Bumitama Gunajaya Agro

Pemodelan Fotosintesis dan Respon Stress di Daun dan Vegetasi dengan Penginderaan Jauh

Oleh:

- **Mukhammad Muryono, Ph. D (Functional Ecology, Dept. Biology, ITS University) -PI /LEAD**
- Professor Kouki Hikosaka (Functional Ecology, Graduate School of Life Science, Tohoku University Japan)
- Putra Maulida, Ph. D (Geomatika, Dept Geomatika, ITS University)
- Indah Trisnawati, Dwi. T (Entomology, Dept. Biology, ITS University)

TUJUAN PROJECT

1. Diskripsi, Seleksi dan Penginderaan Jauh aktivitas Fotosintesis/produktivitas dan Respon Stress Terhadap Perubahan Iklim pada Kelapa Sawit
2. Pembuatan dashboard high-portofolio berbasis pengindraan jauh yang terintegrasi sebagai data growth fenotyping dan fisiologi tanaman
3. Ekofisiologi tanaman terhadap perubahan lingkungan : Effect of climate change on harvest failure and oil palm production

JUSTIFIKASI RISET/PROJECT

- Hasil - hasil Riset/Project sebelumnya yang dilakukan orang lain dan posisi kita di depan melakukan Riset/Project seperti apa.

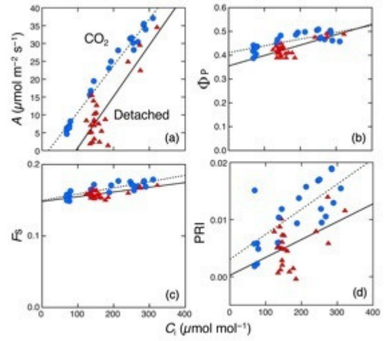
State of Art :
Journal of Plant Research (2021) 134:649–651 https://doi.org/10.1007/s10265-021-01324-1

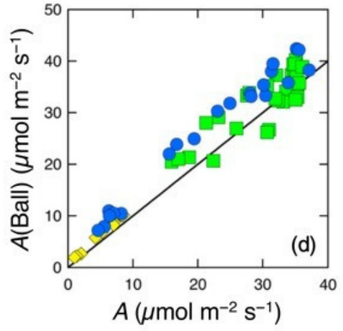
All lives rely on photosynthesis. It provides energy and carbohydrates not only to photosynthetic organisms themselves but also to heterotrophic organisms through the food web. It is also one of the most important processes in global carbon cycling. Improvement of photosynthesis is a key to solving problems that human society faces. Crop management and breeding of cultivars with higher photosynthetic activities may contribute to increasing crop yields, which are needed to meet rapid population growth. Enhancement of carbon sequestration in terrestrial ecosystems may be one of the effective ways for a low-carbon economy.
Previous studied have a variety of options for photosynthesis measure- ments, but we also understand the problems. Yu et al. (2021) have used a combination of UAV observations and another method, implying that it is difficult to obtain accurate values by only remote sensing. Understanding various measurement methods, theories, and the advantages and disadvantages of each are expected to link to the development of new technology and new knowledge. The integration and constant updating of plant physiological information and eco-physiological information would expect this special issue to be a good opportunity to widely disseminate photosynthesis measurement methods with many researchers and connect researchers with their respective research fields.

NEXT :
OIL PALM FIELD PHENOTYPING AND HIGH-INTEGRITY REALTIME ASSESSMENT DASHBOARD WITH REMOTE SENSING FOR PHOTOSYNTHESIS - PRODUCTIVITY AND STRESS RESPONSE TO CLIMATE CHANGE

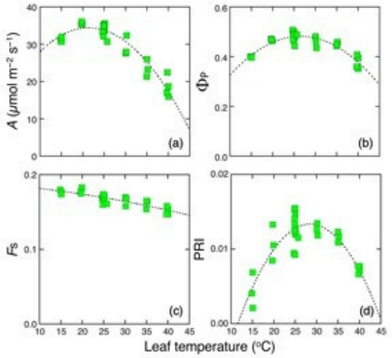
METHODOLOGY
The research method was carried out using the Geo-Biophysical Parameter Detection and Machine Learning Classification using Random Forest and Support Vector Machine (SVM) Methods.

