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Consiglio per la ricerca in agricoltura e l'analisi dell'economia agraria

Research Centre
Vegetable and Ornamental Crops

Applicazioni digitali avanzate in Orticoltura
Esempi per la difesa

Dr Catello Pane
Consiglio per la Ricerca in Agricoltura e l'Analisi dell'Economia Agraria

OSSERVATORIO AGRICOLTURA DI PRECISIONE –ORADP –L.R.N. 15/2018

FOCUS SULLE PRATICHE DI AGRICOLTURA DI PRECISIONE IN REGIONE

Webinar, 17 DICEMBRE 2021

Sistemi Orticoli

Ambiente di coltivazione

- Suolo-Aria (**Ambiente Fisico**)
- Piante-fauna-microfauna-microorganismi (**Ambiente Biologico**)
- Interazioni - Input - Managing (**Condizionamento**)



Black Box or Green Toolbox?

Dir 128/2009/EU – Green Deal

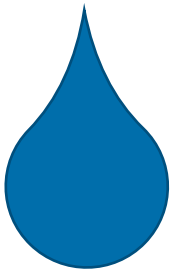
Sustainable use of pesticides

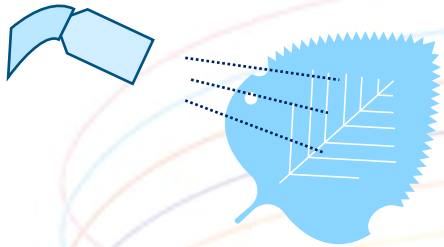
What?

- Development of new methods to reduce crop dependence from chemicals
- Operator training · Best practices

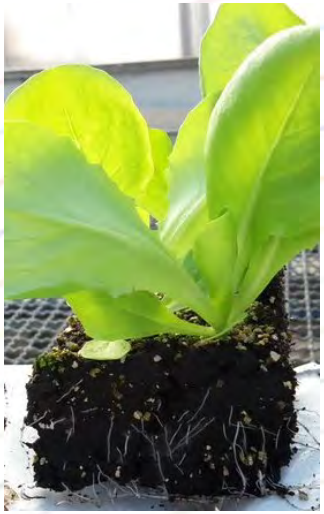
One Health

Agricoltura Digitale





Monitoraggio dei «segnali» dalla «coltura» e/o dall'«ambiente»



Digital Technologies in Agriculture

Decisional Support System(DSS)

