

Changes of Growth Characteristics and Yield according to the Cultivation Types of Waxy Corn, Chalok 1

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ABSTRACT: The appearances of growth and yield according to the cultivation types were investigated in chalok 1. The days to harvest under double vinyl house, open mulching and open cultivation were 87.7, 95.8, and 101.8 days, respectively and significantly different in each cultivation types. The branched ears of open mulching, double vinyl house and open cultivation were started at 7, 8, and 13 days after silking, respectively. The frequency of branched ear per total plants to double vinyl house, open cultivation and open mulching were 10%, 13%, and 19%, respectively. The ear weight of open mulching and open cultivation was superior to branched ear weight. The yields (kg/10a) of double vinyl house, open mulching and open cultivation were 755.7 kg, 740.7 kg, and 530.0 kg, respectively. The yields (kg/10a) of double vinyl house and open mulching were significantly different to that of open cultivation and LSD (5%) was 133.42. Thus, early cultivations in double vinyl house were more beneficial than other cultivation types because of the highest yield and the lowest branched ear.

Keywords: Chalok 1, Cultivation types, Growth characteristics, Branched ear, Yield

The study of waxy corn was started at 1975 in Korea and corn hybrid Chalok 1 and Chalok 2 were developed at National Crop Experiment Station of RDA in 1989 and 1994(Cha & Moon, 2000). The waxy corn has also been bred to Yeonngong 1 in Chungnam Univ. and Dumaechal in Hongcheon Maize Experimental Station. These waxy corn were white colored varieties with white pericarp(Cha *et al.*, 1995; Jung *et al.*, 2001; Lee & Choe, 1995; Park *et al.*, 1992; Yun *et al.*, 1999).

The characteristics of Chalok 1 is extremely earliness in harvest maturity, uniformity in plant type, of good quality in amylopectin content (99.8%), very suitable taste and high marketability with high percent of tip fill and uniformity of ear length, of resistance with short plant height in lodging, of resistance to *H. maydis*, and MDMV. Chalok 1 will be expected more increasing demands like Chodangok of high sugar content and unique quality

and replaced with local waxy corn which was late mature, lack of uniformity and susceptible in lodging(Cha & Moon, 2000; Kim *et al.*, 1994; Park *et al.*, 1992).

Lodging resistant and high quality corn hybrid Chalok 2 was later in maturity, longer in ear length, lighter in 100 kernel weight and more resistant to *B. maydis*, *E. turcicum*, and maize dwarf mosaic virus than Chalok 1. The average yield of Chalok 2 was more heavy than Chalok 1 in ear weight(Cha *et al.*, 1995). Kim *et al.*(1972) reported that the influence of early planting with or without vinyl cover and transplanting on the grain and silage yield and earliness of corn. Waxy corn hybrids were also studied at different planting dates(Yun *et al.*, 1999) and different plant density of the second crop in a double cropping system.

The branched ears were shown in Chalok 1 during the cultivation of farmer and decreased the marketable values in view of exterior. The branched ears are affected by environmental and genetic factors. The branched ears were appeared one or more numbers and outside or inside of ears afterwards in silking date in Chalok 1. Unmarketable values of branched ears were investigated approximately 7% among the occurrence of branched ears at Gyeongbuk ATA in 2001. The yield loss resulted from branched ears were shown nearly 7% (Gyeongbuk ATA, 2001, unpublished).

This study was carried out for the investigation of growth and yield according to double vinyl house, open mulching and open field cultivation in Chalok 1.

MATERIALS AND METHODS

This study was carried out to examine the Chalok 1 according to the cultivation types, that is, under double vinyl house, open mulching and open field cultivation, which served as control. The period of planting to the early cultivation under double vinyl house was at 8 Mar, seeded in small plastic pots and transplanting time was 18 Mar, 2002, plant spacing was 60×25 cm which was a stand 6,600 plants per 10a. Direct sowing in open mulching and open cultivation was at 2 Apr and plant spacing was 50×30 cm which was also a stand 6,600 plants per 10a. The three cultivation types were made of open mulching, open field cultivation and early cultivation under double vinyl house, respectively. In

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open mulching soil was covered with vinyl after seeds sowing. The double vinyl house was constructed with a single large pipe of arc type, covered with vinyl under the single large pipe of arc type covered with vinyl, each of large pipe was closely located upper and lower. Fertilizer of N-P-K was applied at the rate of 14.5 kg-3.0 kg-6.0 kg per 10a and irrigated fortnightly for 30 min. The investigations on growth patterns of three cultivation types were based on days to tassel and silk; length, width and weight of ear. The patterns and degrees of appearance of branched ear and yields were also investigated.

RESULTS AND DISCUSSION

This study was carried out for the aspects of growth and yield during the cultivation of the double vinyl house, the open mulching, and the open field in chalok 1. The investigations of growth and yield according to the three cultivation types were also shown as follows.

