Korean J.Plant.Res. 5(2) 118~123(2002)

Agronomic Characters and Their Correlation Coefficient on Black Seeded Soybeans Collected in Chonnam Province

Byung-Sun Kwon, Seongkyu Choi*, Jeong-Sik Shin, Dong-Young Shin and Kyu-Hwan Hyun
College of Agriculture and Life Science, Sunchon National University
*Department of Oriental Medicine Resources, Sunchon National University ,Sunchon 540-742, Korea

ABSTRACT

In order to obtain the genetic information on the quantitative characters of black seeded soybeans, which would be needed to improve selection efficiency for breeding high yielding genotype, 45 varieties of black seeded soybeans collected in Chonnam, Korea were grown and variations of several important characters were observed.

Heritability of each observed character, phenotypic and genotypic correlations among the characters and contribution of each yield component on grain yield through path coefficient analysis were estimated. Both number of pods per plant and 100-seed weight showed not only high heritability but also highly significant phenotypic and genotypic correlation with seed yield, and hence it was desirable to select plants with more number of pods per plant and higher 100-seed weight than raise seed yield of black seeded soybeans collected in Chonnam. In addition, number of pods per and 100-seed weight were proved to be the most influential variables on the viability of seed yield by path coefficient analysis. Since these showed the high heritability of number of pods per plant, selection of plants with higher 100-seed weight would be more efficient for breeding high yielding genotype.

Key Words : Black seeded soybeans, Heritability, correation coefficient,

INTRODUCTION

Glycine soja which can be regarded as the origin of soybeans is widely distributed in Jeonnam region, its variations are varied and in an available character of wild or middle species, improvement of germplasm due to the transition of agricultural species can be expected.

Since Jeonnam region has many islands and has been isolated regionally due to its geographical conditions, variety of local species have been cultivated. These local species have been completely maintained and preserved by farmers and the variety of native species with many kinds of morphological and ecological characteristics have been scattered (Kwon, 1972). However, since preservation of the native species is difficult due to rural exodus by a radical industrialization, available genetic resources may be lost or disappeared. Currently cultivated higher crops are selected for man since the beginning of mankind and their hereditary variation is considerably limited. But, wild or native species of crops were not selected or rarely selected and their hereditary variations were considerably found. Therefore exploration and

Corresponding author : **Byung-Sun Kwon,** Tel: +82-61-750-3282, E-mail : kbs@sunchon.ac.kr.

Table 1. Varieties of black seeded soybean used as material.

No. Varieties	No. Varieties	No. Varieties
1 Jido Province	16 Jangsan Province	31 Deokdong Province
2 Docho Province	17 Jeongdo Province	32 Chowan Province
3 Bigeum Province	18 Palgeum Province	33 Guneue Province
4 Gasan Province	19 Haeve Province	34 Geumdang Province
5 Gulim Province	20 Heuksan Province	35 Bogil Province
6 Gwangde Province	21 Gagu Province	36 Saengil Province
7 Dogo Province	22 Wando Province	37 Soan Province
8 Yongso Province	23 Geumil Province	38 Chungsan Province
9 Jadang Province	24 Deokwoo Province	39 Jindo Province
10 Sinye Province	25 Hwangje Province	40 Gogun Province
11 Anja Province	26 Chungdo Province	41 Gunnae Province
12 Ante Province	27 Jangwon Province	42 Yeusin Province
13 Aphae Province	28 Nowha Province	43 Imhae Province
14 Imja Province	29 Uryong Province	44 Jodo Province
15 Jaeun Province	30 Gogeum Province	45 Jisan Province

development of new genetic resources are very important for improving crops.

