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Varietal Variation of Productivity and Chemical Components on Seed-Mustard (*Brassica juncea* Cosson) Lines

Dong Young Shin[1], Byung Sun Kwon[1]*, Kyu Hwan Hyun[1], Yong In Kuk[1], Dong Soo Jung[2] and Young Seok Jang[2]

[1]College of Agriculture and Life Science, Sunchon National University, Sunchon 540-742, Korea
[2]National Institute of Crop Science, RDA, Muan 534-833, Korea

Abstract - Seed mustard is high in nutrient quality and grows continuously under cold condition. Accordingly, it possessess high potential to bring about more efficient use of land when it is grown as a seasonings crop at paddy field in winter season. Recently, Seed mustard has aroused people's interest as a catch crop. The purpose of this trial is to examine productivity and chemical components of seed mustard and to select suitable variety in the southern area of Korea. Seed-mustard cv. Yeongsanpo local showed higher seed yield than any other varieties used in the experiment. It showed relatively high content of Oil, Protein, Ash, Carbo, P_2O_5, K_2O, Ca and T-N. The heritabilities of all the characters were estimated to be high. Therefore, it was concluded that Youngsanpo local was the most suitable variety with high yield and high nutrient quality at the southern area of Korea.

Key words - Seed-Mustard, Yield, Quality, Heritability

Introduction

Seed mustard are grown in many countries the world over, spreading their growing area chiefly from India to western Egypt, central Asia (southern or southeastern part of the U.S.S.R) and Europe. Leaf mustards used as vegetables are widely cultivated in Asian countries, centering in China, and there are diversely specialized varieties. In India they are spice plants whose seeds are used in curry as mustard powder or oil. At times their young leaves are also eaten.

They grow rather slowly but have the best tolerance to high temperature and humidity among the allied species. The seeds have dormancy. For bolting and flowering the need generally long days rather than low temperatures but some of the varieties are neutral to both.

As vegetables of B.juncea have wide variation in their flowering behavior, some of them can easily produce seed in the tropics.

But there was not any research work in Korea on the variety and for seed yield and chemical components. Therefore the purpose of this study is to examine the basic data for improving the variety of seed-mustard.

*Corresponding author. E-mail : kbs@sunchon.ac.kr

Materials and Methods

Five varieties of seed-mustard (*Brassica junea* Cosson) listed in table 1 were used in this trial. Field conditions before experiment are listed in table 2. The complete randomized block design with variety as treatment was used and treatment was randomized in each of the three blocks. Each experimental unit was 12.5 m^2(2.5×5 m). Five or six seeds were sown at each spot with 50 cm row spacing and 15 cm plant spacing on Oct.10 and two or three poor seedlings were discarded when first or second main stem leaf was unfolded and one healthy seedlings grown uniformly was remained at the stage that the third or fourth main stem leaf was expanded. Fertilizer was applied at the rate of 10-8-8 kg/10 a. of N-P_2O_5-K_2O. One third of the total N, total P_2O_5 and K_2O and manure of 1 MT/10 a were incorporated into the soil before sowing and the rest of N fertilizer was applied in late-February.

Ten plants were randomly sampled from each plot at maturing stage, and plant length, ear length, total branch, Number

Table 1. Characters of 5 varieties of seed-mustard (*Brassica juncea* Cosson) utilized in the experiment

Variety	Origin	Flowering Time	Maturity	Plant length
Sogcho local	Korea	Apr. 13	Early	Tall
Suweon local	Korea	Apr. 16	Late	Very short
Yeongsanpo local	Korea	Apr. 14	Early	Tall
Bugjeju local	Korea	Apr. 13	Early	Tall
Fukuoka local	Japan	Apr. 15	Medium	Tall

Table 2. Soil properties of the experimental plot at the beginning of experiment

PH (1:5)	OM (%)	P_2O_5 (ppm)	Ex-(me/100 g)			CEC (me/100 g)
			Ca	Mg	K	
5.96	1.31	93	6.07	0.83	0.24	10.8

of pods per ear, fruiting rates and 1,000 grains weights were measured. To determine yield, all the plants in 1 m^2 from each plot were harvested by cutting at about 3 cm above soil level. After determining fresh yield, dry seed yield of samples were measured after drying for 30 min at 105℃, then for 72h at 70℃ in a forced-air oven. Analyses of variance for the characters were used to calculate genetic and environmental variance components, heritabilities (Grafius *et al*., 1952).

Chemical characters was analyzed by the method of National Institute of Agricultural Science and Technology, Rural Development Administration and Allen *et al*. (1986).

P_2O_5 content were measured by pH meter(model:HM30R), by method of Tyurim (Schollen, 1927) and by the method of Lancaster respectively. Contents of ash, carbo, K_2O and Ca were analyzed by photometer (Model:8020) after leading at pH7.

Total nitrogen was measured by the kjeldahl procedure and reported as crude protein (NX 6.25). Oil content analyzed by the soxhlet.

