Mapping of NDVI and SAVI By Using Remote Sensing Technique in Kavakdere Plain, Western Turkey

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Abstract

World is changing at an unexpected rate in terms of climate and land use, and also these changes affect our natural resources. Normalized difference vegetation index (NDVI) and soil adjusted vegetation index (SAVI) are often used worldwide to monitor drought, monitor and predict agricultural production. The study area is located west of Turkey where has a dam and organic plain. Major climate type of the study area is Mediterranean. Main crops of the study area are citrus and grapes. In this study, satellite-based remote sensing data and geographic information system tools will be used for mapping of NDVI and SAVI for growth season. Vegetation indices calculated from Landsat 8 satellite images will be showed for each growth stages for the study area.

The Study Area

The study area is located at Seferihisar in Izmir which is Kavakdere plain (west of Turkey) (Fig. 1). The area has semi-arid climate. The average rainfall is 613.1 mm based on 1981-2010 years rainfall data. Meteorological Data of Citrus For 2014 are given in Table 1.

The major land use/land cover includes citrus (pink), grape (blue) and olive trees (green) (Fig. 1). Total agricultural area is around 500 hectares. The greatest part of it is cultivated with citrus (about 61%) and grapes (about 33%), while the rest is dominated by olive-trees.

Eleven scenes of cloud-free Landsat 8 imagery were collected to jointly cover whole basin (Fig. 2).

Method

The NDVI is the ratio of the differences in reflectivities for the near-infrared band ($\rho4$) and the red band ($\rho3$) to their sum:

NDVI = ($\rho4 - \rho3$) / ($\rho4 + \rho3$)

The NDVI is a sensitive indicator of the amount and condition of green vegetation. Values for NDVI range between -1 and +1

The SAVI is an index that attempts to "subtract" the effects of background soil from NDVI so that impacts of soil wetness are reduced in the index. It is computed as:

SAVI = (1 + L) ($\rho4 - \rho3$) / (L + $\rho4 + \rho3$)

