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Effect of Seeding Date on Growth Habit and Pod Setting of Peanut in Southern Korea

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ABSTRACT : To evaluate growth habits, fresh pod yield potential, and possibility of early and late seeding, seeding dates were extended from March 21 to June 20 by PE mulching and non-mulching. Soil temperature, under 5 cm from surface, above 15°C at 10 a.m. in early seeding reached about March 25 in mulching and April 5 to April 12 in non-mulching. Days to emergence and first flowering were accelerated owing to increasing temperature, as seeding was delayed. Days to emergence according to seeding dates reduced 21 to 8 day in mulching and 33 to 10 day in non-mulching. Days to flowering were ranged from 51 to 26 day in mulching and from 69 to 32 day in non-mulching and differences between mulching and non-mulching on each seeding date had 18 to 4 days. Early seedings till April 21 had 160~170 flowers per plant for 8 weeks, while late seedings from May 21 increased more speedily with 200 flower for 6 weeks. Harvesting of fresh peanut, at 80 days after first flowering, was possible from Aug. 1 to Oct. 7 (133~108 days to harvest) by mulching and from Aug. 19 to Oct. 12 (151 to 114 days) by non-mulching. Yields between mulching and non-mulching in early seeding until April 21 had more difference, but in late seeding after May 21 was higher and showed insignificance. Pod setting periods by early and late seeding were about 3 weeks equally. In late seeding pod setting were almost concentrated for front 15 days. In spite of difference of fresh pod weight between two seeding times, the distributions of average of seed weight showed nearly same tendency.

Keywords **:** peanut, *Arachis hypogaea.* fresh peanut, seeding date, mulching, pod setting.

Peanut originated from tropical areas requires high growth temperature such as 2,800~3,500°C of accumulative temperature and 150~170 days of growing season to harvest mature grain peanut in Korea. So peanut is generally cultivated as single crop except for Jeju island, which has shorter winter season and cultivates as succeeding crop of barley (Moon *et al.*, 1989).

Recent years cultivation area of peanut has severly decreased, as import of foreign dry pod peanut favorable in price have been increased. But fresh pod peanut eaten after boiling that has mainly produced and consumed in Yeongnam region, southeastern part of Korea, is increasingly produced from whole country because of higher favorite for consumers and higher income for producers, compared with dry grain peanut.

Cultivation area for fresh pod peanut is estimated as about 20% of total peanut area. Price of fresh pod peanut in auction market is 1,500~2,300 won per kg showing differences between shipping dates, but this price is similar with 2,000 won per kg of dry pod peanut (Prices from NACF's purchasing price and Daegu auction market for agricultural products in 2001).

Many literatures studied on seeding dates and cultural practices for grain peanut have shown tendencies of higher grain yields from early seeding because of almost concurrent harvesting despite of different seeding dates and recommended digging at 100~110 days after first flowering (DAFF) by seed size for maximum production (Chung *et al.*, 1985; Park Oh, 1992; Park *et al.*, 1986). Fresh pod peanut harvested about 80 DAFF for favorable yield and taste, though harvesting time has some differences by environmental factors and plant types (Ko *et al.*, 1999, Lee *et al.*, 1999.), can reduce about 25 days of growth period, compared to growth period for grain peanut. Shorter growing season makes it possible to extended seeding dates for advance or late shipping.

There were little known about growing characteristics and yield changes according to different seeding dates for fresh pod peanut. The objective of this study is to collect basic data of cultural practices for fresh pod peanut through evaluating growing habits, pod setting, yield and possibility of early and late seeding as seeding dates enlarged to June 20 from March 21 by PE film mulching and non-mulching culture in southern part of Korea.

MATERIALS AND METHODS

This experiment was conducted in paddy field of the

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Table 1. General weather conditions of peanut growing season during this experiment at Miryang area.

Year		Mar. late	Apr.	May	June	July	Aug.	Sep.	Oct.*	Total sum	Index
Accumulated temp. (°C)	'98	112	467	584	613	763	781	665	329	4,314	103
	Avr.**	94	383	542	648	778	798	617	315	4,175	100
Sunshine hours	'98	92	159	215	131	110	116	171	123	1,117	73
	Avr.	75	234	265	210	195	225	193	138	1,535	100
Rain fall (mm)	'98	11	141	136	269	119	430	246	65	1,417	132
	Avr.	20	118	98	208	244	211	137	39	1,075	100

*Oct. : The values summed from Oct. 1 till Oct. 20.
**Avr. : from 1973 to 1997.

