Korean J. Crop Sci. 51(2): 113~117(2006)

Effect of Sowing Dates on Flowering and Maturity of Sesame

Kang-Bo Shim*†, Churl-Whan Kang, Dong-Whi Kim**, and Yong-Am Chae*****

*Yeongnam Agricultural Research Institute, NICS, RDA, Miryang 627-803, Korea
**National Institute of Crop Science, RDA, Suwon 441-707, Korea
***Dept. of Agronomy, Coll. of Agri. and Life Sci., Seoul Nat'l Univ., Seoul 151-921, Korea

ABSTRCAT : To identify the effect of sowing dates on flowering and maturity of sesame, some agronomic traits including days to flowering and days to maturity were investigated under five different sowing dates. Plant height, days to flowering, days to maturity, days from flowering to maturity and number of capsules per plant were showed significantly different by years, sowing dates and varieties. Interaction between sowing dates and varieties affected to days to flowering, days to maturity, days from flowering to maturity and number of capsules per plant. Plant height, days to flowering and days to maturity decreased significantly as sowing dates were delayed, but number of capsules and seed weight per plant showed highest at the sowing date of May 10. At the regression analysis of shortness degree of growth period by the response of days to flowering and days to maturity under different sowing dates, sesame varieties with earlier flowering habit were much less affected by day length rather than ones with later flowering habit. R^2 and gradient value on the days to maturity regression graph were smaller indicating that maturity was much less sensitivity than flowering to the change of day length and temperature in the move of sowing dates. Therefore, it would be concluded that early maturity sesame varieties have higher potential adaptability to various sesame cropping systems in view of their less sensitivity to day length changes under different sowing dates.

Keywords: sesame, sowing date, days to flowering, days to maturity, regression analysis

Sesame (*Sesamum indicum* L.) originated from tropical region of Africa shows early flowering and maturity under 10-12 hours of short day length condition. Optical growth temperature is about 25-27°C, and accumulated temperatures of 3,000-3,600°C are needed to reach normal maturity. Most plants show various reaction to the different sowing dates due to the changed day length, temperature and their interaction (Boote, 1980; Lee *et al.*, 1982). Byth (1968) reported that meteorological factors, such as temperature and day length, determined days to flowering and maturity of soybean under different sowing dates. Boquet *et al.* (1983) reported that insufficient vegetative growth under late sowing dates brought to decrease LAI which in turn caused to reduce yield potential in sesame. Abel (1962) reported that late sowing of early maturity crops in temperate region got shortened days to maturity up to 50%.

One of common sesame cropping systems in Korea is to sow in early May and to harvest in late August indicating total growth period is about 110 days. Nowadays, several new cropping systems in relation to sesame crop have been developed. For example, short period from June to August cropping system in green house and late sowing cropping system from July to September as second crop of upland are typical systems. Those cropping systems require new sesame varieties with short growth periods. Therefore, studies on physiological or genetic aspects of flowering and maturity are needed urgently new sesame types to adapt various cropping systems. This study was conducted to identify the effect of sowing dates on the flowering and maturity and, ultimately, to develop new sesame varieties with short growth period.

MATERIALS AND METHODS

Plant materials and methods

Total twenty sesame varieties were used for experimental materials. Fifteen sesame varieties were from Korea, three from China and two from USA. Total five times of sowing dates from April 25 to June 25 were established at the National Institute of Crop Science, Suwon, in 2001 and 2002.