Vavilov (1928) collected and analyzed cultivation crops every place in the world and Ahn et al. (1990) and Kwon et al. (1988a, 1988b, 1988c, 1990) did in domestic places. Frankel & Soule (1981) emphasized the importance of collecting wild or native species of crops. From such a viewpoint, it will be very meaningful to collect and select the genetic resources of local native species of black soybean. Therefore, this study collected and evaluated the native species of black soybeans in Jeonnam province, systematized them, investigated their agricultural and hereditary characters and examined the variations in quantity, hereditability and hereditary correlations among characters to get the basic data for improving the variety of black soybeans.

MATERIALS AND METHODS

This experiment was conducted at experiment station located at Yongjeon-ri, Haeryong-myon, Suncheon-city, Jeonnam from June 10 to Nov. 30, 2001 and published varieties were 45 native species of black soybeans collected from island regions of Jeollanamdo (Table 1).

Cultivation method used the base manure of N-P_2O_5-K_2O=4-7-6 kg/10a in whole quantities, 5～6 grains were sown at the planting distance of 70×20cm, thinned out twice or three times, one bundle was kept and packing arrangement was conducted through three repetitions. 10 species per experiment plot were sampled to measure characters in harvest season, their hereditability and hereditary correlations were analyzed with their average (Grafius et al. 1952, Robinson et al. 1949) and direct and indirect effects of their quantity and its components are examined by means of analyzing route coefficient using phenotype correlations.

RESULTS AND INVESTIGATION

1. Variations among Varieties of Major Characters

Table 2. Mean, minimum, and maximum of main characters of black seeded soybean varieties.

Characters Item	Flowering date	Maturing date	Plant height (cm)	Lodging (0-9)	SMV (0-9)	No. of pods/plant	100-seed wt.(g)	Seed yield (kg/ha)
Mean	39	114	75	3	3	48	36.8	1,880
Minimum	30	88	40	1	1	33	12.9	1,560
Maximum	49	125	96	5	7	120	54.9	2,880
LSD (0.05)	0.47	0.69	2.5	0.27	0.19	2.7	28.6	172
CV (%)	0.77	0.39	2.09	5.39	4.09	3.19	9.81	5.77

Table 3. Analysis of variance for main characters of black seeded soybean varieties.

Characters	Varieties	Block	Error
Flowering date	63.03**	0.4963	0.0872
Maturing date	294.22**	0.0074	0.1817
Plant height (cm)	696.73**	2.5470	2.3854
Lodging (0-9)	5.00**	0.0296	0.0296
SMV (0-9)	9.27**	0.0296	0.0145
No. of pods per plant	681.99**	2.7434	0.2889
100-seed wt. (g)	1383.82**	626.3882	130.1958
Seed yield(kg/10a)	6119.96**	283.5239	112.4464

** Significant at 1% level

Results of calculate mean, minimum and maximum values of measurements from each variety group by characters are shown in Table 2 and results of variance analysis of characters are in Table 3. According to these results, the variation width in character of native species of black soybeans was very great and the variation among varieties was clear. The character of the greatest variation width was the number of pods per plant, and maturity, stem length, 100-seed weight and quantity belonged to the characters of great variation width. Considering that most of these characters have a high significance with varieties, characteristics of published varieties are clear.

2. Estimation of Hereditability

Variance of specific characters by varieties is composed of hereditary variance from the hereditary difference of each variety and environmental variance ; the former is adjustable through the selection of breeding and the percentage of the whole variance is expressed as hereditability (Robinson et al. 1949).

This hereditability is the index of selection efficiency and genetic gain and the estimation of each character is very important. The estimated hereditability of character of the native species of black soybeans is shown in Table 4.

According to Table 4, the flowering time, maturity, stem length, lodging, crop damage, No. of pods per an individual and 100-seed weight have the highest hereditability over 90% and that of quantity of seeds is relatively high as more than 84%. It showed a great variation width and it will have a great quantity improvement.

3. Correlations among Major Characters

In all crops except rice, breeding of a high-yield variety is one of the most important concerns. But since characters including quantity are complicatedly related

Table 4. Heritabilities (h^2), genotypic variances (σ^2G) and environmental variances(σ^2E) of main characters of black seeded soybean varieties.

