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Effects of Plant Types and Cultivars on Pod Yield in Late Seeding Peanut

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ABSTRACT This experiments were conducted to evaluate suitable plant-type and cultivars for producing fresh pod peanut from late seeding as succeeding crop, compared with early seeding as proceeding crop or single cropping. 12 cultivars according to grain weight and plant types, 6 virginia typed cultivars (ssp. *hypogaea*) and 6 shinpung typed cultivars (ssp. *fastigiata*), were used for early and late seedings.

The plant growth and yield potential in early seeding were better than those in late seeding. But the ratios of dry/fresh pod and of mature pod in late seeding were higher than those of early seeding. The yield of fresh pod by cultivars in two seeding times showed significant correlation with pod scale such as fresh pod weight, 100-grain weight, and dry seed yield positively, but pod number negatively in early seeding only. Yield of fresh peanut between Virginia and Shinpung types didn't show significant difference in early seeding, but showed in late seeding. Average yield of Virginia typed cultivars showed significantly higher than that of Shinpung typed ones. This yield gap between two plant types was the same tendency on extending seedings to July 20.

Keywords : peanut, *Arachis hypogaea*, fresh peanut, seeding date, cultivar, plant type

Recently cultivation area of peanut (*Arachis hypogaea.*) has severely decreased, as the import of foreign peanut to be low in price has been increased. But the area of fresh peanut eaten after boiling that has been mainly produced and consumed in Yeongnam region, southeastern part of Korea, is increased in whole country because of higher favorite for consumers and higher income for producers, compared with dry grain peanut.

There are many literatures studied on the mature grain peanut that was harvested after about 150 days of growth period. This long growing period made peanut cropping system disadvantageous, so it was cultivated as single cropping whole country except for Jeju island, which cultivates as succeeding crop of barley (Moon *et al.*, 1989).

But studies on fresh peanut harvested at about 120 days after seeding have actively accomplished in recent years. Daeyang which has good taste and pod shape was developed in 2000 (Pae *et al.*, 2001). And 2 cultivars, Jakwang and Baekjung that were improved in the quality and fresh pod yield were released in 2003 (Pae *et al.*, 2004).

Cultural practice for labour saving was evaluated by combine machine digging and threshing fresh peanut (Park *et al.*, 1999). Fresh pod peanut is harvested about 80 days after first flower (DAFF) for favorable yield and taste (Ko *et al.*, 1999; Lee *et al.*, 1999), while mature grain peanut is recommended to dig at 100~110 DAFF in the consideration with seed size for maximum production (Chung *et al.*, 1985; Park *et al.*, 1986; Park & Oh, 1992). There were reported studies on changes of growth habit and pod setting by seeding dates for fresh pod peanut (Pae *et al.*, 2002). Shorter growing season makes it possible to extend seeding dates from late March by mulching to mid June (Ko *et al.*, 1999; Pae *et al.*, 2002), so fresh peanut in cropping system can be used as early or late seeding according to shipping time and other crops.

The objective of this study is to collect basic data of cultural practices and breeding for fresh peanut through evaluating cultivars and plant types according to early and late seedings

MATERIALS AND METHODS

This experiment was conducted in upland field of the

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National Yeongnam Agricultural Experiment Station (NYAES), located at 128°45′E and 35°30′N on 12 m above the sea level for three years. 12 cultivars were used according plant types, 6 Virginia typed cultivars (ssp. *hypogaea*); Iksan11, Palkwang, Sinnamkwang, Daepung, Satonoka, and Namkwang, and 6 Shinpung typed cultivars (ssp. *fastigiata*); Chokwang, Daekwang, Daeyang, Jinmi, Milyang9, and Daeshin (Lee & Park, 1884). Seeds were sown on April 20 for early seeding and on June 10 for late seeding under conditions of polyethylene film mulching. Seedings of 6 cultivars according to seed size and plant types (Virginia typed cultivars; Ilksan11, Palkwang and Sinnamkwang, Shinpung typed cultiars; Chokwang, Daekwang and Daeyang) were extended to July 20 to evaluate late seeding adaptability. Planting density is 8,000 plants/10a 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 dressing before seeding with N-P_2O_5-K_2O-$Ca(OH)_2$ of 3-10-9.8-150 kg/10a.

