CRITERIA FOR CHOICE CHARACTERS FOR CONSTRUCTION OF SELECTION INDEX IN SOYBEAN*

Phan Thi Dao

(*The food Crop Research Center, Phu Do – Me Tri – Tuliem – Ha Noi – Vietam*)

Selection indices provide the means for making use of correlated characters for higher efficiency in selection for yield (Smith, 1936). Selection indices have been worked out by several workers in a wide range of crop plant. In all the caser, efficiency of indices have been assessed in term of predicted genetic advance. These studies showed that all the characters were not of equal selection value for improvement in yield. In the absence of criteria for choice of characters a very large number of indices are needed to be constructed in order to find out the best one. This is a very tedious job and impssoible when we are dealing with large number of characters. The present study is to construct selection indices on the basis of some genetic criteria to find out the best criteria for choosing characters involved in indices.

Materials and methods

The experimental materials consisted of 25 newly developed breeding lines of soybean. These were sown in a randomised block design with 4 replications during spring season 1996 at the Food Crop Research Center, Hanoi, Vietnam. Each plot consisted 3 rows, 4 m long and spaced at 60 cm between rows, 5 cm within row, At maturity the following observations were recoededon five random plantsin each plot.

X_1: Maturity

X_2: Plant height

X_3: Pods/plant

X_4: Seeds. pod

X_5: Height to the lowest node

X_6: Number of nodes to lowest nod

* 本文于 1997年 4月 29日收到。
This paper was received on April 29, 1997.

REFERENCE

[1] Al- Jibouri, H. A. Miller P. A. and Robinson, H. D 1980. Genotypic and environmental variance and co- variance in upland cotton crosses of interspecific origin. Agron. J. 50, 633- 636

[2] Bains, K. S. and Sood, K. C. 1980. Index selection for yield improvement in soybean. Crop Improv. 7(2), 102- 108

[3] Brim, C. A; Johnson, H. W. and Cockerham, C. C. 1959. Multiple selection criteria in soybean. Agron. J. 51, 331- 334

[4] Derey, R. D. and Lu, K. H. 1959. A correlation and path coefficient analysis of component of crested wheat grass and production. Agron. J. 51. 515- 518

[5] Johnson, H. W; Robinson, H. F. and Comstock, R. E. 1955. Genotypic and phenotypic correlation in soy- bean and their implication in selection. Agron. J. 47. 477- 493

[6] Misra, R. C. 1985. Criteria for choice of characters for construction of selection indices in green gram. Madras Agric. J. 71(5): 265- 271

[7] Robinson, H. F.; Comstock, R. E. and Harvey, P. H. 1951. Genotypic and phenotypic correlation in corn and their application in selection Agron. J. 43. 282- 287

[8] Sahu, D. P. and Patnaik, M. C. 1980. Selection indices in Niger. Indian J. Agric Sci. 50(12): 914- 917

[9] Smith, H. F. 1936. A discriminant function for plant selection. Ann. Eugen. 7. 240- 250

大豆构建选择指数遴选组成性状的指标

Pham Thi Dao

(食品作物研究中心, Phu Do- Me Tri- Tuliem- Ha Noi越南)

选用25个新品系,估算了熟期、株高等9个性状的遗传力、遗传度等6个遗传参数,并以这些参数为选择性状的指标构建了6组选择指数。试验结果表明:所有选择指数都比直接选择产量的效率高。以遗传进度(rg)为基础的选择指数效率最高,遗传进度(Ga)次之,接下来是遗传力× 遗传相关(h^2× rg),通径系数(p)和遗传变异系数(GCV%),以遗传力(h^2)为基础的选择指数效率最低。选择指数的相对效率随着性状数目的增加而增高,但增加每荚粒数和百粒重两个性状并不提高相对效率,可能是这两个性状与产量的遗传相关较低的缘故。遗传相关是构建选择指数时选择性状的最佳指数。

X_7: Number of nodes/main stem

X_8 Number of primary branches/plant

X_9: 100 seed weight

X_{10}: Yield/plot

Heritability (h^2), genetic advance (Ga) were estimated according to Al-Jibouri et al. (1958)

The genotypic correlation between the characters and yield were computed following Robinson et al. (1951). The path coefficient of these characters on yield were estimated following Dewey and Lu (1959). Coefficient of variability were computed by using the formula:

$$CV\% = \frac{S.D \times 100}{\overline{X}}$$ where, S.D: Standard deviation

$\overline{X}$: mean

Six groups of indices were constructed by using the formula suggested by Robinson et al. (1951), the characters being choosen on the basis of the following criteria: viz. h^2, Ga, GCV% (genotypic coefficient of variability), rg (genotypic correlation), $h^2 \times$ rg and P (direct effect component of the characters on yield in path analysis).

For the improvementt of yield, the indices included two to ten charactece with the yield/plot as the first and basic one, and others being added one by one according to their values of the six paranietes estimates (ie h^2, Ga- and P) in a descending order as shown in table 1 and the following.