Big Data

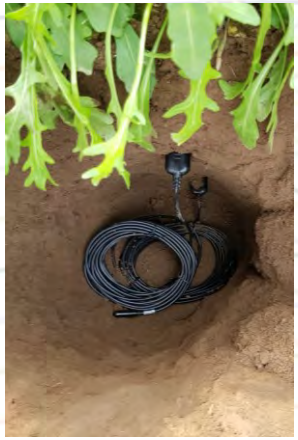
Imaging

Non-imaging

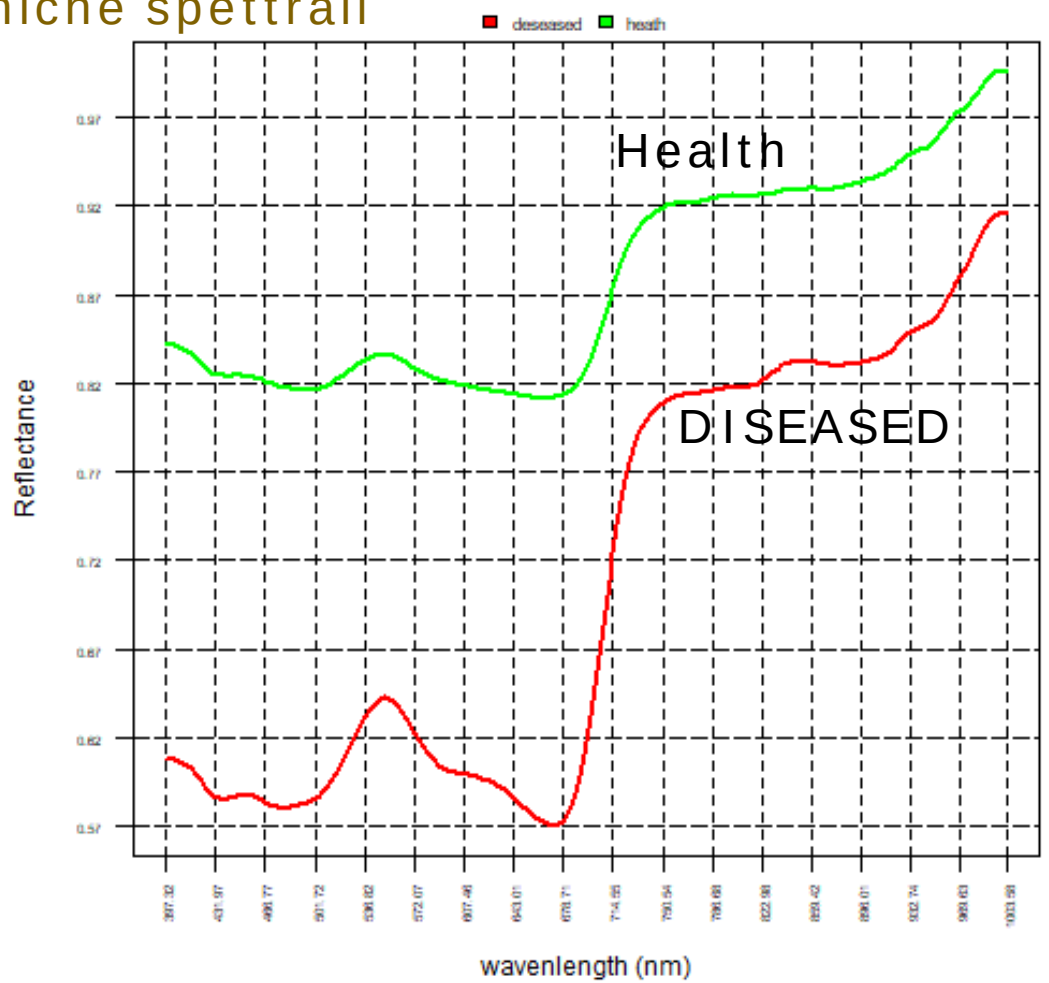
Sensori






Tecniche spettrali



Vegetation indices

Index		Formula	Target	Reference
AI	Anthocyanin index (AI)	$(R_{600}-R_{699})/(R_{500}-R_{599})$	Anthocyanin	Gamon and Surfus, 1999
ARI	Anthocyanin Reflectance Index (ARI)	$(1/R_{550})-(1/R_{700})$	Carotenoids	Gitelson et al., 2001
CAR	Simple ratio 515/570	R_{515}/R_{570}	Carotenoids	Hernandez – Clemente et al., 2012
DVI	Difference Vegetation Index	$R_{782}- R_{675}$	Plant vitality, chlorophyll	Tucker, 1979
FWBI1	Floating-position water band index (FWBI1)	$R_{900}/\min (R_{930}-R_{980})$	Water	Harris et al ., 2006
FWBI2	Floating-position water band index (FWBI2)	$R_{920}/\min (R_{960}-R_{1000})$	Water	Harris et al ., 2006
G	Simple Ratio 550/670 Greenness Index	R_{550}/ R_{670}	Plant vitality, chlorophyll	Smith et al., 1995
GI	Greeness index	R_{539}/ R_{682}	Plant vitality	Zarco-Tejada et al., 2005
Green-NDVI	Green Normalized Difference Vegetation Index	$(R_{750}- R_{550})/(R_{750}+ R_{550})$	Vegetation	Buschmann and Nagel, 1993
HVI	Hyperspectral Vegetation Index	R_{743}/ R_{692}	Plant vitality	Gitelson et al., 1996
LIC3	Simple Ratio 440/740 Lichtenthaler indices 3	R_{440}/R_{740}	Carotenoids	Lichtenthaler et al., 1996
LRDSI	Leaf rust disease severity index (LRDSI)	$6.9 \times (R_{605}/R_{455}) - 1.2$	Rust severity	Ashourloo et al., 2014
MCARI	Modified Chlorophyll Absorption in Reflectance Index	$R_{712}x(R_{712}-R_{682})-0.2x(R_{712}- R_{539})] / R_{682}$	Chlorophyll	Daughtry et al., 2000
MCARI1	Modified Chlorophyll Absorption in Reflectance Index 1	$1.2 \times [2.5 \times (R_{800}-R_{670})-1.3 \times (R_{800}-R_{550})]$	Plant vitality, Chlorophyll	Haboudane, 2004
MSAVI	Modified Soil Adjusted Vegetation Index hyper	$0.5x[2 \times R_{800}+ 1 -v(2 \times R_{800}+1)x 2 - 8 \times (R_{800}-R_{670})]$	Healthy vegetation, reduces soil noise	Qi et al., 1994
mSR705	Modified Simple Ratio 705	$(R_{750}- R_{445})/(R_{705}+ R_{445})$	Vegetation	Wu et al., 2008
NDVI	Normalized Difference Vegetation Index (NDVI)	$(R_{800}-R_{670})/(R_{800}+R_{670})$	Plant vitality, Chlorophyll	Rouse et al., 1973

