Sugarcane healthy monitoring based on high spatial resolution hyperspectral images

Érika Akemi Saito Moriya
Nilton Nobuhiro Imai
Antônio Maria Garcia Tommaselli
Gabriela Takahashi Miyoshi

São Paulo State University- UNESP
Department of Cartograph- Presidente Prudente- SP, Brasil
{erikaasaito; takahashi.gabi}@gmail.com
{nimai, tomaseli}@fct.unesp.br

INTRODUCTION: The aim of this research was the development of an approach to map sugarcane plants infected by mosaic virus based on an UAV (Unmanned Aerial Vehicle) hyperspectral image. In this sense, hyperspectral sensor attached to an UAVs was used to take images on a sugarcane field. Geometric and Radiometric corrections was applied on these images which were classified.

SUGARCANE MOSAIC VIRUS

SYMPTOMS: chlorotic spots with linear arrangement in the middle, or at the base of the leaves, which develop into elongated areas, increasing as the age of the leaf

Source: Jardineiro.net

Aphis

Source:Capital Teresina

Corn (*Zea mays*)

Source: Rural Pecuaria

Sorghum (*Sorghum Bicolor*)

METHODOLOGY

TAKING HYPERSPECTRAL IMAGES OF SUGARCANE CROP

SX8 multirotor UAV

Rikola
Hyperspectral camera
model DT-0014

UAV Payload:
Inertial Navigation System (Novatel)
Raspberry portable computer
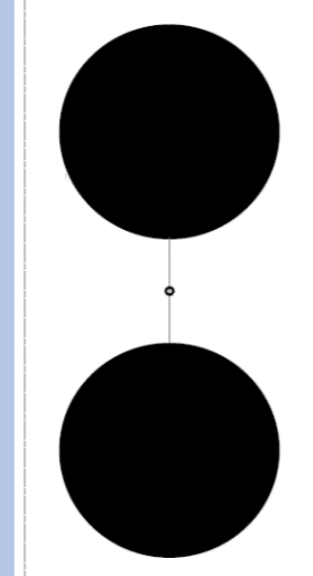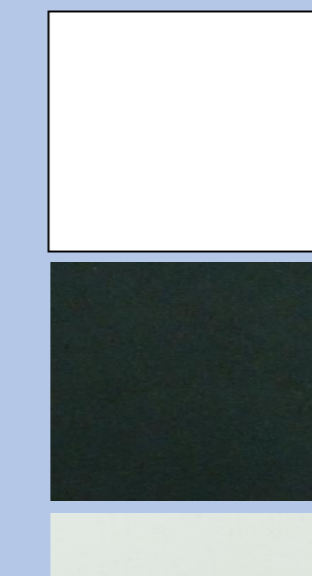Irradiance sensor
GNSS receiver

25 bands
Spectral range 500-900 nm

FIELD SURVEY

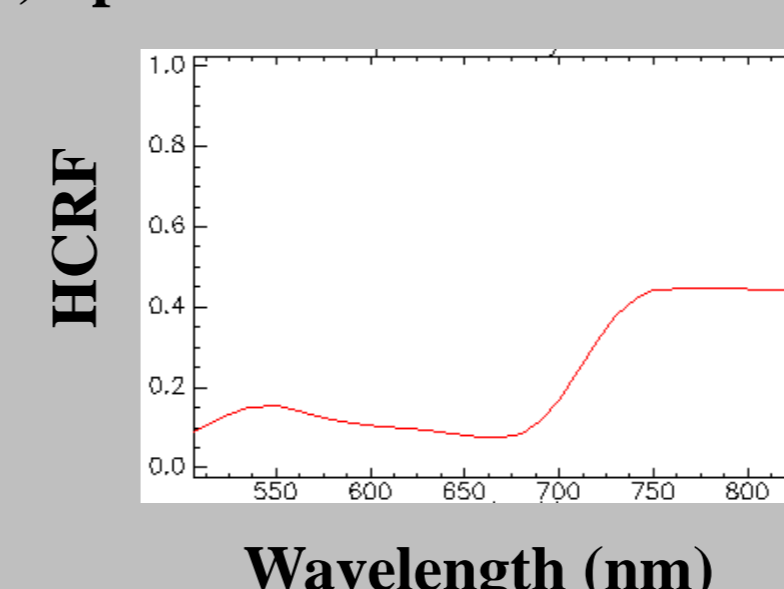### Spectroradiometer ASD-FieldSpec UV/NIR