National Yeongnam Agricultural Experiment Station (NYAES) for 2 years, located at 128° 45'E and 35°30'N on 12 m above the sea level. Used cultivar was Virginia typed Palkwang which is prevail to farmer's culture for fresh peanut. Seeding dates had six times from March 21 to June 20. Seeds were sown under two different conditions of polyethylene (PE) film mulching and non-mulching. Planting density is 80,000 plants/ha and transparent PE film of 0.015 mm punched by interspace 40×25 cm was mulched on soil surface with furrow width of 100 cm.

Experimental plot was arrayed by split plot design with 3 replications and each plot size was 8 m^2. Fertilizer was applied as basal release before seeding with N-P_2O_5-K_2O-$Ca(OH)_2$ of 30-140-100-1,000 kg/ha. Other cultural practices were conducted according to standard cultural methods developed by NYAES.

Temperature under 5 cm of soil surface after early seeding was measured at 10 a.m. and 2 p.m. from March 21 till April 20 everyday. Flowering numbers of 5 mean plants selected on each seeding date were measured everyday from first flower to end. Digging of fresh pod peanut was carried out on 80 DAFF by PE film mulching and non-mulching of each seeding date. Pods having a reticulate surface were used for yield of fresh pod peanut.

Dates of pod setting by each seeding date in mulching followed inflorescence method (Pae *et al*, 1997, 1998a), which certify pod at harvesting after recording date at flowering position on inflorescence drawing.

As weather condition during this experiment, mean temperature was similar with value of average years. Sunshine hours of this year showed especially lower from June to August. The rainfall had higher volume for growing season except July.

RESULTS AND DISCUSSION

Soil temperature

Soil temperature under 5 cm from surface measured at 10 a.m. and 2 p.m. from March 21 to April 20, early seeding period, by PE film mulching and non-mulching was changed as shown Fig. 1.

Generally soil temperature was increased in mulching and non-mulching as time was passed. Soil temperature by mulching is about 4°C at 10 a.m. and about 10°C at 2 p.m. higher than those of by non-mulching. Soil temperature was severely fluctuated by sunshine hour and rainfall daily and shown the largest change at 2 p.m. by mulching. When regarded as about 15°C as peanut germinative temperature practically, this soil temperature at 10 a.m., which is near mean temperature, attained about March 25 in mulching and April 5 to April 12 which had some different days by years in non-mulching. Increasing soil temperature in early seeding by mulching had more than 10 days advanced effects, compared with that by non-mulching. This effect by mulching showed similar tendency with other report that subterraneous temperature from April 10 seeding to emergence was about 4.8°C higher than that of non-mulching (Choi *et al.* 1979).

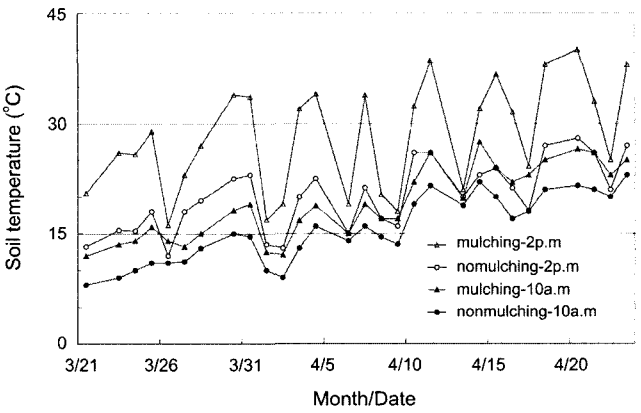

Fig. 1. The changes of temperature at 5 cm under soil surface at 10 a.m. and 2 p.m. according to PE film mulching and non-mulching culture in early growing season.

Table 2. Days to emergence according to seeding dates by PE film-mulching and non-mulching in peanut.

Treatment	Emergence	Seeding dates					
		Mar. 21	Apr. 1	Apr. 21	May 21	June 10	June 20
Non-mulching	Emergence	Apr. 23	Apr. 23	May 5	May 31	June 20	June 30
	Days to emergence	33	22	14	10	10	10
	Emergence rate (%)	35	64	89	96	85	81
PE-mulching	Emergence	Apr. 11	Apr. 16	Apr. 30	May 29	June 19	June 28
	Days to emergence	21	15	9	8	9	8
	Emergence rate (%)	89	98	97	99	98	89

Table 3. Days to first flowering according to seeding dates by PE film mulching and non-mulching in peanut.

Treat		Seeding dates					
		Mar. 21	Apr. 1	Apr. 21	May 21	June 10	June 20
Non-mulching	First flowering	May 29	May 30	June 8	Jul. 2	Jul. 12	Jul. 22
	Days to flowering	69	59	48	42	32	32
	DFEFF*	36	37	34	31	22	22
PE-mulching	First flowering	May 11	May 16	May 27	June 23	Jul. 8	Jul. 16
	Days to flowering	51	45	36	33	28	26
	DFEFF	30	30	27	25	19	18

*DFEFF : Days from emergence to first flowering.

