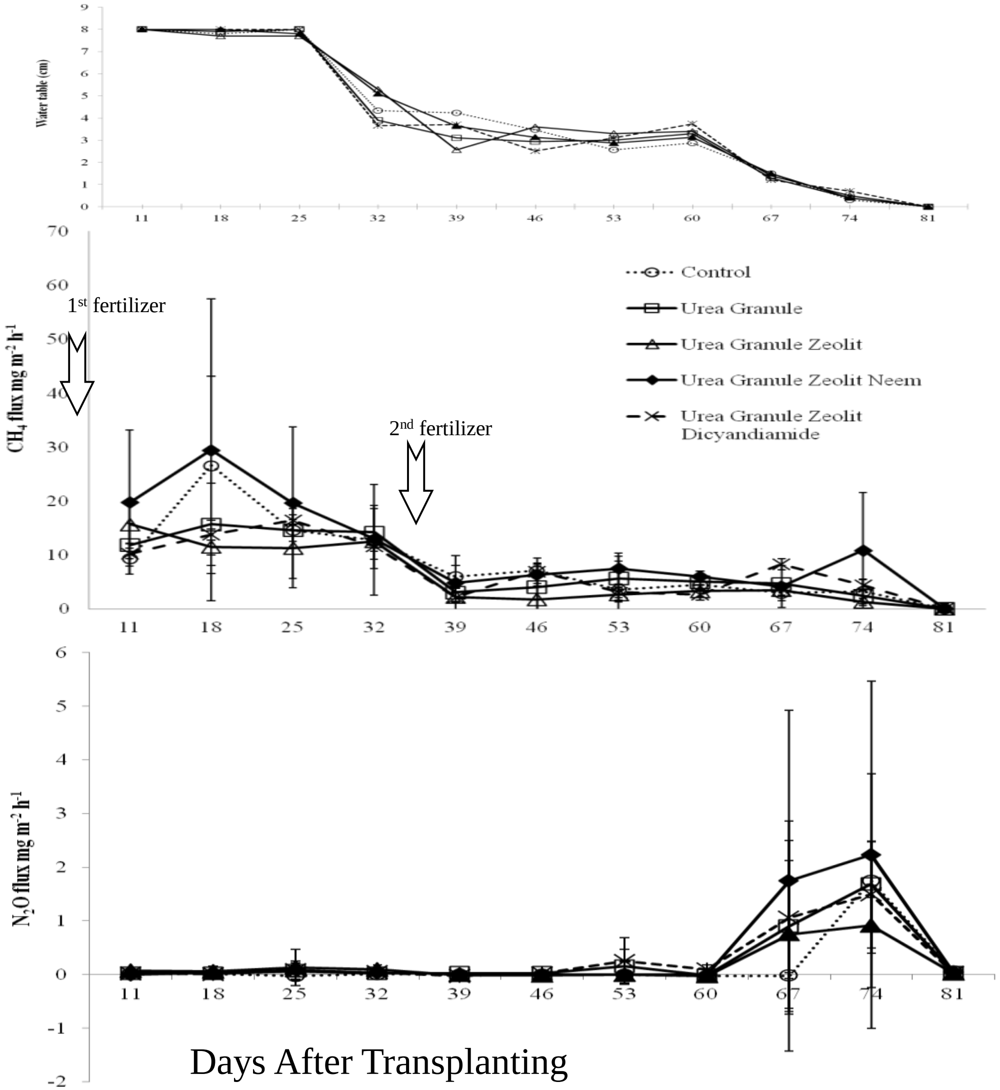
1. Continuous flooded
2. Non continuous flooded




PENGEMBANGAN SISTEM PERTANIAN RENDAH EMISI
PENGINTEGRASIAN INTERMITTED DRAENASE DAN PUPUK
NITRIFIKASI YANG LEPAS LAMBAT
PERLAKUAN
KONTROL, UG, UZ, UZN, dan UZD
RANCANGAN
: SPLIT PLOT DESIGN
ULANGAN
: 3 (TIGA)
LUAS PLOT
: 2 M x 4 M
JARAK TANAM
: JAJAR LEGOWO
TANGGAL TANAM
: 5 APRIL 2015
LOKASI
: KEBUN PERCOBAAN MAROS
BALITSEREAL MAROS

Results and discussions

Continuous flooded



Non Continuous flooded

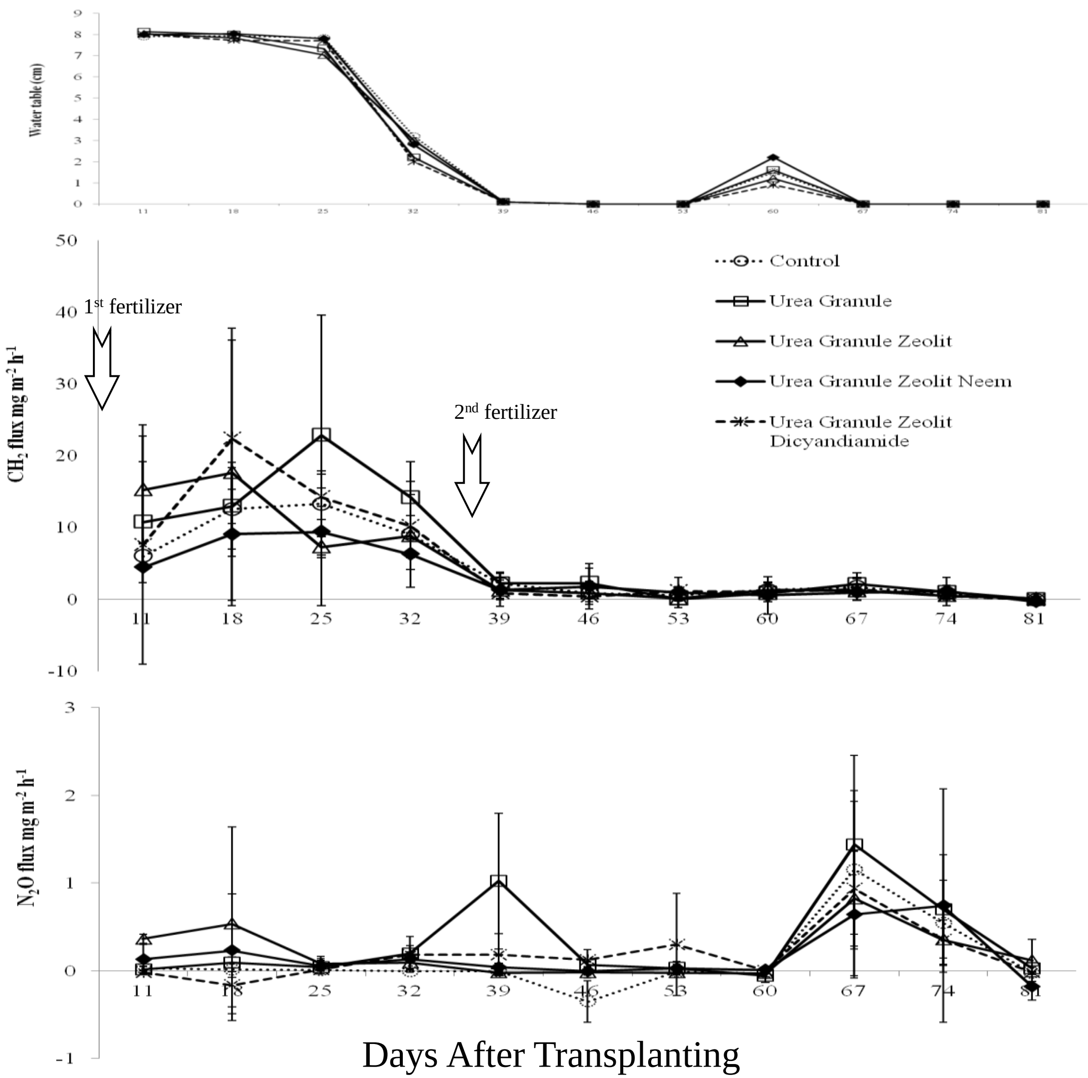


Figure. A. Change of water table height, N_2O and CH_4 fluxes in continuous flooded rice field; B. Change of water table height, N_2O and CH_4 fluxes in non continuous flooded rice field, during rice cropping seasons March 13rd, 2015 to August 5th, 2015). Vertical bars indicate <u>+</u> standard deviations.

Table. Total and reduction of N_2O emission (kg h^{-1} $season^{-1}$)

Treatment	Continuous Flooded	Non Flooded	Reduction	%
Control	**2.9[a]**	2.0[a]	0.9	31.0
Urea Granule	**7.2[a]**	5.9[a]	1.3	18.0
Urea Granule Zeolit	**3.4[a]**	3.3[a]	0.1	2.9
Urea Zeolite Neem	**7.0[a]**	3.0[a]	4.0	57.0
Urea Zeolite Dyciandiamide	**4.7[a]**	3.2[a]	1.5	31.9

Description: Means followed by the same letter are not significantly different at 5% Tukey HSD.

Table. Total and reduction of CH_4 emission (kg h^{-1} $season^{-1}$)

Treatment	Total Emission Continuous Flooded	Total Emission Non Flooded	Reduction	%
Control	141.7[a]	74.1[a]	67.6	**47.7**
Urea Granule	137.7[a]	102.8[a]	34.9	**25.3**
Urea Granule Zeolit	229.6[a]	92.3[a]	137.3	**59.7**
Urea Zeolite Neem	245.2[a]	60.4[a]	184.8	**75.3**
Urea Zeolite Dicyandiamide	147.7[a]	101.1[a]	46.6	**31.0**

Description: Means followed by the same letter are not significantly different at 5% Tukey HSD.

Table. The average of rice grain yield

Treatments	Weight $kg/8m^{-2}$	
	Continuous Flooded	Non Flooded
C	4.30^{a}	3.72^{a}
UG	5.99^{b}	5.06^{b}
UZN	5.90^{b}	4.85^{b}
UZD	6.03^{b}	4.70^{b}
UZ	6.11^{b}	5.36^{b}

Description: Means followed by the same letter are not significantly different at 5% Tukey HSD.