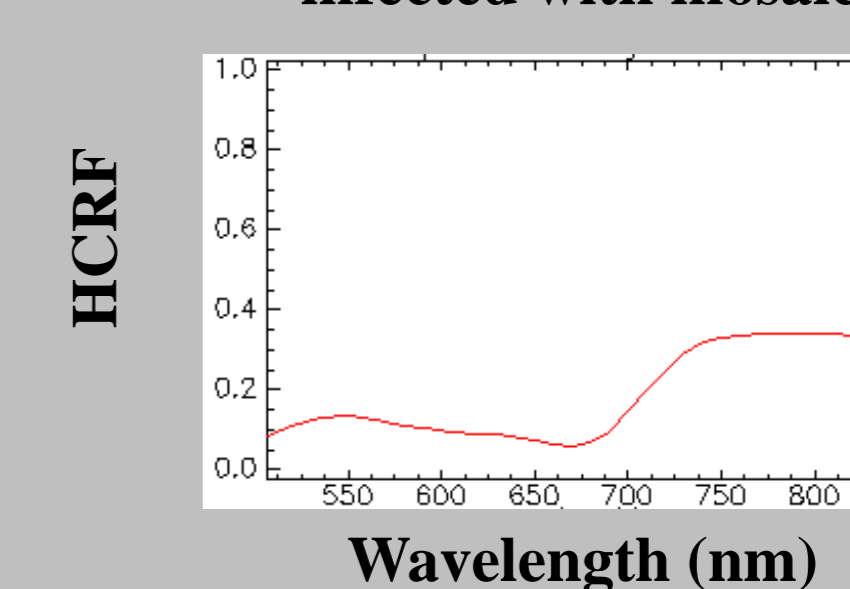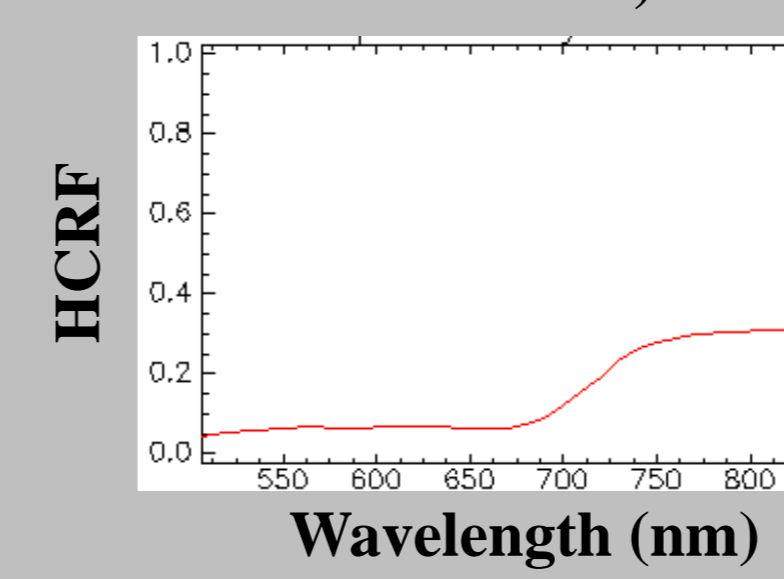Collect reference spectra