Lattughino IV gamma

Rucola IV gamma

Caso studio:

Rhizoctonia/Rucola Sclerotinia/Lattughino Sclerotium/lattughino

frontiers in Plant Science

ORIGINAL RESEARCH
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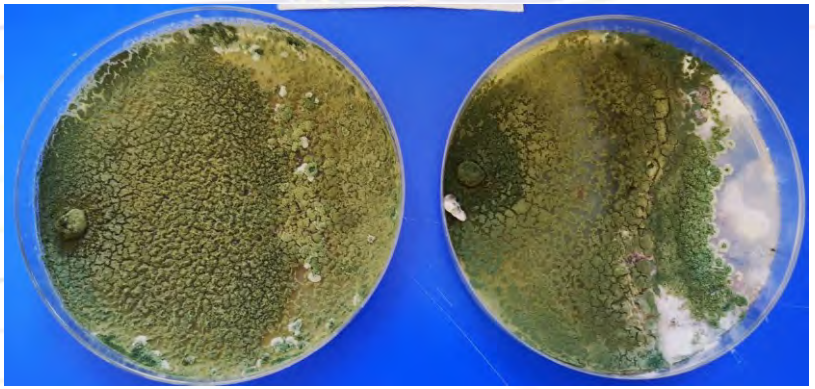
Functional Hyperspectral Imaging by High-Related Vegetation Indices to Track the Wide-Spectrum *Trichoderma* Biocontrol Activity Against Soil-Borne Diseases of Baby-Leaf Vegetables

*Gelsomina Manganiello, Nicola Nicastro, Michele Caputo, Massimo Zaccardelli, Teodoro Cardi and Catello Pane**

