Effect of Planting Date and Plant Density on Yield and Quality of Industrial Rapeseed in Spring Sowing

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ABSTRACT

In spring, to determine the optimal planting date and plant density of rapeseed in southern areas of Korea. Taiwan[#1] variety for spring sowing, the highest yielding variety was grown under five different planting date and plant density.

Yield components such as plant height, ear length, number of seedling stand per m^2, number of per ear and seed set percentage were highest at the plots with Mar. 5 of planting date and 50/20cm drilling of plant density. Yield of seed, oil, gas and 1,000 grains weight and erucic acid content were highest at the Mar. 5 of planting date and 50/20cm drilling of plant density. Judging from the results reported above, at optimum planting date and plant density of rapeseed seemed too be Mar. 5 of planting date and 50/20cm plant density in spring sowing.

Key words : Planting date, Plant density, Rapeseed, Spring sowing

INTRODUCTION

The origin and early culture of rapeseed is obscure due to many interspecific hybrids of *Brassica* species and extremely difficult tracing of the evolution of the species. The earliest written records of rapeseed (200 to 1,000 B.C.) are found in India. Rapeseed was introduced into China from Korea more than 2,000 years ago. However, the cultivation of rapeseed for oil production has a shorter history as compared with sesame and perilla cultivation in korea. Rapeseed has been grown widely as an oil seed crop in the southern part of Korea including Jeju island, increasing cultivation area, production and yield per unit area as an important winter crop. Particularly, rapeseed is grown as one of the most important sightseeing resources for tourists in JeJu island. Monocropping of the rapeseed is obtained from late September to early June for transplanted cultivation, and from early October to mid-June for directly sown cultivation in Korea. Stand establishment of rapeseed is easy, and the plants can tolerate a wide range of pH even though optimum soil acidity is around seven. According to our experience rapeseed also can bo grown on marginal soil. On light, sandy loam soils, rapeseeds do well n Korea since they start regrowing early in spring and the root system is deep, thus suffering less from drought and/or coldness. However, the small seeds need shallow sowing ranging from one to three cm and enough moisture in the surface layers for germination. The winter rapeseed also is

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grown well on the paddy low land after harvesting rice crop in Korea. It seems to be fairly tolerant to wetness and salinity even though prefering well aerated soils and suffering from water-logging. Too much water favours attacks by fungi on the roots and decreases tolerance to low temperatures during winter and early spring. Thus it is important that surplus surface water should be drained away, particularly when grown on the paddy low land. On the other hand the soil should not be laboured too much since a heavy layer of fine particles will cause lack of air if the soil is saturated with water in clay soils.

In Korea, *Sclerotinia* species attacking stem and branches is destructive if cultivation is too intensive, but this fungus is dependent upon quite special weather condition. When grown on the upland, it is generally serious if rapeseed cultivations do come again too often in the rotation. However, when grown on the paddy low land after rice cultivation, continuous rapeseed cultivations are successful because of killing the fungus by flooding during the rice growing period. The rapeseed is sown alone in the sequential cropping systems as a row crop. Rotations are important in growing rapeseed on the upland in Korea (Kae *et al.*, 1994 ; Kwon 1994a ; Kwon 1994b ; Kwon *et al.*, 1984 ; Bang *et al.*, 1994 ; Hwang *et al.*, 1993 ; Lee *et al.*, 1994 ; Lee *et al.*, 1974 ; Kae *et al.*, 1971 ; Kwon *et al.*, 1972 ; Lee *et al.*, 1972a ; Lee *et al.*, 1972b ; Kim *et al.*, 1984a ; kim *et al.*, 1984b)

Taiwan#1 variety, industrial rapeseed currently grown for lubricating oil, materials of cosmetics and plastic film. Therefore the purpose of this study is to examine the effect of planting date and plant density on yield and quality of rapeseed.

MATERIALS AND METHODS

Rapeseed variety, Taiwan#1 for lubricating oil, materials of cosmetics and plastic film was grown at the experimental field of Mokpo Branch station of Crop Experiment Station in Korea. Seeds sown in main field on Mar. 5 with dropping of 50 × 10cm, 50 × 15cm and drilling of 50/10cm, 50/20cm distance with one plant per hill. The control plot was sowing Mar 5. and compare with of Sep. 20 with 12 × 12cm on nursery and transplanting of Mar. 5 with 50 × 30cm on main field.

