

**ASSESSMENT OF THE SPECTRAL CHARACTER-  
ISTICS OF DIFFERENT PHYSIOLOGICAL  
STAGES OF SOME OLIVE CVS.  
AND ITS RELATION WITH  
PRODUCTIVITY**

By

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B.Sc. Agric. Sc. (General Division), Tanta Univ.(2011)

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## **ABSTRACT**

**Amany Farouk Abdelhameed ELwesemy: Assessment of the Spectral Characteristics of Different Physiological Stages of some Olive cvs. and its Relation with Productivity. M.Sc. Thesis, Arid Land Agricultural Graduated Studies and Research Institute, Agriculture in Desert and Salt Affected Areas, Faculty of Agriculture, Ain Shams University, 2016.**

Remote sensing satellite imagery is the tool to obtain synoptic, multi temporal, dynamic and timely efficient information about any target on Earth. The main objective of the current study is to use space born and field spectroradiometric measurements remotely sensed data to identify spectral signature of different olive cultivars, to link productivity for the olive crop with the different vegetation indices that were calculated from spectral characteristics to predict productivity of each cultivar based on statistical empirical models and finally, to produce olive productivity map from RapidEye satellite image.

This study was carried out in Wadi EL-Natron city, EL-Behira governorate during the season of 2014. Observation site was thirty feddans cultivated by three cultivars: Picual, Manzanillo and Kalamata. Field spectroradiometric measurements were carried out for the different growth stages (dormancy, flowering, fruit sat, mature and ripening). As the first step of the observation, spectral reflectance pattern of the three cultivars was observed. It was found three cultivars ,the highest spectral reflectance in near infrared bands was Manzanillo cultivar, then Picual cultivar while the lowest reflectance of near infrared was found with Kalamata cultivar. Spectral reflectance data that are released from the different spectral domains (visible, near infra-red and short wave infrared) and vegetation indices that are calculated from spectral reflectance data were used with yield data to produce yield Simple Linear Regression models using (SPSS) software.

Normalized Difference Vegetation Index (NDVI), Modified Chlorophyll Absorption Ration Index (MCARI), Triangular Vegetation Index (TVI), Modified Chlorophyll Absorption Ration Index 1 (MCARI1), Modified

Chlorophyll Absorption Ratio Index<sup>2</sup> (MCARI<sup>2</sup>), Modified Triangular Vegetation Index<sup>2</sup> (MTVI<sup>2</sup>) Chlorophyll Index (CI) and spectral reflectance from the different spectral domains were for the three cultivars in all stages were used as estimators in the modeling process. It was found that the optimal growth stage for yield prediction was mature stage with Picual and kalamata cultivars while the optimal was fruit sat stage in the case of Manzanillo cultivar. The lowest correlation coefficient was found with dormancy stage with the three observed cultivars. Finally, a yield map was produced through the application of the generated yield prediction models on Rapid- Eye satellite image.

**Keywords:**

Olive tree, Olive cvs., Spectroradiometer, Spectral Characteristics, Vegetation Indices ,Yield prediction.

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# CONTENTS

<b>LIST OF TABLES</b>	<b>III</b>
<b>LIST OF FIGURES</b>	<b>V</b>
<b>LIST OF ABBREVIATIONS</b>	<b>VI</b>
<b>INTRODUCTION</b>	<b>1</b>
<b>REVIEW OF LITERATURE</b>	<b>2</b>
<b>MATERIALS AND METHODS</b>	<b>9</b>
3.1. Study Area:	9
3.2. Crop yield prediction modeling:	11
3.2.1. Field hyper spectral measurements:	11
3.2.2. Data processing:	15
3.2.3. Statistical modeling:	19
3.2.3.1. Descriptive statistics:	19
3.2.3.2. Simple Linear Regression Modeling:	19
3.3. Satellite data processing and yield prediction mapping:	22
<b>RESULTS AND DISCUSSION</b>	<b>23</b>
4.1. Spectral reflectance analysis:	23
4.1.1. Spectral reflectance analysis in dormancy stage:	23
4.1.2. Spectral reflectance analysis in flowering stage:	24
4.1.3. Spectral reflectance analysis in fruit sat stage:	25
4.1.4. Spectral reflectance analysis in mature stage:	26
4.1.5. Spectral reflectance analysis in ripening stage:	27
4.1.6. Spectral reflectance analysis for all cultivars:	28
4.1.7. Spectral reflectance analysis of Picual cultivar in all stages:	29
4.1.8. Spectral reflectance analysis of Manzanillo cultivar in all stages:	30
4.1.9. Spectral reflectance analysis of Kalamata cultivar in all stages	31
4.2. Olive yield prediction:	32
4.2.1. Simple regression analysis for Olive Picual cultivar season 2014:	32