Fig. Gas sampling activities and arrangement of experimental plots and position of the chamber in each plot. K= Control, U= Urea, UZ= Urea Zeolite, UD+Urea+DCD, UZN = Urea+Zeolite+Neem, UZD = Urea+Zeolite+DCD, UN=Urea+Neem

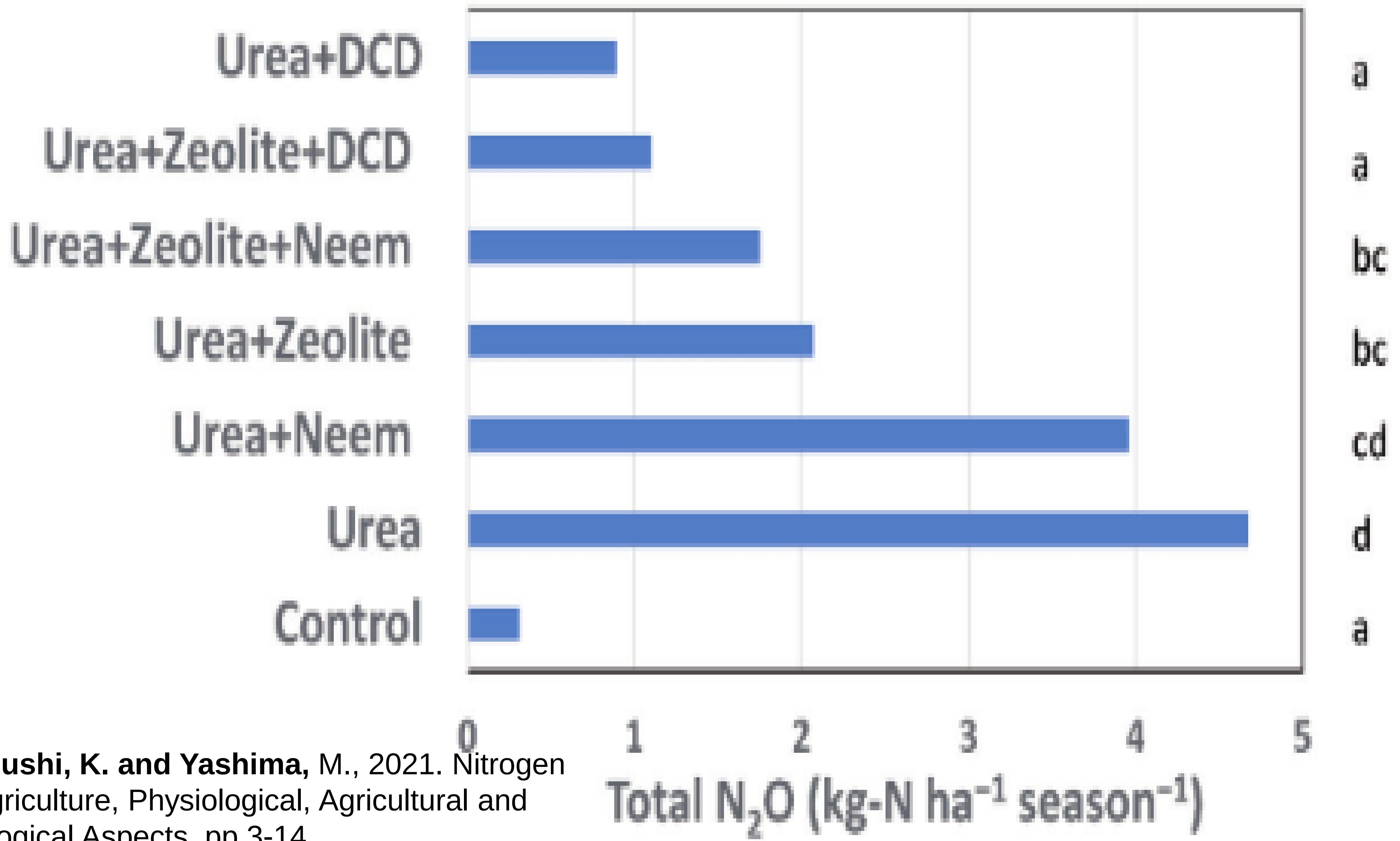

I UD
I USD

I ÜN
UD



MINOLTA
50.0
SPAD
ON
OFF
AVERAGE
ALL DATA CLEAR
DATA RECALL
1 DATA DELETE


II USD



Inubushi, K. and Yashima, M., 2021. Nitrogen in Agriculture, Physiological, Agricultural and Ecological Aspects, pp.3-14.

Table. Total gas, Emission Factor (EF) and N_2O Reduction in a season corn plantation

Treatment	Total gas ($kg\ N_2O\text{-}N\ ha^{-1}\ season^{-1}$)	EF %	Reduction %
C	0,31[a]		
U	4,6[d]	2,1	
UZ	2,0[bc]	0,8	59,6
UN	3,9[cd]	1,8	16,3
UD	0,8[a]	0,2	86,7
UZN	1,7[a]	0,7	66,8
UZD	1,1[a]	0,3	81,9

Description: Means followed by the same letter are not significantly different at 5% LSD.

Table. Dry weight of five corn's cobs and chlorophyll content after harvest.

Treatments	Five Weight of Cobs (gram)	Chlorophyll (%)
C	754[a]	38.2[a]
U	1421[c]	52.5[bc]
UZ	1271[b]	53.5[c]
UZN	1303[bc]	47.1[bc]
UZD	1394[bc]	50.1[bc]
UD	1407[c]	49.2[bc]
UN	1374[bc]	45.7[b]

Description: Means followed by the same letter are not significantly different at 5% Tukey.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BIOINSECT

INSECT TRANSFORMATION AS ALTERNATIVE NUTRIENTS SOURCE FOR AQUACULTURE AND BIOFERTILIZER FOR AGRICULTURE

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oProtein

PROTEIN MEAL

Highest protein content **> 72%**

Almost total Digestibility **> 90%**

Optimum fatty acids and aminoacids profile

oLipids

MEALWORM FAT

Insaturated fats ΣUFA **>75%**

High oleic content **> 40%**

Low acidity, perfect for Premium feed

oFrass

ORGANIC FERTILIZER

N-P-K 5-4-3 M.O. **> 70%**

100% Organic Nitrogen

Non presence of heavy metals

Protect crops and reduces pesticides use

oTosan

CHITOSAN

First regular source for high value technological and biotechnolocial uses.

High reactivity

Deacetylation degree **> 80%**


Pufrass
FRASS FERTILIZER
100 % Natural Organic
Food For Plant
MEALWORM FRASS
250 gram
MEALWORM FRASS
150 gram
Kampus Merdeka
EXPO KEWIRAUSAHAAN UNIVERSITAS NEGERI MAKASSAR
Lembaga Inovasi dan Pengembangan Kewirausahaan
9-10 Desember 2021
Biologi
Pufrass


sobek / gunting di sini
tutup ulang di sini
Pufrass
FRASS FERTILIZER
100 % Natural Organic
Food For Plant
MEALWORM FRASS
250 gram
MEALWORM FRASS
150 gram


Pufrass
FRASS FERTILIZER
DEFENISI
KELEBIHAN FRASS
1 Tidak Berbau
2 Pupuk Organik
5 Mengandung Nutrisi Makro dan Mikro Bagi Tumbuhan
6 Keseimbangan NPK yang Baik
KANDUNGAN FRASS
HASIL PENELITIAN
Berdasarkan penelitian yang telah dilakukan, pengaplikasian frass dilahan pertanian berdampak baik pada produktifitas tanaman.
KONTROL 1
Biologi
Pufrass