To investigate the changes of flowering numbers during growing season, Virginia typed Palkwang and Shinpung typed Daekwang were recorded flowering dates of five plants with each seeding date during flowering period.

Digging of fresh pod peanut was done on 80 DAFF of each seeding date. Pods having a reticulate surface were used to calculate yield of mature fresh pod peanut immediately after digging. Dry pod and seed weights were measured after sufficient air dry. Other cultural practices and investigation methods were conducted according to ordinary cultural methods.

RESULTS AND DISCUSSION

Agronomic growth characteristics of 12 cultivars between early seeding and late seeding are showed in Table 1. Growth showed distinct difference according to seeding dates, plant types and cultivars. Virginia typed Namkwang and Shinpung typed Daeyang showed the largest grain weight, while Inkan11 and Chokwang each plant type did smallest grain weight. In early seeding, flower beginning showed from May 29 to June 5 with 7 days gap according to cultivars that had 43 days to flowering by average, while in late seeding, it had shorter period with 3 days difference from July 5 to July 8 that had 27 days to flowering by average. Stem length and top dry weight in early seeding showed some outgrowth, more severe in Virginia type plant, owing to hot and wet season during July and August but in late seeding showed less growth with 49% reduction of top dry weight.

The number of mature pod per plant, fresh weight per pod, 100 grain weight and fresh pod yield are higher in early seeding than in late seeding. But the ratios of dry/fresh pod and of mature pod weight were higher in late seeding.

Fig. 1 showed some different patterns of the changes of flowering numbers with seeding dates. Through two seeding dates, Shinpung typed Daekwang speeded up more than Virginia typed Palkwang. Maximum flowering day in early seeding was reached after 6 weeks from beginning of flowering, while in late seeding after 3 or 4 weeks. Generally the ratio of effective flower to set mature pod is less than 10% of total flowering number. Especially the first 3 weeks from flowering date is important to increase the number of mature pod for high yield. Flower number for first 3 weeks in late seeding increased more advantageously than that of early seeding. Especially Virginia typed Palkwang in late seeding increased conspicuously compared to that in early seeding. As shown previous report the number of days to flowering date was greatly related to the temperature according to seeding dates (Pae *et al.*, 2002), the number of days to flowering date in late seeding may be accelerated by high temperature of July. But the less fresh pod number and weight in late seeding were mainly caused by unfavorable temperature during pod maturing, compared to those of early seeding.

When 12 cultivars according to grain weight were seeded at early and late times, the distribution of fresh pod yields were shown in Fig. 2. The ranges of fresh pod weights of cultivars were 1.8～4.8 g in early seeding and 1.6～3.9 g in late seeding. Fresh pod yield was also higher in early

Table 1. Growth characteristics as affected by sowing dates and cultivars of peanut.