## II

4.2.2. Simple regression analysis for Olive Manzanillo cultivar season 2014:	37
4.2.3. Simple regression analysis for Olive Kalamata cultivar season 2014:	42
4.4.Crop area map:	49
<b>SUMMARY AND CONCLUSION</b>	<b>53</b>
<b>REFERENCES</b>	<b>56</b>
<b>ARABIC SUMMARY</b>	

### III

#### LIST OF TABLES

Table		Page
1.	The ASD Field Spec 3 Specifications.	12
2.	Times of spectroradiometer measurements.	13
3.	Showed all equations of all vegetation indices.	18
4.	Simple regression models for Picual cultivar yield prediction in dormancy stage in season 2014.	33
5.	Simple regression models for Picual cultivar yield prediction in flowering stage in season 2014.	34
6.	Simple regression models for Picual cultivar yield prediction in fruit sat stage in season 2014.	35
7.	Simple regression models for Picual cultivar yield prediction in mature stage in season 2014.	36
8.	Simple regression models for Picual cultivar yield prediction in ripening stage in season 2014.	37
9.	Simple regression models for Manzanillo cultivar yield prediction in dormancy stage in season 2014.	38
10.	Simple regression models for Manzanillo cultivar yield prediction in flowering stage in season 2014.	39
11.	Simple regression models for Manzanillo cultivar yield prediction in fruit sat stage in season 2014.	40
12.	Simple regression models for Manzanillo cultivar yield prediction in mature stage in season 2014.	41
13.	Simple regression models for Manzanillo cultivar yield prediction in ripening stage in season 2014.	42
14.	Simple regression models for Kalamata cultivar yield prediction in dormancy stage in season 2014.	43
15.	Simple regression models for Kalamata cultivar yield prediction in flowering stage in season 2014.	44
16.	Simple regression models for Kalamata cultivar yield prediction in fruit sat stage in season 2014.	45

## IV

17.	Simple regression models for Kalamata cultivar yield prediction in mature stage in season 2014.	46
18.	Simple regression models for Kalamata cultivar yield prediction in ripening stage in season 2014.	47
19.	The highest correlation coefficient ( $R^2$ ) with all cultivars.	48
20.	Standard error of estimation for the different simple regression Olive cultivars yield prediction models for season 2014.	49

## LIST OF FIGURES

Figure		Page
1.	Observation site.	10
2.	ASD Field Spec (Spectroradiometer) .	13
3.	Cell grid system for measure Olive samples.	14
4.	The apparatus of Global Position System (GPS) .	15
5.	Systematic modeling chart for Olive yield prediction.	21
6.	Spectral reflectance in all cultivars in dormancy stage.	24
7.	Spectral reflectance in all cultivars in flowering stage.	25
8.	Spectral reflectance in all cultivars in fruit sat stage.	26
9.	Spectral reflectance in all cultivars in mature stage.	27
10.	Spectral reflectance in all cultivars in ripening stage.	28
11.	Spectral reflectance in all cultivars generally.	29
12.	Spectral reflectance in Picual cultivar in all stages.	30
13.	Spectral reflectance in Manzanillo cultivar in all stages.	31
14.	Spectral reflectance in Kalamata cultivar in all stages.	32
15.	NDVI for all farm.	50
16.	Productivity map for every cultivar.	51