Laboratory test dan Field experiments

1. Plant responds

a. Vegetative

b. Generative

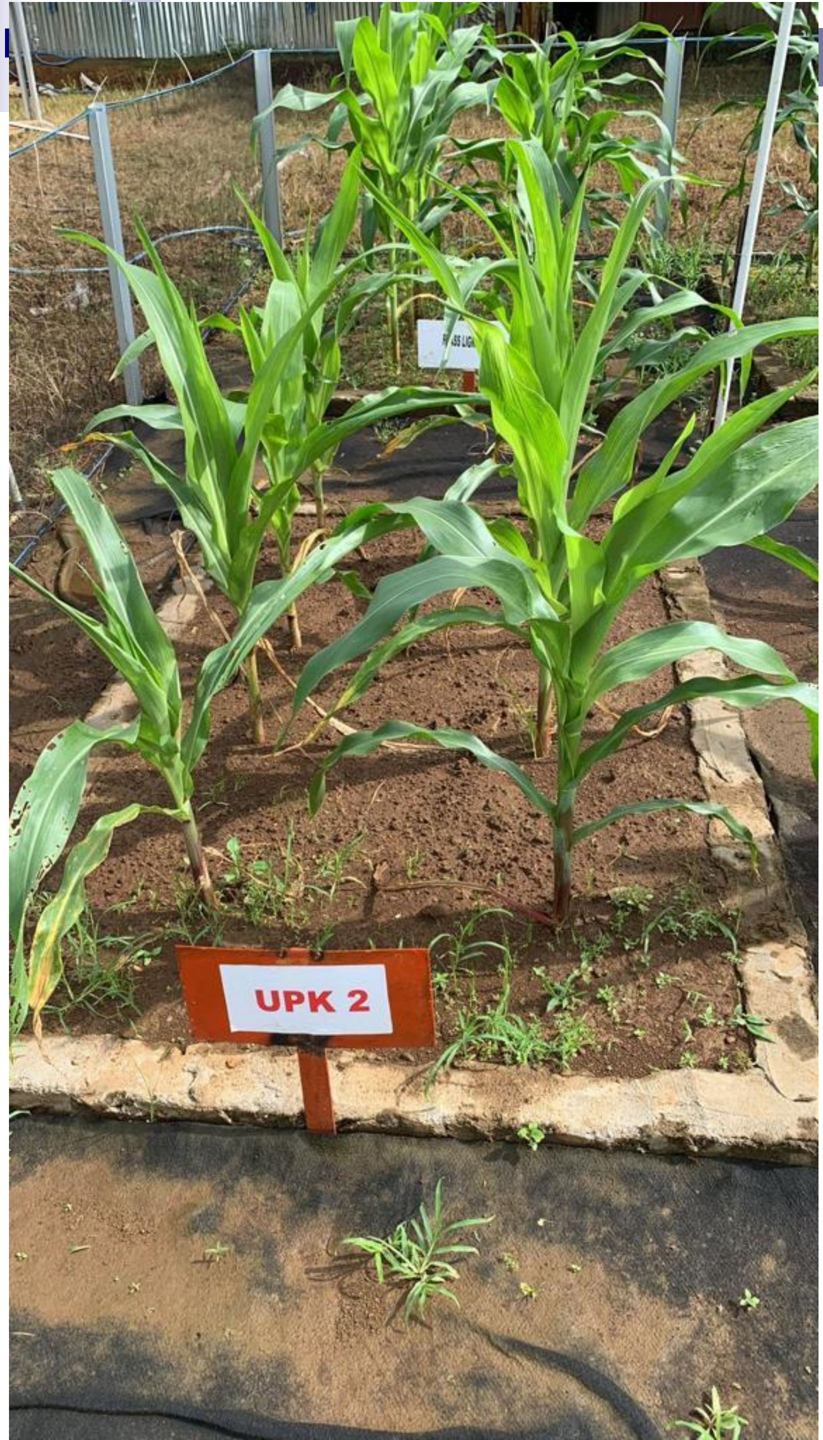
2. Change of NH_4^+ dan NO_3^-

3. Emission of N_2O, CH_4, dan CO_2

4. Soil Microbial -> MPN and

Soil Bacteria Metagenomic


F3(500)
K3(500)
UPK 2
KONTROL 1


UPK 2


KONTROL 3
FRASS 2


FRASS LIGNIN + UPK 3

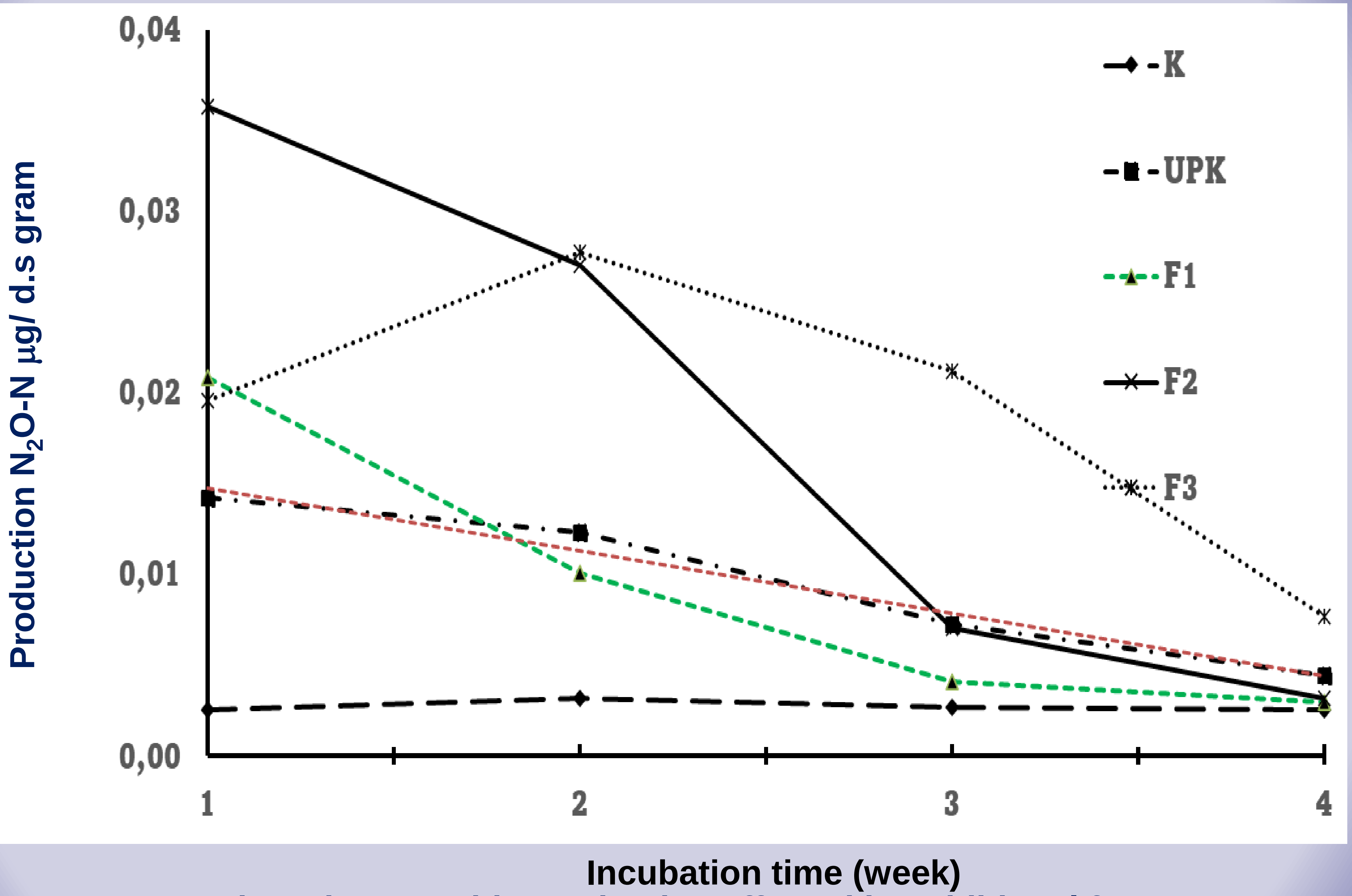
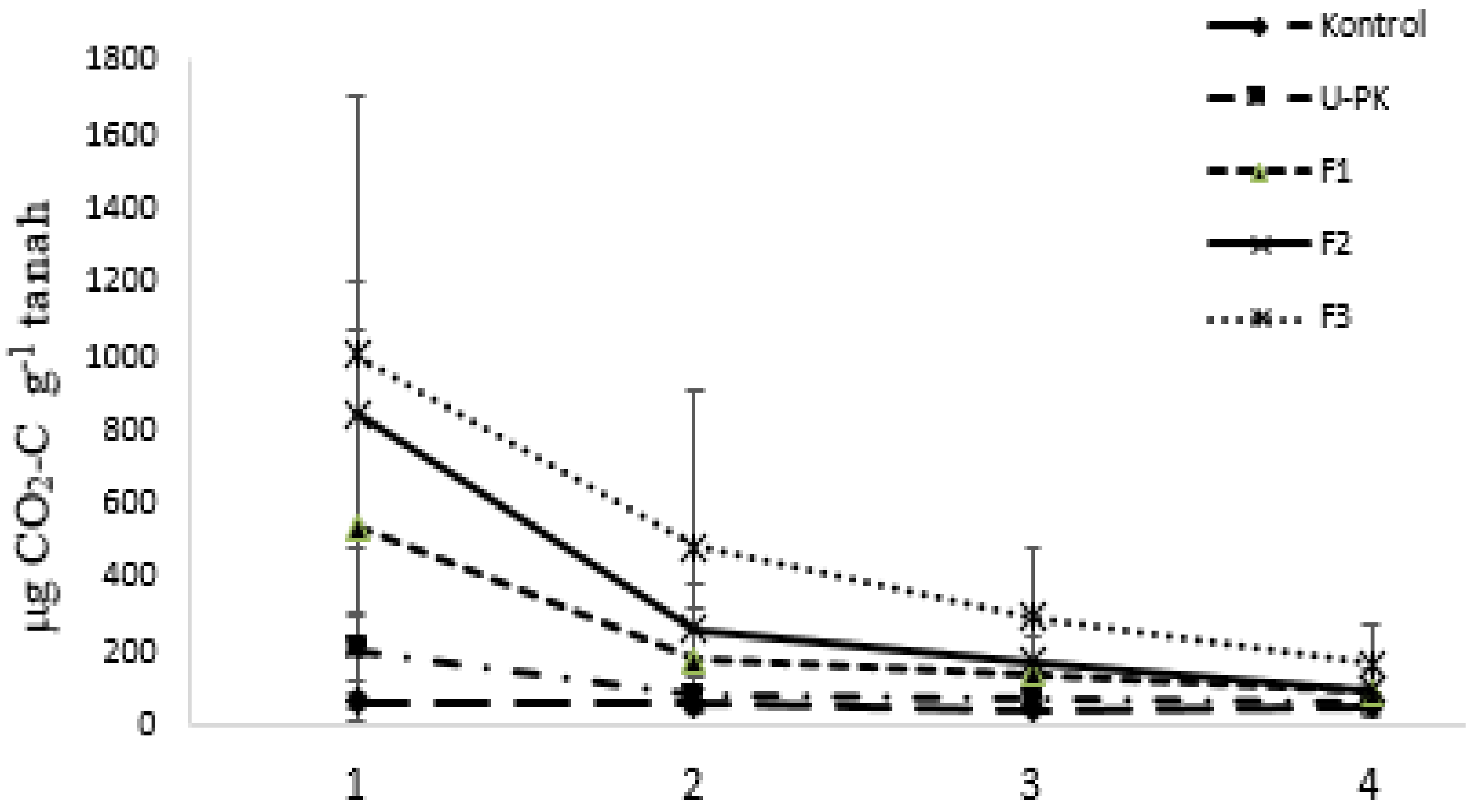


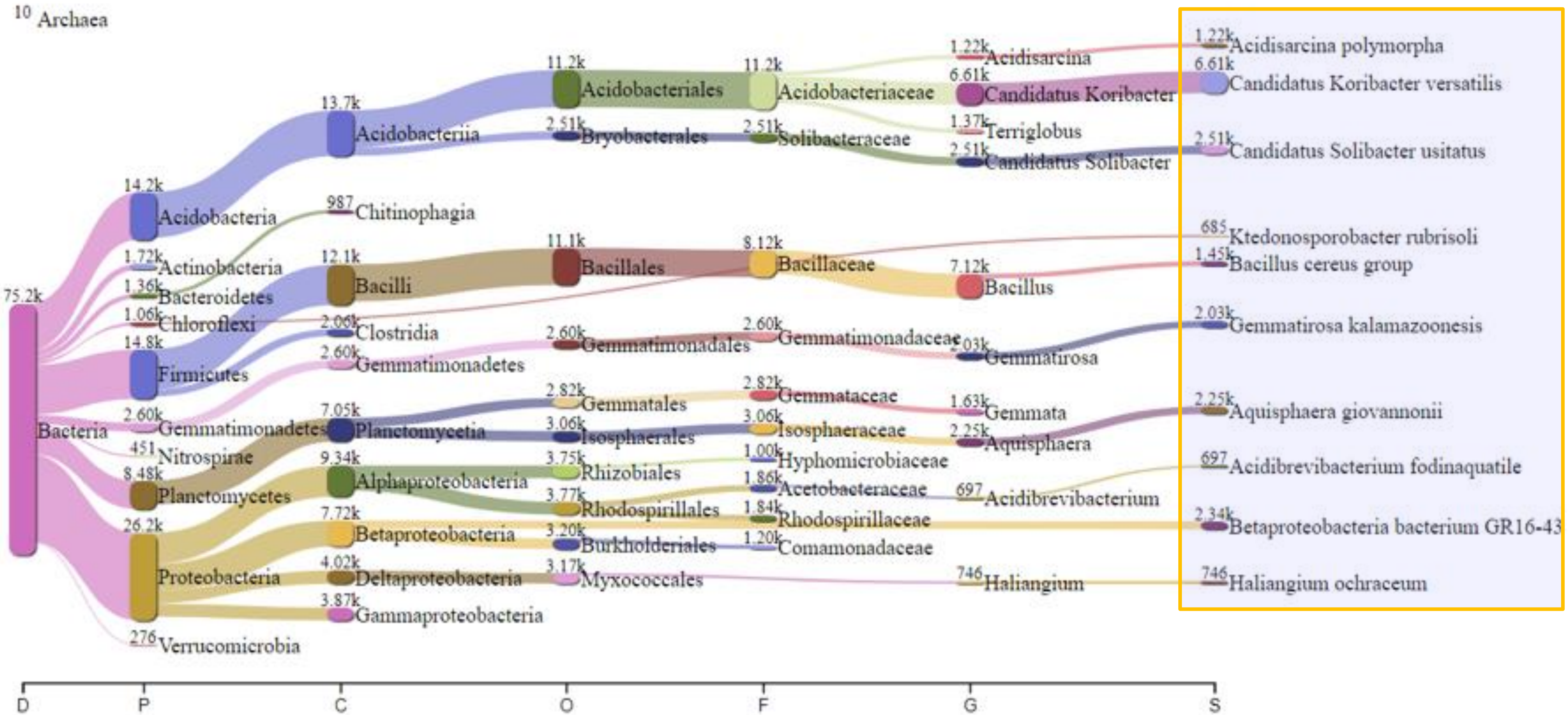
Fig.: Nitrous oxide production affected by additional frass