The results of investigation according to the changes of growth and the characteristics of ear and yield with the cultivation types in chalok 1 were listed in Table 1. Days to harvest of double vinyl house, open mulching, and open field

cultivation were 87.7, 95.8, and 101.8 days, respectively and were significantly different with each cultivation type. The coefficient of variation(CV) and the F values of days to harvest in the three cultivation types were 19.67(%) and 548.56 (Table 1 and 2). Kim *et al.* (1972) found that days to silk in early planting without tunnel or mulching was longer than early seed planted in tunnel and in mulching. Days to harvest of open field cultivation was also longer than double vinyl house and open mulching.

Ear height of double vinyl house, open field, and open mulching were 99.3, 60.3, 54.7 cm, respectively. Plant height of double vinyl house was 215.0 cm and that of open mulching and open field were 150.7 cm and 148.7 cm, respectively. The significant differences of double vinyl house were admitted to open mulching and open field in plant height and ear height.

Tunnel and mulching treatment caused the plants taller than plants in traditional cultivation. These results probably indicated that early plantings were effective only when the seedlings were protected from low temperature by means of tunnel or mulching for ear harvesting (Kim *et al.*, 1972). The plant height and ear height were decreased by late planting in waxy corn hybrids (Yun *et al.*, 1999).

Table 1. Characteristics of growth, ear and yield to three cultivation types in Chalok 1.

	Days to tassel	Days to harvest	Ear height (cm)	Plant height (cm)	Ear length (cm)	Ear width (cm)	Ratio of tip fill	Ear No. per 10a	Yield (kg/10a)
Type A	4.28	87.7	99.3	215.0	15.2	4.4	92.9	5,666.7	755.7
Type B	6.05	95.8	54.7	150.7	15.4	4.3	93.0	4,840.0	740.7
Type C	6.10	101.8	60.3	148.7	16.4	4.1	93.7	3,504.3	530.0
Mean		95.1	71.4	171.4	15.7	4.3	93.2	4,670.3	675.5
LSD(5%)		1.05	6.63	12.35	0.63	0.15	3.15	1,307.04	133.42
CV(%)		19.67	29.71	19.38	4.15	3.94	1.52	23.59	18.30

LSD(5%)=Least significant difference at 5% level of probability.

CV(%)=Coefficient of variation.

Type A=double vinyl house, Type B = open mulching, and Type C = open field cultivation.

Table 2. Mean square of days to harvest, ear characters and yield to three cultivation types in Chalok 1.

	Days to harvest	Ear length (cm)	Ratio of tip fill	Yield (kg/10a)	Branched ear wt (g)
Type A	87.7 ^c	15.2 ^b	92.9 ^a	755.7 ^a	136.0 ^a
Type B	95.8 ^b	15.4 ^b	93.0 ^a	740.7 ^a	146.0 ^b
Type C	101.8 ^a	16.4 ^a	93.7 ^a	530.0 ^b	132.7 ^a
Mean square	151.77	1.39	0.62	47,765.44	141.67
Level of significance	**	**	NS	*	NS
F value	548.56	13.91	0.25	10.71	0.83

Same letters do not differ significantly at 5% level of probability.

*=Significant at 5% level

**=Significant at 1% level

NS=Not significant

Type A=double vinyl house, Type B=open mulching, and Type C=open field cultivation.

Range of ear length and ear width of three cultivation types were 15.2 to 16.4 cm and 4.1 to 4.4 cm and were not significantly different. Ratio of tip fill of cultivation types were 92.9 to 93.7% and were also not significantly different. Ear numbers per 10a under double vinyl house were 5,666 with significant difference to other cultivation types and least significant differences were 1,307.

The yield of double vinyl house were highest among other cultivation types. The significant differences between double vinyl house and open mulching were admitted to open field cultivation and least significant difference of yield according to cultivation types were 133.4. Ear weight under open mulching cultivation were highest in other cultivation types and yield under open mulching cultivation were higher than that of open field cultivation in the significant differences. The yields under double vinyl house, open mulching and open field cultivation were 755.7 kg, 740.7 kg, and 530.0 kg per 10a, respectively. The CV and the F values for the yield of each cultivation types were 18.30(%) and 10.71, respectively (Table 1 and 2). Kim *et al.* (1972) found that early planting in vinyl tunnel increased ear weight and grain yield over seed planted in traditional cultivation. Mulching treatment resulted slight increase in both ear weight and grain yield. Early planting was superior only when planted in tunnel or mulching in both yield and earliness.

The investigated branched ear were corrected for the cumulative scores of each cultivation type and the results were shown in Fig. 1.