Results and Discussion

Recently, many investigators have kept attention to seed mustard as an important seasonings crop because of high nutrient quality as well as productivity. However, since varieties of seed mustard were introduced into Korea in the early 1960s, not only its cultural areas is extremely limited but also there have been few researches for breeding genotypes of seed mustard suitable for the environmental condition in Korea. Also, few researches have been carried out to establish the proper cultural production system.

In this experiment was conducted to select a variety suitable in the southern area of Korea among the five varieties of seed mustard, and to examine the possibility weather variety of seasonings crop.

Mean values of the measured characters are presented in table 3. As shown in Table 3, plant length ranged from 120 to 192 cm, ear length from 40 to 45 cm, total branch from 19 to 34, number of pods per ear from 34 to 38, fruiting rate from 94 to 96%, seed yield from 140 to 184 kg/10 a and 1,000 grains weight from 1.8 to 2.1 gr. All the characters showed large variations, and their varietal differences in mean value were significant at the 5% level.

Yeongsanpo local, the superior variety of seed mustard, showed relatively higher values for all the characters with 192 cm in plant length, 46 cm in ear length, 32 in number of total branches, 36 in number of pods per ear, 96% in fruiting rate 184 kg/10 a in seed yield kg/10 a and 2.1 g in 1,000 grains weight. Compared with the inferior variety Suweon local, Yeongsanpo local showed higher values of 67cm in plant length, 5 cm in ear length, 13 in number of total branches, 2 in number of pods per ear, 5% in fruiting rate, 44 kg/10 a in seed yield and 0.3 g in 1,000 grains weight, and even compared with mean values of the five varieties, it showed 9 cm, 3 cm, 4, 1, 2%, 14 kg/10 a and 0.1 gr higher values, respectively.

Differences in mean values of all the characters were significant at the 5% level.

The results indicate that varieties show different adaptabili-

Table 3. Mean values and LSD's of observed characters and genotypic variances (σ^2G), environmental variances (σ^2E) and heritabilities (h^2) with 5 varieties of seed-mustard (*Brassica juncea* Cosson)

Variety	Plant length (cm)	Ear length (cm)	No. of total branches	No. of pods per ear	Fruitting rate (%)	Seed yield (kg/10 a)	1,000 grains weight (g)	Hot taste (1-5)
Sogcho local	175	40	31	35	95	168	2.1	2
Suweon local	120	41	19	34	91	140	1.8	4
Yeongsanpo local	192	46	32	36	96	184	2.1	1
Bugjeju local	187	41	30	34	94	181	2.1	3
Fukuoka local	191	45	29	36	96	175	2.0	3
LSD (0.05)	43.6	2.9	8.3	2.5	1.2	25.3	0.2	-
σ^2G	472.6800	18.1368	11.0121	4.5237	351.6237	47.3289	1.1321	-
σ^2E	21.8027	1.6721	0.3214	0.0061	0.2166	0.0084	0.0524	-
h^2	93.12	91.60	94.25	97.36	96.89	95.21	94.31	-

※ Hot taste 1= very strong hot
2= strong hot
3= Medium hot
4= Short hot
5= Very short hot

ties to a particular environment and Yeongsanpo local seems to be the most suitable variety in terms of yield and yield components at the southern area of Korea.

Heritabilities in a broad sens for several agronomic characters are listed in table 3. Since the genotypic variance components in all the observed agronomic characters were generally greater than environmental variance components, values of heritaility in all the agronomic characters were estimated to be high.

Since all the agronomic characters showed high values of heritability, selection efficiency to breed such genotypes would be high. According to the study on heritability for some characters of oil seed rape (Lee and Kwon, 1981b), the mean value of heritability for three years, from 1978 to 1980, is 82.3 percent in plant length and 47.3 percent in total number of branches. Lee and Kwon (1981a) reported that values of heritability in oil seed rape varied under different places and mean value of heritability from three different places, Jinju, Jeju and Mokpo, was 80.6 percent in plant length and 54.3 percent in total number of branches. This results may indicate that some effective characters are less affected by environment.

Mean values of the measure chemical characters are presented in table 4. As shown in table 4, oil content ranged from 42.3 to 44.3%, protein ranged from 21.8 to 24.7%, moisture ranged from 5.8 to 6.7%, ash ranged from 4.69 to 5.11%, carbo ranged from 14.0 to 17.6%, P_2O_5 ranged from 1.91 to 2.02%, K_2O ranged from 0.95 to 1.02%, Ca ranged from 0.34 to 0.39% and T-N ranged from 3.49 to 3.79%. All the chemical characters showed large variations, and their varietal differences in mean value were significant at the 5% level.