The complete randomized block design was used and treatment was randomized in each of the three blocks. The size of each experimental unit was 20m2(4m × 5m). The fertilizer was applied in the field at a ratio of N-P2O5-K2O = 8-6-6 kg/10a and other cultural practices followed the conventional method in the southern region of Korea.

RESULTS AND DISCUSSION

Comparisons of the agronomic characters among planting date and plant density.

Mean values of the measured characters are presented in Table 1 and the results from analyses of variance for the characters are in Table 2.

As shown in Table 1 and 2, plant height ranged from 84.0 to 90.7 cm, ear length from 33.0 to 40.7cm, number of seedling stand per m2 from 6.7 to 142.9, number of pods per ear from 23 to 29, seed set percentage from 84 to 87 and harvesting date from June 10 to June 24. All the characters showed large variations and their varietal differences in mean value were significant at the 1% level. Planting date of March 5 and plant density of 50/20cm drilling showed relatively higher values for all characters with 90.7cm in plant height, 40.7cm in ear length, 142.9 in number of seedling stand per m2, 29 in number of pods per ear, 88 in seed set percentage, June 23 in harvesting date.

The results indicate that planting date and plant density show different adaptabilities to a particular environment and planting date of March 5 and plant density of 50/20cm drilling seems to be the most suitable treatment for spring sowing of yield

Table 1. Variation of agronomic characters of industrial rapeseed under different planting date and plant density

Treatment		Plant height (cm)	Ear length (cm)	No. of seedling stand per m^2	No. of pods per ear	Seed set percentage (%)	Harvesting date
Planting date	Plant density						
Mar. 5	50° × 10cm, droping	88.0	37.9	28.8	29	86	June 23
Mar. 5	50° × 15cm, droping	87.3	39.0	19.3	29	87	June 23
Mar. 5	50/10cm, drilling	88.4	36.7	92.5	25	84	June 23
Mar. 5	50/20cm, drilling	90.7	40.7	142.9	29	88	June 23
Sep. 20 sowing, Mar. 5 transplanting	12° × 12cm nursery, 50° × 30cm main field	84.0	33.0	6.7	23	86	June 10

Table 2. Analysis of variance for agronomic characters of industrial rapeseed under different planting date and plant density

SV	df	Plant height (cm)	Ear length (cm)	Effective branches per m2	No. of seedling stand per m2	No. of pods per ear	Seed set percentage (%)	Harvesting date
Treatment	4	16.94**	8.81**	71.01*	25.43**	8.92**	7.36**	0.51**
Error	8	0.20	0.10	0.89	0.14	0.17	0.24	0.04
C.V.(%)		1.87	0.87	4.83	1.53	0.95	0.68	1.11
L.S.D.(0.05)		0.45	0.58	0.71	0.63	0.64	0.71	0.28

** ; Significance at L.S.D. 1%

* ; Significance at L.S.D. 5%

Table 3. Variation of yield and content of erucic acid of industrial rapeseed under different planting date and plant density

Treatment		Yield (kg/10a)			Weight(g)	Content(%)
Planting date	Plant density (Width × Spacing)	Seed	Oil	Gas	1,000 grains	Erucic acid
Mar. 5	50°ø10cm dropping	143.8	57.5	86.3	2.38	53.6
Mar. 5	50°ø15cm dropping	117.3	48.1	69.2	2.27	54.7
Mar. 5	50/10cm drilling	152.0	63.8	88.2	2.56	55.1
Mar. 5	50/20cm drilling	184.7	79.4	105.3	2.56	56.8
Sep. 20, sowing, Mar. 5, transplanting	12 × 12cm nursery, 50 × 30cm main field	131.1	56.4	74.7	2.70	53.4

Table 4. Analysis of variance for yield and content of erucic acid of industrial rapeseed under different planting date and plant density

SV	df	Yield (kg/10a)			Weight(g)	Content(%)
		Seed	Oil	Gas	1,000 grains	Erucic acid
Treatment	4	283.71**	142.45**	138.73**	0.73**	6.37**
Error	8	26.75	13.37	12.12	0.03	0.21
C.V. (%)		3.85	1.87	1.61	3.17	0.63
L.S.D. (0.05)		11.54	0.57	0.45	0.28	0.54

** ; Significance at L.S.D. 1%

* ; Significance at L.S.D. 5%

components at the southern area of Korea.