Modeling of photosynthesis from fluorescence and PRI





Photosynthetic rate was successfully predicted from PRI and fluorescence



ORIGINAL ARTICLE

WILEY

Modeling leaf CO_2 assimilation and Photosystem II photochemistry from chlorophyll fluorescence and the photochemical reflectance index

Kouki Hikosaka[1] | Hibiki M. Noda[2]

Canopy photosynthesis

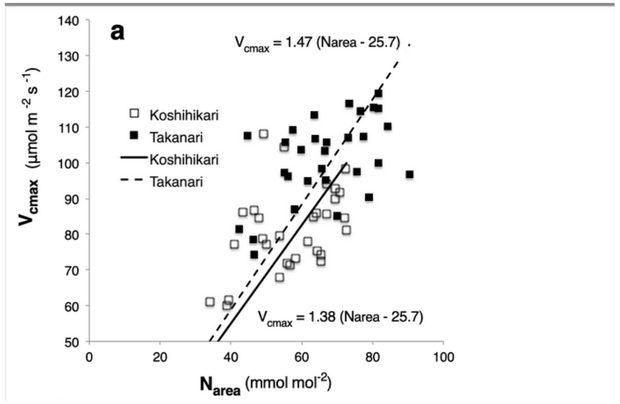
of a high-yielding cultivar of *Oryza sativa* L

(イネ多収性品種における葉群光合成)

TOHOKU UNIVERSITY

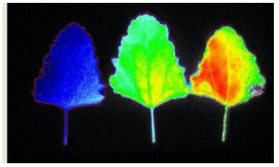
2017

MUKHAMMAD MURYONO



Modeling of photosynthesis from fluorescence and PRI

Photosynthetic rate of photoinhibited leaves can be predicted only when both fluorescence and PRI are used simultaneously

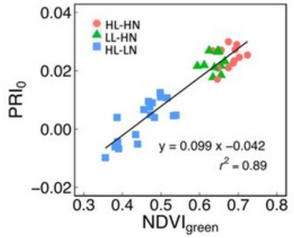


Functional Plant Biology
https://doi.org/10.1071/FP20365

Photosynthesis, chlorophyll fluorescence and photochemical reflectance index in photoinhibited leaves

Kouki Hikosaka

Photosynthetic rate of leaves grown at different light and nutrient conditions can be predicted if PRI is corrected using an index NDVI green



Photosynthesis Research (2021) 148:33–46
https://doi.org/10.1007/s11120-021-00833-3