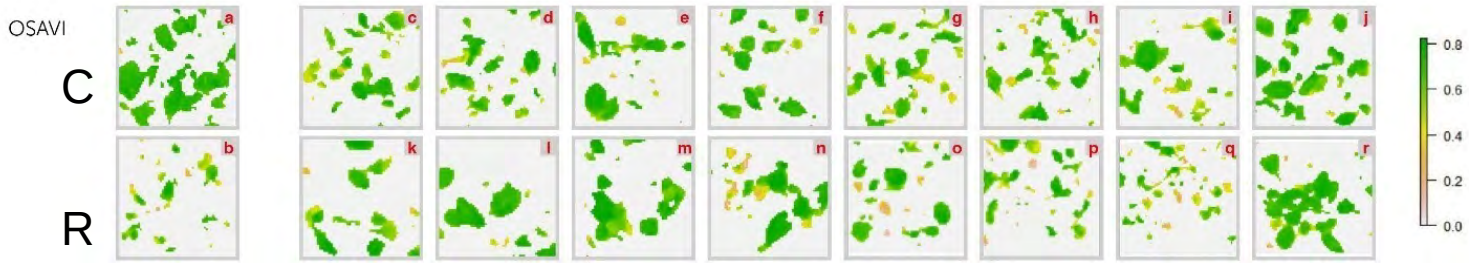


Applicazione di *Tricoderma* spp. come agenti di biocontrollo

Strains	Species
Ta100	*Trichoderma atroviride*
Ta104	*Trichoderma atroviride*
Ta104C	*Trichoderma atroviride*
Ta104S	*Trichoderma atroviride*
Ta105	*Trichoderma atroviride*
Ta116	*Trichoderma atroviride*
Ta117	*Trichoderma atroviride*
Tl35	*Trichoderma longibrachiatum*
Ta56	*Trichoderma atroviride*
TalC12	*Trichoderma atroviride*
Tat11	*Trichoderma atroviride*
Tat3C1	*Trichoderma atroviride*
ThCB	*Trichoderma harzianum*
ThRP	*Trichoderma harzianum*
Th23	*Trichoderma harzianum*
Tl41	*Trichoderma longibrachiatum*

+ *Trichoderma* strains

+ *Trichoderma* strains



Applicazioni digitali avanzate in Orticoltura

Regressione tra previsione vs osservazione degli output del modello di *Machine Learning* realizzato con le reti neurali

Contents lists available at ScienceDirect

Biological Control

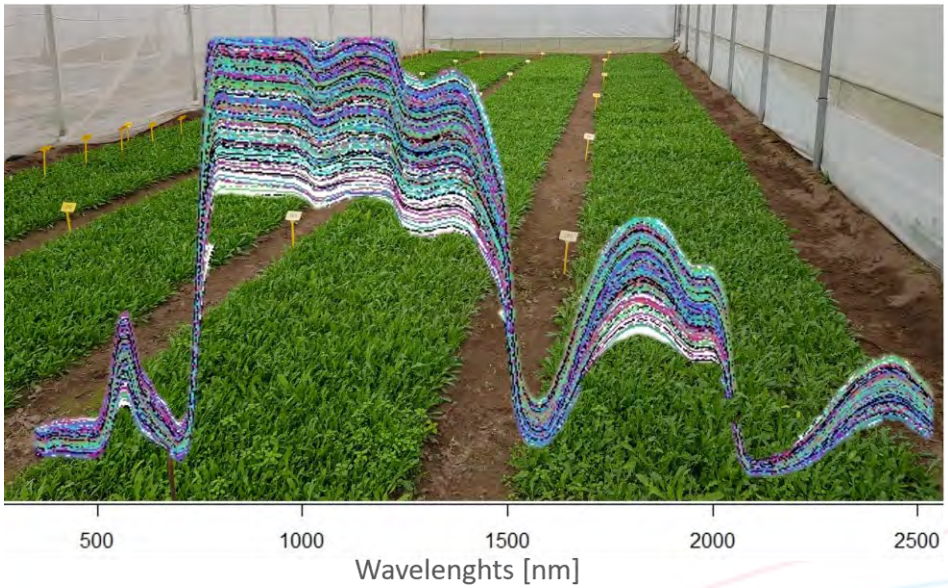
journal homepage: www.elsevier.com/locate/ybcon