Table 1 Heritability (h^2), genetic advance (Ga), variability coefficient of yield component, their genotypic correlation with yield(rg) and direct effect component on yield(P) in soybean

Characters	h^2	Ga	GCV%	rg	h^2.rg	P
1. Maturity	0.86	6.13	2.69	-0.34	-0.29	-0.29
2. Height of plant	0.71	31.52	18.47	-0.84	-0.59	-1.16
3. Pod/plant	0.17	5.67	11.32	0.30	0.05	0.22
4. Seeds/pod	0.13	0.06	4.20	-0.02	-0.003	-0.065
5. Height to lowest pod	0.45	7.68	31.68	-0.78	-0.35	1.59
6. Nodes to lowest pod	0.53	2.59	38.98	-0.69	-0.37	-1.11
7. Nodes/main stem	0.79	4.97	16.21	-0.53	-0.42	0.53
8. Primary branches	0.45	1.35	21.29	-0.74	-0.33	-0.64
9. 100 seed weight	0.75	1.87	10.31	-0.03	-0.02	0.35
10. Yield/plot(kg/7.2m²)	0.62	0.41	38.41			

Croup Ⅰ: $X_{10}, X_1, X_7, X_9, X_2, X_6, X_5, X_8, X_3, X_4$

Ⅱ: $X_{10}, X_2, X_5, X_1, X_3, X_7, X_6, X_9, X_8, X_4$

Ⅲ: $X_{10}, X_6, X_5, X_8, X_2, X_7, X_3, X_9, X_4, X_1$

Ⅳ: $X_{10}, X_2, X_5, X_8, X_6, X_7, X_1, X_3, X_9, X_4$

Ⅴ: $X_{10}, X_2, X_7, X_6, X_5, X_8, X_1, X_3, X_9, X_4$

Ⅵ: $X_{10}, X_5, X_2, X_6, X_8, X_7, X_9, X_1, X_3, X_4$

Ⅰ: based on h^2 Ⅳ: based on rg

Ⅱ: based on Ga Ⅴ: based on h^2. rg

Ⅲ: based on GCV% Ⅵ: based on P

In order to determine the relative efficiency of various selection indices the expected Ga of these indices was expressed as the percentage relative to the expected Ga due to selection for yield alone.

Result and discusion

The predicted gain in efficiency from the use of the indices over direct selection for yield at 5% selection intensity varied from 0.96% to 15.49% (Table 2).

Table 2 Predicted genetic advance on yield and relative efficiency of selection indices involing 2– 10 charachers over direct selection for yield

No. of characters	Genetic advance						Average
	Ⅰ h^2	Ⅱ Ga	Ⅲ GCV%	Ⅳ rg	Ⅴ gr h^2	Ⅵ P	
1	Straight selection for yield 0.413						
2	0.417	0.462	0.425	0.462	0.462	0.428	0.443
3	0.433	0.464	0.428	0.464	0.460	0.464	0.452
4	0.433	0.466	0.433	0.468	0.464	0.463	0.454
5	0.462	0.468	0.466	0.466	0.461	0.466	0.465
6	0.467	0.470	0.469	0.469	0.469	0.469	0.469
7	0.469	0.471	0.470	0.471	0.471	0.467	0.470
8	0.470	0.472	0.476	0.477	0.477	0.470	0.473
9	0.472	0.474	0.477	0.472	0.472	0.472	0.473
10	0.476	0.476	0.476	0.476	0.476	0.476	0.476
Average	0.455	0.469	0.458	0.469	0.468	0.463	

The average predicted advance of indices of each group showed that group Ⅳ – based on genotypic correlation (rg) had the highest efficiency (113.66%) over direct seleciton for yield alone, in turn followed by group Ⅱ (Ga), Ⅴ (h^2. rg), Ⅵ (P), Ⅲ (GCV%) and group Ⅰ which was based on h^2 and was the least effective one.

Misra (1985) evaluated 5 groups of indces based on 5 different criteria (h^2, Ga, rg, h^2, rg, and P) in mungbean. He found that P was the most effective criteria while Sahu and Patnaik (1980) in Niger found that h^2. rg was the most effective criteria for choice of characters to include in selection indices. Both of them found that h^2 is the least effec–

tive criteria.

The average predicted advance for indices with 2 to 10 characters ranged 107.4–115.25% over direct yield selection. In general, in each group, by inclusion of the characters into the index, the relative efficiency was increased (Brim et al. 1959, Johnson et al. 1955, Bains and Sood 1980).

In group Ⅳ and Ⅴ: The highest relative efficiency is 115.49% was obtained when 8 characters (yield/plot, plant height, height to lowest pod, primary branches, nodes to lowest pod, nodes/main stem, maturity, pods/plant) were involved in the indices which showed that these characters were highly useful in selection for yield.

Inclusion of seed/pod and 100 seed weight indices appeared to affect efficiency of indices presumably due to the low genotypic correlation of these characters with seed yield.

Table 3 The efficiency of the indices relative to selection for yield alone

No. of characters	Ⅰ h^2	Ⅱ Ga	Ⅲ GCV%	Ⅳ rg	Ⅴ gr h^2	Ⅵ P	Average
1	Straight selection for yield 100						
2	100.96	111.86	103.07	111.86	111.86	103.55	107.40
3	104.84	112.35	103.56	112.35	111.38	112.35	109.49
4	104.84	112.83	104.84	113.32	112.35	112.11	110.06
5	111.86	113.32	112.83	112.83	112.62	112.83	112.59
6	113.07	113.80	113.56	113.55	113.56	113.56	113.52
7	113.55	114.04	113.80	114.04	114.04	113.07	113.76
8	113.80	114.28	115.25	115.49	115.49	1113.80	114.68
9	114.28	114.76	115.49	114.28	114.28	114.28	114.56
10	115.25	115.25	115.25	115.25	115.25	115.25	115.25
Average	110.27	113.61	110.85	113.66	113.31	112.3	

Ⅳ > Ⅱ > Ⅴ > Ⅵ > Ⅲ > Ⅰ

In the study, the variance and covariance estimates were obtainde from single year's experimentation, so indices worked out here were not generally applicable. Thus the search for an effective criteria for choice of characters for construction indices and the identification of characters that could serve as useful criteria in selection for yield are the more general aspect of this study.

Conclusion: Selection indices were constructed in soybean. All indices showed better efficiency than driect selection for yield. Relative efficiency and increaded as additional character incorporated in the indices. Genotypic correlation of character with seed yield appeared to be the most effective criteria for choosing characters involed in construction of indices.