

D6. Determination of Protein and Oil Contents in Soybean Seed by Near-Infrared Reflectance Spectroscopy(NIRS)

M. G. Chung*, I. Y. Baek, S. T. Kang, W. Y. Han, D. C. Shin, H. P. Moon and K. H. Kang
National Yeongnam Agricultural Experiment Station.
College of Natural Resources, Yeungnam University.

근적외 분광분석을 이용한 콩 함유 단백질 및 지방 분석
영남농업시험장 : 정명근*, 백인열, 강성택, 한원영, 신두철, 문헌팔
영남대학교 자연자원대학 : 강광희

Objectives : The objectives of this study were to determine the applicability of an NIR spectrocomputer system for protein and oil analysis in soybean seed and to provide the mass screening technique for high quality soybean breeding.

Materials and Methods :

Soybean samples : 300 soybean germplasms(ground soybean seed samples)

Measuring protein and oil content : Auto-kjeldahl and soxhlet system

Scanning of NIRS spectra : NIRSystem 6500 monochrometer NIRS(400~2500nm)

Calibration and validation : Using the WinISI program, *Calibrate* and *Monitor*

Calibration method : MPLS, PLS, MLR, PCR

Results : A total of 189 soybean calibration samples and 103 soybean NIRS validation samples were used for NIRS equation development and validation, respectively. In the NIRS equation of protein, the most accurate equation condition was obtained at 2, 8, 6, 1(2nd derivative, 8nm gap, 6 points smoothing and 1 point second smoothing) math treatment condition with SNV-D(Standard Normal Variate and Detrend) scatter correction method and entire spectrum by using MPLS(Modified Partial Least Squares) regression. In the case of oil, the best equation condition was obtained at 1, 4, 4, 1 condition with SNV-D scatter correction method and near infrared(1100~2500nm) region by using MPLS regression. Validation of these NIRS equations showed very low bias(protein : -0.016%, oil : -0.011%) and standard error of prediction(SEP, protein : 0.437%, oil : 0.377%) and very high coefficient of determination(R^2 , protein : 0.985, oil : 0.965). Therefore, these NIRS equation seems reliable for determining the protein and oil contents, and NIRS method could be used as a mass screening method of soybean seed.

Corresponding author - Phone: 055-350-1223, E-mail: cmg7004@rda.go.kr

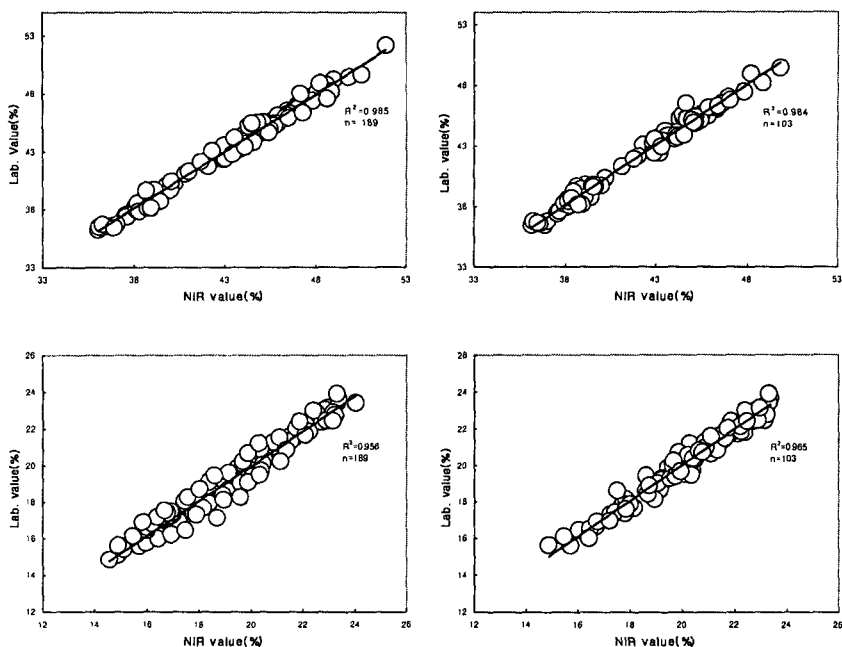


Fig. 1. Scatter plots of protein(upper) and oil(lower) contents by chemical value versus NIRS value for the calibration(left) and validation(right) sample set.

Table 1. Laboratory reference value statistics for protein and oil contents based on ground soybean seed samples.

Sample set		n	Mean	Range		SD
				%		
Calibration	Protein	189	43.23	36.04 ~ 51.83		3.24
	Oil	189	19.15	14.57 ~ 24.05		2.05
Validation	Protein	103	42.13	36.17 ~ 49.83		3.47
	Oil	103	20.06	14.88 ~ 23.38		2.03

Table 2. Comparison on the statistics for protein calibration and validation results with different regression methods.

Math condition	Regression	Calibration			Validation				
		Terms	SEC	R ²	SEP	R ²	Bias	R. SD(%)	SEP/M(%)
2, 8, 6, 1 400~2500mm	MPLS	10	0.394	0.985	0.437	0.984	-0.016	0.44	1.04
	PLS	10	0.637	0.961	0.672	0.963	-0.036	0.67	1.59
	PCR	10	1.099	0.885	1.080	0.903	0.092	0.92	2.57
SNV-D	MLR	9	0.484	0.978	0.492	0.980	-0.011	0.49	1.17

Table 3. Comparison on the statistics for oil calibration and validation results with different regression methods.

Math condition	Regression	Calibration			Validation				
		Terms	SEC	R ²	SEP	R ²	Bias	R. SD(%)	SEP/M(%)
1, 4, 4, 1 1100~2500mm	MPLS	9	0.432	0.956	0.377	0.965	-0.011	0.38	1.88
	PLS	11	0.520	0.936	0.453	0.950	-0.008	0.45	2.26
	PCR	10	0.788	0.853	0.597	0.913	0.021	0.60	2.98
SNV-D	MLR	4	0.774	0.858	0.605	0.912	0.023	0.61	3.02