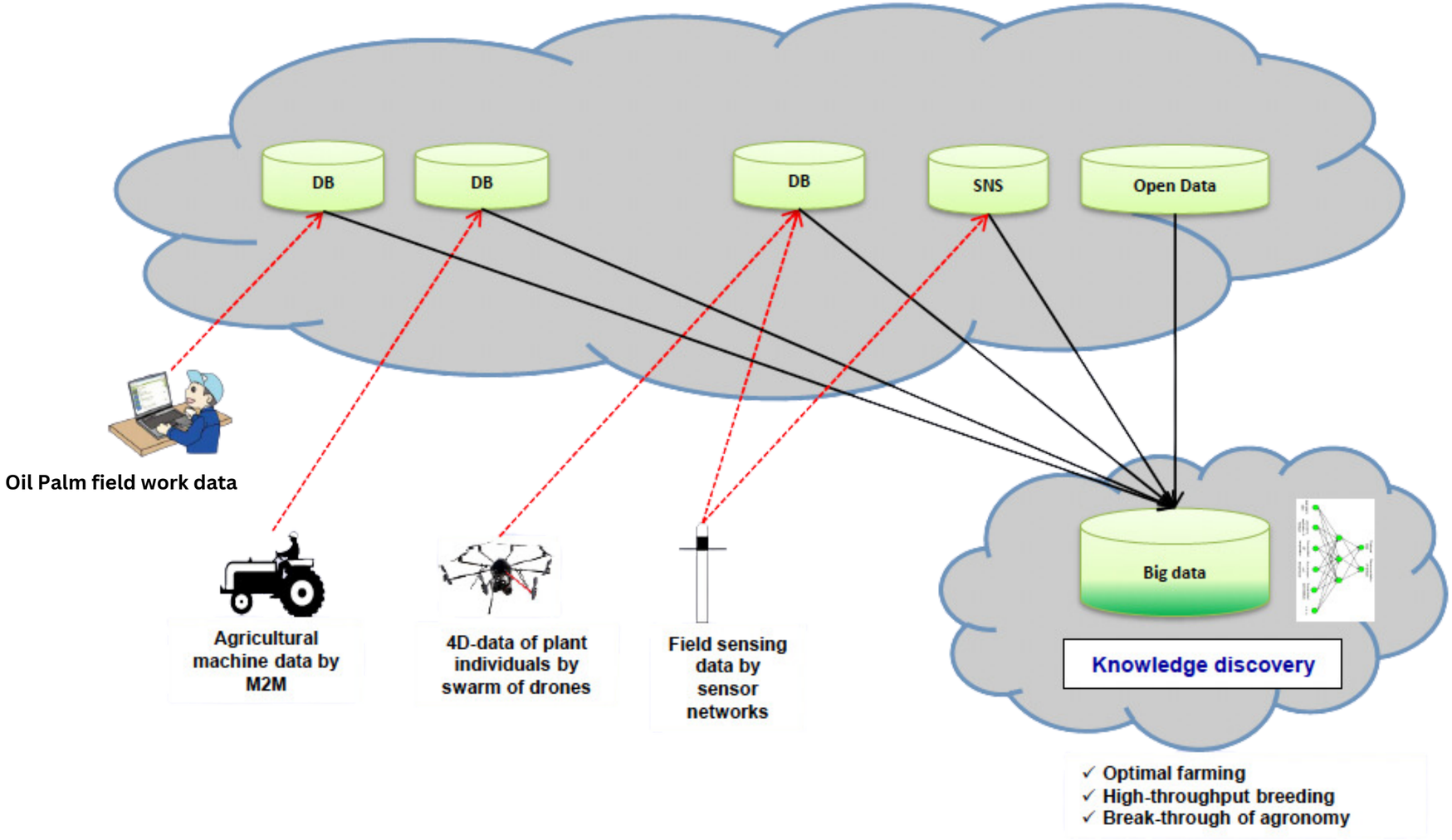
ORIGINAL ARTICLE

Estimating leaf photosynthesis of C_3 plants grown under different environments from pigment index, photochemical reflectance index, and chlorophyll fluorescence

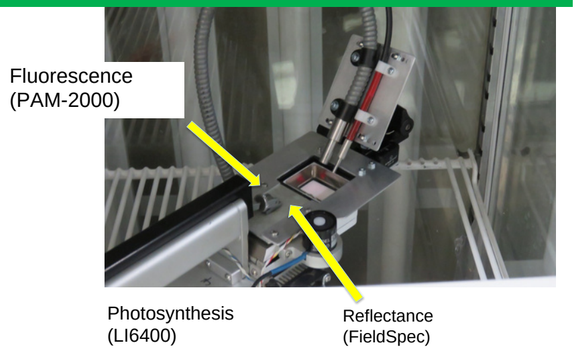
Katsuto Tsujimoto[1] · Kouki Hikosaka[1]

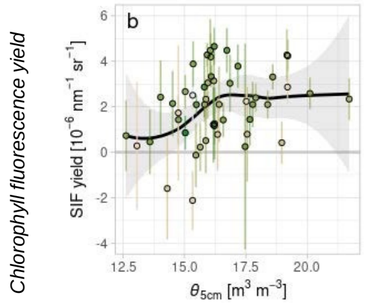
GRANT CHART PELAKSANAAN

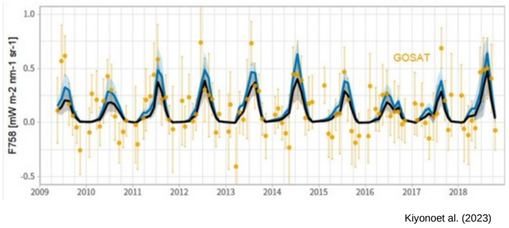
Rencana activity pelaksanaan Riset/Project ditampilkan secara detail.



Simultaneous measurement of gas exchange, fluorescence and reflectance spectra







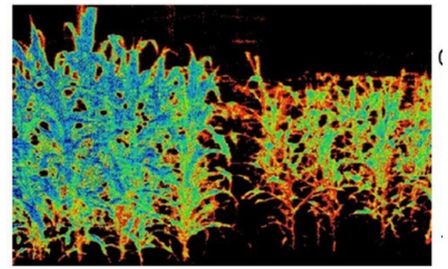
Kiyonoet al. (2023)

Depression in chlorophyll fluorescence around 2016

BIG PICTURE RISET/PROJECT

Milestone dan skala Riset/Projectnya apa bisa dilakukan terus -menerus (multiyears, contoh produk kapan bisa diimplementasikan se BGA dan tahun berapa (Multiyears / 3 Th).