Seeding date	Cultivar	Flower beginning (mon.date)	Main stem (cm)	No. of branch /plant	Top dry wt. (g/plant)	No. of mature pod/plant	Fresh wt./pod (g)	Dry/fresh pod ratio (%)	Mature pod wt. ratio (%)	100-grain wt. (g)
Sown on April 20										
Virginia	Iksan11	6.4	64	40	93	39	1.8	43	83	45.1
	Palkwang	6.4	53	33	83	29	3.0	48	88	74.3
	Sinnamkwang	6.5	62	33	87	22	5.0	37	86	79.5
	Daepung	6.4	57	26	87	39	2.7	45	88	63.2
	Satonoka	6.3	41	30	71	24	2.7	47	90	74.2
	Namkwang	6.5	67	31	96	25	4.6	38	86	77.1
	Mean	6.4±0.1	57±9.4	32±4.6	86±8.8	30±7.6	3.3±1.2	43±4.6	87±2.4	68.9±12.9
Shinpung	Chokwang	6.4	63	21	82	46	1.7	50	92	43.0
	Daekwang	6.1	54	13	68	37	2.3	48	86	59.6
	Daeyang	6.2	47	16	64	26	3.9	48	83	85.6
	Jinmi	5.31	52	16	66	41	2.3	48	81	52.8
	Milyang9	5.29	60	9	68	25	3.7	48	89	84.5
	Daeshin	5.31	56	18	74	30	3.8	46	86	83.8
	Mean	6.1±0.5	56±5.7	15±4.1	71±6.6	34±8.5	3.0±1.0	48±1.3	86±4.0	68.2±18.8
Average		6.3±0.5	56±7.5	24±9.7	78±11.1	32±8.0	3.1±1.1	45±4.1	86.4±3.1	68.5±15.4
Sown on June 10										
Virginia	Iksan11	7.8	51	25	51	34	1.7	55	92	50.4
	Palkwang	7.6	42	18	35	26	2.8	53	94	59.1
	Sinnamkwang	7.7	50	19	40	18	4.1	45	94	81.0
	Daepung	7.7	56	21	44	28	2.7	49	91	62.4
	Satonoka	7.7	40	24	34	32	2.7	55	95	62.2
	Namkwang	7.8	54	23	42	19	4.2	50	95	86.6
	Mean	7.7±0.1	49±6.5	22±2.8	42±6.3	26±6.6	3.0±1.0	51±3.9	94±1.6	66.9±13.9
Shinpung	Chokwang	7.6	46	16	44	28	1.69	53	96	40.4
	Daekwang	7.5	50	14	35	27	2.39	56	94	56.9
	Daeyang	7.6	46	13	28	20	3.40	51	92	68.9
	Mikwang	7.6	54	9	38	28	2.68	56	97	54.0
	Milyang9	7.5	60	5	30	21	3.42	56	94	72.5
	Daeshin	7.6	51	10	31	22	3.17	57	94	69.9
	Mean	7.6±0.1	51±5.3	11±4.0	34±6.0	24±3.7	2.8±0.7	55±2.3	95±1.8	60.4±12.3
Average		7.6±0.1	50±5.8	16±6.4	38±6.8	25±5.2	2.9±0.8	53±3.6	94±1.7	63.7±13.0

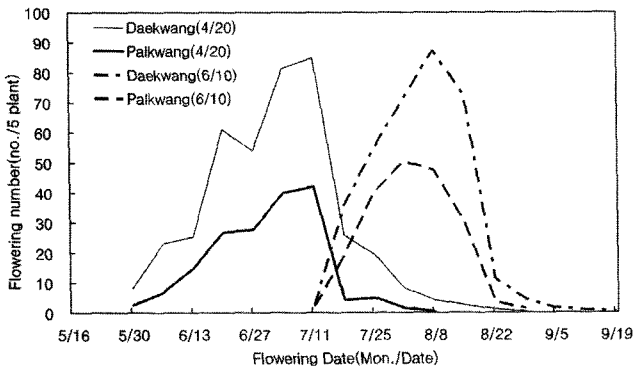

Fig. 1. The change of flowering numbers according to two seeding dates in two peanut cultivars, Virginia typed Palkwang and Shinpung typed Daekwang.

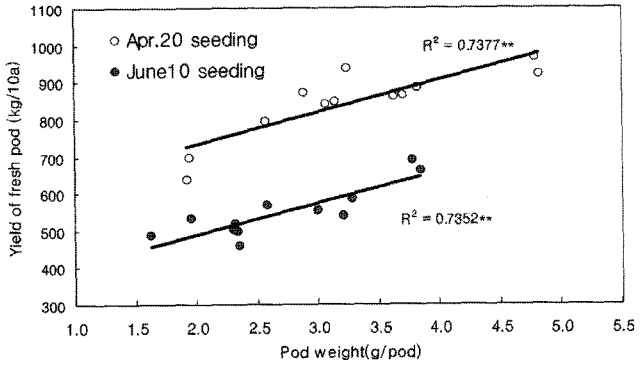

Fig. 2. Distribution of fresh pod yields of peanut cultivars according to pod weight in two seeding dates.

seeding than in late seeding. But fresh pod yields of peanut cultivars in two seedings showed positive correlation with pod weight.

Correlations among yield components of 12 cultivars in each seeding dates were shown in Table 2. In two seeding dates, cultivar with smaller pod weight showed higher pod setting. The number of mature pod and the ratio of dry/fresh pod were significantly low in large grain peanut showing higher water content in fresh peanut shell. But fresh pod yield was closely related to cultivars with large pod and grain weight, and seed yield. This tendency was more clear in early seeding than in late seeding. Consequently, cultivar with large grain in breeding and in cultivation may be favorable to get higher fresh peanut yield.