Incubation time (week)

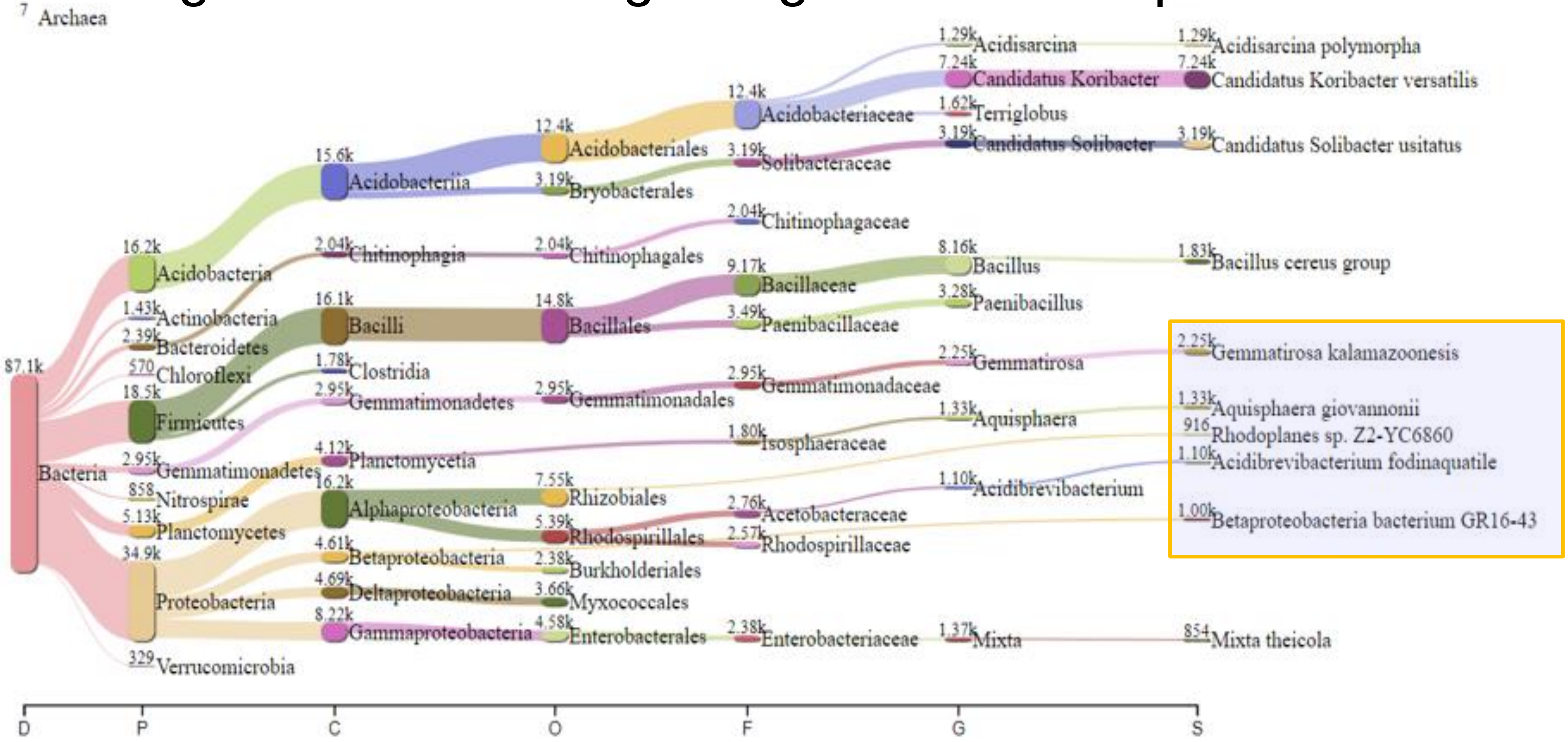
Fig.: Carbon dioxide production affected by additional frass

Full Length 16S Barcoding using Oxford Nanopore Platform



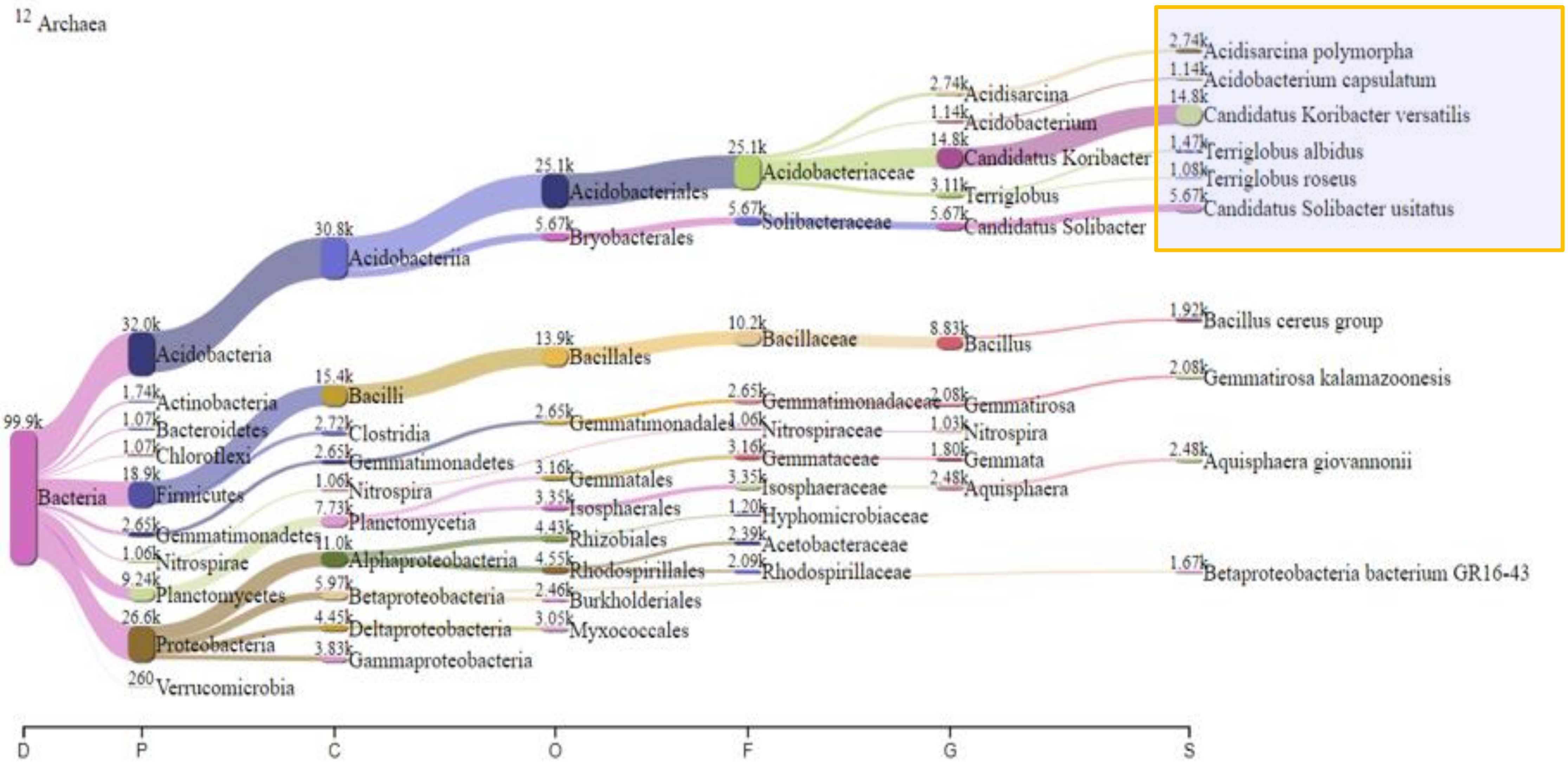
(Soil Bacteria Diversity (Control)→ after 4 week incubation)

Full Length 16S Barcoding using Oxford Nanopore Platform



(Soil Bacteria Diversity (UPK)→ after 4 week incubation)

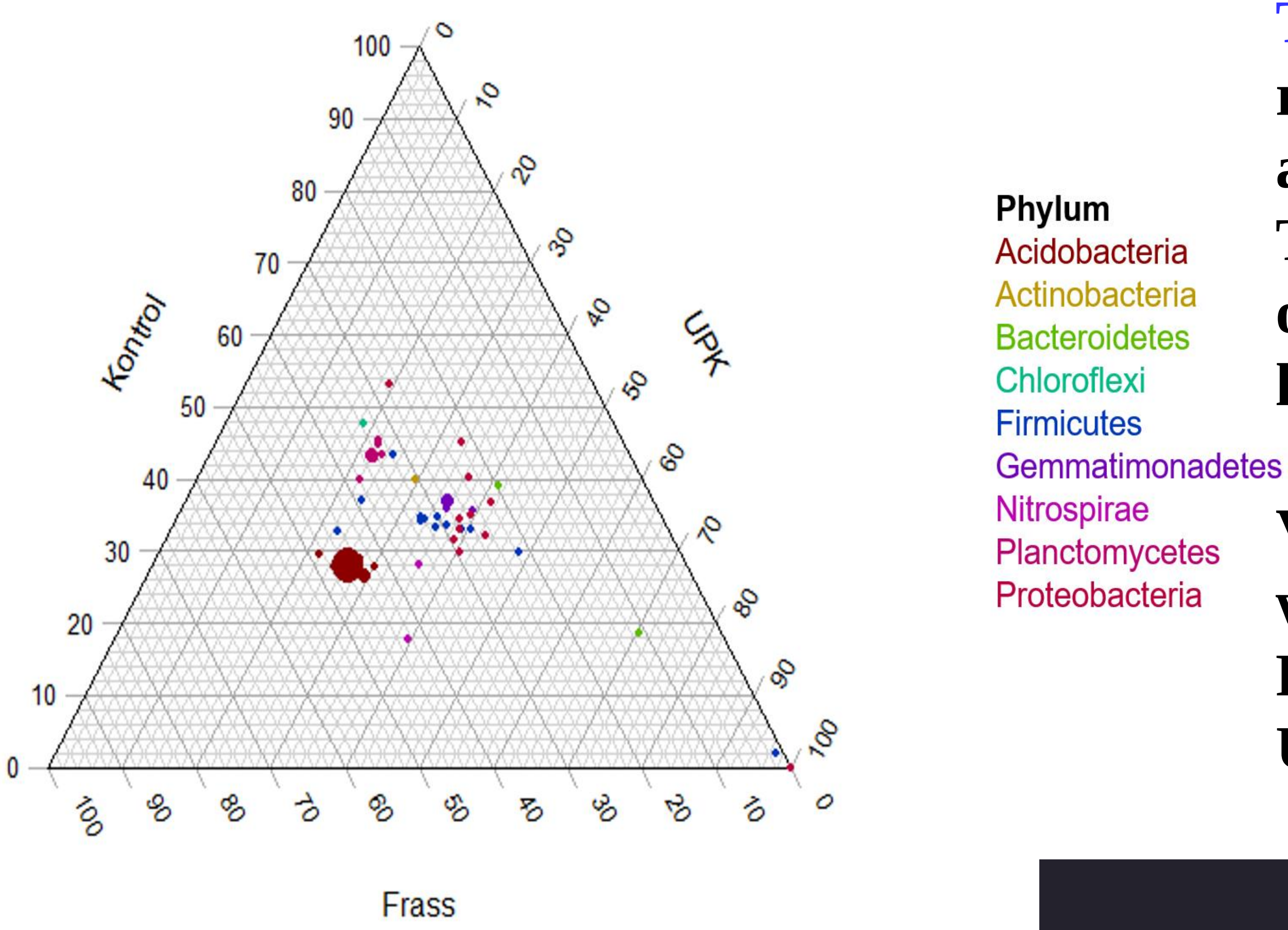
Full Length 16S Barcoding using Oxford Nanopore Platform