2025



Photochemical Reflectance Index (PRI)

Healthy Water stress

2026

DASHBOARD

R Sensing Data

Oil Palm Area

Vegetation I

Rainfall

Reflectance, Temperatur e

Crop and Production Data

Cropping Pattern, Phase/Age

Flood / Drought / Pest

Oil Palm Vulnerability

Oil Palm Acces

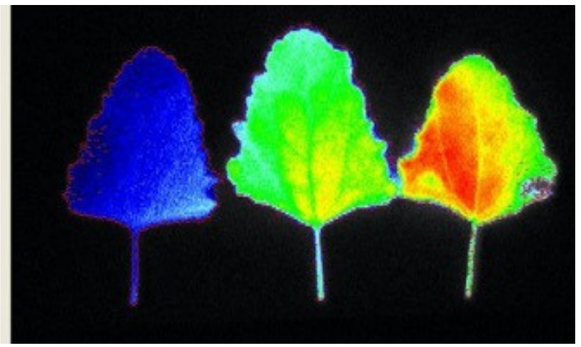
Harvest Area and Productivity

Oil Palm Absorption

Production Availability

Oil Palm Security

Healthy Photoinhibited



Chlorophyll fluorescence

2024

BIG PICTURE RISET/PROJECT

Traction

2024	2025	Semester 1 2026	Semester 2 2026
Assessment Photosynthesis Rate dan stress respons pada daun	Assessment Photosynthesis Rate dan stress respons with satellite imaging	Dashboard/Platform algoritmic monitoring : Project Evaluation Criteria	Crop Improvement and Carbon Project High-Portofolio Profil
1	2	3	4
Measuring leaf photosynthesis as photosynthesis rate and others plant traits related with ecophysiology respons of climate	Use of remote sensing tchnology : Static baseline quantifies non -destructive phenotyping to generate information for breeders and agronomist to make selection of yield planting materials		• Platform company as remote sensing and AI to monitor a high yielding planting /plant healthiness • Future high profile carbon project

RAB RISET/PROJECT (BIAYA, MPP, ALAT DAN BAHAN)

perhitungan anggaran biaya Riset/Project dari kebutukan Biaya, MPP, Alat, Bahan atau jasa yang akan digunakan pada Riset/Project ini.

No	Package	2024/25	2025/26	2026/27	TOTAL
1	Staff Cost	72.435.000	120.725.000	48.290.000	241.450.000
2	Consultancy cost / FGD	17.550.000	29.250.000	11.700.000	58.500.000
3	Overhead costs	112.205.334	187.008.890	74.803.556	374.017.780
4	Travel and Subsistence	76.050.000	126.750.000	50.700.000	253.500.000
5	Operating costs	227.656.248	379.427.080	151.770.832	758.854.160
6	Capital Equipment	274.609.996	457.683.327	183.073.331	915.366.654
7	Other Cost	7.443.000	12.405.000	4.962.000	24.810.000
		787.949.578	1.313.249.297	525.299.719	2.626.498.594

DAMPAK RISET/PROJECT

Mengalisa dampak dari Riset/Project yang dilakukan baik secara financial dan non-financil secara rinci.

RE-IMAGING sets science-based targets for palm oil sector, as

High - throughput Phenotyping to

- **Acceleration of breeding for super cultivars**
- **Identification of new genes for crossing & genome editing**
- **New trait definition with high heritability linked to final target trait**
- **High fertilizer use efficiency**
- **Biotic and abiotic stress resistance & resilience**
- **high performance for yield, high nutrition & profitability**
- **Design breeding based on G X E models**

DAMPAK RISET/PROJECT

Mengalisa dampak dari Riset/Project yang dilakukan baik secara financial dan non-financil secara rinci.

Powerful crop monitoring tool in smart - palm oil agriculture

- **Novel ICT technologies for field and post harvest management**
- **Education materials on ICT for farmers**
- **Development of integrated agriculture data platform**
- **Social economic analysis on climate-smart palm oil production**

High portofolio on Carbon Footprint for Palm Oil

- **MRV Carbon for climate positive**
- **RSPO and ISPO best practives**

Bumitama Gunajaya Agro

THANK YOU