衛星遙測與灰系統理論應用於水稻營養生長期色素之監測

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摘要

本研究運用灰色理論分析水稻營養生長期間，葉綠素與類胡蘿蔔素相關化合物(chlorophyll- and carotenoid-related compound)對衛星遙測水稻之常態化差異植生指數(normalized difference vegetation index，NDVI)之關聯性。灰關聯分析結果顯示，葉綠素與類胡蘿蔔素相關化合物對衛星遙測水稻 NDVI 之灰關聯序與化合物之極性有顯著相關。在葉綠素相關化合物方面，PPIX、MGPP、Pchlide、Chlide a 及 Chlide b 等葉綠素的代謝物質都屬無植醇鏈(phytol chain)之 dephytylated 色素，其成爲極性較大而較易溶於水。而 Chl a、Chl b、Phe a 及 Phe b 則都屬含有植醇鏈之 phytylated 色素，其極性較小而傾向脂溶性。此化學結構的差異造成有植醇鏈的葉綠素相關化合物對衛星遙測影像 NDVI 之貢獻度較大。對類胡蘿蔔素相關化合物而言，極性較低的 LP Car，其對衛星遙測 NDVI 之貢獻度遠大於極性較大的 MP Car。而極性較低的 LP Car 應位於類囊膜，而 MP Car 則可能位於基質中。相對而言，類胡蘿蔔素相關化合物對衛星遙測影像 NDVI 之貢獻度似乎比葉綠素相關化合物較大。

關鍵詞：灰色理論、葉綠素相關化合物、類胡蘿蔔素相關化合物、衛星遙測、水稻、NDVI。

ABSTRACT

The study applied grey theory to analyze the correlation between the contents of chlorophyll- and carotenoid-related compounds and the normalized difference vegeation index (NDVI) calculated from the satellite remote sensing data, during the vegetation growth stage of rice. The results indicate the polarity of chlorophylls or carotenoids is significantly correlated to satellite NDVI. Chlorophylls without phytol chains also called dephytylated pigments, such as PPIX, MGPP, Pchlide, Chlide a and Chlide b, are more polar and located in the stroma. Chlorophylls containing phytol chain also named phytylated pigments, such as Chl a, Chl b, Phe a and Phe b, are less polar or nonpolar and situated in the thylakoid membrane. The less polar carotenoids play more contribution to the satellite NDVI than the more polar carotenoids do. The carotenoid-related compounds play relatively more contribution to the chlorophyll-related compounds do to satellite NDVI.

Keywords: grey theory, chlorophyll-related compounds, carotenoid related compounds, satellite remote sensing, rice, NDVI.

1.前言