(Soil Bacteria Diversity (Frass)→ after 4 week incubation)

Metagenomic Soil Microbe affected by frass

Ternary Plot

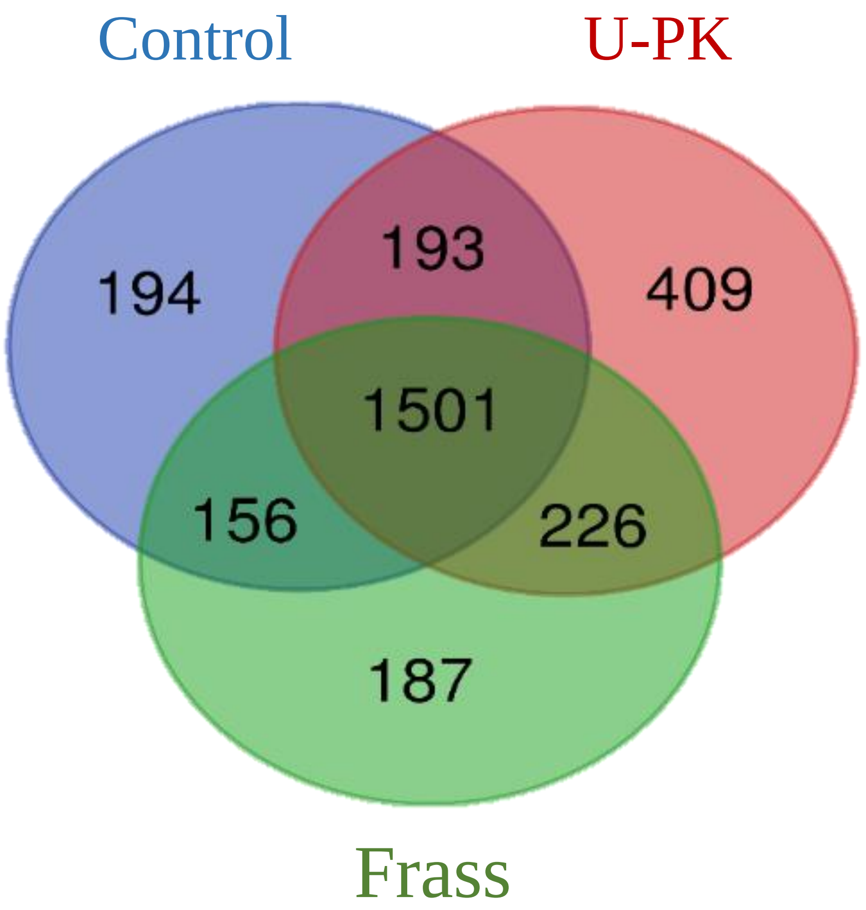


The ternary plot depicts the ratio of the three variables in an equilateral triangle position. The axis reflects the percentage of isolates detected at each location.

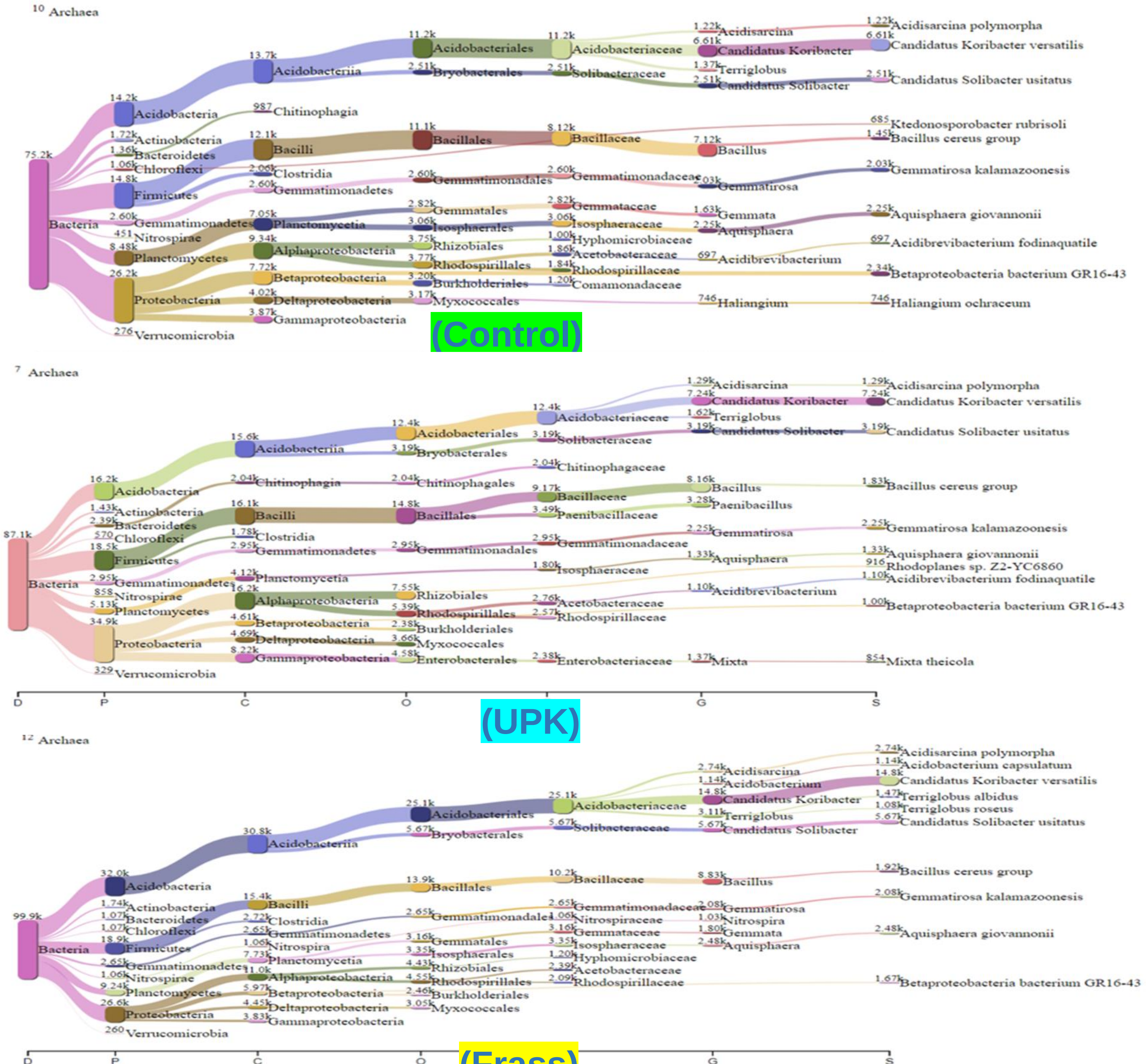
Visually, Phylum Acidobacteria with the highest quantity in the Frass sample reached 70%, UPK 50%, and control 30%.

Diagram Venn

Representing the common microb

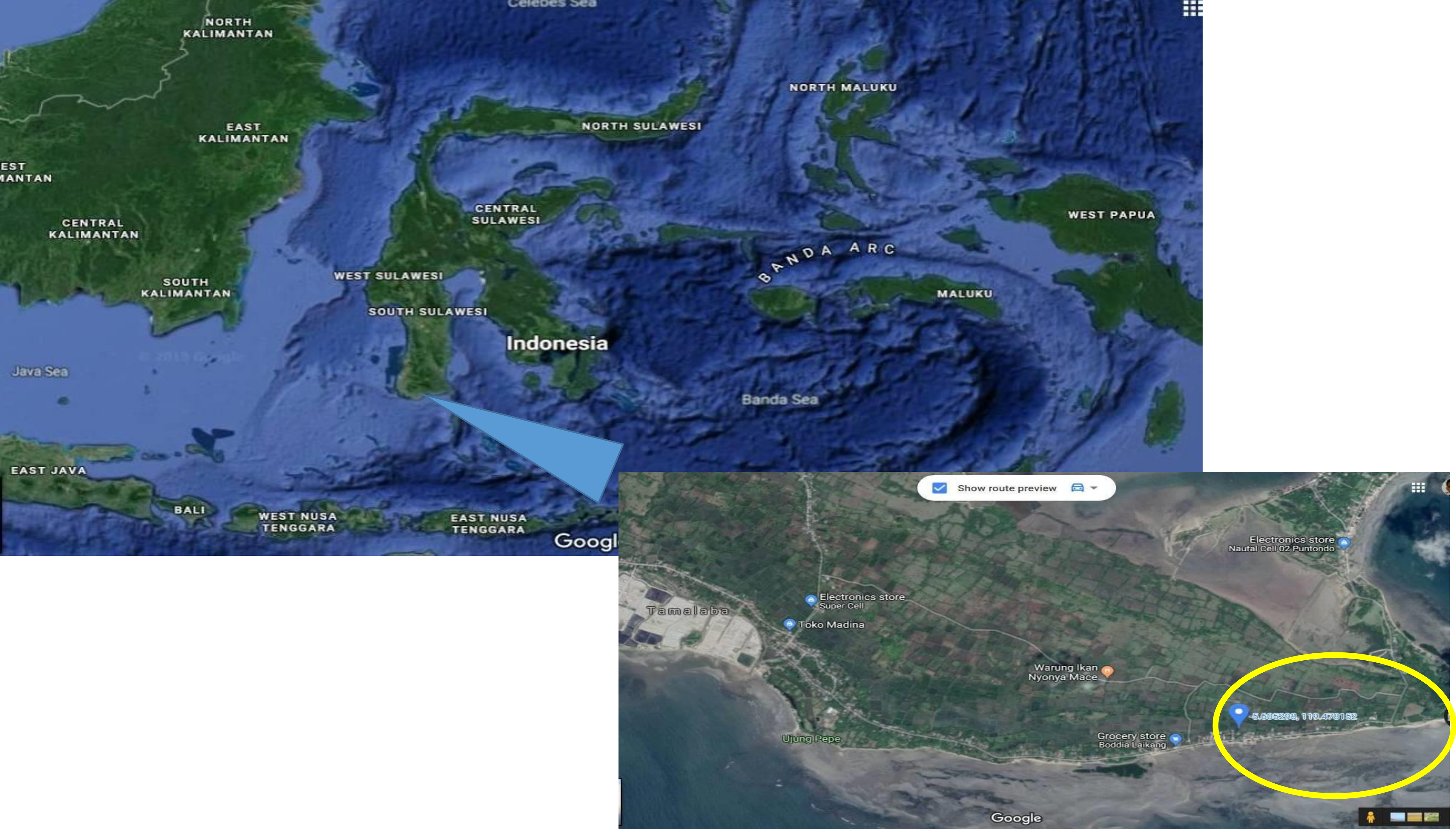


(a)



Development of sustainable liquid *biostimulant extracted* from Indonesia seaweeds to improve soil quality, production food and the crop yield in the corn field

The aims of this work are to develop a marine sustainable liquid biostimulants extracted from Indonesian seaweed by enzyme-assisted extraction and fermentation methods with selecting three species (*Kappaphycus alvarezii*, *kappaphycus stratum* and *Sargassum polycystum*). The soluble extracts were characterized by their respective biochemical composition, antiradical activities, pigments and sugar fractions and as biostimulan.