Figure 1 showed meteorological conditions in two years. Rainfall distribution pattern was one of the most important factors to determine sesame yield potential. General distribution of accumulated temperature and total precipitation were different by years. Accumulated temperature in 2001 was higher than that in 2002 by 91°C. Total amount of precipitation in 2002 recorded much more than that in 2001 by 134 mm. Soil condition was quiet dry in early growth period in 2001, but most period of reproductive stage got much

†Corresponding author: (Phone) +82-55-350-1241 (E-mail) shimkb@rda.go.kr <Received July 12, 2005>

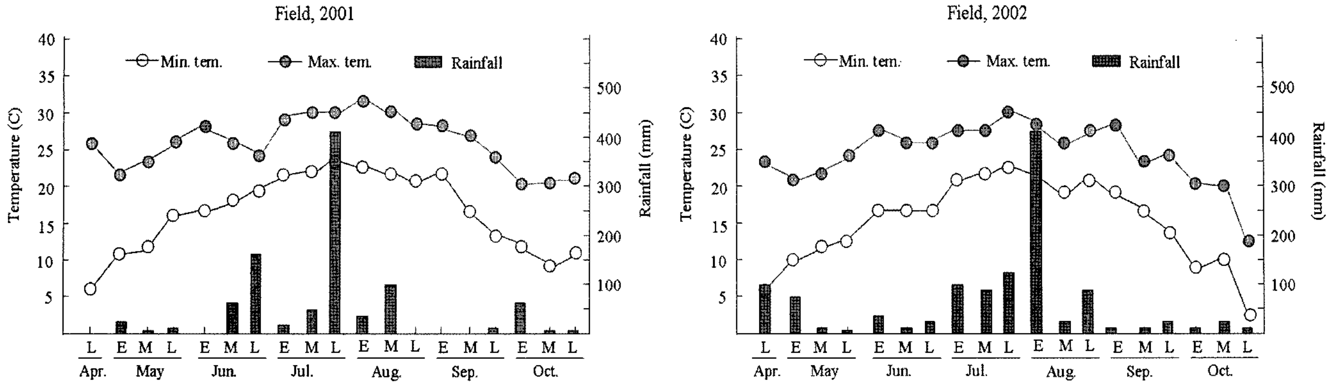

Fig. 1. Rainfall and temperature conditions during sesame cultivation season in 2001-2002.

more precipitation to give enough soil water to the crop. On the other hand, enough soil water condition promoted vegetative growth rate in early period in 2002. A randomized complete block design with three replications was used for this experiment. Spacing between plants was 10cm and row spacing was 30 cm in a 70 cm wide black polyethylene film mulching bed. Days to flowering was from sowing day to the time that one of floral buds in plant was bursting, and days to maturity was from sowing day to the time that one of capsules in plant was dehiscent.

Statistical analysis

Variance of some agronomic traits and physiological responses as affected by sowing dates were analyzed. Significant difference level depending on the mean value of days to flowering and maturity as well as other traits under several sowing dates was determined by Duncan's Multiple Range Test. Regression analysis was conducted to compare reduction degrees of days to flowering and maturity according to the several sowing dates.

RESULTS AND DISCUSSION

Analysis of variance to agronomic traits

Mean values of agronomic traits of sesame varieties under five sowing dates in 2001-2002 showed Table 1. Mean days to flowering and days to maturity were 52, 112 days respectively. Number of capsules per plant was averaged to 56, and seed weight per plant was about 7.5 g. Plant height, days to flowering and days to maturity were decreased significantly as sowing dates were delayed. Shekhar (1988) and Nath *et al.* (2001) also reported that late sowing of sesame caused to reduce accumulated amount of solar radiation and temperature which were major limiting factors of yield decrease. This study showed number of capsules and seed weight per plant of sesame variety showed highest at the sowing date of May 10, thereafter gradually decreased.

Days to flowering, days to maturity, days from flowering to maturity and number of capsules per plant were showed significantly different by years, sowing dates and varieties (Table 2). Meteorological difference was caused by higher accumulated temperature, more amount of solar radiation and less amount of precipitation in 2001. Sensitivity degree to the photo-period and temperature among sesame varieties caused to various physiological response under different sowing dates. Interaction between sowing dates and varieties affected to days to flowering, days to maturity, days from flowering to maturity and number of capsules per plant. Early flowering and maturity sesame varieties, such as Yek,

Table 1. Mean values of agronomic traits of sesame varieties under five sowing dates in 2001-2002.