Characters	h^2(%)	σ^2G	σ^2E
Flowering date	91.6	20.982	0.0872
Maturing date	91.8	98.0133	0.1817
Plant height	91.0	231.4510	2.3854
Lodging	91.3	1.6593	0.0296
SMV	90.5	3.0875	0.0145
No. of pods per plant	99.8	226.4185	2.7434
100-seed wt.	99.2	27.2892	13.0195
Seed yield	84.7	2002.5073	112.4464

Table 5. Phenotypic (γPh), genotypic (γG) and environmental correlation coefficients (γE) in population of black seeded soybean varieties.

Characters		2)	3)	4)	5)	6)	7)	8)
1) Flowering date	γPh	0.8183**	0.6475**	-0.1916	-0.5768**	-0.3397*	0.1496	-0.0866
	γG	0.8213**	0.6528**	-0.1937	-0.5796**	-0.3416*	1.0488	-0.0899
	γE	-0.1311	-0.0367	-0.0166	0.0521	-0.1218	0.0068	-0.0425
2) Maturing date	γPh		0.7581**	0.1550	-0.6440**	-0.4241**	0.1426	-0.0567
	γG		0.7634**	0.1565	-0.6457**	-0.4274**	0.9990**	-0.0580
	γE		0.1435	0.0023	-0.1444	0.0762	0.0031	-0.0333
3) Plant height	γPh			0.0174	-0.6685**	-0.3890**	-0.0767	-0.3106**
	γG			0.0163	-0.6736**	-0.3916**	-0.5566**	-0.4072**
	γE			0.0898	-0.0149	-0.1648	-0.0310	-0.1427
4) Lodging	γPh				0.3095*	0.2212	-0.0661	-0.3851**
	γG				0.3131*	0.2224	-0.4715**	-0.3932**
	γE				0.0163	0.1532	-0.0151	-0.0656
5) SMV	γPh					-0.5259**	-0.1430	-0.0559
	γG					-0.5319**	-1.0069	-0.0583
	γE					-0.2065	-0.0162	-0.0631
6) No. of pods per plant	γPh					0.6884**	0.9071**	
	γG						0.7487*	0.9136**
	γE						0.1627	0.0358
7) 100-seed wt.	γPh							0.8256**
	γG							0.7574**
	γE							0.0003
8) Seed yield	γPh							-
	γG							-
	γE							-

** Significant at 1% level. * Significant at 5% level.

Table 6. Path coefficient analysis of the direct and influences of each character upon seed yield of black seeded soybean varieties.

Maturing date	Plant height	lodging	SMV	No. of pods per plant	100-seed wt.
r1y=-0.0567	r2y=-0.0106	r3y=-0.2851	r4y=-0.0559	r5y=0.6671	r6y=0.6506
p1y=-0.0063	p2y=-0.0323	p3y=0.2889	p4y=-0.1760	p5y=0.3698	p6y=0.3829
r12p3y=-0.0245	r21p1y=-0.0048	r31p1y=-0.0010	r41p1y=0.0041	r51p1y=0.0027	r61p1y=0.0809
r13p3y=-0.0448	r23p3y=-0.0050	r32p2y=-0.0006	r42p2y=0.0216	r52p2y=0.0125	r62p2y=-0.0825
r14p4y=0.1133	r24p4y=0.1176	r34p4y=-0.0545	r43p3y=0.0894	r53p3y=0.0639	r63p3y=-0.0191
r15p5y=-0.0932	r25p5y=-0.0855	r35p5y=-0.0486	r45p5y=0.1156	r54p4y=-0.0925	r64p4y=0.0252
r16p6y=-0.0013	r26p6y=-0.0007	r36p6y=-0.1006	r46p6y=-0.1333	r56p6y=0.1869	r65p5y=-0.1940

to several quantity characters as the quantitative character, information of phenotype and hereditary correlations among characters in an effective high-yield variety is needed and such an information is practically used through the analysis of selection index or route coefficient of each character. The estimations of phenotype, hereditary and environmental correlations are shown in Table 5.