NORTH KALIMANTAN
EAST KALIMANTAN
CENTRAL KALIMANTAN
SOUTH KALIMANTAN
NORTH MALUKU
NORTH SULAWESI
CENTRAL SULAWESI
WEST SULAWESI
SOUTH SULAWESI
WEST PAPUA
BANDA ARC
MALUKU
Indonesia
Java Sea
Banda Sea
EAST JAVA
BALI
WEST NUSA TENGGARA
EAST NUSA TENGGARA
Show route preview
Electronics store
Naufal Cell 02 Puntondo
Tamalaba
Electronics store
Super Cell
Toko Madina
Warung Ikan Nyonya Mace
-5.605298, 119.478152
Grocery store
Boddia Laikang
Ujung Pepe
Google



The Biochemical composition analyses were conducted

Protein by BCA – KIT MICRO BC ASSAY (Smith et al., (1985); Wiechelman et al.(1988))
Neutral Sucrose by DUBOIS (Dubois et al. 1956)
Group Sulfates by AZURE A (Jacques et al. (1968); Pierre (2010))
Polyphenols by FOLIN CIOCALTEAU (Chandler et al. (1983); Heo et al. (2004); Wang et al. (2010))
Uronic acid by META-HYDROXY-DIPHENYL (MHDP) (Blumenkrantz et al 1973); Montreuilet al. (1963)

Antiradical activities of extracts were measured with the 2,2- diphenyl-1-picrylhydrazyl (DPPH) method.

Pigment analysis Chlorophyll a, Chlorophyll b and ß-carotene performed by high performance liquid chromatography (HPLC) (Wright and Jeffrey (1997) and Pinto et al. 2002).

The composition of unitary sugars present in the polysaccharide chains 'was' determined by High Pressure Anion Exchange Chromatography (Dionex).

Seed Coating Using Brown Algae (Sargassum sp.) Extract Fermented with Bacteria from Digestive Organs of Abalone (Haliotis sp.) on Germination of Corn (Zea mays) and Tomato

Table 1. Biochemical composition of raw material (%).

	Neutral Sugars	Uronic Acids	Sulfate	Total Phenol	Proteins
K. alvarezii	27.62±0.20	4.67±0.04	3.42±0.95	0.74±0.00	11.59±1.16
K. striatum	27.38±0.15	4.06±0.07	3.89±1.00	0.71±0.00	12.70±1.26
Sargassum 125 µm	3.62±0.13	2.24±0.59	4.75±0.97	0.32±0.00	11.66±0.50
Sargassum 250 µm	5.01+0.99	1.06±0.04	4.92±0.46	0.27±0.00	10.08±1.05
Sargassum 500 µm	5.01±0.61	2.72±0.91	4.55±0.41	0.05±0.00	8.32±1.43

Biochemical composition of raw material and enzymatic extracts (% *dw* and g).

		Ash	Organic matter	Neutral sugars	Uronic acids	Sulfate	Proteins	Total phenols
Raw algae	% *dw*	15.9 ± 1.2	84.1 ± 1.2	23.2 ± 1.4	21.1 ± 0.1	20.1 ± 0.9	24.4 ± 0.1	0.6 ± 0.1

Hardouin et al., 2016

Table 3-1 Biochemical composition of Indonesian *Sargassum* species.

Algae	Content (% dry algal material)								
	Uronic acid	Protein	Sugar	Sulfates groups	Polyphenol	Ash	Nitrogen	Total	Other
S. aquifolium	4.5 ± 2.0	20.9 ± 1.1	8.4 ± 0.1	10.7 ± 0.6	1.7 ± 0.3	32.5 ± 0.3	1.6 ± 0.1	69.2	30.8
S. ilicifolium	7.8 ± 3.3	30.5 ± 1.2	10.8 ± 0.2	11.4 ± 0.5	2.1 ± 0.4	29.0 ± 2.6	1.6 ± 0.1	77.1	22.9
S. polycystum	6.1 ± 2.6	19.6 ± 0.6	10.3 ± 0.1	13.7 ± 0.7	1.7 ± 0.3	33.6 ± 1.9	1.0 ± 0.2	72.0	28.0

Puspita, M. 2017

Table 2. Antioxidant Activities of raw material

	IC50 (µg ml^{-1})
BHA*	0.00192±0.00
BHT*	0.00245±0.00
K. alvarezii	0.975±0.09
K. striatum	0.685±0.23
S. polycystum	0.649±0.24

* BHA : Butylated Hydroxy Anisole.
** BHT : Butylated HydroxyToluene.

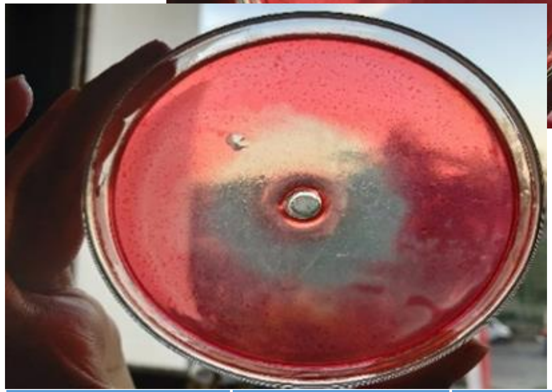
	Crude extracts		
	Cytotoxicity	Antiviral	Antioxidant
	CC_{50} (µg/ml)	EC_{50} (µg/ml)	IC_{50} (µg/ml)
Acyclovir	> 500.0	0.3 ± 0.1	–
BHA*	–	–	0.0048
BHT**	–	–	0.0069
Blk	> 500.0	> 500.0	> 25.0
C1			6.0

Hardouin et al., 2016

Table 3-18 Antiradical scavenging activity of Indonesian *Sargassum* in solid-liquid and enzyme-assisted extraction.

Samples	Methods	DPPH IC_{50} (mg/mL)	Sig. (p<0.05) of Species	Sig. (p<0.05) of Solvents
BHA		7.5±0.4		
BHT		11.7±4.5		
S. aquifolium	Water	8.9 ± 2.1		
	MeOH	n.a		
	MeOH 50%	3.2 ± 1.7		
	EtOH 75%	n.a		
	Viscozyme	n.a		
	Protamex	1.4 ± 0.7		
S. ilicifolium	Water	n.a		
	MeOH	3.4 ± 0.8		
	MeOH 50%	9.0 ± 0.7	.014 (df = 2 ; F= 4.802)	.008 (df = 5; F = 3.691)
	EtOH 75%	9.9 ± 1.8		
	Viscozyme	9.9 ± 6.1		
	Protamex	4.4 ± 2.4		
S. polycystum	Water	n.a		
	MeOH	n.a		
	MeOH 50%	20.3 ± 2.5		
	EtOH 75%	5.5 ± 0.3		
	Viscozyme	n.a		
	Protamex	9.5 ± 2.4		

Puspita, M. 2017



Isolation of Abalone Digestive Organ Bacteria (Gomare et al., 2011).

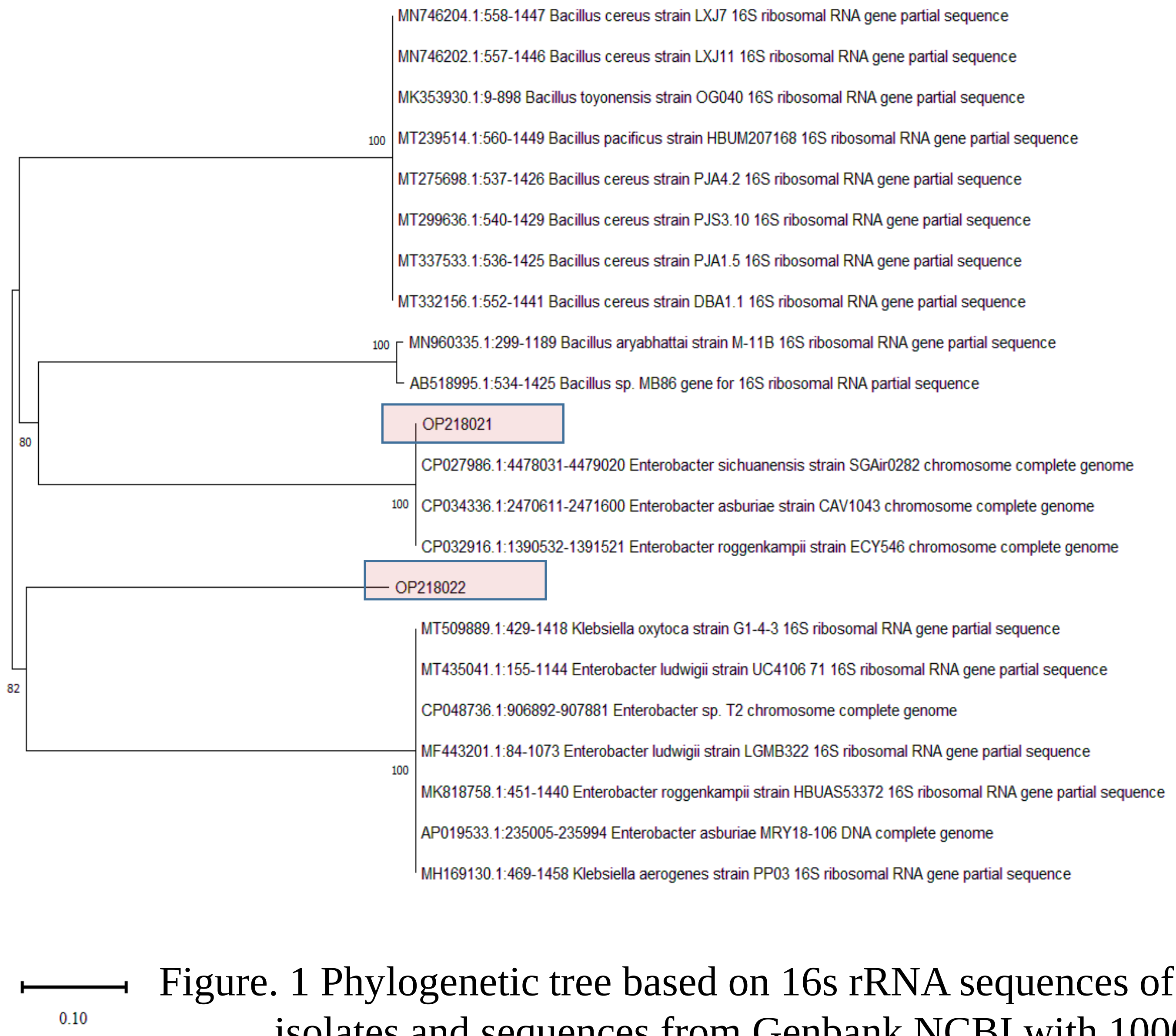
The hydrolysis ability of polysaccharides was carried out using the CMC test medium and evaluated for each isolate using the plate test according to the procedure described by Teather and Wood (1982).