Sowing dates	Plant height (cm)	Days to flowering	Days to maturity	Days from flowering to maturity	No. of capsules per plant	Seed weight per plant (g)
25 April	126[a†]	86[a]	139[a]	52[a]	57[ab]	7.9[ab]
10 May	122[ab]	69[b]	120[ab]	49[a]	64[a]	8.3[a]
25 May	117[b]	61[bc]	108[b]	46[ab]	61[a]	8.0[a]
10 June	106[c]	56[bc]	100[bc]	44[ab]	55[ab]	7.3[b]
25 June	90[d]	52[c]	94[c]	40[b]	41[b]	6.2[c]
Mean	112	65	112	46	56	7.5
C. V. (%)	16.0	21.3	16.2	10.5	17.7	15.6

†Means followed by a same letter are not significantly different at the 5% level by DMRT.

Table 2. Analysis of variance of days to flowering, days to maturity, days from flowering to maturity, number of capsules per plant, 1,000 seed weight, and seed weight per plant of sesame varieties.

Sources	Mean Square					
	PH†	DTF	DTM	DFM	NCP	SWP
Year	1,823**	1,444**	1,767**	750**	897**	15.20ns
Sowing date (S)	20,168**	10,757**	19,138**	1,225**	2,267**	19.60*
Genotype (G)	856**	760**	1,233**	129**	704**	13.90ns
Interaction (S × G)	31*	33*	35*	7*	28*	0.05ns
Error	22	18	24	0.8	5	0.13

†PH: Plant height, DTF: Days to flowering, DTM: Days to maturity, DFM: Days from flowering to maturity, NCP: Number of capsules per plant, SWP: Seed weight per plant. *,**: Significant at the 5%, 1% level, respectively

Whazun among twenty sesame varieties showed less affection to the change of day-length rather than those of late flowering and maturity sesame varieties, such as Ik 22, Whang. This study showed that days to flowering and days to maturity of sesame varieties were short as sowing dates were late.

Response of flowering and maturity as affected by sowing dates

Days to flowering and days to maturity were significantly different according to the sowing dates (Table 1). In general, days to flowering and days to maturity as well as number of capsules and seed weight per plant of most of short-day crops are decreased as sowing dates are late, and standard deviation of those traits are reduced by late of sowing dates. This study also showed similar results. Average days to flowering of sesame varieties were about 86 days at the sowing date of April 25, but 50 days at the sowing date of June 25. Average days to maturity were about 139 days at the sowing date of April 25, but 94 days at the sowing date of June 25. Days from flowering to maturity were showed less different response under different sowing dates. Days to flowering and days to maturity as well as days from flowering to maturity of sesame varieties were short as sowing dates were late.

Park *et al.* (1982) also reported that days to flowering of sesame were reduced as sowing dates were late. Lee (1988) reported that main factor to affect days to flowering of sesame was day length rather than temperature. In this study, degree of sensitivity to the day length and temperature among sesame varieties affected to days to flowering and days to maturity (Table 3). Generally, late flowering sesame varieties showed higher degree of photo-periodic sensitivity and those degree of responses showed different according to the factor of temperatures.

Regression analysis of flowering and maturity

Regression analysis was conducted to investigate the response of mean days to flowering to the shortness degree of growth period as affected by different sowing dates of sesame varieties (Fig. 2). Regression analysis gave the following equation for shortness degree of growth period by

