

## The relationships between different vegetation indices and chlorophyll content index values (CCI) in strawberry leaves

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### GOAL OF THE STUDY

The aim of the present study was to investigate the relationships between different vegetation indices and chlorophyll content index values (CCI) in strawberry leaves from two strawberries varieties – Alba and Asia.

### METHODOLOGY OF THE INVESTIGATION

A total of 100 strawberry leaves were taken, 50 leaves from each variety. The collected leaves were measurement via a portable chlorophyll content meter CCM 200 plus (Opti-Sciences, Tyngsboro, MA) for chlorophyll content index (CCI). Spectral measurements of the all same leaves were also performed using a USB4000 spectrometer (OceanOptics, Inc. Dunedin, Fl., USA) in the wavelengths region 450-1100 nm. On the base of obtained spectral information were calculated 24 different vegetation indices, presented in Table 1. Four different types of predictive regression models defining the relations between the CCI and the investigated vegetation indices for both types of strawberries were compiled.

### CONCLUSIONS

It was found that CARI, MCARI, mNDVI, Clred edge, Clgreen, REI1, REI2, and REI3 indices are more sensitive to chlorophyll concentration than the other tested indices. The Compound model based on calculated vegetative indices for the Alba variety has the best fit for all tested indices. The highest coefficient of determination was found for CARI index -  $R^2 = 0.743$ . Quadratic model best describes the relationship between CCI and the investigated vegetation indices for the Asia strawberry variety. The best fit was found for REI2 index – the obtained coefficient of determination was 0.842.

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### MAIN RESULTS FROM THE STUDY

**Table 1.** Predictive regression models defining the relations between the CCI and the investigated vegetation indices.

Models	Alba		Asia	
	R <sup>2</sup>	Equations	R <sup>2</sup>	Equations
<b>mNDVI</b>				
Linear	0.598	$Y = -39.963 + 114.213x$	0.783	$Y = -29.399 + 103.924x$
Logarithmic	0.592	$Y = 58.837 + 60.062 \log(x)$	0.758	$Y = 54.279 + 45.892 \log(x)$
Quadratic	0.603	$Y = 20.36 - 113.75x + 214.45x^2$	0.811	$Y = 33.97 - 178.01x + 310.09x^2$
Compound	0.630	$Y = 1.10 * 279.034^x$	0.796	$Y = 1.167 * 360.901^x$
<b>CARI</b>				
Linear	0.712	$Y = 44.883 - 2.605x$	0.730	$Y = 41.517 - 3.060x$
Logarithmic	0.716	$Y = 72.793 - 23.552 \log(x)$	0.767	$Y = 65.220 - 23.406 \log(x)$
Quadratic	0.718	$Y = 53.902 - 4.598x - 0.107x^2$	0.773	$Y = 64.471 - 9.189x - 0.392x^2$
Compound	0.743	$Y = 65.876 * 0.88^x$	0.740	$Y = 64.839 * 0.841^x$
<b>MCARI</b>				
Linear	0.652	$Y = 34.789 - 0.602x$	0.727	$Y = 31.141 - 0.530x$
Logarithmic	0.667	$Y = 63.981 - 13.924 \log(x)$	0.798	$Y = 60.531 - 13.530 \log(x)$
Quadratic	0.673	$Y = 40.65 - 1.103x + 0.01x^2$	0.788	$Y = 41.02 - 1.342x + 0.015x^2$
Compound	0.715	$Y = 40.789 * 0.97^x$	0.795	$Y = 37.101 * 0.969^x$
<b>Cl<sub>red edge</sub></b>				
Linear	0.617	$Y = -9.147 + 26.289x$	0.826	$Y = -8.078 + 34.160x$
Logarithmic	0.617	$Y = 17.152 + 30.045 \log(x)$	0.795	$Y = 25.316 + 25.284 \log(x)$
Quadratic	0.619	$Y = -19.958 + 45.135x - 8.07x^2$	0.832	$Y = 0.156 + 12.443x + 13.772x^2$
Compound	0.640	$Y = 4.659 * 3.622^x$	0.815	$Y = 3.993 * 6.733^x$
<b>Cl<sub>green</sub></b>				
Linear	0.520	$Y = -7.788 + 7.415x$	0.774	$Y = -8.611 + 8.800x$
Logarithmic	0.501	$Y = -16.306 + 27.68 \log(x)$	0.744	$Y = -10.664 + 26.313 \log(x)$
Quadratic	0.531	$Y = 16.979 - 5.546x - 1.668x^2$	0.781	$Y = 1.420 + 2.250x + 1.032x^2$
Compound	0.532	$Y = 5.043 * 1.433^x$	0.729	$Y = 4.009 * 1.616^x$
<b>REI1</b>				
Linear	0.624	$Y = -77.425 + 64.507x$	0.832	$Y = -87.634 + 76.899x$
Logarithmic	0.625	$Y = -20.641 + 98.749 \log(x)$	0.826	$Y = -15.417 + 105.652 \log(x)$
Quadratic	0.626	$Y = -182.31 + 201.65x - 44.75x^2$	0.840	$Y = 75.983 - 160.34x + 85.786x^2$
Compound	0.651	$Y = 0.162 * 23.758^x$	0.825	$Y = 0.046 * 74.038^x$
<b>REI2</b>				
Linear	0.528	$Y = -35.975 + 47.078x$	0.835	$Y = -27.461 + 58.949x$
Logarithmic	0.534	$Y = 10.137 + 57.554 \log(x)$	0.822	$Y = 30.028 + 45.178 \log(x)$
Quadratic	0.540	$Y = -120.73 + 186.23x - 56.88x^2$	0.842	$Y = 0.373 - 13.08x + 45.993x^2$
Compound	0.564	$Y = 1.204 * 10.358^x$	0.832	$Y = 1.338 * 27.260^x$
<b>REI3</b>				
Linear	0.506	$Y = -47.817 + 122.101x$	0.826	$Y = -34.611 + 139.511x$
Logarithmic	0.509	$Y = 60.804 + 69.253 \log(x)$	0.815	$Y = 69.208 + 52.255 \log(x)$
Quadratic	0.512	$Y = -136.5 + 435.44x - 275.96x^2$	0.835	$Y = 8.696 - 90.055x + 301.303x^2$
Compound	0.541	$Y = 0.667 * 431.679^x$	0.828	$Y = 0.888 * 2555.745^x$

\* Level of significance  $p < 0.05$