Days to emergence

Table 2 showed days to emergence according to 6 different seeding dates from March 21 to June 20 by PE mulching and non-mulching. It took shorter with 21 to 8 days in mulching and 33 to 10 days in non-mulching, as seeding date was delayed. In mulching, seeding from early in May reduced to 8 days and seeding by non-mulching from middle of May came down to 10 days. In PE mulching, March 21 seeding emerged on April 11 sprouted 5 day earlier than April 1 seeding and had profitable emergence rate, while in non-mulching March 21 and April 1 seedings had emerged on April 23 and poor emergence rates with 35-65%. Judging from this results, seeding from late March by mulching in southern parts of Korea will be favorable to the stable production of fresh peanut.

Days to flowering

Flowering began on May 11 in mulching and May 29 in non-mulching of March 21 seeding as shown Table 3. Days to flowering had 25 days differences changing 51 to 32 days in mulching and 37 days differences from 69 to 32 days in non-mulching by seeding dates. Gaps of first flowering between mulching and non-mulching on each seeding date had 18 to 4 days, which showed more effect in early seeding. Days from emergence to first flowering according to seeding dates required 30~18 days in mulching and 36~22 days in non-mulching and by mulching on each seeding date accelerated 7~3 days.

As other researchers reported that day from seeding to first flowering demanded 417.3 ± 12.8°C of effective accumulated temperature above 12°C (Ono *et al.*, 1974) and was accelerated by higher temperature (Choi *et al.*, 1979, Pae *et al.*, 1998b, Park *et al.*, 1986), this experiment also showed that later seeding and PE film mulching made days to emergence and first flowering shorter obviously, and this experiment area conducted is shorter days to flowering, compared with other places, Gyeongbuk and Gyeonggi provinces.

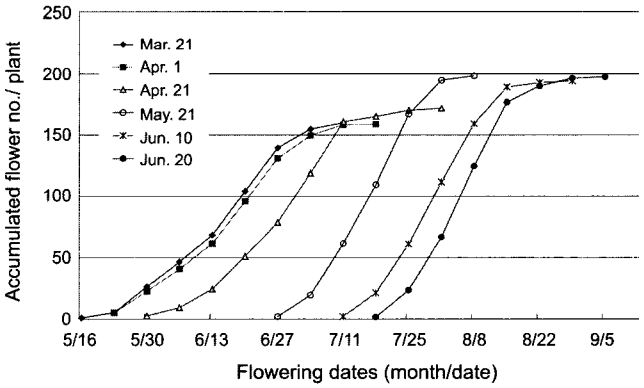

Fig. 2. The changes of accumulated number of flowers according to seeding dates during growing season in peanut cultivar Palkwang.

Table 4. Fresh peanut yield and days to harvest according to seeding dates by PE film mulching and non-mulching.

Treat		Seeding dates					
		Mar. 21	Apr. 1	Apr. 21	May 21	June 10	June 20
Non-mulching	Harvest*	Aug. 19	Aug. 20	Aug. 29	Sep. 22	Oct. 2	Oct. 12
	Days to harvest	151	141	130	124	114	114
	Fresh pod yield (kg/ha)	3,270^{c**}	4,030^{c}	5,040^{b}	6,980^{a}	6,790^{a}	6,250^{a}
PE-mulching	Harvest	Aug. 1	Aug. 6	Aug. 17	Sep. 13	Sep. 28	Oct. 7
	Days to harvest	133	127	118	115	110	108
	Fresh pod yield (kg/ha)	6,330^{ab}	5,680^{b}	59,30^{b}	6,840^{a}	6,570^{a}	7,010^{a}

*Harvest : digging at 80 days after first flowering.
**Value at 5% significance level by Duncan's multiple range test.

Number of flowers according to seeding dates

The changes of accumulated number of flowers according to seeding date are shown as Fig. 2. Flowering was begun on mid May to mid July and had 160~200 flowers per plant for 6 to 8 weeks.

Early seedings till April had 160~170 flowers for 8 weeks, but late seedings from May 21 increased more speedily with 200 flowers for 6 weeks. Because It is important to have much flowers in early stage of flowering for high yielding, the number of flowers for front 3 weeks had large differences among seeding dates, which had 50~60 flower until April 21 seeding and 110 flowers after May 21 seeding. As this, Flower beginning in hot season was more favorable to increasing number of flowers during early stage.