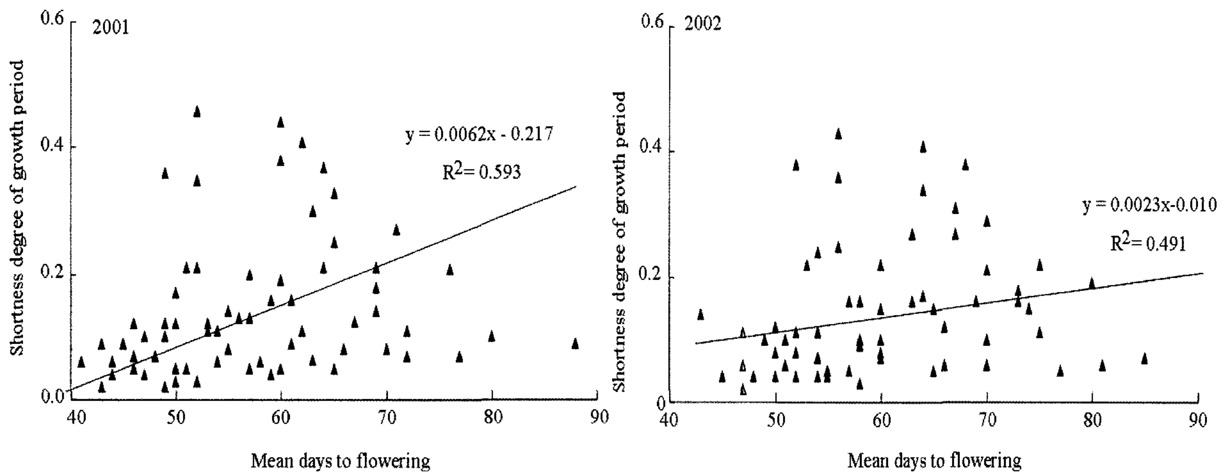

Fig. 2. Response of mean days to flowering to the shortness degree of growth period as affected by different sowing dates of sesame varieties in 2001-2002.

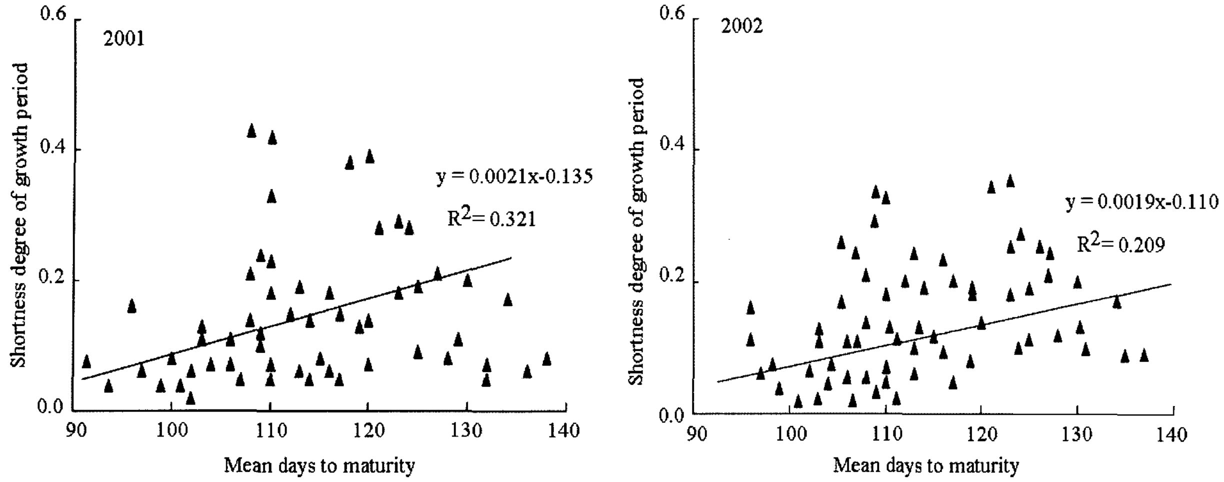

Fig. 3. Response of mean days to maturity to the shortness degree of growth period as affected by different sowing dates of sesame varieties in 2001-2002.

the response of mean days to flowering: Y = 0.0062X − 0.217 in 2001, Y = 0.0023X − 0.010 in 2002, where X = mean days to flowering. Each equation also had R^2 value of 0.593, 0.491 and F value of 6.10 $(^{**})$, 4.03$(^{*})$ respectively. Gradient value of 0.0062 above equation in 2001 was bigger than that of 0.0023 in 2002 indicating sesame varieties grown in 2001 were much more influenced by day-length and temperature under different sowing dates. Therefore, it proved that sesame varieties with short days to flowering were less influenced by environmental factors such as day-length and temperature under different sowing dates to give them smaller gradient value than ones with long days to flowering.