According to these results, stem length and lodging showed highly negative phenotype and hereditary correlations with quantity and No. of pods per plant and 100-seed weight had highly positive phenotype and hereditary correlations with quantity. To sum up the results of these correlations and hereditability, No. of pods per plant and 100-seed weight have high hereditability and showed a highly positive correlation with quantity and it is considered that the selection of this individual will be effective in increasing quantity and while stem length and lodging have high hereditability, it showed a negative correlation and the selection of individual with short stem length and small lodging will be effective. In particular, since No. of pods per plant and 100-seed weight showed a positive correlation with quantity in the research results the selection effects will be high(Kwon et al. 1990).

4. Contributions of Quantity Characters to Quantity

To increase the quantity, it is very important to know the source of variation in a given environment, but since quantity is the character involving complicatedly correlated characters at the same time, it is very difficult to reveal the source of variation through correlation coefficients among them and it is more difficult to reveal the whole relationship between quantity and quantity characters.

While the correlation analysis reveals merely a correlation among variables, the route coefficient analysis shows a relative importance of quantity characters and it is involved more in the source of quantity variation. Direct and indirect effects of quantity characters on quantity through route coefficient analysis are shown in Table 6(Dowey et al. 1959).

According to Table 6, No. of pods per plant and 100-seed weight contributed for quantity greatly and since indirect effects through these two characters were great, these are considered important selection index characters for increasing quantity and No. of pods per plant especially has high hereditability and it will be more effective as a selection index character.

SUMMARY

This study selects 45 varities collected within Jeonnam province to get the basic information for an effective selection of variety of black soybeans, examines their major characters, analyzes their hereditability, phenotype and hereditary correlations and route coefficients and estimates the contributions of each character for quantity. The results of this study are summarized as follows.

1. Since No. of pods per plant and 100-seed weight have high hereditability and phenotype and hereditary correlations, the effects of increasing quantity were effective.

2. As a result of analyzing route coefficients of quantity and quantity characters, No. of pods per plant and 100-seed weight contributed for quantity greatly and the selection through No. of pods per plant with high hereditability was effective.

REFERENCES

Ahn G.S., B.S. Kwon , S.P. Rho 1990. Major agronomic characters and their correlation coefficient in forage rape varieties. Korean J. Breed. 22(1):48-52.

Dewey D.R., K.H. Ju 1959. A correlation and path coefficient analysis of components of crested wheat grass seed production. Agron. J. 51:515-518.

Frankel O.H., M.E. Soule 1981. Conservation and evaluation. Cambridge Univ. Press. Cambridge UK.

Grafius J.E.,W.S. Nelson, and V.A. Dirks 1952. The heritability of yield in barley as measured by early generation bulked progenies. Agron. J. 44:253-257.

Kwon B.S., J.I. Lee 1988a. Genetic studies on quantitative characters in job' s tears. Korean J. Breed. 20(1):22-27.

Kwon B.S., J.I. Lee 1988b. Major agronomic characters and there correlation ships in Wangol. Korean J. Crop Sci. 33(1):81-86.

Kwon B.S., J.I. Lee 1988c. Variation of quantitative characters and correlation coefficients in mat rush cultivars. Korean J. Breed. 20(2):109-114.

Kwon B.S., R.E. Comstock and P.H.Harvey 1990. Quantitative genetic analysis of major agronomic characters in Cassia tora L. Korean J. Breed. 22(3):235-239.

Kwon S.H. 1972. History and landraces of Korean soybean. SABDRJ. 4(2):107-111.

Robinson H.F., J.T. Lim, H.J. Park, H.J.Lee and J.I. Lee 1949. Estimates of heritability and the degree of dominance in corn. Agron. J. 41:353-359.

(Received May 10, 2002)
(Accepted May 31, 2002)