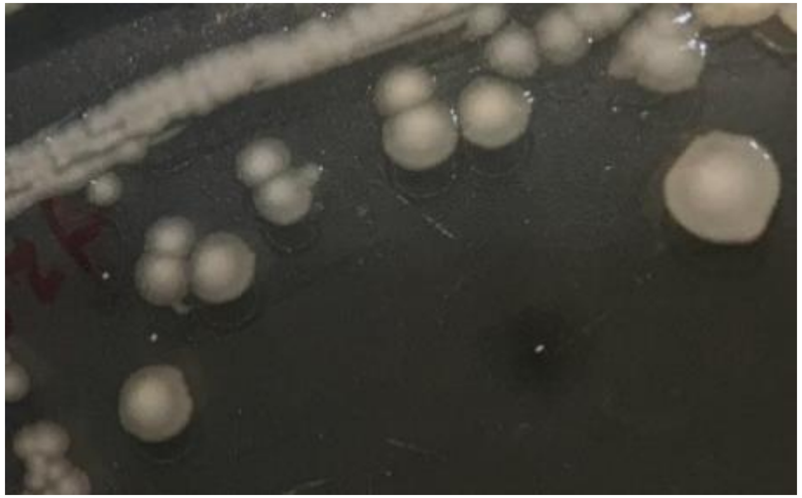
Molecular and Phylogenetic Identification

DNA extraction was carried out using the ZR Bacterial DNA Kit™. PCR amplification was performed using MyTaq Red Mix (Bioline). The primers used were Sequence 27F AGAGTTTGATCMTGGCTCAG and Sequence 1492R TACGGYTACCTTGTTACGACTT. The phylogeny tree schematic was created using the Molecular Evolutionary Genetics Analysis (MEGA-X) application (Kumar et al., 2018). The nucleotide sequences in this study have been deposited in the NCBI under Accession number OP218021 and OP218022.

Seed Extraction, Coating and Germination (Suo et al., 2017).

Isolate Code/ Access Number	CMC hydrolysis zone diameter (cm)	Indo Test	MR Uji test	VP test	Citrate Test	OF test	Test Catalase	Gram stain results		Cell shape	Colony form (form)	Elevation (elevation)	Shape of the edge of the colony (margin)	Colony form (form)
OP218021	2.56	-	+	-	-	-	+	-		Cocci	circular	Raised	Entire	circular
OP218022	4.50	-	+	-	+	-	+	+		Basil	circular	Flat	Entire	circular





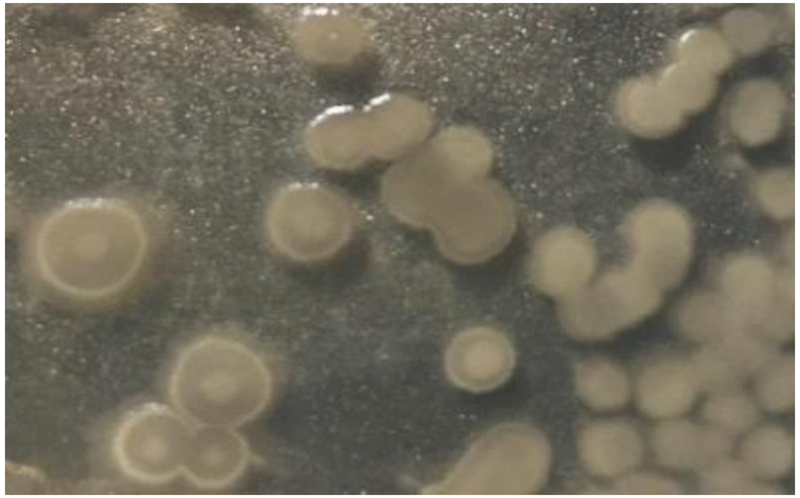
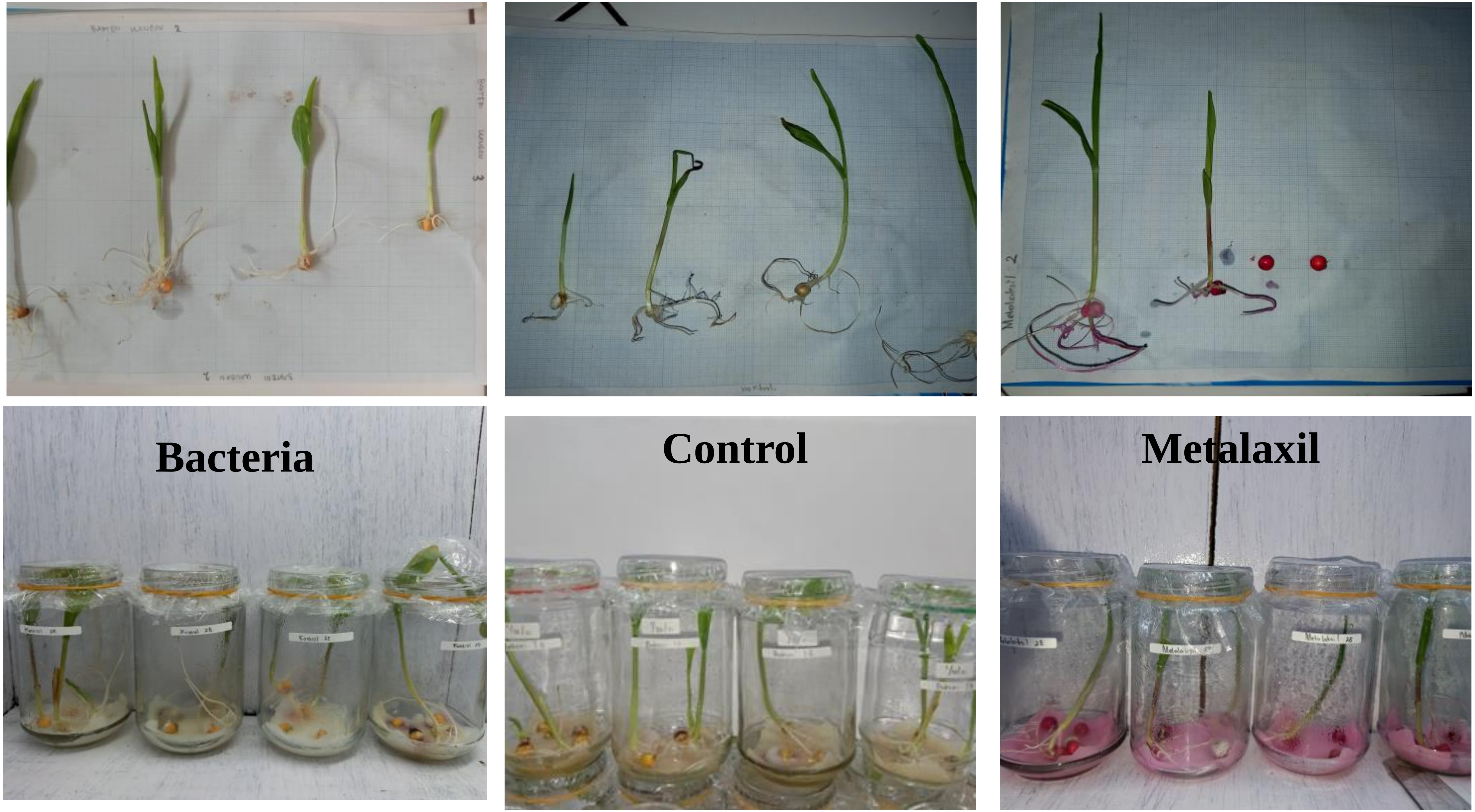


Figure. 1 Phylogenetic tree based on 16s rRNA sequences of selected isolates and sequences from Genbank NCBI with 1000 bootstrap Neighbor Joining method using MEGA-X

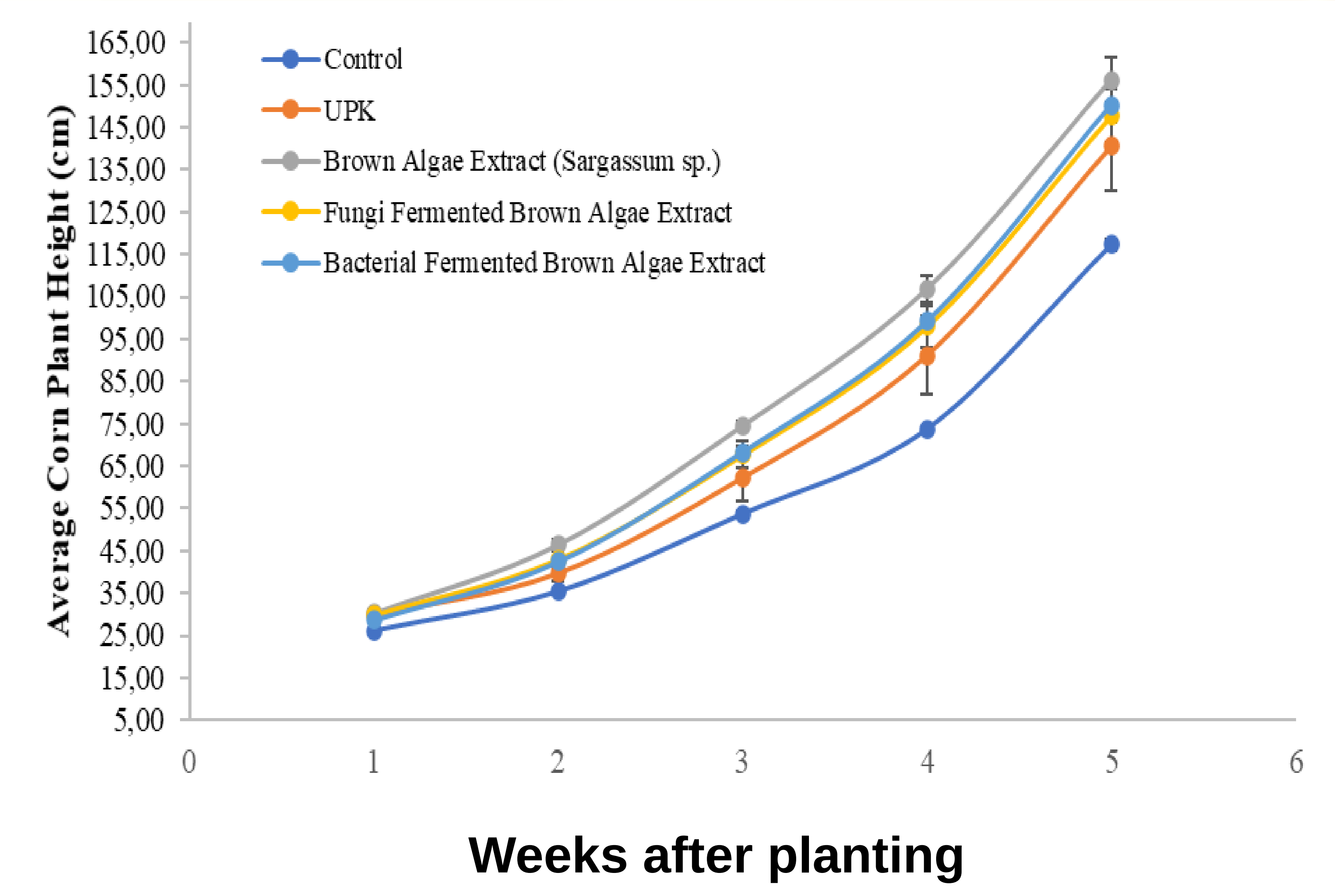
The treatment was Sargassum sp. using several types of starter microbes that have the ability to excrete polysaccharide-degrading enzymes namely a) Sargassum sp. fermented abalone consortia (pasteurized), b) Sargassum sp. fermented abalone consortia (non-pasteurized) c) Metalaxyl (an acylalanine fungicide with systemic function as a positive control), and 4) without treatment (distillated water as negative control).