Yield and content of erucic acid

Mean values of yield erucic acid content are listed in Table 3 and the results from analyses of variance for the characters are Table 4. As shown in Table 3. and 4, seed yield ranged from 117.3 to 184.7 kg/10a, oil yield from 48.1 to 79.4 kg/10a, gas yield from 69.2 to 105.3 kg/10a, 1,000 grains from 2.27 to 2.70g and erucic acid from 53.4 to 56.8%.

All the characters showed large variations, and their planting date and plant density differences in mean value were significant at the 1% level. March 5 of planting date and 50/20cm drilling of plant density showed relatively higher values for all the characters with 184.7 kg/10a in seed yield, 79.4 kg/10a in oil yield, 105.3 kg/10a in gas yield, 2.56g in 1,000 grain weight and 56.8% in erucic acid.

The results indicate that planting date and plant density show different adaptabilities to a particular environment and 50/20cm drilling of Mar. 5 seems to be the most suitable treatment for sprint sowing in yield and yield components at the southern area of Korea.

LITERATURE CITED

Kae, B. M. and B. S. Kwon. 1994. Trial on transplanting in Spring with Fall sowing nursery rapeseed. The Korean Society of Agriculture Promotion, Experiment Research Control of Special Crops : 561-562.

Kwon, B. S. 1994a. Regional cultural practice trial of rapeseed. The Korean Society of Agriculture Promotion, Experiment Research Control of Special Crops : 566-568

Kwon, B. S. 1994b. Weed control test of rapeseed. The Korean Society of Agriculture Promotion, Experiment Research Control of Special Crops : 571-572.

Kwon, B. S., S. G. Kim and S. M. Bae. 1984. Weed control test of rapeseed. Experimental research report of crop experiment station, Rural Development Administration : 449-452.

Bang, J. K., S. G. Kim, B. S. Kwon, S. M. Bae and D. S. Jung. 1984. Trial on mechanized cultivation for winter cropping on drained paddy field of F1 hybrid in rapeseed. Experimental research report of crop experiment station, Rural Development Administration. : 446-449.

Hwang, J. J., Y. S. Jang, D. S. Jung and B. S. Kwon. 1993. Trial on heterosis breeding by nuclear substitution of rapeseed. Experimental research report of crop experiment station, Rural Development Administration. : 441-459.

Lee, J. I. and B. S. Kwon. 1994. Trial on seeding rate and density of rapeseed in Spring. The Korean

Society of Agriculture Promotion, Experiment Research Control of Special Crops. : 556.

Lee, J. I. and B. S. Kwon. 1974. Regional cultural practice trial of rapeseed. The Korean Society of Agriculture Promotion, Experiment Research Control of Special Crops. : 579-580.

Kae, B. M., J. I. Lee and B. S. Kwon. 1971. A new rape variety "Yudal". The research report of office of rural development. vol. 14(crop) : 67-70.

Kwon, B. S. and D. S. Chung. 1972. Trial of weed control of rapeseed. Experimental research report of national crop experiment station, RDA : 291-297.

Lee, J. I. and B. S. Kwon. 1972a. Trial of seeding method of rapeseed in spring sowing. Experimental research report of national crop experiment station, RDA : 274-284.

Lee J. I. and B. S. kwon. 1972b. Regional yield trial of rapeseed in Taejun, Iksan, Taegu, Jinju Korea. Experimental research report of national crop experiment station, RDA : 312-330.

Kim S. G., B. S. Kwon, J. K. Bang and D. S. Jung. 1984a. Trial on high-yielding culture of rapeseed. Experimental research report of crop experiment station, Rural Development Administration. : 449-452.

Kim S. G., B. S. Kwon, J. K. Bang, S M. Bae and Y. J. Kimb. 1984. Trial on F1 seed production culture of rapeseed. Experimental research report of crop experiment station, Rural Development Administration. : 455-457.

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