The appearances of branched ear were starting after 7, 8 and 13 days of silking in open mulching, double vinyl house and open field cultivation, respectively. The high scores of branched ear were 10 days after silking in open mulching, 9, 13, and 19 days after silking in double vinyl house and 16 and 17 days after silking in open culture. The appearances of branched ear were stopped 26 days after silking in three cul-

tivation types mentioned above. The trend of appearances of branched ear was like sigmoid type in open mulching and in open cultivation and was double sigmoid type in double vinyl house. The appearing times of branched ear in open mulching and in double vinyl house were more fast than in open field cultivation.

The weight of the ear and the branched ear of cultivation types were shown in Fig. 2. The branched ear weights under double vinyl house were 136 g which is higher than ear weights with the values of 132 g. The ear weights under open mulching and open field cultivation were 155 g and 145 g and branched ear weights of those were 126 g and 133 g, respectively. The ear weights were higher than branched ear weights in open mulching and open field, but in double vinyl house vice versa. Which is resulted from the difference of cultivation types. The total mean values of ear weight and branched ear weight were 144 g and 138 g and the least significant differences to each cultivation types were 16.93 but not significantly different at the 5% level by DMRT. In this results, the total mean values of ear weight were slightly higher than branched ear weight in cultivation types and which was not affected the marketable ears.

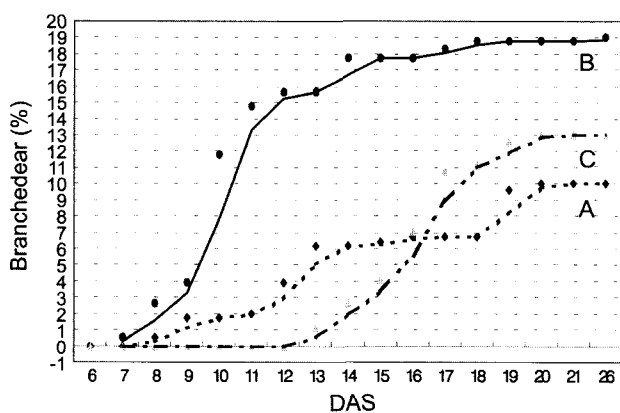


Fig. 1. Cumulative frequency for the total branched ear to three cultivation types in Chalok 1. A(double vinyl house), B(open mulching), C(open cultivation) and DAS(Days after silking).

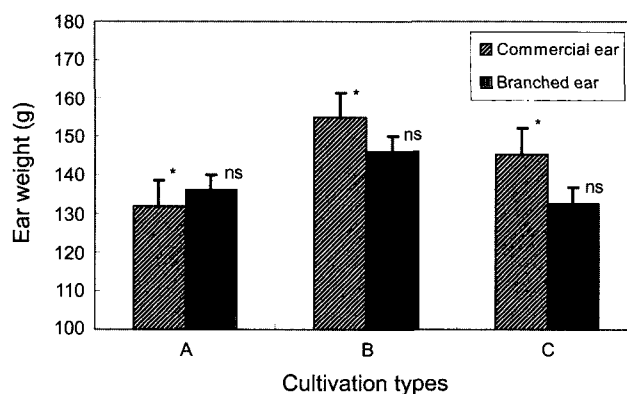


Fig. 2. Ear and branched ear weight(g) of three cultivation types in Chalok 1. A(double vinyl house), B(open mulching) and C(open cultivation). * = Significant at 5% level. ns = Not significant

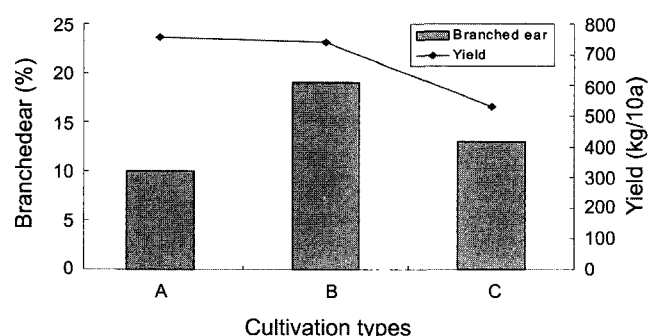


Fig. 3. Branched ear(%) and yield(kg/10a) of three cultivation types in Chalok 1. A(double vinyl house), B(open mulching) and C(open cultivation).

The branched ear ratio per total plants and the yield of each cultivation types were shown in Fig. 3. The ratio of branched ear per total plants of those were 10%, 19%, and 13%, respectively. The appearances of branched ear of double vinyl house in early cultivation were less than open mulching and open field cultivation and the yields of double vinyl house were highest in other cultivation types. In these results, at the time of early cultivation, the planting in the double vinyl house were more useful than open mulching and open field cultivation. It will be required to economic factor and appearance of branched ear analysis for the early cultivation.

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