近赤外分光分析法에 의한 겉보리 品質 分析

I. 近赤外分光分析法에 의한 生育時期別 成分 測定

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Analysis of Grain Quality in Covered Barley by the use of Near Infrared Reflectance Spectroscopy

I . Rapid Determination of Chemical Components at Different Growing Stages of Barley Using Near Infrared Reflectance Spectroscopy

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實驗目的

보리의 良質品種 選拔에 있어서 몇가지 중요한 成分을 迅速 正確히 非破壞的으로 분석이 가능한 近赤外分光分析法을 利用하여 品種育成過程에 있는 많은 系統들에 대한 早期分析 可能性을 검토하고자 본 實驗을 實施하였다.

材料 및 方法

近赤外分光分析法에 따라 檢量式을 作成하고자 1993年 嶺南農業試驗場에서 育成중인 보리 生産力豫備試驗중에 있는 34계통을 供試材料로 하여 出穗後 25日부터 5日간격으로 5회에 걸쳐 분석을 실시하였다. 34계통중 27계통을 이용하여 檢量式을 作成하였으며 나머지 7계통은 作成된 檢量式과 比較分析하여 檢量式의 利用可能性을 검토하였다. 近赤外分光分析法에 使用된 기기는 Filter-type instrument인 Neotec 102(1901~2320nm)이며 檢量式 作成은 standard regression方式으로 作成하였다.

結果 및 考察

1. 보리 出穗後 25日의 種實成分중 澱粉은 2163nm, β-glucan은 2006nm의 檢量式에서 測定正確度가 높아 近赤外分光分析法으로 分析이 可能하였다.

2. 出穗後 30日에서 澱粉은 2053/2081/2235nm, β-glucan은 2064/2110nm, 蛋白質은 2139/2167/2061/1931nm의 檢量式에서 測定正確度가 높았다.

3. 出穗後 35日은 보리 種實成分중 澱粉과 蛋白質, 出穗後 40日은 澱粉과 蛋白質및 灰分의 分析이 可能하였으며 出穗後 45日에는 澱粉과 蛋白質이 近赤外分光分析法으로 分析 可能하였다.

4. 보리 種實成分중 一部成分은 收穫하기전에 分析이 可能하여 보리의 良質品種 早期選拔에 利用될 수 있는 것으로 생각되었다.

Table. Result of standard regression analysis of major components concentration in barley 25 days after heading

Components	Calibration equation (nm)	R^2	SEC	Range(%) Lab	NIR	r	SDD	SEP
Starch	2163	0.762	2.330	50.04 ~ 54.59	48.70 ~ 54.00	0.050	2.400	1.500
β-Glucan	2003	0.772	0.231	1.447 ~ 3.010	1.520 ~ 2.710	0.010	0.259	0.250
Protein	1947 2037 2076 2103	0.560	0.504	3.760 ~ 7.500	4.440 ~ 7.000	0.070	1.339	0.072
Ash	2112	0.300	0.230	2.132 ~ 2.927	2.318 ~ 3.030	0.523	0.159	0.115

R^2 : Coefficient of multiple determination
SEC : Standard Error of Calibration
r : For the samples, simple correlation coefficient between Lab and NIR values
SDD : Standard Deviation of Difference
SEP : Standard Error of Prediction

Table. Result of standard regression analysis of major components concentration in barley 30 days after heading

Components	Calibration equation (nm)	R^2	SEC	Range(%) Lab	NIR	r	SDD	SEP
Starch	2033 2023 2233	0.686	1.770	42.73 ~ 57.07	43.57 ~ 53.31	0.560	1.910	1.690
β-Glucan	2034 2110	0.630	0.392	2.337 ~ 5.251	2.717 ~ 4.907	0.647	0.520	0.233
Protein	2139 2167 2003 1931	0.930	0.406	7.520 ~ 11.34	7.420 ~ 11.64	0.937	1.020	0.997
Ash	2231	0.052	0.180	2.032 ~ 3.123	2.016 ~ 3.110	0.572	0.454	0.123

R^2 : Coefficient of multiple determination
SEC : Standard Error of Calibration
r : For the samples, simple correlation coefficient between Lab and NIR values
SDD : Standard Deviation of Difference
SEP : Standard Error of Prediction

Table. Result of standard regression analysis of major components concentration in barley 35 days after heading

Components	Calibration equation (nm)	R^2	SEC	Range(%) Lab	NIR	r	SDD	SEP
Starch	2022 2256	0.793	2.600	44.70 ~ 53.55	45.93 ~ 53.09	0.030	2.920	2.780
β-Glucan	1923 1922 1920	0.803	0.435	2.933 ~ 5.950	3.511 ~ 6.210	0.810	0.507	0.439
Protein	2042 2253 2289	0.912	0.338	8.010 ~ 11.65	0.170 ~ 11.53	0.033	0.620	0.531
Ash	2160 2261 1972 1953	0.873	0.169	1.502 ~ 2.975	1.670 ~ 2.923	0.716	0.339	0.123

R^2 : Coefficient of multiple determination
SEC : Standard Error of Calibration
r : For the samples, simple correlation coefficient between Lab and NIR values
SDD : Standard Deviation of Difference
SEP : Standard Error of Prediction

Table. Result of standard regression analysis of major components concentration in barley 40 days after heading

Components	Calibration equation (nm)	R^2	SEC	Range(%) Lab	NIR	r	SDD	SEP
Starch	2272 2078 2053 2065	0.814	1.370	47.18 ~ 55.09	47.95 ~ 55.30	0.932	5.900	2.750
β-Glucan	2273 2056	0.665	0.581	3.326 ~ 6.506	3.874 ~ 5.874	0.588	0.636	0.643
Protein	1932 2242 2110	0.943	0.285	9.910 ~ 12.60	10.13 ~ 12.93	0.984	0.330	0.257
Ash	2160 1943 1941	0.857	0.201	1.852 ~ 3.145	1.696 ~ 3.210	0.867	0.446	0.194

R^2 : Coefficient of multiple determination
SEC : Standard Error of Calibration
r : For the samples, simple correlation coefficient between Lab and NIR values
SDD : Standard Deviation of Difference
SEP : Standard Error of Prediction

Table. Result of standard regression analysis of major components concentration in barley 45 days after heading

Components	Calibration equation (nm)	R^2	SEC	Range(%) Lab	NIR	r	SDD	SEP
Starch	2070	0.704	2.660	33.79 ~ 54.10	33.28 ~ 52.65	0.870	1.830	1.520
β-Glucan	2282 2230 2229	0.637	0.460	3.720 ~ 5.725	4.124 ~ 5.877	0.649	1.020	0.516
Protein	2116 2163	0.943	0.509	10.78 ~ 15.01	10.03 ~ 14.60	0.333	0.260	0.250
Ash	2063 2272 2060 2061	0.913	0.140	1.637 ~ 2.810	2.009 ~ 2.633	0.503	0.134	0.119

R^2 : Coefficient of multiple determination
SEC : Standard Error of Calibration
r : For the samples, simple correlation coefficient between Lab and NIR values
SDD : Standard Deviation of Difference
SEP : Standard Error of Prediction