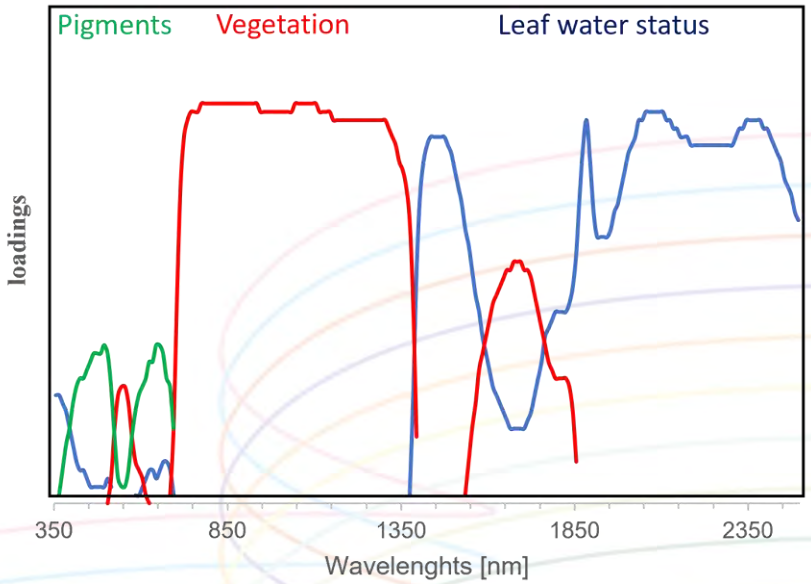
Machine learning applied to canopy hyperspectral image data to support biological control of soil-borne fungal diseases in baby leaf vegetables

Catello Pane [a,*], Gelsomina Manganiello [a], Nicola Nicastro [a], Luciano Ortenzi [b], Federico Pallottino [b], Teodoro Cardi [a], Corrado Costa [b]

Rhizoctonia/Rucola + Sclerotinia/Lattughino + Sclerotium/lattughino

Hyperspectral reflectance response of wild rocket baby-leaf to bio-based disease resistance inducers





Laminarina Fungicidi Compost

Trichoderma

plants

MDPI

Article

Hyperspectral Reflectance Response of Wild Rocket (*Diplotaxis tenuifolia*) Baby-Leaf to Bio-Based Disease Resistance Inducers Using a Linear Mixed Effect Model

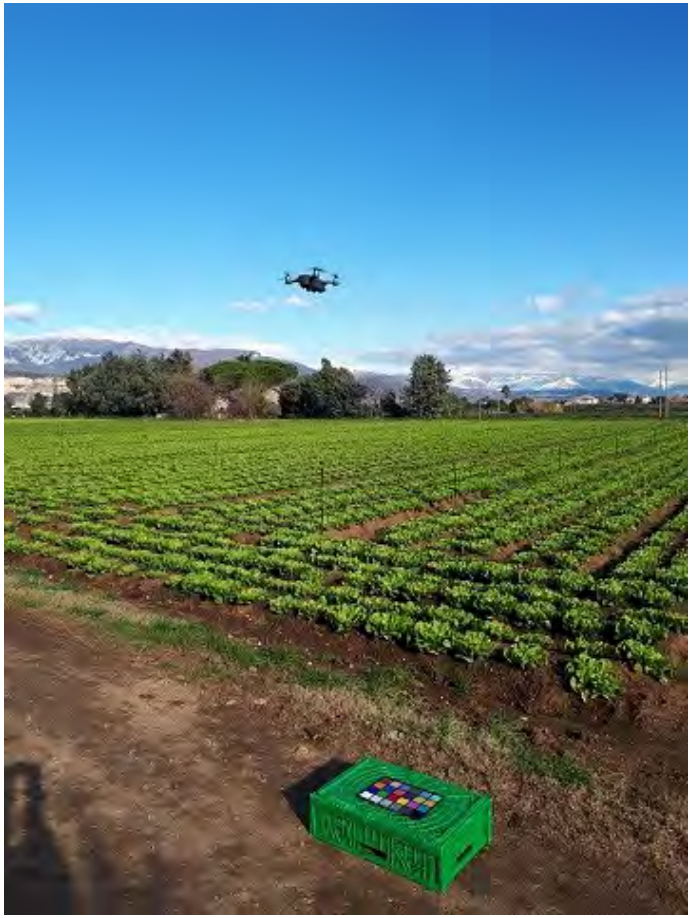
Catello Pane [1,*], Angelica Galieni [2], Carmela Riefolo [3], Nicola Nicastro [1] and Annamaria Castrignanò [4]

Applicazioni digitali avanzate in Orticoltura

Internet of things

Applicazioni digitali avanzate in Orticoltura

Drone leggero



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Grazie!

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