Treatment	Average Corn Sprout Height (cm)	Corn Germination (%)	Average Corr Seed Vigor Ind (%)
Pasteurized Abalone Algae	8.26^{ab}	57.99^{c}	481.65^{c}
Non Pasteurized Abalone Algae	4.96^{ab}	41.67^{ab}	264.42^{b}
Metalaxyl	1.94^{a}	11.11^{a}	46.30^{a}
Control	11.67^{c}	50.69^{c}	710.29^{d}


Bacteria
Control
Metalaxil

The growth of vegetative corn

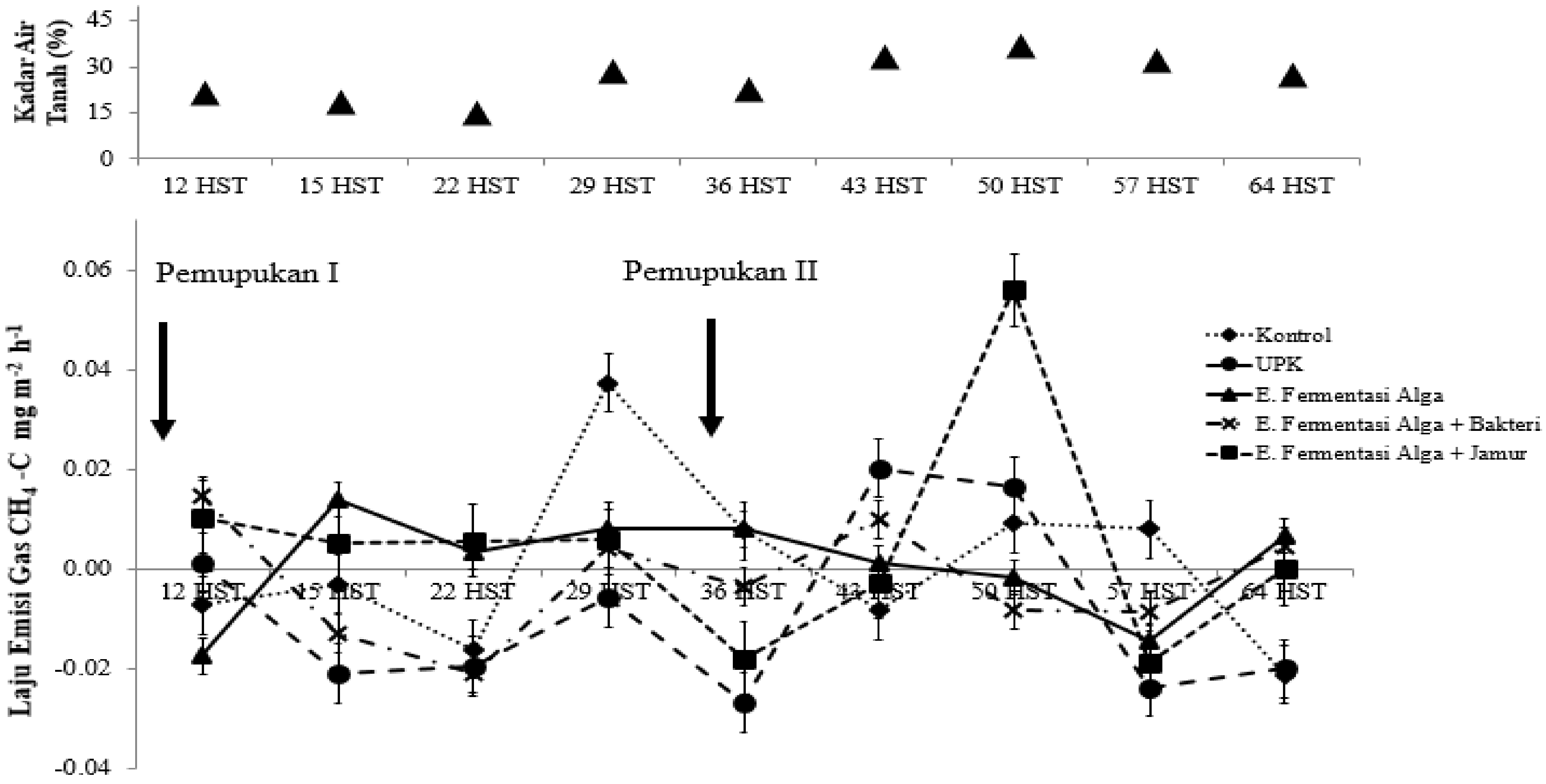
Fig. The average height of corn

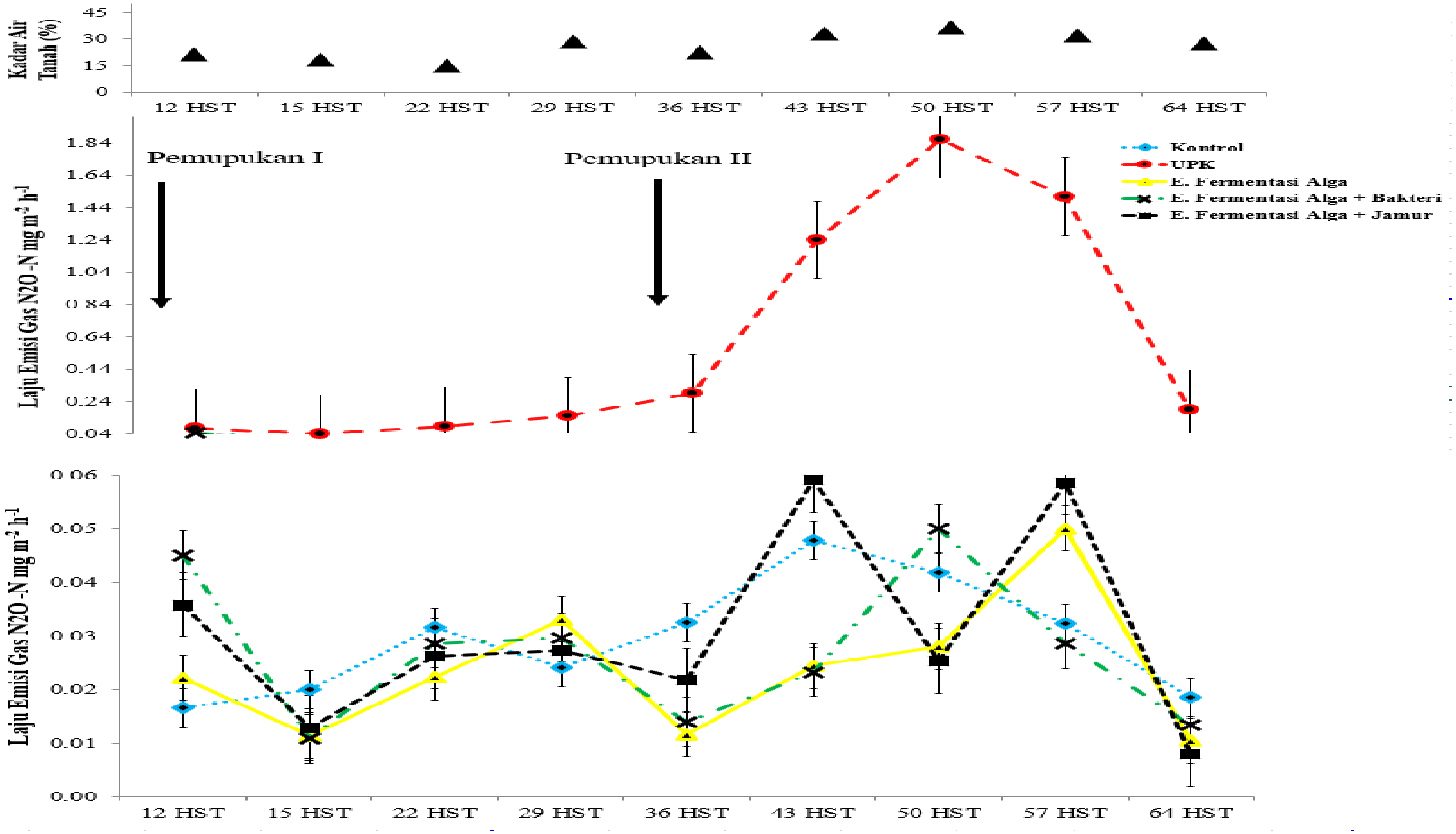


CORN CROP YIELDS

The harvest of corn crops with Five treatments is Control, UPK, Brown Algae Extract, Fungi Fermented Brown Algae Extract and Bacterial Fermented Brown Algae.

Emission of CH_4 gas





Emission of N_2O gas

Conclusion

Mitigation or efforts to reduce greenhouse gases (N_2O) can be done by nitrogen management such as application of organic nitrification inhibition (neem), organic fertilizer shifting, and *a combination of water management in paddy fields (CH_4).*

Fertilizer management can affect soil microbial communities that carry out the nitrogen and carbon cycling processes in soil.

Acknowledgments

This work was supported;

Directorate General of Higher Education Indonesia

Mobility scheme 2023: ***NUSANTARA est le Partenariat Hubert Curien franco-indonésien. Il est mis en œuvre en France par le Ministère de l'Europe et des Affaires étrangères (MEAE) et le Ministère de l'Enseignement Supérieur et de la Recherche (MESR), et dans le pays partenaire par le Ministère de l'Education, de la Culture, de la Recherche et de la Technologie (KEMDIKBUDRISTEK).***

Wishes to thanks all team for their assistances and efforts…


FOREVER


Merci
beaucoup