Reference targets

Geometric correction   Radiometric correction

Berveglieri and Tommaselli (2016)
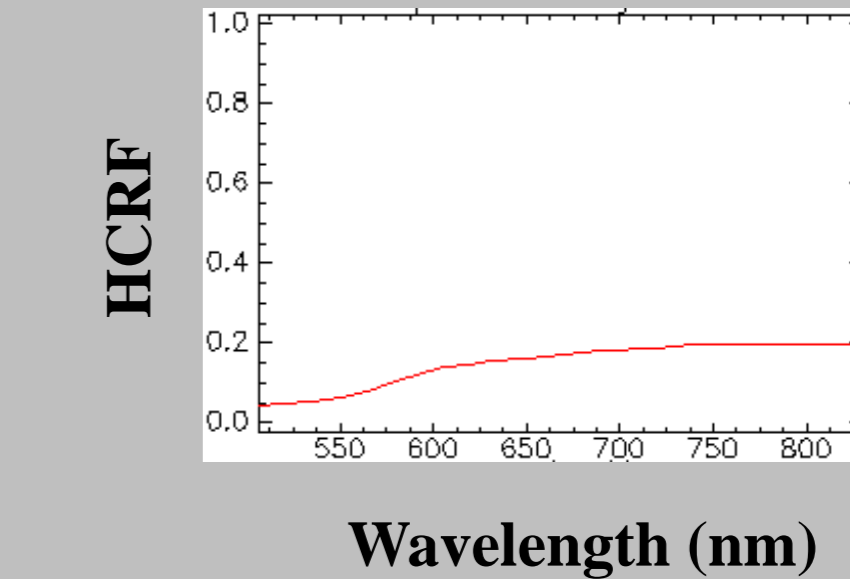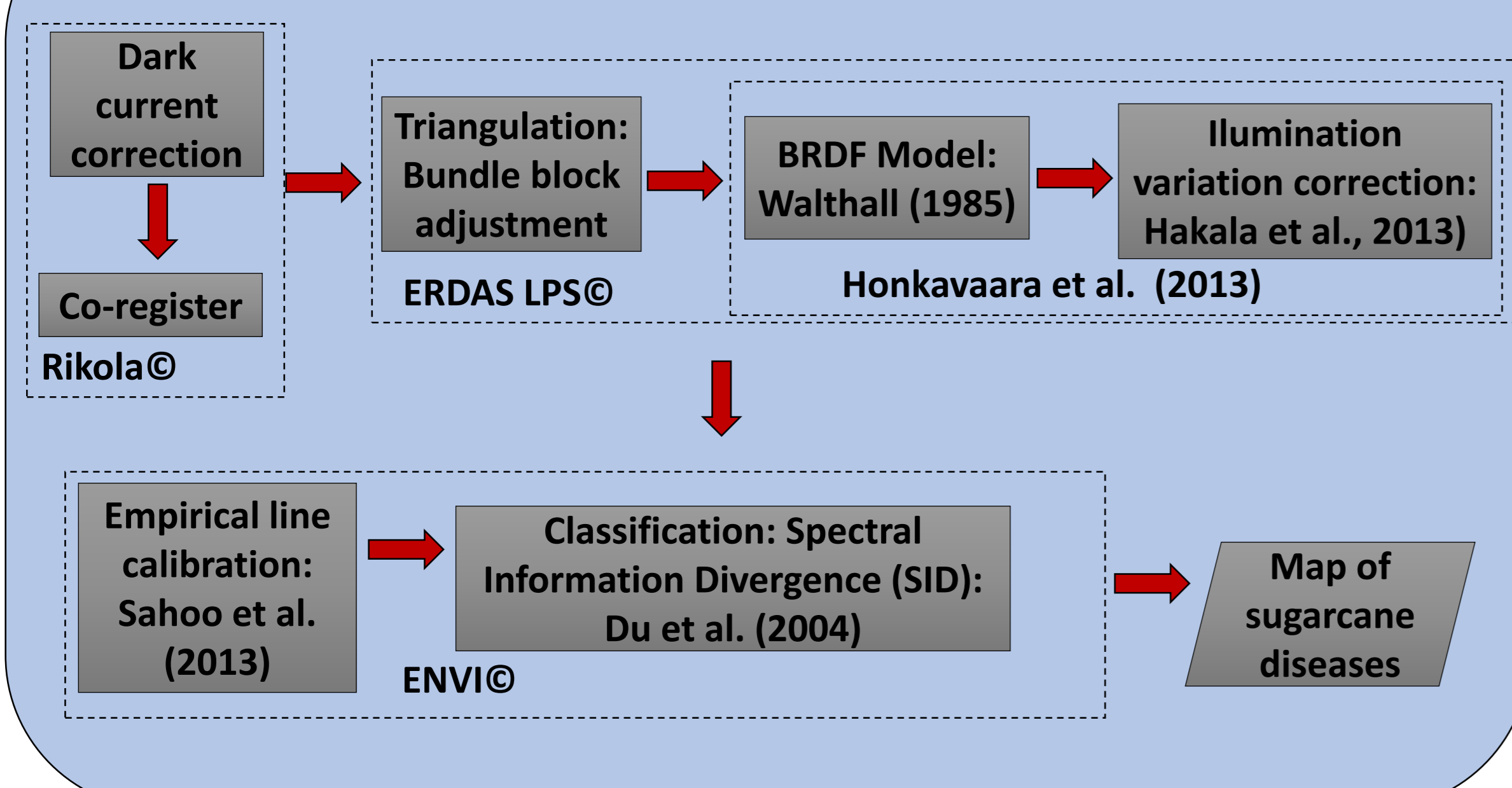
Spectral library