## LIST OF ABBREVIATIONS

<b>ABBREVIATION</b>	<b>Mean</b>
ANOVA	Analysis of variance
CI	Chlorophyll Index
EMS	Electro-magnetic spectrum
Eq	Equation
ETM+	Enhanced Thematic Mapper Plus
GPP	Gross primary production
GPS	Global Positioning System
Ha	Hectare
IR	Infrared
Kg	Kilogram
MCARI	Modified Chlorophyll Absorption Ration Index
MCARI1	Modified Chlorophyll Absorption Ration Index1
MCARI2	Modified Chlorophyll Absorption Ration Index2
MODIS	Moderate Resolution Imaging Spectroradiometer
MTVI2	Modified Triangular Vegetation Index2
NDVI	Normalized Difference Vegetation Index
NIR	Near infrared
Nm	Nanometer
NPP	Net primary production
PLSR	Partial Least Squares Regression
SLR	Simple linear regression
SPOT	Système pour l'observation de la Terre
SPSS	Statistical Package for Social Science
SWIR	Shortwave Infrared
SWIR1	Shortwave Infrared1
SWIR2	Shortwave Infrared2
TM	Thematic mapper band
TVI	Triangular Vegetation Index
VI <sub>s</sub>	Vegetation Indices

## INTRODUCTION

As statistics of 2014, the total Olive (*Olea europaea.L*) area in Egypt is 202743 feddans (14353 feddans in old lands produce about 76017 tons and 188390 feddans in newly reclaimed lands produce about 487053tons).

(<http://www.agricultureegypt.com/ArticleDetails.aspx?CatID=081d64e8-d4d3-43c5-9115-89229e6ddfa0&ID=28218134-827c-4bef-99d11690a11cfa98>). The most important olive producing areas in Egypt are the west coast and the province of Fayoum, oasis of new valley, Northern Sinai and Wadi EL-Natrun and western province of EL-Behira governorate. In spite of importance of olive cultivation in Egypt for the national economy, olive spectral characteristics and its spatial distribution overall the country was never observed by remote sensing techniques. Moreover, there is no statistical models to predict olive productivity.

Field Spectroradiometer is used to recognize the spectral reflectance and spectral characteristics of Olive cultivars. Spectral characteristics could be used as estimators for crop yield through empirical statistical model. Modeling process is based on Vegetation Indices(VIs) such as Normalized Difference Vegetation Index(NDVI), Modified Chlorophyll Absorption Ration Index(MCARI), Triangular Vegetation Index(TVI), Modified Chlorophyll Absorption Ration Index -1(MCARI-1), Modified Chlorophyll Absorption Ration Index-2(MCARI-2), Modified Triangular Vegetation Index-2(MTVI2) Chlorophyll Index(CI). These spectral parameters could be calculated from remote sensing satellite data as well as remotely sensed ground observation tools. Based on the generated models, crop yield map could be produced using Rapid Eye image. The study was carried out in Olive farm in Wadi El-Natrun during the whole season of 2014.

## REVIEW OF LITERATURE

Remote sensing is the ability to measure properties of an object without being in contact with it. It could be also identified as the science to detect, measure, record and analyze energy in a selected portion of the electromagnetic spectrum. Remote sensing techniques, in particular, multispectral visible and Infra red reflectance and emission provides an instantaneous, nondestructive, and quantitative assessment of crops ability to intercept radiation and photosynthesize **Ahmed *et al.*, (2011)**. Estimation of crop acreage, assessment of crop biochemical and biophysical parameters and assessment of crop physiological characteristics started long time ago using traditional methods, however remote sensing techniques could facilitate and accelerate this work in costly effective and timely efficient approach. A lot of studies and observations have been carried in the trend of using remote sensing to study vegetation cover in general or specific.

The importance of Olive as a strategic crop in arid and semi-arid areas of the Mediterranean basin we highlighted over decades through many studies. (**Loukas and Krimbas, 1983**) reported that the cultivation of olive trees started in the Mediterranean basin some 6000 years ago. They reported that the olive tree, *Olea europaea L.*, is adapted to the Mediterranean climate and produces fruit and oil. Both are important commodities in world markets. This fact again confirmed by **De Graaff and Eppink, (1999)**; **Loumou and Giourga, (2003)**; **Villalobos *et al.*, (2012)** who mentioned that Olive (*Olea europaea L.*) is one of the most ancient cultivated fruit trees in the Mediterranean basin where it plays a fundamental role by integrating agriculture, environment and landscape into a complex system.