Yeongsanpo local, the supereior variety of seed mustard, showed relatively higher values for all the character with 44.3% in oil content, 24.7% in protein, 5.8% in moisture, 5.11% in ash, 17.6% in carbo, 2,02% in P_2O_5, 1.02% in K_2O, 0.39% in Ca and 3.79% in T-N, and even compared with mean values of the five varieties, it showed 0.8%, 1.6%, 0.1%, 0.21%,

Table 4. Varietal variances of chemical components and genotypic variances (σ^2G), environmental variances (σ^2E) and heritabilities (h^2) with 5 varieties of seed-mustard (*Brassica juncea* Cosson)

Variety	Oil (%)	Protein (%)	Moist-ure (%)	Ash (%)	Carbo (%)	P_2O_5 (%)	K_2O (%)	Ca (%)	T-N (%)
Sogcho local	43.7	24.2	6.1	4.79	14.0	2.00	1.00	0,34	3.77
Suweon local	42.3	21.8	6.7	5.04	14.0	1.91	1.02	0.36	3.49
Yeongsanpo local	44.3	24.7	6.8	5.11	17.6	2.02	1.01	0.39	3.79
Bugjeju local	44.1	22.4	5.8	4.88	17.4	2.00	0.95	0.36	3.58
Fukuoka local	43.2	22.6	6.2	4.69	17.6	1.98	0.95	0.39	3.62
LSD (0.05)	1.3	1.4	0.1	0.4	2.9	0.1	0.1	0.0	0.2
σ^2G	5.1510	4.0733	1.4382	1.7211	4.0934	1.1146	1.2418	1.03	1.5852
σ^2E	0.0273	0.0037	1.0972	0.0002	0.0063	0.0349	0.0002	0.0001	0.0001
h^2	98.44	96.21	96.88	95.51	94.47	94.55	97.70	94.40	98.63

1.5%, 0.04%, 0.02% and 0.14% higher values, respectively.

Differences in mean values of all the characters were significant at the 5% level.

The results indicate that varieties show different adaptabilities to a particular environment and Yeongsanpo local seems to be the most suitable variety in terms of chemical characters at the southern area of Korea.

Heritabilities in a broad sense for several chemical characters are listed in table 4. Since the genotypic variance components in all the chemical characters were generally greater than environmental variance components, values of heritability in all the chemical characters sere estimated to be high.

Since all the chemical characters showed high values of heritability selection efficiency to bred such genotypes would be high. According to the study on heritability for some characters of mat rush (Kwon and Lee, 1988a) the heritabilities of flowering date, number of stem per plant, fresh and dry weight of stem were higher with from 85.5 to 97.9%. Kwon and Lee (1988b) reported that of heritability in wangol varied under different characters, stem length, stem diameter and number of stem was from 81.77 to 99.65%. This results may indicate that some effective characters are less affected by environment.

Therefore, it was concluded that Yeongsanpo local was the most suitable variety with high yield and high quality at the suthern area of Korea.

Literature Cited

Allen S. E., H. M. Grinshow and A. P. Rowland. (1986). Chemical methods in plant ecology, 2nd ed. Blackwell Scientific Pub. Oxford. 285-344.

Bang J. K., B. S. Kwon and S. M. Bae. 1984. Variety test of seed-mustard *(Brassica juncea* Cosson). The 1984 annual research report of industrial crop. National crop experiment station, Rural Development Administration: 442-446.

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

Kwon B. S., J. K. Bang, S. M. Bae, D. S Jung and B. Y Kim. 1983. Variety test of seed-mustard (*Brassica juncea* Cosson). The 1983 annual research report of industrial crop. National crop experiment station, Rural Development Administration: 441-443.

Kwon B. S. 1974. Introduced winter variety test of seed-mustard (*Brassica juncea* Cosson). The 1974 annual research report of industrial crop. National crop experiment station, Rural

Development Administration: 285-286.

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

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

Lim J. S. 1974. Test of sowing time and transplanting time on seed-mustard (*Brassica juncea* Cosson). The 1974 annual research report of industrial crop. National crop experiment station, Rural Development Administration: 305-309.

Lee J. I., S. R. Lee, H. K. Choi, B. S. Kwon. 1985. Physico-ecological studies on Korean seed-mustard. I. Effects of varieties and seeding date on the variation of agronomic traits. Korean J. Crop Sci. 30(2): 146-153.

Lee J. I. and B. S Kwon. 1981a. Breeding for improvement of fatty acid composition in rapeseed, *Brassica napus* L. I. Local variations of estimated genetic parameters on maturity and yield characteristics of rapeseed cultivars with non-erucic acids and non-glucosinolate, Korean J. Breed. 13(1): 31-39.

Lee J. I. and B. S. Kwon. 1981b. Breeding for improvement of fatty acid composition in rapeseed, *Brassica napus* L. II. Year variations of genetic parameters for main characters of non-erucic acid and non-glucosinolate rapeseed varieties. Korean J. Breed. 13(2): 126-133.

Schollen and C. J. berger. (1927). A rapid approximation method for determining soil organic matter. Soil Sci. 24: 65-68.

Sinkaia, E.N. 1928. Bull. Appl. Bot Genet. PI. Breed. 19(3): 1-648.

Tsunoda S., K. Hinata and C.Gomez-Cmpo. 1980. *Brassica* crops and wild allies, Biology and breeding. pp. 141-150.

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