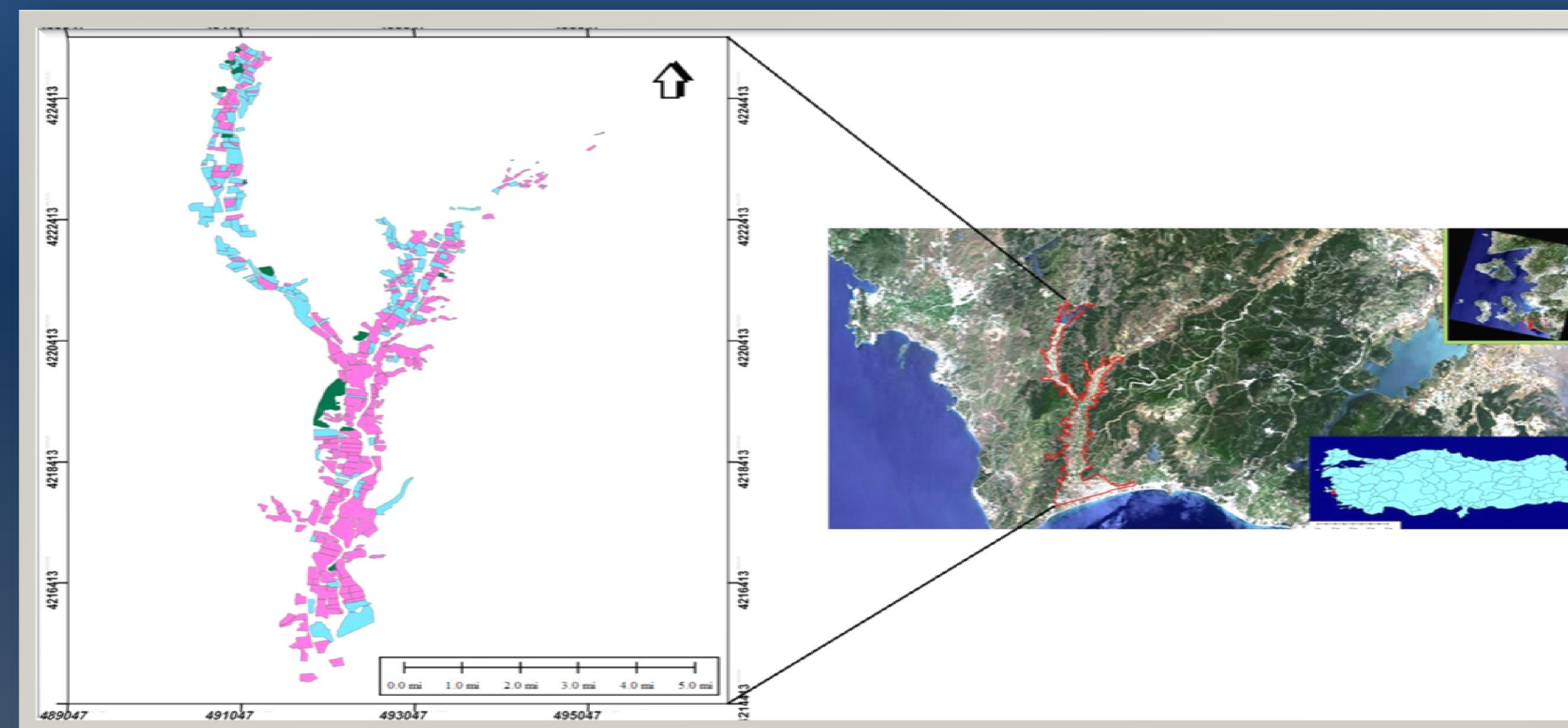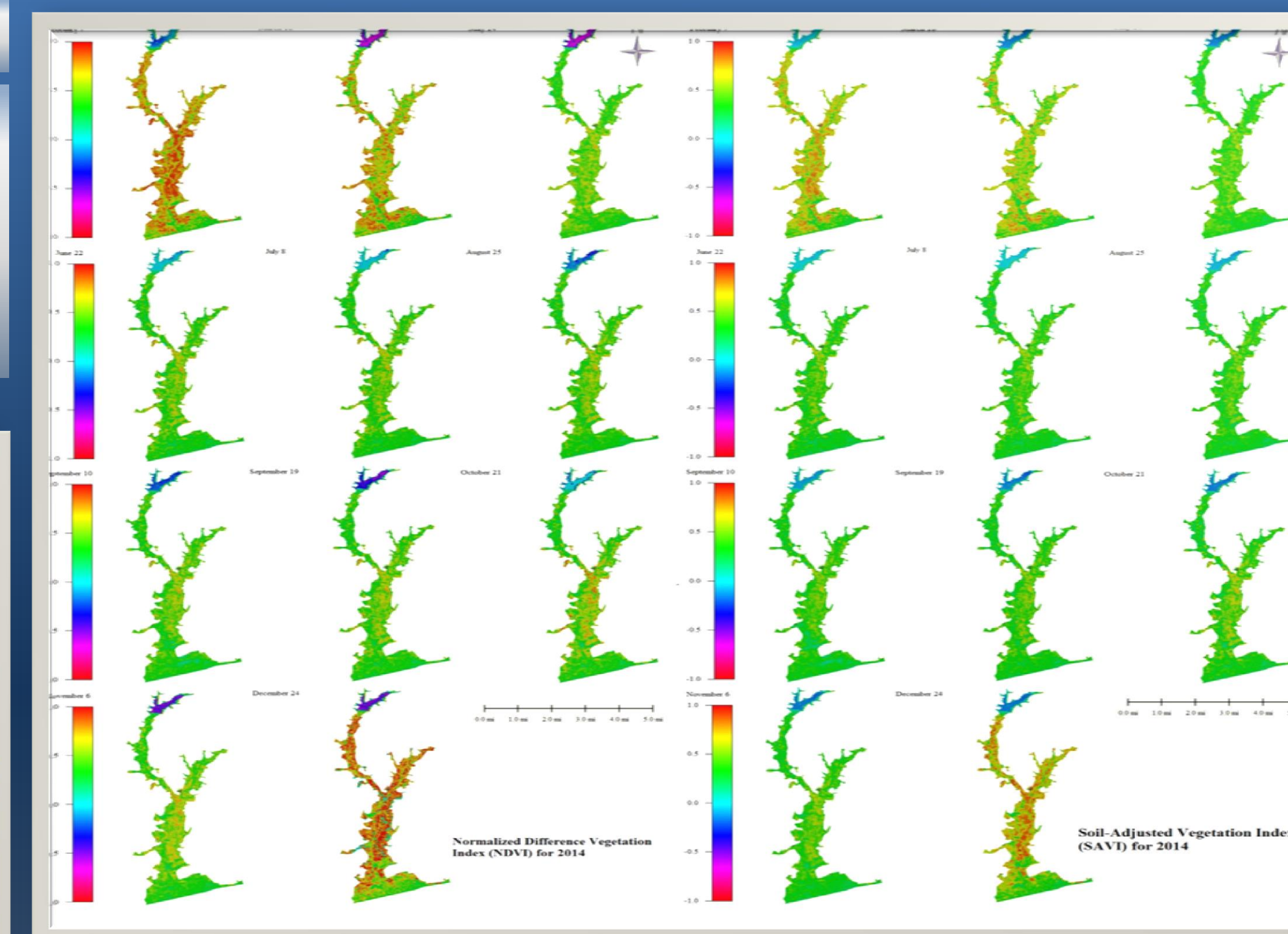 L is a constant for SAVI. If L is zero, SAVI becomes equal to NDVI.

Figure 1. Kavakdere Plain

Results

The vegetation indices calculated from Landsat 8 OLI-TIRS satellite images showed that the values of NDVI and SAVI for first growth stage were higher than other growth stages (Fig. 3).