Distribution of fresh pod yields according to cultivars and plant types in two seeding dates was shown in Table 3. Average yield, 603 kg/10a, in late seeding was 78% of 781 kg/10a in early seeding. Yield difference of each cultivar according to seeding dates showed least variation in Virginia typed cultivars Iksan11, Satonoca and Sinnamkwang, while showed largest in Shinpung typed cultivars Daeshin, Daekwang and Daeyang. Yield gaps between plant

Table 2. Correlations among yield and yield components for fresh pod peanut in two seeding dates.

Seeding date	Yield component	Mature pod no.	Fresh pod wt.	Dry/fresh pod ratio	100-grain wt.	Dry seed yield
Apr. 20	Fresh pod wt.	-0.8309**	-	-	-	-
	Dry/fresh pod ratio	0.5698*	-0.7714**	-	-	-
	100-grain wt.	-0.9564**	0.8540**	-0.4489	-	-
	Dry seed yield	0.1718	0.0872	0.3271	0.1628	-
	Fresh pod yield	-0.6743**	0.8254**	-0.6006*	0.7995**	0.5202*
June 10	Fresh pod wt.	-0.8786**	-	-	-	-
	Dry/fresh pod ratio	0.4436	-0.5249*	-	-	-
	100-grain wt.	-0.8025**	0.9640**	-0.4860*	-	-
	Dry seed yield	0.1072	0.2902	0.2057	0.3153	-
	Fresh pod yield	-0.3378	0.7140**	-0.3012	0.7062**	0.8252**

*, ** : Significant at 5% and 1% level, respectively.

Table 3. Distribution of fresh pod yield according to cultivars and plant types of two seeding dates.

Plant type	Cultivar	Seeding at Apr.20 Yield* (kg/10a. A)	Seeding at June 10 Yield (kg/10a. B)	Index (B/A)
Virginia type	Iksan 11	561e**	501c	89
	Palkwang	805abc	626abc	78
	Sinnamkwang	893a	745a	83
	Daepung	825abc	622abc	75
	Satonoka	709cd	599abc	84
	Namkwang	896a	722ab	81
	Average	782A**	636A	82
Shinpung type	Chokwang	640de	495c	77
	Daekwang	753bcd	531c	71
	Daeyang	840abc	602abc	72
	Mikwang	770abcd	600abc	78
	Milyang9	799abc	612abc	77
	Daeshin	877ab	582bc	66
	Average	780A	570B	74
Total average		781A***	603B	78

*Yield as fresh pod digging at 80 days after first flowering.
Letters in intra-seeding date (**) and inter-seeding dates (***) as value at 5% significance level by Duncan's multiple range test.

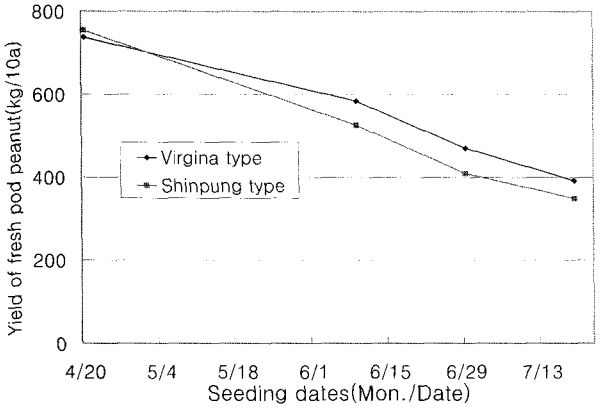

Fig. 3. Changes in fresh pod yield of two plant types according to seeding dates.

types showed little difference in early seeding, but did significant difference in late seeding.

When seeding date of 3 cultivars in each plant type was extended to July 20, yield gaps between plant types were the same tendency that fresh pod yield had linear decrease and that Virginia type had more yield than Shinpung type (Fig. 3). We guess Virginia type, compared to Shinpung type, originally have ability for higher top weight under unfavorable environment in late seeding. And this result is same with report that cultivars of Virginia type, *ssp. hypogaea*, showed better cold tolerance than those of Shinpung and Spanish type, *ssp. fastigiata* (Han & Park,. 1990). Therefore, Virginia typed cultivar in late seeding has more stable yield than Shinpung typed cultivar.

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