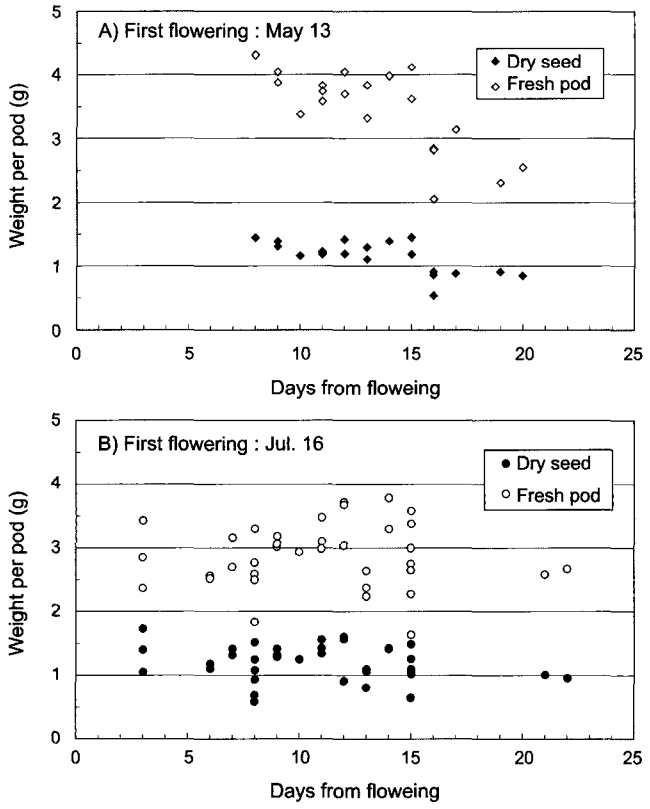

Fig. 3. Distributions of fresh pods and dry seed weight per pod according to days from first flowering, May 13 (left) and July 16, in each peanut plant that was seeded at April 1 and July 20 and harvested at 80 days after first flowering respectively.

Days to harvest and yield potential

Harvested at 80 days after first flowering, each plot by seeding dates had days to harvest as Table 4. In mulching harvesting was started from Aug. 1 at March 21 seeding to Oct. 7 at June 20 seeding for 65 days, but in non-mulching it was from Aug. 19 to Oct. 12 for 54 days.

Differences of Days to harvest by seeding dates showed 25 days gaps from 133 to 108 days in mulching and 37 days gaps from 151 to 114 days in non-mulching. Growing period for fresh peanut was shortened much more than that for mature grain peanut, which usually requires 150 to 170 days according to grain size (Lee & Park, 1984. Park & Oh, 1992). If using this short growing period, fresh peanut will be effectively used to cropping system as preceding or succeeding crop.

Yield of fresh peanut according to seeding dates, digging at 80 DAFF, shown as Fig. 4 revealed 1,330 kg gap with 5,680 to 7,010 kg/ha in mulching, and 3,710 kg gap with 3,270 to 6,980 kg/ha in non-mulching. This means that mulching treatment made more yield stability through whole seeding dates. Yields until April 21 seeding, as seeding was earlier, had more difference between mulching and non-mulching. But yields from late seeding, May 21 to June 20, were higher and showed insignificance difference between non- and mulching. We think these yield variations depend on conditions of temperature and flowering and ripening by seeding dates and mulching treatment.

Distribution of pods by flowering date

The weight of mature fresh peanut according to days from

first flowering of May 13 and July 16, Apr. 1 and June 20 seeding by mulching respectively, was distributed as Fig. 3. Pod setting periods of two seeding dates were about 3 weeks equally. June 20 seeding had more number of pod per plant and better early pod setting for the front 15 days, compared to Apr. 1 seeding.

Weight of fresh pod in Apr. 1 seeding distributed at average 3.7 g per pod for front 15 days and rapidly decreased after 15 days, but in June 20 seeding pod setting were almost concentrated for front 15 days and had broad weight distribution with average 3.0 g per pod. In spite of difference of fresh pod weight between two seeding dates, the distribution of seed weight showed similar tendency with average 1.3 g per pod. Considering above results, fresh peanut for high yield is important key to have more flowering for 3 weeks after first flowering, contrary to mature grain peanut having effective flower for 4 weeks (Pae *et al*, 1998a). Late seeding showed accelerating early growth and was advantage to secure many effective flowers by high temperature, but its ripening may be influenced by temperature after the late of September that become below 20°C having unfavorable growth. Early seeding was some delayed days to emergence and flower and flowering speed by unfavorable temperature and its ripening stage, despite of high temperature, may depend on circumstances of wet and rainy season during July and August that bring about over growth.

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