Figure 3 showed the response of mean days to maturity to the shortness degree of growth period as affected by different sowing dates of sesame varieties. Equations for shortness degree of growth period by the response of mean days to maturity were Y = 0.0021X − 0.135 in 2001, Y = 0.0019X − 0.110 in 2002, where X = mean days to maturity. Each equation also had R^2 value of 0.321, 0.209 and F value of 2.74 $(^{*})$, 1.83$(^{*})$ respectively. Similar response pattern on days to maturity was showed that of days to flowering, but R^2 and gradient value on the graph were smaller indicating that days to maturity was much less influenced by day-length and temperature than days to flowering under different sowing dates.

Mean gradient value of days to flowering and maturity in two years were 0.0043 and 0.0020 respectively indicating days to maturity was much less sensitivity than days to flowering to the change of day length and temperature in the move of sowing dates. Therefore, it showed that flowering stage was relatively more important factor than maturity stage to determine yield potential in sesame varieties. Johnson *et al.* (1960) and Byth (1968) also reported that crops with early flowering and maturity habit showed much less affection to the change of day length rather than that of crops with late flowering and maturity habit. In this study, total twenty sesame varieties ranged 79-126 days of growth period, and some sesame varieties were grouped by sensitivity to the change of day-length and temperature by which sesame varieties with early or late maturity in a group were able to select. From this study, it would be concluded that early maturity sesame varieties were less sensitivity to day length changes under different sowing dates providing them higher adaptability to various sesame cropping systems, such as short period from June to August cropping system in green house or late sowing cropping system from July to September, and those results make it possible to establish breeding target to develope sesame varieties for various cropping systems.

REFERENCES

Abel, G. H. 1962. Response of soybeans to dates of planting in the Imperial Valley of California. Agron. J. 53 : 95-98.

Boote, K. J. 1980. Response of soybeans in different maturity groups to march plantings in Southern USA. Agron. J. 73 : 854-859.

Boquet, D. J., K. L. Koonce, and D. M. Walker. 1983. Row spacing and planting date effect on the yield and growth response of soybeans. Louisiana Agric. Exp. Stn. Bull. 754.

Byth, B. E. 1968. Comparative photo-periodic responses for several soybean varieties of tropical and temperate origin. Aust. J. Agric. Res. 19 : 879-890.

Johnson, H. W., R. C. Leffel, and H. A. Borthwick. 1960. Effect of photoperiod and time of planting on rates of development of the soybean in various stages of the life cycle. Bot. Gaz. 122 :

77-95.
Lee, B. H., J. L. Lee, S. T. Lee, and R. K. Park. 1988. Response of growth and flowering to day-length and temperature in sesame cultivars. Res. Rept. RDA 30(1) : 35-40.
Lee, J. I., S. T. Lee, G. C. Um, and C. H. Park. 1982. Effect of planting date on agronomic characteristics and varietal differences in sesame varieties. Korean. J. Crop Sci. 27(3) : 268-275.
Nath, R., P. K. Chakraborty, and A. Chakraborty. 2001. Effect of climatic variation on yield of sesame at different dates of sowing. J. Agronomy & Crop Science 186 : 97-102.
Park, C. H. and J. I. Lee. 1982. Response of flowering in sesame varieties. Educational-industrial cooperation. 180(29) : 1-48.
Shekhar, J. 1988. Effects of varieties, dates of sowing, row spacing and their interaction on yield of sesame. Seeds and Farms 14 : 25-35.