(a) Spectral curve of health sugarcane

(b) Spectral curve of sugarcane infected with mosaic virus
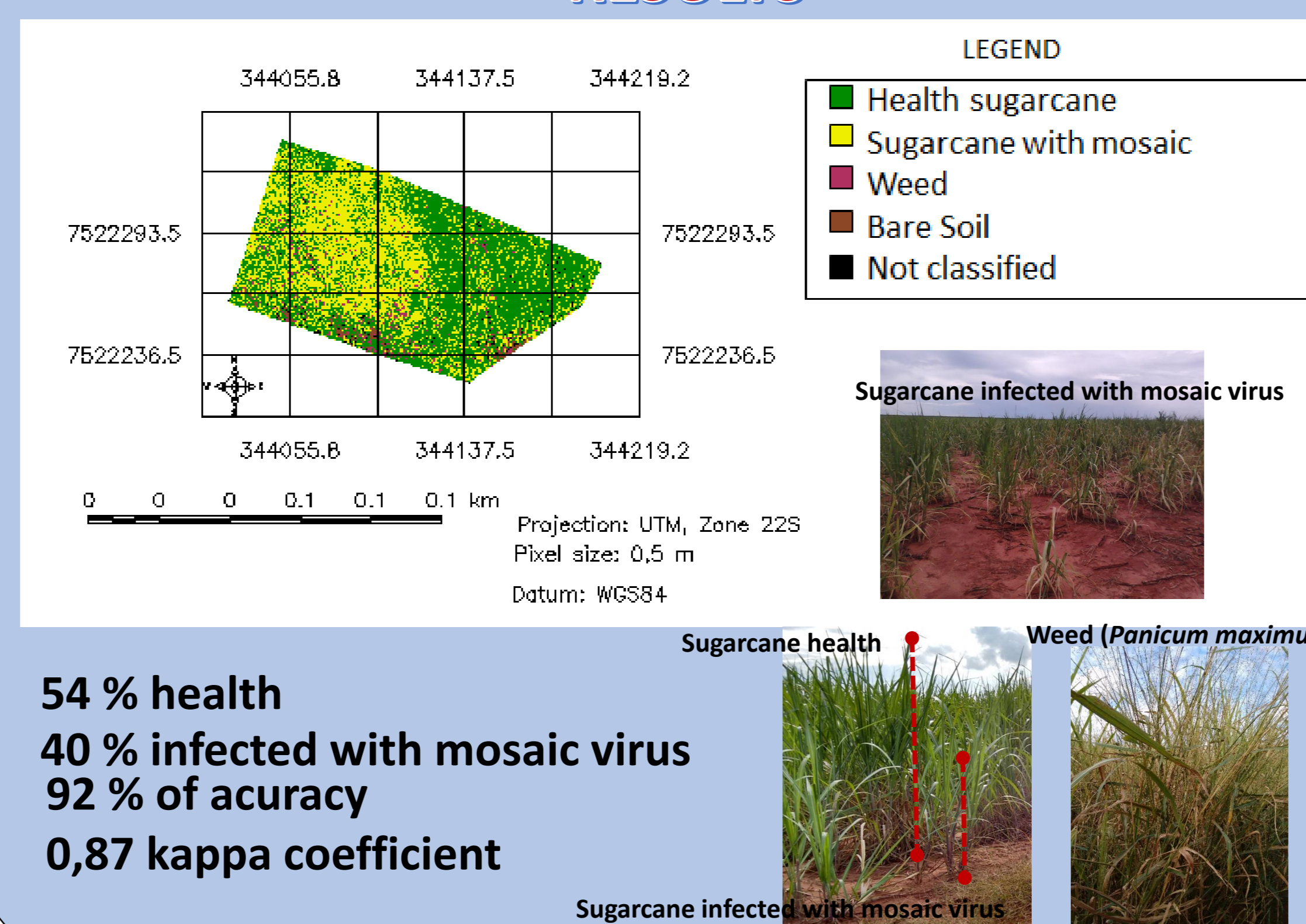
(c) Spectral curve of weed (*Panicum maximum*)

(d) Spectral curve of bare soil

(axes labeled: HCRF vs Wavelength (nm))

DIGITAL IMAGE PROCESSING

Dark current correction → Co-register — Rikola©

Triangulation: Bundle block adjustment — ERDAS LPS©

BRDF Model: Walthall (1985) — Honkavaara et al. (2013)

Ilumination variation correction: Hakala et al., 2013

Empirical line calibration: Sahoo et al. (2013)

Classification: Spectral Information Divergence (SID): Du et al. (2004) — ENVI©

Map of sugarcane diseases

RESULTS

LEGEND
- Health sugarcane
- Sugarcane with mosaic
- Weed
- Bare Soil
- Not classified

344055.8   344137.5   344219.2
7522293.5
7522236.5

0   0   0.1   0.1   0.1 km

Projection: UTM, Zone 22S
Pixel size: 0.5 m
Datum: WGS84

Sugarcane infected with mosaic virus

Sugarcane health   Weed (*Panicum maximum*)

Sugarcane infected with mosaic virus

54 % health
40 % infected with mosaic virus
92 % of acuracy
0,87 kappa coefficient

CONCLUSIONS

The hyperspectral images acquired by UAV have high potential for applications in the culture of sugarcane.

Mapping areas of infected sugarcane provides the exact location of plant health problems in the crop. The precise location of this problem enables the use of pesticides to reach outbreaks of disease or pest, and makes for the most appropriate crop management, either with the application of pesticides or even the disposition of diseased plants.

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