After planting of citrus in 2014, average NDVI values are as respectively; 0.71, 0.49, 0.70. On the other hand, SAVI values are as respectively; 0.61, 0.43, 0.58. And also observed Kc values are 0.7, 0.67, 0.74. During in mid of July and end of December, NDVI starts to increase then reach maximum and starts to decrease from mid of February. The relationships between NDVI, SAVI and Kc for citrus are linear.

NDVI and SAVI values are lesser between April and November whereas December and January show higher vegetation density.

NDVI for citrus decrease in irrigation season (second growth season). Also NIR is very high rather than other seasons. NDVI and SAVI were estimated for each growth seasons. The values of NDVI, SAVI and Kc showed same trend through the different growth stages.

Table 1. Meteorological Data of Citrus For 2014

	Min Temp.(˚C)	Max Temp.(˚C)	Relative Humidity	Wind Speed	Rainfall
First Growth Stage	1.1	22.5	70	2.0	158.8
Second Growth Stage	8.6	37.6	64	2.0	203.4
Third Growth Stage	2.2	24.3	78	4.0	222.3

Figure 2. NDVI and SAVI of Kavakdere Plain for 2014

Citrus

First Growth Stage 01.31-4.20 (80 days)
Second Growth Stage 04.21-01.11 (195 days)
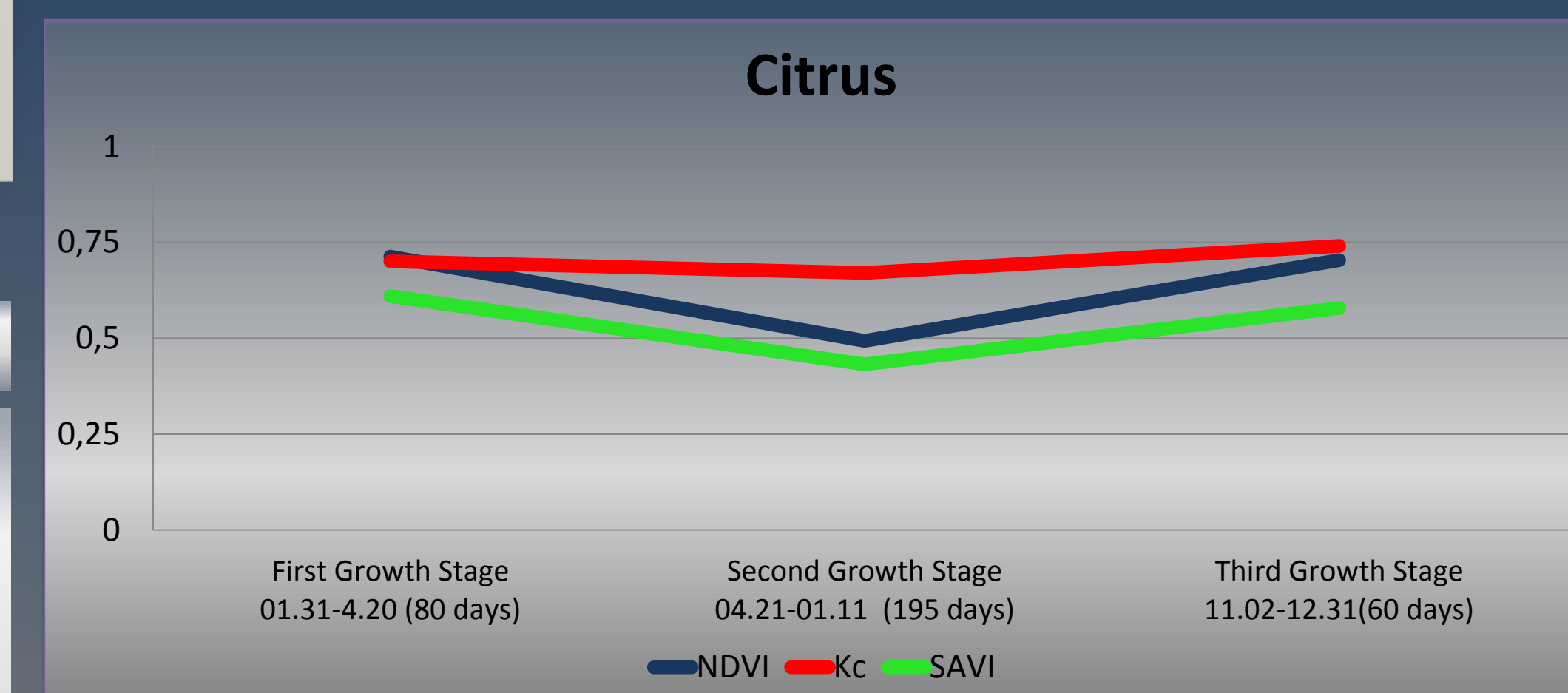Third Growth Stage 11.02-12.31(60 days)

NDVI Kc SAVI

Figure 3. Vegetation Indices of Citrus for Growth Stages for 2014